Caterpillar® Performance Handbook

23rd edition

CATERPILLAR®

CONTENTS

MOTOR GRADERS

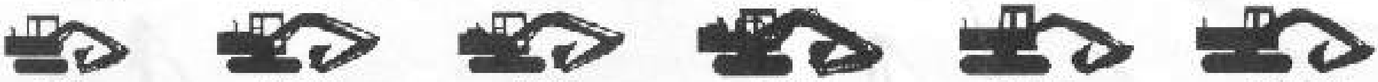
Flywheel power 93 to 205 kW (125 to 275 HP)

120G 130G 12G 140G 140G AWD 14G 16G

HYDRAULIC EXCAVATORS

Operating Weight 6900 to 65 150 kg (15,200 to 143,500 lb)

Track-Type Models

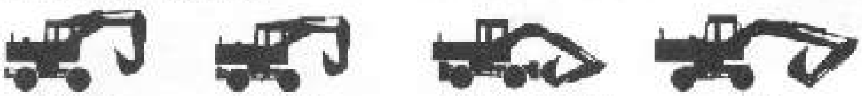


E70B E110B E120B E140 211B LC 213B LC

320 E240C & EL240C 325 231D 231D LC

330 235D E450 E650 245D

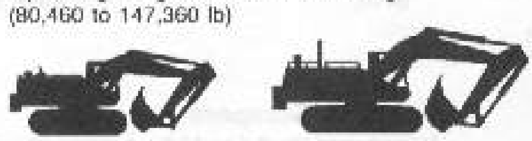
Wheel-Type Models



206B FT 212B FT 214B & 214B FT 224B

Mass Excavators

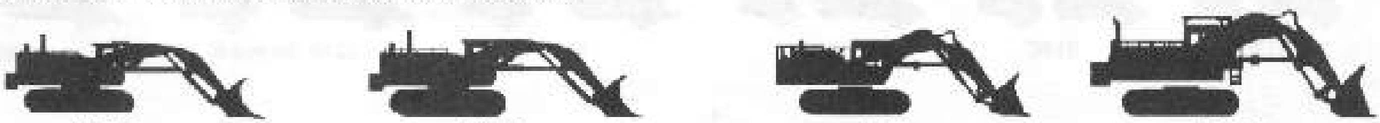
Operating Weight 40 160 to 66 850 kg (80,460 to 147,360 lb)



235D ME 245D ME

Front Shovels

Operating Weight 42 010 to 68 460 kg (92,530 to 150,790 lb)



235D 245D E450 E650

BACKHOE LOADERS

Digging depth 4750 to 6528 mm (15'7" to 21'5")

416B 426B 428B 436B 438B 446

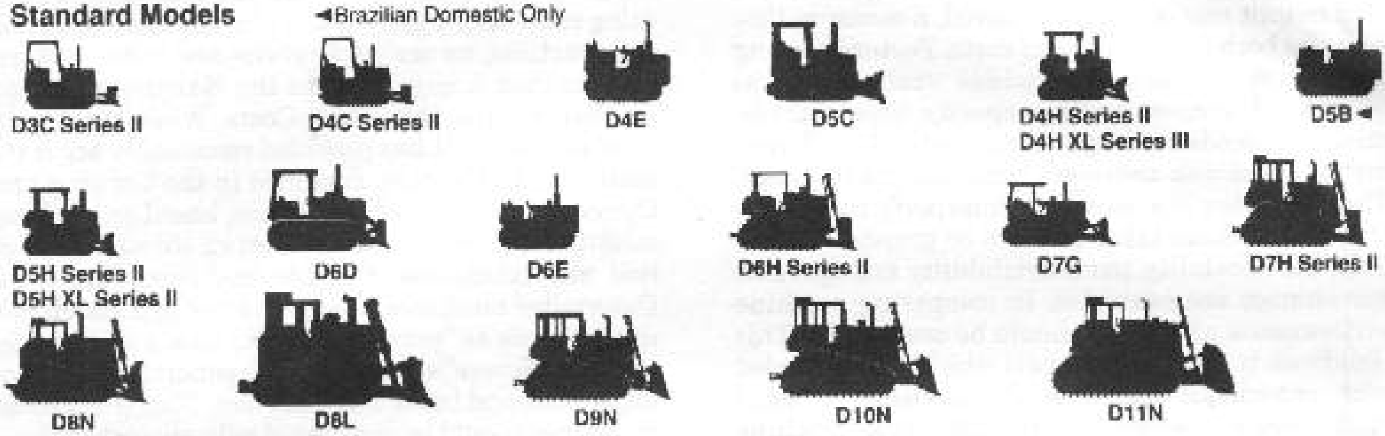
THE CATERPILLAR PRODUCT LINE

TRACK-TYPE TRACTORS

Flywheel power 52 to 575 kW (70 to 770 HP)

Standard Models

◄Brazilian Domestic Only



Low Ground Pressure (LGP)

Wider track, longer undercarriage

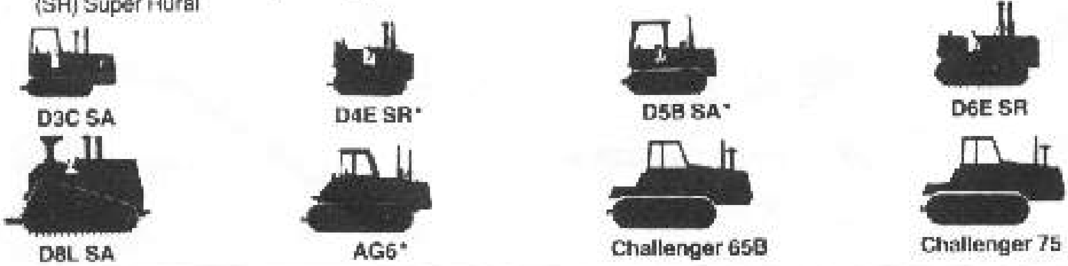
Waste Disposal Arrangements

For sanitary landfill applications

Track Skidders

AGRICULTURAL TRACTORS

*Variable Horsepower arrangements available
(SA) Super Agricultural/Special Application
(SR) Super Rural



CATERPILLAR® PERFORMANCE HANDBOOK

a CAT® publication by Caterpillar Inc., Peoria, Illinois, U.S.A.

OCTOBER 1992

Performance information in this booklet is intended for estimating purposes only. Because of the many variables peculiar to individual jobs (including material characteristics, operator efficiency, underfoot conditions, altitude, etc.), neither Caterpillar Inc. nor its dealers warrant that the machines described will perform as estimated.

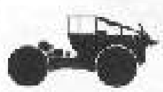
Materials and specifications are subject to change without notice.

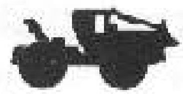
Printed in U.S.A.

SEBD0334

SKIDDERS
Flywheel power 96 to 130 kW (130 to 175 HP)


518 Cable


518 Grapple

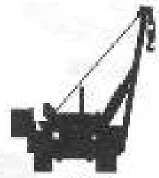

528B


530B

PIPELAYERS
Lifting capacity 27 500 to 104 330 kg (60,600 to 230,000 lb)


571G


572G


578


589

WHEEL TRACTOR-SCRAPERS

Standard Models
Heaped capacity 15.3 to 33.6 m^3 (20 to 44 yd^3)


621E

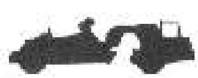

631E Series II


651E

Elevating Scrapers
Heaped capacity 8.4 to 17.5 m^3 (11 to 23 yd^3)


613C


615C


623E

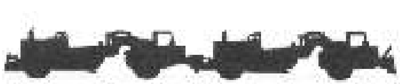
Tandem Powered Scrapers
Heaped capacity 15.3 to 33.6 m^3 (20 to 44 yd^3)

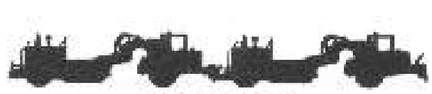

627E

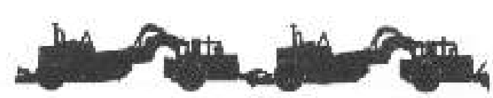

637E Series II


657E

Push-Pull Scrapers
Heaped capacity 15.3 to 33.6 m^3 (20 to 44 yd^3)


627E


637E Series II


657E

PREFACE

Machine performance must ultimately be measured in unit cost of material moved, a measure that includes both production and costs. Factors bearing directly on productivity include such things as weight to horsepower ratio, capacity, type of transmission, speeds and operating costs. The Performance Handbook considers these factors in detail. There are other less direct machine performance factors for which no tables, charts or graphs are possible. Serviceability, parts availability and operator convenience are examples. In comparing machine performance, all factors should be considered. This Handbook is intended as an aid which, when coupled with experience and a good knowledge of local conditions, can assist in estimating true machine performance.

Many sections of the Handbook include tables or curves showing cycle times or hourly production figures for Caterpillar machines under certain conditions. Statements of conditions always accompany or precede the curves or tables. Before using any performance information in this Handbook, a complete understanding of the qualifying conditions is essential. The data is based on field testing, computer analysis, laboratory research and experience; and every effort has been made to assure their correctness.

However, all such data is based upon 100% efficiency in operation — a status which cannot be achieved continuously even under ideal conditions. Thus, in using such performance and production data, it is necessary to correct the results indicated in the handbook tables by appropriate factors. This allows for the anticipated actual job efficiency, operator efficiency, material characteristics, haul road conditions, altitude and other factors which may reduce performance or production on a particular job.

Methods for estimating machine owning and operating costs vary widely, depending on locality, industry practices, owner preferences and other factors. One method is suggested in the Handbook section on Owning and Operating Costs. When used with good judgment, it has provided reasonably accurate estimates in the past. Included in the Owning and Operating Section are guidelines, based on working conditions, to assist in estimating consumption of fuel and lubricants, tire life and repair costs for Caterpillar machines. However, what one Handbook user regards as "excellent" conditions, another may consider "severe" or "average", depending on his own experience and basis of comparison. Therefore, these guidelines should be considered only approximations.

Caterpillar Inc. has made every effort to assure that the information contained in this Handbook is accurate and is a fair statement of the results to be achieved in the circumstances indicated. However, because of the many variables involved in estimating the production or performance of earthmoving machinery, their consumption of fuel and lubricants, tire life and repair costs, and the possibility of inadvertent errors or omissions in assembling this data, Caterpillar cannot and does not imply that all data in this book are complete nor that this level of performance will be achieved on a given job.

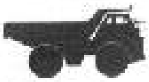
Specifications shown in this Handbook were current at time of printing. However, due to Caterpillar's many machine improvement programs, specifications and materials may change without notice. For current specifications relating to a machine's performance, please refer to the most recent Caterpillar product specification sheet.

Caterpillar Inc.

CONSTRUCTION & MINING TRUCKS/TRACTORS

Construction & Mining Trucks

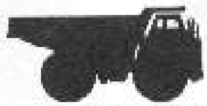
Capacity 31.8 to 218 metric ton — 35 to 240 U.S. tons



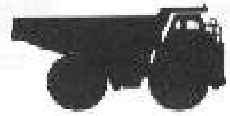
769C 35/40 ton
771C 40/44 ton

773B 50/58 ton
775B 60/65 ton

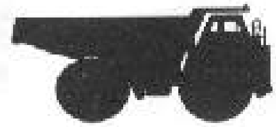
777C 85/95 ton



785 130/150 ton



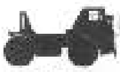
789 170/195 ton



793 240 ton

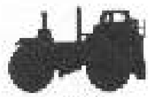
Construction & Mining Tractors

Flywheel power 336 to 962 kW (450 to 1290 HP)

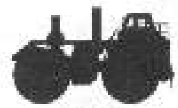


768C

772B



776C



784

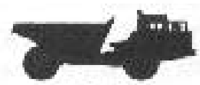
ARTICULATED TRUCKS

Capacity 18 to 36.3 metric tons (20 to 40 U.S. tons)

D20D 20 ton

D25D 25 ton

D30D 30 ton

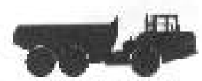


D40D 40 ton

D250D 25 ton

D300D 30 ton

D350D 35 ton



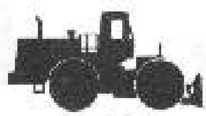
D400D 40 ton

WHEEL-TYPE TRACTORS

Flywheel power 161 to 336 kW (216 to 450 HP)

814B

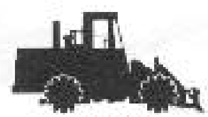
824C



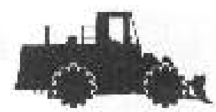
834B

SOIL COMPACTORS

Flywheel power 161 to 235 kW (216 to 315 HP)



815B



825C

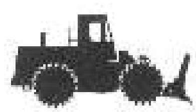
LANDFILL COMPACTORS

Flywheel power 96 to 235 kW (130 to 315 HP)

936 Landfill Compactor

518 Landfill Compactor

816B

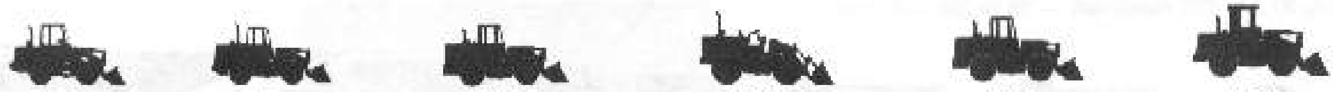


826C

WHEEL LOADERS

Bucket Capacity (Heaped)** 1.0 to 20 m³ (1.3 to 26 yd³)

*High lift arrangement available.
**General Purpose Bucket.
◄Brazilian Domestic Only.



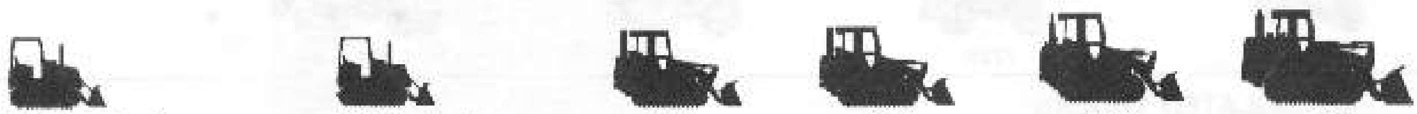
910E | 916 | 926E | 930T◄ | 936F | 950F

966C◄ | 966F | 980F* | 988B* | 992D* | 994*

TRACK-TYPE LOADERS

Bucket Capacity (Heaped)** 0.8 to 2.8 m³ (1.0 to 3.75 yd³)

*Wide track arrangements available.
**General Purpose Bucket.

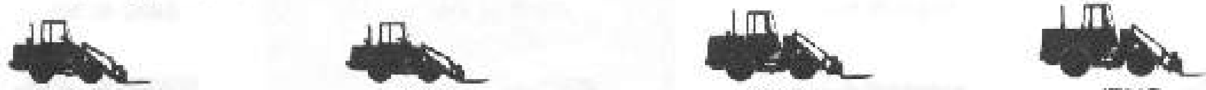


931C* Series II | 935C Series II | 943* | 953* | 963* | 973*

INTEGRATED TOOLCARRIERS

Bucket Capacity (Heaped)* 1.2 to 1.7 m³ (1.6 to 2.25 yd³)

*General Purpose Bucket.

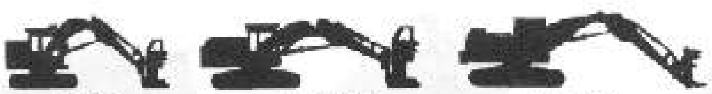


IT12B | IT14B | IT18B | IT28B

LOGGING AND FOREST PRODUCTS

Feller Bunchers

Operating weight 16 636 to 31 746 kg (30,000 to 69,892 lb)



E110B | EL200B | FB227

Log Loaders

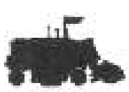
Operating Weight 39 460 and 55 112 kg (87,000 and 121,500 lb)

231D LC LOG LOADER | 235D LC LOG LOADER

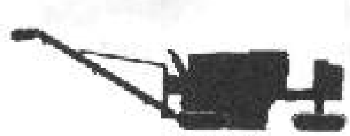
PAVING PRODUCTS

Cold Planers

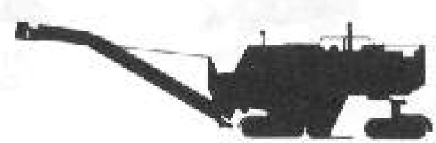
Cutting widths 90 to 3810 mm (3.5" to 150")
Horsepower 52.5 to 746 kW (77 to 1000 HP)



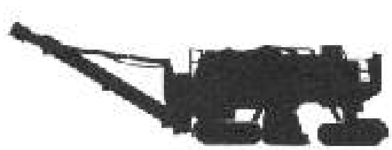
PR-105



PR-450C



PR-750C



PR-1000C

PAVING PRODUCTS

Road Reclaimer/Soil Stabilizer

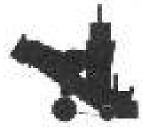
Flywheel power 250 kW (335 HP)
Cutting width 2438 mm (96")

RR-250

SS-250

Windrow Elevators

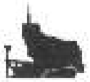
Operating weight 5897 kg (13,000 lb)



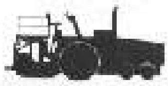
WE-851B

Asphalt Pavers

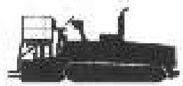
Paving width 914 to 9144 mm (3 to 30 ft)



AP-200B



AP-800B

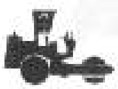


AP-1000

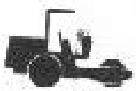
AP-1050

Smooth Drum Vibratory Soil Compactors

Drum width 1220 mm to 2130 mm (48" to 84")

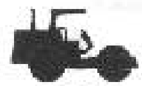


CS-323

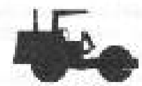


CS-431B

CS-433B



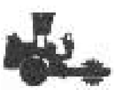
CS-563



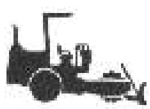
CS-583

Padded Drum Vibratory Soil Compactors

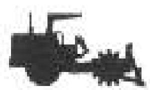
Drum width 1220 to 2130 mm (48" to 84")



CP-323



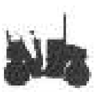
CP-433B



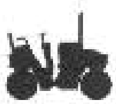
CP-563

Dual Drum Vibratory Asphalt Compactors

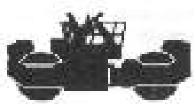
Drum width 1000 to 1981 mm (39.4" to 78")



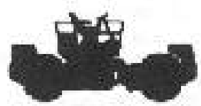
CB-214B



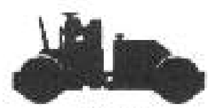
CB-224B



CB-434



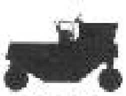
CB-534



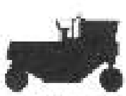
CB-614

Pneumatic Tire Asphalt Compactors

Wheel loads 1134 to 1814 kg (2500 to 4000 lb)



PS-110



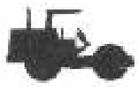
PS-130

PS-180

PAVING PRODUCTS

Smooth Drum Vibratory Soil Compactor (Overseas Model)

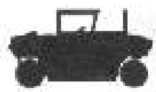
Drum Width 2130 mm (7'0")



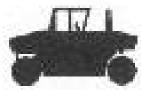
CS-573

Pneumatic Tire Asphalt Compactors (Overseas Models)

Wheel loads 3000 to 5000 kg (6612 to 11,020 lb)



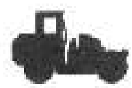
PF-300 PS-300



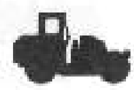
PS-500

Single Drum Combination Vibratory Compactor (Overseas Models)

Drum Width 1700 mm (67")



CB-523B

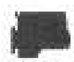


CB-525B

ENGINES

Application configurations include: On and off highway trucks, stationary and mobile industrial, marine, electrical power generation and petroleum. Spark-ignited (SI) available as noted. Generator set kW shown is 60 Hertz.

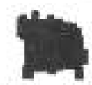
Engine Nomenclature Key
First digits indicate Family (ie. comparable bore & stroke) except for metric engines. Family for metric engines is indicated by the middle two digits which also tell the displacement per cylinder to the nearest tenth of a liter; and the last digit indicates the number of cylinders.



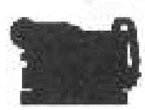
1.1 L Family
- 104 to 224 kW (140 to 300 HP) Diesel Engine

3200 Family
- 93 to 317 kW (125 to 425 HP) Diesel Engine
- 180 to 200 kW Diesel Generator Sets

3300 Family
- 64 to 265 kW (85 to 355 HP) Diesel Engine
- 65 to 250 kW Diesel Generator Sets
- 62 to 164 kW (83 to 220 HP) SI Engine
- 85 to 150 kW SI Generator Sets



3400 Family
- 186 to 746 kW (250 to 1000 HP) Diesel Engine
- 210 to 800 kW Diesel Generator Sets
- 336 kW (450 HP) SI Engine
- 270 to 470 kW SI Generator Sets



3500 Family
- 448 to 1641 kW (600 to 2200 HP) Diesel Engine
- 715 to 2000 kW Diesel Generator Sets
- 392 to 858 kW (525 to 1150 HP) SI Engine
- 360 to 800 kW SI Generator Sets

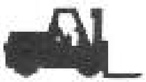
3600 Family
- 1560 to 5420 kW (2000 to 7270 HP) Diesel Engine
- 1375 to 4910 kW Diesel Generator Sets

LIFT TRUCKS

M prefix . . . Electric powered with Cushion tires.
Rated Capacity 1250-5000 kg (2,500-10,000 lb)

F prefix . . . Electric powered with Pneumatic tires.
Rated Capacity 1250-3000 kg (2,500-6,000 lb)

T prefix . . . Engine powered with Cushion tires.
Rated Capacity 1250-6800 kg (2,500-15,000 lb)



V prefix . . . Engine powered with Pneumatic tires.
Rated Capacity 1250-42 000 kg (2,500-92,500 lb)

R prefix . . . Rough terrain Engine powered with Pneumatic tires.
Rated Capacity 2000-4000 kg (4,000-8,000 lb)

Self Guided
Vehicle systems
Very flexible driverless vehicle systems for moving unit loads in manufacturing and warehousing environments 2000 kg (4400 lb) capacity

Container/Trailer Handlers
V1100 CTH lifts containers and trailers from railcars. Rated capacity 41 000 kg (90,000 lb) under the attachment

Additional Identification:
Short Turn Radius (example T60D Short Turn Radius or T60D STR) "C" as a prefix and numerical value indicates "compact" version with the same lifting capacity and load center as another model within the product series (example MC30). Also, "SA" suffix identifies special application lift trucks.

Lifting Capacity in pounds:
The nomenclature numerical value times 100, e.g.,
T30D = 1500 kg (3000 lb), V180B = (8000 lb)

NOTE: For specific information regarding lift trucks, see form No. CEKB0228 — Caterpillar Lift Truck Product Specification Manual or your Caterpillar Industrial Inc. Dealer.

NOTE: A suffix letter may be used to indicate successive generations of construction machine, lift truck or engine models. E.g. 651 Series E or M50 Series B or 3406 Series B. These may be shortened — 651E, M50B, 3406B.

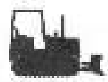
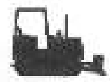
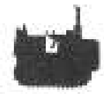
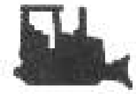
TRACK-TYPE TRACTORS
WASTE DISPOSAL TRACK-TYPE TRACTORS
TRACK SKIDDERS
Hydraulic Controls
Bulldozers
Rippers, Ripper-Scarifiers, Impact Rippers & Backhoe Arrangements
Winches
Towed Scrapers

CONTENTS

TRACK-TYPE TRACTORS

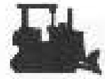
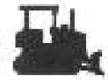
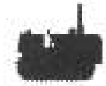
Features:

- **Cat Diesel Engines** provide power, reliability and performance you can depend on.
- **Choice of transmissions** on most models:
  Planetary power shift with high capacity clutch packs provide positive, dependable shifting with single lever control.
  Direct drive transmission with Caterpillar oil clutch.
- **Oil cooled steering clutches and brakes** standard on all models except the D3C Series II and D8N. Improves reliability and component life. Oil disc brakes used on D4H Series II and up. Oil cooled contracting band type used on D3C Series II and D4C Series II.
- **Differential steering** allows infinitely variable turning radius. Standard on the D8N and optional on the D6H Series II and D7H Series II, allows the tractor to make a "power turn" keeping both tracks working for more traction and higher performance.
- **Combined hand lever steering** located left of operator provides easier operation on D4H Series II and up. Combined pedal steering standard on the D3C Series II and D4C Series II. Optional combined hand lever clutch and brake for D3C Series II and D4C Series II.
- **Sealed and Lubricated Track** reduces pin and bushing wear for lower undercarriage repair costs.
- **Elevated sprockets** on D4H Series II and up eliminate final drive stress induced by roller frame lateral movement. Final drives pull chain only. Seals moved up out of dirt, sand and water for longer life. Blade visibility improved because operator sits higher.
- **Resilient mounted bogie undercarriage** on D8N, D9N, D10N and D11N reduces shock transmitted to tractor.
- **Solid mounted undercarriage** standard on D3C Series II through D7H Series II and optional on the D8N provides stable platform for finish grade applications.
- **Modular design** on D4H Series II and up greatly reduces drive train removal and installation labor time resulting in reduced repair costs.
- **Tag link** on D7H Series II and up; L-shaped push arms on D4H Series II through D6H Series II. Both designs allow closer mounting of dozer blades. This reduces total tractor length, improves maneuverability, balance, blade penetration and pryout.

MODEL	D3C Series II		D4C Series II		D4E►		D5C	
Flywheel Power	52 kW	**70 HP**	60 kW	**80 HP**	60 kW	**80 HP**	67.1 kW	**90 HP**
Operating Weight*								
(Power Shift)	7004 kg	**15,435 lb**	7581 kg	**16,661 lb**	9235 kg	**20,363 lb**	8477 kg	**18,650 lb**
(Direct Drive)	—		—		9070 kg	**20,000 lb**	—	
Engine Model	**3204**		**3204**		**3304**		**3204**	
Rated Engine RPM	**2400**		**2400**		**2000 (PS)**	**1900 (DD)**	**2400**	
No. of Cylinders	**4**		**4**		4		4	
Bore	114 mm	**4.5"**	114 mm	**4.5"**	121 mm	**4.75"**	114 mm	**4.5"**
Stroke	127 mm	**5"**	127 mm	**5"**	152 mm	**6"**	127 mm	**5"**
Displacement	5.2 L	**318 in³**	5.2 L	**318 in³**	7 L	**425 in³**	5.2 L	**318 in³**
Track Rollers (Each Side)	5		6		5		**6**	
Width of Standard Track Shoe	356 mm	**14"**	406 mm	**16"**	406 mm	**16"**	460 mm	**18"**
Length of Track on Ground	1.90 m	**6'2.9"**	2.05 m	**6'8.9"**	1.83 m	**6'**	2.14 m	**7'0.4"**
Ground Contact Area (W/Std. Shoe)	1.35 m²	**2094 in²**	1.67 m²	**2589 in²**	1.48 m²	**2294 in²**	1.96 m²	**3038 in²**
Track Gauge	1.42 m	**4'8"**	1.42 m	**4'8"**	1.52 m	**5'0"**	1.54 m	**5'1"**
GENERAL DIMENSIONS:								
Height (Stripped Top)**	1.69 m	**5'6.7"**	1.69 m	**5'6.7"**	1.93 m	**6'4"**	1.75 m	**5'9.2"**
Height (To Top of ROPS)	2.66 m	**8'8.9"**	2.66 m	**8'8.9"**	2.90 m	**9'7"**	2.72 m	**8'11"**
Overall Length (With S Blade)◄	3.70 m	**12'3"**	3.88 m	**12'9"**	—		3.91 m	**12'10"**
(Without Blade)	2.76 m	**9'1"**	2.76 m	**9'1"**	3.20 m	**10'6"**	2.99 m	**9'9.8"**
Width (Over Trunnion)	—		—		—		—	
Width (W/O Trunnion — Std. Shoe)	1.79 m	**5'10.6"**	1.83 m	**6'0"**	1.98 m	**6'6"**	2.01 m	**6'7"**
Ground Clearance	294.8 mm	**11.6"**	294.8 mm	**11.6"**	360 mm	**14.2"**	361.4 mm	**14.2"**
Blade Types and Widths:								
Straight	—		—		—		—	
Angle	—		—		3.12 m	**10'3"**	—	
Angle Straight	—		—		—		—	
Universal	—		—		—		—	
Semi-U	—		—		—		—	
"P" Straight	2.41 m	**7'11"**	2.54 m	**8'4"**	—		2.54 m	**8'10"**
Angled	2.24 m	**7'4"**	2.28 m	**7'6"**	—		2.30 m	**7'6"**
Power Angle & Tilt	—		—		—		—	
Fuel Tank Refill Capacity	121 L	**31.9 U.S. gal**	114 L	**30 U.S. gal**	238 L	**63 U.S. gal**	167 L	**44 U.S. gal**

*Operating Weight includes ROPS canopy, operator, lubricants, coolant, full fuel tank, hydraulic controls and fluids, D3C Series II, D4C Series II, D5C with P-blade, back-up alarm, seat belts, lights, rigid drawbar, front pull device and standard service crankcase guard.
— D3C Series II & D4C Series II includes power angling and tilt blade, 3 valve hydraulics, 3F/3R Transmission, 406 mm (16") track shoes.
**Height (stripped top) — without ROPS, exhaust, seat back or other easily removed encumbrances.
◄D3C Series II, D4C Series II, D5C dimensions measured with P-blade.
►Brazilian Domestic only.

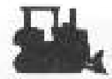
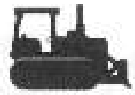
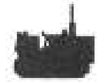
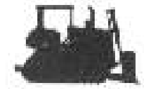
   

MODEL	D4H Series II		D4H XL Series III		D5B►		D5H Series II	
Flywheel Power	71 kW	**95 HP**	78 kW	**105 HP**	78 kW	**105 HP**	89 kW	**120 HP**
Operating Weight*								
(Power Shift)	10 250 kg	**22,597 lb**	11 137 kg	**24,500 lb**	11 320 kg	**24,960 lb**	13 224 kg	**29,159 lb**
(Direct Drive)	10 385 kg	**22,895 lb**	—		11 140 kg	**24,564 lb**	13 303 kg	**29,333 lb**
Engine Model	**3204**		**3304**		**3306**		**3304**	
Rated Engine RPM	**2200**		**2200**		**1750**		**2200**	
No. of Cylinders	**4**		**4**		**6**		**4**	
Bore	114 mm	**4.5"**	121 mm	**4.75"**	121 mm	**4.75"**	121 mm	**4.75"**
Stroke	127 mm	**5"**	152 mm	**6"**	152 mm	**6"**	152 mm	**6"**
Displacement	5.2 L	**318 in³**	7 L	**425 in³**	10.5 L	**638 in³**	7 L	**425 in³**
Track Rollers (Each Side)	**7**		**7**		**6**		**6**	
Width of Standard Track Shoe	460 mm	**18"**	510 mm	**20"**	406 mm	**16"**	510 mm	**20"**
Length of Track on Ground	2.23 m	**7'4"**	2.40 m	**7'9"**	2.18 m	**7'2"**	2.31 m	**7'6"**
Ground Contact Area (W/Std. Shoe)	2.05 m²	**3168 in²**	2.45 m²	**3799 in²**	1.77 m²	**2745 in²**	2.35 m²	**3646 in²**
Track Gauge	1.68 m	**5'6"**	1.77 m	**5'8"**	1.88 m	**6'2"**	1.80 m	**5'9"**
GENERAL DIMENSIONS:								
Height (Stripped Top)**	2.10 m	**6'10.5"**	2.10 m	**6'10.5"**	1.93 m	**6'4"**	2.13 m	**6'11.8"**
Height (To Top of ROPS)	2.98 m	**9'9.5"**	2.48 m	**9'9.5"**	2.95 m	**9'8"**	2.98 m	**9'10"**
Overall Length (With S Blade)	4.26 m	**13'11.5"**	4.43 m	**14'7"**	—		4.53 m	**14'11"**
(Without Blade)	3.42 m	**11'3"**	3.81 m	**12'6"**	3.63 m	**11'11"**	3.60 m	**11'10"**
Width (Over Trunnion)	—		—		—		2.54 m	**8'4"**
Width (W/O Trunnion — Std. Shoe)	2.13 m	**7'0"**	2.28 m	**7'5.8"**	2.36 m	**7'9"**	2.31 m	**7'7"**
Ground Clearance	376 mm	**14.8"**	3.76 mm	**14.8"**	280 mm	**11"**	390 mm	**15.4"**
Blade Types and Widths:								
Straight	2.59 m	**8'6"**	—		—		2.95 m	**9'8.2"**
Angle	—		—		3.63 m	**11'11"**	—	
Angle Straight	—		—		—		—	
Universal	—		—		—		—	
Semi-U	—		—		—		—	
"P" Straight	2.64 m	**8'8"**	3.07 m	**10'1"**	—		3.27 m	**10'9"**
Angled	2.44 m	**8'0"**	2.74 m	**9'**	—		2.92 m	**9'7"**
Power Angle & Tilt	—		—		—		—	
Fuel Tank Refill Capacity	200 L	**52 U.S. gal**	200 L	**52.7 U.S. gal**	238 L	**63 U.S. gal**	246 L	**65 U.S. gal**

*Operating Weight includes ROPS canopy, operator, lubricants, coolant, full fuel tank, hydraulic controls and fluids, D4H Series II & D5H Series II P-blade, rigid drawbar, back-up alarm, seat belts, lights, front towing device and standard service crankcase guards.

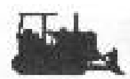
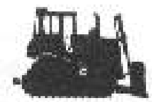
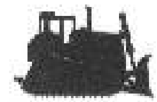
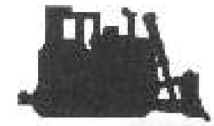
**Height (stripped top) — without ROPS canopy, exhaust, pre-cleaner, seat back or other easily removed encumbrances.

►Brazilian Domestic only.

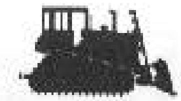
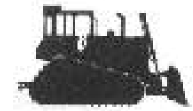
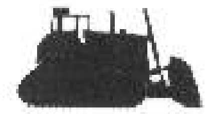
MODEL	**D5H XL Series II**		**D6D**		**D6E**		**D6H Series II**	
Flywheel Power	97 kW	**130 HP**	104 kW	**140 HP**	116 kW	**155 HP**	123 kW	**165 HP**
Operating Weight*								
(Power Shift)	13 982 kg	**30,830 lb**	14 610 kg	**32,215 lb**	14 960 kg	**32,987 lb**	17 761 kg	**39,075 lb**
(Direct Drive)	—		14 300 kg	**31,530 lb**	—		17 765 kg	**39,170 lb**
(Power Shift Diferential Steer)	—		—		—		17 838 kg	**39,325 lb**
Engine Model	**3304**		**3306**		**3306**		**3306**	
Rated Engine RPM	**2200**		**1900**		**1900**		**1900**	
No. of Cylinders	**4**		**6**		**6**		**6**	
Bore	121 mm	**4.75"**	121 mm	**4.75"**	121 mm	**4.75"**	121 mm	**4.75"**
Stroke	152 mm	**6"**	152 mm	**6"**	152 mm	**6"**	152 mm	**6"**
Displacement	7 L	**425 in³**	10.5 L	**638 in³**	10.5 L	**638 in³**	10.5 L	**638 in³**
Track Rollers (Each Side)	**7**		**6**		**7**		**6**	
Width of Standard Track Shoe	600 mm	**24"**	457 mm	**18"**	508 mm	**20"**	560 mm	**22"**
Length of Track on Ground	2.48 m	**8'2"**	2.37 m	**7'9"**	2.67 m	**8'9"**	2.63 m	**8'7.5"**
Ground Contact Area (W/Std. Shoe)	3.03 m²	**4689 in²**	2.16 m²	**3348 in²**	2.72 m²	**4216 in²**	2.94 m²	**4564 in²**
Track Gauge	1.89 m	**6'2"**	1.88 m	**6'2"**	1.88 m	**6'2"**	1.89 m	**6'2"**
GENERAL DIMENSIONS:								
Height (Stripped Top)**	2.13 m	**6'11.8"**	2.03 m	**6'8"**	2.03 m	**6'8"**	2.26 m	**7'5"**
Height (To Top of ROPS)	3.01 m	**9'10.6"**	3.06 m	**10'0"**	3.06 m	**10'0"**	3.12 m	**10'3"**
Height (To Top of Cab ROPS)	—		—		—		3.12 m	**10'3"**
Overall Length (With S Blade)	4.60 m	**15'1"**	4.80 m	**15'9"**	4.80 m	**15'9"**	5.29 m	**17'4"**
(Without Blade)	3.60 m	**11'10"**	3.73 m	**12'3"**	3.73 m	**12'3"**	4.06 m	**13'4"**
Width (Over Trunnion)	2.63 m	**8'7"**	—		—		2.64 m	**8'8"**
Width (W/O Trunnion — Std. Shoe)	2.49 m	**8'2"**	2.36 m	**7'9"**	2.46 m	**8'1"**	2.44 m	**8'0"**
Ground Clearance	415 mm	**16.3"**	310 mm	**12.2"**	310 mm	**12.2"**	376 mm	**14.8"**
Blade Types and Widths:								
Straight	—		3.20 m	**10'6"**	3.20 m	**10'6"**	3.35 m	**11'0"**
Angle	—		3.90 m	**12'9"**	3.90 m	**12'9"**	—	
Angle Straight	—		—		—		4.16 m	**13'7.8"**
Full Angle	—		—		—		3.78 m	**12'4.7"**
Universal	—		—		—		—	
Semi-U	3.16 m	**10'5"**			—		3.26 m	— **10'8.4"**
"P" Straight	3.27 m	**10'9"**	—		—		—	
Angled	2.92 m	**9'7"**	—		—		—	
Power Angle & Tilt	—		—		—		—	
Fuel Tank Refill Capacity	246 L	**65 U.S. gal**	295 L	**78 U.S. gal**	295 L	**78 U.S. gal**	337 L	**89 U.S. gal**

*Operating Weight includes ROPS canopy, operator, lubricants, coolant, full fuel tank, hydraulic controls and fluids, straight dozer with tilt, back-up alarm, seat belts, lights, rigid drawbar and front towing device.
— D6D equipped with 560 mm **(22")** track.
— D6H Series II with extended undercarriage: length of thack on ground 2.78 m **(9'1.5")**, ground contact area 3.11 m² **(4804 in²)**.
**Height (stripped top) — without ROPS canopy, exhaust, seat back or other easily removed encumbrances.

MODEL	D7G		D7H Series II		D8N		D8L	
Flywheel Power	149 kW	**200 HP**	160 kW	**215 HP**	212 kW	**285 HP**	250 kW	**335 HP**
Operating Weight*								
(Power Shift)	20 666 kg	**45,560 lb**	24 195 kg	**53,470 lb**	36 842 kg	**81,222 lb**	38 114 kg	**84,026 lb**
(Direct Drive)	20 510 kg	**45,218 lb**	24 117 kg	**53,298 lb**	—		—	
(Power Shift Diferential Steer)	—		24 469 kg	**54,073 lb**	—		—	
Engine Model	**3306**		**3306**		**3406**		**3408**	
Rated Engine RPM	**2000**		**2100**		2100		**1900**	
No. of Cylinders	**6**		**6**		**6**		**8**	
Bore	121 mm	**4.75"**	121 mm	**4.75"**	137 mm	**5.4"**	137 mm	**5.4"**
Stroke	152 mm	**6"**	152 mm	**6"**	165 mm	**6.5"**	152 mm	**6"**
Displacement	10.5 L	**638 in³**	10.5 L	**638 in³**	14.6 L	**893 in³**	18 L	**1099 in³**
Track Rollers (Each Side)	**6**		**7**		**8**		**8**	
Width of Standard Track Shoe	508 mm	**20"**	560 mm	**22"ES**	560 mm	**22"**	560 mm	**22"**
Length of Track on Ground	2.70 m	**8'11"**	2.90 m	**9'6"**	3.21 m	**10'6"**	3.22 m	**10'6.5"**
Ground Contact Area (W/Std. Shoe)	2.76 m²	**4280 in²**	3.24 m²	**5016 in²**	3.6 m²	**5565 in²**	3.59 m²	**5565 in²**
Track Gauge	1.98 m	**6'5"**	1.98 m	**6'6"**	2.08 m	**6'10"**	2.28 m	**7'6"**
GENERAL DIMENSIONS:								
Height (Stripped Top)**	2.27 m	**7'5"**	2.44 m	**8'0"**	2.59 m	**8'6"►**	2.89 m	**9'6"**
Height (To Top of ROPS)	3.20 m	**10'6"**	3.33 m	**10'11"**	3.43 m	**11'3"►**	3.87 m	**12'8"**
Height (To Top of Cab ROPS)	—		3.42 m	**11'3"**	—		—	
Overall Length (With S Blade)	5.28 m	**17'4"**	6.03 m	**19'9"**	6.24 m	**20'6"**	6.22 m	**20'5"**
(Without Blade)	4.19 m	**13'9"**	4.62 m	**15'2"**	4.93 m	**16'2"**	4.95 m	**16'3"**
Width (Over Trunnion)	—		2.86 m	**9'5"**	3.05 m	**10'**	—	
Width (W/O Trunnion — Std. Shoe)	2.55 m	**8'5"**	2.54 m	**8'4"**	2.7 m	**8'10"**	2.84 m	**9'4"**
Ground Clearance	347 mm	**13.7"**	406 mm	**16"**	528 mm	**20.8"**	456 mm	**18"**
Blade Types and Widths:								
Straight	3.66 m	**12'0"**	3.91 m	**12'10"**	—		4.17 m	**13'8"**
Angle	4.27 m	**14'0"**	—		—		—	
Angle Straight	—		4.49 m	**14'9"**	4.96 m	**16'3"**	—	
Full Angle	—		4.08 m	**13'5"**	—		—	
Universal	3.81 m	**12'6"**	3.96 m	**13'1"**	4.26 m	**14'0"**	—	
Semi-U	—		3.66 m	**12'1"**	3.94 m	**12'11"**	—	
Fuel Tank Refill Capacity	435 L	**115 U.S. gal**	488 L	**129 U.S. gal**	488 L	**129 U.S. gal**	753 L	**199 U.S. gal**

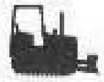
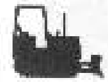
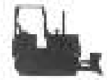
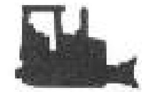
*Operating Weight includes ROPS canopy, operator, lubricants, coolant, full fuel tank, hydraulic controls and fluid, straight dozer with tilt, horn, back-up alarm, retrieval hitch and front pull hook.
— D7G includes end track guiding guards.
— D7H Series II with extended undercarriage: length of track on ground 3.07 m (10'1") ground contact area 3.43 m² (5324 in²).
— D8N equipped with track guides, 635 mm (24") MS shoes, single shank ripper and SU blade.
**Height (stripped top) — without ROPS canopy, exhaust, seat back or other easily removed encumbrances.

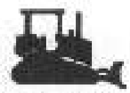
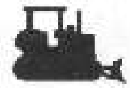
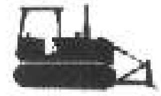
MODEL	D9N		D10N		D11N	
Flywheel Power	276 kW	**370 HP**	338 kW	**520 HP**	575 kW	**770 HP**
Operating Weight*	42 542 kg	**93,789 lb**	57 410 kg	**126,565 lb**	95 846 kg	**211,302 lb**
Engine Model	**3408**		**3412**		**3508**	
Rated Engine RPM	**1900**		**1900**		**1800**	
No. of Cylinders	**8**		**12**		**8**	
Bore	137 mm	**5.4"**	137 mm	**5.4"**	170 mm	**6.69"**
Stroke	152 mm	**6"**	152 mm	**6"**	190 mm	**7.48"**
Displacement	18 L	**1099 in³**	27 L	**1649 in³**	34.5 L	**2104 in³**
Track Rollers (Each Side)	**8**		**8**		**8**	
Width of Standard Track Shoe	610 mm	**24"**	610 mm	**24"**	710 mm	**28"**
Length of Track on Ground	3.47 m	**11'4.8"**	3.87 m	**12'8.5"**	4.44 m	**14'7"**
Ground Contact Area (W/Std. Shoe)	4.24 m²	**6571 in²**	4.73 m²	**7326 in²**	6.32 m²	**9800 in²**
Track Gauge	2.25 m	**7'4.6"**	2.55 m	**8'4"**	2.89 m	**9'6"**
GENERAL DIMENSIONS:						
Height (Stripped Top)**	2.93 m	**9'7.3"►**	3.187 m	**10'5.9"**	3.50 m	**11'6"►**
Height (To Top of ROPS Canopy)	3.91 m	**12'9.8"►**	—		—	
Height (To Top of ROPS)	—		4.24 m	**13'11"►**	4.56 m	**14'11"►**
Overall Length (With S Blade)	6.87 m	**22'6.4"**	7.76 m	**25'5.3"**	8.39 m	**27'6"**
(Without Blade)	5.17 m	**16'11.5"**	5.59 m	**18'3.9"**	6.16 m	**20'3"**
Width (Over Trunnions)	3.25 m	**10'8"**	3.72 m	**12'2.2"**	—	
Width (W/O Trunnions — Std. Shoe)	2.89 m	**9'5.9"**	3.30 m	**10'9.8"**	3.78 m	**12'5"**
Ground Clearance	505 mm	**19.9"■**	615 mm	**24.2"■**	623 mm	**24.5"■**
Blade Types and Widths:						
Straight	—		—		5.65 m	**18'6"**
Angle Straight/Angled	—		—		—	
Universal	4.66 m	**15'3.4"**	5.26 m	**17'3.2"**	6.41 m	**21'0"**
Semi-U	4.32 m	**14'1.9"**	4.86 m	**15'11.4"**	—	
"P" Straight/Angled	—		—		—	
Fuel Tank Refill Capacity	792 L	**209 U.S. gal**	1023 L	**270 U.S. gal**	1490 L	**394 U.S. gal**

*Operating Weight includes ROPS canopy, operator, lubricants, coolant, full fuel tank, hydraulic controls and fluids, straight dozer with tilt, back-up alarm, seat belts, lights, rigid drawbar and front towing device.
— D9N-D11N include track guides.
— D9N and D10N equipped with SU blades.
— D11N equipped with 813 mm **(32")** extreme service track shoes.
— D11N includes 11U Bulldozer, single shank ripper and ROPS cab.
**Height (stripped top) — without ROPS canopy, exhaust, seat back or other easily removed encumbrances.
► Dimensions to flat of shoe. For dimensions to grouser tips add 84 mm **(3.3")** for D9N, add 93 mm (3.7") for D10N and 101 mm (4") for D11N.
■ SAE J1234

• Low Ground Pressure (LGP)

								
MODEL	**D3C LGP Series II**		**D3C LGP-S Series II**		**D4C LGP Series II**		**D5C LGP**	
Flywheel Power	52 kW	**70 HP**	52 kW	**70 HP**	60 kW	**80 HP**	67.1 kW	**90 HP**
Operating Weight*								
(Power Shift)	7788 kg	**17,170 lb**	8592 kg	**18,943 lb**	7905 kg	**17,427 lb**	9000 kg	**19,800 lb**
(Direct Drive)	7744 kg	**17,072 lb**	—		—		—	
Engine Model	3204		3204		3204		3204	
Rated Engine RPM	2400		2400		2400		2400	
No. of Cylinders	4		4		4		4	
Bore	114 mm	**4.5"**	114 mm	**4.5"**	114 mm	**4.5"**	114 mm	**4.5"**
Stroke	127 mm	**5"**	127 mm	**5"**	127 mm	**5"**	127 mm	**5"**
Displacement	5.2 L	**318 in³**	5.2 L	**318 in³**	5.2 L	**318 in³**	5.2 L	**318 in³**
Track Rollers (Each Side)	6		7		6		6	
Width of Standard Track Shoe	635 mm	**25"**	990 mm	**39"**	635 mm	**25"**	660 mm	**26"**
Length of Track on Ground	2.05 m	**6'8.9"**	2.45 m	**8'0.5"**	2.05 m	**6'8.9"**	2.14 m	**7'0.4"**
Ground Contact Area (W/Std. Shoe)	2.61 m²	**4045 in²**	4.85 m²	**7524 in²**	2.61 m²	**4045 in²**	2.83 m²	**4389 in²**
Track Gauge	1.65 m	**5'5"**	2.00 m	**6'6"**	1.65 m	**5'5"**	1.72 m	**5'8"**
GENERAL DIMENSIONS:								
Height (Stripped Top)**	1.69 m	**5'6.7"**	1.69 m	**5'6.7"**	1.69 m	**5'6.7"**	1.75 m	**5'9.2"**
Height (To Top of ROPS)	2.66 m	**8'8.9"**	2.64 m	**8'8"**	2.66 m	**8'8.9"**	2.72 m	**8'11"**
Overall Length (With S Blade)	3.73 m	**12'3"**	4.18 m	**13'9"**	4.05 m	**13'3.4"**	4.07 m	**13'4"**
(Without Blade)	3.00 m	**9'10.1"**	3.40 m	**11'2"**	3.00 m	**9'10.1"**	2.99 m	**9'9.8"**
Width (Over Trunnion)	—		—		—		—	
Width (W/O Trunnion — Std. Shoe)	2.29 m	**7'6"**	3.00 m	**9'10"**	2.29 m	**7'6"**	2.38 m	**7'10"**
Ground Clearance	294.8 mm	**11.6"**	280 mm	**11"**	294.8 mm	**11.6"**	361.4 mm	**14.2"**
Blade Types and Widths:								
Straight	2.80 m	**9'2"**	3.50 m	**11'6"**	—		—	
Angle	—		—		—		—	
"P" Straight	3.16 m	**10'4"**	—		3.26 m	**10'8"**	3.26 m	**10'8"**
Angled	2.85 m	**9'4"**			2.85 m	**9'4"**	2.95 m	**9'8"**
Fuel Tank Refill Capacity	121 L	**31.9 U.S. gal**	121 L	**31.9 U.S. gal**	121 L	**31.9 U.S. gal**	167 L	**44 U.S. gal**

*Operating Weight includes lubricants, coolant, full fuel tank, straight bulldozer, hydraulic controls and fluid, ROPS canopy and operator. D3C LGP Series II has 3F/3R transmission and P-blade. D4H LGP Series II has P-blade.
**Height (stripped top) — without ROPS canopy, exhaust, seat back or other easily removed encumbrances.
***With P-Blade.

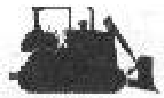
   

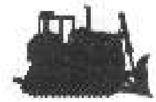
MODEL	D4H LGP Series III		D5H LGP Series II		D6D LGP		D6H LGP Series II	
Flywheel Power	88 kW	**118 HP**	97 kW	**130 HP**	104 kW	**140 HP**	127 kW	**170 HP**
Operating Weight*								
(Power Shift)	12 186 kg	**26,830 lb**	15 337 kg	**33,818 lb**	17 373 kg	**38,300 lb**	19 814 kg	**43,590 lb**
(Direct Drive)	12 356 kg	**27,180 lb**	15 419 kg	**33,999 lb**	—		19 989 kg	**43,976 lb**
(Power Shift Differential Steer)	—		—		—		20 060 kg	**44,131 lb**
Engine Model	**3304**		**3304**		**3306**		**3306**	
Rated Engine RPM	**2200**		**2200**		**1900**		**1900**	
No. of Cylinders	**4**		**4**		**6**		**6**	
Bore	121 mm	**4.75"**	121 mm	**4.75"**	121 mm	**4.75"**	121 mm	**4.75"**
Stroke	152 mm	**6"**	152 mm	**6"**	152 mm	**6"**	152 mm	**6"**
Displacement	7 L	**425 in³**	7 L	**425 in³**	10.5 L	**638 in³**	10.5 L	**638 in³**
Track Rollers (Each Side)	**7**		**8**		**7**		**8**	
Width of Standard Track Shoe	760 mm	**30"**	860 mm	**34"**	910 mm	**36"**	915 mm	**36"**
Length of Track on Ground	2.62 m	**8'7"**	3.12 m	**10'3"**	2.87 m	**9'5"**	3.27 m	**10'8.5"**
Ground Contact Area (W/Std. Shoe)	3.98 m²	**6170 in²**	5.37 m²	**8320 in²**	5.25 m²	**8136 in²**	5.97 m²	**9254 in²**
Track Gauge	2.00 m	**6'6"**	2.16 m	**7'1"**	2.11 m	**6'9"**	2.23 m	**7'3"**
GENERAL DIMENSIONS:								
Height (Stripped Top)**	2.20 m	**7'3"**	2.30 m	**7'6.5"**	2.05 m	**6'8"**	2.32 m	**7'7"**
Height (To Top of ROPS Canopy)	3.63 m	**9'11.4"**	3.12 m	**10'3"**	2.92 m	**9'7.5"**	3.16 m	**10'5"**
Height (To Top of Cab ROPS)	—		3.18 m	**10'5"**	—		3.16 m	**10'5"**
Overall Length (With P Blade)	4.77 m	**15'8"**	5.30 m	**17'6.3"**	—		5.18 m	**17'0"**
(Without Blade)	—		4.13 m	**13'7"**	—		4.49 m	**14'9"**
Overall Length (With S Blade)	—		—		5.16 m	**16'11"**	—	
(Without Blade)	—		—		3.94 m	**12'11"**	—	
Width (Over Trunnion)	—		3.26 m	**10'8.4"**	—		3.43 m	**11'3"**
Width (W/O Trunnion — Std. Shoe)	2.76 m	**9'1"**	3.02 m	**9'11"**	—		3.14 m	**10'3.6"**
Width (With Standard Shoe)	—		—		3.02 m	**9'11"**	—	
Ground Clearance	363 mm	**14.3"**	529 mm	**20.8"**	310 mm	**12.2"**	382 mm	**15"**
Blade Types and Widths:								
Straight	3.26 m	**10'8.2"**	3.65 m	**12'0"**	3.71 m	**12'2"**	3.99 m	**13'1"**
Angle	—		—		—		—	
Power Angle & Tilt	—		3.98 m	**13'0.1"**	—		—	
"P" Straight	3.26 m	**10'8.2"**	—		—		—	
Angled	3.00 m	**9'10.1"**	3.66 m	**11'11.9"**	—		—	
Fuel Tank Refill Capacity	200 L	**52 U.S. gal**	246 L	**65 U.S. gal**	295 L	**78 U.S. gal**	337 L	**89 U.S. gal**

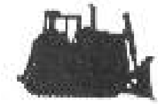
*Operating Weight includes lubricants, coolant, full fuel tank, straight bulldozer, hydraulic controls and fluid, ROPS canopy and operator and rigid drawbar. D5H Series II with P blade.

**Height (stripped top) — without ROPS canopy, exhaust, seat back or other easily removed encumbrances.

Note: D4H LGP Series III has P-blade.





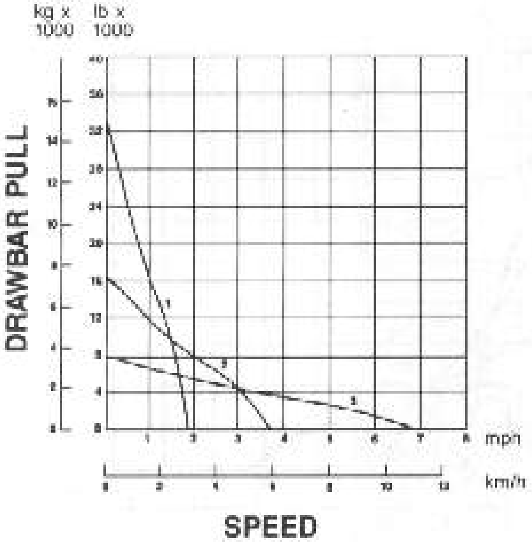


MODEL	D7H LGP Series II		D8N LGP		D8L LGP	
Flywheel Power	160 kW	**215 HP**	212 kW	**285 HP**	250 kW	**335 HP**
Operating Weight*						
(Power Shift)	25 886 kg	**57,645 lb**	36 746 kg	**81,025 lb**	39 483 kg	**87,043 lb**
(Direct Drive)	26 040 kg	**57,903 lb**	—		—	
(Power Shift Differential Steer)	26 087 kg	**58,248 lb**	—		—	
Engine Model	**3306**		**3406**		**3408**	
Rated Engine RPM	**2100**		**2100**		**1900**	
No. of Cylinders	**6**		**6**		**8**	
Bore	121 mm	**4.75"**	137 m	**5.4"**	137 m	**5.4"**
Stroke	152 mm	**6"**	165 m	**6.5"**	152 mm	**6"**
Displacement	10.5 L	**638 in³**	14.6 L	**893 in³**	18 L	**1099 in³**
Track Rollers (Each Side)	**7**		**8**		**8**	
Width of Standard Track Shoe	915 mm	**36"**	965 mm	**38"**	914 mm	**36"**
Length of Track on Ground	3.17 m	**10'5.4"**	3.20 m	**10'6"**	3.213 m	**10'6.5"**
Ground Contact Area (W/Std. Shoe)	5.83 m²	**9029 in²**	6.2 m²	**9576 in²**	5.87 m²	**9108 in²**
Track Gauge	2.23 m	**7'3"**	2.34 m	**7'8"**	2.54 m	**8'4"**
GENERAL DIMENSIONS:						
Height (Stripped Top)**	2.55 m	**8'4"**	2.59 m	**8'6"**	290 m	**9'6"**
Height (To Top of ROPS)	—		3.43 m	**11'3"**	3.87 m	**12'9"**
Height (To Top of ROPS Canopy)	3.42 m	**11'2.6"**	—		—	
Height (To Top of Cab ROPS)	3.50 m	**11'6"**	—		—	
Overall Length (With P Blade)	5.54 m	**18'2"**	—		—	
(Without Blade)	4.62 m	**15'2"**	—		—	
Overall Length (With S Blade)	—		6.24 m	**20'6"**	6.23 m	**20'5"**
(Without Blade)	—		4.93 m	**16'2"**	4.95 m	**16'3"**
Width (Over Trunion)	3.37 m	**11'1"**	—		—	
Width (W/O Trunion — Std. Shoe)	3.15 m	**10'4"**	—		—	
Width (With Standard Shoe)	—		3.37 m	**11'1"**	3.18 m	**10'5.4"**
Ground Clearance	490 mm	**19.3"**	536 mm	**21"**	458 mm	**18"**
Blade Types and Widths:						
Straight	4.40 m	**14'5"**	—		4.92 m	**16'2"**
Universal	—		3.94 m	**12'11"**	—	
Power Angle & Tilt	—		—		5.25 m	**17'3"**
Fuel Tank Refill Capacity	488 L	**129 U.S. gal**	488 L	**129 U.S. gal**	753 L	**199 U.S. gal**

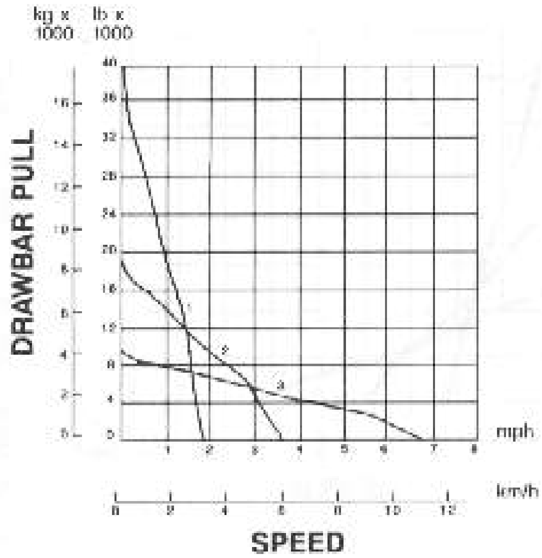
*Operating Weight includes lubricants, coolant, full fuel tank, straight bulldozer, hydraulic controls and fluid, ROPS canopy, and operator
**Height (stripped top) — without ROPS canopy, exhaust, seat back or other easily removed encumbrances.

Note: D8N LGP and D8L LGP are offered as a custom product.

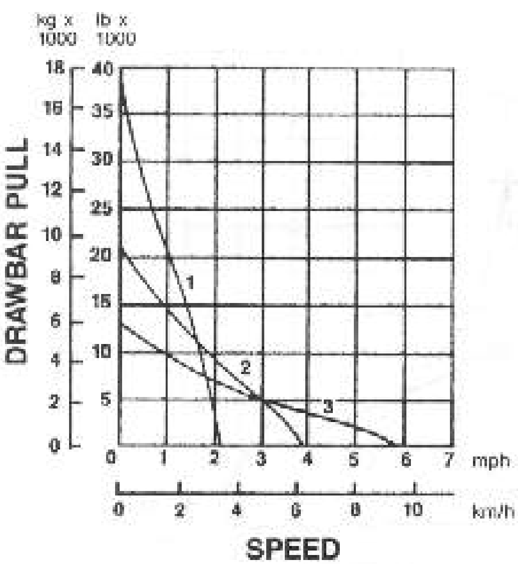
**D3C Series II &
D3C LGP Series II**



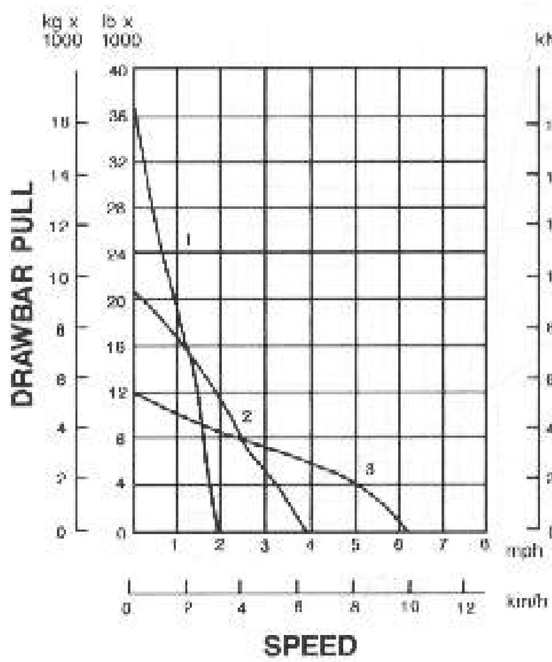
**D4C Series II &
D4C LGP Series II**



D4E



**D5C
D5C LGP**

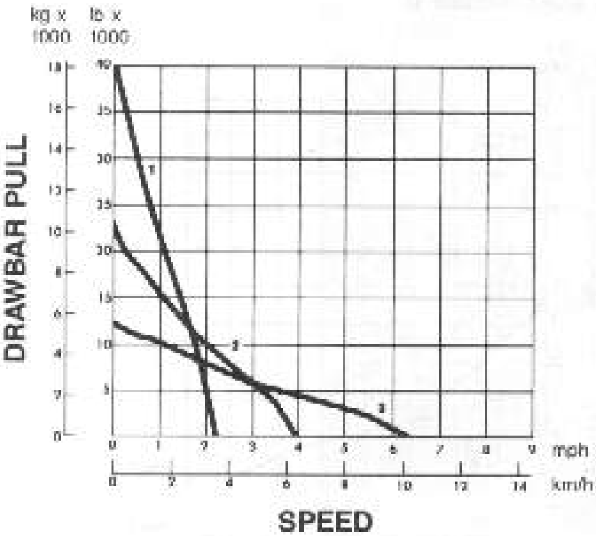


KEY:

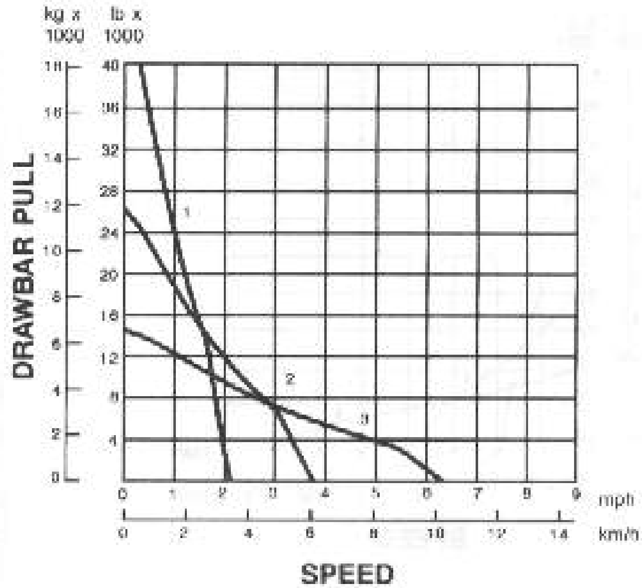
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear

Note: Usable pull will depend upon weight and traction of equipped tractor.

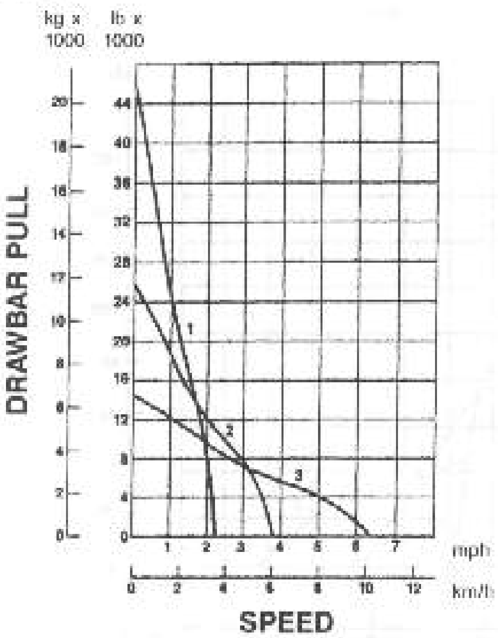
D4H Series II



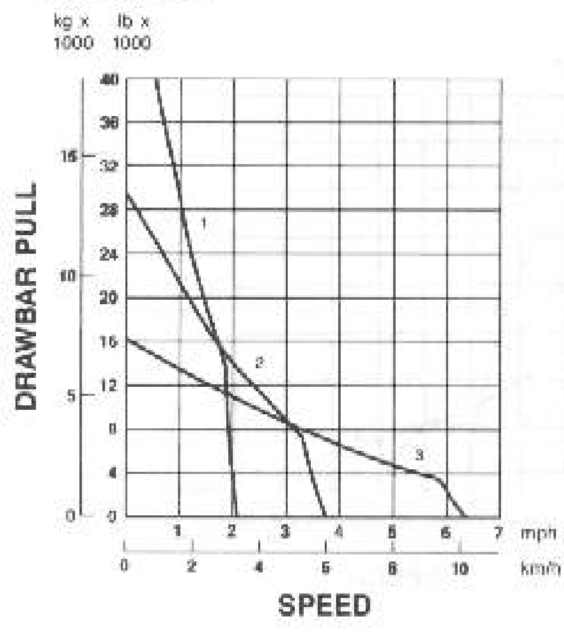
D4H XL Series III
D4H LGP Series III



D5B



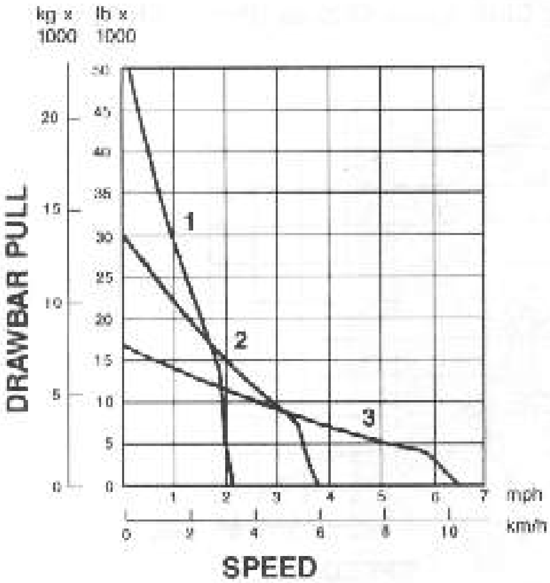
D5H Series II



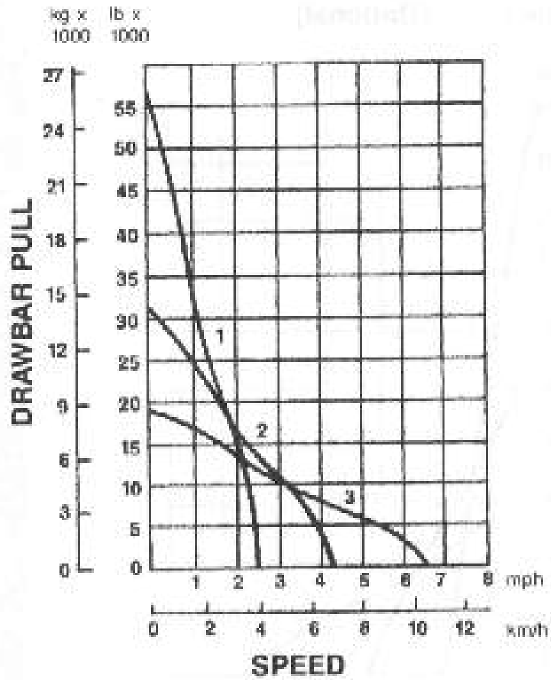
KEY:
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear

Note: Usable pull will depend upon weight and traction of equipped tractor.

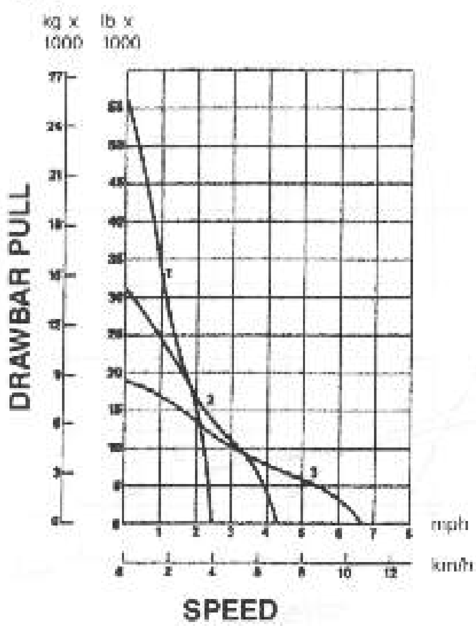
D5H XL Series II
D5H LGP Series II



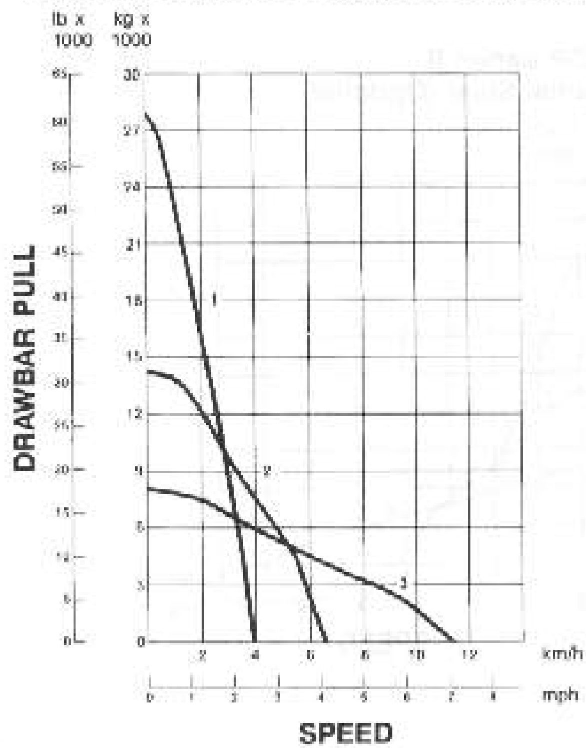
D6D
D6D LGP



D6E



D6H Series II
Steering Clutches & Brakes (Power Shift)

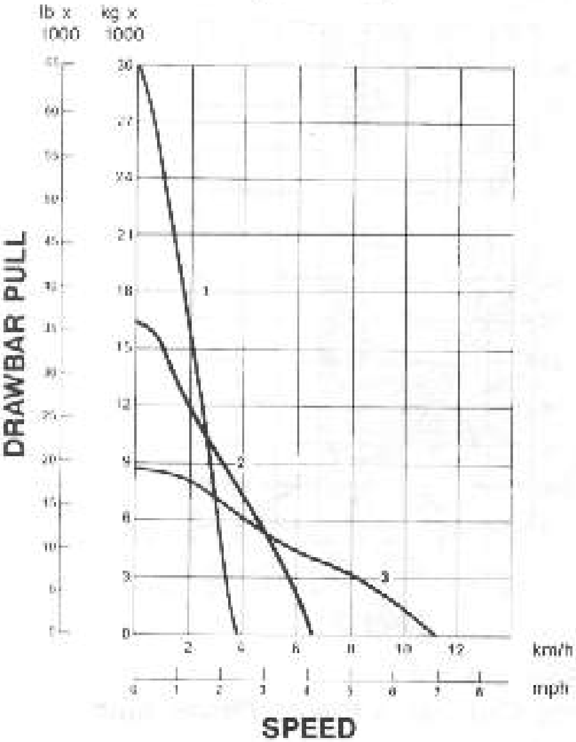


KEY:

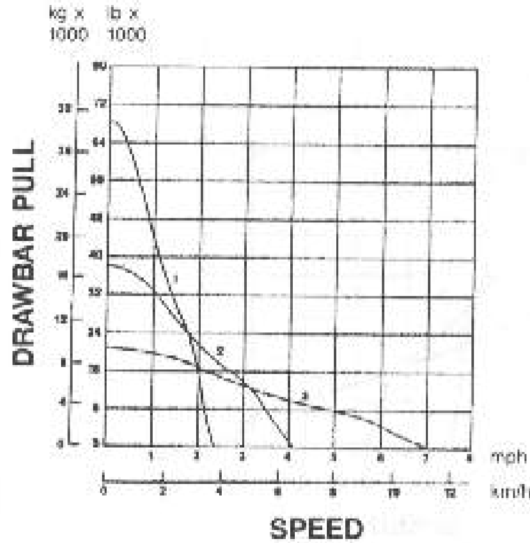
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear

Note: Usable pull will depend upon weight and traction of equipped tractor.

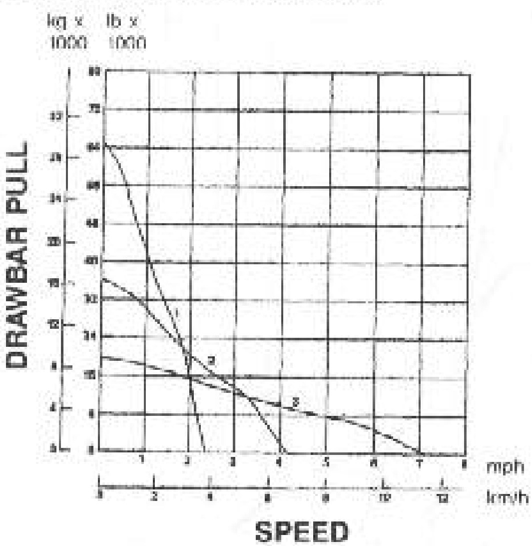
D6H Series II
Differential Steer (Optional)



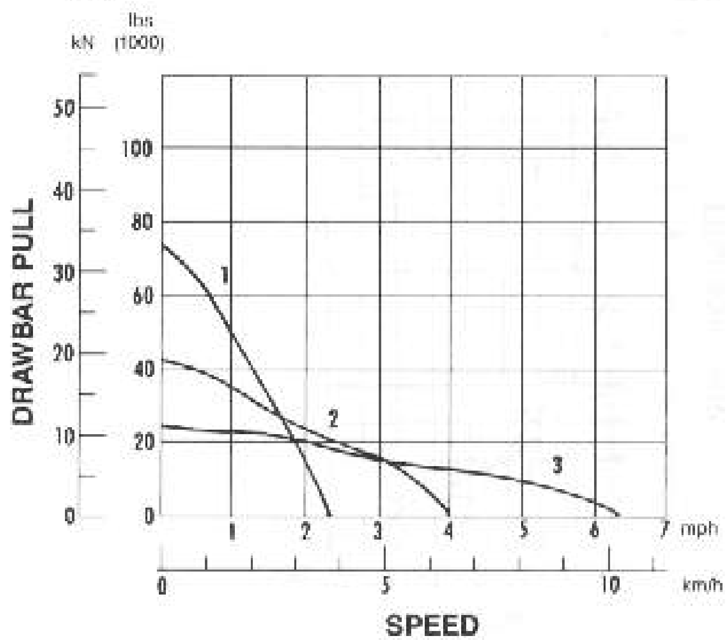
D6H LGP Series II
Steering Clutches & Brakes (Power Shift)



D6H LGP Series II
Differential Steel (Optional)



D7G

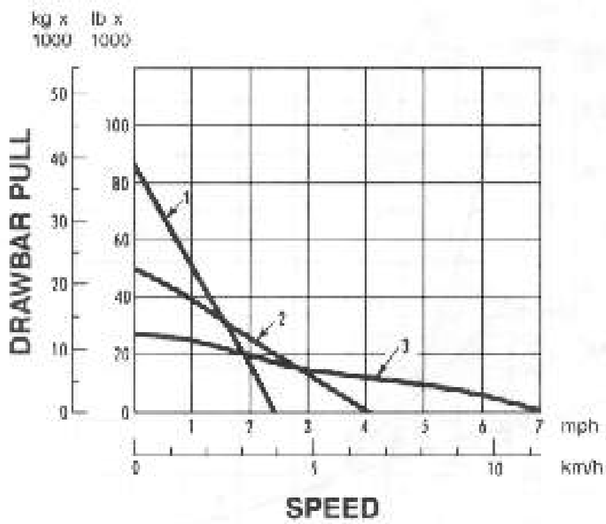


KEY:

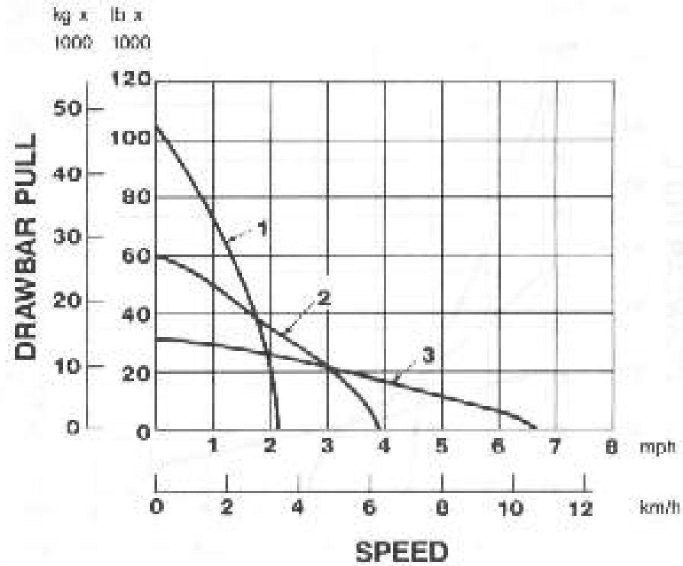
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear

Note: Usable pull will depend upon weight and traction of equipped tractor. Tractors with suspended undercarriage can provide up to 15% more efficient tractive effort than ridge tracked track-type tractors.

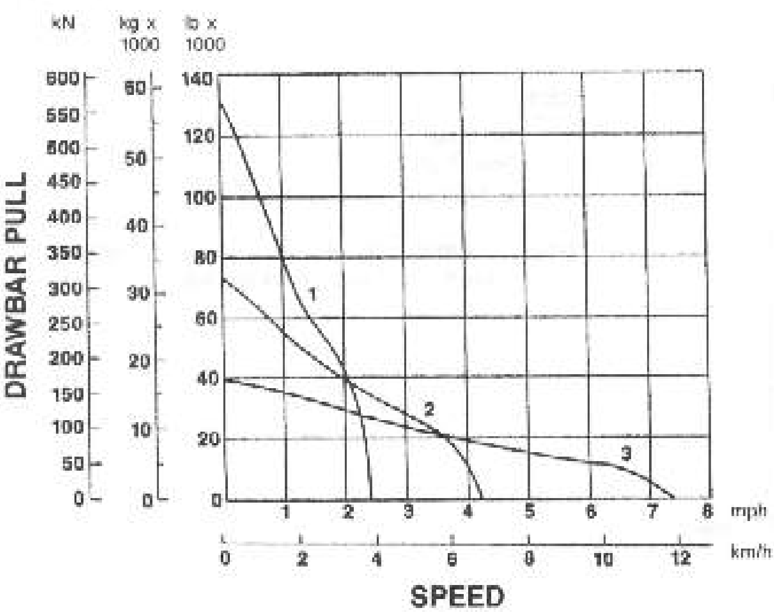
D7H Series II
D7H LGP Series II



D8N
D8N LGP



D8L
D8L LGP

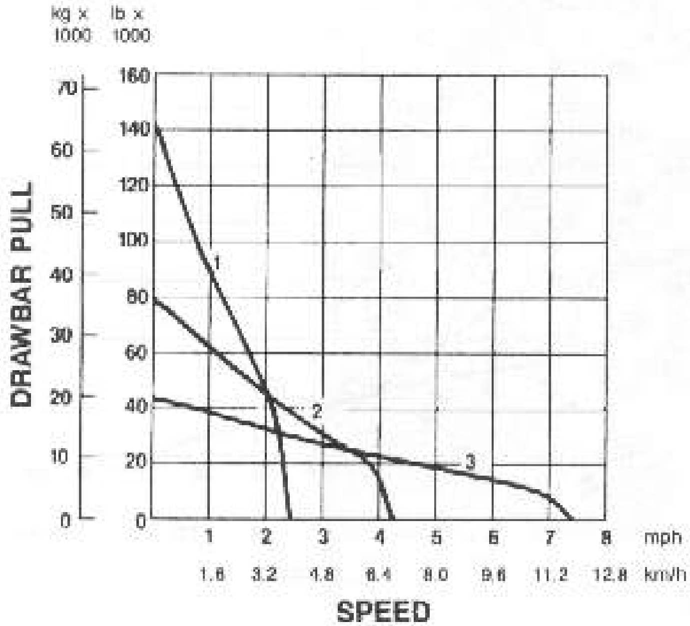


KEY:

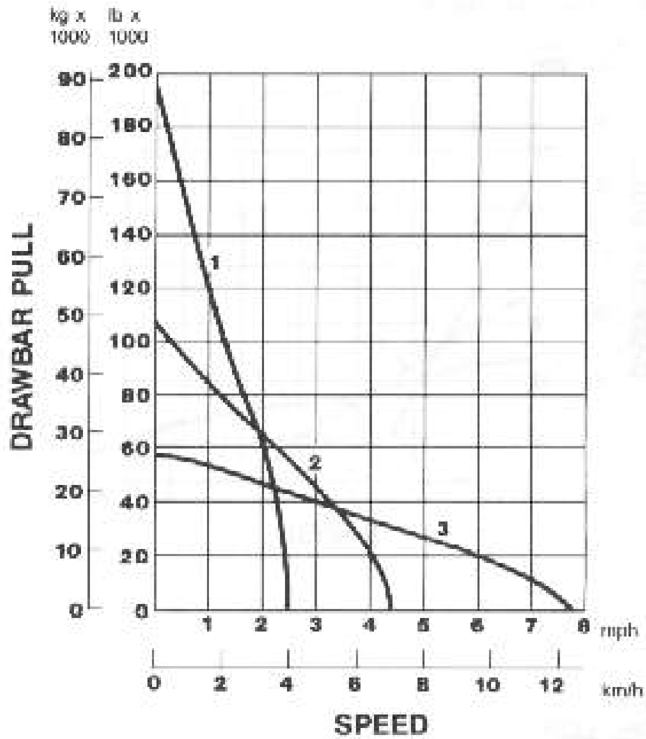
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear

Note: Usable pull will depend upon weight and traction of equipped tractor.

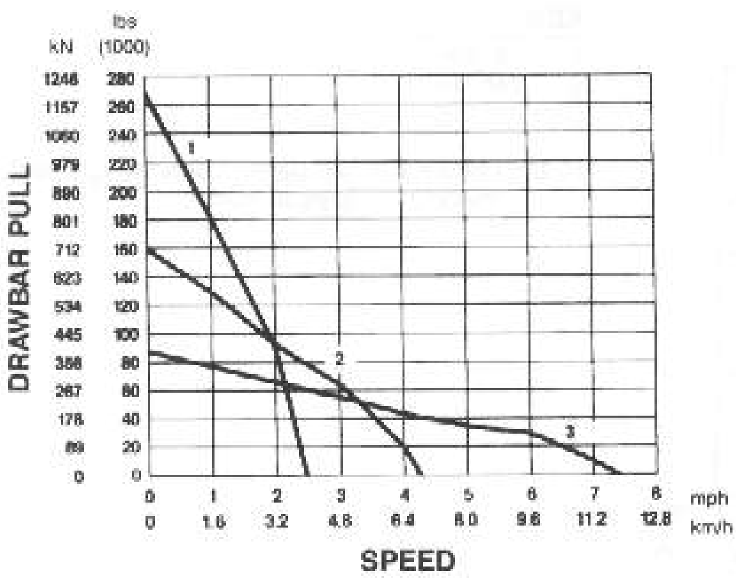
D9N



D10N



D11N



KEY:

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear

Note: Usable pull will depend upon weight and traction of equipped tractor.

TRAVEL SPEED

POWER SHIFT MODEL	D3C* Series II D3C* LGP Series II		D4C Series II LGP		D5C D5C LGP		D4H Series II		D4H XL Series III D4H LGP Series III		D5H Series II		D5H XL Series II D5H LGP Series II	
FORWARD GEAR	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1	3.1	**1.9**	3.2	**2.0**	3.6	**2.0**	3.5	**2.2**	3.4	**2.1**	3.3	**2.1**	3.4	**2.1**
2	5.9	**3.7**	6.0	**3.7**	6.3	**3.9**	6.2	**3.9**	6.0	**3.7**	5.9	**3.7**	6.0	**3.7**
3	10.7	**6.7**	11.1	**6.9**	10.0	**6.2**	10.2	**6.3**	10.2	**6.3**	10.0	**6.2**	10.3	**6.4**
REVERSE GEAR														
1	3.3	**2.0**	3.4	**2.1**	4.2	**2.6**	4.3	**2.7**	4.1	**2.6**	4.2	**2.6**	4.3	**2.7**
2	6.3	**3.9**	6.5	**4.0**	7.5	**4.7**	7.5	**4.7**	7.2	**4.5**	7.3	**4.5**	7.6	**4.7**
3	11.4	**7.1**	11.9	**7.4**	11.9	**7.4**	12.2	**7.6**	12.4	**7.7**	12.5	**7.8**	12.9	**8.0**

POWER SHIFT MODEL	D6H Series II D6H LGP Series II		Differential Steer D6H Series II D6H LGP Series II		D7H Series II D7H LGP Series II		Differential Steer D7H Series II D7H LGP Series II		D8N D8N LGP**		D9N		D10N	
FORWARD GEAR	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1	3.7	**2.3**	3.8	**2.3**	3.9	**2.4**	3.7	**2.3**	3.5	**2.2**	3.9	**2.5**	4.0	**2.5**
2	6.6	**4.1**	6.6	**4.1**	6.8	**4.2**	6.5	**4.0**	6.2	**3.9**	6.9	**4.3**	7.1	**4.4**
3	11.3	**7.0**	11.4	**7.1**	11.9	**7.4**	11.1	**6.9**	10.8	**6.7**	12.1	**7.5**	12.5	**7.7**
REVERSE GEAR														
1	4.8	**3.0**	4.8	**3.0**	4.8	**3.0**	4.6	**2.9**	4.7	**2.8**	4.8	**3.0**	5.0	**3.1**
2	8.4	**5.2**	8.4	**5.2**	8.4	**5.2**	8.0	**5.0**	8.1	**5.0**	8.5	**5.3**	8.9	**5.5**
3	14.4	**8.9**	14.4	**8.9**	14.3	**8.9**	13.7	**8.5**	13.9	**8.7**	14.9	**9.3**	15.6	**9.7**

POWER SHIFT MODEL	D11N		D4E		D5B		D6D D6D LGP		D6E		D7G		D8L D8L LGP**	
FORWARD GEAR	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1	3.9	**2.4**	3.4	**2.1**	3.5	**2.2**	4.0	**2.5**	4.0	**2.5**	3.7	**2.3**	3.9	**2.4**
2	6.8	**4.2**	6.0	**3.7**	6.1	**3.8**	6.9	**4.3**	6.9	**4.3**	6.6	**4.1**	6.8	**4.2**
3	11.6	**7.2**	9.5	**5.9**	10.1	**6.3**	10.8	**6.7**	10.8	**6.7**	10.0	**6.2**	11.9	**7.4**
REVERSE GEAR														
1	4.7	**2.9**	4.0	**2.5**	4.2	**2.6**	4.8	**3.0**	4.8	**3.0**	4.5	**2.8**	4.8	**3.0**
2	8.2	**5.1**	7.1	**4.4**	7.4	**4.6**	8.4	**5.2**	8.4	**5.2**	7.9	**4.9**	8.4	**5.2**
3	14.1	**8.8**	11.4	**7.1**	12.2	**7.6**	12.9	**8.0**	12.9	**8.0**	12.2	**7.6**	14.8	**9.2**

*Speeds of D3C Series II equipped with 3F-1R transmission:
1F = 3.1 km/h (1.9 mph)
2F = 5.6 " (3.5 ")
3F = 11.4 " (7.1 ")
R = 5.1 " (3.2 ")

** D8L and D8N LGP are offered as Custom Products. For more information contact your Caterpillar Dealer.

TRAVEL SPEED

DIRECT DRIVE MODEL	D3C LGP Series II Opt. Trans. with Closely Spaced Working Speeds		D4H Series II Std. Trans.		D4H XL Series III D4H LGP Series III Std. Trans.		D5H Series II Std. Trans.		D5H XL Series II D5H LGP Series II Std. Trans.	
FORWARD GEAR	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1	2.48	**1.5**	2.5	**1.6**	2.7	1.7	2.7	1.7	2.6	**1.6**
2	3.40	**2.1**	3.2	**2.0**	3.4	**2.1**	3.4	**2.1**	3.4	**2.1**
3	4.68	**2.9**	4.2	**2.6**	4.5	**2.8**	4.5	**2.8**	4.5	**2.7**
4	6.45	**4.0**	5.5	**3.42**	5.8	**3.6**	5.8	**3.6**	5.8	**3.6**
5	8.37	**5.2**	7.2	**4.5**	7.6	**4.7**	7.6	**4.7**	7.5	**4.7**
6	—		9.5	**5.9**	9.9	**6.2**	10.0	**6.2**	9.9	**6.2**
REVERSE GEAR										
1	3.06	**1.9**	3.3	**2.1**	3.5	**2.2**	3.3	**2.1**	3.3	**2.1**
2	4.19	**2.6**	4.2	**2.6**	4.5	**2.8**	4.2	**2.6**	4.2	**2.6**
3	5.77	**3.6**	5.6	**3.5**	5.8	**3.6**	5.6	**3.5**	5.5	**3.5**
4	8.05	**5.0**	7.2	**4.5**	7.5	**4.7**	7.2	**4.5**	7.2	**4.5**
5	—		9.5	**5.9**	10.0	**6.2**	9.4	**5.8**	9.4	**5.8**
6	—		12.4	**7.7**	13.0	**8.1**	12.4	**7.7**	12.4	**7.7**

DRAWBAR PULL FORWARD*

FORWARD GEAR	At Rated RPM kN	kg	lb	At Rated RPM kN	kg	lb	At Rated RPM kN	kg	lb	At Rated RPM kN	kg	lb	At Rated RPM kN	kg	lb
1	58.5	5963	**13,147**	73.1	7454	**16,434**	82.3	8387	**18,490**	89.7	9140	**20,150**	98.7	10 061	**22,184**
2	41.8	4262	**9396**	56.1	5715	**12,599**	63.2	6445	**14,209**	68.7	7005	**15,440**	75.8	7725	**17,031**
3	29.4	3004	**6623**	41.5	4235	**9336**	47.0	4792	**10,565**	50.9	5190	**11,440**	56.3	5738	**12,650**
4	19.3	1972	**4348**	30.7	3132	**6904**	34.9	3560	**7850**	37.6	3835	**8450**	41.7	4256	**9384**
5	14.1	1437	**3167**	22.3	2200	**5020**	25.5	2607	**5747**	27.3	2705	**6140**	30.5	3109	**6855**
6		—		15.6	1600	**3520**	18.1	1846	4071	19.1	1950	**4300**	21.5	2195	**4840**
	Max. at Lug			Max. at Lug			Max. at Lug			Max. at Lug			Max. at Lug		
1	75.5	7692	**16,958**	95.7	9767	**21,533**	118.3	12 057	**26,582**	120.1	12 250	**27,000**	140.0	14 270	**31,461**
2	54.2	5524	**12,179**	73.7	7522	**16,583**	91.4	9317	**20,540**	92.7	9435	**20,800**	108.1	11 019	**24,294**
3	38.5	3921	**9644**	55.0	5613	**12,375**	68.5	6985	**15,400**	69.1	7045	**15,530**	81.0	8253	**18,195**
4	25.9	2637	**5814**	41.1	4195	**9248**	51.5	5247	**11,569**	51.6	5260	**11,600**	60.7	6191	**13,650**
5	19.2	1995	**4310**	30.3	3093	**6818**	38.3	3902	**8602**	38.0	3880	**8550**	45.1	4594	**10,129**
6		—		21.7	2115	**4883**	27.7	2829	**6237**	27.3	2780	**6130**	32.6	3322	**7324**

*Specified pull is based on nominal engine performance derated for transmission lube, control and optional implement hydraulic pumps, with corrections made for driveline mechanical efficiency and rolling resistance on firm level ground. Usable pull will depend on particular attachments, and weight and traction of equipped tractor.
Note: For Variable Horsepower Tractor Information, see the Agricultural Tractor section in this handbook.

TRAVEL SPEED

DIRECT DRIVE MODEL	D6H Series II Std. Trans		D6H LGP Series II Std. Trans.		D7H Series II & D7H LGP Series II Std. Trans.		D4E Std. Trans.	
FORWARD GEAR	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1	2.7	**1.7**	2.7	**1.7**	2.7	**1.7**	2.7	**1.7**
2	3.5	**2.2**	3.5	**2.2**	3.5	**2.2**	4.0	**2.5**
3	4.6	**2.9**	4.6	**2.9**	4.6	**2.9**	5.5	**3.4**
4	5.8	**3.6**	5.8	**3.6**	5.8	**3.6**	7.2	**4.5**
5	7.6	**4.7**	7.6	**4.7**	7.6	**4.7**	9.5	**5.9**
6	10.0	**6.2**	10.0	**6.2**	10.0	**6.2**	—	
REVERSE GEAR								
1	3.3	**2.1**	3.3	**2.1**	3.3	**2.1**	3.4	**2.1**
2	4.3	**2.7**	4.3	**2.7**	4.3	**2.7**	4.7	**2.9**
3	5.6	**3.5**	5.6	**3.5**	5.6	**3.5**	6.6	**4.1**
4	7.1	**4.4**	7.1	**4.4**	7.1	**4.4**	8.5	**5.3**
5	9.2	**5.7**	9.2	**5.7**	9.2	**5.7**	11.1	**6.9**
6	12.2	**7.6**	12.2	**7.6**	12.2	**7.6**	—	

DRAWBAR PULL FORWARD*

FORWARD GEAR	At Rated RPM			At Rated RPM			At Rated RPM			At Rated RPM		
	kN	kg	lb	kN	kg	lb	kN	kg	lb	kN	kg	lb
1	122.5	12 500	**27,530**	126.9	12 930	**28,520**	165.2	16 834	**37,113**	63.8	6500	**14,330**
2	93.2	9520	**20,960**	96.7	9850	**21,730**	126.2	12 861	**28,353**	43.5	4430	**9770**
3	70.0	7140	**15,740**	72.7	7410	**16,330**	95.2	9703	**21,390**	29.6	3020	**6660**
4	53.3	5440	**11,990**	55.4	5650	**12,460**	73.0	7436	**16,394**	21.3	2170	**4780**
5	39.3	4010	**8830**	40.9	4170	**9190**	54.2	5522	**12,173**	14.8	1510	**3330**
6	27.6	2820	**6210**	28.8	2940	**6480**	38.7	3940	**8686**		—	
	Max. at Lug			Max. at Lug			Max. at Lug			Max. at Lug		
1	159.0	16 220	**35,750**	168.8	17 200	**37,930**	218.0	22 206	**48,995**	76.9	7840	**17,285**
2	121.8	12 410	**27,340**	129.2	13 170	**29,030**	166.7	16 994	**37,465**	52.7	5375	**11,850**
3	91.9	9370	**20,650**	97.7	9960	**21,960**	126.4	12 888	**28,412**	36.2	3695	**8145**
4	70.5	7200	**15,860**	95.1	7060	**15,880**	97.5	9941	**21,916**	26.4	2690	**5930**
5	52.5	5360	**11,810**	56.1	5710	**12,600**	73.1	7451	**16,427**	18.7	1910	**4210**
6	37.6	3840	**8460**	40.3	4100	**9050**	53.0	5395	**11,894**		—	

*Specified pull is based on nominal engine performance derated for transmission lube, control and optional implement hydraulic pumps, with corrections made for driveline mechanical efficiency and rolling resistance on firm level ground. Usable pull will depend on particular attachments, and weight and traction of equipped tractor. Usable pull will depend upon traction and weight of tractor.

Note: For Variable Horsepower Tractor Information, see the Agricultural Tractor section in this handbook.

TRAVEL SPEED

DIRECT DRIVE MODEL	D5B Std. Trans.			D6D & D6D LGP Std. Trans.			D7G Std. Trans.		D7G Opt. Trans.	
FORWARD GEAR	km/h	km/h	mph	km/h	mph	mph	km/h	mph	km/h	mph
1	2.7		1.7	2.7		1.7	2.6	1.6	3.5	2.2
2	4.2		2.6	4.0		2.5	3.7	2.3	4.8	3.0
3	5.8		3.6	5.6		3.5	5.3	3.3	5.6	3.5
4	8.0		5.0	7.9		4.9	7.9	4.9	6.4	4.0
5	11.1		6.9	11.1		6.9	10.3	6.4	7.2	4.5
6		—			—		—		8.2	5.1
REVERSE GEAR										
1	3.4		2.1	3.4		2.1	3.1	1.9	4.0	2.5
2	5.3		3.3	4.8		3.0	4.3	2.7	5.6	3.5
3	7.4		4.6	6.9		4.3	6.3	3.9	6.8	4.2
4	10.1		6.3	9.7		6.0	9.3	5.8	7.6	4.7
5		—			—		—			
6		—			—		—		—	

DRAWBAR PULL FORWARD*

FORWARD GEAR	D5B kN	D5B kg	D5B lb	D6D kN	D6D kg	D6D lb	D7G Std. kN	D7G Std. kg	D7G Std. lb	D7G Opt. kN	D7G Opt. kg	D7G Opt. lb
	At Rated RPM			At Rated RPM			At Rated RPM			At Rated RPM		
1	86.1	8770	**19,340**	112.9	11 500	**25,360**	163.0	16 610	**36,630**	118.4	12 560	**27,680**
2	54.0	5500	**12,130**	76.1	7750	**17,090**	109.9	11 200	**24,690**	83.5	8700	**19,190**
3	36.8	3750	**8270**	50.8	5180	**11,420**	73.4	7480	**16,500**	69.1	7110	**15,680**
4	24.9	2540	**5600**	32.9	3350	**7385**	46.9	4780	**10,540**	60.5	6170	**13,600**
5	16.3	1660	**3660**	20.5	2090	**4610**	34.5	3510	**7750**	51.7	5190	**11,450**
6		—			—			—		45.1	4460	**9840**
	Max. at Lug			Max. at Lug			Max. at Lug			Max. at Lug		
1	109.2	11 130	**24,540**	143.6	14 640	**32,280**	209.8	21 390	**47,150**	153.0	16 080	**35,440**
2	69.1	7040	**15,525**	97.6	9950	**21,940**	142.2	14 500	**31,960**	108.7	11 260	**24,830**
3	47.6	4850	**10,695**	66.1	6740	**14,880**	95.9	9770	**21,550**	90.4	9270	**20,440**
4	32.9	3350	**7385**	43.7	4460	**9810**	62.1	6330	**13,950**	79.5	8040	**17,840**
5	22.1	2250	**4960**	28.3	2880	**6350**	46.3	4710	**10,400**	68.3	6870	**15,150**
6		—			—			—		59.9	5960	**13,130**

*Specified pull is based on nominal engine performance derated for transmission lube, control and optional implement hydraulic pumps, with corrections made for driveline mechanical efficiency and rolling resistance on firm level ground. Usable pull will depend on particular attachments, and weight and traction of equipped tractor. Usable pull will depend upon traction and weight of tractor.
Note: For Variable Horsepower Tractor Information, see the Agricultural Tractor section in this handbook.

GROUND PRESSURES

Pressures computed from operating weights given earlier in this section in the specifications tables.

MODEL	SHOE WIDTH mm	SHOE WIDTH in	CONTACT AREA m²	CONTACT AREA in²	GROUND PRESSURE kPa	GROUND PRESSURE psi
D3C Series II ◄	356	14	1.35	2097	52	7.2
	406	16	1.54	2394	44	6.45
D3C LGP Series II	635	25	2.61	4045	29	4.2
D3C LGP-S Series II	990	39	4.85	7524	17	2.52
D4C Series II	406	16	1.67	2589	44	6.44
D4C LGP Series II	635	25	2.61	4045	30	4.3
D5C	457	18	1.92	3036	42.3	6.14
D5C LGP	660	26	2.83	4389	31.0	4.51
D4H Series II	360	14	1.59	2464	63	9.1
	410	16	1.82	2826	55	8.0
◄	460	18	2.05	3168	49	7.1
D4H XL Series III ◄	510	20	2.45	3799	45	6.37
	560	22	2.69	4172	41	5.87
D4H LGP	610	24	3.20	4954	34	4.90
Series III ◄	760	30	4.03	6252	29	4.19
	770	30	3.98	6180	29.2	4.24
D5H Series II	460	18	2.11	3276	50.9	8.69
◄	510	20	2.35	3646	54.4	7.9
D5H XL Series II	560	22	2.78	4309	50	7.10
◄	600	24	3.63	4689	47	6.67
D5H LGP	710	28	4.43	6866	32	4.70
Series II ◄	860	34	5.37	8320	29.4	4.18
	865	34	5.40	8369	29.3	4.16
D6H Series II	508	20	2.67	4140	65.0	9.44
◄	560	22	2.94	4564	59.0	8.56
	610	24	3.21	4971	54.2	7.86
D6H Series II	508	20	2.82	4380	62.0	9.00
(Extend U/C) ◄	560	22	3.10	4804	56.6	8.21
	610	24	3.39	5253	51.7	7.51
D6H LGP	760	30	4.9	7689	38	5.54
	610	24	3.98	6170	48.6	7.06
Series II ◄	915	36	5.97	9255	32.5	4.71
	1000	39	6.53	10,129	29.6	4.30
D7H Series II	510	20	2.94	4560	80.6	11.7
◄	560	22	3.24	5016	73.0	10.6
	610	24	3.53	5472	67.2	9.8
	660	26	3.82	5928	61.6	8.94
D7H Series II	560	22	3.43	5324	69.4	10.07
(Extended U/C) ◄	610	24	3.75	5808	63.7	9.24
	660	26	4.06	6292	58.7	8.52

◄Standard Shoe

MODEL	SHOE WIDTH mm	SHOE WIDTH in	CONTACT AREA m²	CONTACT AREA in²	GROUND PRESSURE kPa	GROUND PRESSURE psi
D7H LGP	760	30	4.8	7504	53	7.46
Series II	915	36	5.83	9029	43.5	6.32
D8N ◄	560	22	3.59	5565	100.6	14.6
	610	24	3.91	6062	92.3	13.4
	660	26	4.23	6559	85.4	12.4
	710	28	4.55	7056	79.2	11.5
D8N LGP*	965	38	6.2	9576	53.7	7.8
D9N	560	22	3.89	6033	106.11	15.39
◄	610	24	4.24	6571	98.41	14.27
	685	27	4.76	7379	88.76	12.87
	760	30	5.28	8187	79.06	11.47
D10N ◄	610	24	4.73	7326	119.12	17.28
	710	28	5.50	8527	103.55	15.02
	860	31.5	6.66	10,328	86.31	12.52
D11N ◄	710	28	6.32	9800	149	21.6
	810	32	7.20	11,200	130	18.9
	915	36	8.13	12,600	116	16.8
D4E ◄	406	16	1.49	2310	60	8.70
	457	18	1.67	2590	53	7.69
	508	20	1.86	2883	48	6.96
D5B	406	16	1.77	2745	62	9.0
◄	457	18	1.99	3085	55	7.98
	508	20	2.21	3426	49.8	7.22
	560	22	2.44	3784	45	6.53
D6D ◄	457	18	2.17	3364	66	9.42
	508	20	2.41	3736	59	8.56
	560	22	2.65	4108	53	7.68
	610	24	2.89	4480	49	7.10
D6E	457	18	2.43	3766	60	8.70
◄	508	20	2.71	4200	54	7.83
	560	22	2.98	4619	49	7.10
D7G ◄	508	20	2.76	4280	73	10.6
	559	22	3.04	4708	66	9.6
	610	24	3.31	5136	60	8.8
D8L ◄	560	22	3.60	5580	103.8	15.05
	610	24	3.92	6076	95.3	13.82
	660	26	4.24	6572	88	12.76
	711	28	4.57	7084	81.7	11.85
D8L LGP*	914	36	5.87	9098	71	10.3

◄Standard shoe. *Offered as a Custom Product.

NOTE: Ground contact area = width of track shoe × length of track on ground × 2.

$$\text{Ground pressure} = \frac{\text{operating weight}}{\text{ground contact area}}$$

EXTREME SLOPE OPERATION

The following table gives the MAXIMUM fore and aft slope on which each tractor will have proper lubrication. Consult Operation & Maintenance Manual (if applicable) for POWER TRAIN fluid level overfill requirements for operation on extreme slopes. Extreme slope operation is anytime the slope exceeds 25° (47%).

The ENGINE should never be overfilled with oil. This may lead to rapid overheating. For extreme slope operation, engine oil should be maintained at the full mark.

NOTE: Both ENGINE and POWER TRAIN fluid levels should be checked on level ground before working sidehills and slopes.

Tractor	D3C Series II	D4C Series II	D5C	D4E	D4H Series II	D5B & D5H Series II
Percent Grade or Degrees slope	100 45	100 45	100 45	92 45	100 45	100 45

Tractor	D6D, D6E & D6H Series II	D7G & D7H Series II	D8L & D8N	D9N	D10N	D11N
Percent Grade or Degrees slope	100 45	100 45*	100 45	100 45	100 45	100 45

When working sidehills and slopes, consideration should be given to the following important points:

- Speed of travel — At higher speeds, inertia forces tend to make the tractor less stable.
- Roughness of terrain or surface — Ample allowance should be made where the terrain or surface is uneven.
- Mounted equipment — Bulldozers, sidebooms, winches, and other mounted equipment cause the tractor to balance differently.
- Nature of surface — New earthen fills may give way with the weight of the tractor. Rocky surfaces may promote side slipping of tractor.
- Track slippage due to excessive loads — This may cause downhill track to "dig in," increasing angle of tractor.
- Implements hitched to the drawbar — This may decrease weight on uphill track, e.g., logging arch, two-wheel wagon.
- Height of hitch on tractor — When a high draw bar is used the tractor is less stable than with the standard drawbar.
- Width of shoes — Wide track shoes tend to decrease "digging in", hence tractor is more stable.
- Operated equipment — Be aware of the stability and other performance features of the equipment operated by the tractor.

*The D7G requires a 23 L (6 gal) transmission overfill for acceptable operation on slopes above 25° (47%).

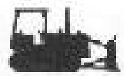
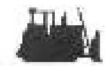
NOTE: Safe operation on steep slopes may require special machine maintenance as well as excellent operator skill and proper equipment for the specific application. Consult Operation & Maintenance Manual (if applicable) for proper fluid level requirements.

WASTE DISPOSAL TRACK-TYPE TRACTORS

CONTENTS

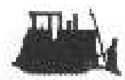
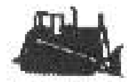
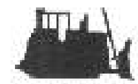
Features:

- **Hinged heavy duty radiator** doors are guarded to prevent excessive trash build-up. Quick release handles allow easy access for cleaning.
- **Low fin density radiator** (optional) helps reduce radiator plugging.
- **Final drive, pivot shaft, and idler seal guarding** helps prevent wire, cable and similar material from winding around components and damaging seals.
- **Striker bars for front, rear and ripper** (all optional) keep trash from damaging fenders, fuel and hydraulic tanks or other sheet metal.
- **Front lighting protection.** D8N lights are ROPS mounted away from debris. D9N fender lights are guarded.
- **Elevated sprocket** removes final drives from wear environment and eliminates impact loading for extended power train life.
- **Sheet metal guarding** near track and on dozer tilt hoses.
- **Heavy duty steps and grab handles** resist damage from landfill debris.
- **Trapezoidal-shaped center hole track shoes (optional)** help keep track clean during machine operation.
- **Blade trash racks (optional)** prevent blade spill-over and damage to cylinders or radiator guard.
- **75 amp alternator** on D8N, D9N insures adequate current is available to maintain battery and operate accessories.
- **Elevated prescreener** to remove engine air inlet from debris environment. Larger surface area to resist plugging.
- **ROPS mounted air conditioning (optional)** to eliminate condensor core plugging. Provides full utilization of jacket water cooling system by avoiding additional heat load from radiator mounted condensor.

MODEL	 D6E WDA		 D6H WDA Series II		 D7H WDA Series II	
Flywheel Power	116 kW	**155 HP**	123 kW	**165 HP**	160 kW	**215 HP**
Operating Weight (PS)*	14 960 kg	**32,987 lb**	18 191 kg	**40,104 lb**	24 948 kg	**55,000 lb**
Engine Model	**3306**		**3306**		**3306**	
Rated Engine RPM	**1900**		**1900**		**2100**	
No. of Cylinders	6		**6**		**6**	
Bore	121 mm	**4.75"**	121 mm	**4.75"**	121 mm	**4.75"**
Stroke	152 mm	**6"**	152 mm	**6"**	152 mm	**6"**
Displacement	10.5 L	**638 in³**	10.5 L	**638 in³**	10.5 L	**638 in³**
Track Rollers (Each Side)	**7**		**6**		**7**	
Width of Standard Track Shoe	560 mm	**22"**	560 mm	**22"**	560 mm	**22"**
Length of Track on Ground	2.63 m	**8'9"**	2.62 m	**8'7.5"**	2.90 m	**9'6"**
Ground Contact Area (W/Std. Shoe)	2.98 m²	**4619 in²**	2.94 m²	**4564 in²**	3.24 m²	**5016 in²**
Track Gauge	1.88 m	**6'2"**	1.88 m	**6'2"**	1.98 m	**6'5"**
GENERAL DIMENSIONS:						
Height (Stripped Top)**	2.03 m	**6'8"**	2.26 m	**7'5"**	2.44 m	**8'0"**
Height (To Top of Cab ROPS)	3.06 m	**10'0"**	3.11 m	**10'2.25"**	3.42 m	**11'3"**
Overall Length (S Blade)	4.80 m	**15'9"**	5.01 m	**16'5"**	5.56 m	**18'3"**
(W/O Blade)	3.73 m	**12'3"**	—		—	
Width (Over Trunnion)	—		2.64 m	**8'8"**	2.87 m	**9'6"**
(W/O Trunnion)	2.56 m	**8'4"**	—		2.54 m	**8'4"**
Ground Clearance	—		377 mm	**14.8"**	406 mm	**16"**
Blade Types and Widths:						
Straight	3.2 m	**10'6"**	3.2 m	**10'6"**	3.81 m	**12'6"**
Semi-Universal	—		3.24 m	**10'7.5"**	3.66 m	**12'0"**
Universal	—		—		3.96 m	**13'0"**
Fuel Tank Refill Capacity	295 L	**78 U.S. gal**	337 L	**89 U.S. gal**	488 L	**129 U.S. gal**

* D6H Series II Operating Weight includes lubricants, coolant, full fuel tank, hydraulic controls, 6SU/tilt, 610 mm **(24")** trash rack, 560 mm **(22")** shoes, ROPS canopy, engine enclosure, extreme service crankcase guard, fuel tank guard, hydraulic cooler, prescreener, six lights, hinged HD radiator guard, lower radiator guarding, final drive seal guards, idler seal guards, engine compartment guarding, tilt cylinder guards.
D7H Series II Operating Weight includes lubricants, coolant, full fuel tank, hydraulic controls, 7SU/tilt, 610 mm **(24")** trash rack, 610 mm **(24")** shoes, ROPS canopy, engine enclosure, extreme service crankcase guard, fuel tank guard, hydraulic cooler, prescreener, six lights, hinged HD radiator guard, lower radiator guarding, final drive seal guards, idler seal guards, engine compartment guarding, tilt cylinder guards.

** Height with ROPS canopy, exhaust pipe, seat or all easily removed encumbrances. Add 71.1 mm **(2.8")** for grouser tips on D7H Series II.

MODEL	 D8N WDA		 D8L WDA		 D9N WDA	
Flywheel Power	212 kW	**285 HP**	250 kW	**335 HP**	276 kW	**370 HP**
Operating Weight (PS)*	34 645 kg	**76,375 lb**	37 305 kg	**82,243 lb**	46 815 kg	**103,209 lb**
Engine Model	**3406**		**3408**		**3408**	
Rated Engine RPM	**2100**		**1900**		**1900**	
No. of Cylinders	**6**		**8**		**8**	
Bore	137 mm	**5.4"**	137 mm	**5.4"**	137 mm	**5.4"**
Stroke	165 mm	**6.5"**	152 mm	**6"**	152 mm	**6"**
Displacement	14.6 L	**893 in^3**	18 L	**1099 in^3**	18 L	**1099 in^3**
Track Rollers (Each Side)	**8**		**8**		**8**	
Width of Standard Track Shoe	560 mm	**22"**	560 mm	**22"**	610 mm	**24"**
Length of Track on Ground	3.21 m	**10'6.5"**	3.21 m	**10'6.5"**	3.47 m	**11'4.8"**
Ground Contact Area (W/Std. Shoe)	3.59 m^2	**5553 in^2**	3.59 m^2	**5565 in^2**	4.24 m^2	**6571 in^2**
Track Gauge	2.08 m	**6'8"**	2.20 m	**7'2.6"**	2.25 m	**7'4.6"**
GENERAL DIMENSIONS:						
Height (Stripped Top)**	2.59 m	**8'6"**	2.90 m	**9'6"**	2.93 m	**9'7.3"**
Height (To Top of Cab ROPS)	3.42 m	**11'3"**	3.89 m	**12'9"**	3.91 m	**12'9.8"**
Overall Length (S Blade)	6.24 m	**20'6"**	6.23 m	**20'5"**	6.87 m	**22'6.4"**
(W/O Blade)	4.88 m	**16'2"**	4.88 m	**16'2"**	5.17 m	**16'11.5"**
Width (Over Trunnion)	2.94 m	**9'8"**	2.84 m	**9'4"**	3.25 m	**10'8"**
(W/O Trunnion)***	—	—	—	—	—	—
Ground Clearance	536 mm	**21.1"**	457 mm	**18"**	505 mm	**19.9"**
Blade Types and Widths:						
Straight	3.94 m	**12'11"**	4.17 m	**13'8"**	4.32 m	**14'1.9"**
Universal	4.26 m	**14'0"**	—	—	4.66 m	**15'3.4"**
Fuel Tank Refill Capacity	481 L	**127 U.S. gal**	753L	**199 U.S. gal**	792 L	**209 U.S. gal**

*D8N Operating Weight includes lubricants, coolant, full fuel tank, hydraulic controls, 8S with 762 mm (**30"**) trash rack, 660 mm (**26"**) shoes, and ROPS — FOPS canopy. Also included are special radiator core and ejector fan, drawbar, engine enclosures, fuel tank guard, extreme service crankcase guard, HD hinged radiator guard, higher prescreener, front & rear striker bars and operator.
D9N Operating Weight includes lubricants, coolant, full fuel tank, hydraulic controls, 9SU with 914 mm (**36"**) trash rack, 685 mm (**27"**) shoes, and ROPS — FOPS canopy. Also included are special radiator core and ejector fan, fuel tank guards, engine enclosures, extreme service crankcase guard, HD hinged radiator guard, higher prescreener, front & rear striker bars and operator.

**Height with ROPS canopy, exhaust pipe, seat or all easily removed encumbrances.

***D8N-660 mm (**26"**) track shoes.
D9N-685 mm (**27"**) track shoes.

MODEL	D6E WDA		D6H WDA Series II			
Type	6S		6S		6SU	
Blade Capacities*	7.0 m³	**9.17 yd³**	8.6 m³	**11.2 yd³**	11.2 m³	**14.6 yd³**
Blade Weight	1300 kg	**2860 lb**	2831 kg	**6242 lb**	2920 kg	**6438 lb**
Tractor & Dozer Dimensions						
Length Blade Straight	5.01 m	**16'5.3"**	5.11 m	**16'9"**	5.30 m	**17'5"**
Length Blade Angled	—		—		—	
Width Blade Angled	—		—		—	
Width C Frame Only	—		—		—	
Blade Dimensions						
Width including std. end bits	3200 mm	**10'6"**	3355 mm	**11'0"**	3262 mm	**10'8"**
Height	1730 mm	**5'7"**	1866 mm	**6'1"**	2019 mm	**6'7"**
Maximum Dig Depth	650 mm	**25.6"**	473 mm	**18.6"**	473 mm	**18.6"**
Ground Clearance at full raise	850 mm	**32"**	1104 mm	**43.5"**	1104 mm	**43.5"**
Maximum Manual Tilt	—		—		—	
Maximum Pitch	—		—		—	
Maximum Hydraulic Tilt	500 mm	**18.4"**	765 mm	**30.1"**	744 mm	**29.3"**
Blade Angle	—		—		—	

MODEL	D7H WDA Series II					
Type	7S		7SU		7U	
Blade Capacities*	10.9 m³	**14.2 yd³**	14.0 m³	**18.4 yd³**	16.8 m³	**22.0 yd³**
Blade Weight	3843 kg	**8473 lb**	3985 kg	**8784 lb**	4234 kg	**9333 lb**
Tractor & Dozer Dimensions						
Length Blade Straight	5806 mm	**19'1"**	6029 mm	**19'9"**	6271 mm	**20'7"**
Length Blade Angled	—		—		—	
Width Blade Angled	—		—		—	
Width C Frame Only	—		—		—	
Blade Dimensions						
Width including std. end bits	3904 mm	**12'10"**	3690 mm	**12'1"**	3980 mm	**13'1"**
Height	1971 mm	**6'6"**	2133 mm	**7'0"**	2162 mm	**7'1"**
Maximum Dig Depth	527 mm	**20.7"**	527 mm	**20.7"**	527 mm	**20.7"**
Ground Clearance at full raise	1145 mm	**45.1"**	1145 mm	**45.1"**	1145 mm	**45.1"**
Maximum Manual Tilt	—		—		—	
Maximum Pitch	—		—		—	
Maximum Hydraulic Tilt	845 mm	**33.3"**	861 mm	**33.9"**	799 mm	**31.5"**
Blade Angle	—		—		—	

*Blade capacities, weights and heights include 610 mm (24") trash rack on D6H Series II blades and D7H Series II blades, 762 mm (30") trash rack on D8N blades and 914 mm (36") trash rack on D9N blades.

MODEL	D8N WDA				D8L WDA	
Type	8SU		8U		8SU	
Blade Capacities*	19.9 m³	**26.0 yd³**	24.4 m³	**31.9 yd³**	21.48 m³	**28.1 yd³**
Blade Weight	5295 kg	**11,674 lb**	5934 kg	**13,082 lb**	6198 kg	**13,663 lb**
Tractor & Dozer Dimensions						
Length Blade Straight	6.39 m	**21'0"**	6.79 m	**22'3"**	6.55 m	**21'6"**
Length Blade Angled	—		—		—	
Width Blade Angled	—		—		—	
Width C Frame Only	—		—		—	
Blade Dimensions						
Width including std. end bits	3942 mm	**12'11"**	4262 mm	**14'0"**	4166 mm	**13'8"**
Height	3465 mm	**8'1"**	2646 mm	**8'8"**	2483 mm	**8'8"**
Maximum Dig Depth	582 mm	**22.9"**	582 mm	**22.9"**	657 mm	**26"**
Ground Clearance at full raise	1231 mm	**48.5"**	1231 mm	**48.5"**	1295 mm	**51"**
Maximum Manual Tilt	—		—		—	
Maximum Pitch	—		—		—	
Maximum Hydraulic Tilt	951 mm	**37.4"**	1028 mm	**40.5"**	795 mm	**30"**
Blade Angle	—		—		—	

MODEL	D9N WDA			
Type	9SU		9U	
Blade Capacities*	27.1 m³	**35.5 yd³**	32.0 m³	**41.8 yd³**
Blade Weight	5803 kg	**12,793 lb**	6706 kg	**14,784 lb**
Tractor & Dozer Dimensions				
Length Blade Straight	6.87 mm	**22'6"**	7.17 mm	**23'6"**
Length Blade Angled	—		—	
Width Blade Angled	—		—	
Width C Frame Only	—		—	
Blade Dimensions				
Width including std. end bits	4316 mm	**14'2"**	4658 mm	**15'3"**
Height	2721 mm	**8'11"**	2723 mm	**8'11"**
Maximum Dig Depth	619 mm	**24.4"**	619 mm	**24.4"**
Ground Clearance at full raise	1368 mm	**53.9"**	1368 mm	**53.9"**
Maximum Manual Tilt	—		—	
Maximum Pitch	—		—	
Maximum Hydraulic Tilt	940 mm	**37.0"**	1014 mm	**39.9"**
Blade Angle	—		—	

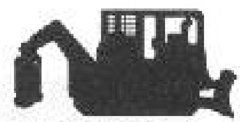
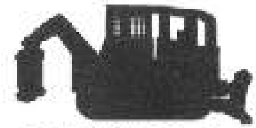
*Blade capacities, weights and heights include 610 mm (24") trash rack on D6H Series II blades and D7H Series II blades, 762 mm (30") trash rack on D8N blades and 914 mm (36") trash rack on D9N blades.

TRACK SKIDDERS

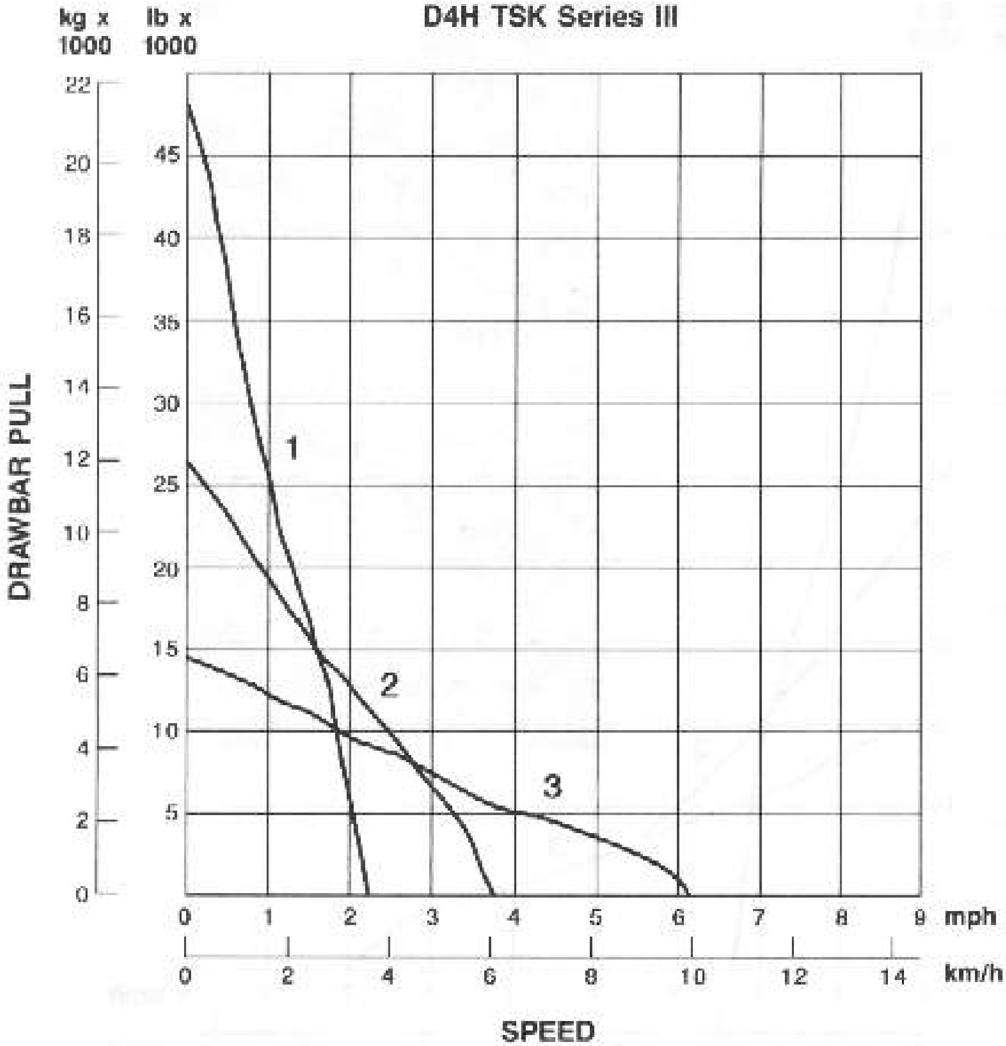
CONTENTS

Features (D4H TSK Series III) and (D5H TSK Series II):

- **Dual Purpose Versatility** — A tractor for both skidding and dozing applications.
- **Exceptional Balance** — Roller frames extended significantly to the rear for a more forward center of gravity, balanced for skidding and dozing.
- **Better Ground Clearance** — a minimum of 559 mm (22") and no diagonal braces — less chance of getting hung up on a rock, stump, or in soft ground.
- **Excellent Side Slope Capabilities** — Exceptional balance and stability. More track on ground and wider gauge than conventional tractors.
- **Improved Flotation** — more track on the ground and wider track shoes for effective log skidding where conventional tractors have difficulty.
- **Superior Component Durability** — Final drives raised above the work area isolating them and other power train components from ground impact shocks, moisture, and abrasive material.
- **Reliable and Durable** — Built to withstand logging conditions.
- **Total Customer Support** — Unmatched in the industry!

				
MODEL	**D4H TSK Series III**		**D5H TSK Series II**	
Flywheel Power	78 kW	**105 HP**	97 kW	**130 HP**
Operating Weight* (Cable)	13 975 kg	**30,745 lb**	17 677 kg	**38,889 lb**
(Grapple)	15 096 kg	**33,211 lb**	18 801 kg	**41,362 lb**
Engine Model	**3304**		**3304**	
Rated Engine RPM	**2200**		**2200**	
No. of Cylinders	**4**		**4**	
Bore	121 mm	**4.75"**	121 mm	**4.75"**
Stroke	152 mm	**6"**	152 mm	**6"**
Displacement	7 L	**425 in³**	7 L	**425 in³**
Track Rollers (Each Side)	**7**		**7**	
Width of Standard Track Shoe	460 mm	**18"**	510 mm	**20"**
Length of Track on Ground	2.64 m	**8'7.8"**	2.74 m	**9'0"**
Ground Contact Area (W/Std. Shoe)	2.42 m²	**3751 in²**	2.79 m²	**4332 in²**
Track Gauge	2.0 m	**6'6.7"**	2.16 m	**7'1"**
GENERAL DIMENSIONS:				
Height (Stripped Top)**	2.27 m	**7'5.6"**	2.33 m	**7'8"**
Height (To Top of ROPS)	3.16 m	**10'4.5"**	3.16 m	**10'4.5"**
Overall Length (With Blade)	4.53 m	**14'10.5"**	4.83 m	**15'10"**
(Without Blade)	3.77 m	**12'4.5"**	3.96 m	**13'0"**
Width (W/O Trunnion)	2.46 m	**8'1"**	2.67 m	**8'9"**
Ground Clearance	559 mm	**22"**	563 mm	**22.1"**
PAT Types and Widths:				
Straight	2.64 m	**8'7.8"**	3.17 m	**10'4.8"**
Angle	2.44 m	**8'0"**	2.92 m	**9'7"**
Fuel Tank Refill Capacity	215 L	**60 U.S. gal**	257 L	**68 U.S. gal**

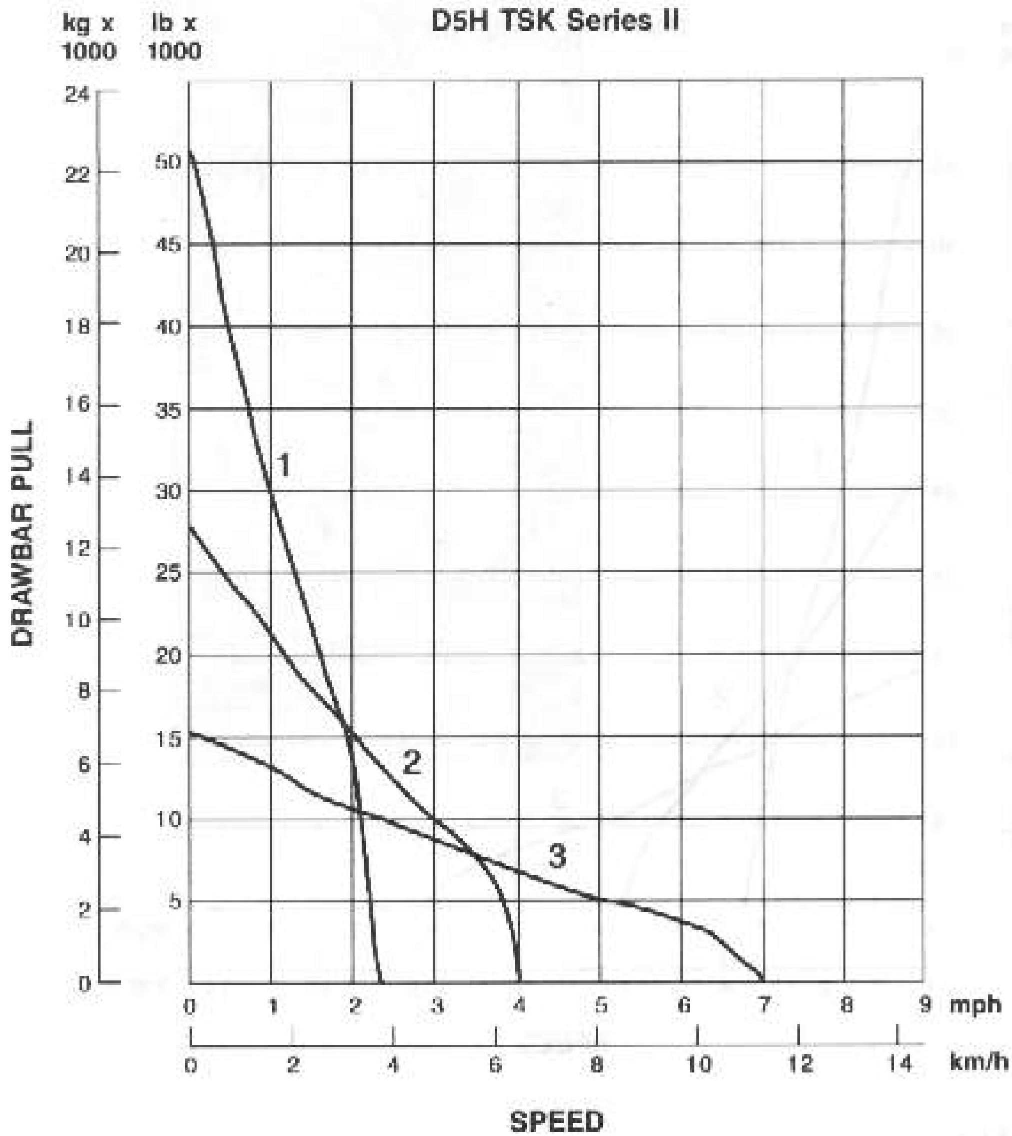
*D4H TSK Series III includes lubricants, coolant, ROPS canopy, 100% fuel, operator, PAT bulldozer, 54 winch, 3 valve hydraulics, guarding, and 460 mm (18") shoes. (Grapple machines include all the above less 54 winch and fairlead, plus grapple subframe arch and AEM grapple head and 508 winch.)
D5H TSK Series II includes lubricants, coolant, ROPS canopy, 100% fuel, operator, PAT bulldozer, 55 winch, 3 valve hydraulics, guarding, and 510 mm (20") track shoes. (Grapple machines include all the above less 55 winch and fairlead, plus grapple subframe arch and AEM grapple head and 518 winch.)
**Without ROPS exhaust, seat back, or other easily removed encumberances.



KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear

NOTE: Usable pull will depend upon weight and traction of equipped tractor.



KEY

1 — Ist Gear
2 — 2nd Gear
3 — 3rd Gear

NOTE: Usable pull will depend upon weight and traction of equipped tractor.

HYDRAULIC CONTROLS

CONTENTS

Features:

- **Designed and built for specific vehicle applications.** Valves and components sized for exacting quality and performance.
- **Job requirements matched** through various arrangements.
- **Pressure compensated control valves** for ease of operation on "H" series tractors and D8N. Pilot operated on D9N, D10N and D11N tractors except for dozer lift which is pressure compensated and manually operated.
- **Full flow filters*** . . . all oil completely filtered.
- **Dual tilt** available for D9N, D10N and D11N.

*Exception — D8N 2-pump

MODEL	D3C Series II		D4C Series II		D5C	
Mounting Point	Fender		Fender		Fender	
Number of Valves	4		4		4	
Flow at 6890 kPa (1000 psi)	55 L/min	14.5 gpm	55 L/min	14.5 gpm	55 L/min	14.5 gpm
	@ 2640 RPM		@ 2640 RPM		@ 2640 RPM	
Tank Capacity (Oil)	57 L	15 U.S. gal	57 L	15 U.S. gal	57 L	15 U.S. gal
Lift Relief Valve Setting	17 225 kPa	2500 psi	17 225 kPa	2500 psi	17 225 kPa	2500 psi
Weight Installed (Four Valves)	16.5 kg	36.3 lb	79 kg	175 lb	16.5 kg	36 lb

MODEL	D4H Series II		D5H Series II		D6H Series II	
Mounting Point	Right Rear Fender		Right Rear Fender		Right Fender	
Number of Valves	3 or 4		3 or 4		2 or 3	
Flow at 6890 kPa (1000 psi)	96.6 L/min	25.5 gpm	109.5 L/min	28.9 gpm	167 L/min	44 gpm
	@ 2200 RPM		@ 2200 RPM		@ 1900 RPM	
Tank Capacity (Oil)	30 L	7.8 U.S. gal	39.8 L	10.5 U.S. gal	46 L	12.1 U.S. gal
Lift Relief Valve Setting	18 600 kPa	2700 psi	20 670 kPa	3000 psi	19 800 kPa	2875 psi
Weight Installed (Four Valves)	200 kg	440 lb	281 kg	620 lb	311 kg	686 lb

MODEL	D6H Series II (Differential Steer)		D7H Series II		D7H Series II (Differential Steer)	
Mounting Point	Right Fender		Under Operators Platform		Right Fender	
Number of Valves	2 or 3		2 or 3		2 or 3	
Flow at 6890 kPa (1000 psi)	198 L/min	51.8 gpm	175 L/min	46.2 gpm	265 L/min	70.0 gpm
	@ 1900 RPM		@ 2100 RPM (ENG.)		@ 2100 RPM (ENG.)	
Tank Capacity (Oil)	46 L	12.1 U.S. gal	52 L	13.7 U.S. gal	54 L	14.3 U.S. gal
Lift Relief Valve Setting	19 800 kPa	2875 psi	22 750 kPa	3300 psi	22 750 kPa	3300 psi
Weight Installed (Two Valves)	311 kg	686 lb	358 kg	789 lb	273.2 kg	602.5 lb

Note: Weight installed, two valves, includes pump, tank with filters, valves, lines, linkage, oil cooler and control levers. D3C Series II weight does not include hydraulic tank.

MODEL	D8N		D9N		D10N		D11N	
Mounting Point	**Under Operators Platform**		**Under Operators Platform**		**Under Operators Platform**		**Under Operators Platform**	
Number of Valves	**3 Ripper ◄ Requires optional electronic diverter**		**2 At Rear Under Fuel Tank 2◄ + Dual* Tilt Radiator Guard**		**2 At Rear Under Fuel Tank 2◄ + Dual Tilt Attach. Radiator Guard**		**2 At Rear Under Fuel Tank 2◄ + Dual Tilt Attach. Radiator Guard**	
Flow at 6890 kPa (1000 psi)	240 L/min	**63 gpm**	310 L/min	**82 gpm**	408 L/min	**107.8 gpm**	610 L/min	**161.1 gpm**
Tank Capacity (Oil)	70 L	**18.5 U.S. gal**	89 L	**23.5 U.S. gal**	108 L	**28.6 U.S. gal**	169 L	**44.7 U.S. gal**
Lift Relief Valve Setting	24 100 kPa	**3500 psi**	18 600 kPa	**2700 psi**	18 600 kPa	**2700 psi**	22 750 kPa	**3300 psi**
Weight Installed (Two Valves)	**Included in Std. Tractor**		**Included in Std. Tractor**		**Included in Std. Tractor**		**Included in Std. Tractor**	

MODEL	D6D (163)		D7G (173B)	
Mounting Point	**Dash**		**Fender**	
Number of Valves	**1, 2 or 3**		**1, 2 or 3**	
Flow at 6890 kPa (1000 psi)	DD: 166 L/min PS: 169 L/min	**44 gpm** **44.6 gpm**	221 L/min	**58.5 gpm**
Tank Capacity (Oil)	45.8 L	**12.1 U.S. gal**	78 L	**20.6 U.S. gal**
Lift Relief Valve Setting	15 500 kPa	**2250 psi**	15 500 kPa	**2250 psi**
Weight Installed (Two Valves)	318 kg	**700 lb**	458 kg	**1010 lb**

Note: Weight Installed, two valves, includes pump, tank with filters, valves, lines, linkage, oil cooler and control levers.

*Custom Product

◄Ripper valve

BULLDOZERS

CONTENTS

Features:

- **Straight Bulldozers** — adjustable pitch angle controls blade penetration.
- **Power Angle and Tilt blades** for D3C Series II, D4C Series II, D5C, D4H Series II and D5H Series II are designed for finish grading, backfilling ditches, cutting V ditches, windrowing, fill spreading, landscaping and medium duty land clearing, as well as heavy duty applications.
- **Angling Bulldozers** — 25° right left angling; C-frame allows mounting other tools.
- **Universal Bulldozers** — 25° wings provide increased capacity, less spillage.
- **Semi-Universal Bulldozers** — combines penetration ability of straight blade with increased load capacity provided by short 25° wings.
- **Wheel Dozer blades** are straight design, with hydraulic pitch and tilt control.
- **Box-section construction** on blades adds rigidity and strength.
- **Cutting edges** are heat treated and reversible for extra life.

	CATERPILLAR BLADES							SPECIAL ATTACHMENTS															
MODEL	S	U	SU	A	FS	LFS	P	RC	WC	CL	HU	LF	PAT	K/G	TP	VTC	RK	CU	CS	VR	WCS	SB	RCB
D3C Series II							•										•					•	•
D4C Series II							•																•
D3C LGP Series II	•						•										•						
D4C LGP Series II							•																
D3C LGP-S Series II	•																						
D4E				•																			
D5C							•										•						•
D5C LGP							•																
D4H Series II	•						•										•					•	•
D4H XL Series III							•																
D4H LGP Series III	•						•										•						
D5E				•																			
D5H Series II	•		•				•		•	•							•			•		•	•
D5H XL Series II			•				•																
D5H LGP Series II	•						•										•			•			
D6H Series II	•		•	•					•	•	•	•	•	•	•	•	•			•		•	•
D6H LGP Series II	•																•			•			
D6D	•			•					•	•	•	•		•	•	•	•		•				
D6D LGP	•			■						•			•	•			•						
D6E	•			•						•		•		•	•	•	•						
D7H Series II	•	•	•	•					•	•	•	•	•	•	•	•	•			•		•	•
D7H LGP Series II	•											•					•						
D7G	•	•		•					•	•	•	•	•	•	•	•	•						•
D8L		•	•					•	•	•	•	•			•	•	•	•		•			•
D8L LGP			*																				
D8N		•	•	•				•	•	•		•		•	•	•	•	•		•		•	•
D8N LGP			*																				
D9N		•	•					•	•	•		•		•	•	•	•	•		•			
D10N		•	•					•	•	•								•		•			
D11N		•	•					•		•								•		•			

CATERPILLAR SUPPLIED
S — Straight
U — Universal
SU — Semi-Universal
A — Angling
FS — Fill Spreading
LFS — Landfill Spreading
P — Power Angle Tilt

SPECIAL ATTACHMENTS SUPPLIED
RC — Reclamation U
WC — Woodchips
CL — Coal
HU — Heavy U
LF — Landfill
PAT — Power Angle Tilt
K/G — KG Blade
VR — Variable Radius
TP — Tree Pusher
VTC — V-Tree Cutter
RK — Rake
CU — Cushion
CS — Coal Scoop
WCS — Wood Chip Scoop
SB — Slope Boards
RCB — Rolling Chopper Blade

Note: This chart suggests a range of blade options for Caterpillar built machines. It is not totally inclusive of all blades available. For additional information consult Caterpillar Special Attachments, Balderson.

*Available as a Cat Special Attachment.
■ Heavy duty logging special.

CATERPILLAR BLADES / SPECIAL ATTACHMENTS

MODEL	S	U	SU	A	FS	LFS	P	RC	WC	CL	HU	LF	PAT	K/G	TP	VTC	RK	CU	CS	VR	WCS	SB	RCB
814B	•								•	•	•								•		•		
815B					•																		
816B						•		•				•											
824C	•								•	•	•								•		•		
825C					•																		
826C						•		•				•											
834B	•	•							•	•									•		•		

CATERPILLAR SUPPLIED
S — Straight
U — Universal
SU — Semi-Universal
A — Angling
FS — Fill Spreading
LFS — Landfill Spreading
P — Power Angle Tilt

SPECIAL ATTACHMENTS SUPPLIED
RC — Reclamation U
WC — Woodchips
CL — Coal
HU — Heavy U
LF — Landfill
PAT — Power Angle Tilt
K/G — KG Blade
VR — Variable Radius
TP — Tree Pusher
VTC — V-Tree Cutter
RK — Rake
CU — Cushion
CS — Coal Scoop
WCS — Wood Chip Scoop
SB — Slope Boards
RCB — Rolling Chopper Blade

ADDITIONAL SPECIAL ATTACHMENTS

WORK TOOLS	D11N	D10N	D9N	D8L	D8N	D7H	D7G	D6H	D6D	D5H	D4H	D3C
Semi U-Blade				•			•		•			
Inside mounted S-Blade							•		•			
Rear Cushion Push Block	•	•	•	•	•							
Multi-Application Rake				•	•	•	•	•		•	•	
Rock and Root Rake				•	•	•	•	•		•		•
Jungle Canopy				•	•	•	•	•				
Oval Top Canopy							•					
Safety Canopy									•			
Logging Arch						•	•	•	•	•	•	•

Note: These charts suggest a range of attachments for Caterpillar built machines and are not totally inclusive. For additional information consult Catepillar Special Attachments, Balderson.

BLADE SELECTION

Properly matching tractor and dozer is a basic requirement for maximizing production. First consider the kind of work the tractor will be doing most of its life. Then evaluate:

- Material to be moved.
- Tractor limitations.

Materials to be moved.

Most materials are dozeable. However, dozer performance will vary with material characteristics such as:

Particle Size & Shape — The larger the individual particle size, the harder it is for a cutting edge to penetrate. Particles with sharp edges resist the natural rolling action of a dozer blade. These particles require more horsepower to move than a similar volume of material with rounded edges.

Voids — Few voids or the absence of voids means the individual particles have most or all of their surface area in contact with other particles. This forms a bond which must be broken. A well graded material, which lacks voids, is generally heavy, and will be hard to remove from the bank state.

Water Content — In most materials the lack of moisture increases the bond between particles and makes the material difficult to remove from the bank state. A high moisture content makes dozing difficult because the material is heavy and requires more force to move. Optimum moisture reduces dust and offers the best condition for dozing ease and operator comfort.

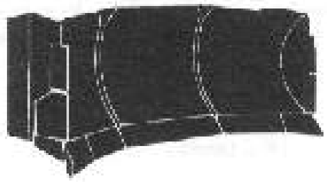
The effect of freezing depends on the moisture content. When frozen, the material's bond strengthens as moisture content increases and temperature decreases. However, freezing a completely dry material does not change its characteristics.

An indication of a blade's ability to penetrate and obtain a blade load is kW per meter (or horsepower per foot) of cutting edge. The higher the kW/meter (HP/foot), the more aggressive the blade. Kilowatt per Lm^3 (horsepower per loose cubic yard) indicates a blade's ability to push material. The higher the kW/Lm^3 (HP/LCY), the greater the blade's potential capability for carrying material at a greater speed.

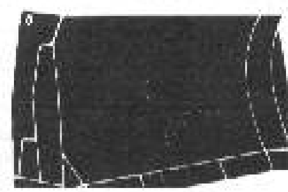
Tractor Limitations

The weight and horsepower of the machine determines its ability to push. No tractor can exert more pounds push than the machine itself weighs and its power train can develop. Various terrain and underfoot conditions on the job limit the tractor's ability to use its weight and horsepower. The "approximate coefficient of traction factors" chart in the Tables Section presents these traction factors for common materials. To use the chart, take the total tractor weight (with attachments) times the factor to arrive at the maximum usable push the dozer can exert.

Production Dozing Tools

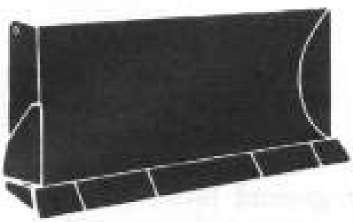


"U" — Universal blade—the large wings on this blade include one end bit and at least one section of cutting edge which make it efficient for moving big loads over long distances as in land reclamation, stockpile work, charging hoppers and trapping for loaders. As this blade has a lower kW/meter (HP/foot) of cutting edge than an "S", penetration should not be a prime objective. With a lower kW/Lm^3 (HP/LCY) than an "S" or "SU", this blade is best for lighter or relatively easily dozed material. Equipped with single tilt cylinders (standard on D7G, D7H Series II, D8N, D9N, D10N and D11N, dual available on D10N and D11N as attachments and on the D9N as a custom modification), it has some of the versatility of the S-blade. A tilt cylinder improves its ability to ditch, pry out, and level. This extends its use to many utility tasks.

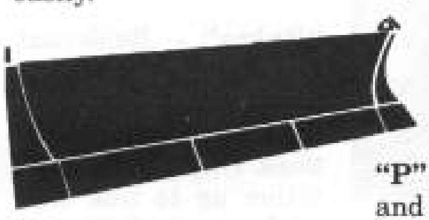


"SU" — The Semi-U blade combines the desirable characteristics of S and U-blades into one package. It has increased capacity by the addition of short wings which include only the dozer end bits. The wings provide improved load retention capabilities while maintaining the blade's ability to penetrate and load quickly in tightly packed materials and to handle a wide variety of materials in production oriented applications. A tilt cylinder (standard on D5H Series II, D6H Series II, D7H Series II, D8N, D9N, D10N and D11N, or dual tilt cylinders on D10N and D11N as attachments and on the D9N as a custom modification) increases both the productivity and versatility of this dozer. Though the SU-blade has production advantages over the S-blade, it does not, however, have the same ability to spread material in finish grading applications. Equipped with a push plate, it is effectively used for push loading scrapers on the D8N, D9N, D10N and D11N.

General Purpose Dozing Tools

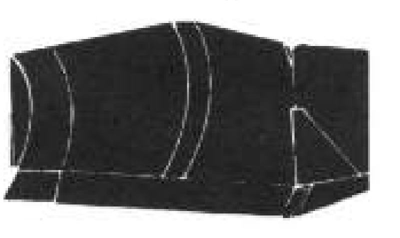


"S" — The Straight blade provides excellent versatility. Since it is physically smaller than the SU or U-blade, it is easier to maneuver and can handle a wider range of materials. It has a higher kW/meter (HP/foot) of cutting edge than the SU or U-blade; consequently, the "S" is more aggressive in penetrating and obtaining a blade load. A tilt cylinder (standard on D4H Series II, D5H Series II, D6H Series II, D7H Series II, and D7G and optional on the D6D) increases both the productivity and versatility of this dozer. With a high kW/Lm^3 (HP/LCY), the S-blade can handle heavy material easily.



"P" — The Power Angle and Tilt blade is offered by Caterpillar on the D3C Series II, D4C Series II, D5C, D4H Series II and D5H Series II models. Versatility is its key feature with its ability to perform a variety of site development to general dozing work as well as heavy-duty applications. Two lever control is used on D3C Series II, D4C Series II models. One lever is for lift and tilt control. The other lever is for angling the blade left or right. A single lever dozer control is used on D4H Series II and D5H Series II models. Blade lift, tilt and angle are all controlled by a single lever.

Balderson "VR Blades" (Variable Radius)



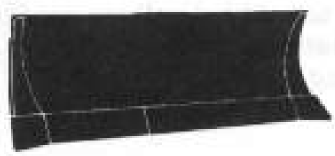
The Balderson Variable Radius Semi-U-Blade combines the benefits of a semi-U-blade such as "cutting" ability and ground penetration with U-blade characteristics of better load retention and less side spill.

This is achieved with the variable radius moldboard. The variable radius moldboard causes dirt to move to the center of the blade creating more rolling action. The extended side plates retain the load and increase capacities.

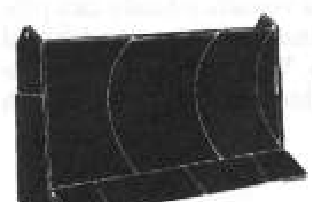
The variable radius semi-U-blade is an excellent tool for land improvement, soil conservation, site development, or general construction.

Special Application Dozing Tools

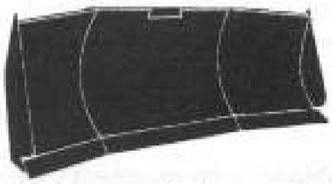
Caterpillar and other blade manufacturers provide specialty bulldozers for specific applications. The blades are designed to increase production while performing certain tasks. However, specialization may reduce the blade versatility. Following are the most popular special applications blades.



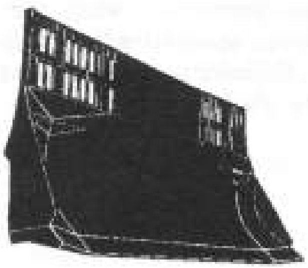
"A" — Or Angling blade can be positioned straight or angled 25 degrees to either side. It is designed for side-casting, pioneering roads, backfilling, cutting ditches and other similar tasks. It can reduce the amount of maneuvering required to do these jobs. Its "C" frame can be used for attachments such as pushing, land clearing, or snow removal tools. A-blades are not recommended for heavy rock or severe applications.



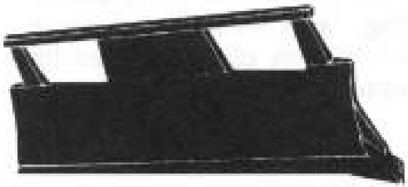
"C" — The Balderson Cushion blade is used on the D8N through the D11N for on-the-go push-loading. Rubber cushions allow the dozer to absorb the impact of contacting a scraper push block. When not push-loading, the dozer can be used for cut maintenance and other general dozing jobs. The narrow width of the C-blade increases machine maneuverability in congested cuts and reduces the possibility of cutting tires associated with SU and U-blades.



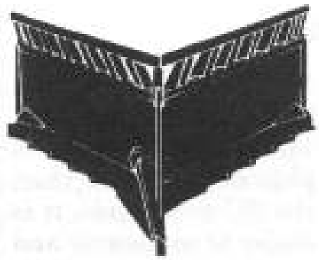
"U-Blades" — Balderson offers a variety of U-blades for use in a wide range of applications. They provide high volume movement of light non-cohesive materials such as coal and woodchips. Heavier U-blades are also offered for production dozing and reclamation work.



"Landfill" — Caterpillar and Balderson offer versions of the landfill or fill spreading dozer. Designed to handle refuse and cover material. Open trash screen on top of blade allows good visibility and protects radiator. Curved moldboard keeps cover material rolling evenly.

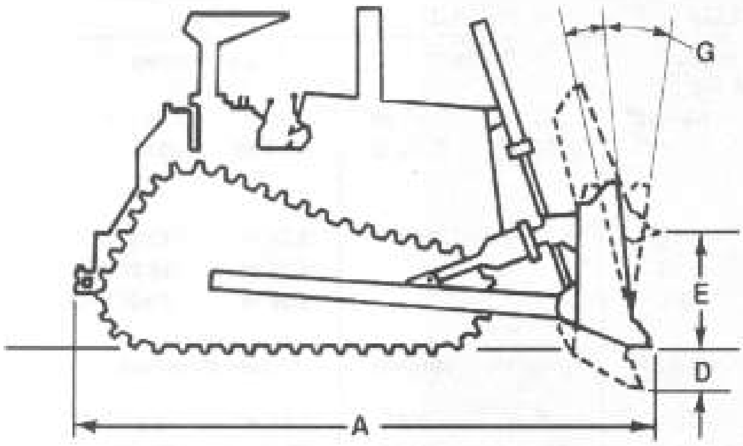


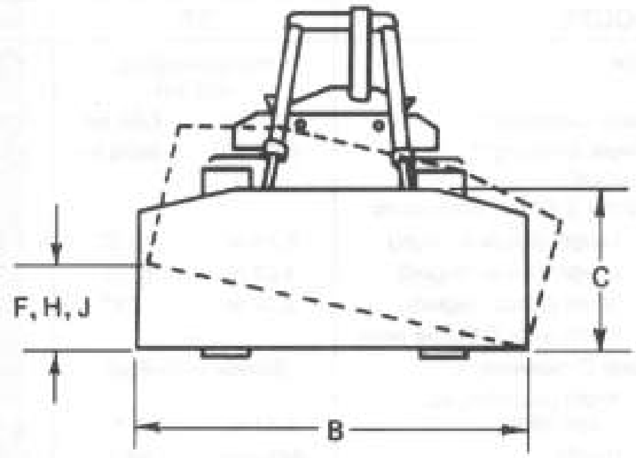
"K/G" — Offered by Rome, the K/G-blade is used in many land clearing applications. In addition to cutting trees this versatile blade can pile vegetation, cut v-type drainage ditches and build woods roads and firebreaks. Weldco-Beales offers a blade of similar design called the One-Way Brush Cutter.

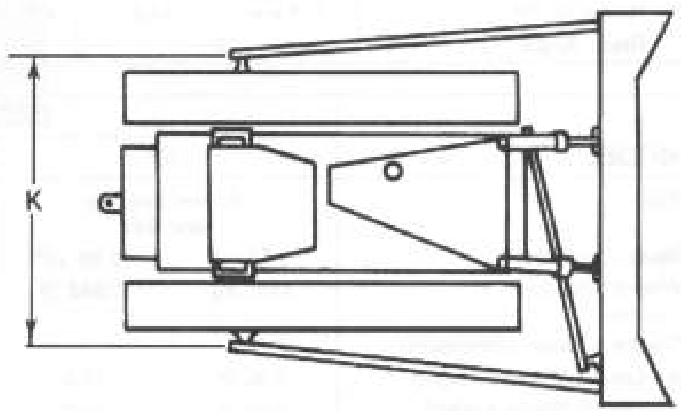


"V-Tree Cutter" — Balderson and Rome offer this clearing blade for shearing trees, stumps and brush at ground level. A sharp angle or "V", formed by two cutting blades, utilizes tractor weight and horsepower through the centerline of the cutter. Utilization of tractor force allows most growth to be cut at a steady pace and cast to the sides.

"Rakes" — Balderson and Rome offer a variety of rakes for use in land clearing applications. They handle vegetation up to tree size, and offer good soil penetration for removal of small stumps, rocks and roots. In most cases rake tines are replaceable.







KEY:

A Length (Blade Straight)
Blade:
B Width (including standard end bits)
C Height
D Maximum Digging Depth
E Ground Clearance @ Full Lift
F Maximum Tilt (Manual)
G Maximum Pitch Adjustment
H Maximum Hydraulic Tilt
J Hydraulic Tilt (manual brace centered)
K Pusharm Trunnion Width (to Ball Centers)

Blade capacities on the following pages are as determined by SAE recommended practice J1265. Capacities are defined as:

$Vs = 0.8\ WH^2$.
$Vu = Vs + ZH\ (W\text{-}Z)\ \tan X$.

Where: Vs = Capacity of straight or angling blade.
Vu = Capacity of semi-U or full U-blade.
W = Blade width exclusive of end bits.
H = Effective blade height considering tapered top corners, etc.
Z = Wing length measured parallel to blade width.
X = Wing angle.

Blade Specifications
• D3C Series II • D3C LGP Series II
• D4C Series II • D4C LGP Series II

MODEL	D3C Series II & D3C LGP Series II							
	3P		3P LGP		3S LGP		3P►	
Type	Power Angling and Tilt		Power Angling and Tilt		Straight		Power Angling and Tilt	
Blade Capacities*	1.25 m³	**1.64 yd³**	1.27 m³	**1.67 yd³**	1.20 m³	**1.57 yd³**	1.64 m³	**2.15 yd³**
Weight Shipping** (Dozer)	1075 kg	**2370 lb**	1213 kg	**2674 lb**	1089 kg	**2400 lb**	1200 kg	**2646 lb**
Tractor & Dozer Dimensions:								
A Length (Blade Straight)	3.74 m	**12′3″**	4.07 m	**13′4″**	3.89 m	**12′9″**	3.74 m	**12′3″**
Length (Blade Angled)	4.23 m	**13′10″**	4.70 m	**15′5″**	—		4.27 m	**14′0″**
Width (Blade Angled)	2.24 m	**7′4″**	2.85 m	**9′4″**	—		2.39 m	**7′10″**
Width (with C-Frame only)	—		—		—		—	
Blade Dimensions:	**(inside mounted)**		**(inside mounted)**		**(outside mounted)**		**(inside mounted)**	
B Width (including std. end bits)	2.47 m	**8′1″**	3.14 m	**10′4″**	2.8 m	**9′2″**	2.64 m	**8′8″**
C Height	841 mm	**33.1″**	749 mm	**29.5″**	739 mm	**29.1″**	930 mm	**36.6″**
D Max. Digging Depth	396 mm	**15.6″**	424 mm	**16.7″**	351 mm	**13.8″**	396 mm	**15.6″**
E Ground Clearance @ Full Lift	820 mm	**32.3″**	879 mm	**34.6″**	792 mm	**31.2″**	820 mm	**32.3″**
G Max. Pitch	**+2° −4°**		**+2° −4°**		**±5°**		**+2°-4°**	
J Hydraulic Tilt	370 mm	**14.5″**	470 mm	**18.5″**	333 mm	**13.1″**	368 mm	**14.5″**
Blade Angle	**25°**		**25°**		—		**25°**	

MODEL	D4C Series II & D4C LGP Series II					
	4P		4P LGP		4P LGP►	
Type	Power Angling and Tilt		Power Angling and Tilt		Power Angling and Tilt	
Blade Capacities*	1.58 m³	**2.06 yd³**	1.66 m³	**2.17 yd³**	1.64 m³	**2.15 yd³**
Weight Shipping** (Dozer)	1153 kg	**2542 lb**	1281 kg	**2824 lb**	1280 kg	**2822 lb**
Tractor & Dozer Dimensions:						
A Length (Blade Straight)	3.88 m	**12′9″**	4.07 m	**13′4″**	4.54 m	**14′11″**
Length (Blade Angled)	4.38 m	**14′4″**	4.72 m	**15′6″**	5.08 m	**16′8″**
Width (Blade Angled)	2.30 m	**7′6″**	2.95 m	**9′8″**	2.39 m	**7′10″**
Width (with C-Frame only)	—		—		—	
Blade Dimensions:	**(inside mounted)**		**(inside mounted)**		**(inside mounted)**	
B Width (including std. end bits)	2.54 m	**8′4″**	3.26 m	**10′8″**	2.64 m	**8′8″**
C Height	930 mm	**36.6″**	841 mm	**33.1″**	930 mm	**36.6″**
D Max. Digging Depth	439 mm	**17.3″**	462 mm	**18.2″**	450 mm	**17.7″**
E Ground Clearance @ Full Lift	780 mm	**30.7″**	848 mm	**33.5″**	841 mm	**33.1″**
G Max. Pitch	**+2° −4°**		**+2° −4°**		**+2° −4°**	
J Hydraulic Tilt	373 mm	**14.7″**	486 mm	**19.1″**	368 mm	**14.5″**
Blade Angle	**25°**		**25°**		**25°**	

Notice that the capacity of the U-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade. It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.

**Shipping Weight — Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.

►Supplied by Balderson — Note shipping weight blade only.

*Blade capacities as determined by SAE recommended practice J1265. Capacities are defined as:

$Vs = 0.8\ WH^2$.

$Vu = Vs + ZH\ (W\text{-}Z)\ \tan X$.

Where: Vs = Capacity of straight or angling blade.
Vu = Capacity of semi-U or full U-blade.
W = Blade width exclusive of end bits.
H = Effective blade height considering tapered top corners, etc.
Z = Wing length measured parallel to blade width.
X = Wing angle.

MODEL	D5C & D5C LGP			
	5P		5P LGP	
Type	Power Angling and Tilt		Power Angling and Tilt	
Blade Capacities*	1.94 m³	2.54 yd³	2.08 m³	2.72 yd³
Weight, Shipping** (Dozer)	1282 kg	2826 lb	1288 kg	2840 lb
Tractor & Dozer Dimensions:				
A Length (Blade Straight)	3.92 m	12'10"	3.98 m	13'1"
Length (Blade Angled)	4.45 m	14'7"	4.63 m	15'2"
Width (Blade Angled)	2.44 m	8'0"	2.95 m	9'8"
Width (with C-Frame only)	—		—	
Blade Dimensions:	(inside mounted)		(inside mounted)	
B Width (including std end bits)	2.69 m	8'10"	3.26 m	10'8"
C Height	1000 mm	39.4"	929 mm	36.6"
D Max. Digging Depth	400 mm	15.7"	414 mm	16.3"
E Ground Clearance @ Full Lift	821 mm	32.3"	845 mm	33.3"
G Max. Pitch	+2° −4°		+2° −4°	
J Hydraulic Tilt	408 mm	16.1"	487 mm	19.2"
Blade Angle	25°		25°	

MODEL	D4H Series II					
	4S		4P		4P►	
Type	Straight		Power Angling and Tilt		Optional	
Blade Capacities*	1.89 m³	2.47 yd³	2.31 m³	3.01 yd³	2.59 m³	3.39 yd³
Weight, Shipping** (Dozer)	1568 kg	3452 lb	1655 kg	3649 lb	1689 kg	3784 lb
Tractor & Dozer Dimensions:						
A Length (Blade Straight)	4.23 m	13'10"	4.23 m	13'11"	4.31 m	14'2"
Length (Blade Angled)	—		4.76 m	15'7"	4.92 m	16'2"
Width (Blade Angled)	—		2.44 m	8'0"	2.79 m	9'2"
Width (with C-Frame only)	—		—		—	
Blade Dimensions:	(outside mounted)		(inside mounted)		(inside mounted)	
B Width (including std. end bits)	2.58 m	8'6"	2.64 m	8'8"	3.08 m	10'1"
C Height	965 mm	38"	1085 mm	42.7"	1105 mm	44"
D Max. Digging Depth	414 mm	16.3"	405 mm	15.9"	405 mm	16"
E Ground Clearance @ Full Lift	870 mm	34.3"	878 mm	34.6"	890 mm	35"
G Max. Pitch	—		—		—	
J Hydraulic Tilt	402 mm	15.8"	397 mm	15.6"	460 mm	18"
Blade Angle	—		25°		25°	

**Shipping Weight — Total bulldozer arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.
►Caterpillar custom product.

Blade Specifications
• D4H XL Series III • D4H LGP Series III
• D5H Series II

	D4H XL Series III		D4H LGP Series III			
MODEL	**4P**		**4S LGP**		**4P LGP**	
Type	**Power Angling and Tilt**		**Straight**		**Power Angling and Tilt**	
Blade Capacities*	2.59 m³	**3.39 yd³**	2.17 m³	**2.84 yd³**	2.04 m³	**2.68 yd³**
Weight, Shipping** (Dozer)	1880 kg	**4145 lb**	1622 kg	**3578 lb**	1862 kg	**4106 lb**
Tractor & Dozer Dimensions:						
A Length (Blade Straight)	4.43 m	**14'7"**	4.77 m	**15'5"**	4.90 m	**16'1"**
Length (Blade Angled)	5.05 m	**16'7"**	—		5.56 m	**18'3"**
Width (Blade Angled)	2.79 m	**9'2"**	—		3.00 m	**9'10"**
Width (with C-Frame only)	—		—		—	
Blade Dimensions:	**(inside mounted)**		**(inside mounted)**		**(inside mounted)**	
B Width (including std. end bits)	3.08 m	**10'1"**	3.26 m	**10'8"**	3.26 m	**10'8"**
C Height	1105 mm	**43.5"**	920 mm	**36.2"**	908 mm	**35.7"**
D Max. Digging Depth	405 mm	**16"**	459 mm	**18.1"**	420 mm	**16.5"**
E Ground Clearance @ Full Lift	890 mm	**35"**	899 mm	**35.4"**	920 mm	**36.2"**
G Max. Pitch	—		—		—	
J Hydraulic Tilt	460 mm	**18.1"**	421 mm	**16.6"**	491 mm	**19.3"**
Blade Angle	25°		—		25°	

	D5H Series II					
MODEL	**5S**		**5SU**		**5P**	
Type	**Straight**		**Semi U**		**Power Angling and Tilt**	
Blade Capacities*	2.66 m³	**3.47 yd³**	3.8 m³	**5.06 yd³**	3.18 m³	**4.15 yd³**
Weight, Shipping** (Dozer)	1854 kg	**4087 lb**	2060 kg	**4541 lb**	2166 kg	**4780 lb**
Tractor & Dozer Dimensions:						
A Length (Blade Straight)	4.54 m	**14'11"**	4.54 m	**14'11"**	4.57 m	**15'0"**
Length (Blade Angled)	—		—		5.22 m	**17'2"**
Width (Blade Angled)	—		—		2.97 m	**9'9"**
Width (with C-Frame only)	—		—		—	
Blade Dimensions:	**(outside mounted)**		**(outside mounted)**		**(inside mounted)**	
B Width (including std. end bits)	2.95 m	**9'8"**	2.90 m	**9'6"**	3.27 m	**10'8"**
C Height	1070 mm	**42.1"**	1236 mm	**48.6"**	1195 mm	**47"**
D Max. Digging Depth	408 mm	**16"**	408 mm	**16"**	438 mm	**17.2"**
E Ground Clearance @ Full Lift	936 mm	**36.9"**	936 mm	**36.9"**	962 mm	**37.9"**
G Max. Pitch	±5°		±5°		—	
H Max. Hydraulic Tilt	728 mm	**28.7"**	728 mm	**28.7"**	—	
J Hydraulic Tilt	446 mm	**17.6"**	446 mm	**17.6"**	489 mm	**19.3"**
Blade Angle	—		—		25°	

Notice that the capacity of the U-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade. It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.
**Shipping Weight — Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.

MODEL	D5H XL Series II 5SU		5P	
Type	Semi-U			
Blade Capacities*	4.28 m³	5.60 yd³	3.18 m³	4.15 yd³
Weight, Shipping** (Dozer)	2393 kg	5276 lb	2219 kg	4892 lb
Tractor & Dozer Dimensions:				
A Length (Blade Straight)	4.78 m	15'8"	4.66 m	15'4"
Length (Blade Angled)	—		5.32 m	17'5"
Width (Blade Angled)	—		2.97 m	9'9"
Width (with C-Frame only)	—		—	
Blade Dimensions:	(outside mounted)		(inside mounted)	
B Width (including std. end bits)	3.17 m	10'5"	3.27 m	10'9"
C Height	1244 mm	49"	1195 mm	47"
D Max. Digging Depth	537 mm	20.9"	430 mm	17.2"
E Ground Clearance @ Full Lift	998 mm	39.3"	963 mm	37.9"
G Max. Pitch	±5°		—	
H Max. Hydraulic Tilt	665 mm	26.2"	—	
J Hydraulic Tilt	372 mm	14.6"	497 mm	19.6"
Blade Angle	—		25°	

MODEL	D5H LGP Series II 5S LGP		5P LGP	
Type	Straight		Power Angling and Tilt	
Blade Capacities*	2.99 m³	3.91 yd³	3.16 m³	4.13 yd³
Weight, Shipping** (Dozer)	2096 kg	4621 lb	2615 kg	5765 lb
Tractor & Dozer Dimensions:				
A Length (Blade Straight)	5.26 m	17'3"	5.33 m	17'6"
Length (Blade Angled)	—		6.08 m	19'11"
Width (Blade Angled)	—		3.66 m	12'0"
Width (with C-Frame only)	—		—	
Blade Dimensions:	(outside mounted)		(inside mounted)	
B Width (including std. end bits)	3.66 m	12'0"	3.98 m	13'0.7"
C Height	1020 mm	40.2"	1025 mm	40.4"
D Max. Digging Depth	565 mm	22.2"	498 mm	19.6"
E Ground Clearance @ Full Lift	966 mm	38"	992 mm	39.1"
G Max. Pitch	±5.4°		—	
H Max. Hydraulic Tilt	751 mm	27"	—	
J Hydraulic Tilt	400 mm	16.1"	599 mm	23.5"
Blade Angle	—		25°	

Notice that the capacity of the U-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade. It is intended for **relative comparisons of dozer sizes**, and not for predicting capacities or productivities in actual field conditions.
**Shipping Weight — Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.

MODEL	D6H Series II & D6H LGP Series II									
	6A		6A Heavy Duty		6S		6SU		6S LGP	
Type	Angling		Angling		Straight		Semi Universal		Straight	
Blade Capacities*	3.18 m³	4.16 yd³	3.93 m³	5.14 yd³	3.89 m³	5.09 yd³	5.61 m³	7.34 yd³	3.70 m³	4.83 yd³
Weight, Shipping** (Dozer)	2712 kg	5979 lb	3166 kg	6980 lb	2533 kg	5584 lb	2673 kg	5893 lb	2700 kg	5952 lb
Tractor & Dozer Dimensions:										
A Length (Blade Straight)	5.22 m	17'1"	5.22 m	17'1"	5.12 m	16'9"	5.31 m	17'5"	5.71 m	18'9"
Length (Blade Angled)	6.05 m	19'10"	6.05 m	19'10"	—		—		—	
Width (Blade Angled)	3.78 m	12'5"	3.78 m	12'5"	—		—		—	
Width (with C-Frame only)	2.91 m	9'7"	2.91 m	9'7"	—		—		—	
Blade Dimensions:	—		—		—		—		—	
B Width (Including std. end bits)	4.16 m	13'8"	4.16 m	13'8"	3.36 m	11'0"	3.26 m	10'8"	3.98 m	13'1"
C Height	1033 mm	40.7"	1155 mm	45.5"	1257 mm	49.5"	1411 mm	55.6"	1101 mm	43.3"
D Max. Digging Depth	506 mm	19.9"	506 mm	19.9"	473 mm	18.6"	473 mm	18.6"	655 mm	25.8"
E Ground Clearance @ Full Lift	1141 mm	44.9"	1141 mm	44.9"	1104 mm	43.5"	1104 mm	43.5"	1083 mm	42.6"
F Manual Tilt	408 mm	16.1"	408 mm	16.1"	689 mm	27.1"	670 mm	26.4"	632 mm	24.9"
G Max. Pitch	—		—		+5.3°	4.8°	+5.3°	−4.8°	+4.8°	−5.3°
H Max. Hydraulic Tilt	408 mm	16.1"◄	408 mm	16.1"◄	764 mm	30.1"	743 mm	29.3"	701 mm	27.6"
Blade Angle	25°		25°		—		—		—	
J Hydraulic Tilt (Manual Brace Centered)	—		—		420 mm	16.5"	408 mm	16.1"	385 mm	15.2"

*Blade capacities as determined by SAE recommended practice J1265. Capacities are defined as:

$V_s = 0.8 WH^2$.

$V_u = V_s + ZH (W-Z) \tan X$.

Where: V_s = Capacity of straight or angling blade.
V_u = Capacity of semi U or full U-blade.
W = Blade width exclusive of end bits.
H = Effective blade height considering tapered top corners, etc.
Z = Wing length measured parallel to blade width.
X = Wing angle.

Notice that the capacity of the U blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade. It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.
**Shipping Weight — Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.
◄Attachment includes two cylinders.

MODEL	D7H Series II & D7H LGP Series II									
	7A		7S		7SU		7U		7S LGP	
Type	**Angling**		**Straight**		**Semi Universal**		**Universal**		**Straight**	
Blade Capacities*	3.89 m^3	**5.08 yd^3**	5.16 m^3	**6.75 yd^3**	6.86 m^3	**8.98 yd^3**	8.34 m^3	**10.91 yd^3**	5.89 m^3	**7.7 yd^3**
Weight, Shipping** (Dozer)	3453 kg	**7613 lb**	3500 kg	**7716 lb**	3581 kg	**7896 lb**	3860 kg	**8510 lb**	3699 kg	**8156 lb**
General Dimensions (Tractor & Dozer)										
A Length (Blade Straight)	6.10 m	**20'0"**	5.81 m	**19'1"**	6.03 m	**19'9"**	6.27 m	**20'7"**	5.81 m	**19'1"**
Length (Blade Angled)	6.98 m	**22'11"**	—		—		—		—	
Width (Blade Angled)	4.12 m	**13'6"**	—		—		—		—	
Width (with C-Frame only)	3.09 m	**10'1"**	—		—		—		—	
Blade:										
B Width (including std. end bits)	4.50 m	**14'9"**	3.90 m	**12'10"**	3.69 m	**12'1"**	3.99 m	**13'1"**	4.50 m	**14'9"**
C Height	1111 mm	**43.7"**	1363 mm	**53.7"**	1524 mm	**60"**	1553 mm	**61.1"**	1343 mm	**52.9"**
D Max. Digging Depth	669 mm	**26.3"**	527 mm	**20.7"**	527 mm	**20.7"**	527 mm	**20.7"**	668 mm	**26.3"**
E Ground Clearance @ Full Lift	1115 mm	**43.9"**	1146 mm	**45.1"**	1145 mm	**45.1"**	1145 mm	**45.1"**	1153 mm	**45.4"**
F Manual Tilt	466 mm	**18.3"**	—		—		—		—	
G Max. Pitch Adjustment	—		**+3.1° −3.8°**		**+3.1° −3.9°**		**+3.1° −3.9°**		**+3.0° −3.3°**	
Blade Angle (either side)	**25°**		—		—		—		—	
H Max. Hydraulic Tilt	627 mm	**24.7"** ◄	845 mm	**33.3"**	798 mm	**31.4"**	861 mm	**33.9"**	686 mm	**27.0"**
J Hydraulic Tilt (Manual Brace Centered)	—		501 mm	**19.7"**	474 mm	**18.6"**	511 mm	**20.1"**	428 mm	**16.8"**

*Blade capacities as determined by SAE recommended practice J1265. Capacities are defined as:

$Vs = 0.8\,WH^2$,
$Vu = Vs + ZH\,(W\text{-}Z)\tan X$.

Where: Vs = Capacity of straight or angling blade.
Vu = Capacity of semi-U or full U-blade.
W = Blade width exclusive of end bits.
H = Effective blade height considering tapered top corners, etc.
Z = Wing length measured parallel to blade width.
X = Wing angle.

Notice that the capacity of the U-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade. It is intended for relative comparisons of dozer sizes, and not for predicting capacities or productivities in actual field conditions.

**Shipping Weight — Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.

◄Attachment includes two cylinders.

MODEL	D8N 8A	D8N 8SU	D8N 8U	D9N 9SU	D9N 9U
Type	Angling	Semi-U	Universal	Semi-U	Universal
Blade Capacities*	4.66 m^3 6.09 yd^3	8.68 m^3 11.4 yd^3	11.70 m^3 15.3 yd^3	11.9 m^3 15.6 yd^3	14.4 m^3 18.8 yd^3
Weight, Shipping** (Dozer)	5354 kg 11,803 lb	4778 kg 10,534 lb	5358 kg 11,812 lb	6380 kg 14,066 lb	6867 kg 15,139 lb
General Dimensions (Tractor & Dozer)					
A Length (Blade Straight)	6.57 m 21'7"	6.39 m 21'0"	6.79 m 22'3"	6.87 m 22'6"	7.17 m 23'6"
Length (Blade Angled)	7.54 m 24'9"	—	—	—	—
Width (Blade Angled)	4.50 m 14'9"	—	—	—	—
Width (with C-Frame only)	3.38 m 11'1"	—	—	—	—
Blade:					
B Width (including std. end bits)	4.95 m 16'3"	3.94 m 12'11"	4.26 m 14'	4.32 m 14'2"	4.66 m 15'3"
C Height	1174 mm 46.2"	1690 mm 66.5"	1740 mm 68.5"	1809 mm 71.2"	1809 mm 71.2"
D Max. Digging Depth	628 mm 24.7"	582 mm 22.9"	582 mm 22.9"	619 mm 24.4"	619 mm 24.4"
E Ground Clearance @ Full Lift	1309 mm 51.5"	1231 mm 48.5"	1231 mm 48.5"	1368 mm 53.9"	1368 mm 53.8"
G Max. Pitch Adjustment	—	+3.0° −2.9°	+3.0 −2.9°	+3.4° −2.9°	+3.4° −2.8°
Blade Angle (either side)	25°	—	—	—	—
H Max. Hydraulic Tilt	729 mm 28.7"◄	951 mm 37.4"	1028 mm 40.5"	940 mm 37"	1014 mm 39.9"
J Hydraulic Tilt (Manual Brace Centered)	—	650 mm 25.6"	703 mm 27.7"	570 mm 22.4"	616 mm 24.3"
K Pusharm Trunnion Width (to Ball Centers)	2.98 m 9'9"	2.98 m 9'9"	2.98 m 9'9"	—	—
Maximum Track Width Permitted	712 mm 28"	711 mm 28"	711 mm 28"	762 mm 30"	762 mm 30"
Dual Tilt Option					
G Dual Pitch Adj.	—	—	—	+4.8° −5.2°	+4.8° −4.8°
H Dual Max. Hyd. Tilt	—	—	—	1139 mm 44.8"	1231 mm 48.5"

*Blade capacities as determined by SAE recommended practice J1265. Capacities are defined as:

$V_s = 0.8\ WH^2$.

$V_u = V_s + ZH\ (W-Z) \tan X$.

Where: V_s = Capacity of straight or angling blade.

V_u = Capacity of semi-U or full U-blade.

W = Blade width exclusive of end bits.

H = Effective blade height considering tapered top corners, etc.

Z = Wing length measured parallel to blade width.

X = Wing angle.

Notice that the capacity of the U-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade. It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.

**Shipping Weight — Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.

◄Attachment includes two cylinders.

MODEL	D10N				D11N			
	10SU		10U		11SU		11U	
Type	Semi-U		Universal		Semi-U		Universal	
Blade Capacities*	17.2 m^3	22.6 yd^3	20.9 m^3	27.3 yd^3	25.6 m^3	33.5 yd^3	32.4 m^3	42.4 yd^3
Weight, Shipping**								
Standard Dozer	9840 kg	21,694 lb	10 236 kg	22,565 lb	14 886 kg	32,819 lb	15 846 kg	34,935 lb
Abrasion Dozer	10 633 kg	23,442 lb	11 596 kg	25,565 lb	16 309 kg	35,955 lb	17 608 kg	38,819 lb
General Dimensions (Tractor & Dozer)								
A Length	7.76 m	25'6"	8.01 m	26'3"	8.50 m	27'11"	8.82 m	29'3"
Width	4.86 m	15'11"	5.26 m	17'3"	5.60 m	18'4"	6.35 m	20'10"
Blade:								
B Width (including std. end bits)	4.86 m	15'11"	5.26 m	17'3"	5.60 m	18'4"	6.35 m	20'10"
C Height	2.05 m	6'9"	2.05 m	6'9"	2.31 m	7'7"	2.31 m	7'7"
D Max. Digging Depth	674 mm	26.5"	674 mm	26.5"	774 mm	30.5"	774 mm	30.5"
E Ground Clearance @ Full Lift	1497 mm	58.9"	1497 mm	58.9"	1557 mm	61.3"	1557 mm	61.3"
G Max. Pitch Adjustment	+1.7° −2.3°		+1.7° −2.3°		+2.1° −2.2°		+2.1° −2.2°	
H Max. Hydraulic Tilt	993 mm	39.1"	1074 mm	42.3"	1184 mm	46.6"	1344 mm	52.9"
J Hydraulic Tilt (Manual Brace Centered)	722 mm	28.4"	782 mm	30.8"	886 mm	34.9"	1006 mm	39.6"
K Pusharm Trunnion Width (In Ball Centers)	3.60 m	11'10"	3.60 m	11'10"	4.11 m	13'6"	4.11 m	13'6"
Maximum Track Width Permitted	762 mm	30"	762 mm	30"	914 mm	36"	914 mm	36"
Dual Tilt Option								
G Dual Pitch Adj.	+5.2° −5.5°		+5.2° −5.5°		+6.1° −5.6°		+6.1° −5.6°	
H Dual Max. Hyd. Tilt	1441 mm	56.7"	1560 mm	61.4"	1706 mm	67.2"	1908 mm	75.3"

*Blade capacities as determined by SAE recommended practice J1265. Capacities are defined as:

$V_s = 0.8\,WH^2$

$V_u = V_s + ZH(W-Z)\tan X$.

Where: V_s = Capacity of straight or angling blade.

V_u = Capacity of semi-U or full U-blade.

W = Blade width exclusive of end bits.

H = Effective blade height considering tapered top corners, etc.

Z = Wing length measured parallel to blade width

X = Wing angle.

Notice that the capacity of the U-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade. It is intended for relative comparisons of dozer sizes, and not for predicting capacities or productivities in actual field conditions.

**Shipping Weight — Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.

MODEL	D4E 4A		D5E 5A		D6D 6A		D6D 6S	
Type	**Angling**		**Angling**		**Angling**		**Straight**	
Blade Capacities	1.24 m³	**1.62 yd³**	1.77 m³	**2.32 yd³**	2.40 m³	**3.14 yd³**	3.07 m³	**4.02 yd³**
Weight, Shipping** (Dozer)	1290 kg	**2844 lb**	1695 kg	**3737 lb**	2332 kg	**5142 lb**	2001 kg	**4412 lb**
General Dimensions (Tractor & Dozer):								
A Length (Blade Straight)	3.87 m	**12'8"**	4.60 m	**15'1"**	4.86 m	**15'11"**	4.81 m	**15'9"**
Length (Blade Angled)	4.50 m	**14'9"**	5.26 m	**17'3"**	5.83 m	**18'8"**	—	
Width (Blade Angled)	2.84 m	**9'4"**	2.95 m	**9'8"**	3.52 m	**11'6"**	—	
Width (with C-frame only)	2.39 m	**7'10"**	2.36 m	**7'9"**	2.85 m	**9'4"**	—	
Blade:								
B Width (including std. end bits)	3.12 m	**10'3"**	3.25 m	**10'8"**	3.88 m	**12'9"**	3.21 m	**10'6"**
C Height	706 mm	**27.8"**	861 mm	**33.9"**	924 mm	**36.4"**	1127 mm	**44.4"**
D Max. Digging Depth	373 mm	**14.7"**	457 mm	**18"**	464 mm	**18.3"**	441 mm	**17.4"**
E Ground Clearance @ Full Lift	810 mm	**31.9"**	937 mm	**36.9"**	967 mm	**38.1"**	1012 mm	**39.8"**
F Manual Tilt	476 mm	**18.7"**	312 mm	**12.3"**	330 mm	**13"**	679 mm	**26.7"**
G Max. Pitch Adjustment	—		—		—		+6° −4°	
Blade Angle (either side)	26°		25°		25°		—	
H Max. Hydraulic Tilt	—		—		—		613 mm	**32"**
J Hydraulic Tilt (Manual Brace Centered)	—		—		—		467 mm	**18.4"**

**Shipping Weight – Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and tilt cylinder mountings.

MODEL	D6D LGP				D6E					
	6A*		6S		6A		6S		6SU►	
Type	Angling		Straight		Angling		Straight		Semi-U	
Blade Capacities	2.40 m^3	3.14 yd^3	3.09 m^3	4.04 yd^3	2.40 m^3	3.14 yd^3	3.07 m^3	4.01 yd^3	3.80 m^3	4.98 yd^3
Weight, Shipping** (Dozer)	2290 kg	5049 lb	1997 kg	4403 lb	2325 kg	5126 lb	1998 kg	4405 lb	2460 kg	5423 lb
General Dimensions (Tractor & Dozer):										
A Length (Blade Straight)	5.15 m	16'11"	5.15 m	16'11"	5.15 m	16'11"	5.07 m	16'8"	5.13 m	16'10"
Length (Blade Angled)	5.91 m	19'5"	—		5.91 m	19'5"	—		—	
Width (Blade Angled)	3.52 m	11'6"	—		3.52 m	11'6"	—		—	
Width (with C-frame only)	2.85 m	9'4"	—		2.85 m	9'4"	—		—	
Blade:										
B Width (including std. end bits)	3.89 m	12'9"	3.71 m	12'2"	3.88 m	12'9"	3.22 m	10'7"	3.20 m	10'6"
C Height	924 mm	36.4"	1036 mm	40.8"	924 mm	36.4"	1127 mm	44.4"	1235 mm	48.6"
D Max. Digging Depth	536 mm	21.1"	616 mm	24.2"	605 mm	23.8"	645 mm	25.4"	472 mm	18.6"
E Ground Clearance @ Full Lift	739 mm	29.1"	995 mm	39.2"	945 mm	37.2"	925 mm	36.4"	915 mm	36.0"
F Manual Tilt	330 mm	13.0"	692 mm	27.5"	330 mm	13.0"	681 mm	26.8"	680 mm	26.8"
G Max. Pitch Adjustment	—		—		—		—		—	
Blade Angle (either side)	25°		—		25°		—		—	
H Max. Hydraulic Tilt	—		857 mm	33.8"	—		813 mm	32.0"	810 mm	31.9"
J Hydraulic Tilt (Manual Brace Centered)	—		367 mm	14.5"	—		467 mm	18.4"	465 mm	18.3"

*Logging Special

Notice that the capacity of the U-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade. It is intended for **relative comparisons of dozer sizes**, and not for predicting capacities or productivities in actual field conditions.

**Shipping Weight — Total Bulldozer Arrangement Includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and tilt cylinder mountings.

► Caterpillar Custom Product.

MODEL	D7G						D8L & D8L LGP	
	7A		7S		7U		8SU	
Type	Angling		Straight		Universal		Semi-U	
Blade Capacities*	2.9 m^3	3.8 yd^3	4.2 m^3	5.5 yd^3	5.8 m^3	7.6 yd^3	11 m^3	14.4 yd^3
Weight, Shipping** (Dozer)	3227 kg	7115 lb	3475 kg	7660 lb	3820 kg	8420 lb	5410 kg	11,927 lb
General Dimensions (Tractor & Dozer):								
A Length (Blade Straight)	5.49 m	18'0"	5.30 m	17'5"	5.76 m	18'11"	6.24 m	20'6"
Length (Blade Angled)	6.35 m	20'10"	—		—		—	
Width (Blade Angled)	3.86 m	12'8"	—		—		—	
Width (with C-Frame only)	3.12 m	10'3"	—		—		—	
Blade:								
B Width (Including std. end bits)	4.26 m	14'0"	3.65 m	12'0"	3.82 m	12'6"	4.17 m	13'8"
C Height	960 mm	37.8"	1274 mm	50.1"	1274 mm	50.1"	1765 mm	69.3"
D Max. Digging Depth	468 mm	18.4"	438 mm	17.2"	438 mm	17.2"	614 mm	24.2"
E Ground Clearance @ Full Lift	1206 mm	47.5"	1188 mm	46.8"	1188 mm	46.8"	1288 mm	50.7"
F Manual Tilt	—		—		—		—	
G Max. Pitch Adjustment	—		+6.2° −3.0°		+5.2° −3.0°		+3.6° −3.2°	
Blade Angle (either side)	25°		—		—		—▲	
H Max. Hydraulic Tilt	300 mm	11.8"◄	721 mm	28.4"	754 mm	29.7"	850 mm	33.5"
J Hydraulic Tilt (Manual Brace Centered)	—		505 mm	19.9"	528 mm	20.8"	536 mm	21.1"

*Blade capacities as determined by SAE recommended practice J1265. Capacities are defined as:

Notice that the capacity of the U-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade. It is intended for relative comparisons of dozer sizes, and not for predicting capacities or productivities in actual field conditions.

**Shipping Weight — Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and tilt cylinder mountings.

◄Attachment includes two cylinders.
▲Neutral Tilt Distance from the tilt arm to the ground when blade is neutral position at maximum height.

MODEL	814B		824C		834B		834B	
Type	Straight		Straight		Straight		U-Blade	
Capacity**	2.89 m³	3.77 yd³	4.60 m³	6.00 yd³	7.18 m³	9.38 yd³	10.26 m³	13.4 yd³
Weight, Dozer*	4033 kg	8892 lb	5784 kg	12,752 lb	4738 kg	10,443 lb	4803 kg	10,586 lb
General Dimensions (Tractor & Dozer)								
Length	6.82 m	22'5"	7.69 m	25'3"	8.72 m	28'7"	9.40 m	30'10"
Width	3.65 m	12'0"	4.19 m	13'9"	4.62 m	15'2"	4.86 m	15'11"
Blade:								
Width (including std. end bits)	3.65 m	12'0"	4.19 m	13'9"	4.62 m	15'2"	4.88 m	15'11"
Height	1004 mm	39.5"	1219 mm	48"	1448 mm	57"	1448 mm	57"
Max. Digging Depth	500 mm	19.69"	390 mm	15.4"	441 mm	17.4"	441 mm	17.4"
Ground Clearance @ Full Lift Under Skid Plate	731 mm	28.78"	992 mm	39"	956 mm	37.64"	956 mm	37.64"
Tilt Adjust. from Horizontal	778 mm	30.63"	1120 mm	44.1"	1278 mm	50.3"	1340 mm	53"
Max. Tip Adjustment from Vertical	+10° −6°		+11° −12°		+10° −12°		+10° −12°	

MODEL	815B		825C		816B		826C	
Type	Fill Spreading		Fill Spreading		Land Fill Spreading		Land Fill Spreading	
Capacity**								
Earth	2.16 m³	2.82 yd³	3.76 m³	4.91 yd³	2.90 m³	3.79 yd³	3.74 m³	4.89 yd³
Refuse	—		—		10.48 m³	13.70 yd³	12.75 m³	16.78 yd³
Weight, Dozer	1460 kg	3220 lb	2463 kg	5430 lb	2385 kg	5259 lb	3265 kg	7198 lb
General Dimensions:								
(Tractor & Dozer)								
Length	6.80 m	22'4"	7.69 m	25'3"	7.07 m	23'2.3"	8.20 m	26'11"
Width	3.76 m	12'4"	4.50 m	14'9"	3.65 m	12'0"	4.50 m	14'9"
Blade Dimensions:								
Width, End Bits	3.76 m	12'4"	4.50 m	14'9"	3.65 m	12'0"	4.50 m	14'9"
Height, Moldboard	860 mm	34"	1041 mm	41"	1006 mm	39.6"	1041 mm	41"
Height, Trash Rack	—		—		1927 mm	75.9"	1936 mm	76.2"
Max. Digging Depth	407 mm	16"	197 mm	7.8"	573 mm	22.6"	515 mm	20.3"
Ground Clearance @ Full Lift	628 mm	24.7"	947 mm	37.3"	905 mm	35.6"	1049 mm	41.3"
Tilt Adjust. from Horizontal	328 mm	12.9"	436 mm	17.2"	—		—	

*Total Bulldozer Arrangement.
**Blade capacities determined by SAE recommended practice J1265.

BULLDOZER PRODUCTION OFF-THE-JOB

You can estimate bulldozer production using the production curves that follow and the correction factors that are applicable. Use this formula:

$$\text{Production } \frac{Lm^3/hr}{(LCY/hr)} = \text{Maximum production} \times \text{Correction factors}$$

The bulldozer production curves give maximum uncorrected production for universal, semi-universal, and straight blades and are based on the following conditions:

1. 100% efficiency (60 minute hour — level cycle).
2. Power shift machines with 0.05 min. fixed times.
3. Machine cuts for 15 m (50 feet), then drifts blade load to dump over a high wall. (Dump time — 0 sec.)
4. Soil density of 1370 kg/Lm³ (2300 lb/LCY).
5. Coefficient of traction:
   a. Track machines — 0.5 or better
   b. Wheel machines — 0.4 or better*
6. Hydraulic controlled blades used.
7. Dig 1F**
   Carry 2F**
   Return 2R**

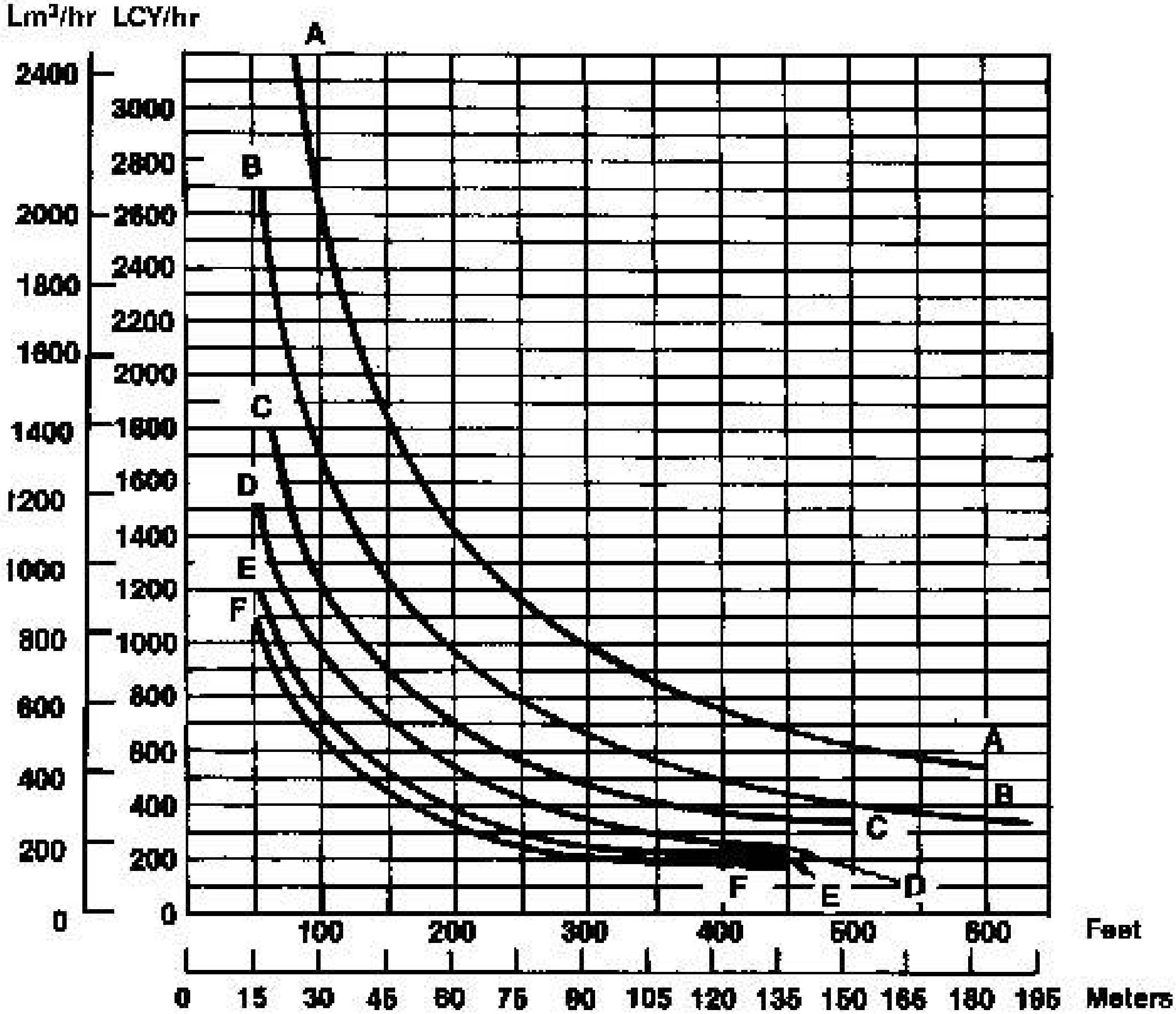
To obtain estimated production in bank cubic meters or bank cubic yards, appropriate load factor from the Tables section should be applied to the corrected production as calculated above.

$$\text{Production } \frac{Bm^3/hr}{(BCY/h)} = \frac{Lm^3/hr \times LF}{(LCY/h) \times LF}$$

*Coefficient of traction assumed to be at least 0.4. While poor traction affects both track and wheel vehicles, causing them to take smaller blade loads, wheeled units are affected more severely and production falls much more rapidly. While no fixed rules can predict this production loss, a rough rule of thumb is that wheel dozer production falls off 4% for each one-hundredth decrease in coefficient of traction below 0.40. If, for example, coefficient of traction is 0.30, the difference is ten-hundredths (0.10), and production is 60% (10 × 4% = 40% decrease).

**This gear sequence is based on level to downhill terrain, light to medium density material, and no blade extensions such as spill plates, rock guards, etc. Exceeding these conditions may require carry in 1F, but productivity should equal or exceed "standard conditions" due to the larger loads that can be carried in 1F.

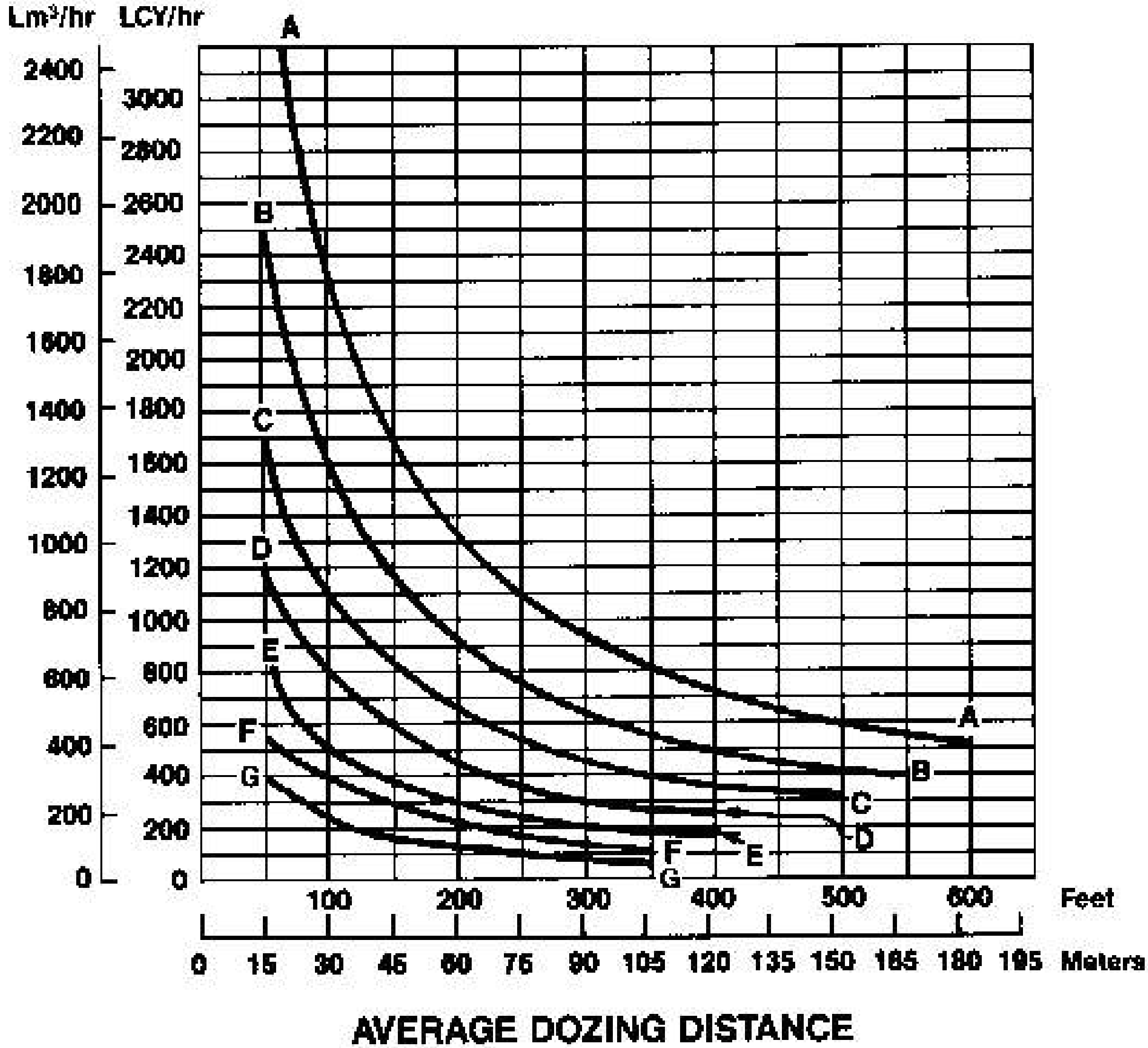
ESTIMATED DOZING PRODUCTION • Universal Blades • D7G through D11N



KEY
A — D11N-11U
B — D10N-10U
C — D9N-9U
D — D8N-8U
E — D7H-7U
F — D7G-7U

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

ESTIMATED DOZING PRODUCTION • Semi-Universal Blades • D5H through D11N

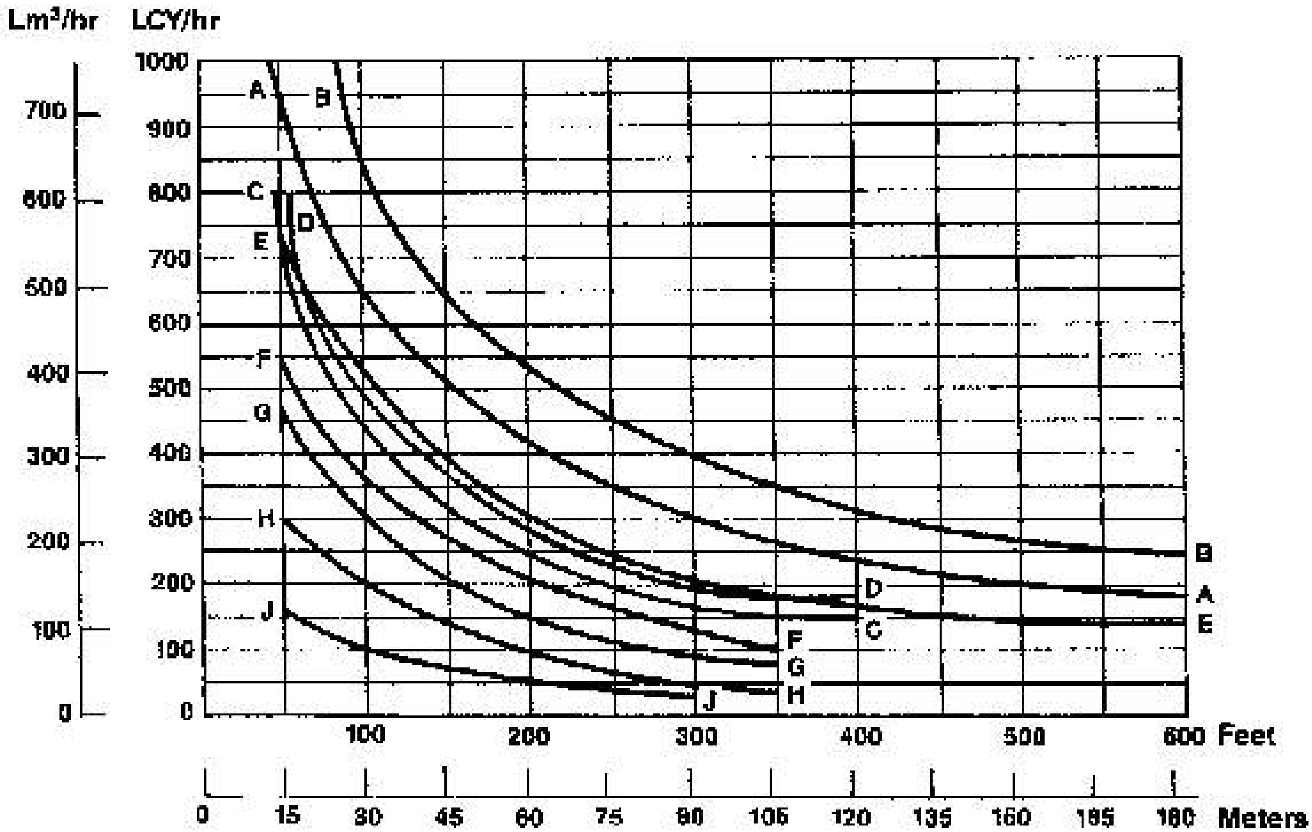


KEY

A — D11N-11SU
B — D10N-10SU
C — D9N-9SU
D — D8N-8SU
E — D7H-7SU
F — D6H-6SU
G — D5H XL-5SU XL

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

ESTIMATED DOZING PRODUCTION
Straight Blades • D3, D4, D5, D6, D7, 814, 824, 834



AVERAGE DOZING DISTANCE

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors on the next page.
*The 3S represented is for the D3C LGP Series II

Estimated production of the 834B with U-blade can be found in the Coal Handling section of this handbook.

KEY

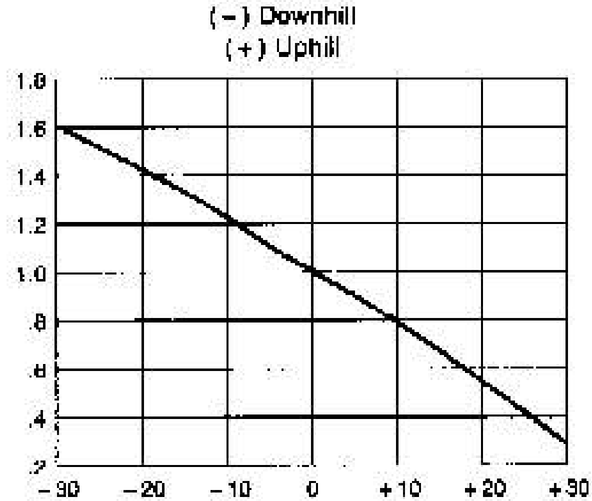
A — 824S
B — 834S
C — D7G-7S
D — D7H-7S
E — 814S
F — D6H-6S
G — D5H-5S
H — D4H-4S
J — D3CLGP-3SLGP

JOB CONDITION CORRECTION FACTORS

	TRACK-TYPE TRACTOR	WHEEL-TYPE TRACTOR
OPERATOR —		
Excellent	1.00	1.00
Average	0.75	0.60
Poor	0.60	0.50
MATERIAL —		
Loose stockpile	1.20	1.20
Hard to cut; frozen —		
with tilt cylinder	0.80	0.75
without tilt cylinder	0.70	—
cable controlled blade	0.60	
Hard to drill; "dead" (dry, non-cohesive material) or very sticky material	0.80	0.80
Rock, ripped or blasted	0.60-0.80	—
SLOT DOZING	1.20	1.20
SIDE BY SIDE DOZING	1.15-1.25	1.15-1.25
VISIBILITY —		
Dust, rain, snow, fog or darkness	0.80	0.70
JOB EFFICIENCY —		
50 min/hr	0.83	0.83
40 min/hr	0.67	0.67
DIRECT DRIVE TRANSMISSION		
(0.1 min. fixed time)	0.80	—
BULLDOZER*		
Adjust based on SAE capacity relative to the base blade used in the Estimated Dozing Production graphs.		
GRADES — See following graph.		

*Note: Angling blades and cushion blades are not considered production dozing tools. Depending on job conditions, the A-blade and C-blade will average 50-75% of straight blade production.

% Grade vs. Dozing Factor



ESTIMATING DOZER PRODUCTION OFF-THE-JOB

Example problem:

Determine average hourly production of a D8N/8SU (with tilt cylinder) moving hard-packed clay an average distance of 45 m (150 feet) down a 15% grade, using a slot dozing technique.

Estimated material weight is 1600 kg/Lm^3 (2650 lb/LCY). Operator is average. Job efficiency is estimated at 50 min/hr.

Uncorrected Maximum Production — 458 Lm^3/h (600 LCY/hr) (example only)

Applicable Correction Factors:

Hard-packed clay is "hard to cut" material – 0.80
Grade correction (from graph) .... – 1.30
Slot dozing .... – 1.20
Average operator .... – 0.75
Job efficiency (50 min/hr) .... – 0.83
Weight correction ....(2300/2650) – 0.87

Production = Maximum Production × Correction Factors
= (600 LCY/hr) (0.80) (1.30) (1.20) (0.75) (0.83) (0.87)
= 405.5 LCY/hr

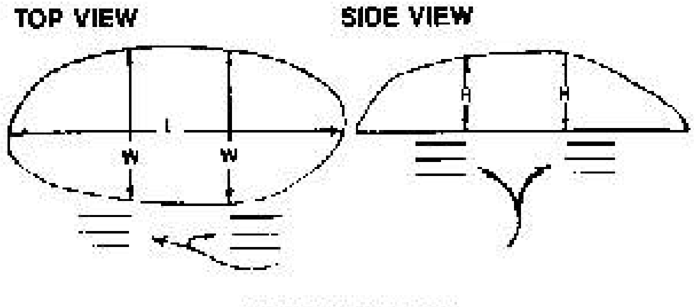
To obtain production in metric units, the same procedure is used substituting maximum uncorrected production in Lm^3.

= 458 Lm^3/h × Factors
= 309.6 Lm^3/h

MEASURING PRODUCTION ON-THE-JOB

Three generally accepted methods of measuring bulldozer production are listed below. The third method is empirical, but is the simplest to conduct.

1. Employing Surveying Techniques
   a. Conduct time study and then cross-section the cut to determine the volume of material removed. (Production in Bm^3 or BCY per unit of time)
   b. Conduct time study and then cross-section the fill to determine the volume of fill material. (Production in Lm^3 or LCY per unit of time)
2. Weighing Blade Loads
   Conduct time study and weigh material moved by bulldozer by weighing the loader bucket loads.
3. Measuring Blade Loads
   a. Dozer operation
      (1) Pick up and carry load onto a level area and stop.
      (2) Raise the blade directly over the pile pulling forward slightly as blade comes up, leaving a nearly symmetrical pile.
      (3) Reverse to clear the pile.
   b. Measurements
      (1) The average *height* (H) of the pile in feet. Hold the tape vertically at the inside edge of each grouser mark. Sight along top of the pile to obtain the correct measurement.



      (2) The average *width* (W) of the pile in feet. Hold the tape horizontally over the pile and sight at the inside edge of each grouser mark and the corresponding opposite side of the pile.
      (3) The greatest *length* (L) of the pile in feet. Hold the tape horizontally over the pile and sight at each end of the pile.
   c. With the above measurements, now compute the blade load.
      (1) Average the height measurement (H)
      (2) Average the width measurement (W)
      (3) Load (Lm^3 or LCY) = 0.0138 × (HWL)
      (4) Load (Bm^3 or BCY) = Lm^3 or LCY × LF
   d. Combine the calculated blade load with time study to figure production.

Special Attachments
- Balderson Cushion Dozers
- Balderson Coal U-Blades
- Balderson Slope Boards
- Balderson Woodchip Dozers
- Balderson Reclamation U-Blades

BALDERSON COAL U-BLADES	D5H Series II		D6H Series II		D7H Series II		D8N		D9N	
Capacity	7.6 m³	10.25 yd³	9.9 m³	13 yd³	13.4 m³	17.5 yd³	21.4 m³	28 yd³	30.6 m³	40 yd³
Width	4039 mm	159"	4267 mm	168"	4877 mm	192"	5486 mm	216"	5791 mm	228"
Height	1372 mm	54"	1524 mm	60"	1626 mm	64"	1980 mm	78"	2311 mm	91"
Weight	1395 kg	3075 lb	1905 kg	4200 lb	2540 kg	5600 lb	3266 kg	7200 lb	4491 kg	9900 lb

BALDERSON COAL U-BLADES	D10N		D11N	
Capacity	45.9 m³	60 yd³	71.9 m³	94 yd³
Width	6096 mm	240"	7315 mm	288"
Height	2794 mm	110"	3200 mm	126"
Weight	6620 kg	14,600 lb	10 115 kg	22,300 lb

BALDERSON WOODCHIP DOZERS	D5H Series II		D6H Series II		D7H Series II		D8N		D9N	
Capacity	11.5 m³	15 yd³	15.3 m³	20 yd³	20.3 m³	26.6 yd³	28.3 m³	37 yd³	—	—
Width	3657 mm	144"	4267 mm	168"	4826 mm	190"	5486 mm	216"	5791 mm	228"
Height	1829 mm	72"	1880 mm	74"	2083 mm	82"	2337 mm	92.8"	2311 mm	91"
Weight	1542 kg	3400 lb	1905 kg	4200 lb	2765 kg	6100 lb	2925 kg	6450 lb	4490 kg	9900 lb

BALDERSON RECLAMATION U-BLADES	D8N		D9N		D10N		D11N	
Capacity	16.4 m³	21.5 yd³	21.6 m³	28.3 yd³	30.6 m³	40 yd³	44.3 m³	58 yd³
Width	4877 mm	192"	5182 mm	204"	5791 mm	228"	7010 mm	276"
Height	1880 mm	74"	2083 mm	82"	2413 mm	95"	2515 mm	99"
Weight	3810 kg	8400 lb	4990 kg	11,000 lb	6441 kg	14,200 lb	8936 kg	19,700 lb

BALDERSON CUSHION DOZERS	D11N		D10N		D9N		D8L		D8N	
Width	3981 mm	156.75"	3499 mm	137.75"	3048 mm	120"	2997 mm	118"	2889 mm	113.75"
Height	1930 mm	76.0"	1753 mm	69"	1575 mm	62"	1524 mm	60"	1499 mm	59"
Weight	8445 kg	19,500 lb	6115 kg	13,480 lb	4275 kg	9420 lb	3855 kg	8500 lb	3185 kg	7020 lb
Balderson Rear Cushion Push Block	*		3105 kg	6850 lb	2175 kg	4800 lb	*		*	

*Available upon request

BALDERSON SLOPE BOARDS	D8N		D6H Series II		D4H Series II		D4C/D3C Series II	
Length	2438 mm	96"	2070 mm	81.5"	2083 mm	82"	1778 mm	70"
Extension	610 mm	24"	610 mm	24"	—		—	
Height	699 mm	27.5"	622 mm	24.5"	508 mm	20"	457 mm	18"
Weight	1640 kg	3610 lb	955 kg	2110 lb	446 kg	980 lb	380 kg	835 lb

BALDERSON VARIABLE RADIUS (VR) SEMI-U BLADES	D5H Series II		D6H Series II		D7H Series II		D8N	
Capacity	4.67 m^3	6.11 yd^3	5.81 m^3	7.6 yd^3	7.84 m^3	10.25 yd^3	11.28 m^3	14.75 yd^3
Width	3018 mm	118.8"	3404 mm	134"	3861 mm	152"	4521 mm	178"
Height	1340 mm	52.77"	1473 mm	58"	1626 mm	64"	1778 mm	70"
Weight	1180 kg	2650 lb	1360 kg	3000 lb	1860 kg	4100 lb	2995 kg	6600 lb

BALDERSON LANDFILL BLADES	D6H Series II		D7H Series II		D8N		D9N	
Capacity	12.2 m^3	16 yd^3	17.6 m^3	23 yd^3	24.4 m^3	32 yd^3	38.2 m^3	50 yd^3
Width	3886 mm	153"	4267 mm	168"	4877 mm	192"	5182 mm	205"
Height	1824 mm	71.8"	2083 mm	82"	2299 mm	90.5"	2794 mm	104"
Weight	1500 kg	3300 lb	2495 kg	5500 lb	3310 kg	7300 lb	5216 kg	11,500 lb
Capacity (Earth)	8.9 m^3	11.6 yd^3	11.9 m^3	15.6 yd^3	16.8 m^3	22 yd^3	26 m^3	34 yd^3

BALDERSON COAL DOZERS	814B		824C		834B	
Balderson Models:						
Replaces "S" Blade	BD814U-14		BD824U-15'6"		BD834U-20	
Blade:						
Capacity	10.55 m^3	13.8 yd^3	16.13 m^3	21.1 yd^3	21.18 m^3	27.7 yd^3
Length (Cutting Width)	4318 mm	170"	4775 mm	188"	6172 mm	243"
Height, wing section (tapered down)	1473 mm	58"	1753 mm	69"	1803 mm	71"
Wing Angle	25°		25°		30°	
Max. usable track shoe	—		—		—	
Weight, Installed (Without Hydraulics)	1810 kg	3985 lb	3220 kg	7100 lb	4070 kg	8975 lb

Bulldozers

Special Attachments
- Balderson Chip Scoops
- Balderson Landfill Compactors
- Balderson Coal Scoops

BALDERSON CHIP SCOOPS WITH TILT

	814B		824C		834B	
Balderson Models:						
Replaces "S" Blade	B14-20S		B24-27S		B34-40S	
Scoop:						
Capacity/Lift & Carry	15.3 m³	20 yd³	20.6 m³	27 yd³	30.2 m³	39.5 yd³
Capacity/Doze	30.6 m³	40 yd³	41.3 m³	54 yd³	49.7 m³	65 yd³
Width	3734 mm	147"	4026 mm	158.5"	4826 mm	190"
Height	2286 mm	90"	2794 mm	110"	2248 mm	88.5"
Depth	2464 mm	97"	2946 mm	116"	3023 mm	119"
Weight	5390 kg	11,880 lb	7560 kg	16,670 lb	11,105 kg	24,480 lb

BALDERSON LANDFILL COMPACTOR (U-Blade)

	816B		826C	
Balderson Models:				
Replaces "S" Blade	BD816UL-12		BD826UL-14	
Blade:				
Capacity (Refuse)	11.9 m³	15.5 yd³	17.5 m³	22.9 yd³
(Earth)	8.3 m³	10.8 yd³	12.2 m³	16 yd³
Length (Cutting Width)	3658 mm	144"	4382 mm	172.5"
Height	1219 mm	48"	1295 mm	51"
Moldboard height	1857 mm	73.1"	2032 mm	80"
Wing Angle	25°		25°	
Max. lift above ground	889 mm	35"	864 mm	34"
Weight, Installed (Without Hydraulics)	1615 kg	3560 lb	2160 kg	4760 lb

BALDERSON COAL SCOOP

	814B		824C		834B	
Balderson Models:						
Replaces "S" Blade	B14-12		B24-17		B34-26	
Scoop:						
Lift and Carrying Capacity	11.5 m³	15 yd³	13.0 m³	17 yd³	19.9 m³	26 yd³
Dozing Capacity	19.1 m³	25 yd³	26.0 m³	34 yd³	37.5 m³	49 yd³
Width	3734 mm	147"	4026 mm	158.5"	5283 mm	208"
Height	1626 mm	64"	2032 mm	80"	2083 mm	82"
Depth	2083 mm	82"	2426 mm	95.5"	2540 mm	100"
Overall length	7.3 m	24'0"	9.5 m	31'0"	11.0 m	36'0"
Weight	5216 kg	11,500 lb	7030 kg	15,500 lb	8700 kg	19,180 lb
Dump Clearance	1041 mm	41"	1321 mm	52"	1448 mm	57"

RIPPERS, RIPPER-SCARIFIERS, IMPACT RIPPERS & BACKHOE ARRANGEMENTS

CONTENTS

Features:

- **Parallelogram linkage with hydraulically variable pitch** on D8L, D8N, D9N, D10N and D11N. Operator can adjust angle of ripper tip to the material for penetration at all ripping depths to increase production.
- **Fixed Parallelogram linkage design** used on D4E, D5B, D6D, D6E, D6H Series II, D7G and D7H Series II. This design holds tooth angle constant at all ripping depths.
- **Radial rippers** are Multishank with wide beam coverage for utility ripping close to walls, footings and embankments. Five shanks available on the D3C Series II, D4C Series II, and 931C Series II, 935C Series II. Three shanks available for the 943, 953, 963, 973, D4H Series II and D5H Series II.
- **Single shank** arrangements available for D8L, D8N, D9N, D10N and D11N for tough ripping applications and deep ripping requirements.
- **Multishank** arrangements in all ripper models, including D8L, D8N, D9N, D10N and D11N allow wide-beam coverage in easier-to-rip materials.
- **Impact Rippers** are single shank, hydraulic powered units. In tough applications the impact ripper cannot only break through more rock, but more difficult rock. The unit is available from Custom Products as a new machine, factory installed attachment for the D10N and D11N.

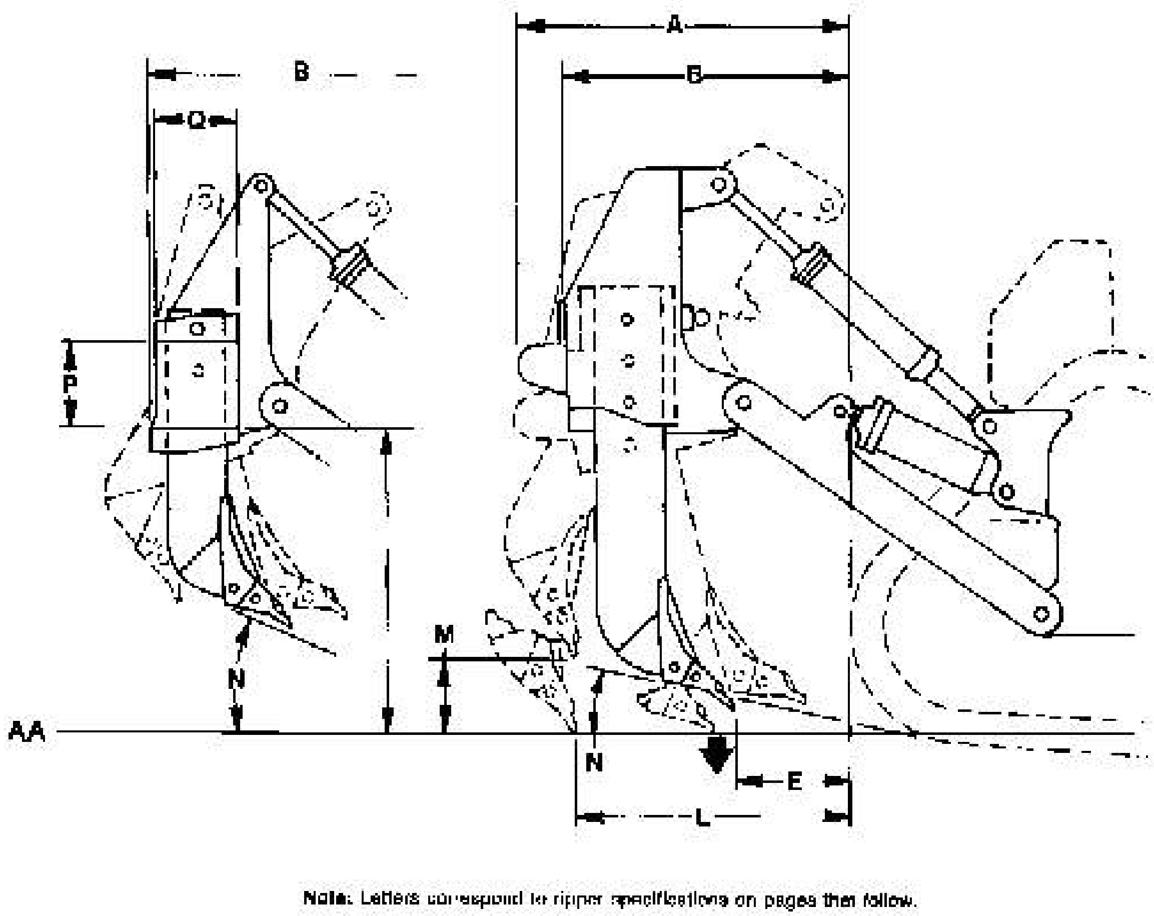
DEFINITION OF FORCES SHOWN IN TABLES THAT FOLLOW

"Pryout," (Breakout) newtons (and pounds) — the maximum sustained upward force, generated by the lift cylinders measured at the ripper tip. Breakout force is measured with the shank in the top hole, shank vertical and ripper full down. Breakout force may be hydraulically or balance limited.

"Penetration force," kilonewtons (and pounds) — the maximum sustained downward force, generated by the ripper lift cylinders measured at the ripper tip, which is required to raise the back end of the vehicle with the tip on ground and the shank (pinned in the top hole) vertical.

"Impact Ripper Forces" are measured with the shank at its maximum rearward position, and do not include the effect of hammer impact force. Peak impact forces given are along the tip centerline.

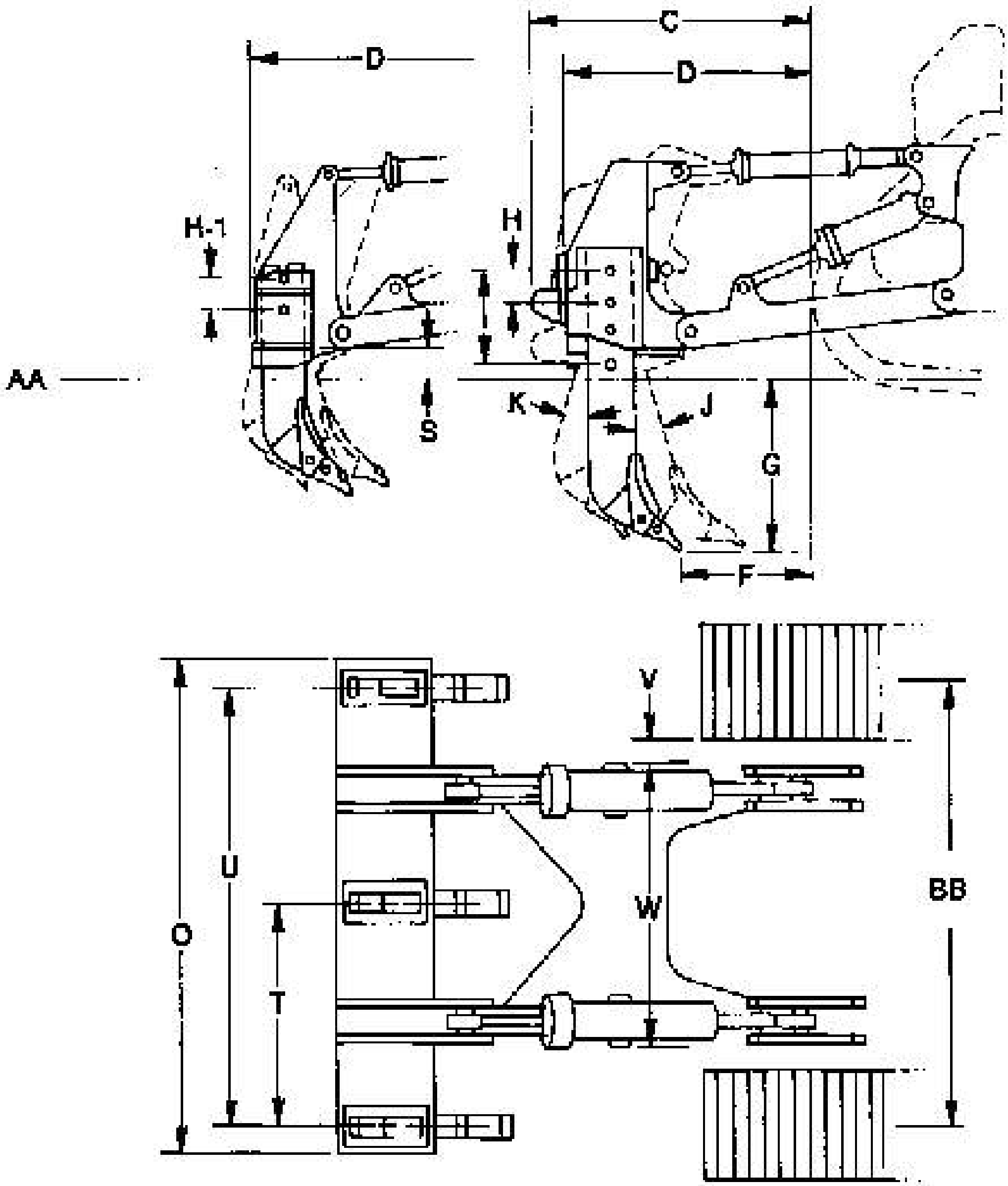
Adjustable Parallelogram Ripper



Note: Letters correspond to ripper specifications on pages that follow.

KEY
AA — Ground Line

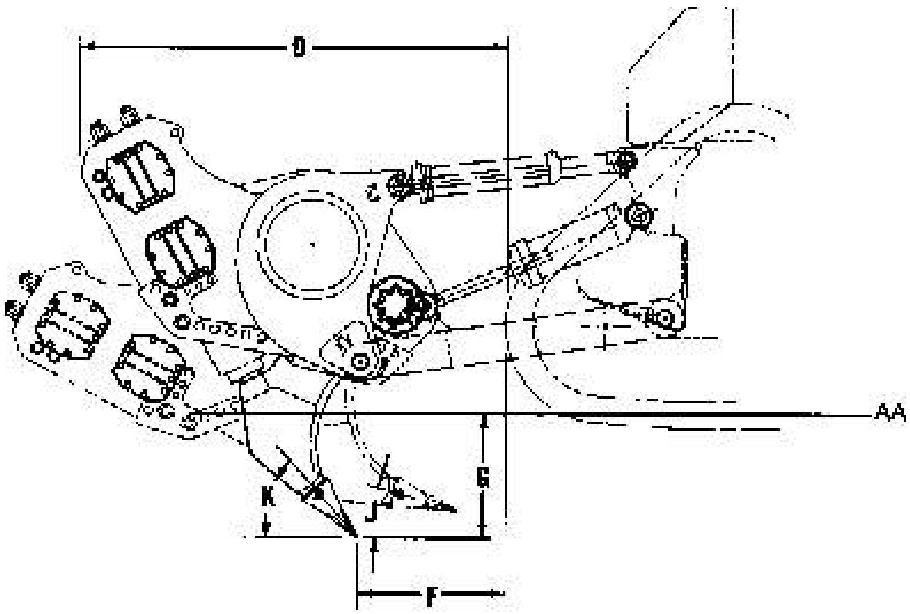
Adjustable Parallelogram Ripper

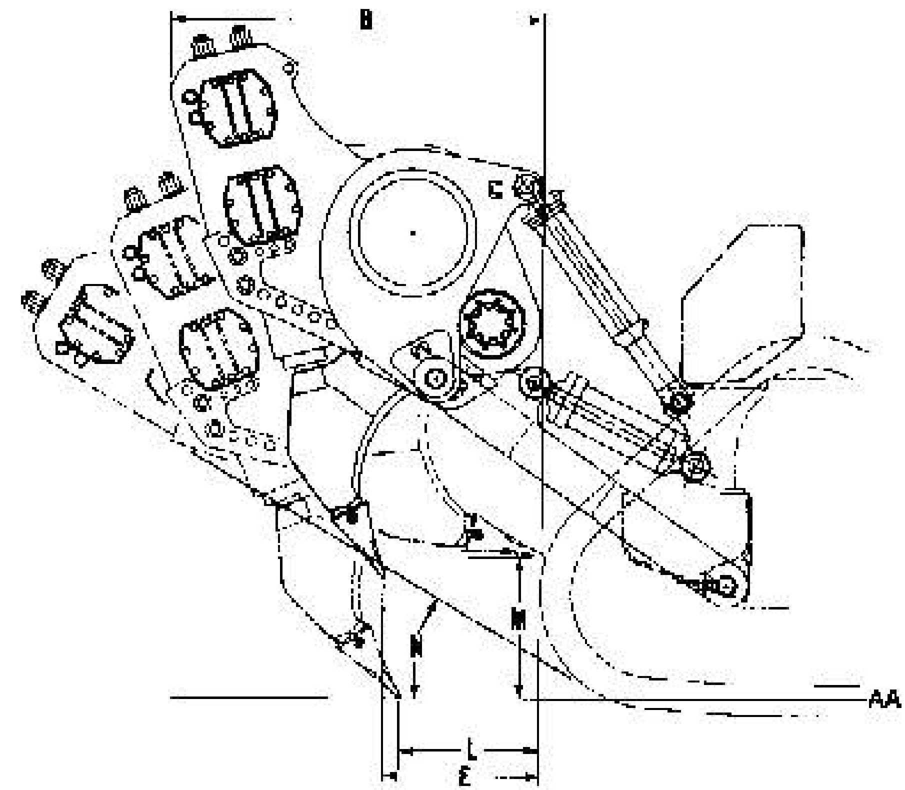


Note: Letters correspond to ripper specifications on pages that follow.

KEY
AA — Ground Line
BB — Track Gauge

Adjustable Parallelogram Impact Ripper

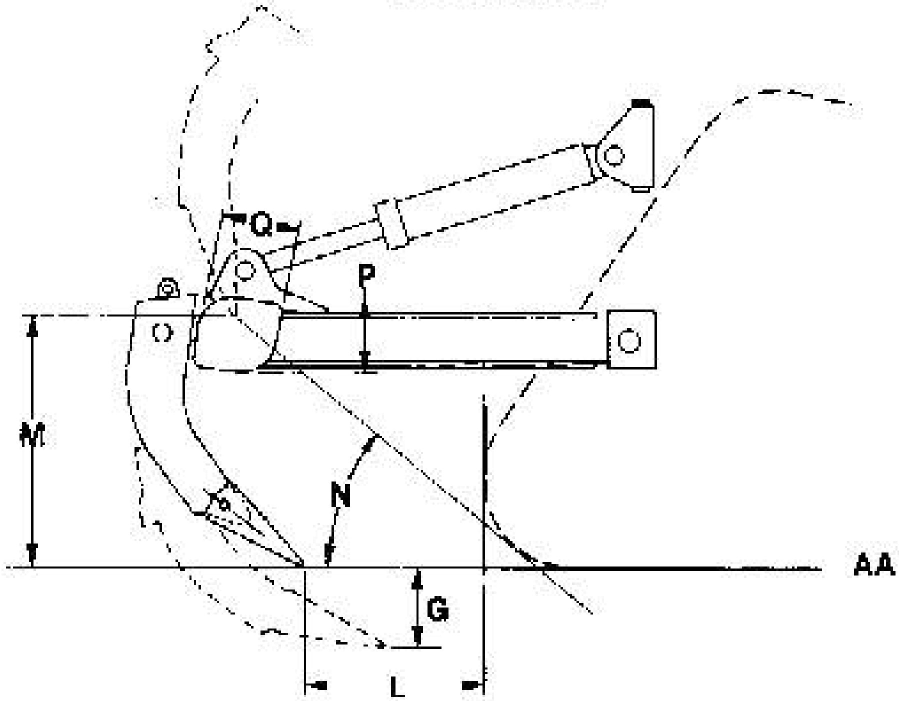




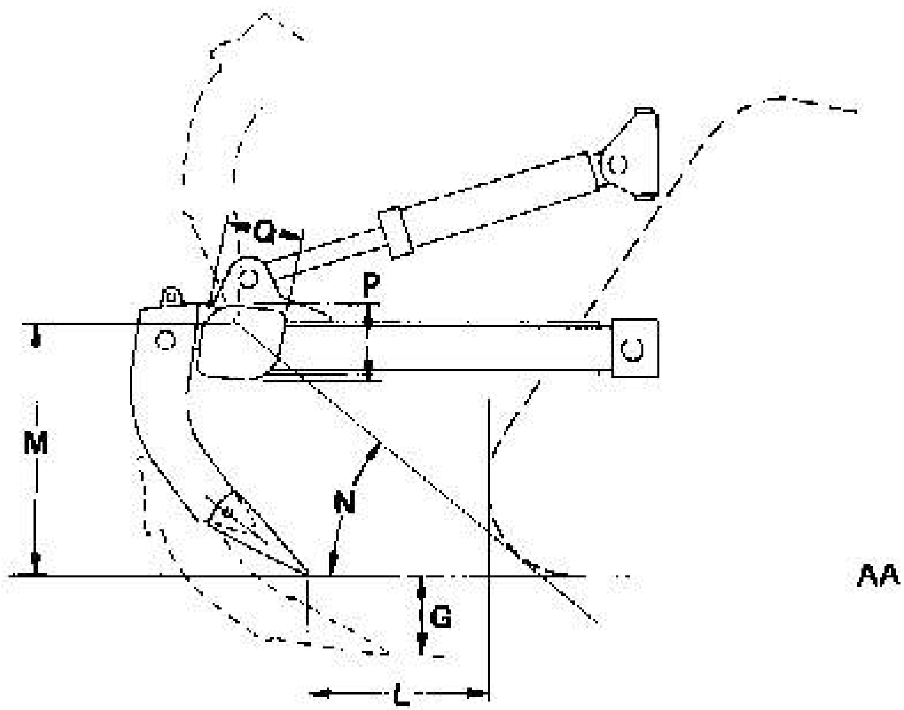
Note: Letters correspond to ripper specifications on pages that follow.

KEY	
AA	Ground Line

Radial Ripper*



Fixed Parallelogram Ripper



Note: Letters correspond to ripper specifications on pages that follow.

KEY
AA — Ground Line
* — Tip Standard

Specifications
• D3C Series II • D4C Series II
• D4H Series II • D4H XL Series III
• D4H LGP Series III

TRACTOR/RIPPER	D3C Series II D4C Series II		D4H** Series II		D4H XL Series III		D4H LGP Series III	
Ripper Type	Radial		Radial		Radial		Radial	
Dimensions:								
Ripper Shank								
G Maximum digging depth	260 mm	10.2"	375 mm	14.8"	375 mm	14.8"	375 mm	14.8"
L Maximum reach at ground line	686 mm	27"	645 mm	25.4"	645 mm	25.4"	645 mm	25.4"
M Maximum ground clearance under tip (shank pinned in bottom hole)	546 mm	21.5"	475 mm	19"	475 mm	19"	475 mm	19"
N Maximum ramp angle, ripper up (shank pinned in bottom hole)	26°		26.5°		26.5°		26.5°	
Shank section	36 x 76 mm (1.4" x 3")		58 x 139 mm (2.3" x 5.5")		58 x 139 mm (2.3" x 5.5")		58 x 139 mm (2.3" x 5.5")	
Ripper Beam								
O Overall width	1.58 m	5'2"	1.95 m	6'5"	1.95 m	6'5"	1.95 m	6'5"
P Height	130 mm	5.1"	165 mm	6.5"	165 mm	6.5"	165 mm	6.5"
Q Length	140 mm	5.5"	211 mm	8.3"	211 mm	8.3"	211 mm	8.3"
Number of Pockets	5		3		3		3	
T Pocket Spacing	356 mm	14"	896 mm	35.3"	896 mm	35.3"	896 mm	35.3"
U Shank Gauge	1.42 m	4'8"	1.79 m	5'10"	1.79 m	5'10"	1.79 m	5'10"
V Track clearance with standard shoe	151 mm	5.9"	86 mm	3.4"	86 mm	3.4"	86 mm	3.4"
Installed weights:								
Ripper with standard shank	260 kg	560 lb	625 kg	1378 lb	625 kg	1378 lb	625 kg	1378 lb
Each additional shank	11 kg	24 lb	34 kg	74 lb	34 kg	74 lb	34 kg	74 lb
Ripper Forces*:								
Penetration Force	2454 kg	5411 lb	3512 kg	7744 lb	3903 kg	8610 lb	4547 kg	10,026 lb
Pryout Force	6117 kg	13,488 lb	16 912 kg	37,291 lb	18 000 kg	39,690 lb	18 115 kg	39,943 lb

*This value may vary slightly with various vehicle configurations.
Note: Letters correspond to ripper dimension drawings.
**D4H Series II, D4H XL Series III and D4H LGP Series III Penetration and pryout forces are for machines equipped with P-Blade and Powershift Transmission

TRACTOR/RIPPER	D5H Series II		D5H XL Series II		D5H LGP Series II		D6H Series II		D7H Series II	
Ripper Type	Radial		Radial		Radial		Parallelogram		Parallelogram	
Dimensions:										
Ripper Shank										
G Maximum digging depth	406 mm	16"	406 mm	16"	406 mm	16"	500 mm	19.7"	746 mm	29.4"
L Maximum reach at ground line	652 mm	25.7"	652 mm	25.7"	652 mm	25.7"	729 mm	28.7"	1.03 m	40.7"
M Maximum ground clearance under tip (shank pinned in bottom hole)	592 mm	23.3"	592 mm	23.3"	592 mm	23.3"	520 mm	20.5"	551 mm	21.7"
N Maximum ramp angle, ripper up (shank pinned in bottom hole)	28°		28°		28°		26°		21°	
Shank section	74 x 175 mm (2.9" x 6.9")		74 x 175 mm (2.9" x 6.9")		74 x 175 mm (2.9" x 6.9")		74 x 176 mm (2.9" x 6.9")		72 x 228 mm (2.8" x 9")	
Ripper Beam										
O Overall width	2.20 m	7'3"	2.20 m	7'3"	2.20 m	7'3"	2.20 m	7'3"	2.21 m	7'3"
P Height	216 mm	8.5"	216 mm	8.5"	216 mm	8.5"	216 mm	8.5"	279 mm	11"
Q Length	254 mm	10"	254 mm	10"	254 mm	10"	254 mm	10"	343 mm	13.5"
Number of Pockets	3		3		3		3		3	
T Pocket Spacing	1000 mm	39.4"	1000 mm	39.4"	1000 mm	39.4"	1000 mm	39.4"	991 mm	39"
U Shank Gauge	2.00 m	6'7"	2.00 m	6'7"	2.00 m	6'7"	2.00 m	6'7"	1.98 m	6'6"
V Track clearance with standard shoe	100 mm	3.9"	100 m	3.9"	100 mm	3.9"	120 mm	4.7"	95 mm	3.7"
Installed weights:										
Ripper with standard shank	936 kg	2059 lb	936 kg	2059 lb	936 kg	2059 lb	1456 kg	3203 lb	2964 kg	6512 lb
Each additional shank	70 kg	154 lb	70 kg	154 lb	70 kg	154 lb	70 kg	154 lb	145 kg	320 lb
Ripper Forces*:										
Penetration Force	4510 kg	9946 lb	5151 kg	11,360 lb	6242 kg	13,764 lb	6556 kg	14,428 lb	8671 kg	19,100 lb
Pryout Force	21 738 kg	47,932 lb	23 585 kg	52,000 lb	21 738 kg	47,932 lb	9155 kg	20,140 lb	21 202 kg	46,760 lb

*This value may vary slightly with various vehicle configurations.
Note: Letters correspond to ripper dimension drawings.

TRACTOR/RIPPER	D8N				D9N			
Ripper Type	Adjustable Parallelogram				Adjustable Parallelogram			
	Single Shank		Multishank		Single Shank		Multishank	
Dimensions:								
Ripper to Track								
Ripper length behind track, shank vertical, ripper up								
A With Pushblock	NA		NA		NA		NA	
B Without Pushblock	1.58 m	5'2"	1.46 m	4'8"	1.46 m	4'9"	1.33 m	4'4"
Ripper length behind track, shank vertical, ripper down								
C With Pushblock	NA		NA		NA		NA	
D Without Pushblock	1.84 m	6'0"	1.71 m	5'7"	1.84 m	6'0"	1.71 m	5'7"
Tip to track distance, shank vertical								
E Ripper Up	694 mm	27.3"	640 mm	25.2"	568 mm	22.4"	510 mm	20.1"
F Ripper Down	950 mm	37.4"	899 mm	35.4"	948 mm	37.3"	890 mm	35"
Ripper Shank*								
G Maximum digging depth	1130 mm	44.5"	780 mm	30.7"	1230 mm	48.4"	802 mm	31.6"
H Dig adjustment per hole	305 mm	12"	250 mm	10"	295 mm	12"	250 mm	10"
I Total dig adjustment	610 mm	24"	250 mm	10"	590 mm	23.2"	250 mm	10"
Pitch Adjustment, ripper down:								
J Forward	15.0°		14.9°		10.0°		10.0°	
K Backward	9.9°		10.0°		15.1°		15.10°	
L Maximum reach at ground line	1.32 m	4'3"	1.17 m	3'10"	1.27 m	4'2"	1.16 m	3'10"
M Maximum ground clearance under tooth (shank pinned in bottom hole)	636 mm	25"	593 mm	23.3"	798 mm	31.4"	881 mm	34.7"
N Maximum ramp angle, ripper up (shank pinned in bottom hole)	26.2°		28.4°		34.2°		37.5°	
Shank Section	75 x 333 mm 2.9" x 13.1"		75 x 333 mm 2.9" x 13.1"		75 x 333 mm 2.9" x 13.1"		75 x 333 mm 2.9" x 13.1"	
Ripper Beam								
O Overall width	NA		2.46 m	8'1"	NA		2.64 m	8'8"
P Height	NA		334 mm	13.1"	NA		380 mm	15"
Q Length	NA		457 mm	18"	NA		457 mm	18"
Clearance under beam, shank vertical								
R Ripper Up	NA		1.55 m	5'1"	NA		1.77 m	5'10"
S Ripper Down	NA		449 mm	17.7"	NA		378 mm	14.9"
Number of Pockets	1		3		1		3	
T Pocket Spacing	NA		1092 mm	43"	NA		1180 mm	46.4"
U Shank Gauge	NA		2.17 m	7'1"	NA		2.35 m	7'8"
V Track Clearance with standard shoe	76 mm	3"	76 mm	3"	71 mm	2.8"	71 mm	2.8"
W Width across widest part of lift cylinders	1.37 m	4'5"	1.37 m	4'5"	1.50 m	4'11"	1.50 m	4'11"
Installed Weights:								
Ripper with standard shank	4128 kg	9100 lb	4050 kg	8930 lb	4463 kg	9840 lb	4810 kg	10,600 lb
Each additional tooth group	NA		332 kg	733 lb	NA		332 kg	733 lb
Ripper Forces**:								
Penetration Force, shank vertical	121,660 N	27,350 lb	117,480 N	26,410 lb	150,080 N	33,740 lb	147,150 N	33,080 lb
Pryout Force, shank vertical	209,290 N	47,050 lb	219,560 N	49,360 lb	316,130 N	71,070 lb	324,600 N	72,990 lb

*Deep Ripping Shank is available for D8N and D9N single shank rippers. Hydraulic pin puller is standard with deep ripping shank.

D8N Deep Ripping Arrangement maximum digging depth is 1.57 m (5'2").
D9N Deep Ripping Arrangement maximum digging depth is 1.66 m (5'5").

**Forces are for a ripper on a tractor equipped with EROPS, U-Dozer and performance track. Forces will vary slightly with other vehicle configurations.
Note: Letters correspond to ripper dimension drawings.
NA — Not Applicable

TRACTOR/RIPPER	D5H Series II		D5H XL Series II		D5H LGP Series II		D6H Series II		D7H Series II	
Ripper Type	Radial		Radial		Radial		Parallelogram		Parallelogram	
Dimensions:										
Ripper Shank										
G Maximum digging depth	406 mm	16"	406 mm	16"	406 mm	16"	500 mm	19.7"	746 mm	29.4"
L Maximum reach at ground line	652 mm	25.7"	652 mm	25.7"	652 mm	25.7"	729 mm	28.7"	1.03 m	40.7"
M Maximum ground clearance under tip (shank pinned in bottom hole)	592 mm	23.3"	592 mm	23.3"	592 mm	23.3"	520 mm	20.5"	551 mm	21.7"
N Maximum ramp angle, ripper up (shank pinned in bottom hole)	28°		28°		28°		26°		21°	
Shank section	74 x 175 mm (2.9" x 6.9")		74 x 175 mm (2.9" x 6.9")		74 x 175 mm (2.9" x 6.9")		74 x 175 mm (2.9" x 6.9")		72 x 228 mm (2.8" x 9")	
Ripper Beam										
O Overall width	2.20 m	7'3"	2.20 m	7'3"	2.20 m	7'3"	2.20 m	7'3"	2.21 m	7'3"
P Height	216 mm	8.5"	216 mm	8.5"	216 mm	8.5"	216 mm	8.5"	279 mm	11"
Q Length	254 mm	10"	254 mm	10"	254 mm	10"	254 mm	10"	343 mm	13.5"
Number of Pockets	3		3		3		3		3	
T Pocket Spacing	1000 mm	39.4"	1000 mm	39.4"	1000 mm	39.4"	1000 mm	39.4"	991 mm	39"
U Shank Gauge	2.00 m	6'7"	2.00 m	6'7"	2.00 m	6'7"	2.00 m	6'7"	1.98 m	6'6"
V Track clearance with standard shoe	100 mm	3.9"	100 m	3.9"	100 mm	3.9"	120 mm	4.7"	95 mm	3.7"
Installed weights:										
Ripper with standard shank	936 kg	2059 lb	936 kg	2059 lb	936 kg	2059 lb	1456 kg	3203 lb	2954 kg	6512 lb
Each additional shank	70 kg	154 lb	70 kg	154 lb	70 kg	154 lb	70 kg	154 lb	145 kg	320 lb
Ripper Forces*:										
Penetration Force	4510 kg	9946 lb	5151 kg	11,360 lb	6242 kg	13,764 lb	6558 kg	14,426 lb	8671 kg	19,100 lb
Pryout Force	21 738 kg	47,932 lb	23 586 kg	52,000 lb	21 738 kg	47,932 lb	9155 kg	20,140 lb	21 202 kg	46,750 lb

*This value may vary slightly with various vehicle configurations.
Note: Letters correspond to ripper dimension drawings.

TRACTOR/RIPPER	D8N		D9N	
Ripper Type	Adjustable Parallelogram		Adjustable Parallelogram	
	Single Shank	Multishank	Single Shank	Multishank
Dimensions:				
Ripper to Track				
Ripper length behind track, shank vertical, ripper up				
A With Pushblock	NA	NA	NA	NA
B Without Pushblock	1.58 m 5'2"	1.46 m 4'9"	1.46 m 4'9"	1.33 m 4'4"
Ripper length behind track, shank vertical, ripper down				
C With Pushblock	NA	NA	NA	NA
D Without Pushblock	1.84 m 6'0"	1.71 m 5'7"	1.84 m 6'0"	1.71 m 5'7"
Tip to track distance, shank vertical				
E Ripper Up	694 mm 27.3"	640 mm 25.2"	568 mm 22.4"	510 mm 20.1"
F Ripper Down	950 mm 37.4"	899 mm 35.4"	948 mm 37.3"	890 mm 35"
Ripper Shank*				
G Maximum digging depth	1130 mm 44.5"	780 mm 30.7"	1230 mm 48.4"	802 mm 31.6"
H Dig adjustment per hole	305 mm 12"	250 mm 10"	295 mm 12"	250 mm 10"
I Total dig adjustment	610 mm 24"	250 mm 10"	590 mm 23.2"	250 mm 10"
Pitch Adjustment, ripper down:				
J Forward	15.0°	14.9°	10.0°	10.0°
K Backward	9.8°	10.0°	15.1°	15.10°
L Maximum reach at ground line	1.32 m 4'3"	1.17 m 3'10"	1.27 m 4'2"	1.16 m 3'10"
M Maximum ground clearance under tooth (shank pinned in bottom hole)	635 mm 25"	593 mm 23.3"	798 mm 31.4"	881 mm 34.7"
N Maximum ramp angle, ripper up (shank pinned in bottom hole)	28.2°	28.4°	34.2°	37.5°
Shank Section	75 x 333 mm 2.9" x 13.1"	75 x 333 mm 2.9" x 13.1"	75 x 333 mm 2.9" x 13.1"	75 x 333 mm 2.9" x 13.1"
Ripper Beam				
O Overall width	NA	2.46 m 8'1"	NA	2.64 m 8'8"
P Height	NA	334 mm 13.1"	NA	380 mm 15"
Q Length	NA	457 mm 18"	NA	457 mm 18"
Clearance under beam, shank vertical				
R Ripper Up	NA	1.55 m 5'1"	NA	1.77 m 5'10"
S Ripper Down	NA	449 mm 17.7"	NA	378 mm 14.9"
Number of Pockets	1	3	1	3
T Pocket Spacing	NA	1092 mm 43"	NA	1180 mm 46.4"
U Shank Gauge	NA	2.17 m 7'1"	NA	2.35 m 7'8"
V Track Clearance with standard shoe	76 mm 3"	76 mm 3"	71 mm 2.8"	71 mm 2.8"
W Width across widest part of lift cylinders	1.37 m 4'5"	1.37 m 4'5"	1.50 m 4'11"	1.50 m 4'11"
Installed Weights				
Ripper with standard shank	4128 kg 9100 lb	4050 kg 8930 lb	4463 kg 9840 lb	4810 kg 10,600 lb
Each additional tooth group	NA	332 kg 733 lb	NA	332 kg 733 lb
Ripper Forces**:				
Penetration Force, shank vertical	121,660 N 27,350 lb	117,480 N 26,410 lb	150,080 N 33,740 lb	147,150 N 33,080 lb
Pryout Force, shank vertical	209,290 N 47,050 lb	219,560 N 49,360 lb	316,130 N 71,070 lb	324,680 N 72,990 lb

*Deep Ripping Shank is available for D8N and D9N single shank rippers. Hydraulic pin puller is standard with deep ripping shank.
D8N Deep Ripping Arrangement maximum digging depth is 1.57 m (5'2").
D9N Deep Ripping Arrangement maximum digging depth is 1.66 m (5'5").

**Forces are for a ripper on a tractor equipped with EROPS, U-Dozer and performance track. Forces will vary slightly with other vehicle configurations.
Note: Letters correspond to ripper dimension drawings.
NA — Not Applicable.

TRACTOR/RIPPER

Ripper Type	D10N Adjustable Parallelogram Single Shank		Multishank		Impact Ripper	
Dimensions:						
Ripper to Track						
Ripper length behind track, shank vertical, ripper up (A)						
A With Pushblock	2.08 m	6'10"	NA		NA	
B Without Pushblock	1.76 m	5'8"	1.56 m	5'1"	2.44 m	8'0"
Ripper length behind track, shank vertical, ripper down (A)						
C With Pushblock	2.48 m	8'2"	NA		NA	
D Without Pushblock	2.16 m	7'1"	1.96 m	6'5"	2.92 m	9'7"
Tip to track distance, shank vertical (A)						
E Ripper Up	730 mm	28.7"	651 mm	25.6"	1030 mm	40.6"
F Ripper Down	1130 mm	44.5"	1050 mm	41.3"	1350 mm	53.1"
Ripper Shank*						
G Maximum digging depth	1370 mm	53.9"	941 mm	37"	907 mm	35.7"
H Dig adjustment per hole	355 mm	14"	250 mm	10"	NA	
I Total dig adjustment	710 mm	28"	250 mm	10"	NA	
Pitch Adjustment, ripper down:						
J Forward (C)	18.0°		18.0°		16.8°	
K Backward (C)	18.7°		19.7°		54.4°	
L Maximum reach at ground line	1.50 m	4'11"	1.36 m	4'6"	1.19 m	3'11"
M Maximum ground clearance under tooth (shank pinned in bottom hole)	1070 mm	42.1"	1060 mm	41.7"	952 mm	37.5"
N Maximum ramp angle, ripper up (shank pinned in bottom hole)	36.9°		37.5°		36.5°	
Shank Section	90 x 380 mm		90 x 355 mm		NA	
	3.5" x 15"		3.5" x 14"		NA	
Ripper Beam						
O Overall width	NA		2.92 m	9'7"	1.84 m	6'1"
P Height	NA		460 mm	18.1"	NA	
Q Length	NA		485 mm	19.1"	NA	
Clearance under beam, shank vertical						
R Ripper Up	NA		2.03 m	6'8"	NA	
S Ripper Down	NA		380 mm	15"	NA	
Number of Pockets	1		3		1	
T Pocket Spacing	NA		1320 mm	52"	NA	
U Shank Gauge	NA		2.63 m	8'8"	NA	
V Track Clearance with standard shoe	97 mm	4"	97 mm	4"	97 mm	4"
W Width across widest part of lift cylinders	1.75 m	5'9"	1.75 m	5'9"	1.75 m	5'9"
Installed Weights:						
Ripper with standard shank	6713 kg	14,800 lb	6940 kg	15,300 lb	11 544 kg	25,450 lb
Each additional tooth group	NA		490 kg	1080 lb	NA	
Ripper Forces** (B):						
Penetration Force, shank vertical (A)	197,150 N	44,320 lb	193,500 N	43,500 lb	229,390 N	51,570 lb
Pryout Force, shank vertical (A)	419,810 N	94,400 lb	425,160 N	95,580 lb	384,420 N	86,420 lb

*Deep Ripping Shank is available for D10N single shank rippers.
Hydraulic pin puller is standard with deep ripping shank.
D10N Deep Ripping Arrangement maximum digging depth is 1.88 m (6'2").

**Forces are for a ripper on a tractor equipped with an EROPS, U-Dozer and performance track. Forces will vary slightly with other vehicle configurations.

(A) Impact ripper with shank full back.
(B)—Impact ripper peak impact force along tip centerline [D10N 1,335,000 N (300,000 lb)].
(C)—Impact ripper angle of tip centerline to ground line

Note: Letters correspond to ripper dimension drawings.
NA — Not Applicable

TRACTOR/RIPPER	D11N					
Ripper Type	Adjustable Parallelogram					
	Single Shank		Multishank		Impact Ripper	
Dimensions:						
Ripper to Track						
Ripper length behind track, shank vertical, ripper up (A)						
A With Pushblock	2.21 m	7'3"	NA		NA	
B Without Pushblock	1.88 m	6'3"	1.57 m	5'2"	2.52 m	8'3"
Ripper length behind track, shank vertical, ripper down (A)						
C With Pushblock	2.65 m	8'8"	NA		NA	
D Without Pushblock	2.33 m	7'8"	1.99 m	6'6"	3.35 m	11'0"
Tip to track distance, shank vertical (A)						
E Ripper Up	687 mm	27"	651 mm	25.6"	1063 mm	41.8"
F Ripper Down	1130 mm	44.5"	1030 mm	40.6"	1160 mm	45.7"
Ripper Shank*						
G Maximum digging depth	1610 mm	63.4"	1070 mm	42.1"	1003 mm	39.5"
H Dig adjustment per hole	280 mm	11"	280 mm	11"	NA	
I Total dig adjustment	840 mm	33.1"	280 mm	11"	NA	
Pitch Adjustment, ripper down:						
J Forward (C)	18.4°		16.4°		16.8°	
K Backward (C)	16.9°		16.9°		49.1°	
L Maximum reach at ground line	1.78 m	5'10"	1.56 m	5'1"	1.21 m	4'0"
M Maximum ground clearance under tooth (shank pinned in bottom hole)	1160 mm	3'10"	1116 mm	3'8"	979 mm	3'3"
N Maximum ramp angle, ripper up (shank pinned in bottom hole)	34.2°		36.9°		30.8°	
Shank Section	110 x 450 mm		100 x 400 mm		NA	
	4.3" x 17.7"		3.9" x 15.7"		NA	
Ripper Beam						
O Overall width	NA		3.33 m	10'11"	2.03 m	6'8"
P Height	NA		560 mm	22"	NA	
Q Length	NA		560 mm	22"	NA	
Clearance under beam, shank vertical						
R Ripper Up	NA		2.06 m	6'9"	NA	
S Ripper Down	NA		282 mm	11.1"	NA	
Number of Pockets	1		3		1	
T Pocket Spacing	NA		1500 mm	59"	NA	
U Shank Gauge	NA		2.99 m	9'10"	NA	
V Track Clearance with standard shoe	127 mm	5"	127 mm	5"	127 mm	5"
W Width across widest part of lift cylinders	1.93 m	6'4"	1.93 m	6'4"	1.93 m	6'4"
Installed Weights:						
Ripper with standard shank	8945 kg	19,720 lb	9612 kg	21,190 lb	17 020 kg	37,530 lb
Each additional tooth group	NA		660 kg	1454 lb	NA	
Ripper Forces** (B):						
Penetration Force, shank vertical (A)	266,450 N	59,900 lb	257,420 N	57,870 lb	337,660 N	75,910 lb
Pryout Force, shank vertical (A)	610,870 N	137,330 lb	601,220 N	135,160 lb	539,000 N	121,330 lb

*Deep Ripping Shank is available for D11N single shank rippers.
Hydraulic pin puller is standard with deep ripping shank.
D11N Deep Ripping Arrangement maximum digging depth is 2.18 m (7'2").
**Forces are for a ripper on a tractor equipped with an EROPS, U-Dozer and performance tank. Forces will vary slightly with other vehicle configurations.

(A)—Impact ripper with shank full back.
(B)—Impact ripper peak impact force along tip centerline [D11N 2,000,000 N (450,000 lb)].
(C)—Impact ripper angle of tip centerline in ground line.
Note: Letters correspond to ripper dimension drawings.
NA — Not Applicable.

TRACTOR/RIPPER	D4E/No. 4		D5B/No. 5		D6D/No. 6 D6E/No. 6		D7G/No. 7	
Ripper Type	Parallelogram		Parallelogram		Parallelogram		Parallelogram	
Dimensions:								
Ripper Shank								
G Maximum digging depth	400 mm	16"	478 mm	19"	530 mm	20.9"	737 mm	29"
L Maximum reach at ground line	640 mm	25"	640 mm	25"	551 mm	21.7"	994 mm	39.1"
M Maximum ground clearance under tip (shank pinned in bottom hole)	297 mm	12"	297 mm	12"	218 mm	8.6"	462 mm	18.2"
N Maximum ramp angle, ripper up (shank pinned in bottom hole)	20°		20°		18°		21°	
Shank Section	61 x 140 mm 2.4" x 5.5"		61 x 140 mm 2.4" x 5.5"		76 x 178 mm 3" x 7"		72 x 228 mm 2.8" x 9"	
Ripper Beam								
O Overall width	1.98 m	6'6"	2.34 m	7'8"	2.34 m	7'8"	2.21 m	7'3"
P Height	140 mm	5.5"	140 mm	5.5"	214 mm	8.4"	279 mm	11"
Q Length	171 mm	7"	171 mm	7"	254 mm	10"	343 mm	13.5"
Number of Pockets	6		5		5		3	
T Pocket Spacing	432 mm	17"	432 mm	17"	536 mm	21.1"	991 mm	39"
U Shank Gauge	1.74 m	5'8"	1.74 m	5'8"	2.15 m	7'1"	1.98 m	6'6"
V Track clearance with standard shoe	60 mm	2"	60 mm	2"	213 mm	8.4"	185 mm	7.3"
Installed weights:								
Ripper with standard shank	1080 kg	2380 lb	1380 kg	3043 kg	1500 kg	3308 lb	2590 kg	5710 lb
Each additional shank	31 kg	681 lb	73 kg	161 lb	65 kg	143 lb	191 kg	421 lb

Note: Letters correspond to ripper dimension drawings.

TRACTOR/RIPPER — D8L/No. 8

Ripper Type	Adjustable Parallelogram			
	Single Shank		**Multishank**	
Dimensions:				
Ripper to Track				
Ripper length behind track, shank vertical, ripper up				
A With Pushblock	1.72 m	5'8"	NA	
B Without Pushblock	NA		1.27 m	4'2"
Ripper length behind track, shank vertical, ripper down				
C With Pushblock	2.09 m	6'10"	NA	
D Without Pushblock	NA		1.63 m	5'4"
Tip to track distance, shank vertical				
E Ripper Up	610 mm	24"	550 mm	21.7"
F Ripper Down	875 mm	34.5"	818 mm	32.2"
Ripper Shank*				
G Maximum digging depth	1160 mm	45.7"	820 mm	32.3"
H Dig adjustment per hole	305 mm	12"	250 mm	10"
I Total dig adjustment	1220 mm	48"	500 mm	19.7"
Pitch Adjustment, ripper down:				
J Forward	38.6°		38.6°	
K Backward	2.5°		2.5°	
L Maximum reach at ground line	1.57 m	5'2"	1.29 m	4'3"
M Maximum ground clearance under tooth (shank pinned in bottom hole)	850 mm	33.5"	995 mm	39.2"
N Maximum ramp angle, ripper up (shank pinned in bottom hole)	27°		39°	
Shank Section	73 x 329 mm 2.87" x 12.95"		73 x 329 mm 2.87" x 12.95"	
Ripper Beam				
O Overall width	1.62 m	5'4"	2.19 m	7'2"
P Height	440 mm	17.3"	380 mm	15"
Q Length	480 mm	18.9"	457 mm	18"
Clearance under beam, shank vertical				
R Ripper Up	1.61 m	5'3"	1.65 m	5'5"
S Ripper Down	185 mm	7.3"	245 mm	9.6"
Number of Pockets	1		3	
T Pocket Spacing	NA		950 mm	37.4"
U Shank Gauge	NA		1.9 m	6'3"
V Track Clearance with standard shoe	68 mm	2.7"	68 mm	2.7"
W Width across widest part of lift cylinders	1.50 m	4'11"	1.50 m	4'11"
Installed Weights:				
Ripper with standard shank	4336 kg	9560 lb	4110 kg	9060 lb
Each additional tooth group	–		281 kg	842 lb
Ripper Force				
Penetration Force, shank vertical	135 kN	30,000 lb	130 kN	29,200 lb
Pryout Force, shank vertical	337 kN	75,800 lb	352 kN	79,200 lb

*Deep Ripping Shank is available for D8L single shank rippers.
Hydraulic pin puller is standard with deep ripping shank. Installed weight is 4463 kg (9840 lb).
Note: Letters correspond to ripper dimension drawings.
NA — Not Applicable.

TRACK LOADER/RIPPER	931C Series II 935C Series II		943		963		963		973	
Ripper-Scarifier Type	**Radial**		**Radial**		**Radial**		**Radial**		**Radial**	
Dimensions:										
Ripper Shank (1 std.)*										
G Maximum digging depth	260 mm	10.2"	304 mm	12"	284 mm	11.2"	360 mm	14.2"	428 mm	16.8"
L Maximum reach at ground line	686 mm	27"	1118 mm	44"	1092 mm	43"	1160 mm	45.7"	1295 mm	51"
M Maximum ground clearance under tip (shank pinned in bottom hole)	546 mm	21.5"	415 mm	16.3"	518 mm	20.3"	513 mm	20.2"	670 mm	26.4"
N Maximum ramp angle, ripper up (shank pinned in bottom hole)	26°		15°		19°		19°		20°	
Shank section	36 x 76 mm 1.4" x 3"		60 x 109 mm 2" x 4.3"		50 x 109 mm 2" x 4.3"		58 x 139 mm 2.3" x 5.5"		74 x 175 mm 2.9" x 6.9"	
Ripper Beam										
O Overall width	1.68 m	5'2"	1.95 m	6'5"	1.95 m	6'5"	1.95 m	6'6"	2.20 m	7'3"
P Height	130 mm	5.1"	165 mm	6.5"	165 mm	6.5"	165 mm	6.5"	216 mm	8.5"
Q Length	140 mm	5.5"	211 mm	8.3"	211 mm	8.3"	211 mm	8.3"	254 mm	10"
Number of Pockets	5		3		3		3		3	
T Pocket Spacing	356 mm	14"	900 mm	35.4"	900 mm	35.4"	896 mm	35.3"	1000 mm	39.4"
U Shank Gauge	1.42 m	4'8"	1.80 m	5'11"	1.80 m	5'11"	1.79 m	5'11"	2.0 m	6'7"
V Track clearance with standard shoe	151 mm	5.9"	NA		NA		NA		NA	
Installed weights										
Ripper with standard shank	250 kg	550 lb	525 kg	1155 lb	525 kg	1155 lb	678 kg	1495 lb	1205 kg	2657 lb
Each additional shank	11 kg	24 lb	11.7 kg	25.8 lb	11.7 kg	25.8 lb	34 kg	74 lb	69.8 kg	154 lb
Ripper Forces**:										
Penetration Force	—		3740 kg	8245 lb	4707 kg	10,380 lb	6385 kg	14,080 lb	8820 kg	19,450 lb
Pryout Force	—		10 388 kg	22,905 lb	10 388 kg	22,905 lb	13 897 kg	30,640 lb	17 450 kg	38,480 lb

Note: Letters correspond to ripper dimension drawings.
*One shank is standard on 943 through 973 Rippers.
**These values may vary slightly with different vehicle configurations.

NA — Not Applicable.

MOTOR GRADER/RIPPER	12G/130G/140G		14G		16G	
Ripper-Scarifier Type	Parallelogram — Rear Mounted					
Tire Size (std.) Front & Rear	13.00-24		16.00-24		18.00-25	
Dimensions:						
Ripper Shank						
G Maximum digging depth	462 mm	18.2"	401 mm	15.8"	452 mm	17.8"
L Maximum reach at ground line	1168 mm	46"	1380 mm	54.3"	1500 mm	58"
M Maximum ground clearance under tip (shank pinned in bottom hole)	508 mm	20"	663 mm	26.1"	673 mm	26.5"
N Maximum ramp angle, ripper up (shank pinned in bottom hole)	23°		21°		21°	
Shank Section	61 x 140 mm 2.4" x 5.5"		61 x 140 mm 2.4" x 5.5"		76 x 178 mm 3" x 7"	
Ripper Beam						
O Overall Width	2.30 m	7'7"	2.60 m	8'6"	2.98 m	9'9"
P Height	152 mm	6"	166 mm	6.5"	214 mm	8.4"
Q Length	229 mm	9"	211 mm	8.3"	254 mm	10"
Number of Pockets	5		7		7	
T Pocket Spacing	533 mm	21"	*		**	
U Shank Gauge	2.13 m	7'0"	2.44 m	8'0"	—	
V Tire clearance with standard tire	NA***		NA		NA	
Installed weights:						
Ripper with standard shank	1060.6 kg	2338 lb	1542 kg	3399 lb	2177 kg	4799 lb
Each additional shank	31 kg	68 lb	31 kg	68 lb	68 kg	150 lb
Ripper Forces ◄						
Penetration Force ◄	7480 kg	16,494 lb	10 678 kg	23,541 lb	10 163 kg	22,410 lb
Pryout Force	10 592 kg	23,355 lb	11 804 kg	26,028 lb	15 323 kg	33,786 lb

Note: See Section 1 for Ripper Tips
◄This value may vary slightly with various vehicle configurations.
*Pocket Spacing:
inside — 472 mm (19")
middle — 379 mm (15")
outside — 379 mm (15")
**Pocket Spacing:
inside — 500 mm (20")
middle — 445 mm (17.5")
outside — 445 mm (17.5")
***Entire ripper mounts behind rear tire.
Note: Letters correspond to ripper dimension drawings.
NA — Not Applicable.

TIP SELECTION FOR THE D8N, D9N, D10N AND D11N RIPPERS

Three tip configurations (short, intermediate and long) in two styles (centerline and penetration) are available for economical operation in a variety of conditions.

RECOMMENDED TIP USAGE

Short — Use in high impact conditions where breakage problems occur. The shorter the tip, the more it resists breakage.

Intermediate — Most effective in moderate impact conditions where abrasion is not excessive.

Long — Use in loose, abrasive materials where breakage is not a problem. Generally offers the most wear material.

Centerline vs Penetration

The materials being ripped and the tractor doing the ripping will both have an effect on which tip will do the best job. High density material requires a "penetration" tip. High impact material requires a "centerline" tip. The following is a general guide to tip application.

	Tips to use		
Ripping Condition	**D8N/ D9N**	**D10N**	**D11N**
Tandem Tractors	Short	Short	Short
Single Shank & Multi-Shank			
Extreme Duty	Int.	Short	Short
Medium Duty	Long	Int.	Int.
Abrasive Duty	Long	Long	Long

Always use the longest tip that will wear without excessive breakage. Different tips should be tried to determine the most economical.

ESTIMATING RIPPING PRODUCTION

Ripping costs must be compared to other methods of loosening the material — usually drilling and blasting — on a cost per ton or bank cubic yard basis. Thus, an accurate estimation of ripper production is needed to determine unit ripping costs.

There are three general methods of estimating ripping production:

1. The best method is to record the time spent ripping, then remove (using scrapers or loaders and trucks) and weigh the ripped material. The total weight divided by the time spent will give hourly production. If the contractor is paid by volume, then a density must be used and the accuracy is only as good as the density used. For payment by volume removed, method 2 may be desirable. Some care will be needed to assure that only ripped material is removed.
2. Another method is to cross-section the area and then record the time spent ripping. After the material has been removed, cross-section the area again to determine the volume of rock removed. The volume divided by the time spent ripping gives the ripping rate per minute or hour.
3. Timing the ripper over a measured distance is the least accurate method, but valuable for quick estimating on the job. An average cycle time should be determined from a number of timed cycles. Turn-around or back-up time must be included. Measure the average rip distance, rip spacing and depth of penetration. This data will give the volume per cycle from which the production in bank cubic yards can be calculated. Experience has shown results obtained from this method are about 10 to 20% higher than the more accurate method of cross-sectioning.

An example of the measured distance method for calculating ripper production is:

Data — D10N — No. 10 with one shank.
910 mm (36 in) between passes.
1.6 km/h (1 mph) average speed (including slippage and stalls).

Every 91 m (300 ft) requires .25 min to raise, pivot, turn, and lower again: 91 m (300 ft) = 1 pass.
610 mm (24 in) penetration.
Full time ripping (no pushing or dozing assignment).

Example of Estimating Production (Metric)

Time per pass:

1.6 km/h=26.7 m/min. Then $\frac{91\text{ m}}{26.7\text{ m/min}} = 3.41$ min;

3.41 min + .25 min (turn time) = 3.66 min/pass.

If the operator works an average of 45 min per h, it is possible to make = $\frac{45}{3.66}$ = 12.3 passes per h

Volume ripped: 91 m x 0.9 m x 0.6 m = 49.1 BCM per pass

Production = 49.1 x 12.3 = 604 BCM per h

Remember the results from this method are usually 10 to 20 per cent higher than the actual production that can be expected on the job.

• • •

Example of Estimating Production (English)

Time per pass:

MPH = 88 fpm. Then $\frac{300\text{ ft}}{88\text{ fpm}}$ = 3.41 min;

3.41 min + .25 min. (turn time) = 3.66 min/pass.

If the operator works an average of 45 min per hr, it is possible to make $\frac{45}{3.66}$ = 12.3 passes per hr

Volume ripped: $\frac{300 \times 3 \times 2}{27}$ = 66.7 BCY per pass

Production = 66.7 x 12.3 = 820 BCY per hr

• • •

Note: The demands of heavy ripping will increase the normal owning and operating costs of the tractor.

These costs should be increased no less than 30-40% in heavy ripping applications to estimate rock loosening costs.

There is no ready answer or rule-of-thumb solution to predict ripping production. Even if everything is known about the seismic velocity of the material, its composition, job conditions, equipment and operator, only a "guesstimate" can be given. The final answer must come from a production study obtained on the job site.

Sample problem (Metric)

Determine the loosening costs in the following situation:

Machine	— D10N Tractor with No. 10 Single Shank Ripper
Rip Spacing	— 915 mm
Ripper Penetration	— 610 mm
Rip Distance	— 91 m
Rip Time	— 3.41 minutes
Maneuver Time	— 0.25 minutes
Seismic Velocity	— 1830 meters per second
Assume 60 min. hour	

Solution:

1. Total Cycle Time 3.41 + 0.25 = 3.66 min
   Cycles/hour = $\frac{60\text{ min/hr}}{3.66\text{ min/cycle}}$ = 16.4
2. Production per cycle = 91 m x 0.9 m x 0.6 m = 49.1 BCM/cycle
3. Production = 49.1 BCM/cycle x 16.4 cycles/h = 805 BCM/h
4. Remember results of this method are usually 10 to 20% high.
   Actual Production 80% of 805 BCM/h = 644 BCM/h
   Or 90% of 805 BCM/h = 725 BCM/h
5. Owning and Operating Costs
   A D10N (ripping only) could have a $100.00/h O & O costs including $15/h operator.
6. Loosening Costs
   $100.00/hr ÷ 644 BCM/h = $0.155/BCM
   $100.00/hr ÷ 725 BCM/h = $0.137/BCM
   The loosening cost should range from 13.7¢ to 15.5¢/BCM

• • •

Sample problem (English)

Determine the loosening costs in the following situation:

Machine	— D10N Tractor with No. 10 Single Shank Ripper
Rip Spacing	— 3 feet
Ripper Penetration	— 2 feet
Rip Distance	— 300 feet
Rip Time	— 3.41 minutes
Maneuver Time	— 0.25 minutes
Seismic Velocity	6,000 feet per second
Assume 60 min. hour	

Solution:

1. Total Cycle Time = 3.41 + 0.25 = 3.66 min

$$\text{Cycles/hour} = \frac{60 \text{ min/hr}}{3.66 \text{ min/cycle}} = 16.4$$

2. Production per cycle = $\frac{300 \times 3 \times 2}{27}$ = 66.7 BCY/cycle

3. Production = 66.7 BCY/cycle x 16.4 cycles/hr = 1094 BCY/hour

4. Remember results of this method are usually 10 to 20% high.

   Actual Production = 80% x 1094 = 875 BCY/hr

   or 90% x 1094 = 984 BCY/hr

5. Owning and Operating Costs

   A D10N (ripping only) could have a $100.00/hr O & O cost including $15/hr operator

6. Loosening Costs

   $100.00/hr ÷ 875 BCY/hr = $0.114/BCY

   $100.00/hr ÷ 984 BCY/hr = $0.102/BCY

   The loosening cost should range from 10.2¢ to 11.4¢/BCY

• • •

USE OF SEISMIC VELOCITY CHARTS

The charts of ripper performance estimated by seismic wave velocities have been developed from field tests conducted in a variety of materials. Considering the extreme variations among materials and even among rocks of a specific classification, the charts must be recognized as being at best only one indicator of rippability.

Accordingly, consider the following precautions when evaluating the feasibility of ripping a given formation:

— Tooth penetration is often the key to ripping success, regardless of seismic velocity. This is particularly true in homogeneous materials such as mudstones and claystones and the fine-grained caliches. It is also true in tightly cemented formations such as conglomerates, some glacial tills and caliches containing rock fragments.

— Low seismic velocities of sedimentaries can indicate probable rippability. However, if the fractures and bedding joints do not allow tooth penetration, the material may not be ripped effectively.

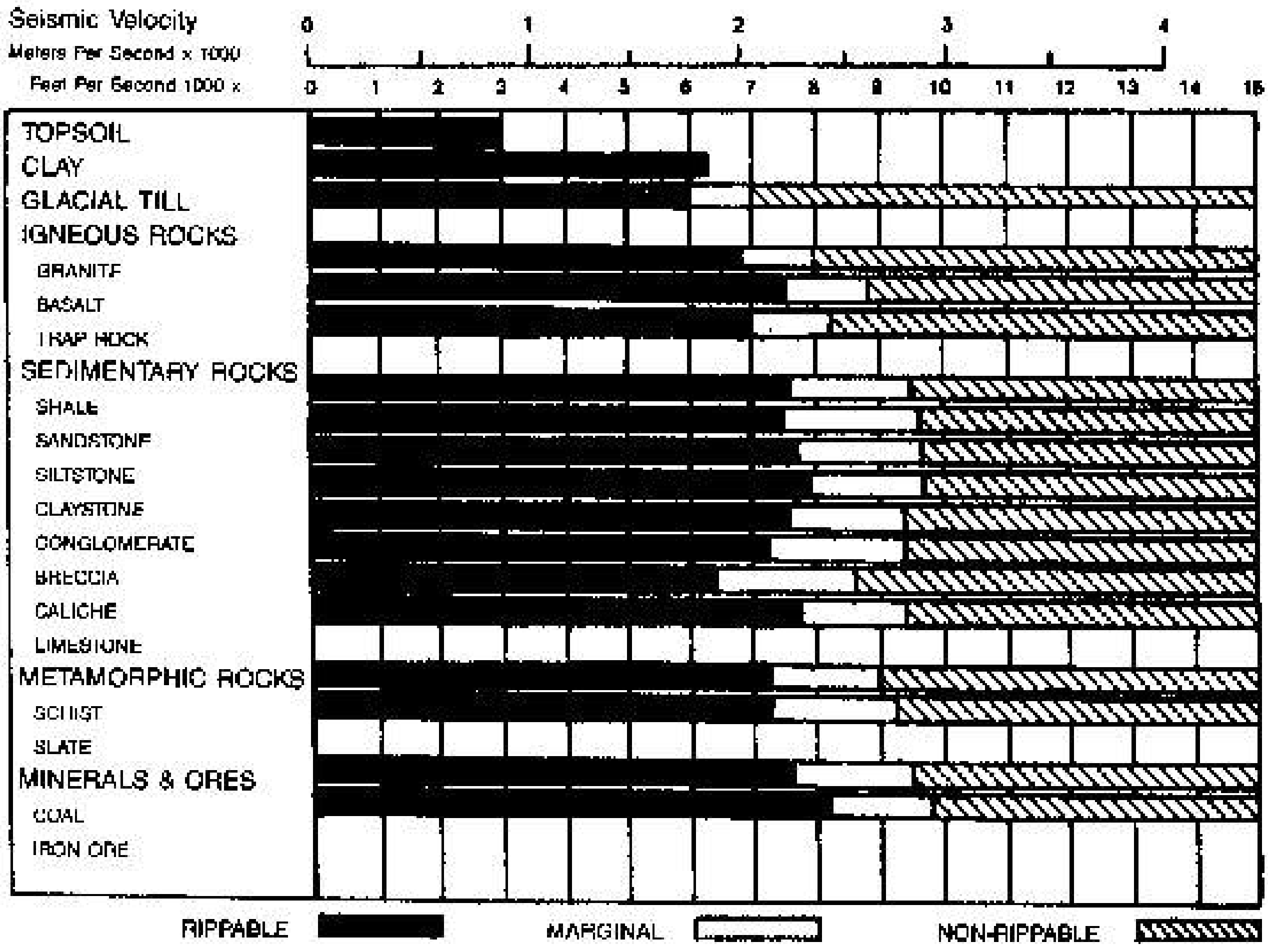
— Pre-blasting or "popping" may induce sufficient fracturing to permit tooth entry, particularly in the caliches, conglomerates and some other rocks; but the economics should be checked carefully when considering popping in the higher grades of sandstones, limestones and granites.

— Impact ripping may be used in marginal situations where tooth penetration, shank advancement or material sizing may be a problem. Significant boosts in production relative to a conventional ripping tractor can be obtained by using an impact ripper on a D10N or D11N.

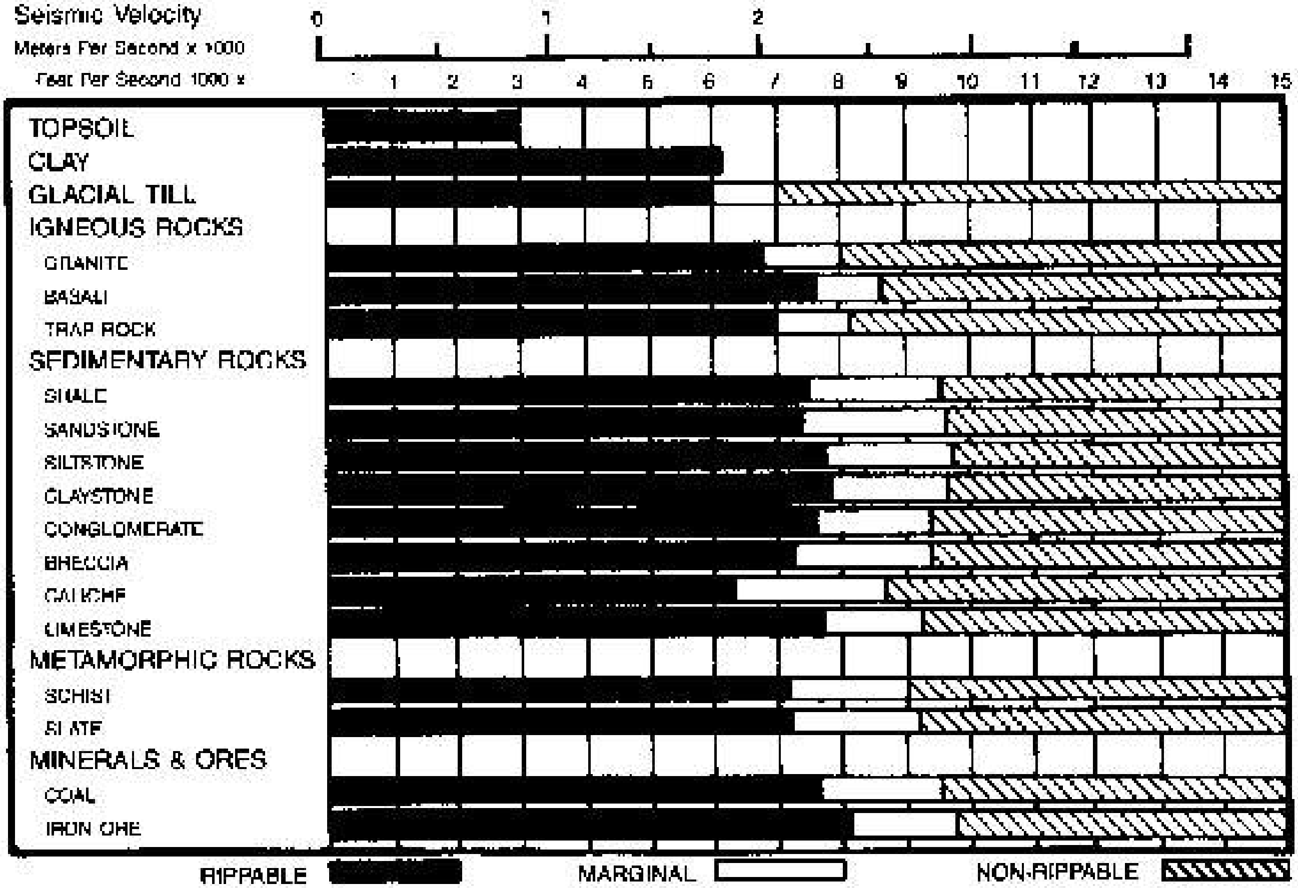
Ripping is still more art than science, and much will depend on operator skill and experience. Ripping for scraper loading may call for different techniques than if the same material is to be dozed away. Cross-ripping requires a change in approach. The number of shanks used, length and depth of shank, tooth angle, direction, throttle position — all must be adjusted according to field conditions. Ripping success may well depend on the operator finding the proper combination for those conditions.

Note: Field Seismic Information shown in the following charts is the best single indication of rippability. However, Caterpillar does not rely on any single parameter to select the best machine for your particular operation and rock type. Field Seismic Information is just one aspect of a complete rippability analysis that can be obtained through your Caterpillar dealer. A Caterpillar rippability analysis includes a geological site survey, field seismic velocity measurements, laboratory analysis of rock properties and an equipment investment analysis. Contact your Caterpillar dealer for a complete rippability analysis.

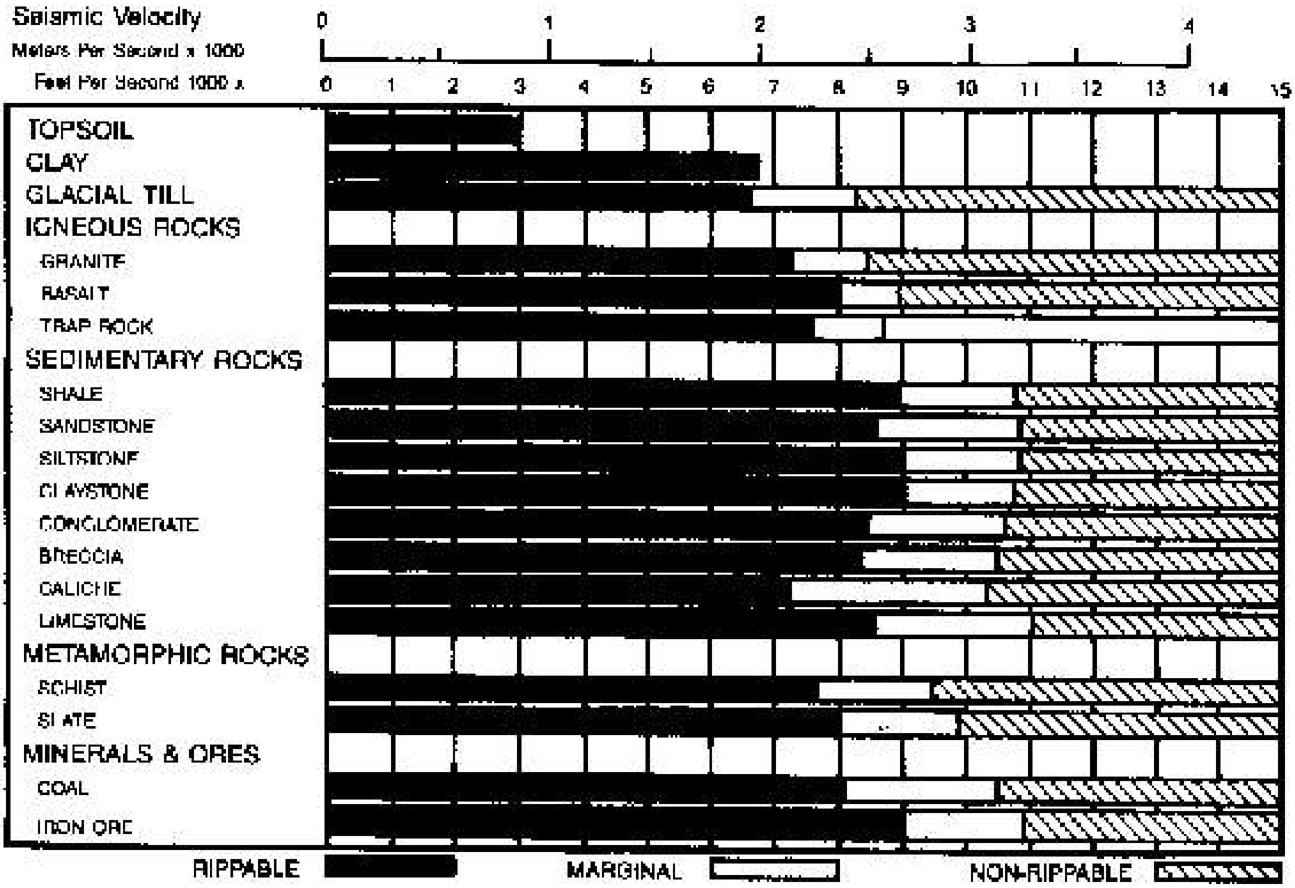
D8L
- **Multi or Single Shank No. 8 Ripper**
- **Estimated by Seismic Wave Velocities**



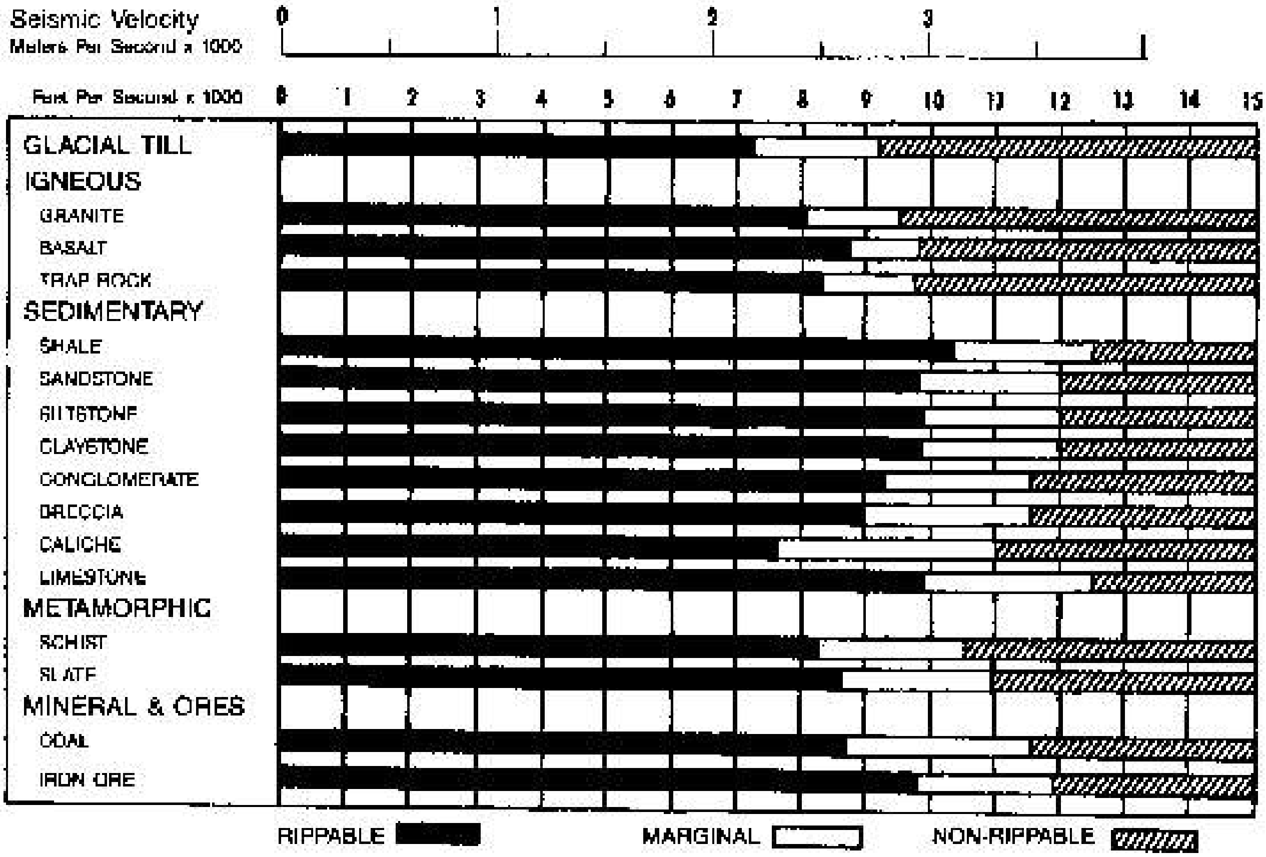
D9N
- **Multi or Single Shank No. 9 Ripper**
- **Estimated by Seismic Wave Velocities**



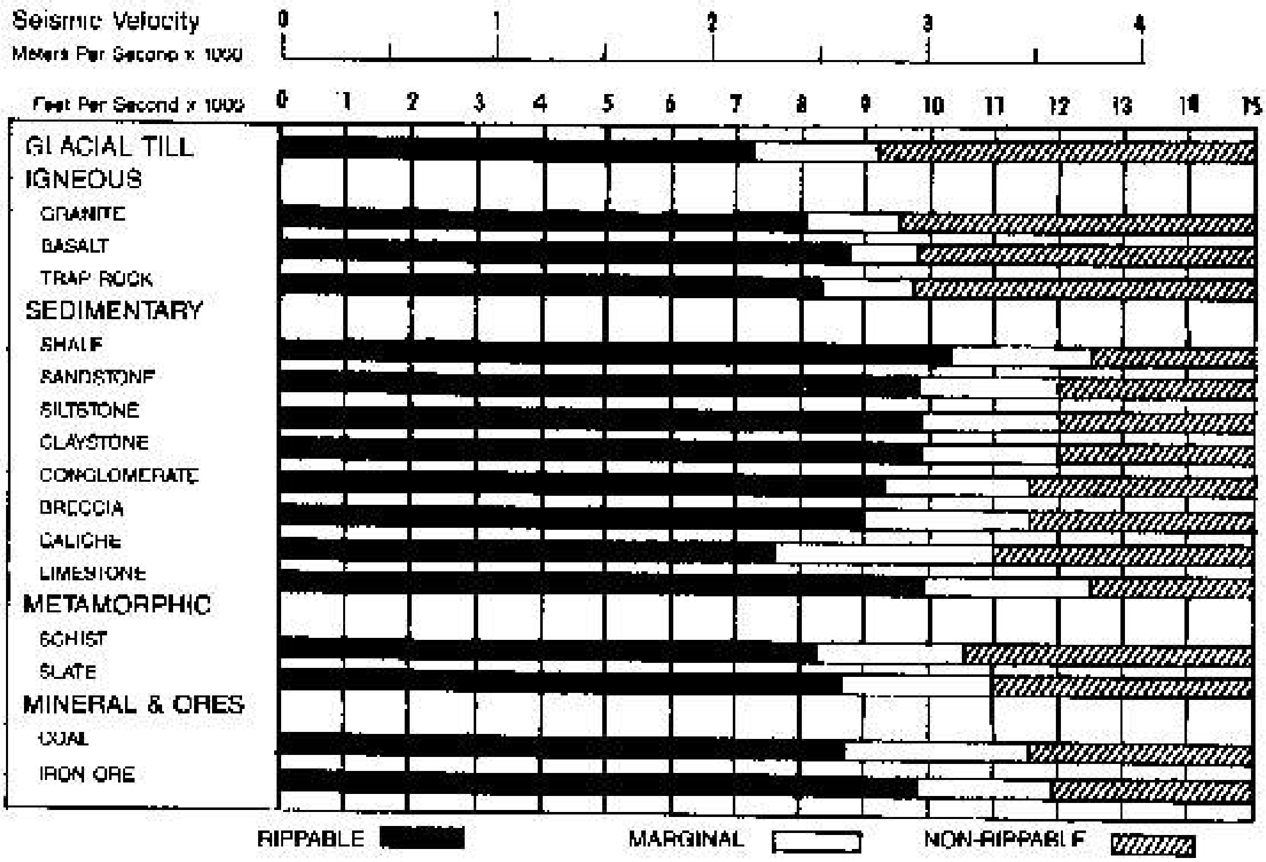
D10N
- **Multi or Single Shank No. 10 Ripper**
- **Estimated by Seismic Wave Velocities**



D10N
- **Single Shank Impact Ripper**
- **Estimated by Seismic Wave Velocities**



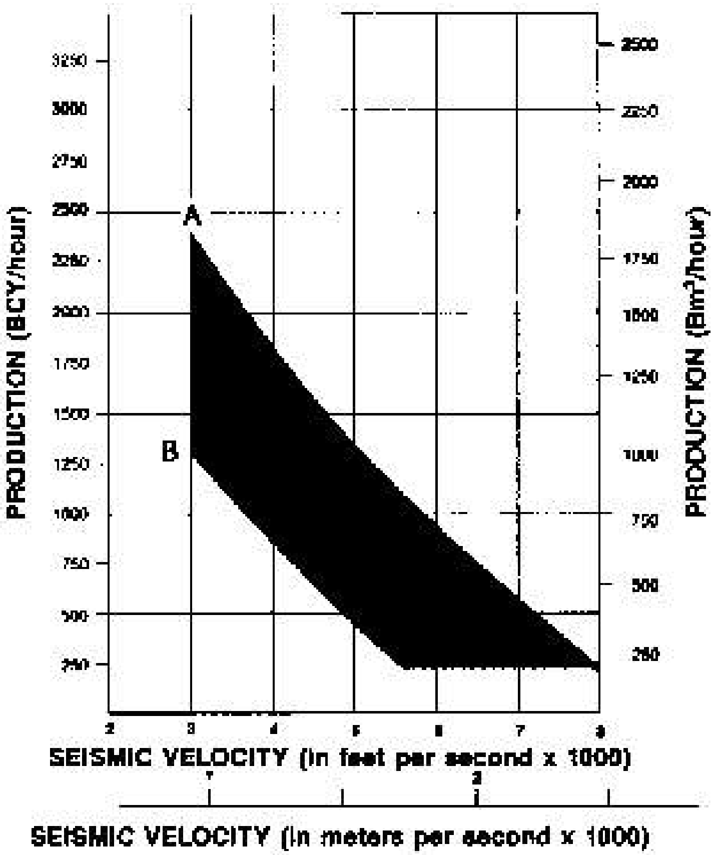
D11N
- **Multi or Single Shank No. 11 Ripper**
- **Estimated by Seismic Wave Velocities**



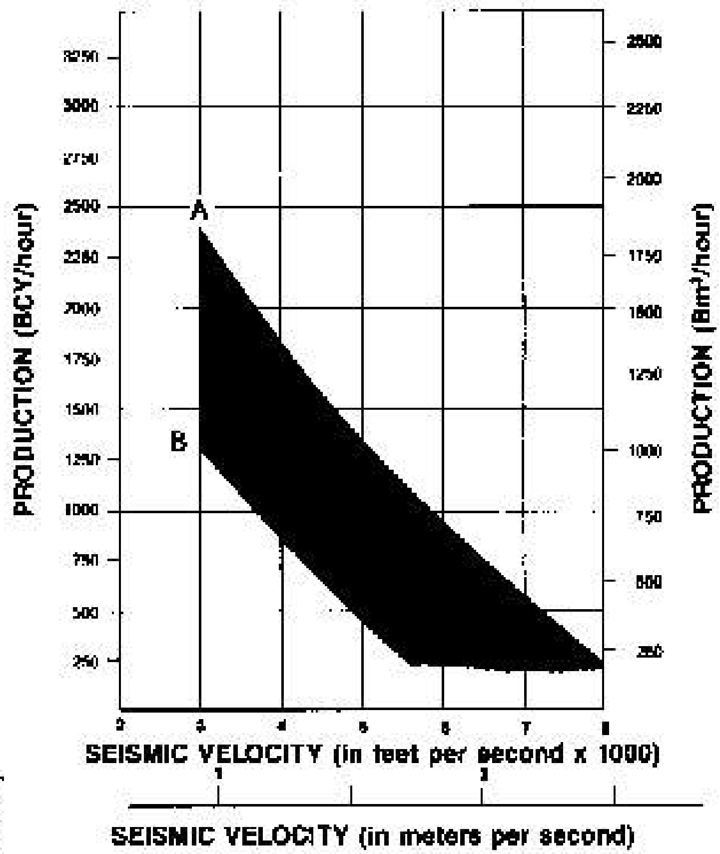
CONSIDERATIONS FOR USING PRODUCTION ESTIMATED GRAPHS:

- Machine rips full-time — no dozing.
- Power shift tractors with single shank rippers.
- 100% efficiency (60 min hour).
- Charts are for all classes of material.
- In igneous rock with seismic velocity of 8000 fps or higher for the D11N, and 6000 fps or higher for the D10N and D9N, the production figures shown should be reduced by 25%.
- Upper limit of charts reflect ripping under ideal conditions only. If conditions such as thick lamination, vertical lamination or any factor which would adversely affect production are present, the lower limit should be used.

D8L WITH SINGLE SHANK

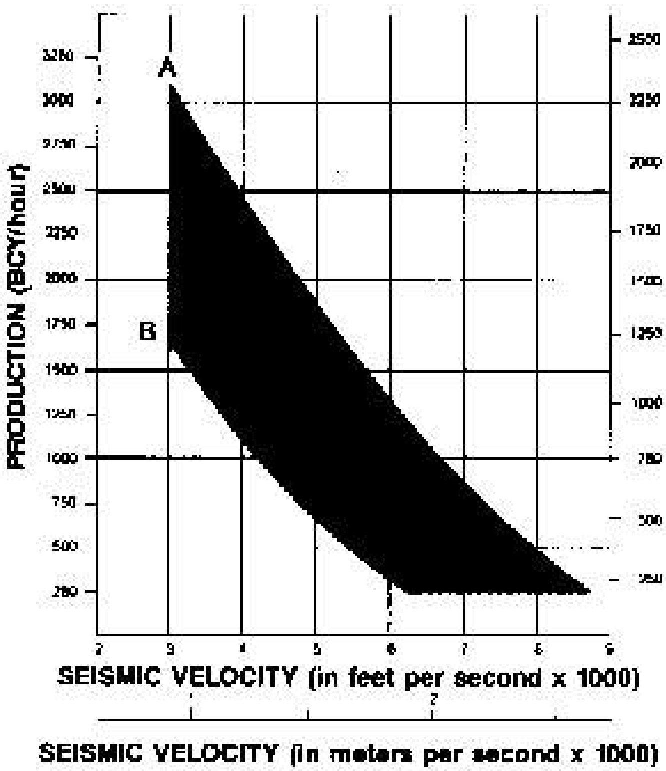


D9N WITH SINGLE SHANK

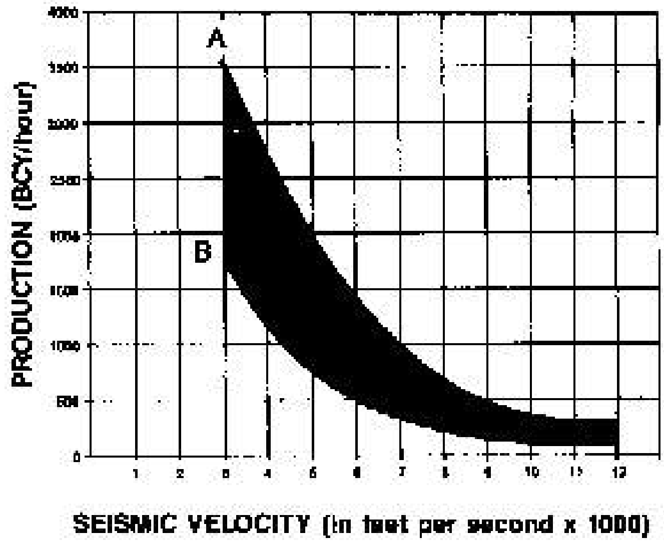


KEY
A — IDEAL
B — ADVERSE

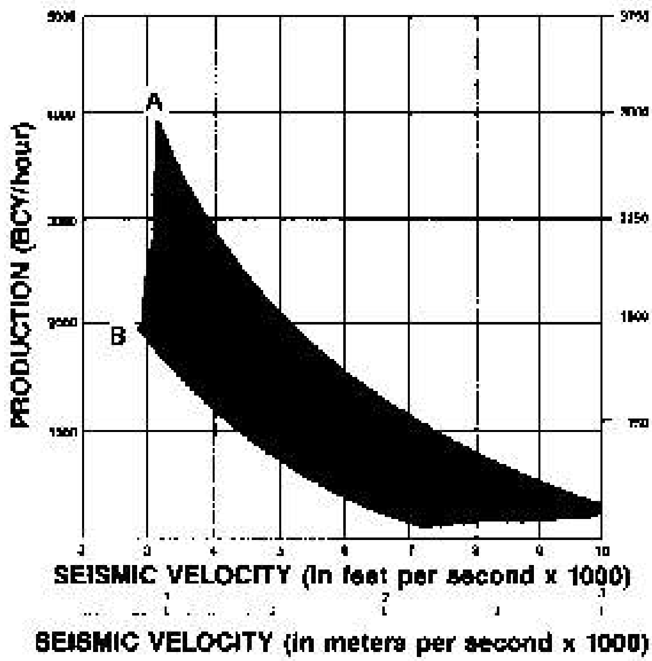
D10N WITH SINGLE SHANK



D10N WITH IMPACT RIPPER



D11N WITH SINGLE SHANK



KEY
A — IDEAL
B — ADVERSE

Features (931C Series II and 935C Series II):

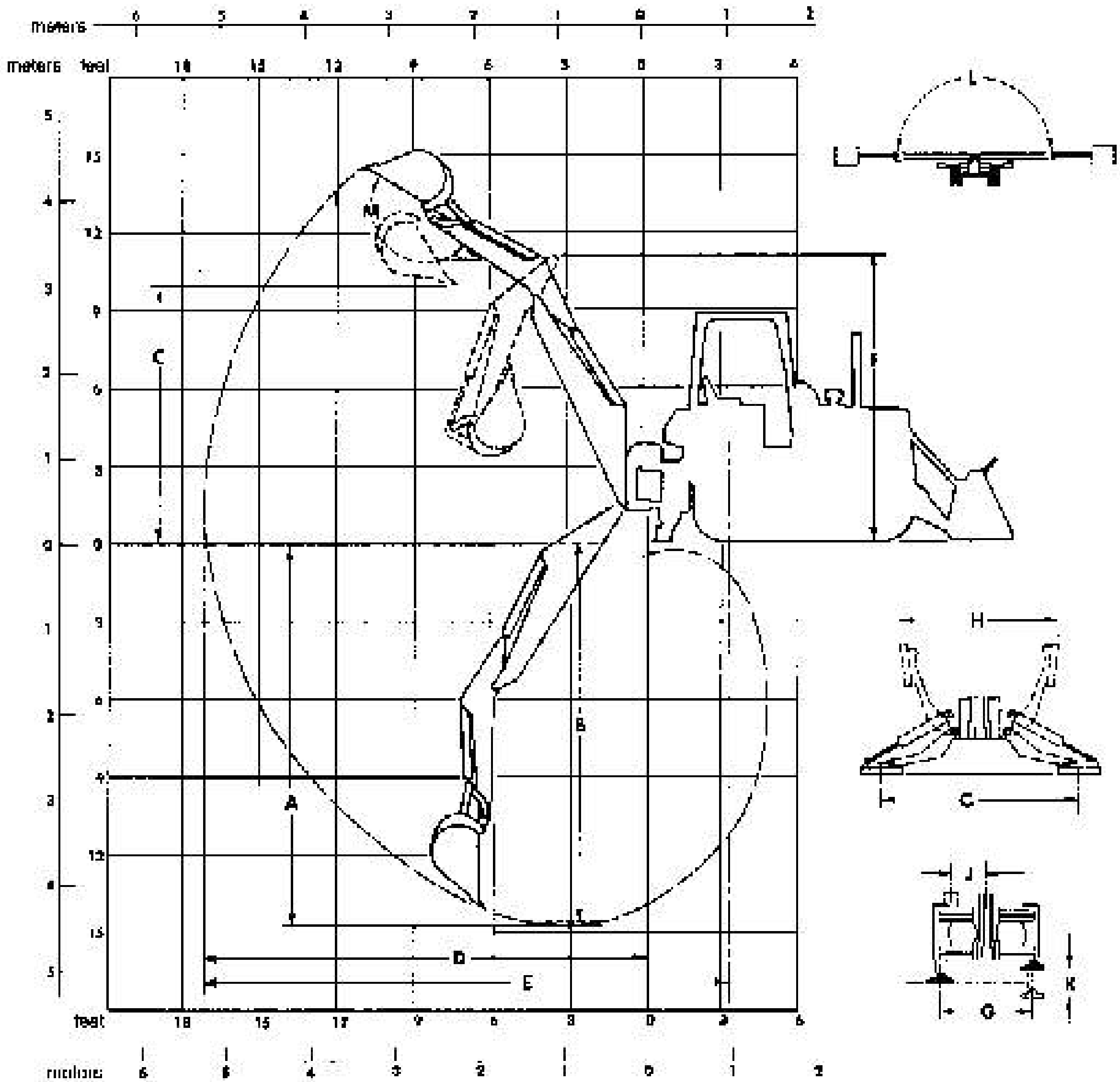
- **Two arrangements** . . . fixed pivot and side shift.
- **4.47 m (14'8")** maximum digging depth.
- **Pin-on mounting** permits installation and removal in minutes.
- **Two-lever backhoe control** . . . simple operation and precise digging.
- **Hydraulically powered vane motor swing system** . . . develops high swing torque for fast cycles and high production. Also provides accurate bucket placement and control.
- **Automatic hydraulic swing braking** protects backhoe components, provides smooth cycles.
- **Single seat** allows easy, comfortable operation of both machine and backhoe.
- **Four job-matched buckets** fit a variety of digging situations.
- **Three-position bucket linkage** to tailor bucket geometry to individual job requirements — straight wall digging, power digging and truck loading.
- **Hydraulic sideshift locks** allow operator to side shift without leaving seat.

Specifications	Fixed Pivot		Side Shift	
Lift capacity:				
Boom cylinder (to full height)	860 kg	1890 lb	860 kg	1890 lb
Stick cylinder (to full height)	870 kg	1910 lb	870 kg	1910 lb
Digging force:				
Stick cylinder	32 590 N	7320 lb	32 590 N	7320 lb
Bucket cylinder	53 400 N	12,000 lb	53 400 N	12,000 lb
Weight, shipping*	1505 kg	3315 lb	1659 kg	3650 lb
Operating weight:**				
931C Series II	9438 kg	20,805 lb	9682 kg	21,345 lb
935C Series II	9987 kg	22,017 lb	10 230 kg	22,554 lb
Machine length:***	6.34 m	20'10"	6.42 m	21'1"

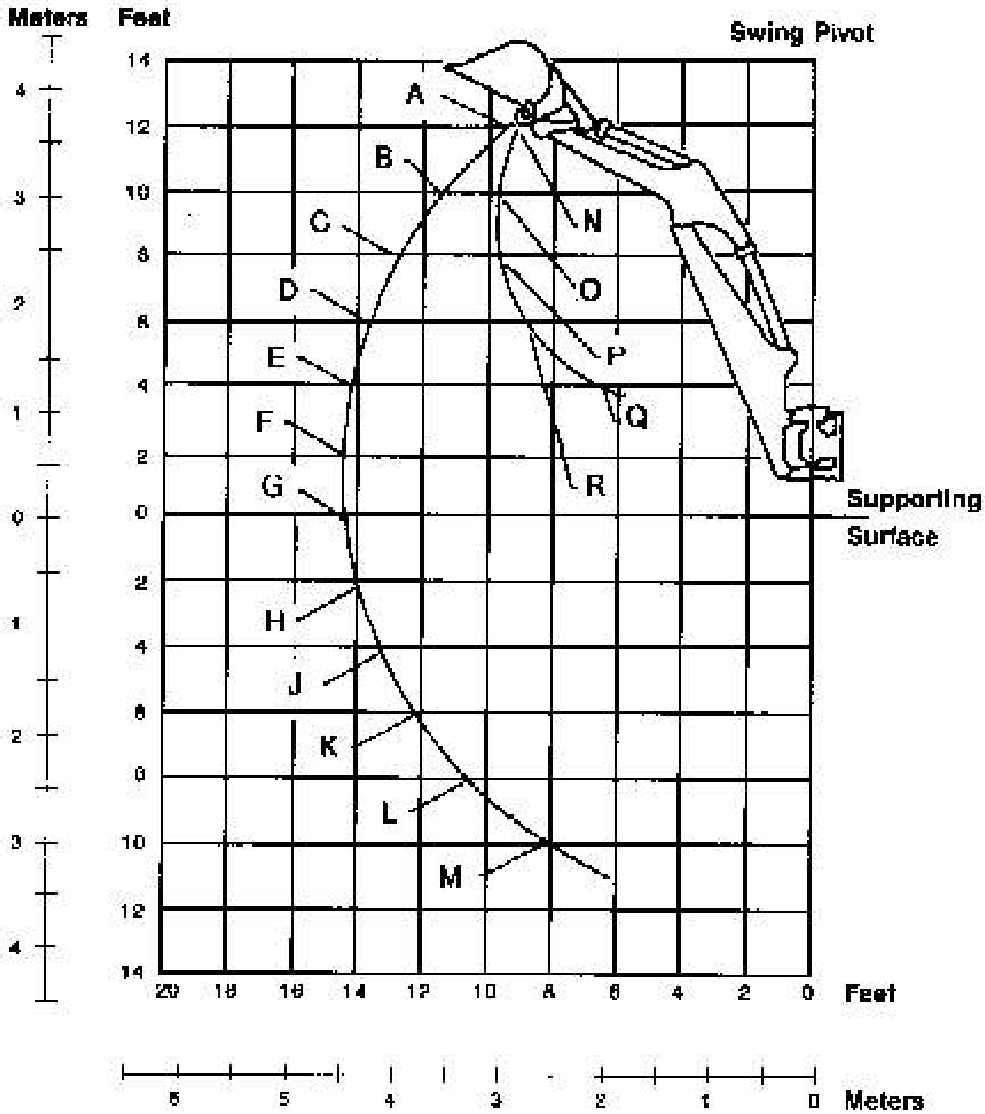
*__Shipping Weight__ does not include mounting parts, bucket, counterweight and piston pump and lines.

**__Operating Weight, installed__ includes 610 mm (24") backhoe bucket, mounting group, counterweight and counterweight mounting group, lubricants, coolant, full fuel tank, ROPS canopy and operator. 931C Series II and 935C Series II includes 3F-3R transmission and GP bucket.

***__Machine Length__ (with backhoe in straight back, fully folded position). 931C Series II and 935C Series II (with GP bucket on ground).



OPERATING SPECIFICATIONS KEY:	Fixed Pivot		Side Shift	
A Max. digging depth	4.47 m	14'8"	4.47 m	14'8"
B Digging depth — 610 mm (24") flat bottom	4.42 m	14'6"	4.42 m	14'6"
C Loading height	3.05 m	10'0"	3.05 m	10'0"
D Reach from center of swing	5.20 m	17'1"	5.20 m	17'1"
E Reach from center of sprocket	6.13 m	20'1"	6.2 m	20'4"
F Transport height	3.42 m	11'3"	3.42 m	11'3"
G Stabilizer spread operating position	2.84 m	9'4"	1.85 m	6'1"
H Stabilizer spread transport position	2.06 m	6'9"	2.13 m	7'0"
J Side shift (to either side of machine centerline)	—		584 mm	23"
K Stabilizer cylinder stroke	450 mm	17.7"	521 mm	20.5"
L Swing arc	190°		180°	
Swing time	2.3 sec (95° swing)		2.2 sec (90° swing)	
M Bucket rotation	127°, 128°, 168°		127°, 129°, 168°	



KEY:

	kg	lb
A	745	1643
B	894	1971
C	942	2077
D	955	2105
E	952	2099
F	943	2079
G	933	2057
H	924	2038
J	922	2033
K	931	2053
L	968	2133
M	1168	2576
N	893	1969
O	799	1761
P	753	1661
Q	1402	3091
R	914	2015

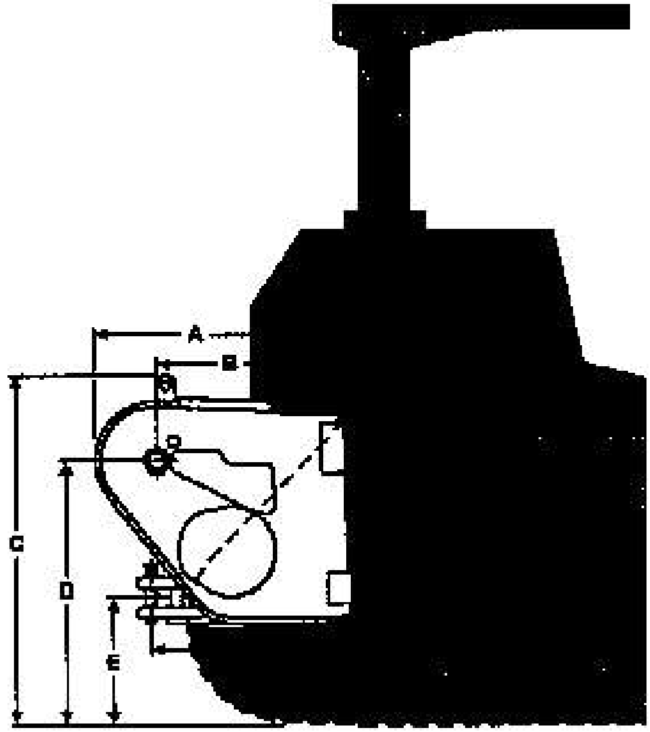
Note: Lift capacities (per SAE J31) are for boom over end and boom swing arc of the 931C Series II and 935C Series II fixed pivot and side shift backhoes.

WINCHES

CONTENTS

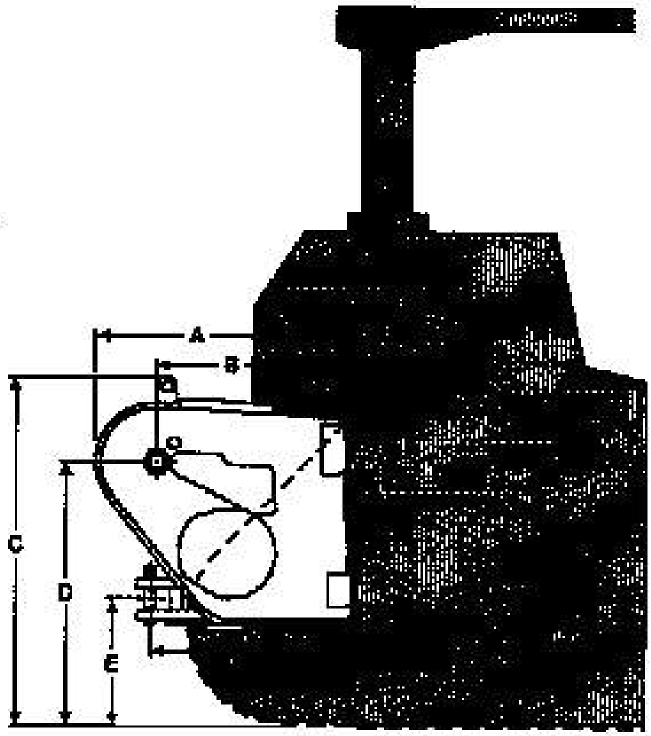
Features:

- **Hydraulically actuated** . . . with dedicated hydraulic pump and full-filtered system.
- **Adjustment free** oil-type clutches and brakes
- **Single lever** control
- **Modulated input clutch** . . . on most models, provides excellent inching control, facilitates tractor efficiency by engaging tractor power take-off only when winch is activated.
- **Adjustable sequence valve** permits winch operation to suit the job by selection of either inching or no inching characteristics (not used on 58 Winch).
- **Equal reel-in and reel-out speeds** (Optional on 53).
- **Line speeds match** to tractor ground speeds.
- **Full pressure lubricated** drum bearings and final reduction gears.
- **Planetary gearing** on 56, 57 and 59 Winches distributes loads which enhance durability.
- **Low-speed gears** available (except 53). This option is for enhanced line control.
- **Free spool** standard on all except winches for the D7G, D8N, D9N and D10N.



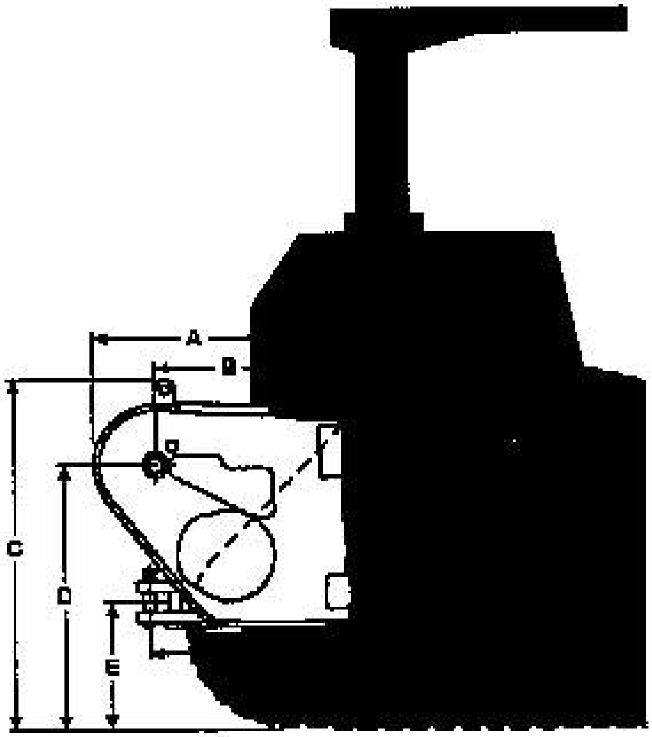
WINCH MODEL	53		55			
TRACTOR MODEL	D3C/D4C/D5C		D4H		D5H	
A Tractor to rear of winch	700 mm	27.6"	1023 mm	40.3"	1023 mm	40.3"
B Tractor to drum centerline	500 mm	19.7"	800 mm	31.5"	800 mm	31.5"
C Ground to top of winch	968 mm	38.1"	1240 mm	48.8"	1277 mm	50.3"
D Ground to drum centerline	704 mm	27.7"	921 mm	36.3"	958 mm	37.7"
E Ground to center of hitch	415 mm	16.3"	472 mm	18.6"	509 mm	20.0"
F Tractor to pin centerline	372 mm	14.6"	764 mm	30.1"	764 mm	30.1"
Overall width (not shown)	819 mm	32.2"	1080 mm	42.5"	1080 mm	42.5"
Drum diameter (not shown)	190 mm	7.5"	203 mm	8.0"	203 mm	8.0"
Weight*	478 kg	1054 lb	999 kg	2198 lb	999 kg	2198 lb
Oil refill capacity	19 L	5 U.S. gal	47 L	12.5 U.S. gal	47 L	12.5 U.S. gal
Wire rope diameter:						
Recommended	13 mm	0.5"	16 mm	0.63"	19 mm	0.75"
Optional	16 mm	0.63"	19 mm	0.75"	22 mm	0.88"
Drum capacity:						
Recommended rope	115 m	377'	107 m	351'	75 m	248'
Optional rope	75 m	246'	76 m	249'	54 m	175'
Wire rope ferrule size (OD × length)	41 × 51 mm	1.63 × 2.0"	41 × 51 mm	1.63 × 2.0"	54 × 67 mm	2.12 × 2.63"

*Operating weight includes pump and operator controls.



WINCH MODEL	56		57			
TRACTOR MODEL	**D6H**		**D7G**		**D7H**	
A Tractor to rear of winch	1107 mm	**43.6"**	873 mm	**34.4"**	1254 mm	**49.4"**
B Tractor to drum centerline	860 mm	**33.9"**	600 mm	**23.6"**	981 mm	**38.6"**
C Ground to top of winch	1473 mm	**58.0"**	259 mm	**10.2"**	1539 mm	**60.6"**
D Ground to drum centerline	1104 mm	**43.5"**	1162 mm	**45.7"**	1161 mm	**45.7"**
E Ground to center of hitch	507 mm	**20.0"**	576 mm	**22.7"**	574 mm	**22.6"**
F Tractor to pin centerline	878 mm	**34.5"**	647 mm	**25.5"**	1044 mm	**41.1"**
Overall width (not shown)	1066 mm	**42.0"**	980 mm	**38.6"**	1220 mm	**48.0"**
Drum diameter (not shown)	260 mm	**10.2"**	305/232 mm[1]	**12/9.12"[1]**	305 mm	**12.0"**
Weight*	1344 kg	**2957 lb**	1796 kg	**3951 lb**	1848 kg	**4066 lb**
Oil refill capacity	52 L	**13.8 U.S. gal**	61 L	**16 U.S. gal**	81 L	**21.5 U.S. gal**
Wire rope diameter:						
Recommended	22 mm	**0.88"**	25 mm	**1"**	25 mm	**1"**
Optional	26 mm	**1"**	29 mm	**1.13"**	29 mm	**1.13"**
Drum capacity:						
Recommended rope	76 m	**249'**	73/79 m[1]	**238/258'[1]**	73 m	**239'**
Optional rope	59 m	**194'**	58/63 m[1]	**190/206'[1]**	58 m	**190'**
Wire rope ferrule size (OD × length)	54 × 67 mm	**2.12 × 2.63"**	60 × 70 mm	**2.38 × 2.75"**	60 × 70 mm	**2.38 × 2.75"**

*Operating weight includes pump and operator controls.
[1] Standard speed winch/slow speed winch



WINCH MODEL	57		59			
TRACTOR MODEL	**D8N**		**D9N**		**D10N**	
A Tractor to rear of winch	1254 mm	49.4"	1152 mm	45.4"	1247 mm	49.1"
B Tractor to drum centerline	981 mm	38.6"	847 mm	33.3"	942 mm	37.1"
C Ground to top of winch	1673 mm	65.9"	1704 mm	67.1"	1787 mm	70.4"
D Ground to drum centerline	1294 mm	50.9"	1297 mm	51.1"	1480 mm	58.3"
E Ground to center of hitch	707 mm	27.8"	709 mm	27.9"	892 mm	35.1"
F Tractor to pin centerline	1044 mm	41.1"	906 mm	35.6"	1000 mm	39.4"
Overall width (not shown)	1220 mm	48.0"	1320 mm	52.0"	1564 mm	61.6"
Drum diameter (not shown)	305 mm	12.0"	330 mm	13.0"	330 mm	13.0"
Weight*	1836 kg	4039 lb	2102 kg	4624 lb	2184 kg	4805 lb
Oil refill capacity	81 L	21.5 U.S. gal	70 L	18.5 U.S. gal	70 L	18.6 U.S. gal
Wire rope diameter:						
Recommended	25 mm	1"	29 mm	1.13"	29 mm	1.13"
Optional	29 mm	1.13"	32 mm	1.25"	32 mm	1.25"
Drum capacity:						
Recommended rope	73 m	239'	69 m	226'	69 m	226'
Optional rope	58 m	190'	55 m	180'	55 m	180'
Wire rope ferrule size (OD × length)	60 × 70 mm	2.36 × 2.75"	60 × 70 mm	2.36 × 2.75"	60 × 70 mm	2.36 × 2.75"

*Operating weight includes pump and operator controls.

Winch Model		53			55		56
Tractor Model		**D3C**	**D4C**	**D5C**	**D4H**	**D5H**	**D6H**
British Units of Measure							
Standard speed gearing							
Bare Drum	Rated Linepull . . . . lbs	15,300	16,500	17,200	11,850	16,763	30,798
	Maximum linepull . . . . lbs	35,675	*35,800	*35,800	46,653	62,561	83,595
	Rated linespeed . . . . fpm	83	83	83	161	144	129
	Maximum linespeed . . . . fpm	189	189	189	183	180	158
Full Drum	Rated linepull . . . . lbs	8000	8500	9000	6192	8955	18,146
	Maximum linepull . . . . lbs	19,000	20,000	21,000	24,378	33,468	49,254
	Rated linespeed . . . . fpm	158	158	158	289	270	208
	Maximum linespeed . . . . fpm	360	360	360	351	336	267
Slow/Low speed gearing		Configuration not available.					
Bare Drum	Rated linepull . . . . lbs				24,792	36,071	*88,800
	Maximum linepull . . . . lbs				*51,200	*69,200	*89,800
	Rated linespeed . . . . fpm				72	69	36
	Maximum linespeed . . . . fpm				88	86	47
Full Drum	Rated linepull . . . . lbs				12,955	18,735	61,203
	Maximum linepull . . . . lbs				51,004	*69,200	*89,800
	Rated linespeed . . . . fpm				138	128	62
	Maximum linespeed . . . . fpm				168	161	79
Tractor rating		70 hp @ 2400 rmp	80 hp @ 2400 rpm	90 hp @ 2400 rpm	90 hp @ 2200 rpm	120 hp @ 2200 rpm	165 hp @ 1800 rpm
Metric Units of Measure							
Standard speed gearing							
Bare Drum	Rated Linepull . . . . kg	6946	7491	7809	5380	7610	13 982
	Maximum linepull . . . . kg	16 196	*16 253	*16 253	21 180	28 403	37 952
	Rated linespeed . . . . mpm	25	25	25	48	44	38
	Maximum linespeed . . . . mpm	58	58	58	56	55	48
Full Drum	Rated linepull . . . . kg	3632	3859	4086	2811	4066	8238
	Maximum linepull . . . . kg	8626	9080	9534	11 068	15 194	22 361
	Rated linespeed . . . . mpm	48	48	48	88	82	63
	Maximum linespeed . . . . mpm	110	110	110	107	102	81
Slow/Low speed gearing		Configuration not available.					
Bare Drum	Rated linepull . . . . kg				11 256	15 922	40 769
	Maximum linepull . . . . kg				*23 245	*31 417	*40 769
	Rated linespeed . . . . mpm				22	21	11
	Maximum linespeed . . . . mpm				27	26	14
Full Drum	Rated linepull . . . . kg				5882	8506	27 827
	Maximum linepull . . . . kg				23 156	*31 417	*40 769
	Rated linespeed . . . . mpm				42	39	18
	Maximum linespeed . . . . mpm				51	49	24
Tractor rating		52 kW @ 2400 rmp	60 kW @ 2400 rpm	67 kW @ 2400 rpm	67 kW @ 2200 rpm	90 kW @ 2200 rpm	123 kW @ 1800 rpm

Winch linepull and linespeed ratings are based on gear train mechanical efficiency of 90%
*Maximum linepull limited by breaking strength of the optional (larger diameter) wire rope

Operating Specifications
- British Units of Measure
- Metric Units of Measure

Winch Model		57G	57		58	
Tractor Model		**D7G**	**D7H**	**D8N**	**D9N**	**D10N**
British Units of Measure						
Standard speed gearing						
Bare Drum	Rated Linepull . . . lbs	40,276	35,960	51,964	47,035	59,157
	Maximum linepull . . . lbs	*113,000	109,657	*113,000	*139,000	*139,000
	Rated linespeed . . . fpm	118	132	129	175	192
	Maximum linespeed . . . fpm	150	167	172	200	216
Full Drum	Rated linepull . . . lbs	25,560	22,820	32,976	35,997	45,274
	Maximum linepull . . . lbs	72,380	69,587	83,017	120,940	121,306
	Rated linespeed . . . fpm	252	208	209	229	211
	Maximum linespeed . . . fpm	186	264	270	282	281
Slow/Low speed gearing						
Bare Drum	Rated linepull . . . lbs	*113,000	86,611	*113,000	85,888	108,151
	Maximum linepull . . . lbs	*113,000	*113,000	*113,000	*139,000	*130,000
	Rated linespeed . . . fpm	40	55	54	96	88
	Maximum linespeed . . . fpm	62	70	71	108	118
Full Drum	Rated linepull . . . lbs	62,480	54,898	79,329	65,810	82,771
	Maximum linepull . . . lbs	*113,000	*113,000	*113,000	*139,000	*139,000
	Rated linespeed . . . fpm	76	86	85	125	115
	Maximum linespeed . . . fpm	103	110	112	143	154
Tractor rating . . .		200 hp @ 2000 rmp	215 hp @ 2100 rpm	285 hp @ 2100 rpm	370 hp @ 1900 rpm	520 hp @ 1900 rpm
Metric Units of Measure						
Standard speed gearing						
Bare Drum	Rated Linepull . . . kg	18 265	16 326	23 592	21 354	26 857
	Maximum linepull . . . kg	*51 302	49 784	*51 302	*63 106	*63 106
	Rated linespeed . . . mpm	36	40	39	53	49
	Maximum linespeed . . . mpm	46	51	52	61	66
Full Drum	Rated linepull . . . kg	11 604	10 360	14 971	16 343	20 554
	Maximum linepull . . . kg	32 861	31 592	37 880	54 907	55 073
	Rated linespeed . . . mpm	77	63	64	70	64
	Maximum linespeed . . . mpm	57	81	82	80	86
Slow/Low speed gearing						
Bare Drum	Rated linepull . . . kg	*51 302	39 276	*51 302	39 039	49 101
	Maximum linepull . . . kg	*51 302	*51 302	*51 302	*63 106	*63 106
	Rated linespeed . . . mpm	12	17	16	29	27
	Maximum linespeed . . . mpm	18	21	22	33	36
Full Drum	Rated linepull . . . kg	28 366	24 924	36 015	29 878	37 578
	Maximum linepull . . . kg	*51 302	*51 302	*51 302	*63 106	*63 106
	Rated linespeed . . . mpm	23	26	26	38	35
	Maximum linespeed . . . mpm	31	34	34	44	47
Tractor rating . . .		149 kW @ 2000 rmp	160 kW @ 2100 rpm	210 kW @ 2100 rpm	276 kW @ 1900 rpm	390 kW @ 1900 rpm

Winch linepull and linespeed ratings are based on gear train mechanical efficiency of 90%.
*Maximum linepull limited by breaking strength of the optional (larger diameter) wire rope.

TOWED SCRAPERS

PRODUCTION BASIS FOR ALL TABLES IN THIS SECTION:
- Material 1780 kg/m³ (3000 lb/yd³).
- 60 minute hour.
- Total resistance 100 kg/metric ton ~ (200 lb/U.S. ton).
- Scraper load per trip estimated at rated struck capacity.

- All hydraulic
- Manufactured by Rome Industries

SCRAPER & TRACTOR	STRUCK CAPACITY		HAUL 120 m	400′	HAUL 180 m	600′	HAUL 250 m	800′	HAUL 300 m	1000′
PUSH LOADED			ESTIMATED HOURLY PRODUCTION							
RS6H	m³	yd³	m³	yd³	m³	yd³	m³	yd³	m³	yd³
D5H Series II (Power Shift)	6.9	9.0	107	140	88	116	76	88	66	86
D5H Series II (Direct Drive)	6.9	9.0	101	132	83	109	71	93	61	80
D5B (Power Shift)	6.9	9.0	106	138	86	113	74	96	63	83
D5B (Direct Drive)	6.9	9.0	104	136	87	114	75	98	65	85
D6H Series II (Power Shift)	6.9	9.0	126	164	102	133	86	113	75	98
D6H Series II (Direct Drive)	6.9	9.0	128	168	108	141	93	121	82	107
D6D (Power Shift)	6.9	9.0	123	161	99	130	84	110	73	95
D6D (Direct Drive)	6.9	9.0	125	163	104	136	89	116	78	102
SELF LOADED										
D5H Series II (Power Shift)	6.9	9.0	95	124	80	104	69	90	61	80
D5H Series II (Direct Drive)	6.9	9.0	89	117	75	98	64	84	57	75
D5B (Power Shift)	6.9	9.0	93	122	78	102	67	88	59	77
D5B (Direct Drive)	6.9	9.0	92	121	79	103	68	89	60	79
D6H Series II (Power Shift)	6.9	9.0	112	147	93	122	80	105	70	92
D6H Series II (Direct Drive)	6.9	9.0	114	149	98	128	85	111	76	100
D6D (Power Shift)	6.9	9.0	110	144	91	119	78	102	68	89
D6D (Direct Drive)	6.9	9.0	111	145	94	123	82	107	73	95

Load time (average):

	Push Loaded	Self Loaded
D5	1.0 min	1.5 min
D6	0.8 min	1.2 min

Dump and turn time: D5 1.2 min; D6 1.0 min

Shift time: P.S. 0.0 min; D.D 0.2 min

SCRAPER & TRACTOR	STRUCK CAPACITY		HAUL 120 m	400′	HAUL 180 m	600′	HAUL 250 m	800′	HAUL 300 m	1000′
PUSH LOADED			ESTIMATED HOURLY PRODUCTION							
R67H	m^3	yd^3	m^3	yd^3	m^3	yd^3	m^3	yd^3	m^3	yd^3
D6H Series II (Power Shift)	9.2	12	161	210	130	170	109	142	93	121
D6H Series II (Direct Drive)	9.2	12	144	188	119	156	102	133	86	113
D6D (Power Shift)	9.2	12	152	200	122	160	100	132	85	112
D6D (Direct Drive)	9.2	12	140	183	114	150	97	127	82	108
D7H Series II (Power Shift)	9.2	12	208	272	169	221	140	183	118	154
D7H Series II (Direct Drive)	9.2	12	206	270	172	225	145	190	126	165
D7G (Power Shift)	9.2	12	198	260	159	208	131	172	110	144
D7G (Power Shift)	10.7	14	222	291	177	232	151	198	126	165
D7G (Direct Drive)	10.7	14	215	281	168	221	146	191	123	162
D8N (Power Shift)	10.7	14	238	312	191	250	158	208	137	180
D8K (Power Shift)	10.7	14	238	312	191	250	159	208	137	180
D8K (Direct Drive)	10.7	14	228	298	181	236	152	200	132	173
R89H										
D7H Series II (Power Shift)	13.8	18	257	336	206	269	170	222	147	192
D7H Series II (Direct Drive)	13.8	18	240	314	194	254	160	209	141	185
D7G (Power Shift)	13.8	18	245	320	193	253	158	207	136	178
D7G (Direct Drive)	13.8	18	229	299	184	240	150	198	131	171
D8N (Power Shift)	13.8	18	275	360	213	278	176	230	151	198
D8K (Power Shift)	13.8	18	276	360	213	278	176	230	151	198
D8K (Direct Drive)	13.8	18	257	336	203	266	170	222	145	190
D8L (Power Shift)	13.8	18	325	425	165	328	207	271	179	234

Load time (average):

	Push Loaded	Self Loaded		Push Loaded	Self Loaded
R67H			**R89H**		
D6	0.8 min	1.2 min	D7	0.8 min	1.2 min
D7	0.6 min	1.0 min	D8	0.6 min	1.0 min
D8	0.5 min	0.8 min	D8	0.5 min	0.8 min

Dump and turn time: D6 — 1.0 min
All others — 0.8 min

Shift time: Power Shift — 0.0 min
Direct Drive — 0.2 min

SCRAPER & TRACTOR	STRUCK CAPACITY		HAUL 120 m	400'	HAUL 180 m	600'	HAUL 250 m	800'	HAUL 300 m	1000'
SELF LOADED			ESTIMATED HOURLY PRODUCTION							
R67H	m^3	yd^3	m^3	yd^3	m^3	yd^3	m^3	yd^3	m^3	yd^3
D6H Series II (Power Shift)	9.2	12	143	187	119	156	101	132	88	115
D6H Series II (Direct Drive)	9.2	12	134	175	112	147	95	124	82	107
D6D (Power Shift)	9.2	12	136	178	112	147	94	123	81	107
D6D (Direct Drive)	9.2	12	129	170	107	141	90	118	77	102
D7H Series II (Power Shift)	9.2	12	187	244	161	187	128	168	109	142
D7H Series II (Direct Drive)	9.2	12	174	227	136	178	113	148	97	129
D7G (Power Shift)	9.2	12	177	232	142	186	120	158	100	132
D7G (Direct Drive)	9.2	12	174	228	137	180	114	150	99	130
D7G (Power Shift)	10.7	14	194	255	160	210	137	180	116	152
D7G (Direct Drive)	10.7	14	189	248	156	205	133	175	113	149
D8N (Power Shift)	10.7	14	214	280	175	230	147	193	128	168
D8K (Power Shift)	10.7	14	214	280	175	230	147	193	128	168
D8K (Direct Drive)	10.7	14	206	270	168	220	143	180	123	162
R89H										
D7H Series II (Power Shift)	13.8	18	229	299	189	247	156	204	129	169
D7H Series II (Direct Drive)	13.8	18	216	283	179	234	151	198	128	168
D7G (Power Shift)	13.8	18	218	285	178	232	146	190	129	168
D7G (Direct Drive)	13.8	18	206	270	169	221	141	185	119	156
D8N (Power Shift)	13.8	18	238	312	192	251	162	212	141	184
D8K (Power Shift)	13.8	18	238	312	192	251	162	212	141	184
D8K (Direct Drive)	13.8	18	229	300	184	241	157	206	136	178
D8L (Power Shift)	13.8	18	281	368	226	296	191	250	166	217

Load time (average):

R67H	Push Loaded	Self Loaded	R89H	Push Loaded	Self Loaded
D6	0.8 min	1.2 min	D7	0.8 min	1.2 min
D7	0.6 min	1.0 min	D8	0.6 min	1.0 min
D8	0.5 min	0.8 min	D8	0.5 min	0.8 min

Dump and turn time: D6 — 1.0 min
All others — 0.8 min

Shift time: Power Shift — 0.0 min
Direct Drive — 0.2 min

SCRAPER & TRACTOR	HEAPED CAPACITY		HAUL 100 m	330'	HAUL 200 m	660'	HAUL 300 m	1000'	HAUL 400 m	1300'
			ESTIMATED HOURLY PRODUCTION							
Agricultural	m^3	yd^3	m^3	yd^3	m^3	yd^3	m^3	yd^3	m^3	yd^3
2 × 6C + D4E DD	4.6	6	160	209	110	144	90	118	80	105
2 × 14C + D6D DD	10.7	14	380	497	270	353	210	275	175	229
Industrial										
1 × R89H + D8L	27.5	36	325	425	251	328	207	271	179	234

AGRICULTURAL TRACTORS
Special Application
Super Agricultural
Super Rural
Challenger 65B
Challenger 75
AG6

CONTENTS

Features:

- **Cat diesel Engines** with large piston displacement and individual adjustment-free fuel pumps and valves.
- **Sealed and Lubricated Track*** greatly reduces internal pin and bushing wear for lower undercarriage maintenance costs.
- **High drawbar performance** . . . Cat diesel Engines deliver high drawbar power for all-day hard work, season after season.
- **Direct drive transmission** helps deliver maximum engine power to the drawbar. Closely spaced speeds match implement requirements.
- **Excellent balance** with weight forward and low center of gravity.
- **Easy maintenance** with spin-on fuel filter, two-piece master link*, hydraulic track adjusters*. Power train oil dipstick and filler spout are within easy reach from ground level (not offered on D7G and D8L).
- **Variable horsepower arrangements** are available for increased production in high speed tillage operations.*

*Except Challenger 65B and Challenger 75.

Features of AG6 Tractor . . .

- **Extended Main Frame — 965 mm (38") provides** excellent balance using only machine components and no counterweight. Operator station located over center of track and center of gravity for improved ride. Cab position provides excellent fore and aft visibility.
- **Track Roller Frame extended to 2870 mm** (113") reduces compactive forces, improves tractive capability. The extended frame also increases directional stability resulting in less implement steering inputs.
- **Halogen Daylight Extended Lighting System** consists of four lights each to the front and rear of the tractor. The lighting system provides near-daylight visibility for working in all directions. The working capability of the machine is extended in hours per day with the efficiency of daylight operation.
- **Extended Fuel Range Capacity** provides up to 14 hours working capability at an 80% load factor. The location of the fuel supply is easily accessible for refueling from a side filler port.
- **On-Demand Hydraulic Features**
  Increase pump life because of minimum flow and pressure in system when no demand is present for hydraulic work.
  — Provides fast response to need for hydraulic work.
  — Consist of large volume reservoir for cooling and a wide variety of hydraulic work demands.
  — Low effort hydraulic valves provide easy operator control.
  — Closed center valve circuitry is easily adaptable to laser control systems and hydraulic motor drives.
- **Agricultural Application Cab Features**
  — Multi-position, swivel seat
  — Steering controls located on seat arm move with seat
  — Low effort master clutch
  — Optimized visibility
  — 85 db sound level (at operating speeds)
  — Air conditioning — Pressurization
  — Decelerator for row-end speed control
- **Fenders, walkways and steps** all provide easy access to cab, provide dust control and service access to all compartments.

And these additional features of the Challenger 65B, and 75 . . .

Innovative Mobil-trac System — The machine rides on flexible rubber belts, reinforced with steel cables bonded into the rubber. The unique traction system combines the speed and mobility of wheels with the improved traction and flotation of tracks. Ground pressure of 5.9 pounds per square inch on the Challenger 65B and 5.3 psi on the Challenger 75 reduce compaction depth, penetration density and overall area effected. The Mobil-trac system provides up to 15% more drawbar power in first pass tillage and up to 35% more drawbar power in plowed ground compared to 4WD tractors.

Engine — The Challenger 65B is powered by the 6-cylinder, 4-stroke cycle 3306 DITA diesel engine, rated at 285 gross horsepower, 250 PTO horsepower, 271 flywheel horsepower, and 220 drawbar horsepower at 2100 revolutions per minute. The turbocharged and aftercooled direct injection fuel system has individual adjustment-free injection pumps and valves and offers 34%* torque rise for heavy drawbar applications.

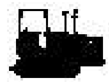
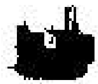
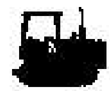
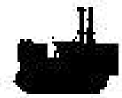
Challenger 75 power is provided by the 6-cylinder, 4-stroke cycle 3176 ATAAC diesel engine, rated at 325 minimum gross horsepower, 285 PTO horsepower, 309 flywheel horsepower, and 250 drawbar horsepower at 2100 revolutions per minute. The turbocharged and air to air aftercooled direct injection fuel system has individual unit injectors and offers 36%* torque rise for heavy drawbar applications.

Direct Drive Power Shift Transmission — Has 10 speeds forward (from 2.6 to 18.1 miles per hour), and two reverse (up to 4.5 miles per hour). Shifting is done on-the-go by a single-lever without clutching. Closely spaced field working gears precisely match implement and tractor to field operations.

Differential Steering — Automotive, adjustable-type steering wheel for precise response with differentials that vary the relative speed and direction of each rubber belt. Continuous power to both tracks for excellent maneuverability and smooth, even, power turns results in better traction and performance.

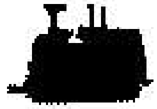
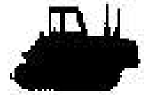
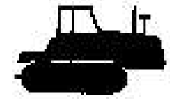
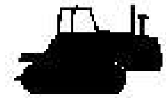
Cab — State-of-the-art agricultural tractor cab with standard filtered air conditioner and heater, windshield wiper, hinged side and rear windows, tinted safety glass and AM-FM cassette stereo. The resiliently mounted operator's compartment isolates the operator to reduce vibration and noise to a quiet 75.5 decibels. Fully adjustable suspension seat swivels 30 degrees. Convenience is matched by comfort and style to assure high, daylong field performance.

*Numbers attained at the University of Nebraska Tractor Test Lab. Test No. 1653 for Challenger 65B and No. 1654 for Challenger 75.

MODEL	D3C SA		D4E SR		D5B SA		D6E SR	
Flywheel Power*	75 kW	101 HP	60 kW	80 HP	89 kW	120 HP	116 kW	155 HP
Operating Weight**	7202 kg	15,846 lb	9400 kg	20,730 lb	10 936 kg	24,110 lb	14 960 kg	32,987 lb
Engine Model	3204		3304		3306		3306	
Rated Engine RPM	2400		2200		2100		1900	
No. of Cylinders	4		4		6		6	
Bore	114.3 mm	4.5"	121 mm	4.75"	121 mm	4.75"	121 mm	4.75"
Stroke	127 mm	5"	152 mm	6"	152 mm	6"	152 mm	6"
Displacement	5.2 L	318 in³	7 L	425 in³	10.5 L	638 in³	10.5 L	638 in³
Max. Torque Rise								
(standard)	33%		18.6%		28%		13.7%	
(variable horsepower)	—		16.5		33%		—	
Track Rollers (each side)	6		5		6		7	
Width of Standard Track Shoe	355 mm	14"	406 mm	16"	457 mm	18"	508 mm	20"
Length of Track on Ground	2.058 m	6'9"	1.89 m	6'2"	2.18 m	7'2"	2.667 m	8'9"
Ground Contact Area (with std. shoe)	1.46 m²	2266 in²	1.53 m²	2380 in²	1.99 m²	3085 in²	2.72 m²	4212 in²
Grouser Height	47.2 mm	1.85"	48 mm	1.86"	60 mm	2.25"	—	
Track Gauge	1.52 m	5'0"	1.52 m	5'0"	1.88 m	6'2"	1.88 m	6'2"
GENERAL DIMENSIONS:								
Height (without ROPS or exhaust)	2.10 m	6'10"	1.93 m	6'4"	1.93 m	6'4"	2.03 m	6'8"
Height (to top of ROPS)	2.71 m	8'11"	2.71 m	8'11"	2.77 m	9'1"	3.06 m	10'0"
Overall Length	3.68 m	12'1"	3.37 m	11'0"	3.63 m	11'11"	3.73 m	12'3"
Width with Standard Shoe	1.94 m	6'4"	1.98 m	6'6"	2.36 m	7'9"	—	
Ground Clearance	299 mm	11.75"	360 mm	14"	278 mm	10.93"	310 mm	12.2"
Fuel Tank Refill Capacity	205 L	63 U.S. gal	295 L	78 U.S. gal	295 L	78 U.S. gal	435 L	115 U.S. gal

*For variable horsepower ratings see the power ratings on adjacent page.
***Operating Weight** includes lubricants, coolants, standard track shoes, ROPS canopy, full fuel tank and operator.

								
MODEL	**D8L SA**		**AG6**		**Challenger 65B**		**Challenger 75**	
Flywheel Power	298 kW	**400 HP**	123 kW	**165 HP****	202 kW	**271 HP**	230 kW	**309 HP**
Gross Horsepower	—		—		212.5 kW	**285 HP**	242 kW	**325 HP**
PTO Horsepower	—		—		186 kW	**250 HP**	208 kW	**280 HP**
Operating Weight*	36 650 kg	**80,820 lb**	14 787 kg	**32,600 lb**	14 061 kg	**31,000 lb**	14 060 kg	**31,000 lb**
Engine Model	**3406**		**3306**		**3306**		**3176**	
Rated Engine RPM	**1900**		**2200**		**2100**		**2100**	
No. of Cylinders	**6**		**6**		**6**		**6**	
Bore	137 mm	**5.4"**	121 mm	**4.75"**	121 mm	**4.75"**	125 mm	**4.92"**
Stroke	152 mm	**6"**	152 mm	**6"**	152 mm	**6"**	140 mm	**5.5"**
Displacement	18 L	**1099 in³**	10.5 L	**638 in³**	10.5 L	**638 in³**	10.2 L	**629 in³**
Max. Torque Rise (standard)	**25%**		**21.5%**		**34%*****		**38%*****	
Track Rollers (each side)	**8**		**7**		**4**		**4**	
Width of Standard Track Shoe/Belt	560 mm	**22"**	610 mm	**24"**	622 mm	**24.5"▲**	698.5 mm	**27.5"▲**
Length of Track on Ground	3.213 m	**10'6.5"**	2.870 m	**9'4"**	2.718 m	**8'10"**	2.718 m	**8'10"**
Ground Contact Area (with std. shoe)	3.54 m²	**5487 in²**	3.5 m²	**5424 in²**	3.4 m²	**5213 in²**	3.9 m²	**5830 in²**
Grouser Height (std. Shoe/Belt)	78 mm	**3.1"**	60 mm	**2.36"**	63.5 mm	**2.5"▼**	63.5 mm	**2.5"▼**
Track Gauge	2.20 m	**7'8"**	—		2.150 m	**7'1"**	2.150 m	**7'1"**
GENERAL DIMENSIONS:								
Height (without ROPS or exhaust)	3.61 m	**11'10"**	—		—		—	
Height (to top of ROPS)	3.874 m	**12'8"**	3.48 m	**11'5"**	3.24 m	**10'7.5"**	3.24 m	**10'7.5"**
Overall Length	5.46 m	**17'11"**	5.13 m	**16'10"**	5.72 m	**18'9"**	5.72 m	**18'9"**
Width with Standard Shoe/Belt	3.45 m	**11'4"**	2.49 m	**8'2"**	2.86 m	**9'5"**	2.86 m	**9'5"**
Ground Clearance	456 mm	**17.9"**	310 mm	**12.3"**	378 mm	**14.9"**	378 mm	**14.9"**
Fuel Tank Refill Capacity	753 L	**199 U.S. gal**	624.5 L	**165 U.S. gal**	839 L	**219 U.S. gal**	838 L	**218 U.S. gal**

*Operating Weight includes lubricants, coolants, standard track shoes, ROPS canopy, full fuel tank and operator.
**AG6 Generation Two has 149 kW (200 HP).
***Torque rise as obtained from the University of Nebraska Tractor Test Nos. Test No. 1653 for Challenger 65B and 1654 for Challenger 75.
▲Optional Belt Widths
524 mm (20.6")
622 mm (24.5")
700 mm (27.5")
900 mm (35.5")
▼Standard 63.5 mm (2.5") or Heavy Duty 38.0 mm (1.5") extra wide Grousers available for all belts

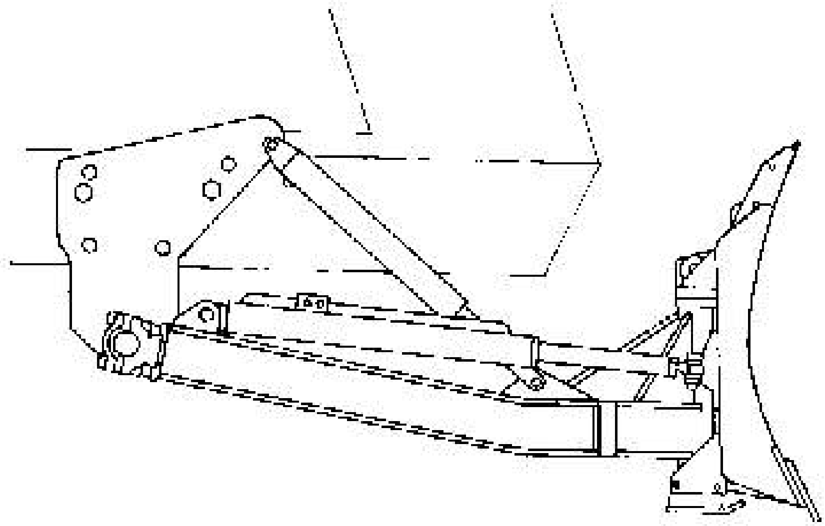
HORSEPOWER RATINGS

MODEL	Flywheel kW	Flywheel HP	Drawbar kW	Drawbar HP
D3C SA	75	**101**	62	**82**
D3C industrial DD	48	**65**	37	**50**
D4E industrial DD	60	**80**	44	**60**
D5B SA	80	**120**	70	**94**
D5H industrial DD	78	**105**	59	**80**
D6D industrial DD	104	**140**	81	**109**
D8L SA	298	**400**	242	**325**
Challenger 65B	202	**271**	171	**229***
Challenger 75	230	**309**	199	**267***

*University of Nebraska Tractor Test Lab Test No. 1653 for Challenger 65B and No. 1654 for Challenger 75. Drawbar power figures obtained with engine at maximum power. The tests were performed on a concrete track. Actual usable drawbar pull may be less depending on soil conditions.

VARIABLE HORSEPOWER RATINGS

MODEL	Flywheel kW	Flywheel HP	Drawbar kW	Drawbar HP
D4E SR VHP				
Gears 1-2	59	**80**	47	**64**
Gears 3-5	92	**125**	78	**104**
D6E SR VHP				
Gears 1-2-6	116	**155**	162	**121**
Gears 3-4-5	162	**216**	228	**170**
AG6 (Generation One)				
Gears 1-2-6	123	**165**	95	**128**
Gears 3-4-5	179	**240**	140	**188**
AG6 (Generation Two)				
Gears 1-2	149	**200**	119	**160**
Gears 3-4-5	179	**240**	140	**188**



Balderson
B65A — 11'6"
Group No. 7002C1

	Challenger 65B and Challenger 75	
Capacity	3.3 m³	4.3 yd³
Width — Straight	3556 mm	140 in
Width — Angled	3226 mm	127 in
Height	1118 mm	44 in
Max. Dig Depth	610 mm	24 in
Max. Lift Height	762 mm	30 in
Blade Angle	25°	
Weight (Approx.)	1360 kg	3000 lb

NOTE: The Balderson Angle Blade includes a box section C-Frame that is trunnion mounted to the Challenger main frame. Cutting edges are replaceable with Cat edges.

Manual angle bracings and bolt on silage rack are available upon request.

MODEL	Std. Trans. D3C		D4E SR VHP		Std. Trans. D5B SA VHP	
FORWARD GEAR*	km/h	mph	km/h	mph	km/h	mph
1	4.1	2.5	3.2	2.0	4.4	2.8
2	5.0	3.1	4.6	2.9	5.2	3.2
3	5.7	3.6	5.6	3.5	6.3	3.9
4	6.5	4.0	6.4	4.0	7.2	4.6
5	7.6	4.7	7.2	4.5	8.1	5.1
6	—		—		10.0	6.2
REVERSE GEAR						
1	3.8	2.3	3.8	2.4	5.6	3.5
2	4.6	2.8	5.4	3.4	6.7	4.2
3	5.3	3.3	6.6	4.1	8.2	5.1
4	6.1	3.7	7.5	4.7	9.4	5.8
5	—		8.6	5.3	—	
6	—		—			

DRAWBAR PULL FORWARD*

FORWARD GEAR	D3C At Rated RPM kN	kg	lb	D4E SR VHP At Rated RPM kN	kg	lb	D5B SA VHP At Rated RPM kN	kg	lb
1	54.4	5552	12,250	53.4	5450	12,012	55.8	5693	12,550
2	44.3	4521	9960	36.7	3744	8252	46.8	4772	10,520
3	37.5	3827	8450	49.7	5068	11,170	37.5	3819	8420
4	31.7	3235	7130	43.2	4408	9715	50.7	5171	11,400
5	26.9	2755	6070	37.5	3832	8448	44.1	4491	9900
6	—	—	—	—	—	—	34.9	3561	7850
	Max. at Lug			Max. at Lug			Max. at Lug		
1	74.8	7634	16,820	57.5	5868	12,933	75.9	7735	17,052
2	61.0	6226	13,730	50.5	5148	11,349	64.0	6523	14,380
3	51.9	5306	11,680	57.2	5831	12,859	51.6	5262	11,600
4	44.4	4531	9990	48.1	5002	11,207	68.5	7008	15,450
5	38.0	3888	8560	43.5	4433	9773	60.0	6115	13,480
6			—				48.0	4890	10,780

*Specified pull is based on nominal engine performance derated for transmission lube, control and optional implement hydraulic pumps, with corrections made for driveline mechanical efficiency and rolling resistance on firm level ground. Usable pull will depend on particular attachments and weight and traction of equipped tractor.

MODEL	D6E SR VHP			Direct Drive-Powershift Trans. D8L SA		
FORWARD GEAR*	km/h	mph			km/h	mph
1	3.0	1.9		1 Lo	2.9	1.8
2	4.3	2.7		1 Hi	3.9	2.4
3	5.8	3.6		2 Lo	5.0	3.1
4	6.8	4.3		2 Hi	6.8	4.2
5	7.7	4.8		3 Lo	8.8	5.5
6	9.3	5.8		3 Hi	11.9	7.4
REVERSE GEAR						
1	4.1	2.5		1 Lo	3.5	2.2
2	5.8	3.6		1 Hi	4.7	2.9
3	7.9	4.9		2 Lo	6.3	3.9
4	9.1	5.7		2 Hi	8.4	5.2
5	10.5	6.6		3 Lo	10.9	6.8
6	—			3 Hi	14.8	9.2

DRAWBAR PULL FORWARD*

FORWARD GEAR	D6E SR VHP kN	kg	lb	D8L SA	kN	kg	lb
	At Rated RPM				At Rated RPM		
1	110	11 308	24,878	1 Lo	311	31 679	69,840
2	77	7771	17,097	1 Hi	227	23 115	60,960
3	79	8130	17,887	2 Lo	169	17 196	37,910
4	67	6860	15,105	2 Hi	122	12 388	27,310
5	58	5920	13,097	3 Lo	90	9154	20,180
6	31	3135	6987	3 Hi	63	6428	14,170
	Max. at Lug				Max. at Lug		
1	144	14 770	32,496	1 Lo	395	40 252	88,740
2	100	10 221	22,487	1 Hi	289	29 466	64,960
3	100	10 190	22,420	2 Lo	218	22 013	48,530
4	84	8634	18,996	2 Hi	157	15 953	35,170
5	73	7477	16,450	3 Lo	117	11 850	26,190
6	42	4268	9388	3 Hi	83	8448	18,620

*Specified pull is based on nominal engine performance derated for transmission lube, control and optional implement hydraulic pumps, with corrections made for drivetrain mechanical efficiency and rolling resistance on firm level ground. Usable pull will depend on particular attachments, and weight and traction of equipped tractor.

MODEL	Direct Drive-Powershift Trans. Challenger 65B		Direct Drive-Powershift Trans. Challenger 75	
FORWARD GEAR**	km/h	mph	km/h	mph
1	4.2	2.6	4.2	2.6
2	6.4	4.0	6.4	4.0
3	7.5	4.7	7.5	4.7
4	8.6	5.3	8.6	5.3
5	9.9	6.1	9.9	6.1
6	11.3	7.0	11.3	7.0
7	13.0	8.1	13.0	8.1
8	14.9	9.3	14.9	9.3
9	19.3	12.0	19.3	12.0
10	29.3	18.1	29.3	18.1
REVERSE GEAR				
1	3.1	1.9	3.1	1.9
2	7.2	4.5	7.2	4.5

DRAWBAR PULL FORWARD*

FORWARD GEAR	kN	kg	lb	kN	kg	lb
	At Rated RPM			At Rated RPM		
1	141.8	14 459	31,875	152.6	15 563	34,309
2	93.9	9574	21,106	105.5	10 761	23,724
3	80.3	8186	18,046	91.5	9329	20,567
4	70.2	7156	15,775	79.5	8106	17,871
5	60.3	6147	13,551	68.0	6932	15,282
6	51.3	5230	11,530	58.3	5944	13,105
7	44.1	4497	9914	50.4	5095	11,232
8	37.8	3855	8498	43.0	4380	9657
9	26.5	2701	5955	30.1	3076	6780
10	18.0	1837	3610	18.4	1878	4140
	At Max. Power			At Max. Power		
1	145.5	14 839	32,714	150.9	15 391	33,931
2	108.6	11 074	24,413	121.3	12 371	27,273
3	93.1	9492	20,926	150.5	10 753	23,706
4	80.9	8252	18,193	92.0	9382	20,684
5	70.0	7138	15,737	79.2	8073	17,797
6	59.9	6109	13,467	67.9	6923	15,263
7	51.9	5294	11,672	59.0	6017	13,264
8	44.6	4545	10,019	50.6	5162	11,378
9	30.0	3057	6740	35.2	3588	7810
10	18.1	1851	4080	21.5	2191	4830

*Drawbar pull figures on the Challenger tractors are obtained from the University of Nebraska Tractor Tests (except for gears 9 and 10 which are estimates) test number 1653 and 1654 for the Challenger 65B and Challenger 75 respectively. Tests were performed on a concrete track. Therefore, usable pull may be less depending upon soil conditions.

**Ground speed at rated engine speed, no slip condition. Field speed and usable pull will depend on weight of tractor and soil conditions.

	Std. Trans. **AG6** (Generation One)		Std. Trans. **AG6** (Generation Two)		Opt. Trans. **AG6** (Generation Two)	
FORWARD GEAR*	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**
1	4.5	**2.8**	4.5	**2.8**	4.5	**2.8**
2	5.3	**3.3**	5.3	**3.3**	5.3	**3.3**
3	6.1	**3.8**	6.1	**3.8**	7.1	**4.4**
4	7.1	**4.4**	7.1	**4.4**	8.2	**5.1**
5	8.2	**5.1**	8.2	**5.1**	9.8	**6.1**
REVERSE GEAR						
1	6.1	**3.8**	6.1	**3.8**	6.1	**3.8**
2	7.0	**4.4**	7.0	**4.4**	7.1	**4.4**
3	8.4	**5.2**	8.4	**5.2**	9.6	**6.0**
4	9.6	**6.0**	9.6	**6.0**	11.1	**6.9**
5	11.0	**6.8**	11.0	**6.8**	13.3	**8.3**

DRAWBAR PULL FORWARD*

FORWARD GEAR	At Rated RPM			At Rated RPM			At Rated RPM		
	kN	**kg**	**lb**	**kN**	**kg**	**lb**	**kN**	**kg**	**lb**
1	77.3	7875	**17,362**	96.1	9805	**21,616**	96.1	9805	**21,616**
2	65.0	6610	**14,573**	81.0	8259	**18,208**	81.0	8259	**18,208**
3	54.5	5552	**12,240**	84.1	8581	**18,918**	71.0	7250	**15,981**
4	71.1	7250	**15,984**	71.0	7250	**15,984**	61.3	6260	**13,800**
5	61.4	6260	**13,800**	61.3	6260	**13,800**	49.6	5065	**11,167**
	Max. at Lug			Max. at Lug			Max. at Lug		
1	98.4	10 034	**22,120**	121.6	12 407	**27,353**	121.6	12 407	**27,353**
2	83.0	8455	**18,639**	102.7	10 482	**23,110**	102.7	10 482	**23,110**
3	70.0	7134	**15,727**	104.6	10 667	**23,517**	88.6	9040	**19,928**
4	88.7	9041	**19,931**	88.6	9041	**19,931**	76.7	7830	**17,263**
5	77.0	7830	**17,263**	76.7	7830	**17,263**	62.4	6370	**14,044**

*Specified pull is based on nominal engine performance derated for transmission lube, control and optional implement hydraulic pumps, with corrections made for driveline mechanical efficiency and rolling resistance on firm level ground. Usable pull will depend on particular attachments, and weight and traction of equipped tractor.

DRAWBAR POWER AND TILLAGE

Tillage work ability, or rate, is measurable in drawbar power, either kilowatts or horsepower. If the quantity of work done is being emphasized, then a unit of time is also included. The common terminology is Kilowatt hours or horsepower hours.

Work rate is a combination of *load* (or force) times *distance*, divided by *time* or simply *load* times *speed*. For example a 5000 kg (11,000 lb) load pulled at 5 km/h (3.1 mph) is equivalent work to a 2000 kg (4400 lb) load pulled at 12.5 km/h (7.8 mph).

A Pullmeter is used most frequently to measure implement loads. The Towner Pullmeter is a hydraulic cylinder with a head machined precisely to 10 square inches. Gauges are used to read pounds per square inch thus 10 times the gauge reading gives drawbar pounds pull (DBPP) in thousands of pounds exerted by the implement pulled. Similar pullmeters are available with gauges reading in Kilograms pull.

Formulas providing either Metric or English units of work rate are:

Metric:

$$\text{Drawbar Kilowatts (DBkW)} = \frac{\text{kg Drawbar pull} \times \text{km/h}}{367}$$

$$\text{Drawbar Power} = \frac{\text{kg Drawbar pull} \times \text{km/h}}{274}$$

English:

$$\text{Drawbar Horsepower} = \frac{\text{lb Drawbar pull} \times \text{mph}}{375}$$

Example (Metric)

A 6 m implement imposes 5000 kg draft at 5 km/h requires how many drawbar kilowatts to pull it?

Solution: $\frac{5000 \text{ kg} \times 5 \text{ km/h}}{367} = 68.1 \text{ DBkW}$

• • •

Example (English)

A 20 ft wide implement imposing 11,000 DBPP at 3 mph requires how many drawbar horsepower to pull it?

Solution: $\frac{11{,}000 \text{ DBPP} \times 3.0 \text{ mph}}{375}$ 88.0 DBHP

• • •

TILLAGE PRODUCTION

Tillage production is most commonly measured in area covered per hour, i.e. hectares per hour or acres per hour. Production can be determined by field measurement of tractor speed and implement width. If implement width is known and drawbar pull can be estimated, reference to tractor drawbar pull/speed graphs will give estimated speeds for each gear, and use of standard formulas will provide reasonable estimates of tillage production. Drawbar pull is a function of: 1) speed of tractor, 2) implement width and, 3) tillage depth.

Formulas

A. At 100% efficiency (not attainable)

English:

$$\text{Hectares/hr} = \frac{\text{Width (m)} \times \text{Speed (km/h)}}{10}$$

Metrics:

$$\text{Acres/hr} = \frac{\text{Width (ft)} \times \text{Speed (mph)}}{8.25}$$

B. At 82.5% efficiency (average for tillage — includes turns)

Metric:

Hectares/hr meters x km/h x 0.0825

English:

$$\text{Acres/hr} \quad \frac{\text{feet} \times \text{mph}}{10}$$

Example problem

Calculate normal tillage production of a D6D SA with a 6 m (20 ft) cut width disc plowing harrow pulled at a measured speed of 6 km/h (3.7 mph).

Solution:

Hectares/hr

$= 6 \text{ m} \times 6 \text{ km/h} \times 0.0825 = 3 \text{ Hectares/hr}$

$$\text{Acres/hr} = \frac{20 \text{ ft} \times 3.7 \text{ mph}}{10} = 7.4 \text{ Acres/hr}$$

• • •

ESTIMATED DRAFT OR DRAWBAR PULL REQUIRED PER M (FT) OF IMPLEMENT WIDTH OF CUT

			Soil Type				
	Speed	**Depth**	**Heavy Gumbo Clay Loam**	**Moderate Heavy Silty Clay Loam**	**Average Silty Loam**	**Moderate Light Sandy Loam**	**Light Sandy or Coarse**
Moldboard plow	5.6-9.6 km/h **3.5-6 mph**	178-229 mm **7-9"**	1860-2382 kg **1250-1600 lb**	1414-1713 kg **950-1150 lb**	1115-1266 kg **750-850 lb**	745-968 kg **500-650 lb**	522-889 kg **350-480 lb**
Heavy disc plow 965 mm (38")	4.8-8.0 km/h **3-5 mph**	254-457 mm **10-18"**	2677 kg **1800 lb**	2382 kg **1600 lb**	2083 kg **1400 lb**	1489 kg **1000 lb**	1489 kg **1000 lb**
1270 mm (50")	3.7-6.4 km/h **2.3-4 mph**	203-305 mm **8-12"**	3573 kg **2400 lb**	3274 kg **2200 lb**	2976 kg **2000 lb**	2677 kg **1800 lb**	2382 kg **1600 lb**
Heavy offset disc harrow 915 mm (36") (stubble or breaking)	4.8-8.0 km/h **3-5 mph**	102-203 mm **4-8"**	1785 kg **1200 lb**	1637 kg **1100 lb**	1488 kg **1000 lb**	1339 kg **900 lb**	1191 kg **800 lb**
Heavy tandem or med. offset disc harrow 660-813 mm (26-32")	4.8-9.6 km/h **3-6 mph**	102-203 mm **4-8"**	1191 kg **800 lb**	1043 kg **700 lb**	892 kg **600 lb**	775 kg **500 lb**	594 kg **400 lb**
Finishing or seedbed disc harrow 508-610 mm (20-24")	6.4-11.2 km/h **4-7 mph**	51-102 mm **2-4"**	446 kg **300 lb**	410 kg **275 lb**	335 kg **225 lb**	335 kg **225 lb**	148 kg **100 lb**
Disc plow (stubble mulch)	6.4-9.6 km/h **4-6 mph**	76-152 mm **3-6"**	558 kg **375 lb**	482 kg **324 lb**	410 kg **275 lb**	335 kg **225 lb**	259 kg **175 lb**
Chisel plow	5.6-10.5 km/h **3.5-6.5 mph**	203-305 mm **8-12"**	1191 kg **800 lb**	968 kg **650 lb**	776 kg **500 lb**	622 kg **350 lb**	289 kg **200 lb**
Field cultivator or springtooth	6.4-11.2 km/h **4-7 mph**	76-102 mm **3-4"**	775 kg **500 lb**	556 kg **375 lb**	371 kg **250 lb**	299 kg **200 lb**	223 kg **150 lb**
Rod weeder (add to FC or springtooth)	6.4-11.2 km/h **4-7 mph**	76-102 mm **3-4"**	177 kg **120 lb**	157 kg **105 lb**	135 kg **90 lb**	112 kg **75 lb**	89 kg **60 lb**

Adjust estimates of varying moisture content.
Use a pullmeter for more accurate measurements.

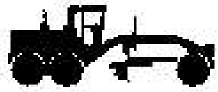
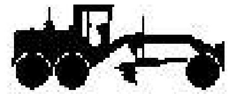
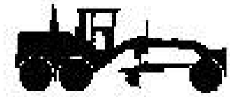
	Depth		Draft or DBPP/Shank Heavy		Medium		Light	
Lister			363 kg	**800 lb**	272 kg	**600 lb**	181 kg	**400 lb**
V. chisel (parabolic shank)	406 mm	**16"**	1162 kg	**2560 lb**	871 kg	**1920 lb**	653 kg	**1440 lb**
	457 mm	**18"**	1306 kg	**2880 lb**	980 kg	**2160 lb**	735 kg	**1620 lb**
	508 mm	**20"**	1452 kg	**3200 lb**	1089 kg	**2400 lb**	816 kg	**1800 lb**
	559 mm	**22"**	1597 kg	**3520 lb**	1198 kg	**2640 lb**	898 kg	**1980 lb**
Subsoilers	508 mm	**20"**	1633 kg	**3600 lb**	1270 kg	**2800 lb**	907 kg	**2000 lb**
	559 mm	**22"**	1814 kg	**4000 lb**	1406 kg	**3100 lb**	998 kg	**2200 lb**
	610 mm	**24"**	1950 kg	**4300 lb**	1542 kg	**3400 lb**	1089 kg	**2400 lb**
	660 mm	**26"**	2132 kg	**4700 lb**	1633 kg	**3600 lb**	1179 kg	**2600 lb**

MOTOR GRADERS

CONTENTS

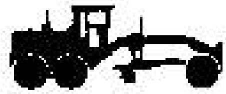
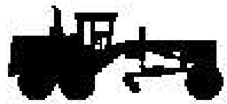
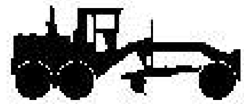
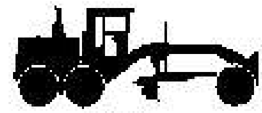
Features, Series G Motor Graders:

- **Articulated frame, sharp turning front wheels and optional differential** (standard on 12G, 14G and 16G) provide excellent maneuverability and short turning radius. Articulation also extends the range of blade positions for added versatility.
- **Low profile or high profile ROPS cab** combines convenient control placement with the comfort of sit-down operation and Electronic Monitoring System (EMS).
- **Hydraulic controls** provide fast, constant-speed blade positioning. Control response is always uniform, regardless of engine RPM, for excellent blading accuracy.
- **Single-lever, direct-drive, power-shift transmissions** provide positive drive to the ground without torque converter lags or surges and provides gear ratios matched to the job for maximum efficiency. An integrated clutch control provides inching capability.
- **Four-wheel oil disc brakes** provide positive stopping performance . . . adjustment-free . . . completely sealed . . . controlled by dual circuit air system for extra protection.
- **Load sensing hydraulic system** matches flow and pressure requirements, provides improved fuel economy and precisely meets load demands.
- **Sound suppressed ROPS cab** (standard in U.S. and Canada) . . rubber-mounted hydraulic pump . . . rear-mounted transmission . . . rear-mounted, large diameter, low speed engine fan combine to provide quiet machine operation.
- **Optional circle drive slip clutch and blade lift accumulator (both standard on 16G)** help cushion high impact loads in horizontal and vertical directions respectively.
- **Replaceable bronze alloy circle, drawbar, and moldboard wear strips** eliminate circle and moldboard rail galling, extend adjustment intervals, and increase component service life by reducing wear rates.
- **140G Motor Grader with Variable Horsepower** configuration provides increased horsepower in higher gears to increase production. Especially beneficial in snow removal applications.
- **140G Motor Grader All Wheel Drive (AWD)** configuration is available through Custom Products. It provides hydrostatically-driven front wheels to increase the application range of the motor grader under poor underfoot conditions, such as snow removal.

MODEL	120G		130G		12G	
Flywheel Power	93 kW	125 HP	101 kW	135 HP	101 kW	135 HP
Basic Operating Weight*	11 476 kg	25,300 lb	12 276 kg	27,064 lb	13 312 kg	29,353 lb
Equipped Operating Weight**	12 863 kg	28,359 lb	13 701 kg	30,205 lb	15 071 kg	33,225 lb
Engine Model	3304		3304		3306	
Rated Engine RPM	2000		2000		2200	
No. of Cylinders	4		4		6	
Displacement	7.0 L	425 in³	7.0 L	425 in³	10.5 L	638 in³
Max. Torque Rise	30%		25%		31%	
No. Speeds Forward/Reverse	6/6		6/6		6/6	
Top Speed Forward	40.9 km/h	25.4 mph	39.4 km/h	24.5 mph	39.4 km/h	24.5 mph
Reverse	40.9 km/h	25.4 mph	39.4 km/h	24.5 mph	39.4 km/h	24.5 mph
Minimum Turning Radius***	6.7 m	22'0"	7.3 m	24'0"	7.3 m	24'0"
Front Frame Minimum Vertical Section Modulus — centimeters cubed (inches cubed)	1399-3180	85-194	1888-4036	115-246	1888-4036	115-246
No. Circle Support Shoes	4		6		6	
Tires — Front & Rear	13.0-24 (8 PR) (G-2)		13.0-24 (8 PR) (G-2)		13.0-24 (10 PR) (G-2)	
GENERAL DIMENSIONS:						
Height (to top of ROPS)	3.10 m	10'2"	3.10 m	10'2"	3.10 m	10'2"
Height (stripped top)****	2.51 m	8'3"	2.69 m	8'10"	2.69 m	8'10"
Overall length	7.92 m	26'0"	8.30 m	27'3"	8.30 m	27'3"
Wheelbase	5.69 m	18'8"	5.92 m	19'5"	5.92 m	19'5"
Blade Base	2.49 m	8'2"	2.57 m	8'5"	2.57 m	8'5"
Over Width (at top of front tires)	2.41 m	7'11"	2.40 m	7'11"	2.40 m	7'11"
Standard Blade Length	3.66 m	12'0"	3.66 m	12'0"	3.66 m	12'0"
Height	610 mm	24"	610 mm	24"	610 mm	24"
Lift Above Ground	451 mm	17.75"	476 mm	18.75"	476 mm	18.75"
Max. Shoulder Reach:						
Frame Straight	1.52 m	5'0"	1.55 m	5'1"	1.87 m	6'1.5"
Articulated Position	2.46 m	8'1"	2.49 m	8'2"	281 m	9'2.5"
Fuel Tank Refill Capacity	224 L	60 U.S. gal	282 L	75 U.S. gal	282 L	75 U.S. gal

***Basic operating weight** — Standard machine plus full fuel tank, lubricants, coolant and operator.
****Equipped operating weight** — Reflects most frequently ordered configurations.
12G — includes Ripper/scarifier, Pushplate, 7267 mm (14') blade and 254 mm (10") rims.
130G — includes V-type scarifier, 3658 mm (12') blade with hydraulic sideshift and tip.
120G — includes V-type scarifier, 3658 mm (12') blade with hydraulic sideshift and tip.
*****Minimum Turning Radius:** combining the use of 20° articulated frame steering, 50° front wheel steer and unlocked differential.
******Height (stripped top)** — without ROPS, exhaust, seat back or other easily removed encumbrances.

MODEL	**140G**		**140G AWD◄**		**14G**		**16G**	
Flywheel Power	112 kW	**150 HP**	134 kW	**180 HP**	149 kW	**200 HP**	205 kW	**275 HP**
Basic Operating Weight*	13 572 kg	**29,789 lb**	14 393 kg	**31,737 lb**	18 524 kg	**40,838 lb**	24 724 kg	**54,507 lb**
Equipped Operating Weight**	15 592 kg	**34,375 lb**	15 751 kg	**34,724 lb**	20 661 kg	**45,550 lb**	27 280 kg	**60,098 lb**
Engine Model	**3306**		**3306**		**3306**		**3408**	
Rated Engine RPM	**2200**		**2200**		**2000**		**2000**	
No. of Cylinders	**6**		**6**		**6**		**6**	
Displacement	10.5 L	**638 in³**	10.5 L	**638 in³**	10.5 L	**638 in³**	14.6 L	**893 in³**
Max. Torque Rise	**29%**		**29%**		**30%**		**30%**	
No. Speeds Forward/Reverse	6/6		**6/6**		**8/8**		**8/8**	
Top Speed Forward	41.0 km/h	**25.5 mph**	41.0 km/h	**25.5 mph**	43.0 km/h	**26.8 mph**	43.6 km/h	**27.1 mph**
Reverse	41.0 km/h	**25.5 mph**	41.0 km/h	**25.5 mph**	50.1 km/h	**31.1 mph**	43.6 km/h	**27.1 mph**
Minimum Turning Radius***	7.3 m	**24'0"**	7.3 m	**24'0"**	7.9 m	**26'0"**	8.2 m	**27'0"**
Front Frame Minimum Vertical Section Modulus — centimeters cubed (inches cubed)	1888-4096	**115-246**	1888-4096	**115-246**	2649-5091	**162-310**	3748-8057	**228-491**
No. Circle Support Shoes	**6**		**6**		**6**		**6**	
Tires: Front & Rear	**14.0-24 (10 PR) (G-2)**		**14.0-24 (10 PR) (G2)**		**16.0-24 (12 PR) (G-2)**		**18.0-25 (12 PR) (E-2)**	
GENERAL DIMENSIONS:								
Height (to top of ROPS)	3.12 m	**10'3"**	3.12 m	**10'3"**	3.34 m	**11'0"**	3.52 m	**11'6"**
Height (stripped top)****	2.72 m	**8'11"**	2.72 m	**8'11"**	2.87 m	**9'5"**	3.07 m	**10'1"**
Overall length	8.33 m	**27'4"**	8.33 m	**27'4"**	9.22 m	**30'3"**	9.99 m	**32'8"**
Wheelbase	5.92 m	**19'5"**	5.92 m	**19'5"**	6.46 m	**21'2"**	6.96 m	**22'10"**
Blade Base	2.57 m	**8'5"**	2.57 m	**8'5"**	2.87 m	**9'5"**	3.10 m	**10'2"**
Over Width (at top of front tires)	2.44 m	**8'0"**	2.44 m	**8'0"**	2.84 m	**9'4"**	3.10 m	**10'2"**
Standard Blade Length	3.66 m	**12'0"**	3.66 m	**12'0"**	4.27 m	**14'0"**	4.88 m	**16'0"**
Height	610 mm	**24"**	610 mm	**24"**	686 mm	**27"**	790 mm	**31"**
Lift Above Ground	476 mm	**18.75"**	476 mm	**18.75"**	480 mm	**18.8"**	444 mm	**17.5"**
Max. Shoulder Reach:								
Frame Straight	1.96 m	**6'5"►**	1.96 m	**6'5"►**	2.08 m	**6'10"**	2.31 m	**7'7"■**
Articulated Position	2.90 m	**9'6"►**	2.90 m	**9'6"►**	3.07 m	**10'1"**	3.37 m	**11'1"■**
Fuel Tank Refill Capacity	282 L	**75 U.S. gal**	282 L	**75 U.S. gal**	370 L	**98 U.S. gal**	489 L	**130 U.S. gal**

***Basic operating weight** — Standard machine plus full fuel tank, lubricants, coolant and operator.
****Equipped operating weight** — Reflects the most commonly ordered configurations.
16G — includes ripper and pushplate.
14G — includes ripper and pushplate.
140G AWD — includes V-type scarifier, 4267 mm (**14'**) blade with hydraulic sideshift and tip, and differential lock unlock.
140G — includes ripper/scarifier, pushplate, 4267 mm (**14'**) blade with hydraulic sideshift and tip; differential lock-unlock and 254 mm (**10"**) rims.
*****Minimum Turning Radius**: combining the use of 20° articulated frame steering, 50° front wheel steer and unlocked differential.
******Height** (stripped top) — without ROPS, exhaust, snap back or other easily removed encumbrances.
► Max. shoulder reach on 140G is to left. All others are to the right.
■ Max. shoulder reach on 16G is obtainable in both directions.
◄ The 140G all-wheel drive version is available through Custom Products. The all-wheel drive version provides additional horsepower (134 kW (**180 HP**)) in all gears when the all-wheel drive feature is engaged and in 3rd through 6th when it is not engaged.

Motor Graders

Travel Speeds
- @ rated engine RPM
- Special Attachments

GEAR	1ST		2ND		3RD		4TH		5TH		6TH		7TH		8TH	
	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
120G — Forward	3.8	2.4	6.2	3.9	9.8	6.1	16.2	10.1	25.8	16.1	40.8	25.4	—		—	
Reverse	3.7	2.3	5.8	3.6	9.2	5.7	15.1	9.4	24.3	15.1	38.3	23.8	—		—	
130G Forward	3.8	2.3	6.0	3.7	9.5	5.9	15.6	9.7	25.0	15.5	39.4	24.6	—		—	
Reverse	3.5	2.2	5.6	3.5	8.9	5.5	14.7	9.1	23.3	14.5	36.9	22.9	—		—	
12G	3.8	2.3	6.0	3.7	9.5	5.9	15.6	9.7	25.0	15.5	39.4	24.5	—		—	
140G, 140G VHP, 140G AWD**	3.9	2.4	6.2	3.9	9.8	6.1	16.2	10.1	26.0	16.1	41.0	25.6	—		—	
14G — Forward	3.8	2.3	5.3	3.3	7.2	4.4	10.4	6.5	15.6	9.7	22.0	13.6	29.8	18.5	43.0	26.8
Reverse	4.4	2.7	6.1	3.8	8.3	5.2	12.0	7.5	18.2	11.3	25.5	15.9	34.6	21.5	50.1	31.1
16G	3.8	2.4	5.4	3.3	7.3	4.3	10.5	6.5	15.9	9.8	22.3	13.8	30.1	18.7	43.6	27.1

Unless otherwise specified, speeds are the same in forward and reverse.

**Wheel Motor Displacement

GEAR	1ST		2ND		3RD		4TH		5TH		6TH	
	cm^3	in^3	cm^3	in^3	cm^3	in^3	cm^3	in^3	cm^3	in^3	cm^3	in^3
140G AWD	1640	100	1640	100	1640	100	655	40	655	40	*	*

*Free wheel

BALDERSON WORK TOOLS

Work Tools	16G	14G	140G	130G	12G	120G
Lift Group	X	X	X	X	X	X
V-Plow	X	X	X	X	X	X
One Way Plow		X	X	X	X	X
Manual Reversible Plow		X	X	X	X	X
Hydraulic Reversible Plow		X	X	X	X	X
Snow Wing		X	X	X	X	X
Scarifier	X	X	X	X	X	X
Manual Angle Blade		X	X	X	X	X
Hydraulic Angle Blade		X	X	X	X	X
Straight Blade	X	X	X	X	X	X
Push Block	X	X	X	X	X	

Note: Balderson Attachments for Cat G Series Graders require additional hydraulics. All front mounted attachments require a Balderson Quick Attach Detach or Pin-On Parallel Lift Group. Contact Balderson Inc. for details.

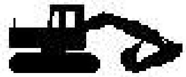
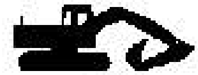
EXCAVATORS

CONTENTS

Model	E70B		E110B		E120B		E140	
Flywheel Power	41 kW	**54 HP**	59 kW	**79 HP**	63 kW	**84 HP**	66 kW	**89 HP**
Operating Weight*	6900 kg	**15,200 lb**	11 600 kg	**25,600 lb**	12 800 kg	**28,200 lb**	13 970 kg	**30,800 lb**
Bucket Capacity Range (heaped)	0.14-0.34 m³	**0.18-0.44 yd³**	0.22-0.63 m³	**0.29-0.82 yd³**	0.22-0.71 m³	**0.29-0.93 yd³**	0.29-0.75 m³	**0.38-0.98 yd³**
Engine Model	**Mitsubishi 4D32**		**3114T**		**3114T**		**Mitsubishi 6D14**	
Rated Engine RPM	**1800**		**1800**		**1900**		**1900**	
No. of Cylinders	4		4		**4**		**6**	
Bore	104 mm	**4.1"**	105 mm	**4.1"**	105 mm	**4.1"**	110 mm	**4.3"**
Stroke	105 mm	**4.1"**	127 mm	**5"**	127 mm	**5"**	115 mm	**4.5"**
Displacement	3.57 L	**218 in³**	4.40 L	**268 in³**	4.40 L	**268 in³**	6.56 L	**400 in³**
Max. Implement Hydraulic Pump Output at Rated RPM	2 × 67 L/min	**2 × 18 gpm**	2 × 107 L/min	**2 × 28 gpm**	2 × 118 L/min	**2 × 31 gpm**	2 × 132 L/min	**2 × 35 gpm**
Relief Valve Settings								
Implement Circuit	27 460 kPa	**3980 psi**	27 460 kPa	**3980 psi**	27 460 kPa	**3980 psi**	24 460 kPa	**3550 psi**
Travel Circuit	31 380 kPa	**4550 psi**	29 420 kPa	**4270 psi**	29 420 kPa	**4270 psi**	26 390 kPa	**3830 psi**
Swing Circuit	19 610 kPa	**2840 psi**	23 050 kPa	**3340 psi**	23 050 kPa	**3340 psi**	21 570 kPa	**3130 psi**
Pilot Circuit	3430 kPa	**500 psi**	3430 kPa	**500 psi**	3430 kPa	**500 psi**	2960 kPa	**430 psi**
Maximum Drawbar Pull	49 kN	**11,020 lb**	86 kN	**19,330 lb**	106 kN	**23,810 lb**	109 kN	**24,420 lb**
Maximum Travel Speed at Rated RPM	4.1 km/h	**2.55 mph**	5.0 km/h	**3.11 mph**	5.0 km/h	**3.11 mph**	3.0 km/h	**1.86 mph**
Width of Standard Track Shoe	450 mm	**18"**	500 mm	**20"**	500 mm	**20"**	500 mm	**20"**
Overall Track Length	2660 mm	**8'9"**	3320 mm	**10'11"**	3490 mm	**11'5"**	3530 mm	**11'7"**
Ground Contact Area with Std. Shoe and Std. Undercarriage	2.01 m²	**3120 in²**	2.86 m²	**4430 in²**	3.03 m²	**4700 in²**	3.0 m²	**4635 in²**
Track Gauge	1750 mm	**5'9"**	1890 mm	**6'6"**	1990 mm	**6'6"**	1990 mm	**6'6"**
Fuel Tank Refill Capacity	110 L	**29 U.S. gal**	250 L	**66 U.S. gal**	250 L	**66 U.S. gal**	240 L	**63 U.S. gal**
Hydraulic System (includes tank)	106 L	**28 U.S. gal**	160 L	**42 U.S. gal**	165 L	**44 U.S. gal**	220 L	**58 U.S. gal**

*Operating weight includes coolant, lubricants, full fuel tank, standard shoes, bucket, medium stick, and operator 75 kg (165 lb).

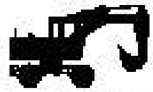
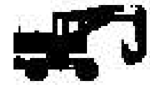
Note: Certain models may not be available in all Sales areas.
Specifications may also vary by Sales area.
Contact your Caterpillar District Office for details.

Model	**211B LC**		**213B LC**	
Flywheel Power	78 kW	**105 HP**	82 kW	**110 HP**
Operating Weight*	16 600 kg	**36,600 lb**	18 610 kg	**41,030 lb**
Bucket Capacity Range (heaped)	0.34-0.855 m^3	**0.32-1.12 yd^3**	0.45-0.98 m^3	**0.56-1.31 yd^3**
Engine Model	**3114T**		**3116T**	
Rated Engine RPM	**2000**		**2000**	
Make & No. of Cylinders	**4**		**6**	
Bore	105 mm	**4.13"**	105 mm	**4.13"**
Stroke	127 mm	**5"**	127 mm	**5"**
Displacement	4.4 l	**268 in^3**	6.6 l	**402 in^3**
Max. Implement Hydraulic Pump Output at Rated RPM	230 L/min	**60.76 gpm**	270 L/min	**71.3 gpm**
Relief Valve Setting	32 000 kPa	**4640 psi**	32 000 kPa	**4640 psi**
Undercarriage:				
Maximum Drawbar Pull	140 kN	**31,500 lb**	162.6 kN	**36,130 lb**
Maximum Travel Speed	4.5 km/h	**2.8 mph**	3.9 km/h	**2.4 mph**
Width of Standard Shoe	600 mm	**23.6"**	600 mm	**23.6"**
Overall Track Length	4160 mm	**13'8"**	4160 mm	**13'8"**
Ground Contact Area	3.513 m^2	**5445 in^2**	3.513 m^2	**5445 in^2**
Track Gauge	2240 mm	**7'4.2"**	2240 mm	**7'4.2"**
Fuel Tank Refill Capacity	270.6 L	**71.5 U.S. gal**	287 L	**75.8 U.S. gal**
Hydraulic System (includes tank)	165 L	**43.6 U.S. gal**	330 L	**87.2 U.S. gal**

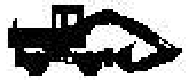
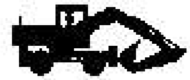
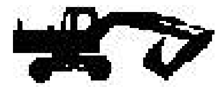
*Operating weight includes 50% full fuel tank, operator 75 kg (165 lb), one-piece boom, long stick and bucket, std. track shoes, optional counterweight if available.

Note: Certain models may not be available in all Sales areas.
Specifications may also vary by Sales area.
Contact your Caterpillar District Office for details.

Model	 206B FT		 212B FT	
Flywheel Power	78 kW	**105 HP**	82 kW	**110 HP**
Operating Weight*	13 500 kg	**29,760 lb**	14 750 kg	**32,500 lb**
Bucket Capacity Range (heaped)	0.28-0.79 m^3	**0.36-1.04 yd^3**	0.28-0.79 m^3	**0.36-1.04 yd^3**
Engine Model	**3114T**		**3114T**	
Rated Engine RPM	**2000**		**2000**	
No. of Cylinders	**4**		**4**	
Bore	105 mm	**4.13"**	105 mm	**4.13"**
Stroke	127 mm	**5"**	127 mm	**5"**
Displacement	4.4 L	**268 in^3**	4.4 L	**268 in^3**
Max. Implement Hydraulic Pump Output at Rated RPM	200 L/min	**52.83 gpm**	230 L/min	**60.76 gpm**
Relief Valve Setting	32 000 kPa	**4640 psi**	32 000 kPa	**4640 psi**
Tires — standard	**Dual 10.00-20 12PR**		**Dual 10.00-20 12PR**	
— optional	**Dual 10.00-20 12PR**		**Dual 10.00-20 12PR**	
	Single 18-19.5 16PR		**Single 18-19.5 16PR**	
Max. Travel Speed	35 km/h	**22 mph**	32 km/h	**20 mph**
Tread Width**	1910 mm	**7'3"**	1910 mm	**7'3"**
Wheel Base	2400 mm	**7'10.5"**	2500 mm	**8'2.4"**
Width Over Tires**	2491 mm	**8'2"**	2491 mm	**8'2"**
Ground Clearance**	355 mm	**14"**	355 mm	**14"**
Fuel Tank Refill Capacity	225 L	**59.4 U.S. gal**	275 L	**71.5 U.S. gal**
Hydraulic System (includes tank)	165 L	**43.6 U.S. gal**	165 L	**43.6 U.S. gal**

*Operating weight includes 50% full fuel tank, operator 75 kg (165 lb), one piece boom, long stick and bucket, one set outriggers, and optional counterweight.
**With standard tires.

Note: Standard cold inflation pressure for all tires is 650 kPa (94 psi).
Certain models may not be available in all Sales areas.
Specifications may also vary by Sales area.
Contact your Caterpillar District Office for details.

						
Model	**214B**		**214B FT**		**224B**	
Flywheel Power	82 kW	**110 HP**	100 kW	**135 HP**	101 kW	**135 HP**
Operating Weight*	18 360 kg	**40,470 lb**	18 360 kg	**40,470 lb**	21 390 kg	**47,170 lb**
Bucket Capacity Range (heaped)	0.95-0.98 m³	**0.56-1.31 yd³**	0.95-0.98 m³	**0.56-1.31 yd³**	0.355-1.2 m³	**0.46-1.57 yd³**
Engine Model	**3116T**		**3116T**		**3116T**	
Rated Engine RPM	**2000**		**2000**		**2000**	
No. of Cylinders	**6**		**6**		**6**	
Bore	105 mm	**4.13"**	105 mm	**4.13"**	105 mm	**4.13"**
Stroke	127 mm	**5"**	127 mm	**5"**	127 mm	**5"**
Displacement	6.6 L	**402.8 in³**	6.6 L	**402.8 in³**	6.6 L	**402.8 in³**
Max. Implement Hydraulic Pump Output at Rated RPM	270 L/min	**71.3 gpm**	270 L/min	**71.3 gpm**	330 L/min	**87.2 gpm**
Relief Valve Setting	32 000 kPa	**4640 psi**	32 000 kPa	**4640 psi**	32 000 kPa	**4640 psi**
Tires — standard	**Dual 10.00-20 12PR**		**Dual 10.00-20 12PR**		**Dual 10.00-20 12PR**	
optional	**Dual 11.00-20 12PR**		**Dual 11.00-20 12PR**		**Dual 11.00-20 12PR**	
	Single 18-19.5 16PR		**Single 18-19.5 16PR**		**Single 18-19.5 16PR**	
	Single 18-22.5 16PR		**Single 18-22.5 16PR**		**Single 18-22.5 16PR**	
Max. Travel Speed	20 km/h	**12.4 mph**	32 km/h	**20 mph**	20 km/h	**12.4 mph**
Tread Width**	1873 mm	**6'2"**	1873 mm	**6'2"**	2053 mm	**6'7"**
Wheel Base	2600 mm	**8'6"**	2600 mm	**8'6"**	2750 mm	**9'0"**
Width Over Tires**	2478 mm	**8'1"**	2478 mm	**8'1"**	2660 mm	**8'7"**
Ground Clearance**	390 mm	**15.3"**	390 mm	**15.3"**	340 mm	**13.4"**
Fuel Tank Refill Capacity	287 L	**75.8 U.S. gal**	287 L	**75.8 U.S. gal**	330 L	**87.2 U.S. gal**
Hydraulic System (includes tank)	330 L	**87.2 U.S. gal**	330 L	**87.2 U.S. gal**	390 L	**101.4 U.S. gal**

*Operating weight includes 50% full fuel tank, operator 75 kg (165 lb), one-piece boom, mid-size stick and bucket, and two sets of outriggers.
**With standard tires.

Note: Standard cold inflation pressure for all tires is 650 kPa (94 psi).
Certain models may not be available in all Sales areas.
Specifications may also vary by Sales area.
Contact your Caterpillar District Office for details.



Model	320**		320 L**		320***	
Flywheel Power	96 kW	**128 HP**	96 kW	**128 HP**	96 kW	**128 HP**
Operating Weight*	19 120 kg	**42,150 lb**	20 370 kg	**44,910 lb**	19 550 kg	**43,100 lb**
Bucket Capacity Range (heaped)	0.74-1.4 m³	**0.92-1.83 yd³**	0.74-1.4 m³	**0.92-1.83 yd³**	0.74-1.4 m³	**0.92-1.83 yd³**
Engine Model	**3066T**		**3066T**		**3116T**	
Rated Engine RPM	**1800**		**1800**		**1800**	
No. of Cylinders	**6**		**6**		**6**	
Bore	105 mm	**4.1"**	105 mm	**4.1"**	105 mm	**4.1"**
Stroke	127 mm	**5.0"**	127 mm	**5.0"**	127 mm	**5.0"**
Displacement	6.4 L	**391 in³**	6.4 L	**391 in³**	6.6 L	**403 in³**
Max. Implement Hydraulic Pump Output at Rated RPM	2 × 185 L/min	**2 × 49 gpm**	2 × 185 L/min	**2 × 49 gpm**	2 × 185 L/min	**2 × 49 gpm**
Relief Valve Settings						
Implement Circuits	31 400 kPa	**4550 psi**	31 400 kPa	**4550 psi**	31 400 kPa	**4550 psi**
Travel Circuits	34 300 kPa	**4975 psi**	34 300 kPa	**4975 psi**	34 300 kPa	**4975 psi**
Swing Circuits	31 400 kPa	**4550 psi**	31 400 kPa	**4550 psi**	31 400 kPa	**4550 psi**
Pilot Circuits	3400 kPa	**500 psi**	3400 kPa	**500 psi**	3400 kPa	**500 psi**
	Two Speed Travel		Two Speed Travel		Two Speed Travel	
Maximum Drawbar Pull	Lo: 177 kN	**39,790 lb**	Lo: 177 kN	**39,790 lb**	Lo: 177 kN	**39,790 lb**
	Hi: 103 kN	**23,150 lb**	Hi: 103 kN	**23,150 lb**	Hi: 103 kN	**23,150 lb**
Maximum Travel Speed at Rated RPM	Lo: 3.4 km/h Hi: 5.5 km/h	**2.1 mph 3.4 mph**	Lo: 3.4 km/h Hi: 5.5 km/h	**2.1 mph 3.4 mph**	Lo: 3.4 km/h Hi: 5.5 km/h	**2.1 mph 3.4 mph**
Width of Standard Track Shoe	600 mm	**24"**	800 mm	**32"**	600 mm	**24"**
Overall Track Length	4064 mm	**13'4"**	4455 mm	**14'7"**	4064 mm	**13'4"**
Ground Contact Area with Std. Shoe and Std. Undercarriage	4.26 m²	**6600 in²**	6.29 m²	**9750 in²**	4.26 m²	**6600 in²**
Track Gauge	2200 mm	**7'3"**	2380 mm	**7'10"**	2200 mm	**7'3"**
Fuel Tank Refill Capacity	310 L	**82 U.S. gal**	310 L	**82 U.S. gal**	290 L	**77 U.S. gal**

*Operating weight includes coolant, lubricants, full fuel tank, standard shoes, bucket and operator 75 kg (165 lb).
**Japan sourced machine.
***Belgium sourced machine.

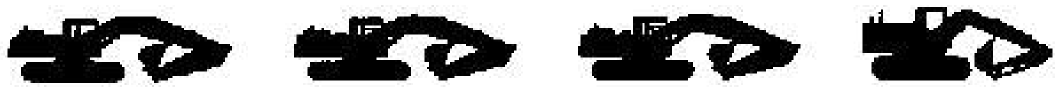
Note: Certain models may not be available in all Sales areas.
Specifications may also vary by Sales area.
Contact your Caterpillar District Office for details.

Model	320 L**		320 N**		E240C		EL240C	
Flywheel Power	96 kW	128 HP	96 kW	128 HP	110 kW	148 HP	110 kW	148 HP
Operating Weight*	20 150 kg	44,423 lb	19 810 kg	43,674 lb	23 000 kg	50,700 lb	23 600 kg	52,000 lb
Bucket Capacity Range (heaped)	0.74-1.4 m³	0.92-1.83 yd³	0.74-1.4 m³	0.92-1.83 yd³	0.58-1.44 m³	0.75-1.88 yd³	0.58-1.44 m³	0.75-1.88 yd³
Engine Model	3116T		3116T		3116T		3116T	
Rated Engine RPM	1800		1800		2200		2200	
No. of Cylinders	6		6		6		6	
Bore	105 mm	4.1"	105 mm	4.1"	105 mm	4.1"	105 mm	4.1"
Stroke	127 mm	5.0"	127 mm	5.0"	127 mm	5.0"	127 mm	5.0"
Displacement	6.6 L	403 in³	6.6 L	403 in³	6.6 L	403 in³	6.6 L	403 in³
Max. Implement Hydraulic Pump Output at Rated RPM	2 × 165 L/min	2 × 49 gpm	2 × 165 L/min	2 × 49 gpm	2 × 230 L/min	2 × 61 gpm	2 × 230 L/min	2 × 61 gpm
Relief Valve Settings:								
Implement Circuits	31 400 kPa	4550 psi	31 400 kPa	4550 psi	27 460 kPa	3980 psi	27 460 kPa	3980 psi
Travel Circuits	34 300 kPa	4975 psi	34 300 kPa	4975 psi	29 420 kPa	4260 psi	29 420 kPa	4260 psi
Swing Circuits	31 400 kPa	4550 psi	31 400 kPa	4550 psi	23 540 kPa	3410 psi	23 540 kPa	3410 psi
Pilot Circuits	3400 kPa	500 psi	3400 kPa	500 psi	4410 kPa	640 psi	4410 kPa	640 psi
	Two Speed Travel		Two Speed Travel					
Maximum Drawbar Pull	Lo: 177 kN	39,790 lb	Lo: 177 kN	39,790 lb	184 kN	41,190 lb	184 kN	41,190 lb
	Hi: 103 kN	23,150 lb	Hi: 103 kN	23,150 lb				
Maximum Travel Speed at Rated RPM	Lo: 3.4 km/h Hi: 5.5 km/h	2.1 mph 3.4 mph	Lo: 3.4 km/h Hi: 5.5 km/h	2.1 mph 3.4 mph	4.6 km/h	2.8 mph	4.5 km/h	2.8 mph
Width of Standard Track Shoe	600 mm	24"	500 mm	20"	800 mm	32"	800 mm	32"
Overall Track Length	4455 mm	14'7"	4064 mm	13'4"	4150 mm	13'7"	4530 mm	14'10"
Ground Contact Area with Std. Shoe and Std. Undercarriage	4.71 m²	7300 in²	3.55 m²	5500 in²	5.8 m²	8990 in²	6.4 m²	9920 in²
Track Gauge	2300 mm	7'10"	1995 mm	6'7"	2390 mm	7'10"	2590 mm	8'6"
Fuel Tank Refill Capacity	290 L	77 U.S. gal	290 L	77 U.S. gal	280 L	74 U.S. gal	280 L	74 U.S. gal

*Operating weight includes coolant, lubricants, full fuel tank, standard shoes, bucket and operator 75 kg (165 lb).
**Belgium sourced machine.

Note: Certain models may not be available in all Sales areas.
Specifications may also vary by Sales area.
Contact your Caterpillar District Office for details.

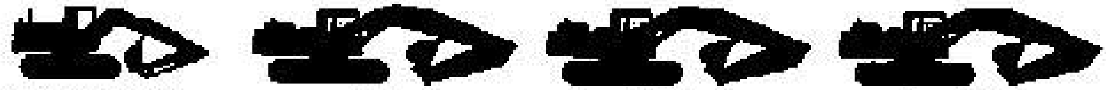
4



Model	325		325 L		325 LN**		231D	
Flywheel Power	125 kW	**168 HP**	125 kW	**168 HP**	125 kW	**168 HP**	149 kW	**200 HP**
Operating Weight*	25 520 kg	**56,270 lb**	27 010 kg	**59,560 lb**	25 910 kg	**57,120 lb**	34 300 kg	**75,600 lb**
Bucket Capacity Range (heaped)	0.82-1.6 m^3	**1.07-2.12 yd^3**	0.82-1.6 m^3	**1.07-2.12 yd^3**	0.82-1.6 m^3	**1.07-2.12 yd^3**	1.2-2.0 m^3	**1.6-2.6 yd^3**
Engine Model	**3116TA**		**3116TA**		**3116TA**		**3208**	
Rated Engine RPM	**2000**		**2000**		**2000**		**2200**	
No. of Cylinders	**6**		**6**		**6**		**8**	
Bore	105 mm	**4.1"**	105 mm	**4.1"**	105 mm	**4.1"**	114 mm	**4.5"**
Stroke	127 mm	**5.0"**	127 mm	**5.0"**	127 mm	**5.0"**	127 mm	**5"**
Displacement	6.6 L	**403 in^3**	6.6 L	**403 in^3**	6.6 L	**403 in^3**	10.4 L	**636 in^3**
Max. Implement Hydraulic Pump Output at Rated RPM	2 × 208 L/min	**2 × 55 gpm**	2 × 208 L/min	**2 × 55 gpm**	2 × 208 L/min	**2 × 55 gpm**	2 × 228 L/min	**2 × 60.5 gpm**
Relief Valve Settings:								
Implement Circuits	31 400 kPa	**4550 psi**	31 400 kPa	**4550 psi**	31 400 kPa	**4550 psi**	29 660 kPa	**4300 psi**
Travel Circuits	34 300 kPa	**4975 psi**	34 300 kPa	**4975 psi**	34 300 kPa	**4975 psi**	33 100 kPa	**4800 psi**
Swing Circuits	31 400 kPa	**4550 psi**	31 400 kPa	**4550 psi**	31 400 kPa	**4550 psi**	33 100 kPa	**4800 psi**
Pilot Circuits	3400 kPa	**500 psi**	3400 kPa	**500 psi**	3400 kPa	**500 psi**	2310 kPa	**335 psi**
	Two Speed Travel		Two Speed Travel		Two Speed Travel			
Maximum Drawbar Pull	Lo: 216 kN Hi: 131 kN	**48,500 lb** **29,540 lb**	Lo: 216 kN Hi: 131 kN	**48,500 lb** **29,540 lb**	Lo: 216 kN Hi: 131 kN	**48,500 lb** **29,460 lb**	266 kN	**59,700 lb**
Maximum Travel Speed at Rated RPM	Lo: 3.1 km/h Hi: 4.6 km/h	**1.9 mph** **2.9 mph**	Lo: 3.1 km/h Hi: 4.6 km/h	**1.9 mph** **2.9 mph**	Lo: 3.1 km/h Hi: 4.6 km/h	**1.9 mph** **2.9 mph**	2.82 km/h	**1.8 mph**
Width of Standard Track Shoe	600 mm	**24"**	800 mm	**32"**	600 mm	**24"**	600 mm	**24"**
Overall Track Length	4350 mm	**14'3"**	4670 mm	**15'4"**	4670 mm	**15'4"**	5230 mm	**17'2"**
Ground Contact Area with Std. Shoe and Std. Undercarriage	4.56 m^2	**7050 in^2**	6.66 m^2	**10,200 in^2**	4.92 m^2	**7630 in^2**	5.49 m^2	**8503 in^2**
Track Gauge	2390 mm	**7'10"**	2590 mm	**8'6"**	2390 mm	**7'10"**	2640 mm	**8'8"**
Optional Narrow Gauge							2.40 m	**7'10"**
Fuel Tank Refill Capacity	400 L	**106 U.S. gal**	400 L	**106 U.S. gal**	400 L	**106 U.S. gal**	400 L	**105 U.S. gal**

*Operating weight includes coolant, lubricants, full fuel tank, standard shoes, bucket and operator 75 kg (165 lb).
**Belgium sourced only.

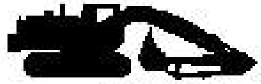
Note: Certain models may not be available in all Sales areas.
Specifications may also vary by Sales area.
Contact your Caterpillar District Office for details.

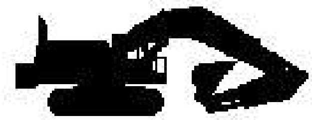


Model	231D LC***		330		330 L		330 LN	
Flywheel Power	149 kW	**200 HP**	166 kW	**222 HP**	166 kW	**222 HP**	166 kW	**222 HP**
Operating Weight*	35 500 kg	**78,100 lb**	32 130 kg	**70,830 lb**	33 510 kg	**73,877 lb**	32 740 kg	**72,179 lb**
Bucket Capacity Range (heaped)	1.1-1.6 m³	**1.4-2.1 yd³**	0.7-2.1 m³	**0.92-2.75 yd³**	0.7-2.1 m³	**0.92-2.75 yd³**	0.7-2.1 m³	**0.92-2.75 yd³**
Engine Model	**3208**		**3306TA**		**3306TA**		**3306TA**	
Rated Engine RPM	**2200**		**1800**		**1800**		**1800**	
No. of Cylinders	**8**		**6**		**6**		**6**	
Bore	114 mm	**4.5"**	121 mm	**4.8"**	121 mm	**4.8"**	121 mm	**4.8"**
Stroke	127 mm	**5"**	152 mm	**6.0"**	152 mm	**6"**	152 mm	**6"**
Displacement	10.4 L	**636 in³**	10.5 L	**638 in³**	10.5 L	**638 in³**	10.5 L	**638 in³**
Max. Implement Hydraulic Pump Output at Rated RPM	2 × 229 L/min	**2 × 60.5 gpm**	2 × 240 L/min	**2 × 63 gpm**	2 × 240 L/min	**2 × 63 gpm**	2 × 240 L/min	**2 × 63 gpm**
Relief Valve Settings:								
Implement Circuits	29 660 kPa	**4300 psi**	31 400 kPa	**4550 psi**	31 400 kPa	**4550 psi**	31 400 kPa	**4550 psi**
Heavy Lift	33 100 kPa	**4800 psi**	—		—			
Travel Circuits	33 100 kPa	**4800 psi**	34 300 kPa	**4975 psi**	34 300 kPa	**4975 psi**	34 300 kPa	**4975 psi**
Swing Circuits	19 800 kPa	**2900 psi**	31 400 kPa	**4550 psi**	31 400 kPa	**4550 psi**	31 400 kPa	**4550 psi**
Pilot Circuits	2310 kPa	**335 psi**	3400 kPa	**500 psi**	3400 kPa	**500 psi**	3400 kPa	**500 psi**
			Two Speed Travel		Two Speed Travel		Two Speed Travel	
Maximum Drawbar Pull	300 kN	**67,300 lb**	Lo: 266 kN Hi: 148 kN	**59,750 lb** **33,300 lb**	Lo: 266 kN Hi: 148 kN	**59,750 lb** **33,300 lb**	Lo: 266 kN Hi: 148 kN	**59,750 lb** **33,300 lb**
Maximum Travel Speed at Rated RPM	5.40 km/h	**3.36 mph**	Lo: 2.7 km/h Hi: 4.6 km/h	**1.7 mph** **2.9 mph**	Lo: 2.7 km/h Hi: 4.6 km/h	**1.7 mph** **2.9 mph**	Lo: 2.7 km/h Hi: 4.6 km/h	**1.7 mph** **2.9 mph**
Width of Standard Track Shoe	813 mm	**32"**	600 mm	**24"**	750 mm	**30"**	600 mm	**24"**
Overall Track Length	5.23 m	**17'2"**	4.90 m	**16'1"**	5.04 m	**16'6"**	5.04 m	**16'6"**
Ground Contact Area with Std. Shoe and Std. Undercarriage	7.43 m²	**11,520 in²**	4.74 m²	**7350 in²**	6.58 m²	**10,200 in²**	5.26 m²	**8150 in²**
Track Gauge	2.64 m	**8'8"**	2.59 m	**8'6"**	2.59 m	**8'6"**	2.39 m	**7'10"**
Fuel Tank Refill Capacity	400 L	**105 U.S. gal**	540 L	**143 U.S. gal**	540 L	**143 U.S. gal**	540 L	**143 U.S. gal**

*Operating weight includes coolant, lubricants, full fuel tank, standard shoes, bucket and operator 75 kg (165 lb).
**Specifications shown are from Belgium source machine.
***Specifications shown are from U.S. source machine.

Note: Certain models may not be available in all Sales areas.
Specifications may also vary by Sales area.
Contact your Caterpillar District Office for details.

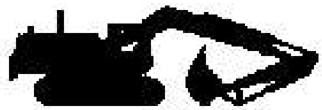
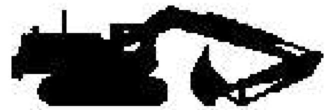
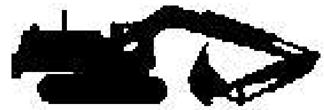


Model	235D		235D LC		E450		E650	
Flywheel Power	186 kW	250 HP	186 kW	250 HP	206 kW	276 HP	280 kW	375 HP
Operating Weight*	46 270 kg	103,780 lb	49 270 kg**	108,620 lb**	46 000 kg	101,430 lb	62 600 kg	138,000 lb
Bucket Capacity Range (heaped)	1.0-2.3 m³	1.0-3.5 yd³	1.0-2.8 m³	1.0-3.5 yd³	1.15-2.35 m³	1.5-3.07 yd³	1.8-3.0 m³	2.3-3.9 yd³
Engine Model	3306		3306		Mitsubishi 6D22TC		Mitsubishi S6B-TA	
Rated Engine RPM	2000		2000		2000		2000	
No. of Cylinders	6		6		6		6	
Bore	121 mm	4.75"	121 mm	4.75"	130 mm	5.1"	135 mm	5.3"
Stroke	152 mm	6"	152 mm	6"	140 mm	5.5"	150 mm	6"
Displacement	10.5 L	638 in³	10.5 L	638 in³	11.15 L	680 in³	12.88 L	786 in³
Max. Implement Hydraulic Pump Output at Rated RPM	2 x 349 L/min	2 x 92 gpm	2 x 349 L/min	2 x 92 gpm	2 x 350 L/min	2 x 92 gpm	2 x 445 L/min	2 x 117 gpm
Relief Valve Settings:								
Implement Circuits	29 650 kPa	4300 psi	29 650 kPa	4300 psi	27 420 kPa	3980 psi	27 420 kPa	3980 psi
Heavy Lift (optional on 245)	33 100 kPa	4800 psi	33 100 kPa	4800 psi	—		—	
Travel Circuits	33 100 kPa	4800 psi	33 100 kPa	4800 psi	27 420 kPa	3980 psi	27 420 kPa	3980 psi
Swing Circuits:								
Accelerate	26 900 kPa	3900 psi	26 900 kPa	3900 psi	20 670 kPa	3000 psi	23 050 kPa	3340 psi
Decelerate	21 400 kPa	3100 psi	21 400 kPa	3100 psi	—		—	
Pilot Circuit	2310 kPa	335 psi	2310 kPa	335 psi	3450 kPa	500 psi	2940 kPa	425 psi
Maximum Drawbar Pull	313 kN	70,460 lb	310 kN	69,770 lb	314 kN	70,400 lb	449 kN	100,940 lb
Maximum Travel Speed at Rated RPM	5.3 km/h	3.3 mph	5.3 km/h	3.3 mph	**Two Speed Travel:** Lo: 3.0 km/h Hi: 4.5 km/h	1.9 mph 2.8 mph	4.6 km/h	2.85 mph
Width of Standard Track Shoe	760 mm	30"	910 mm	36"	760 mm	30"	760 mm	30"
Overall Track Length Std.	5.03 m	16'6"	5.46 m	17'11"	5.125 m	16'10"	5.42 mm	17'9"
Ground Contact Area with Std. Shoe and Std. Undercarriage	6.6 m²	10,312 in²	8.8 m²	13,598 in²	6.7 m²	10,420 in²	7.1 m²	11,000 in²
Track Gauge	2.69 m	8'10"	—		2.39 m	7'10"	2.72 m	8'11"
Extended	—		—		2.88 m	9'6"	3.25 m	10'8"
S.A. Carbody	—		2.69 m	8'10"	—		—	
Wide Gauge Carbody	—		3.30 m	10'10"	—		—	
Fuel Tank Refill Capacity	492 L	130 U.S. gal	492 L	130 U.S. gal	500 L	132 U.S. gal	625 L	165 U.S. gal

*Operating weight includes coolant, lubricants, full fuel tank, one-piece boom, long stick, small profile bucket, operator 75 kg (165 lb) and wide shoes

**Operating weight with wide carbody. Standard Gauge (S.A.) Carbody is 50 592 kg (111,405 lb).

Note: Certain models may not be available in all Sales areas.
Specifications may also vary by Sales area.
Contact your Caterpillar District Office for details.

Model	245D		245D (Deep Trencher Arrangement)		245D (Heavy Lift Trencher)	
Flywheel Power	287 kW	385 HP	287 kW	385 HP	287 kW	385 HP
Operating Weight*	68 420 kg	150,520 lb	75 000 kg	165,340 lb	73 950 kg	163,030 lb
Bucket Capacity Range (heaped)	1.9-3.3 m³	2.5-4.25 yd³	1.9-2.3 m³	2.5-3.0 yd³	1.9-3.3 m³	2.5-4.25 yd³
Engine Model	3406B		3406B		3406B	
Rated Engine RPM	1800		1800		1800	
No. of Cylinders	6		6		6	
Bore	137 mm	5.4"	137 mm	5.4"	137 mm	5.4"
Stroke	165 mm	6.5"	165 mm	6.5"	165 mm	6.5"
Displacement	14.6 L	893 in³	14.6 L	839 in³	14.6 L	839 in³
Max. Implement Hydraulic Pump Output at Rated RPM	2 × 450 L/min	2 × 119 gpm	2 × 450 L/min	2 × 119 gpm	2 × 450 L/min	2 × 119 gpm
Relief Valve Settings						
Implement circuits	31 720 kPa	4600 psi	32 000 kPa	4650 psi	32 000 kPa	4650 psi
Heavy Lift (optional on 245)	34 500 kPa	5000 psi	35 200 kPa	5100 psi	35 200 kPa	5100 psi
Travel circuits	31 720 kPa	4600 psi	32 000 kPa	4650 psi	32 000 kPa	4650 psi
Swing circuits: Accelerate	31 030 kPa	4500 psi	31 030 kPa	4500 psi	31 030 kPa	4500 psi
Decelerate	21 360 kPa	3100 psi	21 360 kPa	3100 psi	21 360 kPa	3100 psi
Pilot circuits	2310 kPa	335 psi	2310 kPa	335 psi	2310 kPa	335 psi
Maximum Drawbar Pull	436 kN	97,970 lb	436 kN	97,970 lb	435 kN	97,920 lb
Maximum Travel Speed at Rated RPM	3.17 km/h	1.97 mph	3.17 km/h	1.97 mph	3.17 km/h	1.97 mph
Width of Standard Track Shoe	760 mm	30"	914 mm	36"	914 mm	36"
Overall Track Length Std.	5.613 m	18'5"	5.613 m	18'5"	5.613 m	18'5"
LC	—		6.00 m	19'9"	6.00 m	19'9"
Ground Contact Area with Std. Shoe and Std. Undercarriage	7.4 m²	11,420 in²	8.8 m²	13,698 in²	8.8 m²	13,706 in²
Ground Contact Area with Ext. U/C	—		9.5 m²	14,803 in²	9.5 m²	14,820 in²
Track Gauge	2.84 m	9'4"	2.84 m	9'4"	3.35 m	11'0"
—Extended	3.24 m	10'8"	3.24 m	10'8"	3.76 m	12'4"
Fuel Tank Refill Capacity	682 L	180 U.S. gal	682 L	180 U.S. gal	682 L	180 U.S. gal

*Operating weight includes coolant, lubricants, full fuel tank, standard shoes, bucket and operator 75 kg (165 lb)

Note: Certain models may not be available in all Sales areas.
Specifications may also vary by Sales area.
Contact your Caterpillar District Office for details.

SHIPPING DIMENSIONS KEYS

E70 through E140 211B, 213B

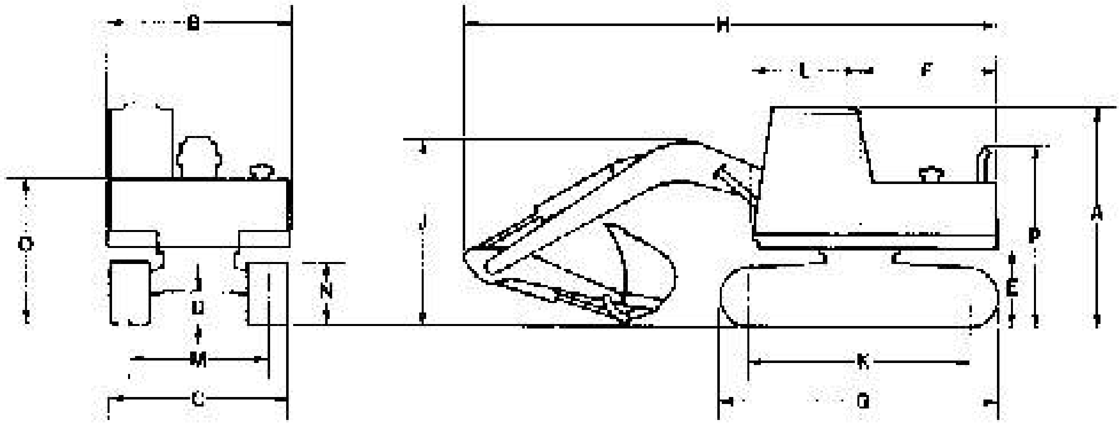
A Cab height
B Transport width
C Track width, standard shoe
D Ground clearance, frame
E Ground clearance, counterweight
F Tail swing radius
G Overall track length (grouser bar to grouser bar)
H Overall transport length
J Transport height
K Track ground contact length
L Cab swing radius
M Track gauge
N Track height, includes grouser
O House height
P Exhaust stack height

320 through 245D

A Cab height
B Transport width
C Track width
D Ground clearance, frame
E Ground clearance, counterweight
F Tail swing radius
G Overall track length (grouser bar to grouser bar)
H Overall transport length
J Transport height

206B FT through 224B

A Cab height
B Transport width
C Tire width
D Ground clearance, frame
E House height
F Exhaust stack height
G Overall length (outrigger to outrigger)
H Overall transport length
J Transport height
K Ground clearance, counterweight
L Transport length without boom
M Cab swing radius
N Tail swing radius
O Wheelbase length
P Overall width (outrigger to outrigger)



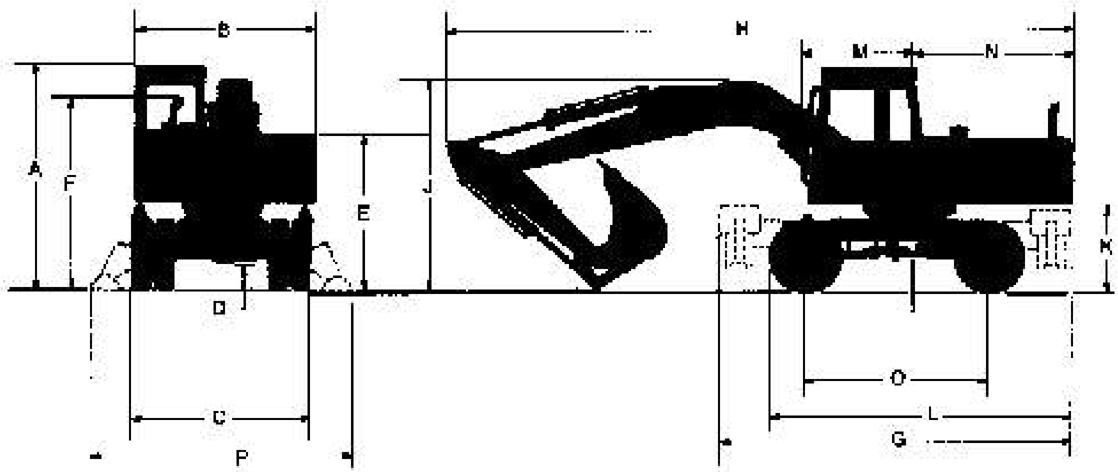
	E70B		E110B		E120B		E140	
A	2570 mm	8'5"	2700 mm	8'10"	2700 mm	8'10"	2890 mm	9'6"
B	2320 mm	7'7"	2495 mm	8'2"	2495 mm	8'2"	2545 mm	8'4"
C*	2260 mm	7'5"	2490 mm	8'2"	2490 mm	8'2"	2490 mm	8'2"
D	300 mm	1'0"	460 mm	1'6"	460 mm	1'6"	430 mm	1'5"
E	780 mm	31"	920 mm	36"	920 mm	36"	1065 mm	3'6"
F	1750 mm	5'9"	2090 mm	6'10"	2115 mm	6'11"	2415 mm	7'11"
G	2660 mm	8'9"	3320 mm	10'10"	3490 mm	11'5"	3530 mm	11'7"
H	6095 mm	20'0"	7250 mm	23'9"	7620 mm	25'0"	8390 mm	27'6"
J	2560 mm	8'6"	2700 mm	8'10"	2700 mm	8'10"	2816 mm	9'3"
K	2000 mm	6'7"	2610 mm	8'7"	2780 mm	9'1"	2695 mm	8'10"
L	860 mm	2'10"	1000 mm	3'3"	1000 mm	3'3"	1115 mm	3'8"
M	1750 mm	5'9"	1990 mm	6'6"	1990 mm	6'6"	1990 mm	6'6"
N	665 mm	26"	785 mm	31"	785 mm	31"	845 mm	33"
O	1680 mm	5'5"	2013 mm	6'7"	2013 mm	6'7"	2196 mm	7'2"
P	2000 mm	6'6"	2180 mm	7'2"	2180 mm	7'2"	2256 mm	7'4"

*Narrow undercarriage.

	211B		211B NLC*		213B LC		213B NLC*	
A	2976 mm	9'9"	2976 mm	9'9"	3016 mm	9'11"	3016 mm	9'11"
B	2395 mm	7'10"	2395 mm	7'10"	2500 mm	8'2"	2500 mm	8'2"
C*	2840 mm	9'4"	2495 mm	8'2"	2844 mm	9'4"	2495 mm	8'2"
D	403 mm	15.9"	420 mm	16.5"	430 mm	17"	430 mm	17"
E	1095 mm	3'7"	1095 mm	3'7"	1095 mm	3'7"	1095 mm	3'7"
F	2240 mm	7'4"	2240 mm	7'4"	2400 mm	7'10"	2400 mm	7'10"
G	4095 mm	13'5"	4142 mm	13'7"	4160 mm	13'8"	4142 mm	13'7"
H	8280 mm	27'2"	8280 mm	27'2"	8630 mm	28'4"	8640 mm	28'4"
J	2910 mm	9'7"	2910 mm	9'7"	3022 mm	9'11"	3016 mm	9'11"
K	3375 mm	11'1"	3375 mm	11'1"	3375 mm	11'1"	3375 mm	11'1"
L	1475 mm	4'10"	1475 mm	4'10"	1480 mm	4'10"	1480 mm	4'10"
M	2240 mm	7'4"	1895 mm	6'3"	2240 mm	7'4"	1895 mm	6'3"
N	864 mm	34"	864 mm	34"	879 mm	34.6"	879 mm	34.6"
O	2130 mm	7'0"	2130 mm	7'0"	2095 mm	6'10"	2095 mm	6'10"
P	2605 mm	8'7"	2605 mm	8'7"	2618 mm	8'7"	2618 mm	8'7"

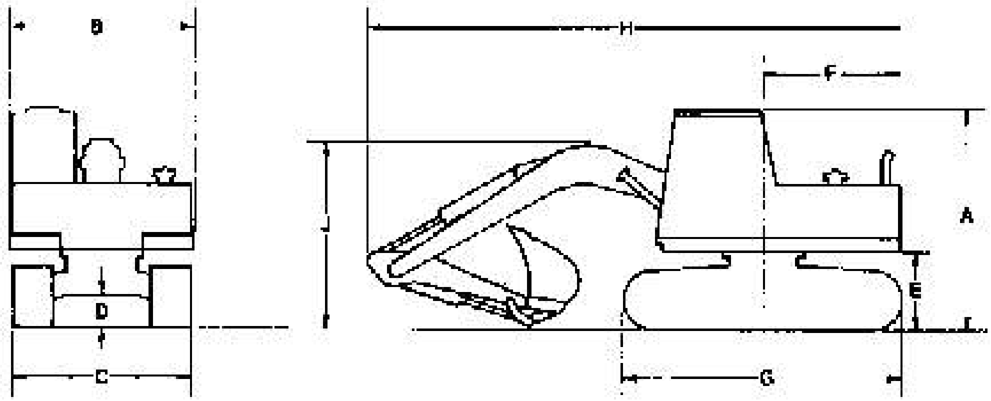
*Narrow undercarriage.

Shipping Dimensions
• 206B FT • 212B FT
• 214B • 214B FT • 224B



	206B FT		212B FT		214B, 214B FT		224B	
A	3096 mm	10'2"	3121 mm	10'3"	3191 mm	10'5"	3190 mm	10'5"
B	2395 mm	7'10"	2395 mm	7'10"	2500 mm	8'2"	2650 mm	8'7"
C*	2491 mm	8'2"	2491 mm	8'2"	2478 mm	8'	2660 mm	8'7"
**	2480 mm	8'1"	2480 mm	8'1"	2480 mm	8'1"	—	
D	355 mm	14"	355 mm	14"	340 mm	13.4"	340 mm	13.4"
E	2250 mm	7'5"	2275 mm	7'6"	2270 mm	7'6"	2310 mm	7'7"
F	2725 mm	8'11"	2750 mm	9'0"	2791 mm	9'2"	2655 mm	8'9"
G***	4600 mm	15'1"	4700 mm	15'6"	4850 mm	15'11"	5385 mm	17'7"
H	7829 mm	26'8"	8280 mm	27'2"	8484 mm	27'10"	9340 mm	30'6"
J	2850 mm	9'4"	2970 mm	9'9"	3420 mm	11'3"	3430 mm	11'3"
K	1215 mm	48"	1240 mm	49"	1270 mm	50"	1290 mm	51"
L	4025 mm	13'2"	4050 mm	13'3"	4200 mm	13'9"	5100 mm	16'7"
M	1475 mm	4'10"	1475 mm	4'10"	1480 mm	4'10"	1480 mm	4'10"
N	2078 mm	6'10"	2251 mm	7'5"	2400 mm	7'10"	2640 mm	8'7"
O	2400 mm	7'10"	2500 mm	8'2"	2600 mm	8'6"	2750 mm	9'0"
P	3650 mm	11'11"	3650 mm	11'11"	3650 mm	11'11"	3870 mm	12'7"

*10 × 20 Dual Tires
**Dozer width
***212B FT with one set outriggers and dozer
214B, 214B FT with two sets outriggers
224B with two sets outriggers
Note: Shipping dimensions above are for standard machine equipped with one-piece boom and medium stick.



	320* Reach		320* Mass		320* VA		320 L* Reach		320 L* Mass		320 L* VA	
A	2930 mm	9'7"	2930 mm	9'7"	2930 mm	9'7"	2930 mm	9'7"	2930 mm	9'7"	2930 mm	9'7"
B	2620 mm	8'7"	2620 mm	8'7"	2620 mm	8'7"	2620 mm	8'7"	2620 mm	8'7"	2620 mm	8'7"
C	2800 mm	9'2"	2800 mm	9'2"	2800 mm	9'2"	3180 mm	10'5"	3180 mm	10'5"	3180 mm	10'5"
D	475 mm	1'7"	475 mm	1'7"	475 mm	1'7"	475 mm	1'7"	475 mm	1'7"	475 mm	1'7"
E	1065 mm	3'6"	1065 mm	3'6"	1065 mm	3'6"	1065 mm	3'6"	1065 mm	3'6"	1065 mm	3'6"
F	2750 mm	9'0"	2750 mm	9'0"	2750 mm	9'0"	2750 mm	9'0"	2750 mm	9'0"	2750 mm	9'0"
G	4064 mm	13'4"	4064 mm	13'4"	4064 mm	13'4"	4455 mm	14'7"	4455 mm	14'7"	4455 mm	14'7"
H	9370 mm	30'9"	9010 mm	29'7"	9300 mm	30'6"	9370 mm	30'9"	9010 mm	29'7"	9300 mm	30'6"
J	2930 mm	9'7"	3050 mm	10'0"	2980 mm	9'9"	2930 mm	9'7"	3050 mm	10'0"	2980 mm	9'9"

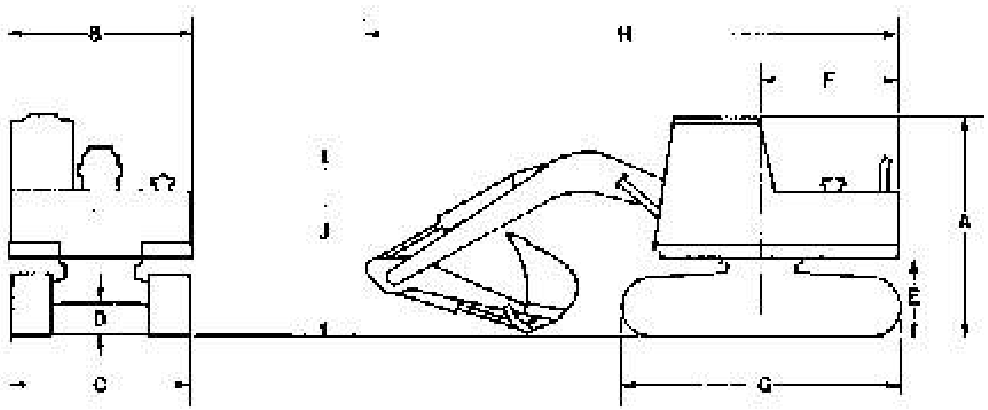
*Japan Sourced.

	320** Reach		320** Mass		320** VA		320 L** Reach		320 L** Mass		320 L** VA	
A	2930 mm	9'7"	2930 mm	9'7"	2930 mm	9'7"	2930 mm	9'7"	2930 mm	9'7"	2930 mm	9'7"
B	2470 mm	8'1"	2470 mm	8'1"	2470 mm	8'1"	2470 mm	8'1"	2470 mm	8'1"	2470 mm	8'1"
C	2800 mm	9'2"	2800 mm	9'2"	2800 mm	9'2"	3180 mm	10'5"	3180 mm	10'5"	3180 mm	10'6"
D	475 mm	1'7"	475 mm	1'7"	475 mm	1'7"	475 mm	1'7"	475 mm	1'7"	475 mm	1'7"
E	1055 mm	3'6"	1055 mm	3'6"	1055 mm	3'6"	1055 mm	3'6"	1055 mm	3'6"	1055 mm	3'6"
F	2750 mm	9'0"	2750 mm	9'0"	2750 mm	9'0"	2750 mm	9'0"	2750 mm	9'0"	2750 mm	9'0"
G	4064 mm	13'4"	4064 mm	13'4"	4064 mm	13'4"	4455 mm	14'7"	4455 mm	14'7"	4455 mm	14'7"
H	9370 mm	30'9"	9010 mm	29'7"	9300 mm	30'6"	9370 mm	30'9"	9010 mm	29'7"	9300 mm	30'6"
J	2930 mm	9'7"	3050 mm	10'0"	2980 mm	9'9"	2930 mm	9'7"	3050 mm	10'0"	2980 mm	9'9"

**Belgium Sourced.

Excavators

Shipping Dimensions
- 320 N Reach, Mass, VA Booms
- E240C, EL240C
- 325, 325 L, Reach, Mass, VA Booms

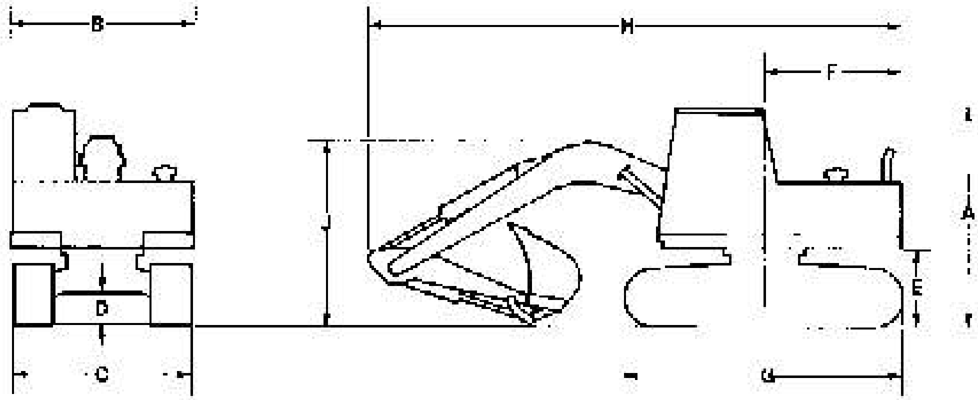


	320 N* Reach		320 N* Mass		320 N* VA		E240C		EL240C	
A	2930 mm	9'7"	2930 mm	9'7"	2930 mm	9'7"	2980 mm	9'9"	2980 mm	9'9"
B	2470 mm	8'1"	2470 mm	8'1"	2470 mm	8'1"	2780 mm	9'2"	2790 mm	9'2"
C	2495 mm	8'2"	2495 mm	8'2"	2495 mm	8'2"	3190 mm	10'6"	3380 mm	11'1"
D	475 mm	1'7"	475 mm	1'7"	475 mm	1'7"	470 mm	1'7"	470 mm	1'7"
E	1055 mm	3'6"	1055 mm	3'6"	1055 mm	3'6"	1100 mm	3'7"	1100 mm	3'7"
F	2750 mm	9'0"	2750 mm	9'0"	2750 mm	9'0"	2790 mm	9'2"	2790 mm	9'2"
G	4064 mm	13'4"	4064 mm	13'4"	4064 mm	13'4"	4150 mm	13'7"	4530 mm	14'10"
H	9390 mm	30'9"	9010 mm	29'7"	9300 mm	30'6"	9730 mm	31'11"	9730 mm	31'11"
J	2930 mm	9'7"	3050 mm	10'0"	2980 mm	9'9"	3020 mm	9'11"	3020 mm	9'11"

*Belgium Sourced.

	325 Reach		325 Mass		325 VA		325 L Reach		325 L Mass		325 L VA	
A	3045 mm	10'0"	3045 mm	10'0"	3045 mm	10'0"	3045 mm	10'0"	3045 mm	10'0"	3045 mm	10'0"
B	2815 mm	9'3"	2815 mm	9'3"	2815 mm	9'3"	2815 mm	9'3"	2815 mm	9'3"	2815 mm	9'3"
C	2990 mm	9'10"	2990 mm	9'10"	2990 mm	9'10"	3390 mm	11'1"	3390 mm	11'1"	3390 mm	11'1"
D	510 mm	1'8"	510 mm	1'8"	510 mm	1'8"	510 mm	1'8"	510 mm	1'8"	510 mm	1'8"
E	1130 mm	3'8"	1130 mm	3'8"	1130 mm	3'8"	1130 mm	3'8"	1130 mm	3'8"	1130 mm	3'8"
F	2970 mm	9'9"	2970 mm	9'9"	2970 mm	9'9"	2970 mm	9'9"	2970 mm	9'9"	2970 mm	9'9"
G	4380 mm	14'4"	4380 mm	14'4"	4380 mm	14'4"	4660 mm	15'3"	4660 mm	15'3"	4660 mm	15'3"
H	10 270 mm	33'8"	9710 mm	31'10"	10 080 mm	33'0"	10 270 mm	33'8"	9710 mm	31'10"	10 060 mm	33'0"
J	3240 mm	10'8"	3290 mm	10'10"	3150 mm	10'4"	3240 mm	10'8"	3290 mm	10'10"	3150 mm	10'4"

Shipping Dimensions
• 325 LN Reach, Mass, VA Booms
• 231D, 231D LC
• 330, 330 L, 330 LN Reach, Mass, VA Booms



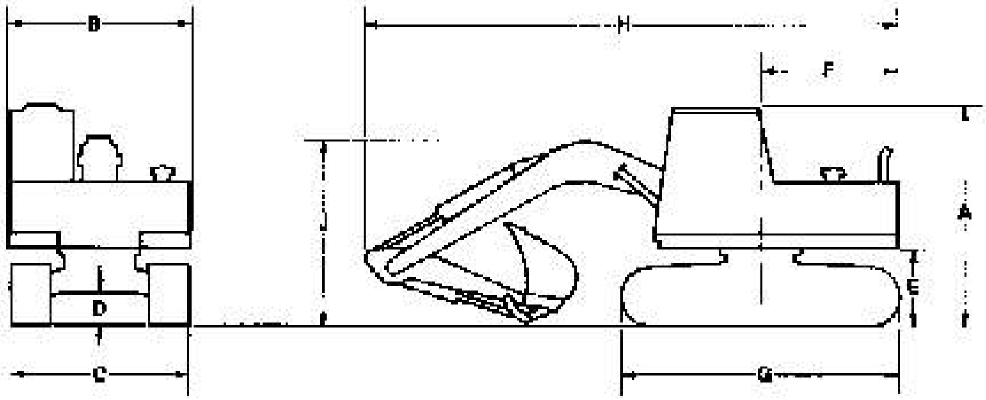
	325 LN* Reach		325 LN* Mass		325 LN* VA		231D		231D LC	
A	3045 mm	10'0"	3045 mm	10'0"	3045 mm	10'0"	3380 mm	11'1"	3380 mm	11'1"
B	2815 mm	9'3"	2815 mm	9'3"	2815 mm	9'3"	3050 mm	10'0"	3050 mm	10'0"
C	2990 mm	9'10"	2990 mm	9'10"	2990 mm	9'10"	3450 mm	11'4"	3450 mm	11'4"
D	510 mm	1'8"	510 mm	1'8"	510 mm	1'8"	580 mm	1'11"	580 mm	1'11"
E	1130 mm	3'8"	1130 mm	3'8"	1130 mm	3'8"	1240 mm	4'1"	1250 mm	4'1"
F	2970 mm	9'9"	2970 mm	9'9"	2970 mm	9'9"	3085 mm	10'2"	3000 mm	9'10"
G	4660 mm	15'3"	4660 mm	15'3"	4660 mm	15'3"	4520 mm	14'10"	5230 mm	17'2"
H	10 270 mm	33'8"	9710 mm	31'10"	10 060 mm	33'0"	10 830 mm	35'6"	10 830 mm	35'6"
J	3240 mm	10'8"	3290 mm	10'10"	3150 mm	10'4"	3460 mm	11'4"	3460 mm	11'4"

*Belgium Sourced

	330 Reach		330 Mass		330 L Reach		330 L Mass		330 LN* Reach		330 LN* Mass	
A	3150 mm	10'4"	3150 mm	10'4"	3150 mm	10'4"	3150 mm	10'4"	3150 mm	10'4"	3150 mm	10'4"
B	2960 mm	9'9"	2960 mm	9'9"	2960 mm	9'9"	2960 mm	9'9"	2960 mm	9'9"	2960 mm	9'9"
C	3190 mm	10'6"	3190 mm	10'6"	3340 mm	10'11"	3340 mm	10'11"	2990 mm	9'10"	2990 mm	9'10"
D	610 mm	1'8"	510 mm	1'8"	510 mm	1'8"	510 mm	1'8"	610 mm	1'8"	610 mm	1'8"
E	1290 mm	4'3"	1290 mm	4'3"	1290 mm	4'3"	1290 mm	4'3"	1290 mm	4'3"	1290 mm	4'3"
F	3410 mm	11'2"	3410 mm	11'2"	3410 mm	11'2"	3410 mm	11'2"	3410 mm	11'2"	3410 mm	11'2"
G	4580 mm	15'0"	4580 mm	15'0"	5040 mm	16'6"	5040 mm	16'6"	5040 mm	16'6"	5040 mm	16'6"
H	11 000 mm	36'1"	10 850 mm	35'7"	11 000 mm	36'1"	10 850 mm	35'7"	11 000 mm	36'1"	10 850 mm	35'7"
J	3290 mm	10'10"	3700 mm	12'2"	3290 mm	10'10"	3700 mm	12'2"	3290 mm	10'10"	3700 mm	12'2"

*Belgium Sourced.

Shipping Dimensions
- 235D, 235D LC, E450
- 245D, E650



	235D		235D LC		E450		E650	
A	3500 mm	11'6"	3600 mm	11'9"	3370 mm	11'1"	3610 mm	11'10"
B	3600 mm	11'10"	3630 mm	11'10"	3035 mm	9'11"	3175 mm	10'5"
C	3450 mm	11'4"	3785 mm*	12'5"*	3150 mm	10'4"	3480 mm	11'5"
D	530 mm	21"	530 mm	21"	600 mm	24"	670 mm	26"
E	1120 mm	44"	1287 mm	50.7"	1430 mm	4'8"	1320 mm	4'4"
F	3300 mm	10'10"	3450 mm	11'4"	3630 mm	11'11"	4280 mm	14'0"
G	5050 mm	16'7"	5480 mm	18'0"	5125 mm	16'10"	5420 mm	17'8"
H	11 500 mm**	37'7"**	11 600 mm**	38'1"**	11 980 mm	39'3"	14 000 mm	46'11"
J	3500 mm**	11'4"**	3400 mm**	11'11"**	3480 mm	11'6"	4840 mm	15'11"

	245D		245D Deep Trench		245D Heavy Lift Trencher W/Wide Gauge Carbody	
A	3600 mm	11'10"	3600 mm	11'10"	3600 mm	11'10"
B	3600 mm	11'10"	3700 mm	12'2"	3700 mm	12'2"
C	3610 mm	11'10"	3760 mm‡	12'4"‡	3760 mm‡	12'4"‡
D	760 mm	30"	760 mm	30"	760 mm	30"
E	1060 mm	42"	1060 mm	42"	1060 mm	42"
F	3810 mm	12'6"	3920 mm	12'11"	3920 mm	12'11"
G	5610 mm	18'5"†	6000 mm†	19'9"†	6000 mm†	19'9"†
H	12 820 mm††	42'0"††	14 960 mm††	49'1"††	13 440 mm††	44'1"††
J	5460 mm††	17'11"††	5000 mm††	16'5"††	4850 mm††	15'11"††

*Outside of carbody, narrow position.
**3660 mm (12') stick.
†Extended undercarriage — Standard U/C available.
††4220 mm (14'6") stick.
‡915 mm (36") shoes

	E70B		E110B		E120B		E140	
Buckets: (see data in bucket section)	kg	lb	kg	lb	kg	lb	kg	lb
Sticks:*								
Short Stick	270	595	490	1080	540	1191	610	1340
Medium Stick	290	639	500	1103	570	1257		—
Long Stick	340	750	590	1301	680	1499	680	1500
Booms:**								
One-piece	630	1389	1160	2558	1240	2734	1440	3170
Parallel-Offset	1156	2548		—		—		—
Other:								
Upperstructure (complete w/o ctwt)	2570	5667	3840	8467	3840	8467	3960	8730
Undercarriage Std Std shoe width	2300	5072	3950	8710	4340	9570	5100	11,240
Counterweight	850	1870	1600	3530	2300	5070	2350	5180

*Stick weights include stick, stick lines, bucket cylinder, bucket cylinder pins and bucket linkage.
**Boom weight include boom, boom lines, boom cylinders and rod end pins, stick cylinder and head end pin.

	211B LC		213B LC	
Buckets: (see data in bucket section)	kg	lb	kg	lb
Sticks:*				
Short stick	560	1235	650	1433
Medium Stick	590	1301	730	1609
Long Stick	640	1411	805	1774
Extra Long	715	1577		—
Extended Reach	800	1764	990	2182
Material Handling — 3000 mm (9'10")	380	838	770	1700
— 3500 mm (11'6")		—	860	1900
Booms:				
One-piece (includes boom and stick cylinders)	1555	3429	1585	3460
Hydraulic Adjustable boom (includes stub boom and cylinders)	945	2084	2060	4542
Foreboom, and stick cylinder	930	2051	1675	3692
Other:				
Upperstructure (with swing bearing, no boom)	7020	15,475	8100	17,858
Undercarriage, Long	6330	13,958	6236	13,748
Narrow undercarriage with boom and 600 mm (23.6") shoes	6210	13,693	5990	13,208

*Stick weight includes stick, bucket cylinder and bucket linkage.

Major Component Weights
• 206B FT • 212B FT • 214B • 214B FT • 224B • 231D • 235D

	206B FT		212B FT		214B 214B FT		224B	
Buckets: (see data in bucket section)	**kg**	**lb**	**kg**	**lb**	**kg**	**lb**	**kg**	**lb**
Sticks: (includes bucket cylinder and linkage)								
Short Stick	520	1147	560	1235	650	1433	850	1875
Medium Stick	565	1246	590	1301	730	1609	940	2070
Long Stick	595	1312	640	1411	805	1775	1030	2270
Extra Long	650	1433	715	1577		—		—
Extended Reach		—	800	1764	990	2182	1230	2712
Material Handling — 3000 mm (9'10")		—	380	838	770	1700		—
— 3500 mm (11'6")		—		—	860	1900	720	1588
Booms:								
One-piece (includes boom and stick cylinders)	1275	2810	1555	3430	1565	3450	2205	4861
Hydraulic Adjustable boom (includes stub boom cylinders)	850	1875	945	2085	2060	4542		—
Foreboom and stick cylinder	785	1731	930	2050	1675	3692	2445	5390
Other:								
Upperstructure (with swing bearing, no boom)	6360	14,000	7020	15,475	8600	18,956	9600	21,160
Undercarriage (with 10 × 20 tires)	3400	7497	3515	7750	4330	9545	7470	16,470
Outriggers (each set, cylinders and linkage)	1070	2360	1070	2360	1070	2360	1250	2760
Dozer Blade (with cylinders and linkage)	670	1477	670	1477	750	1653		—

	231D 231D LC		235D		235D LC		235D SA	
Buckets: (see data in bucket section)	**kg**	**lb**	**kg**	**lb**	**kg**	**lb**	**kg**	**lb**
Sticks:*								
Short Stick		—	1890	4160	1890	4160		—
Medium Stick	1710	3780	1970	4350	1970	4350		—
Long Stick	1810	3990	2260	4970	2260	4970		—
Mass Excavation Stick — Short	1770	3880		—		—		—
Mass Excavation Stick — Medium	1830	4030		—		—		—
SA Stick		—		—		—	2247	4954
Booms:**								
One-piece — General Purpose	3650	8030	5415	11,930	5415	11,930	6178	13,620
One-piece — Special and Mass	3940	8680		—		—		—
Track:								
Track roller frame assembly (each)	5160	11,400	6850	15,100	6850	15,100	6960	15,300
Long track roller frame assembly (each)	5640	12,680		—		—		—
Other:								
Upperstructure (complete w/o ctwt)	8110	17,870	9930	21,870	9940	21,890	9940	21,890
Carbody and swing bearing	2720	6000	3688	8132		—		—
Wide gauge carbody and swing bearing		—		—	4650	10,255	4530	9970
Counterweight***	5690	12,540	7710	17,000	7710	17,000	7710	17,000

*Stick weights include stick, stick lines, bucket cylinder, bucket cylinder pins and bucket linkage.
**Boom weights include boom, boom lines, boom cylinders and rod end pins, stick cylinder and head end pin.
***231D LC counterweight is 4780 kg (10,540 lb).

	E240C		E450		E650	
Buckets: (see data in bucket section)	kg	lb	kg	lb	kg	lb
Sticks:*						
Short Stick	1000	2210	2000	4410	—	
Medium Stick	1130	2490	2320	5110	3200	7056
Long Stick	1280	2820	2220	4890	—	
Extra Long Stick	—		—		—	
Booms:**						
One-piece	2470	5450	3920	8630	7700	17,000
Upperstructure (complete w/o ctwt)	5800	12,790	11 680	25,750	15 900	35,050
Undercarriage Std Std shoe width	8000	17,640	17 980	39,640	24 900	54,900
Undercarriage — Long	8600	18,960	—		—	
Counterweight	4500	9920	7500	16,540	11 000	24,250

*Stick weights include stick, stick lines, bucket cylinder, bucket cylinder pins and bucket linkage.
**Boom weights include boom, boom lines, boom cylinders and rod end pins, stick cylinder and head end pin.

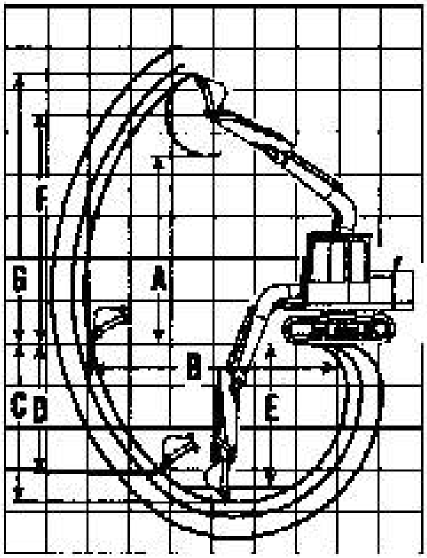
	320		325		330	
Buckets: (see data in bucket section)	kg	lb	kg	lb	kg	lb
Booms:**						
One-piece Reach	1970	4330	2760	6060	3690	8150
Sticks:* (for Reach Boom)						
Short	620	1370	830	1830	960	2120
•	600	1320	765	1690	1000	2210
•	620	1370	860	1900	1130	2600
•	880	1940	990	2180	1180	2680
Long	—		—		1320	2920
Booms:**						
One-piece Mass	1980	4360	2880	6340	3590	7920
Booms:**						
VA Boom	2570	5660	3600	7940	—	
Sticks:* (for Mass Boom & VA Boom)						
Short	620	1370	830	1830	960	2120
•	650	1430	850	1870	1070	2350
Long	650	1430	870	1920	1230	2710
Upperstructure (complete w/o ctwt)	5290† 5630††	11,650 12,420	7040 —	15,520	9030 —	19,900
Undercarriage — Std	(600) 6440	14,200	(600) 9450	20,830	(600) 10 810	23,820
( ) Shoe width — Long	(800) 7670	16,900	(800) 10 530	23,220	(750) 12 180	26,850
Narrow	(500) 6150	13,570	—		—	
Counterweight — Std	3800	8380	4700	10,360	5600	12,350
— Extra	4850	1210	—		5100***	11,250

*Stick weights include stick and stick lines.
**Boom weights include boom, boom lines, boom cylinders and rod end pins, stick cylinder and head end pin.
***U.S. Sourced.
†with 3066T Engine.
††Belgium Sourced 320N.

Major Component Weights
• 245D

	245D***		245D Deep Trencher		245D Heavy Lift Trencher	
Buckets: (see data in bucket section)	kg	lb	kg	lb	kg	lb
Sticks:*						
Short Stick	3350	7380	3350	7380	3350	7380
Medium Stick	3560	7850	3560	7850	3660	7850
Long Stick	4060	8950	4060	8950	4060	8950
Booms:**						
One-piece (includes boom and stick cylinders)	7070	15,580	10 000	22,040	8950	19,730
Track:						
Track roller frame assembly w/36" shoes (each)	10 580	23,300	10 580	23,300	10 580	23,300
Long track roller frame assembly w/36" shoes (each)	—		11 190	24,640	11 190	24,640
Other:						
Upperstructure (complete) (w/o ctwt)	15 950	35,170	15 950	35,170	15 950	35,170
Carbody and swing bearing	6550	14,420	6550	14,420	6550	14,420
Wide gauge carbody and swing bearing	—		7770	17,110	7770	17,110
Counterweight	10 400	23,000	12 250	27,000	12 250	27,000

*Stick weights include stick, stick lines, bucket cylinder, bucket cylinder pins and bucket linkage.
**Boom weights include boom, boom lines, boom cylinders and rod end pins, stick cylinder and head end pin.
***245B Mass Excavation Hoe Weights:
Stick — 3962 kg (8,734 lb)
Boom — 7669 kg (16,905 lb)



One-Piece Boom Digging Envelope

- Standard shoes and undercarriage
- Lug height not included.

KEY:

A Maximum loading height of bucket with teeth

B Maximum reach at ground level

C Maximum digging depth

D Maximum vertical wall

E Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)

F Maximum bucket hinge pin height

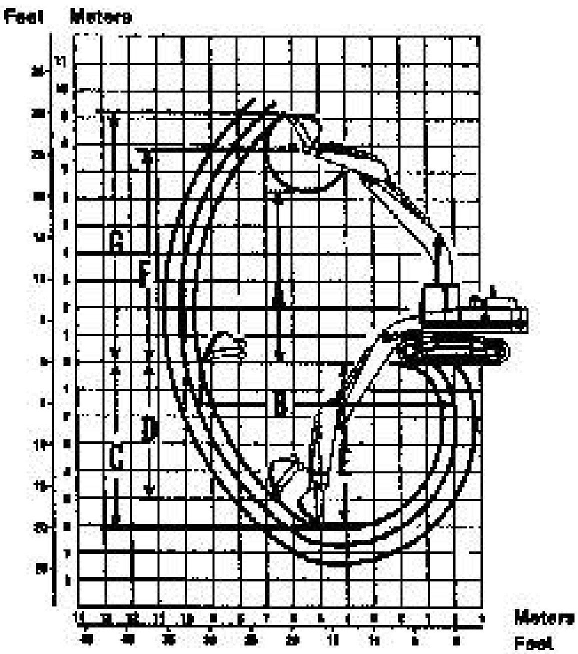
G Maximum height, to bucket teeth at highest arc

E70B

Stick	1.39 m	4'7"	1.72 m	5'8"	2.21 m	7'3"
	m	ft	m	ft	m	ft
A	4.46	14'6"	4.66	15'5"	4.96	16'3"
B	5.93	19'5"	6.245	20'6"	6.72	22'1"
C	3.78	12'5"	4.11	13'6"	4.595	15'1"
D	3.07	10'1"	3.53	11'7"	3.965	13'0"
E	3.415	11'2"	3.80	12'6"	4.35	14'3"
F	5.53	18'2"	5.73	18'10"	6.03	19'8"
G	6.605	21'4"	6.726	22'1"	7.025	23'1"

E110B / E120B

Stick	E110B 1.95 m	6'5"	2.25 m	7'5"	2.80 m	9'2"	E120B 2.10 m	6'11"	2.50 m	8'2"	3.00 m	9'10"
	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft
A	5.29	17'4"	5.44	17'10"	5.765	18'11"	5.845	19'2"	6.095	20'0"	6.33	20'9"
B	7.295	23'11"	7.57	24'10"	8.10	26'7"	7.925	26'0"	8.30	26'4"	8.74	28'8"
C	4.75	15'7"	5.05	16'7"	5.60	18'4"	5.15	16'11"	5.55	18'3"	6.05	19'10"
D	4.225	13'10"	4.45	14'7"	4.965	16'3"	4.515	14'10"	4.97	16'4"	5.34	17'6"
E	4.50	14'9"	4.825	15'10"	5.41	17'9"	4.91	16'1"	5.34	17'6"	5.865	19'3"
F	6.51	21'4"	6.60	21'8"	6.985	22'11"	7.065	23'2"	7.315	24'0"	7.55	24'9"
G	7.665	25'1"	7.795	25'7"	8.12	26'8"	8.215	26'11"	8.475	27'10"	8.695	28'6"



One-Piece Boom Digging Envelope

- Standard shoes and undercarriage

KEY:

A Maximum loading height of bucket with teeth

B Maximum reach at ground level

C Maximum digging depth

D Maximum vertical wall

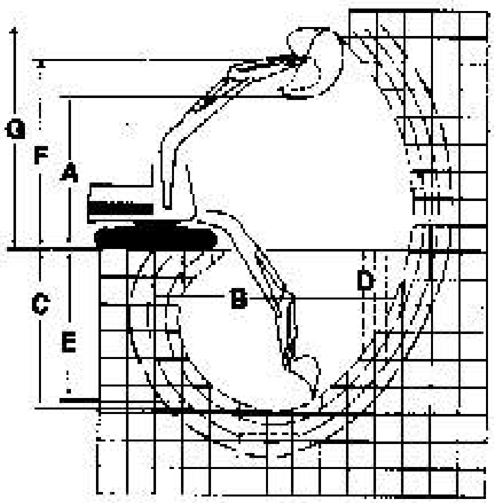
E Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)

F Maximum bucket hinge pin height

G Maximum height, to bucket teeth at highest arc

	E140				E240C, EL240C					
Stick	**2.13 m**	**7'0"**	**2.74 m**	**9'0"**	**2.20 m**	**7'3"**	**2.80 m**	**9'2"**	**3.50 m**	**11'6"**
	m	ft	m	ft	m	ft	m	ft	m	ft
A	5.33	17'6"	5.49	18'0"	6.29	20'8"	6.64	21'9"	6.78	22'3"
B	8.24	27'0"	8.78	28'10"	9.40	30'10"	10.0	32'10"	10.8	34'8"
C	5.33	17'6"	5.93	19'6"	6.11	20'1"	6.71	22'0"	7.41	24'4"
D	4.15	13'7"	4.71	15'5"	5.03	16'6"	5.91	19'5"	6.55	21'6"
E	5.03	16'6"	5.64	18'6"	5.90	19'4"	6.53	21'5"	7.26	23'10"
F	6.86	22'6"	7.02	23'0"	7.87	25'10"	8.22	27'0"	8.36	27'5"
G	7.74	25'5"	7.89	25'11"	9.19	30'2"	9.60	31'6"	9.73	31'11"

	211B LC									
Stick	**1.60 m**	**5'3"**	**2.30 m**	**7'7"**	**2.80 m**	**9'2"**	**3.30 m**	**10'10"**	**4.00 m**	**13'2"**
	m	ft	m	ft	m	ft	m	ft	m	ft
A	5.64	18'6"	5.92	19'5"	5.96	19'7"	6.20	20'4"	6.55	21'6"
B	7.98	26'2"	8.62	28'3"	9.02	29'7"	9.50	31'2"	10.19	33'5"
C	4.76	15'7"	5.46	17'11"	5.94	19'6"	6.44	21'2"	7.14	23'5"
D	3.64	11'11"	4.10	13'6"	4.14	13'7"	4.50	15'0"	5.19	17'0"
E	4.48	14'8"	5.23	17'2"	5.75	18'10"	6.27	20'6"	6.54	21'5"
F	6.80	22'4"	7.13	23'5"	7.16	23'6"	7.41	24'4"	7.75	25'5"
G	7.95	26'1"	8.20	26'11"	8.18	26'10"	8.43	27'8"	8.77	28'9"



One-Piece Boom Digging Envelope

- Standard 600 mm (23.6") track shoes and undercarriage
- General purpose bucket

KEY:

A Maximum loading height of bucket with teeth

B Maximum reach at ground level

C Maximum digging depth

D Maximum vertical wall

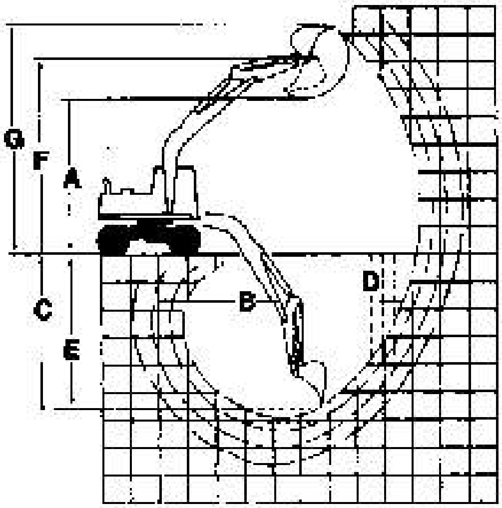
E Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)

F Maximum bucket hinge pin height

G Maximum height, to bucket teeth at highest arc

213B LC

Stick	1.80 m	5'11"	2.30 m	7'7"	2.80 m	9'2"	4.00 m	13'1"
	m	ft	m	ft	m	ft	m	ft
A	5.58	18'3"	5.79	19'0"	5.77	18'11"	6.31	20'8"
B	8.68	28'2"	9.06	29'9"	9.44	31'0"	10.60	34'9"
C	5.2	17'1"	5.70	18'8"	6.18	20'4"	7.38	24'3"
D	3.56	11'8"	3.84	12'7"	3.76	12'4"	4.78	15'8"
E	4.96	16'3"	5.49	18'0"	6.00	19'8"	7.24	23'8"
F	5.94	19'6"	7.21	23'8"	7.19	23'7"	7.73	25'4"
G	8.2	26'11"	8.46	27'9"	8.35	27'5"	8.09	29'2"



One-Piece Boom Digging Envelope

- Standard 10 × 20 tires and undercarriage
- General purpose bucket

KEY:

A Maximum loading height of bucket with teeth

B Maximum reach at ground level

C Maximum digging depth

D Maximum vertical wall

E Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)

F Maximum bucket hinge pin height

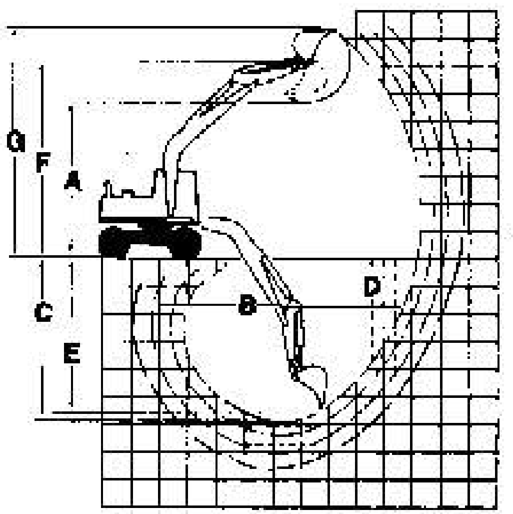
G Maximum height, to bucket teeth at highest arc

206B FT

Stick	1800 mm	5'3"	2100 mm	6'11"	2600 mm	8'6"	3100 mm	10'2"
	m	ft	m	ft	m	ft	m	ft
A	5.48	18'0"	5.65	18'6"	5.72	18'9"	5.97	19'7"
B	7.33	24'1"	7.98	26'2"	8.39	27'6"	8.88	29'2"
C	4.27	14'0"	4.77	15'8"	5.26	17'3"	5.76	18'11"
D	3.25	10'8"	3.50	11'6"	3.55	11'8"	3.98	13'1"
E	3.99	13'1"	4.53	14'10"	5.06	16'7"	5.58	18'4"
F	6.69	21'11"	6.86	22'6"	6.93	22'9"	7.17	23'6"
G	7.79	25'7"	7.93	26'0"	7.95	26'1"	8.19	26'10"

212B FT

Stick	1600 mm	5'3"	2300 mm	7'7"	2800 mm	9'2"	3300 mm	10'10"	4000 mm	13'2"
	m	ft	m	ft	m	ft	m	ft	m	ft
A	5.80	19'0"	6.05	19'10"	6.11	20'1"	6.35	20'10"	6.70	22'0"
B	7.94	26'1"	8.59	28'2"	9.00	29'6"	9.48	31'1"	10.16	33'4"
C	4.60	15'1"	5.30	17'5"	5.79	19'0"	6.29	20'8"	6.99	22'11"
D	3.50	11'6"	3.95	13'0"	3.98	13'1"	4.43	14'6"	5.04	16'6"
E	4.33	14'2"	5.08	16'8"	5.60	18'4"	6.12	20'1"	6.84	22'5"
F	7.00	23'0"	7.28	23'11"	7.31	24'0"	7.56	24'10"	7.90	25'11"
G	8.10	26'7"	8.35	27'5"	8.33	27'4"	8.58	28'2"	8.92	29'3"



One-Piece Boom Digging Envelope

- Standard 10 × 20 tires and undercarriage
- General purpose bucket

KEY:

A Maximum loading height of bucket with teeth

B Maximum reach at ground level

C Maximum digging depth

D Maximum vertical wall

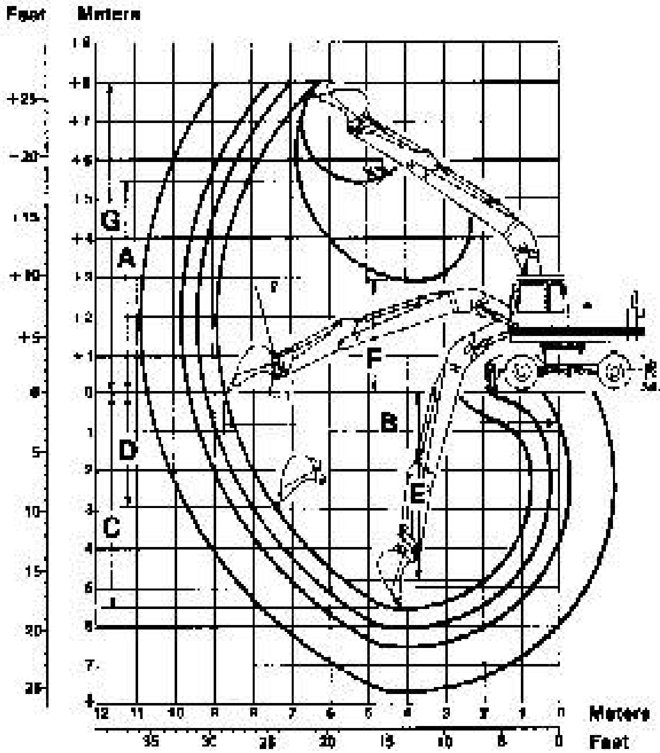
E Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)

F Maximum bucket hinge pin height

G Maximum height to bucket teeth at highest arc

214B, 214B FT

Stick	1800 mm	5'11"	2300 mm	7'7"	2800 mm	9'2"	4000 mm	13'2"
	m	ft	m	ft	m	ft	m	ft
A	5.71	18'9"	5.97	19'7"	5.86	19'6"	6.49	21'3"
B	8.54	28'0"	9.03	29'7"	9.40	30'10"	10.56	34'8"
C	5.02	16'5"	5.52	18'1"	6.00	19'8"	7.2	23'8"
D	3.37	11'1"	3.66	12'0"	3.58	11'9"	4.61	15'2"
E	4.78	15'8"	5.31	17'5"	5.82	19'1"	7.07	23'2"
F	7.12	23'4"	7.39	24'3"	7.37	24'2"	7.91	25'11"
G	8.39	27'6"	8.64	28'4"	8.53	28'0"	9.07	29'9"



One-Piece Boom Digging Envelope

- Standard 10 × 20 tires and undercarriage
- General purpose bucket

KEY:

A Maximum loading height of bucket with teeth

B Maximum reach at ground level

C Maximum digging depth

D Maximum vertical wall

E Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)

F Minimum loading height

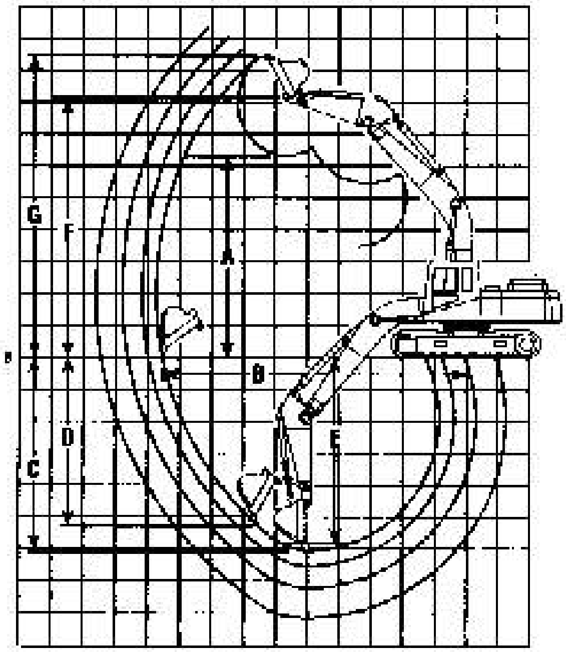
G Maximum height to bucket teeth at highest arc

NOTE: Cutting arcs
For 1800 mm (5'11") and 2300 mm (7'7")
Sticks: Pinhole 1 - 4470 mm (14'8")
Pinhole 2 - 3658 mm (12'0")
For 2800 mm (9'2") and 4000 mm (13'2")
Sticks: Pinhole 1 - 4646 mm (15'3")
Pinhole 2 - 3886 mm (12'9")
Pinhole 1-Speed
Pinhole 2 Power

224B

Stick	1.80 m	5'11"	2.30 m	7'7"	2.80 m	9'2"	4.00 m*	13'2"*
	m	ft	m	ft	m	ft	m	ft
A	5.51	18'1"	5.74	18'10"	5.69	18'8"	6.06	19'11"
B	8.77	28'9"	9.25	30'4"	9.60	31'6"	10.76	35'3"
C	5.54	18'2"	6.02	19'9"	6.52	21'5"	7.72	25'4"
D	3.50	11'6"	4.08	13'5"	3.64	11'11"	4.75	15'7"
E	5.26	17'3"	5.80	19'0"	6.28	20'7"	7.54	24'9"
F	2.62	8'7"	2.43	7'11"	1.93	6'4"	0.73	2'5"
G	8.15	26'8"	8.38	27'6"	8.18	26'10"	8.58	28'2"

*Extended Reach 4000 mm (13'2") Stick must not be used with hammers.



One-Piece Boom Digging Envelope
• Standard shoes and undercarriage

KEY:

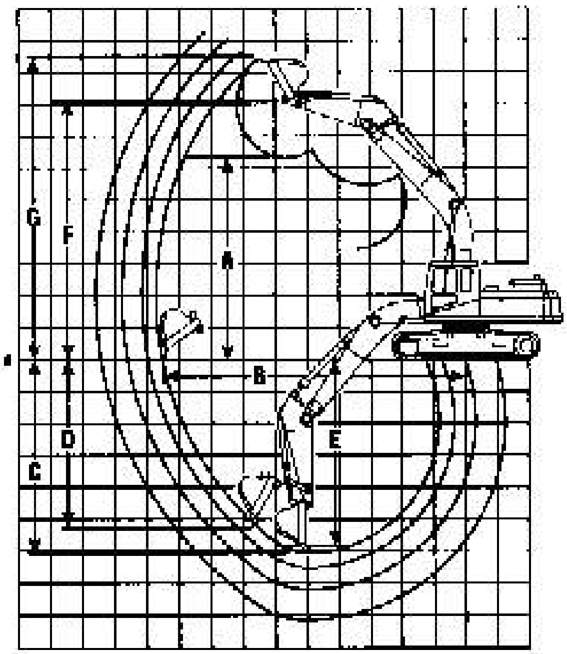
- **A** Maximum loading height of bucket with teeth
- **B** Maximum reach at ground level
- **C** Maximum digging depth
- **D** Maximum vertical wall
- **E** Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)
- **F** Maximum bucket hinge pin height
- **G** Maximum height, to bucket teeth at highest arc

320, 320 L, 320 N with Reach Boom

Stick	3860 mm	12'8"	2920 mm	9'7"	2500 mm	8'2"	1900 mm	6'3"
	m	ft	m	ft	m	ft	m	ft
A	6.93	22.7'	6.50	21.6'	6.32	20.7'	5.96	19.6'
B	10.63	34.9'	9.76	32.1'	9.45	31.0'	8.76	28.7'
C	7.58	24.9'	6.64	21.8'	6.29	20.6'	5.63	18.5'
D	6.81	22.3'	6.05	19.8'	5.61	18.4'	4.68	15.4'
E	7.27	23.9'	6.30	20.7'	5.96	19.6'	5.31	17.4'
F	8.41	27.6'	8.06	26.4'	7.87	25.8'	7.45	24.4'
G	9.76	32.0'	9.42	30.9'	9.20	30.5'	8.78	28.8'

320, 320L, 320N with Mass Boom

Stick	2920 mm	9'7"	2400 mm	7'10"	1900 mm	6'3"
	m	ft	m	ft	m	ft
A	6.25	20.5'	5.92	19.4'	5.68	18.7'
B	9.18	30.1'	8.76	28.7'	8.30	27.2'
C	6.14	20.1'	5.70	18.7'	5.20	17.1'
D	5.40	17.7'	4.91	16.1'	4.43	14.5'
E	5.84	19.2'	5.39	17.7'	4.88	16.0'
F	7.66	25.1'	7.42	24.3'	7.18	23.6'
G	8.94	29.3'	8.76	28.7'	8.54	28.0'



One-Piece Boom Digging Envelope

• Standard shoes and undercarriage

KEY:

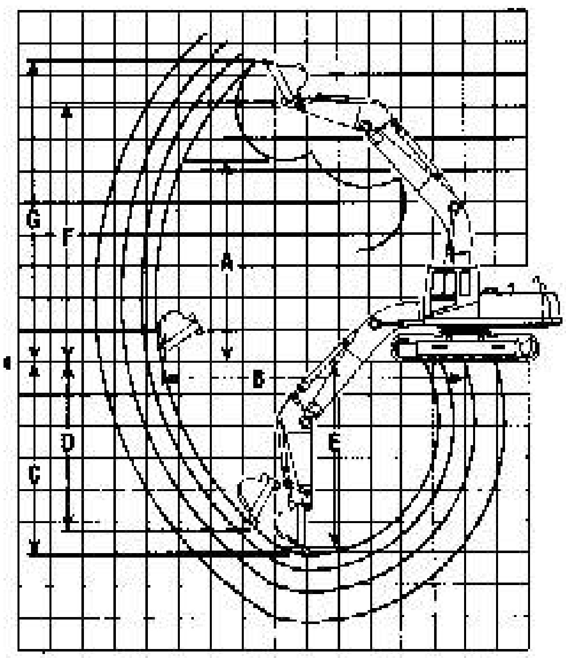
- **A** Maximum loading height of bucket with teeth
- **B** Maximum reach at ground level
- **C** Maximum digging depth
- **D** Maximum vertical wall
- **E** Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)
- **F** Maximum bucket hinge pin height
- **G** Maximum height, to bucket teeth at highest arc

325, 325 L, 325 LN with Reach Boom

Stick	4200 mm	13'9"	3200 mm	10'6"	2650 mm	8'8"	2000 mm	6'7"
	m	ft	m	ft	m	ft	m	ft
A	7.42	24.3'	6.98	22.9'	6.90	22.6'	6.31	20.7'
B	11.50	37.7'	10.64	34.9'	10.01	32.8'	9.52	31.2'
C	8.15	26.7'	7.21	23.7'	6.54	21.5'	6.06	19.9'
D	7.25	23.8'	6.36	20.9'	5.85	19.2'	5.11	16.8'
E	8.00	26.2'	7.05	23.1'	6.35	20.8'	5.83	19.1'
F	8.96	29.4'	8.60	28.2'	8.38	27.5'	7.97	26.1'
G	10.35	34.0'	10.07	33.0'	9.75	32.0'	9.46	31.0'

325, 325 L, 326 LN with Mass Boom

Stick	3200 mm	10'6"	2500 mm	8'2"	2000 mm	6'7"
	m	ft	m	ft	m	ft
A	6.55	21.5'	6.10	20.0'	5.89	19.3'
B	9.82	32.2'	9.35	30.7'	8.89	29.2'
C	6.54	21.5'	6.01	19.7'	5.51	18.1'
D	5.53	18.1'	5.05	16.6'	3.91	12.8'
E	6.37	20.9'	5.81	19.1'	5.28	17.3'
F	8.03	26.3'	7.63	25.0'	7.55	24.8'
G	9.36	30.7'	9.24	30.3'	8.93	29.3'



One-Piece Boom Digging Envelope

• Standard shoes and undercarriage

KEY:

A Maximum loading height of bucket with teeth

B Maximum reach at ground level

C Maximum digging depth

D Maximum vertical wall

E Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)

F Maximum bucket hinge pin height

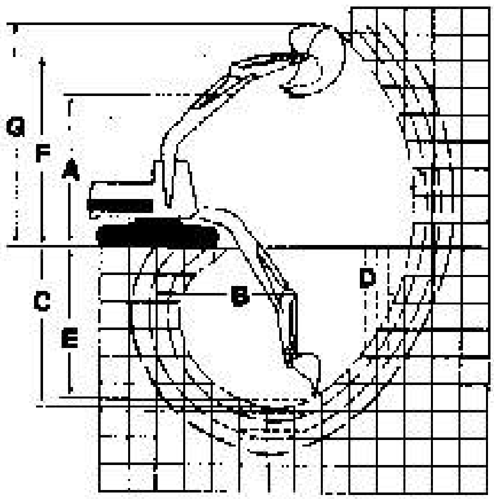
G Maximum height, to bucket teeth at highest arc

330, 330 L, 330 LN with Reach Boom

Stick	4800 mm	15'9"	3900 mm	12'10"	3300 mm	10'10"	2800 mm	9'2"	2150 mm	7'1"
	m	ft	m	ft	m	ft	m	ft	m	ft
A	8.10	26.6	7.61	25.0	7.29	23.9	7.12	23.4	6.50	21.3
B	12.37	40.6	11.62	38.1	11.03	36.2	10.58	34.7	10.09	33.1
C	8.88	29.1	8.09	26.5	7.49	24.6	6.99	22.9	6.52	21.4
D	8.08	26.5	7.21	23.7	6.54	21.5	6.12	20.1	5.14	16.9
E	8.62	28.3	7.75	25.4	7.15	23.5	6.65	21.8	6.13	20.1
F	9.68	31.8	9.29	30.5	8.98	29.5	8.80	28.9	8.37	27.5
G	11.11	36.5	10.77	35.3	10.44	34.3	10.27	33.7	9.90	32.5

330, 330 L, 330 LN with Mass Boom

Stick	3500 mm	11'6"	2550 mm	8'4"	2150 mm	7'1"
	m	ft	m	ft	m	ft
A	7.21	23.7	6.68	21.9	6.25	20.5
B	10.88	35.7	10.21	33.5	9.71	31.9
C	7.36	24.1	6.59	21.6	6.19	20.3
D	6.46	21.2	5.89	19.3	5.49	18.0
E	7.02	23.0	6.20	20.3	5.80	19.0
F	8.89	29.2	8.54	28.0	8.12	26.6
G	10.36	34.0	10.36	34.0	9.92	32.5



One-Piece Boom Digging Envelope

- Standard shoes and undercarriage
- Excavation-type bucket tip radius 1883 mm (74")

KEY:

A Maximum loading height of bucket with teeth

B Maximum reach at ground level

C Maximum digging depth

D Maximum vertical wall

E Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)

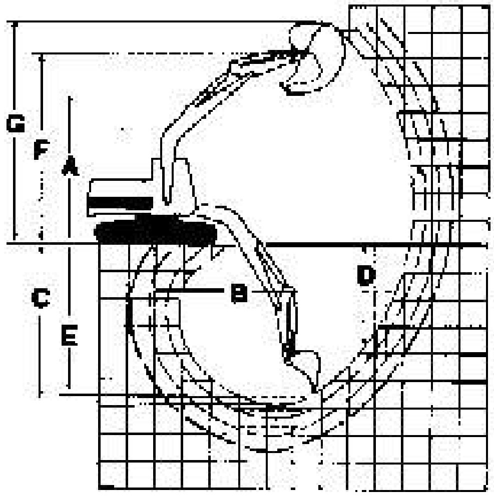
F Maximum bucket hinge pin height

G Maximum height, to bucket teeth at highest arc

	231D Mass Excavation				231D, 231D LC General Purpose			
Stick	**2300 mm**	**7'11"**	**2900 mm**	**9'6"**	**2900 mm**	**9'6"**	**3600 mm**	**11'8"**
	m	ft	m	ft	m	ft	m	ft
A	6.29	20'8"	6.52	21'5"	7.16	23'6"	7.40	24'3"
B	9.67	30'8"	10.22	33'7"	10.64	34'11"	11.20	36'9"
C	6.07	19'11"	6.67	21'11"	6.94	22'9"	7.54	24'9"
D	4.19	13'9"	5.02	16'6"	5.29	17'4"	6.13	20'1"
E	5.85	19'2"	6.48	21'3"	6.76	22'2"	7.37	24'2"
F	8.02	26'4"	8.25	27'1"	8.73	28'6"	8.97	29'5"
G	9.49	31'1"	9.76	32'0"	10.08	33'1"	10.35	33'11"

235D

Stick	**2400 mm**	**8'0"**	**2900 mm**	**9'6"**	**3660 mm**	**12'0"**
	m	ft	m	ft	m	ft
A	6.37	20'11"	6.51	21'4"	6.73	22'1"
B	10.87	35'6"	11.29	37'1"	11.99	39'4"
C	6.90	22'8"	7.36	24'2"	8.12	26'8"
D	4.73	15'6"	5.13	16'10"	5.82	19'1"
E	6.72	22'1"	7.20	23'8"	7.98	26'2"
F	8.26	27'1"	8.38	27'6"	8.61	28'3"
G	9.61	31'6"	9.74	32'0"	9.96	32'8"



One-Piece Boom Digging Envelope

- Standard shoes and undercarriage
- Small profile bucket Tip radius 1880 mm (74")

KEY:

A Maximum loading height of bucket with teeth

B Maximum reach at ground level

C Maximum digging depth

D Maximum vertical wall

E Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)

F Maximum bucket hinge pin height

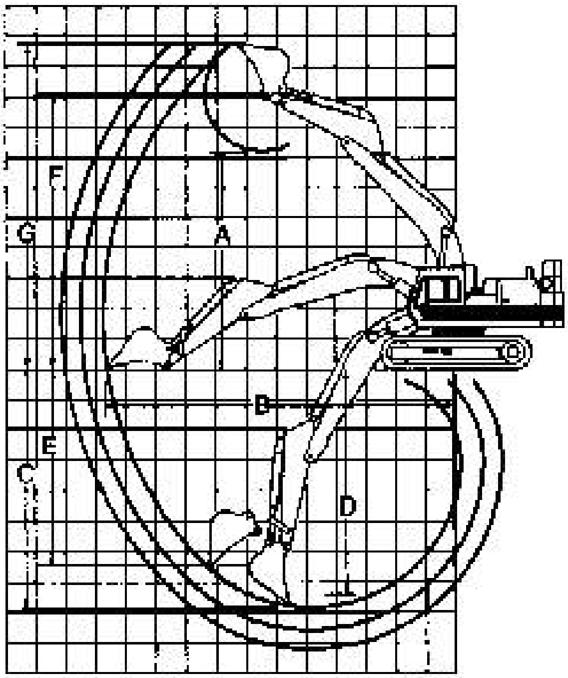
G Maximum height, to bucket teeth at highest arc

235D SA

Stick	3660 mm	12'	2400 mm	8'	2900 mm	9'6"	3660 mm	12'
	m	ft	m	ft	m	ft	m	ft
A	6.83	22'5"	6.48	21'3"	6.61	21'8"	6.83	22'5"
B	11.98	39'4"	10.85	35'7"	11.27	37'0"	11.97	39'3"
C	8.02	26'4"	6.80	22'4"	7.26	23'10"	8.02	26'4"
D	5.72	18'9"	4.62	15'2"	5.02	16'6"	5.71	18'9"
E	7.89	25'11"	6.62	21'9"	7.10	23'3"	7.88	25'10"
F	8.71	28'7"	8.36	27'5"	8.50	27'10"	8.72	28'7"
G	10.06	33'0"	9.72	31'11"	9.85	32'4"	10.01	33'0"

	245D Bucket tip radius 2225 mm (87")						245D* Deep Trenching Arrangement		245D* Heavy Lift Trenching Arrangement	
Stick	2600 mm	8'6"	3200 mm	10'6"	4420 mm	14'6"	4420 mm	14'6"	4420 mm	14'6"
	m	ft	m	ft	m	ft	m	ft	m	ft
A	7.60	24'11"	7.50	24'7"	7.87	25'10"	9.63	31'7"	7.90	25'11"
B	12.41	40'9"	12.83	42'1"	13.94	45'9"	15.93	52'3"	14.14	46'5"
C	7.79	25'7"	8.40	27'7"	9.60	31'6"	10.76	35'4"	9.63	31'7"
D	5.07	16'8"	5.36	17'7"	6.46	21'2"	7.99	26'3"	6.36	20'11"
E	7.63	25'0"	8.24	27'1"	9.48	31'1"	10.65	34'11"	9.50	31'2"
F	9.82	32'3"	9.73	31'11"	10.09	33'1"	11.86	38'11"	10.12	33'3"
G	11.52	37'10"	11.35	37'3"	11.71	38'5"	13.59	44'7"	11.68	38'4"

*Equipped with standard carbody.



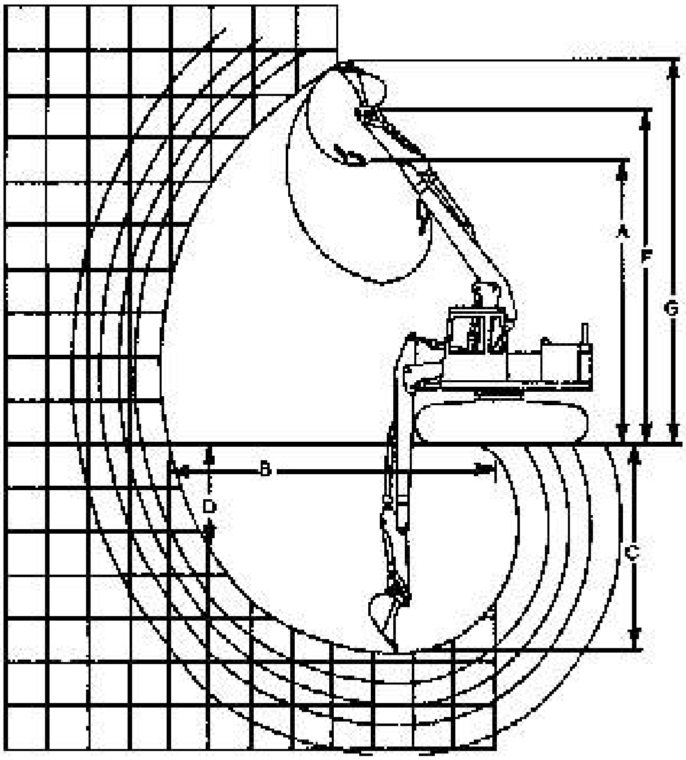
One-Piece Boom Digging Envelope

• Standard shoes and undercarriage

KEY:

- **A** Maximum loading height of bucket with teeth
- **B** Maximum reach at ground level
- **C** Maximum digging depth
- **D** Maximum vertical wall
- **E** Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)
- **F** Maximum bucket hinge pin height
- **G** Maximum height, to bucket teeth at highest arc

	E450						E650	
Stick	3.1 m	10'2"	3.8 m	12'6"	4.8 m	15'9"	3.47 m	11'5"
	m	ft	m	ft	m	ft	m	ft
A	7.40	24'3"	7.64	25'1"	8.05	26'5"	8.38	27'6"
B	11.66	38'3"	12.32	40'5"	13.08	42'11"	13.33	43'9"
C	7.70	25'3"	8.40	27'7"	9.24	30'4"	8.80	28'11"
D	6.48	21'3"	7.15	23'6"	8.05	26'5"	7.40	24'3"
E	7.56	24'9"	8.27	27'2"	9.12	29'11"	8.60	28'3"
F	9.25	30'4"	9.50	31'2"	9.75	32'0"	10.5	34'5"
G	10.80	35'6"	11.04	36'3"	11.15	36'7"	12.3	40'3"



Hydraulic Adjustable Boom Digging Envelope

- Standard 600 mm (23.6") track shoes and undercarriage
- General purpose bucket

KEY:

A Maximum loading height of bucket with teeth

B Maximum reach at ground level

C Maximum digging depth

D Maximum vertical wall

F Maximum bucket hinge pin height

G Maximum height, to bucket teeth at highest arc

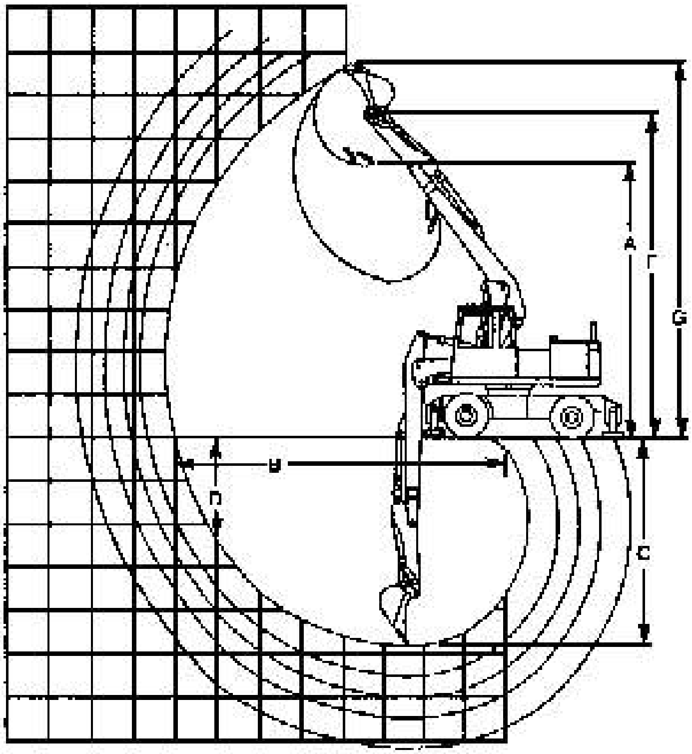
211B LC

Stick	1600 mm	5'3"	2300 mm	7'7"	2800 mm	9'2"	3300 mm	10'10"	4000 mm	13'2"
	m	ft	m	ft	m	ft	m	ft	m	ft
A	6.26	20'6"	6.62	21'9"	6.74	22'1"	7.03	23'1"	7.45	24'5"
B	8.03	26'4"	8.66	28'5"	9.06	29'8"	9.53	31'3"	10.21	33'6"
C	4.62	15'2"	5.16	16'11"	5.44	17'10"	5.85	19'2"	6.43	21'1"
D	0.75	2'6"	0.71	2'4"	1.00	3'3"	0.84	2'9"	0.61	2'0"
F	7.46	24'6"	7.83	25'8"	7.94	26'1"	8.24	27'0"	8.66	28'5"
G	8.09	26'7"	8.41	27'7"	8.41	27'7"	8.71	28'7"	9.13	29'11"

213B LC

Stick	1600 mm	5'11"	2300 mm	7'7"	2800 mm	9'2"	4000 mm	13'2"
	m	ft	m	ft	m	ft	m	ft
A	6.48	21'3"	6.42	21'0"	6.49	21'3"	7.19	23'7"
B	8.48	27'10"	8.66	28'4"	9.33	30'7"	10.49	34'5"
C	5.36	17'7"	5.84	19'2"	6.29	20'8"	7.49	24'7"
D	3.54	11'7"	3.75	12'4"	3.69	12'1"	4.69	15'5"
F	7.51	24'8"	7.84	25'9"	7.91	25'11"	8.61	28'3"
G	8.87	29'1"	9.18	30'1"	9.18	30'1"	9.89	32'5"

Range Dimensions
• 206B FT • 212B FT • 214B • 214B FT



Hydraulic Adjustable Boom Digging Envelope

- Standard 10 × 20 tires and undercarriage
- General purpose bucket

KEY:

A Maximum loading height of bucket with teeth

B Maximum reach at ground level

C Maximum digging depth

D Maximum vertical wall

F Maximum bucket hinge pin height

G Maximum height, to bucket teeth at highest arc

206B FT

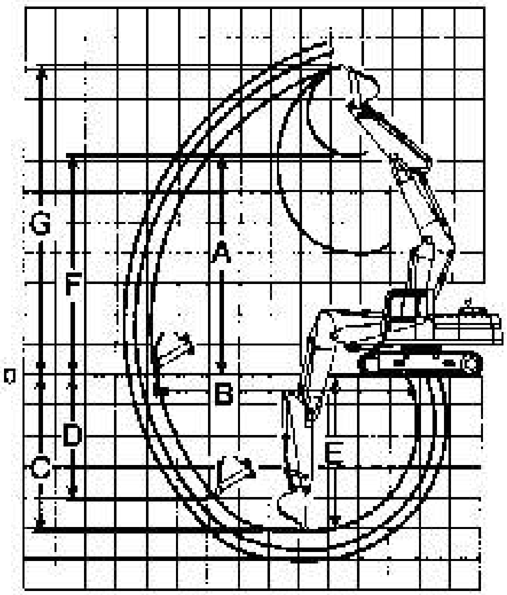
Stick	1600 mm	5'3"	2100 mm	6'11"	2600 mm	8'6"	3100 mm	10'2"
	m	ft	m	ft	m	ft	m	ft
A	6.35	20'10"	6.58	21'7"	6.71	22'0"	7.01	23'0"
B	7.99	26'3"	8.43	27'8"	8.83	29'0"	9.31	30'7"
C	4.48	14'8"	4.85	15'11"	5.13	16'10"	5.54	18'2"
D	3.18	10'5"	3.66	12'0"	4.29	12'0"	4.79	13'6"
F	7.55	24'10"	7.78	25'6"	7.92	26'0"	8.21	26'11"
G	8.71	28'7"	8.81	28'11"	9.00	29'6"	9.30	30'6"

212B FT

Stick	1600 mm	5'3"	2300 mm	7'7"	2800 mm	9'2"	3300 mm	10'10"	4000 mm	13'2"
	m	ft	m	ft	m	ft	m	ft	m	ft
A	6.41	21'0"	6.78	22'3"	6.89	22'7"	7.19	23'7"	7.61	25'0"
B	8.00	26'3"	8.63	28'4"	9.02	29'7"	9.50	31'2"	10.19	33'5"
C	4.47	14'8"	5.02	16'6"	5.29	17'4"	5.70	18'8"	6.28	20'7"
D	3.48	2'11"	4.19	2'10"	4.65	3'10"	5.35	3'3"	5.90	2'6"
F	7.61	25'0"	7.98	26'2"	8.09	26'7"	8.39	27'6"	8.81	28'11"
G	8.25	27'1"	8.56	28'1"	8.57	28'1"	8.87	29'1"	9.30	30'6"

214B, 214B FT

Stick	1800 mm	5'11"	2300 mm	7'7"	2800 mm	9'2"	4000 mm	13'2"
	m	ft	m	ft	m	ft	m	ft
A	6.27	20'7"	6.60	21'8"	6.67	21'8"	7.37	24'2"
B	8.44	27'8"	8.92	29'3"	9.30	30'6"	10.46	34'4"
C	5.17	16'11"	5.66	18'7"	6.11	20'1"	7.30	23'11"
D	3.30	10'10"	3.58	11'9"	3.51	11'6"	4.53	14'10"
F	7.69	25'3"	8.02	26'4"	8.09	26'6"	8.79	28'10"
G	9.04	29'8"	9.35	30'8"	9.36	30'8"	10.07	33'1"



Variable Adjustable Boom Digging Envelope

KEY:

A Maximum loading height of bucket with teeth

B Maximum reach at ground level

C Maximum digging depth

D Maximum vertical wall

E Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)

F Maximum bucket hinge pin height

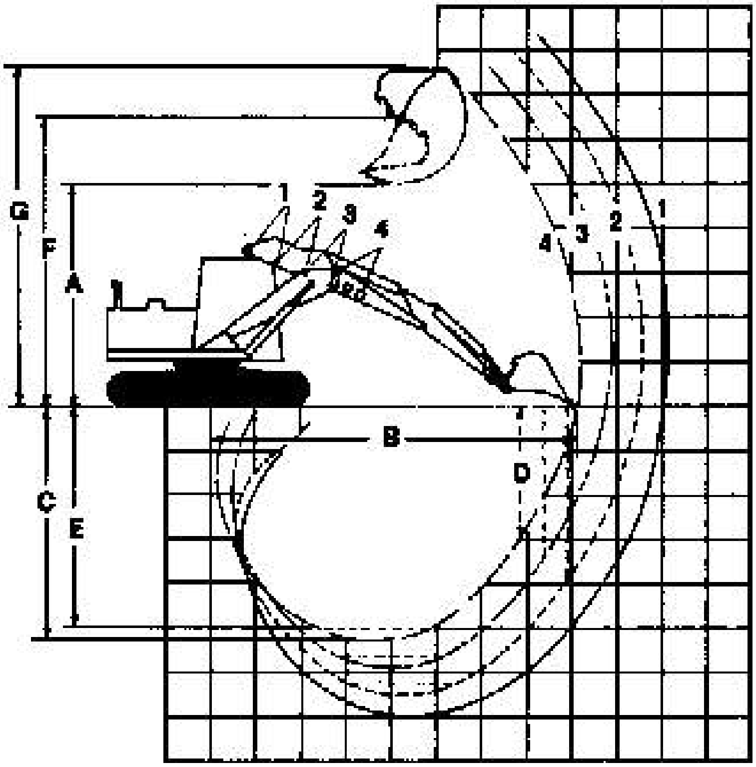
G Maximum height, to bucket teeth at highest arc

320, 320 L, 320 N

Stick	2920 mm	9'7"	2400 mm	7'10"	1900 mm	6'3"
	m	ft	m	ft	m	ft
A	8.07	26.5	7.50	24.6	7.16	23.5
B	9.56	31.3	9.19	30.2	8.65	28.4
C	6.06	19.9	5.69	18.7	5.14	16.9
D	5.03	16.5	4.88	16.0	4.07	13.4
E	5.95	19.5	5.58	18.3	5.01	16.4
F	9.48	31.1	9.05	29.7	8.65	28.4
G	10.88	35.7	10.59	34.7	10.13	33.2

325, 325 L, 325 LN

Stick	3200 mm	10'6"	2500 mm	8'2"	2000 mm	6'7"
	m	ft	m	ft	m	ft
A	8.59	28.2	7.90	25.9	7.51	24.6
B	10.24	33.6	9.75	32.0	9.28	30.4
C	6.40	21.0	5.89	19.3	5.40	17.7
D	5.19	17.0	4.65	15.3	4.17	13.7
E	6.30	20.7	5.78	19.0	5.28	17.3
F	10.08	33.1	9.55	31.3	9.17	30.1
G	11.67	38.0	11.21	36.8	10.83	35.5



Two-Piece Boom Digging Envelope

- Foreboom pin in lower hole

KEY:

- **A** Maximum loading height of bucket with teeth
- **B** Maximum reach at ground level
- **C** Maximum digging depth
- **D** Maximum vertical wall
- **E** Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)
- **F** Maximum bucket hinge pin height
- **G** Maximum height, to bucket teeth at highest arc
  - **1** Boom extended
  - **2** Boom retracted
  - **3** Boom retracted
  - **4** Boom retracted

213B LC

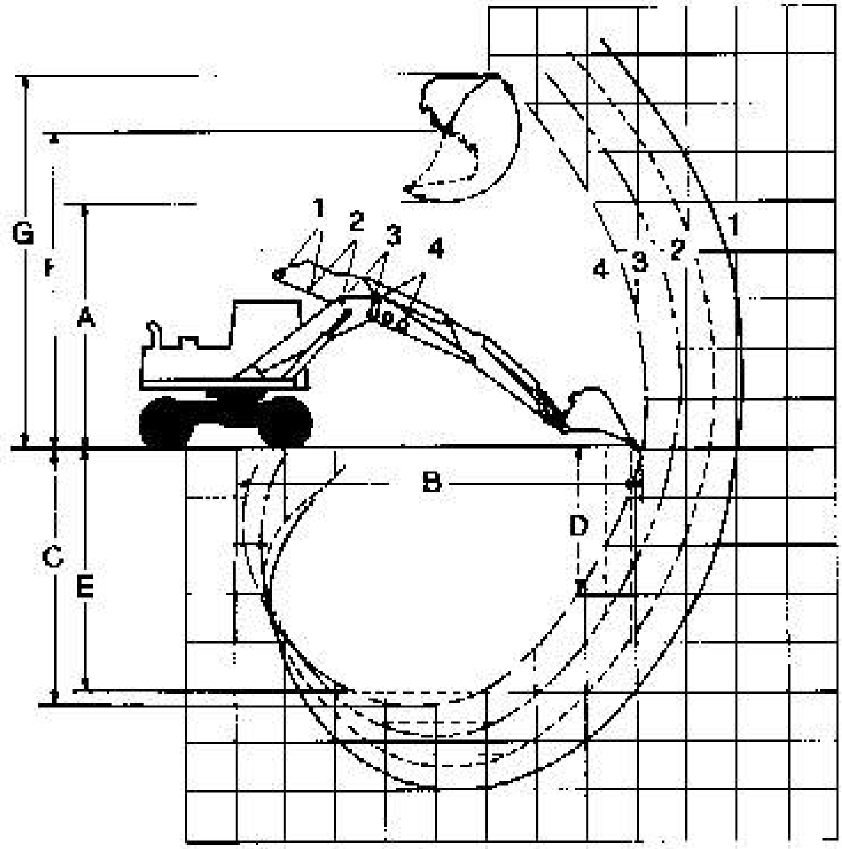
Stick	1800 mm 6'11"								2300 mm 7'3"							
Pin Hole	(1)		(2)		(3)		(4)		(1)		(2)		(3)		(4)	
	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft
A	4.744	15'6.8"	4.439	14'6.8"	4.160	13'7.4"	3.837	12'7.1"	4.932	16'2.2"	4.627	15'2.2"	4.338	14'2.8"	4.025	13'2.5"
B	8.326	27'3.8"	7.728	25'4.3"	7.147	23'5.4"	6.537	21'5.4"	8.803	28'10"	8.204	26'11"	7.620	25'0"	7.007	22'11"
C	5.407	17'8.9"	4.841	15'10"	4.282	14'0.6"	3.700	12'1.7"	5.905	19'4.5"	5.336	17'6.1"	4.777	15'8.1"	4.199	13'9.3"
D	3.139	10'3.6"	2.667	8'9"	2.204	7'2.8"	1.727	5'8"	3.423	11'2.8"	2.961	9'8.6"	2.509	8'2.8"	2.042	6'8.4"
E	5.133	16'10"	4.563	14'11"	4.005	13'1.7"	3.423	11'2.8"	5.671	18'7.3"	5.102	16'8.9"	4.546	14'11"	3.964	13'0.1"
F	6.164	20'2.7"	5.859	19'2.7"	5.570	18'3.3"	5.258	17'3"	6.352	20'10"	6.047	19'10"	5.758	18'10"	5.445	17'10"
G	7.267	23'10"	6.979	22'10"	6.690	21'11"	6.377	20'11"	7.452	24'5.4"	7.145	23'5.3"	6.855	22'5.9"	6.543	21'5.6"

Boom positions: (1) extended-pinholes 1 & 2 (2) retracted-pinholes 2 & 3 (3) retracted-pinholes 3 & 4 (4) retracted-pinholes 4 & 5.

213B LC

Stick	2800 mm 9'2"								4000 mm 13'1"							
Pin Hole	(1)		(2)		(3)		(4)		(1)		(2)		(3)		(4)	
	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft
A	4.808	15'9.3"	4.509	14'9.3"	4.211	13'9.8"	3.901	12'9.6"	5.143	16'10"	4.836	15'10"	4.546	14'11"	4.234	13'10"
B	9.156	30'0.5"	8.552	28'0.7"	7.957	26'1.3"	7.338	24'0.9"	10.289	33'9.5"	9.692	31'9.6"	9.098	29'10"	8.475	27'9.7"
C	6.390	20'11"	5.824	19'1.3"	5.265	17'3.3"	4.686	15'4.5"	7.592	24'10"	7.025	23'0.6"	6.464	21'2.5"	5.885	19'3.7"
D	3.340	10'11"	2.923	9'7.1"	2.517	8'3.1"	2.098	6'10"	4.373	14'4.2"	3.957	12'11"	3.548	11'7.7"	3.126	10'3.1"
E	6.141	20'1.8"	5.572	18'3.4"	5.013	16'5.4"	4.429	14'6.4"	7.396	24'3.2"	6.850	22'5.7"	6.266	20'6.8"	5.687	18'7.9"
F	6.228	20'5.2"	5.923	19'5.2"	5.631	18'5.7"	5.321	17'5.5"	6.563	21'6.4"	6.256	20'6.3"	5.966	19'6.9"	5.654	18'6.6"
G	7.216	23'8.2"	6.910	22'8.1"	6.621	21'8.7"	6.309	20'8.4"	7.556	24'8.5"	7.248	23'9.3"	6.957	22'9.9"	6.644	21'9.6"

Boom positions: (1) extended-pinholes 1 & 2 (2) retracted-pinholes 2 & 3 (3) retracted-pinholes 3 & 4 (4) retracted-pinholes 4 & 5.



Two-Piece Boom Digging Envelope

• Foreboom pin in lower hole

KEY:

- **A** Maximum loading height of bucket with teeth
- **B** Maximum reach at ground level
- **C** Maximum digging depth
- **D** Maximum vertical wall
- **E** Maximum depth of cut for 2.44 m (8') level bottom (straight clean up)
- **F** Maximum bucket hinge pin height
- **G** Maximum height, to bucket teeth at highest arc
  - **1** Boom extended
  - **2** Boom retracted
  - **3** Boom retracted
  - **4** Boom retracted

214B, 214B FT

Stick	1600 mm 5'11"								2300 mm 7'3"							
Pin Hole	(1)		(2)		(3)		(4)		(1)		(2)		(3)		(4)	
	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft
A	4.925	16'1.9"	4.620	15'1.9"	4.330	14'2.5"	4.018	13'2.2"	5.113	16'9.3"	4.808	15'9.3"	4.516	14'9.8"	4.206	13'9.6"
B	8.336	27'4.2"	7.683	25'2.5"	7.099	23'3.5"	6.484	21'3.3"	8.783	28'9"	8.163	26'9.4"	7.574	24'10"	6.957	22'9.9"
C	5.227	17'1.8"	4.660	15'3.5"	4.102	13'5.5"	3.520	11'6.6"	5.726	18'9.4"	6.167	18'11"	4.598	15'1.1"	4.010	13'2.2"
D	2.959	9'8.5"	2.486	8'1.9"	2.024	6'7.7"	1.546	5'0.9"	3.243	10'7.7"	2.781	9'1.5"	2.329	7'7.7"	1.861	6'1.3"
E	4.953	16'3"	4.384	14'4.6"	3.826	12'6.6"	3.249	10'7.7"	5.491	18'0.2"	4.925	16'1.9"	4.368	14'3.9"	3.784	12'5"
F	6.344	20'9.8"	6.040	19'9.8"	5.750	18'10"	4.018	13'2.2"	6.532	21'5.2"	6.220	20'5.2"	5.938	19'5.8"	5.626	18'5.5"
G	7.467	24'6"	7.160	23'5.9"	6.870	22'6.5"	6.558	21'6.2"	7.871	25'0"	7.325	24'0.4"	7.035	23'1"	6.723	22'0.7"

Boom positions: (1) extended-pinholes 1 & 2 (2) retracted-pinholes 2 & 3 (3) retracted-pinholes 3 & 4 (4) retracted-pinholes 4 & 5

214B

Stick	2800 mm 9'2"								4000 mm 13'1"							
Pin Hole	(1)		(2)		(3)		(4)		(1)		(2)		(3)		(4)	
	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft
A	4.988	16'4.4"	4.683	15'4.4"	4.391	14'4.8"	4.081	13'4.7"	5.247	17'2.6"	5.016	16'5.5"	4.725	15'6"	4.414	14'5.8"
B	9.120	29'11"	8.511	27'11"	7.917	25'11"	7.292	23'11"	10.267	33'8.3"	9.659	31'8.3"	9.062	29'8.8"	8.437	27'8.2"
C	6.212	20'4.6"	5.643	18'6.2"	5.085	16'8.2"	4.505	14'9.4"	7.411	24'3.8"	6.846	22'5.5"	6.296	20'7.5"	5.704	18'8.6"
D	3.159	10'4.4"	2.744	9'0"	2.337	7'8"	1.917	6'3.5"	4.193	13'9.1"	3.776	12'4.7"	3.368	11'0.6"	2.947	9'8"
E	5.961	19'6.7"	5.392	17'8.3"	4.833	15'10"	4.251	13'11"	7.216	23'8.1"	6.648	21'9.8"	6.068	19'11"	5.507	18'0.8"
F	6.408	21'0.3"	6.102	20'0.3"	5.811	19'0.8"	5.501	18'0.6"	6.743	22'1.5"	6.436	21'1.4"	6.144	20'1.9"	5.834	19'1.7"
G	7.399	24'3.3"	7.090	23'3.1"	6.799	22'3.7"	6.489	21'3.5"	7.736	25'4.6"	7.426	24'4.4"	7.137	23'5"	6.824	22'4.7"

Boom positions. (1) extended-pinholes 1 & 2 (2) retracted-pinholes 2 & 3 (3) retracted-pinholes 3 & 4 (4) retracted-pinholes 4 & 5.

EXCAVATOR LIFTING CAPACITY

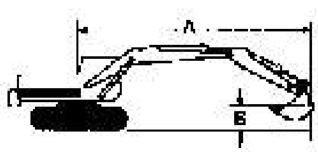
On many sewer jobs an excavator must lift and swing heavy sections of pipe into the trench. The machine also places manholes, unloads material from trucks, or lifts heavy manboxes in and out of the trench. In some situations the lifting requirements may be so critical that they determine the size excavator selected for a job.

The amount an excavator can lift depends on the weight and center of gravity location of the machine, the position of the lift point (see sketches) and the hydraulic capability of the unit. For any given lift point position the excavator's lifting capacity is limited by either machine tipping stability or hydraulic capability.

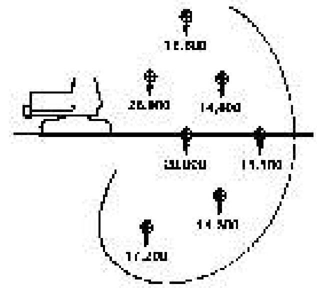
Because changes in boom, stick, and bucket position affect attachment geometry and can drastically reduce a machine's hydraulic lifting capacity, excavator lifting capability is defined using the following SAE guidelines.

Tipping Condition An excavator is considered to be at the point of tipping when the weight acting at the center of gravity of bucket load will cause the rear rollers to be clear of track rails. Suspended loads are considered to be hung by a sling or chain from an eye on the back of the excavator's bucket or bucket linkage, and the weight of attachments, slings, or auxiliary lifting devices are considered part of the suspended load.

Thus, the tipping load is defined as the load producing a tipping condition at a specified radius. The radius of load shall be measured as the horizontal distance from the axis of upper structure rotation (before loading) to the center of vertical load line with load applied (dimension A, below). The rating height is based on the vertical distance of the bucket lift point to the ground (dimension B).



A. Radius from swing centerline
B. Bucket lift point height



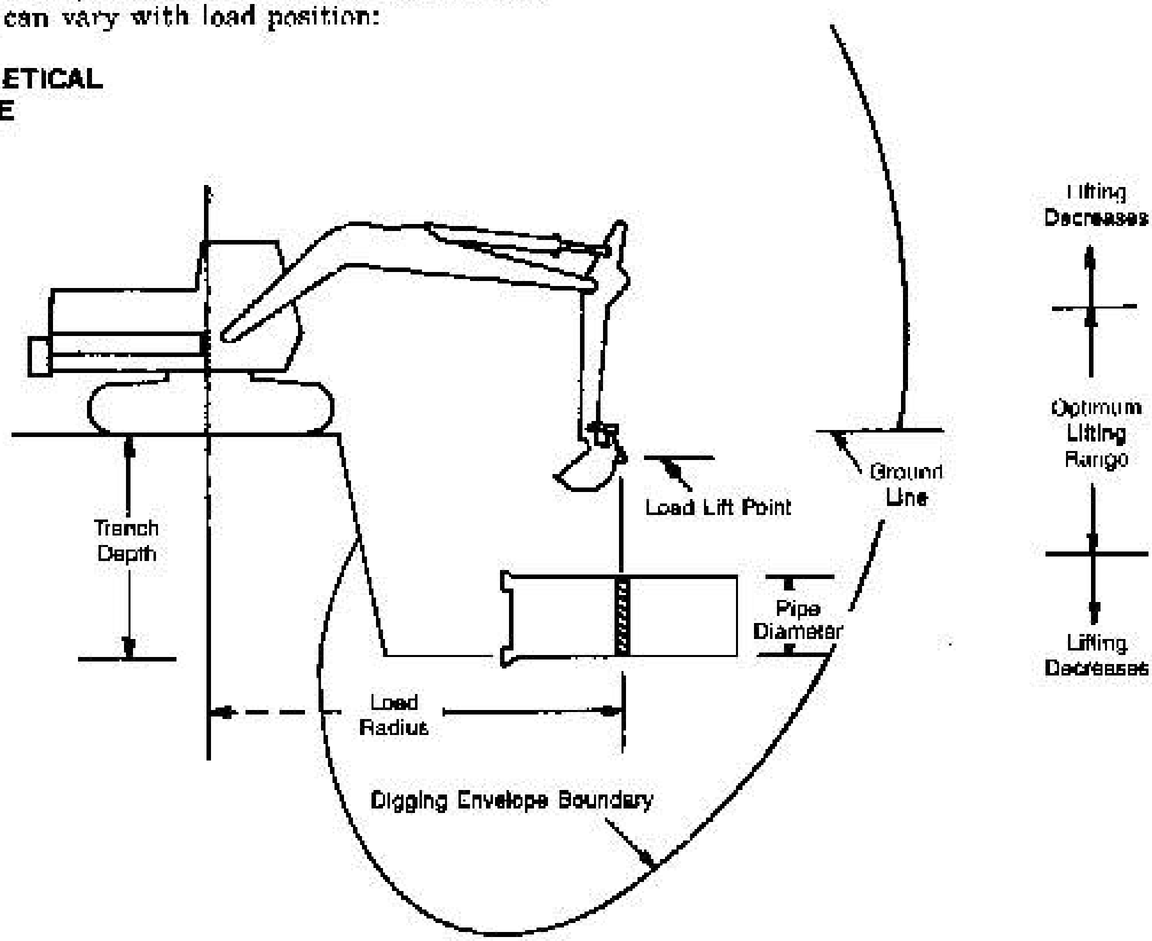
HYPOTHETICAL MACHINE

Rated Hoist Load — The rated load is established using the vertical distance of the lifting point to the ground and the radius of load. Ratings for the ability of a specific machine attachment to lift a load slung from the designated bucket are defined as follows:

a. The rated load will not exceed 75% of the tipping load.
b. The rated load will not exceed 87% of the excavator's hydraulic capacity. This means the machine should be able to lift 115% of the rated load.
c. The rated load will not exceed the machine's structural capability.

This drawing shows how an excavator's lifting capacity can vary with load position:

HYPOTHETICAL MACHINE



Tips for Lifting Above Ground:

Get the load as close to the excavator as possible. Use a cable short enough and position the excavator so as to put the load lift point in the "optimum lifting range" (see sketch).
Problem: Long reach cable — Can't lift.
Solution: Shorten reach and cable — Can lift.

Tips for Lifting Below Grade:

Use a cable for sufficient length to position the load lift point in the "optimum lifting range".
Problem: Short cable, deep trench — Can't lift.
Solution: Lengthen cable to locate bucket hinge pin in optimum lifting area — Can lift.

GROUND LEVEL LIFTING CAPACITIES

The lifting capacities that are shown on the following pages are with the lifting point at ground level. These capacities are rated according to SAE/Std. No. J1097.

(For lifting capacities at other heights or with other tools, refer to current Specification Sheets.)

E70B

• 800 mm (31") Bucket • 450 mm (18") Track Shoes

Stick		1.5 m 5' Front	Side	3.05 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	At Max. Reach Front	Side
1390 mm	kg	—	—	2540	2250	1370	1220	-		1000*	890
4'7"	lb			6480	4830	2940	2620			2200*	1970
1720 mm	kg	1790*	1790*	2540	2250	1370	1220	—	—	820*	810
5'8"	lb	3940*	3940*	6470	4830	2940	2620			1800*	1780
2210 mm	kg	1630*	1630*	2540	2240	1350	1200	850	750	550*	550*
7'3"	lb	3640*	3640*	5450	4820	2900	2590	1820	1610	1220*	1220*

E70B

• 800 mm (31") Bucket • 600 mm (24") Track Shoes

Stick		1.5 m 5' Front	Side	3.05 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	At Max. Reach Front	Side
1390 mm	kg	—	—	2580	2290	1390	1240	—	—	1000*	910
4'7"	lb			5560	4910	2990	2670			2200*	2010
1720 mm	kg	1790*	1790*	2580	2290	1390	1240	—	—	820*	820
5'8"	lb	3940*	3940*	5580	4920	2990	2670			1800*	1800
2210 mm	kg	1630*	1630*	2580	2280	1380	1230	870	770	550*	550*
7'3"	lb	3640*	3640*	5550	4900	2960	2640	1860	1640	1220*	1220*

*Indicates load is limited by hydraulic capacity rather than tipping.

E110B

• 895 mm (35") Bucket • 500 mm (20") Track Shoes

Stick		1.5 m 5' Front	Side	3.05 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	7.5 m 25' Front	Side	At Max. Reach Front	Side
1950 mm	kg	—	—	4940*	4640	3330	2460	2130	1580	—	—	1060*	1060*
6'5"	lb			11,270*	9960	7160	5290	4570	3390			2340*	2340*
2250 mm	kg	—	—	5290*	4660	3350	2470	2130	1580	—	—	1060*	1060*
7'5"	lb			12,000*	9990	7190	5320	4670	3390			2330*	2330*
2800 mm	kg	2420*	2420*	6090*	4650	3350	2470	2110	1560	880*	880*	810*	810*
9'2"	lb	5390*	5390*	13,840*	9980	7200	5320	4630	3340	1930*	1930*	1780*	1780*

E110B

• 895 mm (35") Bucket • 600 mm (24") Track Shoes

Stick		1.5 m 5' Front	Side	3.05 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	7.5 m 25' Front	Side	At Max. Reach Front	Side
1950 mm	kg	—	—	4940*	4740	3400	2520	2180	1620	—	—	1060*	1060*
6'5"	lb			11,270*	10,160	7320	5410	4670	3470			2340*	2340*
2250 mm	kg	—	—	5290*	4780	3420	2530	2180	1620	—	—	1060*	1060*
7'5"	lb			12,000*	10,200	7350	5440	4680	3470			2330*	2330*
2800 mm	kg	2420*	2420*	6090*	4760	3430	2530	2160	1600	880*	880*	810*	810*
9'2"	lb	5390*	5390*	13,840*	10,190	7360	5440	4630	3420	1930*	1930*	1780*	1780*

E110B

• 895 mm (35") Bucket • 700 mm (28") Track Shoes

Stick		1.5 m 5' Front	Side	3.05 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	7.5 m 25' Front	Side	At Max. Reach Front	Side
1950 mm	kg	—	—	4940*	4810	3460	2560	2210	1640	—	—	1060*	1060*
6'5"	lb			11,270*	10,320	7430	5500	4750	3530			2340*	2340*
2250 mm	kg	—	—	5290*	4830	3470	2570	2210	1650	—	—	1060*	1060*
7'5"	lb			12,000*	10,360	7470	5530	4760	3530			2330*	2330*
2800 mm	kg	2420*	2420*	6090*	4820	3480	2570	2200	1630	880*	880*	810*	810*
9'2"	lb	5390*	5390*	13,840*	10,350	7470	5520	4710	3480	1930*	1930*	1780*	1780*

E110B

• 895 mm (35") Bucket • 770 mm (30") Track Shoes

Stick		1.5 m 5' Front	Side	3.05 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	7.5 m 25' Front	Side	At Max. Reach Front	Side
1950 mm	kg	—	—	4940*	4860	3500	2580	2240	1660	—	—	1060*	1060*
6'5"	lb			11,270*	10,420	7510	5560	4810	3570			2340*	2340*
2250 mm	kg	—	—	5290*	4880	3510	2600	2240	1670	—	—	1060*	1060*
7'5"	lb			12,000*	10,460	7550	5590	4810	3570			2330*	2330*
2800 mm	kg	2420*	2420*	6090*	4870	3520	2600	2220	1650	880*	880*	810*	810*
9'2"	lb	5390*	5390*	13,840*	10,450	7550	5590	4770	3530	1930*	1930*	1780*	1780*

*Indicates load is limited by hydraulic capacity rather than tipping.

E120B

• 990 mm (39") Bucket • 500 mm (20") Track Shoes

Stick		3.0 m 10'		4.5 m 15'		6.0 m 20'		7.5 m 25'		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
2100 mm	kg	4070*	4070*	4270	2870	2740	1860	—	—	1620*	1340
6'11"	lb	9220*	9220*	9180	6170	5880	4000			3560*	2950
2500 mm	kg	4050*	4050*	4300	2890	2750	1860	1790*	1290	1330*	1220
8'2"	lb	9150*	9150*	9240	6210	5800	4000	3140*	2770	2940*	2690
3000 mm	kg	4580*	4580*	4310	2890	2730	1840	1690	1260	1200*	1070
9'10"	lb	10,810*	10,810*	9260	6210	5880	3980	4080	2880	2650*	2340

E120B

• 990 mm (39") Bucket • 600 mm (24") Track Shoes

Stick		3.0 m 10'		4.5 m 15'		6.0 m 20'		7.5 m 25'		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
2100 mm	kg	4070*	4070*	4360	2920	2800	1900	—	—	1620*	1370
6'11"	lb	9220*	9220*	9370	6290	6010	4080			3560*	3030
2500 mm	kg	4050*	4050*	4380	2960	2800	1910	1790*	1320	1330*	1250
8'2"	lb	9150*	9150*	9420	6340	6020	4090	3140*	2830	2940*	2750
3000 mm	kg	4580*	4580*	4390	2950	2780	1890	1940	1280	1200*	1090
9'10"	lb	10,810*	10,810*	9430	6340	5980	4050	4150	2750	2650*	2410

E120B

• 990 mm (39") Bucket • 700 mm (28") Track Shoes

Stick		3.0 m 10'		4.5 m 15'		6.0 m 20'		7.5 m 25'		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
2100 mm	kg	4070*	4070*	4420	2970	2840	1930			1620*	1400
6'11"	lb	9220*	9220*	9500	6380	6100	4150			3560*	3080
2500 mm	kg	4050*	4050*	4440	2990	2840	1930	1790*	1340	1330*	1270
8'2"	lb	9150*	9150*	9550	6430	6110	4160	3140*	2880	2940*	2800
3000 mm	kg	4580*	4580*	4450	2990	2830	1910	1970	1310	1200*	1110
9'10"	lb	10,810*	10,810*	9580	6430	6070	4110	4220	2800	2650*	2450

E120B

• 990 mm (39") Bucket • 770 mm (30") Track Shoes

Stick		3.0 m 10'		4.5 m 15'		6.0 m 20'		7.5 m 25'		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
2100 mm	kg	4070*	4070*	4460	3000	2870	1850	—	—	1620*	1410
6'11"	lb	9220*	9220*	9590	6450	6160	4190			3560*	3110
2500 mm	kg	4050*	4050*	4490	3020	2870	1860	1790*	1360	1330*	1290
8'2"	lb	9150*	9150*	9640	6490	6170	4200	3140*	2920	2940*	2840
3000 mm	kg	4580*	4580*	4490	3020	2860	1840	1930	1330	1200*	1130
9'10"	lb	10,810*	10,810*	9660	6490	6130	4150	4260	2840	2650*	2480

*Indicates load is limited by hydraulic capacity rather than tipping.

E140

• 1070 mm (42") Bucket • 500 mm (20") Track Shoes

Stick		3.0 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	7.5 m 25' Front	Side	At Max. Reach Front	Side
2130 mm	kg	3300*	3300*	4500	3150	2900	2050	1750	1450	1450*	1350
7'0"	lb	7450*	7450*	9650	6750	6200	4400	3650	3100	3200*	2950
2740 mm	kg	3050*	3050*	4500	3150	2900	2050	2000	1400	1050*	1050*
9'0"	lb	6950*	6950*	9650	6800	6150	4350	4300	3000	2250*	2250*

211B LC

• 1000 mm (40") Bucket • 600 mm (23.6") Track Shoes • One-Piece Boom

Stick		4.57 m 15' Front	Side	6.10 m 20' Front	Side	7.62 m 25' Front	Side	9.0 m 30' Front	Side	At Max. Reach Front	Side	Maximum Reach m	ft
1600 mm	kg	5790*	4082	3881	2653	—	—	—	—	2080*	1950	7.83	25.7
5'3"	lb	12,800*	9000	6800*	5850					4600*	4300		
2300 mm	kg	5460*	4060	3740*	2631	2985*	1851	—	—	1510*	1519	8.5	27.8
7'7"	lb	12,050*	8950	8250*	5800	6580*	4080			3350*	3350		
2800 mm	kg	5170*	4091	3550*	2640	2835*	1837			1250*	1250*	8.6	28.1
9'2"	lb	11,400*	9020	7800*	5820	6250*	4050			2750*	2750*		
3300 mm	kg	4810*	4128	3300*	2631	2640*	1814	—	—	940*	940*	9.1	29.8
10'10"	lb	10,600*	9100	7300*	5800	5820*	4000			2100*	2100*		
4000 mm	kg	4210*	4196	2940*	2653	2370*	1814	1280*	1270	640	640*	9.78	32.1
13'2"	lb	9300	9250	6500*	5850	5200*	4000	2800*	2800	1400	1400*		

213B LC

• 900 mm (36") Bucket • 600 mm (23.6") Track Shoes • One-Piece Boom

Stick		4.57 m 15' Front	Side	6.10 m 20' Front	Side	7.62 m 25' Front	Side	9.0 m 30' Front	Side	At Max. Reach Front	Side
1800 mm	kg	—	—	4410	2695	—	—	—	—	2580*	1680
5'11"	lb			9730	5610					5690*	3700
2300 mm	kg	7000	4030	4380	2600	3060	1810	—	—	1455*	1455*
7'7"	lb	15,430	8890	9670	5740	6750	3995			3210*	3210*
2800 mm	kg	6760	4045	4370	2690	3030	1790	—	—	1190*	1190*
9'2"	lb	14,900	8920	9700	5700	6660	3900			2620*	2620*
4000 mm	kg	5200*	3590	3400*	2030	2430	1610	1310*	610	150*	150*
13'2"	lb	11,460*	7900	7500*	4480	5350	3550	2900*	1350	330*	330*

*Indicates load is limited by hydraulic capacity rather than tipping.

206B FT

- **One-Piece Boom**
- **1000 mm (40") Bucket**
- **Counterweight 1800 kg (4000 lb)**
- **4-Point Outriggers Down**

Stick		3.05 m 10' Front	3.05 m 10' Side	4.57 m 15' Front	4.57 m 15' Side	6.10 m 20' Front	6.10 m 20' Side	7.62 m 25' Front	7.62 m 25' Side	At Max. Reach Front	At Max. Reach Side	Maximum Reach m	Maximum Reach ft
1600 mm	kg	—	—	—	4360	—	2750	—		1470*	1470*	7.03	23.1
5'3"	lb				9600		6050			3250*	3250*		
2100 mm	kg	—	—	4290*	4290*	—	2730	—	—	1140*	1140*	7.5	24.6
6'11"	lb			9450*	9450*		6050			2500*	2500*		
2600 mm	kg	—	—	4090*	4090*	—	2730	—	—	910*	910*	7.93	26.0
8'6"	lb			9000*	9000*		6050			2000*	2000*		
3100 mm	kg	2990*	2990*	3810*	3810*	2650*	2650*	1840*	1840*	690*	690*	8.43	27.7
10'2"	lb	6600*	6600*	8400*	8400*	5850*	5850*	4100*	4100*	1500*	1500*		

206B FT

- **One-Piece Boom**
- **1000 mm (40") Bucket**
- **Counterweight 1800 kg (4000 lb)**
- **4-Point Outriggers Raised**

Stick		3.05 m 10' Front	3.05 m 10' Side	4.57 m 15' Front	4.57 m 15' Side	6.10 m 20' Front	6.10 m 20' Side	7.62 m 25' Front	7.62 m 25' Side	At Max. Reach Front	At Max. Reach Side	Maximum Reach m	Maximum Reach ft
1600 mm	kg	—	—	3380	1780	2130	1110	—	—	1470*	880	7.03	23.1
5'3"	lb			7450	3900	4700	2450			3250*	1950		
2100 mm	kg		—	3380	1780	2110	1090	—	—	1140*	740	7.5	24.6
6'11"	lb			7450	3900	4650	2400			2500*	1650		
2600 mm	kg	—	—	3400	1790	2110	1090	—	—	910*	660	7.93	26.0
8'6"	lb			7500	3950	4650	2400			2000*	1450		
3100 mm	kg	2990*	2990*	3420	1790	2110	1090	1420	680	690*	540	8.43	27.7
10'2"	lb	6600*	6600*	7560	3960	4650	2400	3100	1500	1500*	1200		

*Indicates load is limited by hydraulic capacity rather than tipping.

206B FT

- **One-Piece Boom**
- **1000 mm (40") Bucket** • **4-Point Outriggers Down**

Stick		3.05 m 10' Front	Side	4.57 m 15' Front	Side	6.10 m 20' Front	Side	7.62 m 25' Front	Side	At Max. Reach Front	Side	Maximum Reach m	ft
1600 mm	kg	—	—	4445	4445*	3107*	3107*	—	—	1470*	1470*	7.03	23.1
5'3"	lb			9800	9800*	6850*	6850*			3250*	3250*		
2100 mm	kg	—	—	4290*	4290*	2971*	2971*	—	—	1140*	1140*	7.5	24.6
6'11"	lb			9460*	9460*	6550*	6550*			2500*	2500*		
2600 mm	kg	—	—	4090*	4090*	2835	2835*	—	—	910*	910*	7.93	26.0
8'6"	lb			9000*	9000*	6250*	6250*			2000*	2000*		
3100 mm	kg	2990*	2990*	3810*	3810*	2650*	2650*	1840*	1840*	680*	680*	8.43	27.7
10'2"	lb	6600*	6600*	8400*	8400*	5850*	5850*	4100*	4100*	1500*	1500*		

206B FT

- **One-Piece Boom**
- **1000 mm (40") Bucket** • **4-Point Outriggers Raised**

Stick		3.05 m 10' Front	Side	4.57 m 15' Front	Side	6.10 m 20' Front	Side	7.62 m 25' Front	Side	At Max. Reach Front	Side	Maximum Reach m	ft
1600 mm	kg	—	—	3946	2449	2685	1587	—	—	1451*	1270	7.03	23.1
5'3"	lb			8700	5400	5700	3500			3200*	2800		
2100 mm	kg	3356*	3356	3946	2449	2495	1587	—	—	1134*	1134	7.5	24.6
6'11"	lb	7400*	7400*	8700	5400	5500	3500			2500*	2500		
2600 mm	kg	4037*	4037	3946	2449	2495	1542	—	—	907*	907*	7.93	26.0
8'6"	lb	8900*	8900*	8700	5400	5500	3400			2000*	2000*		
3100 mm	kg	4354	4354	3900*	2449	2449	1542	1678	1043	680*	680*	8.43	27.7
10'2"	lb	9600*	9600*	8600*	5400	5400	3400	3700	2300	1500*	1500*		

*Indicates load is limited by hydraulic capacity rather than tipping.

212B FT • Counterweight 2500 kg (5512 lb)

• One-Piece Boom • 4-Point Outriggers Down • 1000 mm (40") Bucket

Stick		4.57 m 15' Front	Side	6.10 m 20' Front	Side	7.62 m 25' Front	Side	9.1 m 30' Front	Side	At Max. Reach Front	Side	Maximum Reach m	ft
1600 mm	kg	5820*	4950	4010*	3130	—	—	—	—	2110	2110*	7.46	24.5
5'3"	lb	12,850*	10,900	8850*	6900					4650	4650*		
2300 mm	kg	5820*	4950	3790*	3100	3000*	2150	—	—	1540*	1540*	8.12	26.6
7'7"	lb	12,850*	10,900	8350*	6850	6600*	4750			3400*	3400*		
2800 mm	kg	5260*	4950	3600*	3100	2860	2150	—	—	1270*	1270*	8.53	28.0
9'2"	lb	11,600	10,900	7950*	6850	6300	4750			2800*	2800*		
3300 mm	kg	4920*	4920*	3370	3100	2670	2130	—	—	960*	960*	9.04	29.6
10'10"	lb	10,850*	10,850*	7450	6850	5900	4700			2100*	2100*		
4000 mm	kg	4350*	4350*	3010*	3010	2400*	2130	1250*	1250*	660*	660	9.73	31.9
13'2"	lb	9600*	9600*	6650*	6650	5300*	4700	2750*	2750*	1450*	1450		

212B FT • Counterweight 2500 kg (5512 lb)

• One-Piece Boom • 4-Point Outriggers Raised • 1000 mm (40") Bucket

Stick		4.57 m 15' Front	Side	6.10 m 20' Front	Side	7.62 m 25' Front	Side	9.1 m 30' Front	Side	At Max. Reach Front	Side	Maximum Reach m	ft
1600 mm	kg	4290	2120	2700	1340	—	—	—	—	1970	950	7.46	24.5
5'3"	lb	9450	4700	5950	2950					4350	2100		
2300 mm	kg	4290	2100	2670	1320	1840	860	—	—	1540	770	8.12	26.6
7'7"	lb	9450	4650	5900	2900	4050	1900			3400	1700		
2800 mm	kg	4300	2100	2670	1320	1840	860	—	—	1270	680	8.53	28.0
9'2"	lb	9500	4650	5900	2900	4050	1900			2800	1500		
3300 mm	kg	4340	2140	2670	1320	1810	820	—	—	960	550	9.04	29.6
10'10"	lb	9550	4700	5900	2900	4000	1800			2100	1200		
4000 mm	kg	4350*	2200	2700	1320	1810	820	1250	480	660	410	9.73	31.9
13'2"	lb	9600*	4850	5950	2900	4000	1800	2750	1050	1450	900		

*Indicates load is limited by hydraulic capacity rather than tipping.

212B FT

• One-Piece Boom • 4-Point Outriggers Down • 1000 mm (40") Bucket

Stick		4.57 m 15' Front	Side	6.10 m 20' Front	Side	7.62 m 25' Front	Side	9.1 m 30' Front	Side	At Max. Reach Front	Side	Maximum Reach m	ft
1600 mm	kg	5820*	5398	4010*	3425	—	—	—	—	2110	2110*	7.46	24.5
5'3"	lb	12,850*	11,900	8850*	7560					4650	4650*		
2300 mm	kg	5820*	5375	3790*	3425	3000*	2381	—	—	1540*	1540*	8.12	26.6
7'7"	lb	12,850*	11,850	8350*	7500	6600*	5250			3400*	3400*		
2800 mm	kg	5260*	5262*	3600*	3425	2860*	2372	—	—	1270*	1270*	8.53	28.0
9'2"	lb	11,600	11,600*	7950*	7500	6300*	5230			2800*	2800*		
3300 mm	kg	4920*	4920*	3370	3370*	2470	2350	—	—	960*	960*	9.04	29.8
10'10"	lb	10,850*	10,850*	7450*	7450*	5900*	5180			2100*	2100*		
4000 mm	kg	4360*	4360*	3010*	3016*	2400*	2341	1250*	1250*	650*	650*	9.73	31.9
13'2"	lb	9600*	9600*	6650*	6650*	5300*	5160	2750*	2750*	1450*	1450*		

212B FT

• One-Piece Boom • 4-Point Outriggers Raised • 1000 mm (40") Bucket

Stick		4.57 m 15' Front	Side	6.10 m 20' Front	Side	7.62 m 25' Front	Side	9.1 m 30' Front	Side	At Max. Reach Front	Side	Maximum Reach m	ft
1600 mm	kg	4627	2631	2948	1723	—	—	–		2189	!270	7.46	24.5
5'3"	lb	10,200	5800	6500	3800					4800	2800		
2300 mm	kg	4877	2631	2048	1678		—	—	—	2041	1179	8.12	26.6
7'7"	lb	10,200	5800	6500	3700					4500	2600		
2800 mm	kg	4627	2585	2948	1678	2041	1134	—	—	1360*	907	8.53	28.0
9'2"	lb	10,200	5700	6400	3700	4500	2500			2300*	2000		
3300 mm	kg	4672	2631	2948	1678	1996	1089	—	—	1043*	907	9.04	29.6
10'10"	lb	10,300	5800	6400	3700	4400	2400			2300*	2000		
4000 mm	kg	4400*	2676	2948	1678	1996	1089	1260*	/28	726*	635	9.73	31.9
13'2"	lb	9700*	5900	6400	3700	4400	2400	2750*	1600	1600*	1400		

*Indicates load is limited by hydraulic capacity rather than tipping

214B, 214B FT

• 4-Point Outriggers Down • 910 mm (36") Bucket • One-Piece Boom

Stick		4.57 m 15' Front	Side	6.10 m 20' Front	Side	7.62 m 25' Front	Side	9.1 m 30' Front	Side	At Max. Reach Front	Side
1800 mm	kg	—		5050*	4140	—	—	—	—	2630*	2630*
5'11"	lb			11,140*	9120					5800*	5800*
2300 mm	kg	7100*	6460	4890*	4110	3780*	2900	—	—	1500*	1500*
7'7"	lb	15,700	14,240	10,800*	9060	8340*	6390			3300*	3300*
2800 mm	kg	6860*	6470	4690	4090	3640*	2860	—	—	1230*	1230*
9'2"	lb	15,100*	14,260	10,330	9020	8010*	6300			2700*	2700*
4000 mm	kg	6400*	5400*	3550*	3550*	2300*	2300*	1500*	1500*	200*	200*
13'2"	lb	11,900*	11,900*	7820*	7820*	5090*	5090*	3300*	3300*	440*	440*

214B, 214B FT

• 4-Point Outriggers Raised • 910 mm (36") Bucket • One-Piece Boom

Stick		4.57 m 15' Front	Side	6.10 m 20' Front	Side	7.62 m 25' Front	Side	9.1 m 30' Front	Side	At Max. Reach Front	Side
1800 mm	kg	—	—	3210	1800	—	—	—	—	2060	1140
5'11"	lb			7080	3970					4560	2520
2300 mm	kg	5000	2730	3180	1760	2210	1200	—	—	1500*	980
7'7"	lb	11,020	6030	7000	3900	4880	2640			3300*	2160
2800 mm	kg	5010	2740	3160	1740	2180	1160	—	—	1230*	850
9'2"	lb	11,560	6030	6970	3840	4800	2550			2710*	1870
4000 mm	kg	4590	2290	2650	1200	1530	700	1090	280	200*	130
13'2"	lb	10,100	5048	5850	2660	3380	1550	2400	640	440*	280

*Indicates load is limited by hydraulic capacity rather than tipping.

224B

• 4-Point Outriggers Down • 900 mm (36") Bucket • One-Piece Boom

Stick		4.57 m 15' Front	Side	6.10 m 20' Front	Side	7.62 m 25' Front	Side	9.1 m 30' Front	Side	At Max. Reach Front	Side
1800 mm	kg	—	—	5828*	5360	4661*	3812	—	—	4285*	4285*
5'11"	lb			13,071*	11,820	10,278*	8405			9448*	9448*
2300 mm	kg	8483*	8432	5680*	5361	4444*	3792	—	—	2536*	2536*
7'7"	lb	18,706	18,592	12,525*	11,822	9799*	8361			5591*	5591*
2800 mm	kg	8027*	8027*	5363*	5340	4190*	3758	—	—	2187*	2187*
9'2"	lb	17,700*	17,700*	11,826*	11,776	9242*	8285			4822*	4822*
4000 mm	kg	6610*	6610*	4446*	4446*	3498*	3498*	3053*	2703	1297*	1297*
13'2"	lb	14,576*	14,576*	9804*	9804*	7712*	7712*	6732*	5959	2860*	2860*

224B

• 4-Point Outriggers Raised • 900 mm (36") Bucket • One-Piece Boom

Stick		4.57 m 15' Front	Side	6.10 m 20' Front	Side	7.62 m 25' Front	Side	9.1 m 30' Front	Side	At Max. Reach Front	Side
1800 mm	kg	—	—	4444	2780	3161	1974	—	—	2787	1741
5'11"	lb			9798	6130	6971	4353			6146	3840
2300 mm	kg	6908	4195	4443	2779	3141	1952	—	—	2517	1550
7'7"	lb	15,233	9248	9797	6119	6925	4303			5549	3418
2800 mm	kg	6905	4182	4421	2748	3106	1913	—	—	2187*	1395
9'2"	lb	15,225	9220	9748	6059	6848	4219			4822*	3074
4000 mm	kg	6610*	4256	4424	2733	3054	1852	2197	1271	1297	993
13'2"	lb	14,575*	9385	9754	6027	6733	4084	4846	2804	2860	2190

*Indicates load is limited by hydraulic capacity rather than tipping.

320

• Reach Boom • 600 mm (24") Track Shoes

			3.0 m 10'		4.5 m 15'		6.0 m 20'		7.5 m 25'		9.0 m 30'		At Max. Reach	
Stick	Bucket		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
900 mm	C1307X	kg	—	—	7950	4700	5050	3050	3500	2180	—	—	3050	1850
6'3"	54"	lb			17,100	10,150	10,800	6350	7850	4800			6750	4050
2500 mm	B1000T	kg	—	—	8300	5050	5250	3300	3700	2300	—	—	2700	1750
8'2"	40"	lb			17,800	10,850	11,300	7050	7950	4950			5950	3850
2920 mm	B1000T	kg	4850	4850	8400	5100	5300	3300	3700	2350	—	—	2100	1650
9'7"	40"	lb	11,150	11,150	17,950	10,950	11,350	7100	7950	4950			4600	3600
3860 mm	B900T	kg	6100	6100	8200	5200	5350	3350	3750	2350	2760	1700	1700	1360
12'8"	35"	lb	14,000	14,000	17,700	11,150	11,450	7200	8000	5000	5850	3750	3750	3000

• Mass Boom • 600 mm (24") Track Shoes

			3.0 m 10'		4.5 m 15'		6.0 m 20'		7.5 m 25'		9.0 m 30'		At Max. Reach	
Stick	Bucket		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
1900 mm	C1470X	kg	—	—	8200	4950	5150	3150	—	—	—	—	3450	2100
6'3"	58"	lb			17,600	10,600	11,050	6800					7600	4600
2400 mm	C1370X	kg	7050	7050	8300	5000	5200	3200	930	2250	—	—	3150	1900
7'10"	54"	lb	16,250	16,250	17,750	10,700	11,100	6850	2050	4950			6850	4150
2920 mm	C1470X	kg	8000	8000	8600	5200	5300	3350	3700	2300	—	—	2700	1800
9'7"	58"	lb	17,640	17,640	18,740	11,200	11,400	7150	7900	4900			5950	4000

320 L

• Reach Boom • 800 mm (32") Track Shoes

			3.0 m 10'		4.5 m 15'		6.0 m 20'		7.5 m 25'		9.0 m 30'		At Max. Reach	
Stick	Bucket		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
1900 mm	C1407X	kg	—	—	8650	5600	6200	3650	4450	2590	—	—	3850	2200
6'3"	58"	lb			18,750	12,000	13,450	7750	9800	5700			8450	4800
2500 mm	B1305X	kg			8850	5900	6350	3850	4450	2700	—	—	2750	2100
8'2"	51"	lb			19,150	12,700	13,700	8200	9800	5750			6050	4600
2920 mm	B1000T	kg	4800	4800	8800	6000	6250	3900	4600	2750			2050	1950
9'7"	40"	lb	11,100	11,100	18,950	12,900	13,550	8350	9800	5850			4450	4250
3860 mm	B1000T	kg	6050	6050	8150	6050	5850	3900	4600	2750	3400	2000	1700	1650
12'8"	40"	lb	13,350	13,350	17,600	13,350	12,600	8400	9900	5850	6660	4250	3650	3660

• Mass Boom • 800 mm (32") Track Shoes

			3.0 m 10'		4.5 m 15'		6.0 m 20'		7.5 m 25'		9.0 m 30'		At Max. Reach	
Stick	Bucket		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
1900 mm	C1440X	kg	—	—	8860	5800	6350	3750	—	—	—	—	4300	2500
6'3"	57"	lb			19,100	12,500	13,700	8250					9500	5500
2400 mm	C1470X	kg	7000	7000	8750	5900	6300	3750	4500	2650	—	—	3600	2250
7'10"	58"	lb	16,200	16,200	18,950	12,600	13,600	8250	10,000	5850			7900	4950
2920 mm	B1305X	kg	8000	8000	8800	6100	6300	3950	4600	2750	—	—	2700	2200
9'7"	51"	lb	18,350	18,350	18,950	13,150	13,650	8400	9900	5850			5950	4750

320 N

• Reach Boom • 500 mm (20") Track Shoes

Stick	Bucket		3.0 m 10'		4.5 m 15'		6.0 m 20'		7.5 m 25'		9.0 m 30'		At Max. Reach	
			Front	Side	Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
1900 mm	C1307X	kg	—	—	8600	4500	5350	2950	3800	2100	—		3300	1800
6'3"	54"	lb			18,200	9900	11,500	6350	8400	4650			7250	3900
2500 mm	B1000T	kg	—	—	8800	4800	5600	3150	3950	2250	—	—	2700	1700
8'2"	40"	lb			18,850	10,350	11,950	6800	8450	4950			5950	3700
2920 mm	B1000T	kg	4850	4850	8750	4850	5600	3200	3950	2250	—	—	2100	1600
9'7"	40"	lb	11,150	11,150	18,900	10,450	12,000	7050	8450	4950			4600	3500
3860 mm	B900T	kg	6100	6100	8150	4950	5650	3250	3950	2250	2950	1600	1700	1300
12'8"	36"	lb	13,850	13,850	17,650	10,650	12,100	7150	8500	4800	6500	3500	3750	2900

• Mass Boom • 500 mm (20") Track Shoes

Stick	Bucket		3.0 m 10'		4.5 m 15'		6.0 m 20'		7.5 m 25'		9.0 m 30'		At Max. Reach	
			Front	Side	Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
1900 mm	C1470X	kg	—	—	8700	4700	5500	3050	—	—	—	—	3700	2050
6'3"	56"	lb			18,700	10,100	12,100	6700					8100	4450
2400 mm	C1370X	kg	7050	7050	8750	4750	5500	3100	3900	2150	—	—	3350	1850
7'10"	54"	lb	16,250	16,250	18,300	10,200	11,800	6600	8800	4800			7350	4000
2920 mm	B1305X	kg	8000	8000	8750	4950	5650	3200	3950	2250	—		2700	1750
9'7"	51"	lb	18,350	18,350	19,300	10,650	12,100	6900	8450	4750			5950	3850

E240C

• 1240 mm (49") Bucket • 800 mm (32") Track Shoes

Stick		3.0 m 10'		4.5 m 15'		6.0 m 20'		7.5 m 25'		9.0 m 30'		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
2200 mm	kg	—	—	10 000	6650	6300	4250	4450	3000	—	—	3450	2030
7'3"	lb			21,450	14,050	13,500	9050	9550	6400			7550	5050
2800 mm	kg	3700*	3700*	10 100	6600	6300	4250	4450	3000	3100*	2200	2550*	2050
9'2"	lb	8300*	8300*	21,600	14,200	13,550	9150	9500	6400	6450*	4750	5550*	4460
3500 mm	kg	3600*	3600*	10 100	6600	6350	4250	4450	3000	3300	2200	2000*	1600
11'6"	lb	8000*	8000*	21,600	14,200	13,350	9150	9500	6400	7000	4650	4460*	3860

EL240C

• 1240 mm (49") Bucket • 800 mm (32") Track Shoes

Stick		3.0 m 10'		4.5 m 15'		6.0 m 20'		7.5 m 25'		9.0 m 30'		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
2200 mm	kg	—		10 300*	7500	7600	4800	5350	3450	—	—	4000*	2650
7'3"	lb			24,750*	16,100	16,350	10,350	11,500	7350			8800*	5800
2800 mm	kg	3700*	3700*	11 150*	7550	7650	4850	5350	3400	3100*	2550	2550*	2350
9'2"	lb	8300*	8300*	24,100*	16,200	16,400	10,400	11,500	7300	6450*	5450	5550*	5150
3500 mm	kg	3600*	3600*	10 550	7550	7400	4850	5350	3400	4000	2500	2000*	2000*
11'6"	lb	8000*	8000*	22,760	16,200	16,000	10,400	11,500	7300	8500	5350	4450*	4450*

325

• Reach Boom • 600 mm (24") Track Shoes

Stick	Bucket		3.0 m 10' Front	3.0 m 10' Side	4.5 m 15' Front	4.5 m 15' Side	6.0 m 20' Front	6.0 m 20' Side	7.5 m 25' Front	7.5 m 25' Side	9.0 m 30' Front	9.0 m 30' Side	At Max. Reach Front	At Max. Reach Side
2000 mm	D1430X	kg	—	—	11 250	6600	7100	4350	4950	3050	—	—	3750	2300
6'7"	56"	lb			24,350	14,550	15,200	9400	10,650	6550			8300	5100
2650 mm	C1075	kg	—	—	11 800	7350	7500	4800	5300	3400	—	—	3700	2300
8'8"	42"	lb			25,550	16,200	16,500	10,250	11,350	7250			8150	5100
3200 mm	C1307X	kg	3850	3850	11 600	7350	7550	4800	5300	3400	3950	2500	2900	2100
10'6"	42"	lb	8450	8450	25,100	16,200	16,600	10,550	11,350	7250	8450	5500	6400	4550
4200 mm	B1000T	kg	5350	5350	11 100	9050	7900	5850	6200	4150	4800	3100	2350	2250
13'9"	40"	lb	11,800	11,800	24,450	19,950	17,050	12,900	13,400	9150	10,450	6800	5100	4950

• Mass Boom • 600 mm (24") Track Shoes

Stick	Bucket		3.0 m 10' Front	3.0 m 10' Side	4.5 m 15' Front	4.5 m 15' Side	6.0 m 20' Front	6.0 m 20' Side	7.5 m 25' Front	7.5 m 25' Side	9.0 m 30' Front	9.0 m 30' Side	At Max. Reach Front	At Max. Reach Side
2000 mm	D1600X	kg	—	—	11 650	7100	7350	4550	—	—	—	—	4400	2700
6'7"	59"	lb			24,950	15,300	15,700	9800					9650	5950
2500 mm	D1430X	kg	—	—	11 600	7050	7350	4500	5100	3150	—	—	4000	2450
8'2"	56"	lb			25,050	15,550	15,800	9900	10,900	6750			8800	5400
3200 mm	C1470X	kg	7550	7550	11 650	7450	7650	4800	6350	3400	—	—	3150	2400
10'6"	58"	lb	17,300	17,300	25,150	16,400	16,850	10,500	11,450	7300			6900	5300

325 L

• Reach Boom • 800 mm (32") Track Shoes

Stick	Bucket		3.0 m 10' Front	3.0 m 10' Side	4.5 m 15' Front	4.5 m 15' Side	6.0 m 20' Front	6.0 m 20' Side	7.5 m 25' Front	7.5 m 25' Side	9.0 m 30' Front	9.0 m 30' Side	At Max. Reach Front	At Max. Reach Side
2000 mm	D1500X	kg			11 200	8100	8100	5200	6000	3650	—	—	4550	2750
6'7"	58"	lb			24,300	17,850	17,850	11,150	12,850	7800			10,000	6050
2650 mm	C1470X	kg	—	—	11 750	8600	8350	5550	6250	3850	—	—	3650	2700
8'8"	58"	lb			25,400	18,450	18,050	11,950	13,450	8450			8050	5950
3200 mm	C1075T	kg	3850	3850	11 600	8700	8200	5650	6350	4000	4750	2950	2850	2500
10'6"	42"	lb	8500	8500	25,050	18,700	17,750	12,100	13,600	8550	10,150	6350	6300	5450
4200 mm	B1000T	kg	5350	5350	11 150	7700	7750	5000	5500	3550	4100	2650	2400	1900
13'9"	40"	lb	12,250	12,250	24,050	16,500	16,650	10,800	11,750	7650	8750	5650	5250	4150

• Mass Boom • 800 mm (32") Track Shoes

Stick	Bucket		3.0 m 10' Front	3.0 m 10' Side	4.5 m 15' Front	4.5 m 15' Side	6.0 m 20' Front	6.0 m 20' Side	7.5 m 25' Front	7.5 m 25' Side	9.0 m 30' Front	9.0 m 30' Side	At Max. Reach Front	At Max. Reach Side
2000 mm	D1620MX	kg	—	—	11 600	8450	8250	5400	—	—	—	—	5300	3250
6'7"	60"	lb			24,900	18,150	17,850	11,900					11,650	7150
2500 mm	D1600X	kg	—	—	11 650	8600	8200	5450	6150	3750	—	—	4200	2950
8'2"	59"	lb			25,000	18,400	17,750	11,850	13,100	8050			9250	6450
3200 mm	C1470X	kg	7550	7550	11 650	9000	8300	5750	6400	4050	—	—	3150	2850
10'6"	58"	lb	17,300	17,300	25,150	19,300	17,950	12,350	13,700	8650			6900	6250

325 LN

• Reach Boom • 600 mm (24") Track Shoes

Stick	Bucket		3.0 m 10' Front	3.0 m 10' Side	4.5 m 15' Front	4.5 m 15' Side	6.0 m 20' Front	6.0 m 20' Side	7.5 m 25' Front	7.5 m 25' Side	9.0 m 30' Front	9.0 m 30' Side	At Max. Reach Front	At Max. Reach Side
2000 mm	D1430X	kg	—	—	11 250	6800	8100	4450	5750	3100	—	—	4350	2350
6'7"	56"	lb			24,350	14,800	17,550	9550	12,300	6650			9600	5100
2650 mm	C1370X	kg	—	—	11 800	7450	8450	4850	6050	3450	—	—	3750	2350
8'8"	54"	lb			25,500	16,000	18,250	10,450	13,000	7400			8200	5200
3200 mm	C1075	kg	3850	3850	11 600	7500	8250	4800	6100	3450	4550	2550	2900	2150
10'6"	42"	lb	8950	8950	25,100	16,100	17,800	10,500	13,050	7400	9400	5400	6400	4650
4200 mm	B1000T	kg	5350	5350	11 150	7800	7900	5100	6200	3650	4700	2700	2700	1950
13'9"	40"	lb	12,250	12,250	24,050	16,800	17,100	10,950	13,400	7950	10,250	5250	5250	4250

• Mass Boom • 600 mm (24") Track Shoes

Stick	Bucket		3.0 m 10' Front	3.0 m 10' Side	4.5 m 15' Front	4.5 m 15' Side	6.0 m 20' Front	6.0 m 20' Side	7.5 m 25' Front	7.5 m 25' Side	9.0 m 30' Front	9.0 m 30' Side	At Max. Reach Front	At Max. Reach Side
2000 mm	D1500X	kg		—	11 550	7250	8300	4650	—	—	—	—	5100	2800
6'7"	[illegible]	lb			24,950	15,550	17,900	9950					11,150	6100
2500 mm	D1430X	kg	—	—	11 600	7350	8250	4700	5900	3250	—	—	4250	2500
8'2"	56"	lb			25,050	15,800	17,850	10,050	12,600	6900			9300	5500
3200 mm	C1470X	kg	7550	7550	11 650	7750	8300	5000	6100	3450	—	—	3150	2450
10'6"	58"	lb	17,300	17,300	25,150	16,650	17,950	10,650	13,100	7400			6900	5300

231D

- **Heavy Lift Attachment**
- **Mass Excavation Boom, Sticks & 1653 mm (65") Bucket**

Stick		4.5 m Front	4.5 m Side	6.0 m Front	6.0 m Side	7.5 m Front	7.5 m Side	At Max. Reach Front	At Max. Reach Side
2300 mm	kg	15 510*	10 450	9900	6730	6850	4730	5170	3470
2900 mm	kg	16 330*	10 610	9970	6790	6970	4740	4640	3080

231D LC

- **Heavy Lift Attachment**
- **Mass Excavation Boom, Sticks & 1653 mm (65") Bucket**

Stick		4.5 m Front	4.5 m Side	6.0 m Front	6.0 m Side	7.5 m Front	7.5 m Side	At Max. Reach Front	At Max. Reach Side
2300 mm	kg	15 510*	9790	10 910*	6280	8370*	4390	6400*	3200
2900 mm	kg	15 330*	9950	10 660*	6340	8170*	4400	5150*	2820

*Indicates load is limited by hydraulic capacity rather than tipping.

Note: Kg capacities are calculated at even 1.5 m distances. Lb capacities are at even 5 ft. distances. Metric & English values within any block do not necessarily agree.

231D

- **Heavy Lift Attachment**
- **1375 mm (54") Bucket** • **813 mm (32") Shoes**

Stick		3.0 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	7.5 m 25' Front	Side	9.0 m 30' Front	Side	At Max. Reach Front	Side
2900 mm	kg	—	—	14 480*	10 840	10 380	7100	7360	5060	5630	3780	4680	3180
9'6"	lb			33,800*	23,500	22,300	15,300	15,800	10,900	11,900	8100	10,300	7000
3500 mm	kg	5040*	5040*	15 300*	11 020	10 390	7120	7350	5050	5500	3740	3840*	3830
11'6"	lb	11,500*	11,500*	33,000*	23,700	22,300	15,300	15,800	10,800	11,800	8000	8500*	6200

231D LC

- **Heavy Lift Attachment**
- **1375 mm (54") Bucket** • **813 mm (32") Shoes**

Stick		3.0 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	7.5 m 25' Front	Side	9.0 m 30' Front	Side	At Max. Reach Front	Side
2900 mm	kg	—	—	14 480*	10 360	10 820*	6710	8350*	4770	6830*	3540	4770*	2970
9'6"	lb			33,800*	22,300	23,600*	14,400	18,100*	10,200	14,800*	7800	10,500*	6500
3500 mm	kg	5040*	5040*	15 300*	10 440	10 530*	6730	8040*	4760	6580*	3500	3840*	2640
11'6"	lb	11,500*	11,500*	33,000*	22,400	22,700*	14,500	17,400*	10,200	14,300*	7500	8500*	5800

330

- **Reach Boom** • **600 mm (24") Track Shoes**

Stick	Bucket		3.0 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	7.5 m 25' Front	Side	9.0 m 30' Front	Side	At Max. Reach Front	Side
2150 mm	E1470X	kg	—	—	15 050	10 000	9600	6400	6750	4500	—	—	4700	3100
7'1"	58"	lb			32,650	21,450	20,650	13,750	14,450	9700			10,350	6850
2800 mm	D1500X	kg			15 750	10 550	10 000	6800	7050	4850	5250	3550	4500	3050
9'2"	59"	lb			34,050	22,700	21,500	14,650	15,150	10,350	11,650	7850	9850	6650
3300 mm	D1430X	kg	6250	6250	15 500	10 550	10 000	6800	7000	4800	5200	3500	3450	2750
10'10"	56"	lb	14,200	14,200	33,560	22,700	21,500	14,800	15,050	10,250	11,150	7600	7800	6000
3900 mm	D1200T	kg	6850	6850	15 250	10 800	10 200	6950	7150	4900	5300	3600	2950	2550
12'10"	47"	lb	15,550	15,550	33,000	23,200	21,900	14,950	15,350	10,550	11,400	7750	6450	5550
4000 mm	C1075T	kg	7950	7950	14 600	11 350	10 400	7350	7500	5250	5600	3900	2800	2400
15'9"	42"	lb	18,100	18,100	31,500	24,400	22,450	15,850	16,050	11,250	12,000	8350	6100	5300

- **Mass Boom** • **600 mm (24") Track Shoes**

Stick	Bucket		3.0 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	7.5 m 25' Front	Side	9.0 m 30' Front	Side	At Max. Reach Front	Side
2150 mm	E1600X	kg	—	—	15 450	10 400	9800	6600	6800	4600	—	—	5050	3400
7'1"	63"	lb			33,500	22,350	21,050	14,150	14,500	9800			11,150	7450
2550 mm	E1470X	kg	—	—	15 550	10 450	9850	6600	6800	4600	—	—	4600	3050
8'4"	58"	lb			33,600	22,450	21,100	14,200	14,600	9800			10,100	6700
3500 mm	D1500X	kg	7650	7650	15 550	10 850	10 200	6860	7100	4900	5250	3550	3900	2850
11'6"	59"	lb	17,450	17,450	33,650	23,350	21,850	14,950	15,250	10,450	11,300	7650	8600	6250

4

330 L

• Reach Boom • 750 mm (30") Track Shoes

Stick	Bucket		3.0 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	7.5 m 25' Front	Side	9.0 m 30' Front	Side	At Max. Reach Front	Side
2150 mm	E1470X	kg			15 050	10 450	10 950	6750	8350	4750	—	—	5650	3300
7'1"	58"	lb			32,650	22,450	23,700	14,450	17,950	10,200			12,900	7250
2800 mm	D1500X	kg	—	—	15 700	11 000	11 200	7100	8650	5050	6450	3750	5050	3150
9'2"	58"	lb			33,950	23,800	24,250	15,250	18,550	10,800	14,200	8200	11,150	6950
3300 mm	D1430X	kg	6200	6200	15 500	11 000	11 000	7100	8500	5000	6450	3900	3450	2900
10'10"	56"	lb	14,200	14,200	33,850	23,650	23,750	15,250	18,350	10,750	13,800	7900	7550	6350
3900 mm	D1200T	kg	6850	6850	15 250	11 250	10 750	7250	8360	6150	6660	3900	2900	2650
12'10"	47"	lb	15,500	15,500	32,950	24,150	23,250	15,600	18,000	11,000	14,000	8100	6400	5650
4800 mm	C1075T	kg	7900	7900	14 600	11 800	10 350	7700	8160	5450	6750	4100	2700	2600
15'9"	42"	lb	17,950	17,950	31,500	25,400	22,450	16,500	17,600	11,750	14,600	8700	5950	5500

• Mass Boom • 750 mm (30") Track Shoes

Stick	Bucket		3.0 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	7.5 m 25' Front	Side	9.0 m 30' Front	Side	At Max. Reach Front	Side
2150 mm	E1735MX	kg	—	—	15 550	10 800	11 060	6860	8400	4760	—	—	6200	3500
7'1"	68"	lb			33,300	23,200	23,900	15,600	18,950	10,150			13,650	7700
2550 mm	E1600X	kg	—	—	15 650	10 800	11 000	6900	8400	4760	—	—	4900	3150
8'4"	63"	lb			33,500	23,350	23,800	14,750	19,000	10,200			10,800	6850
3500 mm	D1500X	kg	7650	7650	15 550	11 350	11 050	7250	8550	5100	6500	3750	3900	3000
11'6"	59"	lb	17,450	17,450	33,650	24,350	23,900	15,600	18,500	10,950	13,900	8050	8600	6550

330 LN

• Reach Boom • 600 mm (24") Track Shoes

Stick	Bucket		3.0 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	7.5 m 25' Front	Side	9.0 m 30' Front	Side	At Max. Reach Front	Side
2150 mm	E1470X	kg			15 050	9100	10 950	5900	8150	4150	—	—	5700	2850
7'1"	58"	lb			32, 650	19,650	23,700	12,850	17,500	8900			12,550	6250
2800 mm	D1500X	kg	—	—	15 750	9650	11 250	6300	8450	4450	6300	3300	5100	2800
9'2"	58"	lb			34,050	20,800	24,350	13,500	18,200	9550	13,900	7250	11,200	6150
3300 mm	D1430X	kg	6250	6250	15 500	9050	11 000	6250	8450	4450	6250	3250	3450	2500
10'10"	56"	lb	14,200	14,200	33,550	20,600	23,800	13,450	18,100	9500	13,450	6900	7600	5500
3900 mm	D1200T	kg	6850	6850	15 250	9800	10 800	6450	8350	4550	6400	3350	2850	2350
12'10"	47"	lb	15,550	15,550	33,000	21,300	23,300	13,850	18,050	9750	13,650	7150	6450	5100
4800 mm	C1075T	kg	7950	7950	14 600	10 450	10 400	6860	8160	4850	6650	3600	2800	2200
15'9"	42"	lb	18,100	18,100	31,500	22,450	22,450	14,700	17,650	10,450	14,300	7750	6100	4850

• Mass Boom • 600 mm (24") Track Shoes

Stick	Bucket		3.0 m 10' Front	Side	4.5 m 15' Front	Side	6.0 m 20' Front	Side	7.5 m 25' Front	Side	9.0 m 30' Front	Side	At Max. Reach Front	Side
2150 mm	E1600X	kg	—	—	15 490	9300	11 150	6100	8250	4200	—	—	6100	3100
7'1"	63"	lb			33,500	20,400	24,100	13,050	17,650	9000			13,450	6800
2550 mm	E1470X	kg	—	—	15 550	9550	11 050	6100	8250	4200	—	—	4950	2800
8'4"	58"	lb			33,600	20,550	23,900	13,050	17,650	9000			10,900	6100
3500 mm	D1500X	kg	7650	7650	15 550	9950	11 050	6450	8550	4500	6350	3300	3900	2650
11'6"	59"	lb	17,450	17,450	33,650	21,400	23,800	13,800	18,300	9650	13,550	7000	8100	5750

235D

• Heavy Lift Attachment • Bottom, Lines and Swivel Guards • One-Piece Boom
• 1219 mm (48") Bucket • Full length Track Guards • 762 mm (30") Triple Grousers

Stick		4.5 m 15' Front	4.5 m 15' Side	6.0 m 20' Front	6.0 m 20' Side	7.5 m 25' Front	7.5 m 25' Side	9.0 m 30' Front	9.0 m 30' Side	10.5 m 35' Front	10.5 m 35' Side	At Max. Reach Front	At Max. Reach Side
2440 mm	kg	—	—	16 310*	10 140	11 910*	7340	9020	5560	—	—	6250*	4510
8'0"	lb			33,200*	21,900	25,700	15,600	19,400	11,900			13,800*	10,000
2900 mm	kg	—	—	16 360*	10 220	11 840*	7370	9020	5550	—	—	5320*	4180
9'6"	lb			33,200*	22,000	25,600*	15,900	19,400	11,900			11,700*	9200
3660 mm	kg	14 840*	14 840*	14 970*	10 230	11 460*	7330	8950	5470	6860	4170	4070*	5610
12'0"	lb	35,200*	33,600	32,400*	22,000	24,800*	15,800	19,200	11,700	13,300*	8900	9000*	7900

• One-Piece SA Boom with SA Stick • Heavy Hydraulic Circuit Attachment

Stick		4.5 m 15' Front	4.5 m 15' Side	6.0 m 20' Front	6.0 m 20' Side	7.5 m 25' Front	7.5 m 25' Side	9.0 m 30' Front	9.0 m 30' Side	10.5 m 35' Front	10.5 m 35' Side	At Max. Reach Front	At Max. Reach Side
2900 mm	kg	—	—	14 670*	14 270	11 290*	10 210	9070	7710	—	—	5280*	5280*
9'6"	lb			31,600*	30,700	24,400*	22,000	19,600*	16,600			11,600*	11,600*

*Load limited by hydraulic capacity rather than tipping

235D LC

• Heavy Lift Attachment • Bottom, Lines and Swivel Guards • 7710 kg (17,000 lb) Counterweight
• 1219 mm (48") Bucket • Full length Track Guards • 762 mm (30") Track Shoes
• Wider 610 mm (24") Variable gauge carbody

Stick		4.5 m 15' Front	4.5 m 15' Side	6.0 m 20' Front	6.0 m 20' Side	7.5 m 25' Front	7.5 m 25' Side	9.0 m 30' Front	9.0 m 30' Side	10.5 m 35' Front	10.5 m 35' Side	At Max. Reach Front	At Max. Reach Side
2440 mm	kg	—	—	15 280*	14 020	11 900*	10 050	9570*	7630	—	—	6300*	6280
8'0"	lb			33,100*	30,200	25,800*	21,600	20,700*	16,400			13,900*	13,900
2800 mm	kg	—	—	15 350*	14 100	11 840*	10 080	9540*	7630	—	—	5370*	5370*
9'6"	lb			33,200*	30,300	25,600*	21,700	20,600*	16,400			11,800*	11,800*
3660 mm	kg	16 070*	16 070*	16 010*	14 110	11 480*	10 040	9270*	7660	7600*	5850	4110*	4110*
12'0"	lb	35,700*	35,700*	32,500*	30,400	24,800*	21,600	20,100*	16,200	13,100*	12,500	9100*	9100*

E450

• 760 mm (36") Track Shoes • One-Piece Boom

Stick		6.0 m 20' Front	6.0 m 20' Side	7.5 m 25' Front	7.5 m 25' Side	9.0 m 30' Front	9.0 m 30' Side	10.5 m 35' Front	10.5 m 35' Side	At Max. Reach Front	At Max. Reach Side
3100 mm	kg	15 300*	11 500	11 500*	8100	9100	6100	2600	2600	2000	2000
10'2"	lb	32,800*	24,600	24,900*	17,500	19,600	13,100	5300	5300	4300	4300
3800 mm	kg	14 800*	11 600	11 200*	8200	9100*	6200	5800*	4700	1400*	1400*
12'6"	lb	31,900*	24,900	24,100*	17,700	19,600*	13,200	10,400*	10,100	3000*	3000*
4800 mm	kg	14 200*	12 200	10 900*	8700	8900*	6600	7500*	5100	1800*	1800*
15'9"	lb	30,700*	26,200	23,500*	18,800	19,300*	14,100	16,100*	11,000	4000*	4000*

Note: 4800 mm stick is equipped with 1330 mm (52") bucket.
3800 mm stick is equipped with 1405 mm (55") bucket.
3100 mm stick is equipped with 1605 mm (63") bucket.

E650

- **1633 mm (64") Bucket** • **760 mm (30") Track Shoes** • **One-Piece Boom**

Stick		6.0 m 20' Front	Side	7.5 m 25' Front	Side	9.0 m 30' Front	Side	10.5 m 35' Front	Side	At Max. Reach Front	Side
3470 mm	kg	19 550*	15 650	15 650	11 100	11 650	8300	9200	6400	3950*	3950*
11'5"	lb	**47,800***	**33,650**	**34,000**	**23,800**	**25,450**	**17,800**	**19,750**	**13,650**	**6650***	**6650***

*Indicates load is limited by hydraulic capacity rather than tipping.

245D

- **Heavy Lift Attachment**
- **1219 mm (48") Bucket** • **762 mm (30") Double Grouser Track (Extended Gauge)**

Stick		7.5 m 25' Front	Side	9.0 m 30' Front	Side	10.5 m 35' Front	Side	12.0 m 40' Front	Side	At Max. Reach Front	Side
2606 mm	kg	15 760*	12 800	12 490*	9700	10 250*	7610	—	—	8560*	6530
8'6"	lb	**34,100***	**27,500**	**27,000***	**20,900**	**22,100***	**16,400**			**18,800***	**14,400**
3715 mm	kg	15 560*	12 800	12 240*	9680	10 050*	7540	—	—	8170*	6000
10'6"	lb	**33,600***	**27,600**	**26,400***	**20,800**	**21,700***	**16,200**			**18,000***	**13,200**
4420 mm	kg	14 640*	12 840	11 440*	9620	9380*	7410	7950*	5790	5860*	4860
14'6"	lb	**31,800***	**27,600**	**24,700***	**20,700**	**20,300***	**15,900**	**17,200***	**12,400**	**12,900***	**10,700**

*Load limited by hydraulic capacity rather than tipping.

245D

- **Deep Trencher Arrangement** • **Weldco Boom** • **12 250 kg (27,000 lb) Counterweight**
- **1372 mm (54") Bucket** • **Extended U/C 381 mm (15")**

Stick		7.5 m 25' Front	Side	9.0 m 30' Front	Side	10.5 m 35' Front	Side	12.0 m 40' Front	Side	13.5 m 45' Front	Side	At Max. Reach Front	Side
4420 mm	kg	—	—	15 630*	9140	12 700*	7120	10 660*	5600	9030	4410	5510*	3390
14'6"	lb	**40,500***	**26,900**	**33,700***	**19,700**	**27,400***	**16,300**	**23,000***	**12,000**	**19,400**	**9400**	**12,200***	**7500**

245D

- **Heavy Lift Trencher Arrangement** • **Weldco Boom** • **12 250 kg (27,000 lb) Counterweight**
- **Wider (608 mm/20") Variable gauge carbody** • **1372 mm (54") Bucket**
- **Extended U/C 381 mm (15")**

Stick		6.0 m 20' Front	Side	7.5 m 25' Front	Side	9.0 m 30' Front	Side	10.5 m 35' Front	Side	12.0 m 40' Front	Side	At Max. Reach Front	Side
4420 mm	kg	21 500*	21 500*	21 220*	16 610	16 770*	12 480	13 870*	9680	11 480	7860	5990*	5990*
14'6"	lb	**52,100***	**50,600**	**45,800***	**35,700**	**36,200***	**26,600**	**30,000***	**20,800**	**24,200***	**16,400**	**13,200***	**13,200***

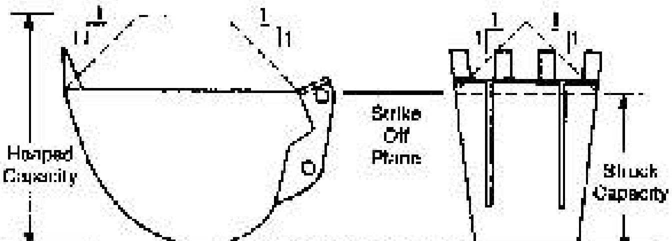
*Indicates load is limited by hydraulic capacity rather than tipping.
Note: Kg capacities are calculated at even 1.5 m distances. Lb capacities are at even 5 ft. distances.
Metric & English values within any block do not necessarily agree.

EXCAVATOR BUCKET CAPACITIES

Caterpillar rates excavator buckets to conform with both PCSA standard No. 3 and SAE standard J-296. Buckets are rated on both their struck and heaped capacities as follows:

Struck Capacity

Volume actually enclosed inside the outline of the sideplates and rear and front bucket enclosures without any consideration for any material supported or carried by the spillplate or bucket teeth.



Excavator Bucket Rating

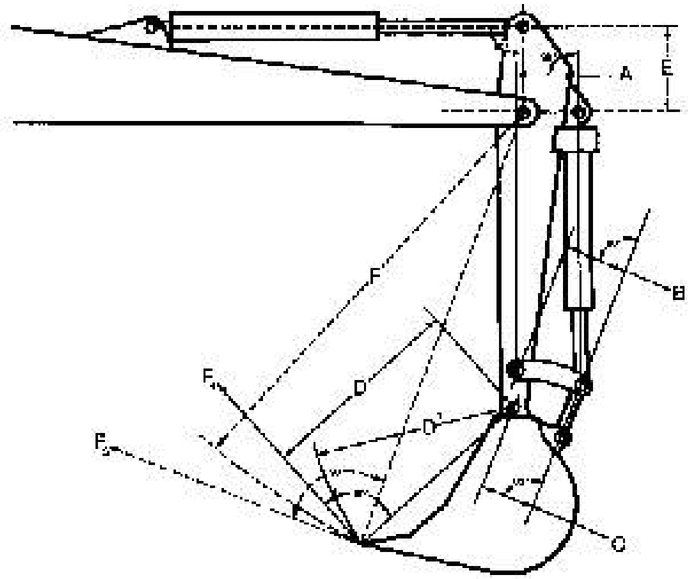
Heaped Capacity

Volume in the bucket under the strike off plane plus the volume of the heaped material above the strike off plane, having an angle of repose of 1:1 without any consideration for any material supported or carried by the spillplate or bucket teeth.

The Committee on European Construction Equipment (CECE) rates heaped bucket pay loads on a 2:1 angle of repose for material above the strike off plane. CECE ratings for Caterpillar buckets are included in the bucket tables in this section.

CURL AND CROWD FORCES

Bucket penetration into a material is achieved by the bucket curling force (F_B) and stick crowd force (F_S). Rated digging forces are the digging forces that can be exerted at the outermost cutting point. These forces can be calculated by applying working relief hydraulic pressure to the cylinder(s) providing the digging force. The digging forces listed on next page conform with SAE Standard J1179 and PCSA Standard No. 3. The values may not be directly comparable to forces for machines rated by other methods than those described below.



F_B = Radial tooth force due to bucket cylinder

$$= \frac{\text{Bucket cylinder force}}{\text{Arm D length}} \left(\frac{\text{Arm A} \times \text{Arm C}}{\text{Arm B}} \right)$$

Cylinder force = (Pressure) x (End area of cylinder head)

Arm D   Bucket tip radius

Maximum radial tooth force due to bucket cylinder (bucket curling force) is the digging force generated by the bucket cylinder(s) and tangent to the arc of radius D^1. The bucket shall be positioned to obtain maximum output moment from the bucket cylinder(s) and connecting linkages. When calculating, maximum F_B occurs when the factor — Arm A times Arm C divided by Arm B — becomes the maximum.

F_S – Radial tooth force due to stick cylinder

$$= \frac{\text{(Stick cylinder force) x (Arm E length)}}{\text{(Arm F length)}}$$

Arm F   Bucket tip radius + stick length

Maximum radial tooth force due to stick cylinder (stick crowd force) is the digging force generated by the stick cylinder(s) and tangent to the arc of radius F. The stick shall be positioned to obtain the maximum output moment from the arm cylinder and the bucket positioned as described in the bucket force rating. When calculating, maximum F_S occurs when the axis in the stick cylinder working direction is at a right angle to the line connecting the stick cylinder pin and the boom nose pin.

Bucket Selection Considering Bucket Curl and Stick Crowd Forces

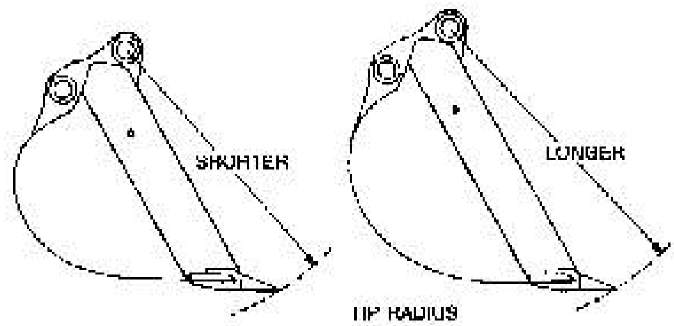
The combination of the excavator's stick crowd force and bucket curling force give this machine configuration more effective bucket penetration force per mm (inch) of bucket cutting edge than is available with other machine types such as wheel and track loaders.

As a result of high penetration force, an excavator bucket is comparatively easy to load. Also, the higher unit breakout forces allow the excavator's economic application range to be extended farther into the tougher soils (coral, caliche, shale, limestone) before blasting or ripping is required.

To take full advantage of an excavator's high penetration forces, buckets should be selected so they are well matched to soil conditions that are encountered. The two important things to consider are bucket width and bucket tip radius.

As a general rule, wide buckets are used in easily dug soil and narrow buckets in harder material. In hard rocky soils, tip radius also has to be considered in bucket selection. Because the shorter tip radius buckets provide more total bucket curling force than the long tip radius buckets, they are generally the easiest to load. A good rule of thumb when selecting a Caterpillar bucket for hard material is to choose the narrowest bucket that has a short tip radius.

Other factors such as trench bottom width specifications, manbox size, or the desire to conserve bedding material may also influence excavator bucket selection.



Note: See the following pages for listing of Caterpillar buckets by tip radius and cutting edge width.

MODEL	BUCKET TIP RADIUS		BUCKET CURLING FORCES		STICK CROWD FORCES					
					SHORT STICK		MEDIUM STICK		LONG STICK	
	mm	in	kN	lb	kN	lb	kN	lb	kN	lb
E70B**	1070	42.13	44.1	9914	39.2	8812	34.3	7711	29.4	6609
E110B**	1220	48.03	73.5	16,523	56.8	12,769	52.9	11,892	46.1	10,363
E120B**	1220	48.03	77.4	17,340	64.7	14,545	57.8	12,993	51.9	11,667
E140**	1340	53.00	77.00	17,240	57.0	12,850	—	—	48.0	10,930
211B LC, 211B NLC	1205	47.40	93.50	21,000	67.9	15,265	54.1	12,265	47.3	10,630
213B LC, 213B NLC	1420	55.90	127.00	28,500	108.0	24,200	88.0	19,700	77.0	17,325
206B FT	1205	47.40	73.30	16,500	50.0	12,000	47.9	10,200	42.0	9450
212B FT	1205	47.40	93.50	21,000	67.9	15,265	54.1	12,265	47.3	10,630
214B/214B FT	1420	55.90	127.00	28,500	108.0	24,200	88.0	19,700	77.0	17,325
224B	1420	55.90	156.1	35,080	120.3	27,030	98.1	22,045	87.4	19,640
E240C/EL240C	1550	61.00	127.00	29,980	119.0	26,620	98.0	22,000	83.0	18,700
231D/231D LC	1570	61.8	179.3	40,300	—	—	135.2	30,400	118.6	26,700
	1680	66.4	169.6	38,100		—	131.4	29,600	115.7	26,000
	1730	68.1	162.9	36,600	—	—	129.3	29,100	114.1	25,600
231D/231D LC ME	1730	68.1	169.1	38,000	156.5	35,160	135.9	30,530	—	—
235D/235D LC	1596*	62.83	236.9	53,230	219.7	49,370	196.7	44,210	168.2	37,800
	1883	74.13	200.8	45,120	211.0	47,410	189.6	42,610	163.3	36,700
	1980	77.95	190.9	42,910	206.3	46,360	185.8	41,760	160.5	36,070
235D ME	1756	69.20	203.00	45,520	—	—	185.0	41,530	—	—
	1790	70.50	199.00	44,680	—	—	185.0	41,660	—	—
	1880	74.00	190.00	42,580	—	—	185.0	40,190	—	—
E450**	1870	73.82	201.00	45,100	168.0	37,820	142.2	32,000	127.7	28,700
245D	1916	75.43	304.8	68,480	277.7	62,410	243.6	54,740	196.8	44,250
	2008	79.05	284.3	63,830	277.3	62,350	243.9	54,830	197.8	44,450
	2225	86.60	251.2	56,450	260.0	58,420	229.8	51,630	187.8	42,210
	2306	90.79	242.3	54,450	255.6	57,430	226.3	50,860	185.5	41,680
	2344	92.30	243.6	54,760	256.7	57,700	227.8	51,210	187.1	42,060
245D ME	2090	82.00	302.0	68,000	—	—	244.0	54,800	—	—
	2121	83.50	351.0	79,000	—	—	262.0	58,900	—	—
	2134	84.00	351.0	78,900	—	—	263.0	59,200	—	—
E650**	2150	84.00	262.00	58,740	—	—	236.0	53,020	—	—

*Without Bucket Tips **Akashi Sourced Buckets

320

Boom		Reach Boom			
Stick		**R1.9C**	**R2.5B**	**R2.9B**	**R3.9B**
Bucket Tip Radius	mm	1487	1543	1480	1480
	in	**58.5**	**61.0**	**58.2**	**58.2**
Bucket Curling Forces	kN	146	120	115	115
	lb	**32,800**	**26,900**	**25,800**	**25,800**
Stick Crowd Forces	kN	133	103	90	78
	lb	**30,000**	**23,100**	**20,300**	**17,200**

Boom		Mass Boom		
Stick		**M1.9C**	**M2.4C**	**M2.9B**
Bucket Tip Radius	mm	1487	1487	1409
	in	**58.5**	**58.5**	**55.4**
Bucket Curling Forces	kN	146	146	120
	lb	**32,800**	**32,800**	**26,900**
Stick Crowd Forces	kN	133	116	100
	lb	**30,000**	**26,000**	**22,500**

Boom		VA Boom		
Stick		**M1.9C**	**M2.4C**	**M2.9B**
Bucket Tip Radius	mm	1370	1550	1409
	in	**53.9**	**61.0**	**55.4**
Bucket Curling Forces	kN	146	141	120
	lb	**32,800**	**31,700**	**26,900**
Stick Crowd Forces	kN	133	116	100
	lb	**30,000**	**25,800**	**22,500**

325

Boom		Reach Boom			
Stick		**R2.0D**	**R2.7C**	**R3.2C**	**R4.2B**
Bucket Tip Radius	mm	1660	1487	1550	1480
	in	65.4	58.5	61.0	58.2
Bucket Curling Forces	kN	174	146	141	115
	lb	39,000	32,800	31,700	25,800
Stick Crowd Forces	kN	148	124	107	90
	lb	33,300	27,800	24,000	20,300

Boom		Mass Boom		
Stick		**M2.0D**	**M2.5D**	**M3.2C**
Bucket Tip Radius	mm	1660	1660	1487
	in	65.4	65.4	58.6
Bucket Curling Forces	kN	182	174	146
	lb	41,000	39,000	32,800
Stick Crowd Forces	kN	148	128	110
	lb	33,300	28,800	24,700

Boom		VA Boom		
Stick		**M2.0D**	**M2.5D**	**M3.2C**
Bucket Tip Radius	mm	1660	1660	1487
	in	65.4	65.4	58.5
Bucket Curling Forces	kN	174	174	146
	lb	39,000	39,000	32,800
Stick Crowd Forces	kN	148	128	110
	lb	33,300	28,800	24,700

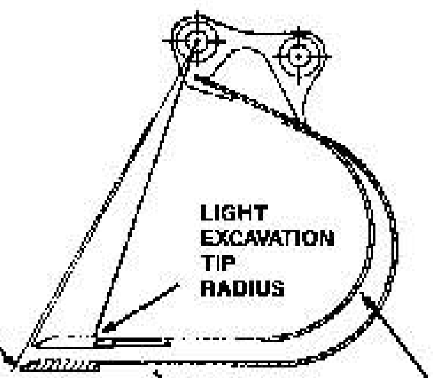
330

Boom		Reach Boom				
Stick		**R2.2E**	**R2.8D**	**R3.3D**	**R3.8D**	**R4.8C**
Bucket Tip Radius	mm	1832	1660	1660	1660	1550
	in	72.1	65.4	65.4	65.4	61.0
Bucket Curling Forces	kN	209	174	174	174	140
	lb	47,000	39,000	39,000	39,000	31,500
Stick Crowd Forces	kN	191	159	138	124	110
	lb	43,000	35,700	31,100	27,800	24,700

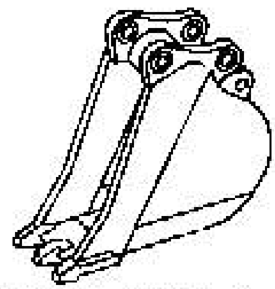
Boom		Mass Boom		
Stick		**M2.2E**	**M2.8E**	**M3.5D**
Bucket Tip Radius	mm	1832	1832	1660
	in	72.1	72.1	65.4
Bucket Curling Forces	kN	209	209	174
	lb	47,000	47,000	39,000
Stick Crowd Forces	kN	191	159	134
	lb	43,000	35,700	30,200

Caterpillar offers a bucket design featuring transverse wear strips. This design features extended bucket service life and reduced repair costs. (**Note:** These buckets are not available in all sales areas. Contact the regional sales office for availability.)

This bucket design uses two basic profiles . . . 1) a deep pocket with a long tip radius for trenching, 2) a comparatively shallow profile with a short tip radius for loading/excavating work.

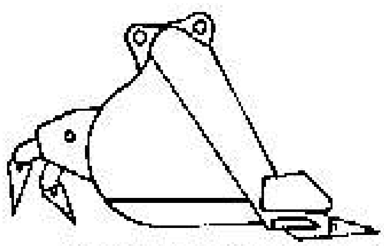


From these two basic profiles, six different bucket types are provided. Each is described in the following discussion.



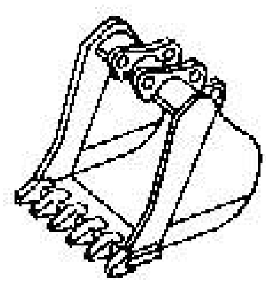
Trenching Buckets (T)

Bite width is usually dictated by pipe diameter in trenching applications. Therefore, the new trenching buckets (T) have profiles designed for optimum capacity and performance for a given bite width.



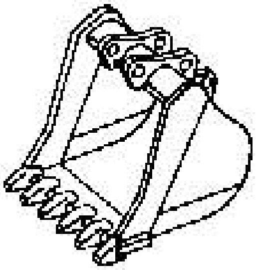
Extreme Service Trenching Bucket (ET)

The extreme service trenching bucket (ET) is designed for tougher trenching applications such as fragmented rock, frozen ground, caliche, etc. It is equipped with three pockets on the rear of the bucket to accept optional ripper shanks. These rear mounted rippers assist in extreme applications . . . where penetration is impossible with the front cutting edge.



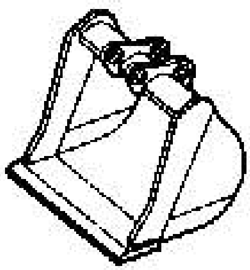
Excavation Bucket (X)

Excavation buckets (X) are designed for volume truck loading with shorter tip radii (maintaining more force) and greater bite width for easier loading and dumping.



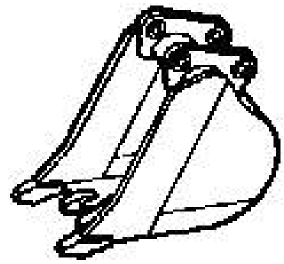
Extreme Service Excavation (EX)

Like the excavation bucket, the Extreme Service Excavation bucket (EX) is designed for volume truck loading, but in tough, more abrasive materials. Therefore, its shell, cutting edge, and side plates are all thicker than the standard excavation bucket. A size larger GET is used on many of the EX buckets.



Utility (UT)

For excavating, loading and easy-digging in light material, this bucket provides increased bucket capacity. It can also be used as a "finishing/clean-up" bucket for a variety of utility applications. It can be equipped with a bottom cutting edge if necessary.



Rock Ripping Bucket (R)

The rock ripping bucket (R) is specially designed for extreme digging and rock conditions. The staggered tooth design allows the center tooth to enter the ground first at a 45° angle, allowing it to use all of the machines force to rip. The two teeth on each side of the center tooth enter the ground next. The outer teeth, which project outward enter last and slice the trench wall, leaving the wall clean and straight. For added durability, all plate thicknesses on the rock bucket are on the average 75% greater than on a standard bucket.

MODEL	BUCKET TYPE	BUCKET BITE WIDTH		BUCKET TIP RADIUS		HEAPED CAPACITY		BUCKET WEIGHT WITH TEETH	
		mm	in	mm	in	L	yd³	kg	lb
E70B	General Purpose	400	16	1070	42	140	.18	145	320
	General Purpose	500	20	1070	42	180	.24	165	367
	General Purpose	800	32	1070	42	280	.37	210	463
	General Purpose	840	33	1070	42	340	.44	220	485
	Ejector	300	12	1070	42	130	.17	175	386
	Bank Forming/Grading	1100	43	1070	42	340	.44	235	518
	Clamshell	—	—	—	—	—	—	—	—
E110B	General Purpose	450	18	1220	48	220	.29	270	595
	General Purpose	600	24	1220	48	320	.42	305	673
	General Purpose	700	28	1220	48	380	.50	335	739
	General Purpose	886	35	1220	48	450	.59	380	838
	General Purpose	990	39	1220	48	520	.68	400	882
	General Purpose	1000	39	1220	48	570	.75	405	893
	General Purpose	1090	43	1220	48	630	.82	430	948
	Bank Forming/Grading	1800	71	1130	44	610	.80	490	1080
E120B	General Purpose	450	18	1220	48	220	.29	270	595
	General Purpose	600	24	1220	48	320	.42	305	673
	General Purpose	700	28	1220	48	380	.50	335	739
	General Purpose	886	35	1220	48	450	.59	380	838
	General Purpose	990	39	1220	48	520	.68	400	882
	General Purpose	1000	39	1220	48	570	.75	405	893
	General Purpose	1090	43	1220	48	630	.82	430	948
	General Purpose	1200	47	1220	48	710	.93	460	1014
	Bank Forming	1800	71	1130	44	610	.80	490	1080
E140	General Purpose	610	24	1340	53	290	.38	366	807
	General Purpose	990	39	1340	53	570	.75	467	1030
	General Purpose	1070	42.1	1340	53	630	.82	495	1091
	Excavation	1150	45.3	1340	53	750	.98	509	1122
	Ejector	500	19.7	1340	53	330	.43	443	977
	Bucket/Ripper	565	22.2	1340	53	220	.29	466	1028

MODEL	BUCKET TYPE	BUCKET BITE WIDTH		BUCKET TIP RADIUS		HEAPED CAPACITY		BUCKET WEIGHT WITH TEETH	
		mm	in	mm	in	L	yd³	kg	lb
206B FT, 211B LC 211B NLC, 212B FT	General Purpose	510	20	1205	47.4	280	.36	295	650
	General Purpose	610	24	1205	47.4	350	.45	315	694
	General Purpose	810	32	1205	47.4	500	.65	370	816
	General Purpose	910	36	1205	47.4	570	.74	410	904
	General Purpose	1010	40	1205	47.4	640	.84	435	960
	General Purpose	1110	44	1205	47.4	720	.94	460	1010
	General Purpose	1210	48	1205	47.4	790	1.04	510	1120
	Rock	610	24	1415	55.7	350	0.57	500	1102
	Rock	760	30	1415	55.7	475	0.74	570	1257
	Ditch Cleaning†	1800	71	—	—	430	.56	405	895
	Ditch Cleaning†	2000	78	—	—	480	.63	440	970
	Ditch Cleaning†	1500	56	—	—	336	.48	496***	1090
	Ditch Cleaning†	1800	71	—	—	430	.58	550***	1215
	Ditch Cleaning†	2000	79	—	—	480	.63	585***	1290
213B LC, 213B NLC, 214B, 214B FT, 224B**	General Purpose	610	24	1420	55.9	450	0.58	457	1010
	General Purpose	710	28	1420	55.9	520	0.67	515	1136
	General Purpose	810	32	1420	55.9	610	0.79	573	1263
	General Purpose	910	36	1420	55.9	700	0.91	596	1315
	General Purpose	1010	40	1420	55.9	790	1.03	628	1385
	General Purpose	1110	44	1420	55.9	880	1.15	680	1500
	General Purpose	1210	48	1420	55.9	960	1.26	720	1590
	General Purpose*	1410	56	1420	55.9	1170	1.53	775	1710
	Rock	760	30	1495	58.9	650	0.85	650	1430
	Rock	1010	40	1495	58.9	920	1.21	790	1740
	Rock	1110	44	1495	58.9	1040	1.35	850	1870
	Rock	1210	48	1495	58.9	1150	1.34	890	1960
213B LC, 213B NLC, 214B, 214B FT	Ditch Cleaning†	1800	71	—	—	480	.63	480***	1060
	Ditch Cleaning†	2000	79	—	—	720	.94	710***	1565
	Ditch Cleaning†	2300	91		—	620	.80	550***	1210
224B	Ditch Cleaning†	2000	79	-	—	640	.84	—	—
	Ditch Cleaning†	2400	95	—	—	770	1.01	—	—

*224B Only

**Buckets for the 214B and 213B LC are not interchangeable with the 224B due to pin size differences. All three models share the same bucket specifications; however 224B buckets have different hinge plates.

***With Tilting Mechanism.

†Without Teeth

MODEL	BUCKET TYPE	BUCKET FAMILY	BUCKET BITE WIDTH		BUCKET TIP RADIUS		HEAPED CAPACITY		BUCKET WEIGHT WITH TEETH	
			mm	in	mm	in	L	yd³	kg	lb
320	Excavation	B	1200	47.2	1409	55.4	900	1.18	706	1560
		•B*	1226	48.3	1401	55.2	900	1.18	713	1568
		B	1305	51.4	1409	55.4	1000	1.31	739	1626
		C	1370	53.9	1487	58.5	1100	1.44	859	1890
		•B*	1378	54.2	1401	55.2	1000	1.31	764	1681
		C	1470	57.9	1487	58.5	1200	1.57	894	1967
	Extreme Service	•B*	1096	43.1	1431	56.3	800	1.02	815	1793
	Excavation	B	1115	43.9	1424	56.1	800	1.05	758	1667
		C	1200	47.3	1518	59.8	1000	1.33	1016	2235
	Mass Excavation	C	1440	56.7	1487	58.5	1300	1.70	937	2061
	Extreme Service Mass Excavation	C	1378	54.3	1518	59.8	1200	1.57	1111	2444
	Trenching	B	800	35.4	1480	58.2	700	0.92	605	1330
		B*	925	36.4	1548	60.9	800	1.06	691	1521
		B	1000	39.4	1480	58.2	800	1.05	651	1431
		B	1000	39.4	1548	61.0	900	1.18	675	1484
		B*	1075	42.3	1548	60.9	1000	1.29	742	1633
		C	800	31.4	1607	63.2	700	0.92	683	1503
		C	925	36.4	1607	63.2	900	1.18	737	1621
		C	1075	42.4	1550	61.0	1000	1.31	798	1756
		C	1075	42.4	1607	63.2	1100	1.44	819	1802
	Extreme Service	B*	625	24.6	1563	61.5	400	0.61	591	1301
	Trenching	B*	775	30.5	1563	61.5	400	0.61	683	1504
		C	823	32.4	1638	64.4	700	0.95	813	1789
		C	940	37.3	1638	64.4	900	1.18	908	1998
	Rock	C	860	33.5	1540	60.5	600	0.78	965	2123
	Utility	B	1725	67.9	1206	47.4	1200	1.57	—	—
		C	1730	68.0	1258	49.6	1400	1.83	860	1892
E240C	General Purpose		1130	44	1580	62	900	1.18	755	1665
	General Purpose		1240	49	1580	62	1020	1.31	805	1775
	General Purpose		1350	53	1580	62	1140	1.50	840	1850
	Excavation		1200	47	1670	66	1250	1.64	790	1740
	Excavation		1390	55	1670	66	1480	1.95	855	1885
	Trenching*		629	25	1653	65	565	0.74	602	1324
	Trenching* ■		775	31◄	1653	65	760	1.00	725	1599
	Trenching* ■		925	36◄	1653	65	900	1.18	827	1824
	Trenching* ■		1075	42◄	1543	61	1100	1.43	817	1802
	Extreme Service Trenching* ■		816	32◄	1731	68	773	1.01	1076	2373
	Excavation* ■		1227	48◄	1546	61	1168	1.53	882	1945
	Excavation* ■		1377	54◄	1546	61	1351	1.77	959	2115
	Excavation* ■		1525	60◄	1420	56	1291	1.69	1159	2556
	Light Excavation* ■		1676	66◄	1304	51	1587	2.08	956	2108
	Bucket/Ripper		1000	39	1500	59	680	0.89	1080	2380
	Clamshell		1180	46	—	—	600	0.79		—
	Clamshell		1120	44	—	—	800	1.05	—	—

*Available only from Aurora, Illinois (NACD).
•Do not use shim adjuster group.
■VERSA-LINK coupler available in North America Only.
◄Width measured over outside corners of long tips.

MODEL	BUCKET TYPE	BUCKET FAMILY	BUCKET BITE WIDTH		BUCKET TIP RADIUS		HEAPED CAPACITY		BUCKET WEIGHT WITH TEETH	
			mm	in	mm	in	L	yd³	kg	lb
325	Excavation	B	1200	47.2	1409	55.4	900	1.18	705	1550
		B	1305	51.4	1409	55.4	1000	1.31	739	1626
		C	1370	53.9	1487	58.5	1100	1.44	884	1945
		C	1470	57.9	1487	58.5	1200	1.57	894	1967
		D	1430	56.3	1660	65.4	1400	1.83	1145	2519
		D	1500	59.1	1660	65.4	1500	1.96	1162	2557
	Extreme Service	C	1200	47.3	1518	59.8	1000	1.31	1031	2268
	Excavation	D	1300	51.2	1695	66.7	1300	1.70	1284	2825
	Mass Excavation	C*	1440	56.7	1487	58.5	1300	1.70	966	2126
		D	1520	59.8	1660	65.4	1600	2.09	1267	2787
	Extreme Service	C	1378	54.3	1518	59.8	1200	1.57	1131	2488
	Mass Excavation	D	1440	56.7	1695	66.7	1500	1.96	1377	3029
	Trenching	B	900	35.4	1480	58.2	700	0.92	605	1330
		B*	925	36.4	1548	60.9	800	1.00	691	1521
		B	1000	39.4	1548	61.0	900	1.18	675	1484
		B*	1075	42.3	1548	60.9	1000	1.25	742	1633
		C	800	31.4	1607	63.2	700	0.92	683	1503
		C	925	36.4	1607	63.2	900	1.18	772	1699
		C	1076	42.4	1550	61.0	1000	1.31	798	1758
		C	1076	42.4	1607	63.2	1100	1.44	861	1895
		C*	1225	48.2	1550	61.0	1200	1.60	886	1950
		C*	1370	53.9	1550	61.0	1400	1.87	958	2108
		D	1050	41.3	1730	68.1	1100	1.44	969	2132
		D	1200	47.2	1660	65.4	1200	1.57	1046	2306
		D	1200	47.2	1730	68.1	1300	1.70	1107	2441
	Extreme Service	C*	775	30.5	1638	64.5	700	0.88	827	1820
		C	823	32.4	1638	64.4	700	0.95	813	1789
	Trenching	C	948	37.3	1638	64.4	900	1.18	906	1998
		D	1070	42.1	1764	69.4	1100	1.44	1135	2498
	Rock	C	850	33.5	1540	60.5	600	0.78	1142	2513
		D	900	35.4	1665	65.6	700	0.92	1167	2568
	Utility	B	1726	67.9	1206	47.4	1200	1.57		—
		C	1730	68.0	1266	49.8	1400	1.83	848	1864
		D	1800	70.9	1386	54.6	1700	2.22	1116	2466

*Available only from Aurora, Illinois (NACD).

MODEL	BUCKET TYPE	BUCKET FAMILY	BUCKET BITE WIDTH ◄		BUCKET TIP RADIUS		HEAPED CAPACITY		BUCKET WEIGHT WITH LONG TIPS	
			mm	in	mm	in	L	yd³	kg	lb
231D, 231D LC	Trenching		1060	41	1730	68.1	1098	1.44	956	2106
	Excavation		1200	47	1660	65.4	1200	1.57	1035	2280
	Excavation		1345	53	1660	65.4	1387	1.81	1108	2440
	Excavation		1420	56	1660	65.4	1486	1.94	1147	2526
	Excavation		1377	54	1570	61.8	1351	1.78	1008	2222
	Excavation		1525	60	1570	61.8	1531	2.00	1031	2271
	Mass Excavation		1653	65	1730	68.1	2020	2.64	1304	2876
	Utility		1725	68	1300	51.2	1567	2.06	995	2192
330	Excavation	C	1370	53.9	1487	58.5	1100	1.44	884	1945
		C	1470	57.9	1487	58.5	1200	1.57	894	1967
		D	1430	56.3	1660	65.4	1400	1.83	1145	2519
		D	1500	59.1	1660	65.4	1500	1.96	1162	2557
		E	1470	57.9	1832	72.1	1700	2.22	1456	3203
		E	1600	63.0	1832	72.1	1900	2.49	1506	3314
	Extreme Service Excavation	C	1200	47.3	1518	59.8	1000	1.31	1031	2268
		D	1300	51.2	1695	66.7	1300	1.70	1284	2824
		E	1504	59.2	1890	74.4	1700	2.22	1660	3653
	Mass Excavation	D	1520	59.8	1660	65.4	1600	2.09	1267	2787
		E	1735	68.3	1832	72.1	2100	2.75	1265	3575
	Extreme Service Mass Excavation	C	1378	54.3	1518	59.8	1200	1.57	1131	2488
		D	1440	56.7	1695	66.7	1500	1.96	1377	3029
		E	1634	64.3	1890	74.4	1900	2.49	1755	3862
	Trenching	C	800	31.4	1607	63.2	700	0.92	683	1503
		C	925	36.4	1607	63.2	900	1.18	772	1699
		C	1075	42.4	1550	61.0	1000	1.31	798	1756
		C	1075	42.4	1607	63.2	1100	1.44	861	1895
		D	1060	41.3	1730	68.1	1100	1.44	969	2132
		D*	1075	42.3	1730	68.1	1200	1.50	1010	2222
		D	1200	47.2	1660	65.4	1200	1.57	1048	2306
		D	1200	47.2	1730	68.1	1300	1.70	1107	2441
		D*	1225	48.2	1730	68.1	1400	1.75	1112	2446
		D*	1375	54.1	1730	68.1	1600	2.12	1188	2616
	Extreme Service Trenching	C*	775	30.5	1638	64.5	700	0.88	827	1820
		D*	775	30.5	1764	69.4	700	0.88	957	2105
		D*	925	36.4	1764	69.4	900	1.25	1046	2301
		C	823	32.4	1638	64.4	700	0.95	813	1789
		C	948	37.3	1638	64.4	900	1.18	908	1998
		D	1070	42.1	1764	69.4	1100	1.44	1135	2498
	Rock	C	850	33.5	1540	60.5	600	0.78	1142	2513
		D	900	35.4	1665	65.6	700	0.92	1181	2599
	Utility	C	1730	68.0	1258	49.6	1400	1.83	888	1954
		D	1800	70.9	1385	54.5	1700	2.22	1138	2504

*Available only from Aurora, Illinois (NACD).

MODEL	BUCKET TYPE	BUCKET FAMILY	BUCKET BITE WIDTH		BUCKET TIP RADIUS		HEAPED CAPACITY		BUCKET WEIGHT WITH LONG TIPS	
			mm	in	mm	in	L	yd³	kg	lb
235D	Trenching		777	30.5	1980	78.0	1000	1.25	1110	2450
	Trenching ■		927	36	1980	78.0	1300	1.62	1270	2800
	Trenching ■		1077	42	1980	78.0	1600	2.00	1416	3120
	Rock ■		840	33	1778	70.0	800	1.00	1500	3310
	ET ■		861	34	1985	78.1	1100	1.38	1550	3400
	ET ■		1087	43	2060	81.1	1600	2.00	1815	3993
	Excavation ■		1227	48	1883	74.1	1600	2.12	1430	3150
	Excavation ■		1377	54	1883	74.1	1900	2.50	1560	3440
	Excavation ■		1600	63	1883	74.1	2300	3.00	1705	3758
	Excavation ■		1680	66	1735	68.3	2100	2.75	1690	3710
	Excavation ■		1800	71	1883	74.1	2680	3.50	2010	4431
	Utility		1760	69	1553	61.1	2300	3.00	1520*	3350*
235D ME	Excavation		1760	69	1760	69.2	2490	3.25	1880	4150
	EX (Rock)		1790	70.5	1790	70.5	2300	3.00	2230	4920
	LX		1880	74	1880	74.0	3540	4.62	1860	4100
E450	General Purpose		1160	46	1710	67	1150	1.50	1110	2450
	General Purpose		1330	52	1710	67	1380	1.80	1190	2620
	Excavation		1400	55	1710	67	1630	2.13	1270	2800
	General Purpose		1405	55	1870	73	1600	2.10	1505	3320
	General Purpose		1605	63	1870	73	1950	2.55	1660	3660
	Excavation		1680	66	1870	73	2350	3.07	1712	3775
E650	General Purpose		1240	49	2150	84	1800	2.3	2020	4455
	General Purpose		1413	56	2150	84	2100	2.8	2180	4805
	General Purpose		1633	64	2150	84	2600	3.4	2360	5200
	Excavation		1646	64	2150	84	3000	3.9	2420	5336
245D	Trenching		1081	42.5	2306	90.8	1900	2.50	1970	4330
	ET		1081	43	2310	90.9	1900	2.50	2610	5750
	Excavation		1231	48.5	2225	87.6	2000	2.62	1990	4370
	Excavation		1385	54.5	2225	87.6	2400	3.12	2160	4790
	Excavation		1739	68.5	1916	75.4	2800	3.50	2420	5330
	Excavation		2050	81	1916	75.4	3300	4.25	2760	6080
	Excavation		2083	82	2344	92.3	5100	6.67	2530	5578
	Excavation		2134	84	2007	79.0	3822	5.00	2850	6282
245D ME	Excavation		2168	84	1985	78.1	3900	5.10	2467	5440
	EX (Rock)		2168	84	2110	83.0	3021	3.95	3300	7270
	LX		2090	82	2298	90.5	5130	6.71	2650	5850

*Without tips

■ = VERSA LINK coupler available.

ET = Extreme Service Trenching.

LX = Light Material Excavation.

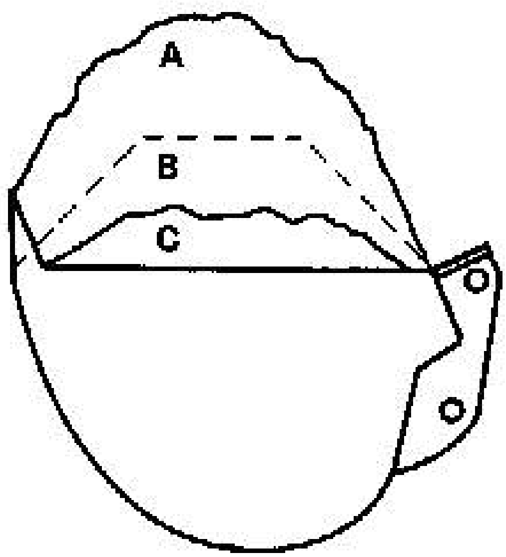
EX = Extreme Service Excavation.

BUCKET PAYLOAD

An excavator's bucket payload (actual amount of material in the bucket on each digging cycle) is dependent on bucket size, shape, curl force, and certain soil characteristics, i.e., the fill factor for that soil. Fill factors for several types of material are listed below.

Average Bucket Payload =
(Heaped Bucket Capacity) × (Bucket Fill Factor)

Material	Fill Factor Range (Percent of heaped bucket capacity)
Moist Loam or Sandy Clay	A — 100-110%
Sand and Gravel	B — 95-110%
Hard, Tough Clay	C — 80-90%
Rock — Well Blasted	60-75%
Rock — Poorly Blasted	40-50%



Working Weights — Bucket & Payload

The following tables give maximum "bucket plus payload" weights to assist in selecting the correct bucket for a specific application. These weights are based on actual job conditions. In better than average conditions the excavator may be able to achieve rated lift capacities listed in this section.

Stick	One-Piece Boom kg	One-Piece Boom lb
231D ME		
Short	5262	11,600
Medium	4717	10,400
231D LC ME		
Short	4899	10,800
Medium	4355	9600
231D		
Medium	4000	8800
Long	3540	7800
231D LC		
Medium	4180	9200
Long	3720	8200
235D		
Short	6850	15,100
Medium	6350	14,000
Long	5488	12,100
235D LC		
Short	9300	20,500
Medium	8660	19,100
Long	7570	16,700
245D (Extended Gauge Position)		
Short	9660	21,300
Medium	8890	19,600
Long	7210	15,900
245D Deep Trencher (Extended Gauge Position)		
Short	6800	15,100
Medium	6300	13,900
Long	5120	11,300
245D Heavy Lift Trencher (Wide Gauge Carbody — Extended)		
Short	12 000	26,600
Medium	11 200	24,700
Long	9300	20,600

Stick	One-Piece Boom kg	One-Piece Boom lb	Hydraulic Adjustable Boom kg	Hydraulic Adjustable Boom lb
211B LC — 600 mm (23.6") Track Shoes				
Short	2450	5400	2400	5300
Medium	2130	4700	2090	4600
Long	1950	4300	1900	4200
Ext. Long	1720	3800	1720	3800
Ext. Reach	1500	3300	1500	3300

Stick	One-Piece Boom kg	One-Piece Boom lb	Two-Piece Boom Fully Extended Lower Position kg	Two-Piece Boom Fully Extended Lower Position lb	Hydraulic Adjustable Boom kg	Hydraulic Adjustable Boom lb
213B LC — 500 mm (19.7") Track Shoes						
Short	2310	5100	2630	5800	2500	5500
Medium	1990	4400	2270	5000	2130	4700
Long	1810	4000	2090	4600	1950	4300
Ext. Reach	1310	2900	1540	3400	1450	3200

Stick	One-Piece Boom kg	One-Piece Boom lb	Hydraulic Adjustable Boom kg	Hydraulic Adjustable Boom lb
206B FT — Dozer Raised				
Short	1540	3400	1310	2900
Medium	1410	3100	1180	2600
Long	1250	2750	1040	2300
Ext. Long	1090	2400	910	2000
206B FT — Dozer Lowered				
Short	1810	4000	1590	3500
Medium	1630	3600	1410	3100
Long	1450	3200	1270	2800
Ext. Long	1270	2800	1130	2500
206B FT — 2 PT. Outriggers — Lowered				
Short	2130	4700	1950	4300
Medium	1900	4200	1770	3900
Long	1720	3800	1590	3500
Ext. Long	1540	3400	1410	3100
206B FT — Dozer & 2 Outriggers — Lowered				
Short	2450	5400	2450	5400
Medium	2220	4900	2220	4900
Long	1990	4400	2040	4500
Ext. Long	1790	3950	1790	3950
206B FT — 4 PT. Outriggers — Lowered				
Short	2880	6350	2940	6500
Medium	2540	5600	2680	5900
Long	2340	5150	2450	5400
Ext. Long	2090	4600	2180	4800

• **Counterweight 3000 kg (6615 lb)**

Stick	One-Piece Boom kg	One-Piece Boom lb	Hydraulic Adjustable Boom kg	Hydraulic Adjustable Boom lb
212B FT — Rear Dozer Raised				
Short	1500	3300	1410	3100
Medium	1270	2800	1180	2600
Long	1130	2500	1040	2300
Ext. Long	950	2100	910	2000
Ext. Reach	770	1700	730	1600
212B FT — Rear Dozer Lowered				
Short	1770	3900	1680	3700
Medium	1500	3300	1460	3200
Long	1360	3000	1220	2700
Ext. Long	1180	2600	1130	2500
Ext. Reach	1000	2200	950	2100
212B FT — 2PT. Rear Outriggers Lowered				
Short	2040	4500	2090	4600
Medium	1770	3900	1790	3950
Long	1590	3500	1630	3600
Ext. Long	1410	3100	1460	3200
Ext. Reach	1180	2600	1220	2700
212B FT — 2 PT. Outriggers & Rear Dozer Lowered				
Short	2360	5200	2610	5750
Medium	2040	4500	2270	5000
Long	1840	4050	2060	4550
Ext. Long	1630	3600	1860	4100
Ext. Reach	1410	3100	1590	3500
212B FT — 4 PT. Outriggers Lowered				
Short	2720	6000	3311	7300
Medium	2360	5200	2900	6400
Long	2180	4800	2650	5850
Ext. Long	1900	4200	2400	5300
Ext. Reach	1630	3600	2040	4500

Stick	One-Piece Boom kg	lb	Two-Piece Boom Fully Extended Lower Position kg	lb	Two-Piece Boom Fully Retracted Lower Position kg	lb	Hydraulic Adjustable Boom kg	lb
214B/214B FT Rear Dozer Raised								
Short	1630	3600	1860	4100	3400	7500	1770	3900
Medium	1360	3000	1590	3500	2900	6400	1510	3400
Long	1220	2700	1450	3200	2680	5900	1360	3000
Ext. Reach	820	1800	1040	2300	1950	4300	950	2100
214B Outriggers on Rear — Lowered								
Short	2310	5100	2630	5800	4630	10,200	2500	5500
Medium	1950	4300	2270	5000	3960	8700	2180	4800
Long	1810	4000	2090	4600	3630	8000	1990	4400
Ext. Reach	1360	3000	1540	3400	2680	5900	1500	3300
214B Rear Dozer Lowered								
Short	1860	4100	2270	5000	3990	8800	2130	4700
Medium	1680	3700	1900	4200	3400	7500	1810	4000
Long	1500	3300	1770	3900	3080	6800	1680	3700
Ext. Reach	1090	2400	1270	2800	2270	5000	1180	2600
214B/214B FT with 4PT. Outriggers Lowered								
Short	3670	8100	4040	8900	7030	15,500	3900	8600
Medium	3220	7100	3540	7800	5940	13,100	3400	7500
Long	2950	6500	3270	7200	5440	12,000	3130	6900
Ext. Reach	2270	5000	2540	5600	4040	8900	2400	5300
214B Dozer + 2PT. Outriggers — Lowered								
Short	3080	6800	3450	7600	5990	13,200	3310	7300
Medium	2720	6000	2990	6600	5080	11,200	2860	6300
Long	2450	5400	2770	6100	4630	10,200	2630	5800
Ext. Reach	1860	4100	2130	4700	3450	7600	2000	4400
224B with 2PT. Outriggers — Lowered								
Short	2860	6300	3080	6800	6440	14,200		
Medium	2540	5600	2720	6000	5580	12,300		
Long	2360	5200	2540	5600	5220	11,500		
Ext. Reach	1860	4100	2000	4400	3990	8800		
224B with 4PT. Outriggers — Lowered								
Short	4400	9700	4720	10,400	9570	21,100		
Medium	3950	8700	4220	9300	8260	18,200		
Long	3720	8200	3990	8800	7760	17,100		
Ext. Reach	2990	6600	3180	7000	5860	12,900		
224B 4PT. Outriggers Raised								
Short	2000	4400	2180	4800	4670	10,300		
Medium	1720	3800	1910	4200	4080	9000		
Long	1580	3500	1770	3900	3860	8500		
Ext. Reach	1220	2700	1360	3000	2950	6500		

Model	Stick	Stick Length m	Stick Length ft	Bucket Capacity** SAE Heaped L	Bucket Capacity** SAE Heaped yd³	Bucket Payload kg	Bucket Payload lb	Bucket Weight kg	Bucket Weight lb	Working Weight Bucket & Payload kg	Working Weight Bucket & Payload lb
E70B	Short	1.39	4'6"	280	.37	420	926	210	463	630	1390
	Medium	1.72	5'8"	280	.37	420	926	210	463	630	1390
	Long	2.21	7'3"	180	.24	285	627	166	364	450	992
E110B	Short	1.95	6'5"	520	.68	780	1720	400	882	1180	2602
	Medium	2.25	7'5"	450	.59	675	1488	380	838	1055	2326
	Long	2.80	9'2"	450	.59	675	1488	380	838	1055	2326
E120B	Short	2.10	6'11"	570	.75	855	1885	405	893	1260	2778
	Medium	2.50	8'2"	520	.68	780	1720	400	882	1180	2602
	Long	3.00	9'10"	520	.68	780	1720	400	882	1180	2602
E140	Short	2.13	7'0"	630	.82	945	2084	495	1091	1440	3175
	Long	2.74	9'0"	570	.75	855	1885	467	1030	1322	2915
E240C	Short	2.2	7'3"	1140	1.50	1710	3766	858	1892	2568	5658
	Medium	2.8	9'2"	950	1.26	1425	3138	818	1804	2243	4942
	Long	3.5	11'6"	860	1.12	1290	2841	741	1634	2031	4475
	Short	2.2	7'3"	1430*	1.87*	2145	4724	806	1976	3041	6700
	Medium	2.8	9'2"	1240*	1.62*	1860	4096	828	1826	2688	5922
E450	Short	3.1	10'2"	1950	2.50	2925	6442	1660	3660	4585	10,110
	Medium	3.8	12'5"	1600	2.09	2400	5286	1505	3319	3905	8611
	Long	4.8	15'9"	1380	1.81	2070	4565	1190	2624	3260	7188
	Short	3.1	10'2"	2350*	3.07*	3525	7764	1712	3775	5237	11,548
	Medium	3.8	12'5"	1950*	2.5*	2925	6442	1660	3660	4585	10,110
E650	Medium	3.47	11'5"	2600	3.4	3900	8600	2500	5511	6400	14,110
	Medium	3.47	11'5"	3000	3.9	4500	9920	2560	5543	7060	15,463

*Bucket sizes suitable for Material Density 1500 kg/m³ (2528 lb/yd³)

**Akashi Sourced Buckets

Model	Boom	Stick Length m	Stick Length ft	Bucket Capacity* SAE Heaped L	Bucket Capacity* SAE Heaped yd³	Bucket Payload kg	Bucket Payload lb	Bucket Weight kg	Bucket Weight lb	Working Weight Bucket & Payload kg	Working Weight Bucket & Payload lb
320	Reach	1.90	6'3"	1100	1.44	1650	3638	801	1766	2451	5404
		2.50	8'2"	900	1.18	1350	2976	642	1415	1992	4392
		2.92	9'7"	800	1.05	1200	2646	618	1362	1818	4008
		3.86	12'8"	700	0.92	1050	2315	573	1263	1623	3578
	Mass	1.90	6'3"	1200	1.57	1800	3968	836	1843	2636	5811
		2.40	7'10"	1100	1.44	1650	3638	801	1766	2451	5404
		2.92	9'7"	1000	1.31	1500	3307	702	1548	2202	4855
	VA	1.90	6'3"	1100	1.44	1650	3638	801	1766	2451	5404
		2.40	7'10"	1000	1.31	1500	3307	734	1618	2234	4925
		2.92	9'7"	900	1.18	1350	2976	657	1448	2007	4424
325	Reach	2.00	6'7"	1400	1.83	2100	4630	1085	2392	3185	7022
		2.66	8'8"	1100	1.44	1650	3638	801	1766	2451	5404
		3.20	10'6"	1000	1.31	1500	3307	734	1618	2234	4925
		4.20	13'9"	800	1.05	1200	2646	618	1362	1818	4008
	Mass	2.00	6'7"	1500	1.96	2250	5622	1099	2423	3349	7383
		2.50	8'2"	1400	1.83	2100	4630	1085	2392	3185	7022
		3.20	10'6"	1200	1.57	1800	3968	836	1843	2636	5811
	VA	2.00	6'7"	1400	1.83	2100	4630	1085	2392	3185	7022
		2.50	8'2"	1200	1.57	1800	3968	974	2147	2774	6118
		3.20	10'6"	1100	1.44	1650	3638	801	1766	2451	5404
330	Reach	2.15	7'1"	1700	2.22	2550	5622	1350	2976	3900	8598
		2.80	9'2"	1500	1.96	2250	4960	1099	2423	3349	7383
		3.30	10'10"	1400	1.83	2100	4630	1085	2392	3185	7022
		3.90	12'10"	1200	1.57	1800	3968	974	2147	2774	6116
		4.80	15'9"	1000	1.31	1500	3307	734	1618	2234	4925
	Mass	2.15	7'1"	1900	2.49	2850	6283	1420	3131	4270	9414
		2.55	8'4"	1700	2.22	2550	5622	1350	2976	3900	8598
		3.50	11'6"	1500	1.96	2250	4960	1099	2423	3349	7383

Note: Bucket sizes suitable for Material Density 1500 kg/m³ (2529 lb/yd³)
*[illegible] buckets

INTRODUCTION

Long reach excavators are designed specifically for those jobs requiring reach capability beyond the range of normal excavators. Applications for which long reach excavators are ideally suited include ditch cleaning, slope finishing, river conservation, and other work formerly reserved for draglines.

Caterpillar offers three hydraulic excavator models in long reach arrangements. Each model uses purpose-built booms and sticks designed by Caterpillar for maximized performance and durability.

320 L LONG REACH
325 L LONG REACH

Long Reach Front Includes: Boom, stick, linkage cylinders (boom, stick, and bucket), hydraulic lines, and additional counterweight for stability while working over the side.

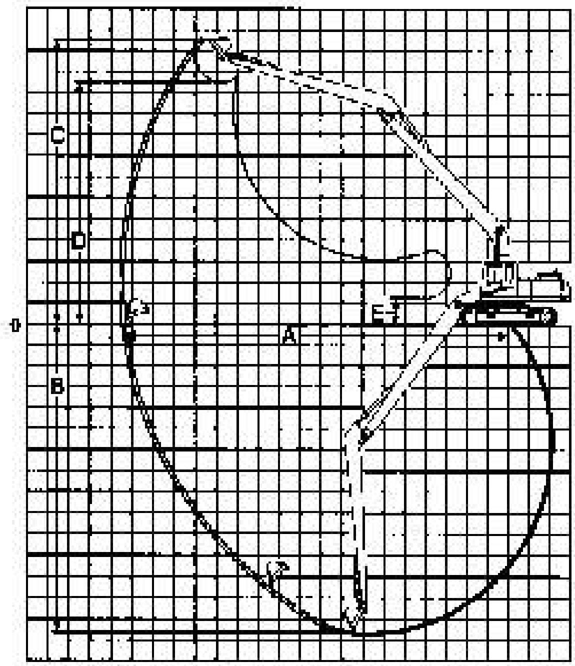
EL240C LONG REACH

Long Reach Front Includes: Boom, stick, linkage, cylinders (boom, stick, and bucket), hydraulic lines.

Also included are upper frame reinforcements and additional counterweight for stability while working over the side.

Caterpillar does not offer a long reach front end for the standard undercarriage E240B.

Note: Retrofit of the long reach front end to a standard, general purpose EL240B is not recommended because of the significant modifications needed to the upper frame. However, a machine equipped from the factory with a long reach front can be converted easily to a conventional excavator by replacing the front end attachments with standard backhoe front attachments.



Model	320 L LONG REACH mm	320 L LONG REACH ft	EL240C LONG REACH mm	EL240C LONG REACH ft
A Maximum Reach at Ground Level	15 725	51'7"	18 340	60'2"
B Maximum Digging Depth	11 880	39'0"	14 625	48'
C Maximum Cutting Height	13 290	43'7"	13 785	45'3"
D Maximum Dumping Height	11 010	36'1"	11 735	38'6"
E Minimum Loading Height	1970	6'6"	1175	3'9"

Model	325 L LONG REACH mm	325 L LONG REACH ft
A Maximum Reach at Ground Level	18 290	60'0"
B Maximum Digging Depth	14 625	48'0"
C Maximum Cutting Height	13 580	44'7"
D Maximum Dumping Height	11 560	37'11"
E Minimum Loading Height	3147	10'4"

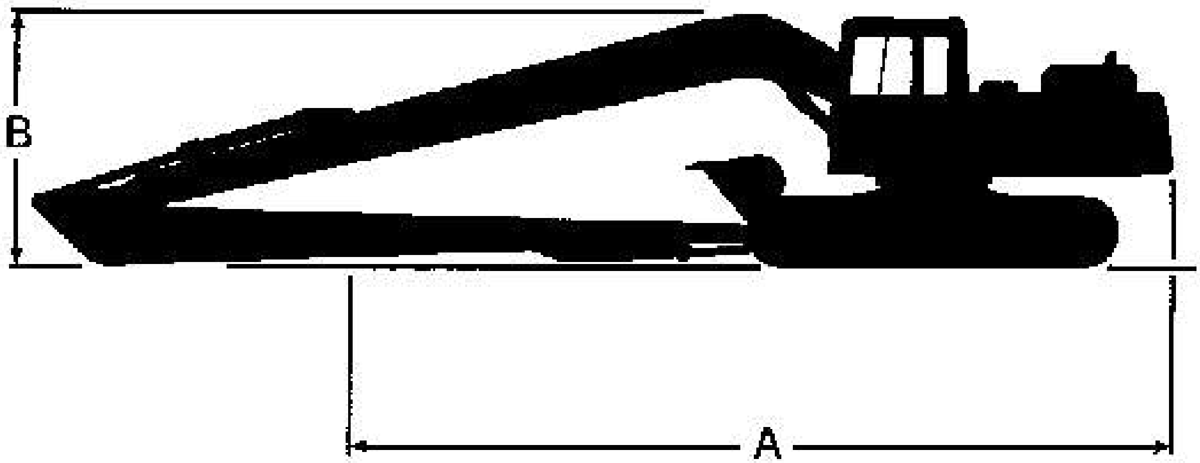
Note: All dimensions reflect machines equipped with ditch cleaning bucket.

320 L, 325 L LONG REACH

Bucket Type	Bucket Width		Tip Radius		SAE Heaped Cap.		Bucket Weight		No. of Teeth
	mm	in	mm	in	L	yd^3	kg	lb	
General Purpose	810	32	1220	48	450	.59	275	606	5
Ditch Cleaning	1142	45	1091	43	600	.78	346	763	None

EL240C LONG REACH

Bucket Type	Bucket Width		Tip Radius		SAE Heaped Cap.		Bucket Weight		No. of Teeth	Bucket Curl Force		Stick Crowd Force	
	mm	in	mm	in	L	yd^3	kg	lb		kN	lb	kN	lb
General Purpose	825	32.5	1220	48.0	450	.59	365	805	5	59	13,300	36	8155
Ditch Cleaning	1080	42.5	1090	42.9	550	.73	269	593	None	73	16,397	36	8155



LONG REACH ATTACHMENT SHIPPING DIMENSIONS

Model	320 L m	320 L ft	EL240C m	EL240C ft	325 L m	325 L ft
A Overall Transport Length (Front Folded)	12.65	41'6"	14.11	46'4"	13.50	44'3"
B Overall Height (To Top of Boom)	3.21	10'6"	3.03	9'11"	3.14	10'4"
Overall Width (To Widest Point)	3.18	10'5"	3.40	11'1"	3.39	11'1"

*225D LC Long Reach equipped with 18' stick
Note: For other base machine dimensions, see section on machines with GP attachments

LONG REACH ATTACHMENT COMPONENT WEIGHTS

Model	320 L kg	320 L lb	EL240C kg	EL240C lb	325 L kg	325 L lb
Additional Counterweight	800	1764	1600	3527	1100	2425
Long Reach Boom: Includes boom, stick cylinder, hydraulic lines, and pins for stick, stick cylinder, and boom rod end	2270	5004	2500	5510	3110	6858
Long Reach Stick: Includes stick, bucket linkage and pins, bucket cylinder and pin, and hydraulic lines	1260	2778	1400	3086	1570	3461

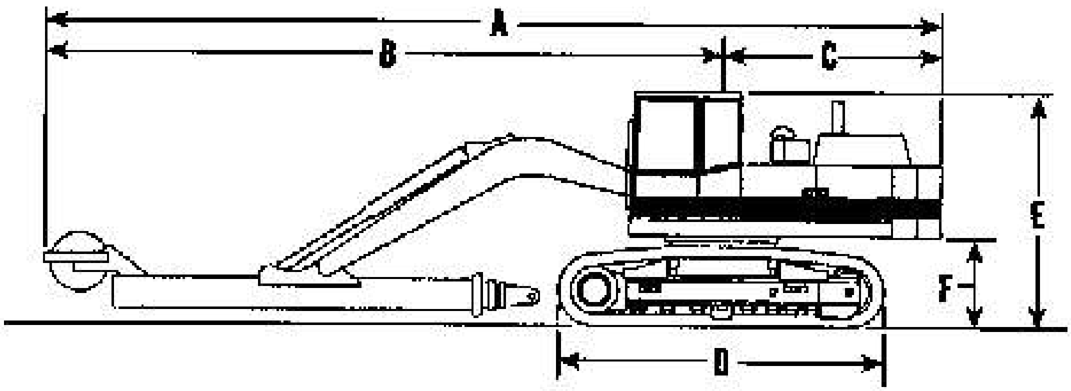
INTRODUCTION

Caterpillar offers a telescopic stick for the 320/320 L and the E/EL240B. This special stick arrangement is used in the same light- to medium-duty applications as are clamshell buckets on conventional sticks, but it provides additional digging depth and dump height.

This hydraulically extendable and retractable stick consists of an outer tube, a middle tube, and an inner tube. A hydraulic cylinder mounted inside the assembly extends and retracts the stick much like a retractable radio antenna. A hose reel mounted at the top of the stick dispenses extra hose as required and safely stores the hose when the stick is retracted.

The additional digging depth and dump height of the telescopic stick expand the application zone of a normal clamshell arrangement. Typical applications include material rehandling, placing small rip rap below water level, and light-duty digging. Urban jobs requiring extended digging depth while working within the limitations of trench shoring or utility lines (i.e. sewer/water/gas laterals) are other applications to which the telescopic stick arrangement is suited. The design of this special stick limits its use to light- to medium-duty applications.

In addition to the telescopic stick and special hydraulic controls, these arrangements include upper frame reinforcements and additional counterweight. Because of the nature of these modifications, retrofitting this stick is not recommended. However, a machine equipped with this telescopic stick arrangement can be converted to a conventional excavator by replacing the telescopic stick and clamshell bucket with a standard backhoe stick and bucket.

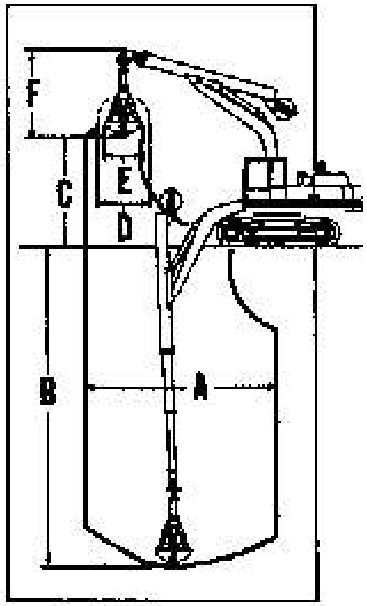


TELESCOPIC STICK SHIPPING DIMENSIONS

Model	320* mm	320* ft	320 L* mm	320 L* ft	E240C mm	E240C ft	EL240C mm	EL240C ft
A Overall transport length	13 960	45'10"	13 960	45'10"	14 325	47'0"	14 325	47'0"
B Swing radius	11 270	37'0"	11 270	37'0"	11 460	37'7"	11 460	37'7"
C Tail swing radius	2690	8'10"	2690	8'10"	2865	9'5"	2865	9'5"
D Overall track length	4075	13'4"	4455	14'7"	4150	13'7"	4350	14'10"
E Cab height	2930	9'7"	2930	9'7"	2980	9'9"	2980	9'9"
F Ground clearance, counterweight	1030	3'5"	1030	3'5"	1100	3'7"	1100	3'7"

*Custom Product Available in Akashi sourced version.

Telescopic Stick
- Specifications
- Range Dimensions



Model	320*		320 L*		E240C		EL240C	
Weight	22 200 kg	48,940 lb	22 800 kg	50,270 lb	25 400 kg	56,000 lb	26 450 kg	58,320 lb
Bucket Capacity (With Ejector)	430 L	0.56 yd³	430 L	0.56 yd³	600 L	0.85 yd³	800 L	1.05 yd³
Type	Hydraulic Actuation		Hydraulic Actuation		Hydraulic Actuation		Hydraulic Actuation	
Speed: Extend	8 seconds		8 seconds		8 seconds		8 seconds	
Retract	11 seconds		11 seconds		11 seconds		11 seconds	
Down Pressure	5000 kg	11,020 lb	5000 kg	11,020 lb	5500 kg	12,125 lb	5500 kg	12,125 lb
Additional Counterweight	600 kg	1320 lb	600 kg	1320 lb	500 kg	1102 lb	500 kg	1102 lb
A Max Working Radius	8000 mm	26'3"	9000 mm	29'6"	9500 mm	31'2"	8000 mm	26'3"
B Depth	20 226 mm	66'4"	20 226 mm	66'4"	20 310 mm	66'8"	20 570 mm	67'6"
C Max Dump Height	5100 mm	16'8"	5100 mm	16'9"	5280 mm	17'3"	5000 mm	16'5"
D Max Opening	1505 mm	4'11"	1505 mm	4'11"	1605 mm	4'11"	1575 mm	5'2"
E Side Profile Width (Bucket Closed)	1275 mm	4'2"	1275 mm	4'2"	1275 mm	4'2"	1440 mm	4'2"
F Distance From Stick End to Bottom of Bucket	2865 mm	9'5"	2865 mm	9'5"	2865 mm	9'5"	3125 mm	10'3"
Cutting Width	1000 mm	3'3"	1000 mm	3'3"	1000 mm	3'3"	1328 mm	4'4"

*Custom Product: Available in Akashi sourced version.

EXCAVATOR SELECTION: TRACKS VERSUS WHEELS

Tracks (211B LC, 213B LC)

Unless the application calls for a lot of travel to, from, and around the job sites, a track-type excavator could be the better choice. Track-type excavators provide good traction and flotation in almost all kinds of underfoot conditions. Consistently good drawbar power provides excellent maneuverability. The tracked undercarriage also provides good overall stability. If the job calls for frequent machine repositioning, a track-type excavator will provide better operating efficiency — where raising and lowering outriggers would take extra time.

Wheels (206B FT, 212B FT, 214B, 214B FT, 224B)

Mobility is the key for wheel-type excavators. For instance, a wheel-type excavator can travel to and from the job site without a trailer. It can travel around the job site faster. And a wheel unit can travel over paved surfaces without damaging them.

The front axle oscillates 8.5° above and below ground level helping to keep all four wheels on the ground for maximum traction, smooth ride, and excellent stability. There's good stability when lifting heavy loads, even if the machine is working only on its wheels. This is especially true when the oscillating axle is locked. Dual tires are more rigid and provide greater stability than single tires. When a dozer blade or rear outrigger is used, stability is better than that of a track type machine. And the ultimate in stability comes from two sets of outriggers. A wheel-type excavator can be tailored to job requirements by (1) choice of tires, (2) choice of one or two sets of outriggers, and (3) use of dozer blade. When working on uneven terrain, the optional independently controlled outriggers can be used to level the machine within the limits of outrigger movement. The 206B/212B dozer can be mounted front or rear to handle light dozing and backfilling operations.

Features:

Tracks	Wheels
• Flotation	• Mobility
• Traction	• No pavement damage
• Maneuverability	• Better stability with outriggers or dozers
• Severe underfoot	• Leveling machine with outriggers
• Faster machine repositioning	• Dozing capability

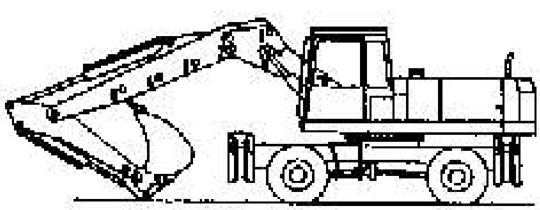
213B LC and 214B/214B FT Stick/Bucket Combinations

The following charts list possible stick/bucket combinations for the 213B LC and 214B/214B FT based on excavator stability factor as determined according to DIN standard 24087. This standard applies to excavators when being used for excavating and not for lifting. It applies to wheeled and tracked machines.

Excavator stability is measured:

1. At maximum reach
2. With a material density of 1800 kg/LCM (3030 lb/LCY)
3. Over 360 degrees swing

All data is for a two-piece boom with foreboom in the upper position. Data in parentheses represents foreboom in lower position.



1 = Foreboom fully extended (holes 1 and 2), also indicates stick/bucket combination with a one-piece boom.
2 = Foreboom in holes 2 and 3 (partially retracted)
3 = Foreboom in holes 3 and 4 (213B LC, 214B, 224B: partially retracted)
4 = Foreboom in holes 4 and 5 (213B LC, 214B, 214B FT, 224B fully retracted)
0 = Stability not assured
NOTE: All data assumes machine on firm, level ground

213B LC

	General Purpose Buckets	Rock Buckets	Clamshells					All Ditch Cleaning Buckets
Cutting Width (mm)			<810	910	1010	910**	1010**	
Cutting Width (in)			<32	36	40	36**	40**	
Capacity (ISO) (L)			<450	505	560	1060	1170	
Capacity (ISO) (yd^3)			<0.59	0.66	0.77	1.39	1.53	
1800 mm (5'11") Stick Long U/C	1	1	1	1	1	1	1	1
2300 mm (7'6.5") Stick Long U/C	1	1	1	1	1	1	2	1
2800 mm (9'2") Stick Long U/C	1	1	1	1	1	1	2	1

214B, 214B FT

	General Purpose Buckets				Rock Buckets		Clamshells						All Ditch Cleaning Buckets
Cutting Width (mm)	<910	1010	1110	1210	<760	1010	<810	810	910	1010	910**	1010**	
Cutting Width (in)	<36	40	44	48	<30	40	<32	32	36	44	36**	44**	
Capacity (ISO) (L)	<486	552	617	683	<475	600	<410	450	505	560	1060	1170	
Capacity (ISO) (yd^3)	<0.64	0.73	0.81	0.90	<0.63	0.79	<0.54	0.59	0.66	0.73	1.39	1.53	
1800 mm (5'11") Stick dozer or out-rig. raised	1	1	1	1	1	1	1	1	1	1	3	3	1
dozer on ground	1	1	1	1	1	1	1	1	1	1	2	2	1
rear outrig. on ground	1	1	1	1	1	1	1	1	1	1	1	1	1
2300 mm (7'6.5") Stick dozer or out-rig. raised	1	1	2	2	1	1	1	1	1	2	3	0	1
dozer on ground	1	1	1	1	1	1	1	1	1	1	2	3	1
rear outrig. on ground	1	1	1	1	1	1	1	1	1	1	1	2	1
2800 mm (9'2") Stick dozer or out-rig. raised	1	1	1	2	1	1	1	1	2	2	0	0	1
dozer on ground	1	1	1	1	1	1	1	1	1	1	3	4	1
rear outrig. on ground	1	1	1	1	1	1	1	1	1	1	2	3	1

**Loose material buckets

206B FT*

	General Purpose Buckets								Rock Buckets		Clamshells					Ditch Cleaning Buckets: Rigid		Ditch Cleaning Buckets: +/−45 Degrees	
Cutting Width (mm)	<610	610	710	810	910	1010	1110	1210	610	760	<380	610	710	810	810	1800	2000	1800	2000
Cutting Width (in)	<20	24	28	32	36	40	44	48	24	30	<15	24	28	32	32	71	79	71	79
Capacity (ISO) (L)	<260	320	355	420	486	552	617	683	350	475	<180	310	380	410	450	430	480	430	480
Capacity (ISO) (yd^3)	<0.34	0.42	0.46	0.55	0.64	0.73	0.81	0.90	0.46	0.63	<0.25	0.41	0.47	0.54	0.59	0.57	0.63	0.57	0.63

211B LC*

	General Purpose Buckets							Rock Buckets			Clamshells			Ditch Cleaning Buckets: Rigid		Ditch Cleaning Buckets: +/−45 Degrees		
Cutting Width (mm)	<510	610	810	910	1010	1110	1210	<610	760	1010	<710	810	810	<1800	2000	<1500	1800	2000
Cutting Width (in)	<20	24	32	36	40	44	48	<24	28	40	<28	32	32	<71	79	<59	71	79
Capacity (ISO) (L)	<260	320	420	486	552	617	683	<350	475	600	<360	410	450	<430	480	<355	430	480
Capacity (ISO) (yd^3)	<0.34	0.42	0.55	0.55	0.64	0.73	0.82	<0.46	0.63	0.79	<0.47	0.54	0.59	<0.57	0.63	<0.47	0.57	0.63

212B FT*

	General Purpose Buckets									Rock Buckets		Clamshells				Ditch Cleaning Buckets: Rigid		Ditch Cleaning Buckets: +/−45 Degrees		
Cutting Width (mm)	<510	610	810	910	1010	1110	1210	1310	1410	<610	760	<610	710	810	810	<1800	2000	1500	1800	2000
Cutting Width (in)	<20	24	32	36	40	44	48	52	56	<24	30	<24	28	32	32	<71	79	59	71	79
Capacity (ISO) (L)	<260	320	420	486	552	617	683	780	866	<360	475	<310	360	410	460	<430	480	355	430	480
Capacity (ISO) (yd^3)	<0.34	0.42	0.55	0.64	0.73	0.81	0.90	1.04	1.13	<0.46	0.63	<0.41	0.47	0.54	0.59	<0.57	0.63	0.47	0.57	0.63

*For use with hydraulic adjustable boom.

EXCAVATOR SHOE SELECTION

Undercarriage life can be extended by equipping the machine properly for the application.

Many excavators work on pavement or flat, soft ground and experience few undercarriage problems. But if those same machines (usually equipped with wide track pads) were placed in severe underfoot conditions, undercarriage destruction could occur very rapidly.

The rule, used for other track-type machines — *"Whenever possible use the narrowest shoes available" — is even more valid for excavators.*

The best general purpose track shoe is the triple grouser section. It has a good section modulus and offers the best compromise between traction and minimum disturbance to paved surface.

The double grouser shoe has a better section modulus and is more aggressive than the triple grouser section. Single grouser shoes are offered for maximum traction. Some users like single grousers for added mobility in hilly terrain.

The following table lists ground pressures for various width shoes (one-piece boom, medium stick and bucket):

Model	Shoe Type	Shoe Width mm	Shoe Width in	Pressure kPa	Pressure psi
E70B	Triple	450	18	32.36	4.69
	Triple	600	24	25.50	3.70
	Apex	600	24	26.48	3.84
	Flat	450	18	33.34	4.83
E110B	Triple	500	20	39.23	5.69
	Triple	600	24	33.34	4.83
	Triple	700	28	29.42	4.27
	Triple	770	30	26.48	3.84
	Apex	770	30	26.48	3.84
	Flat	500	20	39.23	5.69
E120B	Triple	500	20	41.19	5.97
	Triple	600	24	35.03	5.08
	Triple	700	28	30.40	4.41
	Triple	770	30	28.44	4.12
	Apex	770	30	28.44	4.12
	Flat	500	20	41.19	5.97
E140	Triple	500	20	46.16	6.70
	Triple	600	24	39.27	5.70
	Triple	700	28	34.45	5.00
	Apex	770	30	30.32	4.40
	Flat	500	20	46.16	6.70
211B LC	Triple	600	24	35.3	5.1
	Triple	750	30	28.4	4.1
	Triple	900	35.4	24.6	3.6
	Triple	1000	39.4	22.5	3.3
211B NLC	Triple	600	24	35.3	5.1
	Triple	750	30	28.4	4.1
	Triple	900	35.4	24.6	3.6
213B LC	Triple	600	24	39.96	5.8
	Triple	750	30	33.07	4.8
	Triple	900	35.4	28.25	4.1
	Triple	1000	39.4	25.49	3.7

Model	Shoe Type	Shoe Width mm	in	Pressure kPa	psi
213B NLC	Triple	600	24	39.96	5.8
	Triple	760	30	33.07	4.8
	Triple	900	35.4	28.25	4.1
320*	Triple	600	24	44.04	6.39
	Triple	700	28	38.44	5.57
	Triple	800	32	34.05	4.94
	Apex	800	32	34.39	4.99
	Apex	900	35	31.55	4.57
	Flat	600	24	44.64	6.47
320 L*	Triple	600	24	41.04	5.95
	Triple	700	28	35.85	5.20
	Triple	800	32	31.77	4.61
	Apex	800	32	32.12	4.66
	Apex	900	35	29.56	4.28
320 N	Triple	500	20	54.50	7.90
E240C	Triple	600	24	50.00	7.2
	Triple	800	32	39.73	5.7
	Apex	900	35	36.28	5.25
EL240C	Triple	600	24	46.08	6.67
	Triple	800	32	36.28	5.26
	Apex	900	35	33.34	4.83
325	Triple	600	24	53.94	7.80
	Triple	700	28	48.05	6.97
	Triple	800	32	42.17	6.11
325 L	Triple	600	24	51.98	7.54
	Triple	700	28	45.11	6.54
	Triple	800	32	40.21	5.83
	Apex	900	35	35.30	5.12
325 LN	Triple	600	24	51.98	7.54
231D	Single	710	28	61.7	9.0
	Triple	600	24	72.5	10.5
	Triple	813	32	55.0	8.0
	Triple	914	36	49.3	7.2
231D LC	Triple	600	24	61.2	8.9
	Triple	813	32	46.7	6.8
	Triple	914	36	41.9	6.1
330	Triple	600	24	68.39	9.93
	Triple	750	30	53.94	7.82
330 L	Triple	600	24	61.39	8.90
	Triple	750	30	49.92	7.24
	Triple	850	32	44.91	6.51
330 LN	Triple	600	24	60.80	8.83

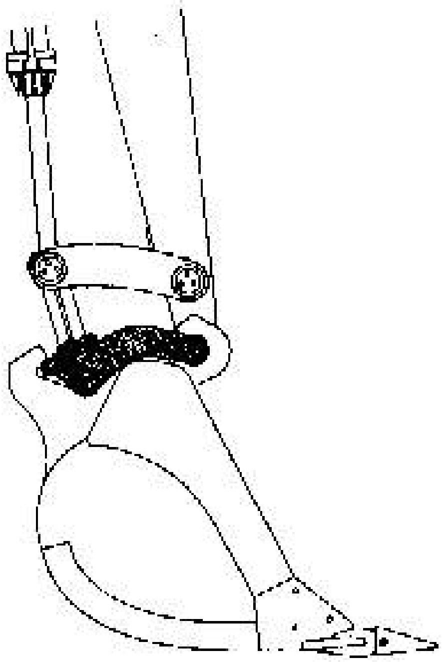
*3066T Engine

Model	Shoe Type	Shoe Width mm	Shoe Width in	Pressure kPa	Pressure psi
235D	Double	457	18	111.0	16.1
	Double	610	24	83.4	12.1
	Triple	760	30	68.2	9.9
	Triple	910	36	56.5	8.2
***235D LC**	Triple	610	24	81.4	11.8
	Triple	760	30	65.5	9.5
	Triple	910	36	54.5	7.9
235D SA	Double	810	32	71.1	10.4
***235D ME**	Double	457	18	103.4	15.0
	Double	610	24	77.9	11.3
	Triple	760	30	62.1	9.0
E450	Triple	610	24	80.34	11.66
	Triple	760	30	66.63	9.67
	Triple	910	36	57.19	8.25
E650	Triple	610	24	107.87	15.65
	Triple	760	30	88.25	12.80
	Triple	910	36	74.63	10.80
245D	Double	610	24	110.3	16.0
	Double	760	30	88.3	12.8
	Double	910	36	73.8	10.7
***245D ME**	Double	610	24	108.2	15.7
	Double	760	30	88.2	12.8
	Double	910	36	74.4	10.8
***245D Deep Trencher**					
Std. Roller Frame	Double	760	30	95.1	13.8
Std. Roller Frame	Double	910	36	79.3	11.5
Long Roller Frame	Double	910	36	75.8	11.0
***245D Heavy Lift Trencher**					
Std. Undercarriage	Double	760	30	94.4	13.7
Std. Undercarriage	Double	910	36	78.6	11.4
Wide Carbody, Long Roller Frame	Double	910	36	75.8	11.0

*Long stick

VERSA-LINK COUPLER FOR CATERPILLAR EXCAVATORS

The VERSA-LINK quick coupler is a unique Cat designed and built system for use with conventional bucket linkage. This system can be retrofitted to



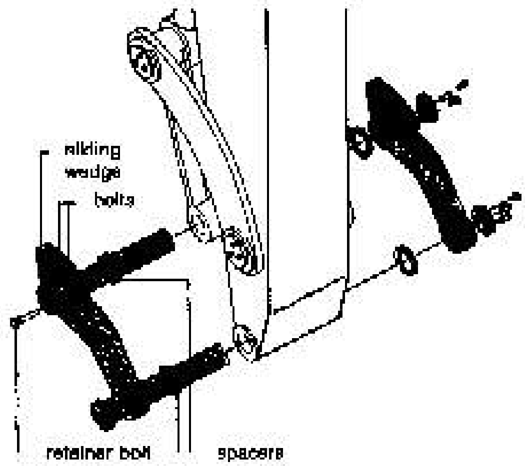
earlier model Cat excavators. The VERSA-LINK coupler allows you to match the right tool for the job.

Saves Time

One person can easily change any attachment in three minutes or less. Conventional methods require 2 or 3 men about 15 minutes or more to manually drive out the bucket pins, align the new attachment pin holes and reinstall the pins. The VERSA-LINK coupler eliminates this work and the subsequent damage that often occurs to the pins and seals.

Save Money

Special operators and equipment can be eliminated. The VERSA-LINK coupler reduces overall operating costs.



Increases Productivity

SELECT THE RIGHT TOOL FOR THE JOB . . . quick and easy tool change allows matching the most efficient attachment for the job.

INCREASED MACHINE VERSATILITY . . . with the VERSA-LINK coupler one excavator can do multiple tasks: drilling, ripping, compacting, etc.

INCREASED LIFT CAPACITY . . . removing the bucket eliminates dead weight and increases lift capacity.

INCREASED LIFT HEIGHT . . . removing the bucket also increases the lifting height. By eliminating the buckets "dead space."

INCREASED PRODUCTION TIME . . . downtime from changing attachments is cut to a minimum with the VERSA-LINK coupler. The machine spends more time at work.

Superior Design

LIGHTWEIGHT . . . the VERSA-LINK coupler with its lightweight and compact design gets greater payloads than heavier competitive couplers.

COMPACT . . . no loss of bucket breakout force since the VERSA-LINK coupler does not increase bucket tip radius.

Durable and Dependable — Designed and Built by Caterpillar

Can be used for extreme service applications. Sliding wedges compensate for wear and keep linkage arrangement tight. Wedge retainer bolts guard against tool loss if bolts are not fully tightened.

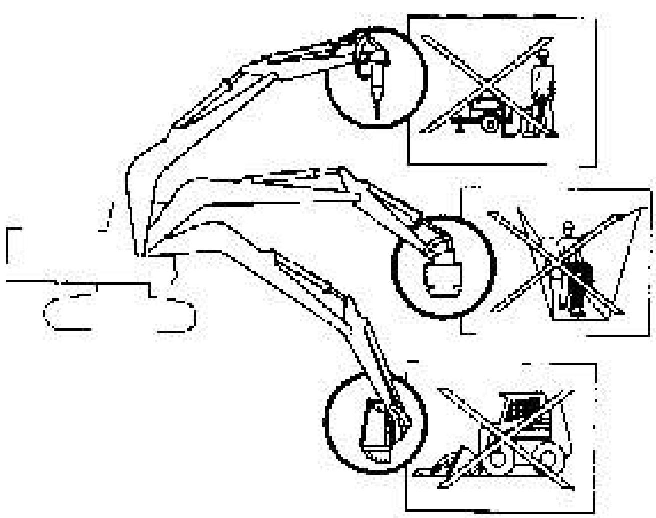
Adaptable/Versatile

The VERSA-LINK coupler adapts easily to a wide variety of work tools. Standard bucket pins are used for the installation and can be retrofitted.

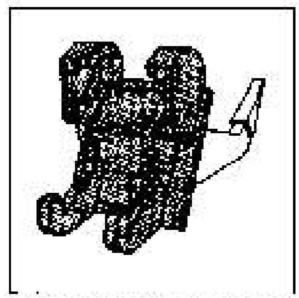
CONVERT BACK AND FORTH FROM VERSA-LINK SYSTEM TO CONVENTIONAL SYSTEMS . . . for non-coupler mated tools, the VERSA-LINK coupler can be removed by one person in 5-10 minutes without the need for special tools or lifting devices.

Adapter Assemblies and Conversion Kits

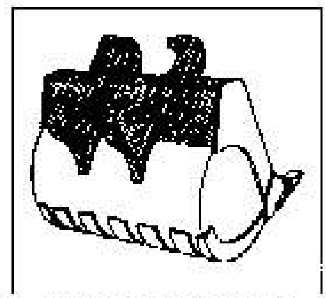
These are available to allow use of a variety of attachments and older model Cat buckets.



Adapter assemblies and conversion kits are available to permit a variety of attachments and earlier model Cat buckets to be used with Cat's VERSA-LINK system.



Adapter assemblies are attached to flat surfaces on tools such as hydraulic hammers, compactor wheels, hydraulic compactors, etc. for quick coupling.



Conversion kits eliminate the need for all new buckets. Mounting brackets on older model Cat buckets are replaced to match up with the new coupler system.

HYDRAULIC HAMMER APPLICATIONS

An excavator equipped with a hydraulic hammer can do a wide variety of work and reduce costs.

Hydraulic hammers are available from Balderson for the complete range of Cat hydraulic excavators.

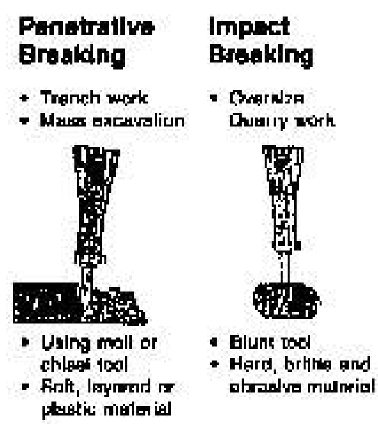
Hammer Applications

- Sewer and Water — The hammer can be used on pockets of rock that slow down production. Also good for breaking up old concrete pipes, manholes, etc.
- Road Construction — An essential tool during improvements and upgrading. The hammer works well on removing existing curbs, traffic islands, ramps, or sections of concrete. With special tools, it can cut asphalt.
- Bridge Renewal — Hammers are increasingly used to remove old bridge surfaces, railing supports, abutments, retaining walls, etc.
- Demolition — The hammer-equipped excavator is often a key helper in industrial demolition. It can break up fallen wall sections and floor sections as well as handling loading ramps, foundations, or other brick and concrete structures near ground level.
- Mining — Hammers can break oversized material to avoid secondary blasting, and size riprap.
- Trenching/ Primary Excavation — In soft or layered materials, the hydraulic hammer with a moil or chisel point can be cost-effective.
- Tunneling — This work has traditionally been performed by tunnel boring machines or the drill-and blast method. As hydraulic hammers have improved in power and reliability, they have been proven an economical alternative.
- Direct Quarrying — In many types of limestone, direct quarrying with hydraulic hammers can prove cost effective, especially where blasting is prohibited. See graphs on page 4-96 for production estimates.

A hammer need not be full time attachment for these applications. It can be replaced by a bucket in very little time so the excavator can be used for digging, loading, lifting, or other tasks.

Consult your Caterpillar dealer for advice on correct sizing, installation and tool selection.

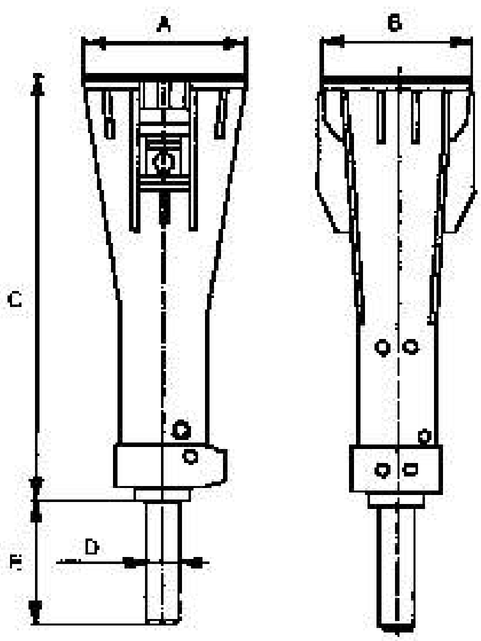
NOTES: Internal components of hammers are finely machined to close tolerances and require clean oil with full lubricating properties. Hammers also tend to heat hydraulic oil considerably and this can lead to earlier oil deterioration and the need for more frequent oil changes than recommended for the basic excavator. Extra care should also be taken to avoid the entry of dust or dirt when installing or removing a hammer in the field.



Balderson Hydraulic Hammer Selection Guide

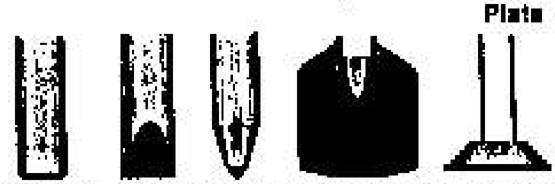
	HYDRAULIC EXCAVATORS											
	Track										Wheel	
Cat Model	245D	235D	231D	330	325	E240C	320	E120B	E110B	E70B	224B	214B
Hammer	B195											
	B170	B170										
		B160	B160									
			B140	B140*	B140*							
				B130*	B130*	B130*	B130*				B130	
							B115*	B115*			B115	B115
								B110*	B110*			B110
										B90*		
										B70*		

*Depends on hammer application and boom-stick combination



Tool Selection

Blunt | Chisel | Moil | Spade | Compacting Plate



Blunt	Chisel / Moil	Spade	Compacting Plate
Igneous and tough metamorphic rock into which tool doesn't penetrate	Sedimentary and weak metamorphic rock into which tool penetrates	Frozen or Compact Ground	Ground Compacting
Concrete	Concrete	Asphalt	B70
Breaking Boulders	Trenching	B70, B90	
B110 B195	Benching		
	All Models		

	A		B		C		D		E	
	mm	in	mm	in	mm	in	mm	in	mm	in
B195	1090	42.9	1090	42.9	2805	110.4	195	7.7	732	28.8
B170	730	28.7	730	28.7	2445	96.2	170	6.7	655	25.7
B160	730	28.7	730	28.7	2320	91.3	160	6.3	700	27.5
B140	585	23.0	540	21.3	2060	81.1	140	5.5	525	20.6
B130	570	22.4	510	20.0	1855	73.64	130	5.1	475	18.7
B115	570	22.4	510	20.0	1550	61.1	115	4.5	450	17.7
B110	520	20.5	400	15.8	1580	62.2	110	4.4	520	20.5
B90	480	18.9	380	15.0	—	—	90	3.5	409	16.1
B70	470	18.5	380	15.0	—	—	70	2.76	395	15.5

MODEL	**B195**		**B170**		**B160**	
Working weight[1]	5800 kg	**12,790 lb**	3450 kg	**7605 lb**	2900 kg	**6395 lb**
Impact frequency[2]	**300-400 bpm**		**300-400 bpm**		**400-600 bpm**	
Impact energy	12 000 J	**8851 ft-lb**	8200 J	**6048 ft-lb**	6000 J	**4426 ft-lb**
Impact energy class	20 340 J	**15,000 ft-lb**	13 560 J	**10,000 ft-lb**	10 170 J	**7500 ft-lb**
Operating pressure[3]	140 bar	**2030 psi**	155 bar	**2248 psi**	145 bar	**2103 psi**
Minimum carrier relief pressure[4]	190 bar	**2755 psi**	190 bar	**2755 psi**	180 bar	**2610 psi**
Hammer circuit maximum relief pressure[5]	215 bar	**3120 psi**	200 bar	**2900 psi**	190 bar	**2755 psi**
Acceptable oil flow	300-400 L/min	**79-105 gpm**	190-250 L/min	**50-60 gpm**	210-310 L/min	**55-82 gpm**
Maximum back pressure	10 bar	**145 psi**	5.1 bar	**75 psi**	5.1 bar	**75 psi**
Low pressure	—	—	—	—	—	—
Oil temperature	−15-77°C	**4-170°F**	−15-77°C	**4-170°F**	−15°-77°C	**4-170°F**
Oil viscosity	**15-1000 cSt**		**15-1000 cSt**		**15-1000 cSt**	
Line size (minimum)						
ID pressure	31.75 mm	**1.25 in**	25.4 mm	**1.00 in**	25.4 mm	**1.00 in**
ID return	50.8 mm or 2 x 38.1 mm	**2.00 in or 2 x 1.50 in**	31.75 mm	**1.25 in**	31.75 mm	**1.25 in**

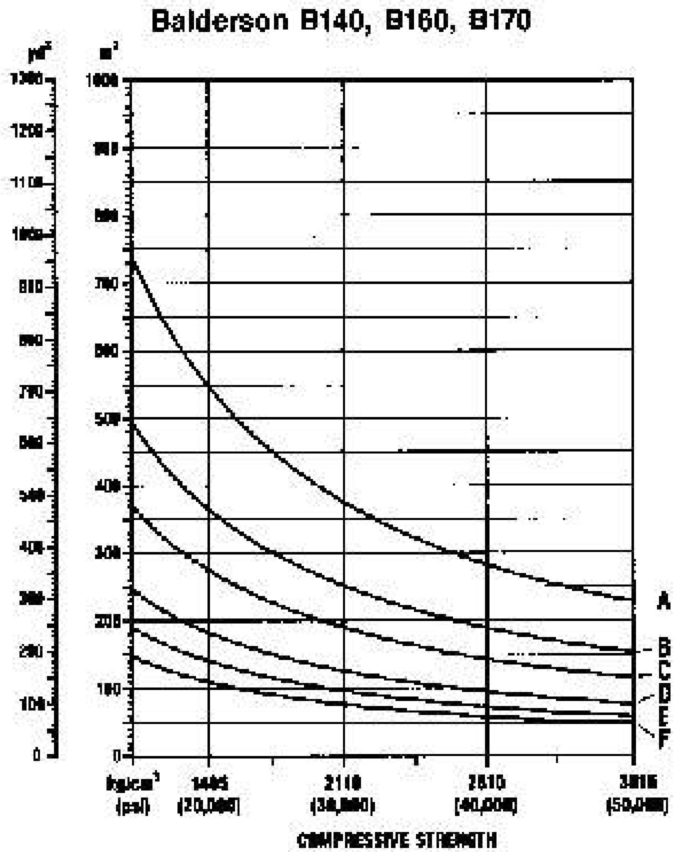
[1] Includes average mounting bracket and standard tool.
[2] Approximate value, actual impact frequency depends on oil flow, oil viscosity, temperature, and materials to be broken.
[3] Average value, actual pressure depends on flow, oil viscosity, temperature, material to be broken and back pressure.
[4] Setting of relief valve in carrier, correct valve depends on oil flow.
[5] Calculated hammer circuit relief = Actual Operating Pressure (PSI) + Actual Back Pressure (PSI) + Value Setting 435 PSI

MODEL	**B140**		**B130**		**B115**	
Working weight[1]	2200 kg	**4840 lb**	1690 kg	**3720 lb**	970 kg	**2136 lb**
Impact frequency[2]	**360-520 bpm**		**350-600 bpm**		**350-650 bpm**	
Impact energy	5200 J	**3838 ft-lb**	3600 J	**2681 ft-lb**	2200 J	**1623 ft-lb**
Impact energy class	6780 J	**5000 ft-lb**	4070 J	**3000 ft-lb**	2710 J	**2000 ft-lb**
Operating pressure[3]	140 bar	**2030 psi**	140 bar	**2030 psi**	140 bar	**2030 psi**
Minimum carrier relief pressure[4]	180 bar	**2610 psi**	175 bar	**2540 psi**	175 bar	**2540 psi**
Hammer circuit maximum relief pressure[5]	190 bar	**2755 psi**	185 bar	**2685 psi**	185 bar	**2685 psi**
Acceptable oil flow	160-230 L/min	**42-61 gpm**	120-160 L/min	**31-42 gpm**	70-110 L/min	**18-29 gpm**
Maximum back pressure	5.1 bar	**75 psi**	5.1 bar	**75 psi**	5.1 bar	**75 psi**
Low pressure	—	—	—	—	—	—
Oil temperature	−15-77°C	**4-170°F**	−15-77°C	**4-170°F**	15°-77°C	**4-170°F**
Oil viscosity	**15-1000 cSt**		**15-1000 cSt**		15-1000 cSt	
Line size (minimum)						
ID pressure	25.4 mm	1.00 in	25.4 mm	1.00 in	19.0 mm	.75 in
ID return	31.75 mm	1.25 in	25.4 mm	1.00 in	25.4 mm	1.00 in

[1] Includes average mounting bracket and standard tool.
[2] Approximate value, actual impact frequency depends on oil flow, oil viscosity, temperature, and materials to be broken.
[3] Average value, actual pressure depends on flow, oil viscosity, temperature, material to be broken and back pressure
[4] Setting of relief valve in carrier, correct valve depends on oil flow
[5] Calculated hammer circuit relief = Actual Operating Pressure (PSI) + Actual Back Pressure (PSI) + Value Setting 435 PSI

MODEL	B110		B90		B70	
Working weight[1]	850 kg	**2090 lb**	450 kg	**990 lb**	405 kg	**890 lb**
Impact frequency[2]	**390-560 bpm**		**450-1000 bpm**		**600-1800 bpm**	
Impact energy	1800 J	**1328 ft-lb**	1000 J	**738 ft-lb**	730 J	**538 ft-lb**
Impact energy class	2035 J	**1500 ft-lb**	1355 J	**1000 ft-lb**	1015 J	**750 ft-lb**
Operating pressure[3]	130-140 bar	**1885-2030 psi**	90-100 bar	**1305-1450 psi**	100-130 bar	**1450-1885 psi**
Minimum carrier relief pressure[4]	185 bar	**2685 psi**	155-175 bar	**2248 to 2538 psi**	130-190 bar	**1885 to 2756 psi**
Hammer circuit maximum relief pressure[5]	210 bar	**3045 psi**	210 bar	**3045 psi**	220 bar	**3190 psi**
Acceptable oil flow	70-100 L/min	**18-29 gpm**	60-135 L/min	**16-36 gpm**	50-150 L/min	**13-40 gpm**
Maximum back pressure	6 bar	**90 psi**	20 bar	**290 psi**	30 bar	**435 psi**
Low pressure	—	—	33-34 bar	**480-495 psi**	38-40 bar	**550-580 psi**
Oil temperature	– 15-77°C	**4-170°F**	– 15-77°C	**4-170°F**	– 15°-77°C	**4-170°F**
Oil viscosity	**15-1000 cSt**		**15-1000 cSt**		**15-1000 cSt**	
Line size (minimum)						
ID pressure	19 mm	**.75 in**	19 mm	**.75 in**	25.4 mm	**1.00 in**
ID return	25.4 mm	**1.00 in**	19 mm	**.75 in**	25.4 mm	**1.00 in**

[1] Includes average mounting bracket and standard tool.
[2] Approximate value, actual impact frequency depends on oil flow, oil viscosity, temperature, and materials to be broken.
[3] Average value, actual pressure depends on flow, oil viscosity, temperature, material to be broken and back pressure.
[4] Setting of relief valve in carrier, correct valve depends on oil flow.
[5] Calculated hammer circuit relief = Actual Operating Pressure (PSI) + Actual Back Pressure (PSI) + Value Setting 435 PSI

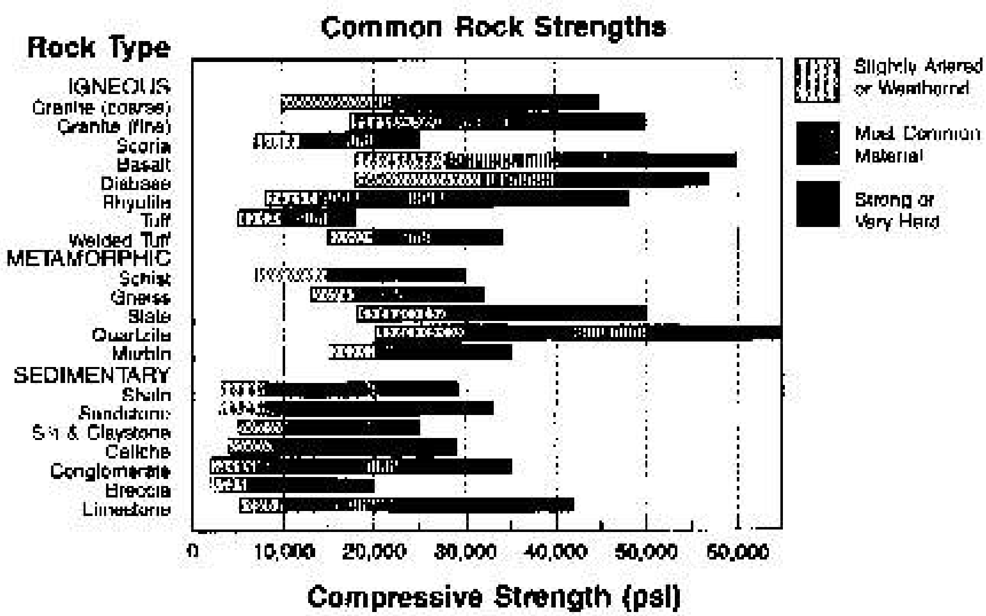


KEY

A — Bedding thickness less than 20 inches
B — Bedding thickness — 20 to 40 inches
C — Bedding thickness — 40 to 60 inches or closely spaced vertical fractures
D — Some vertical fracturing
E — Widely spaced vertical fractures
F — Massive formation

The figures are for comparison and evaluation purposes only. Results will vary depending on operation, carrier and job conditions.

In tunneling, trenching and primary breaking applications, production estimate should be reduced according to trench shape and dimensions of section to be excavated. Reduction factors range from .8 to .6 on average.



The rock strengths shown are those most commonly encountered by Caterpillar in near surface excavations. Highly altered or deeply weathered rocks can have strength values much lower than those listed. Also, strength values greater than those shown may occasionally be encountered.

EQUIPMENT FOR . . .	E70B	E110B	E120B	E140B	320 320 L 320 N
Undercarriage:					
Standard	•	•	•	•	•
Long					•
Narrow					•
Boom					
One Piece Reach	•	•	•	•	•
Sticks	mm / ft	mm / ft	mm / ft	mm / ft	mm / ft
Short	1390 / 4'7"	1950 / 6'5"	2100 / 6'11"	2130 / 7'0"	1900 / 6'3"
•	1720 / 5'8"	2250 / 7'5"	2500 / 8'2"	2740 / 9'0"	2500 / 8'2"
•	2210 / 7'3"	2800 / 9'2"	3000 / 9'10"	— / —	2920 / 9'7"
Long	— / —	— / —	— / —	— / —	3860 / 12'8"
Boom					
One Piece Mass					•
Two Piece VA					•
Sticks	mm / ft	mm / ft	mm / ft	mm / ft	mm / ft
Short					1900 / 6'3"
•					2400 / 7'10"
Long					2920 / 9'7"
Bucket Family					B, C
Buckets (No. of)	5	7	6	6	18
Teeth					
Long	•	•	•	•	•
Side Cutters:					
Blade					•
Track Shoes:	Triple Grouser 450, 600 mm (18", 24") Apex 600 mm (24") Flat 460 mm (18")	Triple Grouser 500, 600, 700, 770 mm (19.7, 23.6, 27.6, 30.3") Apex 770 mm (30.3") Flat 500 mm (19.7")	Triple Grouser 500, 600, 700, 770 mm (19.7, 23.6, 27.6, 30.3") Apex 770 mm (30.3") Flat 500 mm (19.7")	Triple Grouser 500, 600, 700 mm (19.7, 23.6, 27.6") Apex 770 mm (30.3") Flat 500 mm (19.7")	Triple Grouser 500, 600, 700, 800 mm (19.7, 23.6, 27.6 31.5") Apex 800, 900 mm (31.5, 35.4") Flat 600 mm (23.6")
Cat VERSA-LINK					
Coupler*					

*Available in North America sales area only.
Note: Number of buckets includes Gen. Purpose, Trenching and Rock. Other types of buckets have not been included.

EQUIPMENT FOR . . .	E240C EL240C	325 325 L 325 LN	330 330 L 330 LN	E450	E650
Undercarriage:					
Standard	•	•	•	•	•
Long	•	•	•		
Long Narrow*		•	•		
Boom					
One Piece Reach	•	•	•	•	•
Sticks	mm ft	mm ft	mm ft	mm ft	mm ft
Short	2200 7'3"	2000 6'7"	2150 7'1"	3100 10'2"	3470 11'5"
•	2800 9'2"	2650 8'8"	2800 9'2"	3800 12'5"	— —
•	3500 11'6"	3200 10'6"	3300 10'10"	4800 15'9"	— —
•	— z-	4200 13'9"	3900 12'10"	— —	— —
Long	— —	— —	4900 15'9"	— —	— —
Boom					
One Piece Mass		•	•		
Two Piece VA		•			
Sticks	mm ft	mm ft	mm ft	mm ft	mm ft
Short		2000 6'7"	2150 7'1"		
•		2500 8'2"	2550 8'4"		
Long		3200 10'6"	3500 11'6"		
Bucket Family		B, C, D	C, D, F		
Buckets (No. of)	9	26	26	6	7
Teeth					
Short	•	•	•	•	•
Side Cutters:					
Blade	•	•	•	•	
Track Shoes:	Triple Grouser 600, 800 mm (23.6, 31.5") Apex 900 mm (35.4")	Triple Grouser 600, 700, 800 mm (23.6, 27.6, 31.5") Apex 900 mm (35.4")	Triple Grouser 600, 750, 850 mm (23.6, 29.5, 33.5")	Triple Grouser 610, 760, 910 mm (24, 30, 36")	Triple Grouser 610, 760, 910 mm (24, 30, 36")
VERSA-LINK					
Coupler*	•				

*Available in North America sales area only.
Note: Number of buckets includes Gen. Purpose, Trenching and Rock. Other types of buckets have not been included.

EQUIPMENT FOR . . .	231D 231D LC		235D		245D	
Undercarriage:						
Standard, track-type	•		•		•	
Long (LC)	•					
Special App.						
Vari. Gauge	•		•		•	
Wide gauge						
Wheeled						
Booms:						
One-piece	•		•		•	
Backhoe Sticks:	mm	ft	mm	ft	mm	ft
Short	2300	7'7"	2440	8'0"	2605	8'6"
Medium	2900	9'6"	2900	9'5"	3214	10'6"
Long	3500	11'6"	3660	12'0"	4420	14'6"
Extra Long	—	—		-	4672	15'0"
Buckets (No. of)	8		10		6	
Teeth:						
Abrasion	•		•		•	
Long (G.P.)	•		•		•	
Short (Rock)	•		•		•	
Penetration	•		•		•	
Wide (Spade)	•		•		•	
Sharp	•		•		•	
Side Cutters:						
One-Piece						
Blade	•		•		•	
Combination	•		•		•	
Tooth	•		•		•	
Strike Off	•		•		•	
Track Shoes:	Single grouser 711 mm (28")		Double 457 & 610 mm (18" & 24")		Double grouser 610, 760, 910 mm (24", 30", 36")	
	Triple 600 & 710 813 & 914 mm (24", 28", 32", 36")		Triple 760 & 813 & 914 mm (30", 32", 36")		910 mm (36")	
VERSA-LINK Coupler			•			

Note: Number of buckets shown includes general purpose, rock, mass excavation and trenching. Not included are ditch cleaning, ditch grading and trapezoidal ditching.

EQUIPMENT FOR . . .	206B FT	211B LC	212B FT	213B LC	214B 214B FT	224B
Undercarriage:						
Standard, track-type						
Long (LC)		•		•		
Special App.						
Narrow Gauge		•		•		
Wheeled	•		•		•	•
Booms:						
One piece	•	•	•	•	•	•
Hyd. Adjust.	•	•	•	•	•	•
Two piece				•	•	•
Backhoe Sticks:	mm / ft	mm / ft	mm / ft	mm / ft	mm / ft	mm / ft
Short	1600 / 5'3"	1600 / 5'3"	1600 / 5'3"	1800 / 5'11"	1800 / 5'11"	1800 / 5'11"
Medium	2100 / 6'10.5"	2300 / 7'6.5"	2300 / 7'6.5"	2300 / 7'6.5"	2300 / 7'6.5"	2300 / 7'6.5"
Long	2600 / 8'6"	2800 / 9'2"	2800 / 9'2"	2800 / 9'2"	2800 / 9'2"	2800 / 9'2"
Extra Long	— / —	4000 / 13'2"	4000 / 13'2"	4000 / 13'2"	4000 / 13'2"	4000 / 13'2"
Material Handling	—	3000 / 9'10"	3000 / 9'10"	3000 / 9'10" 3500 / 11'6"	3000 / 9'10" 3500 / 11'6"	— 3500 / 11'6"
Buckets (No.)	14	14	14	14	14	10
Teeth:						
Abrasion	•	•	•	•	•	•
Long (G.P.)	•	•	•	•	•	•
Short (Rock)	•	•	•	•	•	•
Penetration	•	•	•	•	•	•
Wide (Spade)	•	•	•	•	•	•
Sharp						
Side Cutters:						
One-Piece	•	•	•			
Blade	•	•	•			
Combination						
Tooth						
Strike Off	•	•	•			
Track Shoes: or Tires:	Tires: Duals 10.00-20 Singles 18-19.5	Triple grouser 600, 750 900 mm 1000 mm (23.6", 29.5", 35.4", 39.4")	Tires: Duals 10.00-20 Singles 18-19.5	Triple grouser 600, 750 900 mm 1000 mm (23.6", 29.5", 35.4", 39.4")	Tires: Duals 10.00-20 11.00-20 Singles 18-22.5	Tires: Duals 10.00-20 11.00-20 Singles 18-19.5 18-22.5

Note: Number of buckets shown includes general purpose, rock and trenching. Not included are ditch cleaning, ditch grading and trapezoidal ditching. Some rock buckets are made as ordered for the 213B LC, 214B, 214B FT and 224B.

Work Tools	206B FT	211B LC	212B FT	213B LC	214B/214B FT	224B
Clamshell*	X	X	X	X	X	X
Ditch Cleaning Bucket	X	X	X	X	X	X
Ditch Grading Bucket	X	X	X			
Grapples*	X	X	X	X	X	X
Hammer Installation Kit	X	X	X	X	X	X

*With hydraulic rotator.

Work Tools	E70B	E110B	E120B	E140	E240C	E450	E650
General Purpose Buckets	X	X	X	X	X	X	X
Clamshells				X	X		
Grapple				X			
Ripper Tooth	X	X	X	X	X		X
Nipper		X	X	X			
Hydraulic Hammer Installation Kit	X	X	X	X	X		
Long Reach Ditch Cleaning Bucket					X		
Bucket w/Ripper				X	X		X
Bucket w/Ejector	X			X			
Bank Forming Bucket	X	X	X	X			
Trapezoidal Bucket	X						
Loading Bucket						X	X
Extreme Service Bucket w/Ripper							X
Extreme Service Bucket							
Ditch Cleaning Bucket		X	X				

Note: Models and tools shown above are only available in selected sales areas. Contact the Caterpillar Regional sales office for availability.
320, 325, 330 No work tools other than buckets in attachment list.

Work Tools	245D	235D	231D	325	E240C	E120B	E70
Quick Coupler	X	X	X		X	X	X
Swinger Coupler					X	X	X
Cemetery Bucket							X
Ditch Cleaning	X	X	X	X	X	X	
Perform Plus	X	X	X		X	X	X
Extreme Duty	X	X	X		X		
Trapezoidal	X	X			X		
Coal	X						
Coal Stripping		X					
Tilt Bucket			X	X	X		
Jaw Bucket							
Ripper Bucket		X			X	X	X
Ripper Tooth	X	X			X	X	
Thumb	X	X	X	X	X	X	X
Construction Grapple		X	X	X	X	X	
Medium Grapple		X	X		X	X	
Trash Grapple		X	X		X	X	
Hydraulic Hammer	X	X	X		X	X	X
Backfill Blade						X	X

CYCLE TIME ESTIMATING CHARTS

The digging cycle of the excavator is composed of four segments:

1. Load Bucket
2. Swing Loaded
3. Dump Bucket
4. Swing Empty

Total excavator cycle time is dependent on machine size (small machines can cycle faster than large machines) and job conditions. With excellent job conditions the excavator can cycle fast. As job conditions become more severe (tougher digging, deeper trench, more obstacles, etc.), the excavator slows down accordingly. As the soil gets harder to dig, it takes longer to fill the bucket. As the trench gets deeper and the spoil pile larger, the bucket has to travel farther and the upper structure has to swing farther on each digging cycle.

Spoil pile or truck location also affects cycle time. If a truck is located on the floor of the excavation beside material being moved, 10 to 17 second cycles are practical. The other extreme would be a truck or spoil pile located above the excavator 180° from the excavation.

In sewer construction work the operator may not be able to work at full speed because he has to dig around existing utilities, load the bucket inside a trench shield, or avoid people working in the area.

The Cycle Time Estimating Chart (next page) outlines the range of total cycle time that can be expected as job conditions range from excellent to severe. Many variables affect how fast the excavator is able to work. The chart defines the range of cycle times frequently experienced with a machine and provides a guide to what is an "easy" or a "hard" job. The estimator can then evaluate the conditions of his job and use the Cycle Time Estimating Chart to select the appropriate working range. A practical method of further calibrating the Cycle Time Estimating Chart is to observe excavators working in the field and correlate measured cycle times to job conditions, operator ability, etc.

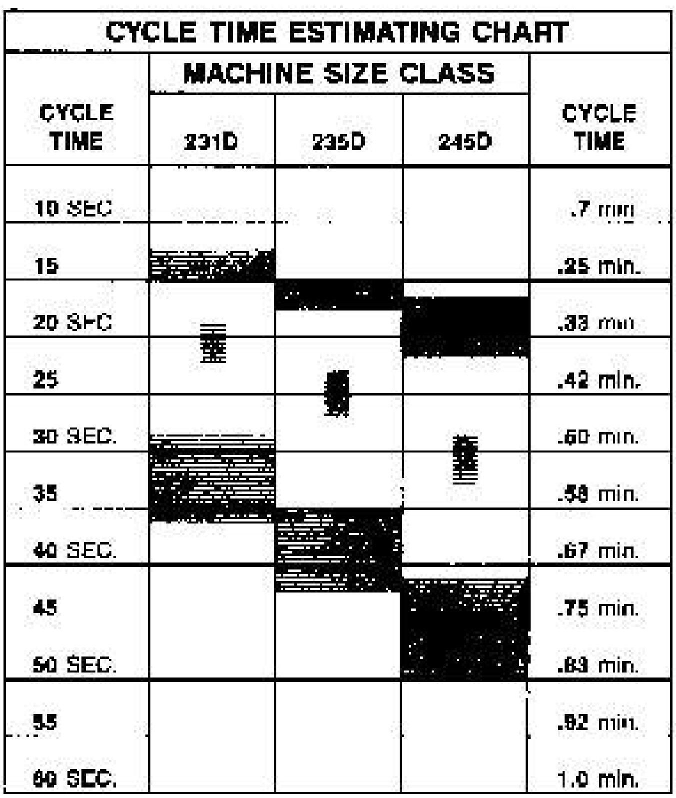
The following table breaks down what experience has shown to be typical Caterpillar excavator cycle times with

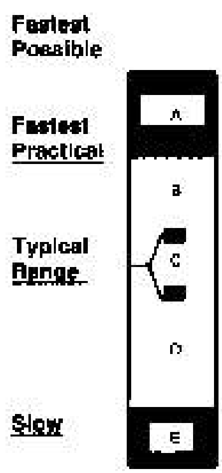
— no obstruction in the right of way
— above average job conditions
— an operator of average ability and
— 60°-90° swing angle.

These times would decrease as job conditions or operator ability improved and would get slower as conditions become less favorable.

Cycle Time Estimating Chart

Model	235D	245D
Bucket Size		
L	2100	2600
(yd^3)	2.75	3.5
Soil Type	Hard Clay	Hard Clay
Digging Depth		
m	4.0	5.2
(ft.)	13	17
Load Bucket	0.11 min.	0.12 min.
Swing Loaded	0.10 min.	0.12 min.
Dump Bucket	0.04 min.	0.05 min.
Swing Empty	0.08 min.	0.10 min.
Total Cycle Time (min.)	0.33 min.	0.39 min.





KEY
A — Excellent
B — Above Average
C — Average
D - Below Average
E — Severe

CYCLE TIME -vs- JOB CONDITION DESCRIPTION

— Easy digging (unpacked earth, sand gravel, ditch cleaning, etc.). Digging to less than 40% of machine's maximum depth capability. Swing angle less than 30°. Dump onto spoil pile or truck in excavation. No obstructions. Good operator.

— Medium digging (packed earth, tough dry clay, and with less than 25% rock content). Depth to 50% of machine's maximum capability. Swing angle to 60°. Large dump target. Few obstructions.

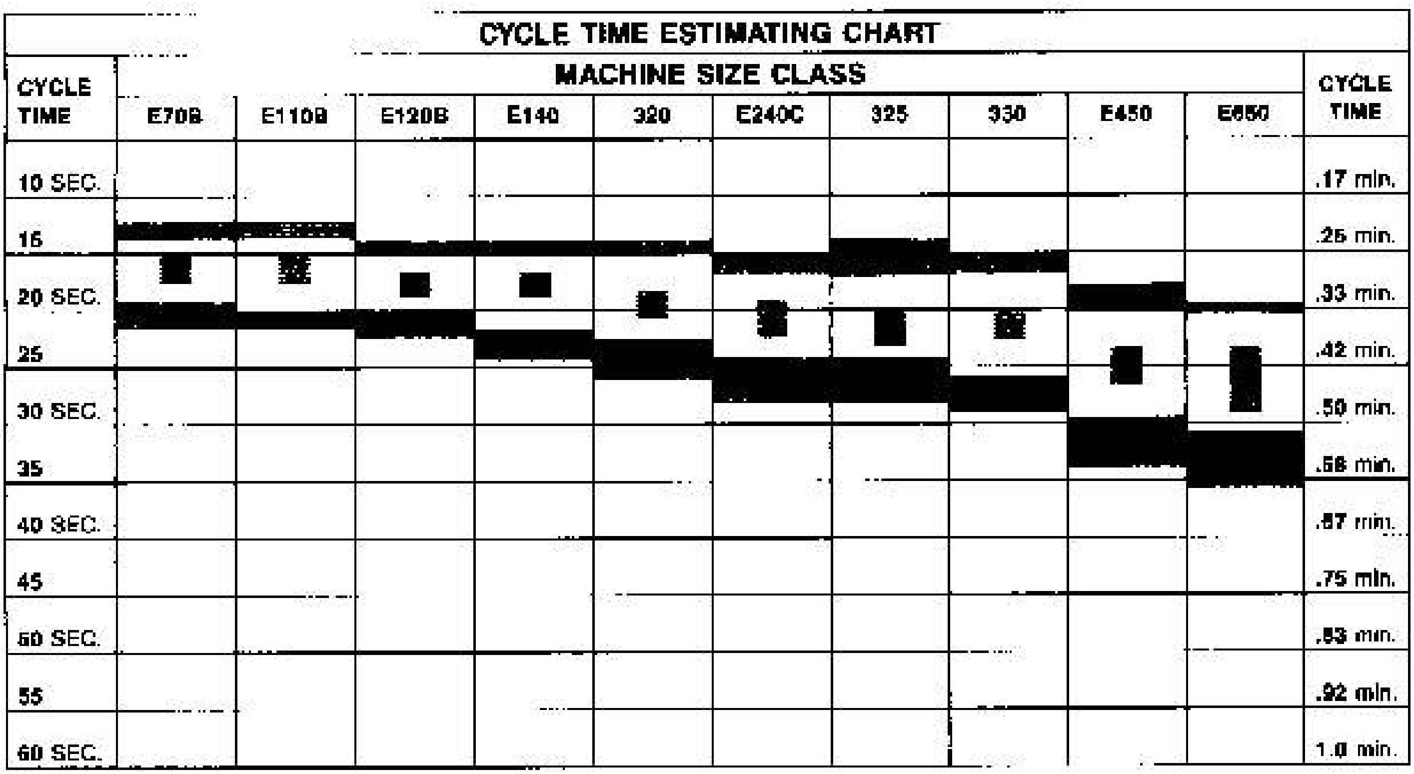
— Medium to hard digging (hard packed soil with up to 50% rock content). Depth to 70% of machine's maximum capability. Swing angle to 90°. Loading trucks with truck spotted close to excavator.

Hard digging (shot rock or tough soil with up to 75% rock content). Depth to 90% of machine's maximum capability. Swing angle to 120°. Shored trench. Small dump target. Working over pipe crew.

Toughest digging (sandstone, caliche, shale, certain limestones, hard frost). Over 90% of machine's maximum depth capability. Swing over 120°. Loading bucket in man box. Dump into small target requiring maximum excavator reach. People and obstructions in the work area.

Cycle Time Estimating Chart

MODEL	E70B	E110B	E120B	E140	320	E240C	325	330	E450	E650	
Bucket Size L JIS (yd³) SAE	250 (3/8)	400 (5/8)	450 (5/8)	650 (3/4)	700 (1-1/8)	900 (1-3/8)	1000 (1-3/8)	1200 (1-3/4)	1700 (2-1/2)	2600 (3.4)	Liters (cubic yards)
Soil Type	← Packed Earth			→	← Hard Clay					→	
Digging Depth m (ft)	1.5 (5)	1.5 (6)	1.8 (6)	1.8 (6)	2.3 (8)	3.2 (10)	3.2 (10)	3.4 (11)	4.2 (14)	5.2 (17)	m (ft)
Load Bucket	0.08	0.07	0.07	0.09	0.09	0.09	0.09	0.09	0.11	0.11	min
Swing Loaded	0.05	0.08	0.08	0.08	0.08	0.07	0.06	0.07	0.09	0.10	min
Dump Bucket	0.03	0.03	0.03	0.03	0.03	0.05	0.04	0.04	0.07	0.08	min
Swing Empty	0.06	0.05	0.06	0.05	0.05	0.06	0.06	0.07	0.07	0.08	min
Total Cycle Time	0.22	0.21	0.21	0.23	0.23	0.27	0.25	0.27	0.34	0.37	min



EARTHMOVING PRODUCTION

As with any other piece of material handling equipment, excavator earthmoving production is dependent on average bucket payload, average cycle time and job efficiency. If an estimator can accurately predict excavator cycle time and bucket payload, a machine's earthmoving production can be derived from the following formula.

$$\text{m}^3 \text{ (yd}^3\text{)/60 min hr} = \text{Cycles/60 min hr} \times \text{Avg. Bucket Payload in m}^3 \text{ (yd}^3\text{)}$$

$$\text{m}^3 \text{ (yd}^3\text{)/60 min hr} = \frac{\text{60 min/hr}}{\text{Cycle Time} - \text{min}} \times \text{Avg. Bucket Payload in m}^3 \text{ (yd}^3\text{)}$$

$$\text{Avg. Bucket Payload} = \text{Heaped Bucket Capacity} \times \text{Bucket Fill Factor}$$

$$\text{Actual m}^3 \text{ (yd}^3\text{)/hr} = \text{m}^3 \text{ (yd}^3\text{)/60 min hr} \times \text{Job Efficiency Factor}$$

The Production Estimating Tables (next page) will provide theoretical earthmoving production in cubic meters (yards) per hour if average payload and cycle time can be estimated. The values in the table are based on a 60 minute work hour or 100% efficiency (a condition that is never achieved in reality). The estimator should apply a job efficiency factor to the figures in the table based on his judgment or knowledge of actual job conditions.

Areas outlined on the Production Estimating Table define the work ranges of excavators in the size classes of Caterpillar E110B through 245D Excavators. The upper limit on each area corresponds to the "fastest practical" cycle time for the machines. The width of each area corresponds to the range of bucket payload sizes the machine can handle. An unshaded box has been provided in each machine area to provide a guide indicating that the upper limit of earthmoving production is being approached. When working beyond the values in the white area, the estimator should be certain that excellent job conditions will be encountered (easy digging, shallow trench, good operator, etc.).

The Production Estimating Table can also serve as a guide when selecting the proper size machine to do a job, as is shown in the following example.

Example problem (Metric)

Contractor has a job to move 15 300 Bm³ (19 100 Lm³ considering 25% swell factor) of wet sandy loam material in rear dump on-highway trucks which will be loaded by an excavator. Average face depth will be 2.4 m with 60-90 degree average swing angle. Ten days are available to do the work. Contractor plans to work 10 hrs/day and estimates a 50 min. work hour (83% job efficiency). He has two excavators that could be made available to do the work — a 320 with 1.0 m³ bucket or a 235D with 1.9 m³ bucket. Experience has shown that either machine can get its rated capacity in the sandy loam soil. Could this job be done with either machine or will the 235D have to be used?

Solution: The excavator must produce 1900 Lm³/Day (19 100 Lm³ ÷ 10 Days) which means the required average hourly rate will be 190 Lm³/50 Min. Hr. (1900 Lm³/Day ÷ 10 hrs/day). Further considering the 83% job efficiency, the excavator's capability will have to be 230 Lm³/60 min hr.

The Production Estimating Table shows that the 320 would have to achieve 15 second average cycle times in order to get this production rate with a 1.0 m³ bucket, while the 235D could obtain the needed production with only 30 second cycle times. The cycle times estimating chart shows that the 320 would be working near its maximum capability to meet the production requirement, whereas, the 235D could handle the job easily. This information can then be weighed against what else is known about the job (reach requirements, job conditions, operator ability, etc.) to decide whether or not the larger machine is needed.

Example problem (English)

Substitute these English values in the preceding problem:

Job — 20,000 BCY (25,000 LCY considering 25% swell).
Average face depth — 8-12 ft
320 L with 1.25 yd³ bucket or 235D with 2.5 yd³ bucket.

Solution: The excavator must produce 2500 LCY/Day, which means the required average hourly rate will be 250 LCY/50 min hr Further considering the 83% job efficiency the excavator's capability will have to be 300 LCY/60 min hr.

The same concluding comments regarding the Production Estimating Table apply here as in the Metric example.

Cubic Meters per 60 Minute Hour*

ESTIMATED CYCLE TIMES		ESTIMATED BUCKET PAYLOAD** — LOOSE CUBIC METERS																		ESTIMATED CYCLE TIMES	
Cycle Time																					
Seconds	Minutes	.2	.3	.5	.7	.9	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	Cycles Per Min.	Cycles Per Hr.
10.0	.17																			6.0	360
11.0	.18																			5.5	330
12.0	.20																			5.0	300
13.3	.22	54	81	135	189															4.5	270
15.0	.25	48	72	120	168	216	264	312												4.0	240
17.1	.29	42	63	105	147	189	231	273	315	357	399	441								3.5	210
20.0	.33	36	54	90	126	162	198	234	270	306	342	378	414	450	486	522	558			3.0	180
24.0	.40	30	45	75	105	135	165	195	225	255	285	315	345	375	405	435	465			2.5	150
30.0	.50			60	84	108	132	156	180	204	228	252	276	300	324	348	372			2.0	120
35.0	.58						112	133	153	173	194	214	235	255	275	296	316			1.7	102
40.0	.67										171	189	207	225	243	261	279			1.5	90
45.0	.75																			1.3	78
50.0	0.83																			1.2	72

Cubic Yards per 60 Minute Hour*

ESTIMATED CYCLE TIMES		ESTIMATED BUCKET PAYLOAD** — LOOSE CUBIC YARDS																		ESTIMATED CYCLE TIMES	
Cycle Time																					
Seconds	Minutes	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.50	5.00	Cycles Per Min.	Cycles Per Hr.
10.0	.17																			6.0	360
11.0	.18																			5.5	330
12.0	.20																			5.0	300
13.3	.22	67	135	202	270															4.5	270
15.0	.25	60	120	180	240	300	360	420												4.0	240
17.1	.29	52	105	157	210	262	315	367	420	472	525	577								3.5	210
20.0	.33	45	90	135	180	225	270	315	360	405	450	495	540	585	630	675	720			3.0	180
24.0	.40	37	75	112	150	187	225	262	300	337	375	412	450	487	525	562	600			2.5	150
30.0	.50			80	120	150	180	210	240	270	300	330	360	390	420	450	480			2.0	120
35.0	.58						154	180	205	231	256	282	308	333	360	385	410			1.7	102
40.0	.67										225	247	270	292	315	337	360			1.5	90
45.0	.75																			1.3	78
50.0	.83																			1.2	72

Job Efficiency Estimator

Work Time/Hour	Efficiency
60 Min	100%
55	91%
50	83%
45	75%
40	67%

*Actual hourly production = (60 min hr production) × (Job Efficiency Factor)

**Estimated Bucket Payload = (Amount of Material in the Bucket)
= (Heaped Bucket Capacity) × (Bucket Fill Factor)

Unshaded area indicates average production.

EXCAVATOR TRENCHING PRODUCTION

When an excavator is used for trenching applications, a meaningful expression of work produced is the machine's trenching rate expressed in meters or lineal feet per hour or per day. Trenching rate depends on the earthmoving production of the excavator being used and the size of the trench being excavated. Earthmoving production converts to trenching production as follows:

$$\text{Lineal Meters of Trench per Hour} = \frac{\text{Cubic Meters Excavated per Hour}}{\text{Cubic Meters per Lineal Meter of Trench}}$$

Lineal Meters of Trench per day = (Lineal Meters per Hour) × (Trenching Hours per Day)

$$\text{Lineal Feet of Trench per Hour} = \frac{\text{Yd}^3\text{ Excavated Per Hour}}{\text{Yd}^3\text{ Per Lineal Foot of Trench}}$$

Lineal Feet of Trench Per Day = (Lineal Ft Per Hour) × (Trenching Hours Per Day)

For machines that work in trenching applications where they dig all of the time, the *Trenching Conversion Chart* provides easy conversion from m^3 (yd^3) per hour to m (lineal feet) per hour, if the excavating rate m^3/hr (yd^3/hr) and trench volume m^3/m (yd^3/ft) are known. The following examples demonstrate how the Trenching Conversion Chart can be used.

Example problem (Metric)

Contractor estimates that the 325 Excavator will produce 200 Lm^3/hour. Trench survey shows that the trench contains 2.5 Lm^3/meter. What trenching rate will the 325 produce?

Solution: Enter the horizontal axis of the Trenching Conversion Chart at 200 m^3/Hour and move up to the 2.5 m^3/m diagonal line. Then move left to the vertical axis of chart and read answer of 80 m/hour.

• • •

Example problem 2 (Metric)

Contractor knows he must produce 1000 meters of trench in every 10 hour work day. Survey shows that trench contains 1.5 Bm^3 per lineal meter and soil swell factor is estimated at 30%. How much earthmoving production will the excavator have to provide in order to get the job done on time assuming a 50 min work hour? What Caterpillar excavator will provide needed production at 6 meter maximum depth in sandy loam soil?

Solution: Determine trenching requirement 1000 meters in 10 hrs = 100 m/h. Convert Bm^3 to Lm^3 (excavator handles Lm^3) 1.5 Bm^3/m × 1.30 = 2.0 Lm^3/m. Enter vertical axis of trenching conversion chart at m/h and travel horizontally to diagonal line representing 2.0 m^3/m. Next move down to horizontal axis and read answer to 200 Lm^3/50 min hr. Convert 200 Lm^3/50 min hr to Lm^3/60 min hr = 200 = 241 Lm^3/60 min hr.

Production estimating tables in this section show that 241 Lm^3/60 min hr is within the capability of a 225D Excavator. Job should then be checked for reach and lifting requirements to make sure that the 225D could handle these aspects of the work.

• • •

Example problem (English)

Contractor estimates that a 325 Excavator will produce 250 LCY/Hour. Trench survey shows that the trench contains 2.5 LCY/Foot. What trenching rate will the 325 produce?

Solution: Enter the horizontal axis of the Trenching Conversion Chart at 250 yd^3/hr. Then move to the vertical axis of chart and read answer of 100 ft/hr.

The Trenching Conversion Chart can also be used to determine the required excavating rate if the contractor can define his trenching production requirement and the trench volume per lineal foot.

• • •

Example problem 2 (English)

Contractor knows he must produce 1000 ft of trench in every 10 hr work day. Survey shows that trench contains 1.6 BCY per lineal ft and soil swell factor is estimated at 25%. How much earthmoving production will excavator have to provide in order to get the job done on time assuming 50 min work hour? What Caterpillar model will provide needed production at 8 ft depth in sandy loam soil?
Solution: Determine trenching requirement — 1000 ft in 10 Hrs. = 100 ft/hr
Convert BCY to LCY — 1.6 BCY/ft × 1.25 = 2.0 LCY/ft.

Enter vertical axis of trenching conversion chart at 100 ft/hr and travel over to diagonal line representing 2.0 yd³/ft. Next move down to horizontal axis and read answer of 200 LCY/50 min hr.

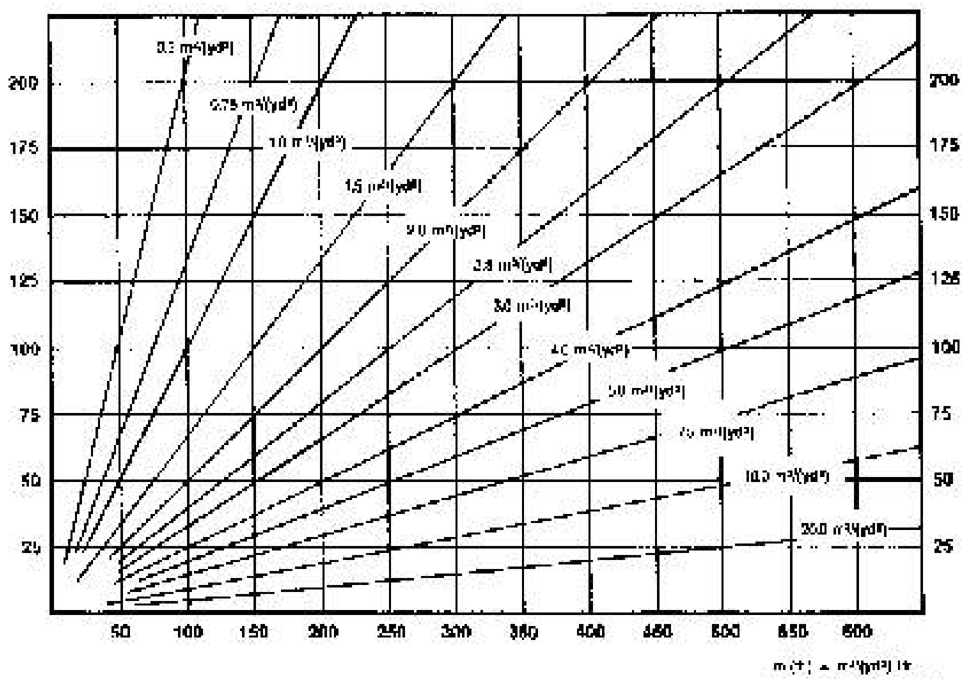
Convert 200 LCY/50 min hr to LCY/60 min hr =

$$\frac{200}{.83} = 241 \text{ LCY/60 min hr}$$

Production estimating tables in this section show that 241 LCY/60 min. hr. is within capability of a 325 Excavator. Job should then be checked for reach and lifting requirements to make sure that the 325 could handle these aspects of the work.

• • •

TRENCHING CONVERSION CHART — CUBIC METERS (yd³) PER HOUR TO METER (ft) PER HOUR



Values in m³/m or yd³/ft

If excavating rate has been calculated in Bm³/h use Bm³/m for Trench Volume/m.
" " " " " " " Lm³/h use Lm³/m for Trench Volume/m.
" " " " " " " BCY/Hr use BCY/ft for Trench Volume/ft.
" " " " " " " LCY/Hr use LCY/ft for Trench Volume/ft.

Estimating Bucket Size

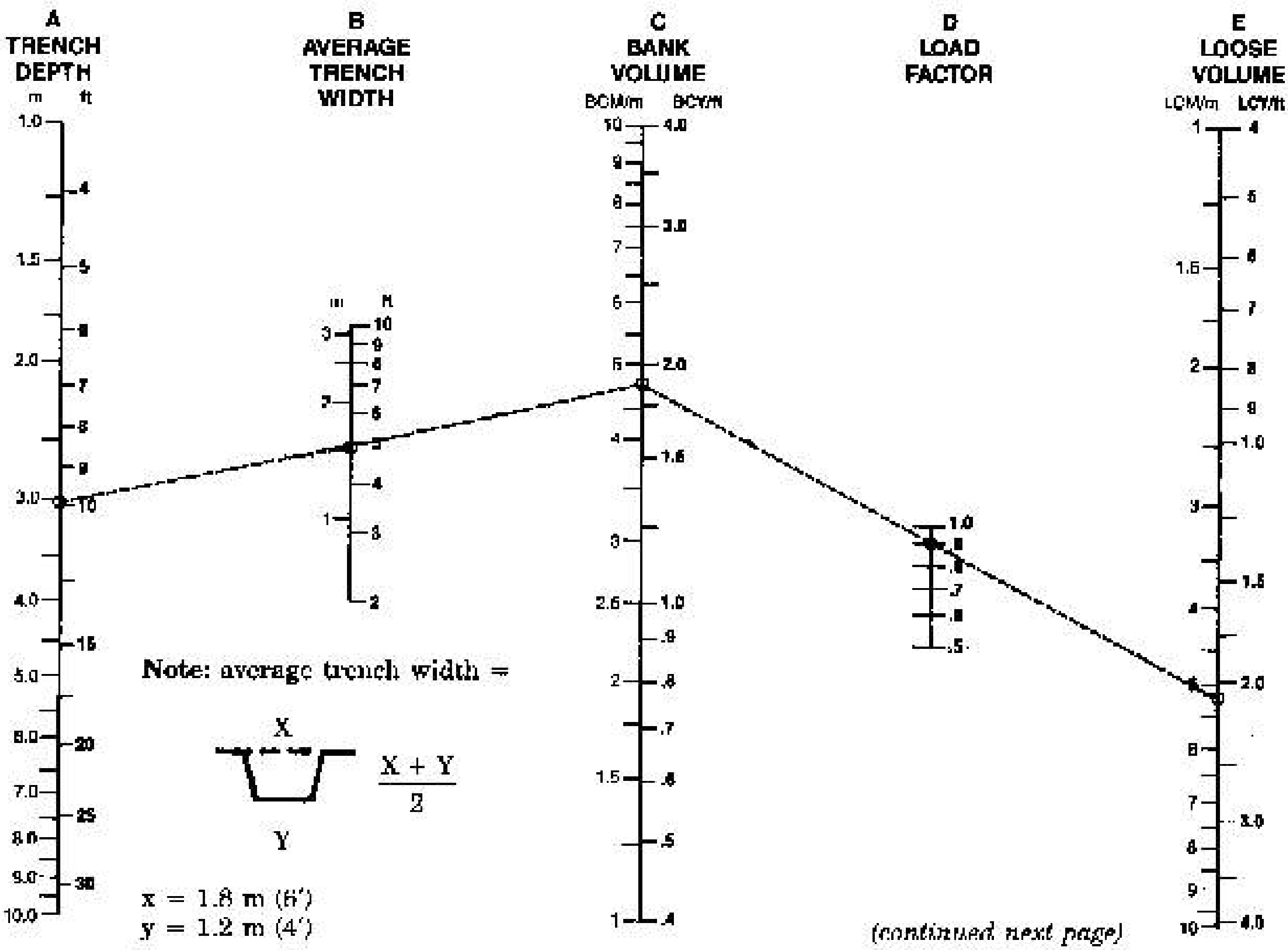
In addition to the trenching calculations on the previous pages, an alternative method of figuring trenching production is the nomograph. Shown on the following pages, this particular nomograph can be used for estimating bucket size when given trench dimensions and linear production rate. The nomograph is quicker and easier than the preceding example because it does not require as many calculations, yet the accuracy is about the same within the normal limits of input data.

Be careful when entering and reading data from the nomographs because some scales increase from bottom to top, while others are the reverse. Do not be overly concerned with the precision as affected by pencil line width or reading to the hundredth of a m^3 (yd^3). Remember that bucket fill factor, material density and cycle time are at best close estimates.

Example problem:

A sewer contractor owns a 325 with 2 piece boom and short stick. He wants to bid a contract for a 3.1 m (10') deep trench which measures 1.8 m (6') at the top and 1.2 m (4') at the bottom. He must dig 9 m/hr (30 ft/hr) to finish on time. The material is sand and gravel with a load factor of .90 and 100% bucket fill factor. He works 54 minutes per hour, half the time digging and half setting pipe. Cycle time is estimated at 23 seconds which includes a 90° swing angle.

1) Enter trench depth 3.1 m (10') on scale A and average trench width 1.5 m (5') on scale B.
2) Connect A and B and extend to scale C for bank volume per m (ft).
3) Enter estimated load factor (.90) on scale D.
4) Connect C & D and extend to scale E for loose volume per m (ft).



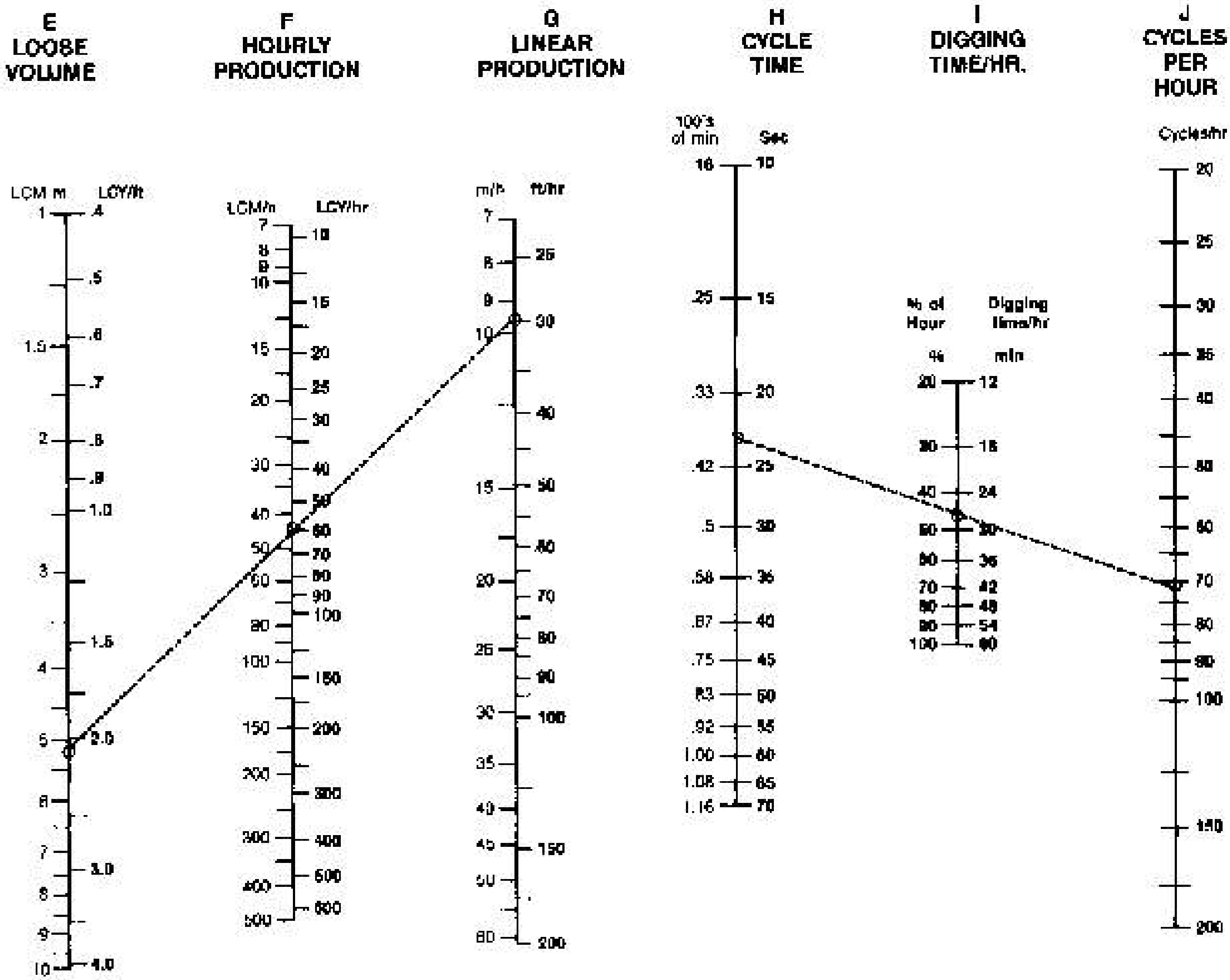
Note: average trench width = $\frac{X + Y}{2}$

x = 1.8 m (6')
y = 1.2 m (4')

(continued next page)

(get loose volume from scale E and enter on this page scale E)

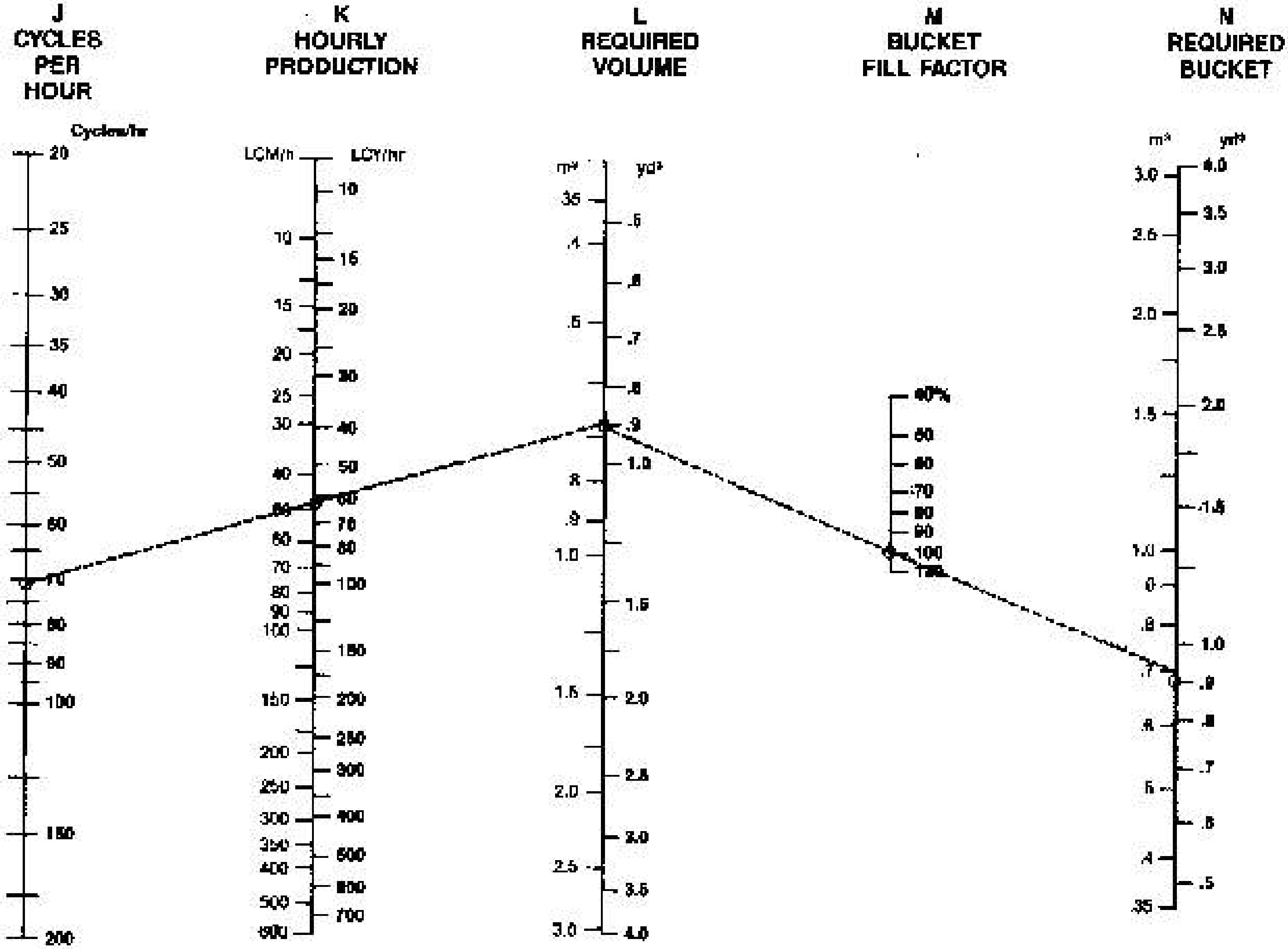
5) Enter required linear production rate 9 m/h (30 ft/hr) on scale G.
6) Connect E and G. Transfer hourly production rate from scale F to scale K (next page).
7) Estimate cycle time (23 sec) based on anticipated conditions and enter on scale H.
8) Estimate hourly digging time (27 min) and enter on scale I.
9) Connect H through I to scale J for cycles per hour.

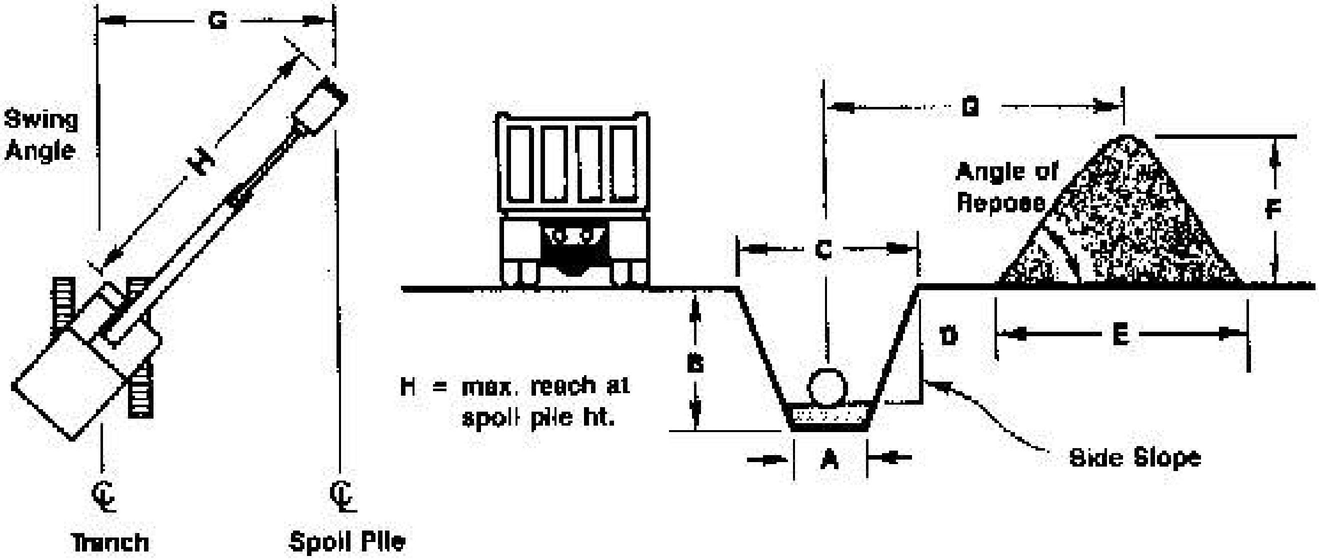


(get cycles per hour from scale J and enter on this page scale J)

10) Connect J through K to scale L for required volume per cycle.
11) Enter estimated bucket fill factor (100%) on scale M.
12) Connect L through M to scale N for required bucket size.

Note: Ensure bucket width does not exceed minimum trench width and also that weight of bucket and payload does not exceed machine working weight capacity (see lift capacity charts in this section).





Excavation Volumes Per Meter or Foot of Trench Length

Metric version

Bank m³/meter = (Trench end area m²) × (one m)
Trench volume (Bm³/m) = ½ (A + C) × B
Spoil pile volume (Lm³/m) = (Bm³/m) × (1.00 + % Swell)

English version

$$\text{Bank yd}^3/\text{foot} = \frac{(\text{Trench end area ft}^2) \times (\text{one ft})}{27}$$

$$\text{Trench volume (BCY/ft)} = \frac{\tfrac{1}{2}(A + C) \times B}{27}$$

Spoil pile volume (LCY/ft) =
(BCY/ft) × (1.00 + % Swell)

The following table provides a general guide to trench bottom width for various outside diameters of pipe.

Pipe Diameter		Trench Width		Pipe Diameter		Trench Width	
mm	in	m	ft	mm	in	m	ft
102	4	.49	1.6	1524	60	2.68	8.5
152	6	.55	1.8	1676	66	2.80	9.2
203	8	.61	2.0	1829	72	3.05	10.0
254	10	.70	2.3	1981	78	3.26	10.7
305	12	.76	2.5	2134	84	3.47	11.4
381	15	.91	3.0	2286	90	3.69	12.1
457	18	1.09	3.4	2438	96	3.93	12.9
533	21	1.18	3.8	2591	102	4.15	13.6
610	24	1.25	4.1	2743	108	4.36	14.3
686	27	1.37	4.5	2896	114	4.54	14.9
838	33	1.58	5.2	3048	120	4.75	15.6
914	36	1.70	5.6	3200	126	4.99	16.4
1067	42	1.92	6.3	3353	132	5.21	17.1
1219	48	2.13	7.0	3505	138	5.43	17.8
1372	54	2.36	7.8	3858	194	5.64	18.5

Note: Trench widths based on 1.25 Bc + 1.0 where Bc is the outside diameter of the pipe in feet
Table courtesy of American Concrete Pipe Association

Trenching Production with Pipesetting

On many sewer construction jobs the excavator does more than just dig the trench. Other tasks include handling the shoring system, placing bedding material, and lowering the pipe. The normal work procedure is to open a section of trench and then stop and make a pipe installation before going on to dig the next section of trench. At that point the key to trenching production is the total amount of time required to install each section of pipe. Pipe installation time can be broken down as follows:
Digging time + other time = Total pipe installation time

Total Pipe Installation Time	Pipe Installed Per Hour
60 min	1 Pipe/hr
30 min	2 Pipe/hr
15 min	4 Pipe/hr
10 min	6 Pipe/hr

Digging Time can be calculated once the trenching rate has been calculated using the methods described earlier in this section. Once Digging Time has been calculated, it can be added to an estimate of "Other Time" to determine Total Pipe Installation Time. "Other Time" can be estimated based on a contractor's judgment, experience, or actual measurement on a job. The following formula and table relate the trenching rate of the excavator to the time required to open a section of trench for pipe of various lengths.

$$\text{Digging Time (Min.)} = \frac{\text{Pipe Length (ft)}}{\text{Trenching Rate (ft/hr)}} \times 60\ (\text{Min/hr})$$

TRENCHING RATE FT. PER HOUR	TIME REQUIRED TO DIG FOR PIPE OF VARIOUS LENGTHS							
	8 ft Pipe		12 ft Pipe		16 ft Pipe		20 ft Pipe	
	Hours	Min.	Hours	Min.	Hours	Min.	Hours	Min.
20 ft/hr	.400	24.00	0.600	36.00	.800	48.00	1.000	60.00
40	.200	12.00	0.300	18.00	.400	24.00	0.500	30.00
60	.133	8.00	0.200	12.00	.267	16.00	0.333	20.00
80	.100	6.00	0.150	9.00	.200	12.00	0.250	15.00
100	.080	4.80	0.120	7.20	.160	9.60	0.200	12.00
120	.067	4.00	0.100	6.00	.120	7.20	0.167	10.00
140	.057	3.43	0.086	5.14	.114	6.86	0.143	8.57
160	.050	3.00	0.075	4.50	.100	6.00	0.125	7.50
180	.044	2.67	0.067	4.00	.089	5.33	0.111	6.67
200	.040	2.40	0.060	3.60	.080	4.80	0.100	6.00

This table can be used to show how an excavator that is capable of more trenching production will provide significant advantages even on jobs where the machine does not dig all of the time. Consider 12,000' job with 12' sections of pipe (1000 pipe to be installed). Excavator "A" can work at 60 ft/hr while Excavator "B" is capable of producing 120 ft/hr. Table shows that Excavator "B" will only take 0.10 hr to do the same work. This means that over the course of installing the 1000 pipe the more productive machine will save 0.10 hr/pipe or 100 hours of working time.

Example problem (English)

The following example shows how trenching production can be calculated on a job where the excavator is also required to set pipe. This example is based on the assumption that the excavator's earthmoving rate and the pipe installation time have already been estimated by the contractor.
Problem: Contractor estimates that the 245B Excavator will be able to produce 500 LCY/60 min. hr. Survey shows that an average cross section trench contains 3.2 BCY/ft and swell factor for sandy clay soil is estimated at 25%. How much trenching production can a contractor expect; assuming it takes 10.0 min. to install each 20 ft. length of pipe after trench has been opened. Also assume 83% job efficiency — 50 min. work hour and 8 work hours out of a 9 hour shift. (0.5 hours for lunch and two 15 minute breaks.)
Solution:
Convert trench volume to LCY/ft:
1.25 (3.2 BCY/ft) = 4.0 LCY/ft

Convert Earthmoving rate to Trenching rate:

$$\frac{500\ \text{LCY/hr}}{4.0\ \text{LCY/ft}} = 125\ \text{ft/hr}$$

Calculate digging time for each pipe:

$$\frac{20\ \text{ft/pipe}}{125\ \text{ft/hr}} = .16\ \text{hr/pipe} = 9.6\ \text{min}$$

Calculate pipe installation time:
Digging time = 9.6 min
Other time = 10.0 min
Pipe Installation time = 19.6 min

Calculate pipe installations/hour:

$$\frac{60\ \text{min/hr}}{19.6\ \text{min/pipe}} = 3.06\ \text{pipe/hr}$$

Calculate max. pipe installations/day:
8 hrs (3.06 pipe/hr) = 24.48 pipe/day
Actual pipe/day:
.83 (24.48 pipe/day) = 20.3 = 20 pipe/day
Actual feet/day:
(20 pipe/day) × (20 ft/pipe) = 400 ft/day

MASS EXCAVATORS

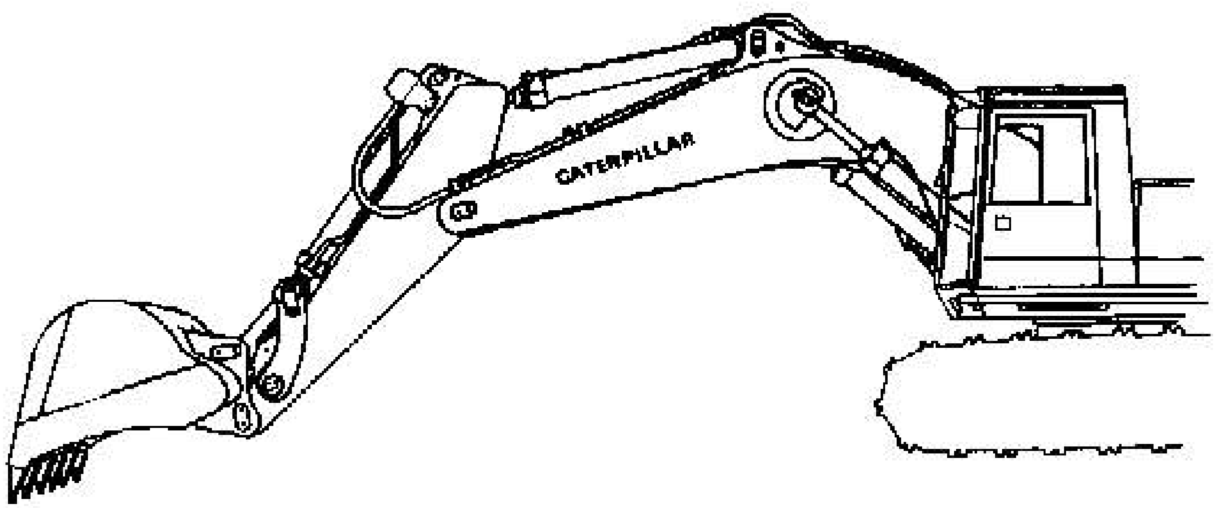
CONTENTS

Note: The 320/325/330 Mass Excavators are listed in the Excavator section of this handbook. The Mass Excavation Boom/Stick configurations for these machines may also be used for other than Mass Excavator applications.

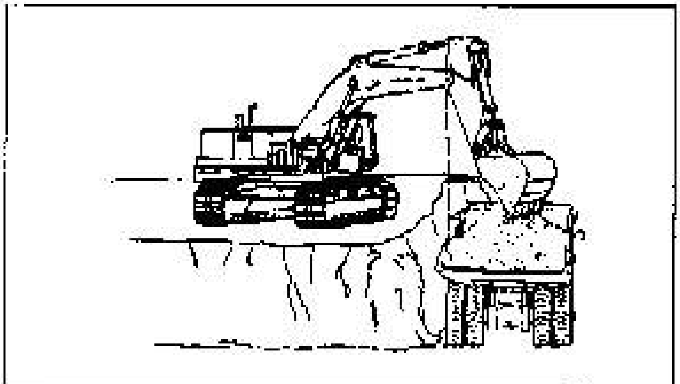
A Mass Excavator is . . .

An excavator with a front end that is purpose-built for volume loading applications. This front end consists of a new boom, stick, linkage, and a choice of three buckets of substantially increased capacity. Compared to General Purpose (GP) front ends, the boom is shorter and both the boom and stick have bigger box sections to handle the larger buckets and higher forces.

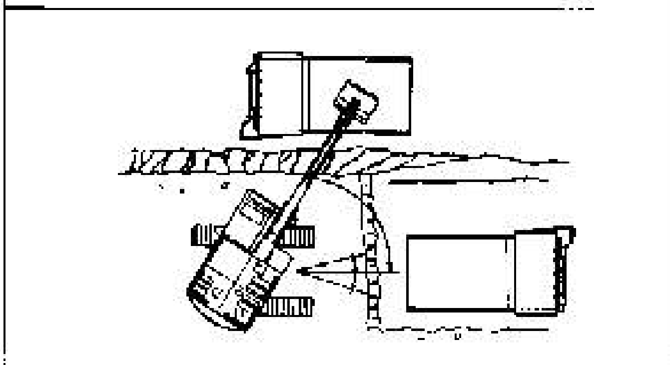
Mass Excavator components are not interchangeable with GP components. A GP medium stick, for example, cannot be attached to a Mass Excavator boom, and the Mass Excavator buckets will not fit on GP sticks.



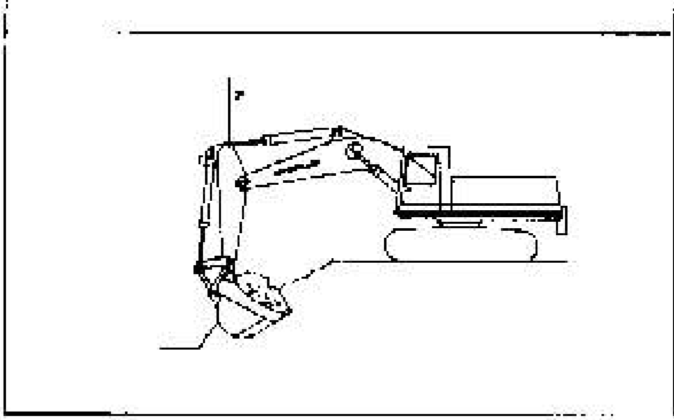
MAXIMIZING PRODUCTION WITH A MASS EXCAVATOR



Ideal Bench Height and Truck Distance – For stable or consolidated materials, bench height should be about equal to stick length. For unstable materials it should be less. The most useful truck position is when the inside truck body rail is below the boom/stick hinge pin.



Optimum Work Zone and Swing Angle – For maximum production, the work zone should be limited to 15° either side of machine center or about equal to undercarriage width. Trucks should be positioned as close as possible to machine centerline. Two alternatives shown here.



Best Distance from the Edge – The machine should be positioned so that the stick is vertical when the bucket reaches full load. If the unit is farther back, breakout force is reduced. If it is closer to the edge, undercutting may occur and time is wasted bringing the stick back out. Also, the operator should begin boom-up when the bucket is 75% of the way through the curl cycle. This should be as the stick nears the vertical position.

This example reflects the ideal situation. Not all points are usable on each job, but incorporation of as many of these points as possible will positively affect production.

235D ME*

Weight** — Bare machine:

• Includes lubricants, coolant, 10% fuel, no front equipment.

Shoes	kg	lb
762 mm (30") Triple Grouser	34 750	76,610
457 mm (18") Double Grouser	32 800	72,320
610 mm (24") Double Grouser	33 560	73,980
For Special Application version 762 mm (30") Triple Grouser shoes — fully guarded	36 020	79,410

Weight** — Operating:

• Shipping weight plus full fuel tank, operator, 5660 mm (18'7") ME boom, 2540 mm (8'4") ME stick and 1800 mm (71") bucket with teeth.

			Ground Pressure		
Shoes	kg	lb	kg/cm²	bar	psi
762 mm (30") Triple Grouser	44 115	97,257	.66	.65	9.4
457 mm (18") Double Grouser	42 972	94,738	1.07	1.06	15.3
610 mm (24") Double Grouser	43 307	95,476	.81	.80	11.6

*U.S. manufactured machines only.
**Approximate

245D ME*

Weight** — Bare machine:

• Includes lubricants, coolant, 10% fuel, no front equipment.

Double Grouser Shoes	kg	lb
610 mm (24")	50 230	109,360
760 mm (30") STD	51 150	111,580
915 mm (36")	52 170	113,790

Weight** — Operating:

• Shipping weight plus full fuel tank, operator, 6500 mm (21'4") ME boom, 2920 mm (9'7") stick and 2115 mm (83.25") bucket.

			Ground Pressure	
Double Grouser Shoes	kg	lb	kg/cm²	psi
610 mm (24")	65 280	143,920	1.11	15.7
760 mm (30") STD	66 200	145,960	.90	12.8
915 mm (36")	67 230	148,220	.76	10.8

*U.S. manufactured machines only.
**Approximate

Shipping Dimensions:

235D ME

Shipping height . . . . 4241 mm (13'11")
Shipping length . . . . 10.311 m (33'10")

Shipping Dimensions:

245D ME	2920 mm 9'7" Stick
Shipping height	4521 mm (14'10")
Shipping length	12.446 m (40'10")

Note: For shipping width and other base machine dimensions, see section on machines with GP attachments.

235D ME

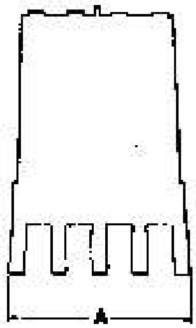
	kg	lb
One-Piece Boom	4990	11,000

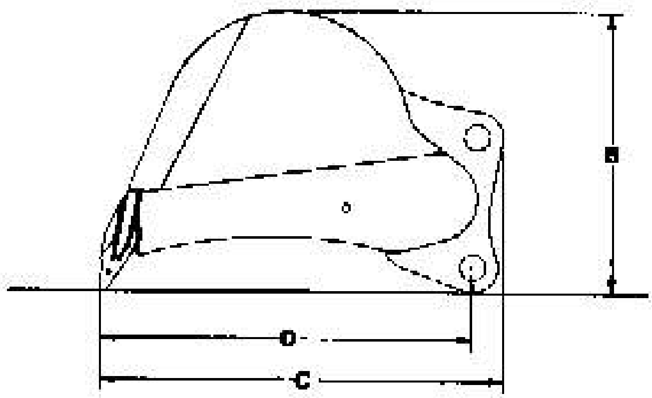
Bucket Type	Bucket Bite Width		Bucket Tip Radius		Bucket Curling Forces		Stick Crowd Forces 2540 mm (8'4") Stick		Maximum material density for 360° stability	
	mm	in	mm	in	kN	lb	kN	lb	kg/m³	lb/yd³
General Purpose	1800	71	1750	69	202	45,500	185	41,500	2230	3760
Rock Bucket V-Edge	1830	72	1790	70	199	44,700	186	41,900	2290	3860
Loose Material	1930	76	1880	74	190	42,600	179	40,200	1750	2950

245D ME

	kg	lb
One-Piece Boom	8120	17,910

Bucket Type	Bucket Bite Width		Bucket Tip Radius		Bucket Curling Forces		Stick Crowd Forces 2920 mm (9'7") Stick		Maximum material density for 360° stability	
	mm	in	mm	in	kN	lb	kN	lb	kg/m³	lb/yd³
General Purpose	2121	83.5	2110	83	351	79,000	262	58,900	1780	3000
Rock Bucket V-Edge	2134	84	2110	83	351	78,900	263	59,200	1920	3230
Loose Material	2080	82	2452	96	302	68,000	244	54,800	1330	2250





A Bite Width
B Height
C Length
D Tip Radius

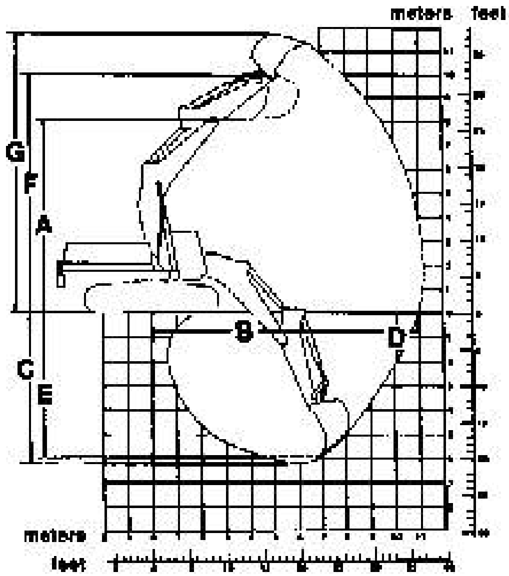
235D ME

Bucket Type	A mm	A in	B mm	B in	C mm	C in	D mm	D in	SAE Heaped L	SAE Heaped yd³	CECE Heaped L	CECE Heaped yd³	Weight With Tips kg	Weight With Tips lb	No. of Teeth
General Purpose	1800	71	1370	54	1960	77	1740	69	2485	3.25	2330	3.05	1880	4150	6
Rock V-Edge	1830	72	1420	56	2080	82	1780	70	2294	3.00	2160	2.82	2230	4920	6
Loose Material	1930	76	1470	58	2050	81	1880	74	3517	4.62	3240	4.24	1860	4100	6

245D ME

Bucket Type	A mm	A in	B mm	B in	C mm	C in	D mm	D in	SAE Heaped L	SAE Heaped yd³	CECE Heaped L	CECE Heaped yd³	Weight With Tips kg	Weight With Tips lb	No. of Teeth
General Purpose	2121	83.5	1618	63.7	2342	92.2	2110	83	3820	5.0	3560	4.66	2970	6540	6
Rock	2134	84	1605	63.2	2385	93.9	2110	83	3360	4.4	3160	4.14	3297	7269	6
Loose Material	2090	82.3	1672	65.8	2631	103.6	2462	96.5	5160	6.75	4650	6.09	2652	5847	6

Note: Above dimensions were originally calculated in metric dimensions and converted to English dimensions.



KEY:

- **A** Maximum loading height of bucket with teeth
- **B** Maximum reach at ground level
- **C** Maximum digging depth
- **D** Maximum vertical wall
- **E** Maximum depth of cut for 2440 mm (8') level bottom
- **F** Maximum bucket hinge pin height
- **G** Maximum height to bucket teeth at highest arc

235D ME

Bucket Type	2540 mm (8'4") Stick Length					
	Excavation (General)		Extreme Service Excavation (Rock)		Light Material Excavation	
	mm	ft	mm	ft	mm	ft
A	6274	20'7"	6233	20'5"	6145	20'2"
B	9474	31'1"	9480	31'1"	9605	31'6"
C	5207	17'1"	5241	17'2"	5330	17'6"
D	1092	3'7"	1323	4'4"	1033	3'5"
E	5029	16'6"	5056	16'7"	5158	16'11"
F	8023	26'4"	8023	26'4"	8023	26'4"
G	9296	30'6"	9133	30'0"	9453	31'0"

245D ME

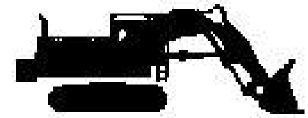
Bucket Type	2920 mm (9'7") Stick Length					
	Excavation (General)		Extreme Service Excavation (Rock)		Light Material Excavation	
	mm	ft	mm	ft	mm	ft
A	7370	24'2"	7366	24'2"	7028	23'1"
B	11 060	36'4"	11 049	36'3"	11 418	37'6"
C	6147	20'2"	6147	20'2"	6490	21'4"
D	617	2'0"	1625	5'4"	1854	6'1"
E	5994	19'8"	5994	19'8"	6350	20'10"
F	9480	31'1"	9474	31'1"	9490	31'1"
G	11 031	36'2"	10 847	35'11"	11 408	37'5"

FRONT SHOVELS

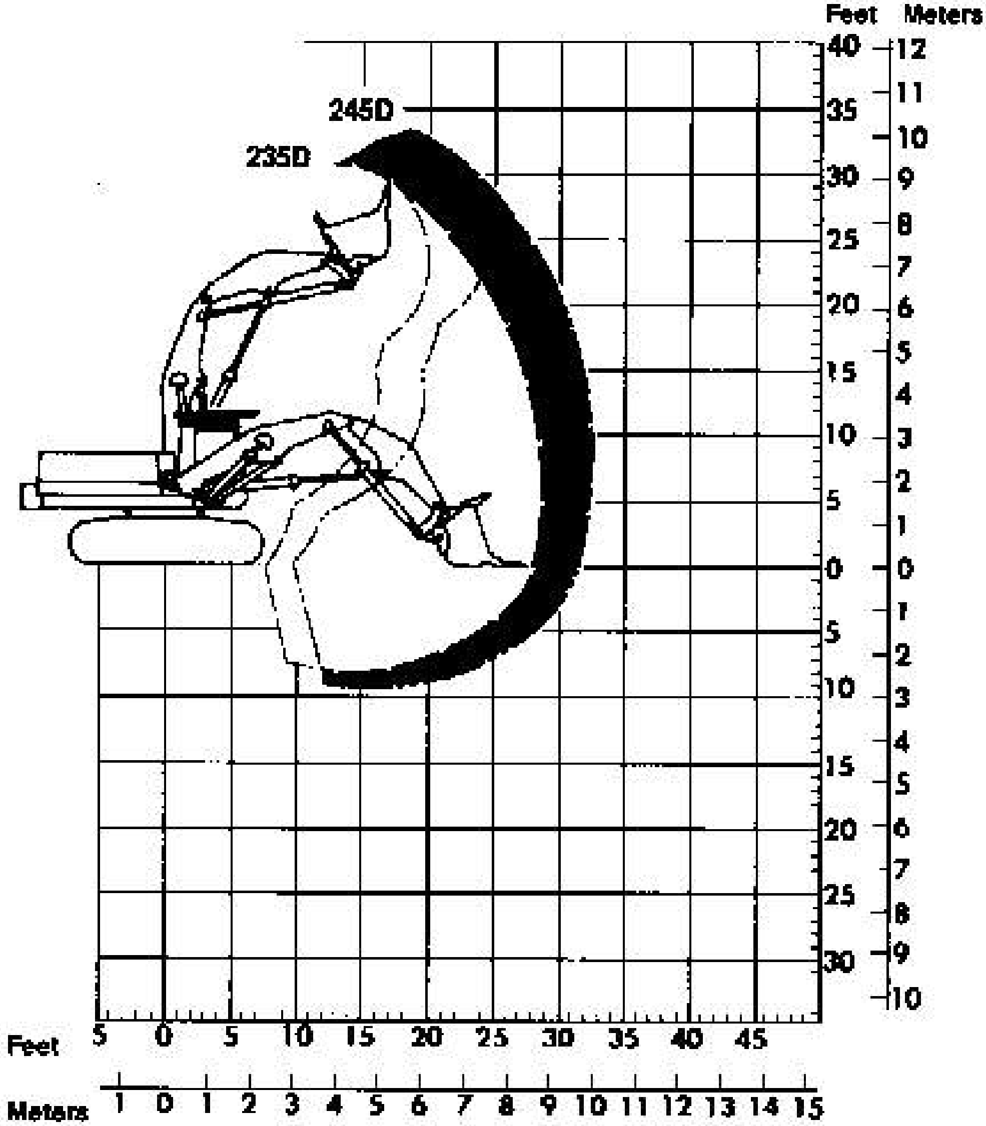
CONTENTS

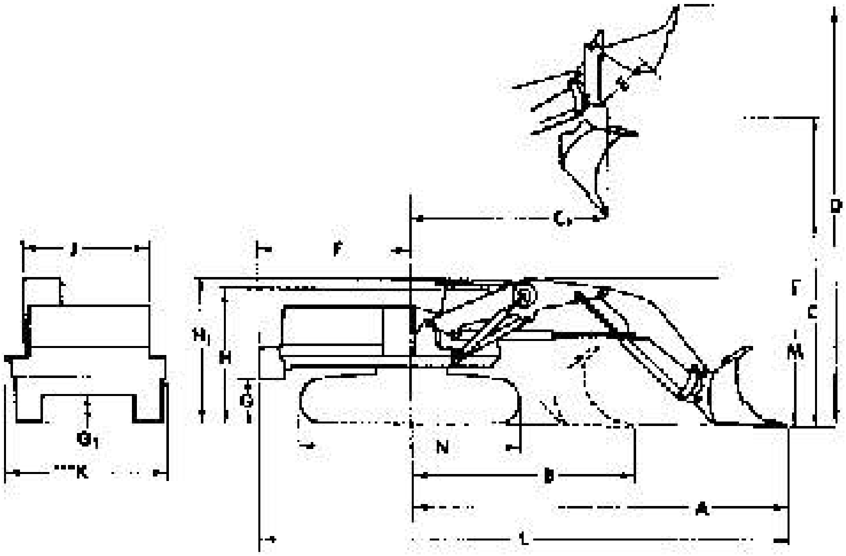
MODEL	235D FRONT SHOVEL		245D FRONT SHOVEL	
Flywheel Power	186 kW	250 HP	287 kW	385 HP
Operating Weight*				
With Front Dump Bucket	43 500 kg	95,900 lb	66 630 kg	146,900 lb
With Bottom Dump Bucket	44 680 kg	98,960 lb	68 800 kg	151,690 lb
Bucket Capacity — Front Dump	2.3 m³	3 yd³	3.8 m³	5 yd³
Bottom Dump	1.8 m³	2.36 yd³	3.1 m³	4 yd³
Engine Model	3306		3406B	
Rated Engine RPM	2000		1800	
No. of Cylinders	6		6	
Bore	121 mm	4.75"	137 mm	5.4"
Stroke	152 mm	6"	165 mm	6.5"
Displacement	10.5 L	638 in³	14.6 L	893 in³
Hydraulic Pump Output at Rated RPM	2 × 349 L/min	2 × 92 gpm	2 × 450 L/min	2 × 119 gpm
Rating Pressure	6097 kPa	1000 psi	6897 kPa	1000 psi
Relief Valve Setting:				
Implement Circuits	24 800 kPa	3600 psi	31 000 kPa	4500 psi
Travel Circuits	33 100 kPa	4800 psi	31 000 kPa	4500 psi
Swing Circuits				
Accelerating	26 900 kPa	3900 psi	31 030 kPa	4500 psi
Decelerating	13 790 kPa	2000 psi	21 380 kPa	3100 psi
Pilot Circuits	2310 kPa	335 psi	1724 kPa	250 psi
Maximum Travel Speed at Rated RPM	3.6 km/h	2.2 mph	3.17 km/h	1.97 mph
Width of Standard Track Shoe	457 mm	18"	610 mm	24"
Overall Track length	5.03 m	16'6"	5.613 m	18'5"
Ground Contact Area with Std. Shoe	3.98 m²	6175 in²	5.90 m²	9132 in²
Track Gauge	2.69 m	8'10"	3.25 m	10'8"
Fuel Tank Refill Capacity	492 L	130 U.S. gal	682 L	180 U.S. gal

*Operating weight includes coolant, lubricants, full fuel tank, standard shoes, bucket and operator.



MODEL	E450 FRONT SHOVEL (Bottom Dump)		E650 FRONT SHOVEL (Bottom Dump)	
Flywheel Power	206 kW	276 HP	280 kW	375 HP
Operating Weight	46 200 kg	101,900 lb	66 000 kg	142,200 lb
Bucket Range — heaped	2.6 m^3	3.4 yd^3	3.8 m^3	5 yd^3
Engine Model	Mitsubishi 6D22TC		Mitsubishi S6B-TA	
Rated Engine RPM	2000		2000	
No. of Cylinders	6		6	
Bore	130 mm	5.1"	135 mm	5.3"
Stroke	140 mm	5.5"	150 mm	6"
Displacement	11.15 L	680 in^3	12.88 L	786 in^3
Max. Implement Hydraulic Pump Output at Rated RPM	2 x 350 L/min	2 x 92 gpm	2 x 445 L/min	2 x 117 gpm
Relief Valve Settings:				
Implement Circuits	27 420 kPa	3980 psi	27 420 kPa	3980 psi
Travel Circuits	27 420 kPa	3980 psi	27 420 kPa	3980 psi
Swing Circuits	20 670 kPa	3000 psi	23 010 kPa	3340 psi
Pilot Circuits	3450 kPa	500 psi	2940 kPa	425 psi
Maximum Drawbar Pull	314 kN	70,400 lb	449 kN	100,940 lb
Maximum Travel Speed at Rated RPM	4.5 km/h	2.8 mph	4.6 km/h	2.85 mph
Width of Standard Track Shoe	610 mm	24"	610 mm	24"
Overall Track Length	5125 mm	16'10"	5420 mm	17'9"
Ground Contact Area	5.4 m^2	8,364 in^2	5.7 m^2	8,835 in^2
Track Gauge	2390 mm	7'10"	2720 mm	8'11"
Working Track Gauge	2890 mm	9'6"	3250 mm	10'8"
Fuel Tank Refill Capacity	500 L	132 U.S. gal	625 L	165 U.S. gal

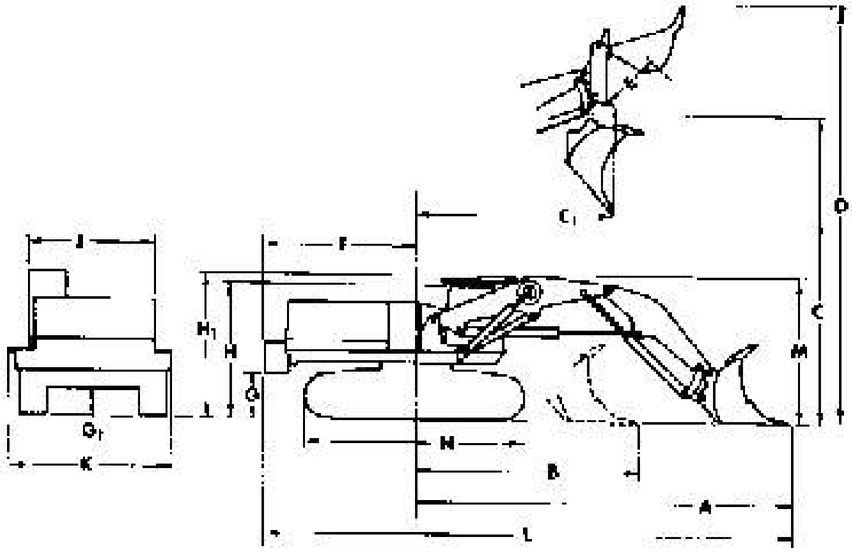

Feet
Meters
245D
235D
40
35
30
25
20
15
10
5
0
5
10
15
20
25
30
12
11
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8
9
10
Feet
5 0 5 10 15 20 25 30 35 40 45
Meters
1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15



	235D FRONT SHOVEL				245D FRONT SHOVEL			
	Front Dump		Bottom Dump		Front Dump		Bottom Dump	
Capacity, Heaped	2.3 m³	3.0 yd³	1.8 m³	2.38 yd³	3.8 m³	5.0 yd³	3.1 m³	4.0 yd³
Struck	1.9 m³	2.5 yd³	1.5 m³	1.9 yd³	3.4 m³	4.4 yd³	2.6 m³	3.5 yd³
Cutting Width	1899 mm	74.8"	1899 mm	74.8"	2350 mm	92.5"	2350 mm	92.5"
A Maximum reach @ grade	8.33 m	27'4"	8.13 m	26'8"	9.49 m	31'2"	9.37 m	30'9"
B Minimum reach @ grade	4.95 m	16'3"	4.75 m	15'7"	5.58 m	18'4"	5.46 m	17'11"
C Maximum dump height	5.03 m	16'6"	6.20 m	20'4"*	5.639 m	18'6"	6.985 m	22'11"*
C' Reach at maximum dump height	5.26 m	17'3"	4.75 m	15'7"	6.30 m	20'8"	5.715 m	18'9"
Truck loading dump height**	3.81 m	12'6"	3.81 m	12'6"	5.03 m	16'6"	5.03 m	16'6"
Reach at truck loading dump height**	5.94 m	19'6"	6.53 m	21'5"*	6.58 m	21'7"	7.19 m	23'7"*
D Maximum height	9.17 m	30'1"	9.14 m	30'0"	10.29 m	33'9"	10.414 m	34'2"
E Maximum bucket throat opening	Not Applicable		1.24 m	4'1"	Not Applicable		1.446 m	4'9"
F Tail swing radius	3.30 m	10'10"	3.30 m	10'10"	3.810 m	12'6"	3.810 m	12'6"
G Ground clearance — counterweight	1.143 m	3'9"	1.143 m	3'9"	1.067 m	3'6"	1.067 m	3'6"
G' Ground clearance — frame	559 mm	22"	559 mm	22"	762 mm	30"	762 mm	30"
H Cab height	3.404 m	11'2"	3.404 m	11'2"	3.607 m	11'10"	3.607 m	11'10"
H' FOPS height	3.531 m	11'7"	3.531 m	11'7"	3.734 m	12'3"	3.734 m	12'3"
J House width	2.997 m	9'10"	2.997 m	9'10"	3.099 m	10'2"	3.099 m	10'2"
K Transport width	3.607 m	11'10"	3.607 m	11'10"	3.708 m	12'2"***	3.708 m	12'2"***
L Transport length	11.63 m	38'2"	11.43 m	37'6"	13.31 m	43'8"	13.18 m	43'3"
M Transport height	3.53 m	11'7"	3.53 m	11'7"	3.759 m	12'4"	3.759 m	12'4"
N Track length	5.05 m	16'7"	5.05 m	16'7"	5.613 m	18'5"	5.613 m	18'5"

*Bottom of bucket linkage.
**235C loading Cat 35-ton truck.
245B Series II loading Cat 35-ton truck.
Front Dump bucket at 45° discharge angle.
Bottom Dump bucket bulldozer vertical.

***Transport width in narrow gauge position with 610 mm (24") shoes and catwalks installed. Reduces to 3455 m (11'4") width over tracks with catwalks and counterweight removed.



	E450 FRONT SHOVEL (Bottom Dump)		E650 FRONT SHOVEL (Bottom Dump)	
Capacity, Heaped	2.6 m³ (SAE)	3.4 yd³	3.8 m³ CECE, PCSA	5.0 yd³
Struck	—	—	—	—
Cutting Width	—	—	—	—
A Maximum reach @ grade	8370 mm	27'6"	9800 mm	32'2"
B Minimum reach @ grade	4670 mm	15'4"	5400 mm	17'9"
C Maximum dump height	7180 mm	23'7"	7390 mm	24'3"
D Maximum height	9740 mm	32'0"	10.50 m	34'5"
E Maximum bucket throat opening	1290 mm	4'3"	1500 mm	4'11"
F Tail swing radius	3700 mm	12'2"	4260 mm	14'0"
G Ground clearance — counterweight	1430 mm	4'8"	1320 mm	4'4"
G' Ground clearance - frame	600 mm	2'0"	670 mm	2'2"
H Cab height	3370 mm	11'1"	4230 mm	13'11"
H' Head Guard Height	3785 mm	12'5"	4630 mm	15'2"
J House width	3035 mm	10'0"	3175 mm	10'5"
K Transport width	3035 mm	10'0"	3490 mm	11'5"
L Transport length	11.94 m	39'2"	13.56 m	44'6"
M Transport height	4140 mm	13'7"	4880 mm	16'0"
N Track length	5125 mm	16'10"	5420 mm	17'9"

CHOOSING A TRACK SHOE

In severe underfoot conditions, narrow shoes impose lower forces on other undercarriage components, and normally result in improved overall track life. Machines working in rock should be equipped with the narrowest available shoe. Wider shoes will improve flotation, but shoes wider than those shown here should not be used. Track shoe width has little effect on stability.

Double grouser shoes will provide adequate traction in most underfoot conditions, and are less damaging to floor and road surfaces. For additional traction in deep mud, or in rock applications which allow some grouser penetration, single grouser shoes are recommended. Hard, smooth quarry floors that allow little or no grouser penetration are best handled by the narrowest double grouser shoes.

Track Shoe Widths and Ground Pressures

Model	Standard Shoe	GROUND PRESSURE			
		With Front Dump Bucket		With Bottom Dump Bucket	
		kPa	psi	kPa	psi
235D Front Shovel	457 mm (18") double grouser	103.3	15.0	106.8	15.5
	610 mm (24") double grouser	78.9	11.4	81.5	11.8
245D Front Shovel	610 mm (24") single grouser	110.6	16.0	112.3	16.3
	610 mm (24") double grouser	110.6	16.0	112.4	16.3
	760 mm (30") double grouser	89.2	12.9	92.1	13.4
E450 Front Shovel	610 mm (24")	—		82.32	11.94
E650 Front Shovel	610 mm (24")	—		113.8	16.5

CURL AND CROWD FORCES

Rated digging forces are the forces that can be exerted at the outermost cutting point. They are calculated by applying working relief hydraulic pressure to the cylinder(s) providing the digging force. Weight of components and friction are excluded from the calculations.

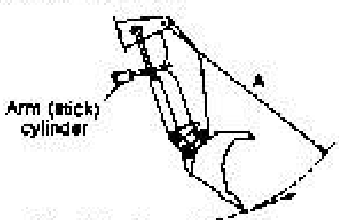


Figure 1

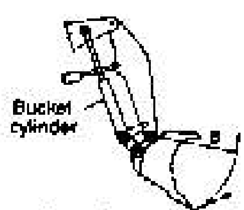


Figure 2

Rated Arm (Stick) Force — is generated by the arm (stick) cylinder and is tangent to the arc of radius "A". The arm is positioned to obtain the maximum output moment from the arm cylinder with the bucket positioned as in figure 1.

Rated Bucket Tangential Force — is generated by the bucket cylinders and is tangent to the arc of radius "B". The bucket is positioned to obtain the maximum output moment from the bucket cylinders and connecting linkage as in figure 2.

Model	Bucket Capacity		A — Arm (Stick) Force		B — Bucket Tangential Force	
	m^3	yd^3	kN	lb	kN	lb
235D Front Shovel						
Front Dump Bucket	2.3	3	299	67,200	265	59,500
Bottom Dump Bucket	1.8	2.38	304	68,400	288	64,800
245D Front Shovel						
Front Dump Bucket	3.8	5	367	82,400	411	92,400
Bottom Dump Bucket	3.1	4	396	89,105	575	129,206
E450 Front Shovel						
Bottom Dump Bucket	2.6	3.4	284	63,800	297	66,660
E650 Front Shovel						
Bottom Dump Bucket	3.8	5	402	90,200	421	94,600

SELECTING A BUCKET

The front dump bucket is best utilized in free dumping materials and unrestricted dump targets. The 245D front dump bucket is sized for high production loading of off-highway trucks. Typically, 35-ton trucks can be loaded in four or five passes in under two minutes.

The bottom dump bucket offers more versatility than the front dump version. However, being heavier it has 20% less rated capacity. This difference may be partially offset by the bottom dump with (1) two-to-three second faster cycle time through easier positioning over the truck and faster dumping action, and (2) less spillage. Hence, the resulting production advantage for the front dump bucket could be approximately 5-10%.

The bottom dump bucket loads like the front dump version, and may either be bottom dumped or front dumped as required. Maximum breakout force is slightly higher than the front dump bucket due to its shorter tip radius. With up to 17% more reach and 35% more dump clearance than the front-dump bucket, the bottom dump will make truck positioning easier. Hauling units can either be kept farther away from loading face without affecting loader cycle times, or be placed several feet above grade on prepared roadways.

Major application features of the bottom-dump are:

- Controlled dumping action permits more accurate loading of narrow trucks with less chance of material spillage. Closer positioning of the bucket over the truck, and metering the material flow on the first pass, lessens impact on truck bodies and increases their life.
- The clamping action of the bottom-dump bucket is ideal for performing sorting work in rock applications. Oversized material can be segregated for secondary breakage prior to hauling to the crusher or fill area. In some cases, the operator can screen material as he dumps by limiting the opening of the bottom dump bucket.
- Sticky material is easier to dislodge from the bottom-dump bucket, thus avoiding material build-up in the bucket which robs production. The bulldozer assembly of the bottom-dump bucket is nearly vertical when the bucket is fully open.

Features:

FRONT DUMP
- 25% greater capacity
- Simple, low maintenance design
- Lower initial cost

BOTTOM DUMP
- 10-15% faster cycle times
- Greater reach and dump clearance
- More versatile for job-matched application

Bucket Selection

Model	Heaped Capacity m^3	Heaped Capacity yd^3	Struck Capacity m^3	Struck Capacity yd^3	Weight kg	Weight lb	Width m	Width ft
235D Front Shovel								
Front Dump Bucket	2.3	3	1.9	2.5	2381	5250	1.88	6'2"
Bottom Dump Bucket	1.8	2.38	1.5	1.94	3492	7700	1.88	6'2"
245D Front Shovel								
Front Dump Bucket	3.8	5	3.34	4.4	4182	9220	2.35	7'8.5"
Bottom Dump Bucket	3.1	4	2.7	3.5	5624	12,400	2.35	7'8.5"
E450 Front Shovel								
Bottom Dump Bucket	2.6	3.4	—		—		1.98	6'6"
E650 Front Shovel								
Bottom Dump Bucket	3.8	5	—		—		2.18	7'2"

4

ESTIMATING FRONT SHOVEL CYCLE TIME

The loading cycle of the front shovel is composed of four segments:

1. Load bucket
2. Swing loaded
3. Dump bucket
4. Swing empty

Total shovel cycle time is dependent on machine size and job conditions. As conditions become more severe (tougher loading, more obstacles, etc.), the shovel slows down accordingly.

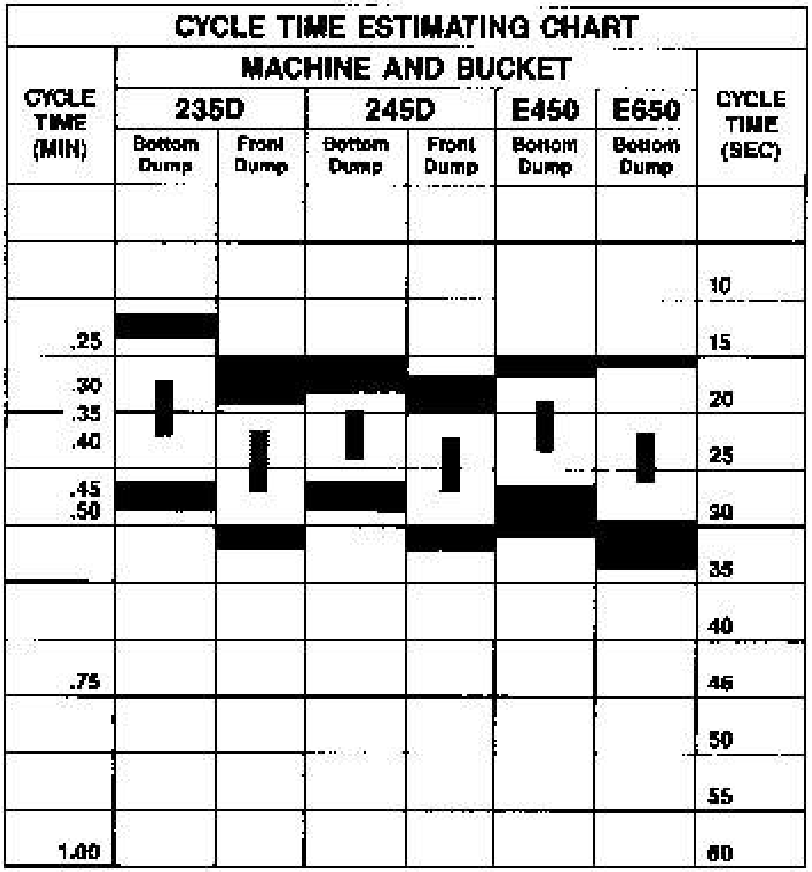
The following table breaks down what experience has shown to be typical Caterpillar Front Shovel cycle times with above average job conditions and an operator of average ability.

These times would decrease as job conditions or operator ability improved and would become slower as conditions become less favorable. For example:

Tough material . . . . Longer bucket fill and dump time.
Greater swing angle . . . . Longer swing times.
Operator ability . . . . Affects total cycle time.
Loading from the top down . . . . May improve swing time.

MODEL	235D Front Shovel		245D Front Shovel	
	Front Dump	Bottom Dump	Front Dump	Bottom Dump
Bucket Size	2.3 m^3 3 yd^3	1.8 m^3 2.38 yd^3	3.8 m^3 5 yd^3	3.1 m^3 4 yd^3
Soil Type	Shot rock	Shot rock	Shot rock	Shot rock
Swing Angle	90°	90°	90°	90°
Load Area	No Obstructions	No Obstructions	No Obstructions	No Obstructions
Operator Ability	Average	Average	Average	Average
Load Bucket	.15 Min.	.13 Min.	.15 Min.	.13 Min.
Swing Loaded	.07 Min.	.07 Min.	.07 Min.	.07 Min.
Dump Bucket	.06 Min.	.04 Min.	.06 Min.	.04 Min.
Swing Empty	.07 Min.	.07 Min.	.07 Min.	.07 Min.
Total Cycle Time	**.35 Min.**	**.31 Min.**	**.35 Min.**	**.31 Min.**

MODEL	E450 Front Shovel	E650 Front Shovel
	Bottom Dump	Bottom Dump
Bucket Size	2.6 m^3 3.4 yd^3	3.8 m^3 5 yd^3
Soil Type	Shot rock	Shot rock
Swing Angle	90°	90°
Load Area	No Obstructions	No Obstructions
Operator Ability	Average	Average
Load Bucket	0.12 Min.	0.13 Min.
Swing Loaded	0.08 Min.	0.09 Min.
Dump Bucket	0.05 Min.	0.05 Min.
Swing Empty	0.07 Min.	0.07 Min.
Total Cycle Time	**0.32 Min.**	**0.34 Min.**



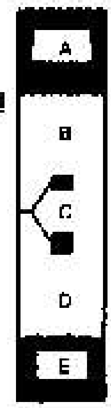
CYCLE TIME vs JOB CONDITION DESCRIPTION

Fastest Possible

Fastest Practical

Typical Range

Slow



Very fast —
Well fragmented material, 45° swing. Excellent operator

Above average —
Shot rock 60° — 90° swing. Above average operator.

Typical range —
Poorly shot or lightly shot material. 90° swing. Average operator.

Slow —
Very severe loading conditions, 120° — 180° swing. New operator.

Key
- A — Excellent
- B — Above Average
- C — Average
- D — Below Average
- E — Severe

FRONT AND BOTTOM DUMP BUCKET FILL FACTORS

Material	Fill Factor*
Bank Clay; Earth	100%-110%
Rock-Earth Mixture	105%-115%
Rock — Poorly Blasted	85%-100%
Rock — Well Blasted	100%-110%
Shale, Sandstone — Standing Bank	85%-100%

*Percent of heaped bucket capacity

ROCK LOADING PRODUCTION TABLES

- **Shot Rock**
- **Estimated Density — 1600 kg/Lm³ or 2700 lb/LCY (1.35 ton/LCY)**

METRIC TONS PER 60 MIN. HOUR*

ESTIMATED CYCLE TIME		ESTIMATED BUCKET PAYLOAD** — LOOSE CUBIC METER									ESTIMATED CYCLES	
Cycle Time (Sec)	Cycle Time (Min)	2 m³	2.25 m³	2.5 m³	2.75 m³	3 m³	3.25 m³	3.5 m³	3.75 m³	4 m³	Cycles/ Minute	Cycles/ Hour
15	.25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	.35	[illegible]	616	684	[illegible]	[illegible]	889	958	[illegible]	[illegible]	[illegible]	[illegible]
24	.40	[illegible]	540	600	[illegible]	[illegible]	780	840	[illegible]	[illegible]	[illegible]	[illegible]
27	.45	[illegible]	480	532	[illegible]	[illegible]	692	745	[illegible]	[illegible]	[illegible]	[illegible]
30	.50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
33	.55	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
36	.60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

U.S. TONS PER 60 MIN. HOUR*

ESTIMATED CYCLE TIME		ESTIMATED BUCKET PAYLOAD** — LOOSE CUBIC YARD									ESTIMATED CYCLES	
Cycle Time (Sec)	Cycle Time (Min)	2 yd³	2.5 yd³	3 yd³	3.5 yd³	4 yd³	4.5 yd³	5 yd³	5.5 yd³	6 yd³	Cycles/ Minute	Cycles/ Hour
15	.25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	.35	[illegible]	577	693	[illegible]	[illegible]	1040	1154	[illegible]	[illegible]	[illegible]	[illegible]
24	.40	[illegible]	506	608	[illegible]	[illegible]	912	1013	[illegible]	[illegible]	[illegible]	[illegible]
27	.45	[illegible]	449	539	[illegible]	[illegible]	809	898	[illegible]	[illegible]	[illegible]	[illegible]
30	.50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
33	.55	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
36	.60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*Actual Hourly Production = (60 Min. Hr. Production) × (Job Efficiency Factor).
**Estimated Bucket Payload = (Heaped Bucket Capacity) × (Bucket Fill Factor).
NOTE: The unshaded areas indicate typical production ranges for 235D and 245D Series II Front Shovels.

ROCK LOADING PRODUCTION TABLES

- **Shot Rock**
- **Estimated Density — 1600 kg/Lm³ or 2700 lb/LCY (1.35 ton/LCY)**

METRIC TONS PER 60 MIN. HOUR*

ESTIMATED CYCLE TIME		ESTIMATED BUCKET PAYLOAD** — LOOSE CUBIC METER					ESTIMATED CYCLES	
Cycle Time (Sec)	Cycle Time (Min)	2.6 m³	3.8 m³	7.5 m³	8.8 m³	12 m³	Cycles/ Minute	Cycles/ Hour
15	.25	998	1459				4.0	240
18	.30	832	1216				3.0	200
21	.35	711	1040	2052	2406	3283	2.9	171
25	.42	599	876	1728	2028	2765	2.5	144
32	.53	470	687	1356	1591	2170	1.9	113
40	.67	374	547	1080	1267	1728	1.5	90
45	.75			960	1126	1536	1.3	80
50	.83			864	1014	1382	1.2	72

U.S. TONS PER 60 MIN. HOUR*

ESTIMATED CYCLE TIME		ESTIMATED BUCKET PAYLOAD** — LOOSE CUBIC YARD					ESTIMATED CYCLES	
Cycle Time (Sec)	Cycle Time (Min)	3.4 yd³	5 yd³	9.75 yd³	11.5 yd³	16.75 yd³	Cycles/ Minute	Cycles/ Hour
15	.25	1102	1620				4.0	240
18	.30	918	1350				3.0	200
21	.35	785	1154	2251	2655	3838	2.9	171
25	.42	661	972	1895	2236	3062	2.5	144
32	.53	519	763	1487	1764	2403	1.9	113
40	.67	413	606	1185	1397	1814	1.5	90
45	.75			1053	1242	1701	1.3	80
50	.83			948	1118	1631	1.2	72

*Actual Hourly Production = (60 Min. Hr. Production) x (Job Efficiency Factor)
**Estimated Bucket Payload — (Heaped Bucket Capacity) x (Bucket Fill Factor)
These tables are calculated using a 100% bucket fill factor.
See bucket fill factors prior to the rock loading production charts.

EARTH LOADING PRODUCTION TABLES

METRIC Lm^3 PER 60 MIN. HOUR*

ESTIMATED CYCLE TIME		ESTIMATED BUCKET PAYLOAD** — LOOSE CUBIC METER									ESTIMATED CYCLES	
Cycle Time (Sec)	Cycle Time (Min)	2 m^3	2.25 m^3	2.5 m^3	2.75 m^3	3 m^3	3.25 m^3	3.5 m^3	3.75 m^3	4 m^3	Cycles/ Minute	Cycles/ Hour
15	.25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	.35	[illegible]	385	428	[illegible]	[illegible]	666	599	[illegible]	[illegible]	[illegible]	[illegible]
24	.40	[illegible]	338	375	[illegible]	[illegible]	488	525	[illegible]	[illegible]	[illegible]	[illegible]
27	.45	[illegible]	299	333	[illegible]	[illegible]	432	466	[illegible]	[illegible]	[illegible]	[illegible]
30	.50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
33	.55	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
36	.60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

U.S. LCY PER 60 MIN. HOUR*

ESTIMATED CYCLE TIME		ESTIMATED BUCKET PAYLOAD** — LOOSE CUBIC YARD									ESTIMATED CYCLES	
Cycle Time (Sec)	Cycle Time (Min)	2 yd^3	2.5 yd^3	3 yd^3	3.5 yd^3	4 yd^3	4.5 yd^3	5 yd^3	5.5 yd^3	6 yd^3	Cycles/ Minute	Cycles/ Hour
15	.25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	.35	[illegible]	428	513	[illegible]	[illegible]	770	855	[illegible]	[illegible]	[illegible]	[illegible]
24	.40	[illegible]	315	450	[illegible]	[illegible]	676	760	[illegible]	[illegible]	[illegible]	[illegible]
27	.45	[illegible]	333	399	[illegible]	[illegible]	599	665	[illegible]	[illegible]	[illegible]	[illegible]
30	.50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
33	.55	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
36	.60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*Actual Hourly Production = (60 Min. Hr. Production) × (Job Efficiency Factor)
**Estimated Bucket Payload = (Heaped Bucket Capacity) × (Bucket Fill Factor).
NOTE: The unshaded areas indicate typical production ranges.

EARTH LOADING PRODUCTION TABLES

METRIC Lm³ PER 60 MIN. HOUR

ESTIMATED CYCLE TIME		ESTIMATED BUCKET PAYLOAD — LOOSE CUBIC METER					ESTIMATED CYCLES	
Cycle Time (Sec)	Cycle Time (Min)	2.6 m³	3.8 m³	7.5 m³	8.8 m³	12 m³	Cycles/ Minute	Cycles/ Hour
15	.25	624	912	[redacted]	[redacted]	[redacted]	4.0	240
18	.30	520	760	[redacted]	[redacted]	[redacted]	3.0	200
21	.35	445	650	1283	1505	2052	2.9	171
24	.40	390	570	1125	1320	1800	2.5	150
27	.45	348	505	998	1170	1596	2.2	133
30	.50	312	456	900	1056	1440	2.0	120
33	.55	283	414	818	959	1308	1.8	109
36	.60	260	380	750	880	1200	1.7	100
40	.67	234	342	675	792	1080	1.5	90
45	.75	208	304	600	704	960	1.3	80
50	.83	187	274	540	634	864	1.2	72

U.S. LCY PER 60 MIN. HOUR

ESTIMATED CYCLE TIME		ESTIMATED BUCKET PAYLOAD — LOOSE CUBIC YARD					ESTIMATED CYCLES	
Cycle Time (Sec)	Cycle Time (Min)	3.4 yd³	5 yd³	9.75 yd³	11.5 yd³	15.75 yd³	Cycles/ Minute	Cycles/ Hour
15	.25	816	1200	[redacted]	[redacted]	[redacted]	4.0	240
18	.30	680	1000	[redacted]	[redacted]	[redacted]	3.0	200
21	.35	581	855	1667	1967	2693	2.9	171
24	.40	510	750	1463	1725	2363	2.5	150
27	.45	452	665	1297	1530	2095	2.2	133
30	.50	408	600	1170	1380	1890	2.0	120
33	.55	370	545	1063	1254	1717	1.8	109
36	.60	340	500	975	1150	1575	1.7	100
40	.67	306	450	878	1035	1418	1.5	90
45	.75	272	400	780	920	1260	1.3	80
50	.83	245	360	702	828	1134	1.2	72

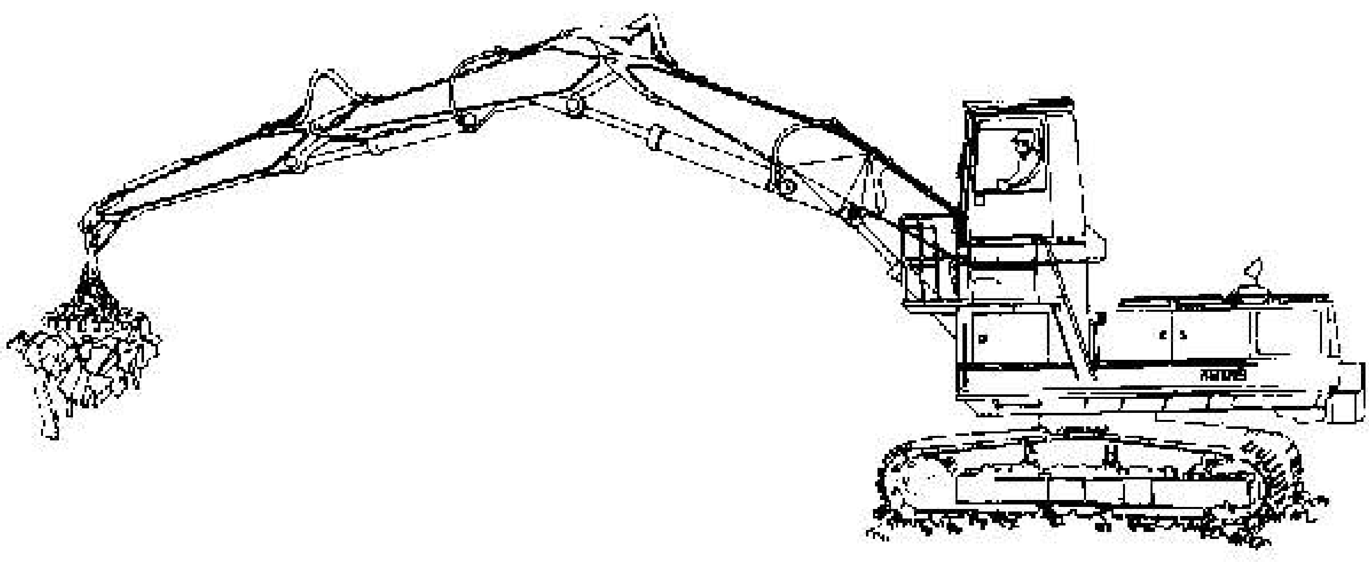
MATERIAL HANDLING ARRANGEMENTS

CONTENTS

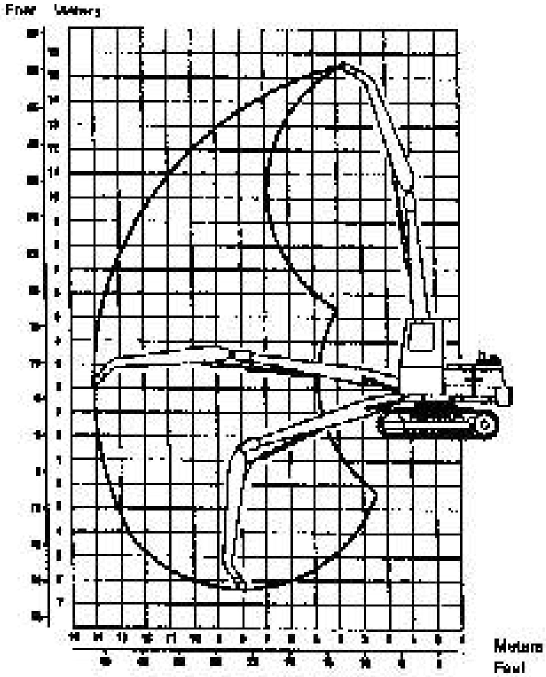
(Scrap specifications and classifications can be found in the Institute of Scrap Iron and Steel Inc.'s "Handbook". The common unit measure for the scrap industry is the gross ton which is 2240 pounds. However, short tons, net tons and metric tons may also be used.)

The versatility of Caterpillar Excavators, plus their ability to be equipped in any number of ways, make them an effective, low cost way to handle scrap and other materials.

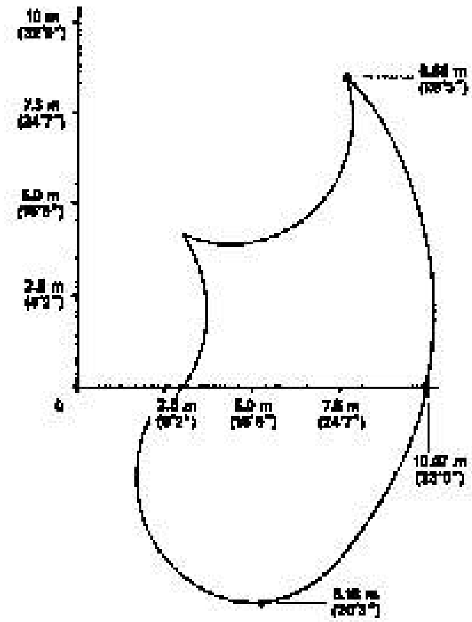
NOTE: Contact Caterpillar Special Attachments for additional information on equipping Caterpillar Excavators for material handling.



231D Range Diagram
- With Young C2-US 46 Material Handler

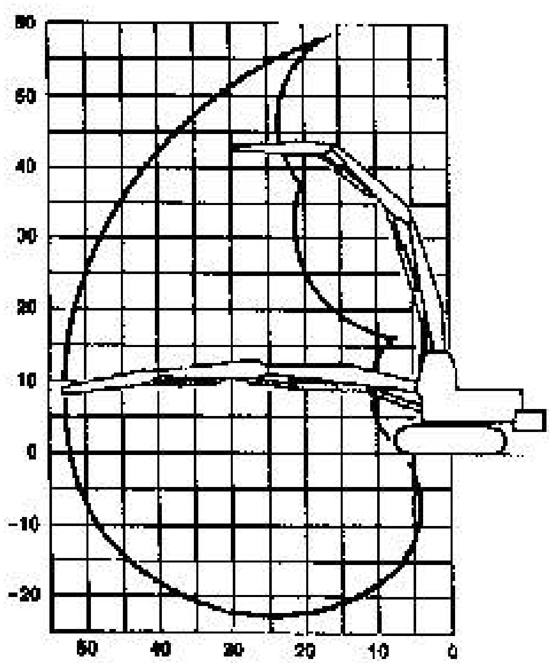


235D Bare Stick Range Diagram
- 3680 mm (12'0") Long Stick
- One-Piece Boom

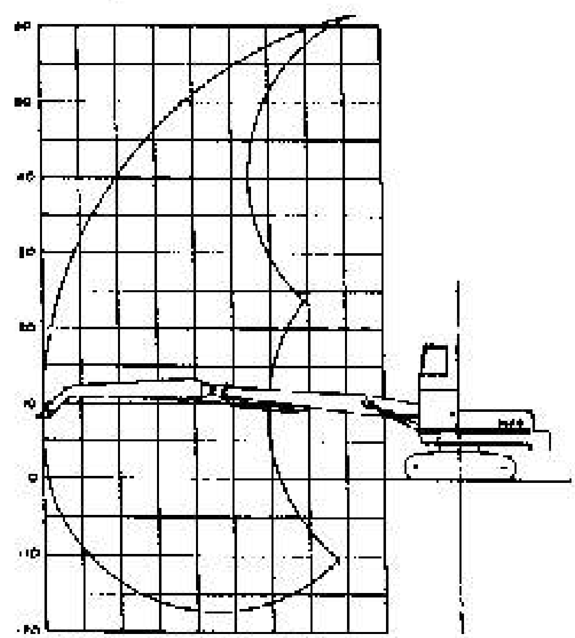


NOTE: A boom foot adapter can be used to further alter the reach above or below ground level in addition to increasing lift capacity.

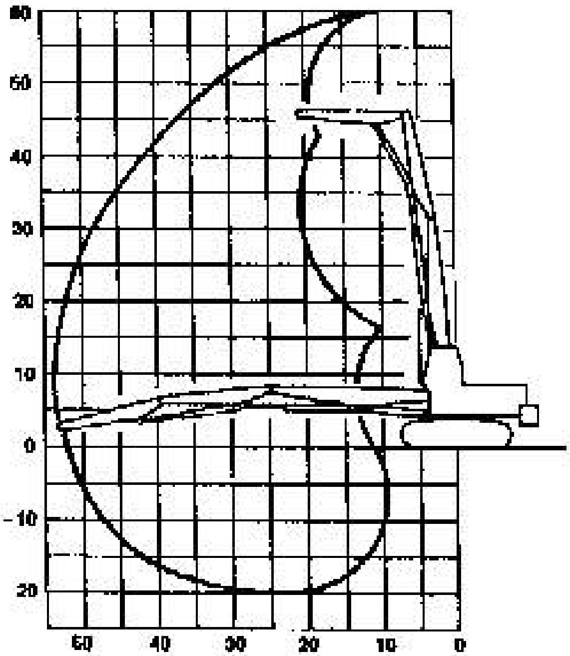
235D Range Diagram
- With Young YC-US 53 Material Handler



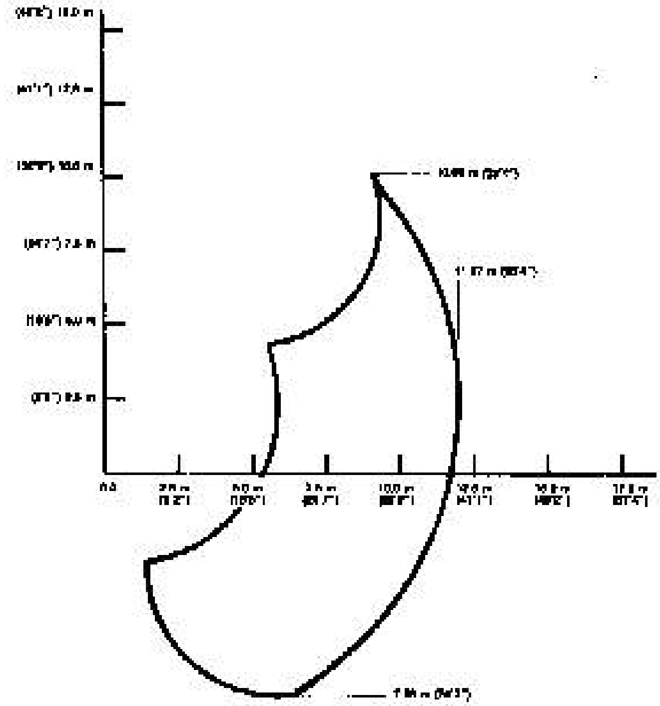
235D Range Diagram
- With Young C2-US 55 Material Handler



235D Range Diagram
- With Pierce-Pacific MHB 3054 Material Handler

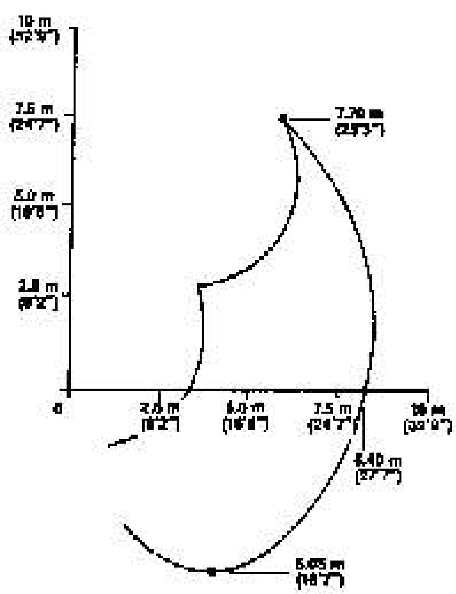


245D Bare Stick Range Diagram
- 4420 mm (14'6") Long Stick
- One-Piece Boom

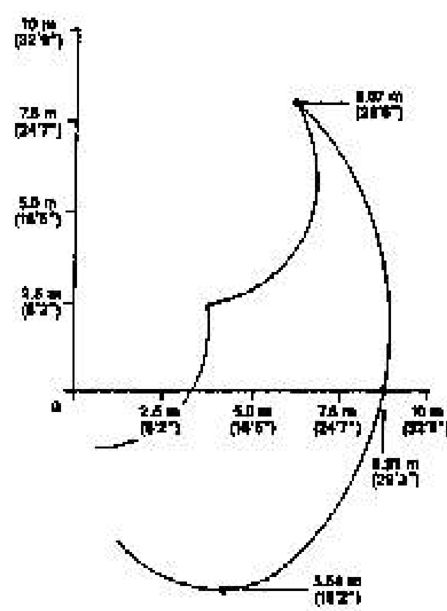


NOTE: A.E.M. material handling arrangements (straight boom, middle stick and end stick) are available. Consult Caterpillar Custom Machine Products for details.

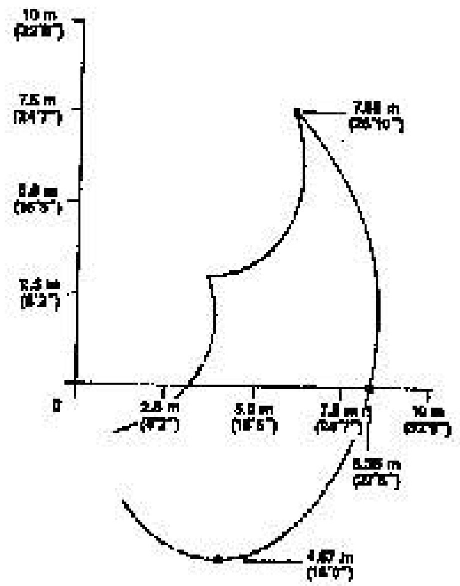
213B LC Bare Stick Range Diagram
- 3000 mm (9'10") Stick
- One-Piece Boom



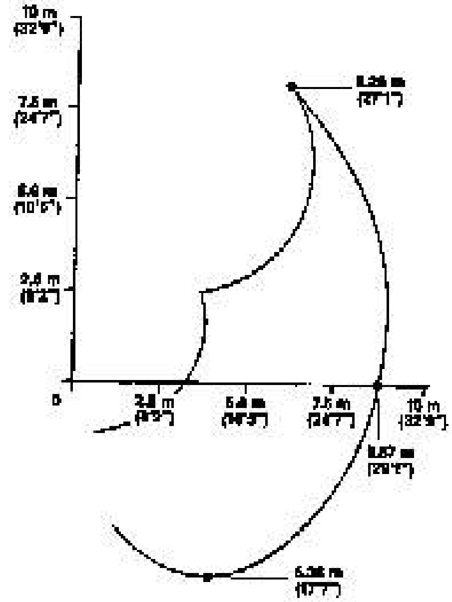
213B LC Bare Stick Range Diagram
- 3500 mm (11'6") Stick
- One-Piece Boom



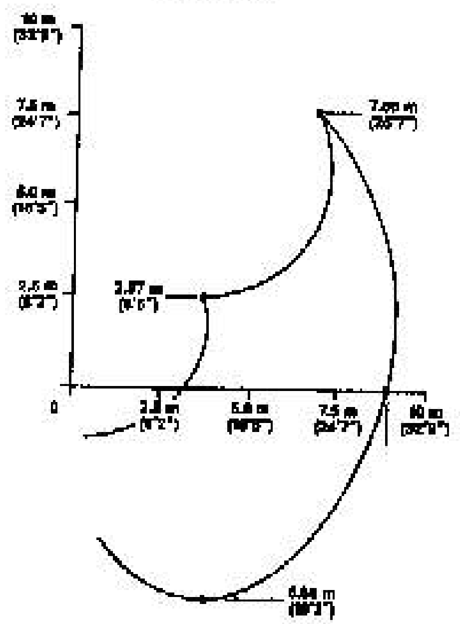
214B, 214B FT Bare Stick Range Diagram
- 3000 mm (9'10") Stick
- One-Piece Boom

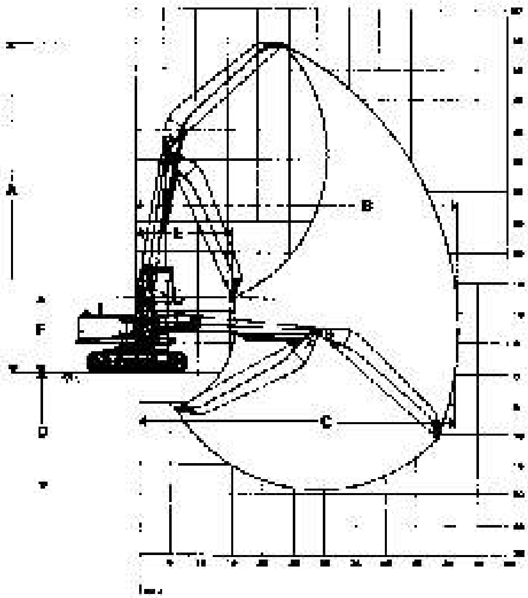


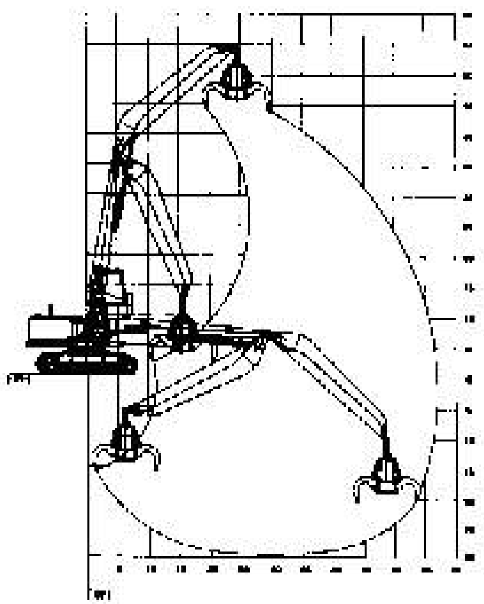
214B, 214B FT Bare Stick Range Diagram
- 3500 mm (11'6") Stick
- One-Piece Boom



224B Bare Stick Range Diagram
- 3500 mm (11'6") Stick
- One-Piece Boom







Two-Piece Boom & Stick Range Diagram

- Custom High/Wide Carbody
- No Attachment

KEY:

A Maximum pin height above ground line

B Maximum reach of pin point

C Maximum reach of pin point at ground line

D Maximum pin point below ground line

E Reach of pin point with Boom full up and stick full down

F Height of pin point with Boom full up and stick full down

*Grapple Range diagram shown for illustration only — varies with brand

235D Balderson Material Handling Arrangement W/8600 mm (28'3") Boom & 8000 mm (26'3") Stick

Stick Pin	W/O Attachment		W/Grapple	
	m	ft	m	ft
A	16.46	54'00"		
B	16.00	52'06"		
C	15.85	52'00"	*(Illustration Only)	
D	5.79	19'00"		
E	4.67	15'00"		
F	3.81	12'06"		

231D Lift Capacity For Young C2-US 46

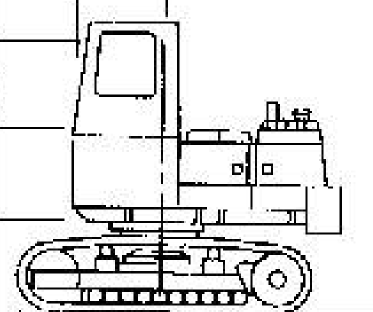
1. Capacities shown are:

*Hydraulic capacity
Tipping over front
Tipping over side

2. Capacities are measured at the tip of the stick and are expressed in thousands of pounds.
3. Capacities are based on machine equipped as follows:
   - 29 650 kPa (4300 psi) operating pressure
   - 152 mm (6") diameter boom hoist cylinders
   - Widened carbody
   - 5690 kg (12,540 lb) counterweight
   - 30 710 kg (69, 940 lb) machine weight without grapple
4. Capacities shown are based on P.C.S.A. Standard No. 3. Rated loads do not exceed **87% of hydraulic capacity or 75% of tipping capacity.**
5. Capacities are gross figures. Weight of grapple must be removed.

YOUNG Model C2-US 46 for 231D Excavator

Feet	45'	40'	35'	30'	25'	20'	15'	10'	5'	0'
45'						*14.1 38.1 26.2				
40'					*12.7 27.5 18.8					
35'				*11.4 20.7 14.2	*12.1 27.9 19.2					
30'			*10.7 16.1 11.0	*11.3 20.7 14.0	*12.0 27.9 19.2					
25'		*10.0 12.9 8.7	*10.7 16.1 11.0	*11.5 20.8 14.1	*12.4 27.6 18.9					
20'		*10.0 12.6 8.6	*10.9 15.8 10.8	*12.0 20.3 13.8	*13.2 27.1 18.5	*14.8 39.2 26.3				
15'	*7.7 10.5 6.9	*10.2 12.7 8.6	*11.3 15.6 10.5	*12.6 19.8 13.4	*14.4 26.3 17.7	*14.8 37.9 26.1	*9.8 63.9 40.1			
10'	*8.9 10.4 6.9	*10.3 12.5 8.3	*11.7 15.3 10.2	*13.4 19.2 12.9	*15.7 25.4 16.9	*18.3 36.1 23.8				
5'	*9.7 10.4 6.8	*10.3 12.3 8.1	*11.9 14.9 9.9	*14.0 18.7 12.4	*16.0 24.4 16.0	*21.4 34.4 22.0				
0'	*8.1 10.1 6.7	*10.2 12.1 8.0	*12.0 14.6 9.6	*14.3 18.2 11.9	*17.5 23.6 15.3	*22.4 33.1 20.8	*5.4 53.7 31.6			
−5'		*9.6 12.0 7.9	*11.7 14.4 9.4	*14.1 17.8 11.6	*17.4 23.1 14.8	*19.6 32.2 20.1	*6.2 52.5 30.7	*1.9 138.6 83.4		
−10'		*8.5 12.0 7.8	*10.9 14.3 9.3	*13.4 17.6 11.4	*16.5 22.8 14.6	*18.4 31.8 19.8	*8.0 52.2 30.4	*4.1 139.1 83.7		
−15'										



235D Lift Capacity (at end of Bare Stick)
- One-Piece Boom
- 3660 mm (12'0") Long Stick
- Wide Gauge Carbody
- W/Increased Lift
- 8620 kg (19,000 lb) counterweight
- 760 mm (30") Track Shoes

OVER FRONT

Load Point Height m (ft)		Cable Reach from Swing Centerline 3.00 m (10')	4.50 m (15')	6.00 m (20')	7.50 m (25')	9.00 m (30')	Lift Capacity at Max Reach kg (lb)
7.5 m (25.00')	kg lb						6800* (15,000)*
6.0 m (20.00')	kg lb				10 490* †	9800* (19,900)*	6700* (14,800)*
4.5 m (15.00')	kg lb				11 330* (24,600)*	10 120* (22,100)*	6790* (14,900)*
3.0 m (10.00')	kg lb		20 360* (43,800)*	14 970* (32,400)*	12 220* (26,500)*	10 550* (22,900)*	7050* (15,500)*
1.5 m (5.00')	kg lb		22 490* (48,600)*	16 290* (35,200)*	12 980* (28,100)*	10 720 (23,100)	7500* (16,500)*
0 m (0.00')	kg lb	8490* (19,000)*	22 470* (49,200)*	16 860* (36,500)*	13 340* (28,900)*	15 520 (22,700)	8230* (18,100)*
−1.5 m (−5.00')	kg lb	14 980* (33,700)*	21 640* (47,000)*	16 560* (35,900)*	13 160* (28,500)*	10 400 (22,400)	9400* (20,700)*
−3.0 m (−10.00')	kg lb	21 720* (48,900)*	19 610* (42,500)*	15 380* (33,300)*	12 240* (26,400)*		9610* (21,100)*
−4.5 m (−15.00')	kg lb	20 390* (44,000)*	16 400* (35,300)*	13 070* (28,000)*	10 060* (21,200)*		9220* (20,200)*
−7.5 m (−25.00')	kg lb		11 260* (23,600)*	8610* (17,500)*			7830* (17,200)*

OVER SIDE

Load Point Height m (ft)		Cable Reach from Swing Centerline 3.00 m (10')	4.50 m (15')	6.00 m (20')	7.50 m (25')	9.00 m (30')	Lift Capacity at Max Reach kg (lb)
7.5 m (25.00')	kg lb						6800* (15,000)*
6.0 m (20.00')	kg lb				10 490* †	9570 (19,900)	6700* (14,800)*
4.5 m (15.00')	kg lb				11 330* (24,600)*	9410 (20,200)	6790* (14,900)*
3.0 m (10.00')	kg lb		20 360* (43,800)*	14 970* (32,400)*	11 940 (25,700)	9170 (19,800)	7050* (15,500)*
1.5 m (5.00')	kg lb		22 490* (48,600)*	15 760 (33,900)	11 510 (24,800)	8930 (19,300)	7420 (16,300)
0 m (0.00')	kg lb	8490* (19,000)*	22 470* (49,200)*	15 230 (32,800)	11 180 (24,100)	8740 (18,900)	7510 (16,600)
−1.5 m (−5.00')	kg lb	14 980* (33,700)*	21 640* (47,000)*	14 970 (32,200)	10 880 (23,700)	8630 (18,600)	7900 (17,400)
−3.0 m (−10.00')	kg lb	21 720* (48,900)*	19 610* (42,500)*	14 830 (32,100)	10 940 (23,600)		8740 (19,300)
−4.5 m (−15.00')	kg lb	20 390* (44,000)*	16 400* (35,300)*	13 070* (28,000)*	10 080* (21,200)*		9220* (20,200)*
−7.5 m (−25.00')	kg lb		11 260* (23,600)*	8610* (17,500)*			7930* (17,200)*

*Indicates load is limited by hydraulic capacity rather than tipping.
†English load point height and cable reach values are not attainable due to linkage limits.

235D Lift Capacity For Young YC-US 53

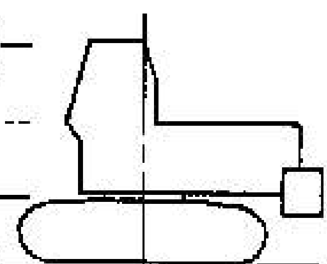
1. Capacities shown are:

*Hydraulic capacity
Tipping over front
Tipping over side

2. Capacities are measured at the bare stick tip of the third member and are expressed in pounds.
3. Capacities are based on machine equipped as follows:
   - 29 650 kPa **(4300 psi)** operating pressure
   - 48 308 kg **(106,500 lb)** total machine weight including base machine, Young YC-US 53 material handling front, 1829 mm (72") manual tilt cab riser, lubricants, full fuel tank and operator
   - Standard crawler undercarriage
   - 760 mm (30") triple grouser shoes
4. Capacities shown are based on P.S.C.A. Standard No. 3. Rated loads do not exceed 87% of hydraulic capacity or 75% of tipping capacity.

YOUNG Model YC-US 53 for 235D Excavator

Feet	50'	45'	40'	35'	30'	25'	20'	15'	10'
50'					*20480 24970 20780	*18490 34100 29440			
45'				*19000 19730 19400	*19020 25830 21810	*17650 34160 28480			
40'			*17620 15780 13030	*20200 20170 16830	*18780 26170 21940	*16930 34010 29350			
35'		*15380 12870 10330	*18160 16040 13260	*21530 20340 16990	*22380 26030 21800	*21440 33840 27990			
30'		*17480 12870 10630	*20630 15940 13190	*22730 19810 16480	*29430 25000 20810	*24860 32110 26530			
25'	*14110 10370 8340	*19090 12750 10420	*22080 15400 12560	*24880 18710 15410	*29060 22960 18840	*35800 31130 25590			
20'	*16990 10390 8360	*20680 12470 10140	*23570 14700 11870	*27290 17800 14280	*32430 22150 18050	*37120 29850 24370	*32230 43710 35510		
15'	*17300 10320 8290	*21940 12550 10220	*24700 14470 11750	*28700 17100 13840	*33130 21270 17200	*38010 28880 23440	*44250 43000 34830	*27550 72760 57560	*12480 179880 128350
10'	*18470 10190 8170	*22060 12300 9970	*24960 15060 12320	*28710 17280 14020	*33510 21080 17000	*39050 29250 22830	*46050 42040 33930	*31160 70880 56560	
5'	*18830 10040 8010	*22120 12010 9690	*25040 14610 11890	*29740 18140 14850	*33310 21540 17460	*40250 27640 22160	*46930 40810 32770	*20090 64740 50250	
0'	*17730 9900 7880	*21810 11720 9410	*25280 14140 11430	*29140 17410 14150	*34070 22060 17960	*41320 28390 22970	*41530 39360 31400	*16760 61320 47130	*12380 145090 98170
−5'	*15290 9850 7830	*20830 11600 9190	*24380 13760 11040	*29260 16760 13540	*34730 21100 17040	*42170 27390 22000	*35390 37780 29810	*18690 59600 45480	*13770 144400 97660
−10'		*18570 11370 9070	*23490 13470 10770	*28930 16340 13100	*34130 20400 16380	*41910 26570 21220	*35610 36860 29050	*19120 59690 44730	*14470 144480 97710
−15'			*20480 13350 10660	*25920 16070 12850	*31740 19960 15950	*39220 25960 20640	*36810 36390 28550	*19700 58810 44670	*14570 144880 98130
−20'				*11780 16060 12830	*15910 19880 15880	*20130 25780 20460	*25330 35110 28340	*14650 58760 44600	



235D Lift Capacity For Young C2-US 55

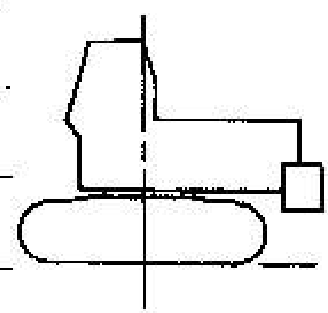
1. Capacities shown are:

*Hydraulic capacity
Tipping over front
Tipping over side

2. Capacities are measured at the tip of the stick and are expressed in thousands of pounds.
3. Capacities are based on machine equipped as follows:
   - 29 650 kPa (**4300 psi**) operating pressure
   - 178 mm (7") diameter boom hoist cylinders
   - Material handling carbody
   - 10 660 kg (**23,500 lb**) counterweight
   - 76 832 kg (**102,804 lb**) total machine weight
4. Capacities shown are based on P.S.C.A. Standard No. 3. Rated loads do not exceed 87% of hydraulic capacity or 75% of tipping capacity.
5. Capacities are gross figures. Weight of grapple must be removed.

YOUNG Model C2-US 55 for 235D Excavator

Feet	55'	50'	45'	40'	35'	30'	25'	20'
45'–40'				15.9 17.5 14.7	17.2 22.1 18.7	18.4 28.3 24.0		
40'–35'				15.8 17.9 15.1	16.8 22.3 18.0			
35'–30'			14.8 14.8 12.4	15.6 18.0 15.3	16.7 22.4 18.0			
30'–25'		11.1 12.3 10.3	14.5 14.8 12.5	15.7 18.0 16.2	17.0 22.2 18.8	18.5 28.5 24.0		
25'–20'		19.9 12.4 10.3	14.5 14.7 12.4	15.9 17.8 15.0	17.4 21.8 18.6	19.2 27.8 23.6		
20'–15'		13.3 12.3 10.3	14.8 14.6 12.2	16.3 17.5 14.8	18.1 21.5 18.2	20.2 27.2 23.0	21.7 36.1 30.4	
15'–10'		13.3 12.2 10.1	14.9 14.4 12.0	16.7 17.2 14.4	18.8 21.0 17.7	21.4 26.4 22.2	25.0 34.8 29.2	21.5 48.5 41.1
10'–5'	9.8 10.4 8.6	13.2 12.0 10.0	15.0 14.1 11.8	17.0 16.8 14.1	19.4 20.4 17.1	22.5 25.5 21.4	26.8 33.4 27.8	33.0 47.0 38.6
5'–0'		12.8 11.9 9.9	14.9 13.9 11.5	17.1 16.4 13.7	19.8 19.9 16.6	23.3 24.7 20.5	28.3 32.0 26.5	36.0 44.5 36.4
0'–−5'		12.2 11.8 9.8	14.6 13.7 11.3	17.0 16.1 13.4	19.8 19.4 16.1	23.5 24.0 19.8	28.8 30.9 25.4	25.9 42.7 34.6
−5'–−10'		11.1 11.7 9.7	13.8 13.5 11.2	16.4 15.8 13.1	19.3 19.0 15.7	23.1 23.4 19.3	28.2 30.1 24.7	21.6 41.6 37.8



235D Lift Capacity For Pierce-Pacific MHB 3054

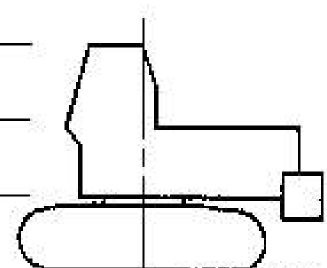
1. Capacities shown are:

*Hydraulic capacity
Tipping over front
Tipping over side

2. Capacities are measured at the bare stick tip of the third member and are expressed in pounds.
3. Capacities are based on machine equipped as follows:
   - 29 650 kPa (4300 psi) operating pressure
   - 48 943 kg (107,900 lb) total machine weight including base machine, Pierce-Pacific MHB 3054 material handling front, 1829 mm (72") manual tilt cab riser, lubricants, full fuel tank and operator
   - Standard crawler undercarriage
   - 760 mm (30") triple grouser shoes
4. Capacities shown are based on P.S.C.A. Standard No. 3. Rated loads do not exceed 87% of hydraulic capacity or 75% of tipping capacity.

PIERCE-PACIFIC Model MHB 3054 for 235D Excavator

Feet	50'	45'	40'	35'	30'	25'	20'	15'	10'
55'						*27090 32900 27320	*27340 48880 40460		
50'					*23580 25400 21210	*24100 34640 28990			
45'				*21370 19810 16510	*21180 28300 22080	*22470 34470 28920			
40'			*19310 15690 12950	*22680 20300 16980	*23700 28000 21890	*24540 34200 28820			
35'		*17000 12550 10220	*20870 15900 13150	*23470 20280 16940	*25040 25800 21400	*28390 33880 28080			
30'		*18820 12830 10300	*22540 15850 13110	*24930 20080 16740	*27970 25130 20950	*33470 33210 27610			
25'	*16170 10140 8110	*20610 12550 10210	*23870 15580 12860	*26750 18810 18290	*30800 26000 20820	*37880 32640 27060			
20'	*18830 10080 8050	*20440 12810 9980	*23750 15150 12420	*27280 18940 15630	*31400 24740 20570	*37800 32040 26480	*47080 45320 37080		
15'	*16460 9970 7940	*20110 12040 9720	*23380 14810 11890	*27300 18270 14990	*31980 23980 19430	*38180 31430 25900	*47770 44330 36160	*83430 71190 56320	
10'	*16310 9750 7730	*19150 11650 9340	*22820 14120 11410	*27020 17530 14250	*32170 22410 18910	*39030 29280 23820	*49410 41100 33100	*20270 64380 60080	
5'	*13790 9570 7560	*17870 11530 8020	*21710 13820 10820	*26160 16780 13530	*31530 21780 17200	*38560 27470 22110	*29700 38100 30270	*16640 59190 45300	
0'	*11820 9450 7430	*16810 11090 8790	*19800 13170 10480	*24370 16100 12880	*29900 20230 16210	*36610 26230 20910	*23450 35880 28170	*17150 58980 43320	
-5'	*9610 9380 7370	*13320 10870 8570	*17480 12800 10200	*21320 15570 12360	*26080 19570 15560	*32860 25310 20000	*24200 35070 27410	*18300 56300 42880	*17900 140910 95870
-10'		*10730 10050 8550	*14700 12750 10070	*18490 15360 12150	*22840 19130 15140	*28290 24870 19810	*24830 34800 26940	*20680 55260 42650	*18580 141820 95010
-15'			*11440 12670 10140	*14850 15340 12130	*19080 19060 15060	*24120 24880 19620	*29890 34980 27320	*22160 50790 43130	



4

245D Lift Capacity (at end of Bare Stick)
- One-Piece Boom
- 4420 mm (14'6") Long Stick
- D9 size undercarriage
- 760 mm (30") Track Shoes
- 4540 kg (10,000 lb) extra counterweight

OVER FRONT

Load Point Height m (ft)		Cable Reach from Swing Centerline 4.50 m (15')	6.00 m (20')	7.50 m (25')	9.00 m (30')	10.5 m (35')	Lift Capacity at Max Reach kg (lb)
7.5 m (25.00')	kg lb				 (22,700)*	10 120* (22,200)*	9640* (21,300)*
6.0 m (20.00')	kg lb				10 010* (24,000)*	10 360* (22,700)*	9660* (21,300)*
4.5 m (15.00')	kg lb		16 460* †	13 580* (29,400)*	11 900* (25,800)*	10 830* (23,800)*	9860* (21,700)*
3.0 m (10.00')	kg lb		19 330* (41,600)*	15 210* (32,900)*	12 870* (27,900)*	11 390* (24,800)*	10 300* (22,600)*
1.5 m (5.00')	kg lb		21 520* (46,400)*	16 600* (35,900)*	13 730* (29,800)*	11 890* (25,800)*	10 650* (23,400)*
0 m (0.00')	kg lb		22 620* (48,900)*	17 490* (37,900)*	14 330* (31,000)*	12 210* (26,500)*	10 900* (24,000)*
−1.5 m (−5.00')	kg lb	19 760* (45,100)*	22 720* (49,200)*	17 770* (38,500)*	14 520* (31,400)*	12 190* (26,300)*	11 170* (24,600)*
3.0 m (−10.00')	kg lb	27 140* (61,900)*	21 890* (47,400)*	17 340* (37,500)*	14 140* (30,500)*	11 520	11 440* (25,200)*
−4.5 m (−15.00')	kg lb	25 810* (56,700)*	20 070* (43,300)*	16 020* (34,600)*	12 630* (27,400)*		11 620* (25,600)*
−6.0 m (−20.00')	kg lb	21 280* (45,500)*	16 630* (35,900)*	13 210* (27,900)*			11 620* (25,300)*

OVER SIDE

Load Point Height m (ft)		Cable Reach from Swing Centerline 4.50 m (15')	6.00 m (20')	7.50 m (25')	9.00 m (30')	10.5 m (35')	Lift Capacity at Max Reach kg (lb)
7.5 m (25.00')	kg lb				 (22,700)*	10 120* (22,200)*	9640* (21,300)*
6.0 m (20.00')	kg lb				11 010* (24,000)*	10 360* (22,700)*	9660* (21,300)*
4.5 m (15.00')	kg lb		16 460* †	13 580* (29,400)*	11 900* (25,800)*	10 830* (23,800)*	9280 (20,500)
3.0 m (10.00')	kg lb		19 330* (41,600)*	15 210* (32,900)*	12 870* (27,900)*	10 820 (23,300)	8930 (19,700)
1.5 m (5.00')	kg lb		21 520* (46,400)*	16 600* (36,800)*	13 040 (28,100)	10 540 (22,700)	8830 (19,400)
0 m (0.00')	kg lb		22 000 (47,400)	16 200 (34,900)	12 690 (27,400)	10 320 (22,300)	8950 (19,700)
−1.5 m (−5.00')	kg lb	19 760* (45,100)*	21 680 (46,700)	15 900 (34,300)	12 470 (26,900)	10 200 (22,000)	9360 (20,600)
−3.0 m (−10.00')	kg lb	27 140* (61,900)*	21 630 (46,600)	15 810 (34,100)	12 410 (26,800)	10 200	10 150 (22,400)
4.5 m (−15.00')	kg lb	25 810* (56,700)*	20 070* (43,300)*	15 910 (34,300)	12 520 (27,100)		11 610* (26,800)*
−6.0 m (−20.00')	kg lb	21 280* (45,500)*	16 630* (35,900)*	13 210* (27,900)*			11 630* (25,300)*

*Indicates load is limited by hydraulic capacity rather than tipping.
†English load point height and cable reach values are not attainable due to linkage limits.
NOTE: Tool and payload rating does not exceed 87% hydraulic or 75% of tipping capacity. (SAE rating method on 245)

213B LC Lift Capacity (at end of Bare Stick)
- One-Piece Boom
- 3000 mm (9'10") Stick
- 600 mm (23.6") Track Shoes

OVER FRONT

Load Point Height m (ft)		Cable Reach from Swing Centerline 1.50 m (6')	3.00 m (10')	4.60 m (15')	6.00 m (20')	7.50 m (25')	Lift Capacity at Max Reach: Max Reach m ft	Lift Capacity kg (lb)
6.0 m (20.00')	kg lb						7.2 (23.6')	2177* (4800)*
4.5 m (15.00')	kg lb				3583 (7900)*	3583* (7900)*	8.0 (26.3")	2041* (4600)*
3.0 m (10.00')	kg lb			5080 (11,200)*	4173 (9200)*	3583 (7900)	8.4 (27.7')	1996 (4400)*
1.5 m (5.00')	kg lb			6622* (14,600)*	4899 (10,800)	3493 (7700)	8.56 (28.1')	2041* (4500)*
0 m (0.00')	kg lb			7303 (16,100)	4672 (10,300)	3402 (7500)	8.3 (27.5')	2223 (4900)*
1.5 m (−5.00')	kg lb	4218 (9300)	7167* (15,800)*	7121 (15,700)	4581 (10,100)	3357 (7400)	7.9 (26.0')	2540* (5600)*
−3.0 m (−10.00')	kg lb	7394* (16,300)*	11 521* (25,400)*	7121 (15,700)	4581 (10,100)		7.0 (23.1')	3175 (7000)*
−4.5 m (−15.00')	kg lb		9072* (20,000)*	6078 (13,400)*				

OVER SIDE

Load Point Height m (ft)		Cable Reach from Swing Centerline 1.50 m (5')	3.00 m (10')	4.50 m (15')	6.00 m (20')	7.50 m (25')	Lift Capacity at Max Reach: Max Reach m ft	Lift Capacity kg (lb)
6.0 m (20.00')	kg lb						7.2 (23.8')	2177 (4800)*
4.5 m (15.00')	kg lb				3493 (7700)	2404 (5300)	8.0 (26.3")	2041 (4500)*
3.0 m (10.00')	kg lb			5080* (11,200)*	3182 (7300)	2313 (6100)	8.4 (27.7')	1905 (4200)
1.5 m (5.00')	kg lb			4661 (10,200)	3084 (6800)	2223 (4900)	8.5 (28.1')	1814 (4000)
0 m (0.00')	kg lb			4309 (9500)	2903 (6400)	2132 (4700)	8.36 (27.5')	1860 (4100)
−1.5 m (−5.00')	kg lb	4218 (9300)*	7167* (15,800)*	4173 (9200)	2812 (6200)	2086 (4600)	7.9 (26.0')	1996 (4400)
−3.0 m (−10.00')	kg lb	7394* (16,300)*	7892 (17,400)	4173 (9200)	2812 (6200)		7.0 (23.1')	2359 (5200)
−4.5 m (−15.00')	kg lb		8164 (18,000)	4309 (9500)				

*Indicates load is limited by hydraulic capacity rather than tipping.

213B LC Lift Capacity (at end of Bare Stick)
- One-Piece Boom
- 3500 mm (11'6") Stick
- 600 mm (23.6") Track Shoes

OVER FRONT

Load Point Height m (ft)		Cable Reach from Swing Centerline 1.50 m (5')	3.00 m (10')	4.50 m (15')	6.00 m (20')	7.50 m (25')	Lift Capacity at Max Reach: Max Reach m ft	Lift Capacity kg (lb)
7.6 m (25.00')	kg lb						6.67 (21.9')	2086* (4600)*
6.0 m (20.00')	kg lb					2531 (5600)*	7.83 (25.7')	1814* (4000)*
4.5 m (15.00')	kg lb					3266* (7200)*	8.56 (28.1")	1724* (3800)*
3.0 m (10.00')	kg lb				3810 (8400)*	3493* (7700)*	8.96 (29.4')	1676* (3700)*
1.5 m (5.00')	kg lb			6078* (13,400)*	4581 (10,100)*	3493 (7700)	9.08 (29.8')	1724 (3800)*
0 m (0.00')	kg lb			7303 (16,100)	4717 (10,400)	3357 (7400)	8.90 (29.2')	1860* (4100)*
−1.5 m (−5.00')	kg lb	3674* (8100)*	6577* (14,500)*	7076 (15,600)	4536 (10,000)	3311 (7300)	8.44 (27.7')	2086* (4600)*
−3.0 m (−10.00')	kg lb	6305* (13,900)*	9979 (22,000)*	7030 (15,500)	4490 (9900)	2812* (6200)*	7.65 (25.1')	2495* (5500)*
−4.5 m (−15.00')	kg lb		10 070 (22,200)*	6668* (14,700)*	4536 (10,000)*			

OVER SIDE

Load Point Height m (ft)		Cable Reach from Swing Centerline 1.50 m (5')	3.00 m (10')	4.50 m (15')	6.00 m (20')	7.50 m (25')	Lift Capacity at Max Reach: Max Reach m ft	Lift Capacity kg (lb)
7.6 m (25.00')	kg lb						6.67 (21.9')	2086* (4600)*
6.0 m (20.00')	kg lb					2449 (5400)	7.83 (25.7')	1814* (4000)*
4.5 m (15.00')	kg lb					2449 (5400)	8.56 (28.1")	1724* (3800)*
3.0 m (10.00')	kg lb				3357 (7400)	2359 (5200)	8.96 (29.4')	1676* (3700)*
1.5 m (5.00')	kg lb			4717 (10,400)	3146 (6900)	2223 (4900)	9.08 (29.8')	1676 (3700)
0 m (0.00')	kg lb			4309 (9500)	2903 (6400)	2132 (4700)	8.90 (29.2')	1676 (3700)
−1.5 m (−5.00')	kg lb	3674* (8100)*	6577* (14,500)*	4128 (9100)	2767 (6100)	2041 (4500)	8.44 (27.7')	1769 (3900)
−3.0 m (−10.00')	kg lb	6305* (13,900)*	7666 (16,900)	4082 (9000)	2721 (6000)	2041 (4500)	7.65 (25.1')	2041 (4500)
−4.5 m (−15.00')	kg lb		7938 (17,500)	4173 (9200)	2858 (6300)			

*Indicates load is limited by hydraulic capacity rather than tipping.

214B, 214B FT Lift Capacity (at end of Bare Stick)

- One-Piece Boom
- 3000 mm (9'10") Stick
- Two Sets of Outriggers — Lowered
- 10 × 20 Dual Tires

OVER FRONT

Load Point Height m (ft)		Cable Reach from Swing Centerline 1.50 m (5')	3.00 m (10')	4.50 m (15')	6.00 m (20')	7.50 m (25')	Lift Capacity at Max Reach: Max Reach m (ft)	Lift Capacity kg (lb)
7.5 m (25.00')	kg lb						6.1 (20.1')	2449 (5400)*
6.0 m (20.00')	kg lb					2676* (5900)*	7.3 (24.2')	2132 (4700)*
4.5 m (15.00')	kg lb				3628* (8000)*	3583* (7900)*	8.1 (26.6")	1996 (4400)*
3.0 m (10.00')	kg lb			5262* (11,600)*	4264* (9400)*	3810* (8400)*	8.4 (27.6')	1996 (4400)*
1.5 m (5.00')	kg lb			6759* (14,900)*	4989 (11,000)*	4128* (9100)*	8.5 (28.1')	2086 (4600)*
0 m (0.00')	kg lb			7756* (17,100)*	5534* (12,200)*	4399* (9700)*	8.3 (27.4')	2268 (5000)*
−1.5 m (−5.00')	kg lb	4581* (10,100)*	4536* (16,700)*	7983* (17,600)*	5760* (12,700)*	4399* (9700)	7.8 (25.7')	2585 (5700)*
−3.0 m (−10.00')	kg lb	7847 (17,300)*	11 340* (25,000)*	7484* (16,500)*	5352* (11,800)*		6.9 (22.7')	3266 (7200)*
−4.5 m (−15.00')	kg lb		8618* (19,000)*	5761* (12,700)*				

OVER SIDE

Load Point Height m (ft)		Cable Reach from Swing Centerline 1.50 m (5')	3.00 m (10')	4.50 m (15')	6.00 m (20')	7.50 m (25')	Lift Capacity at Max Reach: Max Reach m (ft)	Lift Capacity kg (lb)
7.5 m (25.00')	kg lb						6.1 (20.1')	2449 (5400)*
6.0 m (20.00')	kg lb					2676 (5900)*	7.3 (24.2')	2132 (4700)*
4.5 m (15.00')	kg lb				3628* (8000)*	3402 (7500)	8.1 (26.6")	1996 (4400)*
3.0 m (10.00')	kg lb			5262 (11,600)*	4264* (9400)*	3311 (7300)	8.4 (27.6')	1996 (4400)*
1.5 m (5.00')	kg lb			6759 (14,900)*	4989* (11,000)*	4128 (9100)*	8.5 (28.1')	2086 (4600)*
0 m (0.00')	kg lb			6577 (14,500)	4309 (9500)	3130 (6900)	8.3 (27.4')	2268 (5000)*
−1.5 m (−5.00')	kg lb	4581* (10,100)*	4536* (16,700)*	6441 (14,200)	4218 (9300)	3084 (6800)	7.8 (25.7')	2585 (5700)*
−3.0 m (−10.00')	kg lb	7847* (17,300)*	11 340* (25,000)	6486 (14,300)	4218 (9300)		6.9 (22.7')	3266 (7200)*
−4.5 m (−15.00')	kg lb		8618* (19,000*)	5761 (12,700)*				

*Indicates load is limited by hydraulic capacity rather than tipping.

214B, 214B FT Lift Capacity (at end of Bare Stick)

- One-Piece Boom
- 3500 mm (11'6") Stick
- Two Sets of Outriggers -- Lowered
- 10 × 20 Dual Tires

OVER FRONT

Load Point Height m (ft)		Cable Reach from Swing Centerline 1.50 m (5')	3.00 m (10')	4.50 m (15')	6.00 m (20')	7.50 m (25')	Lift Capacity at Max Reach: Max Reach m ft	Lift Capacity kg (lb)
7.5 m (25.00')	kg lb						6.8 (22.4')	2041* (4500)*
6.0 m (20.00')	kg lb					2858* (6300)*	7.8 (26.1')	1824* (4000)*
4.5 m (15.00')	kg lb					3266* (7200)*	8.6 (28.2")	1724* (3800)*
3.0 m (10.00')	kg lb				3901* (8600)*	4368 (7800)*	9.0 (29.5')	1678* (3700)*
1.5 m (5.00')	kg lb			6260* (13,800)*	4672* (10,300)*	3946 (8700)*	9.0 (29.7')	1724* (3800)*
0 m (0.00')	kg lb			7394 (16,300)*	5307* (11,700)*	4264* (9400)*	8.9 (29.1')	1860* (4100)*
−1.5 m (−5.00')	kg lb	3992* (8800)*	6894* (15,200)*	7892* (17,400)*	5876 (12,500)*	4400* (9700)*	8.3 (27.5')	2086* (4600)*
−3.0 m (−10.00')	kg lb	6622* (14,600)*	10 478* (23,100)*	7666* (16,900)*	5534* (12,200)*		8.6 (24.7')	2540* (5600)*
−4.5 m (−15.00')	kg lb		9707* (21,400)*	6441* (14,200)*	4218* (9300)*			

OVER SIDE

Load Point Height m (ft)		Cable Reach from Swing Centerline 1.50 m (5')	3.00 m (10')	4.50 m (15')	6.00 m (20')	7.50 m (25')	Lift Capacity at Max Reach: Max Reach m ft	Lift Capacity kg (lb)
7.5 m (25.00')	kg lb						6.8 (22.4')	2041* (4500)*
6.0 m (20.00')	kg lb					2858* (6300)*	7.9 (26.1')	1824 (4000)*
4.5 m (15.00')	kg lb					3266* (7200)*	8.6 (28.3")	1724* (3800)*
3.0 m (10.00')	kg lb				3901* (8600)*	3357* (7400)*	9.0 (29.5')	1678* (3700)*
1.5 m (5.00')	kg lb			6260* (13,800)*	4536 (10,000)	3220 (7100)	9.0 (29.7')	1724* (3800)*
0 m (0.00')	kg lb			6577 (14,500)	4309 (9500)	3130 (6900)	8.9 (29.1')	1860* (4100)*
−1.5 m (−5.00')	kg lb	3992* (8800)*	6894* (15,200)*	6396 (14,100)	4173 (9200)	3039 (6700)	8.3 (27.6')	2086* (4600)*
−3.0 m (−10.00')	kg lb	6622* (14,600)*	10 478* (23,100)*	6350 (14,000)	4173 (9200)		8.6 (24.7')	2540* (5600)*
−4.5 m (−15.00')	kg lb		9707* (21,400)*	6441* (14,200)*	4218* (9300)*			

*Indicates load is limited by hydraulic capacity rather than tipping.

224B Lift Capacity (at end of Bare Stick)

- One-Piece Boom
- 3500 mm (11'6") Stick
- Two Sets of Outriggers — Lowered
- 10 × 20 Dual Tires

OVER FRONT

Load Point Height m (ft)		Cable Reach from Swing Centerline 1.50 m (5')	3.00 m (10')	4.50 m (15')	6.00 m (20')	7.50 m (25')	9.00 m (30')	Lift Capacity at Max Reach: Max Reach m ft	Lift Capacity kg (lb)
7.5 m (25.00')	kg lb							7.1 (23.3')	2585* (5700)*
6.0 m (20.00')	kg lb					3175* (7000)*		8.1 (26.9')	2359* (5200)*
4.5 m (15.00')	kg lb					3357* (7400)*		8.8 (29.0")	2268* (5000)*
3.0 m (10.00')	kg lb				4037* (8900)*	3810* (8400)*	2631* (5800)*	9.2 (30.2')	2268 (5000)*
1.5 m (5.00')	kg lb			6940* (15,300)*	5126* (11,300)*	4400* (9700)*	3220* (7100)*	9.2 (30.4')	2359* (5200)*
0 m (0.00')	kg lb			8664* (19,100)*	6169* (13,600)*	4225* (11,000)*		9.0 (29.8')	2540* (5600)*
−1.5 m (−5.00')	kg lb	4990* (11,000)*	7938* (17,500)*	9667* (21,200)*	6849* (15,100)*	5443* (12,000)*		8.6 (28.2')	2858* (6300)*
−3.0 m (−10.00')	kg lb	7938* (17,500)*	11 748* (25,900)*	9934 (21,900)*	7167 (15,800)*	5126* (11,300)*		7.7 (25.5')	3482* (7676)*
−4.5 m (−15.00')	kg lb	11 839* (26,100)*	14 515* (32,000)*	9389 (20,700)*	6668* (14,700)*				

OVER SIDE

Load Point Height m (ft)		Cable Reach from Swing Centerline 1.50 m (5')	3.00 m (10')	4.50 m (15')	6.00 m (20')	7.50 m (25')	9.00 m (30')	Lift Capacity at Max Reach: Max Reach m ft	Lift Capacity kg (lb)
7.5 m (25.00')	kg lb							7.1 (23.3')	2585* (5700)*
6.0 m (20.00')	kg lb					3175* (7000)*		8.1 (26.9')	2359* (5200)*
4.5 m (15.00')	kg lb					3357* (7400)*		8.8 (29.0")	2268* (5000)*
3.0 m (10.00')	kg lb				4037* (8900)*	3810 (8400)*	2631* (5800)*	8.2 (30.2')	2268* (5000)*
1.5 m (5.00')	kg lb			6940* (15,300)*	5126* (11,300)*	4400* (9700)*	3220* (7100)*	8.2 (30.4')	2359 (5200)*
0 m (0.00')	kg lb			8664* (19,100)*	5806 (12,800)	4225 (9314)		9.0 (29.8')	2540* (5600)*
−1.5 m (−5.00')	kg lb	4990* (11,000)*	7938* (17,500)*	8664 (19,100)	5626 (12,400)	4128 (9100)		8.6 (28.2')	2858* (6300)*
−3.0 m (−10.00')	kg lb	7938* (17,500)*	11 748* (25,900)*	8618 (19,000)	5578 (12,300)	4128 (9100)		7.7 (25.5')	3482* (7676)*
−4.5 m (−15.00')	kg lb	11 839* (26,100)*	14 515* (32,000)*	8754 (19,300)	5716 (12,600)				

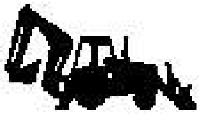
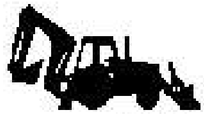
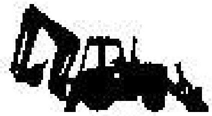
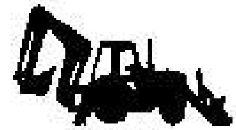
*Indicates load is limited by hydraulic capacity rather than tipping.

BACKHOE LOADERS

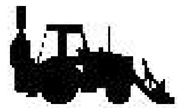
CONTENTS

Features:

- **416B/426B/436B/446 — Centerpivot backhoe design**
- **428B/438B — Sideshift backhoe design**
- **Variable flow, load sensing, pressure compensated hydraulics** . . . provides full hydraulic power to cutting edges at all engine speeds, low fuel consumption and low lever efforts.
- **4F/4R fully synchronized gear box** . . provides on-the-go shifting in all gears and on-the-go engagement of optional 4 wheel drive.
- **Loader design features divergent loader arms, a narrow loader tower and a single bucket tilt cylinder** to provide superior forward visibility.
- **Excavator style backhoe** — provides excellent visibility even with narrow buckets. Utilizes a superior digging envelope. Optimum weight distribution provides superior roading characteristics.
- **Bucket linkage design features maximum dig force in either hole** for superior digging versatility.
- **Extensive use of XT-3 hose with O-Ring face seal connections are designed to provide a dry machine.**
- **Operator Compartment Features:**
  - Resilient mounting to isolate operator from noise.
  - Rear mounted hand throttle for easy operation from backhoe position.
  - Access either side for ease of getting on and off the machine.
  - Side gauge panel visible to operator while operating either loader or backhoe.
  - Audible/visual warning system provides continuous operator awareness of machine conditions.
  - Extremely low lever efforts for less fatiguing operation and more precise control.
  - Transmission disconnect switch on loader lift lever for fast convenient actuation.
  - Forward/Reverse direction control easily operated with hand on steering wheel.

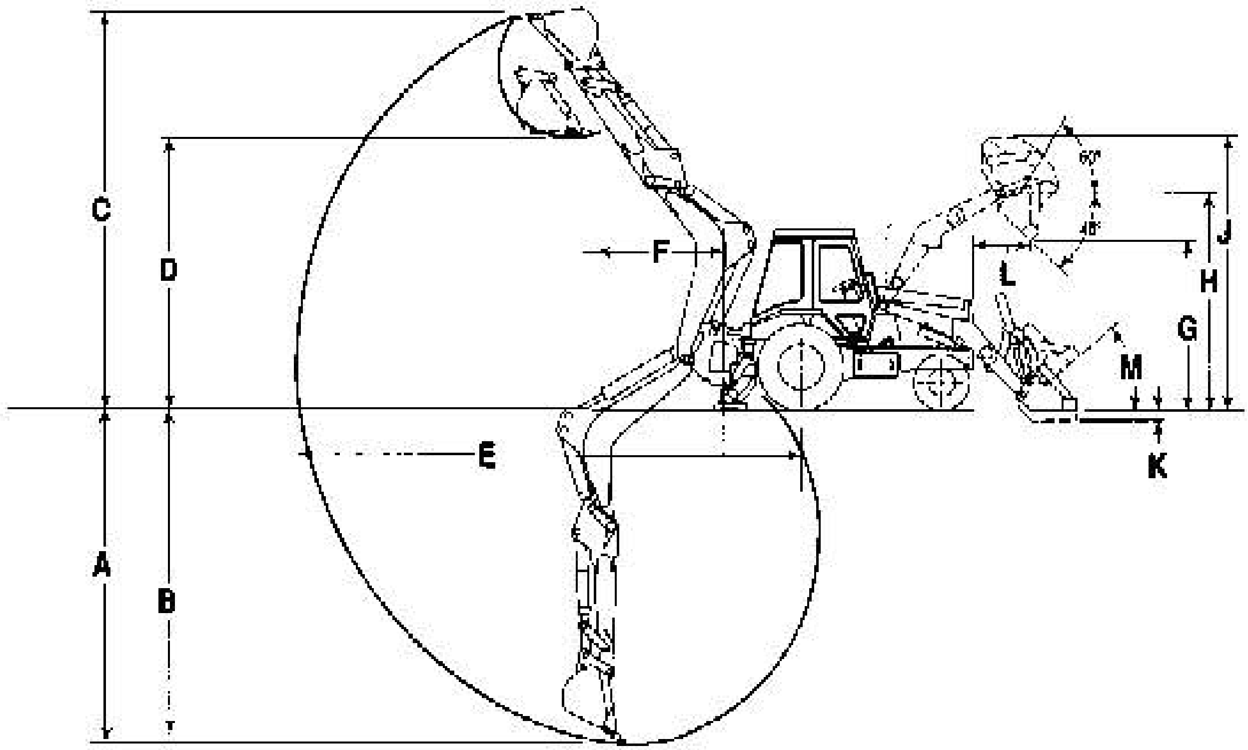
   

MODEL	**416B**		**426B**		**436B**		**446**	
Flywheel Power (Net)	55.2 kW	**74 HP**	61.1 kW	**79 HP**	62.7 kW	**84 HP**	70.8 kW	**95 HP**
Flywheel Power (Gross)	57.4 kW	**77 HP**	58.9 kW	**82 HP**	64.9 kW	**87 HP**	76.8 kW	**103 HP**
Operating Weight	6227 kg	**13,700 lb**	6702 kg	**14,745 lb**	6857 kg	**15,086 lb**	8892 kg	**19,603 lb**
Engine Model — Perkins	**3054**		**3054**		**3054**		**3114**	
Rated Engine RPM	**2200**		**2200**		**2200**		**2200**	
No. of Cylinders	**4**		**4**		**4**		**4**	
Bore	100 mm	**3.94 in**	100 mm	**3.94 in**	100 mm	**3.94 in**	105 mm	**4.13 in**
Stroke	127 mm	**5.0 in**	127 mm	**5.0 in**	127 mm	**5.0 in**	127 mm	**5.0 in**
Displacement	4.0 L	**243 in³**	4.0 L	**243 in³**	4.0 L	**243 in³**	4.40 L	**268 in³**
Speeds Forward	km/h	**mph**	km/h	**mph**	km/h	**mph**	km/h	**mph**
1st	6.2	**3.9**	6.2	**3.9**	6.3	**3.9**	6.6	**4.1**
2nd	11.4	**7.0**	11.4	**7.1**	11.6	**7.2**	12.1	**7.5**
3rd	21.5	**13.3**	21.5	**13.3**	21.8	**13.5**	21.7	**13.5**
4th	32.4	**20.1**	32.3	**20.1**	32.6	**20.2**	33.0	**20.5**
Speeds Reverse								
1st	6.2	**3.9**	6.2	**3.9**	6.3	**3.9**	7.3	**4.5**
2nd	11.5	**7.1**	11.5	**7.1**	11.7	**7.3**	13.4	**8.3**
3rd	21.6	**13.4**	21.6	**13.4**	21.9	**13.6**	24.1	**15.0**
4th	32.8	**20.3**	32.5	**20.2**	32.8	**20.4**	36.5	**22.7**
Turning Radius								
2 wheel drive	3914 mm	**12'10"**	3938 mm	**12'11"**	3905 mm	**12'10"**	4204 mm	**13'10"**
Tires, Front								
Standard, 2WD	**11L-16, 10 PR, F3**		**11L-16, 12 PR, F3**		**11.00-16, 12 PR, F3**		**14.5/75-16.1, 10 PR, F3**	
Standard, 4WD	**10.5-20, 10 PR, R4**		**10.5-20, 10 PR, R4**		**12.5/80-18, 10 PR, I3**		**12.5-20, 10 PR, R4**	
Optional, 4WD	**12.5/80-18, 10 PR, I3**		**12.5/80-18, 10 PR, I3**		**12.5/80-18, 10 PR, I3**		**—**	
Tires, Rear								
Standard, 2WD	**16.9-24, 8 PR, R4**		**16.9-24, 8 PR, R4**		**19.5-24, 10 PR, R4**		**21L-24, 12 PR, R4**	
Optional, 2WD	**16.9-24, 10 PR, R4**		**16.9-24, 10 PR, R4**		—		—	
Optional, 2WD	**19.5L-24, 8 PR, R4**		**19.5L-24, 8 PR, R4**		—		—	
Optional, 2WD	**19.5L-24, 10 PR, R4**		**19.5L-24, 10 PR, R4**		—		—	
Standard, 4WD	**19.5L-24, 8 PR, R4**		**19.5L-24, 10 PR, R4**		**19.5-24, 10 PR, R4**		**21L-24, 12 PR, R4**	
Optional, 4WD	**19.5L-24, 10 PR, R4**		**19.5L-24, 8 PR, R4**		—		—	
Optional, 4WD	—		**19.5L-24, 10 PR, R4**		—		—	
E-Stick, option	**16.9-24, 10 PR, R4**		**19.5L-24, 10 PR, R4**		**Any Combination**		**21L-24, 12 PR, R4**	
E-Stick, option	**19.5L-24, 10 PR, R4**		**19.5L-24, 10 PR, R4**		**2 or 4WD Std or Opt**		**—**	
Hydraulic system, closed center	**LSPC**		**LSPC**		**LSPC**		**LSPC**	
Pump capacity:	157 L/min @ 2200 rpm @ 20 670 kPa **(41 gpm @ 2200 rpm @ 3000 psi)**		157 L/min @ 2200 rpm @ 18 960 kPa **(41 gpm @ 2200 rpm @ 2750 psi)**		157 L/min @ 2200 rpm @ 20 670 kPa **(41 gpm @ 2200 rpm @ 3000 psi)**		162 L/min @ 2200 rpm @ 20 000 kPa **(42.3 gpm @ 2200 rpm @ 2900 psi)**	



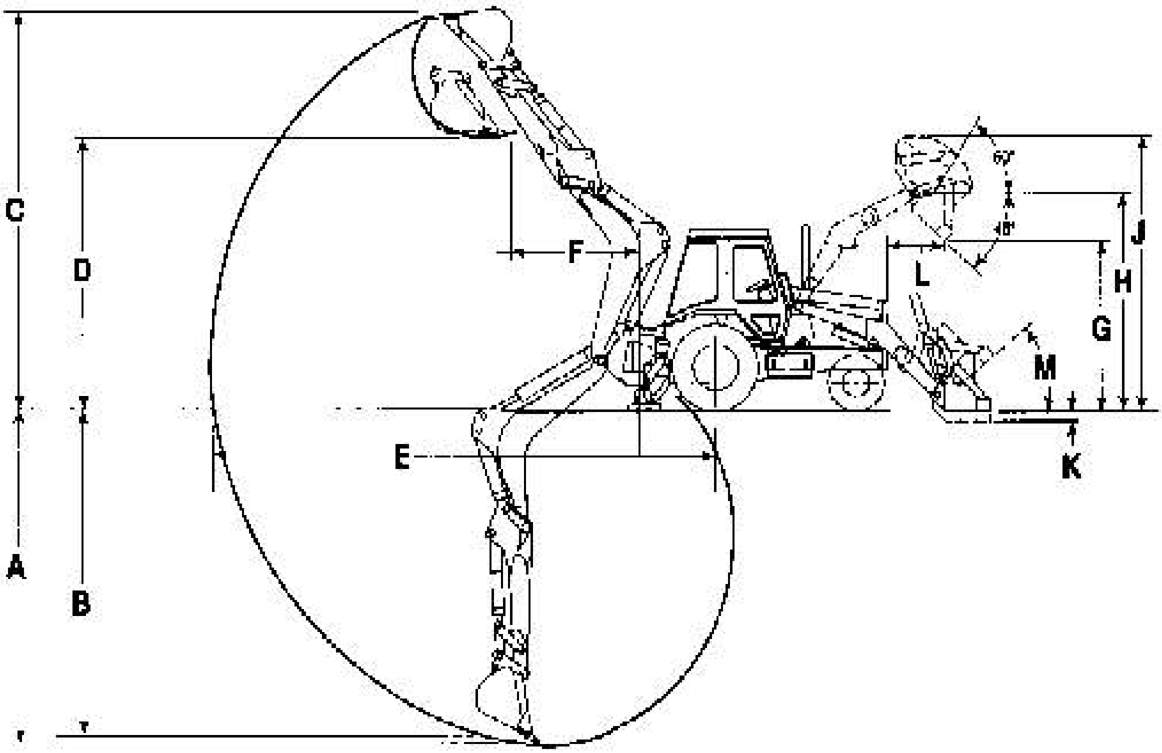
MODEL	428B		438B	
Flywheel Power (Net)	55.2 kW	74 HP	58 kW	80 HP
Flywheel Power (Gross)	57.4 kW	77 HP	74 kW	86 HP
Operating Weight*	7940 kg	17,605 lb	7426 kg	16,339 lb
Engine Model	3054		3054	
Rated Engine RPM	2200		2200	
No. of Cylinders	4		4	
Bore	100 mm	3.94 in	100 mm	3.94 in
Stroke	127 mm	5 in	127 mm	5 in
Displacement	4.0 L	243 in³	4.0 L	243 in³
Speeds Forward	km/h	mph	km/h	mph
1st	5.2	3.3	5.5	3.5
2nd	9.7	6.1	10.2	6.4
3rd	18.2	11.4	19.1	12.0
4th	27.5	17.3	28.8	18.2
Speeds Reverse				
1st	5.2	3.3	5.5	3.5
2nd	9.7	6.1	10.2	6.4
3rd	18.3	11.5	19.2	12.0
4th	27.7	17.4	29.0	18.3
Turning Radius				
2 wheel drive	3914 mm	12'10"	—	
4 wheel drive	3914 mm	12'10"	3920 mm	12'10"
Tires, Front				
Standard, 2WD	9-16, 10 PR, F2		—	
Standard, 2WD	11L-16, 10 PR, F3		—	
Optional, 2WD	11L-16, 10 PR, F3		—	
Optional, 2WD	11L-16, 12 PR, F3		—	
Optional, 2WD	10.5-20, 10 PR, R4		—	
Standard, 4WD	10.5-20, 10 PR, R4		12.5/80-18, 10 PR, I3	
Optional, 4WD	12.5/80-18, 10 PR, I3		12.5/80-18, 10 PR, I3	
Optional, 4WD	12.5/80-16, 10 PR, I3		—	
Tires, Rear				
Standard, 2 WD	16.9-28, 10 PR, R4		—	
Optional, 2WD	16.9-28, 12 PR, R4		—	
Optional, 2WD	16.9/14-28, 12 PR, R4		—	
Standard, 4WD	16.9-28, 10 PR, R4		18.4/15-26, 12 PR, R4	
Optional, 4WD	16.9/28, 10 PR, R4		—	
Optional, 4WD	16.9-28, 12 PR, R4		—	
Optional, 4WD	16.9/14-28, 12 PR, R4		—	
E-Stick, option	16.9-28, 10 PR, R4		18.4/15 x 26, 12 PR, R4	
E-Stick, option	16.9-28, 12PR, R4		—	
Hydraulic system, closed center	LSPC		LSPC	
Pump capacity:	144 L/min @ 2200 rpm @ 20 670 kPa (38.0 gpm @ 2200 rpm @ 3000 psi)		157 L/min @ 2200 rpm @ 18 960 kPa (41 gpm @ 2200 rpm @ 2750 psi)	

*Includes enclosed ROPS



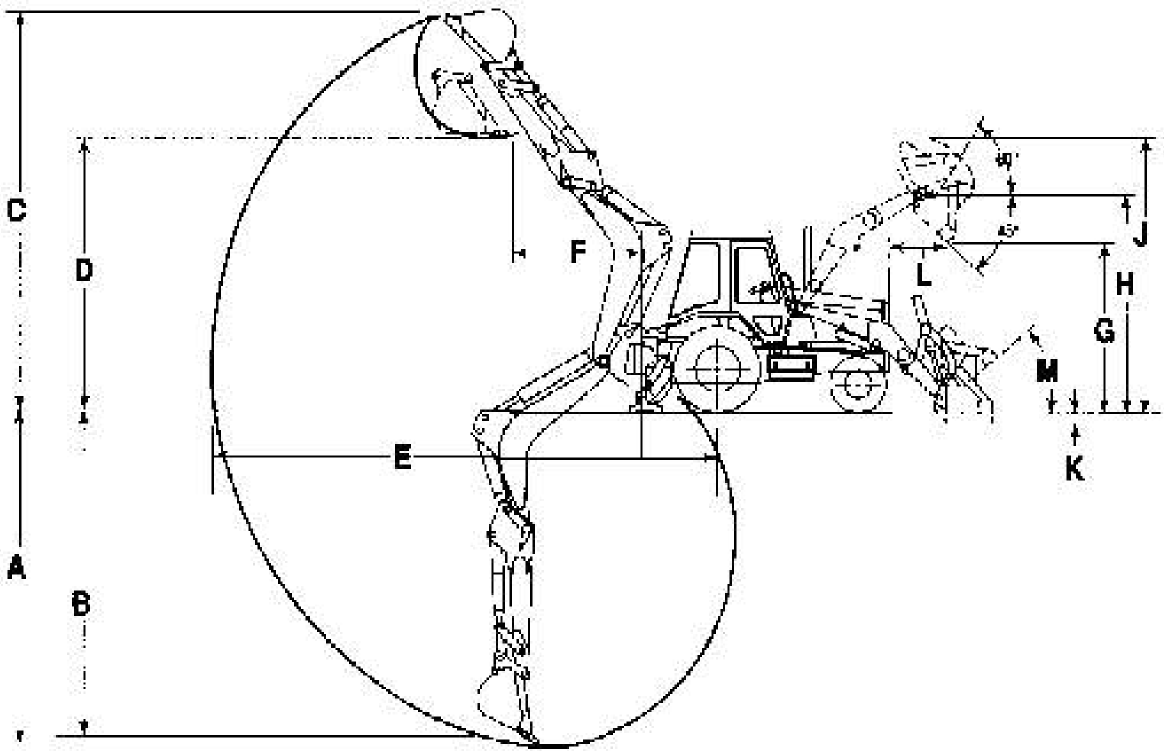
MODEL	416B*					
Backhoe	**Standard Stick**		**Extendable Stick Retracted**		**Extendable Stick Extended**	
A) Manufacturers max. digging depth	4420 mm	14'6"	4498 mm	14'9"	5545 mm	18'2"
B) 2' flat bottom (SAE)	4379 mm	14'4"	4446 mm	14'7"	5488 mm	18'0"
C) Overall operating height — fully raised	5269 mm	17'3"	5240 mm	17'2"	5919 mm	19'5"
D) Loading height	3483 mm	11'5"	3654 mm	12'0"	4223 mm	13'10"
E) Overall reach from rear axle centerline	6729 mm	21'1"	6772 mm	22'3"	7770 mm	25'6"
Overall reach from swing pivot @ ground line	5639 mm	18'6"	5682 mm	18'8"	6680 mm	21'11"
F) Loading reach	1764 mm	5'9"	1804 mm	5'11"	2706 mm	8'11"
Swing arc	180°		160°		160°	
Sideshift from machine centerline	—	—	—	—	—	—
Bucket rotation — #1 Position	170°		165°		165°	
#2 Position	170°		165°		165°	
Stabilizer spread —						
Operating position	3254 mm	10'8"	3254 mm	10'8"	3254 mm	10'8"
Transport position	2130 mm	6'11"	2130 mm	6'11"	2130 mm	6'11"
Digging force, bucket cylinder, SAE	5303 kg	11,693 lb	5468 kg	12,057 lb	5468 kg	12,057 lb
Digging force, stick cylinder, SAE	3494 kg	7704 lb	3551 kg	7830 lb	2554 kg	5631 lb
Leveling angle (maximum slope on which backhoe will make vertical cut)	14°		14°		14°	

*Equipped with 610 mm (24") standard duty bucket



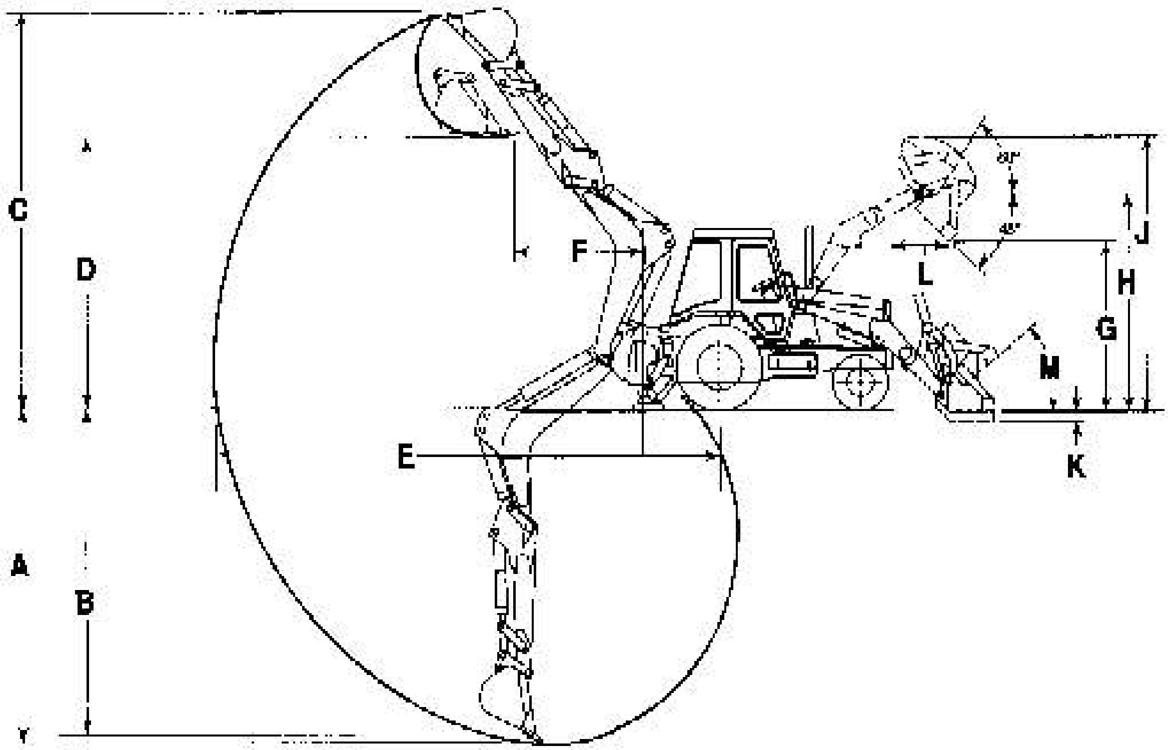
MODEL	426B*					
Backhoe	**Standard Stick**		**Extendable Stick Retracted**		**Extendable Stick Extended**	
A) Manufacturers max. digging depth	4721 mm	15'5"	4956 mm	16'3"	6196 mm	20'4"
B) 2' flat bottom (SAE)	4606 mm	15'4"	4909 mm	16'0"	6129 mm	20'1"
C) Overall operating height — fully raised	5752 mm	18'10"	5832 mm	19'2"	6667 mm	21'10"
D) Loading height	3815 mm	12'6"	4096 mm	13'5"	4925 mm	16'1"
E) Overall reach from rear axle centerline	7146 mm	23'5"	7332 mm	24'1"	8485 mm	27'10"
Overall reach from swing pivot	6056 mm	19'10"	6242 mm	20'6"	7396 mm	24'3"
F) Loading reach	1711 mm	5'7"	1823 mm	5'11"	2717 mm	8'10"
Swing arc	180°		180°		180°	
Sideshift from machine centerline		—	—	—	—	—
Bucket rotation #1 Position	170°		165°		165°	
#2 Position	170°		165°		165°	
Stabilizer spread —						
Operating position	3254 mm	10'8"	3254 mm	10'8"	3254 mm	10'8"
Transport position	2130 mm	7'0"	2130 mm	7'0"	2130 mm	7'0"
Digging force, bucket cylinder, SAE	5325 kg	11,741 lb	5317 kg	11,724 lb	5317 kg	11,724 lb
Digging force, stick cylinder, SAE	3672 kg	8096 lb	3740 kg	8246 lb	2808 kg	6949 lb
Leveling angle (maximum slope on which backhoe will make vertical cut)	14°		14°		14°	

*Equipped with 610 mm (24") standard duty bucket.



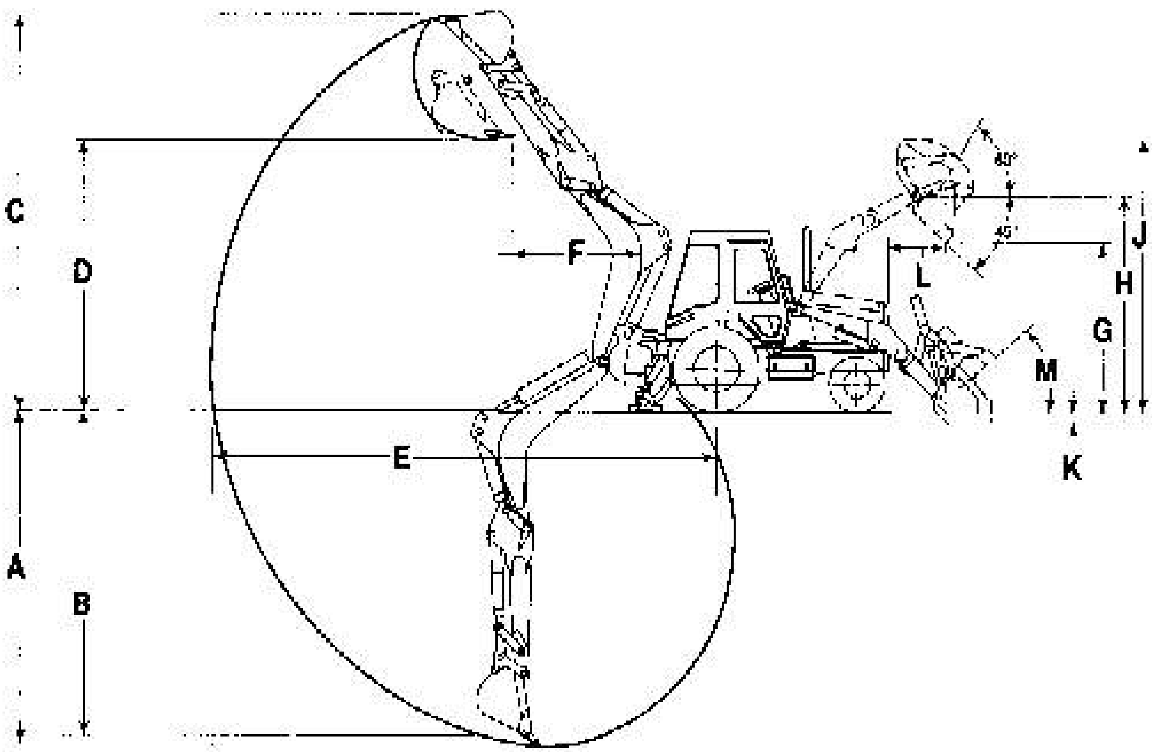
MODEL	436B*					
Operational Data — Backhoe	**Standard Stick**		**Extendable Stick Retracted**		**Extendable Stick Extended**	
A) Manufacturers max. digging depth	4953 mm	16'3"	4995 mm	16'5"	6202 mm	22'4"
B) 2' flat bottom (SAE)	4926 mm	16'1"	4938 mm	16'2"	6160 mm	20'3"
C) Overall operating height — fully raised	5862 mm	19'2"	5864 mm	18'7"	6444 mm	21'2"
D) Loading height	3935 mm	12'11"	4003 mm	13'2"	4783 mm	15'8"
E) Overall reach from rear axle centerline	7358 mm	24'2"	7344 mm	24'1"	8496 mm	27'10"
Overall reach from swing pivot	6268 mm	20'7"	6254 mm	20'6"	7406 mm	24'4"
F) Loading reach	1917 mm	6'3"	2038 mm	6'8"	2717 mm	8'11"
Swing arc	180°		180°		180°	
Sideshift from machine centerline		—			--	—
Bucket rotation #1 Position	170°		165°		165°	
#2 Position	170°		165°		165°	
Stabilizer spread						
Operating position	3254 mm	10'8"	3254 mm	10'8"	3254 mm	10'8"
Transport position	2130 mm	7'0"	2130 mm	7'0"	2130 mm	7'0"
Digging force, bucket cylinder, SAE	5762 kg	12,705 lb	5830 kg	12,855 lb	5830 kg	12,855 lb
Digging force, stick cylinder, SAE	3862 kg	8515 lb	4226 kg	9301 lb	2903 kg	6401 lb
Leveling angle (maximum slope on which backhoe will make vertical cut)	14°		14°		14°	

*Equipped with 610 mm (24") high capacity heavy duty bucket.



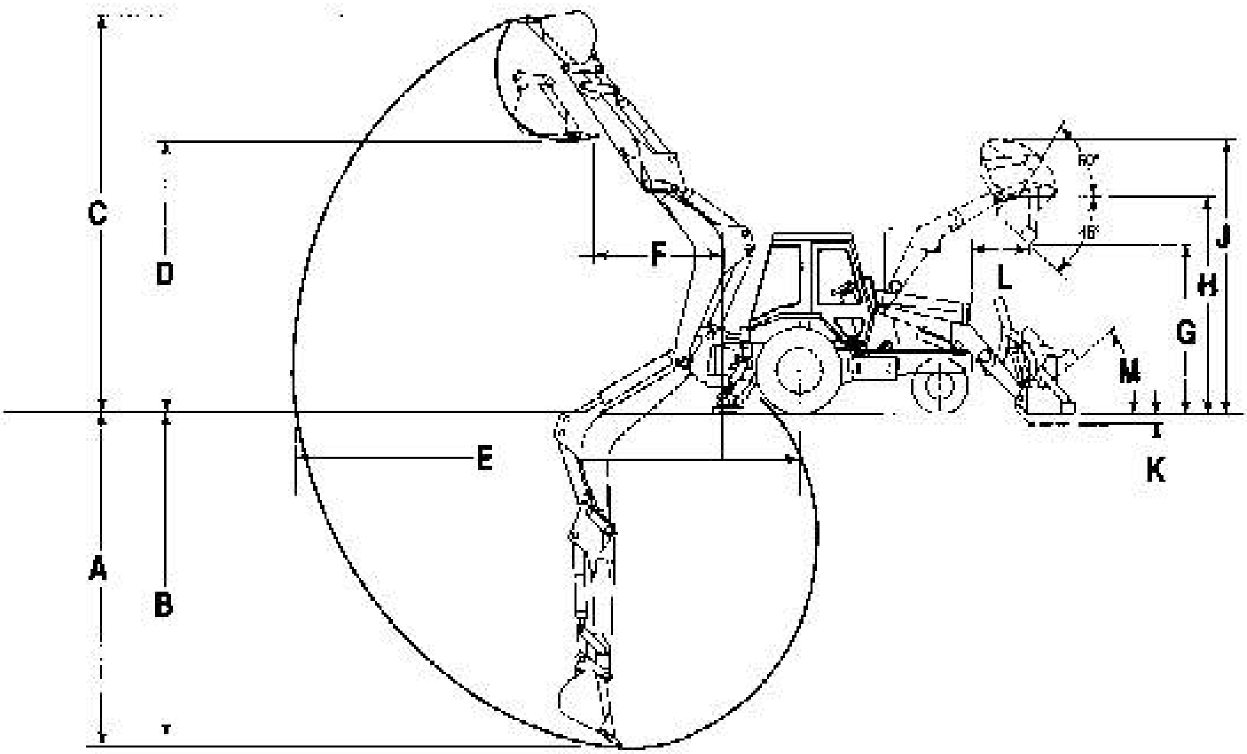
MODEL	446*					
Backhoe	**Standard Stick**		**Extendable Stick Retracted**		**Extendable Stick Extended**	
A) Max. digging depth (SAE)	5219 mm	17'2"	5182 mm	17'0"	6528 mm	21'5"
B) 2' flat bottom (SAE)	5173 mm	17'0"	5134 mm	16'10"	6479 mm	21'3"
C) Overall operating height — fully raised	6337 mm	20'9"	6293 mm	20'8"	7235 mm	23'9"
D) Loading height	4310 mm	14'2"	4205 mm	13'10"	4894 mm	16'1"
E) Overall reach from rear axle centerline	7866 mm	25'10"	7825 mm	25'8"	9130 mm	29'11"
Overall reach from swing pivot	6604 mm	21'8"	6563 mm	21'6"	7868 mm	25'9"
F) Loading reach	2027 mm	6'8"	2070 mm	6'9"	3261 mm	10'8"
Swing arc	180°		180°		180°	
Sideshift from machine centerline	—	—	—	—	—	—
Bucket rotation — #1 Position	169°		163°		163°	
#2 Position	169°		163°		163°	
Stabilizer spread —						
Operating position	4084 mm	13'5"	4084 mm	13'5"	4084 mm	13'5"
Transport position	2405 mm	7'11"	2405 mm	7'11"	2405 mm	7'11"
Digging force, bucket cylinder, SAE	60.3 kN	13,573 lb	60.1 kN	13,523 lb	60.1 kN	13,523 lb
Digging force, stick cylinder, SAE	43.0 kN	9666 lb	44.5 kN	10,002 lb	31.1 kN	6995 lb
Leveling angle (maximum slope on which backhoe will make vertical cut)	13°		13°		13°	

*Equipped with 610 mm (24") standard duty bucket.



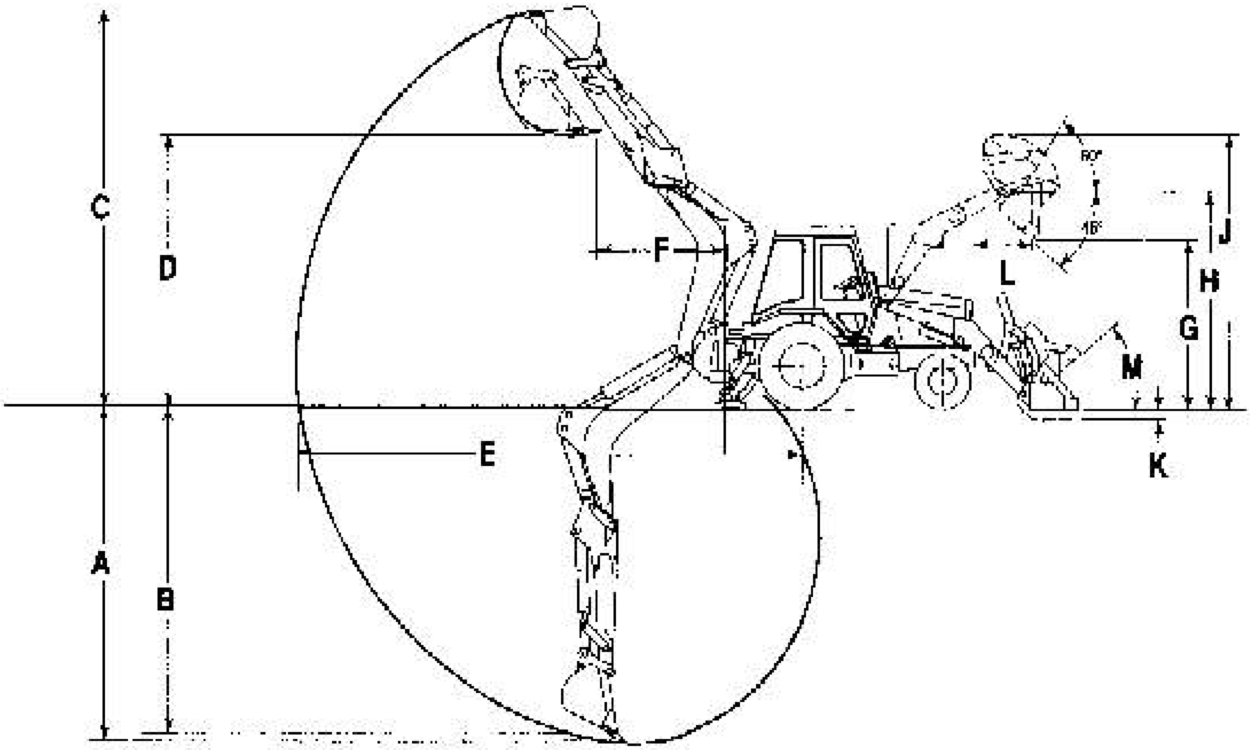
MODEL	428B*					
Backhoe	**Standard Stick**		**Extendable Stick Retracted**		**Extendable Stick Extended**	
A) Manufacturers max. digging depth	4811 mm	15'9"	4859 mm	15'11"	5850 mm	19'3"
B) 2' flat bottom (SAE)	4766 mm	15'7"	4016 mm	15'9"	5842 mm	19'2"
C) Overall operating height — fully raised	5708 mm	18'8"	5541 mm	18'2"	5246 mm	17'3"
D) Loading height	3803 mm	12'5"	3845 mm	12'7"	4454 mm	14'7"
E) Overall reach from rear axle centerline	6903 mm	22'8"	6947 mm	22'10"	7950 mm	26'1"
Overall reach from swing pivot @ ground line	5578 mm	18'3"	5622 mm	18'5"	6625 mm	21'9"
F) Loading reach	1638 mm	5'4"	1677 mm	5'6"	2679 mm	8'8"
Swing arc	180°		180°		180°	
Sideshift from machine centerline	630 mm	25"	630 mm	25"	630 mm	25"
Bucket rotation #1 Position	170°		165°		165°	
#2 Position	170°		165°		165°	
Stabilizer spread						
Operating position	2360 mm	7'9"	2360 mm	7'9"	2360 mm	7'9"
Transport position	2360 mm	7'9"	2360 mm	7'9"	2360 mm	7'9"
Digging force, bucket cylinder, SAE	5303 kg	11,693 lb	5460 kg	12,057 lb	5468 kg	12,056 lb
Digging force, stick cylinder, SAE	3461 kg	7631 lb	3420 kg	7541 lb	2429 kg	5356 lb
Leveling angle (maximum slope on which backhoe will make vertical cut)	11°		11°		11°	

*Equipped with 610 mm (24") standard duty bucket.

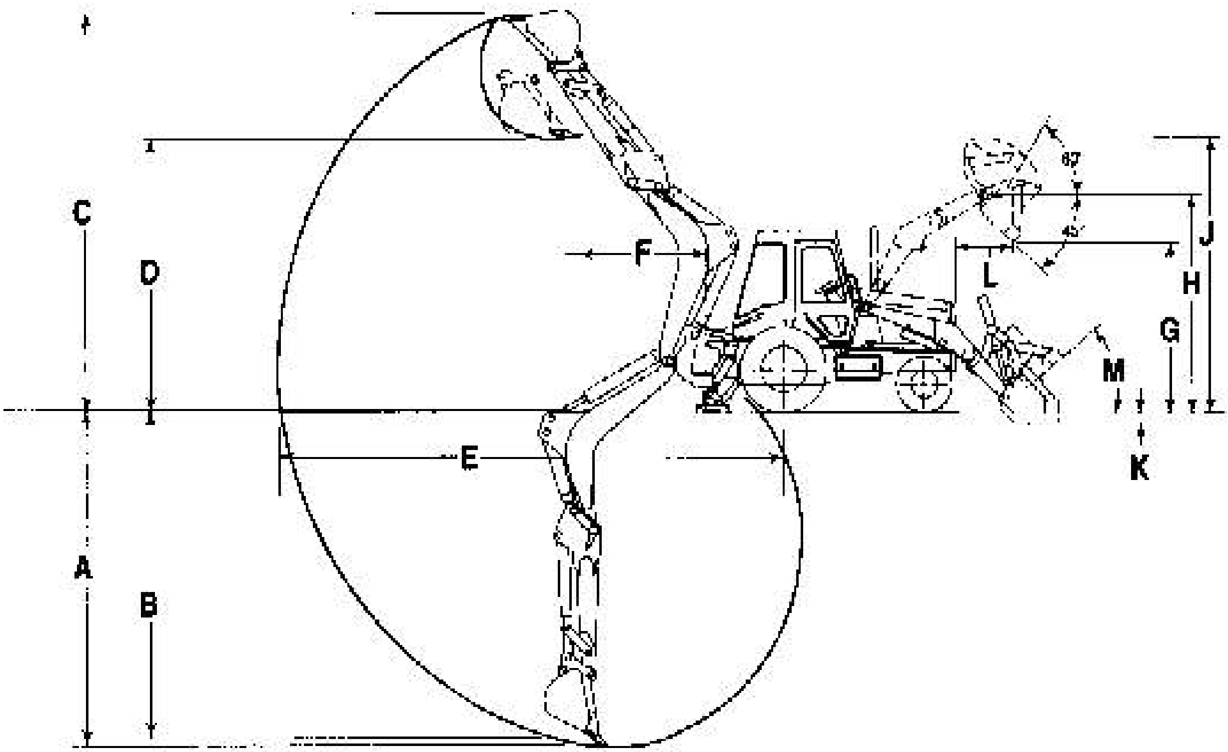


MODEL	438B*					
Backhoe	**Standard Stick**		**Extendable Stick Retracted**		**Extendable Stick Extended**	
A) Manufacturers max. digging depth	4873 mm	15'11"	4924 mm	16'2"	5924 mm	19'5"
B) 2' flat bottom (SAE)	4827 mm	15'10"	4883 mm	16'0"	5910 mm	19'4"
C) Overall operating height — fully raised	5560 mm	18'3"	5532 mm	18'2"	6220 mm	20'5"
D) Loading height	3684 mm	12'1"	3766 mm	12'4"	4344 mm	14'3"
E) Overall reach from rear axle centerline	7036 mm	23'1"	7077 mm	23'3"	8091 mm	26'6"
Overall reach from swing pivot @ ground line	5839 mm	19'1"	5878 mm	19'3"	6876 mm	22'6"
F) Loading reach	1660 mm	5'5"	1699 mm	5'7"	2596 mm	8'6"
Swing arc	180°		180°		180°	
Sideshift from machine centerline	630 mm	25"	630 mm	25"	630 mm	25"
Bucket rotation — #1 Position	170°		165°		165°	
#2 Position	170°		165°		165°	
Stabilizer spread —						
Operating position	2360 mm	7'9"	2360 mm	7'9"	2360 mm	7'9"
Transport position	2360 mm	7'9"	2360 mm	7'9"	2360 mm	7'9"
Digging force, bucket cylinder, SAE	5525 kg	12,181 lb	5466 kg	12,050 lb	5466 kg	12,050 lb
Digging force, stick cylinder, SAE	3369 kg	7428 lb	3416 kg	7531 lb	2427 kg	5350 lb
Leveling angle (maximum slope on which backhoe will make vertical cut)	9°		9°		9°	

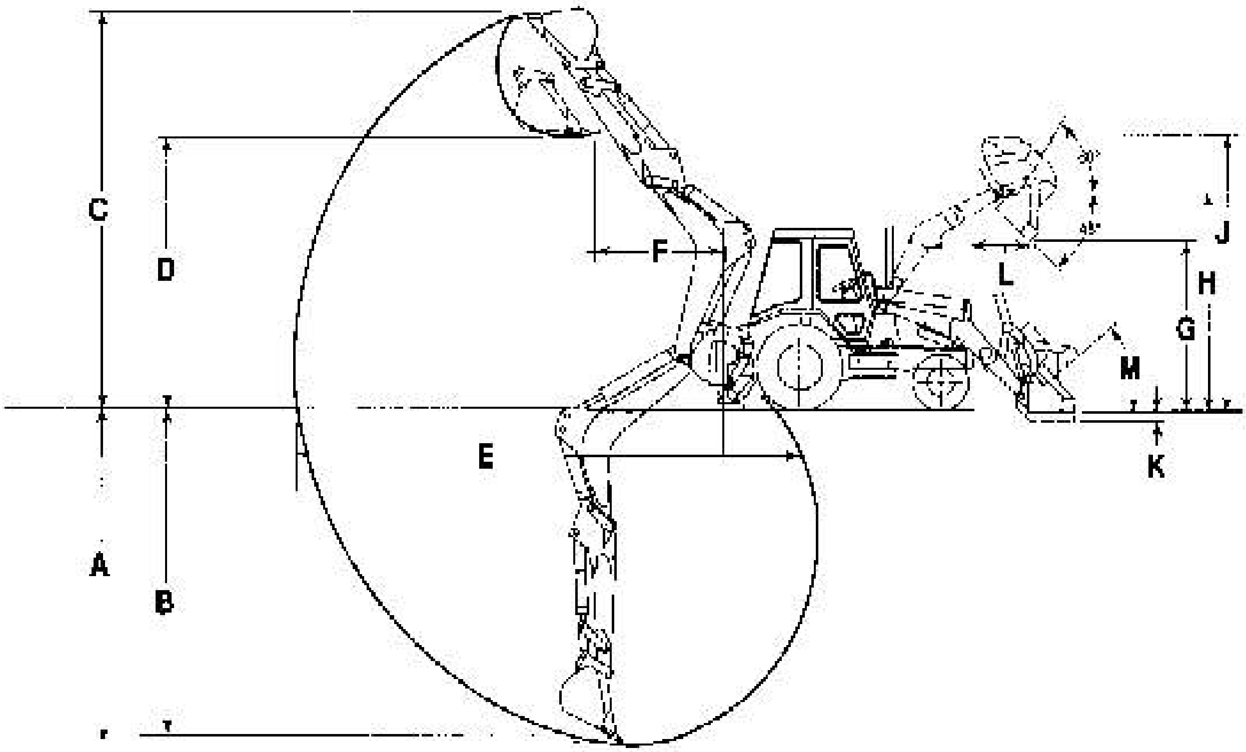
*Equipped with 610 mm (24") high capacity heavy duty backhoe bucket



MODEL	416B				426B			
Loader	**General Purpose**		**Multi-Purpose**		**General Purpose**		**Multi-Purpose**	
Bucket capacity	0.76 m³	**1 yd³**	0.76 m³	**1 yd³**	0.96 m³	**1.25 yd³**	0.76 m³	**1.00 yd³**
Width	2262 mm	**89"**	2262 mm	**89"**	2262 mm	**89"**	2262 mm	**89"**
Lift capacity at full height	2381 kg	**5250 lb**	2265 kg	**4993 lb**	2468 kg	**5437 lb**	2383 kg	**5254 lb**
Breakout force	3787 kg/ 37.1 kN	**8350 lb**	4218 kg/ 41.0 kN	**9300 lb**	3855 kg/ 38.0 kN	**8500 lb**	6803 kg/ 67.0 kN	**15,000 lb**
G) Dump height at 45 degrees	2637 mm	**8'7"**	2637 mm	**8'7"**	2603 mm	**8'6"**	2664 mm	**8'8"**
H) Hinge pin height	3293 mm	**10'9"**	3293 mm	**10'9"**	3293 mm	**10'10"**	3293 mm	**10'10"**
J) Overall operating height — fully raised	4024 mm	**13'2"**	4141 mm	**13'7"**	4177 mm	**13'8"**	4145 mm	**13'7"**
K) Digging depth	104 mm	**4.1"**	134 mm	**5.3"**	104 mm	**4"**	134 mm	**5"**
Grading angle	**112°**		**99°**		**106°**		**99°**	
Width of dozer cutting edge	—	—	2262 mm	**89"**	—	—	2262 mm	**89"**
Clam opening — maximum	—	—	958 mm	**3'1"**	—	—	958 mm	**37"**
L) Reach @ full height/45 degrees	719 mm	**28.3"**	651 mm	**25.6"**	799 mm	**31"**	651 mm	**25"**
M) Maximum rollback @ ground line	**40°**		**41°**		**40°**		**41°**	
Weight	367 kg	**809 lb**	559 kg	**1232 lb**	428 kg	**944 lb**	559 kg	**1232 lb**



MODEL	**436B**				**446**			
Loader	**General Purpose**		**Multi-Purpose**		**General Purpose**		**Multi-Purpose**	
Bucket capacity	1.0 m^3	**1.38 yd^3**	0.76 m^3	**1 yd^3**	1.1 m^3	**1.5 yd^3**	1.1 m^3	**1.5 yd^3**
Width	2262 mm	**89"**	2262 mm	**89"**	2434 mm	**96"**	2432 mm	**96"**
Lift capacity at full height	2748 kg	**6061 lb**	2722 kg	**6001 lb**	3710 kg	**8160 lb**	3530 kg	**7760 lb**
Breakout force	4263 kg/ 42.0 kN	**9400 lb**	7075 kg/ 69.4 kN	**15,600 lb**	5460 kg/ 53.4 kN	**12,038 lb**	5593 kg/ 54.8 kN	**12,330 lb**
C) Dump height — 436 @ 45 degrees, 446 @ 42 degrees	2599 mm	**8'6"**	2725 mm	**8'11"**	2698 mm	**8'10"**	2731 mm	**9'0"**
H) Hinge pin height	3350 mm	10'11"	3350 mm	10'11"	3490 mm	**11'5"**	3490 mm	11'5"
J) Overall operating height fully raised	**4272 mm**	14'0"	4196 mm	13'9"	**4410 mm**	**14'6"**	4482 mm	14'8"
K) Digging depth	82 mm	3"	72 mm	2"	162 mm	6.4"	143 mm	5.6"
Grading angle	**103°**		**99°**		**115°**		**115°**	
Width of dozer cutting edge	—	—	2262 mm	**89"**		—	2440 mm	**96"**
Clam opening — maximum	—	—	965 mm	**38.0"**		·	1000 mm	**39.0"**
L) Reach @ full height — 436 @ 45 degrees, 446 @ 42 degrees	716 mm	**28"**	601 mm	**23"**	868 mm	**34.2"**	863 mm	**34.0"**
M) Maximum rollback @ ground line	**40°**		**38°**		**40°**		**40°**	
Weight	443 kg	**977 lb**	559 kg	**1232 lb**	604 kg	1331 lb	605 kg	**1775 lb**



MODEL	428B				436B			
Loader	**General Purpose**		**Multi-Purpose**		**General Purpose**		**Multi-Purpose**	
Bucket capacity	1.0 m^3	1.38 yd^3	0.92 m^3	1.2 yd^3	1.0 m^3	1.38 yd^3	0.92 m^3	1.2 yd^3
Width	2396 mm	94.3"	2396 mm	94.3"	2996 mm	94.3"	2306 mm	94.3"
Lift capacity at full height	2550 kg	5623 lb	2400 kg	5291 lb	2682 kg	5900 lb	2549 kg	5607 lb
Breakout force	4354 kg/ 2158 N	9600 lb	4399 kg/ 2180 N	9700 lb	4400 kg/ 43.1 kN	9700 lb	4240 kg/ 41.9 kN	9380 lb
G) Dump height — 428 @ 47 degrees; 438 @ 45 degrees	2602 mm	8'6"	2602 mm	8'6"	2604 mm	8'6"	2608 mm	8'6"
H) Hinge pin height	3305 mm	10'10"	3305 mm	10'10"	3308 mm	10'10"	3308 mm	10'10"
J) Overall operating height — fully raised	4188 mm	13'7"	4156 mm	13'7"	4188 mm	13'8"	4156 mm	13'7"
K) Digging depth	94 mm	4"	124 mm	5"	94 mm	4"	124 mm	5"
Grading angle	106°		106°		105°		106°	
Width of dozer cutting edge	—	—	2396 mm	94"	—	—	2396 mm	94"
Clam opening — maximum	—	—	943 mm	37"	—	—	943 mm	37.1"
L) Reach @ full height/45 degrees	862 mm	32"	815 mm	32"	861 mm	33"	814 mm	32"
M) Maximum rollback @ ground line	39°		40°		39°		39°	
Weight	448 kg	988 lb	614 kg	1354 lb	448 kg	986 lb	614 kg	1354 lb

Standard Duty Buckets
416B, 428B

Width mm	Width in	SAE Heaped Capacity L	SAE Heaped Capacity ft³	SAE Struck Capacity L	SAE Struck Capacity ft³	Weight kg	Weight lb	No. of Teeth
300	12	70	2.5	60	2	110	243	3
450	18	130	4.5	100	3.5	120	266	4
600	24	200	7	150	5.5	134	294	4
750	30	260	9	200	7	149	328	5
900	36	320	11	220	8	155	342	6

Heavy Duty Buckets
416B, 426B, 428B, 436B, 438B

Width mm	Width in	SAE Heaped Capacity L	SAE Heaped Capacity ft³	SAE Struck Capacity L	SAE Struck Capacity ft³	Weight kg	Weight lb	* No. of Teeth
300	12	70	2.5	60	2	110	243	3
400	16	100	3.5	80	3	121	265	4
450	18	130	4.5	100	3.5	126	278	4
600	24	200	7	150	5.5	148	325	4
750	30	260	9	200	7	179	395	5
900	36	320	11	220	8	190	417	6

*Bolt-on teeth available

High Capacity Buckets
416B, 426B, 428B, 436B, 438B

Width mm	Width in	SAE Heaped Capacity L	SAE Heaped Capacity ft³	SAE Struck Capacity L	SAE Struck Capacity ft³	Weight kg	Weight lb	No. of Teeth
450	18	180	6.5	120	4.5	149	328	4
600	24	240	9	180	6.5	168	369	4
750	30	320	11	220	8	191	420	5
900	36	380	14	280	10	207	455	6

Teeth Options:
Utility — Short
Penetration — Long
Abrasion

Extreme Service Buckets
416B, 426B, 428B, 436B, 438B

Width mm	Width in	SAE Heaped Capacity L	SAE Heaped Capacity ft³	SAE Struck Capacity L	SAE Struck Capacity ft³	Weight kg	Weight lb	No. of Teeth
450	18	100	3.5	90	3.0	147	323	4
600	24	160	5.5	130	4.5	164	360	4

Heavy Duty Buckets
446

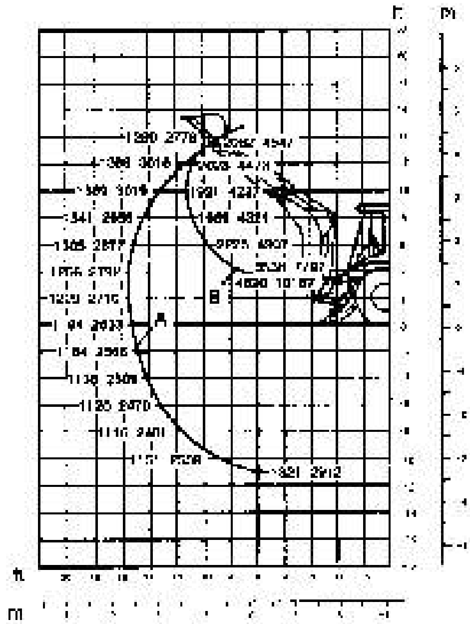
Width mm	Width in	SAE Heaped Capacity L	SAE Heaped Capacity ft³	SAE Struck Capacity L	SAE Struck Capacity ft³	Weight kg	Weight lb	No. of Teeth
457	18	190	6.5	170	5.9	178	392	3
610	24	280	10	240	8.4	216	476	4
762	30	380	13	300	10.5	237	523	5
914	36	480	17	380	13	267	589	6

Extreme Service Buckets
446

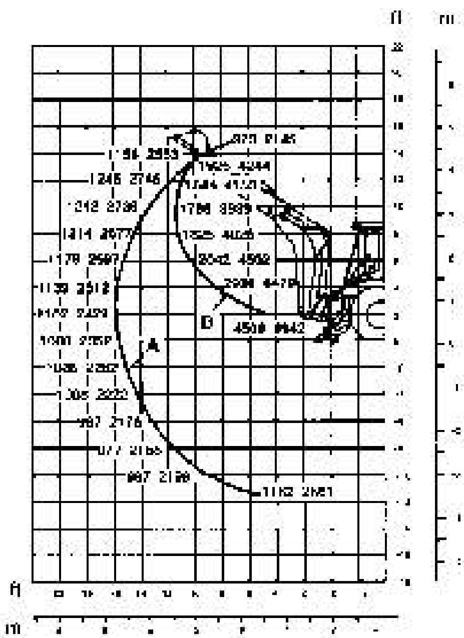
Width mm	Width in	SAE Heaped Capacity L	SAE Heaped Capacity ft³	SAE Struck Capacity L	SAE Struck Capacity ft³	Weight kg	Weight lb	No. of Teeth
600	24	270	9	230	8.1	227	501	4
760	30	370	13	290	10	249	549	5

KEY

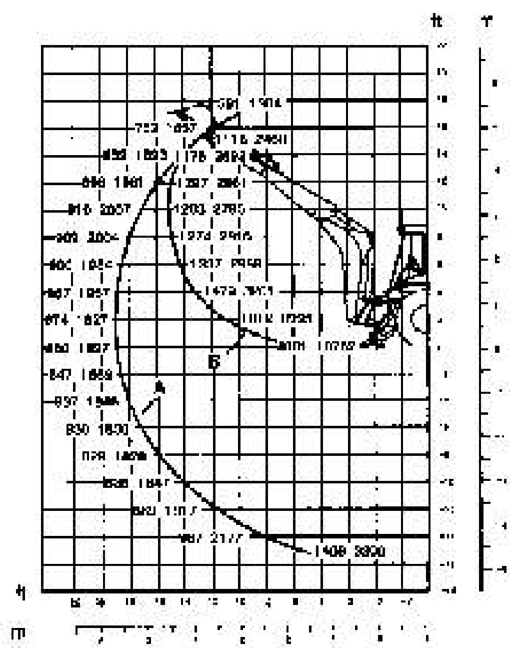
A — Boom lift kg lb
B — Stick lift kg lb



Standard Stick



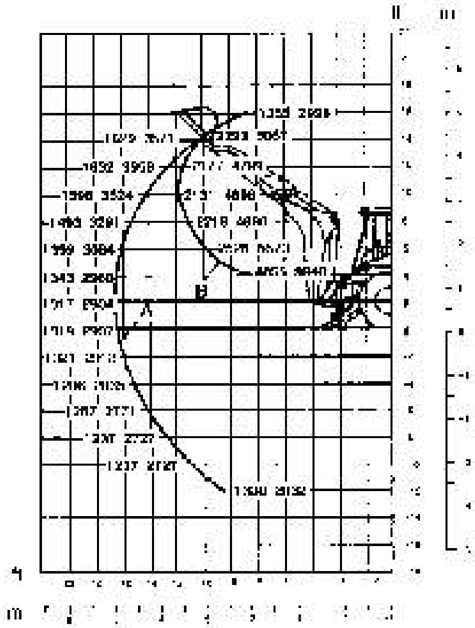
Extendable Stick —
Retracted



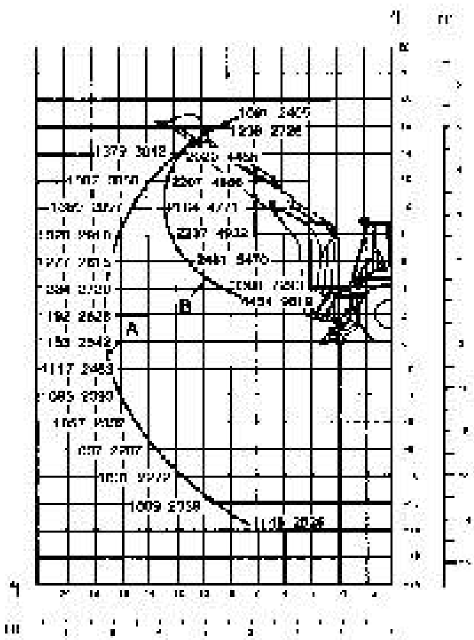
Extendable Stick —
Extended

Note: All lift capacities are throughout the swing arc and are 87% of actual load as per SAE J31

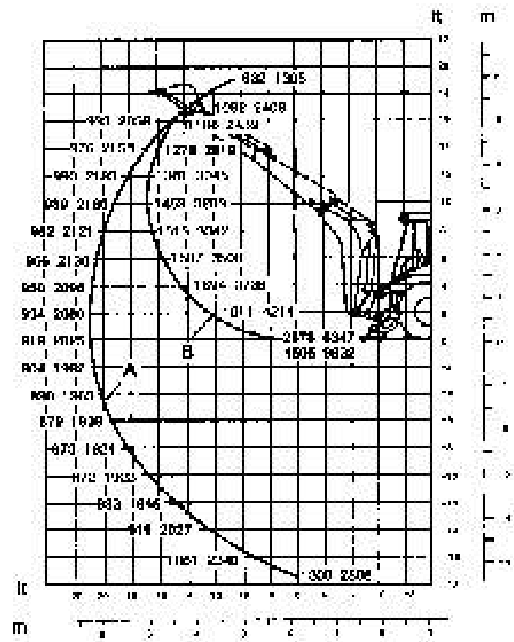
KEY
A — Boom lift kg lb
B — Stick lift kg lb



Standard Stick



Extendable Stick —
Retracted

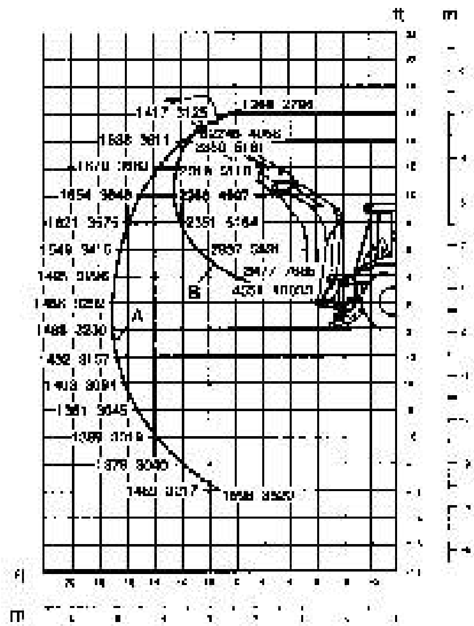


Extendable Stick —
Extended

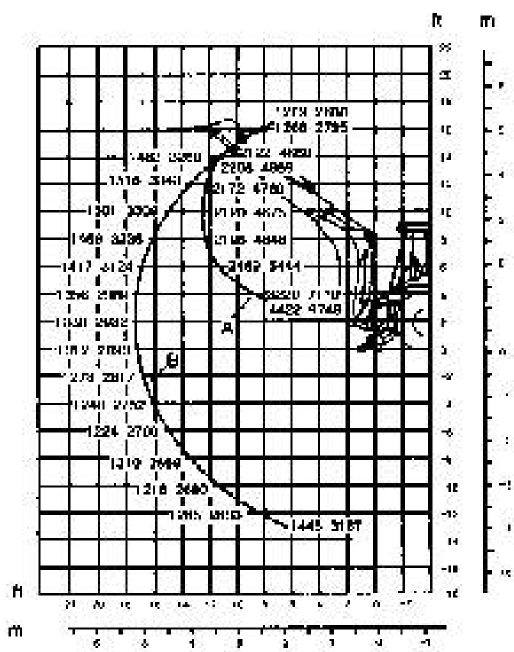
Note: All lift capacities are throughout the swing arc and are 87% of actual load as per SAE J31

KEY

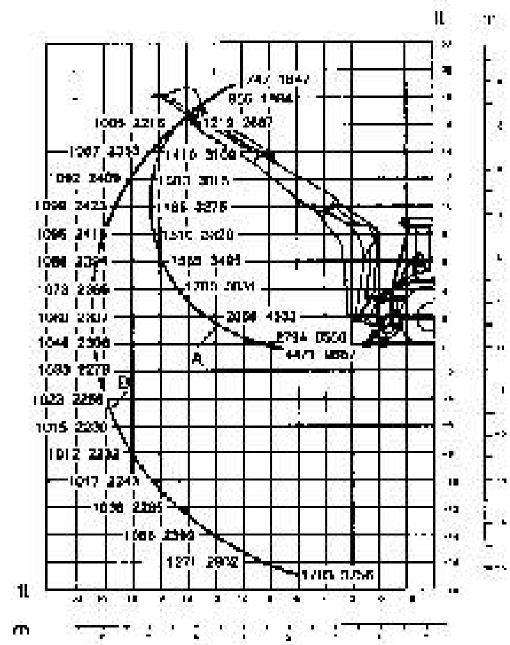
A Boom lift kg lb
B Stick lift kg lb



Standard Stick



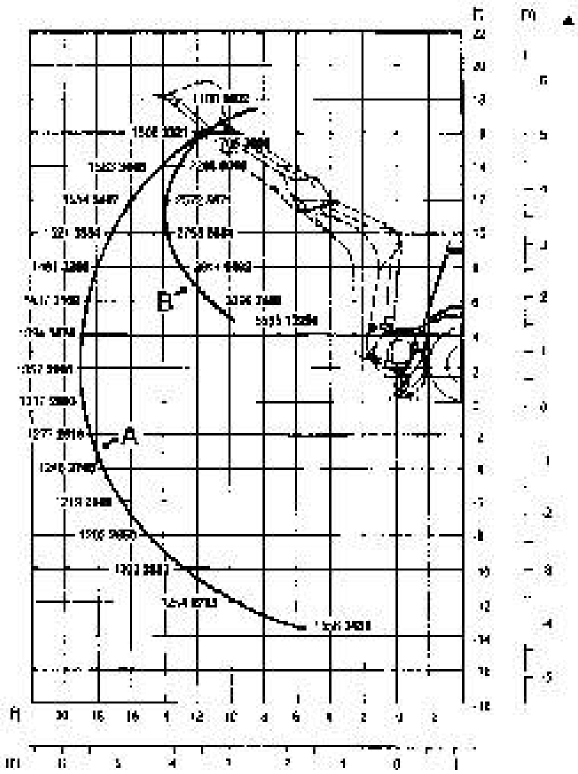
Extendable Stick — Retracted



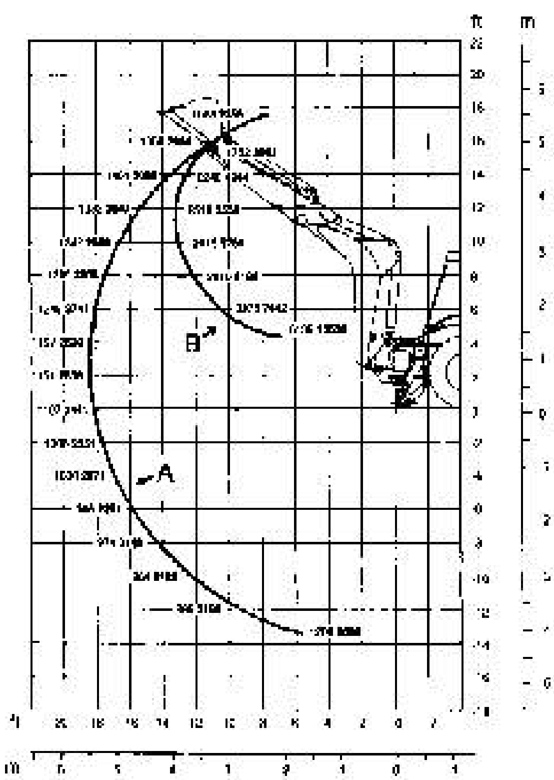
Extendable Stick — Extended

Note: All lift capacities are throughout the swing arc and are 87% of actual load as per SAE J31

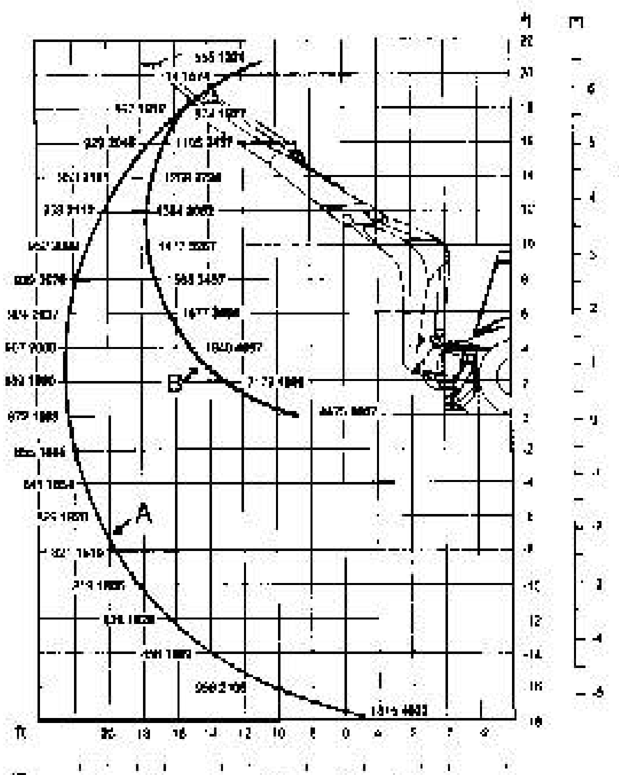
KEY
A — Boom lift kg lb
B — Stick lift kg lb



Standard Stick



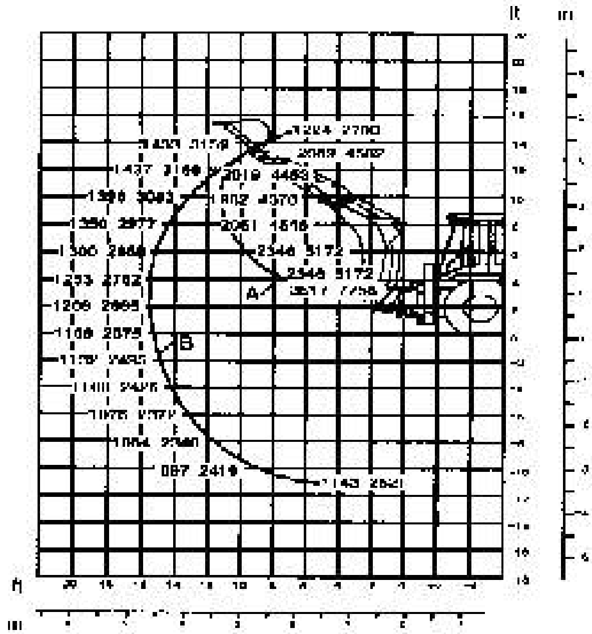
Extendable Stick —
Retracted



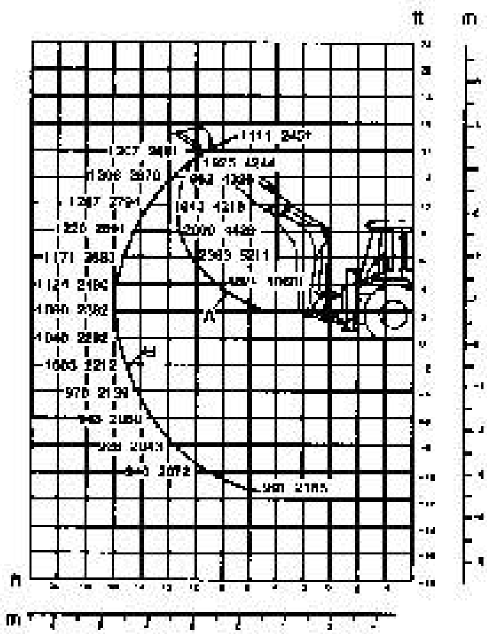
Extendable Stick —
Extended

Note: All lift capacities are throughout the swing arc and are 87% of actual load as per SAE J31

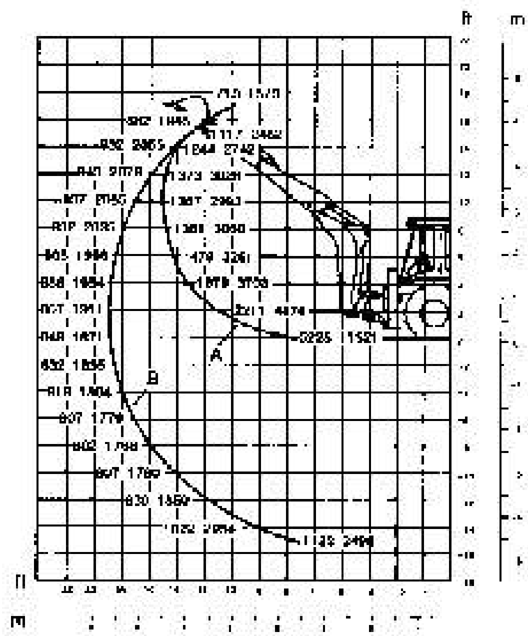
KEY
A — Boom lift kg lb
B — Stick lift kg lb



Standard Stick



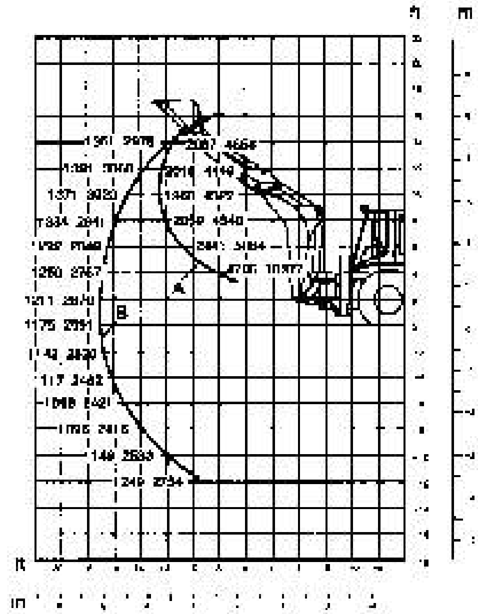
Extendable Stick — Retracted



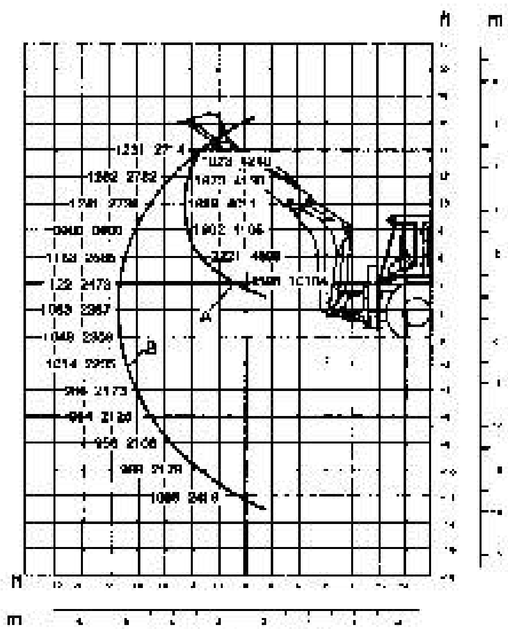
Extendable Stick — Extended

Note: All lift capacities are throughout the swing arc and are 87% of actual load as per SAE J31

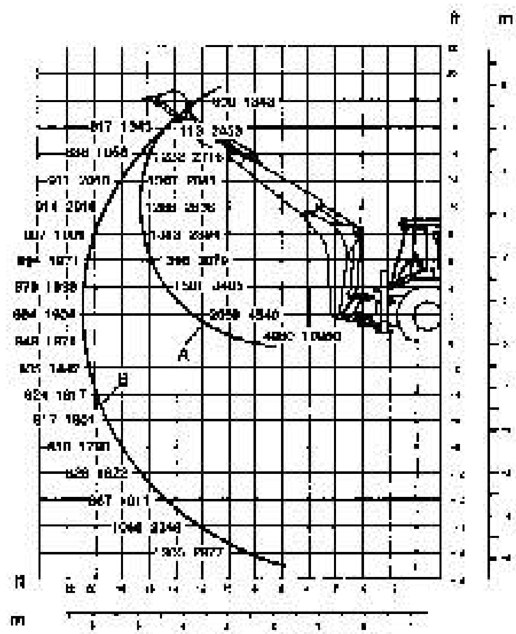
KEY
A — Boom lift kg lb
B — Stick lift kg lb



Standard Stick

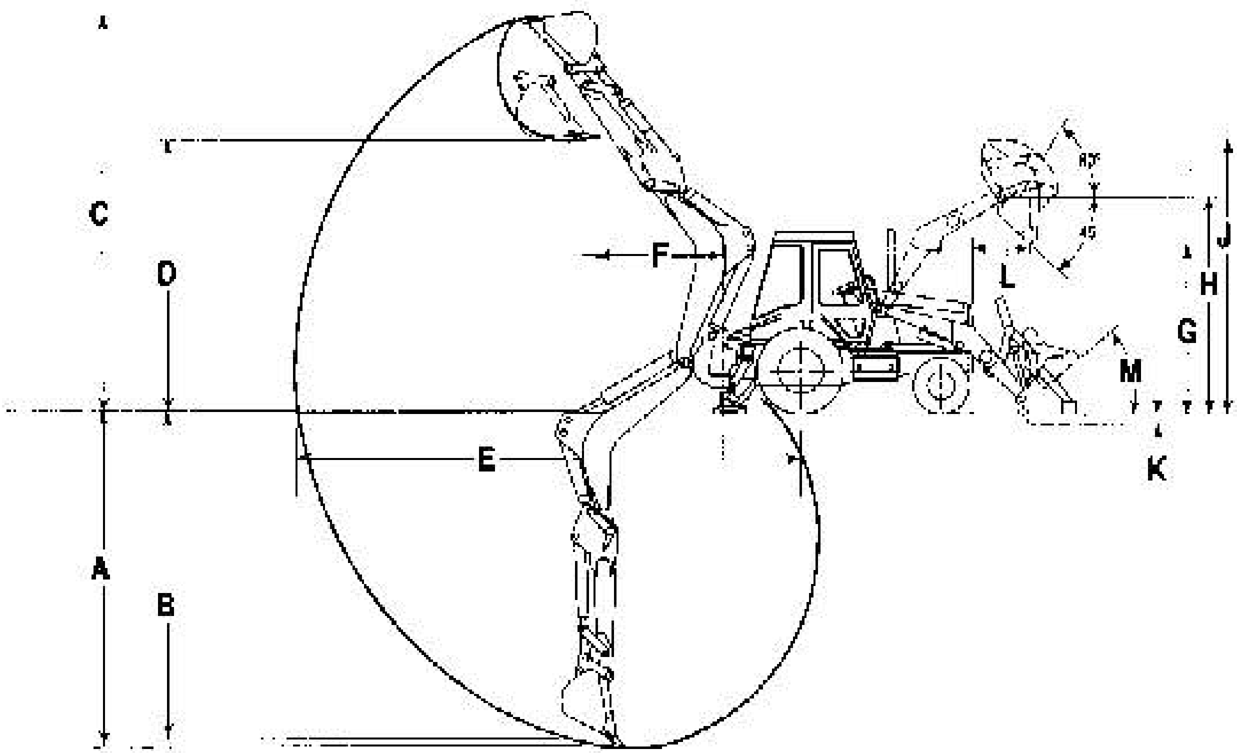


Extendable Stick —
Retracted



Extendable Stick —
Extended

Note: All lift capacities are throughout the swing arc and are 87% of actual load as per SAE J31



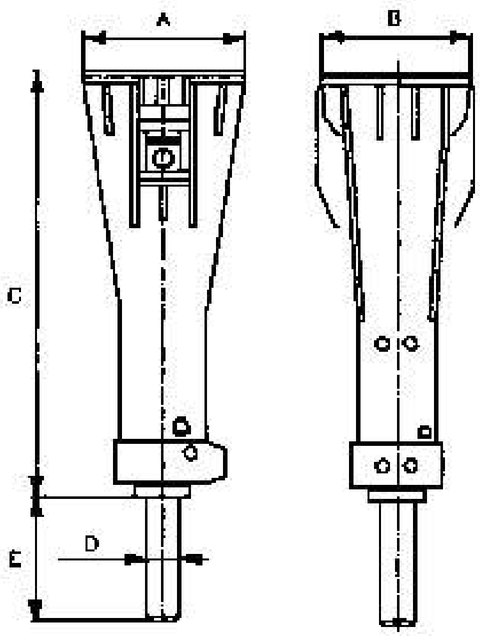
Machine Dimensions	Centerpivot 416B		426B		436B	
Overall transport length	6838 mm	22'6"	6817 mm	22'8"	7094 mm	23'3"
Overall transport height	3448 mm	11'3"	3742 mm	12'3"	3810 mm	12'6"
Overall width, with bucket	2262 mm	7'5"	2262 mm	7'5"	2262 mm	7'5"
Height to top of canopy/cab	2719 mm	8'11"	2714 mm	8'11"	2779 mm	9'1"
Ground clearance	297 mm	12.0"	281 mm	11.0"	352 mm	14.0"
Front wheel tread	1780 mm	5'10"	1780 mm	5'10"	1828 mm	5'11"
Rear wheel tread	1714 mm	5'7"	1714 mm	5'7"	1714 mm	5'7"
Wheel base (2WD)	2100 mm	6'11"	2100 mm	6'11"	2100 mm	6'11"
(4WD)	2067 mm	6'9"	2067 mm	6'9"	2067 mm	6'9"

Machine Dimensions	Centerpivot 446		Sideshift 428B		438B	
Overall transport length	7954 mm	26'1"	5685 mm	18'10"	5719 mm	18'9"
Overall transport height	4193 mm	13'9"	3574 mm	11'9"	3641 mm	11'11"
Overall width, with bucket	2432 mm	8'0"	2390 mm	7'10"	2396 mm	7'10"
Height to top of canopy/cab	2884 mm	9'6"	2743 mm	8'11"	2704 mm	9'8"
Ground clearance	332 mm	13"	320 mm	12.6"	335 mm	13.2"
Front wheel tread	1970 mm	6'6"	1780 mm	5'10"	1870 mm	6'2"
Rear wheel tread	1800 mm	5'11"	1690 mm	5'6"	1690 mm	5'6"
Wheel base (2WD)	2233 mm	7'4"	2100 mm	6'11"	—	—
(4WD)	2233 mm	7'4"	2067 mm	6'9"	2067 mm	6'9"

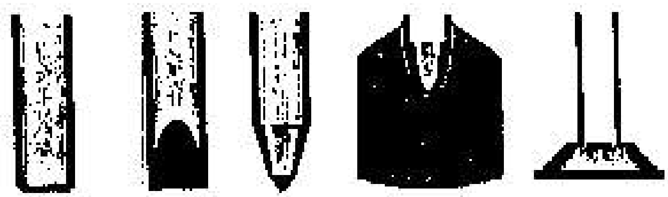
Balderson Hydraulic Hammer Selection Guide

Model	**446**	**436B**	**428B**	**426B**	**416B**
Hammer	B110				
	B90	B90	B90	B90	B90
	B70	B70	B70	B70	B70

5



Choosing the Tool



Blunt	Chisel / Moil	Spade	Compacting Plate
Igneous and tough metamorphic rock into which tool doesn't penetrate	Sedimentary and weak metamorphic rock into which tool penetrates	Frozen or Compact Ground	Ground Compacting
Concrete	Concrete	Asphalt	B70
Breaking Boulders	Trenching	B70, B90	
B110 B185	Benching		
	All Models		

Balderson Hydraulic Hammer Dimensions

	A		B		C		D		E	
	mm	in	mm	in	mm	in	mm	in	mm	in
B110	520	**20.5**	400	**15.8**	1580	**62.2**	110	**4.4**	520	**20.5**
B90	480	**18.9**	380	**15.0**	1098	**43.2**	90	**3.6**	409	**16.1**
B70	470	**18.5**	380	**15.0**	1134	**44.7**	70	**2.76**	398	**15.6**

Balderson Hammers

Model	B110		B90		B70	
Working weight[1]	950 kg	**2090 lb**	450 kg	**990 lb**	405 kg	**890 lb**
Impact frequency[2]	**390-560 bpm**		**450-1000 bpm**		**600-1800 bpm**	
Impact energy	1800 j	**1328 ft-lb**	1000 j	**738 ft-lb**	700 j	**538 ft-lb**
Impact energy class	2035 j	**1500 ft-lb**	1355 j	**1000 ft-lb**	1015 j	**750 ft lb**
Operating pressure[3]	130-140 bar	**1885-2030 psi**	90-100 bar	**1305-1450 psi**	100-130 bar	**1450-1885 psi**
Minimum carrier relief pressure[4]	185 bar	**2685 psi**	155-175 bar	**2248-2538 psi**	130-190 bar	**1885-2756 psi**
Hammer circuit maximum relief pressure[5]	210 bar	**3045 psi**	210 bar	**3045 psi**	220 bar	**3190 psi**
Acceptable oil flow	70-100 l/min	**18-26 gpm**	60-135 l/min	**16-36 gpm**	50-150 l/min	**13-40 gpm**
Maximum back pressure	6 bar	**90 psi**	20 bar	**290 psi**	30 bar	**435 psi**
Low pressure	—		33-34 bar	**480-495 psi**	38-40 bar	**550-580 psi**
Oil temperature	-15-77°C	**4-170°F**	-15-77°C	**4-170°F**	– 15-77°C	**4-170°F**
Oil viscosity	**15-1000 cSt**		**15-1000 cSt**		**15-1000 cSt**	
Line size (minimum)						
ID pressure	19 mm	.75 in	19 mm	.75 in	25.4 mm	1.0 in
ID return	25.4 mm	1.0 in	19 mm	.75 in	25.4 mm	1.0 in

[1] Includes standard tool.
[2] Approximate value, actual impact frequency depends on oil flow, oil viscosity, temperature, and materials to be broken.
[3] Average value, actual pressure depends on flow, oil viscosity, temperature, material to be broken and back pressure.
[4] Setting of relief valve in carrier, correct value depends on oil flow.
[5] Calculated hammer circuit relief = actual operating pressure (psi) + actual back pressure (psi) + valve setting 435 psi

Backhoe Loaders equipped with hydraulic hammers are well-suited to breaking concrete, asphalt and hard or frozen ground. They can be used to break rock for jobs of short duration, but continuous rock applications require hammers classed at 2710 j (2,000 ft lbs) and above.

Loader End Work Tools	446	436	428	426	416
Quick coupler	X	X	X	X	X
Tilt coupler		X	X	X	X
General purpose bucket	X	X	X	X	X
Light material bucket	X	X	X	X	X
Multi-purpose bucket	X	X	X	X	X
Pallet fork	X	X	X	X	X
Hydraulic angle blade	X	X	X	X	X
Hydraulic broom	X	X	X	X	X
Asphalt cutter	X	X	X	X	X
Loader rake	X	X	X	X	X

Stick End Work Tools	446	436	428	426	416
Quick coupler	X	X	X	X	X
Swinger coupler	X	X	X	X	X
Ditch cleaning bucket	X	X	X	X	X
Heavy duty bucket	X	X	X	X	X
Extreme service bucket	X	X	X	X	X
Cemetery bucket		X	X	X	X
Ripper bucket		X	X	X	X
Jaw bucket		X	X	X	X
Rota jaw bucket		X	X	X	X
Hydraulic hammer	X	X	X	X	X
Ripper tooth	X	X	X	X	X
Backfill blade	X	X	X	X	X

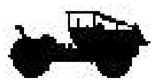
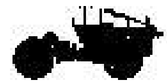
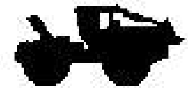
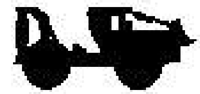
SKIDDERS

CONTENTS

518 Series II, 528B and 530B

518 Series II, 528B and 530B Features:

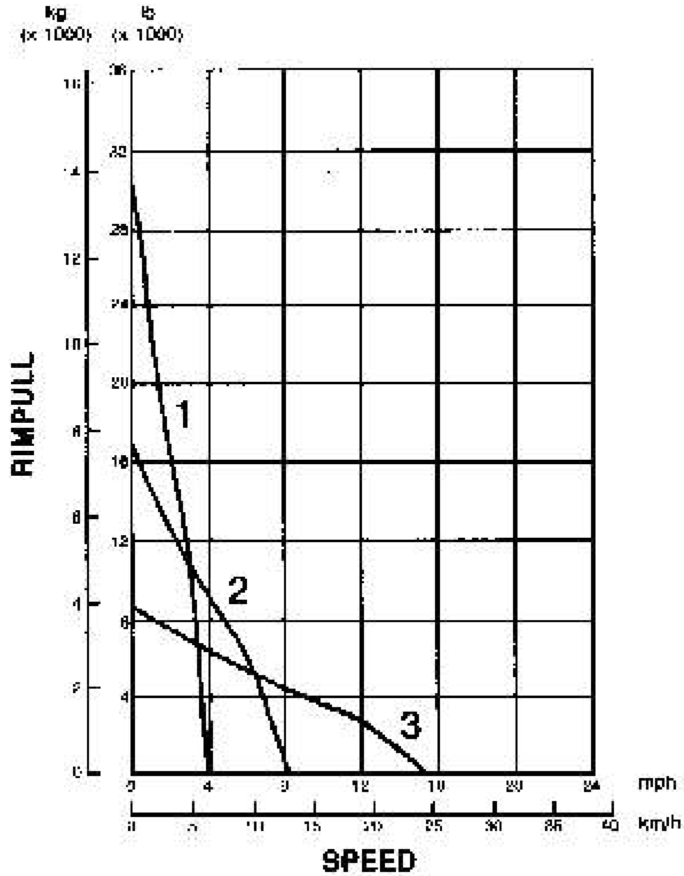
- **Reliable power train** with proven Cat diesel Engine and planetary power shift transmission. Direct injection fuel system . . . uses less fuel . . . runs cooler. Turbocharging eliminates need for spark arrester.
- **Articulated frame steering** with variable flow modulation for quick, easy maneuvering. Non follow-up.
- **Long wheel base** on Cat Skidders adds stability for skidding larger payloads and increasing production rate.
- **Oscillating frame** for operating stability and smooth ride.
- **Caliper Disc brakes** . . . 518 Series II choice of driveline for level terrain or driveline and front wheel for steep slopes . . . 528B/530B driveline and four wheels.
- **Protection for operator and machine** . . . roll-over protective structure meets OSHA regulations . . . screened operator's compartment . . . brush guards . . . steel belly guards . . . hinged radiator guard with lift-out screen . . . perforated engine side guards . . . log kickers on dozer blade.
- **Easy servicing** . . . minimal daily lubrication . . . turn valve on engine side to drain crankcase. Sight gauges and dipsticks are easily accessible.
- **Cat Grapples** available in 2083 mm (82 in) and 2540 mm (100 in) models.

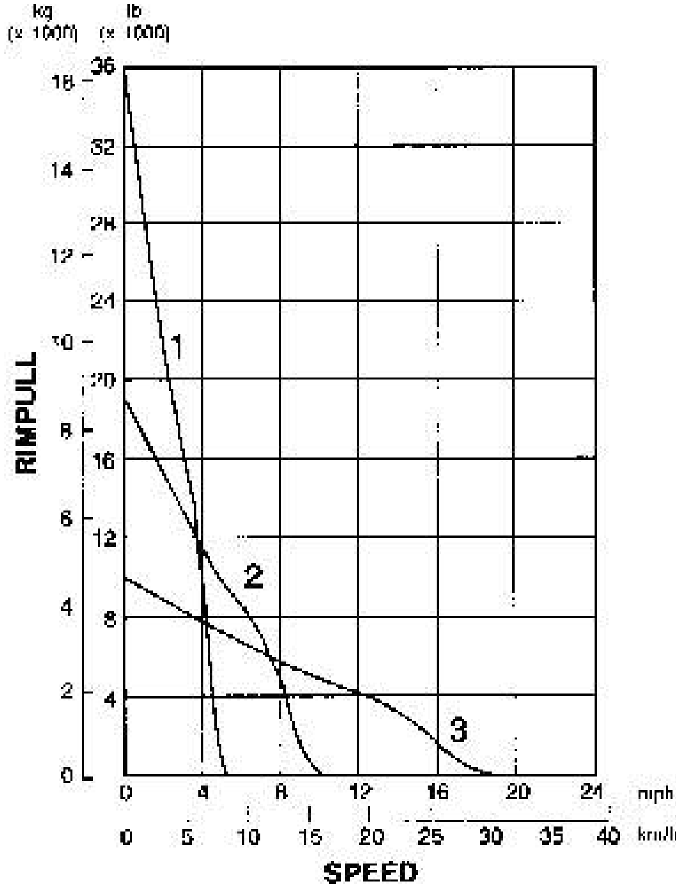
MODEL	518 Series II Cable		518 Series II Grapple		528B		530B	
Flywheel Power	97/108 kW	130/145 HP	96 kW	130 HP	138/145 kW	185/195 HP	138/145 kW	185/195 HP
Operating Weight	10 250 kg	22,600 lb	12 025 kg	26,500 lb	14 515 kg	32,000 lb	15 900 lb	35,000 lb
Engine Model	3304		3304		3306		3306	
Rated Engine RPM	2200		2200		2200		2200	
No. Cylinders	4		4		6		6	
Displacement	7.0 l	425 in³	7.0 l	425 in³	10.5 L	638 in³	10.5 L	638 in³
Oscillation, Frame type, degrees	±14°		±14°		±14°		±14°	
Tires, standard	23.1-26		23.1-26		24.5-32		30.5-32	
optional	18.4-34		24.5-32		30.5-32		24.5-32	
	28L-26		28L-26					
	24.5-32		30.5-32					
	30.5-32							
Turning Diameter (outside rear wheel)*	11.23 m	36'10"	11.23 m	36'10"	11.02 m	36'2"	12.62 m	41'4"
Turning Radius*	5.61 m	18'5"	5.61 m	18'5"	5.51 m	18'1"	6.31 m	20'7"
Winch Line Pull, max. at stall, bare drum	11 983 kg	26,363 lb	11 983 kg	26,363 lb	18 140 kg	40,000 lb	18 140 kg	40,000 lb
Line Speed at Rated Engine RPM, bare drum	92 m/min @ 4243 kg	302 fpm @ 9334 lb	92 m/min @ 4243 kg	302 fpm @ 9334 lb	113 m/min @	370 fpm @ —	113 m/min @	370 fpm @ —
Winch Weight	408 kg	900 lb	408 kg	900 lb	522 kg	1150 lb	522 kg	1150 lb
Drum Capacity	76 m	251'	76 m	251'	66 m	216'	66 m	216'
at Cable Size	16 mm	5/8"	16 mm	5/8"	19 mm	3/4"	19 mm	3/4"
Flange Diameter	419 mm	16.5"	419 mm	16.5"	495 mm	19.5"	495 mm	19.5"
Drum Width	244 mm	9.62"	244 mm	9.62"	200 mm	7.88"	200 mm	7.88"
Drum Diameter	255 mm	10"	255 mm	10"	305 mm	12"	305 mm	12"
Fuel Tank Refill Capacity	193 L	51 U.S. gal	193 L	51 U.S. gal	208 L	55 U.S. gal	300 L	79 U.S. gal
Hydraulic System Refill Capacity	29 L	7.75 U.S. gal	29 L	7.75 U.S. gal	45 L	12 U.S. gal	54 L	14 U.S. gal
GENERAL DIMENSIONS*								
Length with Dozer	5.72 m	18'8"	5.56 m	18'3"	6.93 m	22'8"	7.42 m	24'4"
Wheel Base	3.25 m	10'8"	3.25 m	10'8"	3.25 m	10'8"	3.71 m	12'2"
Width over Tires	2.64 m	8'8.1"	2.64 m	8'8.1"	2.99 m	9'10"	3.32 m	10'11"
Height to Top of ROPS	2.91 m	9'6.5"	2.91 m	9'6.5"	3.08 m	10'1"	3.09 m	10'2"
Height to Exhaust	2.93 m	9'7.5"	2.93 m	9'7.5"	3.11 m	10'3"	3.13 m	10'3"
Ground Clearance	470 mm	18.5"	470 mm	18.5"	610 mm	24"	625 mm	24.6"
Tread Width*	2.07 m	6'9.5"	2.07 m	6'9.5"	2.31 m	7'7"	2.55 m	8'4"
Dozer Width	2.16 m	7'1"	2.16 m	7'1"	2.29 m	7'6"	2.29 m	7'6"

*With standard tires

518 Series II Skidder



528B/530B Skidder



KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear

Usable rimpull depends on traction, tire size and equipped weight of loaded machine. Grapple weights may vary. Note: Rimpull shown with standard 23.1-26 tires. Rimpull can vary with tire size. Consult your Caterpillar Dealer for further information.

	1st	2nd	3rd
Forward, km/h	6.7	12.9	24.0
mph	**4.1**	**8.0**	**14.9**
Reverse, km/h	8.0	15.7	28.7
mph	**5.0**	**9.7**	**17.8**

Usable rimpull depends upon traction, tire size and equipped weight of loaded machine. Maximum unloaded operating weight should not exceed 15 420 kg (34,000 lb). **Note:** Rimpull shown with standard 24.5-32 tires.

	1st	2nd	3rd
Forward, km/h	8.4	16.3	30.1
mph	**5.2**	**10.1**	**18.7**
Reverse, km/h	10.1	19.8	36.7
mph	**6.3**	**12.3**	**22.8**

GRAPPLES

Grapples for Cat 518 Series II and 530B Skidders are supplied both by Caterpillar and by independent manufacturers of auxiliary equipment (AEMs) through Caterpillar Dealers. The following pages contain information on some of the available models, which are presented here to suggest a range of grapple possiblities. The specifications were supplied by the manufacturer and follow the SAE definitions listed below.

SAE specification definition

Reach (A,B,C,D) — The horizontal distance from the vertical center of the rear axle to the vertical center of the grapple fore and aft pivot.

A) With the grapple in its highest farthest position
B) With the grapple in its lowest farthest position
C) With the grapple in its highest fully retracted position
D) With the grapple in its lowest fully retracted position

Lift (E,F,G,H) — The vertical distance from the horizontal center of the rear axle to the horizontal center of the grapple fore and aft pivot.

E) With the grapple in its highest farthest position
F) With the grapple in its lowest farthest position
G) With the grapple in its highest fully retracted position
H) With the grapple in its lowest fully retracted position

Loaded Tire Radius (J) — Vertical distance from horizontal center of axle to horizontal reference plane.

Maximum Grapple Opening (K) — The horizontal distance between the tips of the grapple arms when grapple is fully open.

Area of Opening (L) — The available area with grapple in tips together position.

Minimum Log Size (M) — The smallest diameter which the grapple can close on.

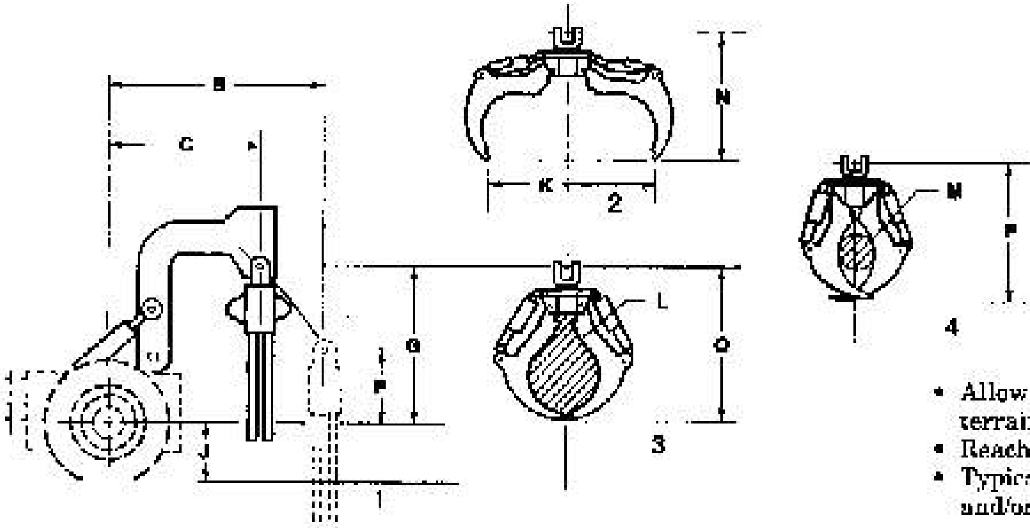
Grapple Length (N,O,P) — The distance from the grapple fore and aft pivot to tips of grapple arms.

N) With grapple fully open.
O) With grapple in tips together position
P) With grapple fully closed

Rear Axle to Boom Pivot Point (Q) — The horizontal distance from the vertical center of the main boom pivot.

Boom Swing (R,S) — The angle in degrees from the longitudinal axis of the vehicle to the longitudinal center of boom at maximum boom position.

Rear Axle to Swing Boom Pivot (T)

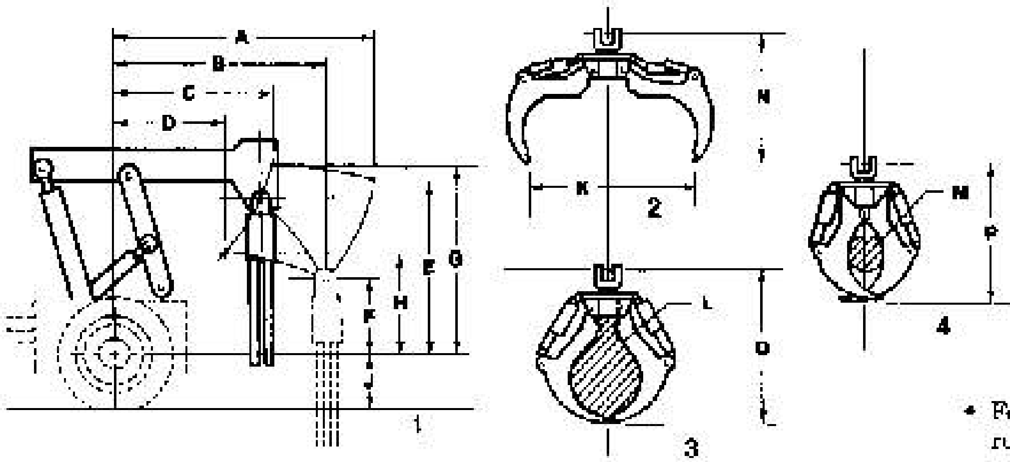


KEY
1 — Horizontal Reference Plane
2 — Fully Open
3 — Tip to Tip
4 — Fully Closed

- Allows skidding pre-bunched wood over terrain with few obstacles.
- Reach consists of one vertical arc.
- Typical application includes short skids and/or large diameter timber.

Grapples for 518 Series II		B	C	F	G	J	K	M	N	O	P	L
Cat 82	mm	2616	1626	89	1981	800	2083	76	1537	1905	1740	.70 m²
	in	103	64	3.5	78	31.5	82	3	60.5	75	68.5	7.5 ft²
Cat 100	mm	2626	1626	89	1981	800	2540	51	1727	2083	1930	.84 m²
	in	103	64	3.5	78	31.5	100	2	68	82	76	9.0 ft²
ESCO Hi-Vis II 82"	mm	2362	1524	165	2172	800	2083	76	1448	1753	1600	.68 m²
	in	93	60	6.5	85.5	31.5	82	3	57	69	63	6.9 ft²
ESCO Hi-Vis II 86"	mm	2362	1524	318	2172	800	2184	76	1422	1829	1776	.76 m²
	in	93	60	12.5	85.5	31.5	86	3	56	72	66	8.2 ft²
ESCO Hi-Vis II 100"	mm	2362	1524	165	2172	800	2540	38	1499	1943	1702	.63 m²
	in	93	60	6.5	85.5	31.5	100	1.5	59	76.5	67	6.9 ft²
YOUNG 130 [2083 mm (82")]	mm	2311	1346	127	2362	800	2083	76	1537	1905	1740	.70 m²
	in	91	53	5	93	31.5	82	3	60.5	75	68.5	7.5 ft²
YOUNG 135 [2540 mm (100")]	mm	2311	1346	127	2360	800	2540	51	1727	2083	1930	.84 m²
	in	91	53	5	93	31.5	100	2	68	82	76	9.0 ft²
YOUNG 138 [2286 mm (90")] (BASKET STYLE GRAPPLE)	mm	2311	1346	127	2360	800	2286	102	1753	1842	1257	.84 m²
	in	91	53	5	93	31.5	90	4	69	72.5	49.5	9.0 ft²
YOUNG 139 [2540 mm (100")] (BASKET STYLE GRAPPLE)	mm	2311	1346	127	2360	800	2540	127	1791	1956	1321	.93 m²
	in	91	53	5	93	31.5	100	5	70.5	77	52	10.0 ft²

Grapples for 530B		B	C	F	G	J	K	M	N	O	P	L
Cat 120 Sorting	mm	2438	1613	102	2540	838	3048	50.8	1981	2591	2362	1.44 m²
	in	96	63.5	−4	100	33	120	2	78	102	93	15.5 ft²
Cat 120 Bunching	mm	2438	1613	102	2540	838	3048	178	2045	2311	1499	1.53 m²
	in	96	63.5	−4	100	33	120	7	80.5	91	59	16.5 ft²
Young 112 Sorting	mm	2438	1613	102	2540	838	2845	50.8	1905	2464	2286	1.30 m²
	in	96	63.5	−4	100	33	112	2	75	97	90	14.0 ft²
Young 112 Bunching	mm	2438	1613	−102	2540	838	2845	178	1905	2159	1473	1.35 m²
	in	96	63.5	−4	100	33	112	7	75	85	58	14.5 ft²
ESCO Hi Vis II 100"	mm	2565	1778	347	2388	800	2540	38	1499	1943	1702	.83 m²
	in	101	70	13.6	94	31.5	100	1.5	59	76.5	67	8.9 ft²
ESCO Hi Vis II 104"	mm	2565	1778	347	2388	800	2642	38	1702	2133	1829	1.23 m²
	in	101	70	13.6	94	31.5	104	1.5	67	84	72	13.2 ft²



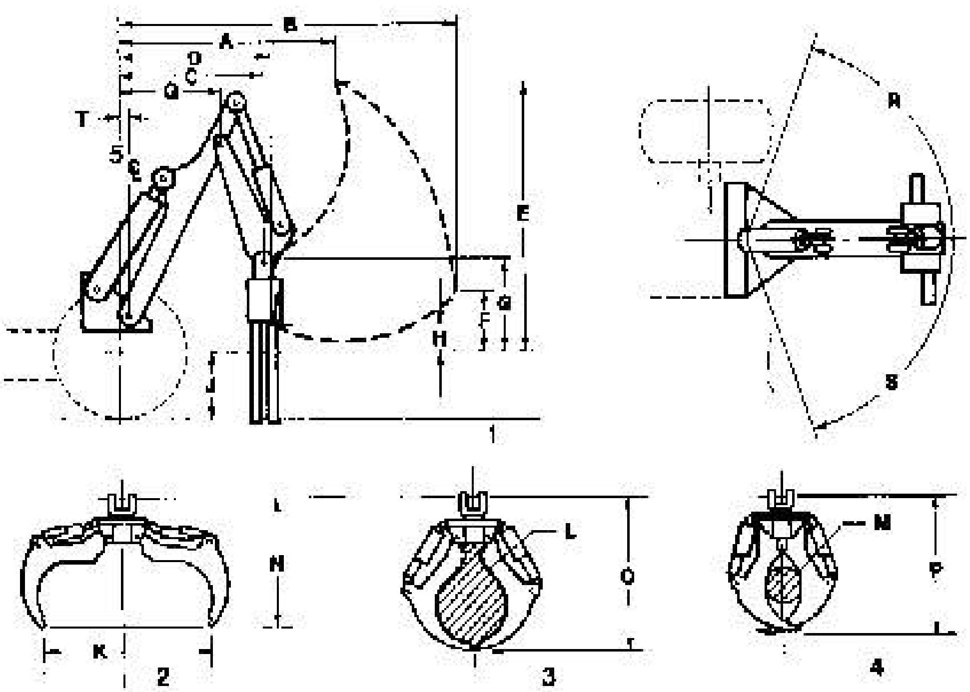
KEY

1 Horizontal Reference Plane
2 — Fully Open
3 — Tip to Tip
4 — Fully Closed

- Fore/aft movement provides extra reach for picking up logs buried in mud or snow, or for reaching over obstacles.
- Positions the load forward over the rear axle for traction and stability.
- Typical application includes long skids and/or small diameter, pre-bunched timber.

Grapples for 518 Series II		A	B	C	D	E	F	G	H	J	K	M	N	O	P	L
YOUNG 425	mm	2921	2286	1321	1270	1270	−3.8	2591	991	800	2540	51	1727	2083	1930	.83 m³
(100 head)	in	115	90	52	50	50	−1.5	102	39	31.5	100	2	68	82	76	9 ft³
YOUNG 427	mm	2921	2286	1321	1270	1270	−3.8	2591	991	800	2794	63.5	1626	2261	2083	1.2 m³
(110 head)	in	115	90	52	50	50	−1.5	102	39	31.5	110	2.5	64	89	82	12.5 ft³
YOUNG 430	mm	2921	2286	1321	1270	1270	−3.8	2591	991	800	2794	139	1854	2172	1397	1.2 m³
(110 basket head)	in	115	90	52	50	50	−1.5	102	39	31.5	110	5.5	73	85.5	55	12.5 ft³

Grapples for 530B		A	B	C	D	E	F	G	H	J	K	M	N	O	P	L
	mm	3048	2083	1600	1499	864	457	2769	991	838	3048	50.8	1981	2591	2362	1.44 m³
Cat 120 Sorting	in	120	82	63	59	34	18	109	39	33	120	2	78	102	93	15.5 ft³
	mm	3048	2083	1600	1499	864	457	2769	991	838	3048	178	2045	2311	1499	1.53 m³
Cat 120 Bunching	in	120	82	63	59	34	18	109	39	33	120	7	80.5	91	59	16.5 ft³
	mm	3048	2083	1600	1499	864	457	2769	991	838	2845	50.8	1905	2464	2286	1.30 m³
Young 112 Sorting	in	120	82	63	59	34	18	109	39	33	112	2	75	97	90	14.0 ft³
	mm	3048	2083	1600	1499	864	457	2769	991	838	2845	178	1905	2159	1473	1.35 m³
Young 112 Bunching	in	120	82	63	59	34	18	109	39	33	112	7	75	85	58	14.5 ft³



KEY
1 — Horizontal Reference Plane
2 — Fully Open
3 — Tip to Tip
4 — Fully Closed
5 — Boom Pivot

- Ability to reach and lift over the side to collect scattered logs.
- Has decking and loading capability.
- Typical application includes long gathering from restrictive skid trails in rough or sloping terrain.

Grapple for 518 Series II		A	B	C	D	E	F	G	H	J	K	M	N	O	P	Q	R	S	T	L
	mm	2527	3879	1499	1651	3786	559	1766	343	800	2083	76	1626	1981	1829	1168	70°	70°	114	.64 m²
ESCO 212C 82"	in	99.5	153.5	59	65	149	22	69.5	13.5	31.5	82	3	64	78	72	46			4.5	6.9 ft²
	mm	2527	3899	1499	1651	3785	559	1766	343	800	2540	38	1473	1981	1702	1168	70°	70°	114	.83 m²
ESCO 212C 100"	in	99.5	153.5	59	65	149	22	69.5	13.5	31.5	100	1.5	58	78	67	46			4.5	8.9 ft²
	mm	2692	3658	1397	1486	3378	305	1626	165	800	2083	76	1524	1905	1727	1245	70°	70°	216	.70 m²
YOUNG 170	in	106	144	55	58.5	133	12	64	6.5	31.5	82	3	60	75	68	49			8.5	7.5 ft²

PIPELAYERS

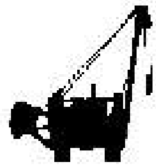
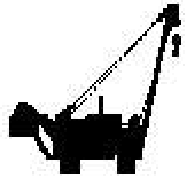
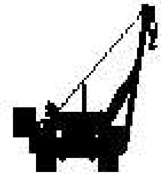
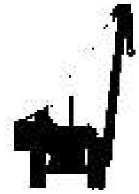
CONTENTS

Features:

- **Planetary power shift transmission** on all models.
- **Control levers shape coded** for operator efficiency.
- **Boom pawl** helps prevent dropping boom (571G & 572G only).
- **Winch transmission reverse lock** reduces the possibility of accidentally powering boom down (571G & 572G only).
- **Kick-out helps prevent boom bending** as boom approaches near-vertical (except 578).
- **Sealed Track,** with metal-to-metal disc seals.

And these additional features for the 578 and 589 Pipelayers . . .

- **Simplified Controls,** two levers control all functions including raise, lower, quick-drop and power down, high and low range and speed adjustments.
- **Modular design of major components and accessory drive system** for simplified repair.
- **Separate, self-energizing brakes** for boom and hook winches (578 hook only).
- **Sealed & Lubricated Track with Positive Pin Retention.**
- **Hydraulic Drawworks** with two independently driven hydraulic motors for boom and hook winches on 589 (578 has 1 winch only).
- **Suspended Undercarriage** for improved ride and greater operator comfort.

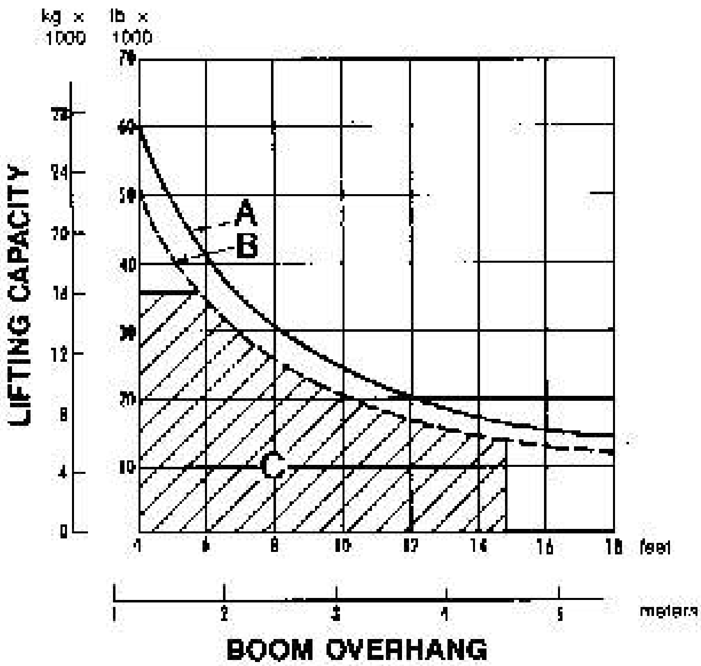





MODEL	571G		572G		578		589	
Flywheel Power	149 kW	200 HP	149 kW	200 HP	224 kW	300 HP	313 kW	420 HP
Operating Weight (with full fuel tank and operator)	23 040 kg	50,800 lb	27 800 kg	61,300 lb	46 580 kg	102,690 lb	67 857 kg	149,600 lb
Engine Model	3306		3306		3406		3408	
Rated Engine RPM	2000		2000		2000		1900	
No. of Cylinders	6		6		6		8	
Displacement	10.5 L	638 in³	10.5 L	638 in³	14.6 L	893 in³	18 L	1099 in³
Lift Capacity at 1.22 m (4') Overhang	27 500 kg	60,600 lb	40 800 kg	90,000 lb	70 307 kg	166,000 lb	104 330 kg	230,000 lb
Standard Boom Length	5.50 m	18'0"	5.50 m	18'0"	6.10 m	20'0"	8.8 m	28'10"
Optional Boom Length	6.10 m	20'0"	—		—		—	
Width of Standard Shoe	560 mm	22"	610 mm	24"	710 mm	28"	914 mm	36"
Length of Track on Ground	2.72 m	8'11"	2.83 m	9'3"	3.638 m	11'11"	4.29 m	14'1"
Ground Contact Area (with standard shoes)	3.04 m²	4710 in²	3.45 m²	5346 in²	5.17 m²	8020 in²	6.98 m²	10,816 in²
Track Gauge	1.98 m	6'6"	2.18 m	7'2"	2.54 m	8'4"	2.9 m	9'6"
Fuel Tank Refill Capacity	435 L	115 U.S. gal	435 L	115 U.S. gal	417 L	110 U.S. gal	776 L	205 U.S. gal
GENERAL DIMENSIONS:								
Height to Top of Stack	3.35 m	11'0"	3.35 m	11'0"	3.92 m	12'10"	3.92 m	12'10"
Height to Top of Counterweight	2.72 m	8'9"	2.62 m	8'7"	2.65 m	8'8"	2.88 m	9'5"
Width, Weights Retracted	3.28 m	10'9"	3.56 m	11'8"	3.98 m	13'0"	4.63 m	15'2"
Minimum Shipping Width (both side frames removed)	2.57 m	8'5"	2.95 m	9'8"	3.36 m	11'0"	3.55 m	11'8"
Shipping Width (left frame removed)	3.02 m	9'11"	3.38 m	11'1"	3.65 m*	12'0"*	—	
Overall Length	4.22 m	14'6"	4.93 m	16'2"	5.28 m▲	17'4"▲	5.94 m	19'6"
Ground Clearance	399 mm	15.7"	483 mm	19"	452 mm	17.8"	625 mm	24.6"
DRUMS and CABLES:								
Drum Capacity — Load	108 m	355'	189 m	620'	93 m	304'	152 m	500'
Drum Capacity — Boom	35 m	115'	78 m	255'	—		93 m	305'
Cable Diameter — Load	19 mm	.75"	19 mm	.75"	22 mm	0.88"	22 mm	.88"
Cable Diameter — Boom	15.7 mm	.62"	19 mm	.75"	—		22 mm	.88"
Drum Diameter — Load	216 mm	8.5"	260 mm	10.25"	345 mm	13.6"	343 mm	13.5"
Drum Diameter — Boom	216 mm	8.5"	260 mm	10.25"	—		343 mm	13.5"
WEIGHTS: Chassis Only	14 740 kg	32,500 lb	16 500 kg	36,500 lb	27 379 kg	60,360 lb	48 149 kg	106,150 lb
Pipelaying Equipment	7938 kg	17,500 lb	10 900 kg	24,000 lb	18 831 kg	41,515 lb	18 937 kg	41,750 lb
Adjustable Counterweights	5 @ 600 kg ea	1330 lb ea	6 @ 600 kg ea	1330 lb ea	5 @ 1215 kg ea	2678 lb ea	7 @ 1315 kg ea	2900 lb ea
Total Weight Extendable	4350 kg	9600 lb	6400 kg	14,200 lb	11 777 kg	25,963 lb	11 854 kg	26,134 lb

*Boom and counterweight only removed.
▲Shipping length: 5.70 m (18'8").

571G

LIFTING CAPACITY* 5.49 m (18') BOOM



***Specified Equipment:**

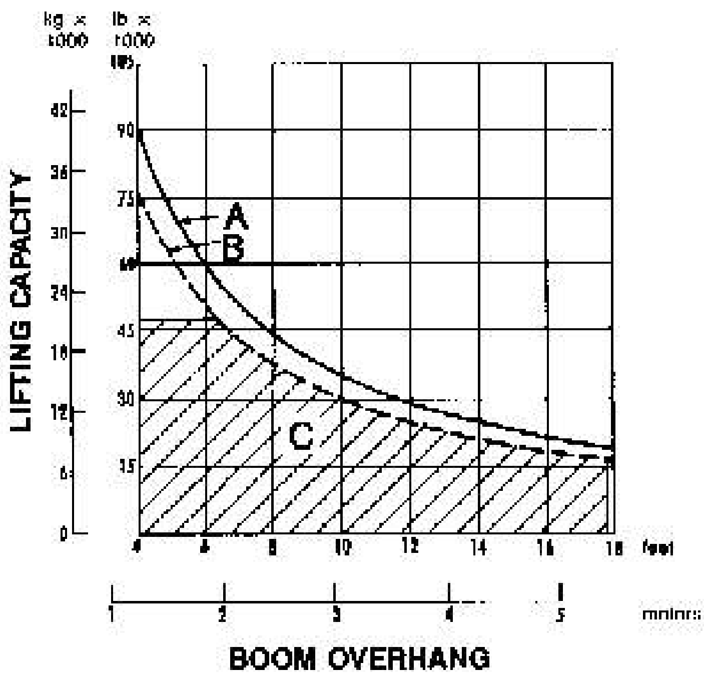
- 3 part load line.
- 19 mm **(3/4")** dia. wire rope 21 591 kg **(47,600 lb)** minimum breaking strength.
- 3 part boom line.
- 16 mm **(5/8")** dia. wire rope 15 150 kg **(33,400 lb)** minimum breaking strength.
- 4355 kg **(9,600 lb)** of counterweights extended.

KEY

A — Max Lift Capacity Per S.A.E. J743b
B — Max Load Capacity Per A.N.S.I. B30.14
C — Working Range Per A.N.S.I. B30.14

572G

LIFTING CAPACITY* 5.49 m (18') BOOM



***Specified Equipment:**

- 19 mm **(3/4")** dia. wire rope 21 591 kg **(47,600 lb)** minimum breaking strength.
- 4 part load line.
- 4 part boom line.
- 6441 kg **(14,200 lb)** of counterweights extended.

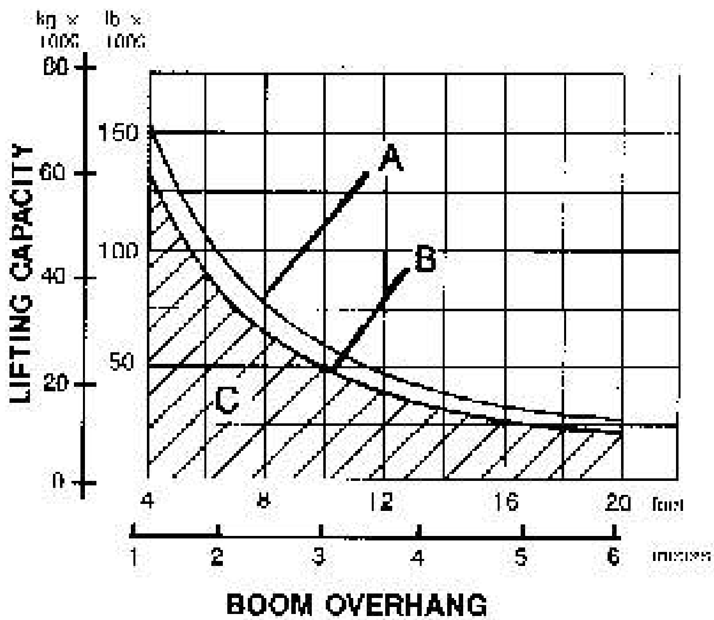
KEY

A — Max Lift Capacity Per S.A.E. J743b
B — Max Load Capacity Per A.N.S.I. B30.14
C — Working Range Per A.N.S.I. B30.14

NOTE: S.A.E. stands for the Society of Automotive Engineers. A.N.S.I. stands for American National Standard Institute.

578

LIFTING CAPACITY* 6.10 m (20') BOOM



Specified Equipment:

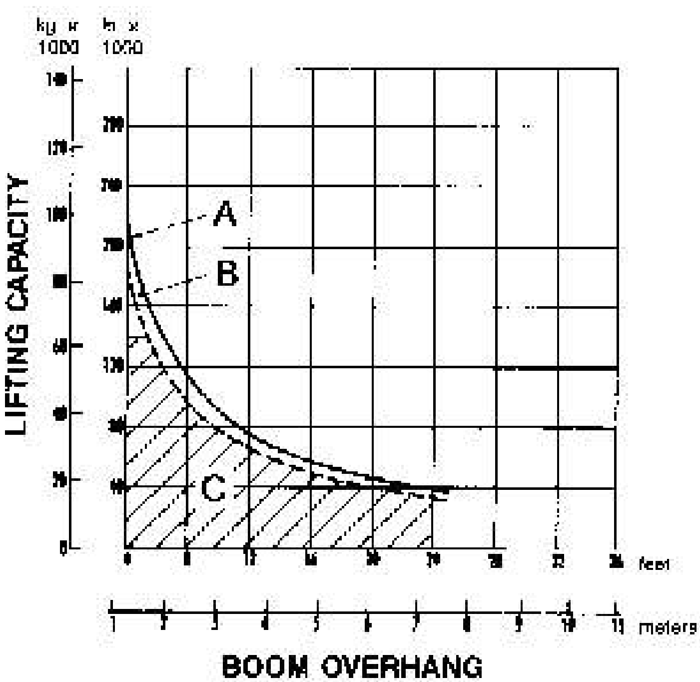
- 22 mm (7/8") dia. wire rope 31 389 kg **(69,200 lb)** minimum breaking strength.
- 5 part load line.
- 11 777 kg **(25,963 lb)** of counterweights extended.
- 6.1 m **(20')** Boom.

KEY

A — Max Lift Capacity Per S.A.E. J743b
B — Max Load Capacity Per A.N.S.I. B30.14
C — Working Range Per A.N.S.I. B30.14

589

LIFTING CAPACITY* 7.600 m (24.9') BOOM



Specified Equipment:

- Load: 22 mm (.88") dia. wire rope 31 389 kg **(69,200 lb)** minimum breaking strength.
- Boom: 22 mm **(.88")** dia. wire rope 31 389 kg **(69,200 lb)** minimum breaking strength.
- 8 part load line.
- 6 part boom line.
- 14 633 kg **(32,260 lb)** of counterweights extended.
- 7.60 m **(24'11")** Boom.

KEY

A — Max Lift Capacity Per S.A.E. J743b
B — Max Load Capacity Per A.N.S.I. B30.14
C — Working Range Per A.N.S.I. B30.14

NOTE: S.A.E. stands for the Society of Automotive Engineers. A.N.S.I. stands for American National Standard Institute

MODEL	571G				572G			
Travel	Forward		Reverse		Forward		Reverse	
Speeds (at rated RPM)	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1st Gear	3.7	2.3	4.5	2.8	3.7	2.3	4.5	2.8
2nd Gear	6.4	4.0	7.9	4.9	6.4	4.0	7.9	4.9
3rd Gear	10.0	6.2	11.9	7.4	10.0	6.2	11.9	7.4

Pipelayer Hook Speeds per minute. Bare drum at rated engine RPM	m	ft	m	ft
First	8.9	29.2	7.6	25.0
Second	15.4	50.5	15.1	49.7
Third	62.9	206.4	36.2	118.8
Lower	8.8	29.0	16.3	53.4

MODEL	578				589			
Travel	Forward		Reverse		Forward		Reverse	
Speeds (at rated RPM)	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1st Gear	3.8	2.35	4.7	2.9	3.5	2.2	4.3	2.7
2nd Gear	6.3	3.9	8.0	5.0	6.3	3.9	7.8	4.8
3rd Gear	10.8	6.7	13.8	8.6	10.8	6.8	13.7	8.5

Pipelayer Hook Speeds per minute. Bare drum at rated engine RPM	m	ft	m	ft
Low Raise	7.92	26	5.8	19
High Raise	23.77	78	17.4	57
Lower (Powered)	32.31	106	23.5	77

7

Specifications
• Caterpillar-Built Machines with Midwestern Sidebooms

MODEL		814B	824C	910E	930	936E	950E	966E	980C
Flywheel Power	kW	157	231	48	75	100	119	160	194
	HP	210	300	65	100	135	160	215	260
Weight installed:									
Boom only	kg	680	680	340	454	454	454	680	680
	lb	1500	1500	750	1000	1000	1000	1500	1500
Counterweight only	kg	NA	NA	864	NA	NA	NA	NA	NA
	lb			1900					
Complete sideboom attachment	kg	1816	1816	862	1168	1168	1168	1816	1816
	lb	4000	4000	1900	2575	2575	2575	4000	4000
GENERAL DIMENSIONS (machine)									
Length	m	6.47	7.67	5.48	6.07	6.88	6.30	7.81	8.6
	ft	21'3"	25'2"	18'0"	19'11"	22'7"	20'8"	25'8"	28'3"
Shipping width, boom vertical	m	2.95	3.21	2.15	2.43	2.67	2.74	2.98	3.25
	ft	9'6.38"	10'6.5"	7'1"	8'0"	8'9"	9'0"	9'9"	10'8"
Boom removed	m	2.95	3.09	2.15	2.43	2.67	2.74	2.84	2.95
	ft	9'6.38"	10'2"	7'1"	8'0"	8'9"	9'0"	9'4"	9'8.5"
Height (ground to top of boom), boom vertical									
Telescopic extended	m	5.49	5.48	4.52	4.57	4.57	4.63	5.33	5.48
	ft	17'10"	18'0"	14'10"	15'0"	15'0"	15'4"	17'6"	18'0"
Telescopic retracted	m	3.45	3.96	3.02	3.04	3.04	3.15	3.56	4.09
	ft	11'4"	13'0"	9'11"	9'11"	9'11"	11'4"	11'8"	13'5"
OPERATING DATA									
Load Winch — Line Speeds	m/min	7.6	20.7	15.25	18.3	24.3	32	21.3	30.48
	ft/min	25	68	50	60	80	105	70	100
Load Drum Cable Cap.	m	45.7	45.7	23	24.4	28	28	45.7	45.7
	ft	150	150	75	80	92	92	150	150
Cable Diameter	mm	16	16	6	10	11	11	16	16
	in	.625"	.625"	.3125"	.375"	.4375"	.625"	.625"	.625"
Recommended Tire Size		23.5-25 22 PR	29.5-29 22 PR	15.5-25 12 PR	20.5-25 12 PR	20.5-25 12 PR	17.5-25 12 PR	23.5-25 12 PR	29.5-25 22 PR
Maximum Shoe Width	mm	—	—	—	—	—			
	in								

NA — Not Available.
'High gear.
*Shipping width with counterweight removed

Wheel loaders with smallest GP bucket

MODEL	614B		824C		910E*		930	
Lift Capacities (approx.) with machines steered straight and boom overhang of:	kg	lb	kg	lb	kg	lb	kg	lb
1.2 m ~ 4'	11 240	**25,000**	19 505	**43,000**	3091	**6800**	5783	**12,750**
1.8 m ~ 6'	7711	**17,000**	13 608	**30,000**	2136	**4700**	3856	**8500**
2.4 m ~ 8'	5897	**13,000**	10 433	**23,000**	1591	**3500**	2835	**6250**
3.0 m ~ 10'	4536	**10,000**	8165	**18,000**	1273	**2800**	2268	**5000**
3.7 m ~ 12'	3175	**7000**	6804	**15,000**	1136	**2500**	1860	**4100**
4.2 m ~ 14'	2722	**6000**	5897	**13,000**	*Counterweight can increase lift capacity about 25%			
4.9 m ~ 16'	2268	**5000**	4990	**11,000**				
OPERATING DATA:								
Winch Line Speeds (Lo-gear only)	7.6 m/min	**25 ft/min**	20.7 m/min	**68 ft/min**	15.2 m/min	**50 ft/min**	18.3 m/min	**60 ft/min**
Drum:								
Cable capacity	45.7 m	**150 ft**	45.7 m	**150 ft**	23 m	**75 ft**	24.4 m	**80 ft**
Cable diameter	16 mm	**.625"**	16 mm	**.625"**	8 mm	**.3125"**	10 mm	**.375"**

MODEL	936E		950E		966E		980C	
Lift Capacities (approx.) with machines steered straight and boom overhang of:	kg	lb	kg	lb	kg	lb	kg	lb
1.2 m ~ 4'	6351	**14,000**	6917	**15,250**	11 840	**26,100**	15 000	**33,000**
1.8 m ~ 6'	4491	**9900**	4876	**10,750**	7940	**17,500**	13 182	**29,000**
2.4 m ~ 8'	3334	**7350**	3629	**8000**	5900	**13,000**	10 000	**22,000**
3.0 m ~ 10'	2608	**5750**	2835	**6250**	4760	**10,500**	8182	**18,000**
3.7 m ~ 12'	2087	**4600**	2268	**5000**	3860	**8500**	6818	**15,000**
4.2 m ~ 14'					3360	**7400**	5455	**12,000**
4.9 m ~ 16'					2950	**6500**	4545	**10,000**
OPERATING DATA:								
Winch Line Speeds (Lo-gear only)	24.4 m/min	**80 ft/min**	32 m/min	**105 ft/min**	25.9 m/min	**85 ft/min**	30.5 m/min	**100 ft/min**
Drum:								
Cable capacity	28 m	**92 ft**	28 m	**92 ft**	45.7 m	**150 ft**	45.7 m	**150 ft**
Cable diameter	11 mm	**.4375"**	11 mm	**.4375"**	16 mm	**.625"**	16 mm	**.625"**

WHEEL TRACTOR-SCRAPERS

CONTENTS

Features, all models:

- **Semi-automatic power shift transmissions.** Eight speed used in 621E thru 657E.
- **Power shift transmissions** with six speeds used in 613C and 615C.
- **Differential lock . . .** operator controlled, rigidly connects both tractor drive wheels for positive traction.
- **Cushion Hitch** on 621E through 657E (optional axle suspension on 615C) absorbs haul road shocks, stabilizes machine travel, substantially increases usable working speeds.
- **Double-acting hydraulics** supply positive cutting edge penetration, apron closure and material ejection. Positive bulldozer-type ejection. Automatic ejector return kickout.
- **Quick-drop valves** for pump loading (except 613C, 615C, 623E). **Carry check valves** isolate bowl cylinders to carry load rather than hydraulic lines.
- **Hydraulic retarder** standard on 651E/657E, optional on 621E through 637E Series II. Not available on 613C or 615C.

Tandem Powered:

- **Push-Pull arrangement** allows two 627E, 637E Series II or 657E scrapers to assist one another in self-loading.

Elevating:

- **Uninterrupted elevator reverse** allows sticky material to be ejected more easily.
- **Two-speed elevator** allows operator to match elevator speed to material conditions.

Auger:

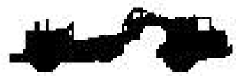
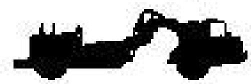
- **AEM attachment** available provides self loading capability in larger scrapers.

8



MODEL	621E		631E Series II		651E	
Flywheel Power	246 kW	330 HP	336 kW	450 HP	410 kW	550 HP
Approx. Operating Weight (Empty)◄	30 460 kg	67,195 lb	43 945 kg	96,880 lb	60 950 kg	134,370 lb
Scraper Capacity						
Struck	10.7 m³	14 yd³	16.1 m³	21 yd³	24.5 m³	32 yd³
Heaped	15.3 m³	20 yd³	23.7 m³	31 yd³	33.6 m³	44 yd³
Rated Load	21 775 kg	48,000 lb	34 020 kg	75,000 lb	47 175 kg	104,000 lb
Weight Distribution — Empty						
Drive	68%		67%		66%	
Rear	32%		33%		34%	
Weight Distribution Loaded						
Drive	53%		53%		53%	
Rear	47%		47%		47%	
Engine Model	3406		3408		3412	
Rated Engine RPM	1900		2000		1900	
Displacement	14.6 L	893 in³	18.0 L	1099 in³	27.0 L	1649 in³
Top Speed (Loaded)	51 km/h	32 mph	53 km/h	33 mph	53 km/h	33 mph
Non-Stop Turning Circle	10.8 m	35'6"	12.2 m	40'1"	13.6 m	44'7"
With ROPS Restriction	—		—		14.5 m	47'7"
Tires — Tractor Drive	33.25-29, 26 PR (E-3)		37.25-35, 30 PR (E-3)		37.5R39 Radial★★(E-3)	
Scraper	33.25-29, 26 PR (E-3)		37.25-35, 30 PR (E-3)		37.5R39 Radial★★(E-3)	
Width of Cut	3.02 m	9'11"	3.49 m	11'6"	3.85 m	12'8"
Maximum Depth of Cut	333 mm	13.1"	437 mm	17.2"	660 mm	26"
Maximum Depth of Spread	522 mm	20.6"	480 mm	18.9"	533 mm	21"
Fuel Tank Refill Capacity	530 L	140 U.S. gal	738 L	195 U.S. gal	954 L	252 U.S. gal
GENERAL DIMENSIONS:						
Height to Top of Scraper	3.71 m	12'2"	4.29 m	14'1"	4.71 m	15'5"
Wheelbase	7.72 m	25'4"	8.77 m	28'9"	9.92 m	32'7"
Overall Length	12.93 m	42'5"	14.28 m	46'10"	16.14 m	52'11"
Overall Width	3.47 m	11'4"	3.94 m	12'11"	4.36 m	14'4"
Shipping Width (Draft Arm on Inside of Bowl)	—		3.64 m	11'11"	3.91 m	12'10"
Scraper Tread	2.18 m	7'2"	2.46 m	8'1"	2.85 m	9'4"
Tractor Tread	2.21 m	7'3"	2.46 m	8'1"	2.64 m	8'8"

◄Operating weight includes standard machine, coolant, lubricants, full fuel tank, and operator.

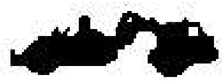
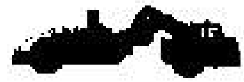

MODEL	627E		637E Series II		657E	
Flywheel Power: Tractor	246.2 kW	330 HP	336 kW	450 HP	410 kW	550 HP
Scraper	168 kW	225 HP	187 kW	250 HP	298 kW	400 HP
Approx. Operating Weight (Empty)◄	35 160 kg	77,510 lb	50 845 kg	112,090 lb	68 860 kg	151,810 lb
Scraper Capacity: Struck	10.7 m^3	14 yd^3	16.1 m^3	21 yd^3	24.5 m^3	32 yd^3
Heaped	15.3 m^3	20 yd^3	23.7 m^3	31 yd^3	33.6 m^3	44 yd^3
Rated Load	21 775 kg	48,000 lb	34 020 kg	75,000 lb	47 175 kg	104,000 lb
Weight Distribution — Empty: Front	59%		59%		60%	
Rear	41%		41%		40%	
Weight Distribution — Loaded: Front	48%		49%		51%	
Rear	52%		51%		49%	
Engine Model: Tractor	3406		3408		3412	
Scraper	3306		3306		3408	
Rated Engine RPM: Tractor	1900		2000		1900	
Scraper	2200		2200		1900	
Displacement: Tractor	14.6 L	893 in^3	18.0 L	1099 in^3	27.0 L	1649 in^3
Scraper	10.5 L	638 in^3	10.5 L	638 in^3	18.0 L	1099 in^3
Top Speed (Loaded)	51.3 km/h	32 mph	53 km/h	33 mph	53 km/h	33 mph
Non-Stop Turning Circle	10.9 m	35'9"	12.2 m	40'1"	13.6 m	44'8"
With ROPS Restriction	—		—		14.5 m	47'7"
Tires — Tractor Drive	33.25-29, 26 PR (E-3)		37.25-35, 30 PR (E-3)		37.5R39 Radial★★(E-3)	
Scraper	33.25-29, 26 PR (E-3)		37.25-35, 30 PR (E-3)		37.5R39 Radial★★(E-3)	
Width of Cut	3.02 m	9'11"	3.51 m	11'6"	3.86 m	12'8"
Maximum Depth of Cut	333 mm	13.1"	437 mm	17"	660 mm	26"
Maximum Depth of Spread	522 mm	20.6"	480 mm	18.8"	533 mm	21"
Fuel Tank Refill Capacity: Tractor	—		—		—	
Scraper	992 L	262 U.S. gal	1200 L	317 U.S. gal	1597 L	422 U.S. gal
GENERAL DIMENSIONS:						
Height to Top of Scraper	3.71 m	12'2"	4.28 m	14'1"	4.71 m	15'5"
Wheelbase	7.72 m	25'4"	8.77 m	28'9"	9.92 m	32'7"
Overall Length	12.93 m	42'5"	14.28 m	46'10"	16.2 m	53'0"
Overall Width	3.47 m	11'4"	3.94 m	12'11"	4.35 m	14'4"
Shipping Width						
(Draft Arm on Inside of Bowl)	—		3.64 m	11'11"	3.91 m	12'10"
Scraper Tread	2.18 m	7'2"	2.46 m	8'1"	2.85 m	9'4"
Tractor Tread	2.21 m	7'3"	2.46 m	8'1"	2.64 m	8'8"
PUSH-PULL GENERAL DIMENSIONS:						
Operating Weight (Empty)◄	36 620 kg	80,735 lb	52 385 kg	115,490 lb	72 640 kg	160,140 lb
Overall Length	15.2 m	49'7"	16.49 m	54'1"		
Weight Distribution — Empty: Front	60%		60%		60%	
Rear	40%		40%		40%	
Weight Distribution — Loaded: Front	49%		50%		51%	
Rear	51%		50%		49%	

◄Operating weight includes standard machine, coolant, lubricants, full fuel tank, and operator.

8

						
MODEL	**613C**		**615C**		**623E**	
Flywheel Power	131 kW	**175 HP**	197.5 kW	**265 HP**	272 kW	**365 HP**
Approx. Operating Weight						
(Empty)◄	14 870 kg	**32,340 lb**	23 860 kg	**52,600 lb**	33 700 kg	**74,300 lb**
Scraper Capacity — Heaped	8.4 m³	**11 yd³**	12.23 m³	**16 yd³**	17.6 m³	**23 yd³**
Rated Load	11 975 kg	**26,400 lb**	17 420 kg	**38,400 lb**	24 950 kg	**55,000 lb**
Weight Distribution — Empty						
Drive	**63%**		**79%**		**65%**	
Rear	**37%**		**21%**		**35%**	
Weight Distribution — Loaded						
Drive	**49%**		**53%**		**52%**	
Rear	**51%**		**47%**		**48%**	
Engine Model	**3206**		**3306**		**3406**	
Rated Engine RPM	**2300**		**2200**		**1900**	
Displacement	10.4 L	**638 in³**	10.5 L	**638 in³**	14.6 L	**893 in³**
Top Speed (Loaded)	38 km/h	**24 mph**	47 km/h	**29 mph**	48 km/h	**30 mph**
Non-Stop Turning Circle	8.9 m	**29'4"**	9.63 m	**31'7"**	10.9 m	**35'8"**
Tires — Standard						
Tractor	**18.00-25, 16 PR (E-2)**		**26.5-25, 26 PR (E-2)**		**29.5-29, 34 PR (E-2)**	
Scraper	**18.00-25, 16 PR (E-2)**		**26.5-25, 26 PR (E-2)**		**29.5-29, 34 PR (E-2)**	
Width of Cut	2.35 m	**7'8.5"**	2.89 m	**9'6"**	3.5 m	**11'6"**
Maximum Depth of Cut	160 mm	**6.3"**	414 mm	**16.3"**	330 mm	**13"**
Elevator Flight Spacing	419 mm	**16.5"**	419 mm	**16.5"**	520 mm	**20.5"**
Number of Flights	15		18		15	
Maximum Floor Opening	1.14 m	**3'9"**	1.181 m	**3'10.5"**	1.53 m	**5'**
Maximum Depth of Spread	370 mm	**14.6"**	399 mm	**15.7"**	390 mm	**15.4"**
Fuel Tank Refill Capacity	250 L	**66 U.S. gal**	399 L	**105 U.S. gal**	570 L	**150 U.S. gal**
GENERAL DIMENSIONS:						
Height to Top of Scraper	3.06 m	**10'0"**	3.589 m	**11'9"**	3.94 m	**12'11"**
Wheelbase	6.26 m	**20'6.5"**	6.995 m	**22'11"**	7.97 m	**26'2"**
Overall Length	10.0 m	**32'9"**	11.6 m	**38'1"**	12.61 m	**41'4"**
Overall Width	2.44 m	**8'**	3.048 m	**10'0"**	3.55 m	**11'8"**
Shipping Width						
(Draft Arms on Inside of Bowl)	—		—		—	
Scraper Tread	1.89 m	**6'2.5"**	2.21 m	**7'3"**	2.18 m	**7'2"**
Tractor Tread	1.89 m	**6'2.5"**	2.21 m	**7'3"**	2.21 m	**7'3"**

◄Operating weight includes coolants, lubricants, ROPS canopy, full fuel tank and operator.

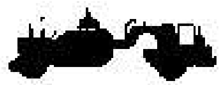
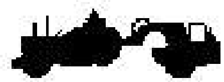
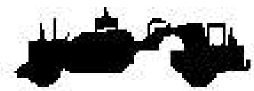




MODEL	**621E**		**631E Series II**		**651E**	
Flywheel Power: Tractor	272 kW	**365 HP**	366 kW	**490 HP**	443 kW	**594 HP**
Approx. Operating Weight (Empty) ◄	36 175 kg	**79,750 lb**	45 980 kg	**101,370 lb**	66 575 kg	**146,770 lb**
Scraper Capacity (Heaped)	15.98 m³	**21 yd³**	23.7 m³	**31 yd³**	33.6 m³	**44 yd³**
Rated Load	21 775 kg	**48,000 lb**	34 020 kg	**75,000 lb**	47 175 kg	**104,000 lb**
Approx. Operating Weight (Loaded)	57 950 kg	**127,750 lb**	80 000 kg	**176,370 lb**	113 750 kg	**250,770 lb**
AUGER ATTACHMENT						
Auger Diameter	1320 mm	**52"**	1524 mm	**60"**	1676 mm	**66"**
Auger RPM	**Variable 55 to 35 RPM**		**Variable 55 to 35 RPM**		**Variable 55 to 35 RPM**	
Auger Power	149 kW	**200 HP**	201 kW	**270 HP**	354 kW	**475 HP**
Hydraulic Flow	273 L/min	**72 gpm**	378 L/min	**100 gpm**	548 L/min	**145 gpm**
Cooling Flow	—	—		—	132 L/min	**35 gpm**
System Pressure	41 370 kPa	**6000 psi**	37 895 kPa	**5500 psi**	41 370 kPa	**5700 psi**
Auger Control	**electronic**		**electronic**		**electronic**	

◄Operating weight includes standard machine, coolant, lubricants, full fuel tank and operator.

The auger scraper is a self-loading system that offers an alternative to conventional, push-pull or elevating scrapers. An independent hydrostatic system powers the auger which is located near the center of the bowl. The rotating auger lifts and evenly distributes over 50% of the material that flows over the scraper cutting edge. This action reduces the cutting edge resistance allowing the wheel tractor-scraper to continue moving through the cut and quickly obtain full rated loads.

Advantages:
- Self-load in equal or less time
- Requires shorter cut distance
- Complete material ejection (angled ejector pushes material)
- Increased tire life
- Broader material appetite
- Better material retention on haul road (closed apron instead of open elevator)

MODEL	627E		637E Series II		657E	
Flywheel Power: Tractor	246 kW	330 HP	336 kW	450 HP	410 kW	550 HP
Scraper	168 kW	225 HP	187 kW	250 HP	298 kW	400 HP
Approx. Operating Weight (Empty) ◄	40 365 kg	89,035 lb	54 540 kg	120,235 lb	75 875 kg	167,270 lb
Scraper Capacity (Heaped)	15.98 m³	21 yd³	23.7 m³	31 yd³	33.6 m³	44 yd³
Rated Load	21 775 kg	48,000 lb	34 020 kg	75,000 lb	47 175 kg	104,000 lb
Approx. Operating Weight (Loaded)	62 160 kg	137,035 lb	88 560 kg	195,235 lb	123 050 kg	271,270 lb
AUGER ATTACHMENT						
Auger Diameter	1320 mm	52"	1524 mm	60"	1676 mm	66"
Auger RPM	Variable 55 to 36 RPM		Variable 55 to 35 RPM		Variable 55 to 36 RPM	
Auger Power	149 kW	200 HP	201 kW	270 HP	354 kW	475 HP
Hydraulic Flow	273 L/min	72 gpm	378 L/min	100 gpm	548 L/min	145 gpm
Cooling Flow	—	—	—	—	132 L/min	35 gpm
System Pressure	41 370 kPa	6000 psi	37 923 kPa	5500 psi	41 340 kPa	5700 psi
Auger Control	electronic		electronic		electronic	

◄Operating weight includes standard machine, coolant, lubricants, full fuel tank and operator.

The auger scraper is a self-loading system that offers an alternative to conventional, push-pull or elevating scrapers. An independent hydrostatic system powers the auger which is located near the center of the bowl. The rotating auger lifts and evenly distributes over 50% of the material that flows over the scraper cutting edge. This action reduces the cutting edge resistance allowing the wheel tractor-scraper to continue moving through the cut and quickly obtain full rated loads.

Advantages:

- Self-load in equal or less time
- Requires shorter cut distance
- Complete material ejection (angled ejector pushes material)
- Increased tire life
- Broader material appetite
- Better material retention on haul road (closed apron instead of open elevator)

TIRE OPTIONS			613C Tr.	613C Sc.	615C Tr.	615C Sc.	621E 623E 627E Tr.	621E 623E 627E Sc.	631E Series II 637E Series II Tr.	631E Series II 637E Series II Sc.	651E 657E Tr.	651E 657E Sc.
18.00-25	16 PR	E2	• 1	•								
23.5-25	16 PR	E2	•	•								
"	"	E3	•	•								
26.5-25	26 PR	E2			• 2	•						
26.5R25	★	E2			•	•						
29.5-25	22 PR	E2			•	•						
"	"	E3			•	•						
29.5R25	★	E2			•	•						
29.5R25	★ ★	E2			•	•						
29.5-29	34 PR	E2					• 4	•				
"	"	E3					•	•				
29.5R29	★ ★	E2					•	•				
"	"	E3					•	•				
33.25-29	26 PR	E3					• 5	•				
33.25R29	★ ★	E2					• 6	•				
"	"	E3					• 6	•				
33.25R35	★ ★	E2							•	•		
"	"	E3							•	•		
37.25-35	30 PR	(E-3)							• 7	•		
37.25R35	★ ★	E2							•	•		
37.5-39	44 PR	E3									•	•
37.5-39	52 PR	E3									•	•
37.5-39	★ ★	E3									•	•
37.5R39	★ ★	E3									• 8	•
40.5/75R39	★ ★	E3									•	•

KEY

1. Standard on 613C.
2. Standard on 615C.
4. Standard on 623E. Not available on 621E and 627E.
5. Standard on 621E and 627E. Not available on 623E.
6. Not available on 623E.
7. Standard on 631E Series II and 637E Series II.
8. Standard on 651E and 657E.

USE OF RIMPULL-SPEED-GRADEABILITY CURVES

Maximum speed attainable, gear range and available rimpull can be determined from curves on the following pages when vehicle weight and total effective grade (or total resistance) are known.

Rimpull is the force (in kg, lb or kN) available between the tire and the ground to propel the vehicle (limited by traction).

Weight is defined as Gross Vehicle Weight (kg or lb) = Tractor + Scraper + Payload.

Total Effective Grade (or Total Resistance) is grade resistance plus rolling resistance expressed as percent grade.

Grade is measured or estimated.

Rolling resistance is estimated (see Tables section for typical values.)

10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade.

Example

With a 6% grade and a rolling resistance of 40 kg/metric ton (80 lb/U.S. ton), find total resistance.

Rolling resistance = 40 kg/t ÷ 10 = 4% Effective Grade

(English: 80 lb ÷ 20 = 4%)

Total resistance = 4% rolling + 6% grade = 10%

Altitude Derating

Rimpull force and speed must be derated for altitude similar to flywheel horsepower. The percentage loss in rimpull force approximately corresponds to the percentage loss in flywheel horsepower. See Tables Section for altitude derations.

Example problem:

A 631E Series II with an estimated payload of 34 020 kg (75,000 lb) is operating on a total effective grade of 10%. Find the available rimpull and maximum attainable speed.

Empty weight + payload = Gross Weight
43 945 kg + 34 020 kg = 77 965 kg
(96,880 lb + 75,000 lb = 171,880 lb)

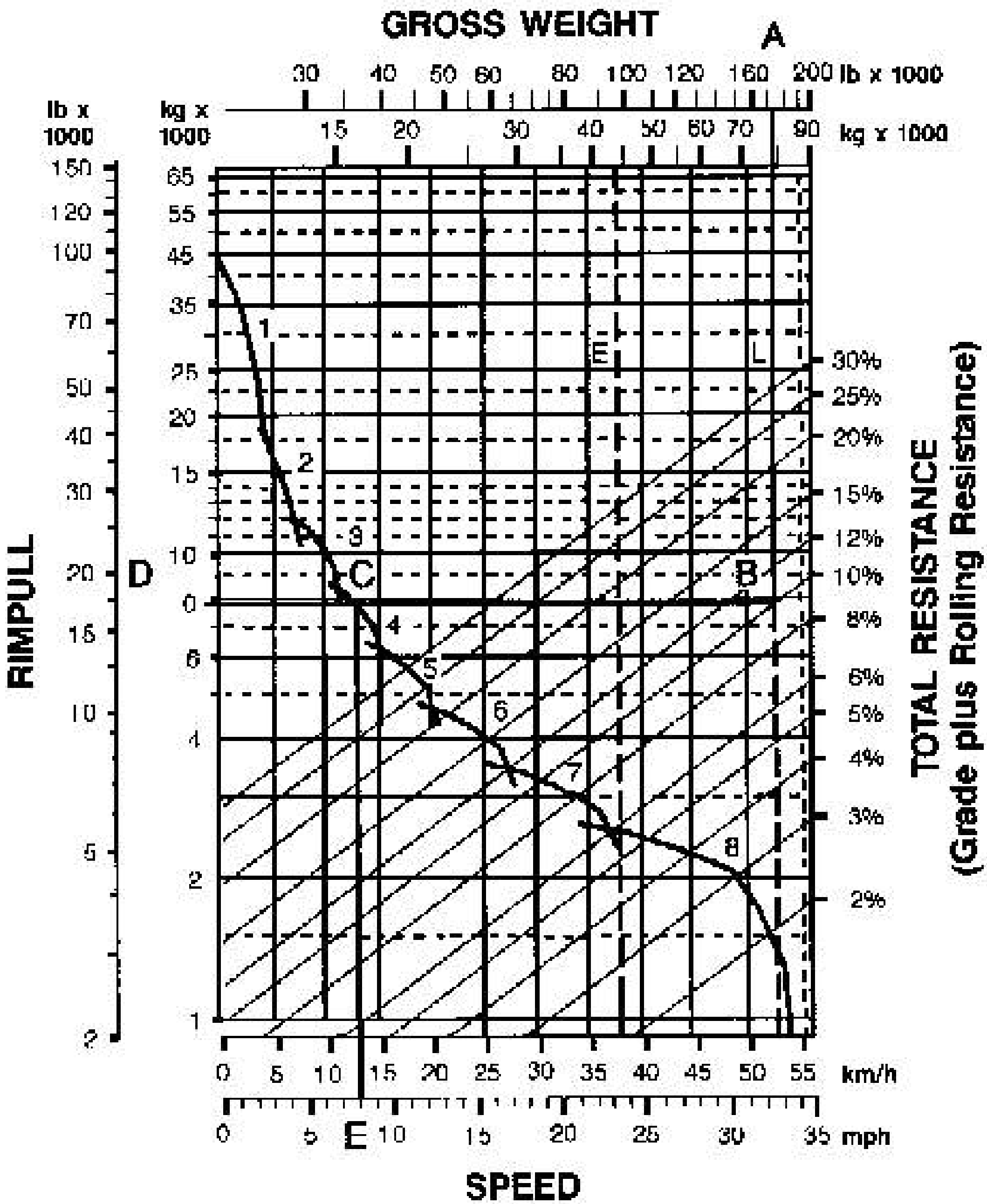
Solution: Using graph on the next page, read from 77 965 kg (171,880 lb) (point A) on top of gross weight scale down the line to the intersection of the 10% total resistance line (point B).

Go across horizontally from B to the Rimpull Scale on the left (point D). This gives the required rimpull: 7756 kg (17,100 lb).

Where the line cuts the speed curve (point C), read down vertically (point E) to obtain the maximum speed attainable for the 10% effective grade: 12.9 km/h (8.0 mph).

ANSWER: The vehicle will climb the 10% effective grade at a maximum speed of 12.9 km/h (8.0 mph) in 4th gear. Available rimpull is 7756 kg (17,100 lb).

• • •



KEY

1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

A — Loaded 77 965 kg (171,880 lb)
B — Intersection with 10% total resistance line
C — Intersection with rimpull curve (4th gear)
D — Required rimpull 7756 kg (17,100 lb)
E — Speed 12.9 km/h (8 mph)

USE OF TRAVEL TIME CHARTS

One-way travel time can be determined from graphs on the following pages when one-way travel distance and total resistance (expressed in percent) are known. 10 kg/metric ton (20 lb/U.S. ton) equals 1% equivalent grade.

If total resistance is negative (grade assistance greater than rolling resistance) machine may accelerate downhill requiring the use of retarder or brakes. Travel time charts *cannot* be used in these cases. Consult respective machine retarder curve to establish maximum safe downhill speed.

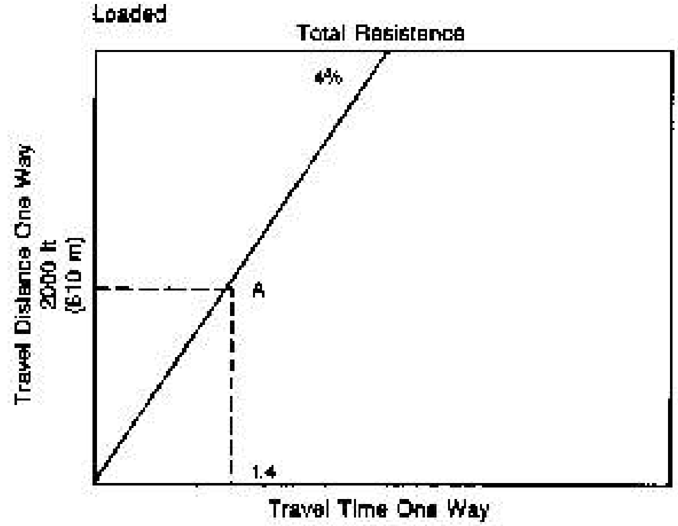
Two graphs are given for each hauling unit: one for the vehicle carrying its rated payload and one for the empty vehicle.

Example problem:

631E Series II hauls its rated payload 34 020 kg — 19.1 bank cubic meters (75,000 lb — 25 bank cubic yards) on a 4% road for 610 m (2000 feet) and returns on a 0% road for 760 m (2500 feet). Find the cycle time.

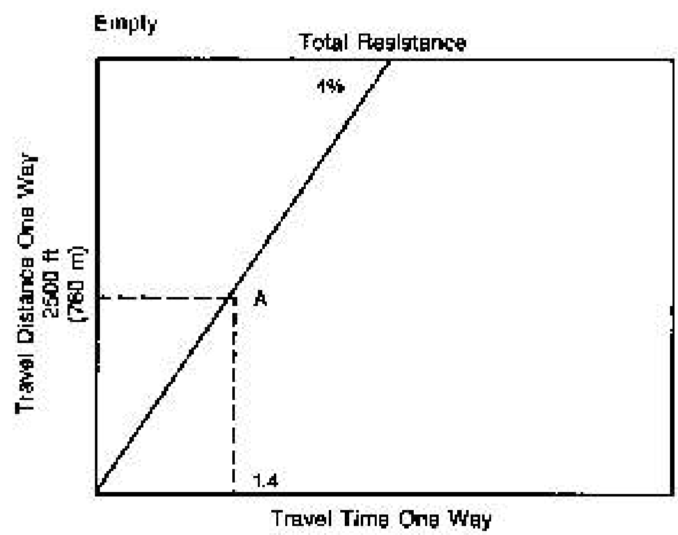
Haul —

Using the graph for the Loaded vehicle, read from the Travel Distance (one way) scale at 610 m (2000 feet) across to the 4% total resistance line (point A). From (point A) read down to the Travel Time (one way) scale to determine haul time = 1.4 minutes.



Return —

Using the graph for the Empty vehicle, read from the Travel Distance (one way) scale at 760 m (2500 feet) across to the 0% total resistance line (point A). From (point A) read down to the Travel Time (one way) scale to determine return time = 1.0 min.



Cycle Time —

= load* + haul + maneuver & spread* + return
= 0.6 + 1.4 + .7 + 1.0
= 3.7 min.

*For fixed time (load, maneuver and spread) see the table below.

When cycle time and payload are known, productivity can be calculated. For a more complex example see the Earthmoving Section.

■ ■ ■

TYPICAL FIXED TIMES FOR SCRAPERS

(Times may vary depending on job conditions)

Model	Loaded By	Load Time (Min.)	Maneuver and Spread or Maneuver and Dump (Min.)
613C	Self	0.9	0.7
615C	Self	0.9	0.7
623E	Self	0.9	0.7
621E	One D8N	0.5	0.7
627E	One D8N	0.5	0.6
621E	One D9N	0.4	0.7
627E	One D9N	0.4	0.6
627E/PP	Self	0.9*	0.6
631E Series II	One D9N	0.6	0.7
637E Series II	One D9N	0.6	0.6
631E Series II	One D10N	0.5	0.7
637E Series II	One D10N	0.5	0.6
637E/PP Series II	Self	1.0*	0.6
651E	One D11N	0.6	0.7
657E	One D11N	0.6	0.6
657E	Push Pull Self	1.1*	0.6
621E	Auger	0.9	0.7
627E	Auger	0.7	0.7
631E Series II	Auger	0.9	0.7
637E Series II	Auger	0.8	0.7
651E	Auger	1.3	0.7
657E	Auger	1.0	0.7

*Load time per pair, including transfer time

NOTE: Vehicle Empty Weights shown on the following charts includes ROPS Canopy. The travel times will remain within acceptable limits when applied to a non-ROPS equipped machine. When calculating TMPH loadings *any* additional weight must be considered in establishing mean tire loads.

USE OF RETARDER CURVES

The speed that can be maintained (without use of service brake) when the vehicle is descending a grade with retarder fully on can be determined from the retarder curves in this section if gross vehicle weight and total effective grade are known.

Total Effective Grade (or Total Resistance) is grade assistance *minus* rolling resistance.

10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade.

Example

15% favorable grade with 5% rolling resistance. Find Total Effective Grade.

Total Effective Grade = 15% Grade Assistance — 5% Rolling Resistance = 10% Total Effective Grade Assistance.

Example Problem:

A 651E with an estimated payload of 47 175 kg (104,000 lb) descends a 10% total effective grade. Find constant speed and gear range with maximum retarder effort. Find travel time if the slope is 610 m (2000 ft) long.

Empty Weight + Payload = Gross Weight
= 60 950 kg + 47 175 kg = 108 125 kg
(134,370 lb + 104,000 lb = 238,370 lb)

Solution: Using the retarder curve below, read from 108 125 kg (238,370 lb) (point A) on top of gross weight scale down the line to the intersection of the 10% effective grade line (point B).

Go across horizontally from point B to the intersection of the retarder curve (point C). Point C intersects at the 5 (5th gear) range.

Where point C intersects the retarder curve, read down vertically to point D on the bottom scale to obtain the constant speed: 21.7 km/h (13.5 mph).

ANSWER: The 651E will descend the slope at 21.7 km/h (13.5 mph) in 5th gear. Travel time is 1.68 minutes.

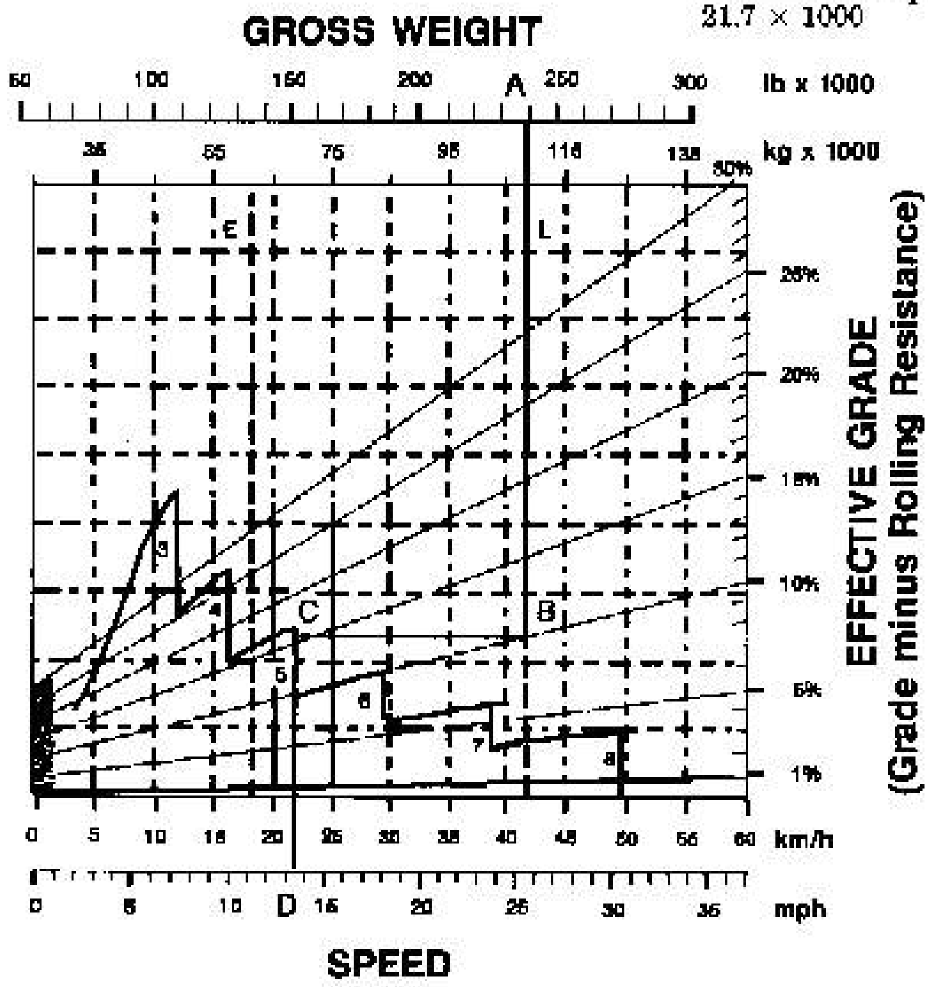
$$\frac{610 \text{ m}}{363 \text{ m/min}} = 1.68 \text{ min}$$

*(mph × 88 = F.P.M.)

$$\frac{2000 \text{ ft}}{13.5 \text{ mph} \times 88^{*}} = 1.68 \text{ min}$$

(NOTE: The basic Distance-Speed-Time formula is 60D = ST (or "60 D Street"), where 60 is minutes, D is distance, S is speed and T is time. In the above problem, 60 × 610 m ÷ 21.7 km/h × 1000 = T.

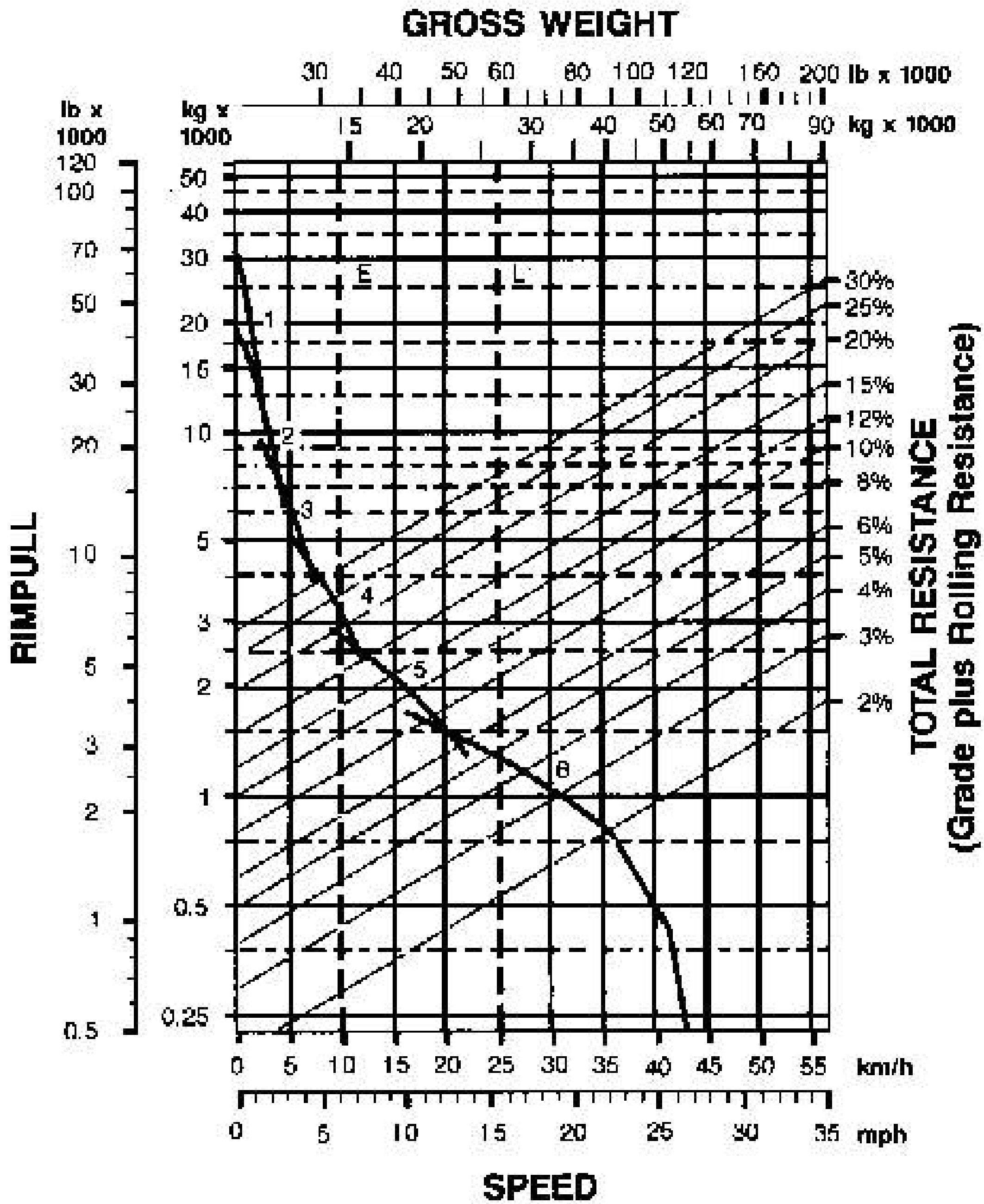
$$\frac{60 \times 610}{21.7 \times 1000} = T = (1.68)$$



KEY
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY
A — Loaded 108,125 kg (238,370 lb)
B — Intersection with 10% effective grade line
C — Intersection with retarder curve (5th gear)
D — Constant speed 21.7 km/h (13.5 mph)

8



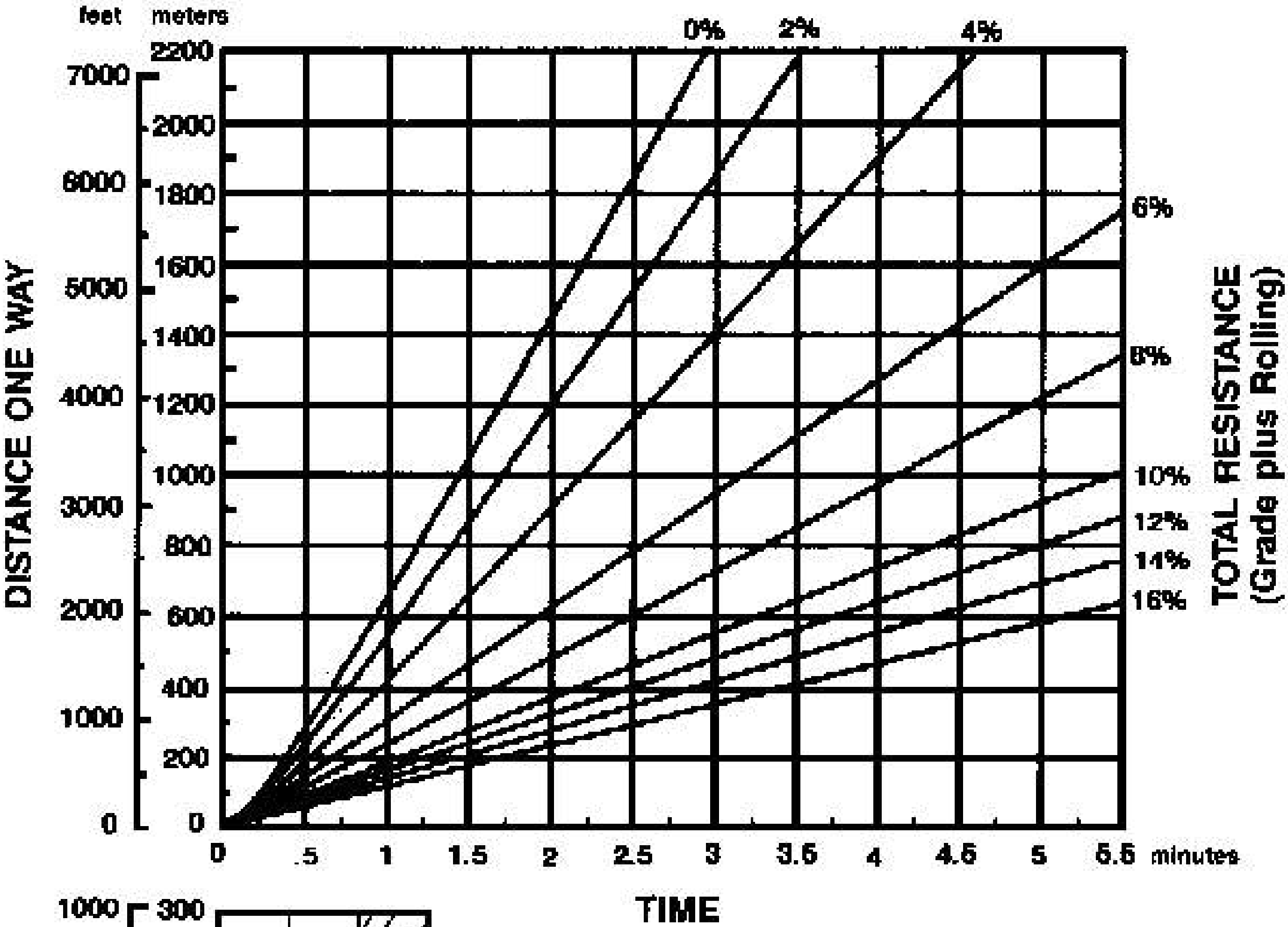
KEY

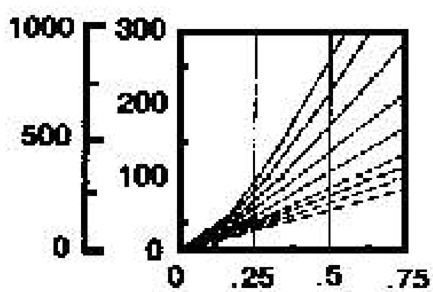
1 — 1st Torque Converter Drive
2 — 2nd Torque Converter Drive
3 — 3rd Torque Converter Drive
4 — 4th Torque Converter Drive
5 — 5th Torque Converter Drive
6 — 6th Torque Converter Drive

KEY

E — Empty 14 670 kg (32,340 lb)
L — Loaded 26 460 kg (58,330 lb)

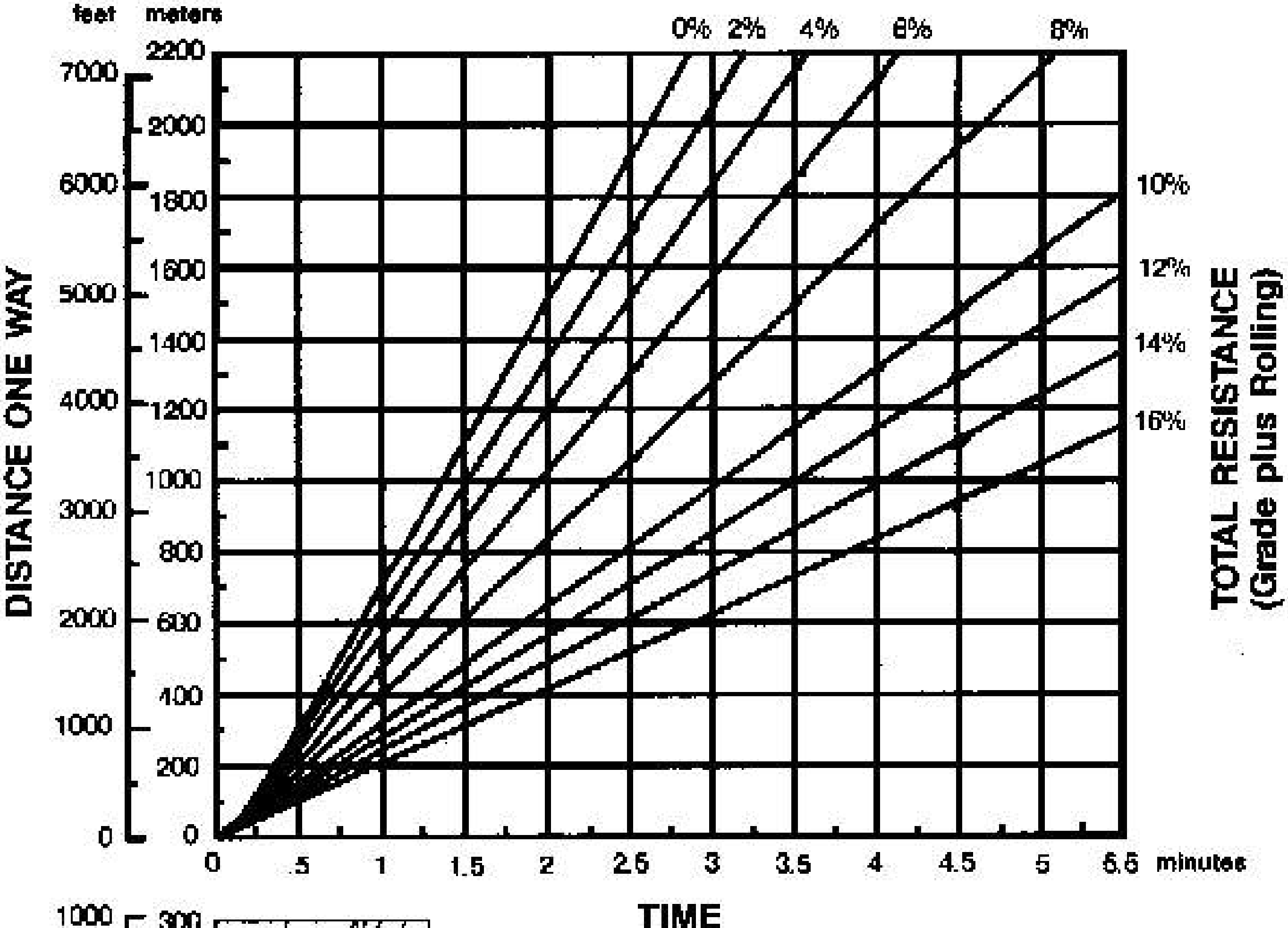
LOADED

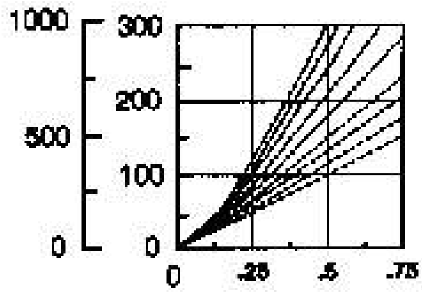




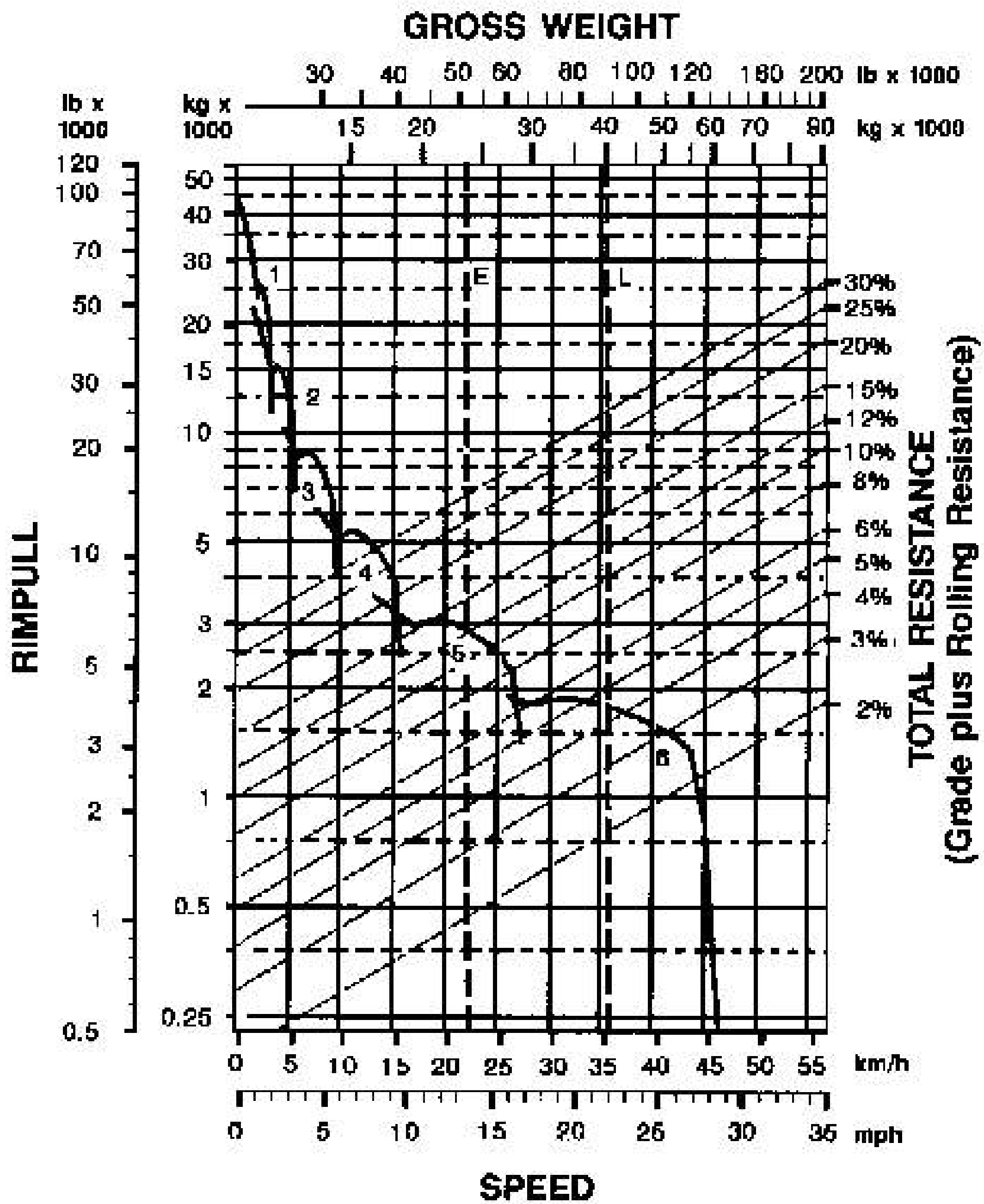
Empty weight: 14 670 kg (32,340 lb)
Payload: 11 975 kg (26,400 lb)

EMPTY





Empty weight: 14 670 kg (32,340 lb)



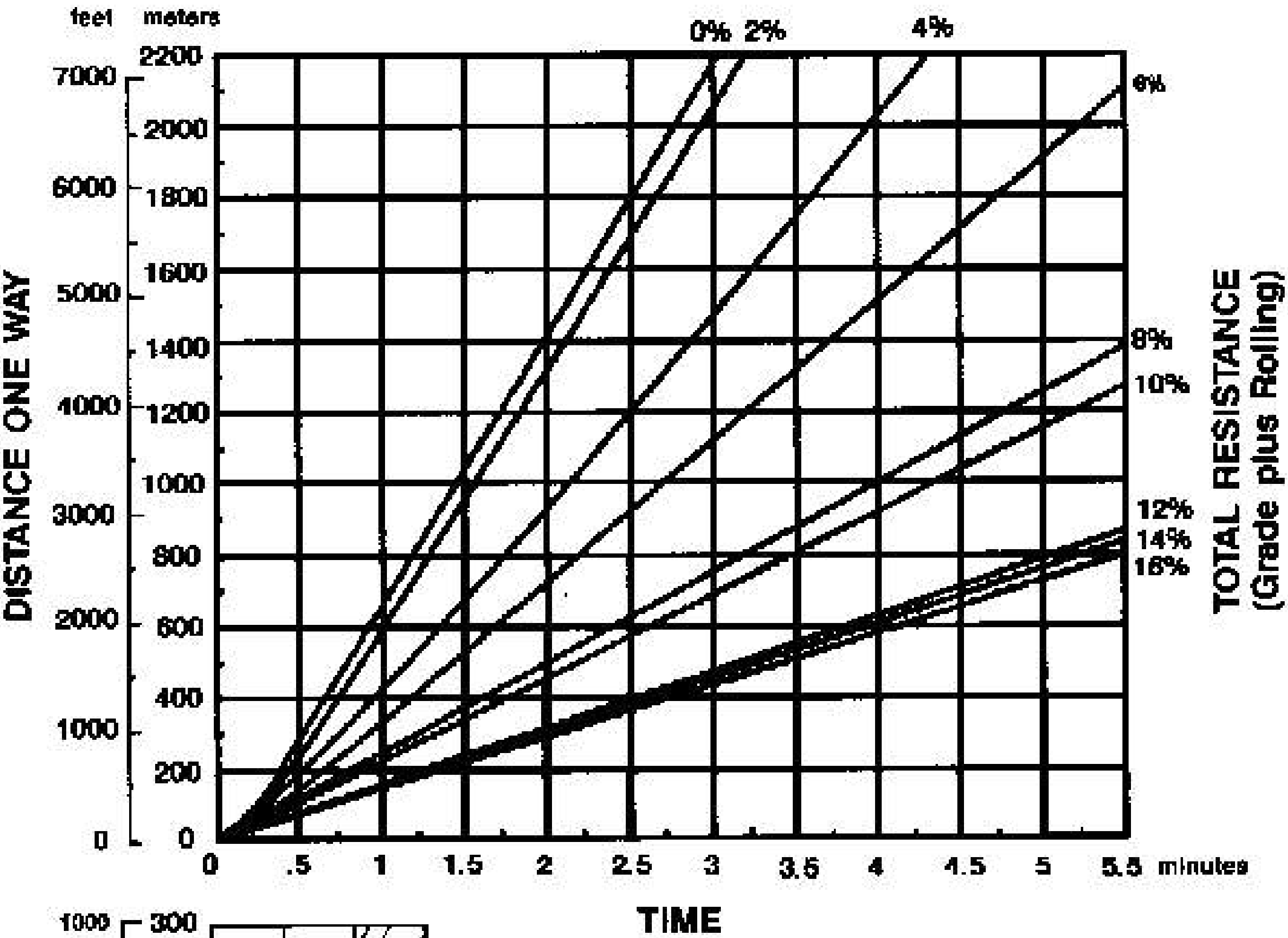
KEY

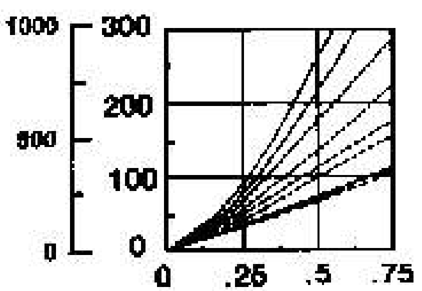
1 — 1st Gear Direct Drive
2 — 2nd Gear Direct Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive

KEY

E — Empty 23 005 kg (50,715 lb)
L — Loaded 40 420 kg (89,115 lb)

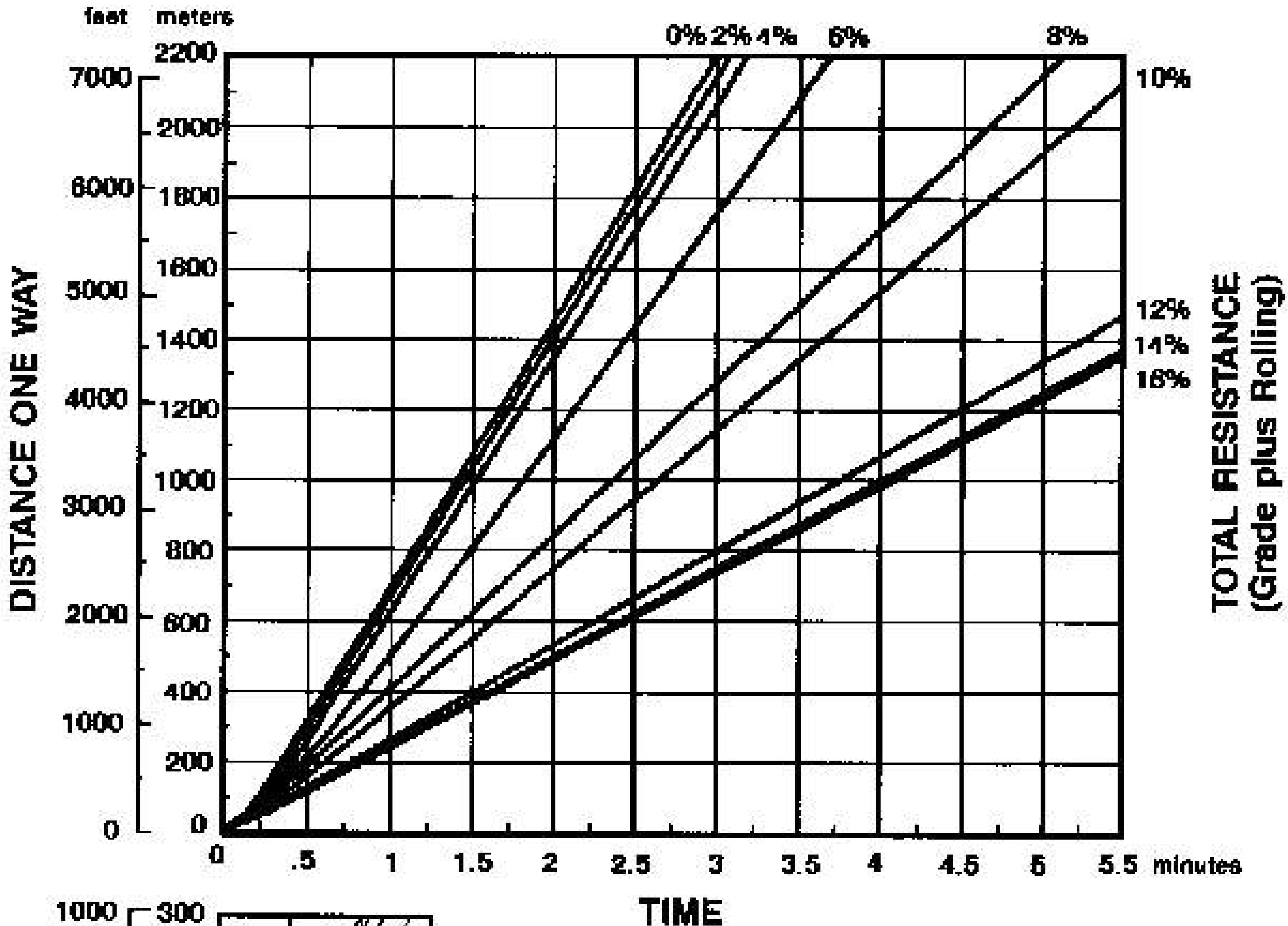
LOADED

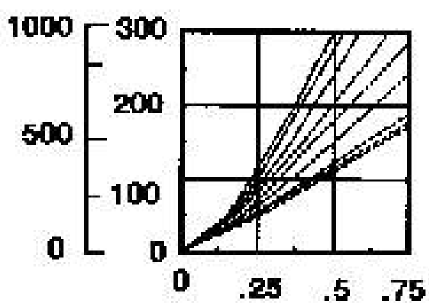




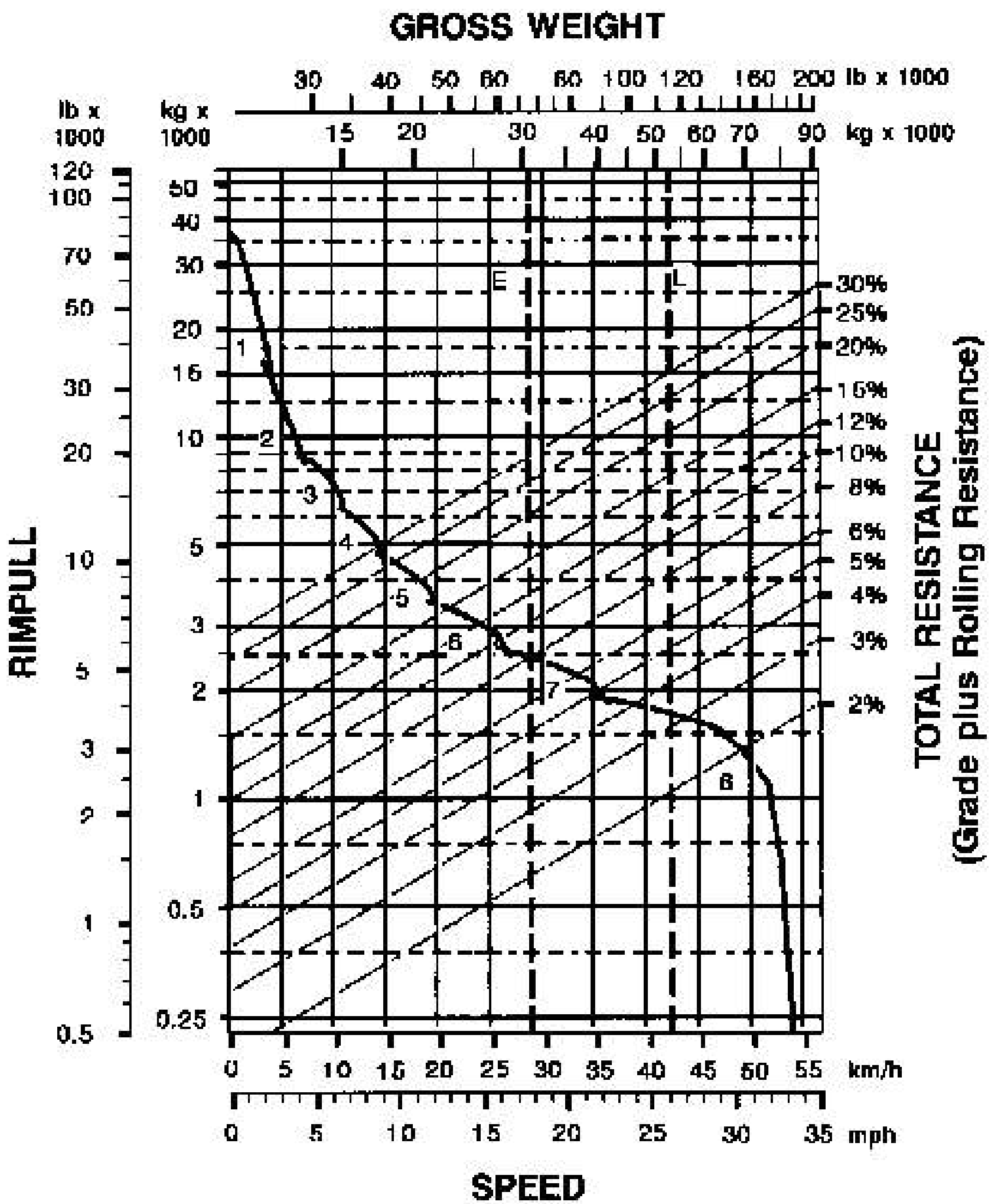
Empty weight: 23 860 kg (52,600 lb)
Payload: 17 420 kg (38,400 lb)

EMPTY



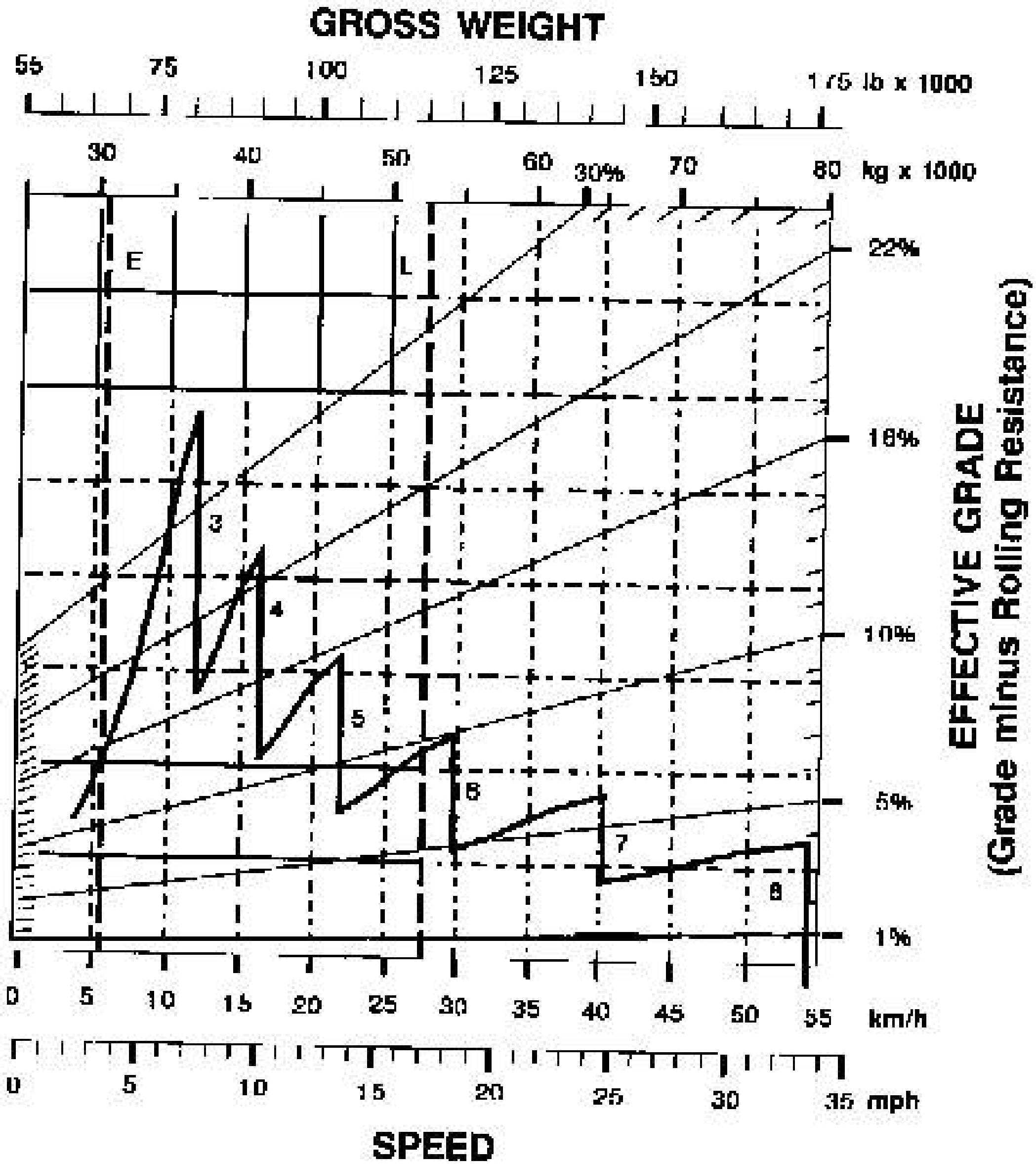


Empty weight: 23 860 kg (52,600 lb)



KEY
1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY
E — Empty 30 480 kg (67,195 lb)
L — Loaded 52 255 kg (115,195 lb)



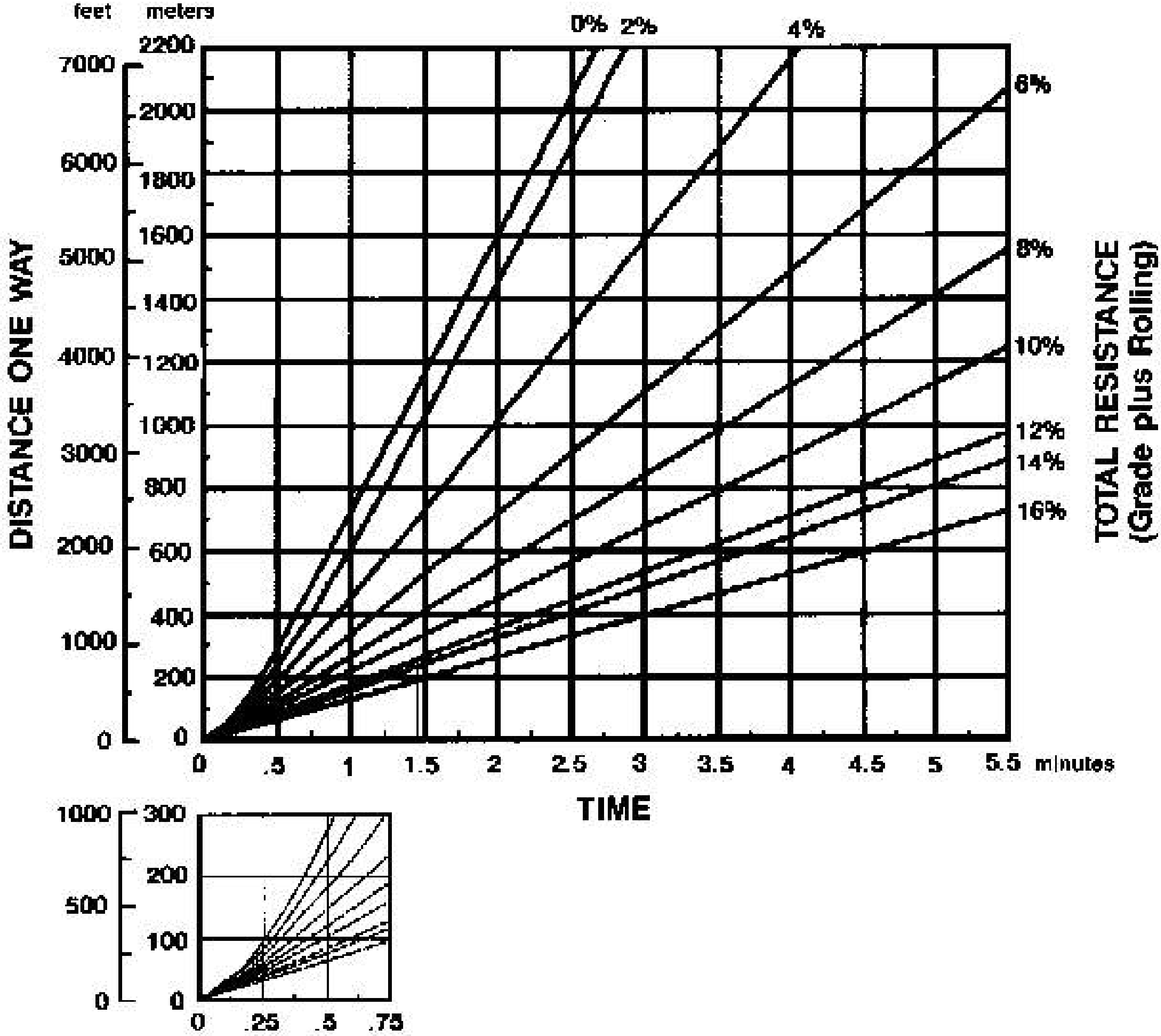
KEY

3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

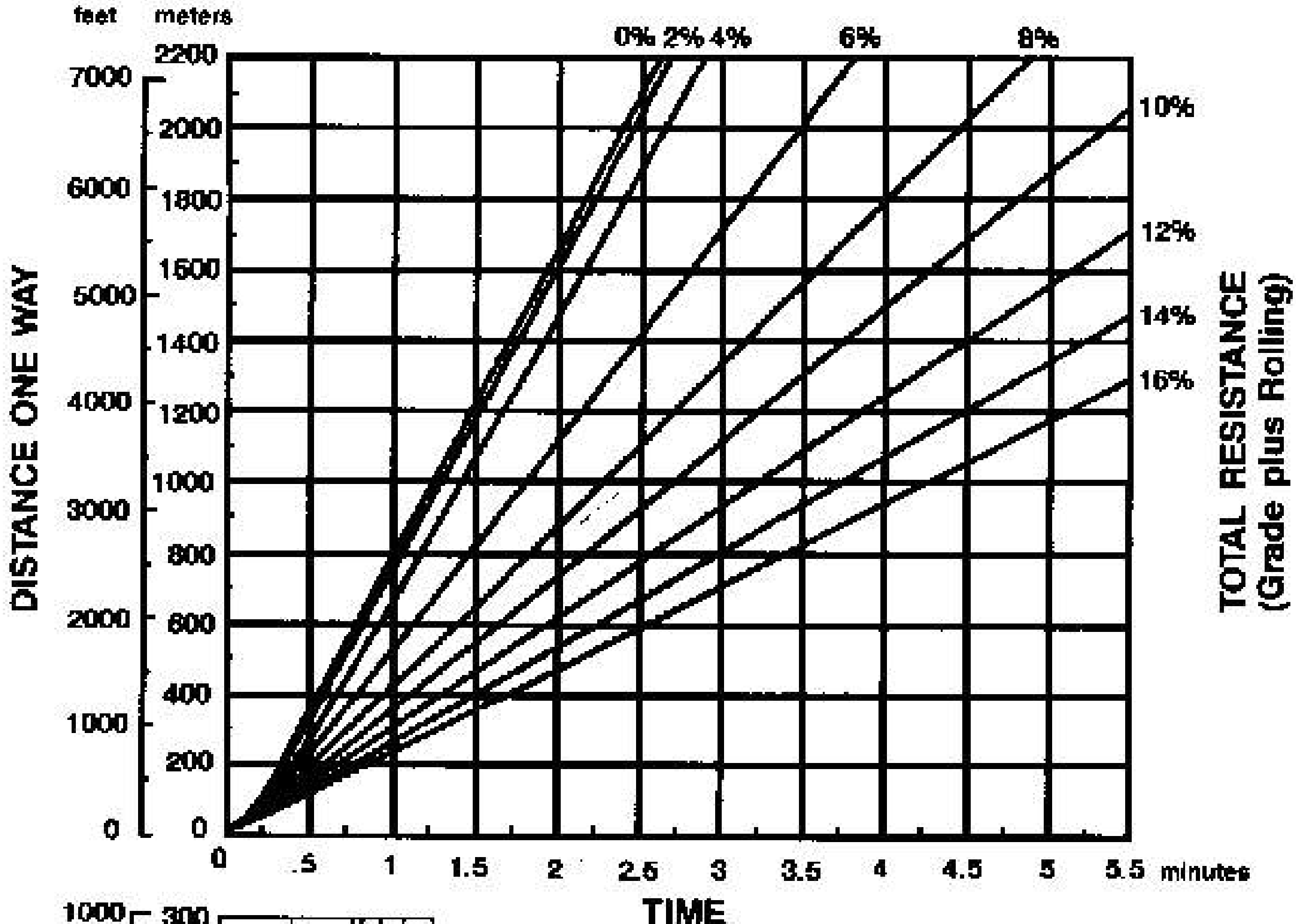
E — Empty 30 480 kg (67,195 lb)
L — Loaded 52 255 kg (115,195 lb)

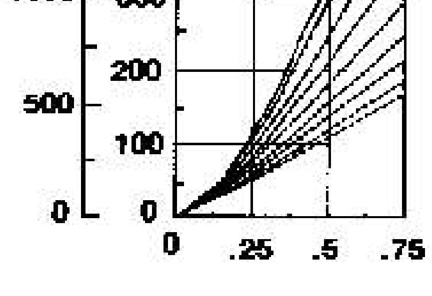
LOADED



Empty weight: 30 480 kg (67,195 lb)
Payload: 21 775 kg (48,000 lb)

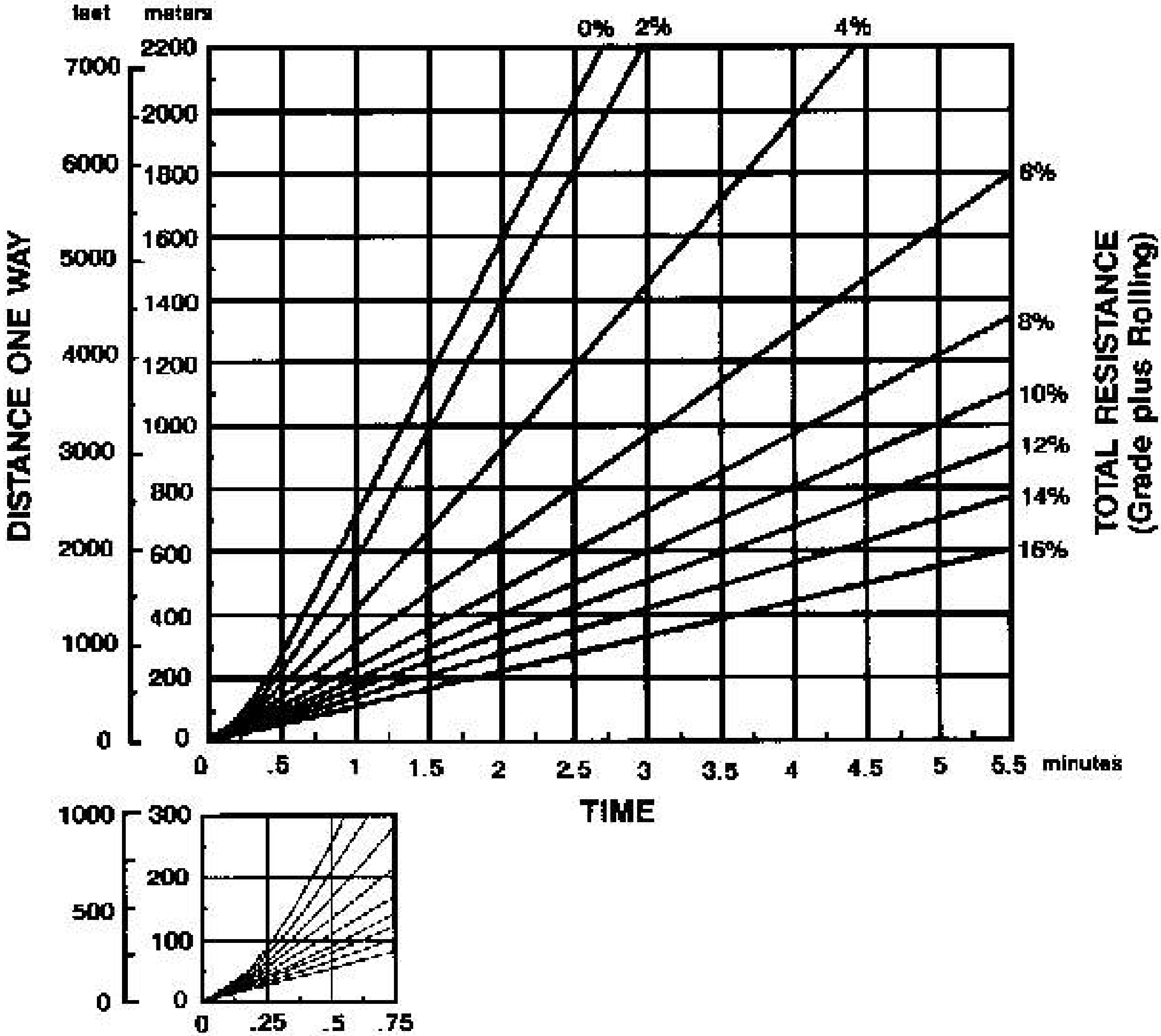
EMPTY





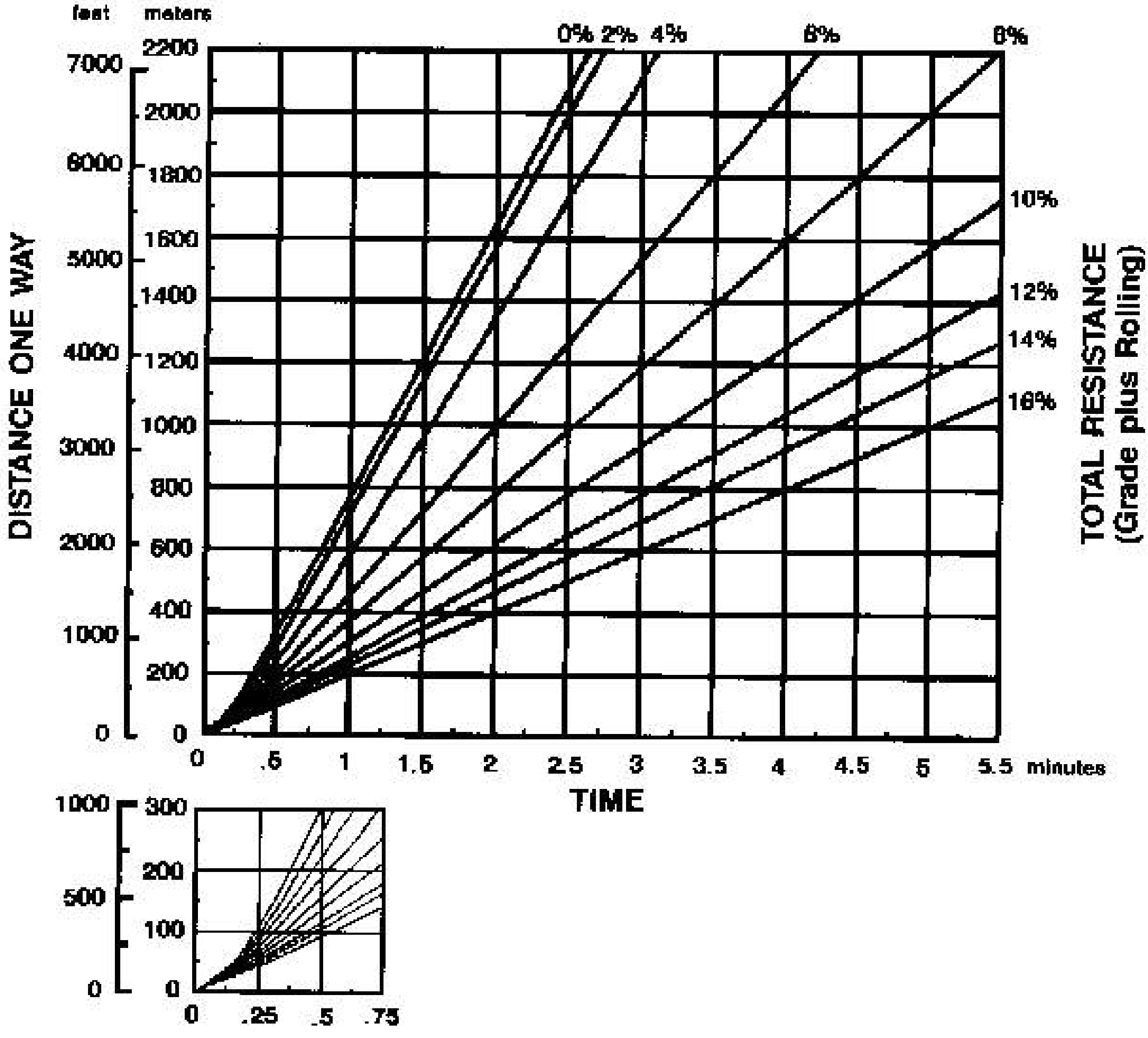
Empty weight: 30 480 kg (67,195 lb)

LOADED

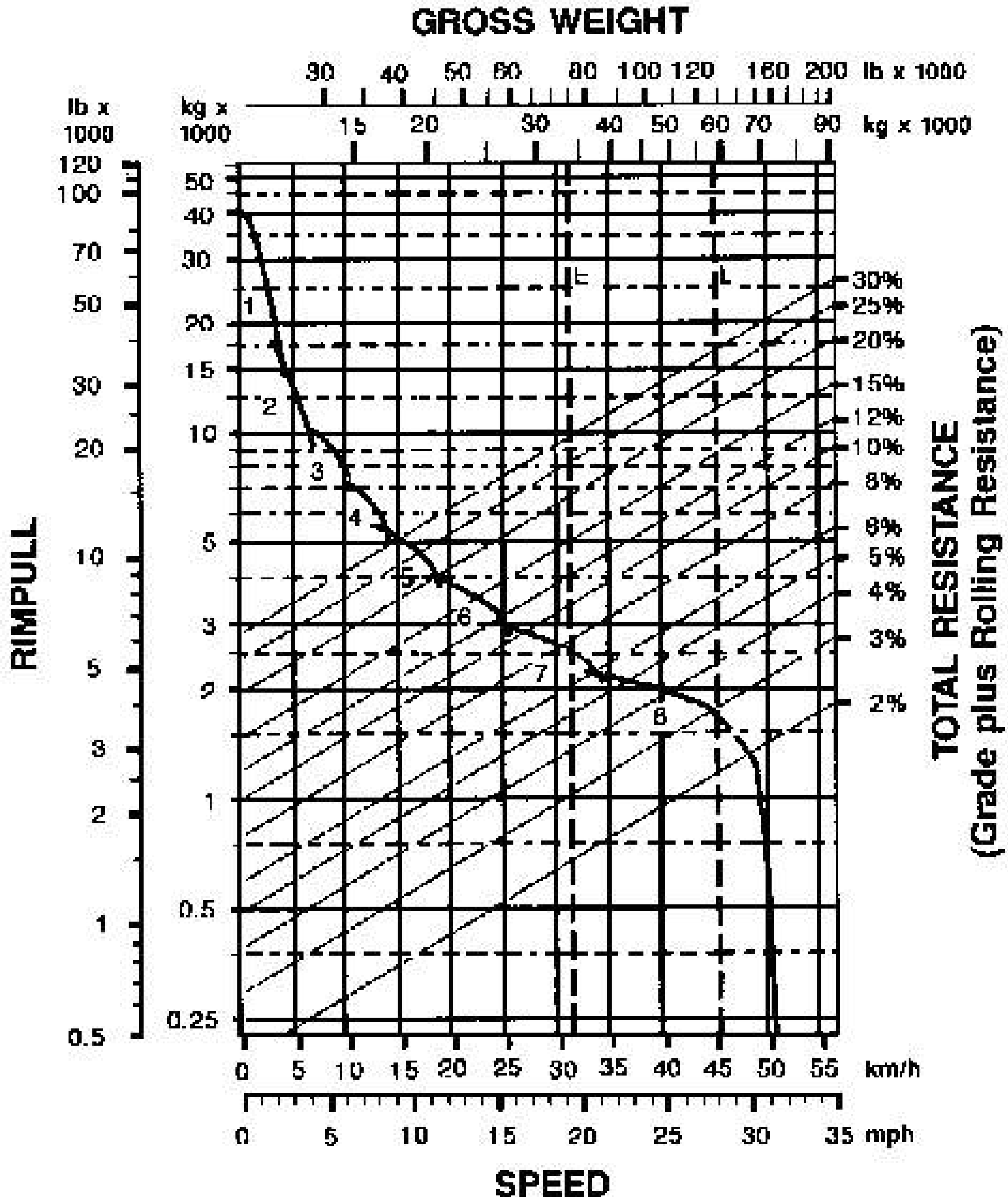


Empty weight: 36 175 kg (79,750 lb)
Payload: 21 775 kg (48,000 lb)

EMPTY



Empty weight: 36 175 kg (79,750 lb)

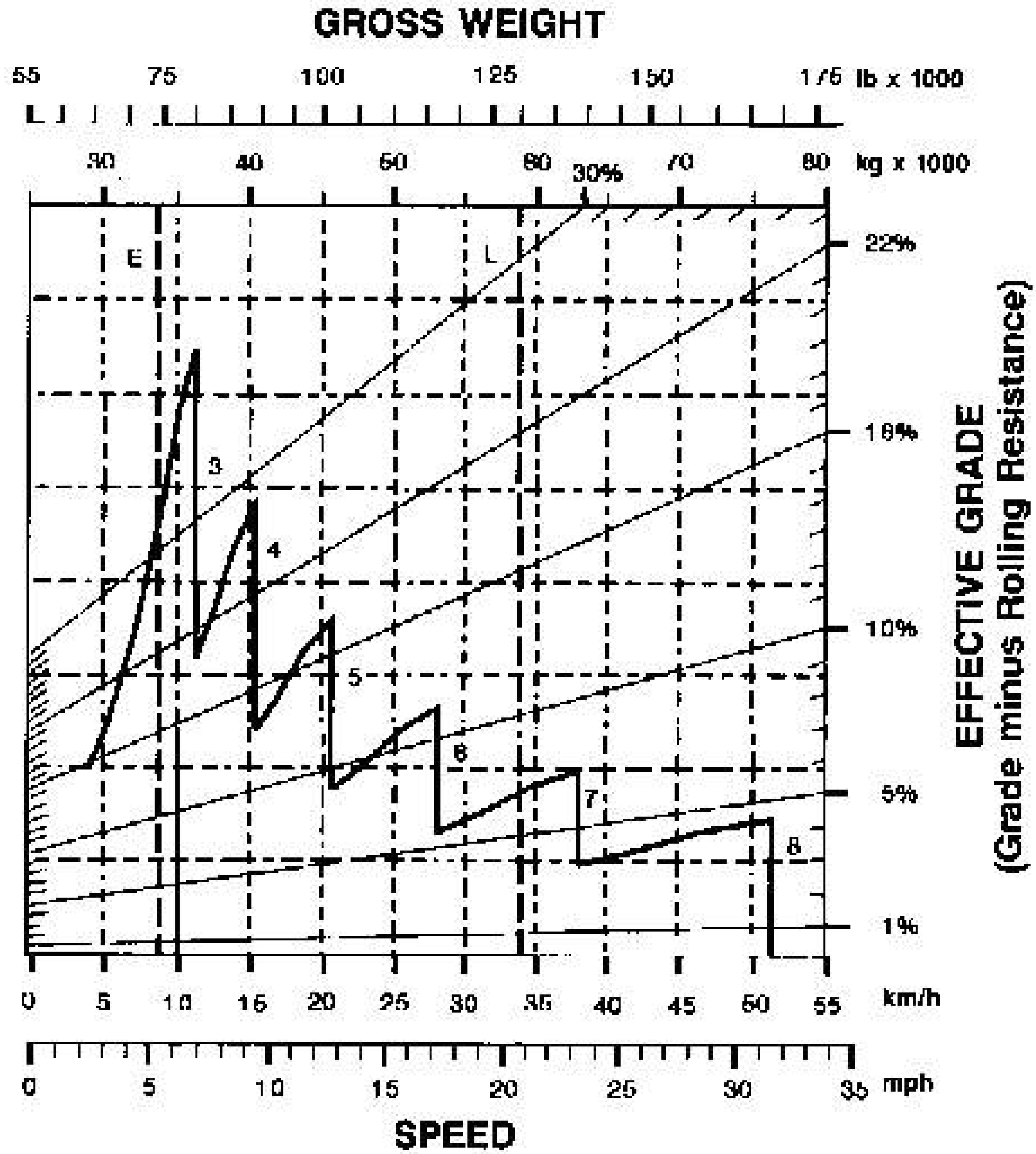


KEY

1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

E — Empty 33 700 kg (74,300 lb)
L — Loaded 58 650 kg (129,300 lb)



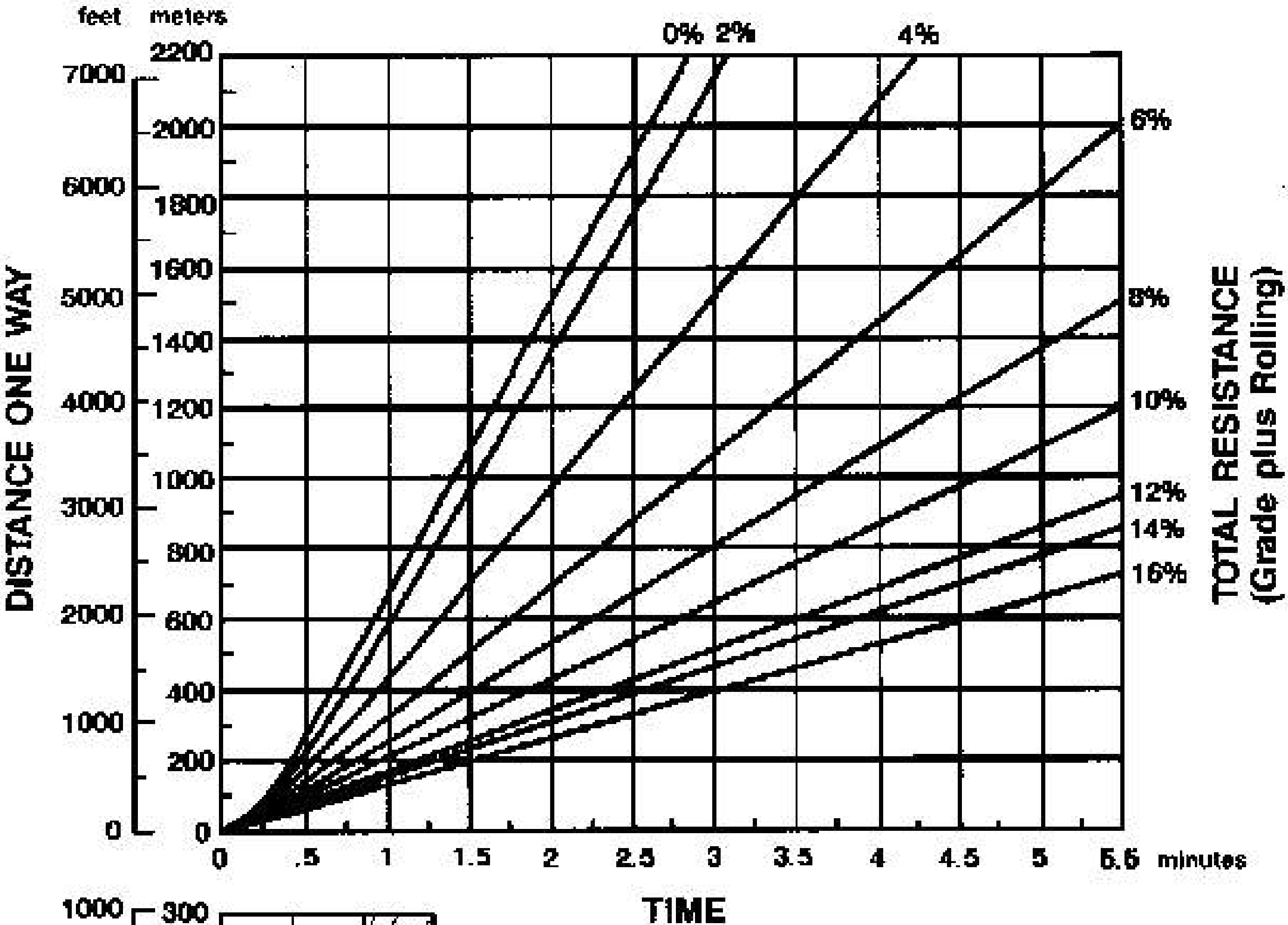
KEY

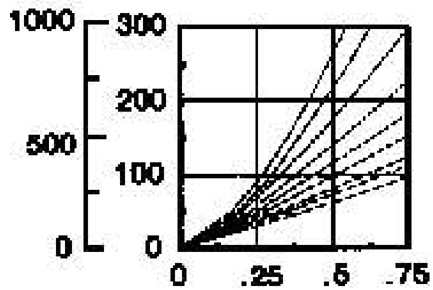
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

E — Empty 33 700 kg (74,300 lb)
L — Loaded 58 650 kg (129,300 lb)

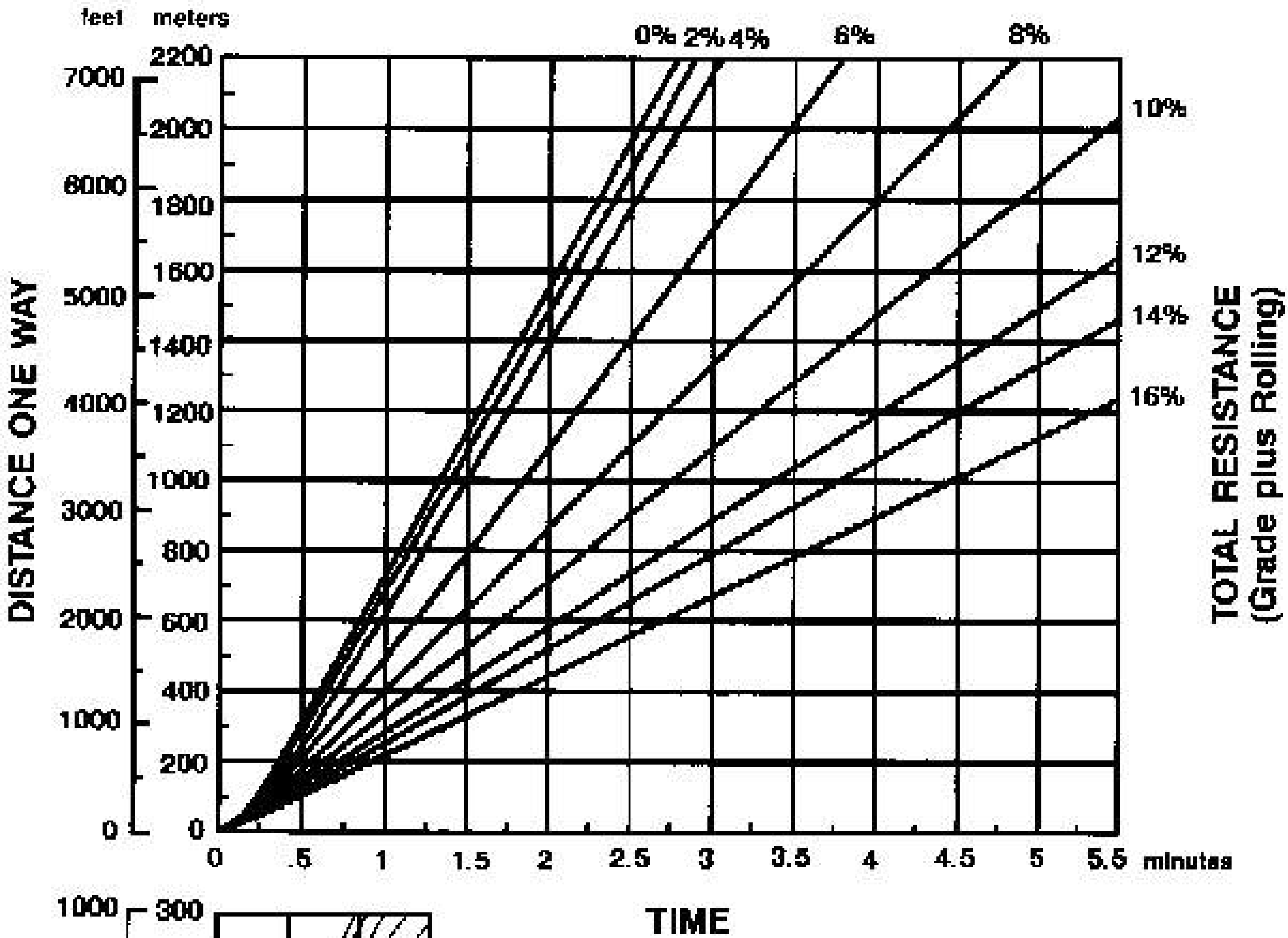
LOADED

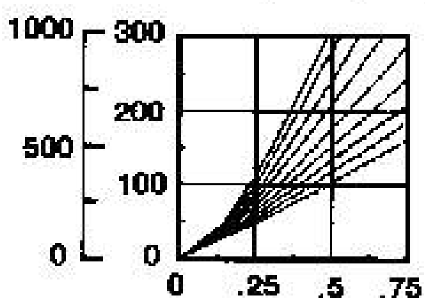




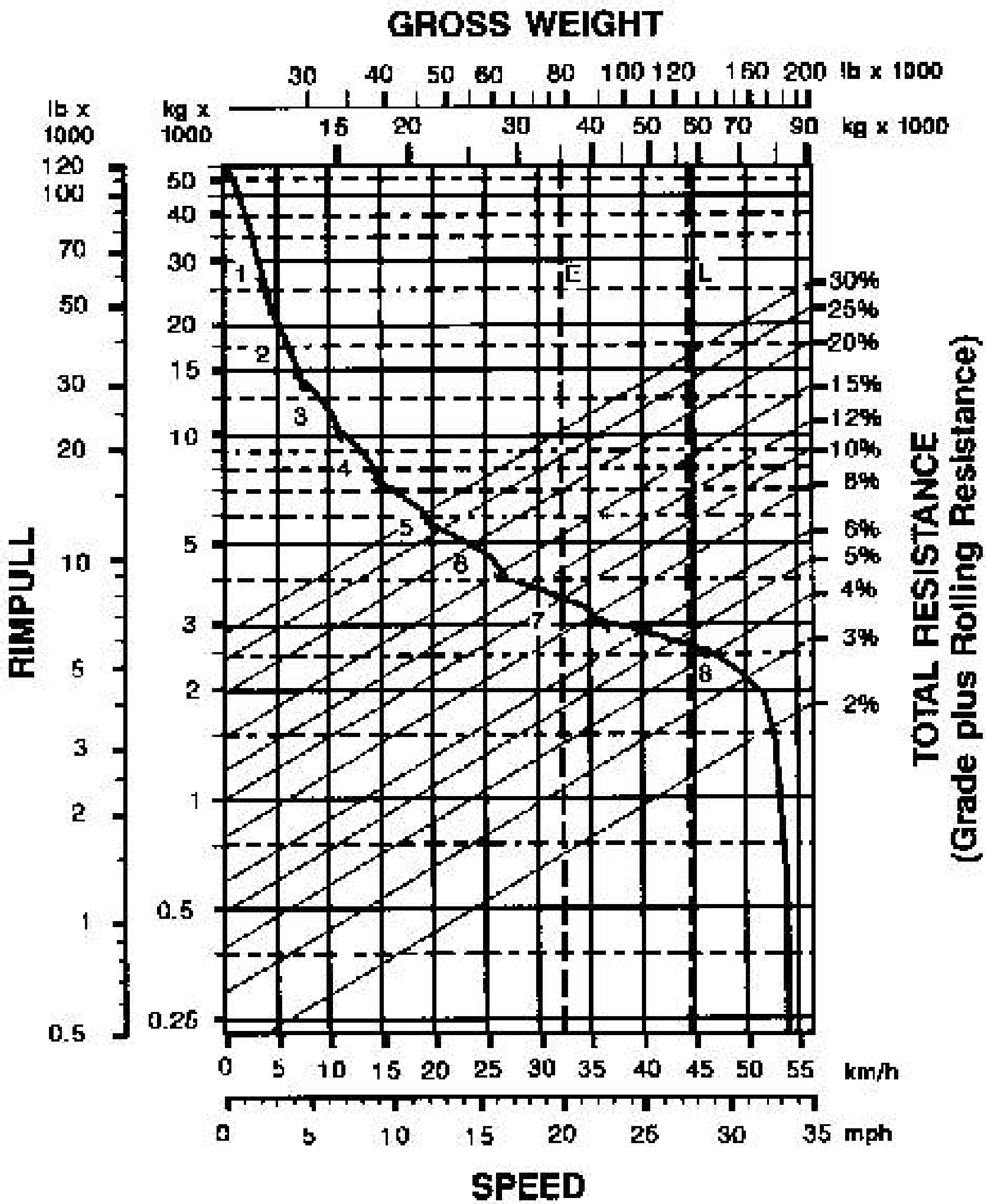
Empty weight: 33 700 kg (74,300 lb)
Payload: 24 950 kg (55,000 lb)

EMPTY





Empty weight: 33 700 kg (74,300 lb)

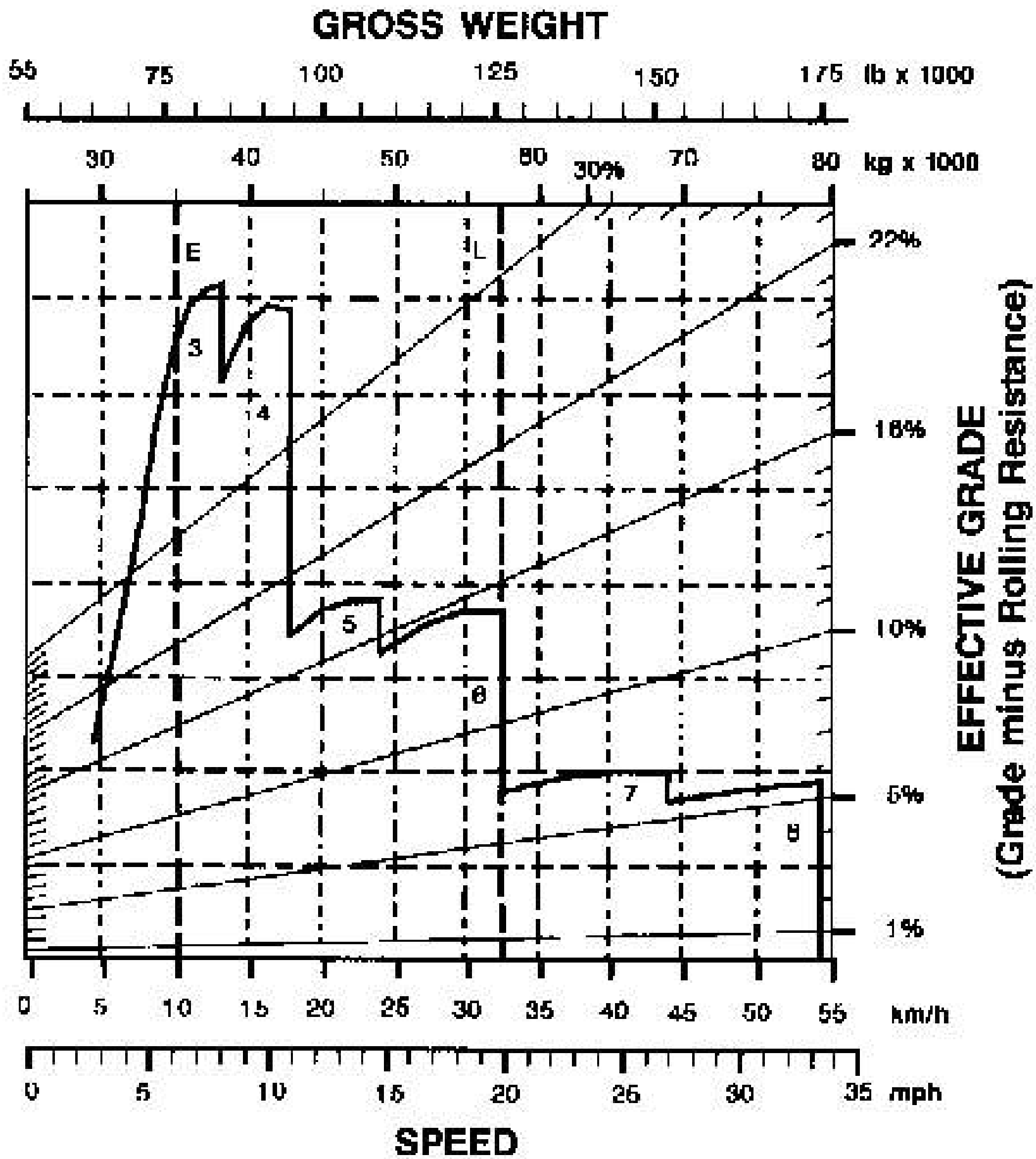


KEY

1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

E — Empty 35 160 kg (77,510 lb)
L — Loaded 56 935 kg (125,510 lb)



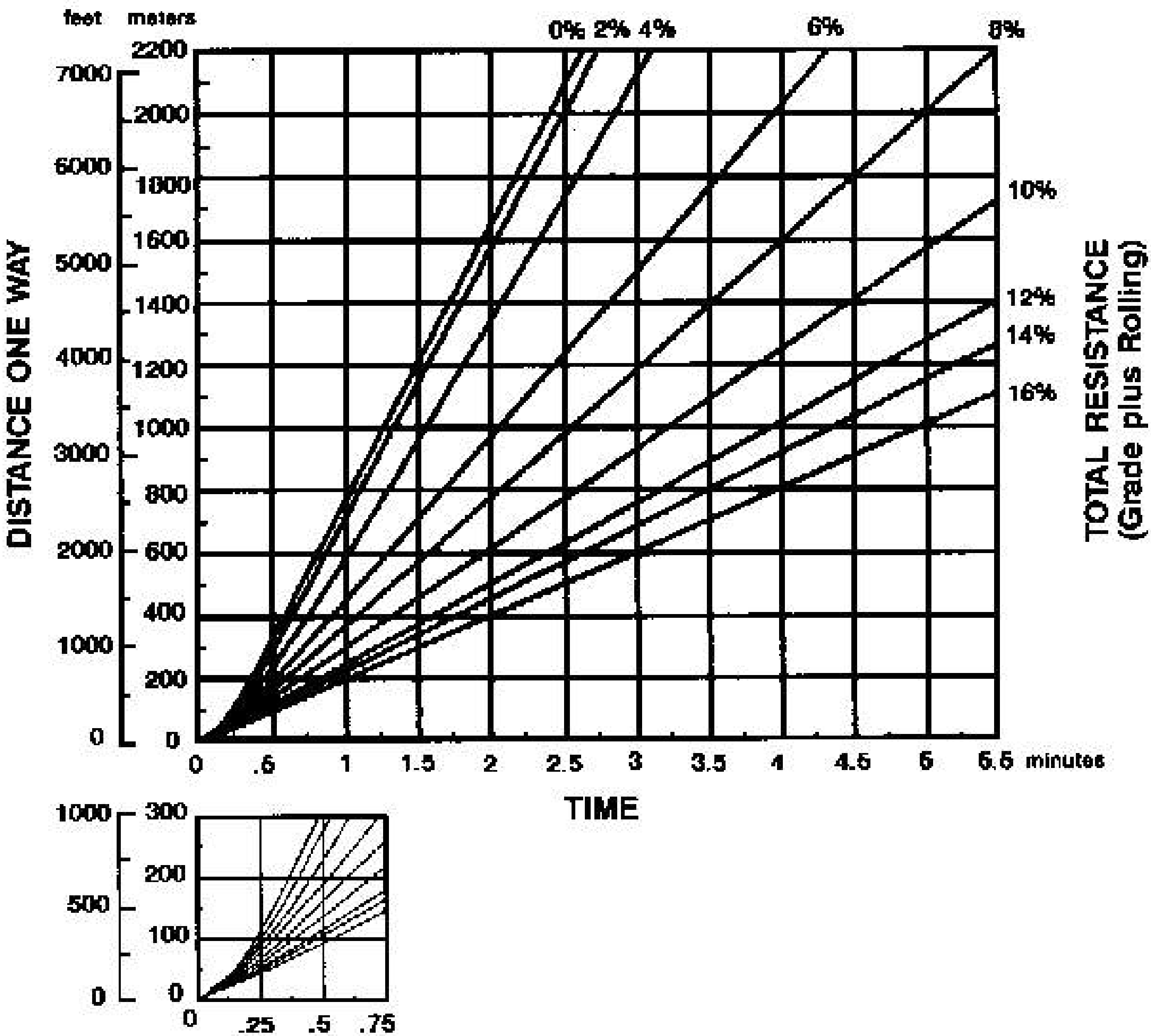
KEY

3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

E — Empty 35 160 kg (77,510 lb)
L — Loaded 56 935 kg (125,510 lb)

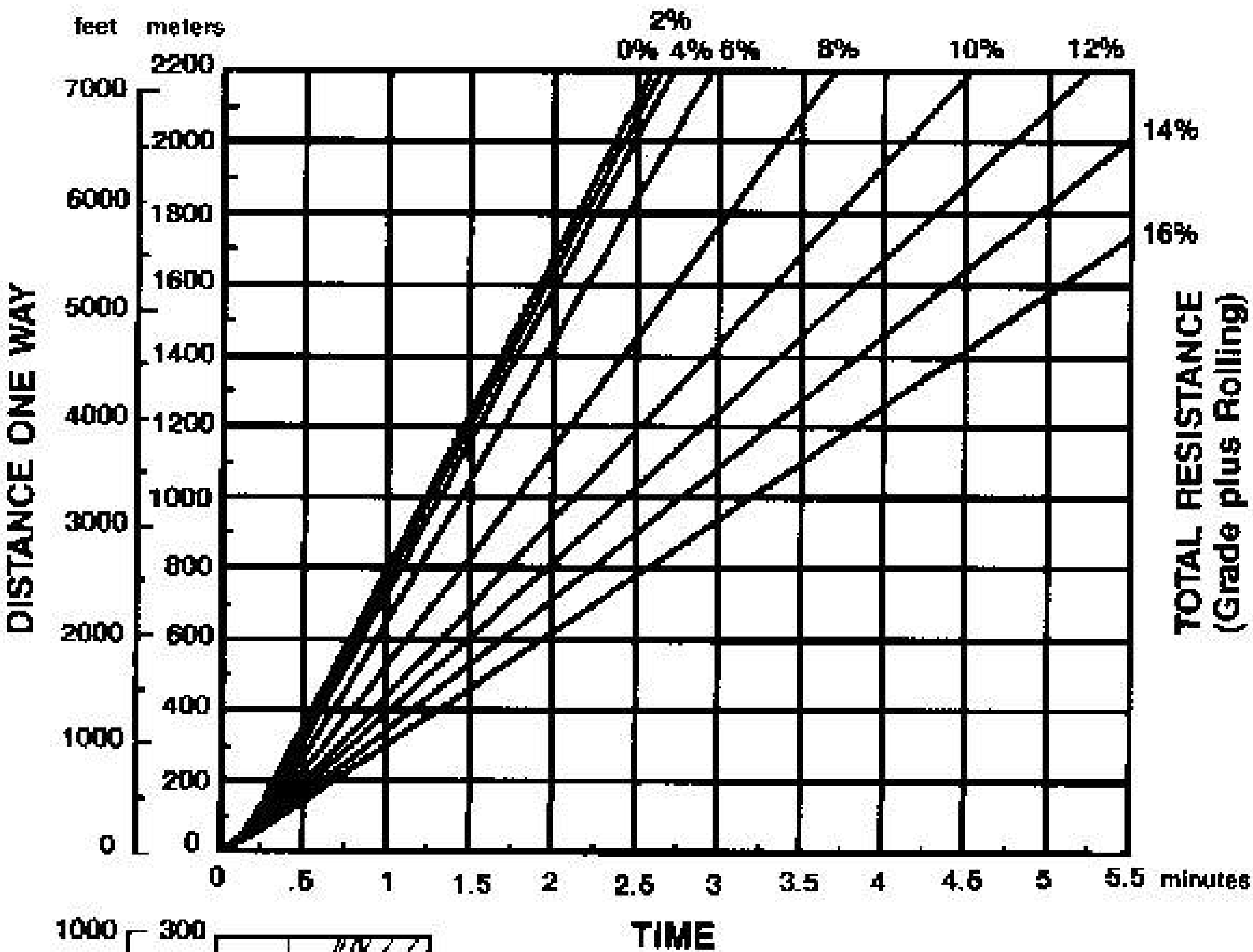
LOADED

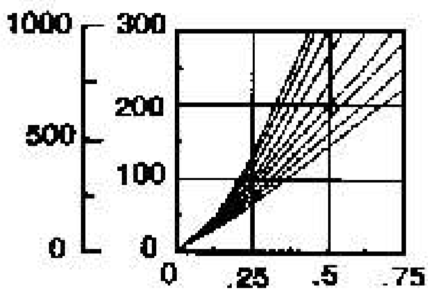


Empty weight: 35 160 kg (77,510 lb)
Payload: 21 775 kg (48,000 lb)

627E Travel Time — Empty
- 33.25-29 Tires
- Standard and Push-Pull

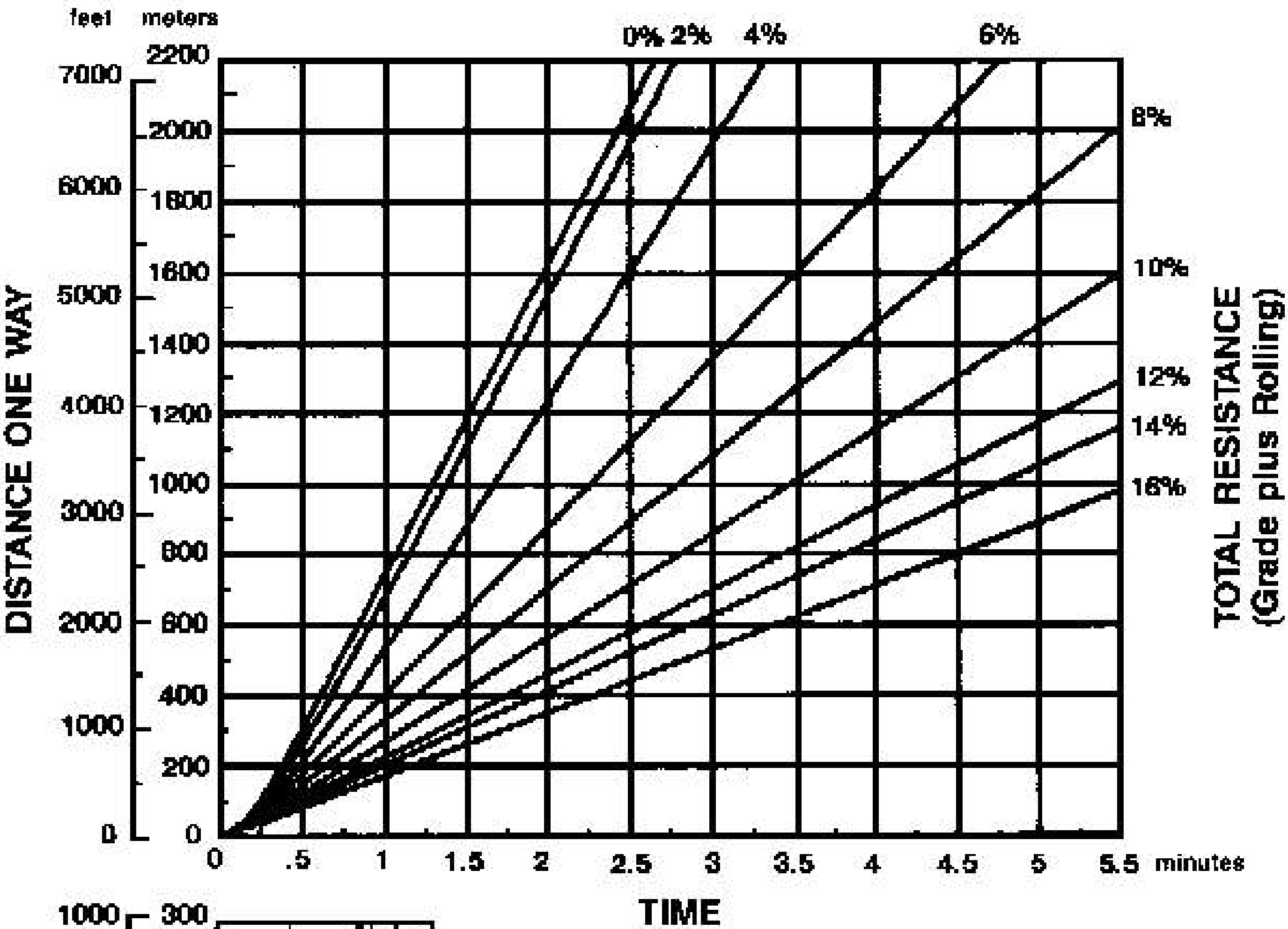
EMPTY

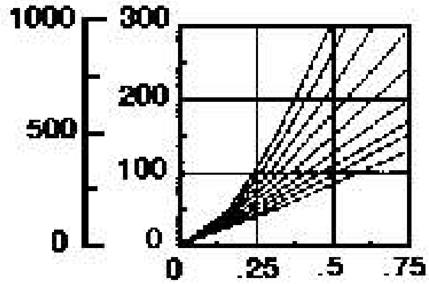




Empty weight: 35 160 kg (77,510 lb)

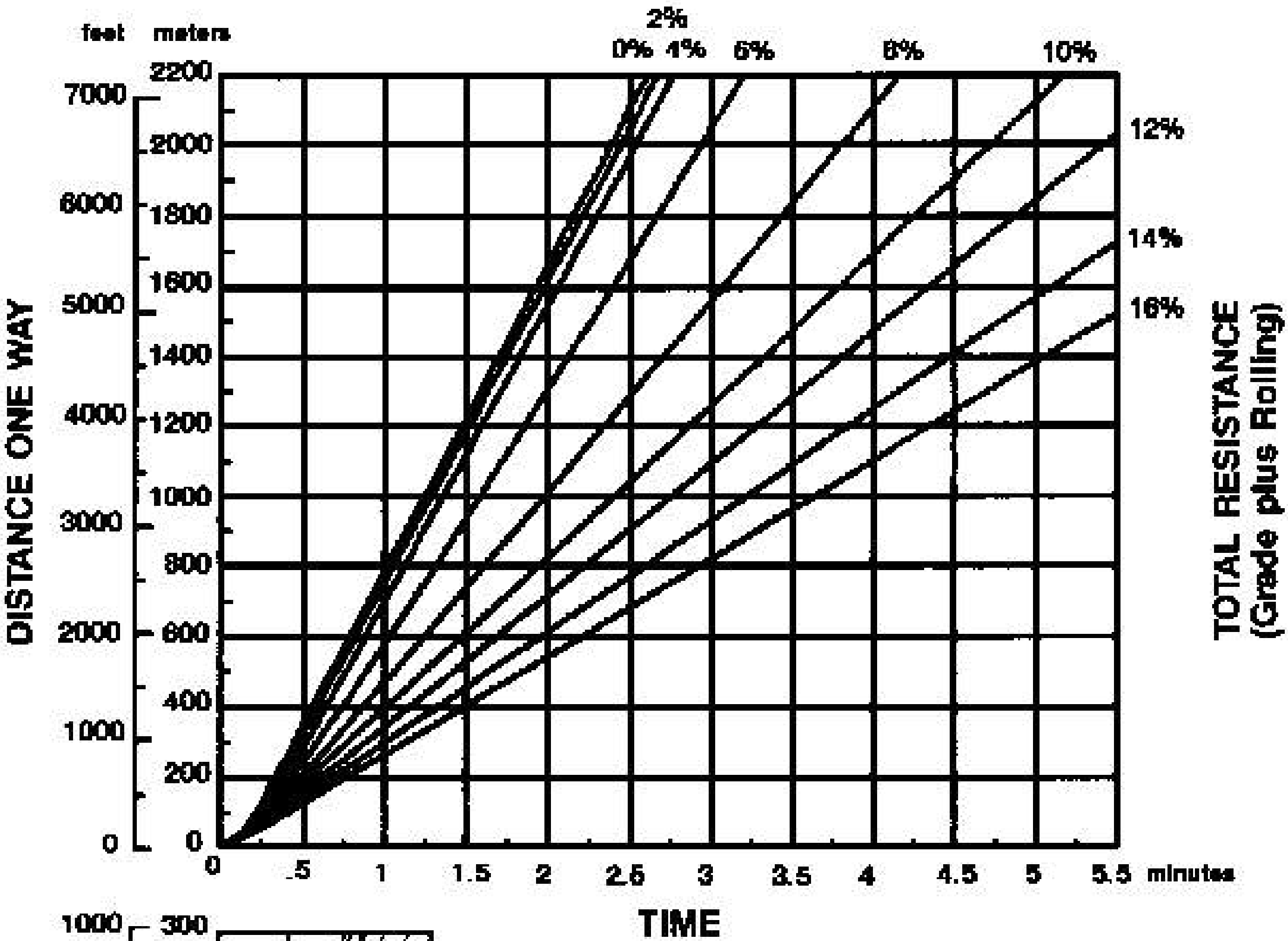
LOADED

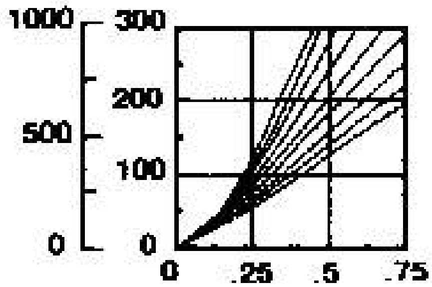




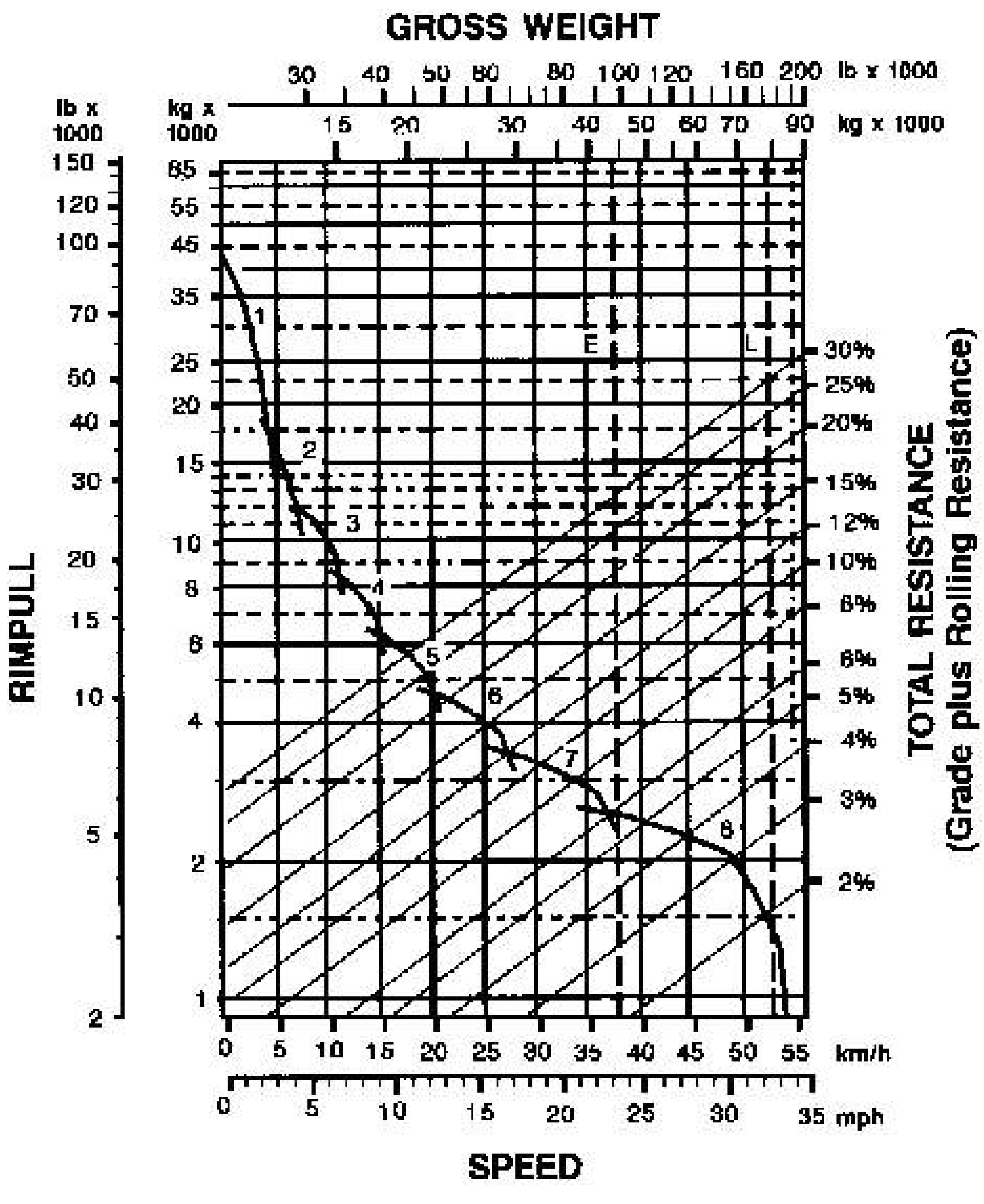
Empty weight: 40 385 kg (89,035 lb)
Payload: 21 775 kg (48,000 lb)

EMPTY





Empty weight: 40 385 kg (89,035 lb)

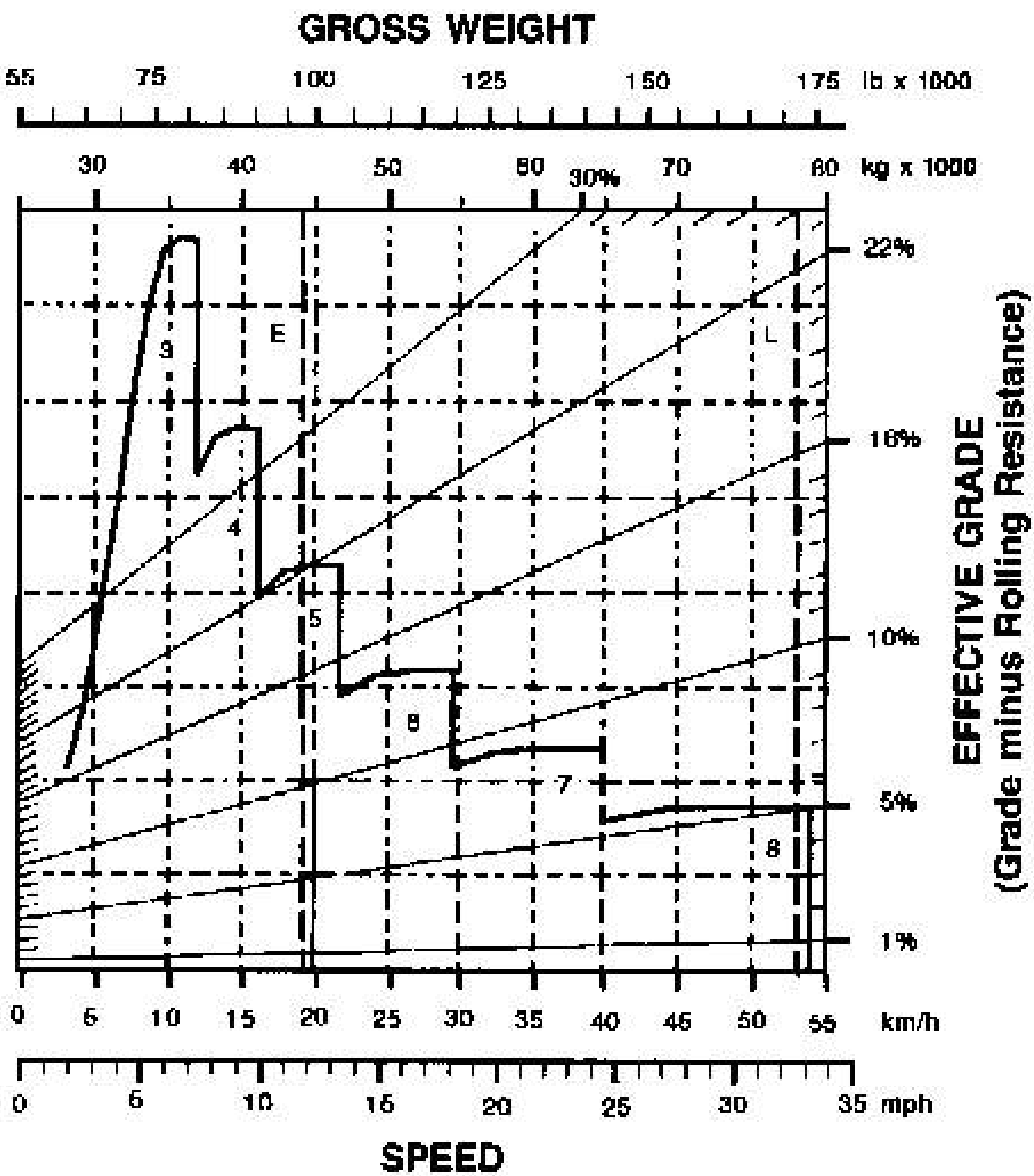


KEY

1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

E — Empty 43 945 kg (96,880 lb)
L — Loaded 77 965 kg (171,880 lb)



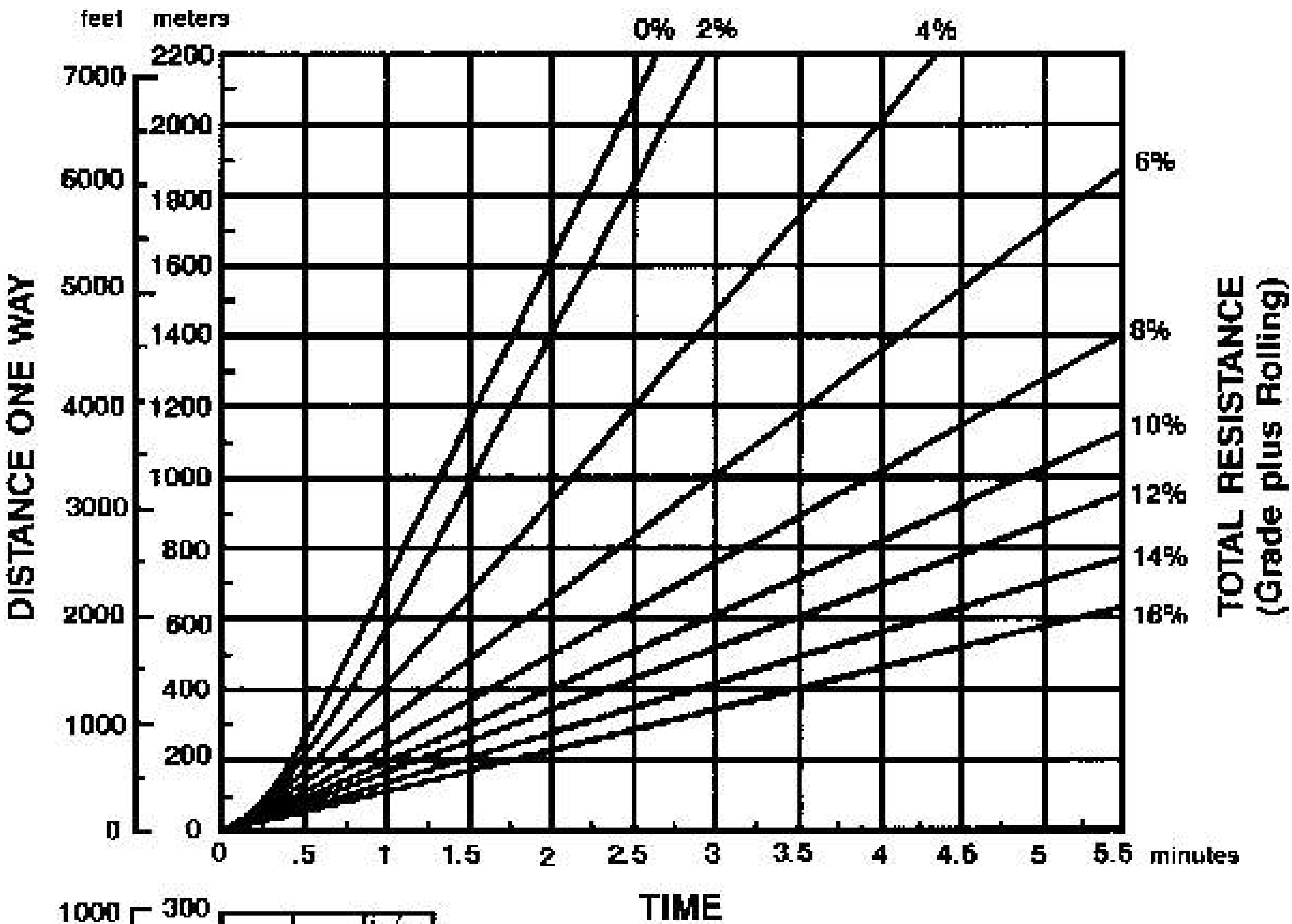
KEY

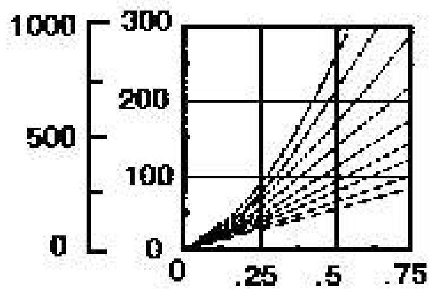
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

E — Empty 43 945 kg (96,880 lb)
L — Loaded 77 965 kg (171,880 lb)

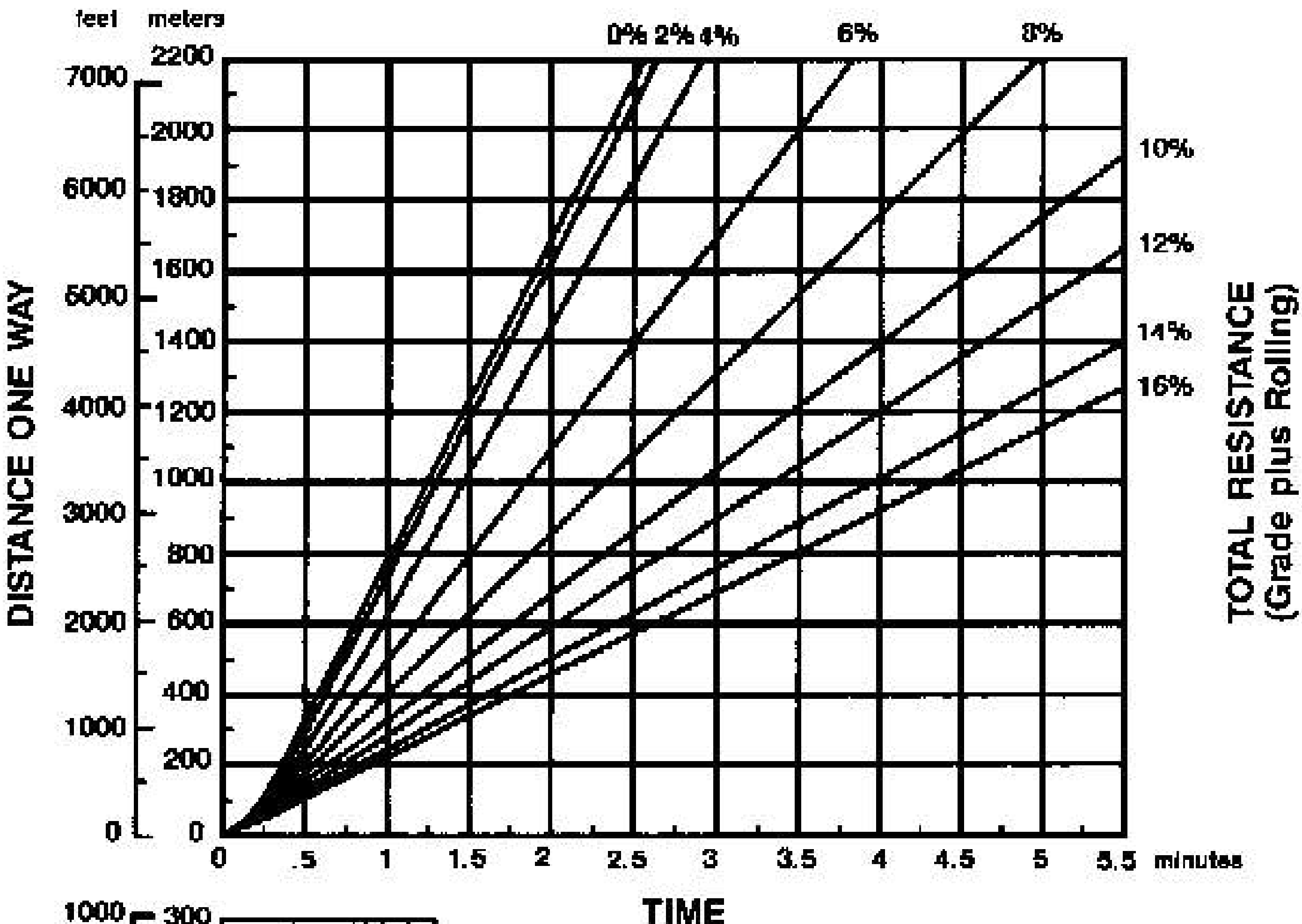
LOADED

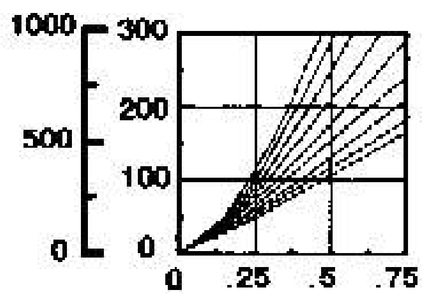




Empty weight: 43 945 kg (96,880 lb)
Payload: 34 020 kg (75,000 lb)

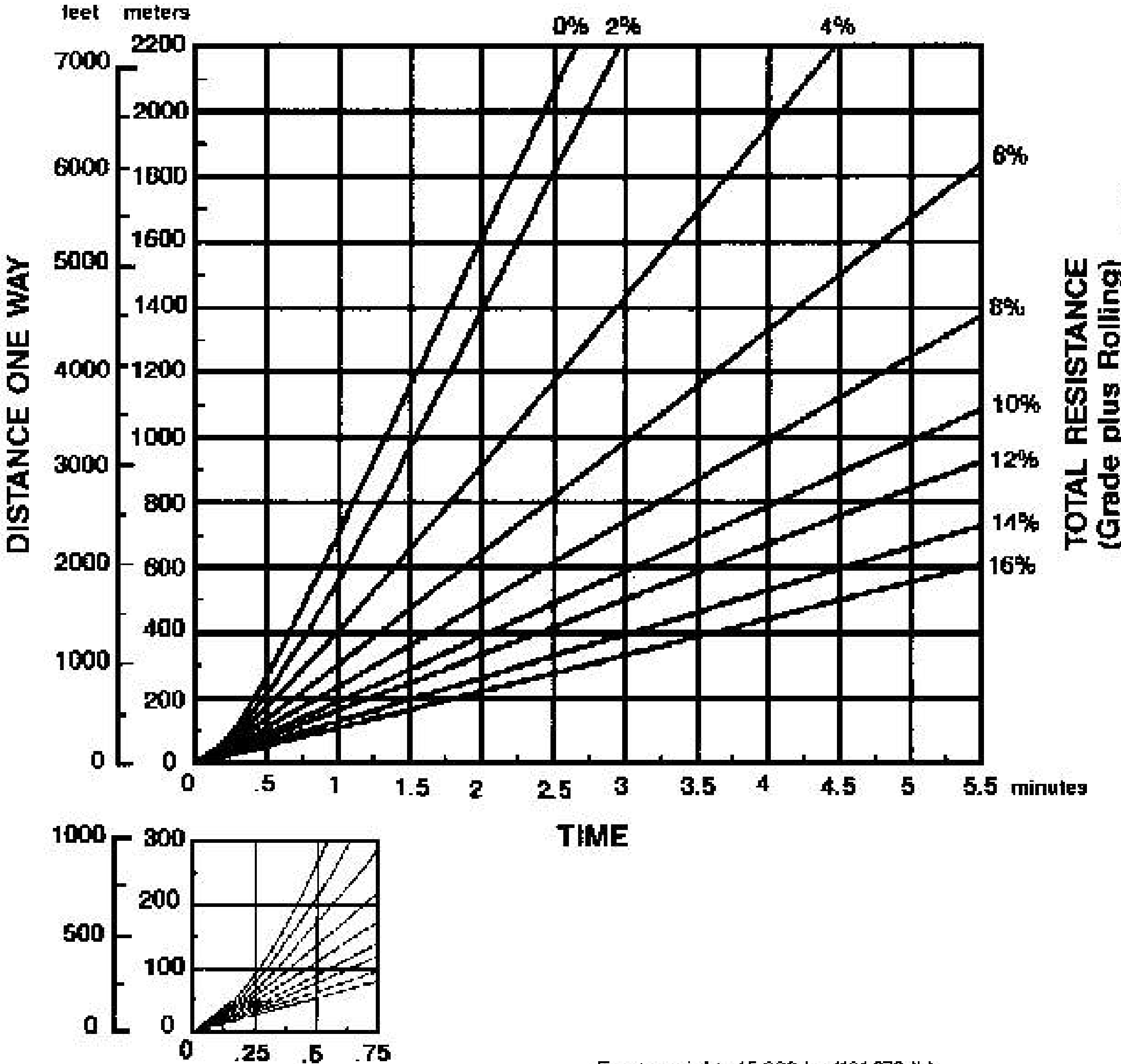
EMPTY





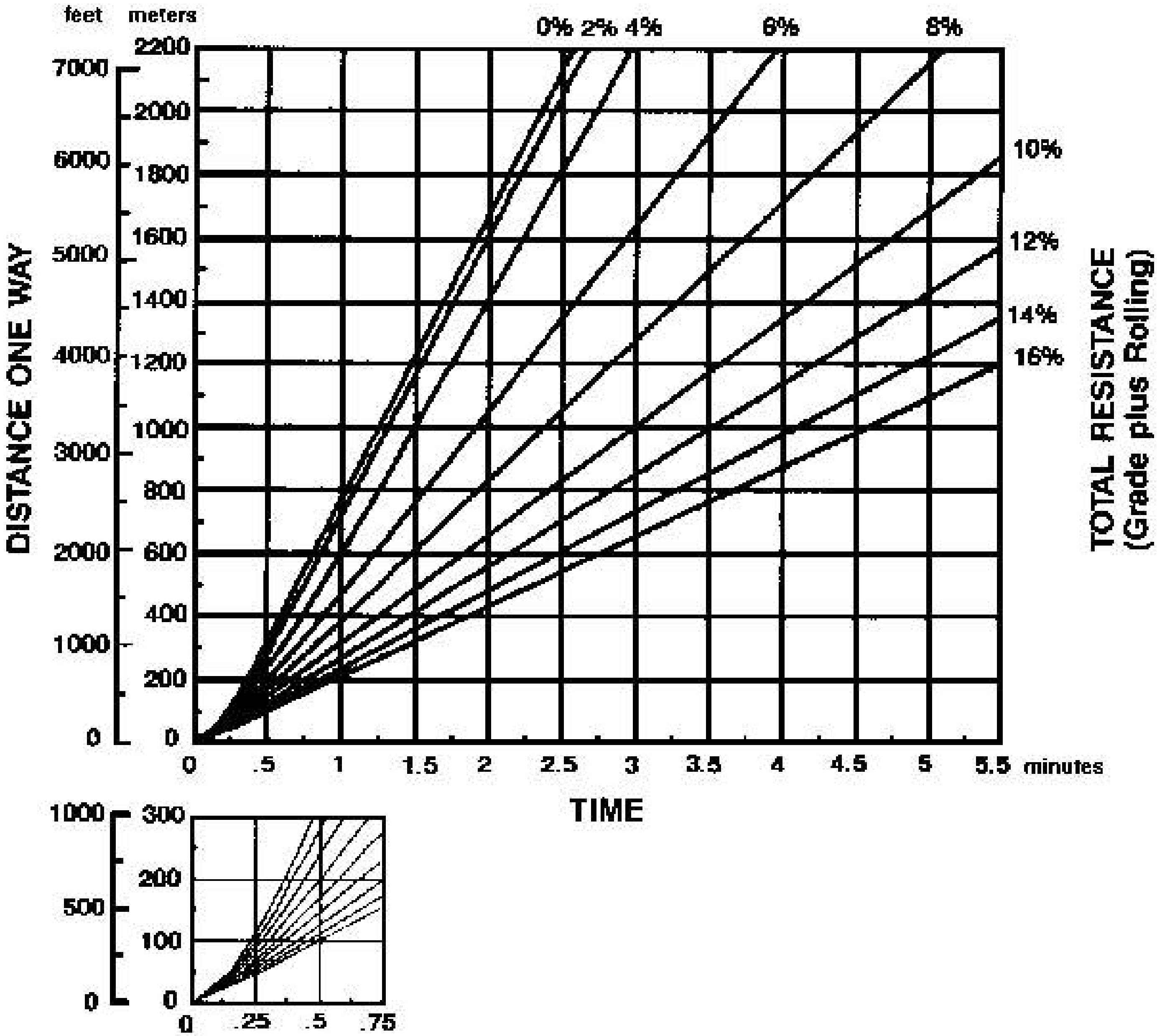
Empty weight: 43 945 kg (96,880 lb)

LOADED

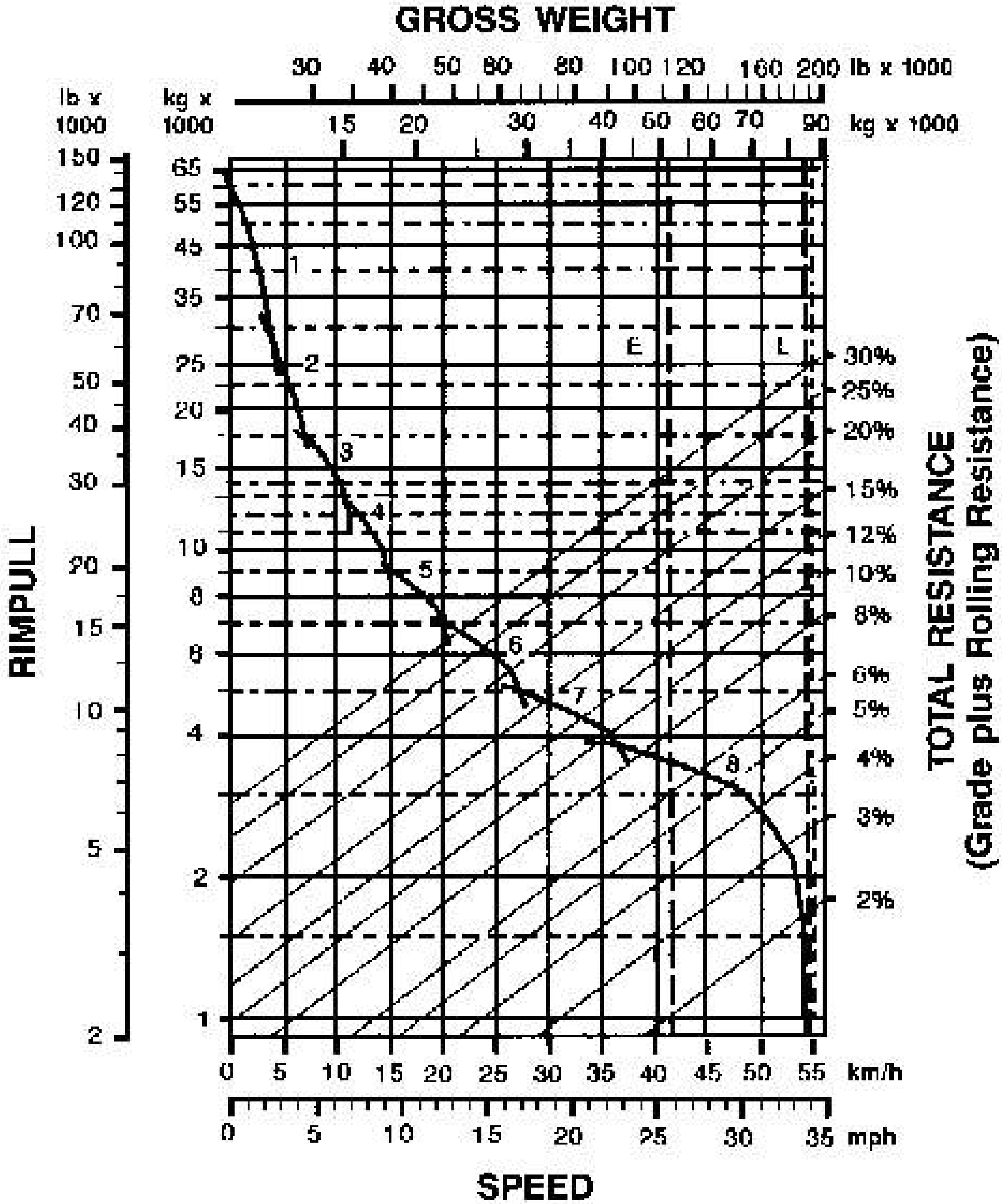


Empty weight: 45 980 kg (101,370 lb)
Payload: 34 020 kg (75,000 lb)

EMPTY

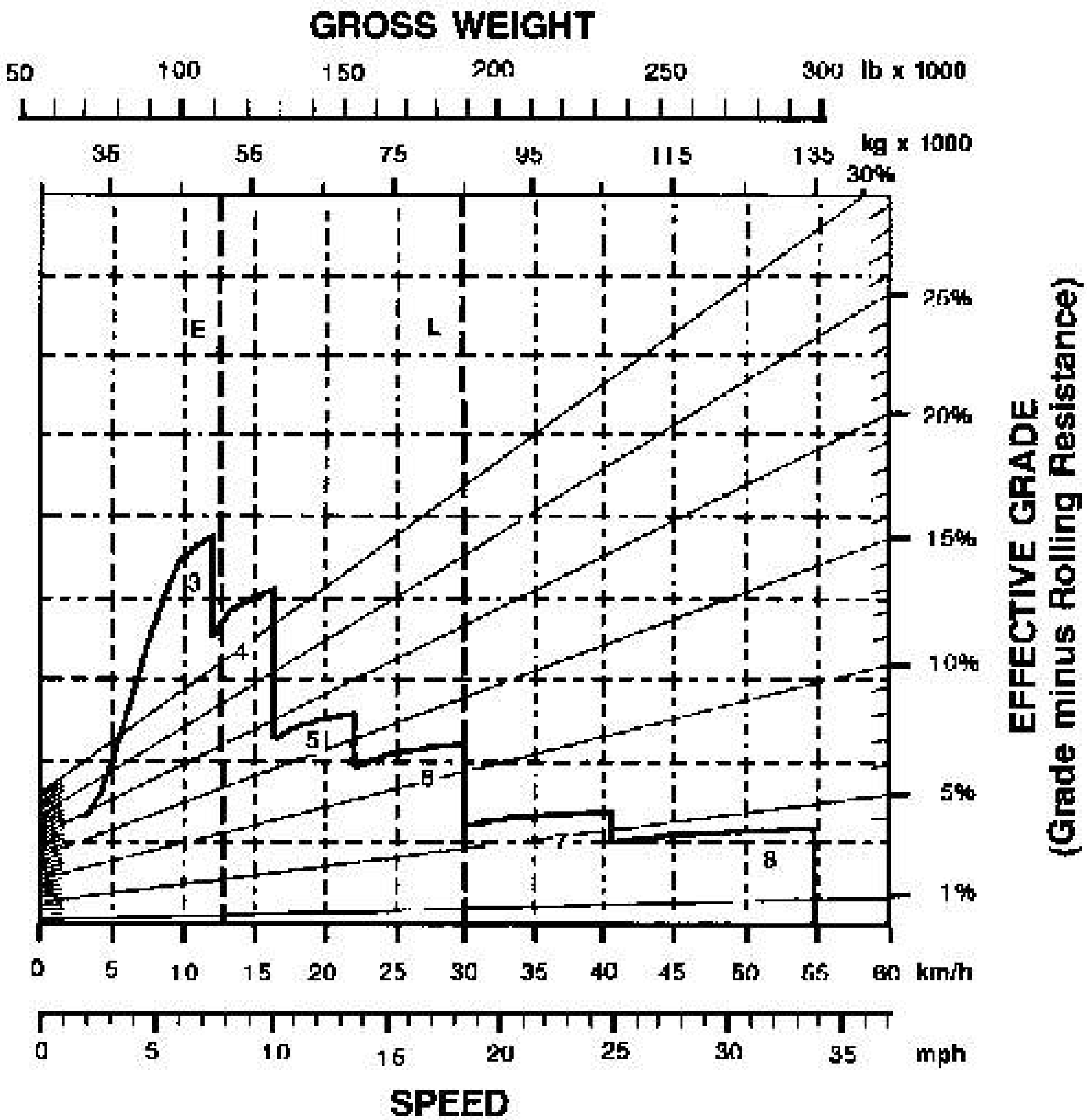


Empty weight: 45 980 kg (101,370 lb)



KEY
1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

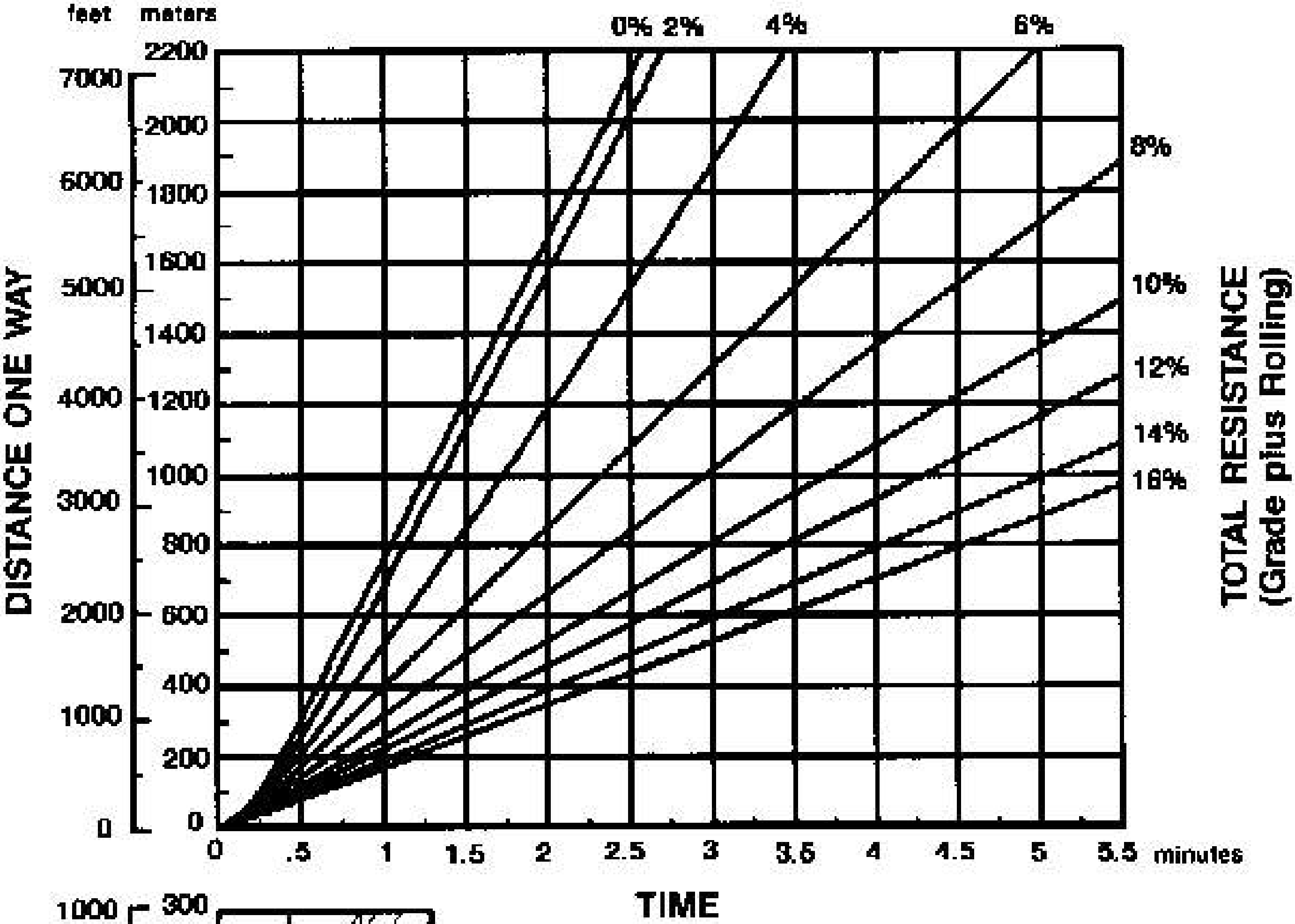
KEY
E — Empty 50 845 kg (112,090 lb)
L — Loaded 84 865 kg (187,090 lb)

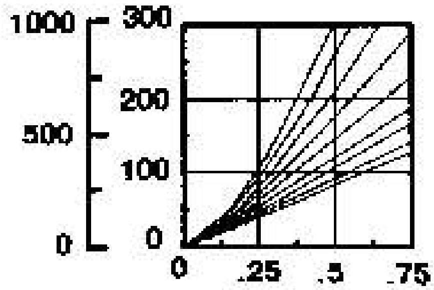


KEY
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY
E — Empty 50 845 kg (112,090 lb)
L — Loaded 84 865 kg (187,090 lb)

LOADED

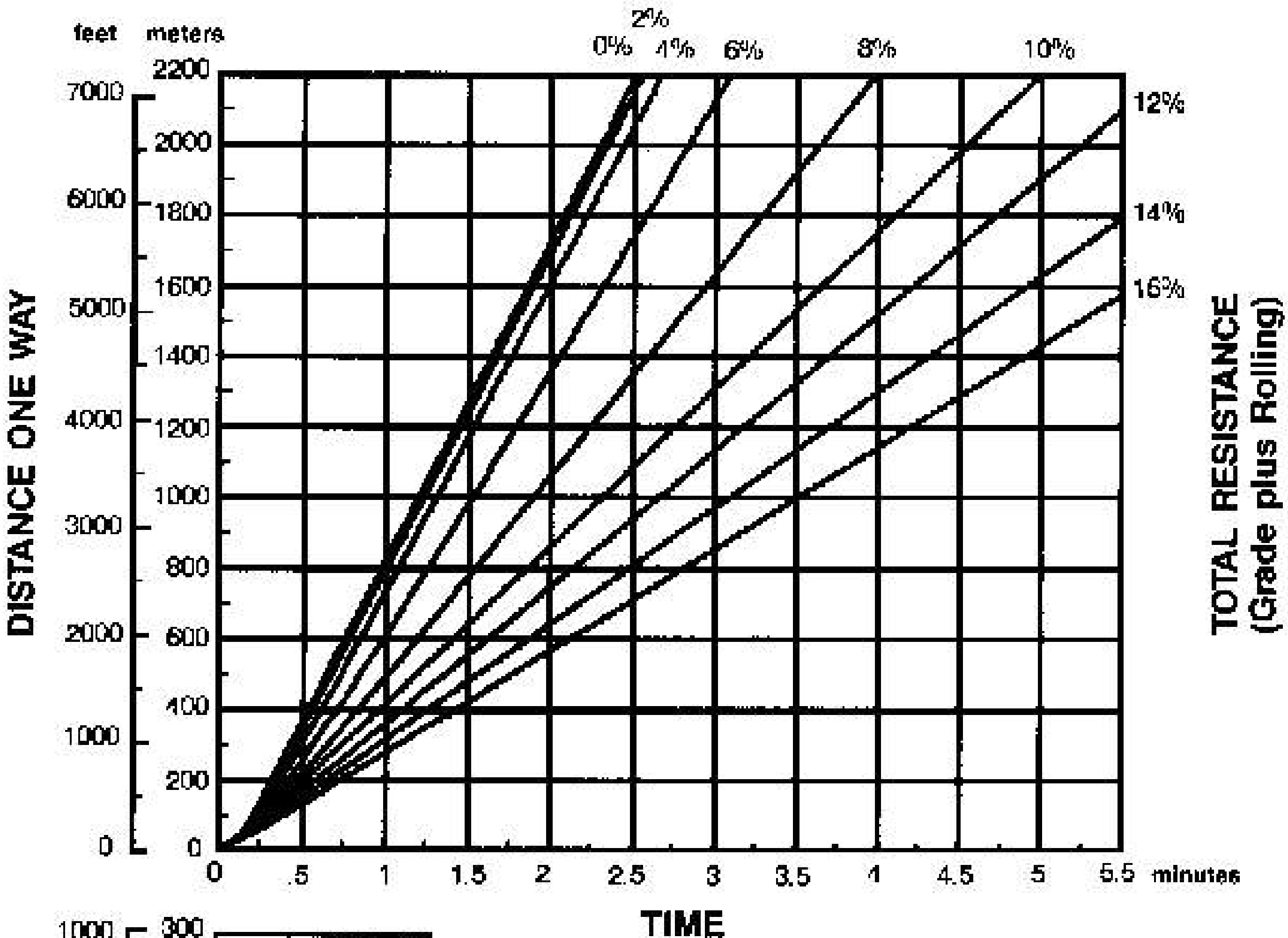


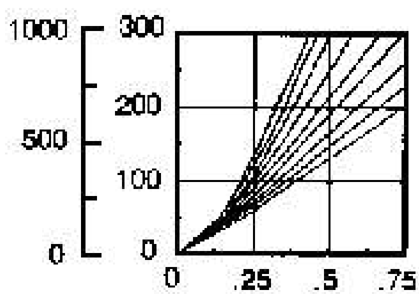


Empty weight: 50 845 kg (112,090 lb)
Payload: 34 020 kg (75,000 lb)

637E Series II Travel Time — Empty
- 37.25-35 Tires
- Standard and Push-Pull

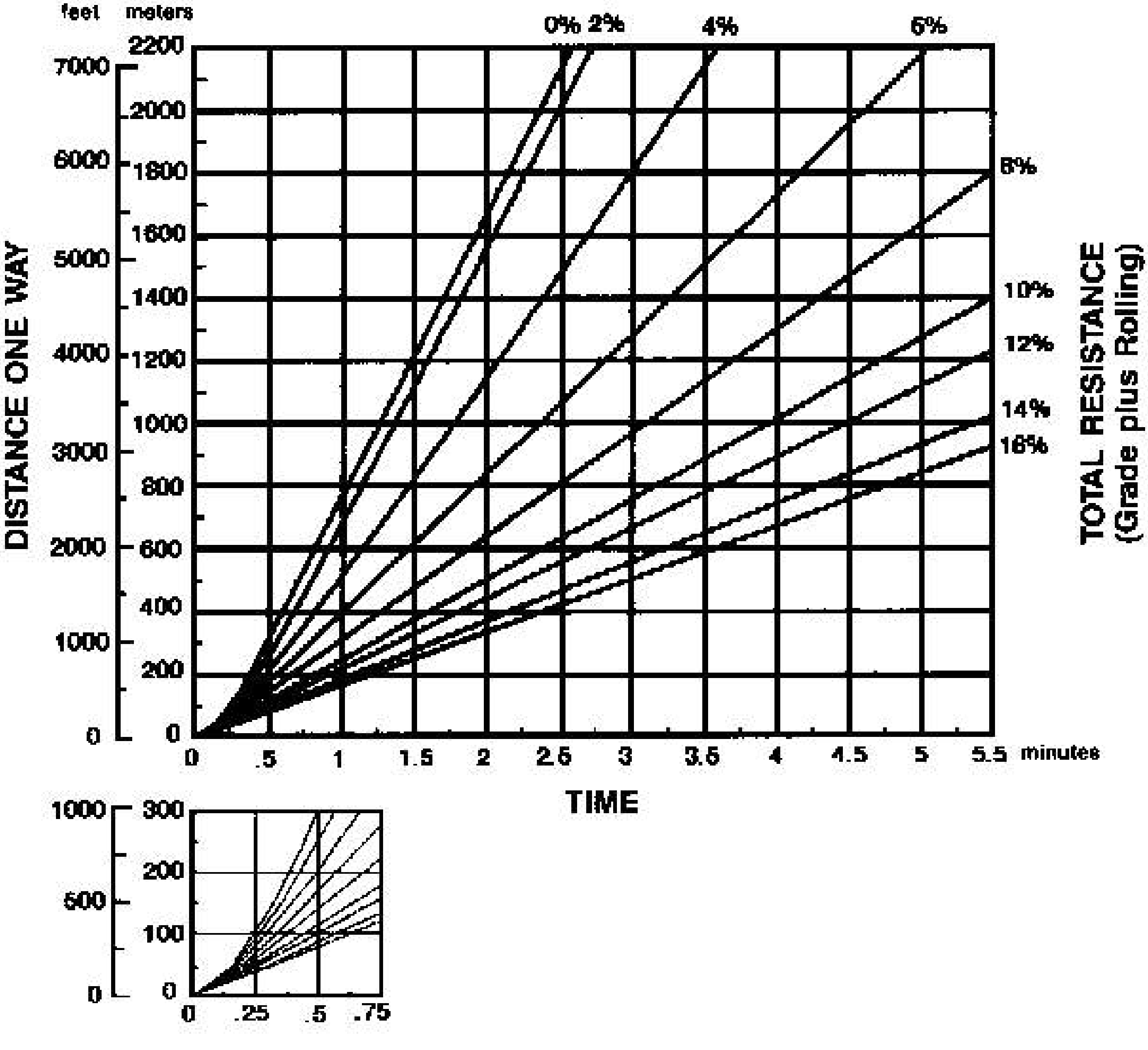
EMPTY





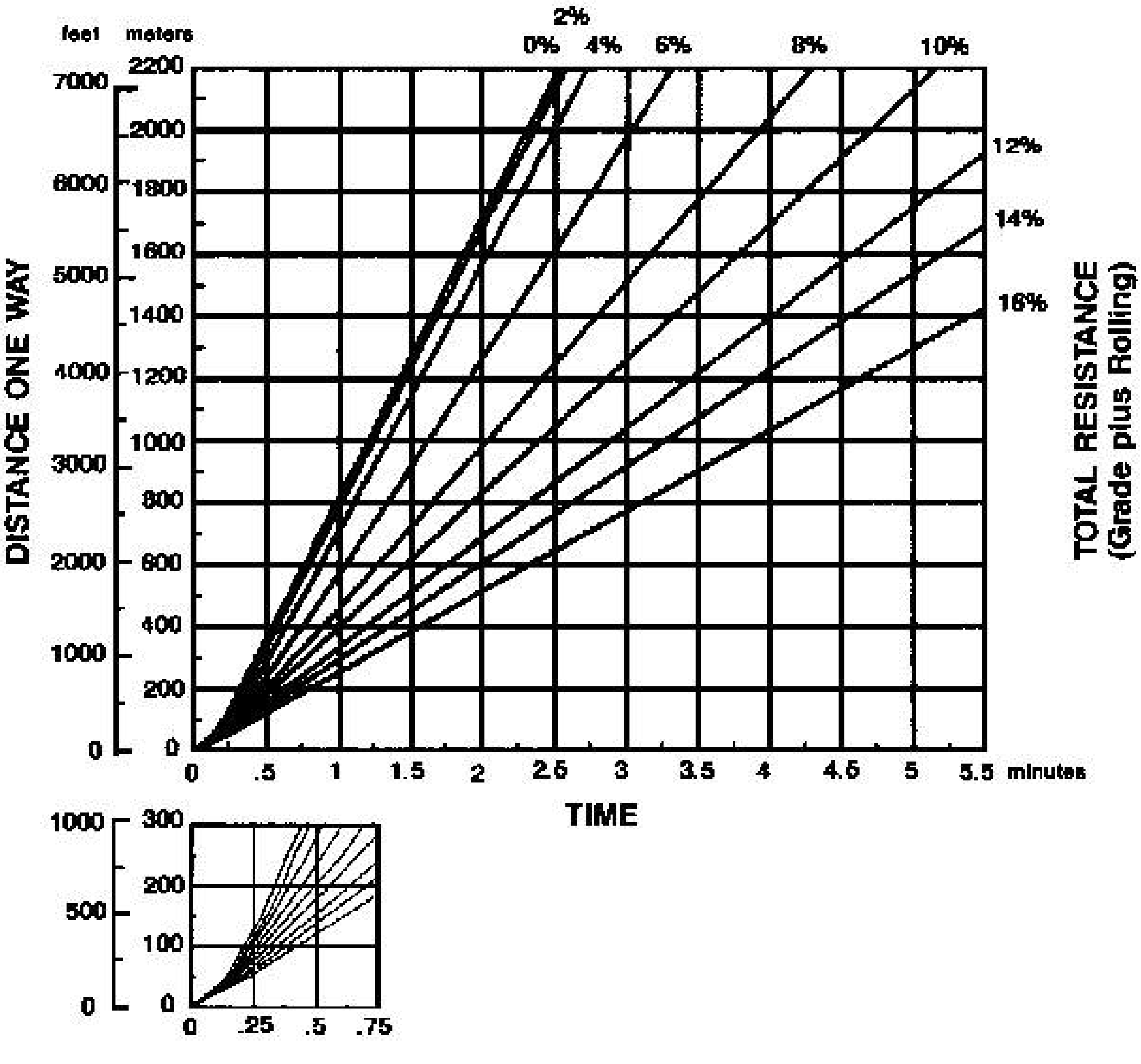
Empty weight: 50 845 kg (112,090 lb)

LOADED

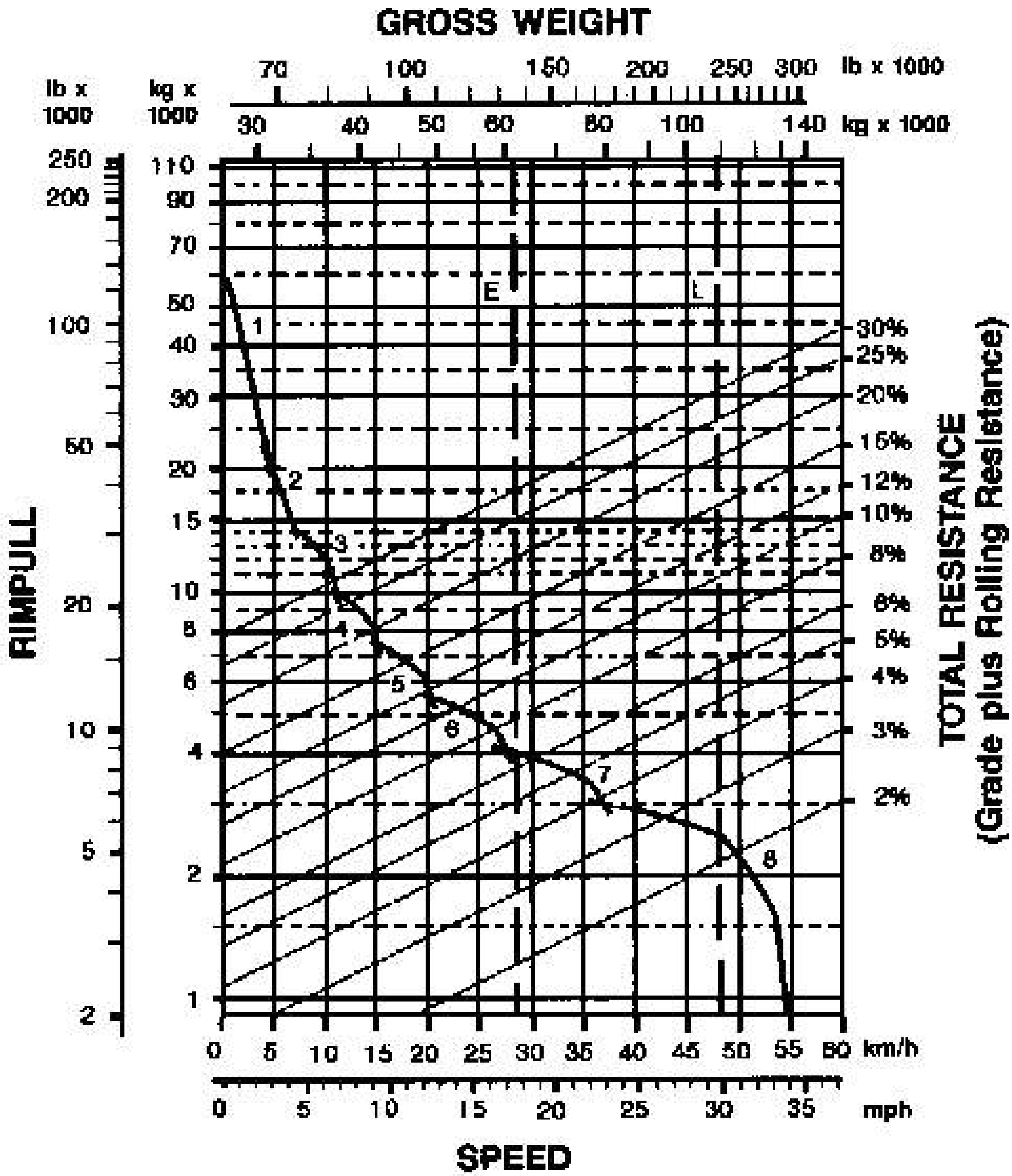


Empty weight: 54 540 kg (120,235 lb)
Payload: 34 020 kg (75,000 lb)

EMPTY



Empty weight: 54 540 kg (120,235 lb)

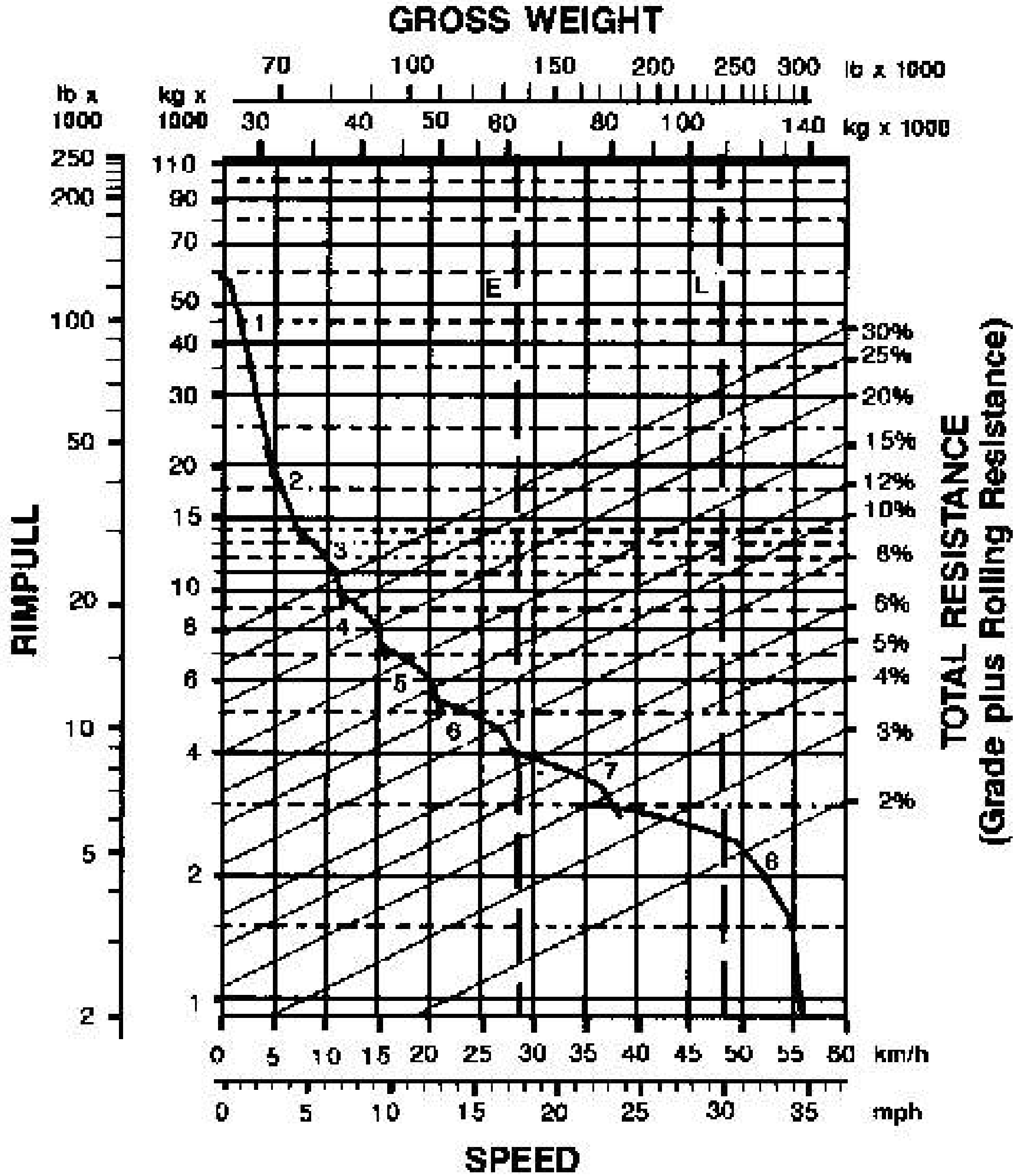


KEY

1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

E — Empty 60 950 kg (134,370 lb)
L — Loaded 108 125 kg (238,370 lb)

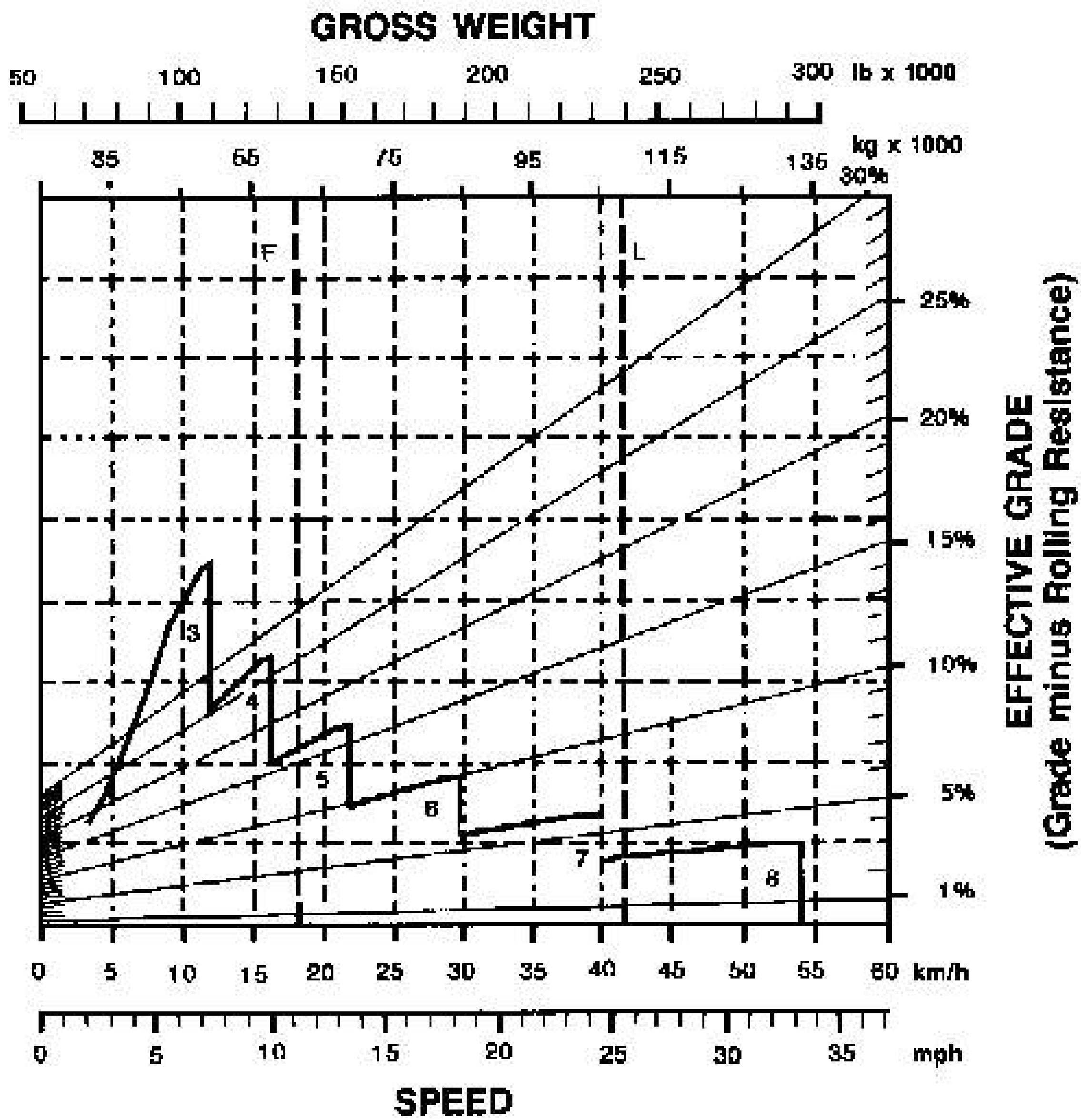


KEY

1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

E — Empty 60 950 kg (134,370 lb)
L — Loaded 108 125 kg (238,370 lb)

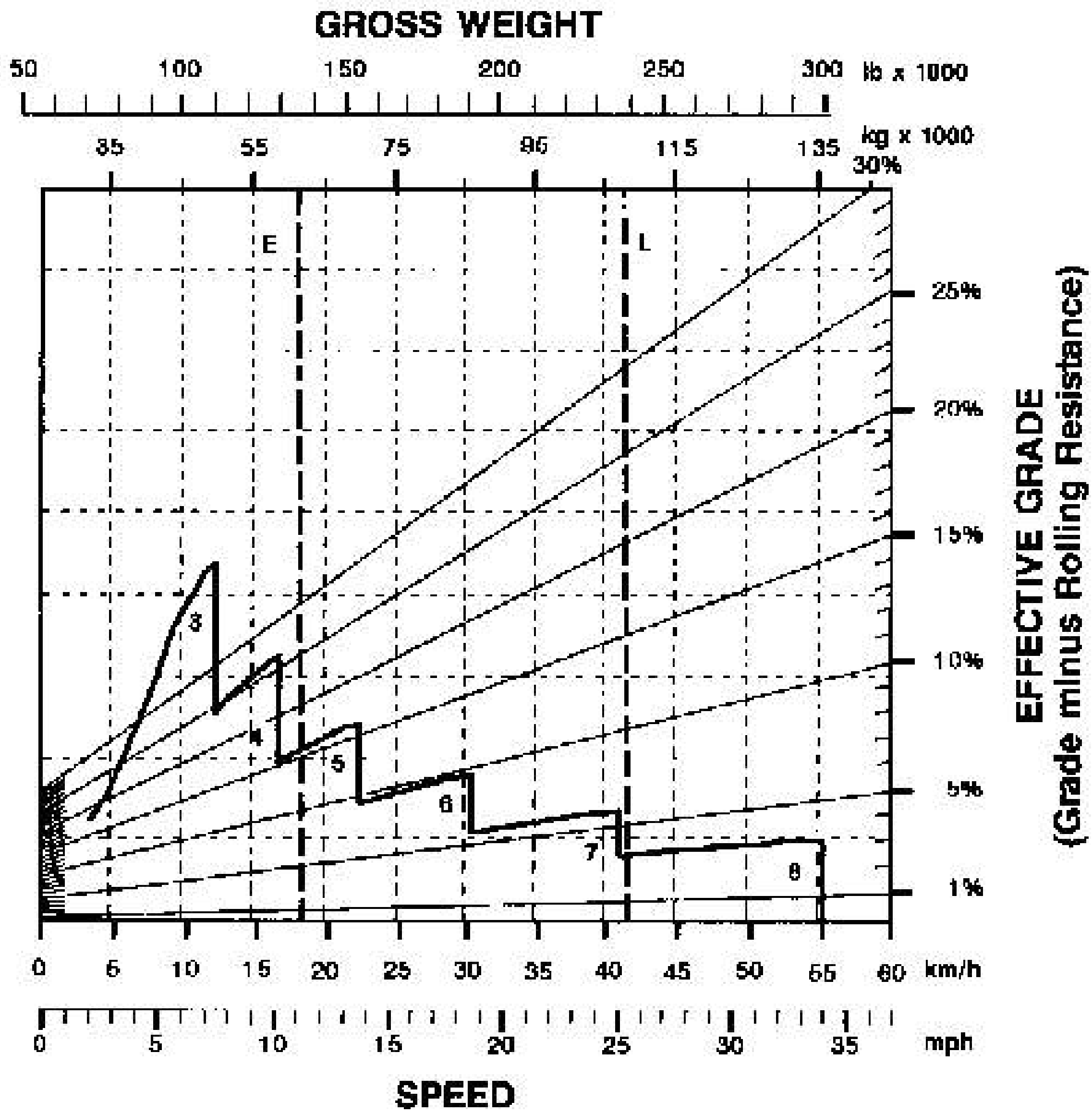


KEY

3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

E — Empty 60 950 kg (134,370 lb)
L — Loaded 108 125 kg (238,370 lb)



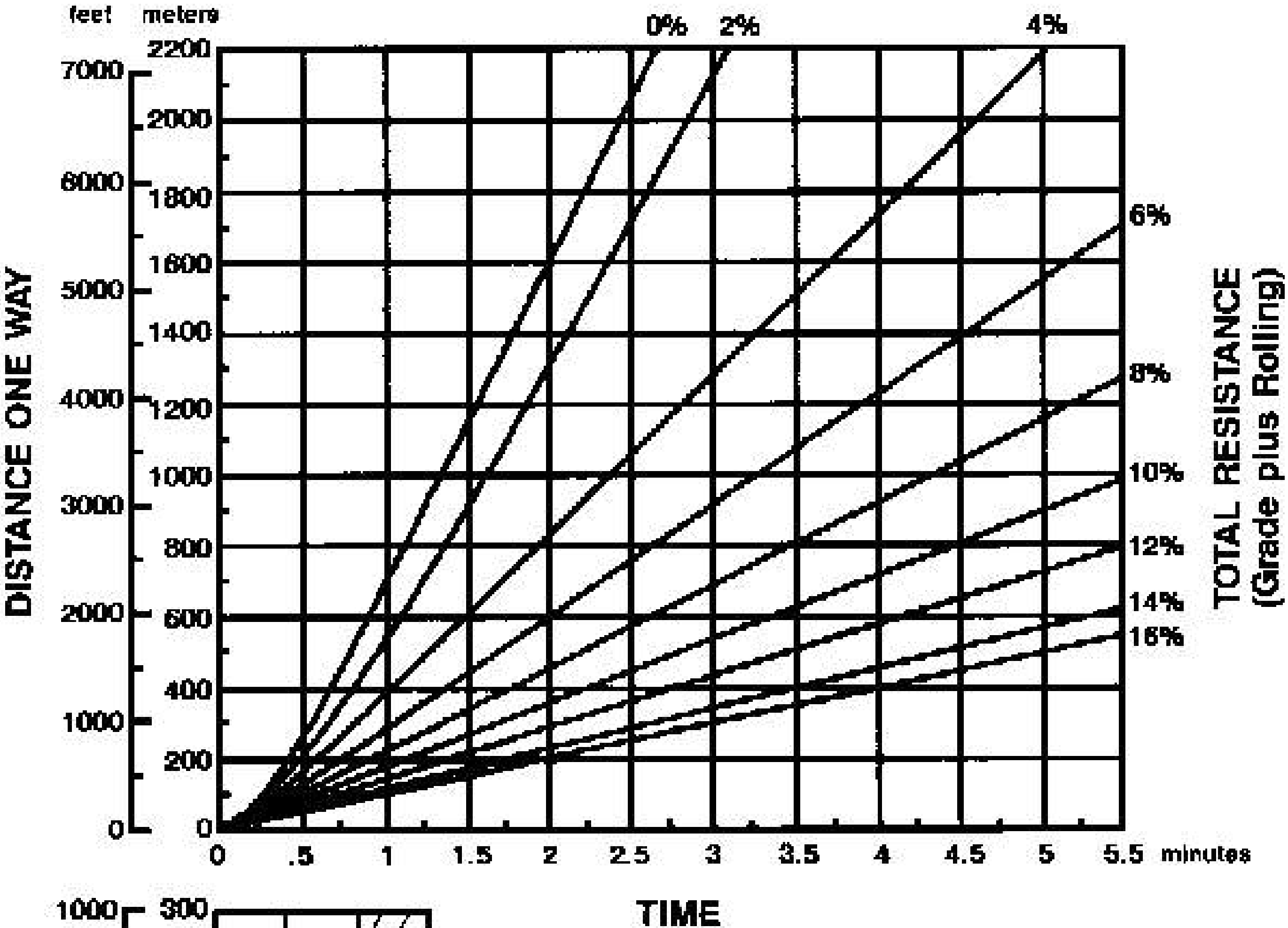
KEY

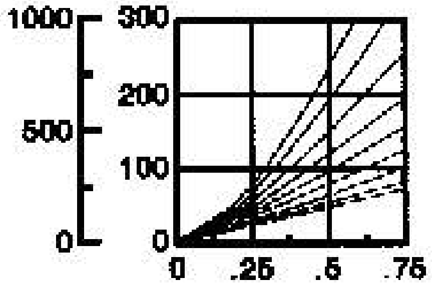
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

E — Empty 60 950 kg (134,370 lb)
L — Loaded 108 125 kg (238,370 lb)

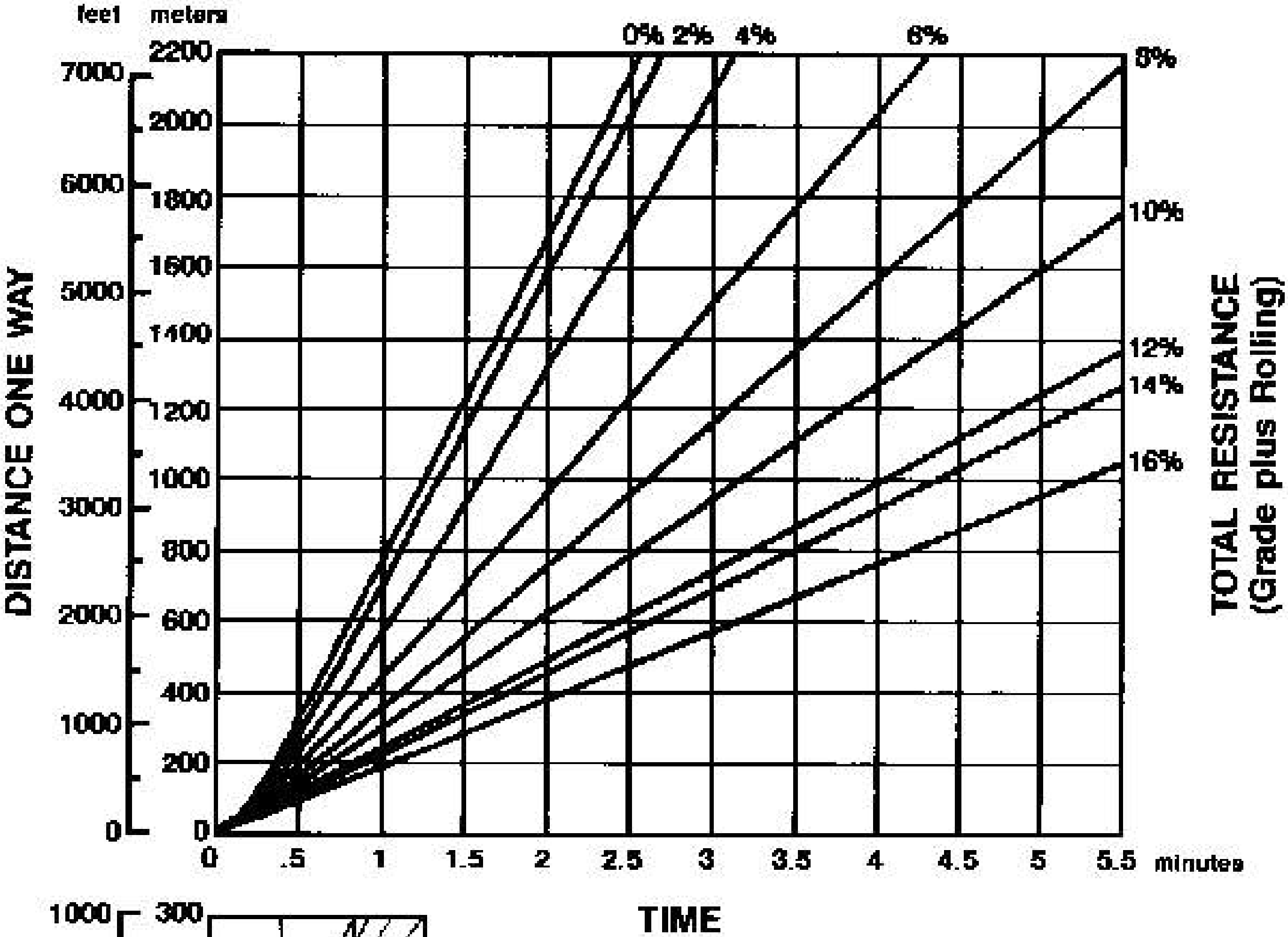
LOADED

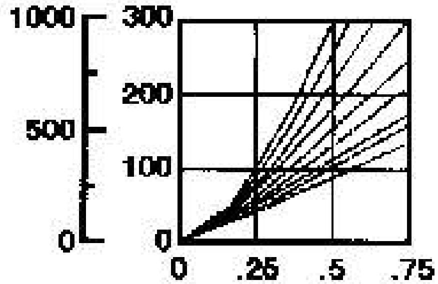




Empty weight: 60 950 kg (134,370 lb)
Payload: 47 175 kg (104,000 lb)

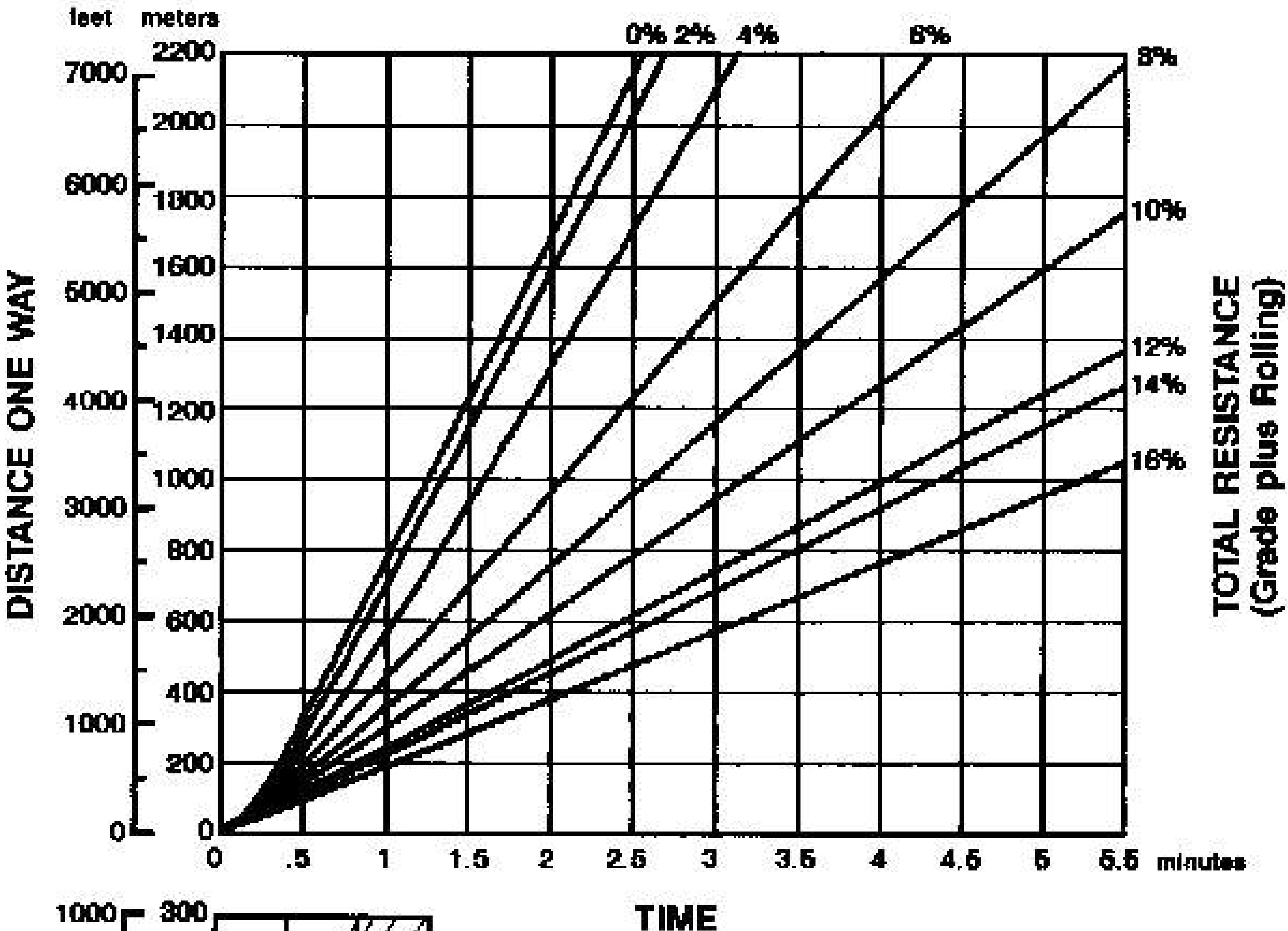
EMPTY

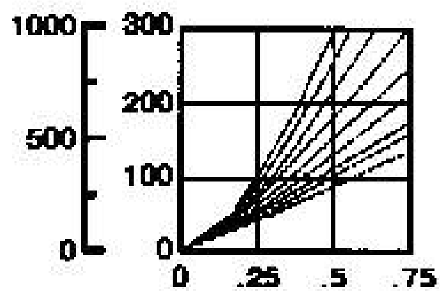




Empty weight: 60 950 kg (134,370 lb)

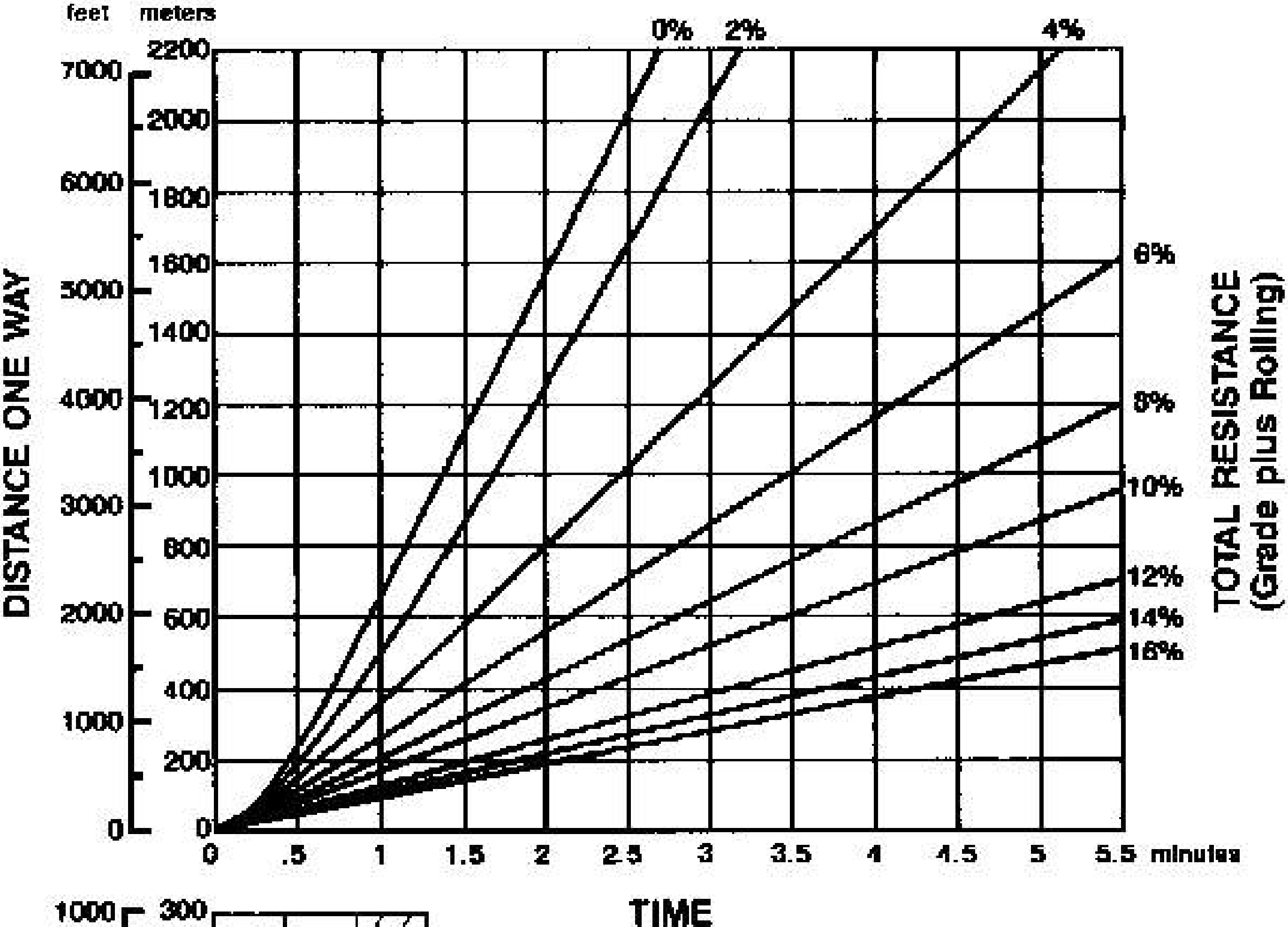
EMPTY

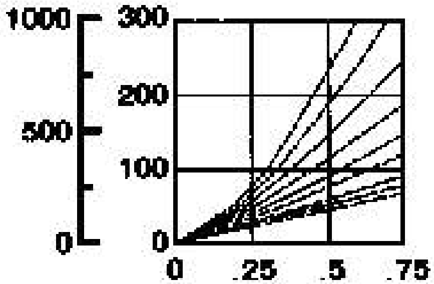




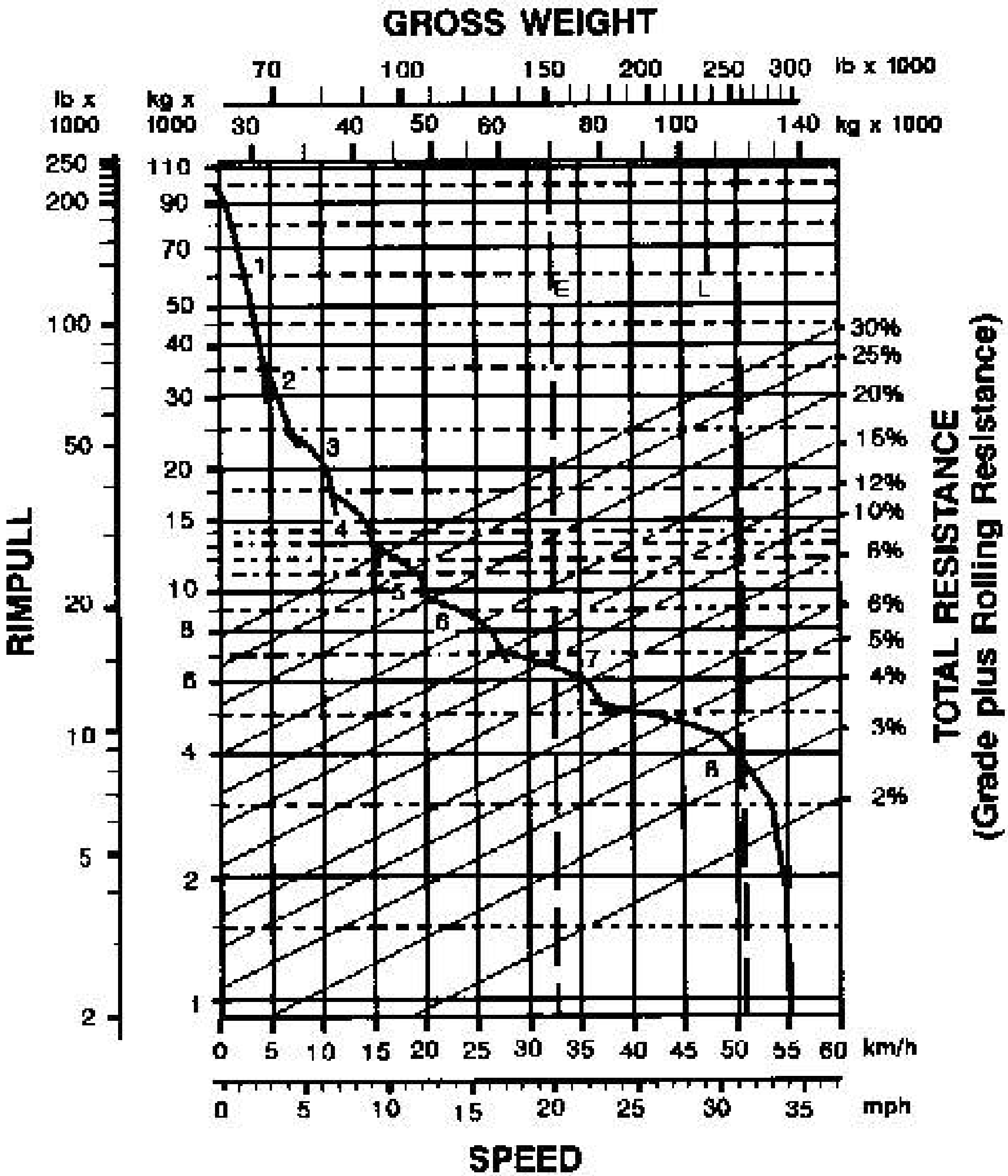
Empty weight: 66 575 kg (146,770 lb)

LOADED





Empty weight: 66 575 kg (146,770 lb)
Payload: 47 175 kg (104,000 lb)

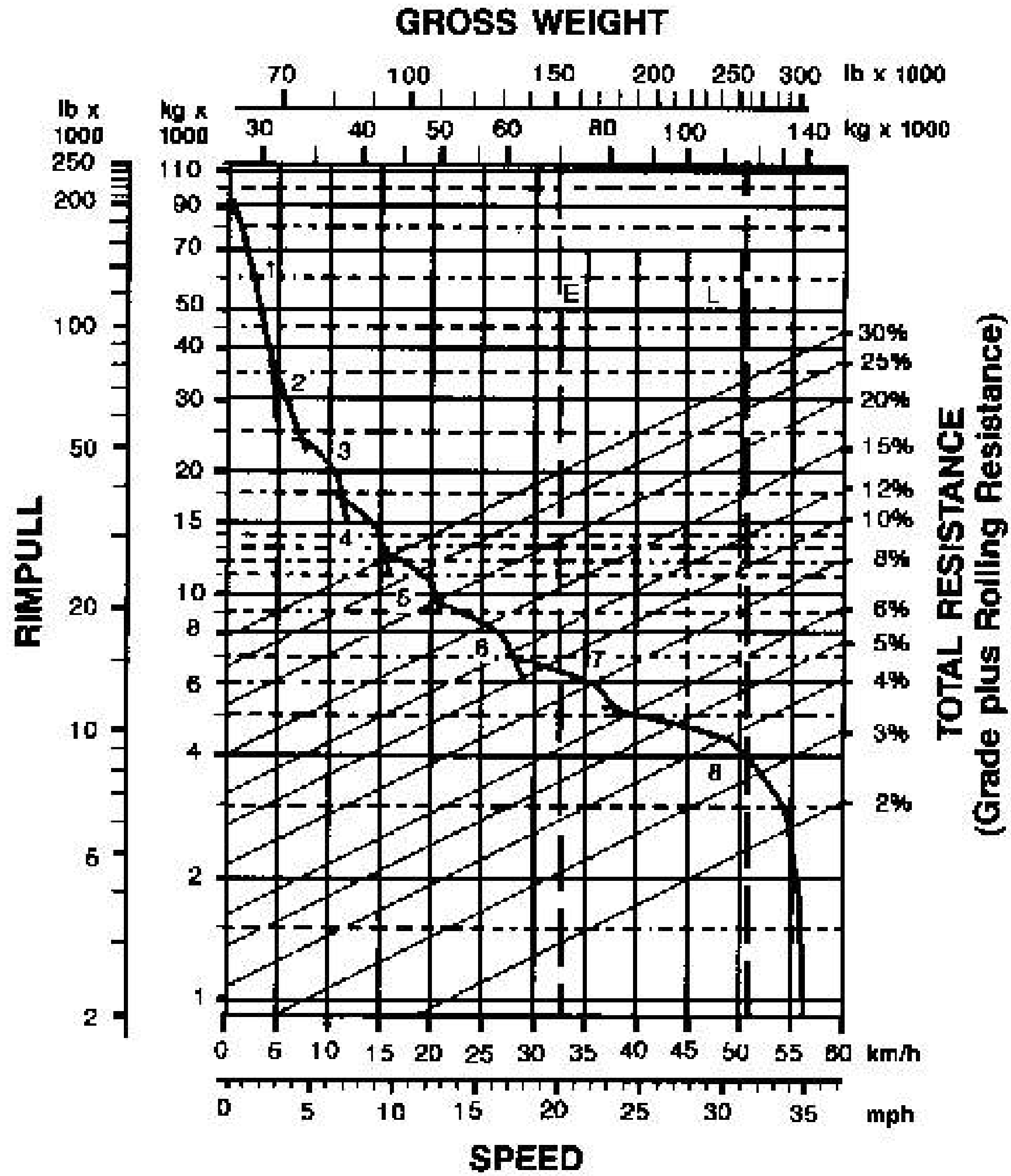


KEY

1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

E — Empty 68 860 kg (151,810 lb)
L — Loaded 116 035 kg (255,810 lb)

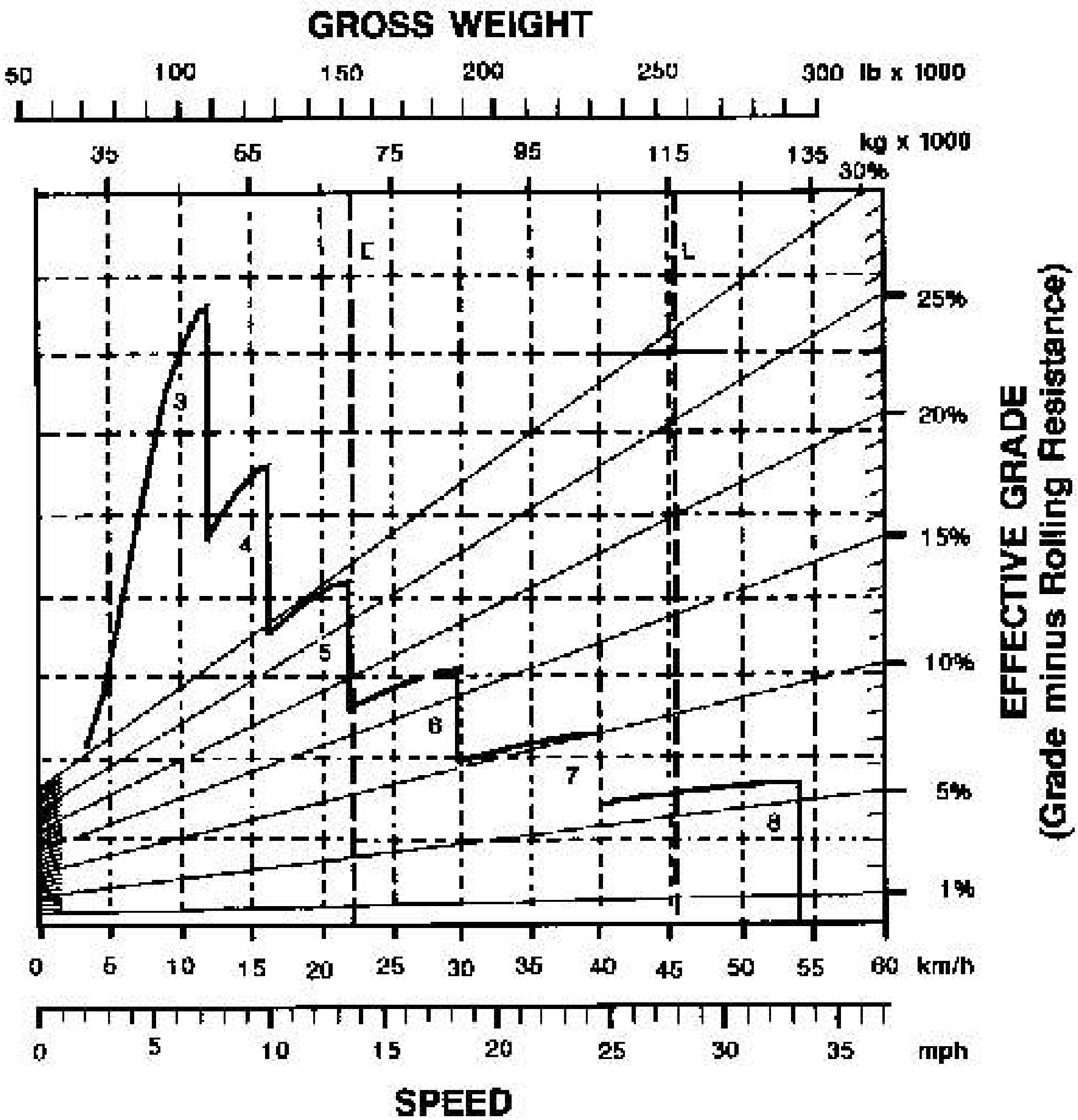


KEY

1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 8th Gear Direct Drive

KEY

E — Empty 68 860 kg (151,810 lb)
L — Loaded 116 035 kg (255,810 lb)

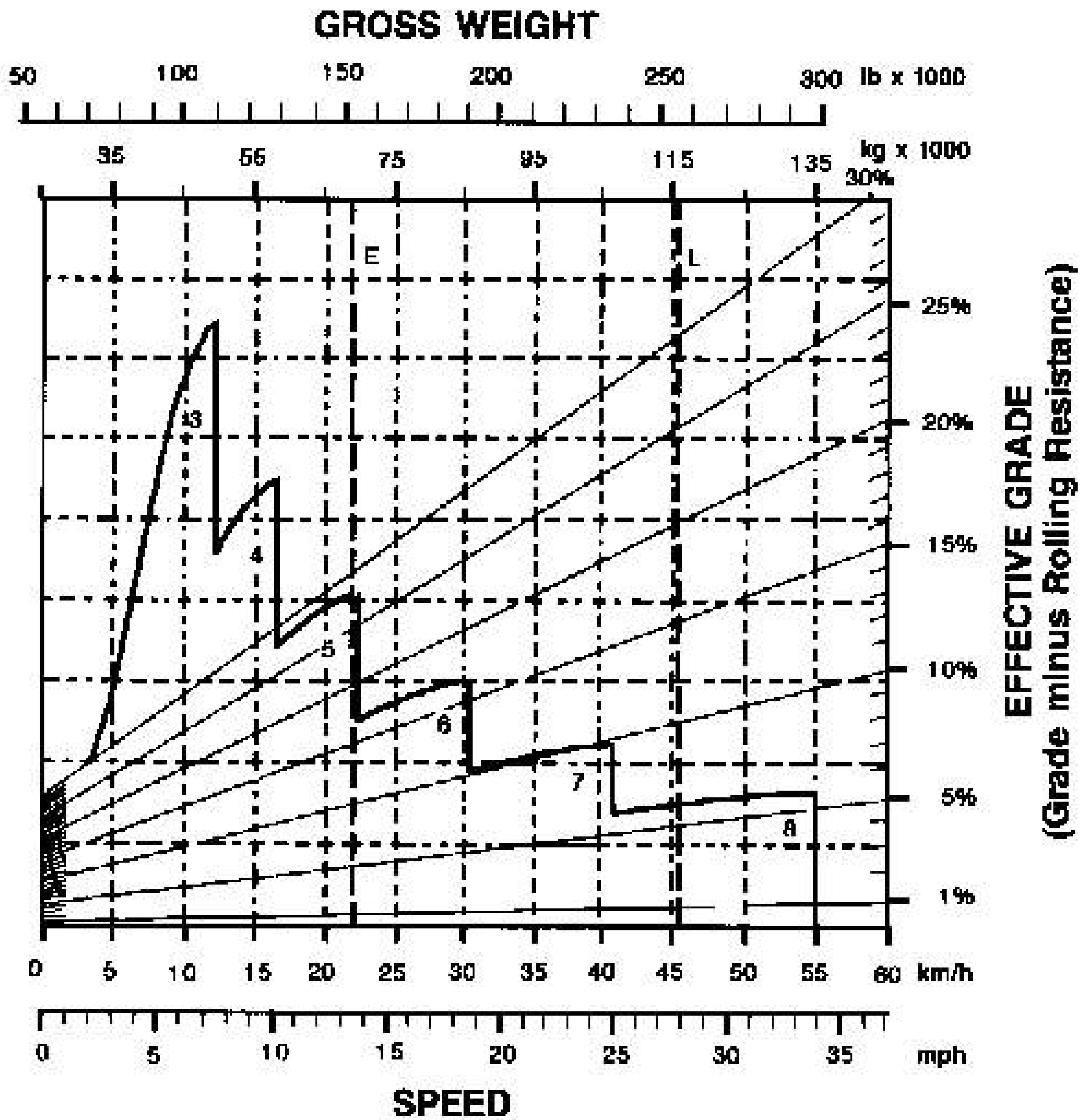


KEY

3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

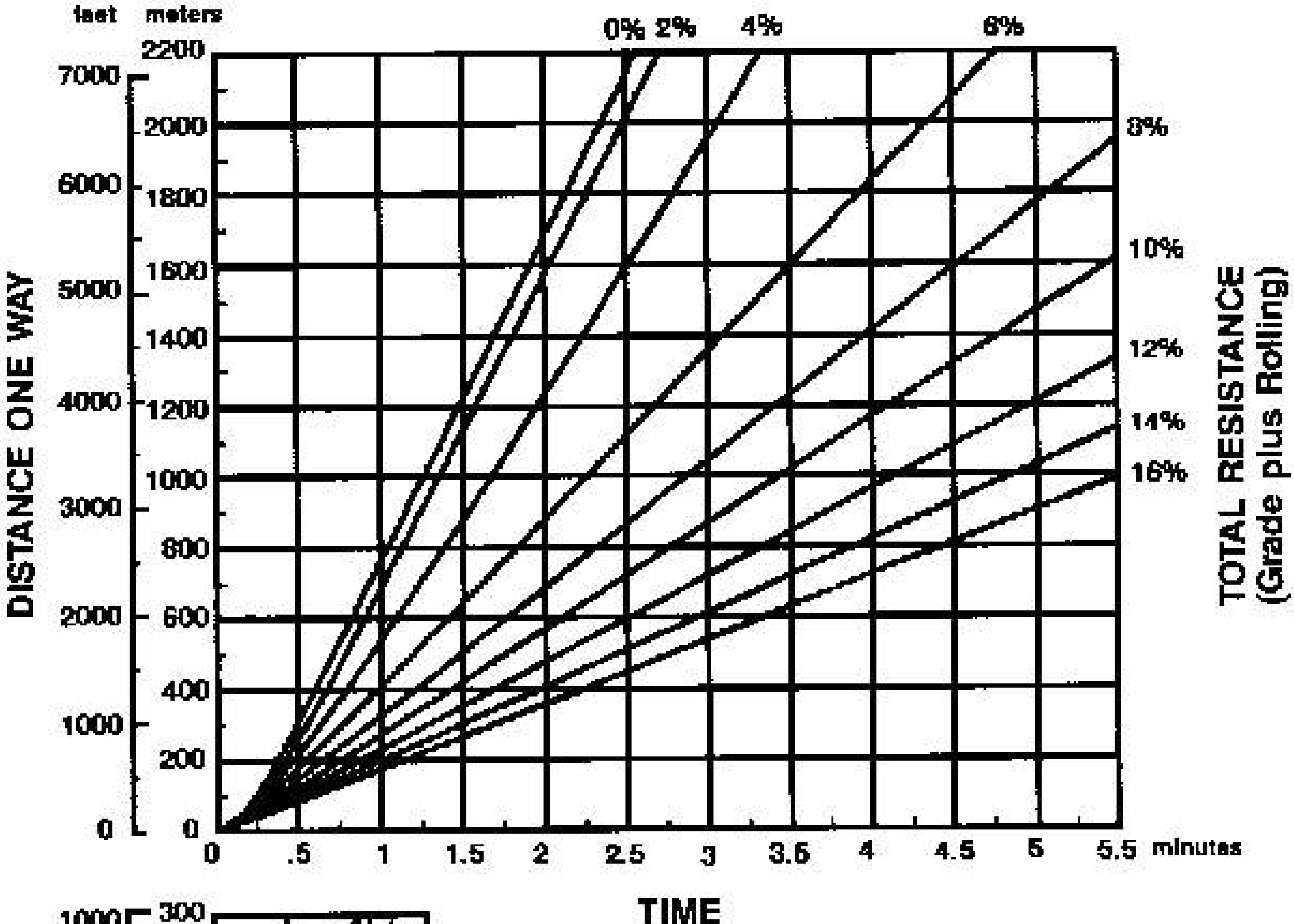
E — Empty 68 860 kg (151,810 lb)
L — Loaded 116 035 kg (255,810 lb)

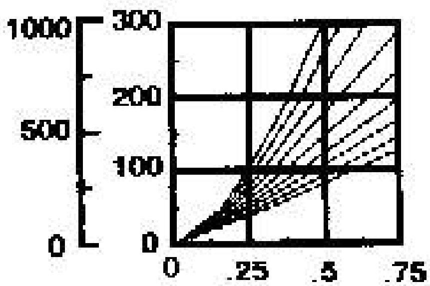


KEY
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY
E — Empty 68 860 kg (151,810 lb)
L — Loaded 116 035 kg (255,810 lb)

LOADED

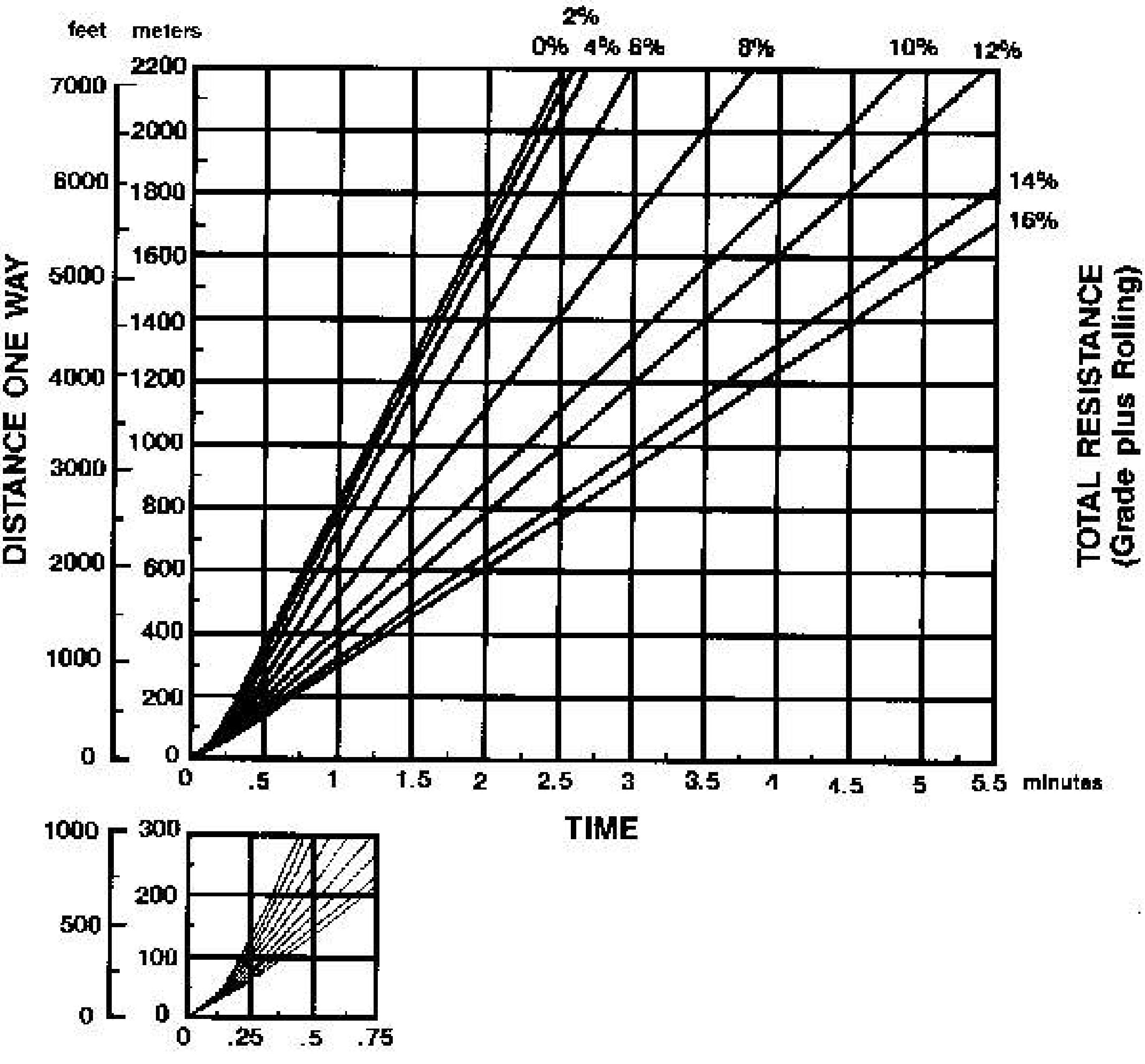




Empty weight: 68 860 kg (151,810 lb)
Payload: 47 175 kg (104,000 lb)

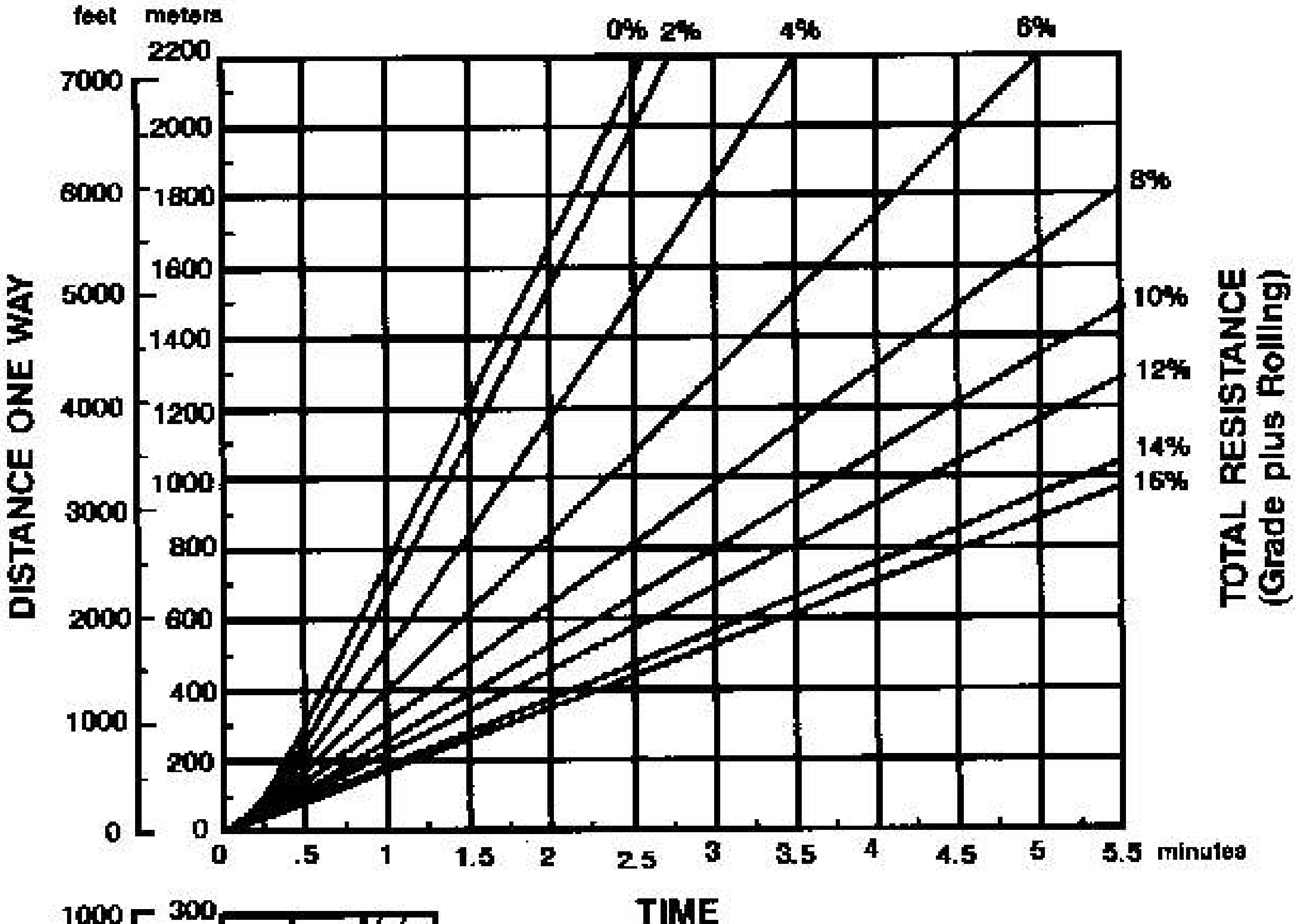
657E Travel Time — Empty
- 37.5-39 Tires
- Standard and Push-Pull

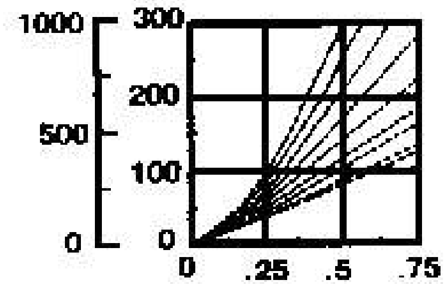
EMPTY



Empty weight: 68 860 kg (151,810 lb)

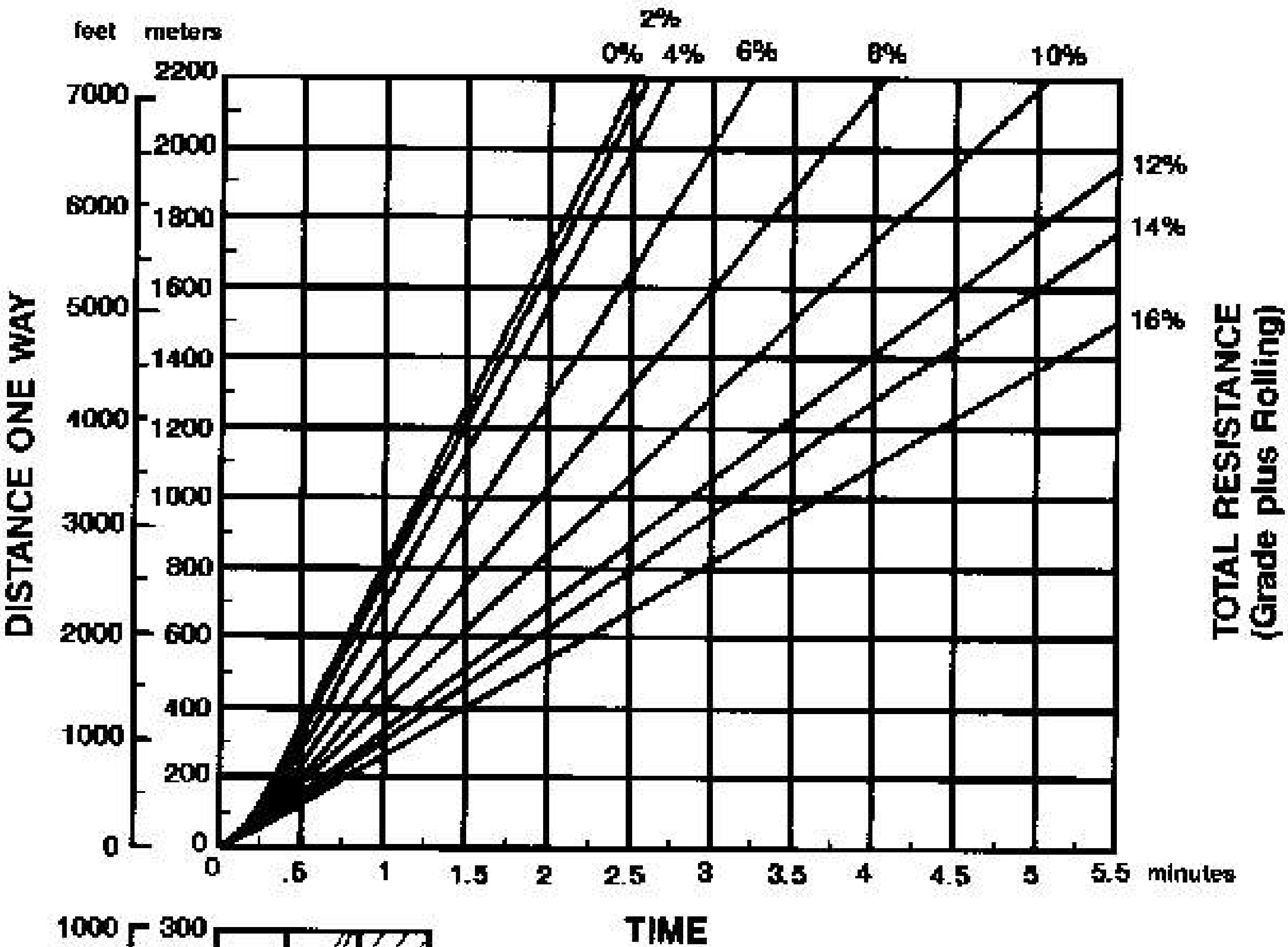
LOADED

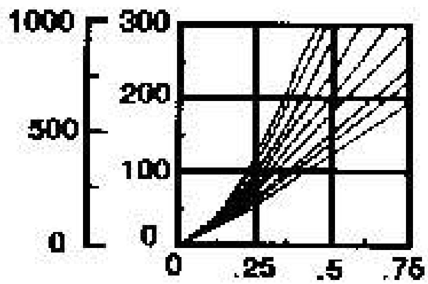




Empty weight: 75 875 kg (167,270 lb)
Payload: 47 175 kg (104,000 lb)

EMPTY



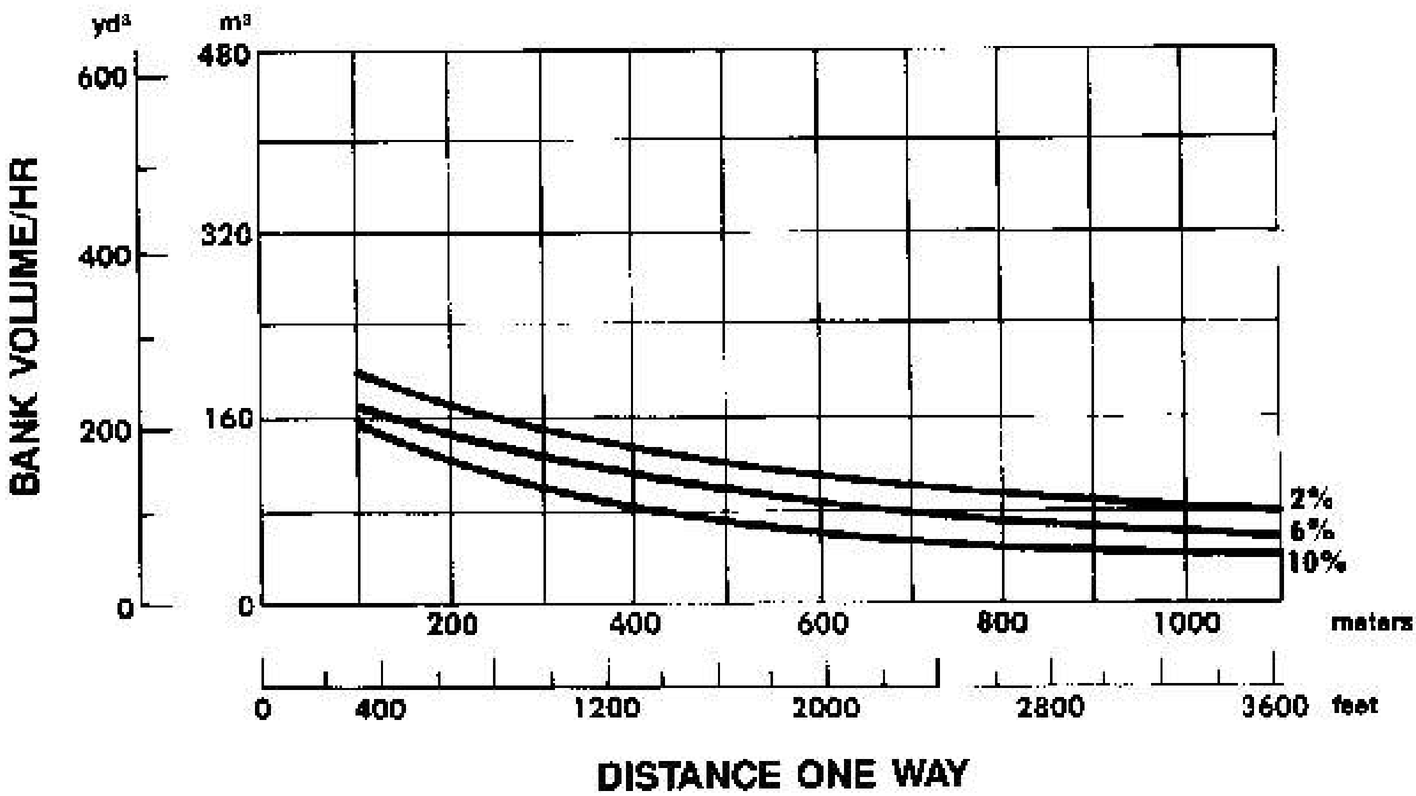


Empty weight: 75 875 kg (167,270 lb)

DISTANCE vs. PRODUCTION

CONDITIONS: Flat haul. Percentages shown are rolling resistance only.
100% efficiency (60 min hour).

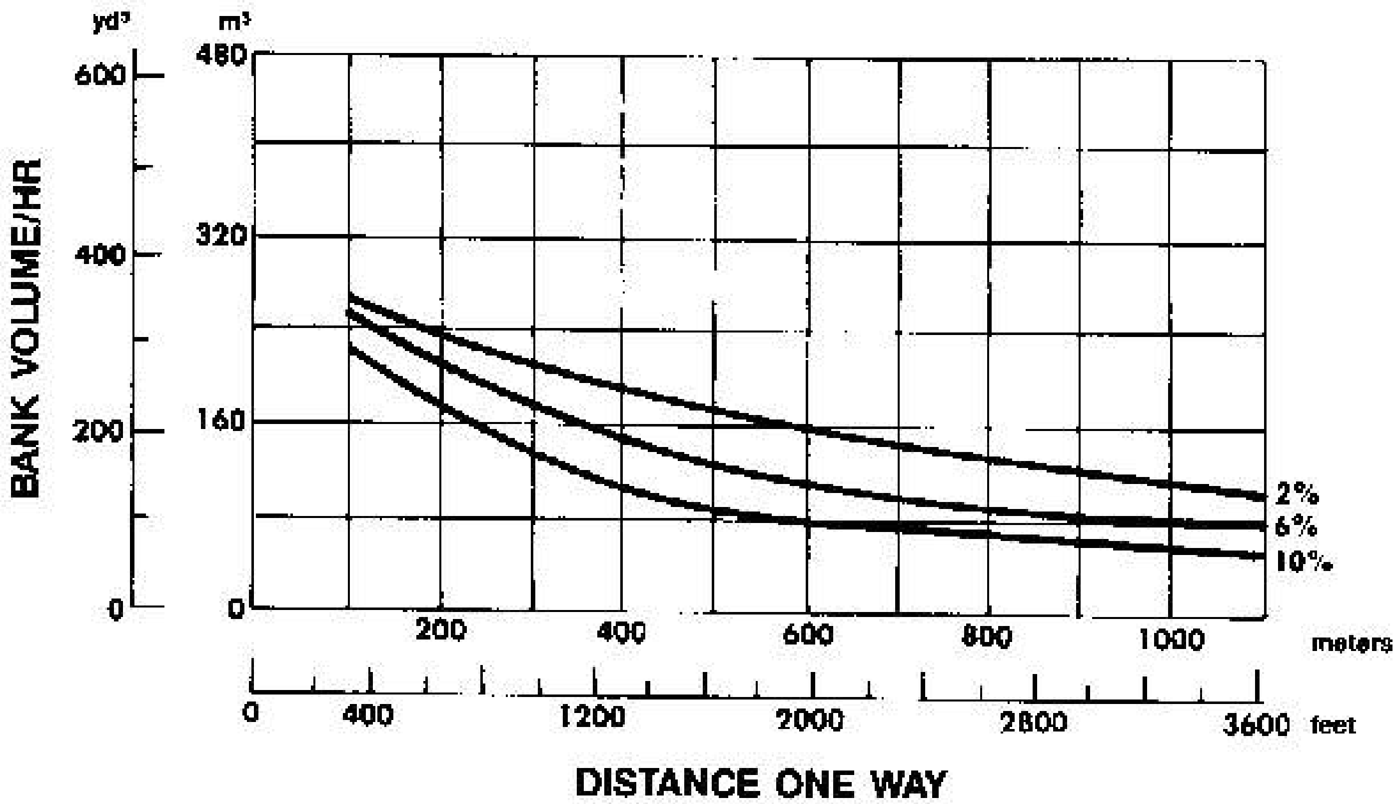
- Material: 1780 kg/m³ (3,000 lb/yd³).
- Payload: 11 790 kg, 6.7 Bm³ (25,989 lb, 8.8 BCY).
- Empty weight: 14 670 kg (32,340 lb).
- Fixed time: 1.6 min.



DISTANCE vs. PRODUCTION

CONDITIONS: Flat haul. Percentages shown are rolling resistance only.
100% efficiency (60 min hour).

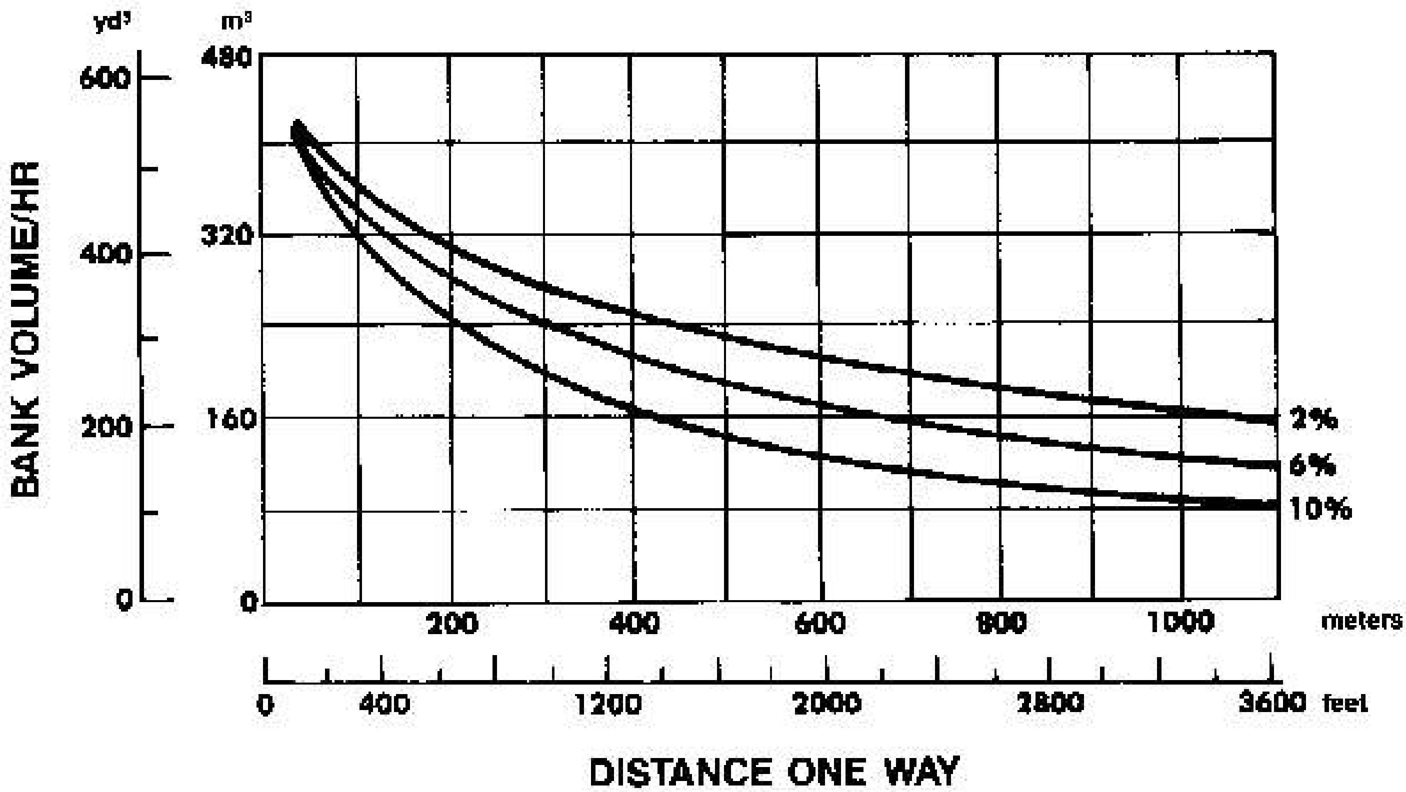
- Material: 1780 kg/m³ (3,000 lb/yd³).
- Payload: 17 420 kg, 9.7 Bm³ (38,400 lb, 12.8 BCY).
- Empty weight: 23 860 kg (52,600 lb).
- Fixed time: 1.6 min.



DISTANCE vs. PRODUCTION

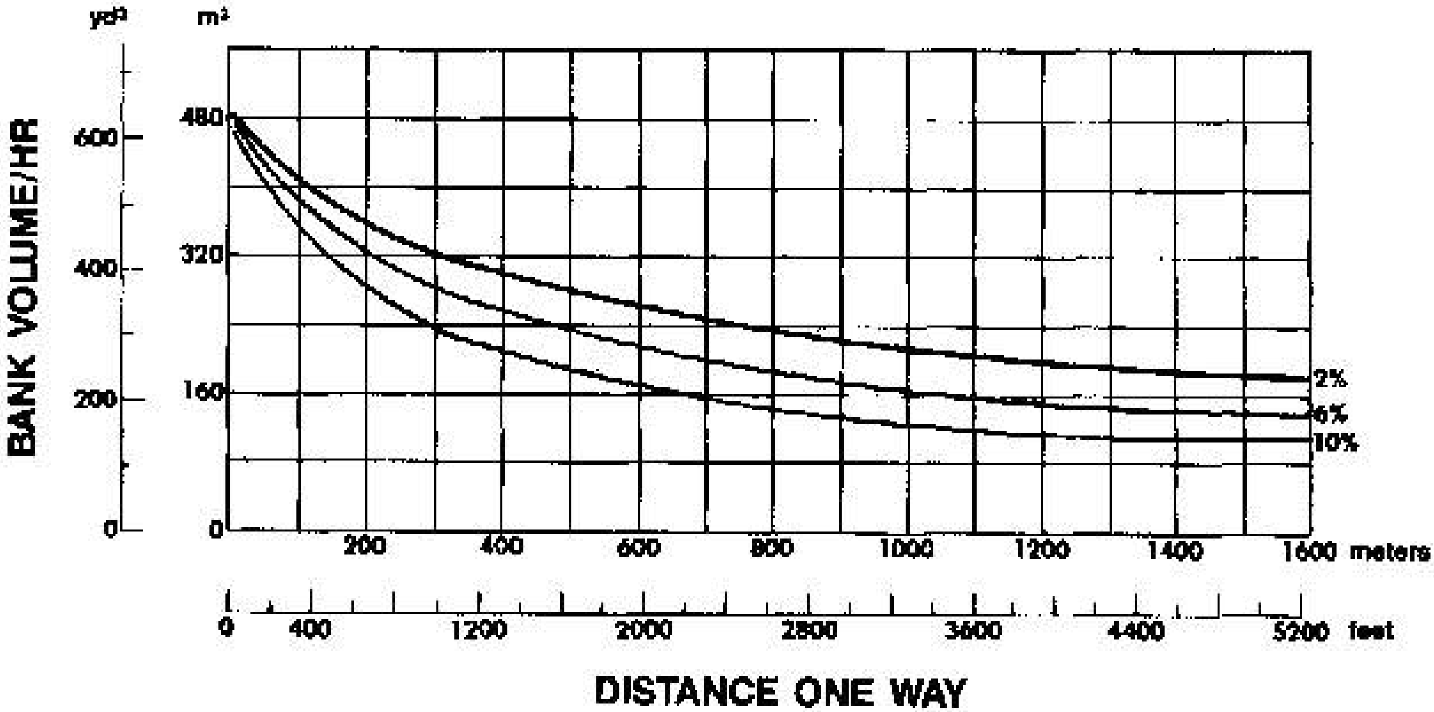
CONDITIONS: Flat haul. Percentages shown are rolling resistance only. 100% efficiency (60 min hour).

- Material: 1780 kg/m³ (3,000 lb/yd³).
- Payload: 21 770 kg, 12.2 Bm³ (48,000 lb, 16.0 BCY).
- Empty weight: 30 480 kg (67,195 lb).
- Fixed time: 1.4 min.



DISTANCE vs. PRODUCTION

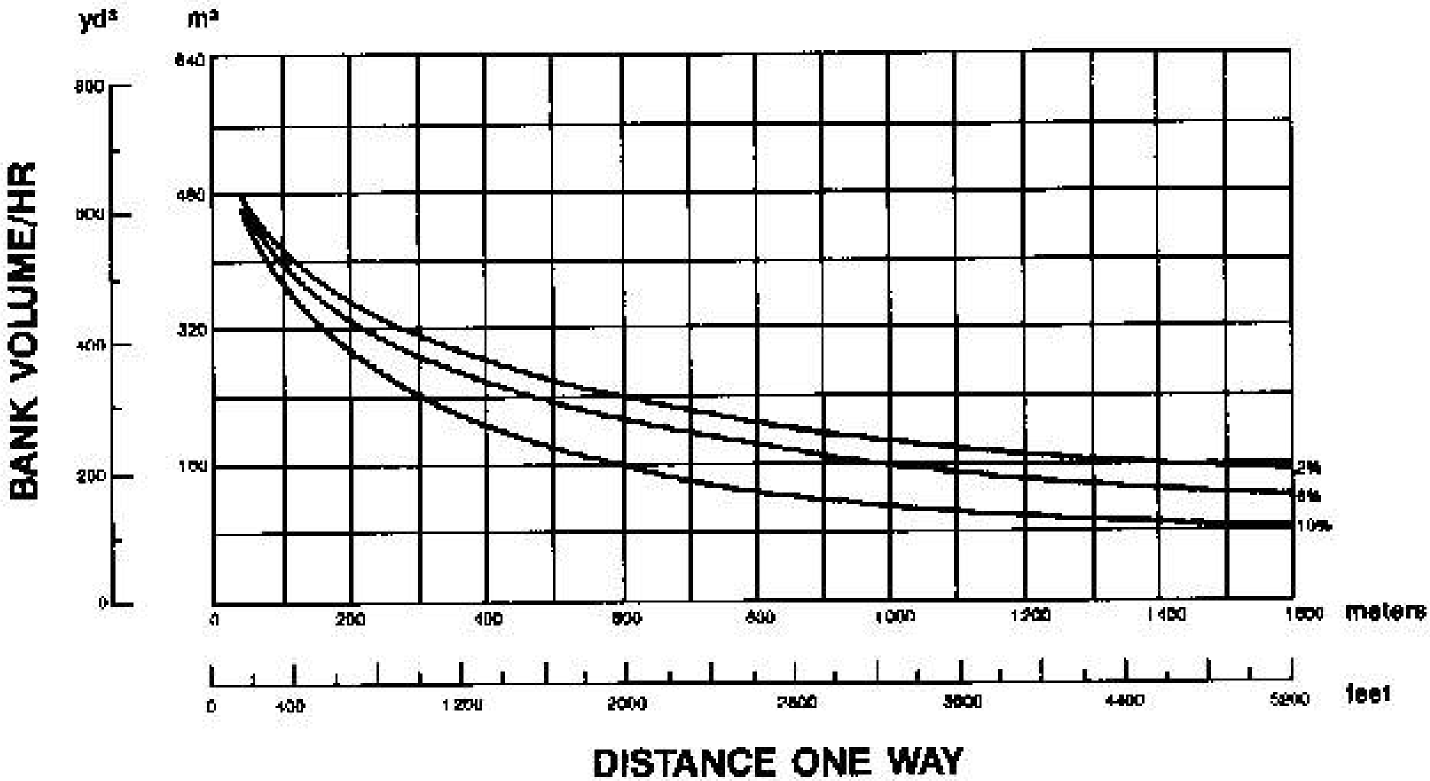
CONDITIONS: Flat haul. Percentages shown are rolling resistance only. 100% efficiency (60 min hour).
- Material: 1780 kg/m³ (3,000 lb/yd³).
- Payload: 24 950 kg, 12.2 Bm³ (55,000 lb, 16.0 BCY).
- Empty weight: 33 700 kg (74,300 lb).
- Fixed time: 1.6 min.



DISTANCE vs. PRODUCTION

CONDITIONS: Flat haul. Percentages shown are rolling resistance only.
100% efficiency (60 min hour).

- Material: 1780 kg/m³ (3,000 lb/yd³).
- Payload: 21 770 kg, 12.2 Bm³ (48,000 lb, 16.0 BCY).
- Empty weight: 35 160 kg (77,510 lb).
- Fixed time: 1.2 min.

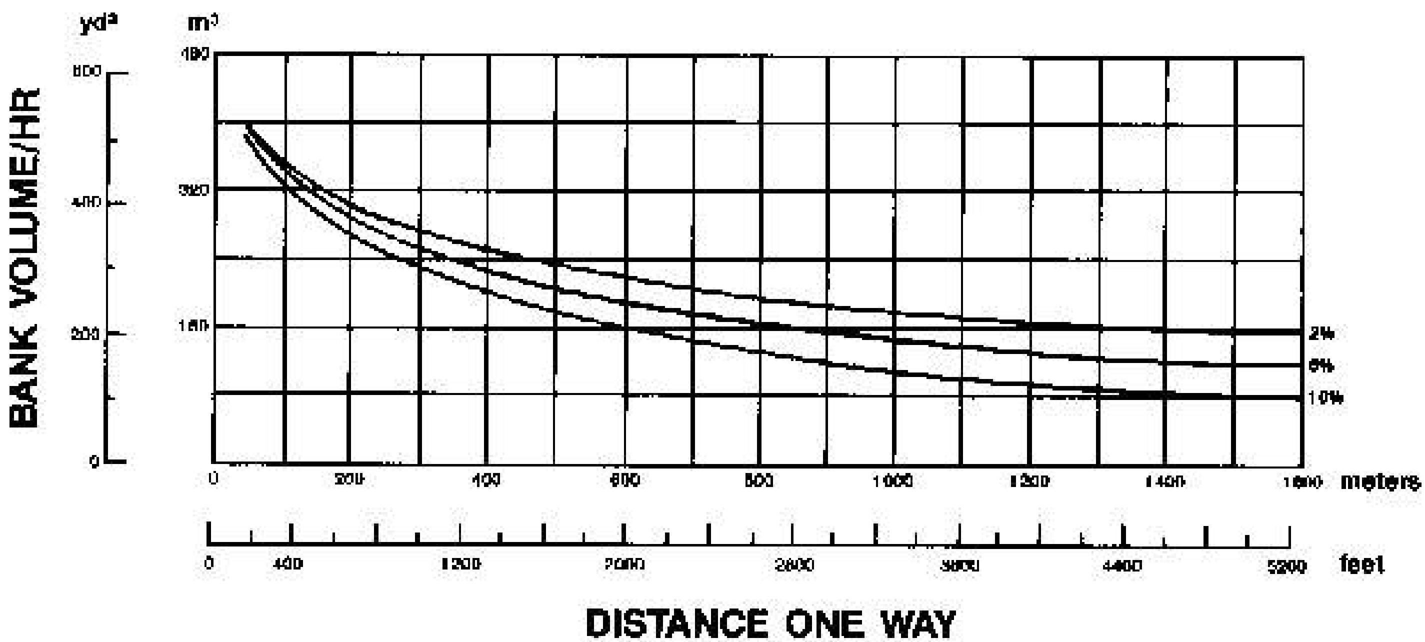


DISTANCE vs. PRODUCTION

CONDITIONS: Flat haul. Percentages shown are rolling resistance only.
100% efficiency (60 min hour).

- Material: 1780 kg/m^3 (3,000 lb/yd^3).
- Payload: 21 770 kg, 12.2 Bm^3 (48,000 lb, 16.0 BCY).
- Empty weight: 36 620 kg (80,735 lb).
- Fixed time: 1.5 min. (Includes loading both units and transfer time).

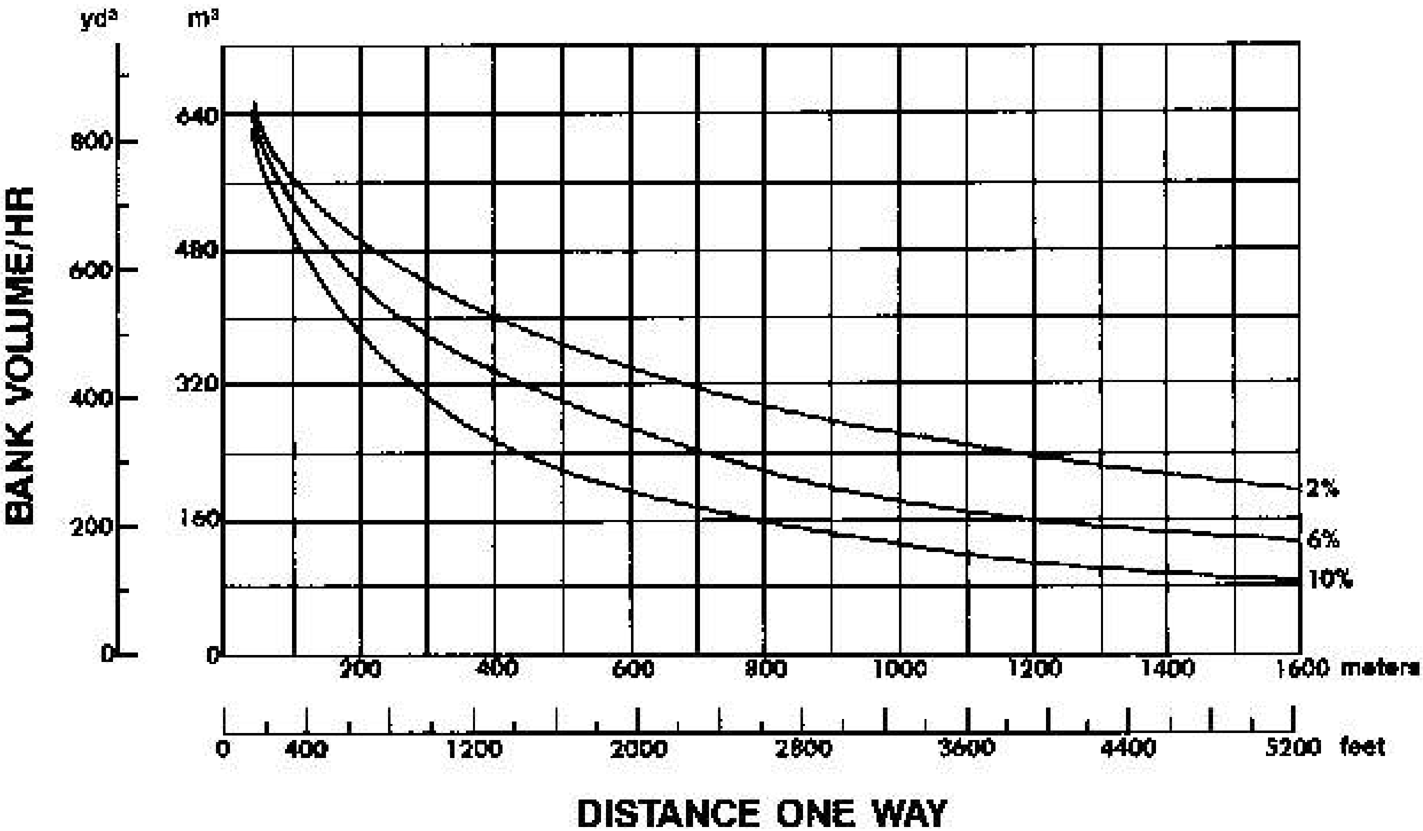
NOTE: Production estimates apply to one vehicle. Double these figures for a push-pull pair.



DISTANCE vs. PRODUCTION

CONDITIONS: Flat haul. Percentages shown are rolling resistance only.
100% efficiency (60 min hour).

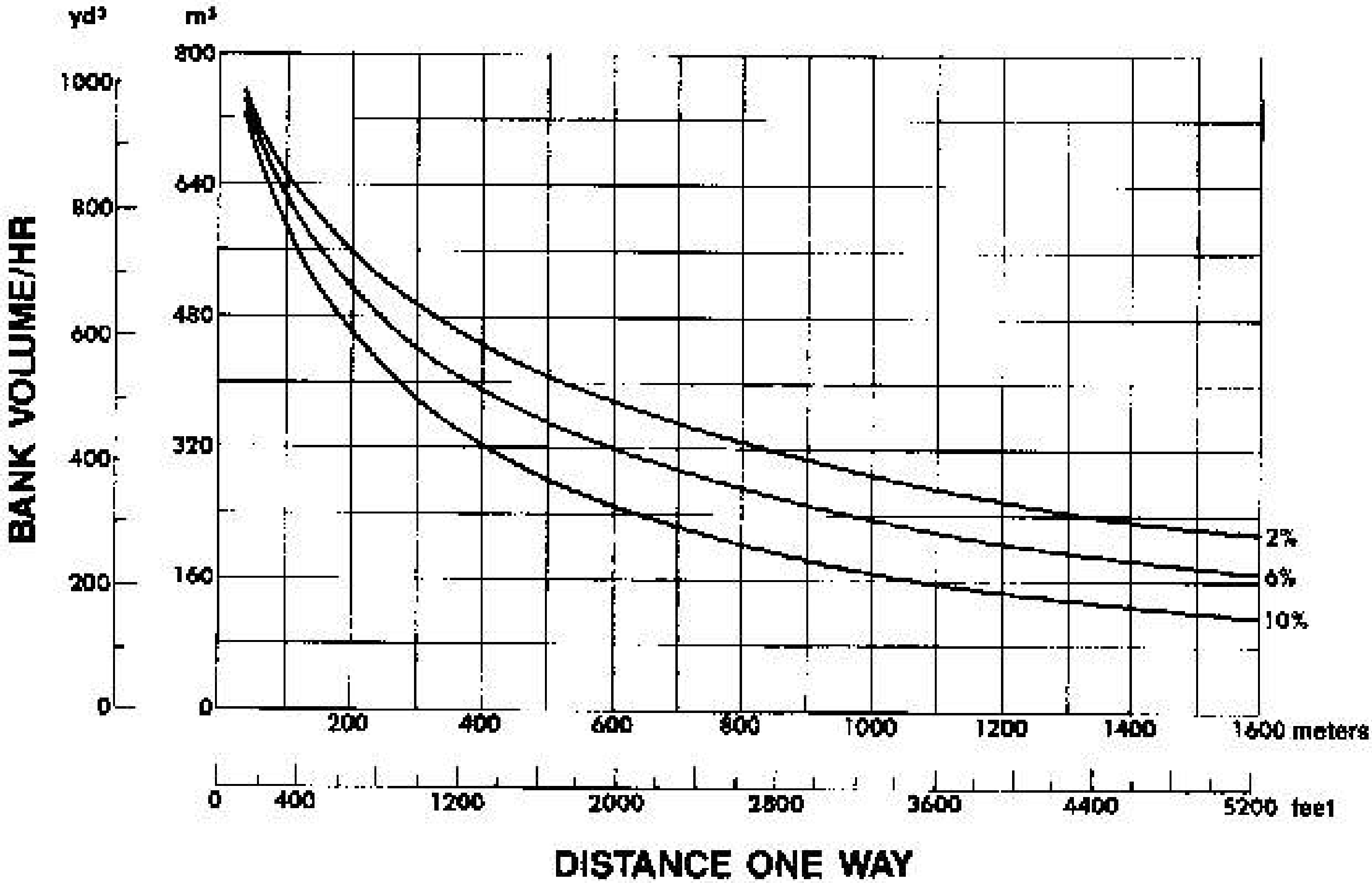
- Material: 1780 kg/m³ (3,000 lb/yd³).
- Payload: 34 020 kg, 19.1 Bm³ (75,000 lb, 25.0 BCY).
- Empty weight: 43 945 kg (96,880 lb).
- Fixed time: 1.3 min.



DISTANCE vs. PRODUCTION

CONDITIONS: Flat haul. Percentages shown are rolling resistance only. 100% efficiency (60 min hour).

- Material: 1780 kg/m³ (3,000 lb/yd³).
- Payload: 34 020 kg, 19.1 Bm³ (75,000 lb, 25.0 BCY).
- Empty weight: 50 845 kg (112,090 lb).
- Fixed time: 1.1 min.

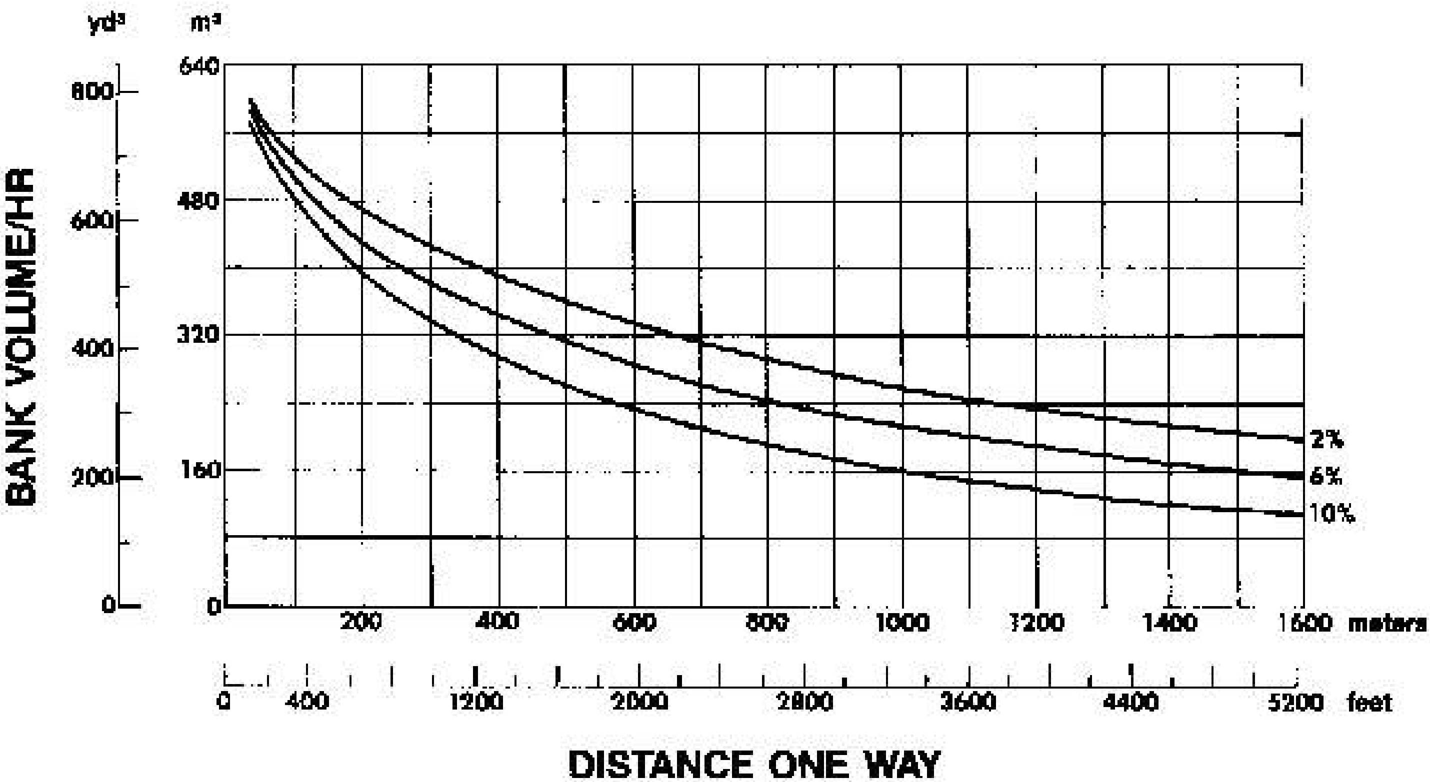


DISTANCE vs. PRODUCTION

CONDITIONS: Flat haul. Percentages shown are rolling resistance only. 100% efficiency (60 min hour).

- Material: 1780 kg/m³ (3,000 lb/yd³).
- Payload: 34 020 kg, 19.1 Bm³ (75,000 lb, 25.0 BCY).
- Empty weight: 52 385 kg (115,490 lb).
- Fixed time: 1.6 min. (includes loading both units and transfer time).

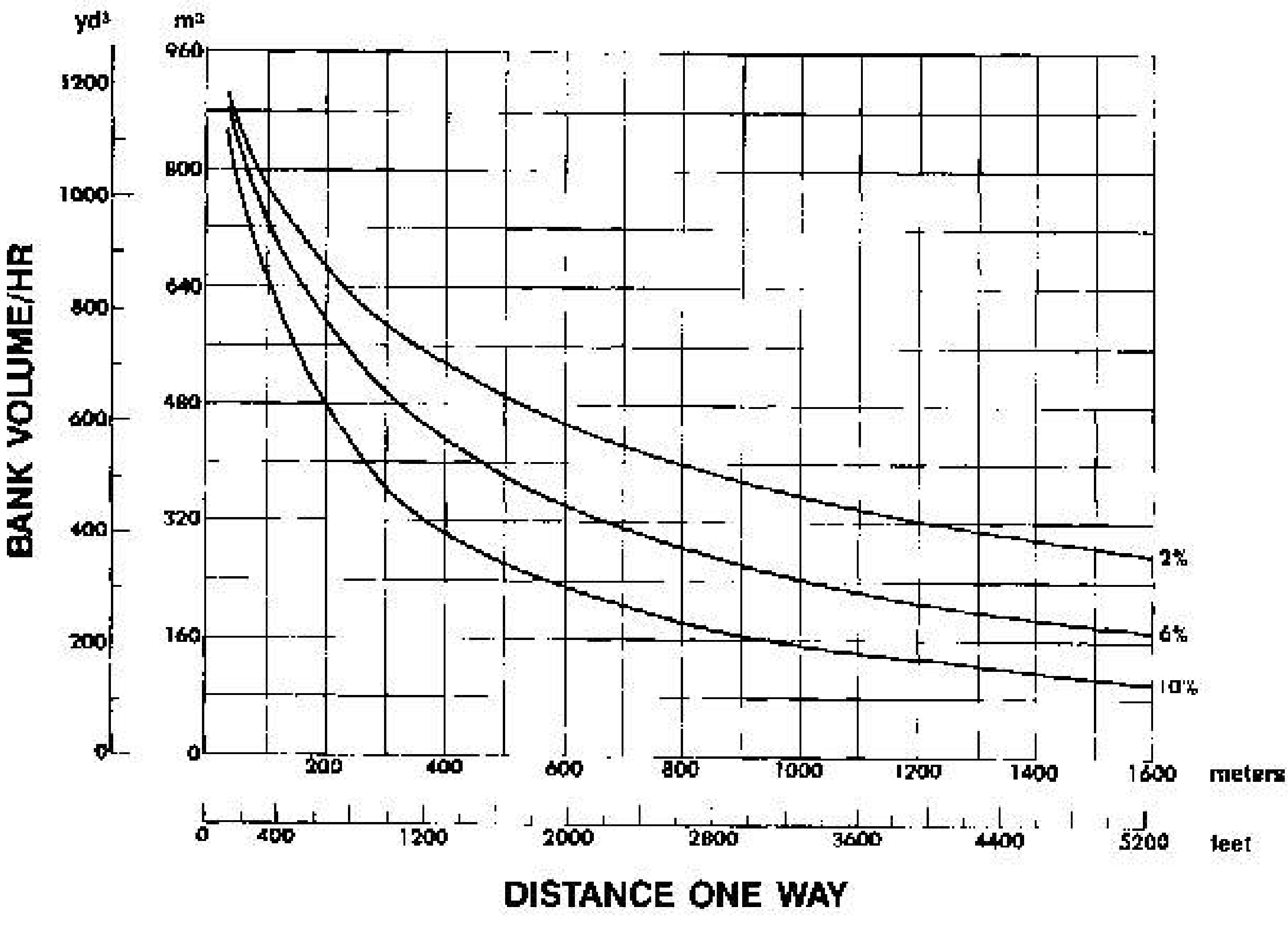
NOTE: Production estimates apply to one vehicle. Double these figures for a push-pull pair.



DISTANCE vs. PRODUCTION

CONDITIONS: Flat haul. Percentages shown are rolling resistance only.
100% efficiency (60 min hour).

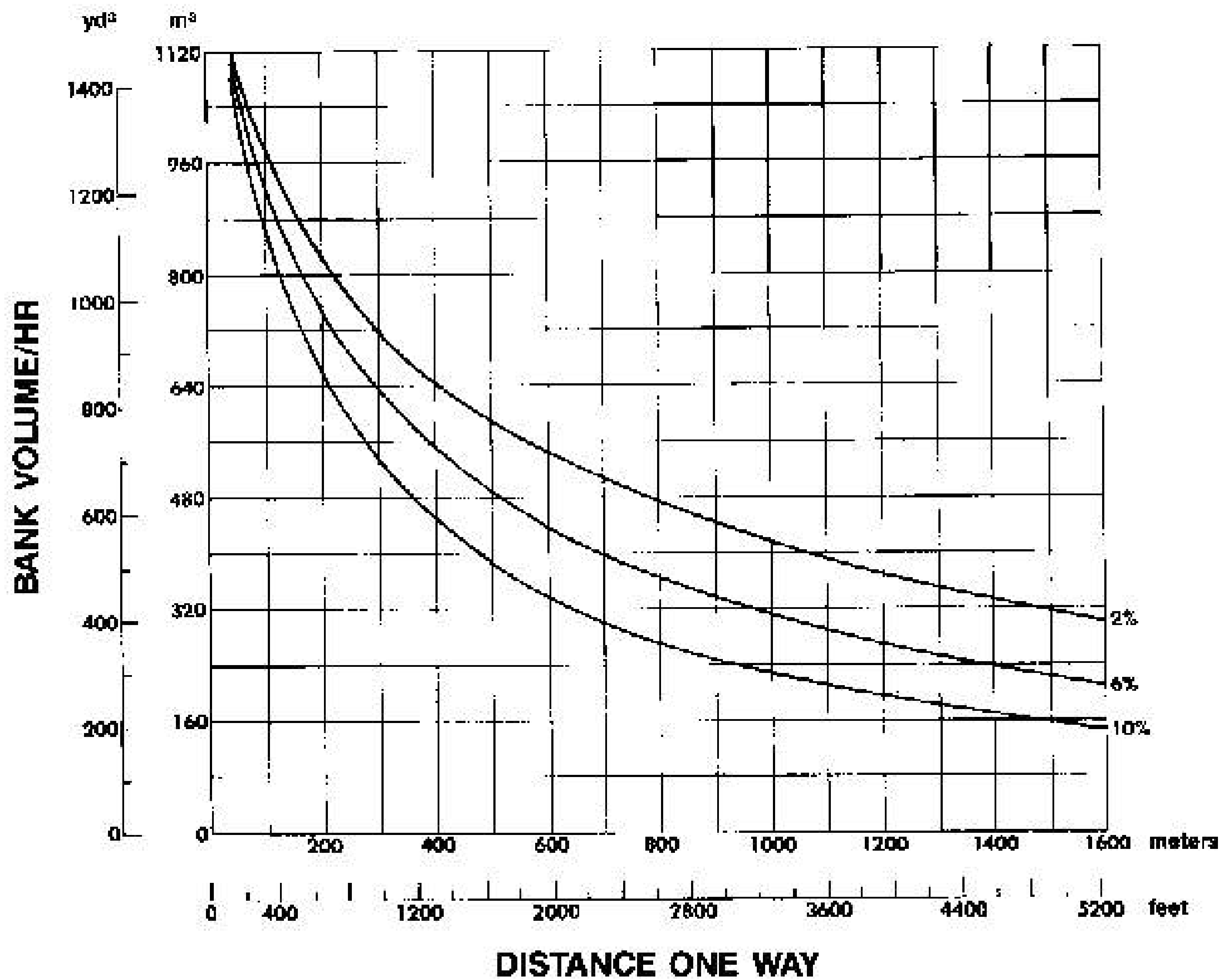
- Material: 1780 kg/m^3 (3,000 lb/yd^3).
- Payload: 47 200 kg, 26.5 Bm^3 (104,056 lb, 34.6 BCY).
- Empty weight: 60 950 kg (134,370 lb).
- Fixed time: 1.3 min.



DISTANCE vs. PRODUCTION

CONDITIONS: Flat haul. Percentages shown are rolling resistance only. 100% efficiency (60 min hour).

- Material: 1780 kg/m³ (3,000 lb/yd³).
- Payload: 47 200 kg, 26.5 Bm³ (104,000 lb, 34.6 BCY).
- Empty weight: 68 860 kg (151,810 lb).
- Fixed time: 1.0 min.

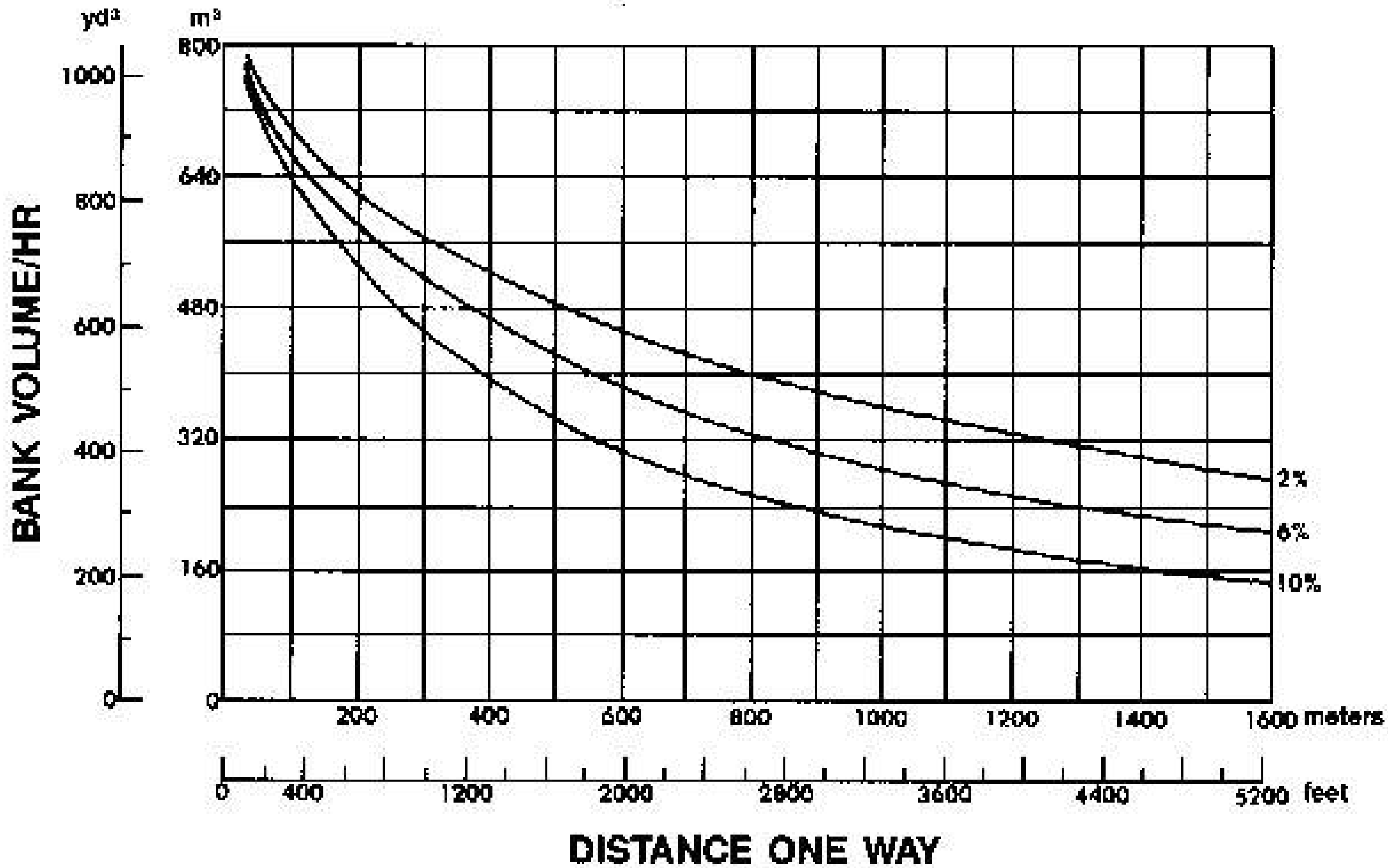


DISTANCE vs. PRODUCTION

CONDITIONS: Flat haul. Percentages shown are rolling resistance only.
100% efficiency (60 min hour).

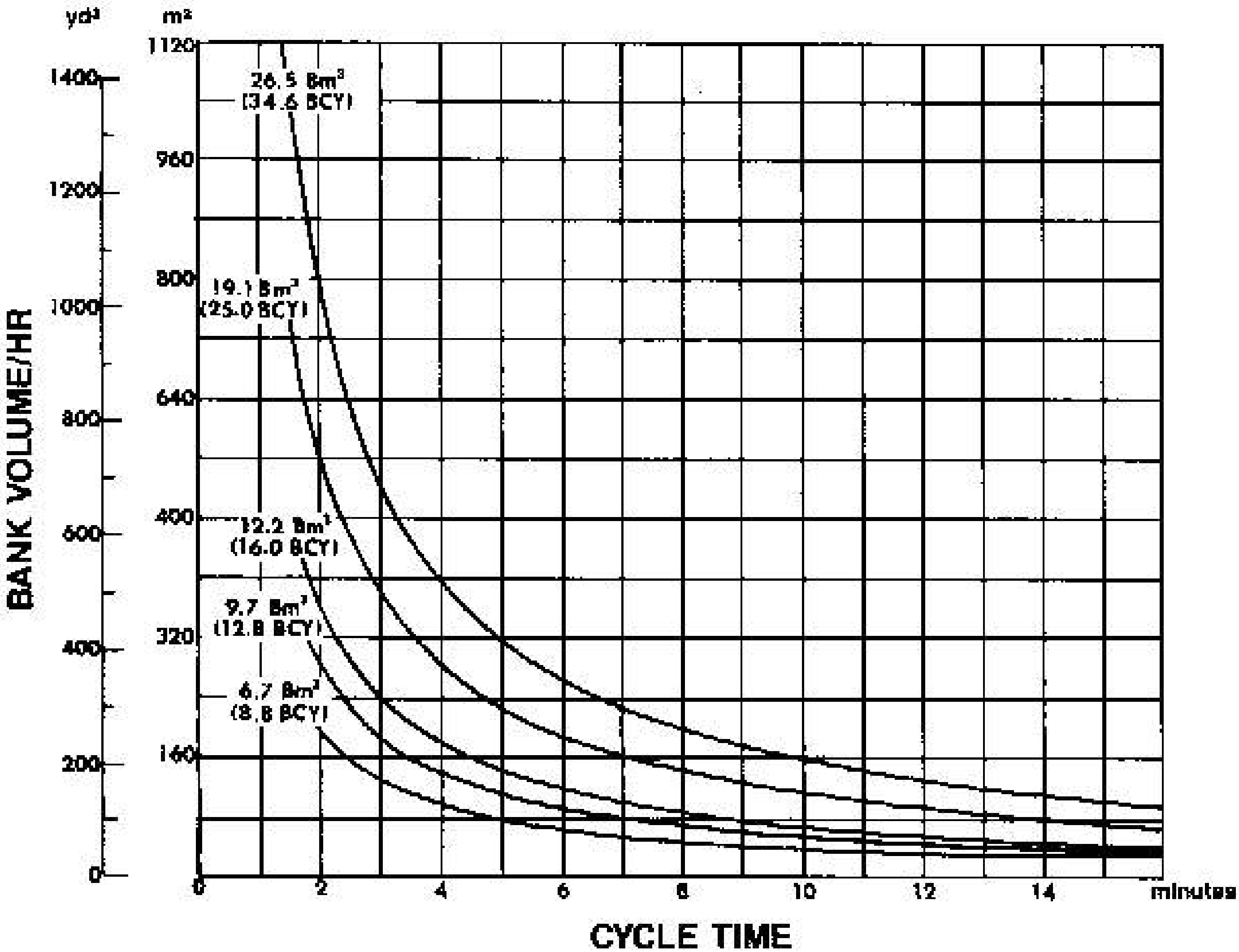
- Material: 1780 kg/m³ (3,000 lb/yd³).
- Payload: 47 200 kg, 26.5 Bm³ (104,000 lb, 34.6 BCY).
- Empty weight: 72 640 kg (160,140 lb).
- Fixed time: 1.7 min. (includes loading both units and transfer time).

NOTE: Production estimates apply to one vehicle.
Double these figures for a push-pull pair.



HOURLY PRODUCTION vs. CYCLE TIME

VEHICLE CAPACITY:
613C @ 6.7 Bm³/trip (8.8 BCY)
615C @ 9.7 Bm³/trip (12.8 BCY)
621E, 623E, 627E @ 12.2 Bm³/trip (16.0 BCY)
631E Series II, 637E Series II @ 19.1 Bm³/trip (25.0 BCY)
651E, 657E @ 26.5 Bm³/trip (34.6 BCY)



CONSTRUCTION & MINING TRUCKS
CONSTRUCTION & MINING TRACTORS

CONTENTS

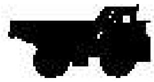
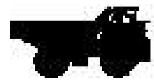
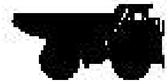
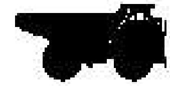
Features:

- **Caterpillar four-stroke-cycle diesels . . .** turbocharged, aftercooled, automatic variable timing . . . adjustment-free fuel system (direct injection).
- **Electronically-controlled automatic transmission** . . . seven speeds forward (6 for 785 and 789), one reverse . . . speed sensing device automatically shifts transmission between 1st and gear selected by operator.
- **Oil cooled disc brakes** provide retarding, service, parking, and secondary braking in one sealed, fade-resistant, maintenance-free unit. 769C, 771C, 773B, 775B and 777C front brakes are caliper disc. The operator can switch the front brakes (769C, 771C, 773B, 775B and 777C) out of the service system when not needed. Front brakes will continue to activate as part of the secondary system. 784, 785, 789 and 793 front brakes are oil-cooled disc. Optional on 777C.
- **Full hydraulic steering,** with front suspension cylinders serving as kingpins.
- **Four independent,** self-contained, oil-pneumatic suspension cylinders absorb loading and road shocks. Wide spacing for stability.
- **Dual slope body** has V-bottom for load balance and retention. Low loading height and center of gravity.
- **Quarry trucks** have single-slope flat floor for smooth, metered dumping of materials into crushers or hoppers.
- **Roll Over Protective Structure (ROPS) cab** standard on all models.
- **Separate hydraulic systems** prevents cross contamination of system.

Tractor Features:

- **Yoke type hitch** oscillates four ways to reduce frame stresses.

9

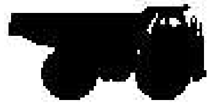
MODEL	769C		771C Quarry Truck		773B		775B Quarry Truck	
Flywheel Power	336 kW	450 HP	336 kW	450 HP	485 kW	650 HP	485 kW	650 HP
Gross Power	353 kW	474 HP	353 kW	474 HP	509 kW	682 HP	509 kW	682 HP
Operating Weight (Empty)*	31 176 kg	68,750 lb	33 814 kg	74,560 lb	39 396 kg	86,869 lb	42 324 kg	93,325 lb
Max. Gross Vehicle Weight	67 586 kg	149,000 lb	73 970 kg	163,100 lb	92 534 kg	204,000 lb	101 700 kg	224,300 lb
Top Speed (Loaded)	75 km/h	47 mph	40 km/h	25 mph	62 km/h	38 mph	45 km/h	28 mph
Distribution: Empty:								
Front	50%		46%		47%		44%	
Rear	50%		54%		53%		56%	
Distribution: Loaded:								
Front	33%		33%				33%	33%
Rear	67%		67%				67%	67%
Max. Capacity, Tons**	36.3 t	40 T	40 t	44 T	52.6 t	58 T	60 t	66 T
Cubic Yards —								
Struck (SAE)	17.5 m³	22.9 yd³	17.9 m³	23.4 yd³	26.0 m³	34.0 yd³	28.5 m³	37.2 yd³
Heaped (2:1) (SAE)	23.6 m³	30.9 yd³	27.1 m³	35.5 yd³	34.1 m³	44.6 yd³	39.3 m³	51.4 yd³
Engine Model	3408		3408		3412		3412	
No. Cylinders	8		8		12		12	
Bore	137 mm	5.4"	137 mm	5.4"	137 mm	5.4"	137 mm	5.4"
Stroke	152 mm	6.0"	152 mm	6.0"	152 mm	6.0"	152 mm	6.0"
Displacement	18 L	1099 in³	18 L	1099 in³	27 L	1649 in³	27 L	1649 in³
Standard Tires, Front & Dual Rear	18.00-33, 28 PR (E-3)		18.00R33 (E-4)		21.00-35, 32 PR (E-3)		24.00R35 (E-4)	
Vehicular Clearance Turning Circle	18.5 m	60'8"	18.5 m	60'8"	23.5 m	77'0"	23.5 m	77'0"
Fuel Tank Refill Capacity	530 L	140 U.S. gal	530 L	140 U.S. gal	700 L	185 U.S. gal	700 L	185 U.S. gal
GENERAL DIMENSIONS (Empty):								
Height to Canopy Rock Guard Rail	4.03 m	13'2.5"	4.03 m	13'2.5"	4.33 m	14'2.3"	4.33 m	14'2.3"
Wheel Base	3.71 m	12'2"	3.71 m	12'2"	4.19 m	13'9"	4.19 m	13'9"
Overall Length◄	8.19 m	26'10"	8.38 m	27'6"	9.27 m	30'5"	9.47 m	31'1"
Loading Height (Empty)	3.22 m	10'7.4"	3.22 m	10'7.4"	3.71 m	12'2"	3.71 m	12'2"
Height at Full Dump	7.70 m	25'3"	7.70 m	25'3"	8.70 m	28'6.7"	8.70 m	28'6.7"
Body Length	5.31 m	17'5"	5.51 m	18'1"	6.43 m	21'1"	6.71 m	22'
Width	4.514 m	14'10"	4.91 m	16'2"	4.70 m	15'5"	4.91 m	16'2"
Width (Shipping)***	3.64 m	11'11"	4.24 m	13'11"	3.79 m	12'5"	4.24 m	13'11"
Front Tire Tread	3.10 m	10'2"	3.10 m	10'2"	3.18 m	10'5"	3.18 m	10'5"

*Weights include lubricants, coolant, full fuel tank and standard body.

**Maximum rating requires selection of proper tires and is dependent on selection of optional equipment. Maximum gross vehicle weight (empty vehicle weight plus payload) should not be exceeded.

◄Includes catwalk protrusion beyond front bumper on 769C, 771C, 773B and 775B.

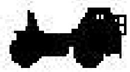
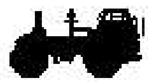
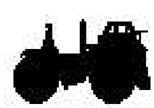
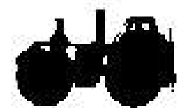
***Disassembled.

MODEL	777C		785		789		793	
Flywheel Power	649 kW	870 HP	962 kW	1290 HP	1272 kW	1705 HP	1534 kW	2057 HP
Gross Power	686 kW	920 HP	1028 kW	1380 HP	1342 kW	1800 HP	1611 kW	2160 HP
Operating Weight (Empty)*	60 065 kg	132,422 lb	96 353 kg	212,458 lb	121 922 kg	268,837 lb	143 564 kg	323,708 lb
Max. Gross Vehicle Weight	146 966 kg	324,000 lb	249 433 kg	550,000 lb	317 460 kg	700,000 lb	376 488 kg	830,000 lb
Top Speed (Loaded)	60 km/h	37 mph	56 km/h	35 mph	54 km/h	34 mph	54 km/h	34 mph
Distribution: Empty:								
Front	47%		47%		47%		47%	
Rear	53%		53%		53%		53%	
Distribution: Loaded:								
Front	33%		33%		33%		33%	
Rear	67%		67%		67%		67%	
Max. Capacity, Tons**	86.2 t	96 T	136 t	150 T	177 t	195 T	218 t	240T
Cubic Yards (Option 1 Body)								
Struck (SAE)	36.4 m³	47.6 yd³	57 m³	74 yd³	73 m³	96.0 yd³	98 m³	128 yd³
Heaped (2:1) (SAE)	51.3 m³	67.1 yd³	78 m³	102 yd³	105 m³	137 yd³	129 m³	169 yd³
Engine Model	3508 (EUI)		3512		3516		3516	
No. Cylinders	8		12		16		16	
Bore	170 mm	6.7"	170 mm	6.7"	170 mm	6.7"	170 mm	6.7"
Stroke	190 mm	7.5"	190 mm	7.5"	190 mm	7.5"	190 mm	7.5"
Displacement	34.5 L	2105 in³	51.8 L	3158 in³	69.0 L	4211 in³	69.0 L	4211 in³
Standard Tires, Front & Dual Rear	24.00-49, 48 PR (E-3)		33.00-51		37.00R57		40.00-57	
Vehicular Clearance Turning Circle	25.8 m	84'6"	30.5 m	100'4"	30.2 m	99'2"	30.2 m	99'2"
Fuel Tank Refill Capacity	946 L	250 U.S. gal	1893 L	500 U.S. gal	3222 L	851 U.S. gal	3861 L	1020 U.S. gal
GENERAL DIMENSIONS (Empty):								
Height to Canopy Rock Guard Rail	4.97 m	16'3.7"	5.77 m	18'11"	6.15 m	20'2"	6.43 m	21'1"
Wheel Base	4.57 m	15'	5.18 m	17'0"	5.70 m	18'8"	5.90 m	19'4"
Overall Length	9.79 m	32'1"	11.02 m	36'2"	12.18 m	39'11"	12.86 m	42'3"
Loading Height (Empty)	4.17 m	13'8"	4.98 m	16'4"	5.21 m	17'1"	5.86 m	19'3"
Height at Full Dump	9.42 m	30'11"	11.20 m	36'9"	11.61 m	38'1"	13.21 m	43'4"
Body Length (Inside)	6.86 m	22'6"	7.65 m	25'1"	8.15 m	26'9"	8.94 m	29'4"
Width (Operating)	5.463 m	17'11"	6.64 m	21'9"	7.34 m	24'1"	7.41 m	24'4"
Width (Shipping)	3.51 m†	11'6"†						
(Knocked down)			3.84 m	12'6"	3.84 m	12'6"	3.84 m	12'6"
Front Tire Tread	4.16 m	13'8"	4.85 m	15'11"	5.43 m	17'10"	5.61 m	18'6"

*Weights include lubricants, coolant, full fuel tank and option 1 body.
**Maximum rating requires selection of proper tires and is dependent on selection of optional equipment. Maximum gross vehicle weight (empty vehicle weight plus payload) should not be exceeded.
†3.65 m (12'0") Sub Assembled Body.
4.88 m (16'0) Assembled machine catwalk removed.

9

MODEL	**768C**		**772B**		**776C**		**784**	
Flywheel Power	336 kW	**450 HP**	405 kW	**650 HP**	648 kW	**870 HP**	962 kW	**1290 HP**
Gross Power	353 kW	**474 HP**	509 kW	**682 HP**	686 kW	**920 HP**	1029 kW	**1380 HP**
Operating Weight*	24 326 kg	**53,626 lb**	33 976 kg	**74,905 lb**	49 896 kg	**110,000 lb**	49 896 kg	**196,825 lb**
Engine Model	**3408**		**3412**		**3508 (EUI)**		**3512**	
No. Cylinders	**8**		**12**		**8**		**12**	
Bore	137 mm	**5.4"**	137 mm	**5.4"**	170 mm	**6.7"**	170 mm	**6.7"**
Stroke	152 mm	**6"**	152 mm	**6"**	190 mm	**7.5"**	190 mm	**7.5"**
Displacement	18 L	**1099 in³**	27 L	**1649 in³**	34.5 L	**2105 in³**	51.8 L	**3156 in³**
Standard Tires, Front & Dual Rear	**18.00-33 24 PR (E-3)**		**24.00-35 36 PR (E-3)**		**27.00-49 36 PR (E-3)**		**36.00R51 (E-3)**	
Vehicular Clearance Turning Circle	18.5 m	**60'8"**	23.6 m	**77'0"**	25.8 m	**84'6"**	33.5 m	**109'10"**
Fuel Tank Refill Capacity	530 L	**140 U.S. gal**	700 L	**185 U.S. gal**	946 L	**250 U.S. gal**	3222 L	**850 U.S. gal**
GENERAL DIMENSIONS (Empty):								
Height to Top of Cab	3.61 m	**11'10"**	3.96 m	**13'0"**	4.55 m	**14'11"**	5468 mm	**17'1"**
Wheel Base	3.71 m	**12'2"**	4.19 m	**13'9"**	4.57 m	**15'0"**	5180 mm	**17"**
Overall Length**	6.72 m	**22'8"**	7.59 m	**24'11"**	8.06 m	**26'5.5"**	9343 mm	**30'8"**
Ground Clearance	610 mm	**24.0"**	584 mm	**23.0"**	699 mm	**27.5"**	933 mm	**3'4"**
Width, shipping (Disassembled)	3.63 m	**11'11"**	3.79 m	**12'5"**	3.51 m	**11'6"**	6742 mm	**22'2"**
Height to Yoke Seat	2.13 m	**7'0"**	2.84 m	**9'4"**	3.40 m	**11'2"**	3953 mm	**13'4"**
Rear axle to Hitch Pin	91 mm	**3.58"**	508 mm	**20"**	762 mm	**30"**	850 mm	**2'9"**
Front Tire Tread	3.10 m	**10'2"**	3.25 m	**10'8"**	4.07 m	**13'4"**	4935 mm	**16'2"**

*Operating Weights include coolant, lubricants, hitch, full fuel tank and operator
**Includes catwalk protrusion beyond front bumper on the 768C and 772B

MODEL TIRE SIZE	PLY RATING/ STAR RATING*	TYPE
769C		
18.00-33◄	28	E-3
18.00-33	28	E-4
18.00-33	32	E-3
18.00-33	32	E-4
18.00R33	★★	E-2
18.00R33	★★	E-4
771C		
18.00R33	★★	E-4
18.00R33◄	★★	E-3
773B		
21.00-35◄	32	E-3
21.00-35	32	E-4
21.00-35	36	E-3
21.00-35	36	E-4
21.00R35	★★	E-3
21.00R35	★★	E-4
24.00-35	30	E-3
24.00-35	30	E-4
24.00R35	★★	E-3
24.00R35	★★	E-4
775B		
24.00R35	★★	E-4
24.00R35◄	★★	E-3
24.00-35	42	E-4
777C		
24.00-49◄	48	E-3
24.00-49	48	E-4
24.00R49	★★	E-3
24.00R49	★★	E-4
27.00-49	36	E-4
27.00-49	42	E-4
27.00R49	★★	E-3
27.00R49	★★	E-4
785		
33.00-51	50	E-4
33.00-51	58	E-4
33.00R51	★★	E-3
33.00R51	★★	E-4

MODEL TIRE SIZE	PLY RATING/ STAR RATING*	TYPE
789		
36.00-51	58	E-4
36.00R51	★★	E-3
36.00R51	★★	E-4
37.00R57	★★	E-4
793		
40.00-57	68	E-4
40.00R57	★★	E-4
768C		
18.00-33◄	24	E-3
18.00-33	24	E-4
18.00-33	28	E-3
18.00-33	28	E-4
18.00R33	★★	E-2
18.00R33	★★	E-3
18.00R33	★★	E-4
772B		
24.00-35◄	36	E-3
24.00-35	36	E-3
24.00-35	36	E-4
24.00R35	★★	E-3
24.00R35	★★	E-4
776C		
27.00-49◄	36	E-3
27.00-49	36	E-4
27.00R49	★★	E-3
784		
36.00-51	58	E-4
36.00R51	★★	E-3
36.00R51	★★	E-4

◄Standard Tire
*Manufacturer uses star (★) rating system instead of ply rating.

USE OF RIMPULL-SPEED-GRADEABILITY CURVES

Machine speed attainable, gear range and available rimpull can be determined from the curves in this section when gross vehicle weight and total effective grade (for total resistance) are known.

Rimpull is the force (in kg, lb or kN) available between the tire and the ground to propel the machine (limited by traction).

Gross Vehicle Weight, in kilograms or pounds, is Truck Weight + Payload.

Total Effective Grade (or Total Resistance) is Grade Resistance plus Rolling Resistance expressed as percent grade. Grade is measured or estimated. Rolling resistance is estimated (see "Tables" section for typical values.) 10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade.

Example —

With a grade of 6% and a rolling resistance of 40 kg/metric ton (80 lb/U.S. ton), find total resistance.

Rolling resistance =
40 kg/metric ton ÷ 10 = 4% Effective Grade.
(80 lb/ton ÷ 20 = 4%.)
Total resistance = 4% rolling + 6% grade = 10%.

Altitude Derating

Rimpull force and speed must be derated for altitude similar to flywheel horsepower. The percentage loss in rimpull force approximately corresponds to the percentage loss in flywheel horsepower. See Tables Section for altitude derations.

Rimpull-Speed-Gradeability

To determine gradeability performance: Read from gross weight down to the % of total resistance. (Total resistance equals actual % grade *plus* 1% for each 10 kg/metric ton (20 lb./U.S. ton) of rolling resistance.) From this weight-resistance point, read horizontally to the curve with the highest obtainable speed range, then down to maximum speed. Usable rimpull depends upon traction available and weight on drive wheels.

USE OF BRAKE PERFORMANCE CURVES

The speed that can be maintained when the machine is descending a grade with retarder applied can be determined from the retarder curves in this section when gross vehicle weight and total effective grade are known.

Select appropriate grade distance chart that covers total downhill haul; don't break haul into individual segments.

To determine brake performance: Read from gross weight down to the percent effective grade. (Effective grade equals actual % grade *minus* 1% for each 10 kg/metric ton (20 lb./U.S. ton) of rolling resistance.) From this weight-effective grade point, read horizontally to the curve with the highest obtainable speed range, then down to maximum descent speed brakes can safely handle without exceeding cooling capacity. When braking, engine RPM should be maintained at the highest possible level without overspeeding. If cooling oil overheats, reduce ground speed to allow transmission to shift to next lower speed range.

Total Effective Grade (or Total Resistance) is grade assistance *minus* rolling resistance.
10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade.

Example —

With a favorable grade of 20% and rolling resistance of 50 kg/metric ton (100 lb/U.S. ton), find Total Effective Grade.

(50 kg/metric ton) = 50 ÷ 10 = 5% Effective Grade
(from Rolling Resistance)
100 lb/ton = 100 ÷ 20 = 5% Effective Grade
20% (grade) − 5% (resistance) =
15% Total Effective Grade

MECHANICAL POWER TRAIN EFFICIENCIES

In selling against electric drive trucks, power train efficiency is an important consideration. To better illustrate the advantages of mechanical drive performance, grade horsepower, power train efficiency, and retarding horsepower should be compared to electric drive trucks.

Grade horsepower can be calculated by the following formula:

Metric

$$\text{grade HP} = \frac{\text{GVW (kg)} \times \text{TR} \times \text{Speed (km/h)}}{273.75}$$

English

$$= \frac{\text{GVW (lb)} \times \text{TR} \times \text{Speed (mph)}}{375}$$

where TR (total resistance) = Rolling resistance + Grade resistance (expressed as a decimal)

English example

643,000 lb GVW, 2% rolling resistance, +8% actual grade at 8.9 mph would require 1530 HP

$$\frac{643{,}000 \times (.02 + .08) \times 8.9}{375} = 1530 \text{ HP}$$

Metric example

291 665 kg GVW, 2% rolling resistance, +8% actual grade at 14.4 km/h would require 1530 HP

$$\frac{291\,665 \times (.02 + .08) \times 14.4}{273.75} = 1530 \text{ HP}$$

We then calculate power train efficiency by dividing grade horsepower by the gross horsepower produced by the engine. Most electric drive trucks run at constant maximum horsepower while under load. Mechanical drive trucks, however, lug the engine and may produce somewhat less than maximum horsepower. Engine power curves must be utilized to determine exact horsepower produced.

Example

$$\frac{\text{1530 grade horsepower}}{\text{1800 gross engine HP}} \times 100 = 85\% \text{ power train efficiency}$$

This exercise illustrates the effect of an efficient mechanical drive power train and should yield results in the 80-85% efficiency range. The same calculation for electric drive trucks would be lower (70-78% range) with a maximum efficiency of about 78% for the most common systems.

Likewise, retarding horsepower being consumed by the retarding system can be calculated by the following formula:

Metric

$$\text{retarding HP} = \frac{\text{GVW (kg)} \times \text{TR} \times \text{Speed (km/h)}}{273.75}$$

English

$$= \frac{\text{GVW (lb)} \times \text{TR} \times \text{Speed (mph)}}{375}$$

where TR (total resistance) = Rolling resistance + Grade resistance (expressed as a decimal)

English example

643,000 lb GVW, 2% rolling resistance, −8% actual grade at 16 mph would equate to −1646 HP

$$\frac{643{,}000 \times (.02 - .08) \times 16}{375} = 1646 \text{ HP}$$

Metric example

291 665 kg GVW, 2% rolling resistance, −8% actual grade at 20 km/h would equate to −1278 HP

$$\frac{291\,665 \times (.02 - .08) \times 20}{273.75} = 1278 \text{ HP}$$

Maximum continuous retarding horsepowers are:

769C	581 HP	785	1865 HP
773B	705 HP	789	2110 HP
777C	1200 HP	793	2515 HP

This formula is intended for use in determining horsepower being consumed in the field based on field measurements. It is not intended to indicate how fast trucks should be operated on grade. Only job conditions, proper operating procedure, and good judgement should determine safe operating speeds during retarder use.

USE OF THE TRAVEL TIME CHARTS

One-way travel time can be determined from graphs on the following pages when one-way travel distance and total resistance are known. (Total resistance is rolling resistance + grade resistance expressed in percent.) 10 kg/metric ton (or 20 lbs/U.S. ton) equals 1% equivalent grade.

If total resistance is negative (grade assistance greater than rolling resistance) machine may accelerate down hill requiring the use of retarder or brakes. Travel time charts *cannot* be used in these cases. Consult respective machine retarder curve to establish maximum safe downhill speed.

Travel times include vehicle acceleration and deceleration at the load and dump points.

Two graphs are given for each hauling unit: one for the vehicle carrying its rated payload and one for the empty vehicle.

Travel times were derived using Caterpillar Vehicle Simulation Program and standard tire inputs. Travel times for machines equipped with (larger) optional tires vary slightly.

TYPICAL FIXED TIMES FOR HAULING UNITS

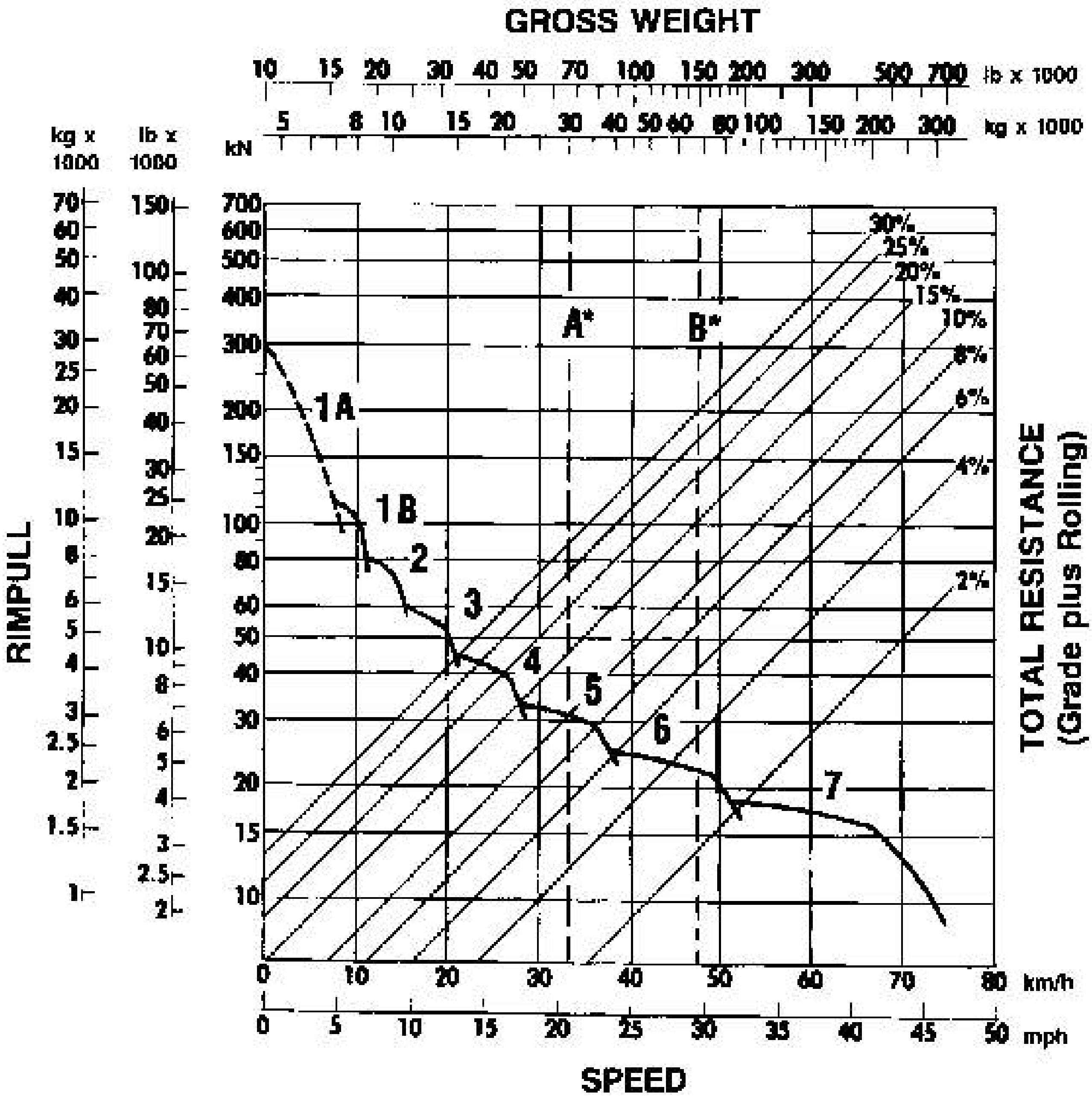
Fixed time for hauling units include:
1. Truck load time (various with loading tool)
2. Truck maneuver in load area (Truck exchange) (Typically 0.6-0.8 min.)
3. Maneuver and dump time at dump point (Typically 1.0-1.2 min.)

Total cycle time is the combination of:
1. The above fixed time
2. Hauling time (Loaded)
3. Return time (Empty)

Example — assume load tool spots hauler with full bucket

	988B	245D FS (Bottom Dump)	Power Shovel
cycle times	.60	.40	.45
First pass (dump time) ..	.10 min.	.05 min.	.05 min
2 passes (full cycle)	.70	.45	.50
3 passes " ...	1.30	.85	.95
4 passes " ...	1.90	1.25	1.40
5 passes " ...	2.50	1.65	1.85
6 passes " ...	3.10	2.05	2.30
7 passes " ...	3.70	2.45	2.75
8 passes " ...	4.30	2.85	3.30
9 passes " ...	4.90	3.25	3.65
10 passes " ...	5.40	3.65	4.10

NOTE: Other sizes of loading tools will have different cycle times. See Wheel Loader section for **average** cycle times for truck loading.



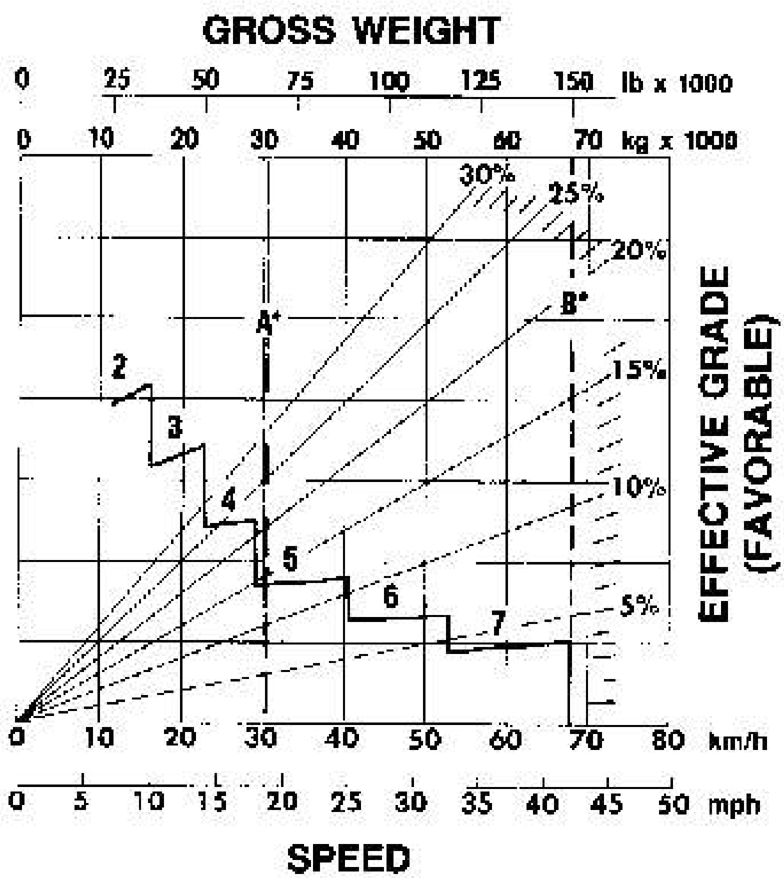
KEY

1A — 1st Gear (Torque Converter)
1B — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A* — Empty 31 178 kg (68,750 lb)
B* — Max GVW 67 586 kg (149,000 lb)

*These two reference lines (A and B) apply only to 769C.



CONTINUOUS GRADE LENGTH

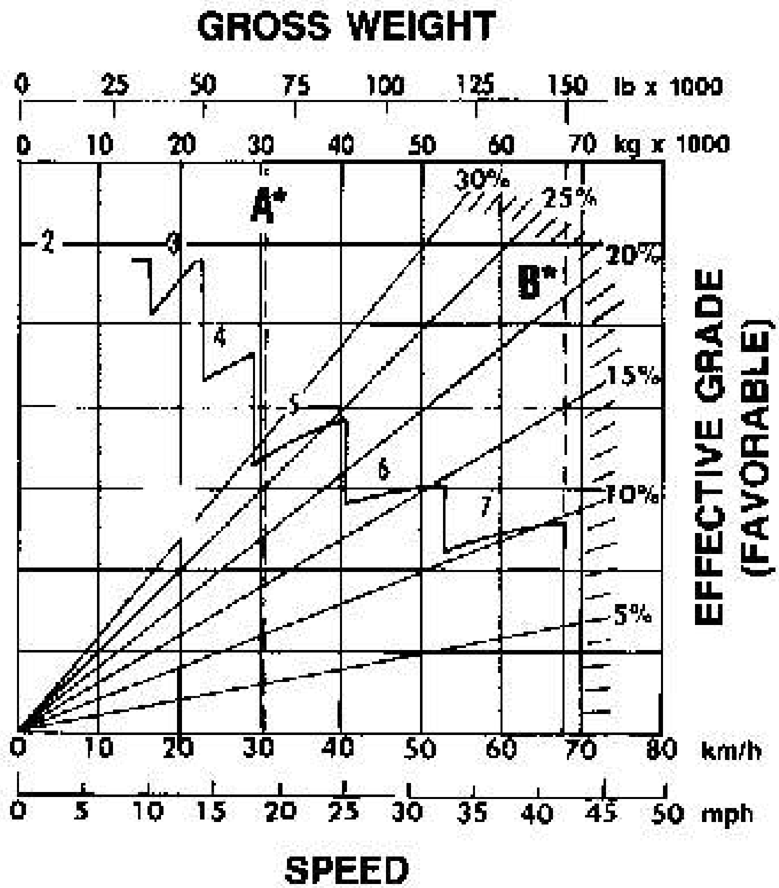
KEY

2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A* — Empty 31 178 kg (68,750 lb)
B* — Max GVW 67 586 kg (149,000 lb)

*These two reference lines (A and B) apply only to 769C.



GRADE DISTANCE — 450 m (1500 ft)

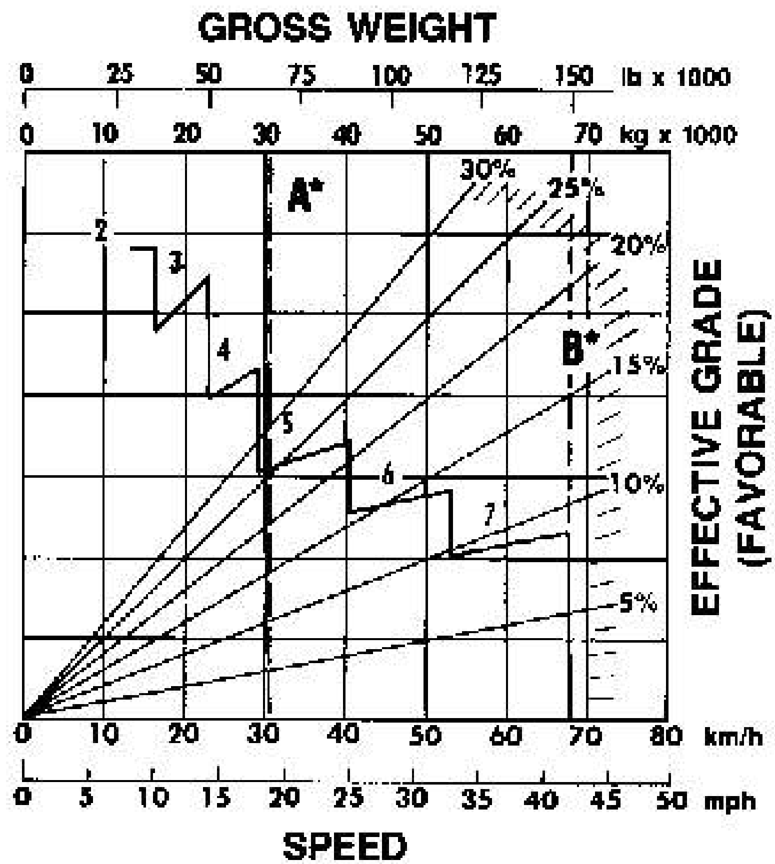
KEY

2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A* — Empty 31 179 kg (68,750 lb)
B* — Max GVW 67 586 kg (149,000 lb)

*These two reference lines (A and B) apply only to 769C



GRADE DISTANCE — 600 m (2000 ft)

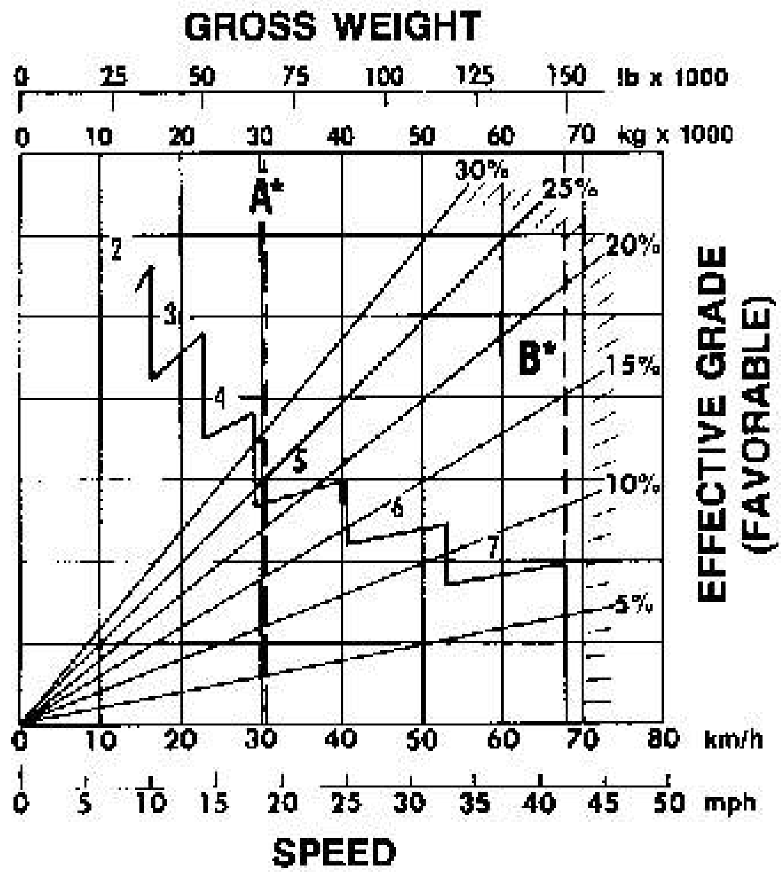
KEY

2 — 2nd Gear
3 - 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A* Empty 31 178 kg (68,750 lb)
B* — Max GVW 67 586 kg (149,000 lb)

*These two reference lines (A and B) apply only to 769C



GRADE DISTANCE — 900 m (3000 ft)

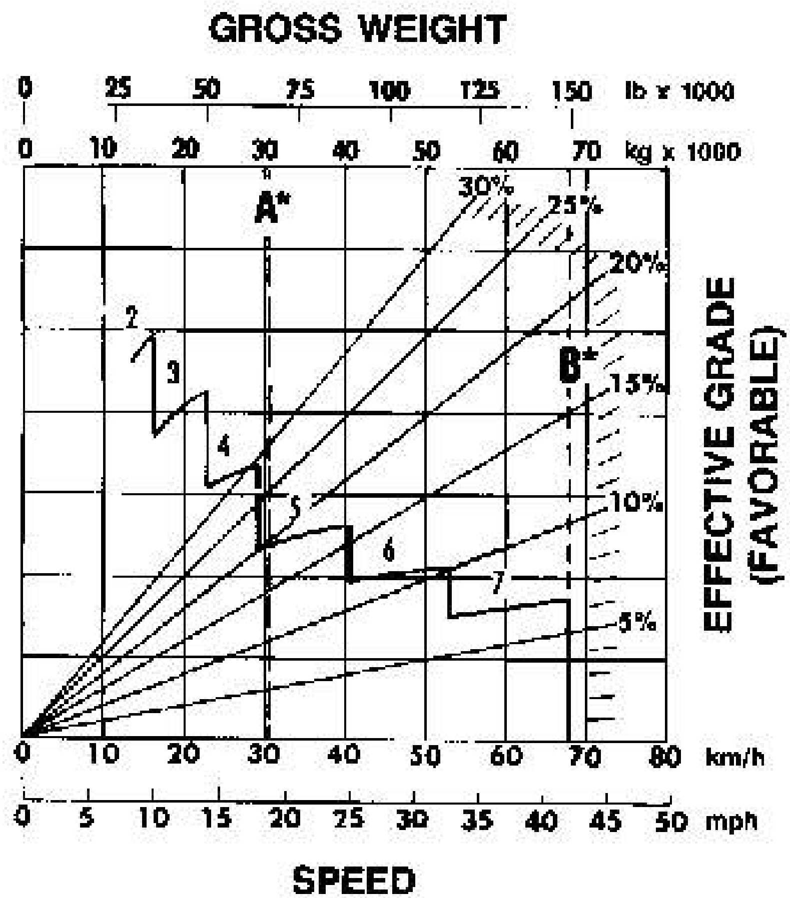
KEY

2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A* — Empty 31 178 kg (68,750 lb)
B* — Max GVW 67 586 kg (149,000 lb)

*These two reference lines (A and B) apply only to 769C.



GRADE DISTANCE — 1500 m (5000 ft)

KEY

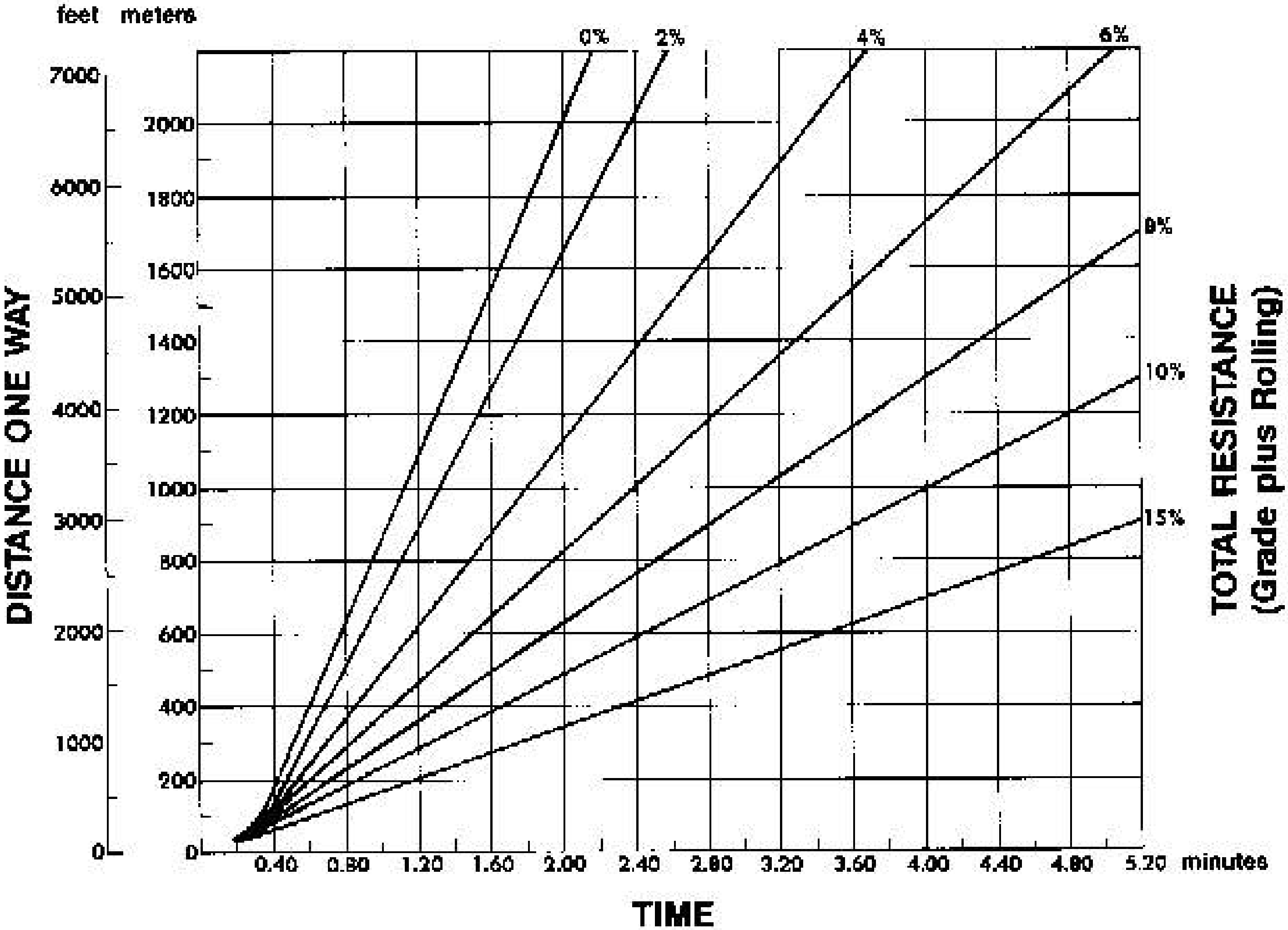
2 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

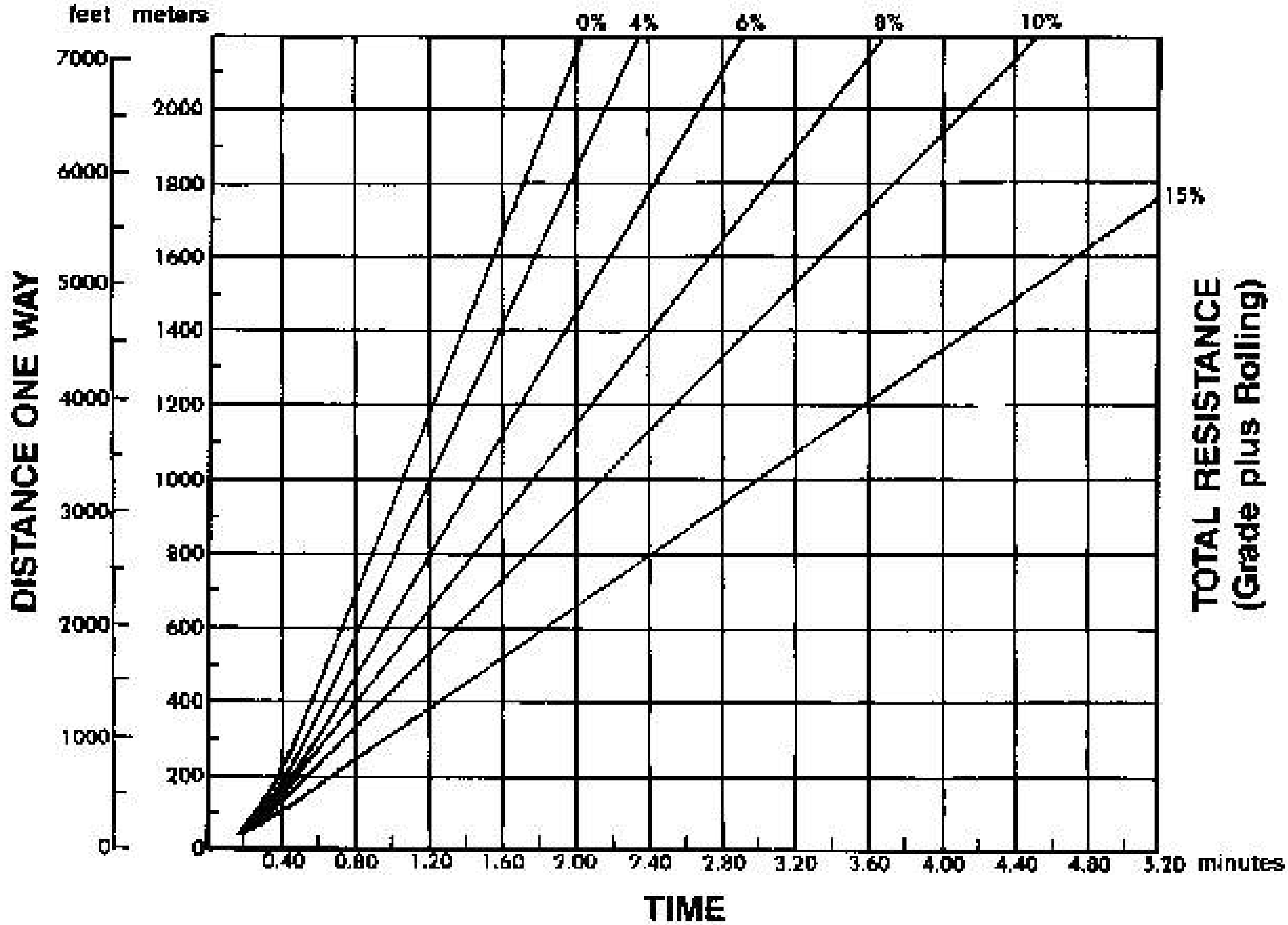
A* — Empty 31 178 kg (68,750 lb)
B* — Max GVW 67 586 kg (149,000 lb)

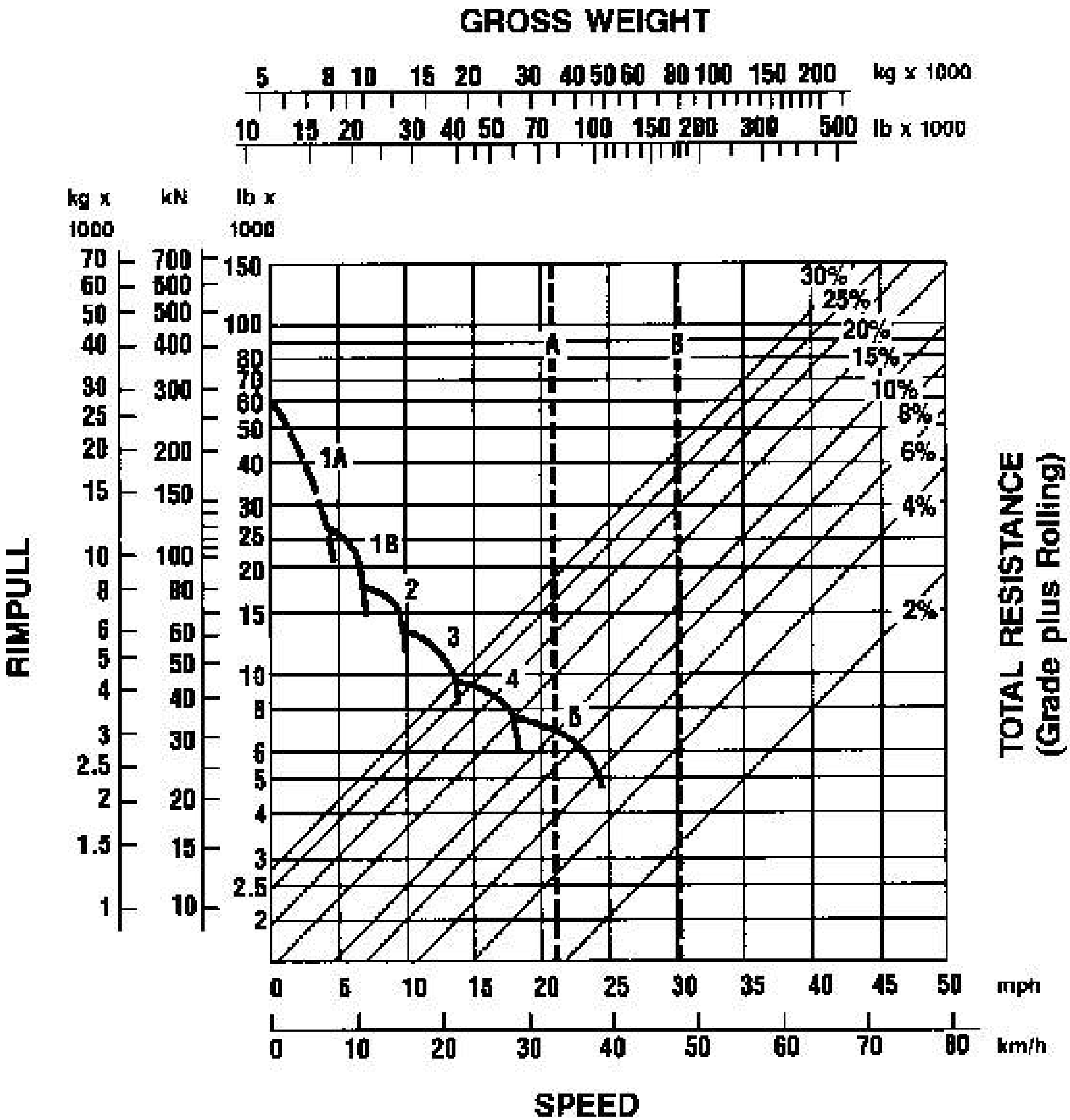
*These two reference lines (A and B) apply only to 769C.

LOADED


feet
meters
0%
2%
4%
6%
8%
10%
15%
7000
6000
5000
4000
3000
2000
1000
0
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0.40
0.80
1.20
1.60
2.00
2.40
2.80
3.20
3.60
4.00
4.40
4.80
5.20
minutes
DISTANCE ONE WAY
TIME
TOTAL RESISTANCE
(Grade plus Rolling)

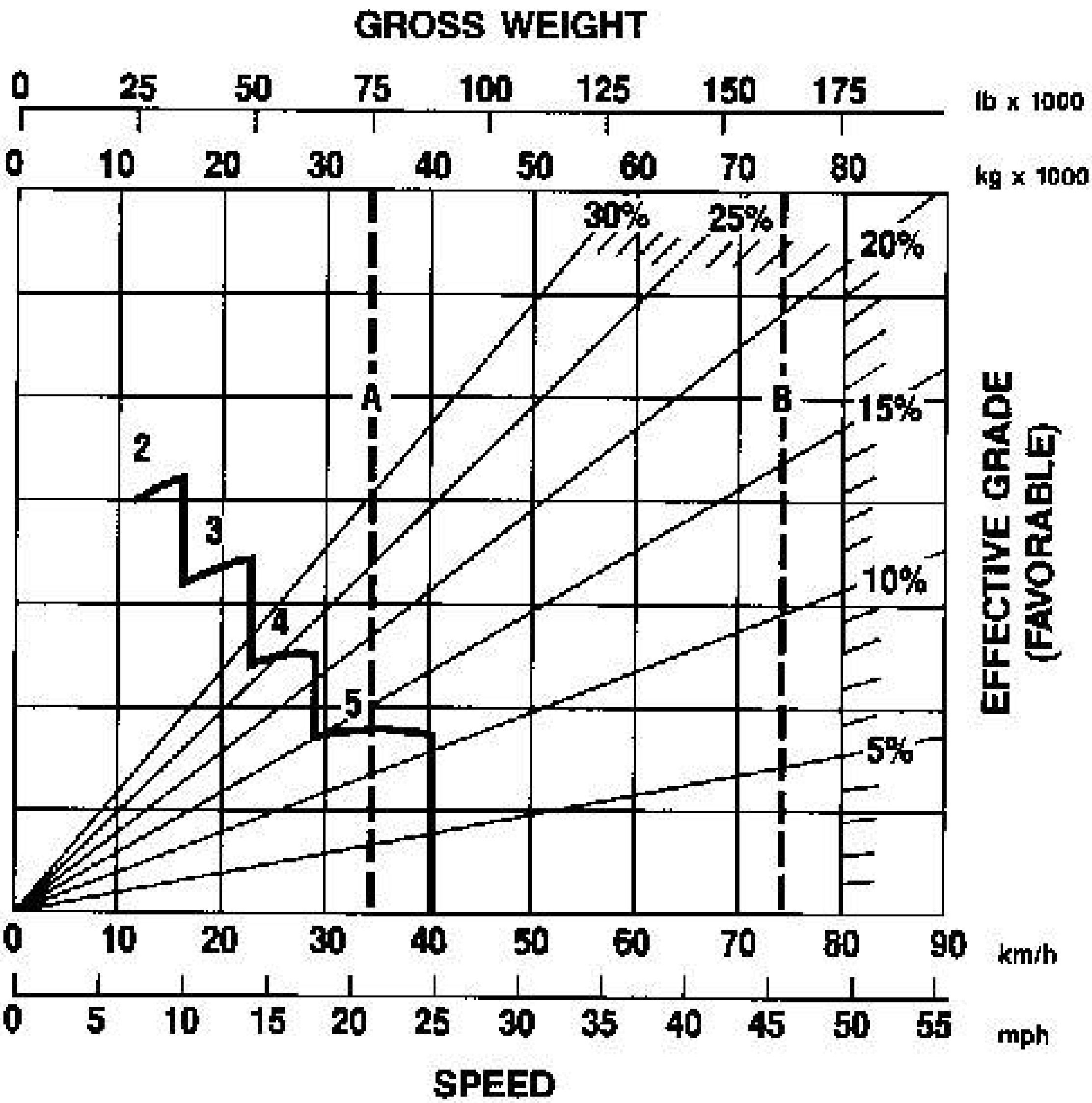
EMPTY


feet meters
DISTANCE ONE WAY
7000
6000
5000
4000
3000
2000
1000
0
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0% 4% 6% 8% 10%
15%
TOTAL RESISTANCE
(Grade plus Rolling)
0.40 0.80 1.20 1.60 2.00 2.40 2.80 3.20 3.60 4.00 4.40 4.80 5.20 minutes
TIME



KEY
1A — 1st Gear (Torque Converter)
1B — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

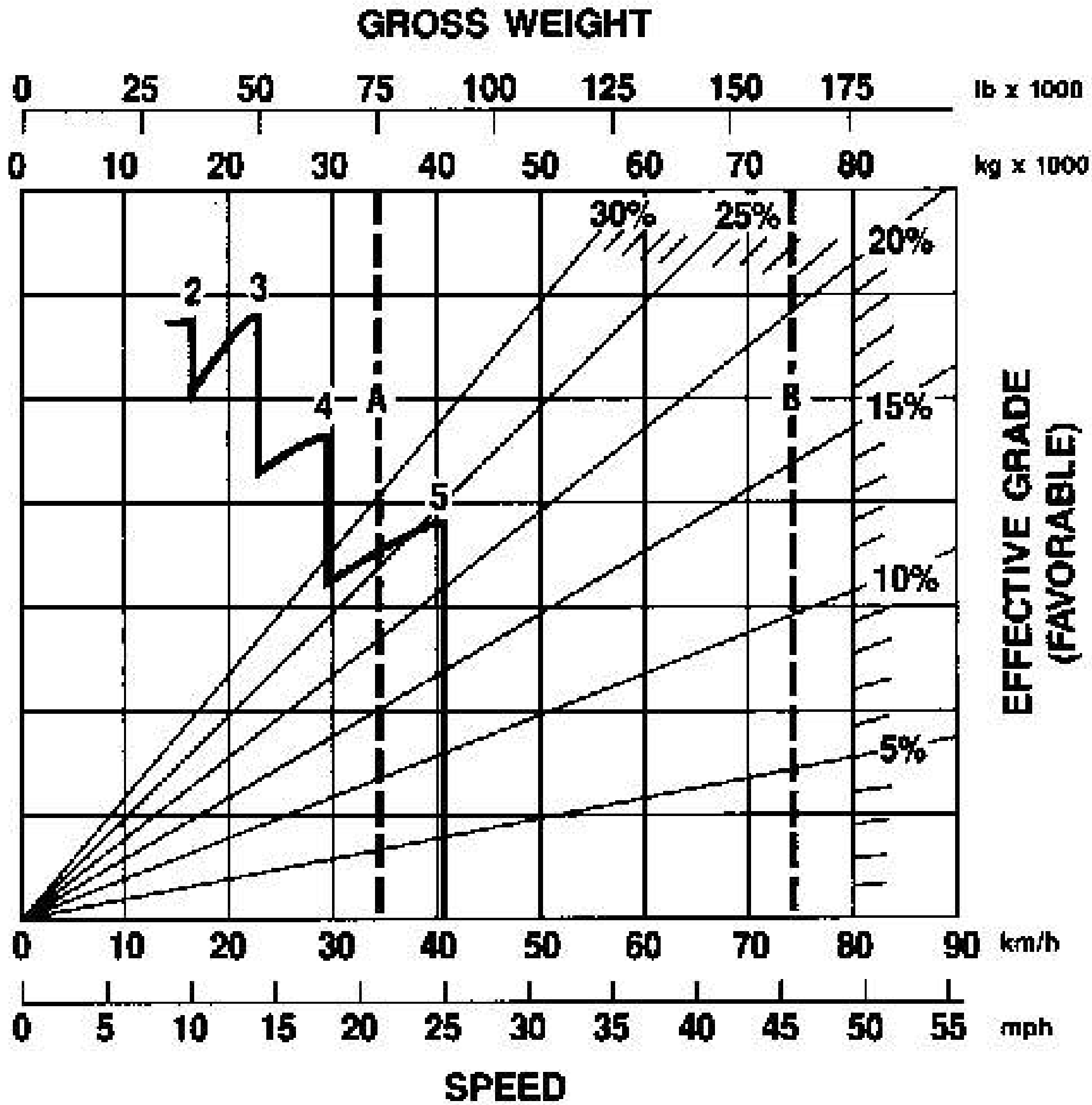
KEY
A — Empty
B — Max GVW 73 970 kg (163,100 lb)



CONTINUOUS GRADE LENGTH

KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

KEY
A* — Empty
B* — Max GVW 73 970 kg (163,100 lb)



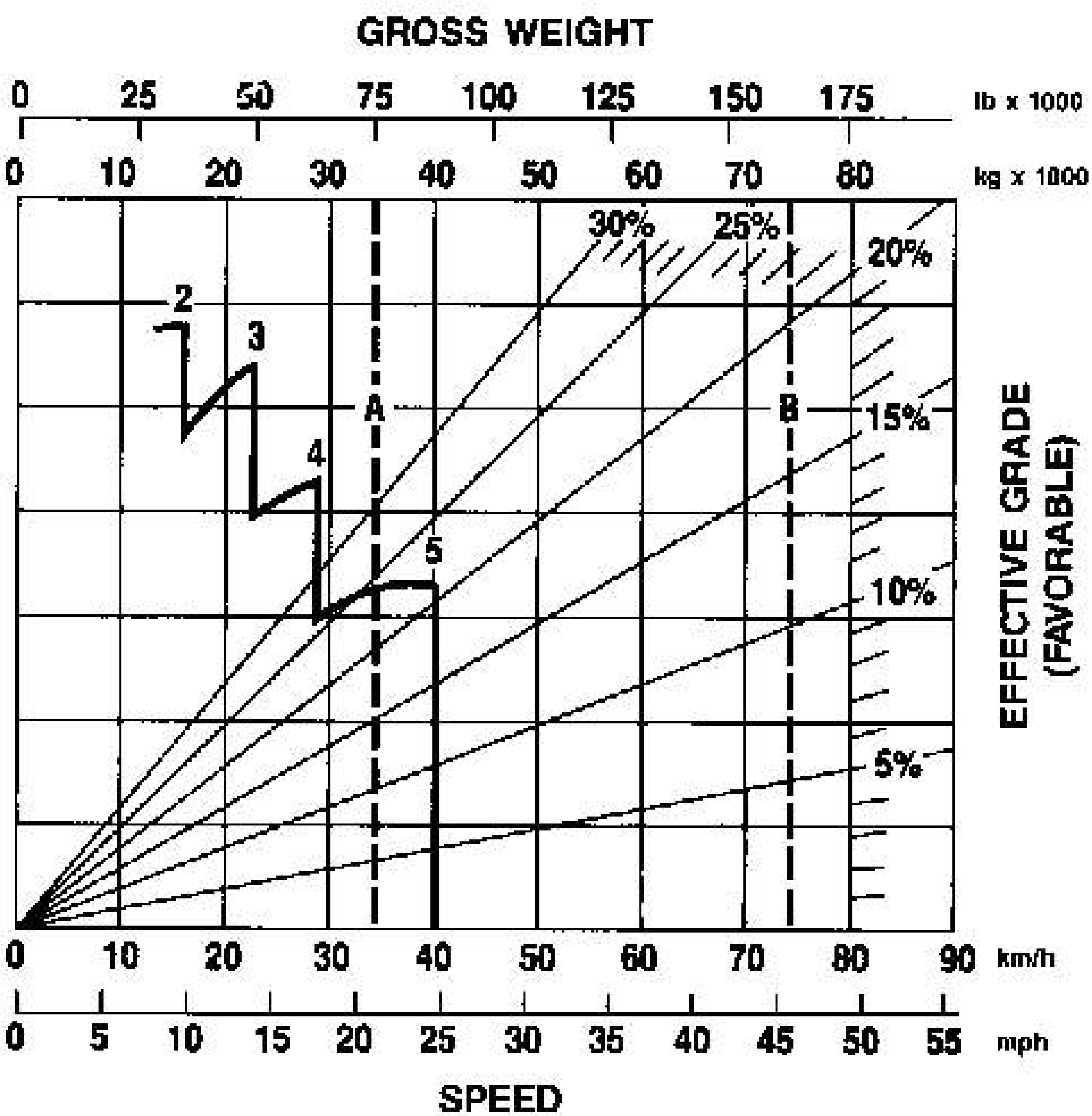
GRADE DISTANCE — 450 m (1500 ft)

KEY

2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

KEY

A* — Empty
B* — Max GVW 73 790 kg (163,100 lb)



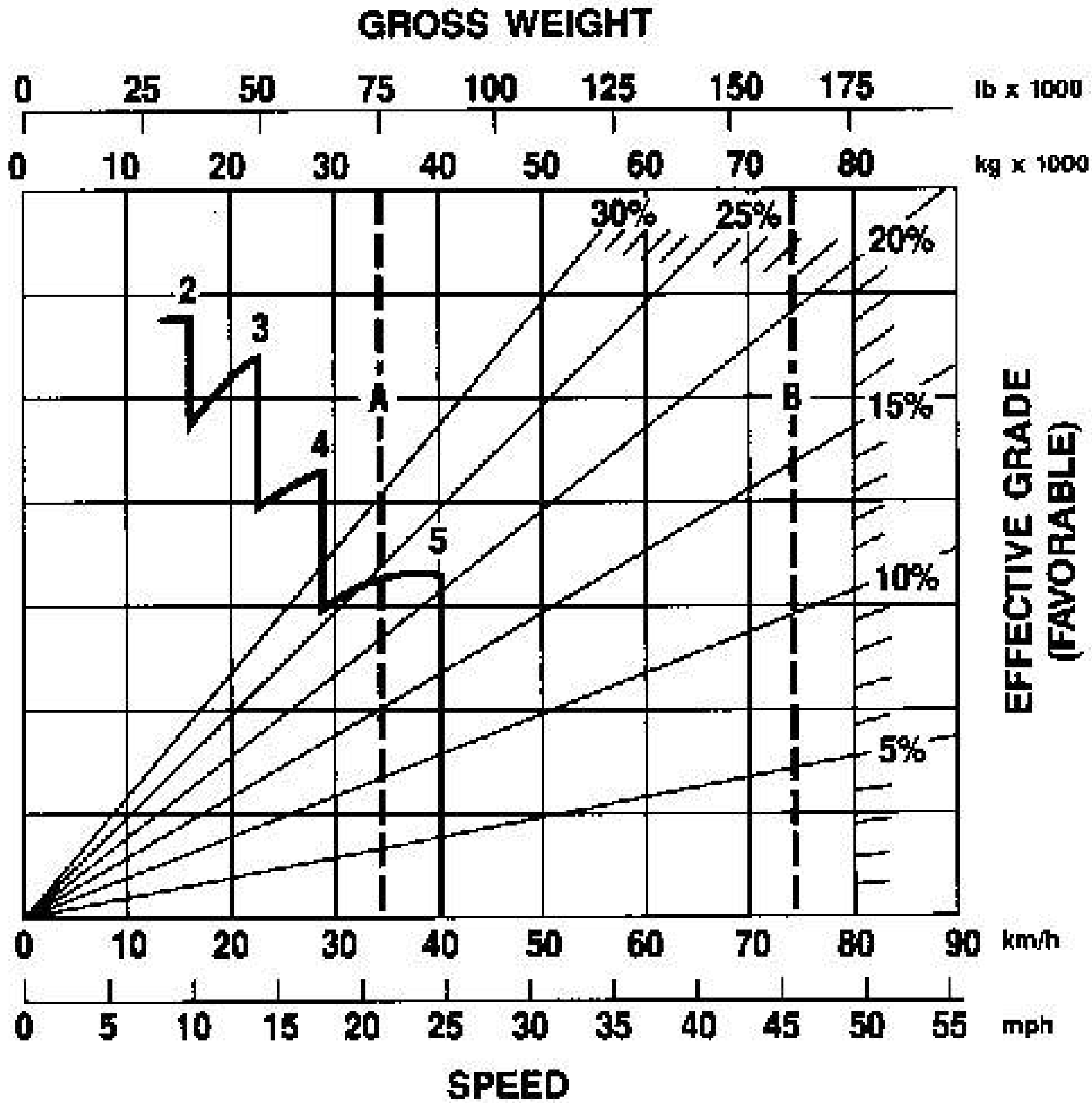
GRADE DISTANCE — 600 m (2000 ft)

KEY

2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

KEY

A* — Empty
B* — Max GVW 73 970 kg (163,100 lb)



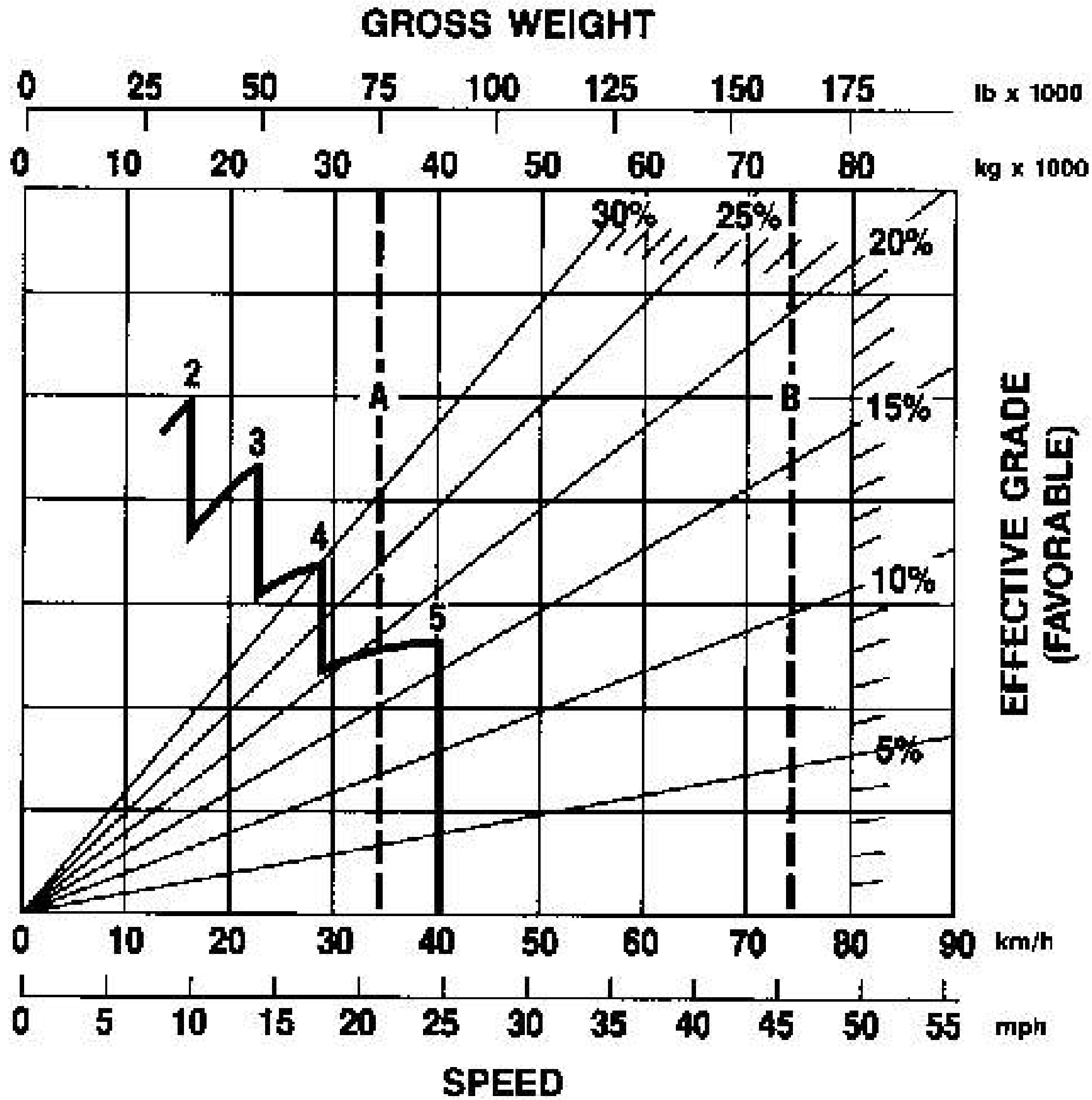
GRADE DISTANCE — 900 m (3000 ft)

KEY

2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

KEY

A* — Empty
B* — Max GVW 73 790 kg (163,100 lb)

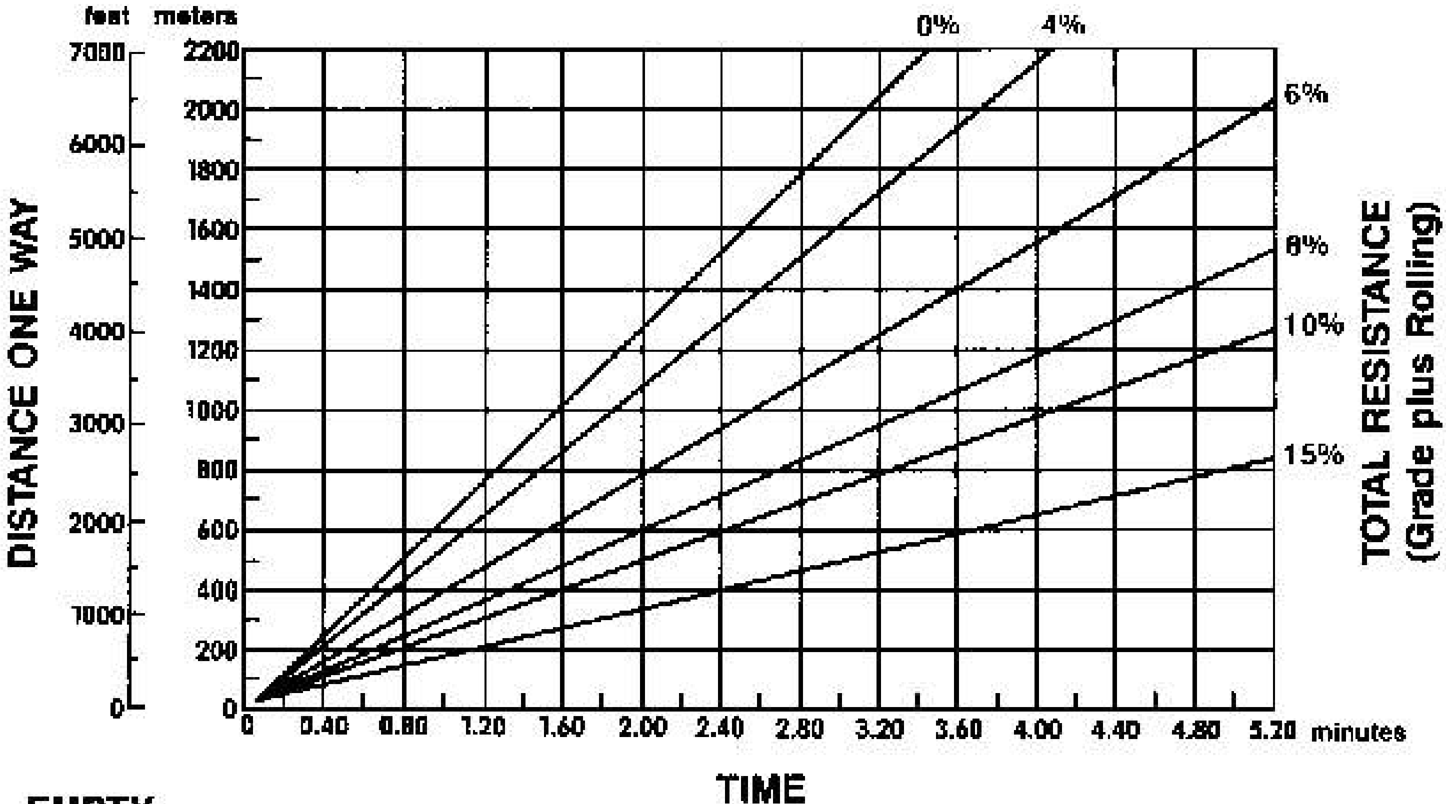


GRADE DISTANCE — 1500 m (5000 ft)

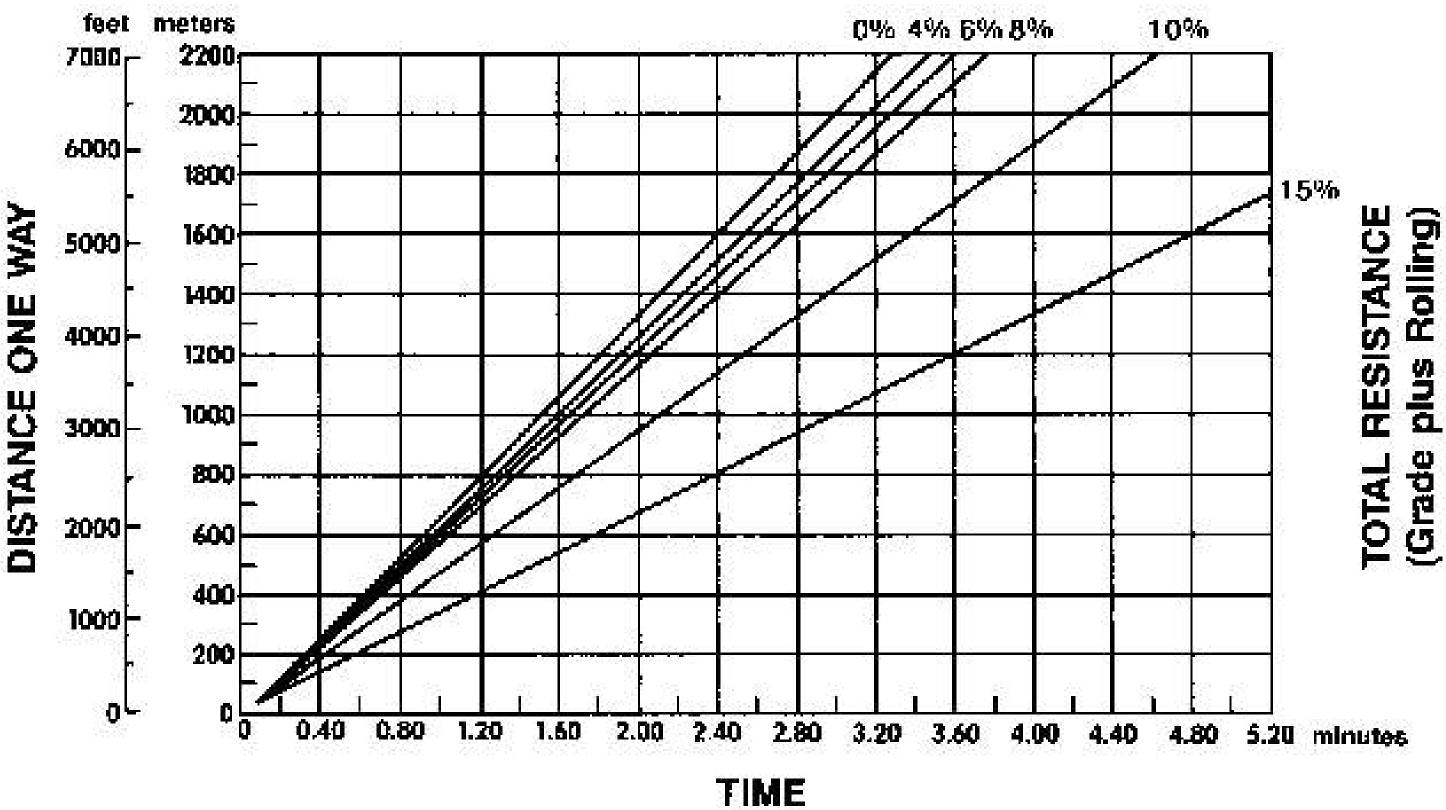
KEY
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

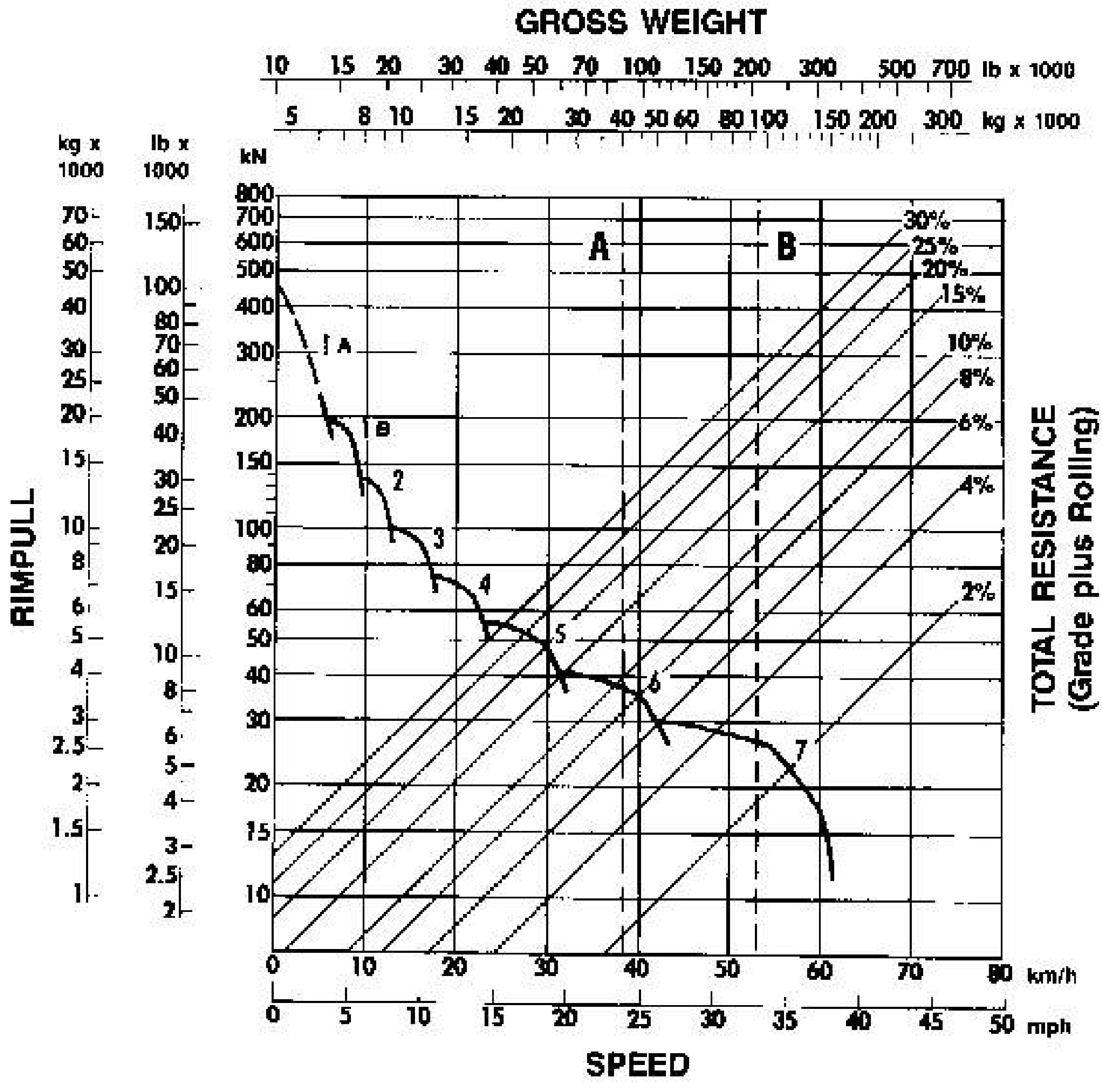
KEY
A* — Empty
B* — Max GVW 73 970 kg (163,100 lb)

LOADED



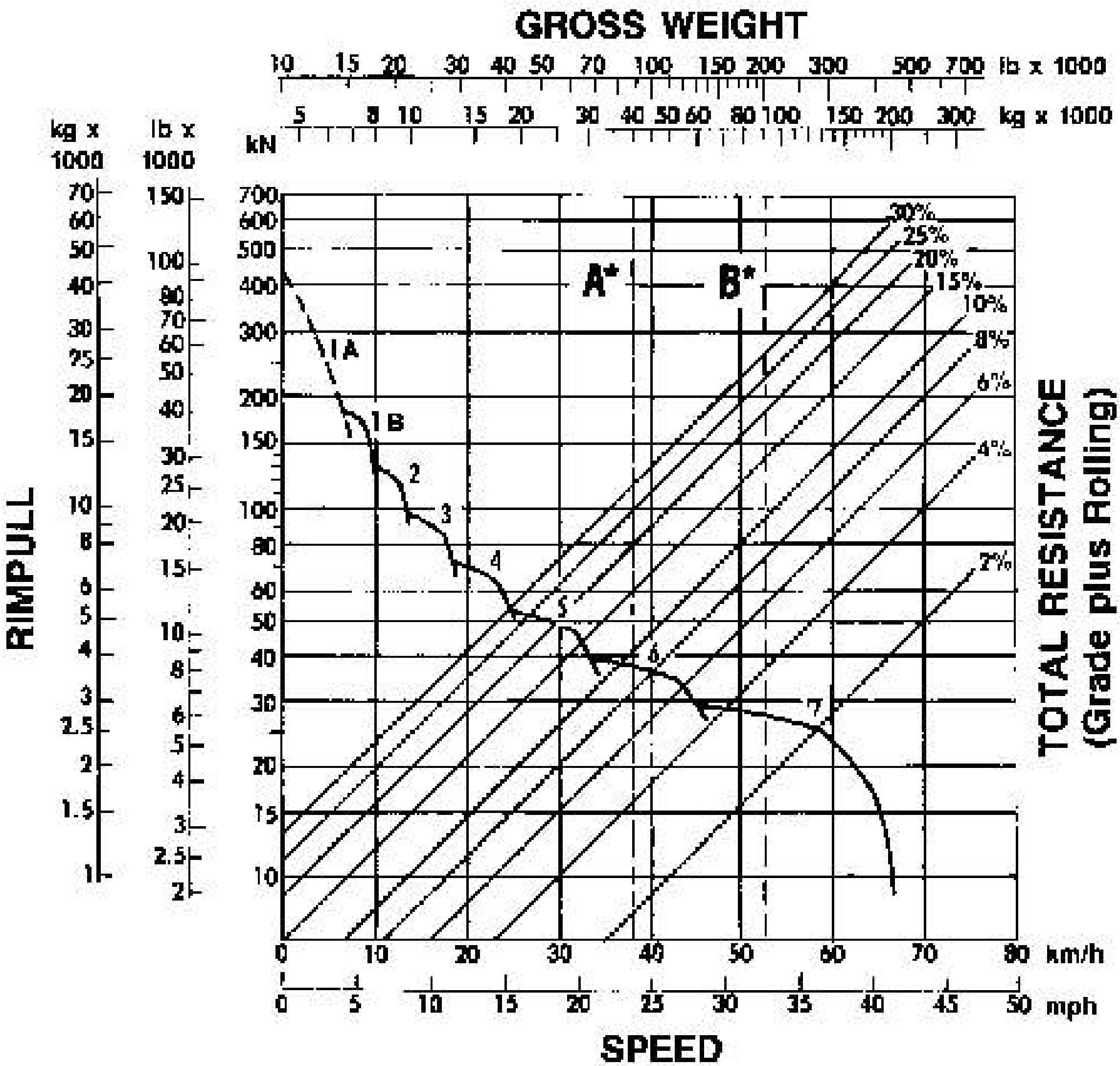
EMPTY





KEY
1A — 1st Gear (Torque Converter)
1B — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY
A — Empty 39 396 kg (86,869 lb)
B — Max GVW 92 534 kg (204,000 lb)



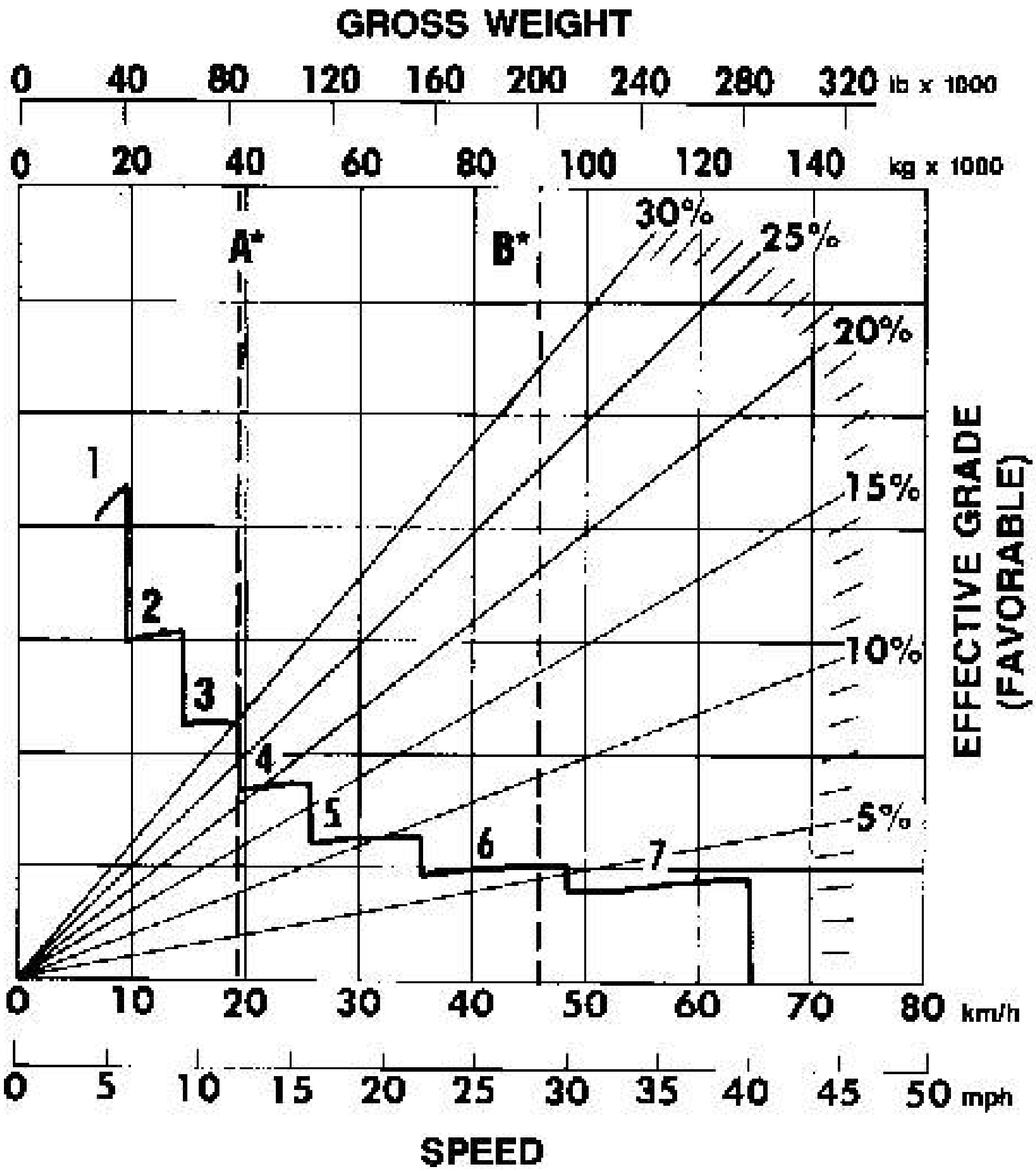
KEY

1A — 1st Gear (Torque Converter)
1B 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A* — Empty 39 396 kg (86,869 lb)
B* — Max GVW 92 534 kg (204,000 lb)

*These two reference lines (A and B) apply only to 773B.



CONTINUOUS GRADE LENGTH

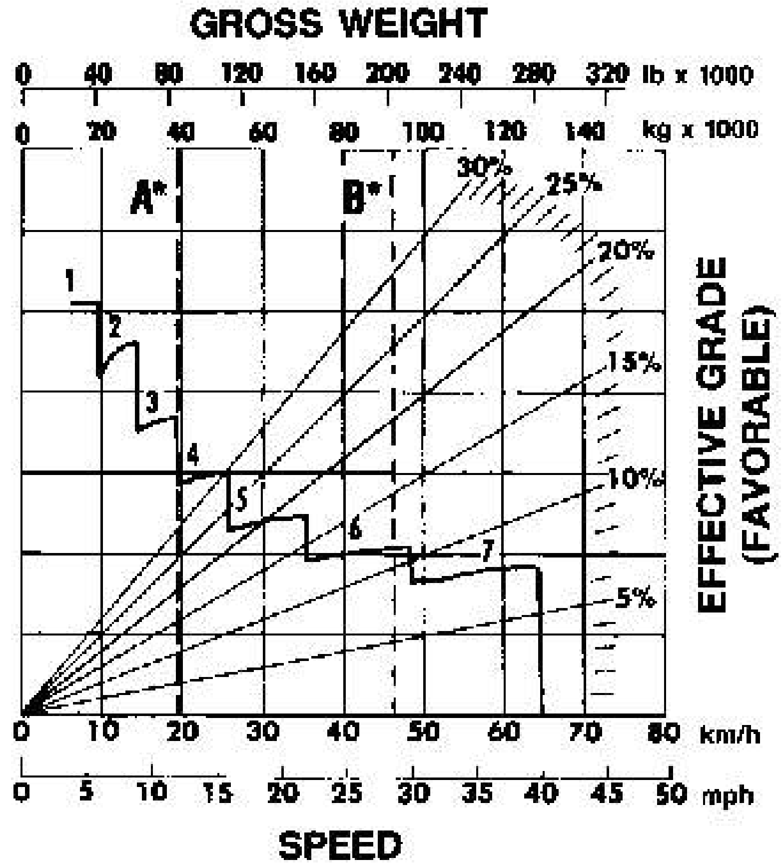
KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A* — Empty 39 396 kg (86,869 lb)
B* — Max GVW 92 534 kg (204,000 lb)

*These two reference lines (A and B) apply only to 773B.



GRADE DISTANCE — 450 m (1500 ft)

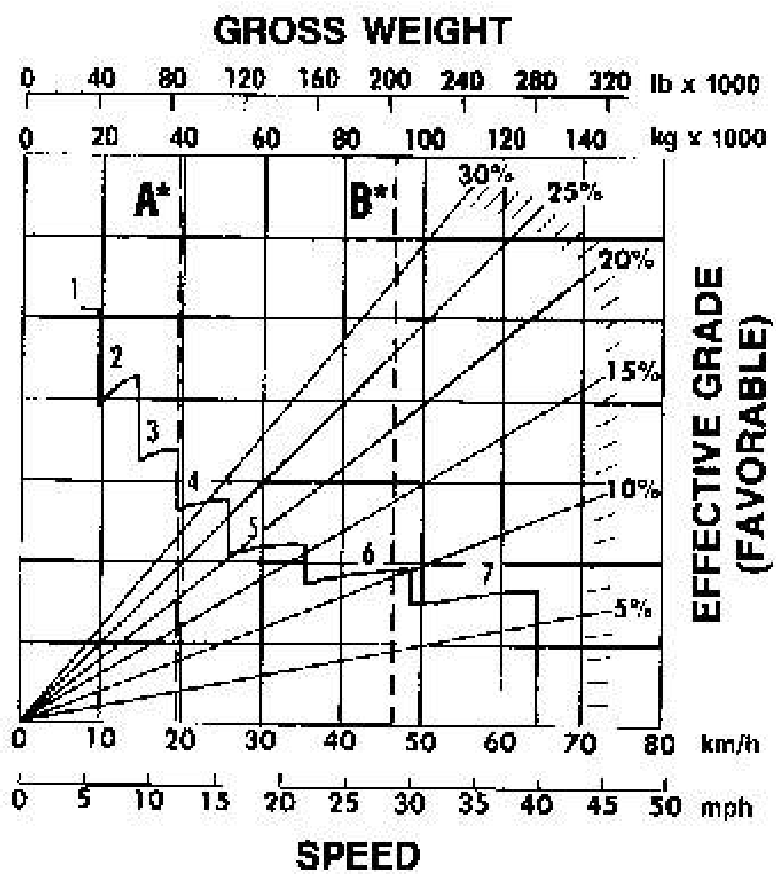
KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A* — Empty 39 396 kg (86,869 lb)
B* Max GVW 92 534 kg (204,000 lb)

*These two reference lines (A and B) apply only to 773B.



GRADE DISTANCE — 600 m (2000 ft)

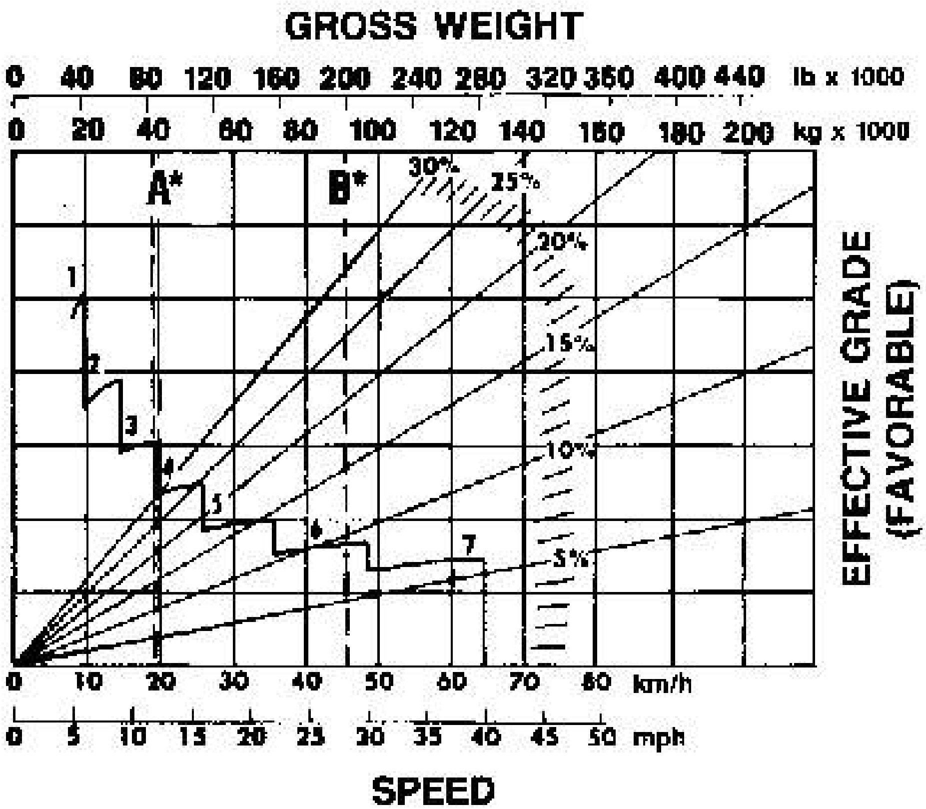
KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A* — Empty 39 396 kg (86,869 lb)
B* — Max GVW 92 534 kg (204,000 lb)

*These two reference lines (A and B) apply only to 773B.



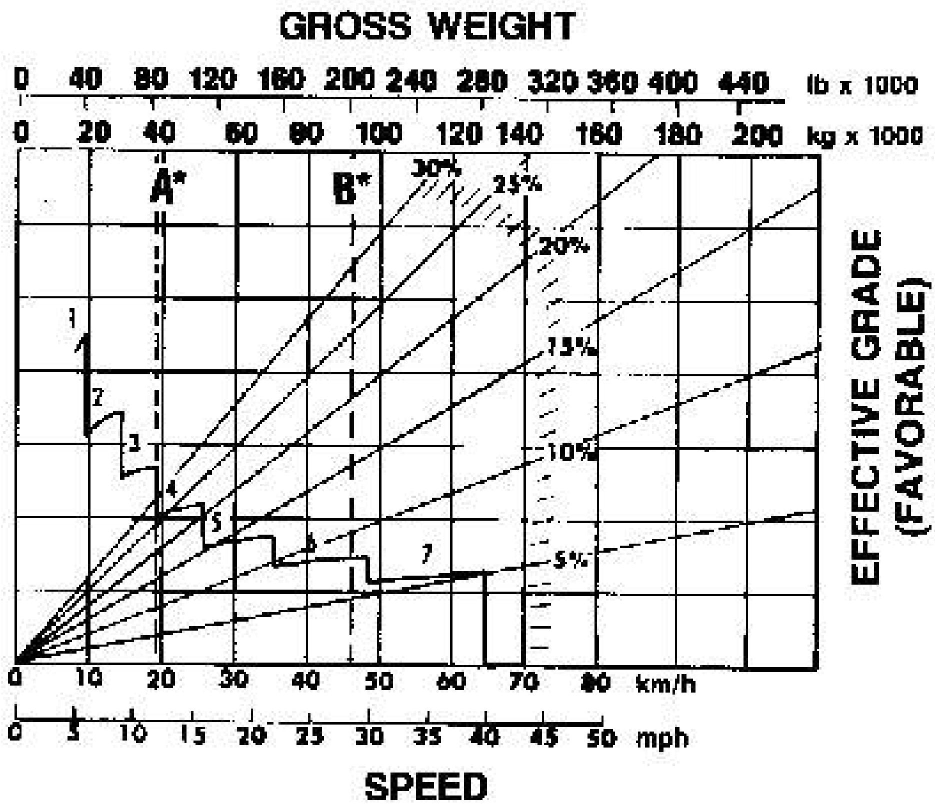
GRADE DISTANCE — 900 m (3000 ft)

KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY
A* — Empty 39 396 kg (86,869 lb)
B* — Max GVW 92 534 kg (204,000 lb)

*These two reference lines (A and B) apply only to 773B.

773B, 772B Brake Performance
• 1500 m (5000 ft)



GRADE DISTANCE — 1500 m (5000 ft)

KEY

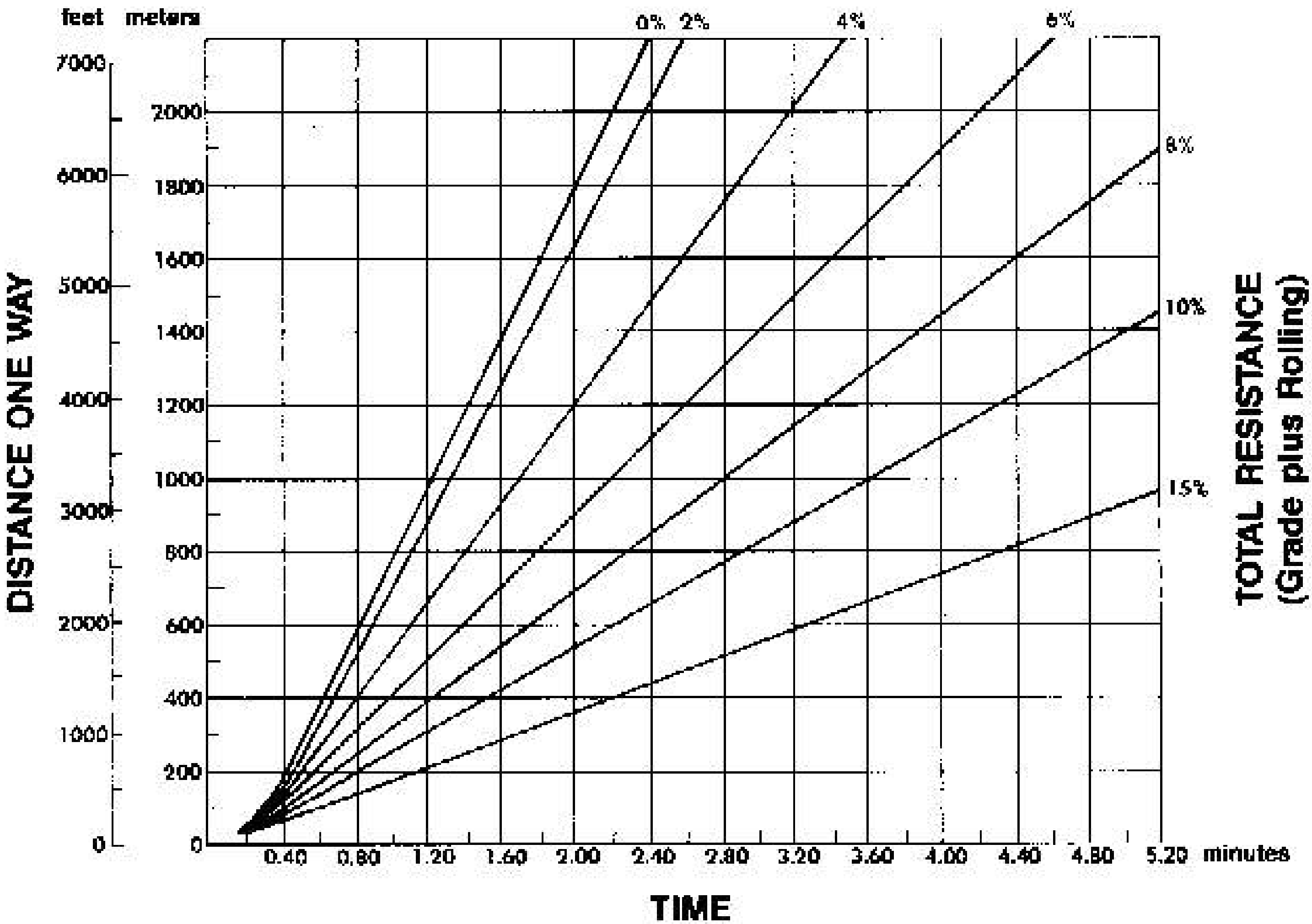
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

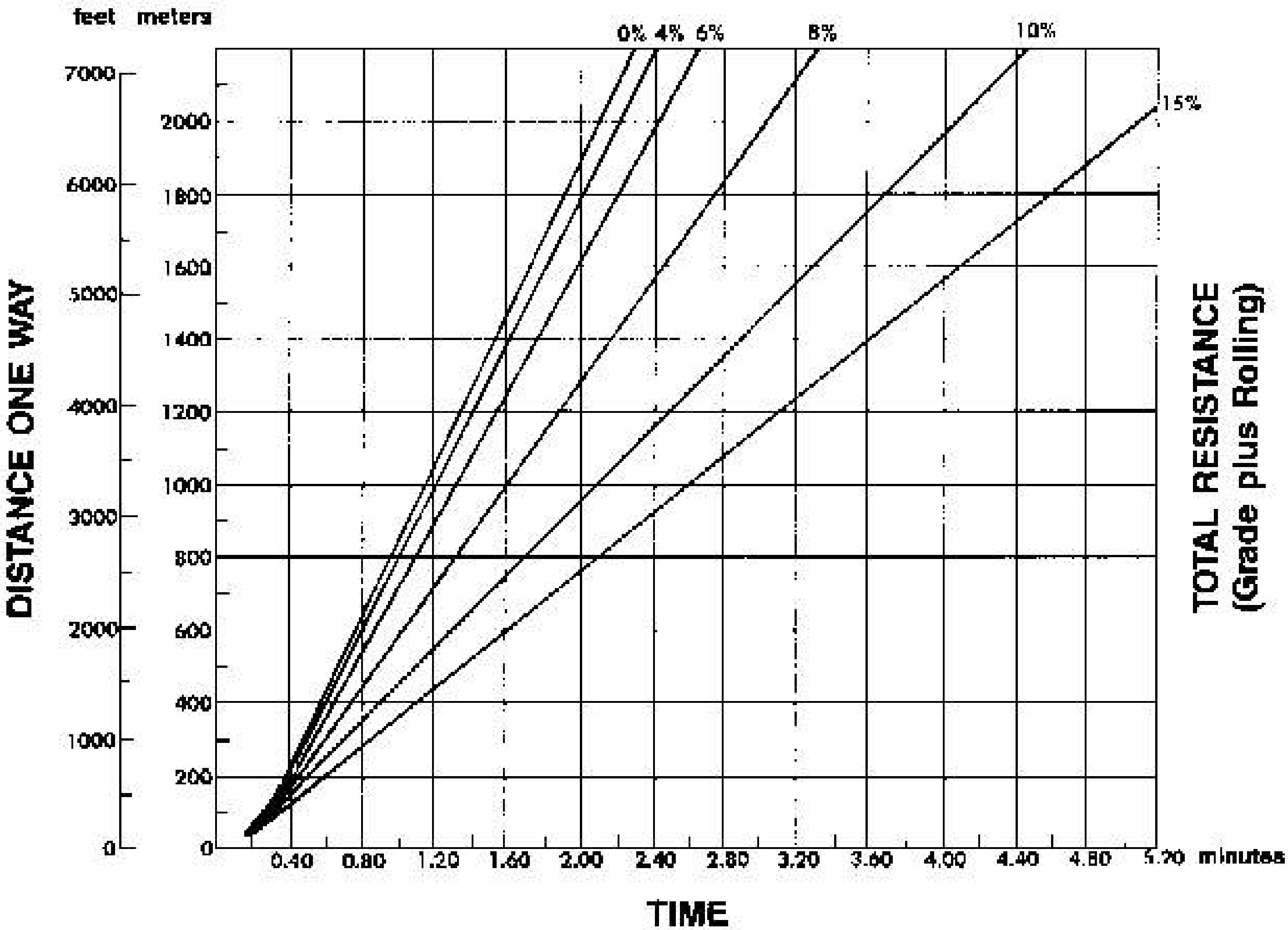
A* — Empty 39 396 kg (86,869 lb)
B* — Max GVW 92 534 kg (204,000 lb)

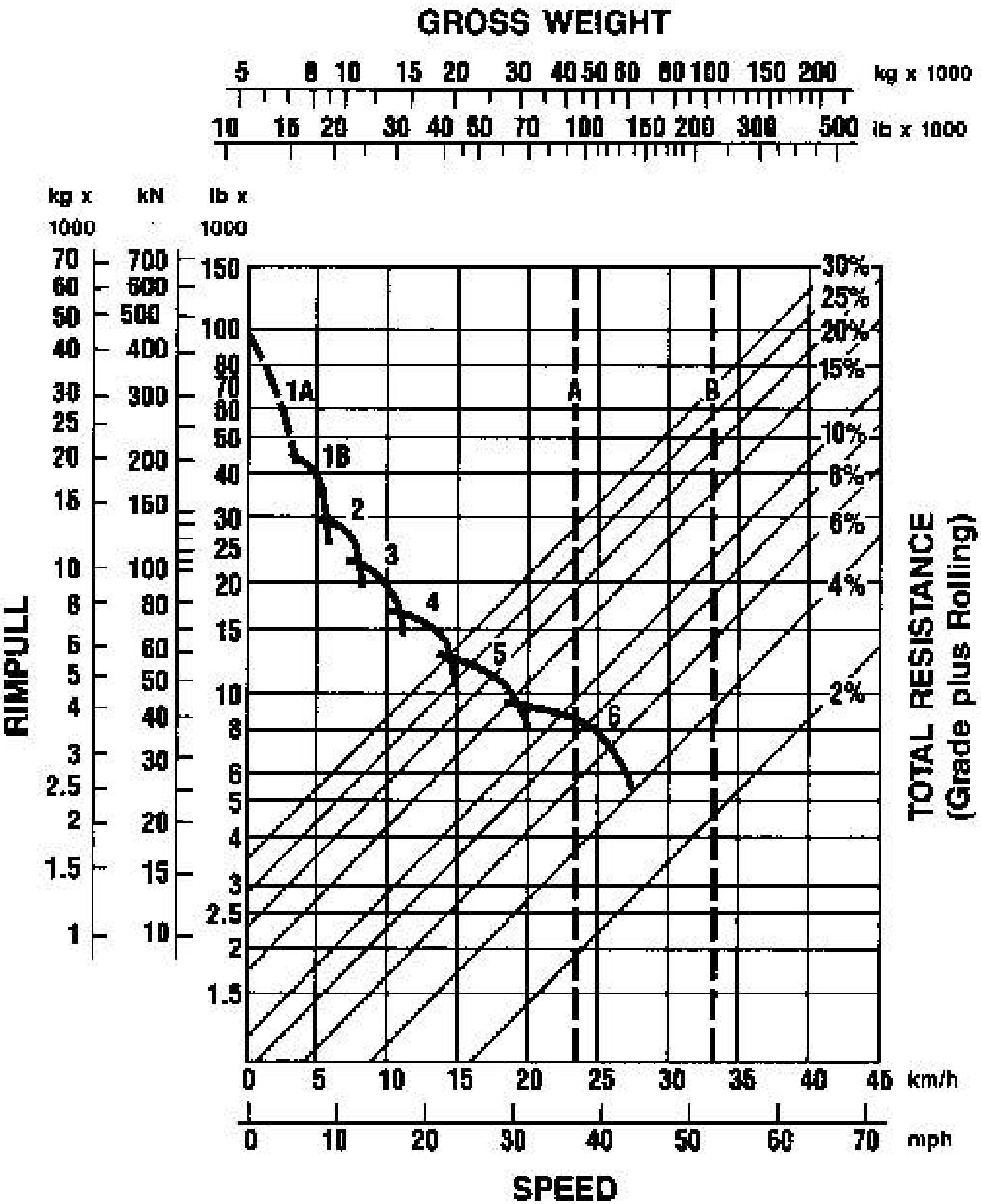
*These two reference lines (A and B) apply only to 773B.

LOADED


feet
meters
0% 2%
4%
6%
8%
10%
15%
7000
6000
5000
4000
3000
2000
1000
0
2000
1800
1600
1400
1200
1000
800
600
400
200
0
DISTANCE ONE WAY
0.40
0.80
1.20
1.60
2.00
2.40
2.80
3.20
3.60
4.00
4.40
4.80
5.20
minutes
TIME
TOTAL RESISTANCE
(Grade plus Rolling)

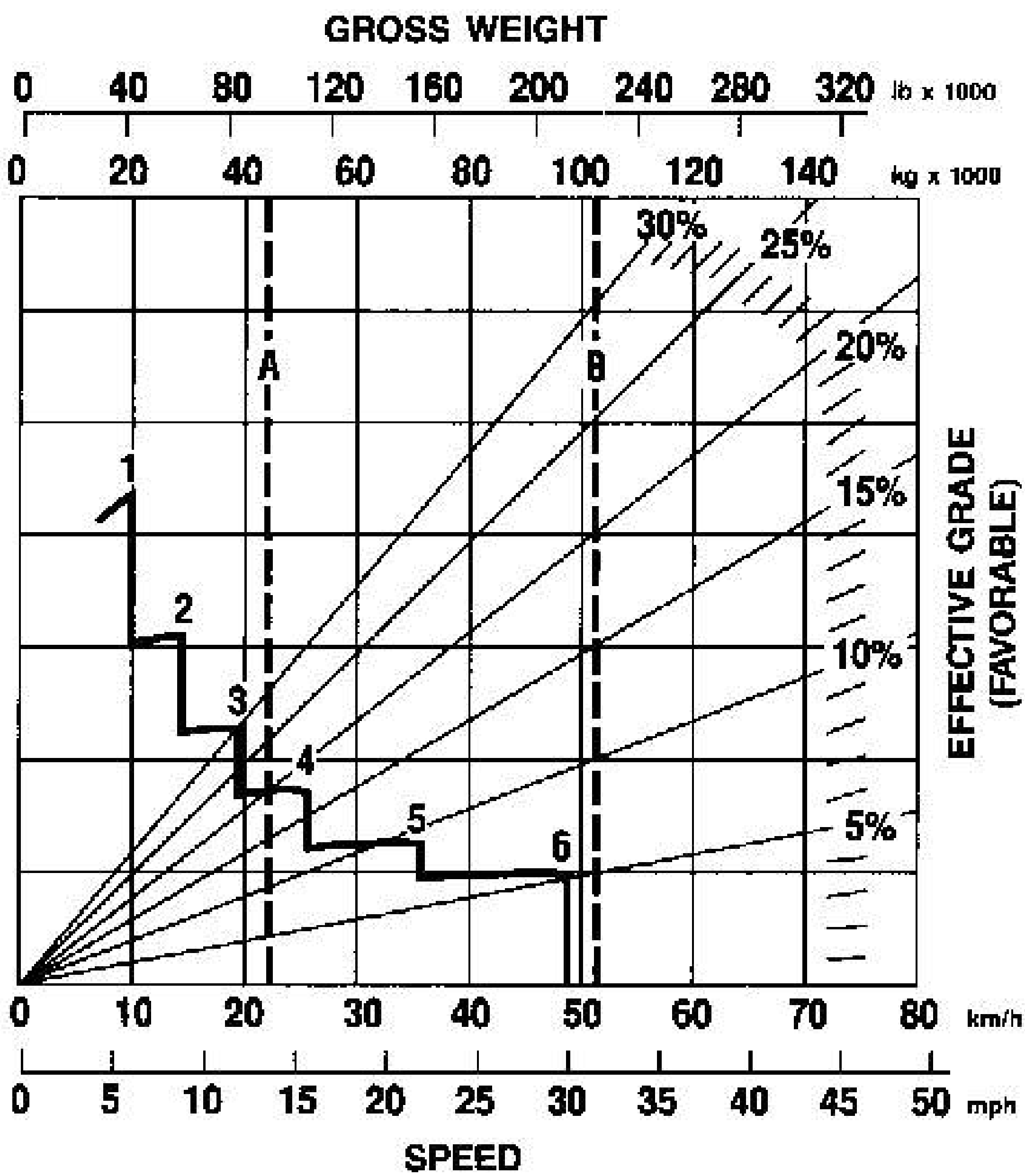
EMPTY


feet meters
7000
6000
5000
4000
3000
2000
1000
0
2000
1800
1600
1400
1200
1000
800
600
400
200
0
DISTANCE ONE WAY
0% 4% 6%
8%
10%
15%
TOTAL RESISTANCE
(Grade plus Rolling)
0.40
0.80
1.20
1.60
2.00
2.40
2.80
3.20
3.60
4.00
4.40
4.80
5.20 minutes
TIME



KEY
1A — 1st Gear (Torque Converter)
1B — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

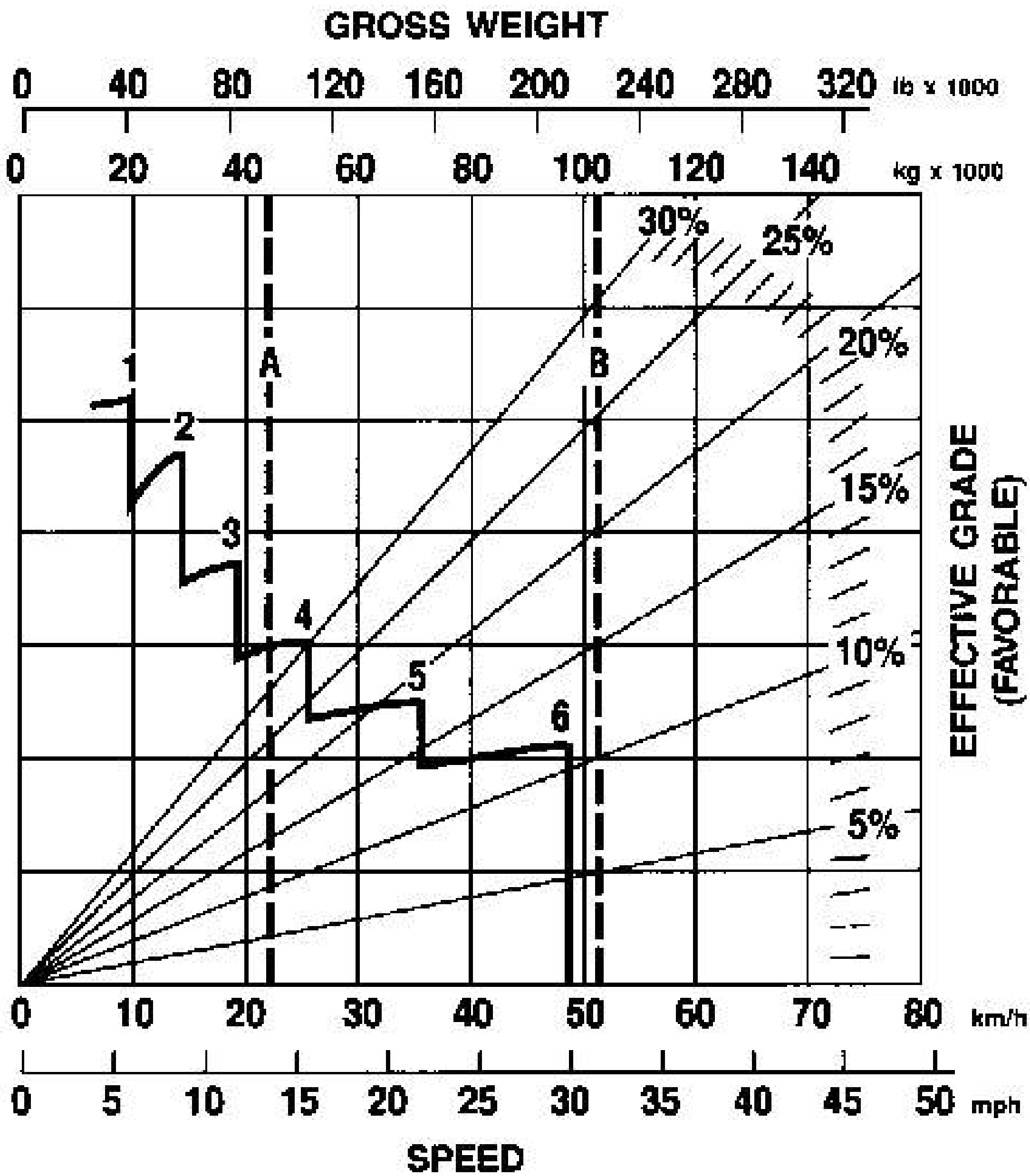
KEY
A — Empty
B — Max GVW 101 700 kg (224,300 lb)



CONTINUOUS GRADE LENGTH

KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 6th Gear

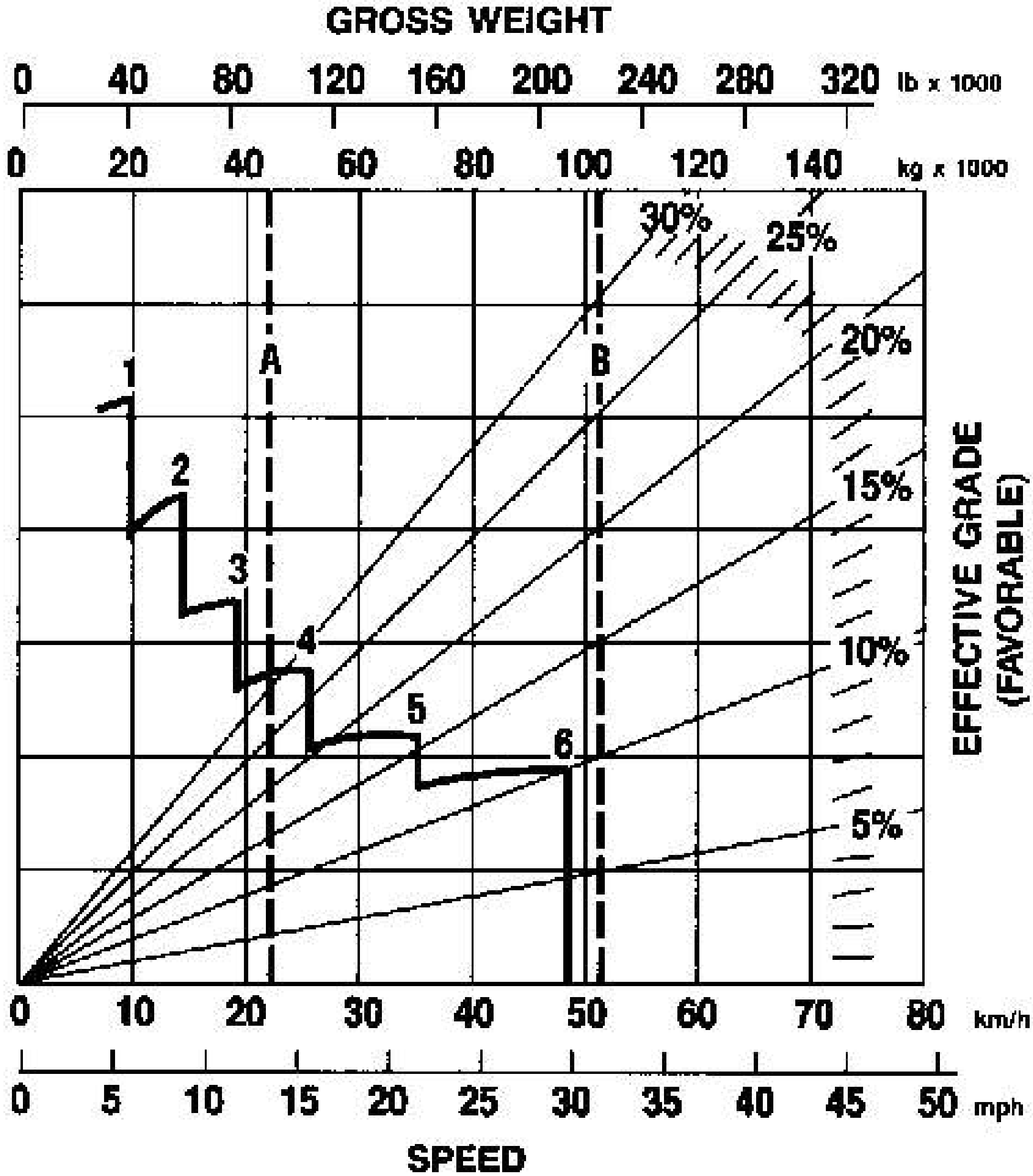
KEY
A — Empty
B — Max GVW 101 700 kg (224,300 lb)



GRADE DISTANCE — 450 m (1500 ft)

KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY
A — Empty
B — Max GVW 101 700 kg (224,300 lb)



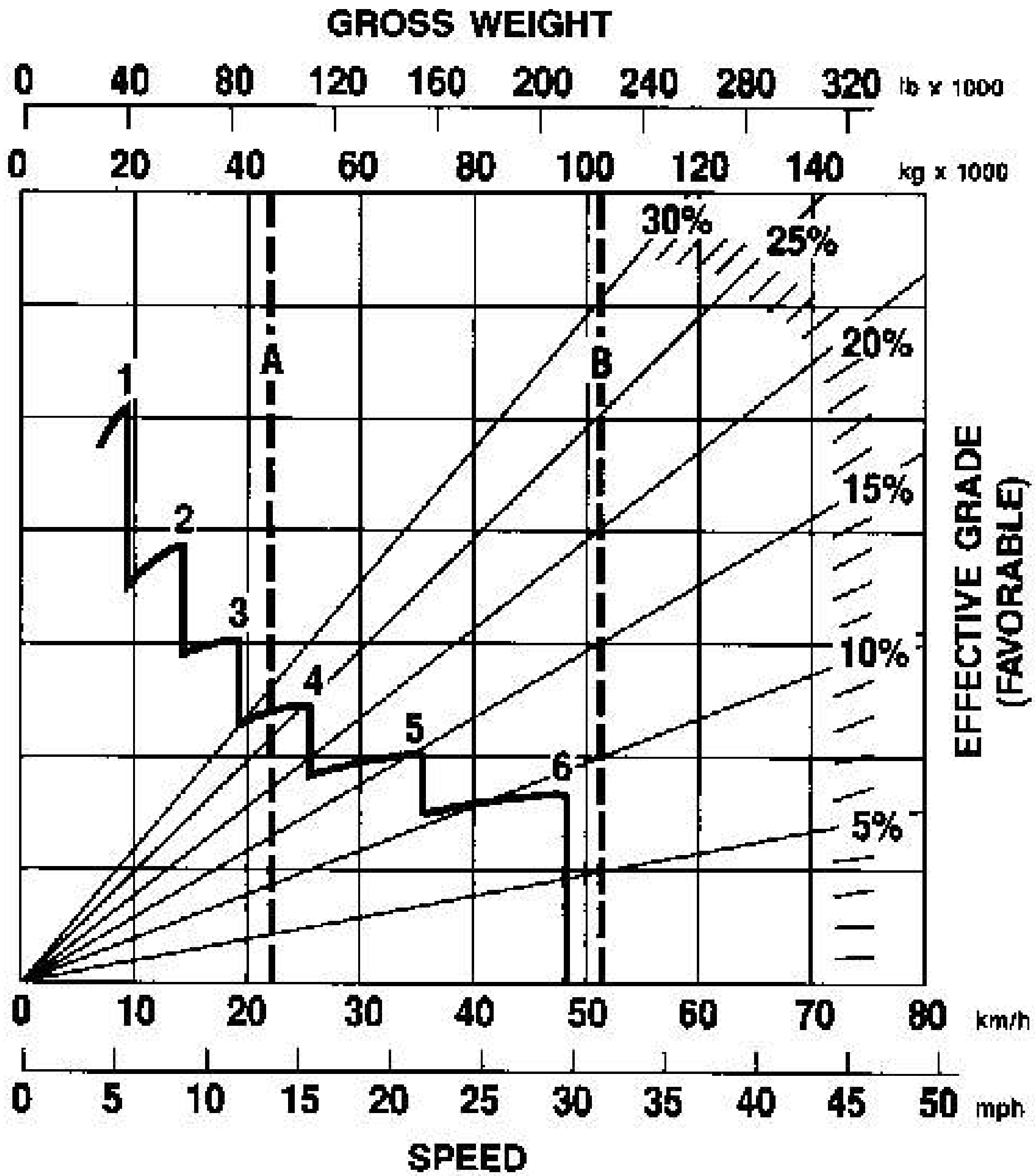
GRADE DISTANCE — 600 m (2000 ft)

KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY

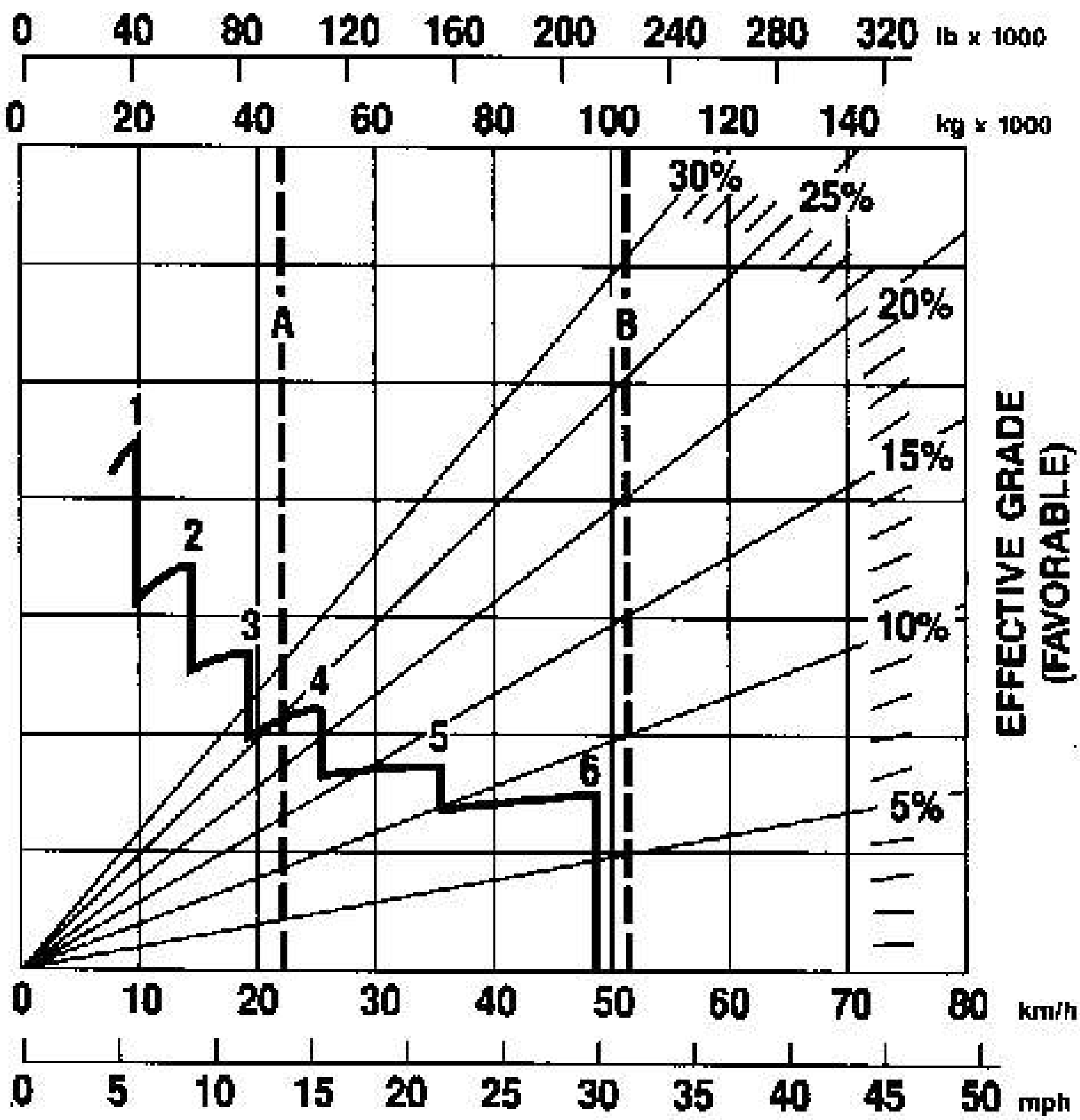
A — Empty
B — Max GVW 101 700 kg (224,300 lb)



GRADE DISTANCE — 900 m (3000 ft)

KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY
A — Empty
B — Max GVW 101 700 kg (224,300 lb)

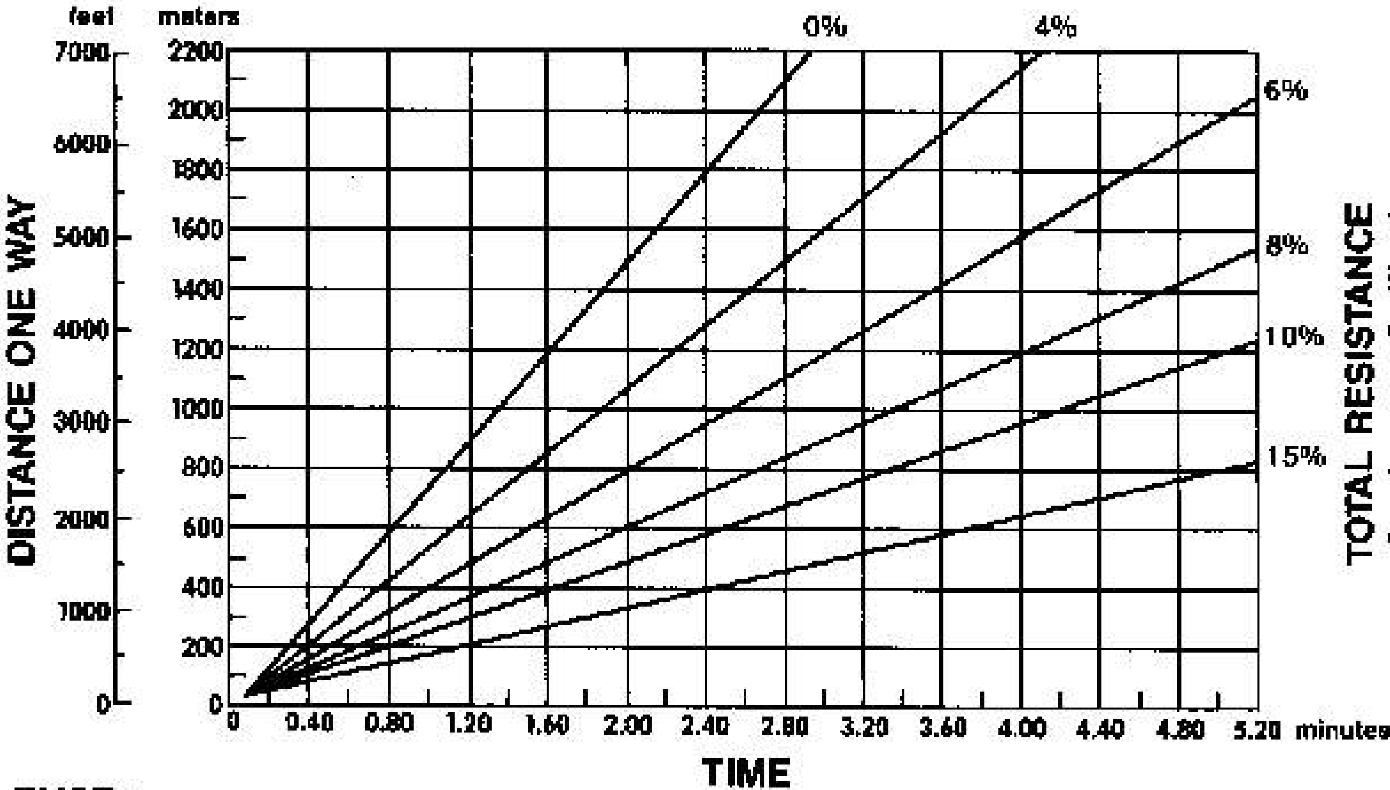


GRADE DISTANCE — 1500 m (5000 ft)

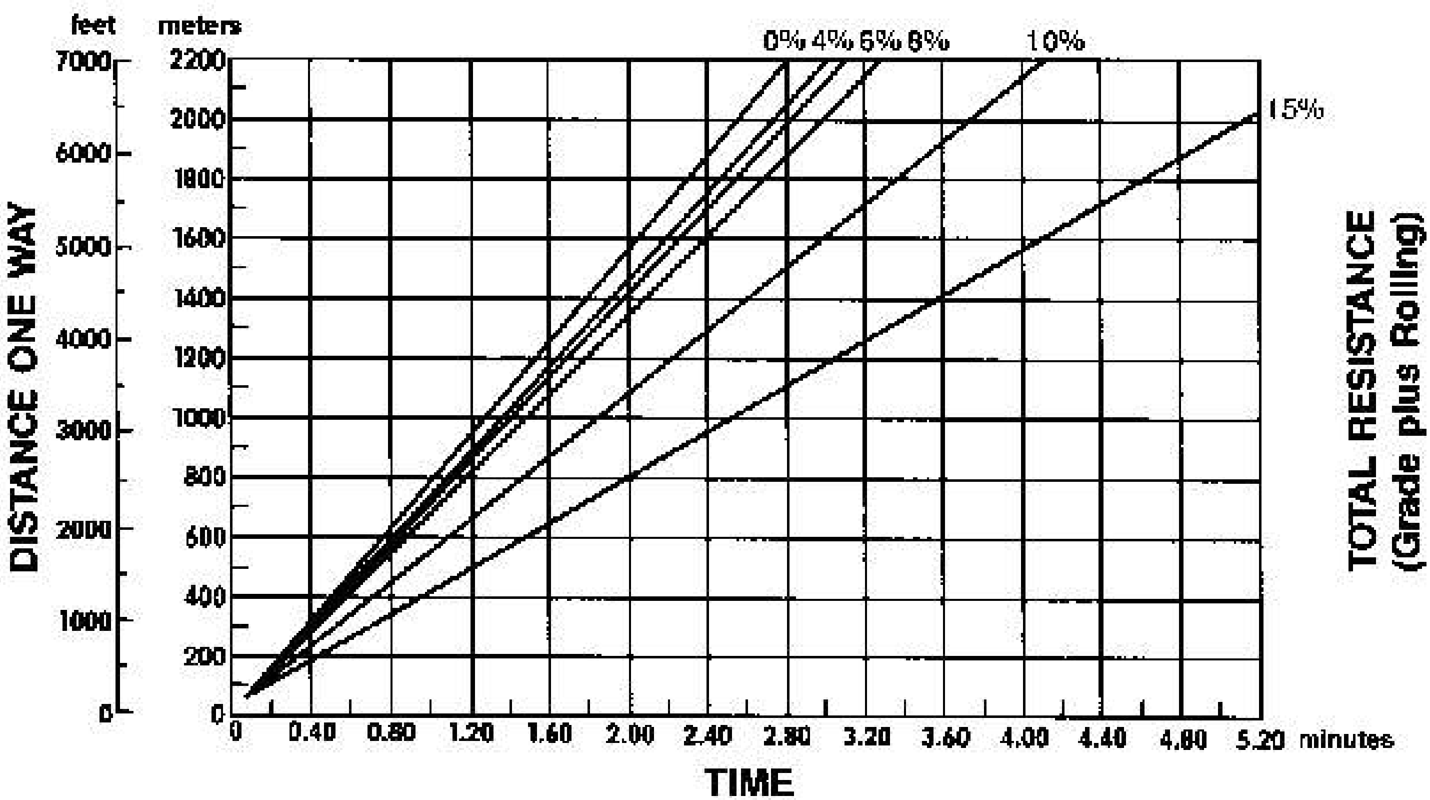
KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

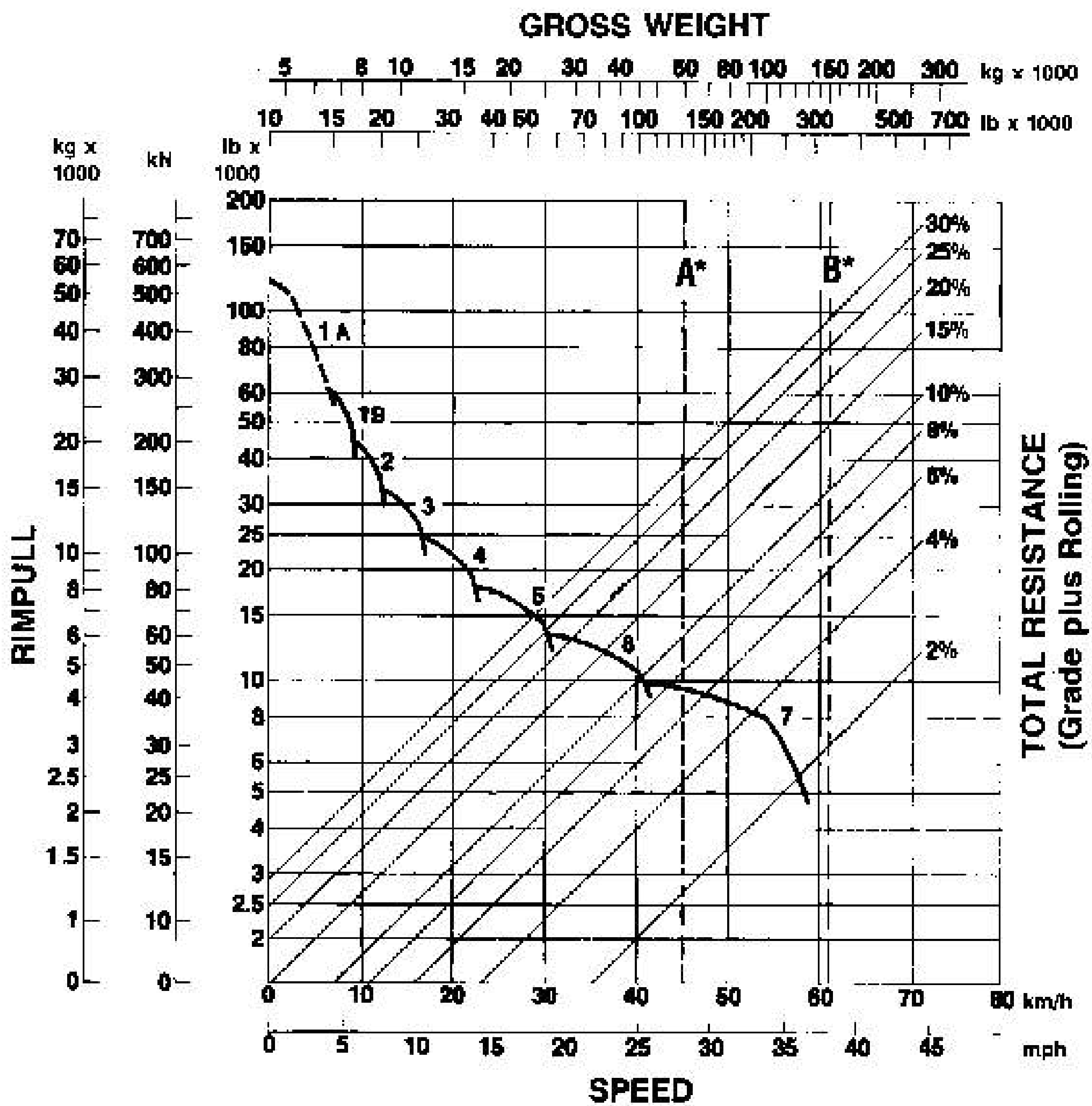
KEY
A — Empty
B — Max GVW 101 700 kg (224,300 lb)

LOADED



EMPTY

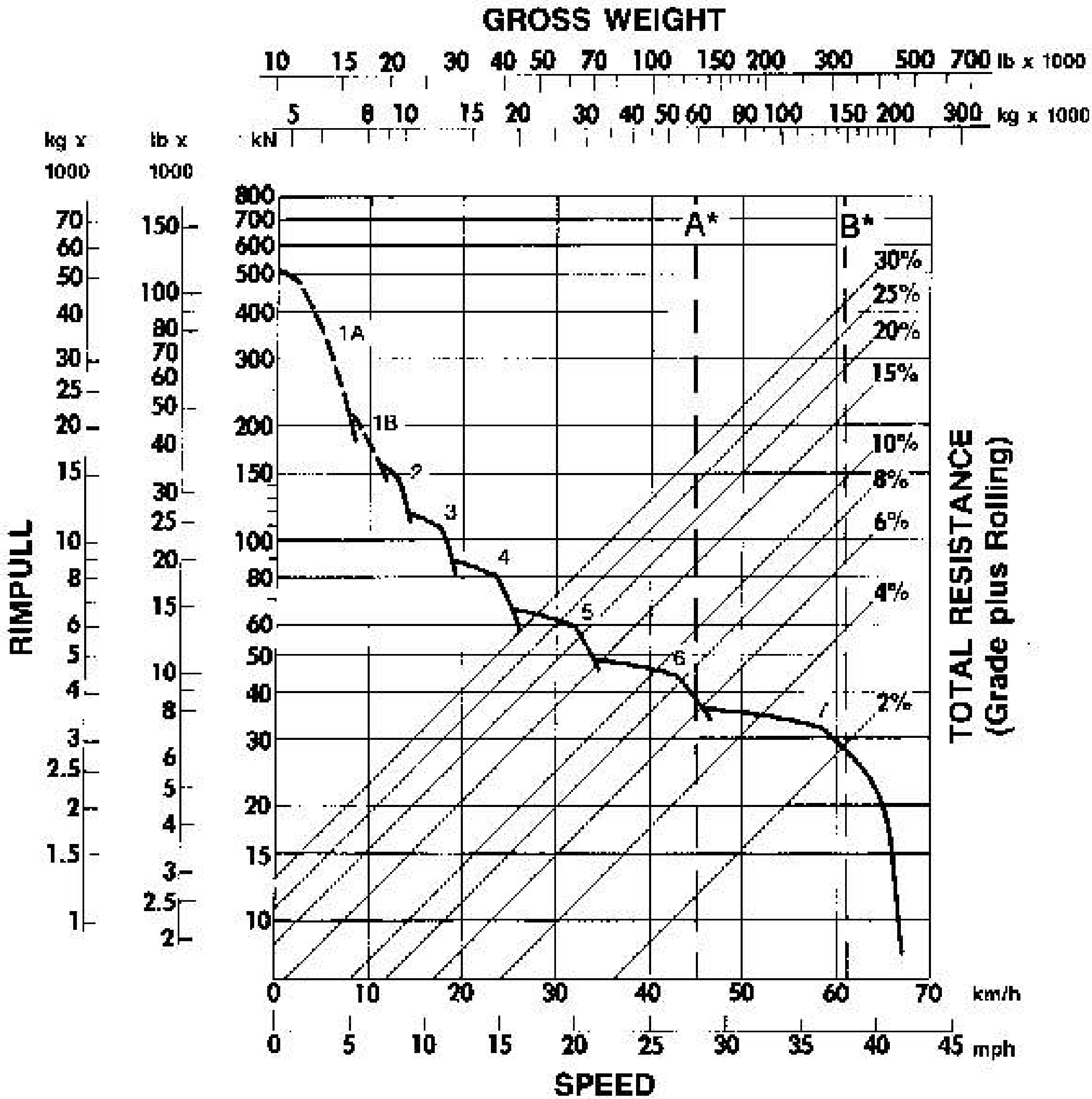




KEY
1A — 1st Gear (Torque Converter)
1B — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 7th Gear

KEY
A* — Empty 60 280 kg (132,900 lb)
B* Max GVW 146 966 kg (324,000 lb)

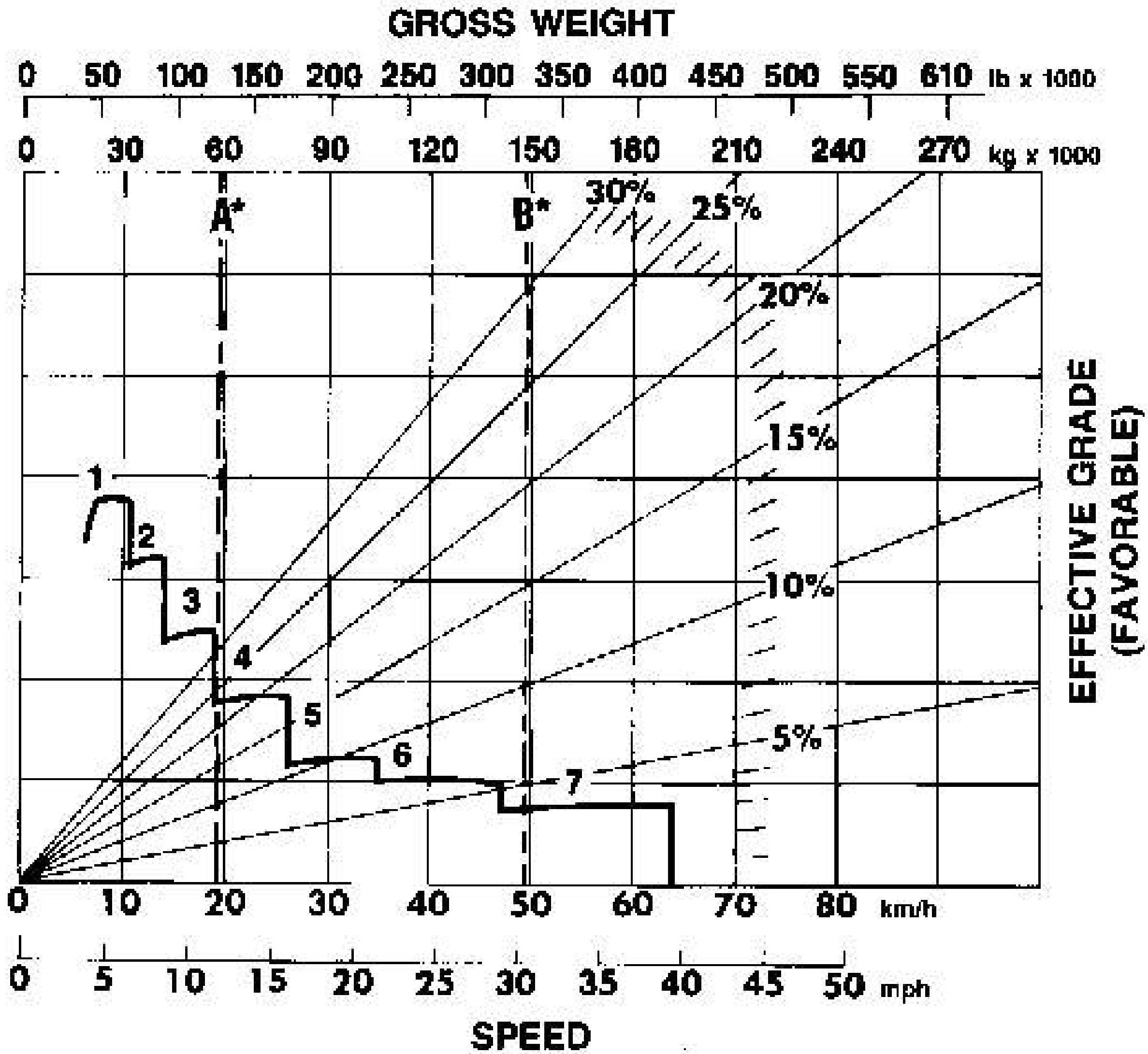
* These two reference lines (A and B) apply only to 777C.



KEY	
1A	— 1st Gear (Torque Converter)
1B	— 2nd Gear
2	— 2nd Gear
3	3rd Gear
4	— 4th Gear
5	— 5th Gear
6	— 6th Gear
7	7th Gear

KEY	
A*	— Empty 61 790 kg (136,230 lb)
B*	— Max GVW 146 966 kg (324,000 lb)

*These two reference lines (A and B) apply only to 777C.



CONTINUOUS GRADE LENGTH

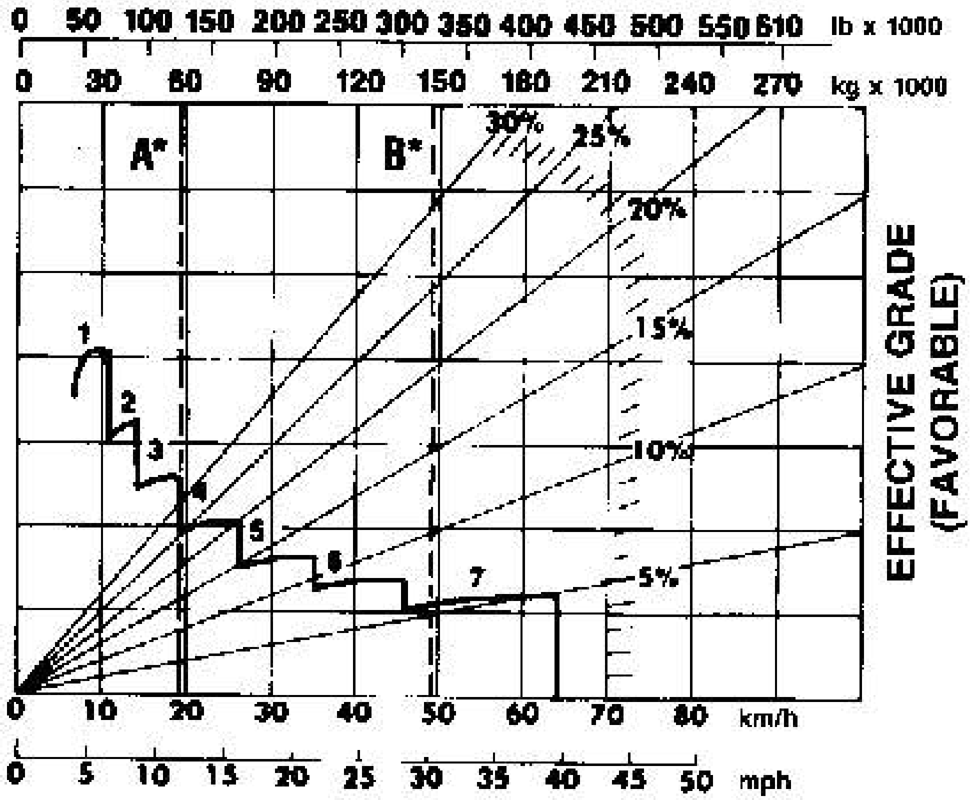
KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A* — Empty 61 790 kg (136,230 lb)
B* — Max GVW 146 966 kg (324,000 lb)

*These two reference lines (A and B) apply only to 777C

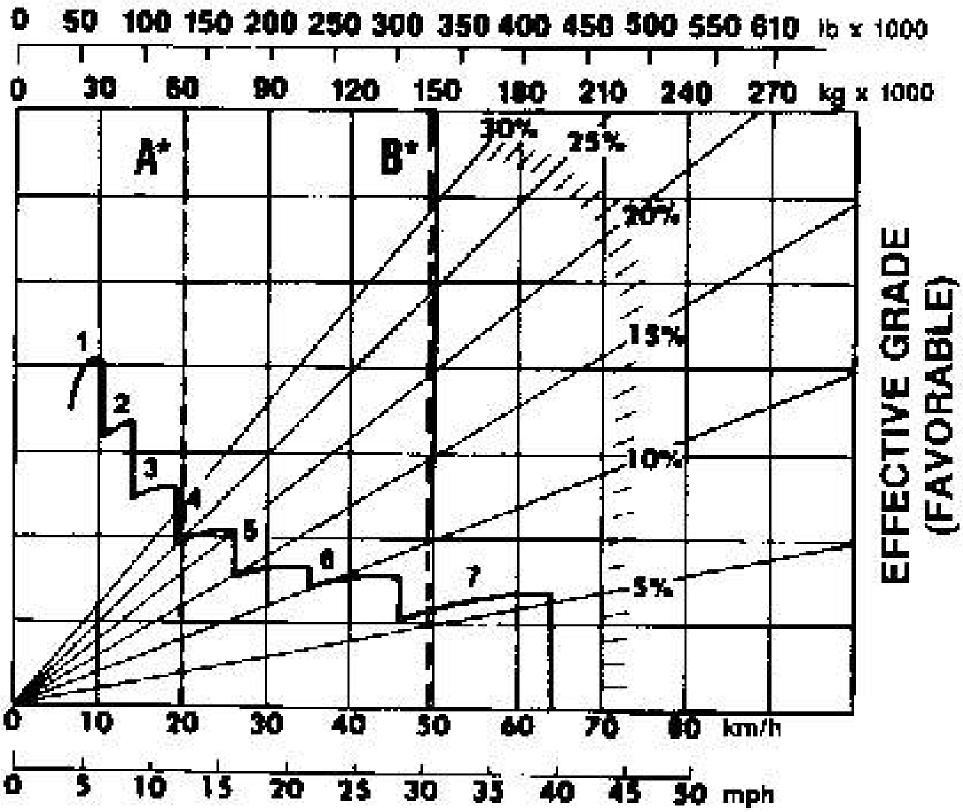


GRADE DISTANCE — 450 m (1500 ft)

KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY
A* — Empty 61 790 kg (136,230 lb)
B* — Max GVW 146 966 kg (324,000 lb)

* These two reference lines (A and B) apply only to 777C.



GRADE DISTANCE — 600 m (2000 ft)

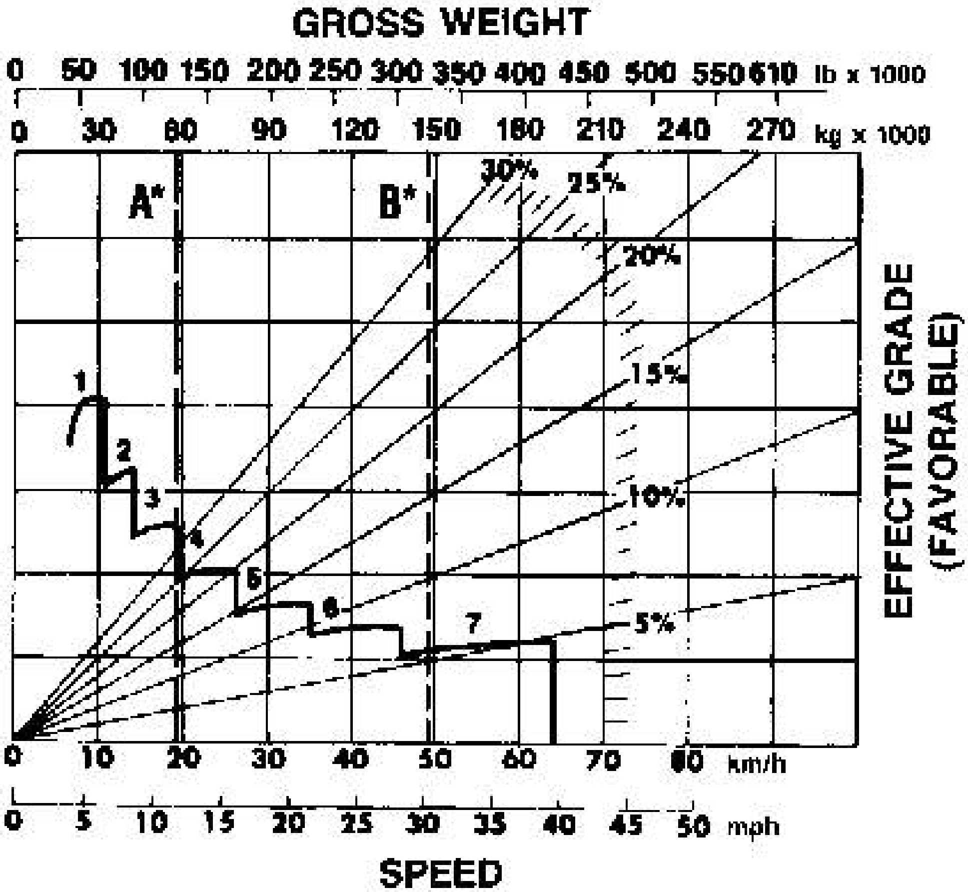
KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A* — Empty 61 790 kg (136,230 lb)
B* — Max GVW 146 966 kg (324,000 lb)

*These two reference lines (A and B) apply only to 777C.



GRADE DISTANCE — 900 m (3000 ft)

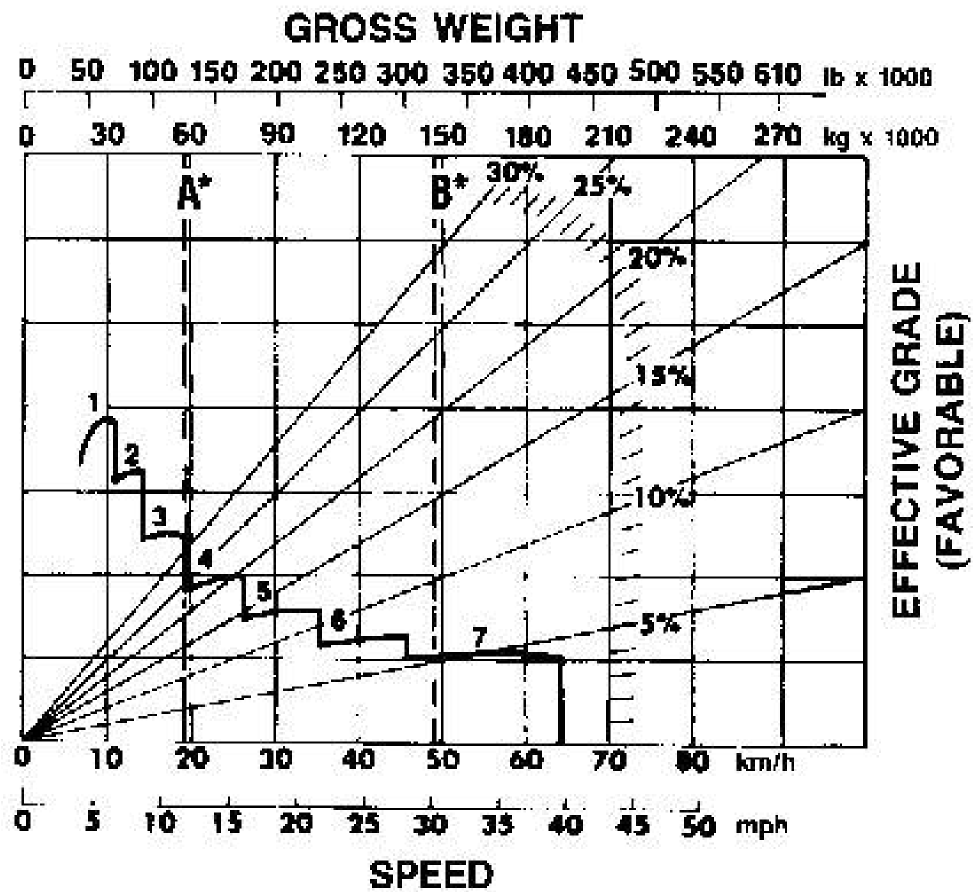
KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A* — Empty 61 790 kg (136,230 lb)
B* — Max GVW 146 966 kg (324,000 lb)

* These two reference lines (A and B) apply only to 777C.



GRADE DISTANCE — 1500 m (5000 ft)

KEY

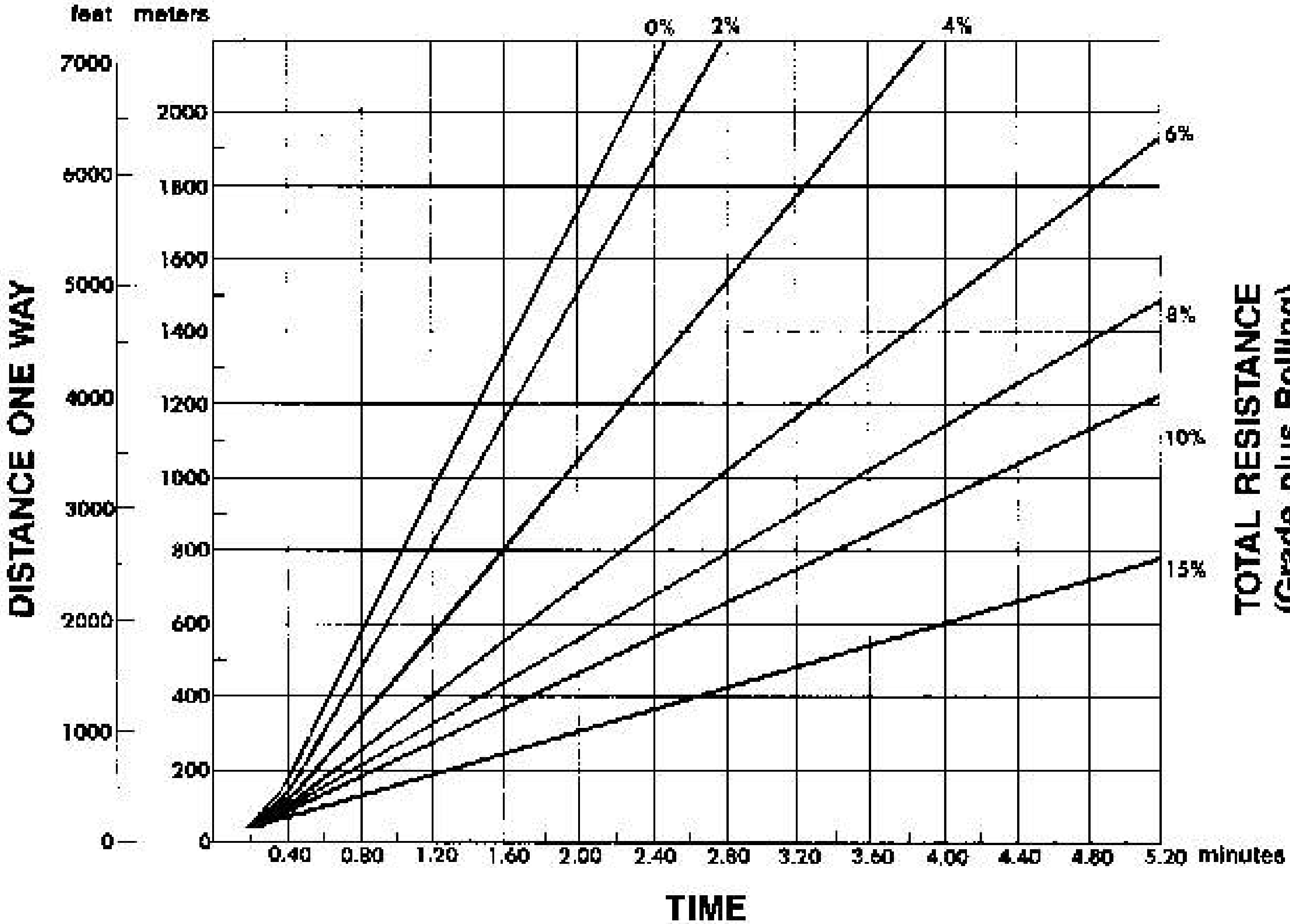
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

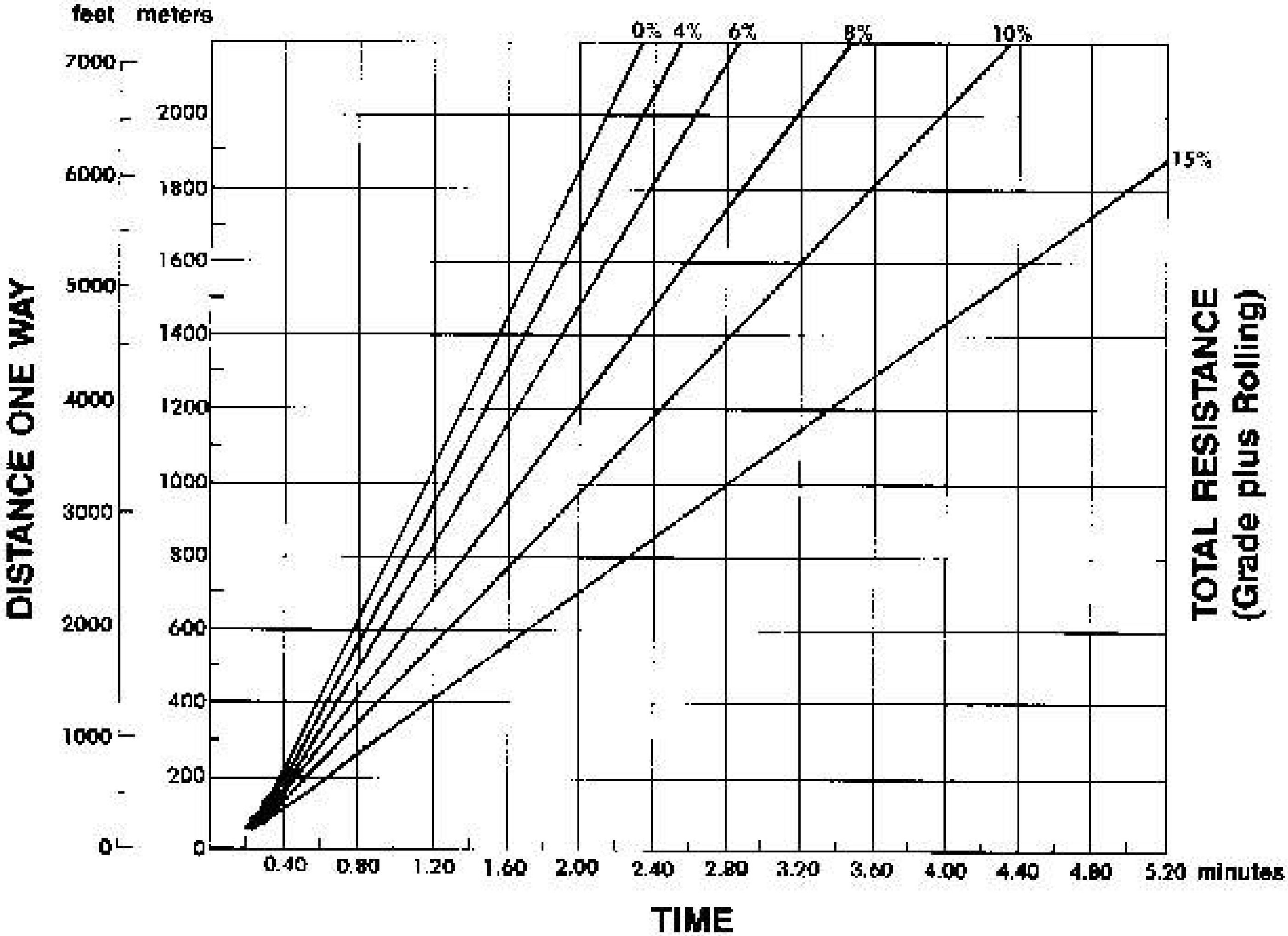
A* — Empty 61 790 kg (136,230 lb)
B* — Max GVW 146 966 kg (324,000 lb)

*These two reference lines (A and B) apply only to 777C.

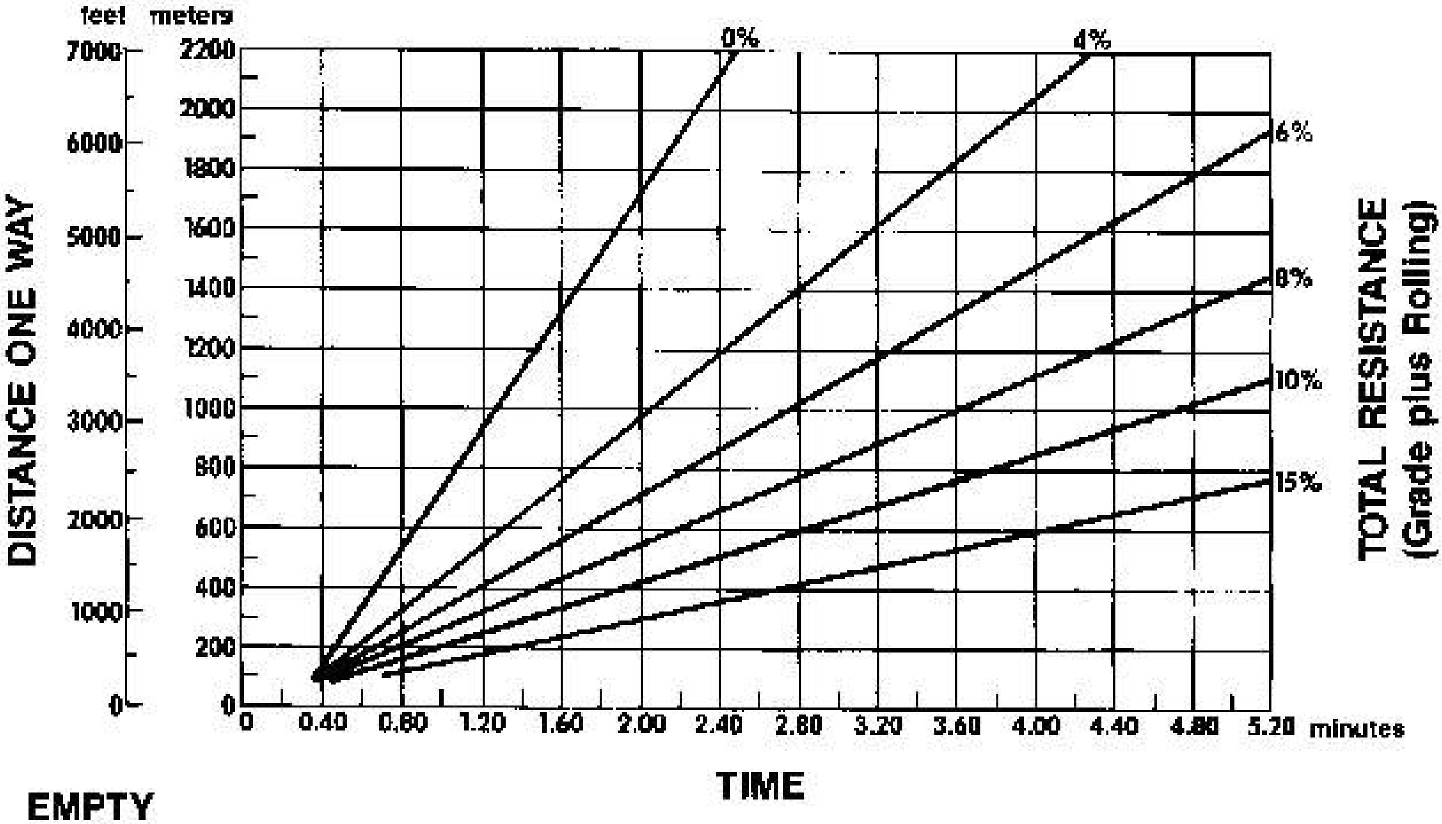
LOADED


feet
meters
DISTANCE ONE WAY
7000
6000
5000
4000
3000
2000
1000
0
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0%
2%
4%
6%
8%
10%
15%
TOTAL RESISTANCE
(Grade plus Rolling)
0.40
0.80
1.20
1.60
2.00
2.40
2.80
3.20
3.60
4.00
4.40
4.80
5.20
minutes
TIME

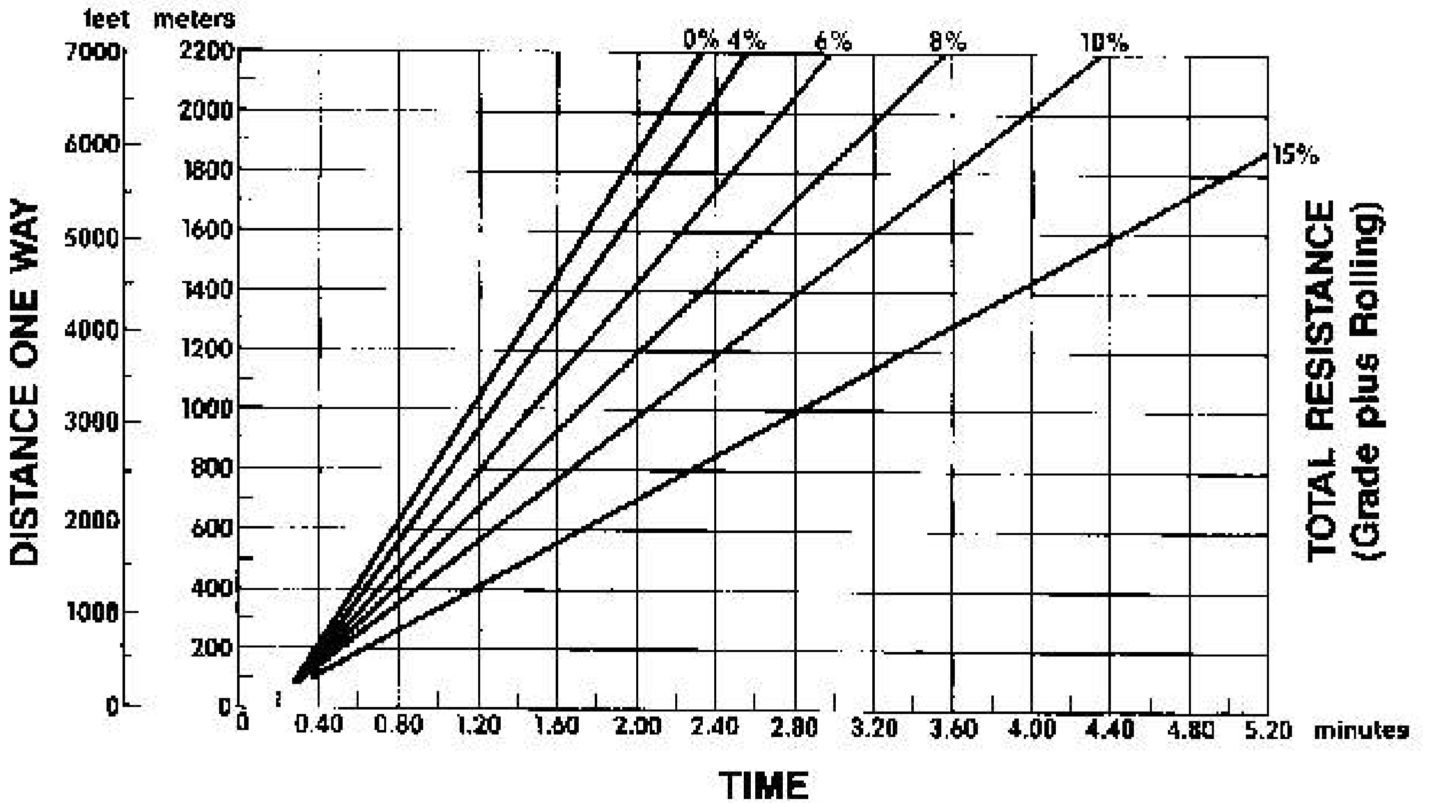
EMPTY


feet meters
0% 4% 6% 8% 10%
15%
7000
6000
5000
4000
3000
2000
1000
0
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0.40 0.80 1.20 1.60 2.00 2.40 2.80 3.20 3.60 4.00 4.40 4.80 5.20 minutes
DISTANCE ONE WAY
TIME
TOTAL RESISTANCE
(Grade plus Rolling)

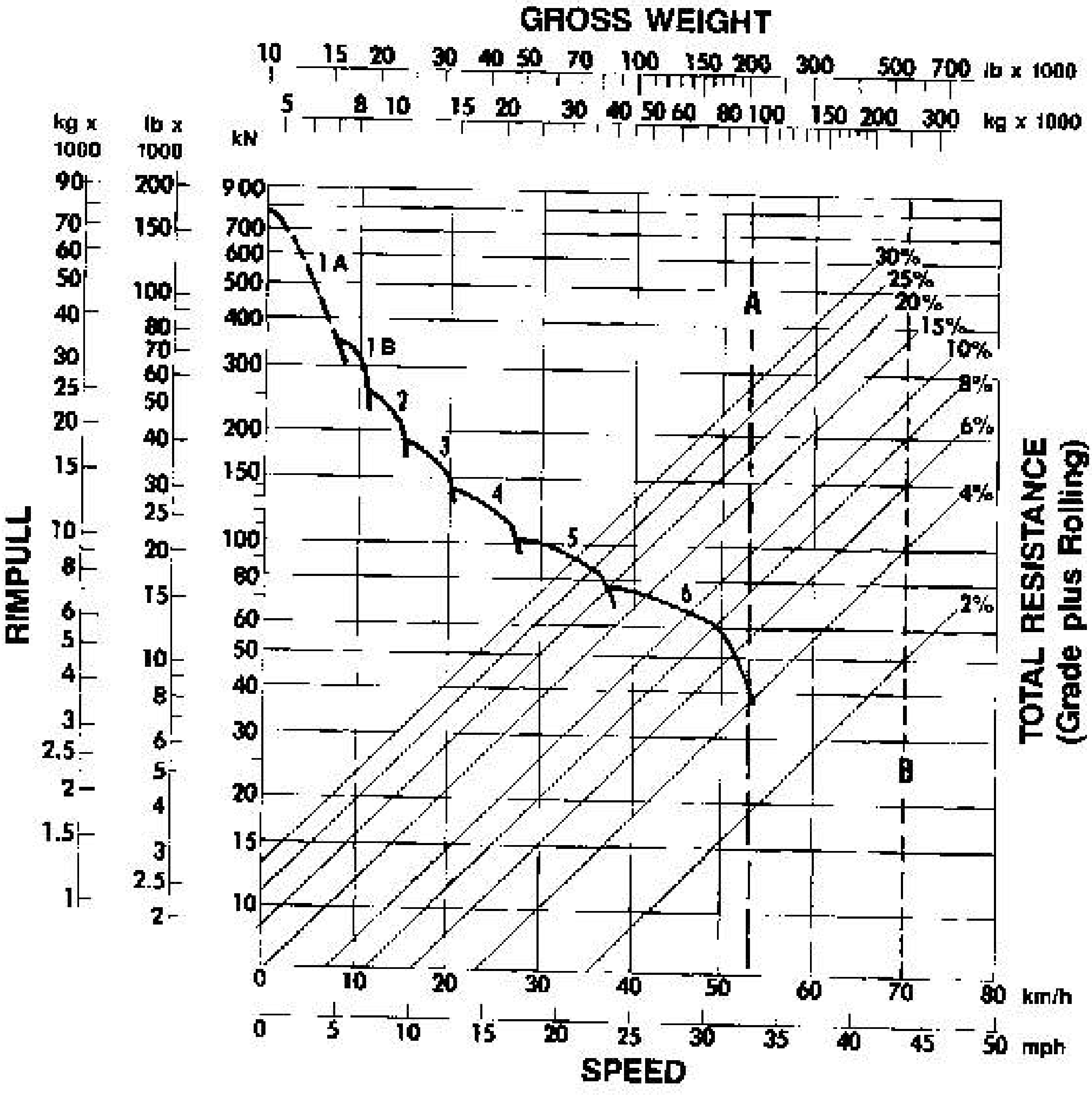
LOADED



EMPTY



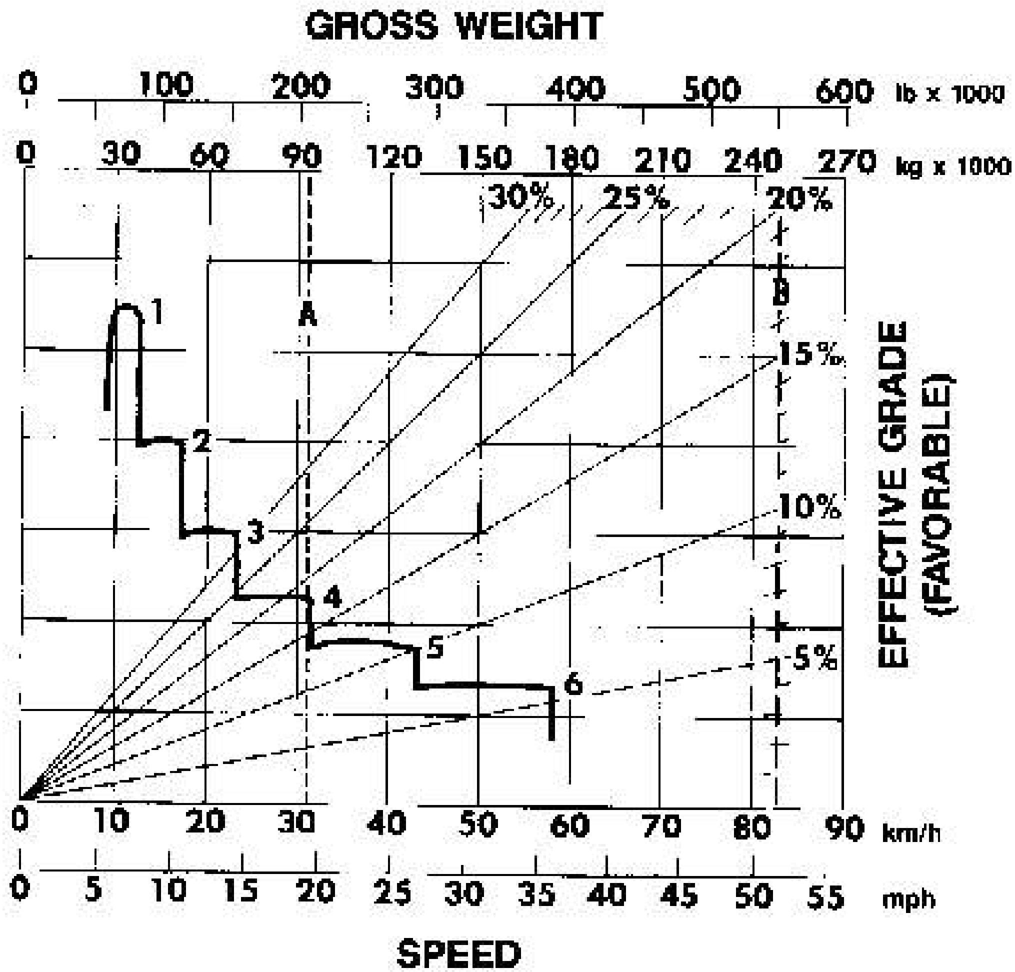
785, 784 Rimpull-Speed-Gradeability
• 33.00-51 Tires



KEY
1A — 1st Gear (Torque Converter)
1B — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY
A* — Empty 96 353 kg (212,458 lb)
B* — Max GVW 249 433 kg (550,000 lb)

*These two reference lines (A and B) apply only to 785.



CONTINUOUS GRADE LENGTH

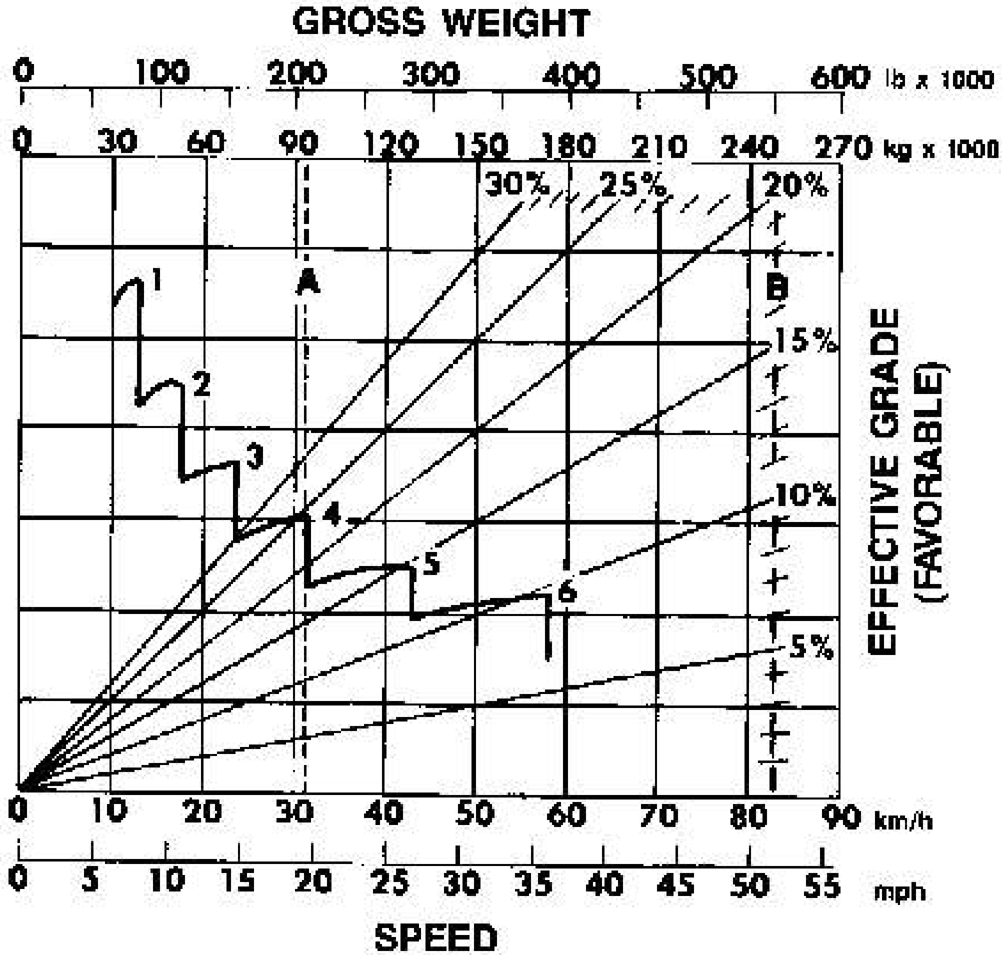
KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY

A* — Empty 96 353 kg (212,458 lb)
B* — Max GVW 249 433 kg (550,000 lb)

*These two reference lines (A and B) apply only to 785.



GRADE DISTANCE — 450 m (1500 ft)

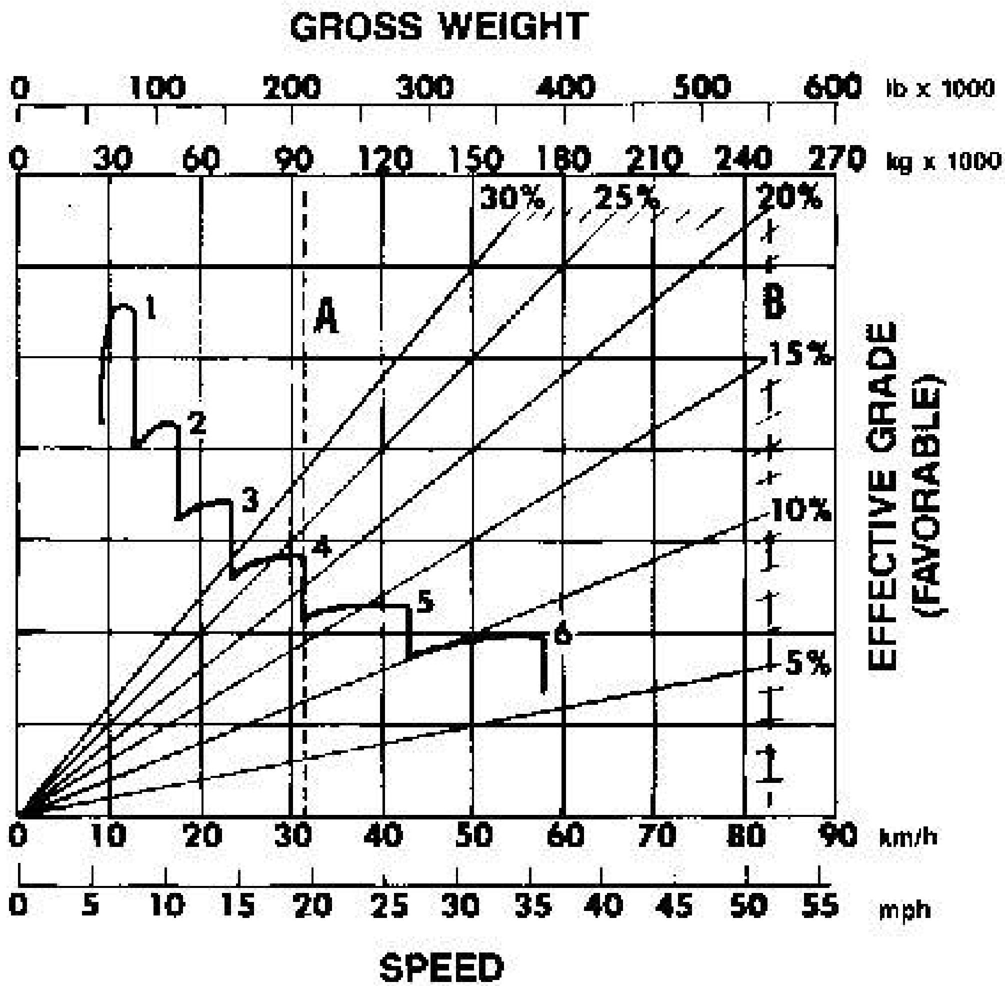
KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY

A* — Empty 90 353 kg (212,458 lb)
B* — Max GVW 249 433 kg (550,000 lb)

*These two reference lines (A and B) apply only to 785.



GRADE DISTANCE — 600 m (2000 ft)

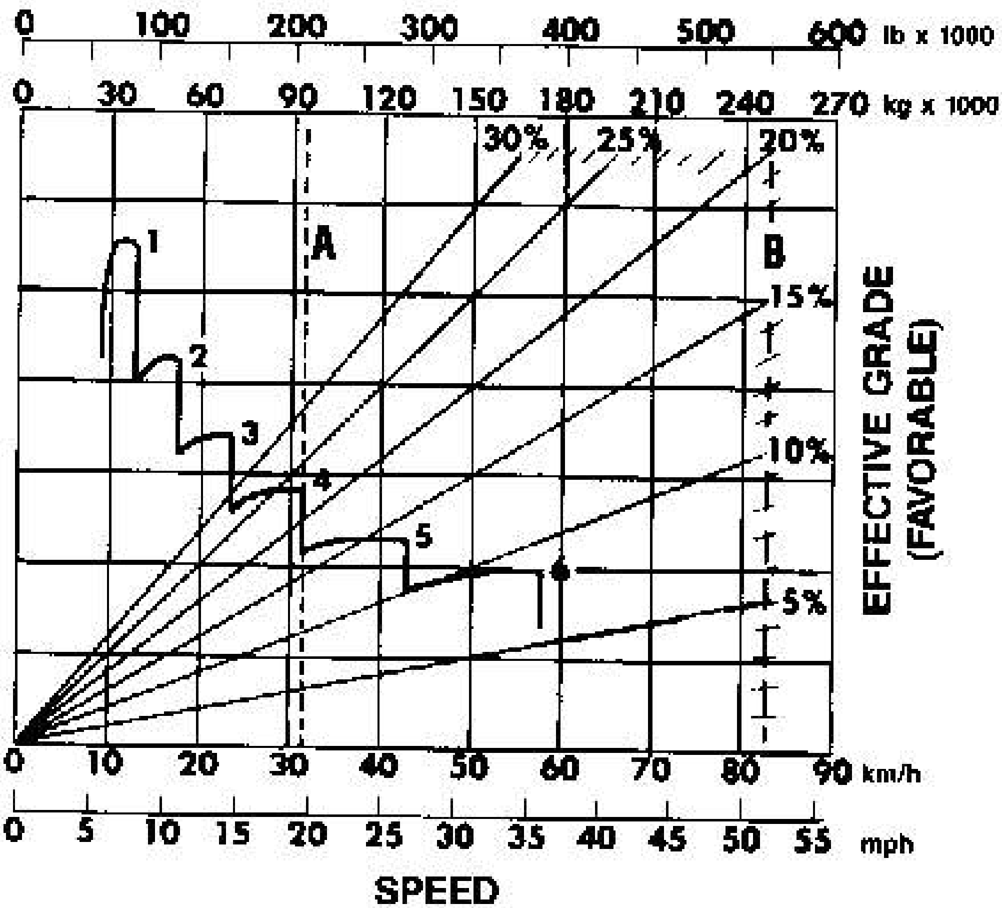
KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY

A* — Empty 96 353 kg (212,458 lb)
B* — Max GVW 249 433 kg (550,000 lb)

*These two reference lines (A and B) apply only to 785.



GRADE DISTANCE — 900 m (3000 ft)

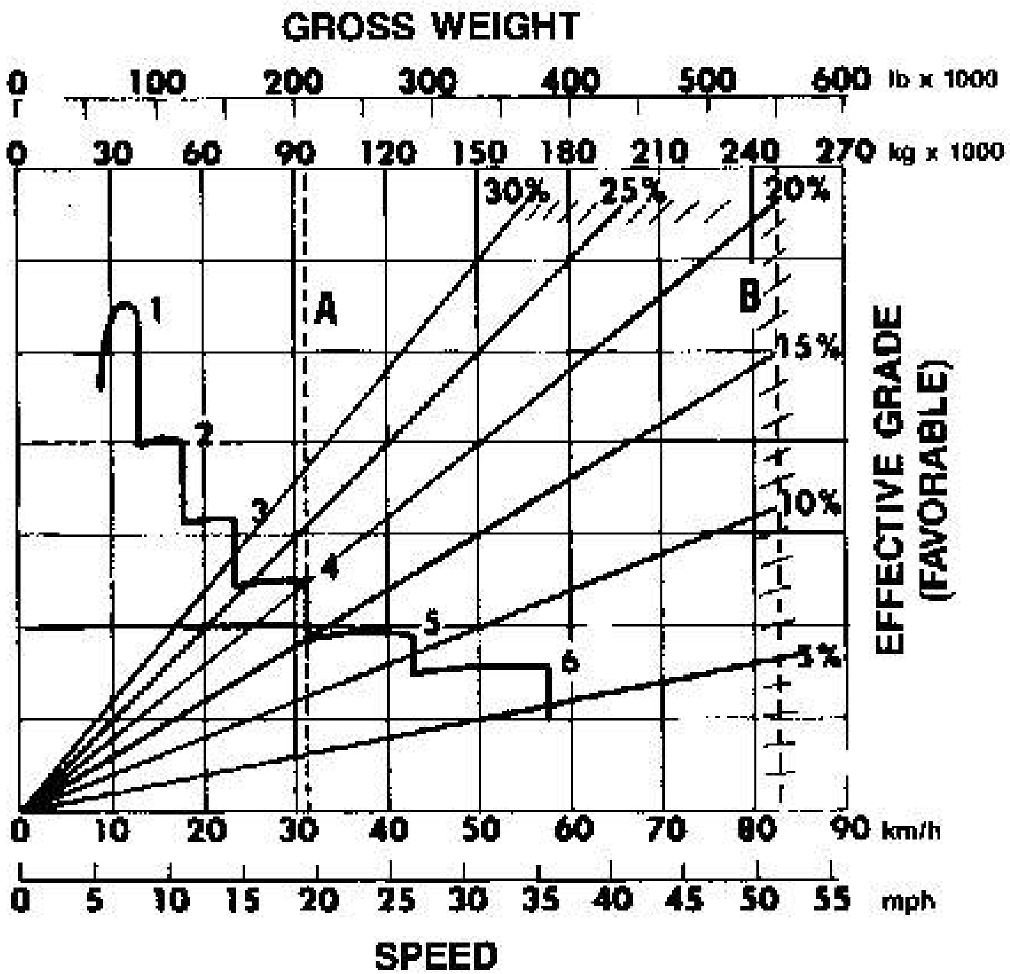
KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY

A* — Empty 96 363 kg (212,458 lb)
B* — Max GVW 249 433 kg (550,000 lb)

*These two reference lines (A and B) apply only to 785.



GRADE DISTANCE — 1500 m (5000 ft)

KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

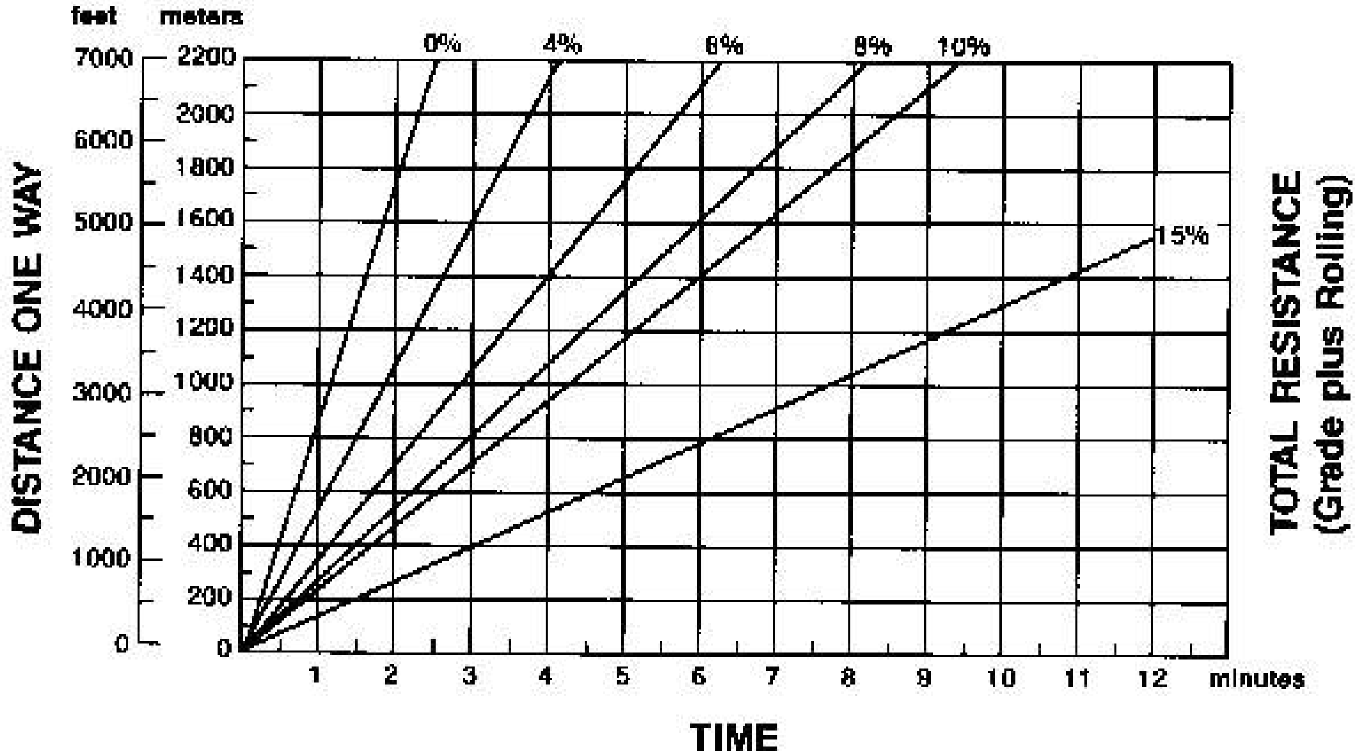
KEY

A* — Empty 96 353 kg (212,456 lb)
B* — Max GVW 249 433 kg (550,000 lb)

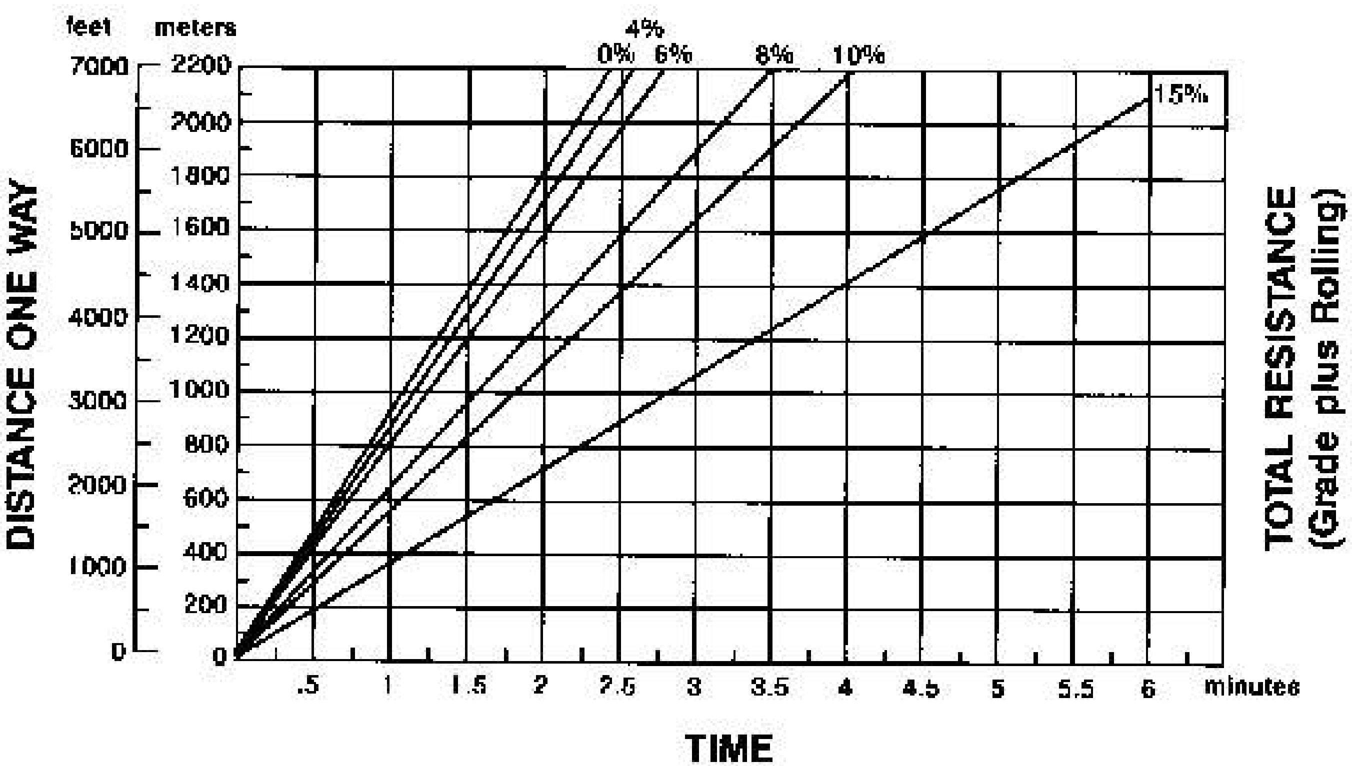
*These two reference lines (A and B) apply only to 785.

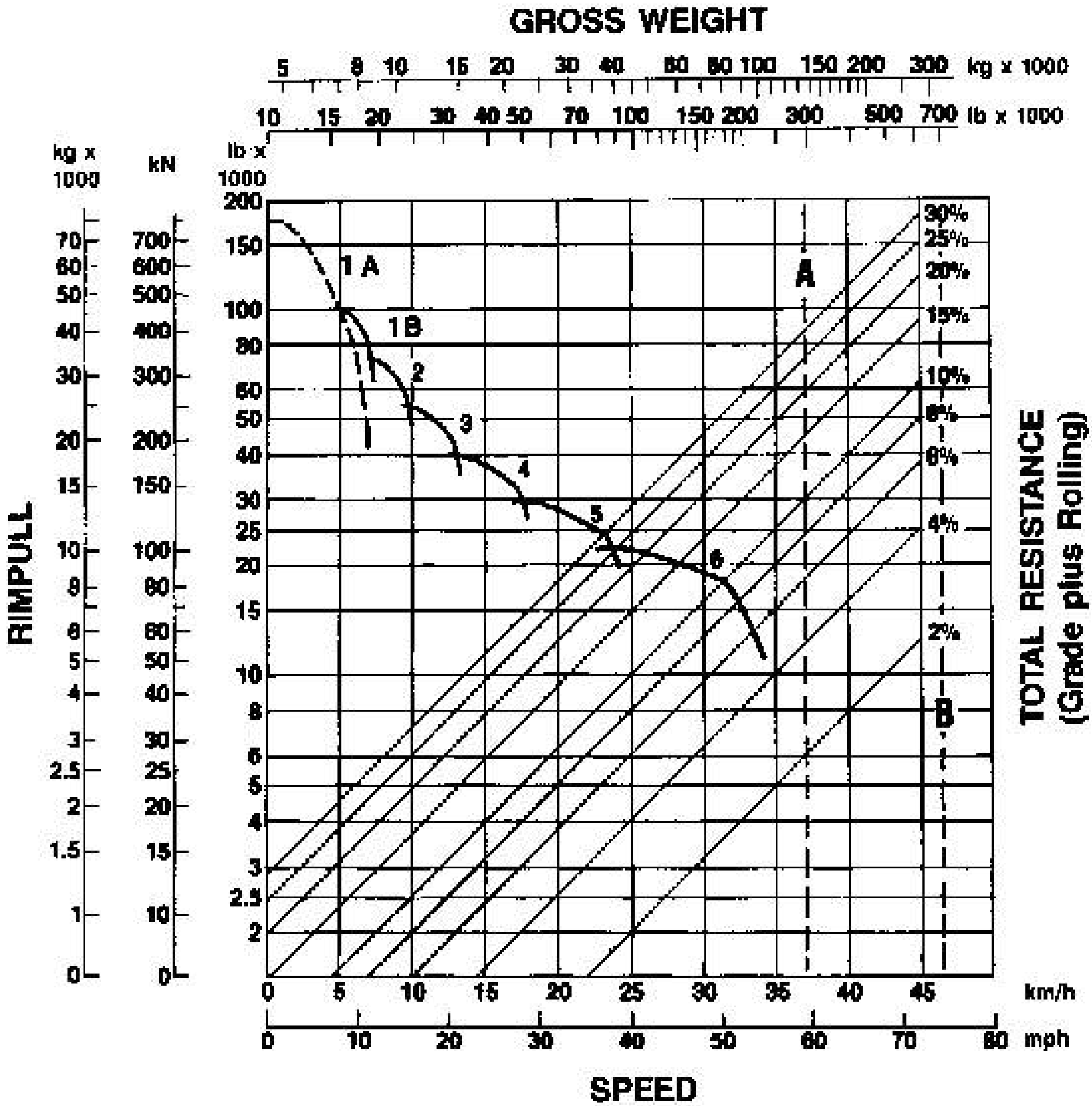
9

LOADED



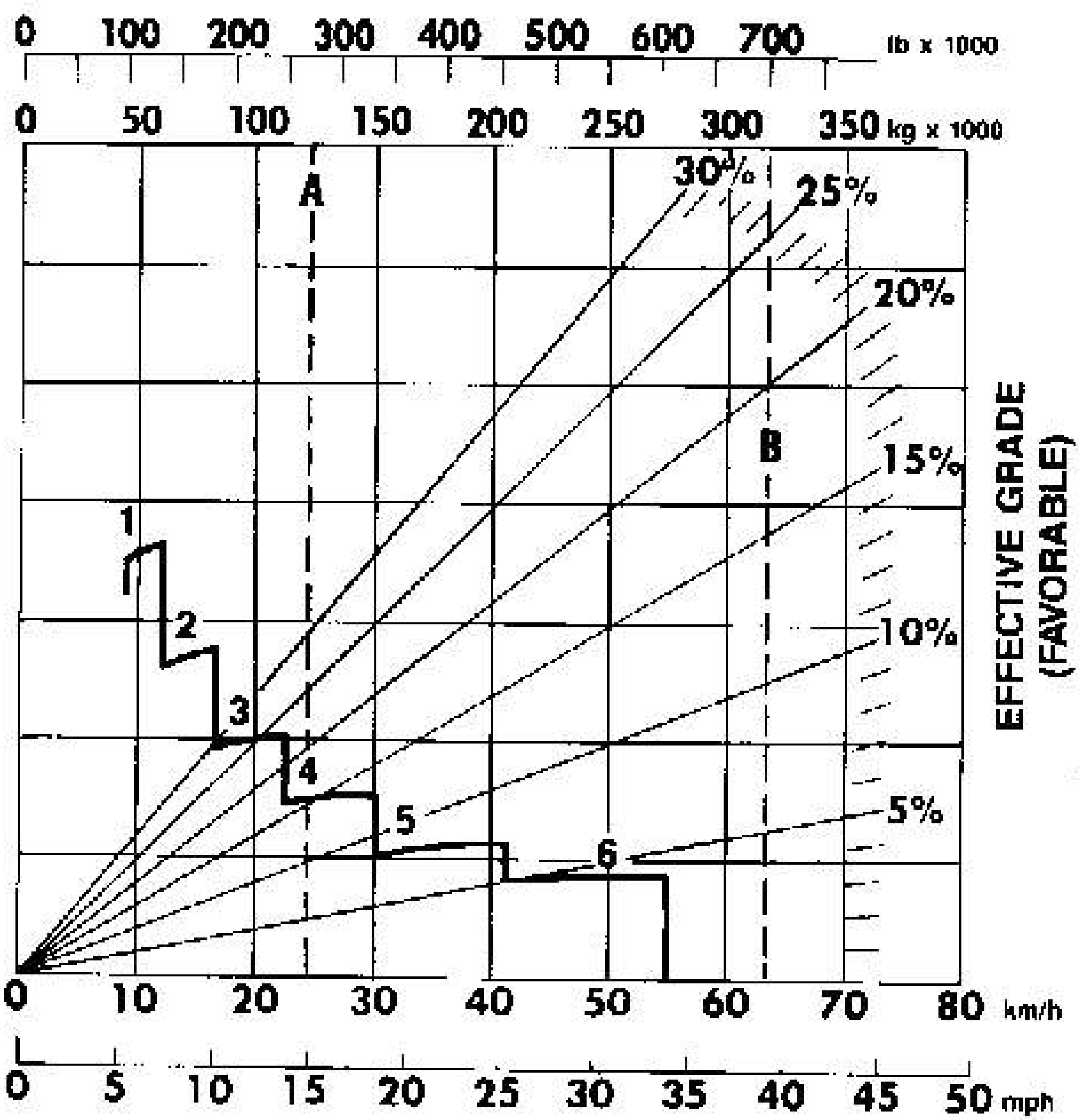
EMPTY





KEY
1A — 1st Gear (Torque Converter)
1B — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

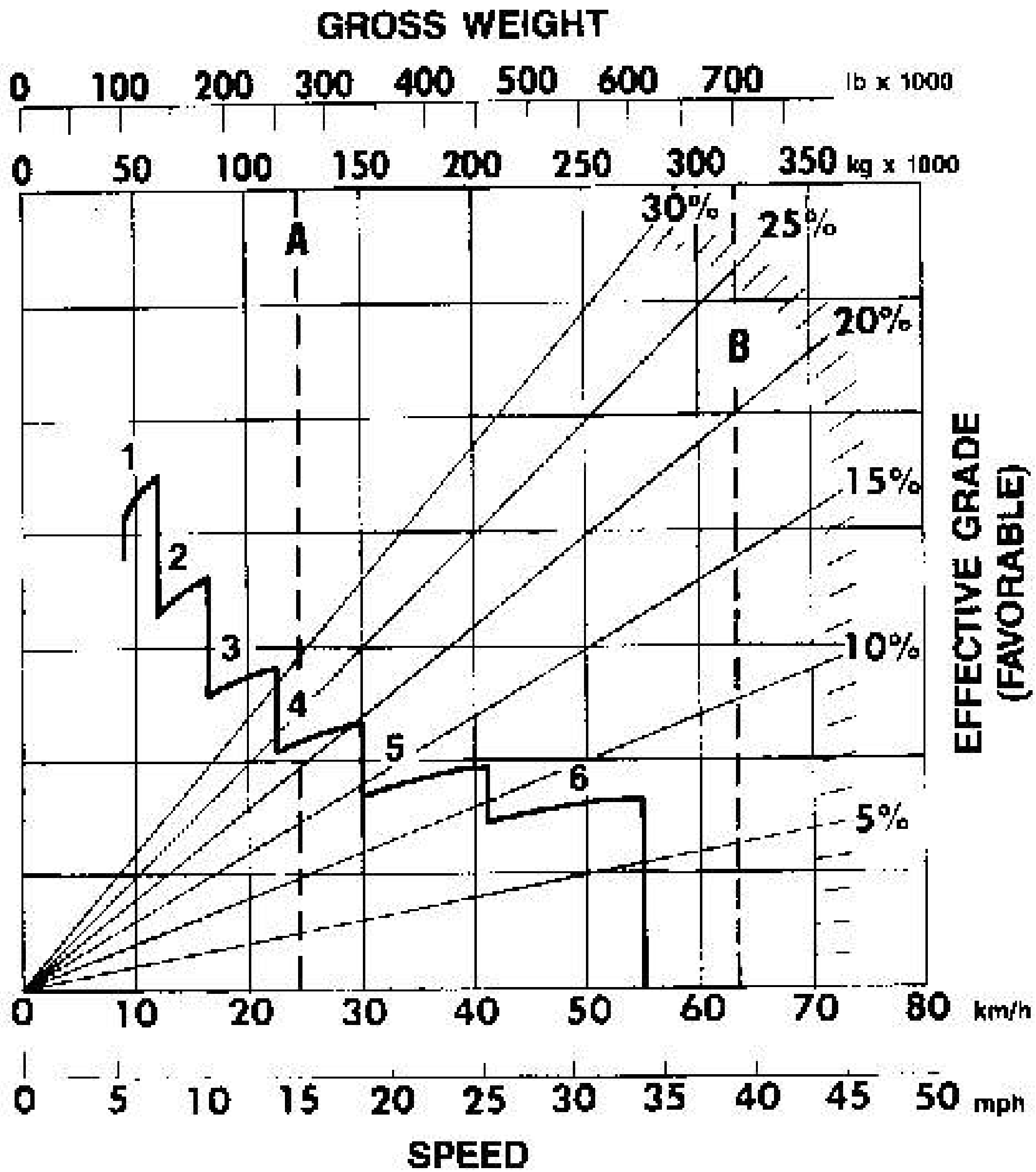
KEY
A — Empty 121 922 kg (268,837 lb)
B — Max GVW 317 460 kg (700,000 lb)



CONTINUOUS GRADE LENGTH

KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY
A — Empty 121 922 kg (268,837 lb)
B — Max GVW 317 460 kg (700,000 lb)



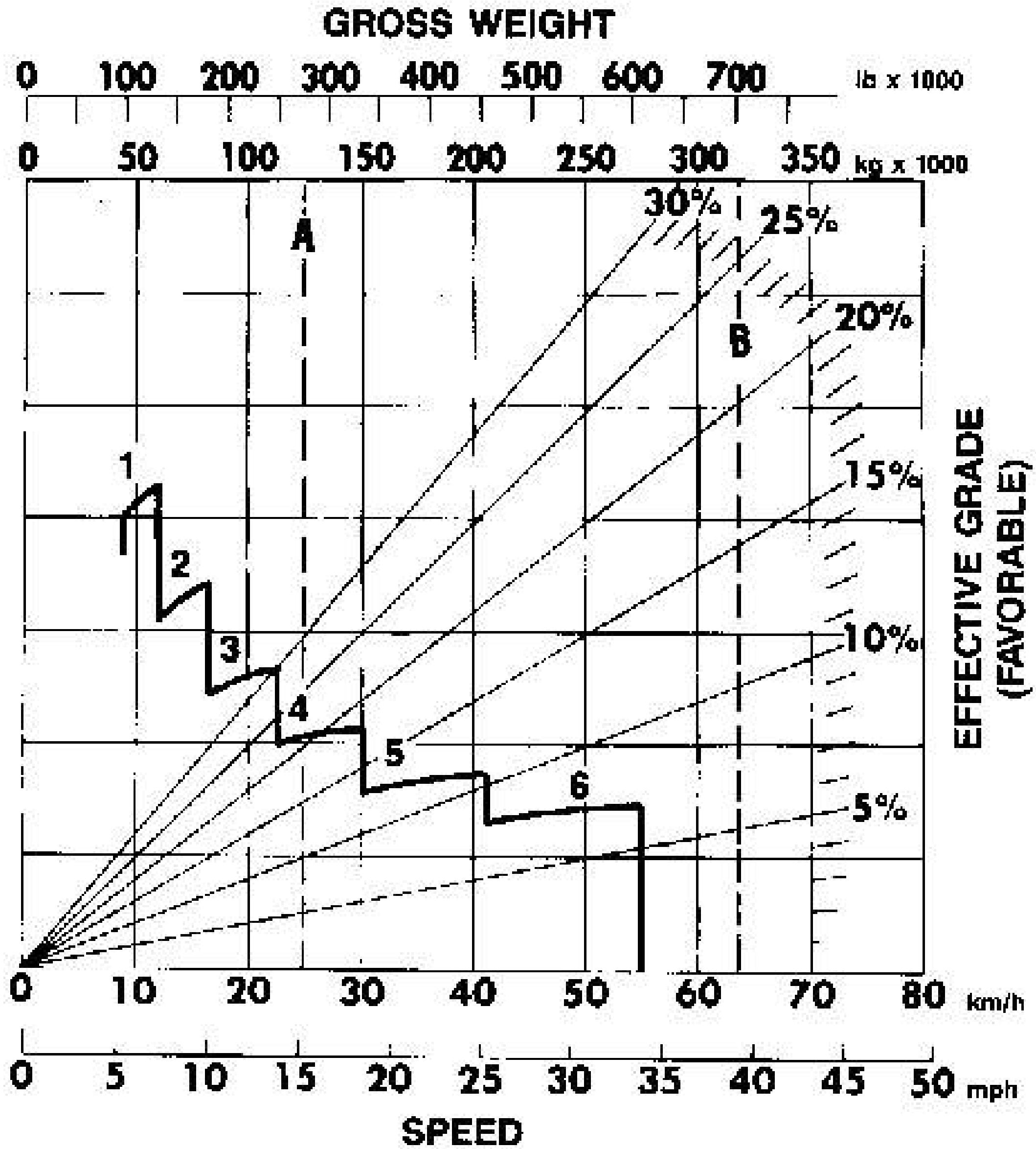
GRADE DISTANCE — 450 m (1500 ft)

KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY

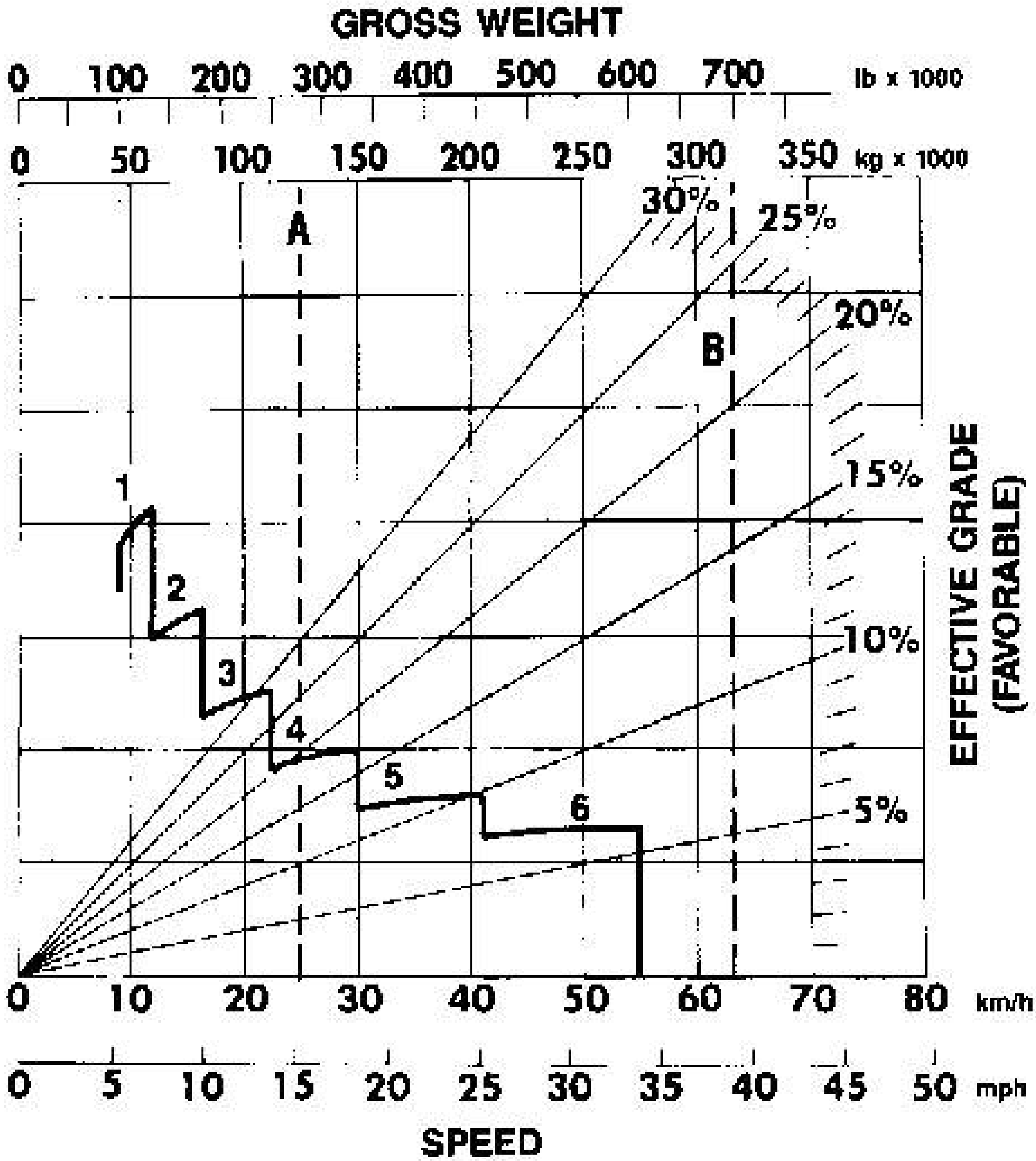
A — Empty 121 922 kg (268,837 lb)
B — Max GVW 317 460 kg (700,000 lb)



GRADE DISTANCE — 600 m (2000 ft)

KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 6th Gear

KEY
A — Empty 121 922 kg (268,837 lb)
B — Max GVW 317 460 kg (700,000 lb)



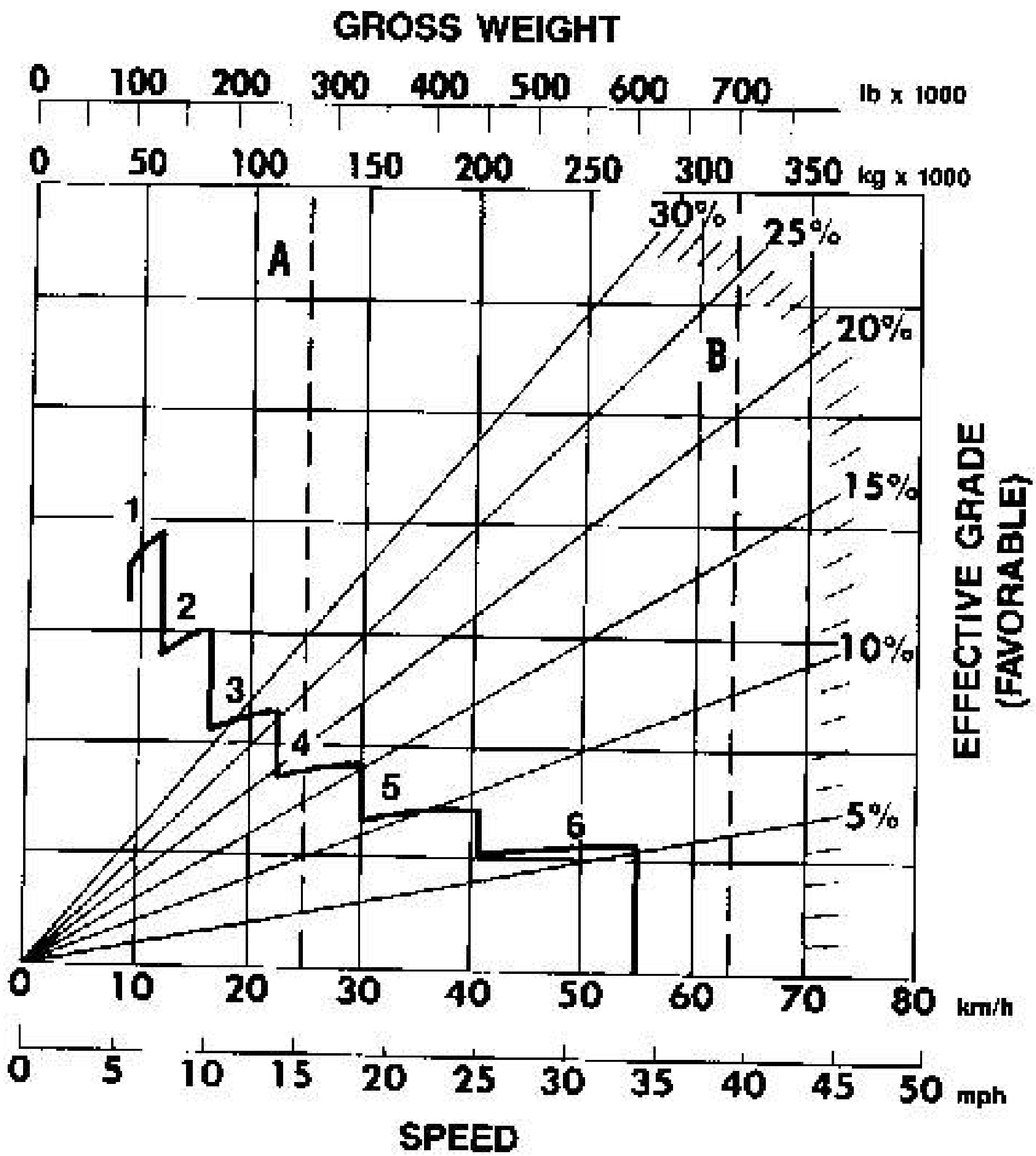
GRADE DISTANCE — 900 m (3000 ft)

KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 6th Gear

KEY

A — Empty 121 922 kg (268,837 lb)
B — Max GVW 317 460 kg (700,000 lb)

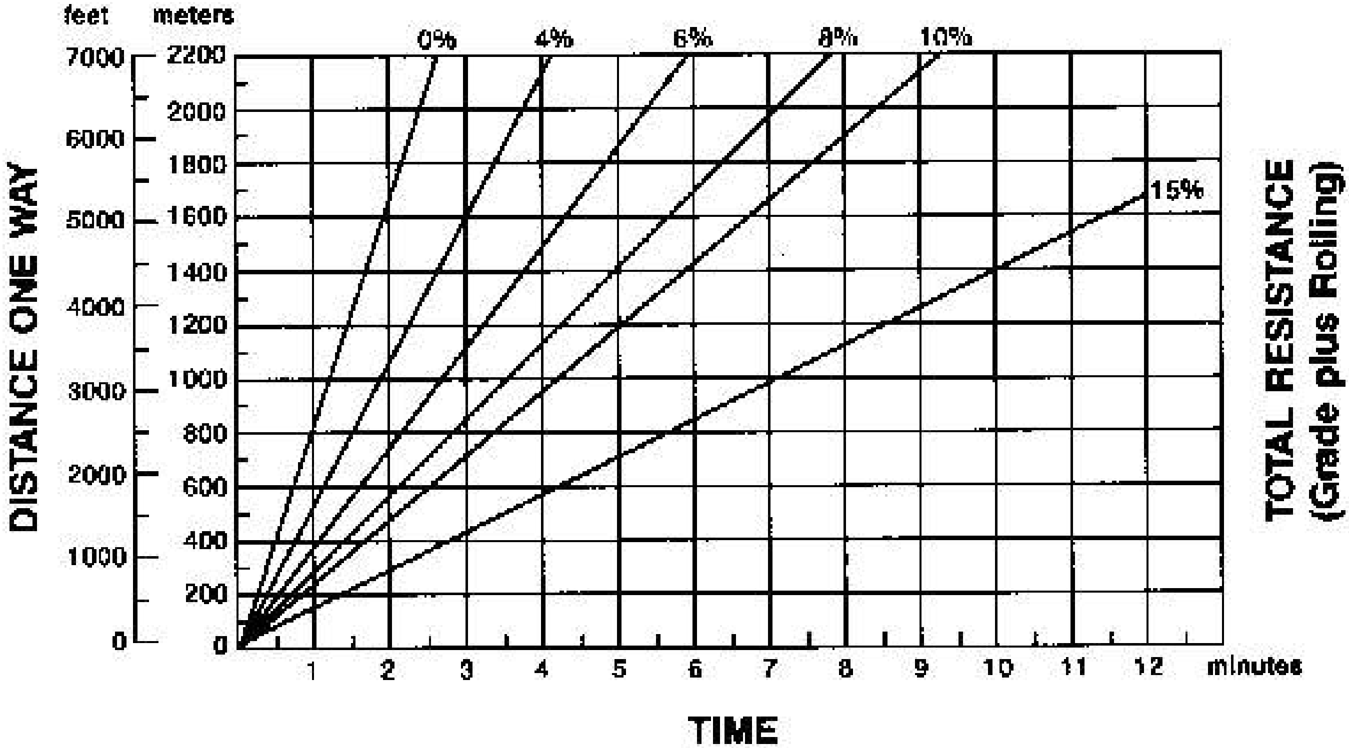


GRADE DISTANCE — 1500 m (5000 ft)

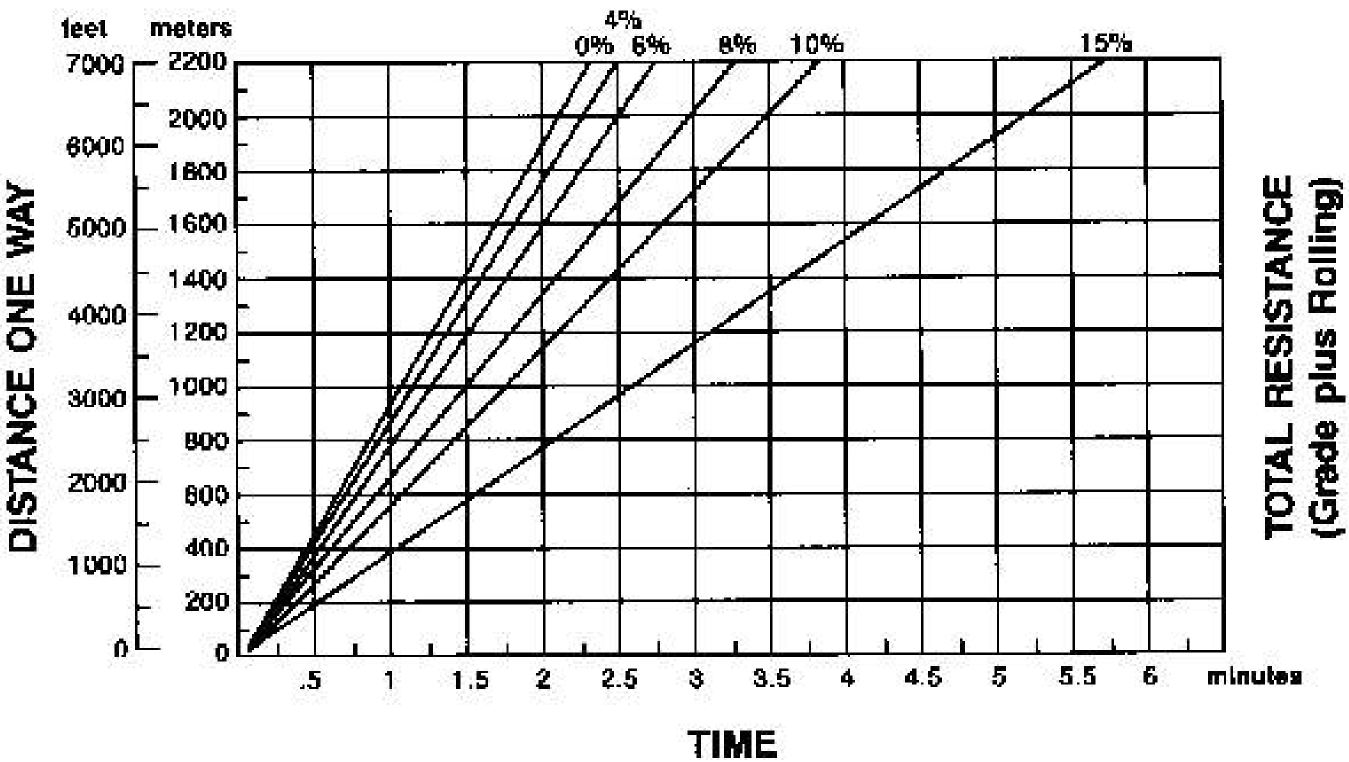
KEY
1 — 1st Gear
2 - 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

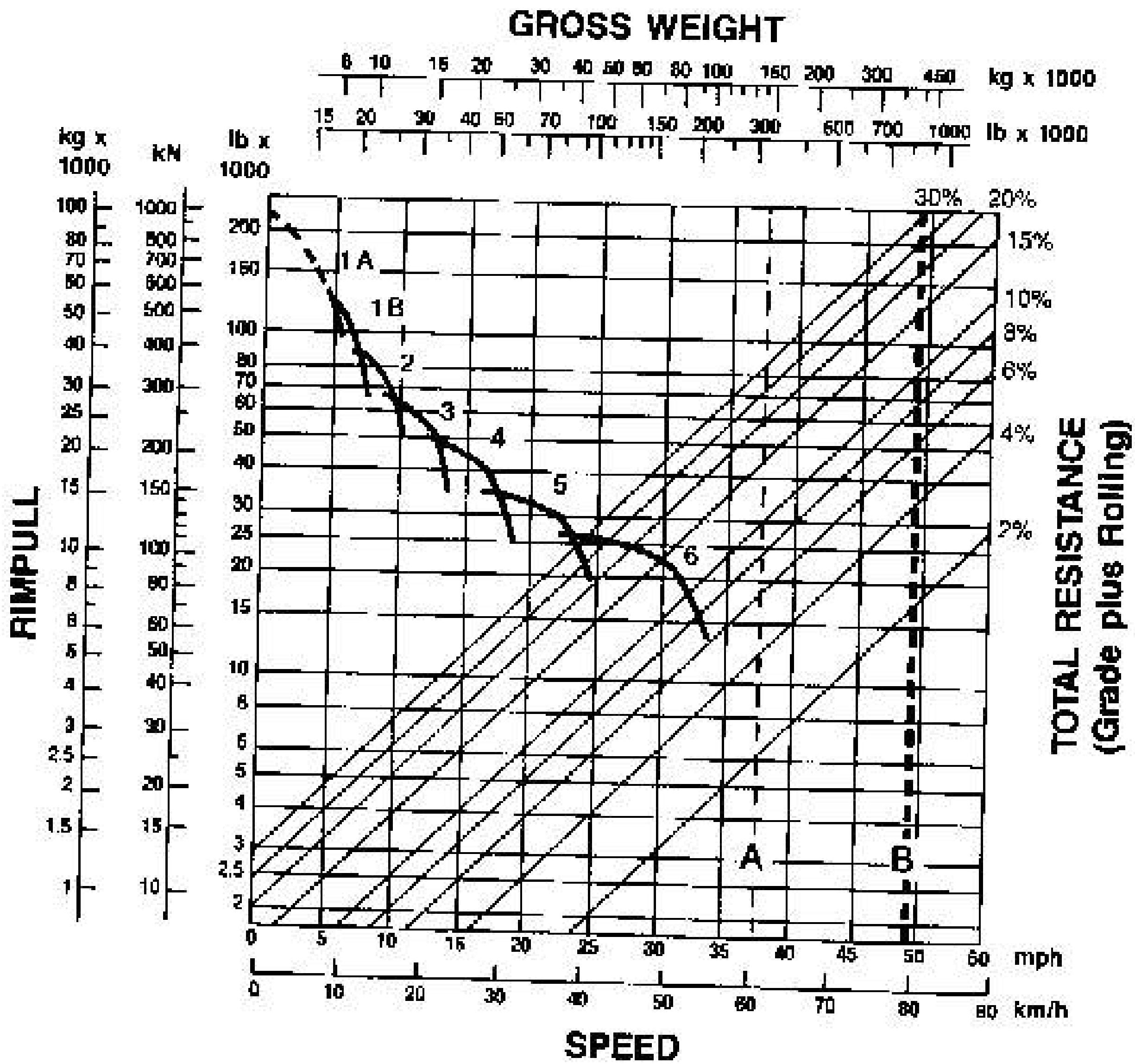
KEY
A — Empty 121 922 kg (268,837 lb)
B — Max GVW 317 460 kg (700,000 lb)

LOADED



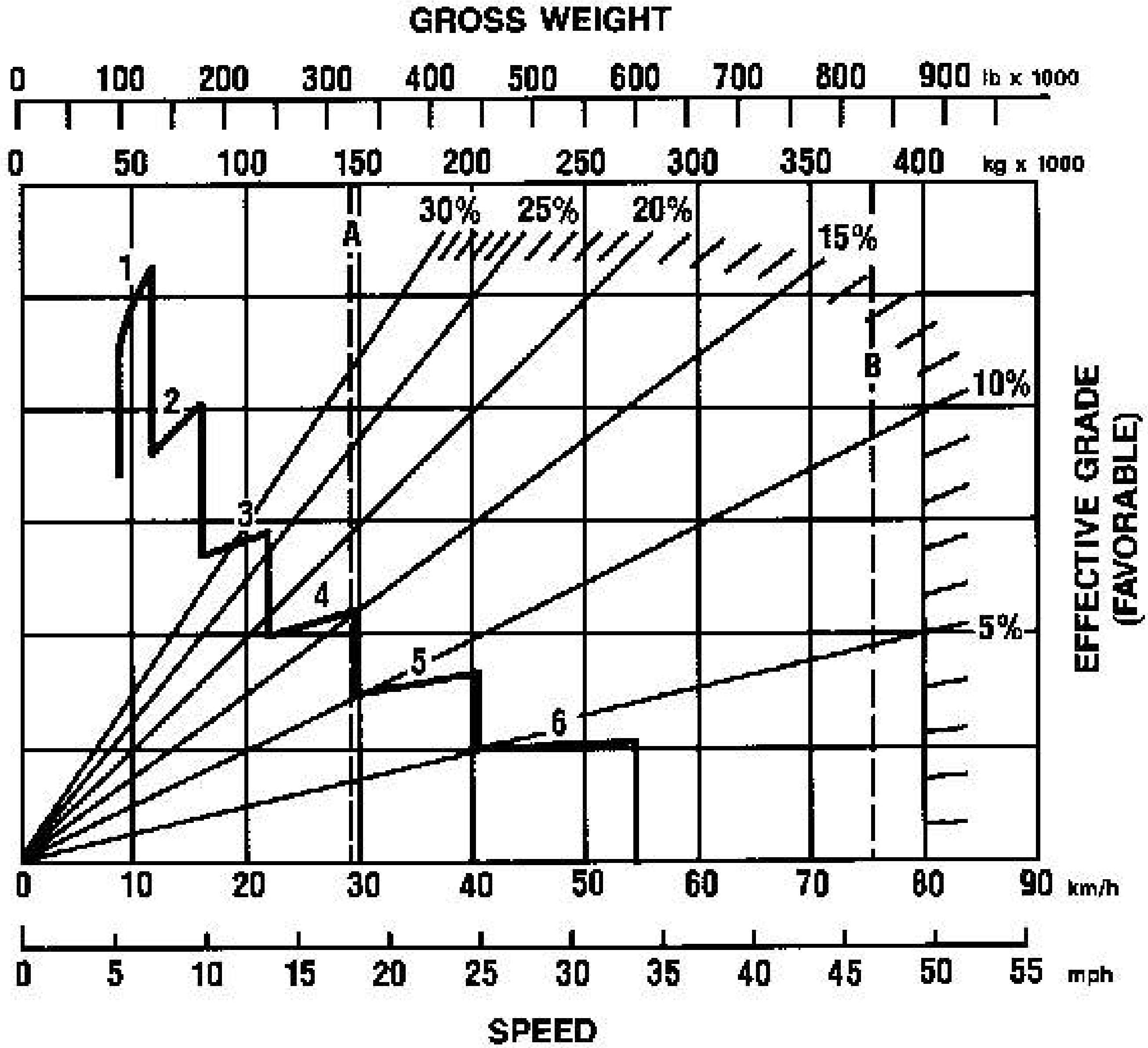
EMPTY





KEY
1A — 1st Gear (Torque Converter)
1B — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY
A — Empty 143 554 kg (323,709 lb)
B - Max GVW 376 488 kg (830,000 lb)

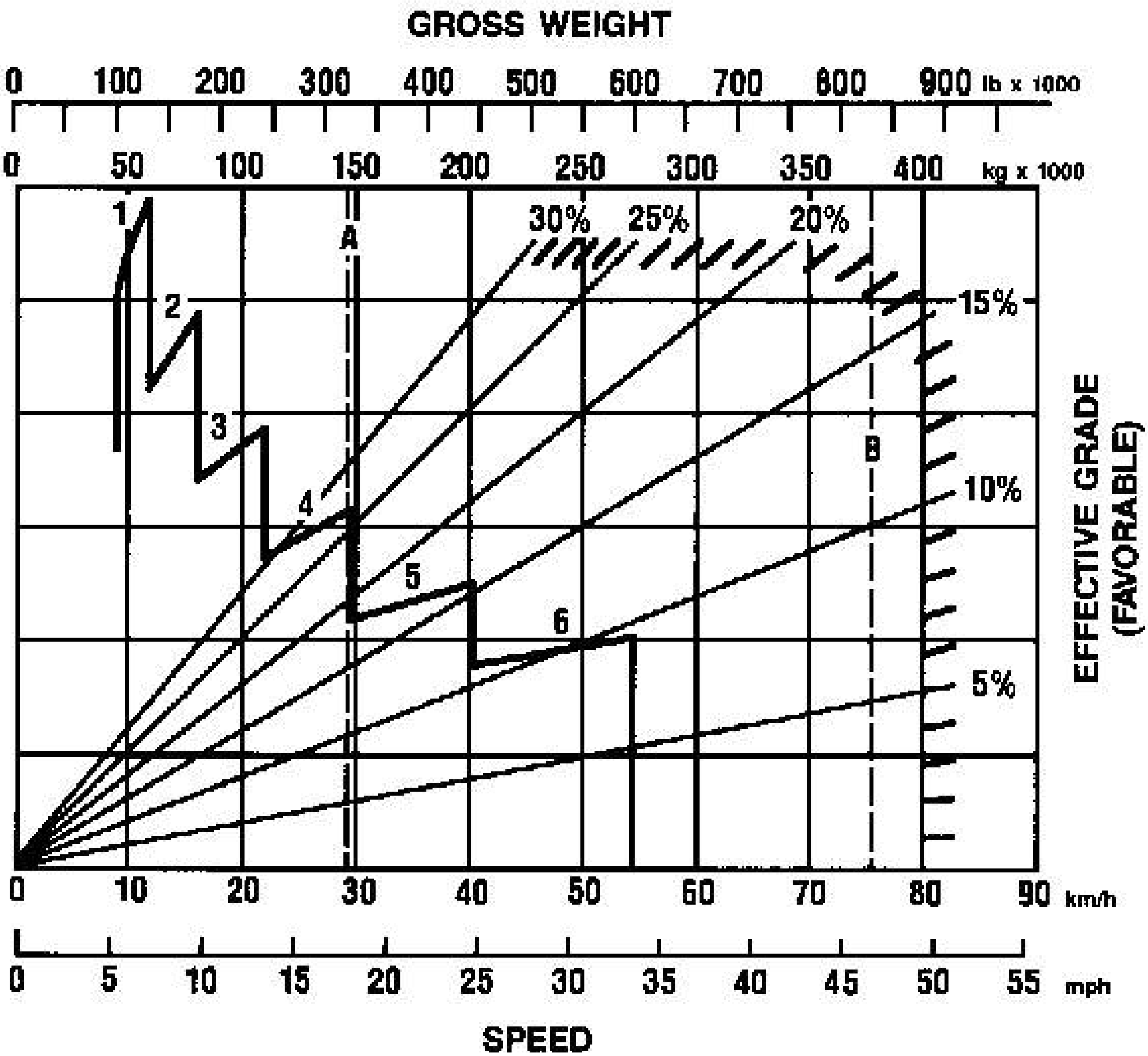


CONTINUOUS GRADE LENGTH

KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 6th Gear

KEY
A — Empty 143 564 kg (323,709 lb)
B — Max GVW 376 488 kg (830,000 lb)

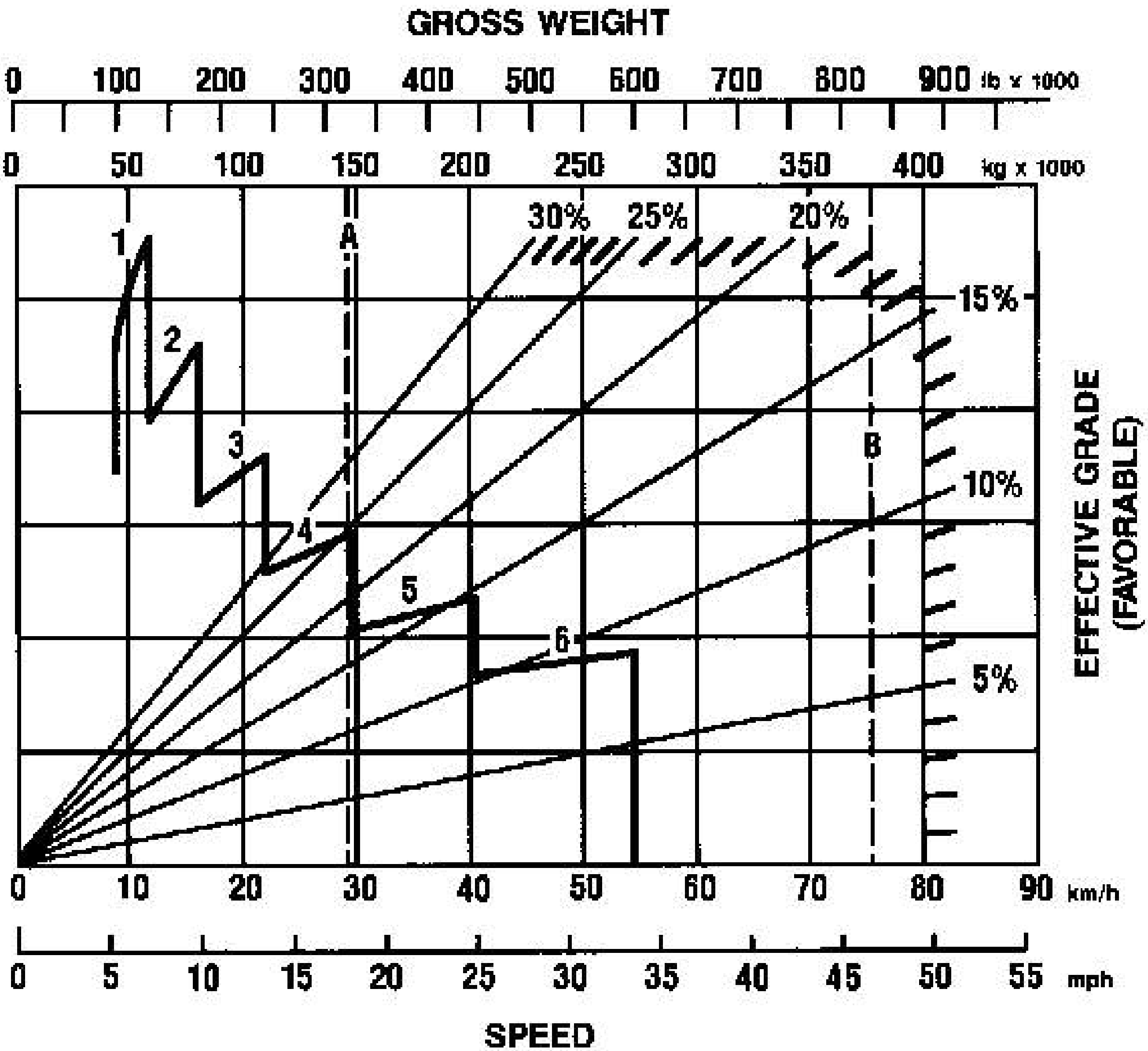
9



GRADE LENGTH — 450 m (1500 ft)

KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY
A — Empty 143 564 kg (323,709 lb)
B — Max GVW 376 488 kg (830,000 lb)



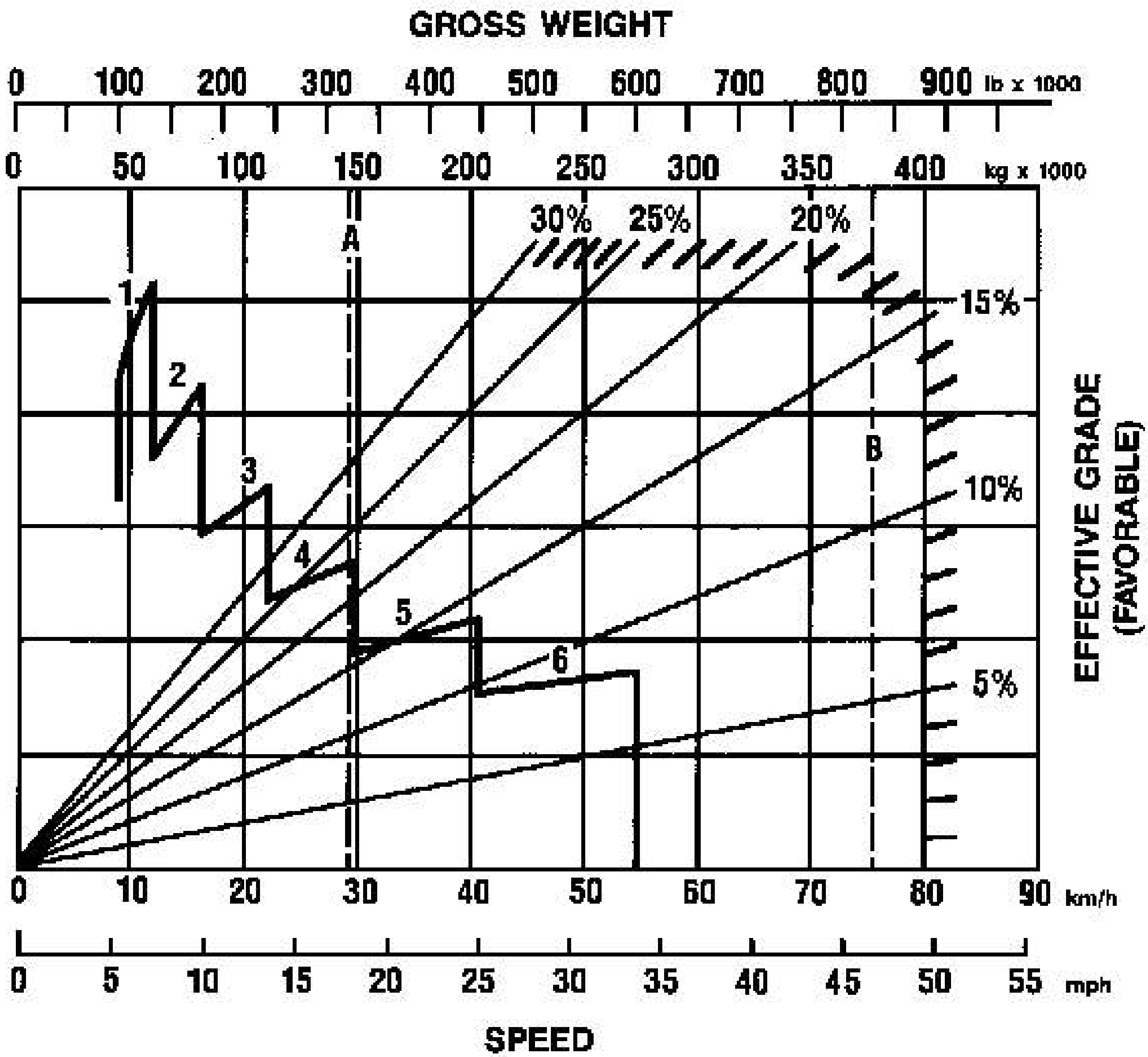
GRADE LENGTH — 600 m (2000 ft)

KEY

1 — 1st Gear
2 — 2nd Gear
3 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY

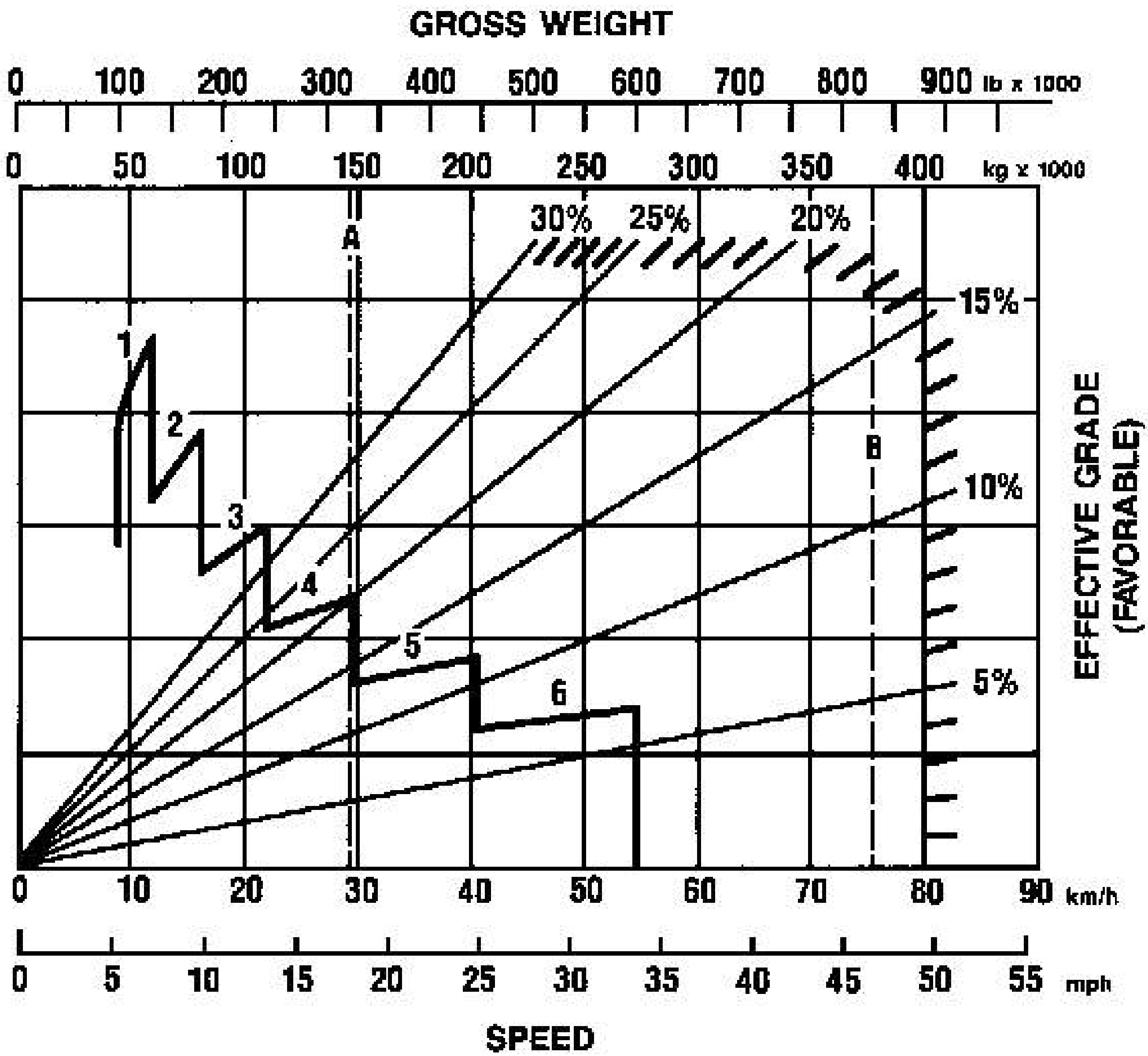
A — Empty 143 564 kg (323,709 lb)
B — Max GVW 376 488 kg (830,000 lb)



GRADE LENGTH — 900 m (3000 ft)

KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY
A — Empty 143 664 kg (323,709 lb)
B — Max GVW 376 488 kg (830,000 lb)



GRADE LENGTH — 1500 m (5000 ft)

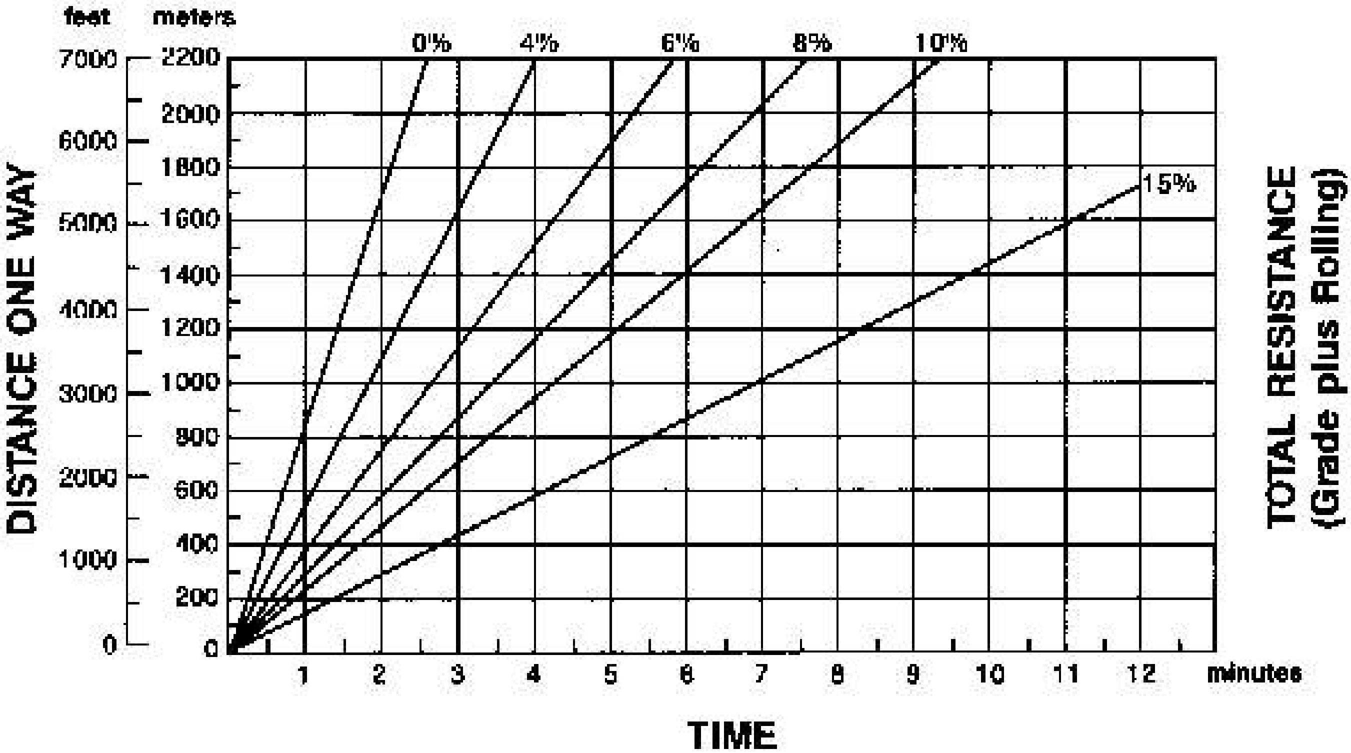
KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

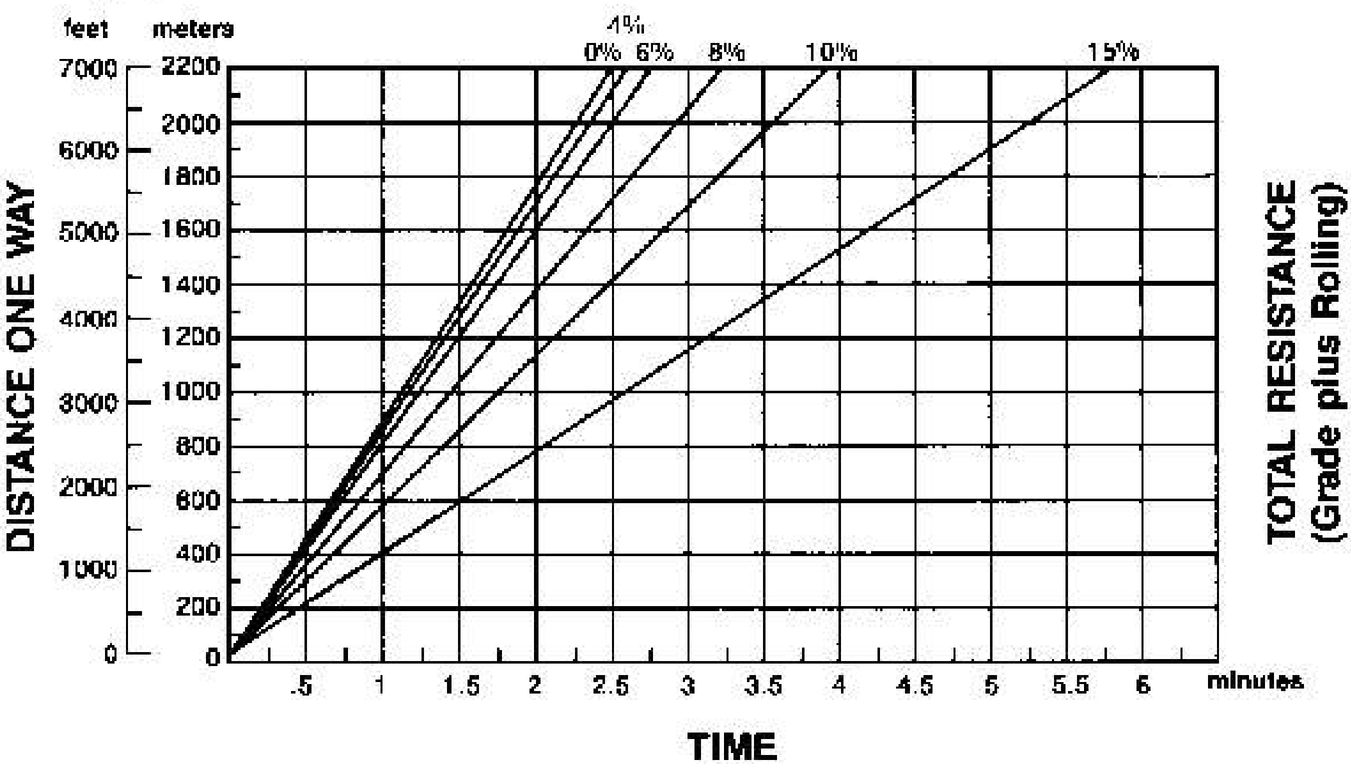
KEY

A — Empty 143 584 kg (323,709 lb)
B — Max GVW 376 488 kg (830,000 lb)

LOADED



EMPTY



ARTICULATED TRUCKS

CONTENTS

Features:

- **Caterpillar four-stroke-cycle diesels** . . . turbocharged or turbocharged and aftercooled, automatic variable timing . . . parallel porting . . . adjustment-free fuel system (direct injection).
- **Articulated hydraulic steering** . . . fully oscillating, torsion-free front and rear frames provide exceptional maneuverability and reversibility.
- **Heavy duty, wide wedge-shaped body** gives easy loading and clean load ejection, with ducktail for superior load retention.
- **Low load-over-height** provides versatile loader match.
- **High capacity low pressure tires in single formation.**
- **High power-to-weight ratio and excellent gradeability.**
- **Standard ROPS/FOPS sound-proofed cab with tinted safety glass.**

MODEL	D20D		D25D		D30D	
Flywheel Power	134 kW	180 HP	194 kW	260 HP	213 kW	285 HP
Operating Weight (Empty)	15 000 kg	33,070 lb	19 700 kg	43,428 lb	21 900 kg	48,278 lb
Top Speed (Loaded)	46 km/h	28.6 mph	48 km/h	30 mph	52 km/h	32 mph
GVW — Gross Vehicle Weight	33 000 kg	72,754 lb	42 371 kg	93,428 lb	48 108 kg	106,378 lb
Distribution Empty:						
Front	67%		70%		66%	
Rear	33%		30%		34%	
Distribution Loaded:						
Front	45%		44%		44%	
Rear	55%		56%		61%	
Capacity (Standard Body)	18 t	20 T	22.7 t	25 T	27.2 t	30 T
Struck (SAE)	8.7 m^3	11.3 yd^3	10 m^3	13 yd^3	12.6 m^3	16.5 yd^3
Heaped (2:1) (SAE)	11.7 m^3	15.3 yd^3	14 m^3	18 yd^3	17.2 m^3	22.5 yd^3
Engine Model	3116		3306		3306	
No. Cylinders	6		6		6	
Bore	105 mm	4.13"	121 mm	4.75"	121 mm	4.75"
Stroke	127 mm	5.0"	152 mm	6"	152 mm	6"
Displacement	6.6 L	401 in	10.5 L	638 in^3	10.5 L	638 in^3
Standard Tires, Front & Rear	23.5 x 25 Radials		26.5 x 25 Radials		29.5 x 25 Radials	
Circular Clearance Diameter	15.16 m	50'0"	16.14 m	52'11"	16.93 m	55'7"
Fuel Tank Refill Capacity	210 L	55 U.S. gal	450 L	120 U.S. gal	450 L	120 U.S. gal
GENERAL DIMENSIONS (Empty):						
Height to Cab Top	3.28 m	10'9"	3.34 m	10'11.5"	3.40 m	11'1.5"
Wheel Base	4.44 m	14'7"	4.61 m	15'1.5"	4.95 m	16'3"
Overall Length	8.43 m	27'8"	8.76 m	28'8.5"	8.88 m	29'1.5"
Loading Height (Empty)	3.66 m	12'0"	2.53 m	8'7.5"	2.86 m	9'4"
Height at Full Dump	5.00 m	16'5"	5.34 m	17'6.5"	5.46 m	17'11"
Body Length	4.47 m	14'8"	4.64 m	15'2.5"	4.69 m	15'4.5"
Width (Operating)	2.74 m	9'0"	3.00 m	9'10"	3.30 m	10'10"
Front Tire Tread	2.13 m	7'0"	2.32 m	7'7.5"	2.55 m	8'4"

						
MODEL	**D40D**		**D250D**		**D300D**	
Flywheel Power	287 kW	**385 HP**	160 kW	**214 HP**	213 kW	**285 HP**
Operating Weight (Empty)	28 027 kg	**61,800 lb**	17 300 kg	**38,150 lb**	20 680 kg	**45,600 lb**
Top Speed (Loaded)	55 km/h	**34 mph**	42.8 km/h	**26.6 mph**	48.6 km/h	**30.2 mph**
GVW — Gross Vehicle Weight	64 308 kg	**141,800 lb**	40 080 kg	**88,350 lb**	47 900 kg	**105,600 lb**
Distribution Empty:						
Front	**62%**		**62%**		**56%**	
Center	**N/A**		**19%**		**22%**	
Rear	**38%**		**19%**		**22%**	
Distribution Loaded:						
Front	**39%**		**32%**		**30%**	
Center	**N/A**		**34%**		**35%**	
Rear	**61%**		**34%**		**35%**	
Capacity (Standard Body)	36.3 t	**40 T**	22.8 t	**25 T**	27.2 t	**30 T**
Struck (SAE)	16.9 m³	**22.1 yd³**	9.9 m³	**12.9 yd³**	12 m³	**15.7 yd³**
Heaped (2:1) (SAE)	22.4 m³	**29.3 yd³**	13 m³	**17 yd³**	16.5 m³	**21.6 yd³**
Engine Model	**3408**		**3116**		**3306**	
No. Cylinders	**6**		**6**		**6**	
Bore	137 mm	**5.4"**	105 mm	**4.13"**	120.7 mm	**4.75"**
Stroke	165 mm	**6.4"**	127 mm	**5.0"**	152.4 mm	**6.0"**
Displacement	14.6 L	**893 in³**	6.6 L	**401 in³**	10.5 L	**638 in³**
Standard Tires, Front, Center & Rear	**F: 29.5 × 25 Radials R: 33.25 × 29 Radials**		**20.5 × 25 Radials**		**23.5 × 25 Radials**	
Circle Clearance Diameter	16.8 m	**51'8"**	15.22 m	**50'0"**	15.54 m	**51'2"**
Fuel Tank Refill Capacity	450 L	**120 U.S. gal**	300 L	**78.5 U.S. gal**	360 L	**95 U.S. gal**
GENERAL DIMENSIONS (Empty):						
Height to Cab Top	3.58 m	**11'8"**	3.23 m	**10'7"**	3.25 m	**10'8"**
Wheel Base (Front-Rear)	4.85 m	**15'11"**	5.38 m	**17'6"**	5.69 m	**18'8"**
Overall Length	9.78 m	**32'0.6"**	9.60 m	**31'6"**	9.85 m	**32'4"**
Loading Height (Empty)	3.2 m	**10'6"**	2.59 m	**8'6"**	2.62 m	**8'7"**
Height at Full Dump	5.49 m	**18'0"**	6.65 m	**21'1"**	6.50 m	**21'4"**
Body Length	5.22 m	**17'1.5"**	5.79 m	**19'0"**	5.66 m	**18'7"**
Width (Operating)	3.48 m	**11'5"**	2.94 m	**9'2"**	2.87 m	**9'5"**
Front Tire Tread	2.55 m	**8'4"**	1.96 m	**6'5"**	2.26 m	**7'6"**

NOTE: All trucks standard spec.

10



MODEL	D350D (Std. Axle)		D350D (Wide Axle)		D400D	
Flywheel Power	213 kW	**285 HP**	213 kW	**285 HP**	287 kW	**385 HP**
Operating Weight (Empty)	24 695 kg	**54,221 lb**	24 735 kg	**54,540 lb***	28 027 kg	**61,800 lb**
Top Speed (Loaded)	48 km/h	**30 mph**	48 km/h	**30 mph**	55.5 km/h	**34.4 mph**
GVW — Gross Vehicle Weight	56 338 kg	**124,221 lb**	56 481 kg	**124,540 lb***	64 308 kg	**141,800 lb**
Distribution Empty:						
Front	**58%**		**56%**		**59%**	
Center	**22%**		**22%**		**20.6%**	
Rear	**22%**		**22%**		**20.6%**	
Distribution Loaded:						
Front	**34%**		**34%**		**31%**	
Center	**33%**		**33%**		**34%**	
Rear	**33%**		**33%**		**35%**	
Capacity (Standard Body)	31.8 t	**35 T**	31.8 t	**35 T**	36.3 t	**40 T**
Struck (SAE)	16 m^3	**20.9 yd^3**	14 m^3	**18.3 yd^3****	16.1 m^3	**21.0 yd^3**
Heaped (2:1) (SAE)	20.5 m^3	**26.8 yd^3**	20 m^3	**26.2 yd^3****	21.9 m^3	**28.6 yd^3**
Engine Model	**3306**		**3306**		**3406**	
No. Cylinders	**6**		**6**		**6**	
Bore	121 mm	**4.75"**	121 mm	**4.75"**	137 mm	**5.4"**
Stroke	152 mm	**6"**	152 mm	**6"**	165 mm	**6.5"**
Displacement	10.5 L	**638 in^3**	10.5 L	**638 in^3**	14.6 L	**893 in^3**
Standard Tires, Front, Center & Rear	**26.5 × 25 Radials**		**26.5 × 25 Radials** **29.5 × 25 Radials (Opt.)**		**29.5 × 25 Radials** **26.5 × 25 Radials (Opt.)**	
Circle Clearance Diameter	16.06 m	**52'8"**	16.08 m	**52'9"**	16.52 m	**54'3"**
Fuel Tank Refill Capacity	450 L	**120 U.S. gal**	450 L	**120 U.S. gal**	450 L	**120 U.S. gal**
GENERAL DIMENSIONS (Empty):						
Height to Cab Top	3.33 m	**10'11.5"**	3.33 m	**10'11.5"**	3.56 m	**11'8"**
Wheel Base (Front-Rear)	5.89 m	**19'3.5"**	6.02 m	**19'9"**	6.05 m	**19'10.5"**
Overall Length	9.95 m	**32'7.5"**	10.09 m	**33'1"**	10.62 m	**34'10"**
Loading Height (Empty)	2.93 m	**9'7"**	2.77 m	**9'1"**	2.98 m	**9'9"**
Height at Full Dump	6.52 m	**21'4.5"**	6.46 m	**21'2.5"**	6.73 m	**22'1"**
Body Length	5.98 m	**19'7.5"**	6.11 m	**20'0.5"**	6.24 m	**20'5.5"**
Width (Operating)	3.00 m	**9'10"**	3.30 m	**10'10"**	3.30 m	**10'10"**
Front Tire Tread	2.32 m	**7'7.5"**	2.54 m	**8'4"**	2.55 m	**8'4.5"**

NOTE: All trucks standard spec.
*Available in 6 × 6 and 6 × 4 arrangement.
6 × 4 specifications shown.
6 × 4 operating weight (empty) and GVW is 544.3 kg (1200 lb) less.

TIRE SPECIFICATIONS

MODEL TIRE SIZE	PLY RATING/ STAR RATING*	TYPE	FLAT PLATE CONTACT AREA IN²
D20D			
23.5R25	★★	E-3	358
D25D			
26.5-25	★★	E-3	470
D30D			
29.5-25	★★	E-3	589
D40D			
F: 29.5-25	★★	E-3	589
R: 33.25-29	★★	E-3	677
D250D			
20.5R25◄	★★	E-3	281
23.5R25	★★	E-3	358
D300D			
23.5R25	★★	E-3	358
D350D			
26.5-25◄	★★	E-3	470
29.5-25	★★	E-3	589
D400D			
26.5-25	★★	E-3	470
29.5-25◄	★★	E-3	589

◄standard tire
*Manufacturer uses Star (★) rating system instead of ply rating.

PRESSURE/LOAD SCHEDULE

Tire Size	Tire Load Limits (kg/lb) and Cold Inflation Pressure (bar/psi)							
	bar psi	3.0 44	3.5 51	4.0 58	4.5 65	4.75 69	5.0 73	5.5 80
23.5 x 25	kg lb	7000 15,435	7900 17,420	8700 19,185	**9250** **20,400**			
26.5 x 25	kg lb	8500 18,740	9600 21,170	10 700 23,590	11 300 24,915	**11 500** **25,360**		
29.5 x 25	kg lb	10 150 22,380	11 400 25,135	12 700 28,005	13 400 29,545	13 700 30,200	**14 000** **30,870**	
33.25 x 29	kg lb	12 000 26,460	13 450 29,650	14 950 32,965	16 400 36,160	17 150 37,815	17 900 39,470	**18 500** **40,800**

NOTE: Bold load figures indicate maximum recommended capacity.
NOTE: Michelin recommended Figures 50 km/h (30 mph) speed rating.

USE OF RIMPULL-SPEED-GRADEABILITY CURVES

Machine speed attainable, gear range and available rimpull can be determined from the curves in this section when gross vehicle weight and total effective grade (for total resistance) are known.

Rimpull is the force (in kg, lb or kN) available between the tire and the ground to propel the machine (limited by traction).

Gross Vehicle Weight, in kilograms or pounds, is Truck Weight + Payload.

Total Effective Grade (or Total Resistance) is Grade Resistance plus Rolling Resistance expressed as percent grade. Grade is measured or estimated. Rolling resistance is estimated (see "Tables" section for typical values). 10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade.

Example —

With a grade of 6% and a rolling resistance of 40 kg/metric ton (80 lb/U.S. ton), find total resistance.

Rolling resistance –
40 kg/metric ton ÷ 10 – 4% Effective Grade.
(80 lb/ton ÷ 10 – 4%.)
Total resistance – 4% rolling + 6% grade – 10%.

Altitude Derating

Rimpull force and speed must be derated for altitude similar to flywheel horsepower. The percentage loss in rimpull force approximately corresponds to the percentage loss in flywheel horsepower. See Tables Section for altitude derations.

Rimpull-Speed-Gradeability

To determine gradeability performance: Read from gross weight down to the % of total resistance. (Total resistance equals actual % grade *plus* 1% for each 10 kg/metric tons [20 lb./U.S. ton] of rolling resistance.) From this weight-resistance point, read horizontally to the curve with the highest obtainable speed range, then down to maximum speed. Usable rimpull depends upon traction available and weight on drive wheels.

USE OF BRAKE/RETARDER PERFORMANCE CURVES

The speed that can be maintained when the machine is descending a grade with retarder applied can be determined from the retarder curves in this section when gross vehicle weight and total effective grade are known.

Total Effective Grade (or Total Resistance) is grade assistance *minus* rolling resistance. 10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade.

Example —

With a favorable grade of 20% and rolling resistance of 50 kg/metric ton (100 lb/U.S. ton), find Total Effective Grade.

(50 kg/metric ton) = 50 ÷ 10 = 5% Effective Grade
(from Rolling Resistance)
100 lb/ton = 100 ÷ 20 = 5% Effective Grade
20% (grade) – 5% (resistance) =
15% Total Effective Grade

USE OF THE TRAVEL TIME CHARTS

One-way travel time can be determined from graphs on the following pages when one-way travel distance and total resistance are known. (Total resistance is rolling resistance ± grade resistance expressed in percent.) 10 kg/metric ton (or 20 lbs/U.S. ton) equals 1% equivalent grade.

If total resistance is negative (grade assistance greater than rolling resistance) machine may accelerate down hill requiring the use of retarder or brakes. Travel time charts *cannot* be used in these cases. Consult respective machine retarder curve to establish maximum safe downhill speed.

Travel times include vehicle acceleration and deceleration at the load and dump points.

Two graphs are given for each hauling unit: one for the vehicle carrying its rated payload and one for the empty vehicle.

Travel times were derived using Caterpillar Vehicle Simulation Program and standard tire inputs. Travel times for machines equipped with (larger) optional tires vary slightly.

TYPICAL FIXED TIMES FOR HAULING UNITS

Fixed time for hauling units include:

1. Truck load time (varies with loading tool)
2. Truck maneuver in load area (Truck exchange) (Typically 0.6-0.8 min.)
3. Maneuver and dump time at dump point (Typically 1.0-1.2 min.)

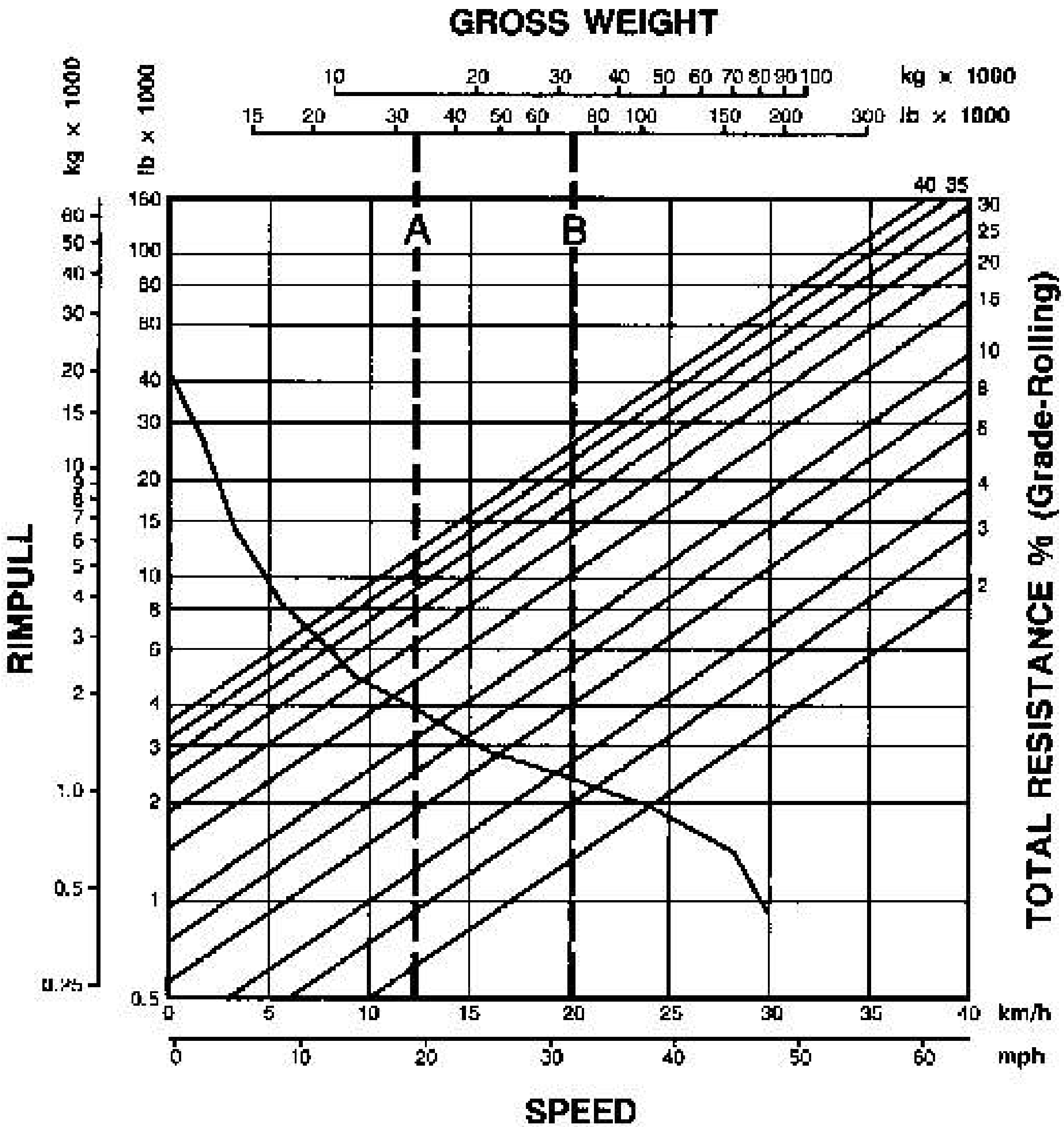
Total cycle time is the combination of:

1. The above fixed time
2. Hauling time (Loaded)
3. Return time (Empty)

Example — assume load tool spots hauler with full bucket

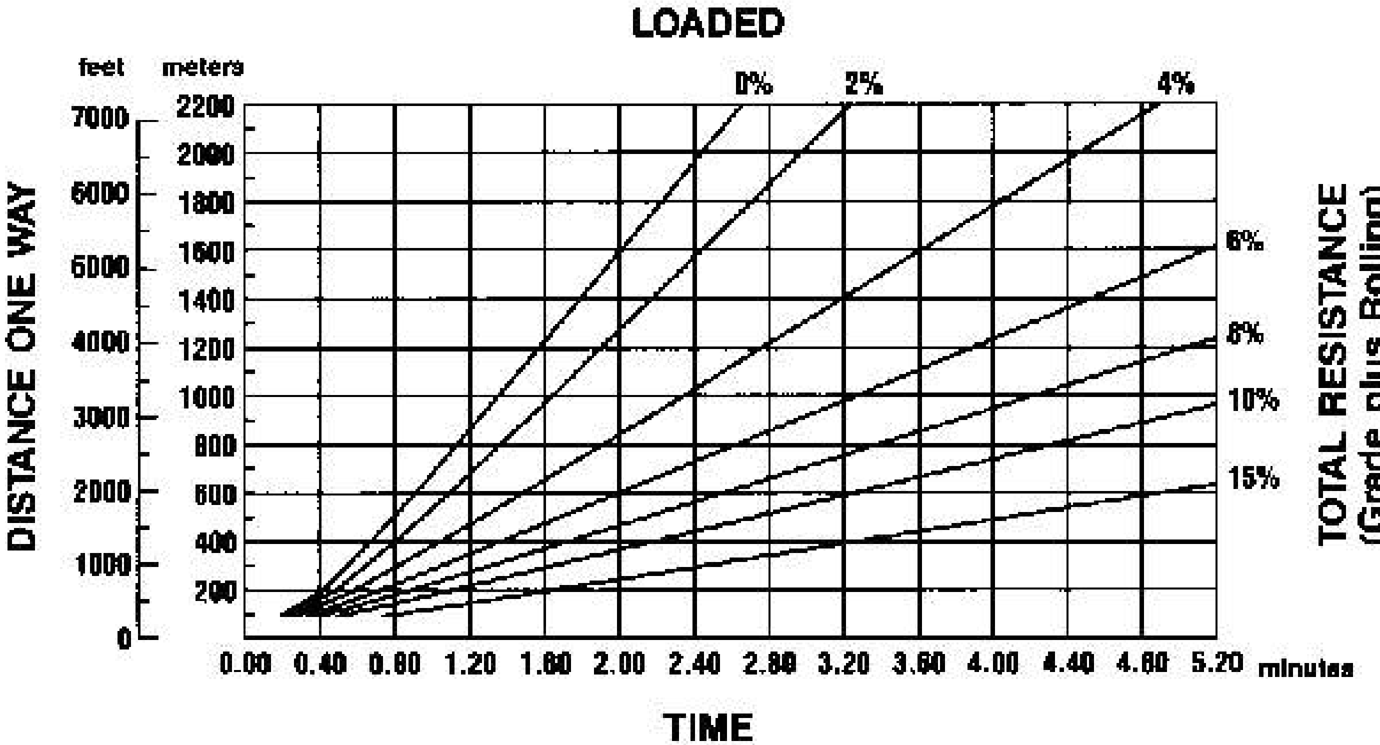
	988B	245 FS (Bottom Dump)	Power Shovel 3 m³ (4 yd³)
cycle time	.60	.40	.45
First pass (dump time)	.10 min.	.05 min.	.05 min.
2 passes (full cycle)	.70	.45	.50
3 passes "	1.30	.85	.95
4 passes "	1.90	1.25	1.40
5 passes "	2.50	1.65	1.85
6 passes "	3.10	2.05	2.30

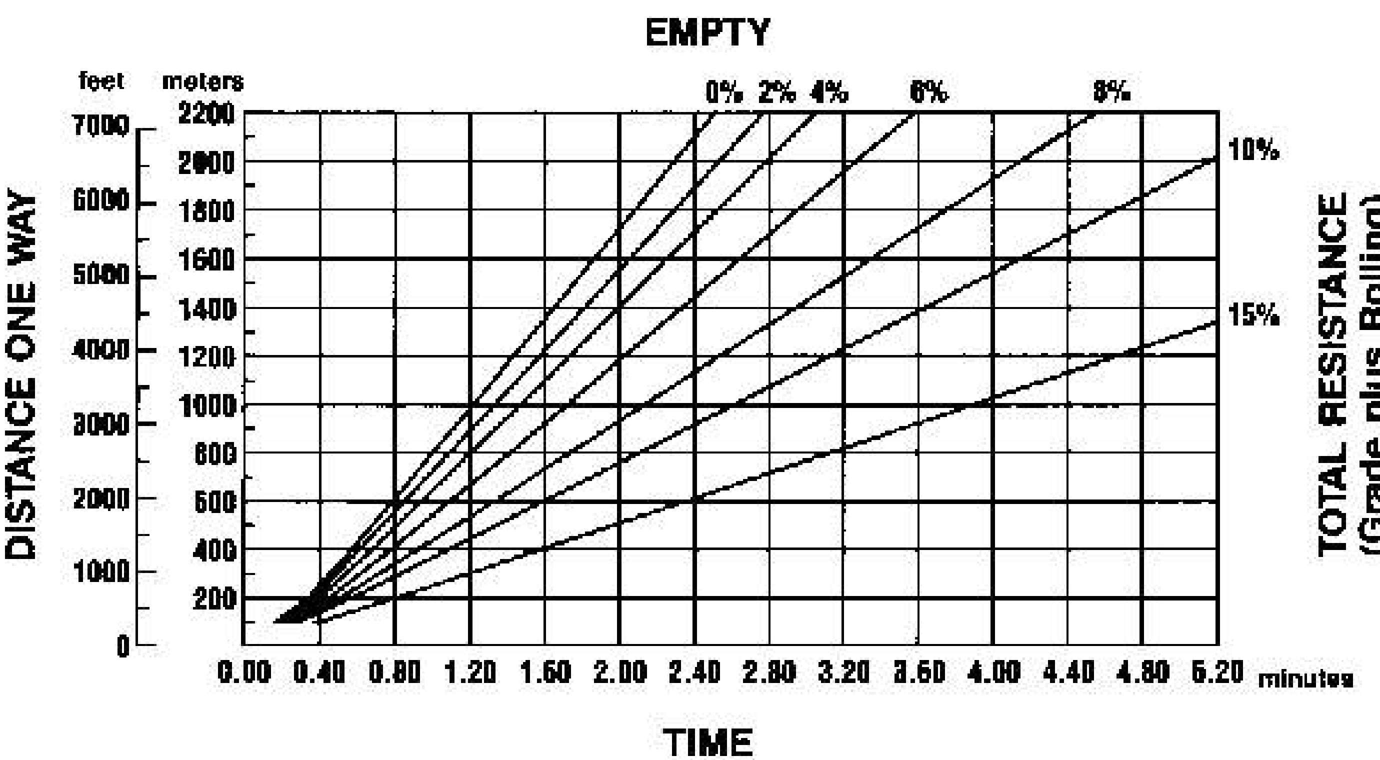
NOTE: Other sizes of loading tools will have different cycle times. See Wheel Loader section for average cycle times for truck loading.

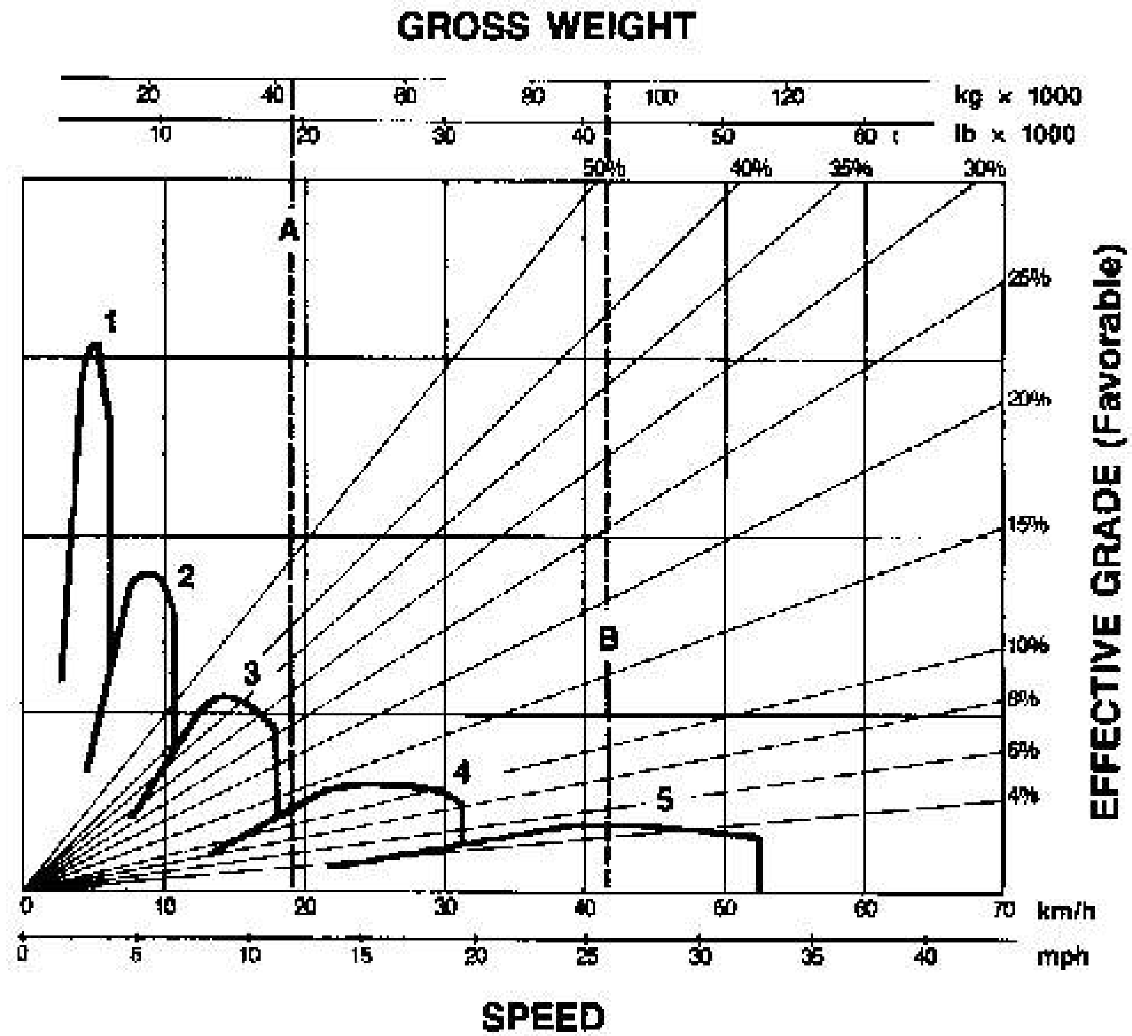


KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

KEY
A — Empty 15 000 kg (33,070 lb)
B — Max GVW 33 000 kg (72,754 lb)

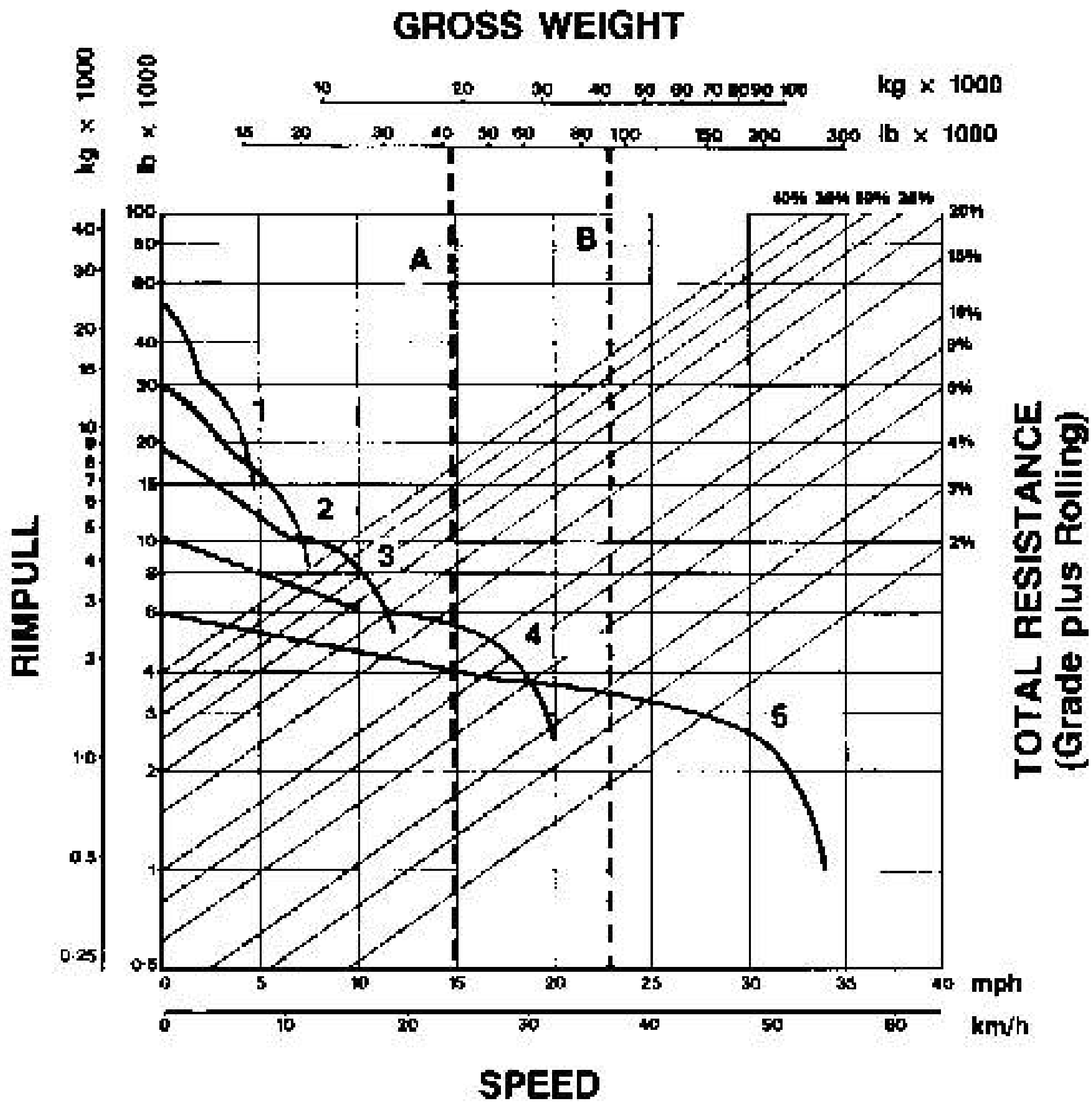

LOADED
feet
meters
DISTANCE ONE WAY
TOTAL RESISTANCE (Grade plus Rolling)
0%
2%
4%
6%
8%
10%
15%
7000
6000
5000
4000
3000
2000
1000
0
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0.00 0.40 0.80 1.20 1.60 2.00 2.40 2.80 3.20 3.60 4.00 4.40 4.80 5.20 minutes
TIME


EMPTY
feet
meters
DISTANCE ONE WAY
TOTAL RESISTANCE (Grade plus Rolling)
0%
2%
4%
6%
8%
10%
15%
7000
6000
5000
4000
3000
2000
1000
0
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0.00 0.40 0.80 1.20 1.60 2.00 2.40 2.80 3.20 3.60 4.00 4.40 4.80 5.20 minutes
TIME



KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

KEY
A — Empty 19 700 kg (43,428 lb)
B — Max GVW 42 371 kg (93,428 lb)

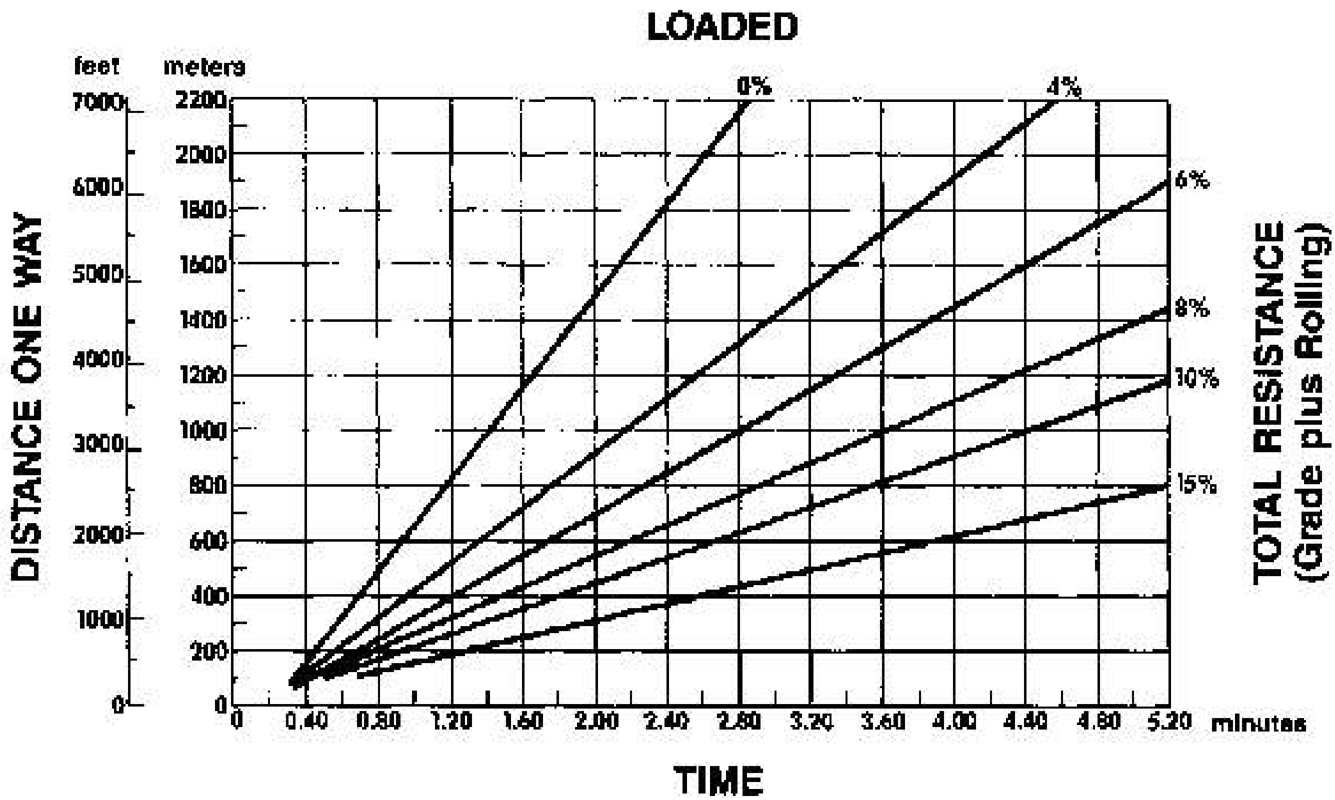


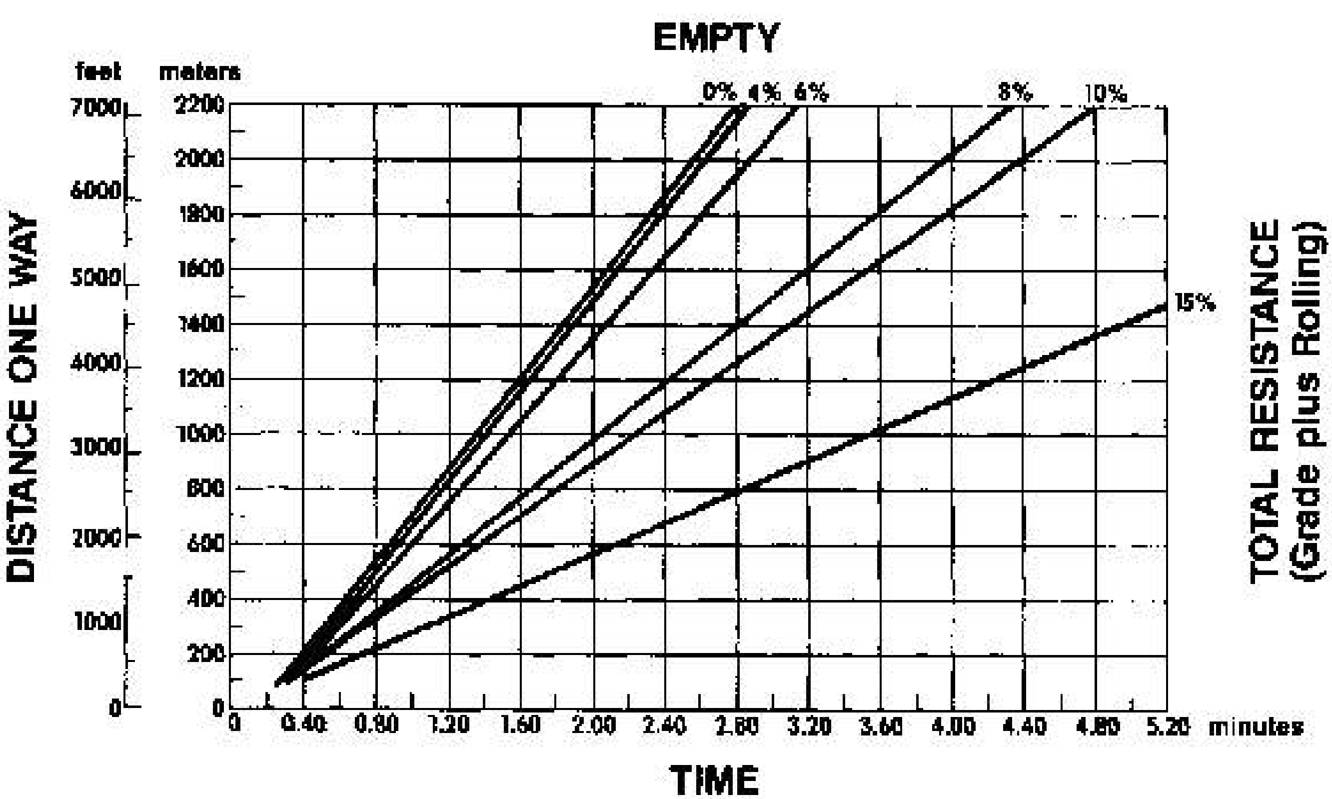
KEY

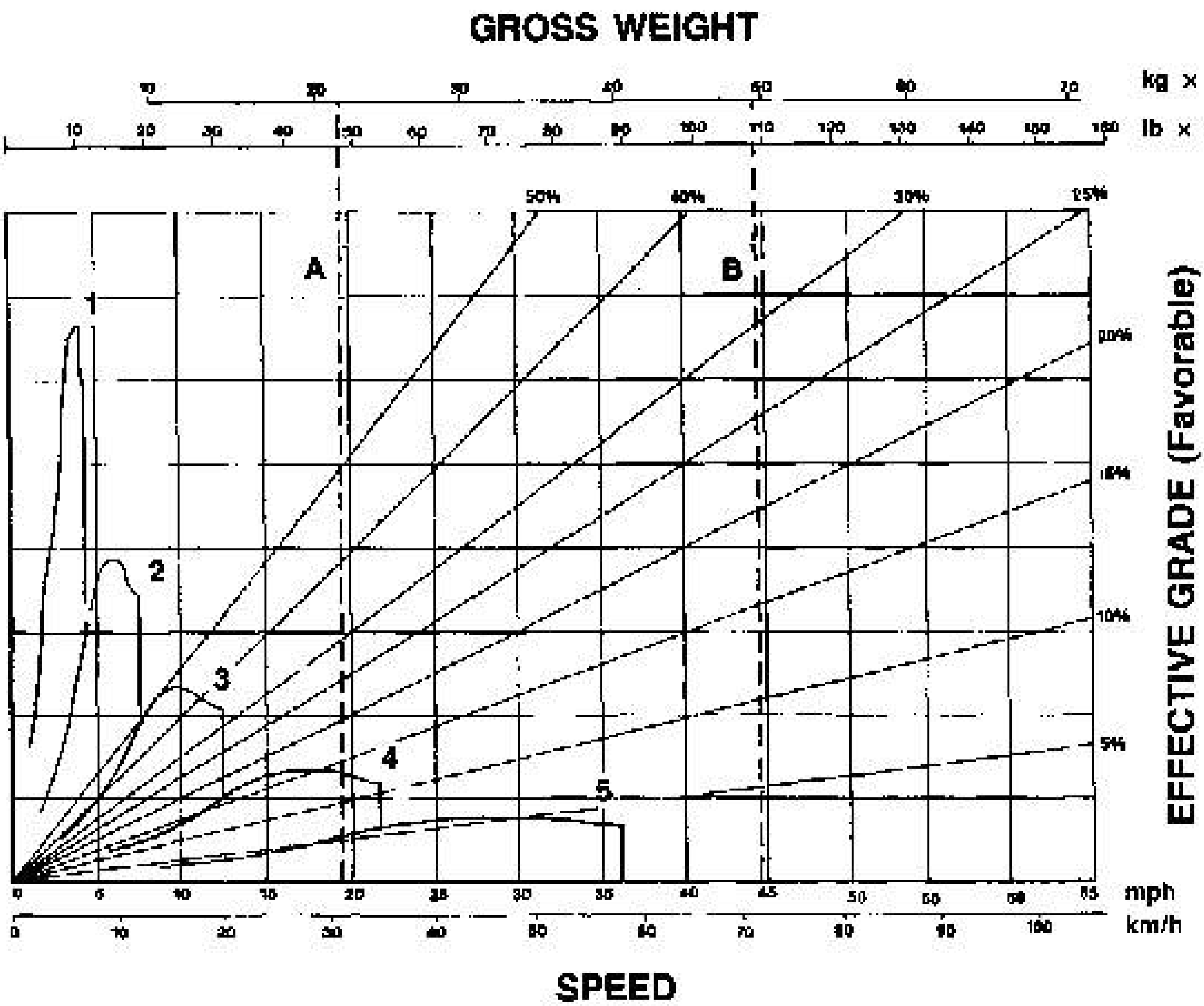
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

KEY

A — Empty 19 700 kg (43,428 lb)
B — Max GVW 42 371 kg (93,428 lb)


LOADED
feet
meters
7000
6000
5000
4000
3000
2000
1000
0
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0%
4%
6%
8%
10%
15%
0
0.40
0.80
1.20
1.60
2.00
2.40
2.80
3.20
3.60
4.00
4.40
4.80
5.20
minutes
DISTANCE ONE WAY
TOTAL RESISTANCE (Grade plus Rolling)
TIME


EMPTY
feet
meters
7000
6000
5000
4000
3000
2000
1000
0
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0%
4%
6%
8%
10%
15%
0
0.40
0.80
1.20
1.60
2.00
2.40
2.80
3.20
3.60
4.00
4.40
4.80
5.20
minutes
DISTANCE ONE WAY
TOTAL RESISTANCE (Grade plus Rolling)
TIME



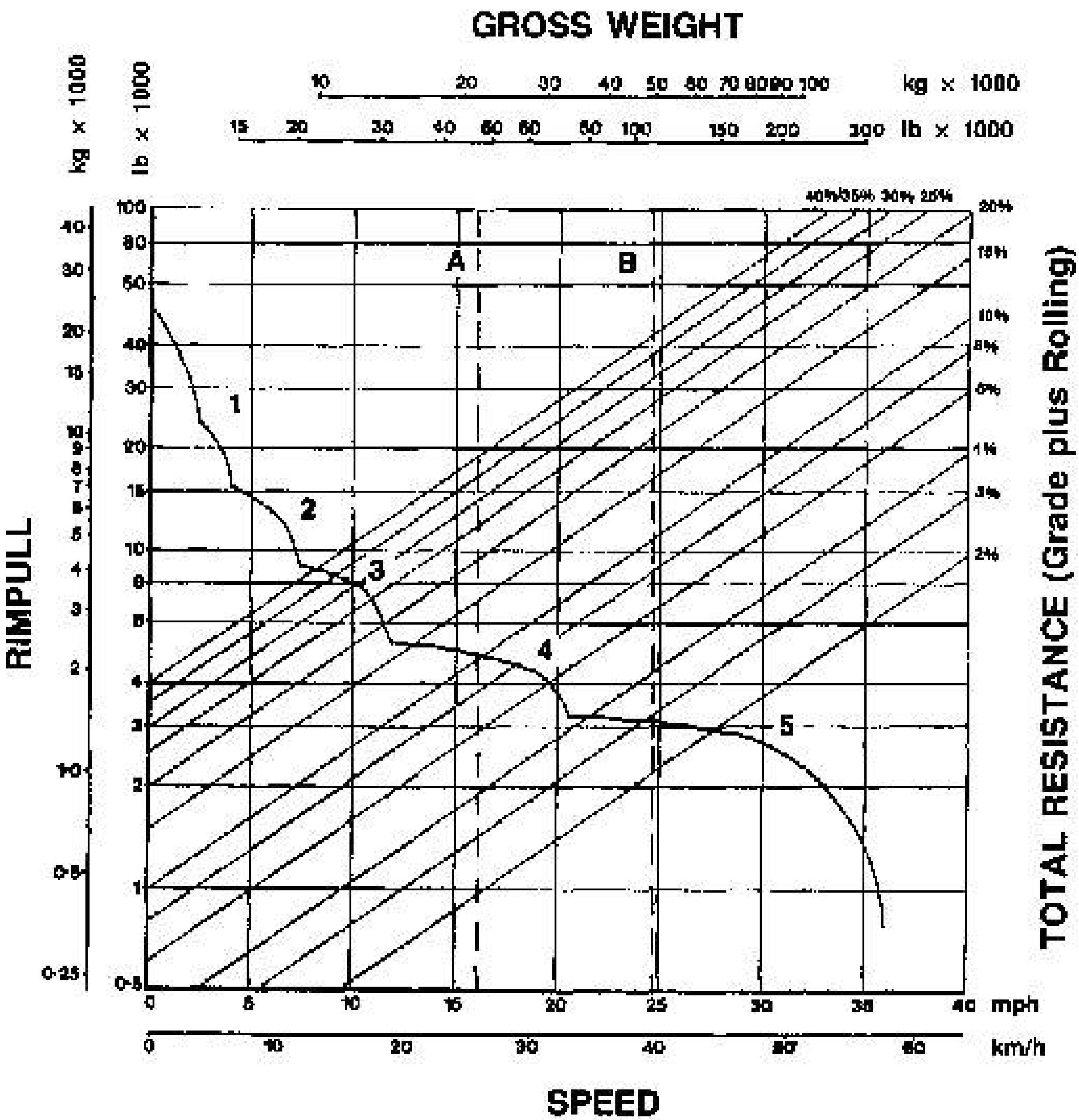
10

KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

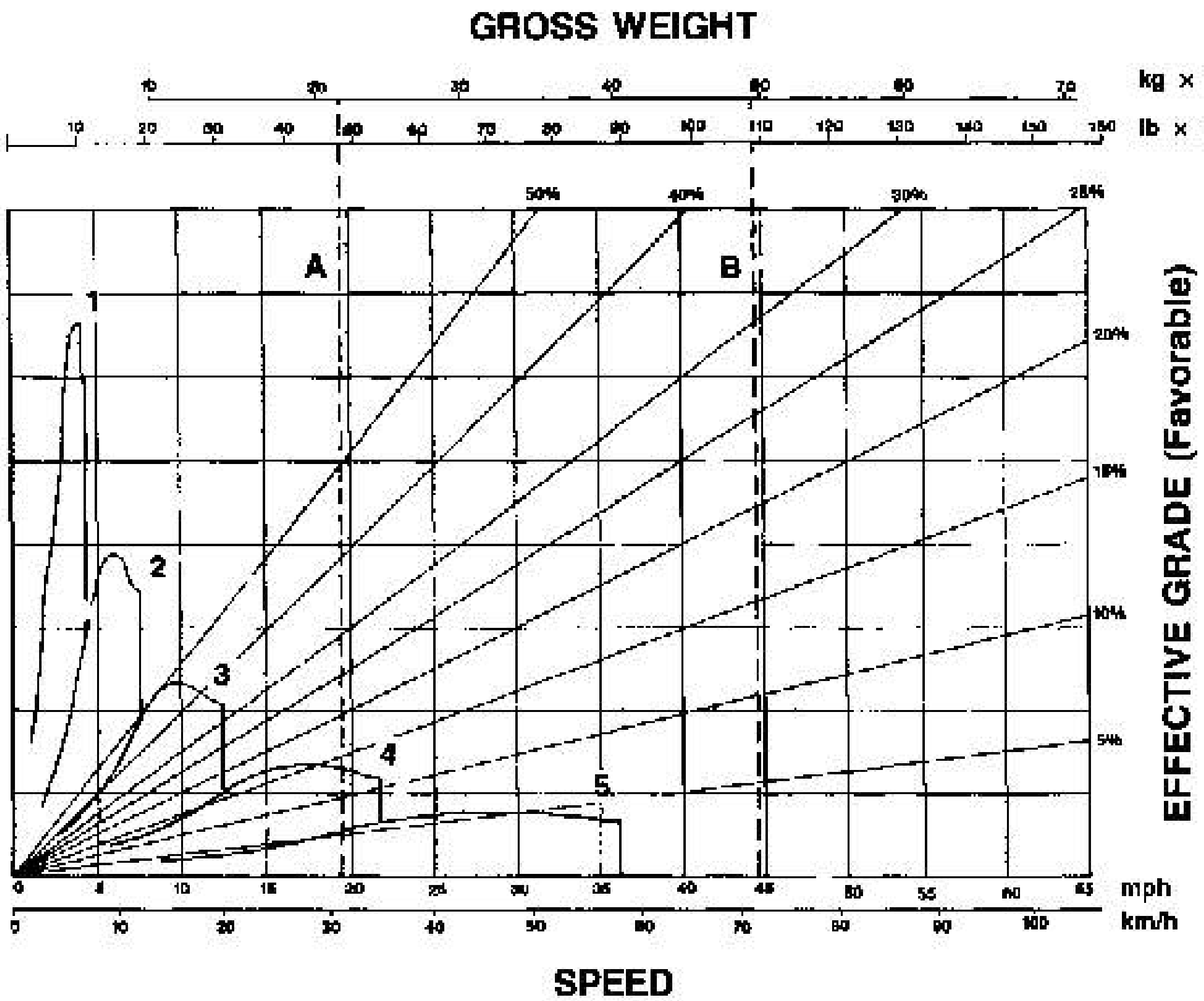
KEY

A — Empty 21 900 kg (48,278 lb)
B — Max GVW 49 106 kg (108,278 lb)



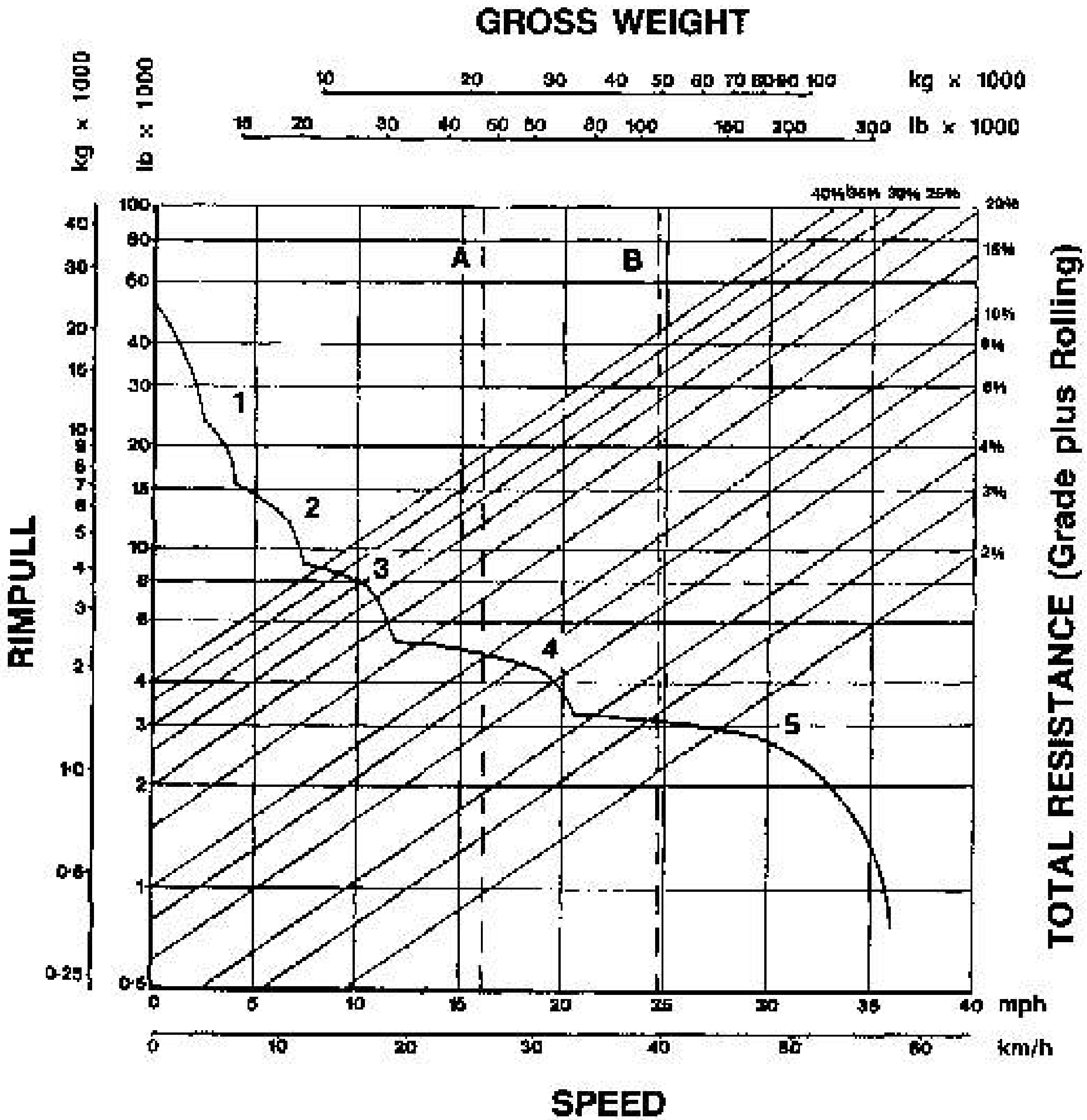
KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

KEY
A — Empty 21 900 kg (48,278 lb)
B — Max GVW 49 106 kg (108,278 lb)



KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

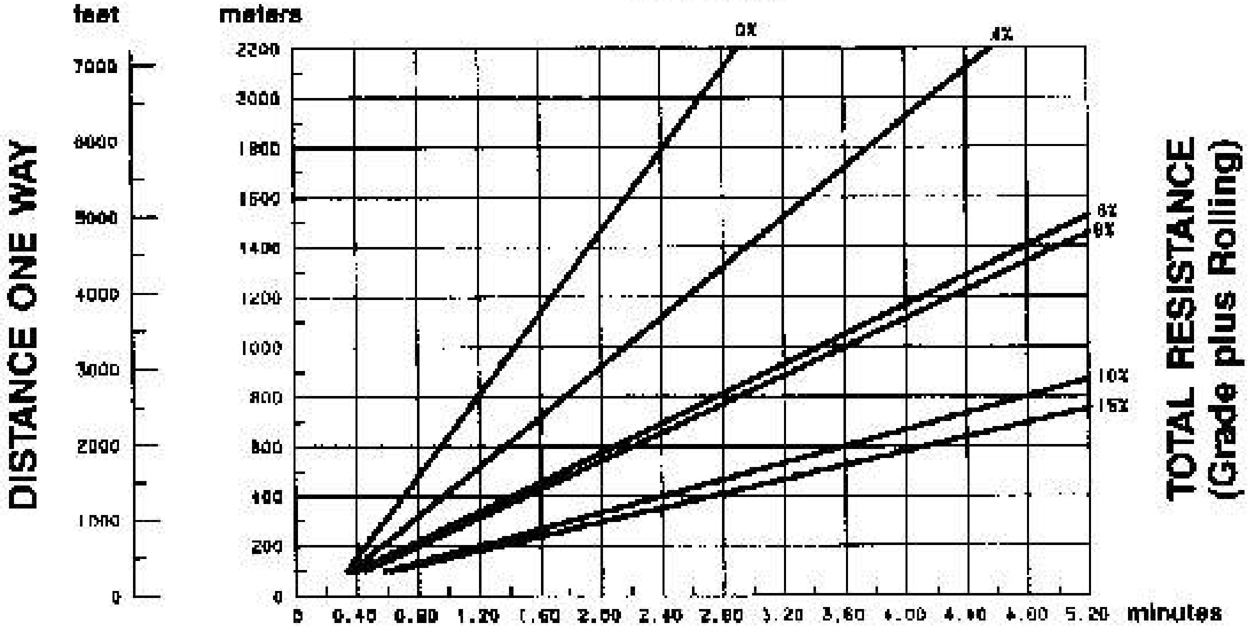
KEY
A — Empty 21 900 kg (48,278 lb)
B — Max GVW 49 106 kg (108,278 lb)



KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

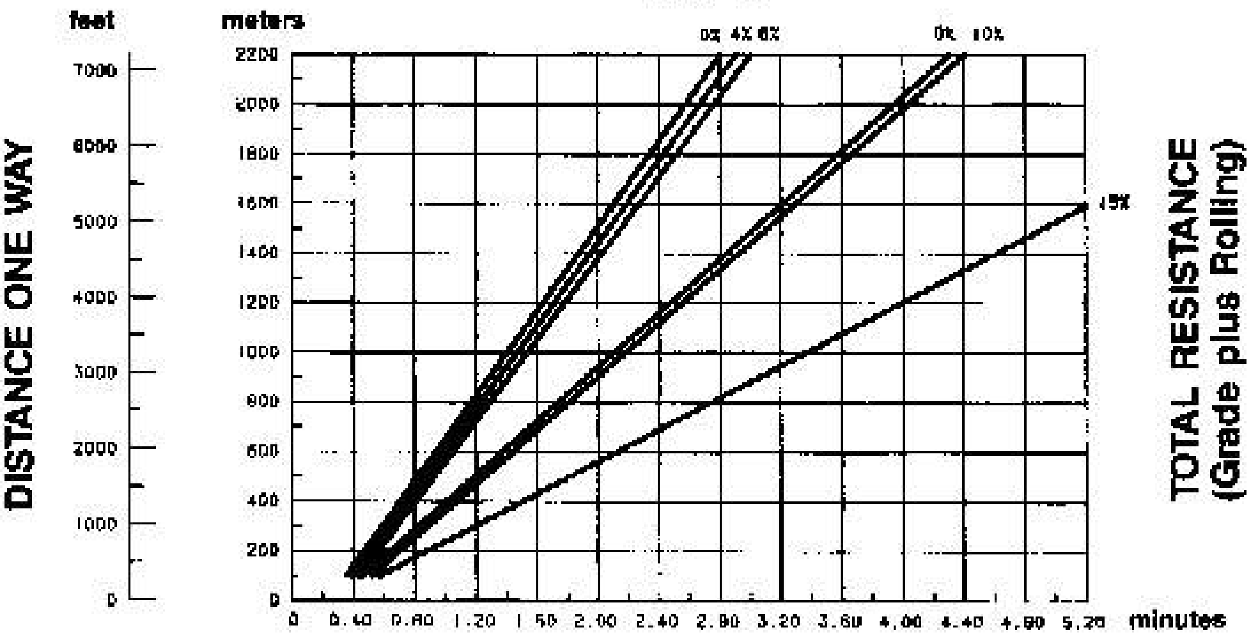
KEY
A — Empty 21 900 kg (48,278 lb)
B — Max GVW 49 106 kg (108,278 lb)

LOADED



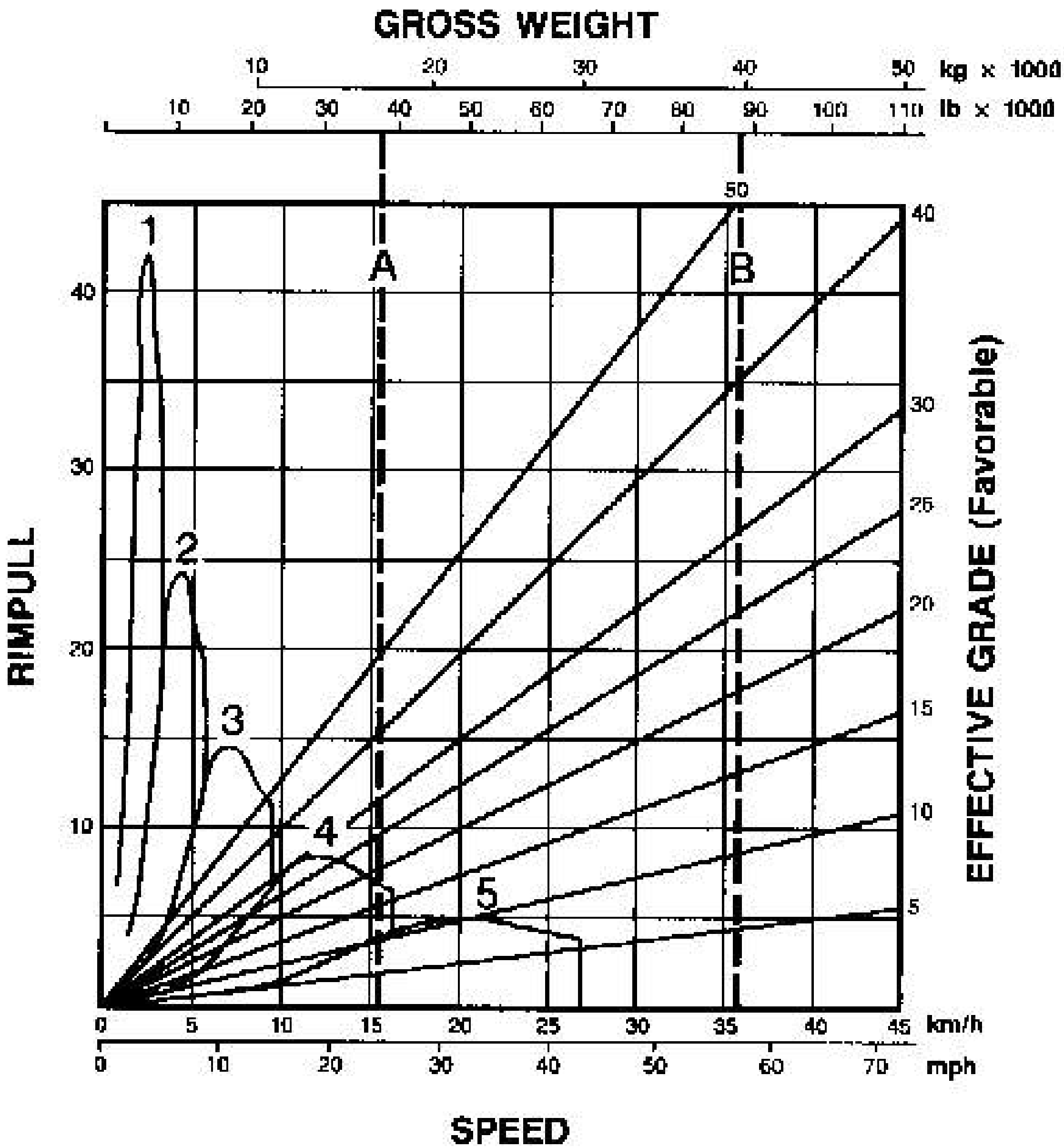
TIME

EMPTY



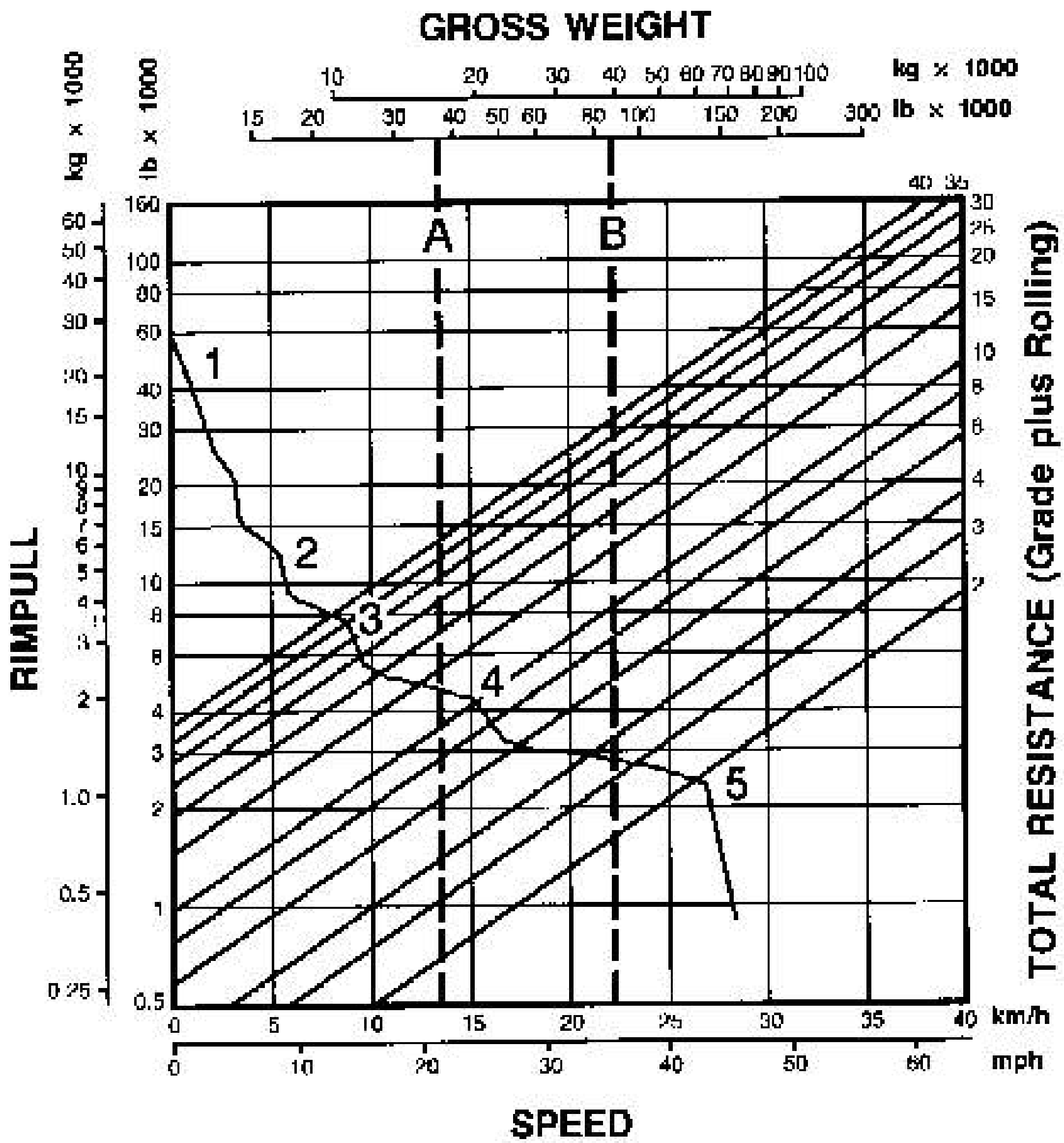
TIME

D250D Brake/Retarder Performance Curve
- 20.5R25 Tires
- 23.5R25 Tires



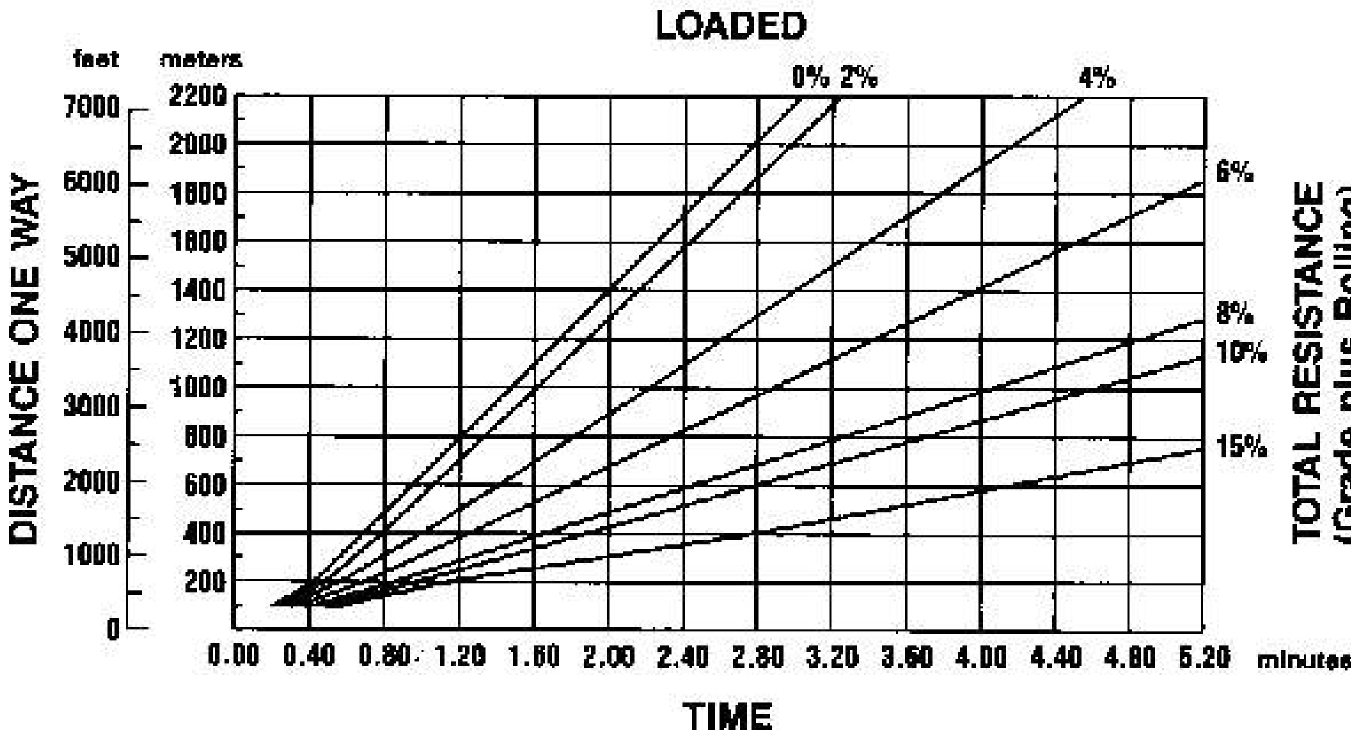
KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

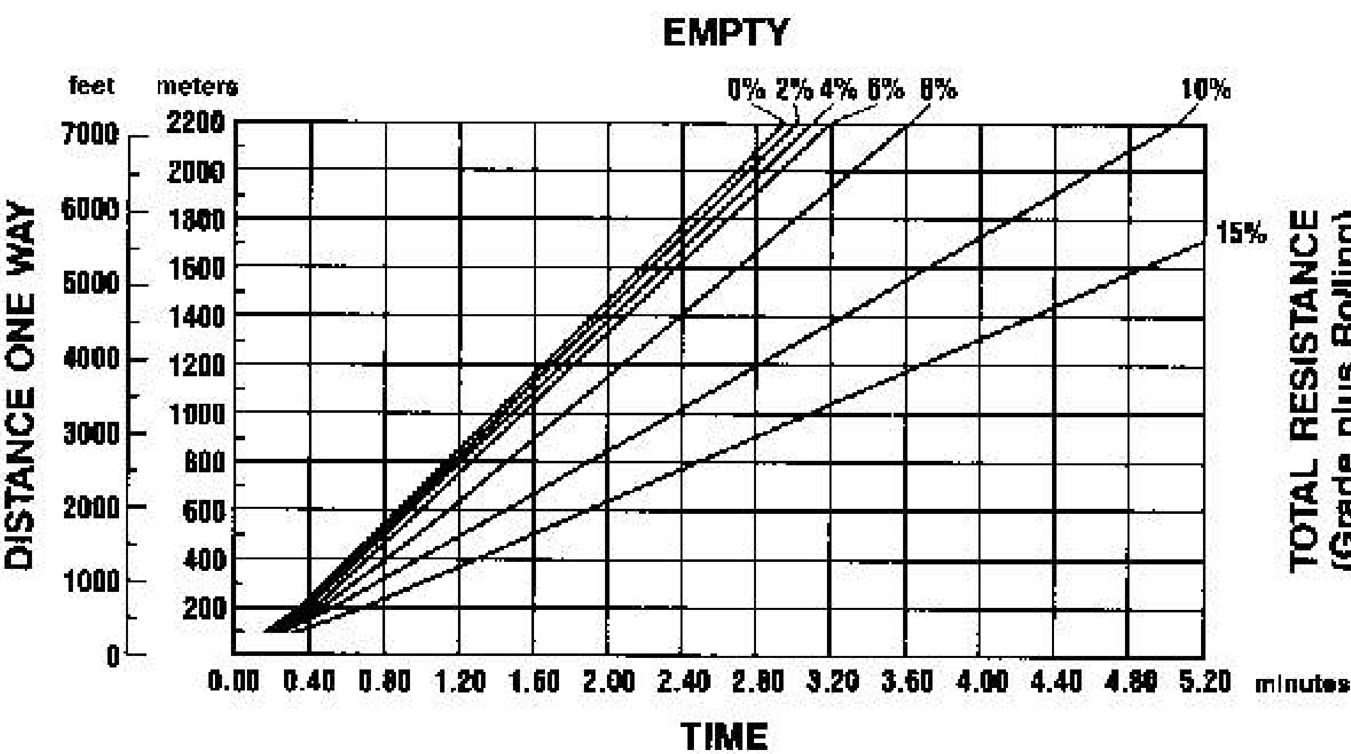
KEY
A — Empty 17 300 kg (38,150 lb)
B — Max GVW 40 080 kg (88,360 lb)

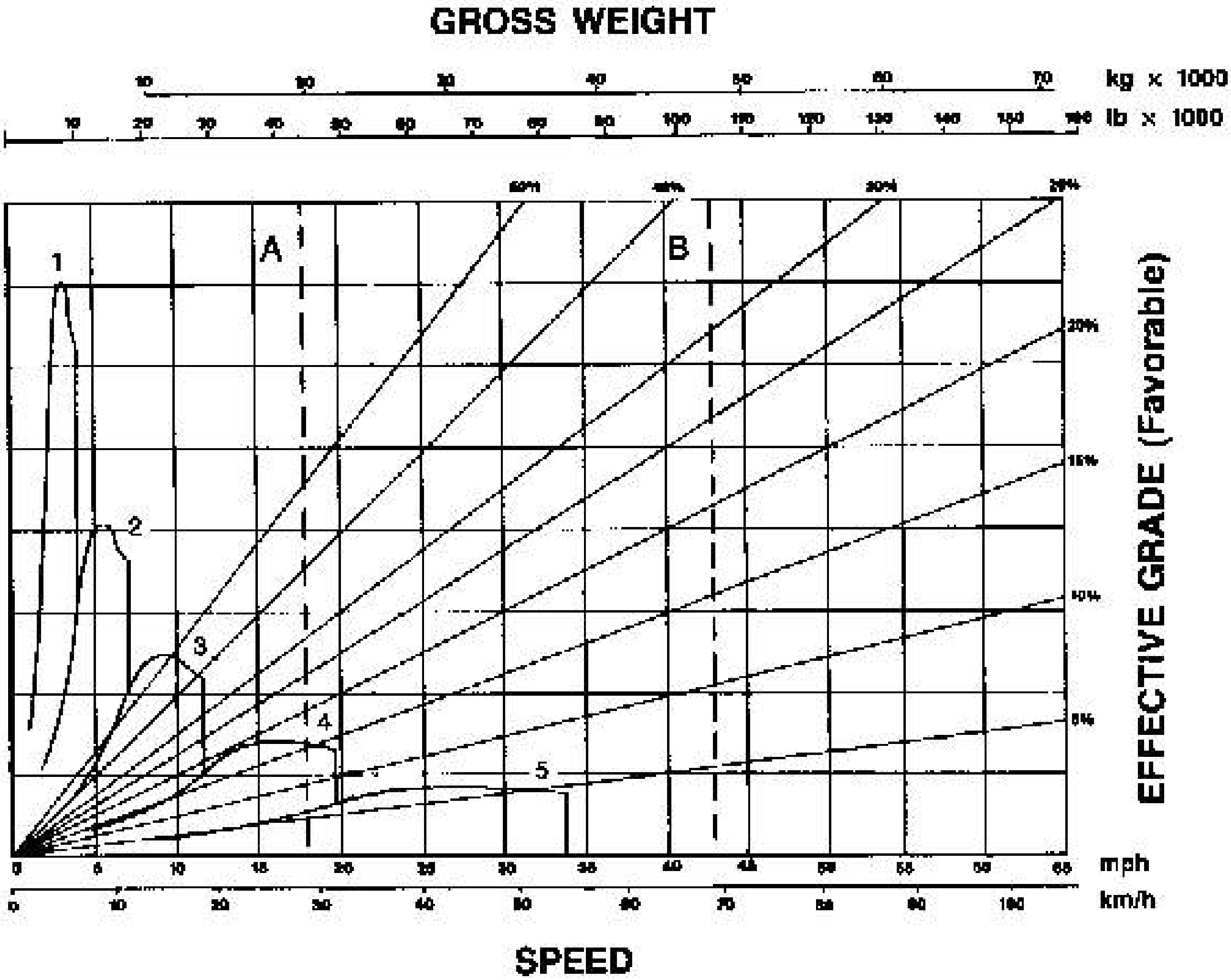


KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

KEY
A — Empty 17 300 kg (38,150 lb)
B — Max GVW 40 080 kg (88,350 lb)


LOADED
feet
meters
0% 2%
4%
6%
8%
10%
15%
DISTANCE ONE WAY
TOTAL RESISTANCE (Grade plus Rolling)
7000
6000
5000
4000
3000
2000
1000
0
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0.00 0.40 0.80 1.20 1.60 2.00 2.40 2.80 3.20 3.60 4.00 4.40 4.80 5.20 minutes
TIME


EMPTY
feet
meters
0% 2% 4% 6% 8%
10%
15%
DISTANCE ONE WAY
TOTAL RESISTANCE (Grade plus Rolling)
7000
6000
5000
4000
3000
2000
1000
0
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0.00 0.40 0.80 1.20 1.60 2.00 2.40 2.80 3.20 3.60 4.00 4.40 4.80 5.20 minutes
TIME

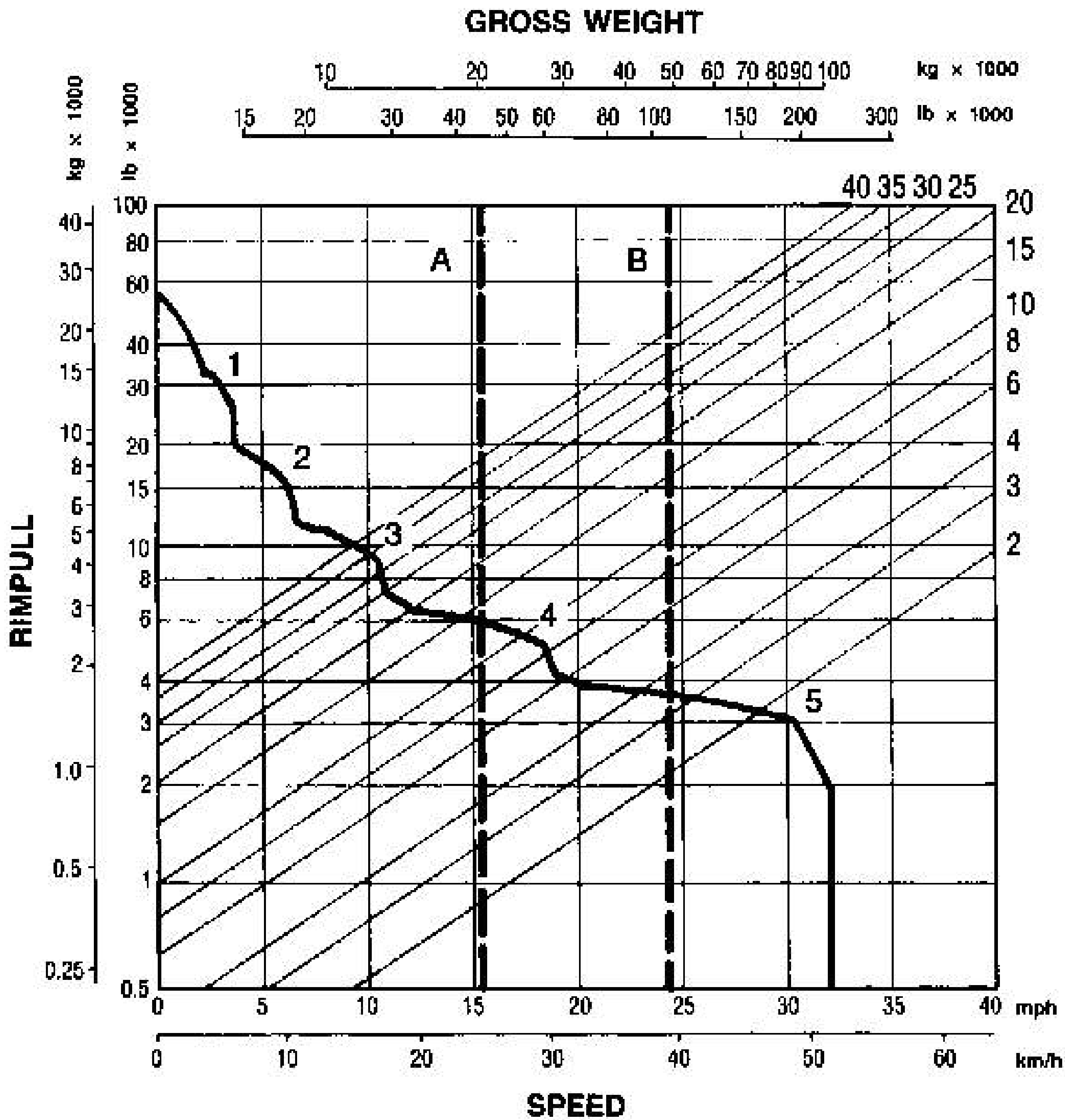


KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

KEY

A — Empty 20 680 kg (45,600 lb)
B — Max GVW 47 900 kg (105,600 lb)

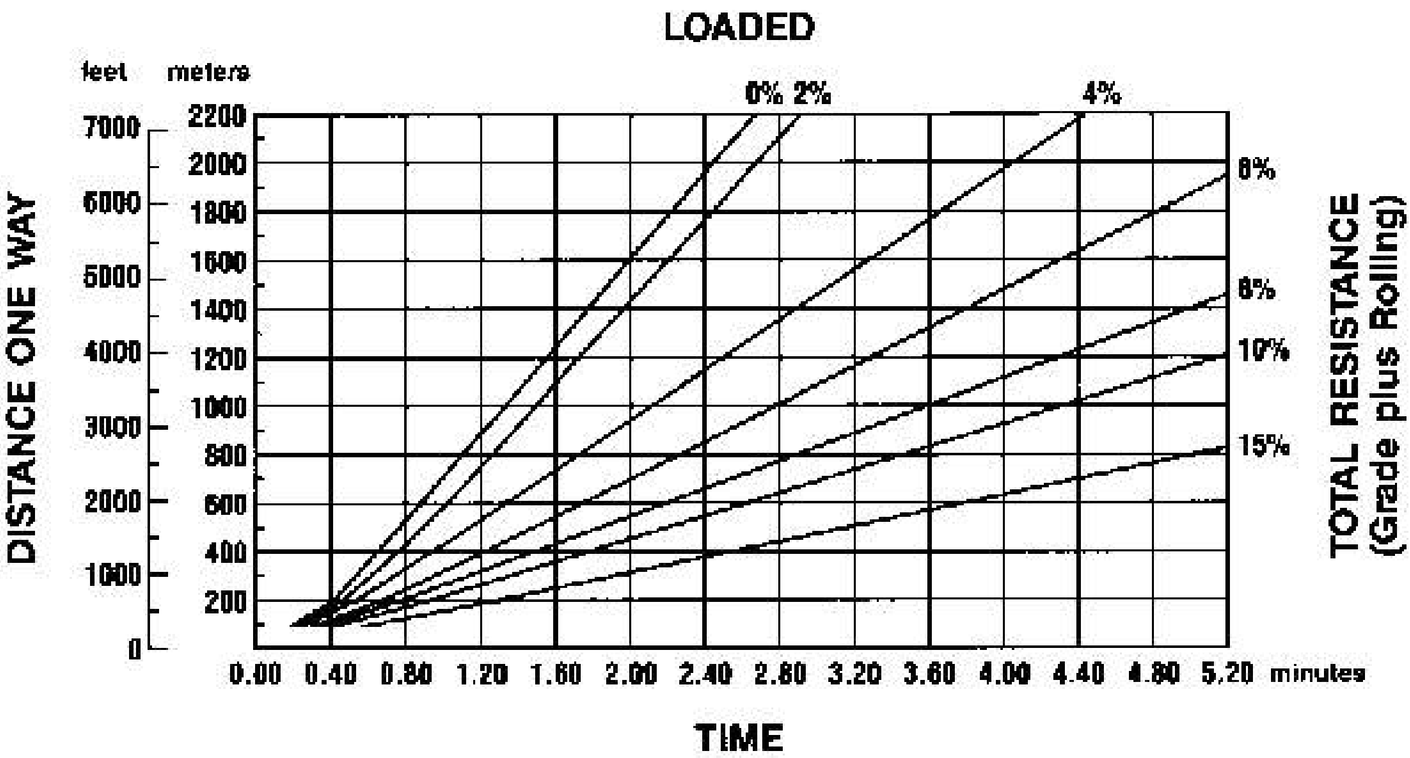


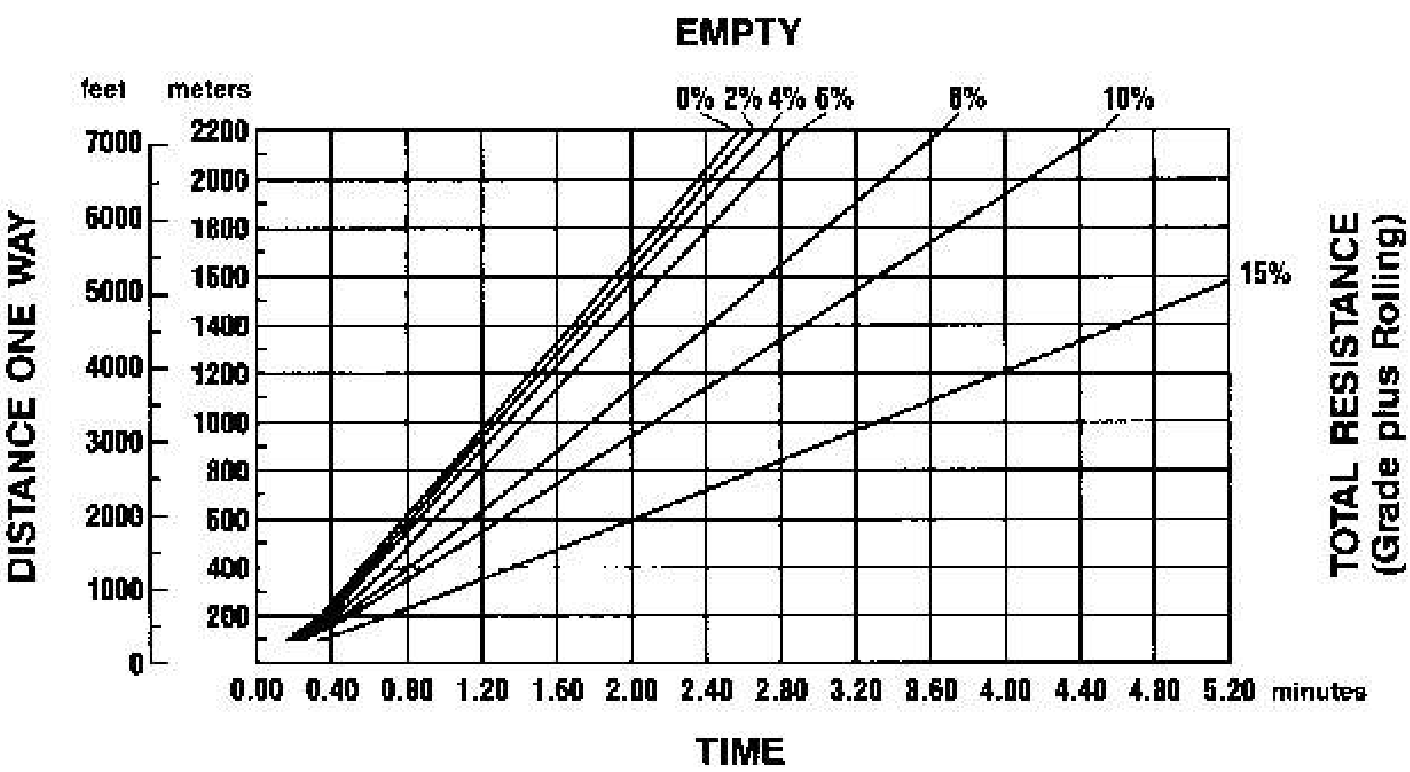
KEY

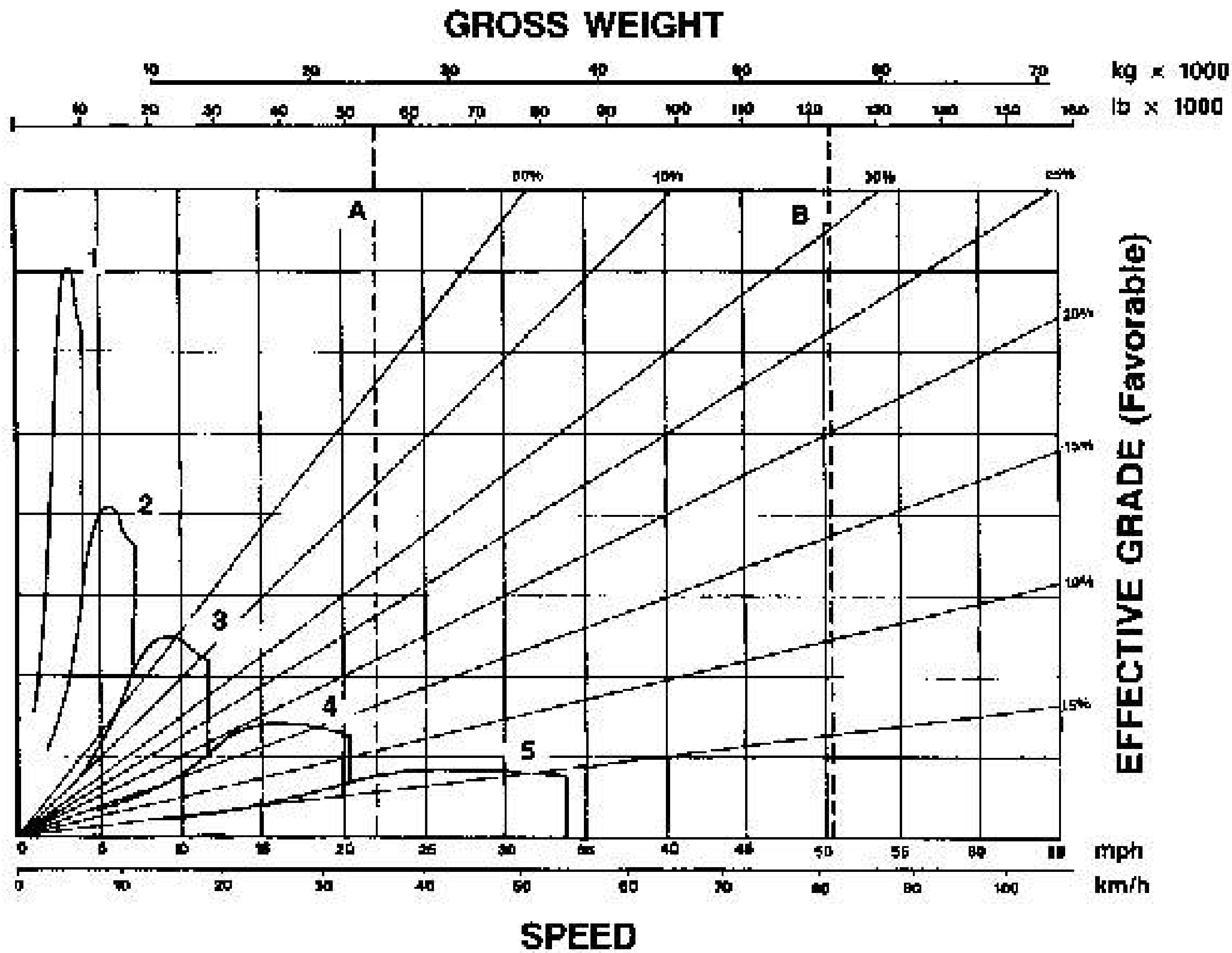
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

KEY

A — Empty 20 680 kg (45,600 lb)
B — Max GVW 47 900 kg (105,600 lb)

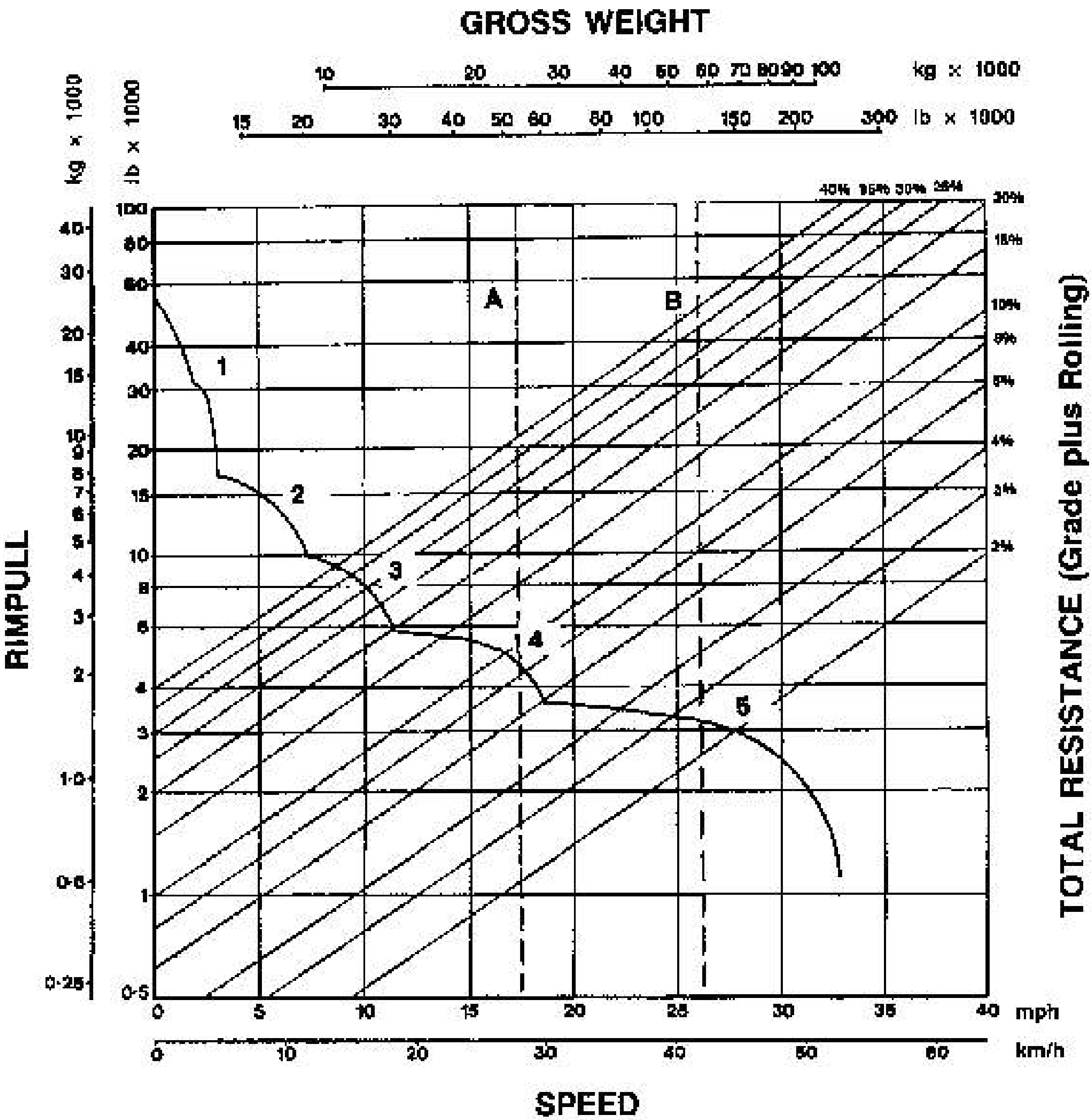

LOADED
feet
meters
DISTANCE ONE WAY
7000
6000
5000
4000
3000
2000
1000
0
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0% 2%
4%
6%
8%
10%
15%
TOTAL RESISTANCE (Grade plus Rolling)
0.00 0.40 0.80 1.20 1.60 2.00 2.40 2.80 3.20 3.60 4.00 4.40 4.80 5.20 minutes
TIME


EMPTY
feet
meters
DISTANCE ONE WAY
7000
6000
5000
4000
3000
2000
1000
0
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0% 2% 4% 6%
8%
10%
15%
TOTAL RESISTANCE (Grade plus Rolling)
0.00 0.40 0.80 1.20 1.60 2.00 2.40 2.80 3.20 3.60 4.00 4.40 4.80 5.20 minutes
TIME



KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear

KEY
A — Empty 24 595 kg (54,221 lb)
B — Max GVW 56 336 kg (124,221 lb)

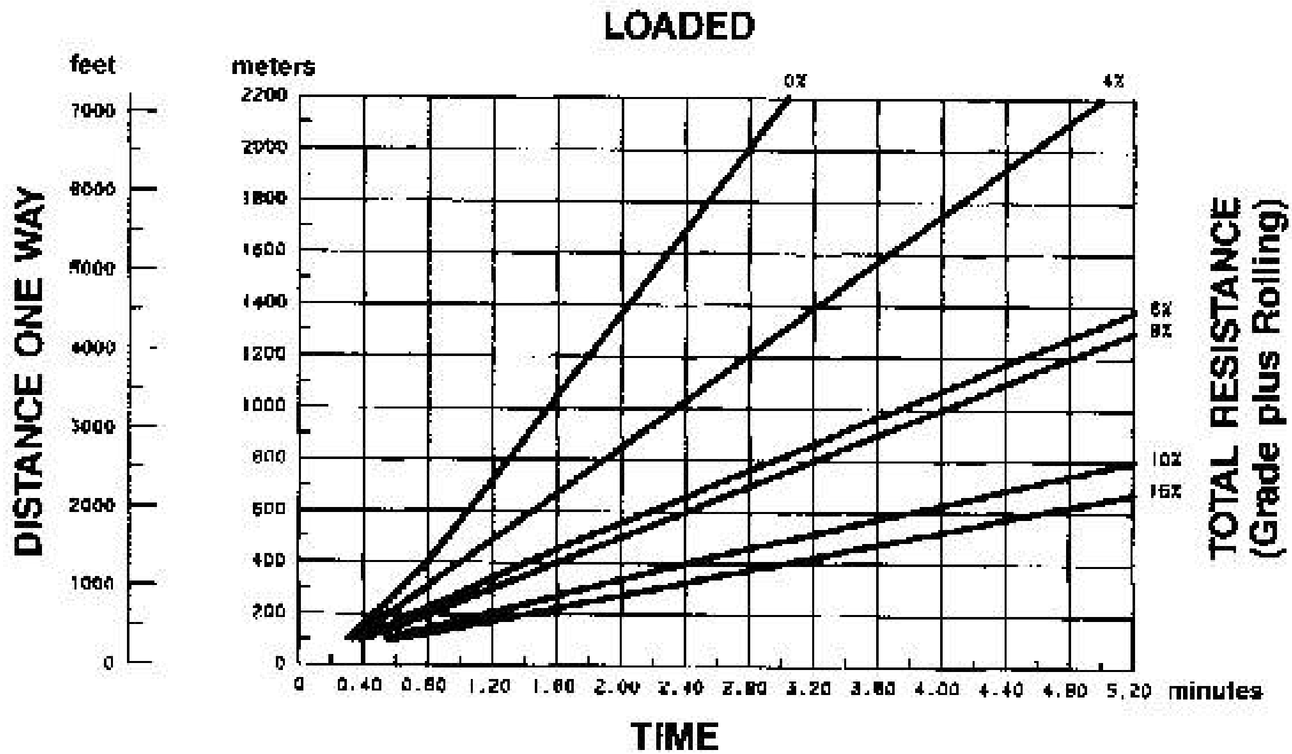


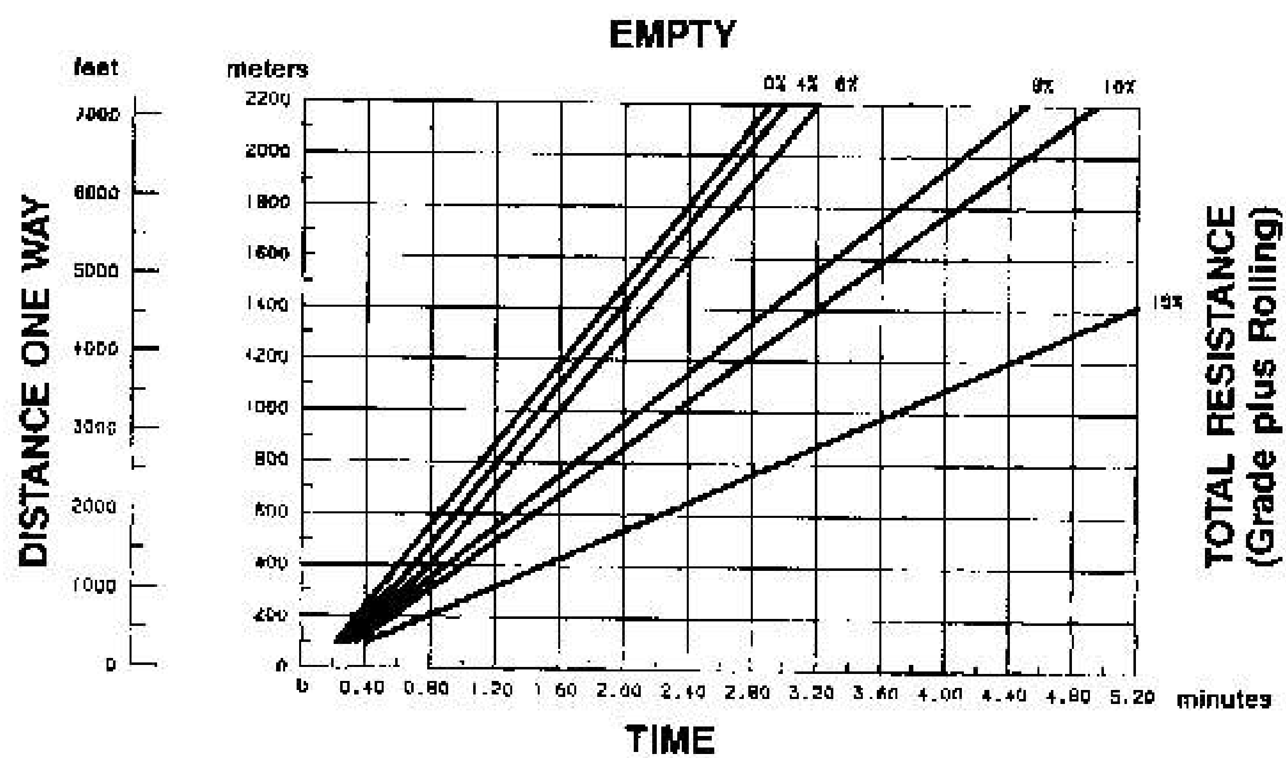
KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 4th Gear
5 — 5th Gear

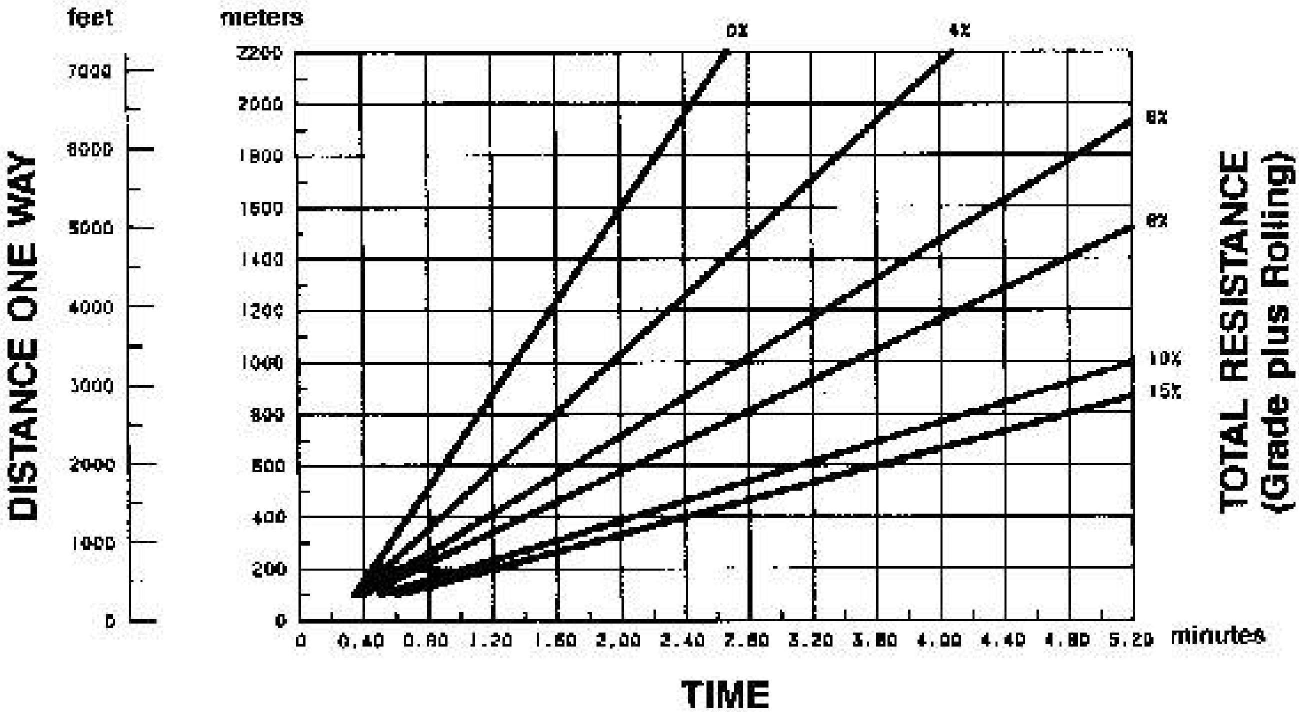
KEY

A — Empty 24 595 kg (54,221 lb)
B — Max GVW 56 336 kg (124,221 lb)

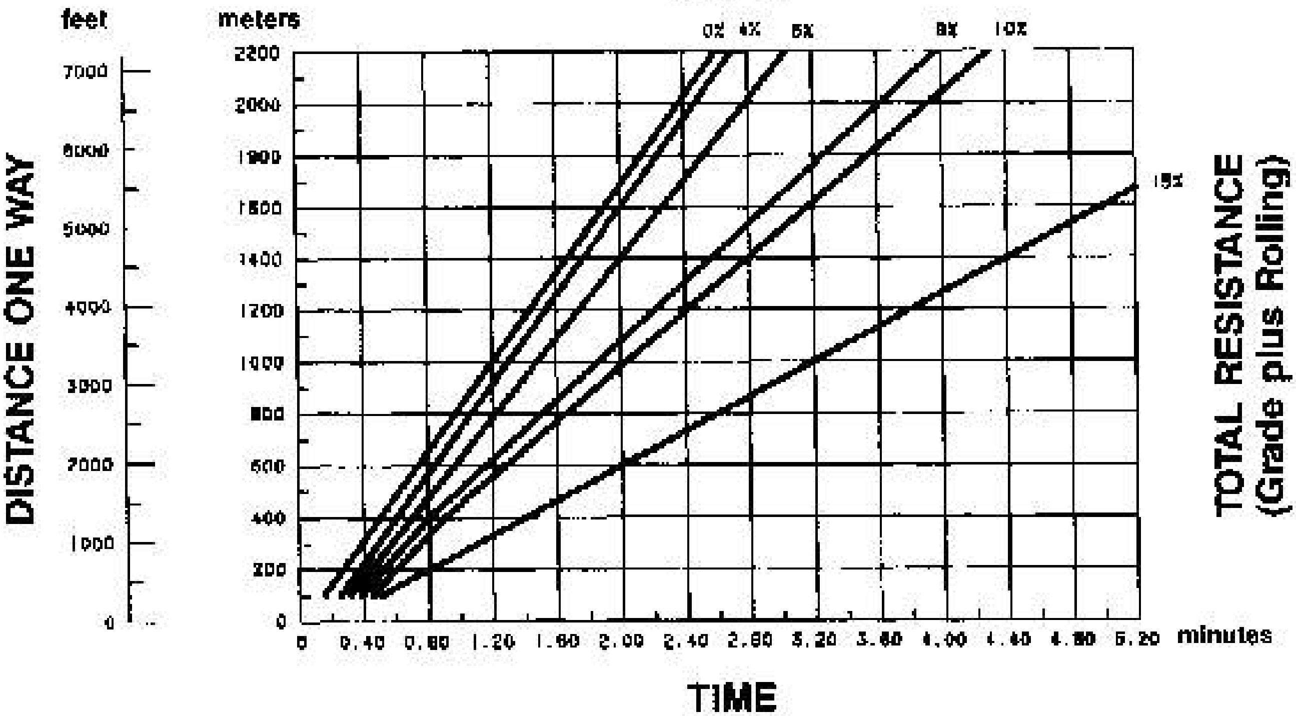

LOADED
feet
meters
DISTANCE ONE WAY
TOTAL RESISTANCE (Grade plus Rolling)
0%
4%
6%
8%
10%
15%
TIME
minutes

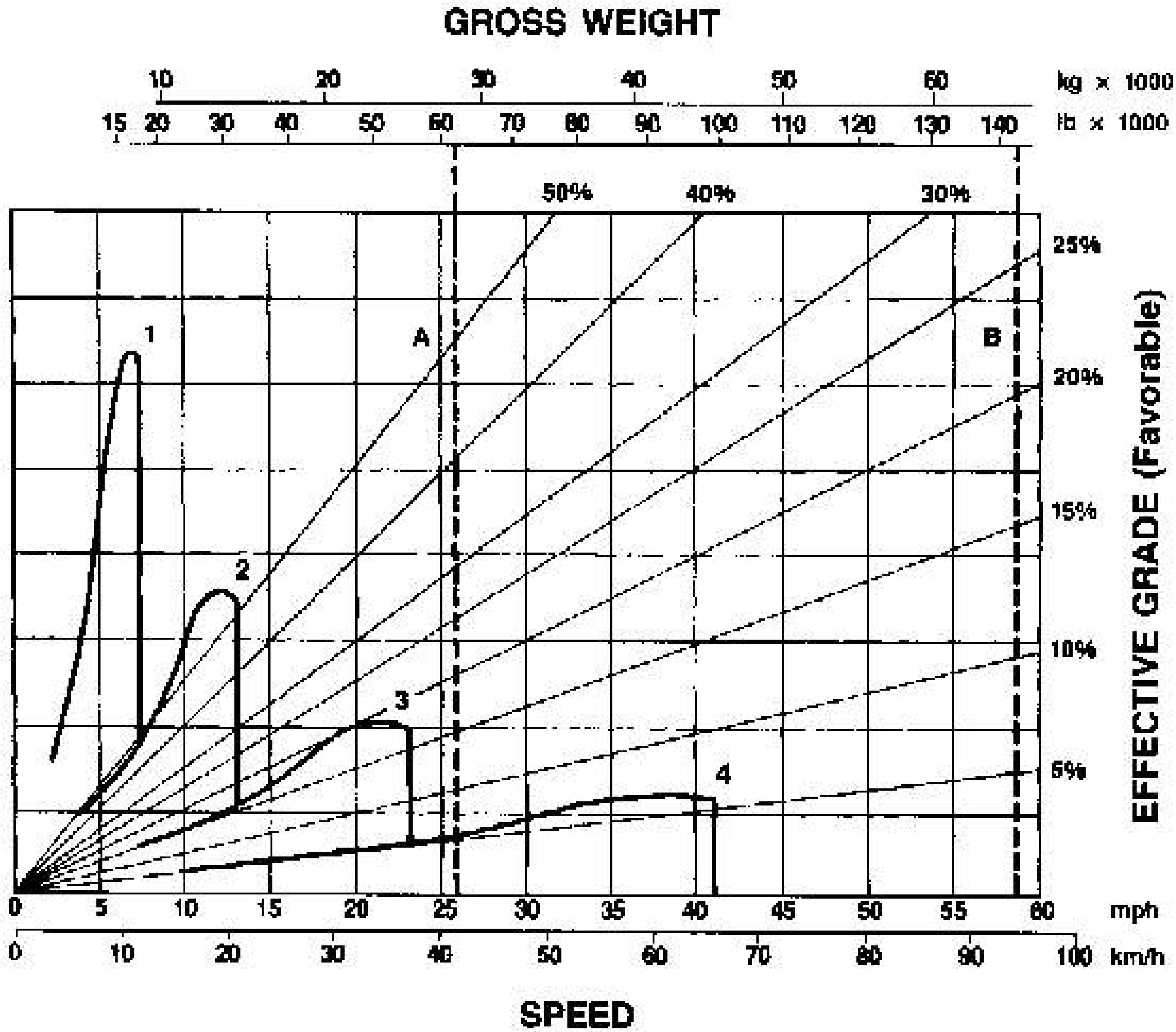

EMPTY
feet
meters
DISTANCE ONE WAY
TOTAL RESISTANCE (Grade plus Rolling)
0% 4% 6%
8%
10%
15%
TIME
minutes

LOADED



EMPTY



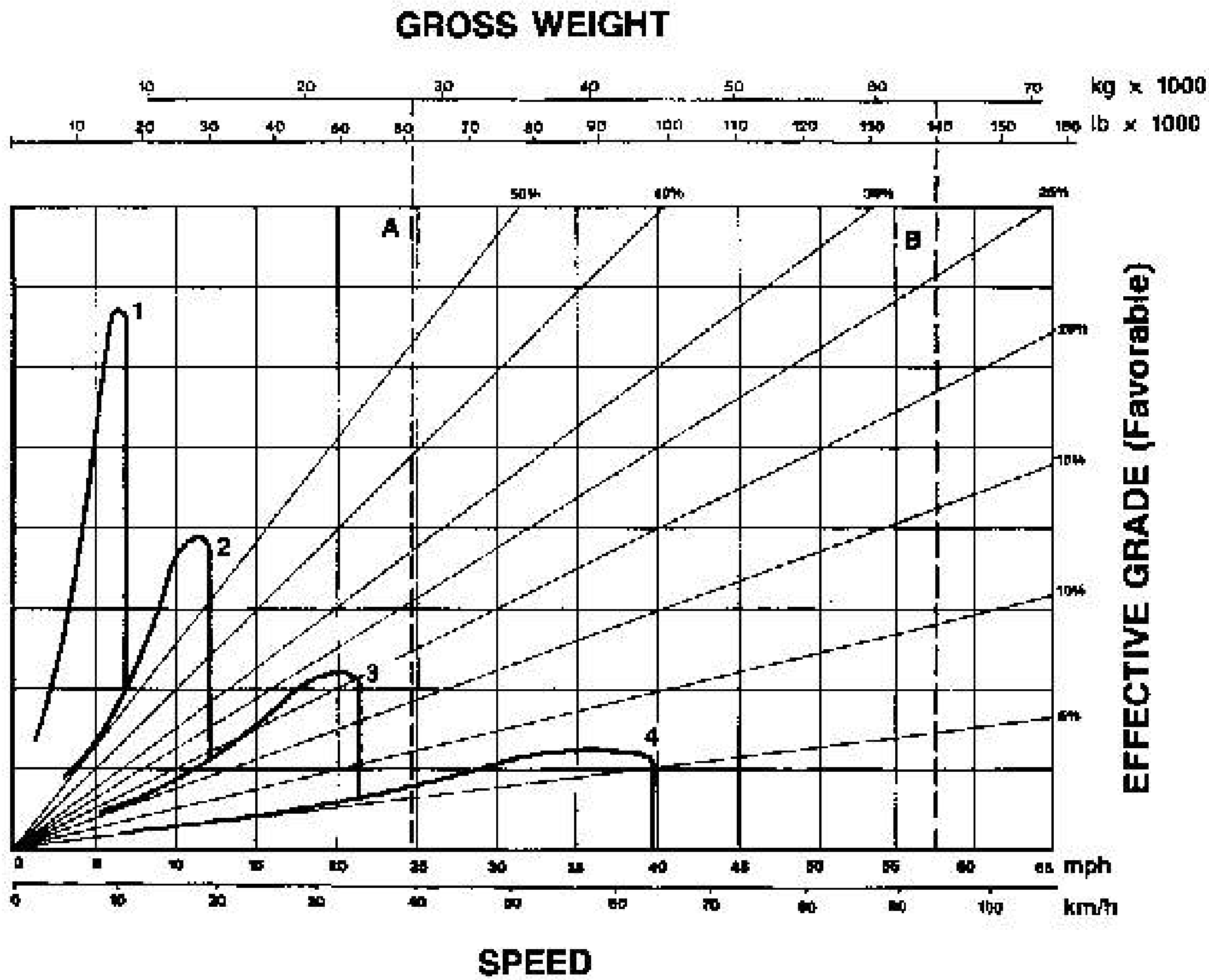


KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear

KEY

A Empty 28 027 kg (61,800 lb)
B — Max GVW 64 308 kg (141,800 lb)



KEY

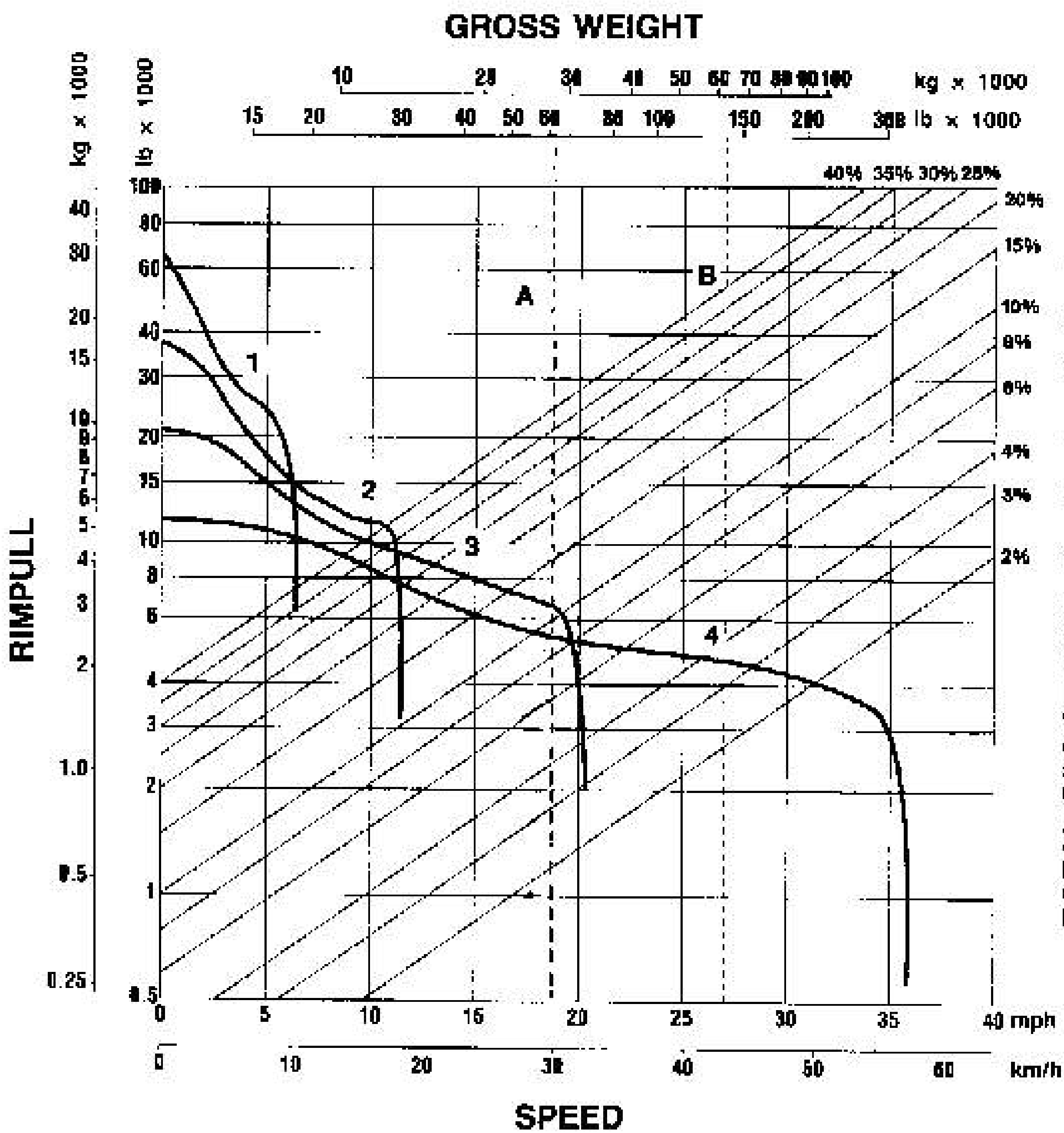
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear

KEY

A Empty 28 027 kg (61,800 lb)
B — Max GVW 64 308 kg (141,800 lb)

D40D/D400D Rimpull-Speed-Gradeability
- D400D — 29.5-25 Tires
- D40D — F: 29.5-25 Tires

R: 33.25-25 Tires

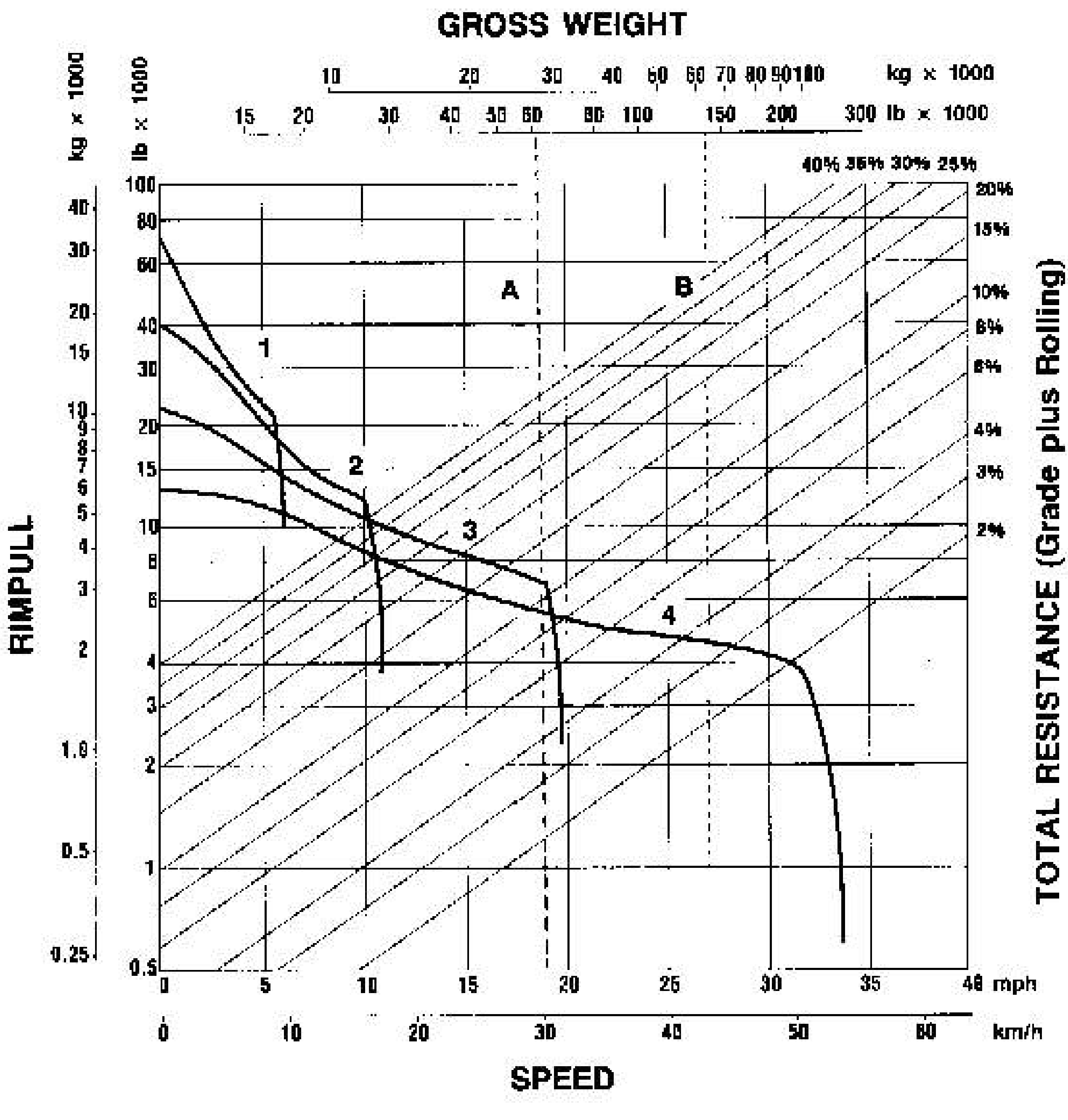


KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear

KEY

A — Empty 28 027 kg (61,800 lb)
B — Max GVW 64 308 kg (141,800 lb)

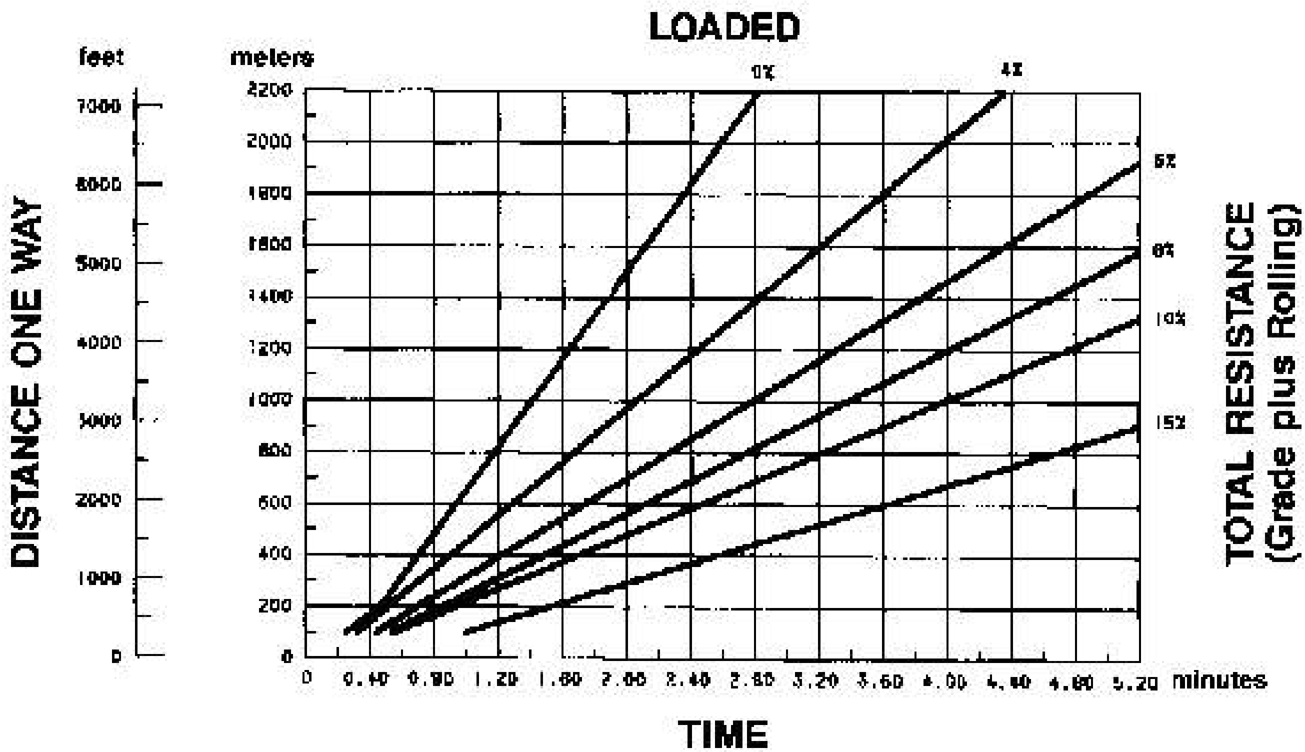


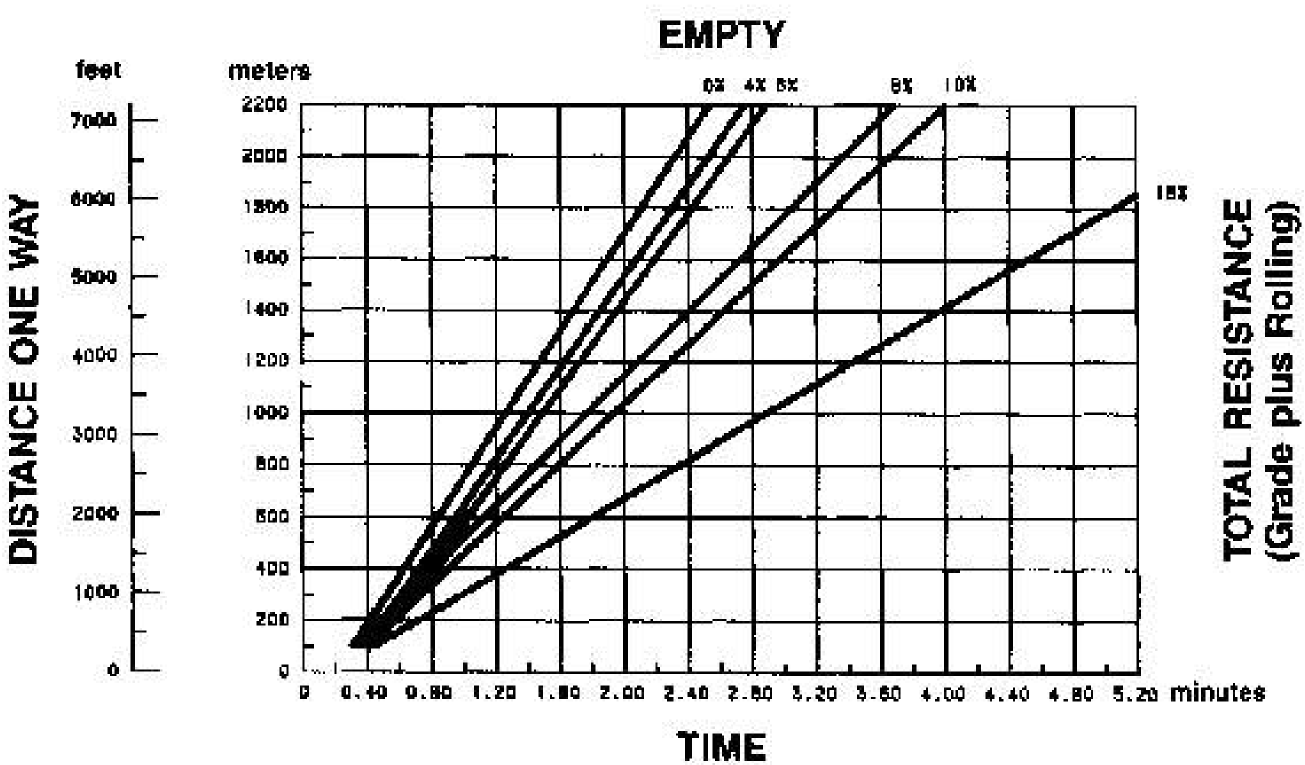
KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear

KEY
A — Empty 28 027 kg (61,800 lb)
B — Max GVW 64 308 kg (141,800 lb)

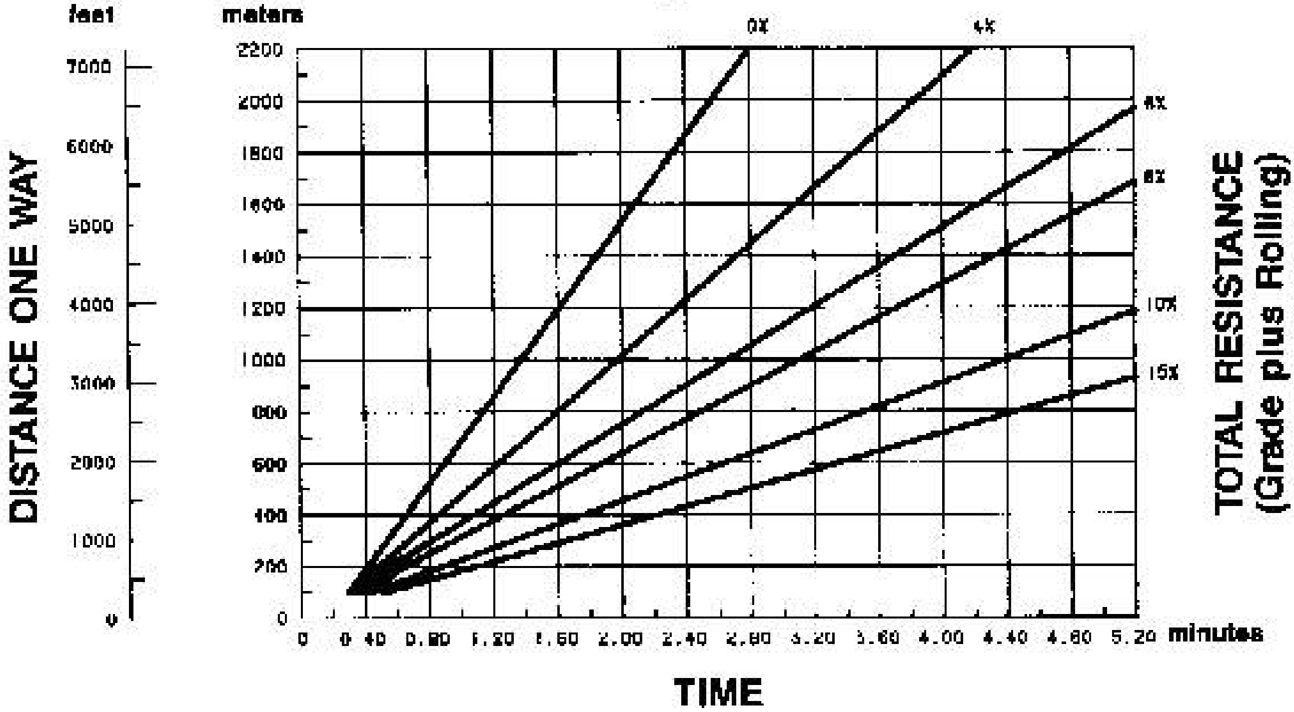
D40D/D400D Travel Time — Loaded/Empty
- D400D — 29.5-25 Tires
- D40D — F: 29.5-25 Tires

R: 33.25-29 Tires

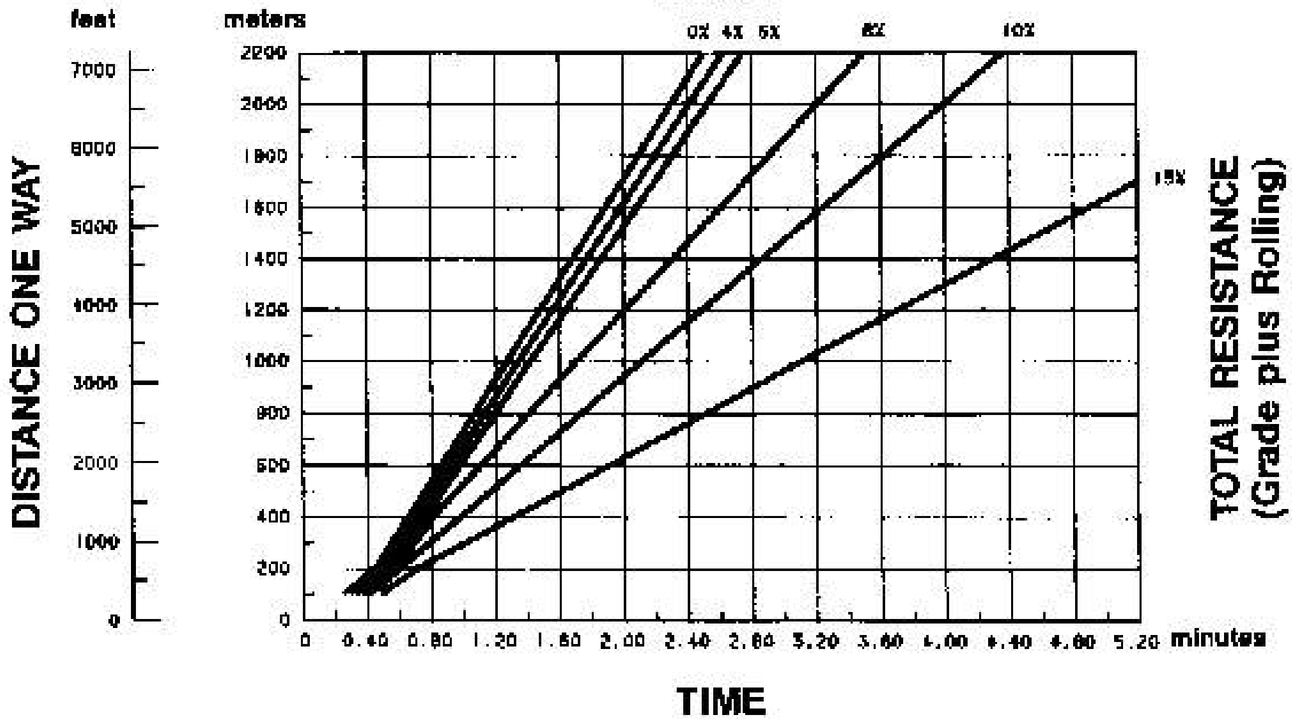




LOADED



EMPTY



WHEEL TRACTORS
SOIL COMPACTORS
LANDFILL COMPACTORS

CONTENTS

WHEEL TRACTORS

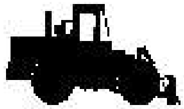
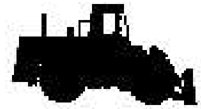
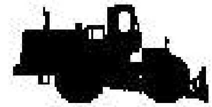
SOIL COMPACTORS

LANDFILL COMPACTORS

WHEEL TRACTORS

Features:

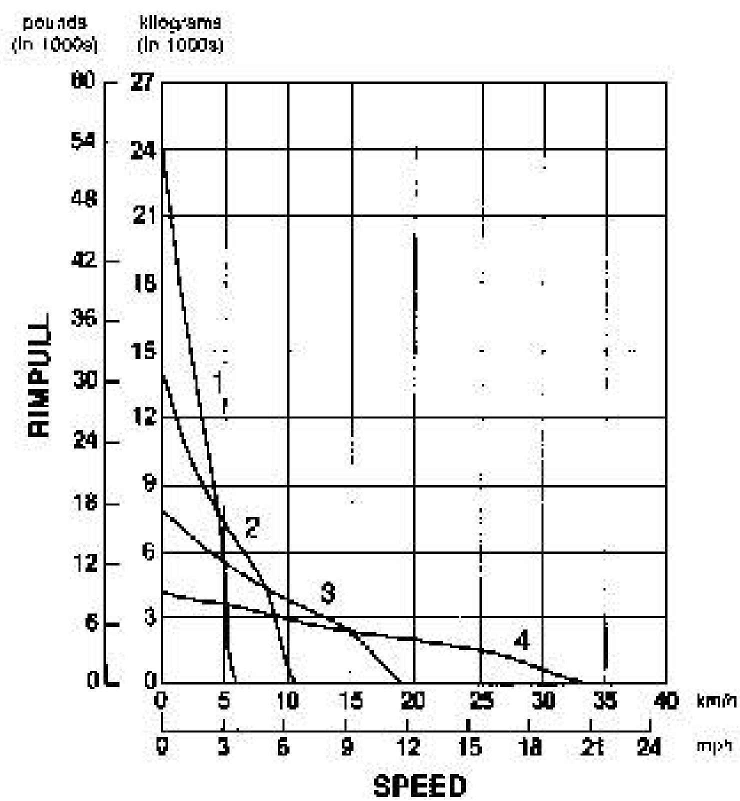
- **Reliable Cat power train:** four-stroke-cycle diesel with adjustment-free fuel system . . . full power shift with single lever on-the-go shifting.
- **Articulated frame steering** with hinge point midway between front and rear axles . . . short turning radius, long wheelbase . . . rear and front wheels track at all times.
- **Machine balance** . . . equal weight distribution on axles when blading.
- **All dozer functions,** including tip and tilt, hydraulically controlled from operator's seat.

MODEL	 814B		 824C		 834B	
Flywheel Power	161 kW	**216 HP**	235 kW	**315 HP**	336 kW	**450 HP**
Operating Weight*	20 580 kg	**45,370 lb**	30 380 kg	**66,975 lb**	46 355 kg	**102,195 lb**
Engine Model	3306		3406		3408	
Rated Engine RPM	2200		2100		2100	
No. Cylinders	6		6		8	
Displacement	10.5 L	**638 in³**	14.6 L	**893 in³**	18 L	**1098 in³**
Speeds:						
Forward	4		4		4	
Reverse	4		4		4	
Top Speed Forward	29.9 km/h	**18.6 mph**	33.2 km/h	**20.6 mph**	34.1 km/h	**21.2 mph**
Turning Circle with Blade	12.3 m	**40'3"**	13.9 m	**45'6"**	17.2 m	**56'6"**
Standard Tire Size	23.5-25, 12 PR (L-2)		29.5-25, 16 PR (L-3)		35/65-33, (L-4)	
Fuel Tank Refill Capacity	462 L	**122 U.S. gal**	589 L	**156 U.S. gal**	595 L	**157 U.S. gal**
GENERAL DIMENSIONS						
Height (to top of ROPS)	3.566 m	**11'8"**	3.959 m	**13'0"**	4.102 m	**13'5.5"**
Height (stripped top)**	2.399 m	**7'10.5"**	2.990 m	**9'10"**	2.955 m	**9'8"**
Wheel Base	3.360 m	**11'0"**	3.530 m	**11'7"**	3.810 m	**12'6"**
Overall Length with Dozer	6.823 m	**22'5"**	7.680 m	**25'2"**	8.716 m	**28'7"**
Width (over standard tires)	2.665 m	**8'6"**	3.170 m	**10'5"**	3.558 m	**11'8"**
Tread Width	2.200 m	**7'3"**	2.360 m	**7'9"**	2.681 m	**8'8"**
Ground Clearance	419 mm	**16.5"**	477 mm	**18.8"**	466 mm	**18"**
STRAIGHT BULLDOZER:						
Width	3.650 m	**12'0"**	4.192 m	**13'9"**	4.620 m	**15'2"**
Height	1.004 m	**3'4"**	1.220 m	**4'0"**	1.448 m	**4'9"**
Capacity	2.91 LCM	**3.8 LCY**	4.67 LCM	**6.11 LCY**	7.27 LCM	**9.5 LCY*****
Ground Clearance Below Skid Shoe	731 mm	**29"**	992 mm	**39"**	964 mm	**3'2"**
Depth of Cut	500 mm	**20"**	390 mm	**15.4"**	441 mm	**17"**
Tilt Adjustment	747 mm	**29.4"**	1.12 m	**3'8"**	1.278 m	**4'2"**
Tip Adjustment	18°		23°		22°	
Lift Speed	0.40 m/sec	**1.3 ft/sec**	0.46 m/sec	**1.5 ft/sec**	0.40 m/sec	**1.3 ft/sec**

*Operating Weight includes straight dozer, 75% $CaCl_2$ in all tires, lubricants, coolant, ROPS cab, full fuel tank and operator. 75% $CaCl_2$ in all tires adds the following weight to each model: 814B — 1996 kg (4,400 lb), 824C — 3001 kg (6596 lb), 834B — 5300 kg (11,615 lb).
**Height (stripped top) — without ROPS, exhaust, seat back or easily removed encumbrances.
***Capacity of 834B U Blade is 10.48 LCM (13.7 LCY)

MODEL	814B		824C		834B	
FORWARD GEAR	km/h	mph	km/h	mph	km/h	mph
1	5.6	3.5	6.0	3.7	6.3	3.9
2	9.8	6.1	10.5	6.5	11.3	7.0
3	17.2	10.7	18.7	11.6	19.8	12.3
4	29.9	18.6	33.2	20.6	34.1	21.2
REVERSE GEAR						
1	6.3	3.9	6.8	4.2	7.9	4.9
2	11.3	7.0	12.1	7.5	14.0	8.7
3	19.6	12.2	21.1	13.2	24.5	15.2
4	34.1	21.1	37.8	23.5	41.8	26

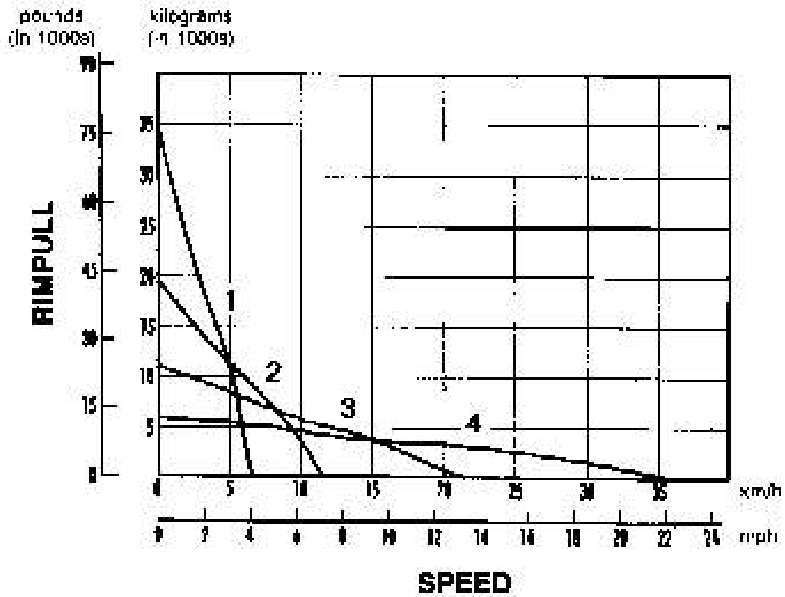
814B



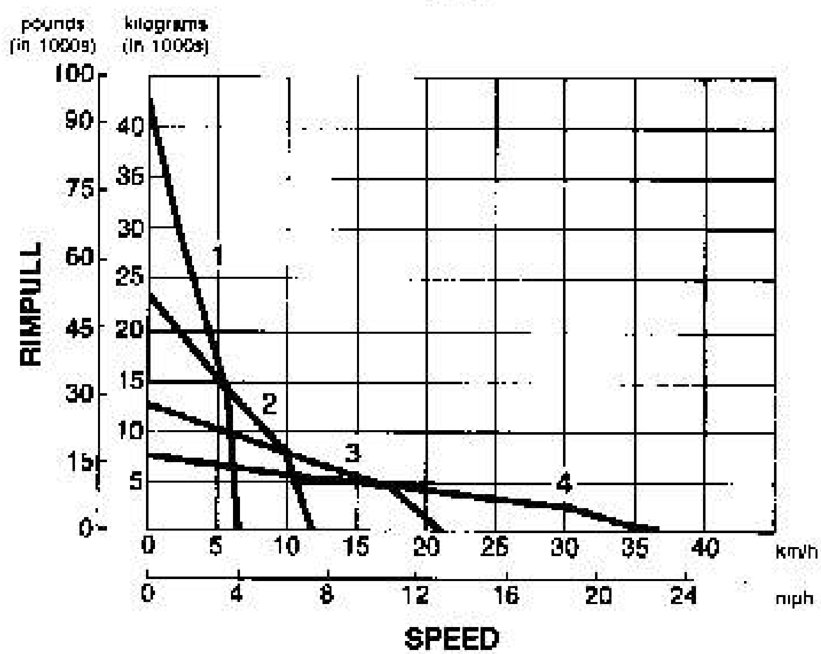
Usable rimpull depends upon traction and weight of tractor.

KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear

824C



834B



Usable rimpull depends upon traction and weight of tractor.

KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear

CONSIDERATIONS IN MACHINE SELECTION

The following factors should be considered when comparing wheels vs. tracks:

Traction
You can figure coefficient of traction, depending on underfoot conditions, from the Table Section in this book.
Wheels — up to 0.65 (in quarry pit with good floor)
Track — up to 0.90 (in soils permitting grouser penetration)
Usable Rimpull = Machine Weight × Coefficient of Traction

Speed
Wheels — travel speeds up to three times higher than track.

Maneuverability
Articulated steering and good visibility give wheel tractors high maneuverability.

Cost
See Owning and Operating Costs section. Tire vs undercarriage costs can often be the deciding factor in selecting wheels or tracks.

Compaction
Ground Pressure:
Wheels — from 241 kPa (35 psi) to 310 kPa (45 psi)
Tracks — from 82 kPa (12 psi) to 97 kPa (14 psi)

Application
Utility . . . mobility, maneuverability and good speed suit wheel tractors for yard and stockpile work and for clean-up around shovels. Lower maintenance costs may be realized in certain soils that can be highly abrasive to track-type undercarriages.
Coal pile . . . recommend wheel tractors in this application when following conditions are present:
— Long push distances
— Need for good material spread
— High degree of compaction desired
Production Dozing . . . a wheel tractor should be considered in the following conditions:
— Long push distances
— Loose soils, little or no rock
— Level or downhill work
— Good underfoot conditions
Pushloading Scrapers . . . a wheel tractor should be considered in the following conditions:
Thin scraper cut
— Good underfoot conditions — no rock
— Higher push speeds
Chip and Coal Scoops . . . may adversely affect performance and/or reliability, particularly when adverse grades are encountered.

COUNTERWEIGHTS AND BALLAST

For each specific application, there is a correct machine weight for proper balancing of traction, flotation, mobility and response.

- Low machine weight may increase tire slipping and wear, but improves flotation, mobility and machine response.
- High machine weight increases traction, but decreases mobility and response.

The machine weight is optimum for the operating conditions when wheel slipping barely occurs in the gear being used. Weight distribution under operating conditions should then be approximately equal between the wheels to balance power to each axle.

Application
Lower machine weight is usually required for typical second gear applications, such as fill spreading, stockpiling, road maintenance, towing compactors and shovel cleanup.

Higher machine weight is usually required for such typical first gear applications as heavy dozing and pushloading.

Tire Ballast
A solution of calcium chloride and water is recommended for tire ballast. It has the advantage of low cost with simple quick adjustment to suit working conditions.

TIRE SELECTION & MAINTENANCE

Requirements of traction, flotation and tire life are met by a choice of tire size, tread design and inflation pressure.

Tire Width
For good conditions with little rolling resistance on surfaces where flotation is no problem, a narrower tire may be most economical. It may also be considered in muddy conditions in which the mud can be penetrated to reach firm earth underneath.

11

Where flotation problems and increased rolling resistance are encountered, wider tires are recommended. The greater contact area and shallower penetration increases flotation.

Tire Size

Larger optional tires will also improve flotation in soft conditions. With larger diameter, rimpull will be reduced which may be desirable to help control wheel spin.

Traction Tread (L-2)

Under some soil conditions, the increased penetration ability of this tread provides improved traction.

Rock Tread (L-3)

Compared to the traction tread, the rock tire tread bars put more rubber at the ground with the same overall footprint area with less possibility of penetration under abrasive conditions. Traction is improved on any hard, smooth surface — rock, concrete, compacted earth — by the use of rock treads and a more cut resistant rubber compounding.

Rock — Deep Tread (L-4)

In rock conditions where sharp fragments cause high tire wear or sudden failure, rock — extra tread tires are recommended. They provide 50% more tread depth and greater thickness of undertread and side wall rubber as compared to the rock tire, with correspondingly increased tire life.

Rock — Extra Deep Tread (L-5)

Intended for severe rock conditions with extreme penetration hazard, this tire provides 150% more tread depth when compared to the L-3 rock tire.

Chains

In severe applications where extra tread tires still give unsatisfactory life, chains should be considered. Operating costs vary greatly depending on application, underfoot conditions, amount of wheel spinning and maintenance of chains. Under normal rock operation (short cycle, low average speed and minimum wheel spinning) the maximum estimated chain life is about 2000 hours. Before installing chains, the over all economics of their use should be carefully weighed against known tire costs. They are not recommended with new rock extra tread tires but can extend the life of a used tire. Always check clearance around tires before using chains.

Major applications where chains can be considered include:

— stripping rock or rocky soils
— clean-up work around rock loading shovels
— any application where underfoot conditions cause excessive tire wear.

Inflation Pressure

In average operating conditions the recommended inflation pressure prevents excessive deflection and minimizes tire rollover on side slopes.

Over-inflation

Reduces amount of tread contact with ground and provides less flotation. Over-inflation causes center of tread to wear faster and increases the chance of cuts and impact breaks.

Under-inflation

Can cause permanent tire damage in the form of flex breaks, radial cracks, and tread or ply separation. On jobs where wrinkling and bead rollover *are not* apparent, inflation pressure may be reduced to a minimum of:

Bias Ply —	170 kPa (25 psi) on 35/65-33
	170 kPa (25 psi) on 29.5-25
	170 kPa (25 psi) on 26.5-25
	170 kPa (25 psi) on 23.5-25
Radial	310 kPa (45 psi) on 35/65R 33
	310 kPa (45 psi) on 29.5R 25
	205 kPa (30 psi) on 26.5R 25
	240 kPa (35 psi) on 23.5R 25

Reduced pressure will:

Increase flotation and traction in sand.

Improve envelopment characteristics to reduce sudden death failure on rock jobs.

Provide better tread wear by reducing contact pressure between tire and ground.

SPECIAL ATTACHMENTS

Balderson Work Tools

Work Tools	834B	824C	814B	826C	816B
Coal Scoop	X	X	X		
Chip Scoop	X	X	X		
Coal U-Blade	X	X	X		
Woodchip U-Blade	X	X	X		
Heavy U-Blade		X	X		
Reclamation U-Blade			X		
Landfill U-Blade				X	X

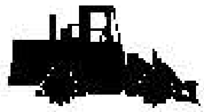
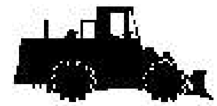
Contact Balderson for spec information

SOIL COMPACTORS

CONTENTS

Features:

- **Dozing, filling and compacting versatility.**
- **High speed operation** with responsive Caterpillar diesel Engine, single-lever planetary power shift transmission, and all wheel drive.
- **Articulated frame** makes maneuvering quick and easy. Long wheel base for stability.
- **Wheels with tamping foot design and chevron pattern** give traction, penetration and compaction needed for high production. Foot pattern reversed on trailing drums to prevent overprinting lead drums.
- **Rear drums track front** for double compactive effort. Drum spacing covers mid-axle strip on return pass.
- **Rear axle oscillation** keeps all drums on ground for traction and stability.
- **Cleaner bars** keep drums free of carry over earth regardless of rolling direction. Adjustable, replaceable.
- **Optional fill spreading dozer** has single lever control for raise, lower, hold and float. (Blade tilt optional.)

MODEL	815B 			825C 		
Flywheel Power	161 kW		216 HP	235 kW		315 HP
Operating Weight*	20 036 kg		44,175 lb	32 400 kg		71,429 lb
Engine Model		3306			3406	
Rated Engine RPM		2200			2100	
No. Cylinders		6			6	
Displacement	10.5 L		638 in³	14.6 L		893 in³
Speeds						
Forward		4			4	
Reverse		4			4	
Turning Circle with Blade	12.3 m		40'3"	14.2 m		46'6"
Fuel Tank Refill Capacity	462 L		122 U.S. gal	589 L		156 U.S. gal
TAMPING FOOT WHEELS:						
Each Drum Width	978 mm		3'2.5"	1118 mm		3'8"
Diameters, over feet	1.42 m		4'8"	1.68 m		5'6"
over drum	1.03 m		3'4.5"	1.29 m		4'3"
Foot per Wheel		60			65	
Feet per Row		12			13	
Rows of Feet		5			5	
Foot Length	198 mm		7.8"	191 mm		7.5"
End Area Per Foot	116 cm²		18 in²	192 cm²		29.75 in²
Width of Two Pass Coverage	4.36 m		14'3"	4.88 m		16'0"
GENERAL DIMENSIONS:						
Height (top of ROPS)	3.53 m		11'7"	3.91 m		12'10"
Height (stripped top)**	2.38 m		7'10"	2.90 m		9'6"
Wheel Base	3.35 m		11'0"	3.53 m		11'7"
Overall Length with Dozer	6.80 m		22'4"	7.69 m		25'2"
Width over Drums	3.24 m		10'8"	3.65 m		11'11"
Ground Clearance***	203 mm		8"	234 mm		9.2"
STRAIGHT BULLDOZER:						
Width	3.76 m		12'	4.53 m		14'10"
Height	0.86 m		2'10"	1.04 m		3'5"

*Operating Weight includes coolant, lubricants, bulldozer, hydraulics, ROPS canopy, full fuel tank and operator.
**Height (stripped top) — without ROPS, exhaust, seat back or other easily removed encumbrances.
***With Compactor feet at 100% penetration.

COMPACTION FUNDAMENTALS

The following discussion applies to soil compaction only. For information on refuse compaction, see Waste Disposal — Section 23 of this book.

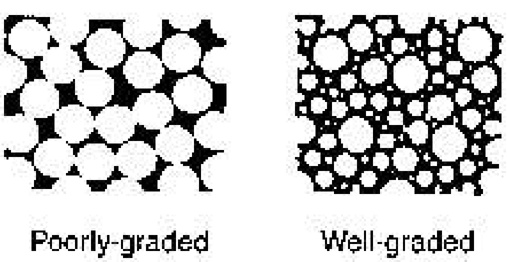
Definition

Compaction is the process of physically densifying or packing the soil . . . resulting in an increase in weight per unit volume. It is generally accepted that the strength of a soil can be increased by densification. Three important factors affect compaction.

— Material gradation
— Moisture content
— Compactive effort

Material Gradation — refers to the distribution (% by weight) of the different sizes of particles within a given soil sample. A sample is described as well-graded if it contains a good, even distribution of particle sizes. If a soil sample is composed of predominantly one size particle, it is said to be poorly-graded. In terms of compaction, a well-graded soil will compact more easily than one that is poorly-graded. In well graded material the smaller particles tend to fill the empty spaces between the larger particles, leaving fewer voids after compaction.

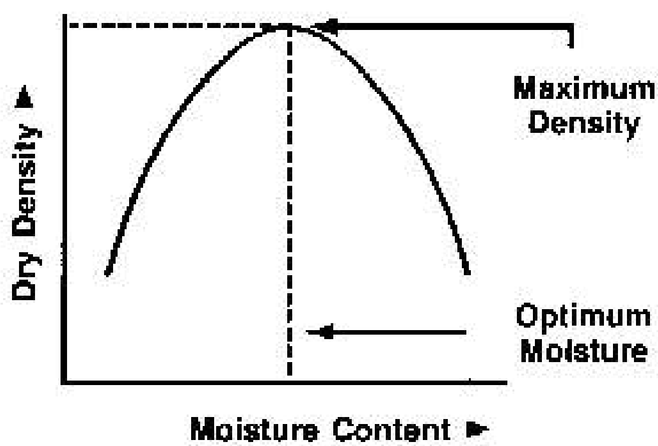
MATERIAL GRADATION



Moisture Content — or the amount of water present in a soil, is very important to compaction. Water lubricates soil particles thus helping them slide into the most dense position. Water also creates clay particle bonding, giving cohesive materials their sticky qualities.

Experience has shown that it is very difficult, if not impossible, to achieve proper compaction in materials that are too dry or too wet. Soil experts have determined that in practically every soil there is an amount of water, called optimum moisture content, at which it is possible to obtain maximum density with a given amount of compactive effort. The curve below shows this relationship between dry density and moisture content. It is called a compaction curve, moisture density curve or Proctor curve.

MOISTURE CONTENT



Compactive Effort — refers to the method employed by a compactor to impart energy into the soil to achieve compaction. Compactors are designed to use one or a combination of the following types of compactive effort.

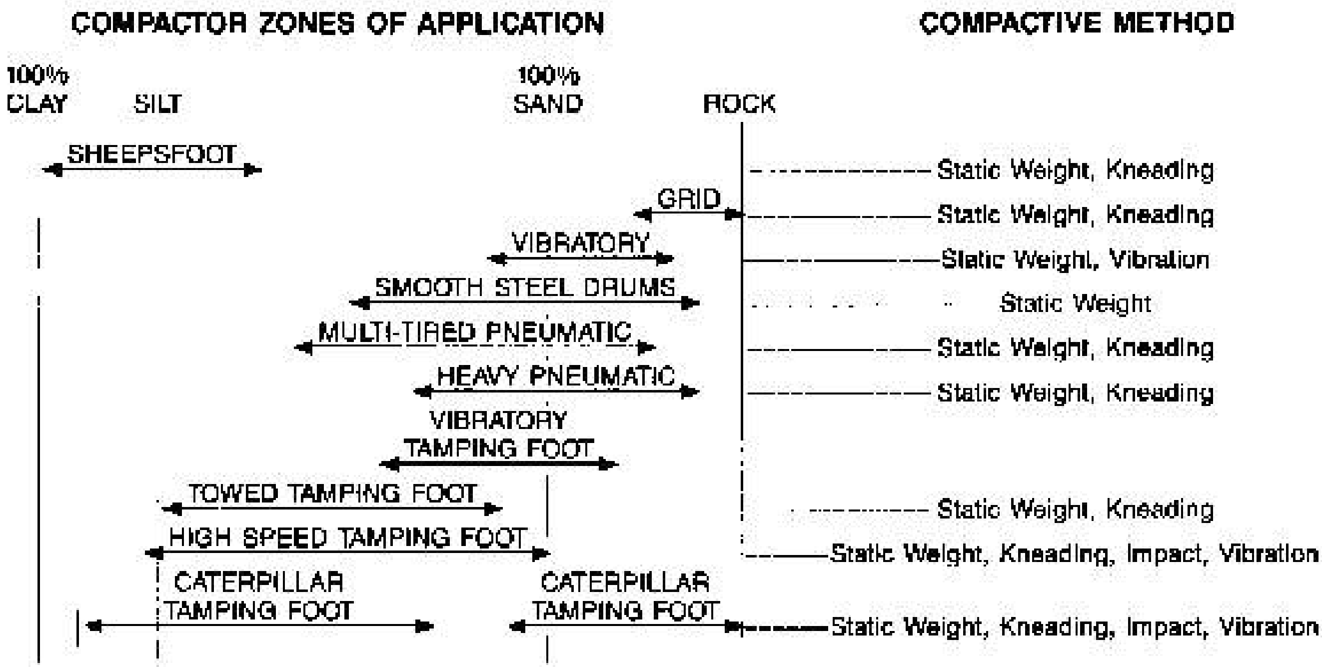
— Static weight (or pressure)
— Kneading action (or manipulation)
— Impact (or sharp blow)
— Vibration (or shaking)

COMPACTOR TYPES

Compaction equipment can be grouped generally into nine different types or classifications:
(1) sheepsfoot
(2) grid or mesh
(3) vibratory
(4) smooth steel drum
(5) multi-tired pneumatic
(6) heavy pneumatic
(7) towed tamping foot
(8) high speed tamping foot
(9) chopper wheels (see Landfill Compactor section)

Combinations of these types are also available, such as a vibrating smooth steel drum.

For ease of comparison, the first eight types of compactors have been placed on the Zones of Application Chart shown below. This chart contains a range of material moistures from 100% clay to 100% sand, plus a rock zone. Each type has been positioned in what is considered to be its most effective and economical zone of application. However, it is not uncommon to find them working out of their zones. Exact positioning of the zones can vary with differing material conditions.



COMPACTOR PRODUCTION

Compactor production is expressed in compacted cubic meters (Cm^3) or compacted cubic yards (CCY) per hour. Material in its natural or bank state is measured in bank cubic meters or yards (Bm^3 or BCY). When it is removed or placed in a fill, it is measured in loose cubic meters or yards (Lm^3 or LCY).

When the loose material is worked into a compacted state, the relationship of *compacted material* to *bank material* is shown as the shrinkage factor (SF).

$$SF = \frac{\text{Compacted cubic meters } (Cm^3)}{\text{Bank cubic meters } (Bm^3)}$$

$$SF = \frac{\text{Compacted cubic yards (CCY)}}{\text{Bank cubic yards (BCY)}}$$

The construction industry has developed the following formula for use in estimating compactor production. This formula gives the volume of material which a given machine can compact in a 60-minute hour.

Metric Method

$$Cm^3 = \frac{W \times S \times L}{P}$$

W = Compacted width per pass, in meters. (For Caterpillar Compactors it is recommended that W = Twice the width of one wheel.)

S = Average speed, in kilometers per hour.

L = Compacted thickness of lift, in millimeters.

P = Number of machine passes to achieve compaction (**can only be determined by testing the density of the compacted material on-the-job).**

English Method

$$CCY/Hr = \frac{W \times S \times L \times 16.3}{P}$$

W = Compacted width per pass, in feet. (For Caterpillar Compactors it is recommended that W = Twice the width of one wheel.)

S = Average speed, in miles per hour.

L = Compacted thickness of lift, in inches.

16.3 = Conversion constant, equals 5280 feet ÷ 12 inches ÷ 27 cubic feet

P = Number of machine passes to achieve compaction (**can only be determined by testing the density of the compacted material on-the-job).**

Example problem (Metric)

Determine production for an 815B operating under the following conditions:

$$P = 5, S = 10 \text{ km/h}, L = 100 \text{ mm}$$

Refer to 815B in the production table on the next page. Read down the first column until reaching section for 5 passes. Within this section in the second column, find the speed closest to 10 km/h. Read across this line to the 100 mm compacted lift. Read the production figure given.

Answer: 377 Cm^3/h. (Since the machine's speed of 10 km/h is slightly faster than the 9.5 of the table, production may be interpolated slightly higher — say 395 Cm^3/h.)

• • •

Example problem (English)

Determine production for an 825C operating under the following conditions:

P = 4, S = 8 mph, L = 6 inches

Refer to the production estimating table below. This table contains estimates for the 815B and 825C Compactors using various speeds, lift thicknesses and number of passes. These figures were calculated using the formula discussed on this page. The figures represent 100% efficiency. W=Twice the width of one wheel.

In the 825 portion of this table, read down the first column until reaching the section for four passes. Within this section in the second column, find the line for 8 mph. Read across this line to the lift thickness column for 6 inches. Read the production figure given.

Answer: 1444 CCY/hr.

■ ■ ■

PRODUCTION TABLE

MODEL AND MACHINE PASSES*	AVERAGE SPEED		COMPACTED LIFT THICKNESS							
	km/h	mph	100 mm m³/h	4 in yd³/hr	150 mm m³/h	6 in yd³/hr	200 mm m³/h	8 in yd³/hr	250 mm m³/h	10 in yd³/hr
815B 3	6.5	4	419	548	628	822	837	1095	—	
	9.5	6	628	822	942	1232	1256	1643	—	
	13.0	8	837	1095	1256	1643	1675	2191	—	
4	6.5	4	314	411	471	616	628	822	—	
	9.5	6	471	616	706	924	942	1232	—	
	13.0	8	628	822	942	1232	1256	1643	—	
5	6.5	4	251	329	377	493	502	657	—	
	9.5	6	377	493	565	739	754	986	—	
	13.0	8	502	657	754	986	1005	1314	—	
6	6.5	4	286	274	314	411	419	548	—	
	9.5	6	314	411	471	616	628	822	—	
	13.0	8	419	548	628	822	837	1095	—	
825C 3	6.5	4	488	642	731	962	975	1283	1219	1604
	9.5	6	713	962	1069	1444	1426	1925	1781	2406
	13.0	8	975	1283	1463	1925	1950	2566	2438	3208
4	6.5	4	366	481	534	722	731	962	914	1203
	9.5	6	534	722	802	1083	1069	1444	1336	1804
	13.0	8	731	962	1097	1444	1463	1925	1828	2406
5	6.5	4	293	385	439	577	585	770	731	962
	9.5	6	428	577	641	866	855	1155	1069	1444
	13.0	8	585	770	878	1155	1170	1540	1463	1925
6	6.5	4	244	321	366	481	488	642	609	802
	9.5	6	356	481	534	722	713	962	891	1203
	13.0	8	488	642	731	962	975	1283	1219	1604

*The number of machine passes required is dependent on soil type, moisture content, desired compaction and machine weight.

LANDFILL COMPACTORS

CONTENTS

816B and 826C Landfill Compactors Features:

- **Exclusive chopper wheels standard** . . . blades alternate in a staggered-chevron design for maximum coverage and density. PLUS TIPS — are optional.
- **Cat designed and manufactured power train** . . . for optimum match, performance and efficiency. Responsive Cat diesel Engine. Single-lever planetary power shift. All-wheel drive.
- **Center-point articulation** . . . excellent maneuverability. Front and rear drums track, so material is chopped and compacted twice each pass.
- **Protective guarding** . . . helps keep trash from damaging machine components.
- **Caterpillar landfill blades** spread refuse and cover material . . . built strong to handle the wide range of refuse encountered in landfills.
- **Operator comfort and convenience** . . . sound suppressed cab with pressurized and filtered air circulation system. Adjustable suspension seat. Electronic Monitoring System and gauge package is standard. Optional air conditioner available.
- **Striker bar** . . . standard on 826C and optional attachment on 816B, prevents refuse from being carried over the rear chopper wheels.

518 Landfill Compactor Features:

- **Frame oscillation** . . . excellent maneuverability, smooth ride and low center of gravity for exceptional stability.
- **Brakes** . . . driveline disc for excellent stopping power and long life. Enclosed brake location prevents contamination from landfill debris.
- **Operating case** . . . power shift transmission with torque converter. Three forward/reverse speeds cover entire work range. NoSPIN differentials (front and rear) automatically lock when needed for superior traction.

Caron modifications to the 518 base unit:

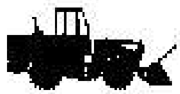
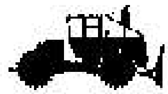
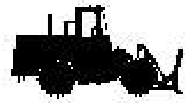
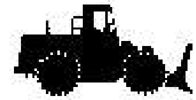
- **Landfill wheels/teeth** with Caron replaceable compactor type wear caps. Drums are 775 mm (30.5") wide.
- **Landfill dozer blade and trash screen** with reversible Caterpillar cutting edges and self-sharpening end bits are standard.
- **Striker bars**, front and rear, keep material from climbing the wheels. Front striker bar is integral with dozer arm. Rear bar is incorporated with a drawbar assembly.
- **Tinted, laminated safety glass** in the doors and front and rear windows of the ROPS cab. Panels slide for excellent ventilation. **Sound-suppression package** is also added.

936 Landfill Compactor Features:

- **Landfill Bucket . . .** for pushing waste and carrying loose cover material.
- **Cat designed and built engine and power train . . .** for optimum match and dependable performance.
- **Operator comfort and ease . . .** sound suppressed cab, Cat planetary transmission with torque converter and single lever control, NoSPIN differential for improved traction in poor underfoot conditions.

Caron modifications to the 936 base unit:

- **Landfill wheels/teeth . . .** with Caron replaceable compactor-type wear caps. Drums are 533.4 mm (21") wide.
- **Striker bars . . .** front and rear, keep material from climbing the wheels. One striker bar is positioned behind each front wheel. The rear wheels are provided with striker bars ahead of and behind each wheel.
- **Brake guards . . .** are attached to axle ends for each wheel and help eliminate wrapping wire and other materials that could cut seals.
- **Guard group . . .** protects the underside and articulation areas of the machine against damage in the landfill environment. Includes access panels for routine maintenance, cleanout, and lubrication.
- **Hinged radiator guard . . .** protects vulnerable areas of the radiator and swings out of the way for ease of service.

MODEL	936 Landfill Compactor		518 Landfill Compactor		816B		826C	
Flywheel Power	101 kW	135 HP	96 kW	130 HP	161 kW	216 HP	235 kW	315 HP
Operating Weight*	15 188 kg	33,485 lb	14 243 kg	31,400 lb	20 628 kg	45,477 lb	31 631 kg	69,733 lb
Engine Model	3304		3304		3306		3408	
Rated Engine RPM	2200		2200		2200		2100	
No. Cylinders	4		4		6		8	
Displacement	7.0 L	425 in³	7.0 L	425 in³	10.5 L	638 in³	14.6 L	893 in³
Speeds:								
Forward	4		3		4		4	
Reverse	4		3		4		4	
Clearance Turning Circle with Blade/Bucket	12.07 m	39'7"	5.7 m	18'10"	12.3 m	40'6"	14.13 m	46'4"
Fuel Tank Refill Capacity	167 L	44 U.S. gal	184 L	48.5 U.S. gal	462 L	122 U.S. gal	600 L	158 U.S. gal
CHOPPER WHEELS:								
Each Drum Width	NA		NA		1.02 m	3'4"	1.20 m	3'11"
Diameters, over Blades	NA		NA		1.45 m	4'9"	1.67 m	5'6"
over Drum	NA		NA		1.30 m	4'3"	1.52 m	5'0"
Blades Per Wheel	NA		NA		20		24	
Blade Length	NA		NA		348 mm	13.7"	419 mm	16.5"
Blade Height	NA		NA		152 mm	6"	152 mm	6"
Blade Thickness	NA		NA		22 mm	0.87"	28.6 mm	1.125"
Each Drum Width	533 mm	21"	755 mm	30.5"	1016 mm	3'4"	1194 mm	3'11"
Diameter of Drum	1.22 m	4'0"	1.22 m	4'0"	1.30 m	4'3"	1.83 m	6'0"
Teeth per Wheel	24		32		—		—	
PLUS TIPS	—		—		20		25	
Width of Two Pass Coverage	2.1 m	7'0"	3.1 m	10'2"	4.5 m	14'9"	4.78 m	15'8"
GENERAL DIMENSIONS:								
Height (to top of ROPS)	3.44 m	11'4"	2.96 m	9'8.5"	4.04 m	13'3"	4.39 m	14'5"
Height (stripped top)**	NA		NA		2.46 m	8'1"	3.04 m	10'0"
Wheel Base	3.02 m	9'11"	3.25 m	10'8"	3.35 m	11'0"	3.53 m	11'7"
Overall Length	6.99 m	22'11"	6.27 m	20'7"	6.00 m	19'8"	7.18 m	23'7"
Overall Length with Dozer	NA		6.27 m	20'7"	7.07 m	23'2"	7.72 m	25'4"
Width over Drums	2.68 m	8'9"	2.9 m	9'6"	3.33 m	10'11"	3.80 m	12'6"
LANDFILL BULLDOZER/BUCKET								
Width	2.68 m	8'9"	3.1 m	10'2"	3.65 m	12'0"	4.47 m	14'8"
Height***			1.8 m	5'11"	1.91 m	6'3"	1.93 m	6'4"

*Operating Weight includes coolant, bulldozer, hydraulics, ROPS cab, full fuel tank, and operator.
**Height (stripped top) — without ROPS cab, exhaust, seat back or other easily removed encumbrances.
***To top of trash screen.
NA — Not Applicable.

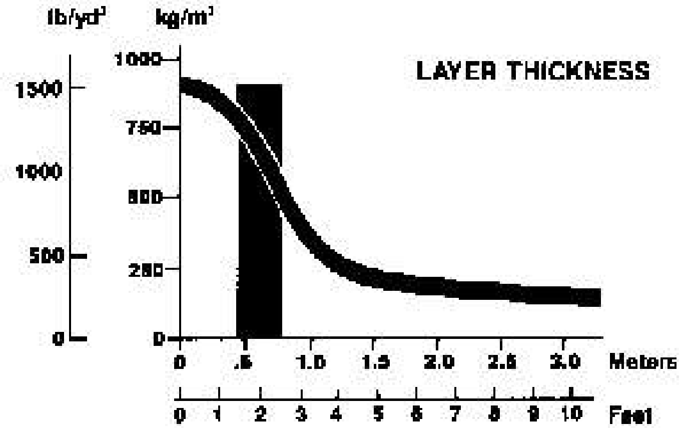
Refer to Track-Type Tractor/Bulldozer section for additional AEM specifications

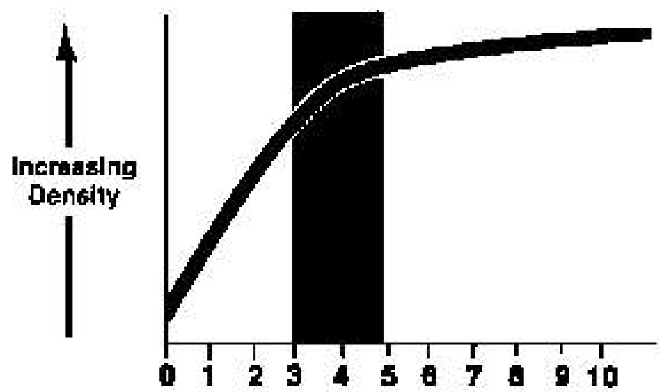
COMPACTION FUNDAMENTALS

To maximize compaction, the following guidelines should be employed when possible:

1. *Refuse Layer Thickness* — The depth of each compacted layer is perhaps the single most important controllable factor influencing density. To obtain maximum density efficiency, waste should be spread and compacted in layers not exceeding a depth of 609 mm (24"). Deeper layers will reduce the density that a machine can develop in a given number of passes. (See top table at right.)
2. *Number of Passes* made over the refuse also affects density. Regardless of what type of machine used, the unit should make 3-5 passes to achieve optimum density. The following graph illustrates that more than five passes result in little additional compactive effort. The added expense of additional passes is not justified by the incremental increase in density. (See bottom table at right).
3. *Slope* — To maximize compaction, a compactor should be operated on as flat a slope as possible. This is because the weight of the landfill compactor is more efficiently utilized and concentrated when working on a flat surface. Landfill compactors should never operate on a slope steeper than 4:1.

(Note: Ballasting the wheels on the 816B and 826C to increase machine weight to achieve higher compaction densities is not recommended. Landfills are high rimpull applications. Ballasting the wheels will significantly increase machine weight but decrease overall performance when traveling on the fill. Also, wheels are not necessarily air tight or leak proof. For more landfill discussion please see Waste Disposal Section 23 of this handbook.)





Number of passes made with each steel wheel, rubber tire or track.

WHEEL LOADERS
TRACK LOADERS
WASTE DISPOSAL TRACK LOADERS

CONTENTS

WHEEL LOADERS

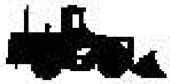
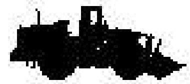
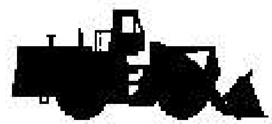
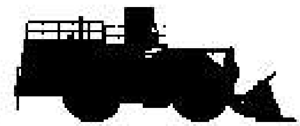
Features:

- **Caterpillar heavy-duty diesel Engine** with large piston displacement and adjustment-free fuel system.
- **Power shift transmission** with fast, easy single lever shift control of all speeds.
- **Articulated frame steering** turns short, has long wheelbase for loading stability. Hinge point is midway between front and rear axles, so rear wheels track the front.
- **Dual brake pedals —** left pedal neutralizes transmission and applies brakes, right pedal applies brake only. Automatically applied emergency braking (except 910E). Transmission neutralizer switch on the 910E converts the left brake pedal to an inching control for precise operation.
- **Automatic bucket controls:** lift control is detent-held and automatically kicks out at pre-set dump height . . . rollback control levels bucket as it returns to ground.
- **Sealed loader linkage** extends lube intervals, reduces maintenance time.
- **Four wheel enclosed wet disc brakes on 980C,** 988B, 992D, 994 . . . completely sealed, adjustment-free and fade-resistant.
- **Four piece axle on 936F, 950F and 966F . . .** inboard mounted final drives and adjustment free, enclosed disc brakes for improved brake life.
- **Variable capacity torque converter** on 988B and 992D lets operator apportion power between hydraulics and drive train.
- **Lock up clutch** on 994 provides direct drive on load and carry applications.

MODEL	910E		916		926E		930T	
Flywheel Power	56 kW	78 HP	63 kW	85 HP	82 kW	110 HP	78 kW	105 HP
Engine Model	3114		3204		3204		3304T	
Rated Engine RPM	2400		2400		2400		2200	
Bore	105 mm	4.13"	114 mm	4.5"	114 mm	4.5"	121 mm	4.75"
Stroke	127 mm	5"	127 mm	5"	127 mm	5"	152 mm	6"
No. Cylinders	4		4		4		4	
Displacement	4.4 L	268 in³	5.2 L	318 in³	5.2 L	318 in³	7.0 L	425 in³
Speeds Forward	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1st	6.6	4.1	6.7	4.2	6.6	4.1	5.4	3.4
2nd	12.4	7.7	13.0	8.1	12.1	7.5	10.2	6.3
3rd	22.4	13.9	24.6	15.4	21.3	13.3	18.3	11.4
4th	34.0	21.1	—		34.2	21.2	30.5	19.0
Speeds Reverse								
1st	6.6	4.1	6.8	4.2	7.1	4.4	5.8	3.6
2nd	12.4	7.7	13.2	8.3	13.1	8.1	11.0	6.8
3rd	22.4	13.9	25.0	15.5	23.0	14.3	19.7	12.2
4th	—		—		36.8	22.9	32.8	20.4
Hydraulic Cycle Time, Rated Load In Bucket:	Seconds		Seconds		Seconds		Seconds	
Raise	5.3		6.3		6.0		6.6	
Dump	1.3		1.3		1.7		1.4	
Lower (Empty, Float Down)	3.2		3.1		3.6		3.6	
Total	9.8		10.7		11.3		11.6	
Tread Width	1.73 m	5'8"	1.85 m	6'1"	1.85 m	6'0"	1.93 m	6'3"
Width Over Tires	2.15 m	7'0.7"	2.32 m	7'7.7"	2.33 m	7'8"	2.39 m	7'8"
Ground Clearance	343.4 mm	13.5"	322 mm	12.7"	322 mm	12.7"	348 mm	13.7"
Fuel Tank Refill Capacity	97 L	25.6 U.S. gal	123 L	32.5 U.S. gal	150 L	39.6 U.S. gal	148 L	39.1 U.S. gal
Hydraulic System Refill Capacity	70 L	18.5 U.S. gal	71 L	18.8 U.S. gal	92 L	24 U.S. gal	74 L	19.6 U.S. gal

MODEL	**936F**		**950F**		**966C**		**966F**	
Flywheel Power	104 kW	140 HP	127 kW	170 HP	127 kW	170 HP	164 kW	220 HP
Engine Model	3304		3116		3306		3306	
Rated Engine RPM	2200		2200		2200		2200	
Bore	121 mm	4.75"	105 mm	4.13"	121 mm	4.75"	121 mm	4.75"
Stroke	152 mm	6"	127 mm	5"	152 mm	6"	152 mm	6"
No. Cylinders	4		6		6		6	
Displacement	7.0 L	426 in³	6.6 L	403 in³	10.5 L	638 in³	10.5 L	638 in³
Speeds Forward	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1st	8.0	5.0	7.4	4.6	7.0	4.3	7.1	4.4
2nd	14.4	9.0	13.4	8.3	12.4	7.7	12.5	7.8
3rd	25.3	15.7	23.3	14.4	21.4	13.3	21.8	13.6
4th	42.3	26.3	39.3	24.4	34.9	21.7	37.6	23.4
Speeds Reverse								
1st	8.9	5.5	8.1	5.0	7.9	4.9	8.1	5.0
2nd	16.0	10.0	14.6	9.0	13.9	8.6	14.3	8.9
3rd	28.0	17.4	25.5	15.8	23.9	14.9	24.8	15.4
4th	46.7	29.0	43.0	26.7	38.9	24.2	42.5	26.4
Hydraulic Cycle Time, Rated Load in Bucket:	Seconds		Seconds		Seconds		Seconds	
Raise	6.6		6.6		6.2		7.1	
Dump	1.6		2.2		1.6		2.0	
Lower (Empty, Float Down)	3.2		3.0		3.8		2.4	
Total	11.6		11.6		11.6		11.5	
Tread Width	1.98 m	6'6"	2.09 m	6'10"	2.16 m	7'1"	2.20 m	7'3"
Width Over Tires	2.67 m	8'5"	2.76 m	9'0"	2.77 m	9'1"	2.84 m	9'4"
Ground Clearance	379 mm	14.9"	474 mm	18.7"	400 mm	15.7"	476 mm	18.7"
Fuel Tank Refill Capacity	200 L	52.8 U.S. gal	222 L	58.7 U.S. gal	246 L	65 U.S. gal	304 L	79 U.S. gal
Hydraulic System Refill Capacity	146 L	38.5 U.S. gal	153 L	40.4 U.S. gal	197 L	52 U.S. gal	205 L	53 U.S. gal

12

MODEL	**980F**		**988B**		**992D**		**994**	
Flywheel Power*	205 kW	**275 HP**	280 kW	**375 HP**	515 kW	**690 HP**	932 kW	**1250 HP**
Engine Model	**3406**		**3408**		**3412**		**3516**	
Rated Engine RPM	**2100**		**2200**		**2200**		**1800**	
Bore	137 mm	**5.4"**	137 mm	**5.4"**	137 mm	**5.4"**	170 mm	**6.69"**
Stroke	165 mm	**6.5"**	162 mm	**6"**	162 mm	**6"**	190 mm	**7.48"**
No. Cylinders	**6**		**8**		**12**		**16**	
Displacement	14.6 L	**893 in³**	18 L	**1099 in³**	27 L	**1649 in³**	69 L	**4211 in³**
Speeds Forward	km/h	**mph**	km/h	**mph**	km/h	**mph**	km/h	**mph**
1st	6.5	**4.0**	6.4	**4.0**	6.9	**4.3**	7.0	**4.3**
2nd	11.4	**7.1**	11.5	**7.1**	12.2	**7.6**	12.7	**7.9**
3rd	20.0	**12.4**	20.4	**12.7**	20.9	**13.0**	22.2	**13.8**
4th	34.6	**21.5**	36.2	**22.5**		—		—
Speeds Reverse								
1st	7.4	**4.6**	7.4	**4.6**	7.5	**4.7**	7.7	**4.8**
2nd	13.0	**8.1**	13.2	**8.2**	13.0	**8.3**	14.1	**8.7**
3rd	22.8	**14.2**	23.3	**14.5**	22.9	**14.2**	24.5	**15.2**
4th	39.6	**24.6**	41.4	**25.7**		—		—
Hydraulic Cycle Time, Rated Load In Bucket:	**Seconds**		**Seconds**		**Seconds**		**Seconds**	
Raise	**7.3**		**9.4**		**11.4**		**12.5**	
Dump	**2.0**		**3.0**		**3.4**		**3.4**	
Lower (Empty, Float Down)	**3.4**		**4.5**		**3.7**		**4.2**	
Total	12.7		16.9		18.5		20.1	
Tread Width	2.36 m	**7'9"**	2.59 m	**8'6"**	3.30 m	**10'10"**	3.90 m	**12'10"**
Width Over Tires	3.15 m	**10'4"**	3.52 m	**11'7"**	4.50 m	**14'9"**	5.20 m	**17'0"**
Ground Clearance	469 mm	**18.5"**	457 mm	**18"**	544 mm	**21.4"**	650 mm	**25.6"**
Fuel Tank Refill Capacity	475 L	**125 U.S. gal**	620 L	**164 U.S. gal**	1136 L	**300 U.S. gal**	3030 L	**800 U.S. gal**
Hydraulic System Refill Capacity	208 L	**55 U.S. gal**	235 L	**62 U.S. gal**	541 L	**143 U.S. gal**	492 L	**130 U.S. gal**

*Material Handling Arrangement 980F flywheel hp 224 kW 300 HP.

Bucket Type and Ground Engaging Tools		General Purpose: Teeth		General Purpose: Teeth/ Segments	General Purpose: Bolt-On Cutting Edge		Penetr. Weld-on Flush Teeth
Capacity, heaped	m³	1.0	1.2	1.1	1.1	1.3	1.2
	yd³	1.3	1.6	1.4	1.4	1.7	1.6
Capacity, struck (§)	m³	.84	1.02	.88	.89	1.07	1.02
	yd³	1.1	1.33	1.16	1.16	1.39	1.33
Width (§)	mm	2320	2428	2320	2294	2401	2434
	ft/in	7'7"	8'0"	7'7"	7'6.3"	7'10.5"	8'0"
Dump clearance @ full lift and 45° discharge (§)	mm	2577	2545	2577	2604	2571	2509
	ft/in	8'5.5"	8'4"	8'5.5"	8'6.5"	8'5.2"	8'2.8"
Reach at full lift and 45° discharge (§)	mm	1006	1098	1006	969	1001	1095
	ft/in	3'3.6"	3'4.7"	3'3.6"	3'2.1"	3'3.4"	3'5.7"
Reach at 45° discharge angle, 2130 mm (7'0") clearance (§)	mm	1320	1335	1320	1298	1313	1361
	ft/in	4'4"	4'4.6"	4'4"	4'3.1"	4'3.7"	4'5.6"
Digging depth (§)	mm	98	98	117	117	117	98
	in	3.9"	3.9"	4.6"	4.6"	4.6"	3.9"
Overall length (§)	mm	5970	6015	5977	5931	5977	6067
	ft/in	19'7"	19'9"	19'7.3"	19'5.5"	19'7.3"	19'11"
Overall height (bucket @ full raise) (§)	mm	4216	4305	4216	4216	4305	4305
	ft/in	13'10"	14'1.5"	13'10"	13'10"	14'1.5"	14'1.5"
Loader clearance circle (bucket in carry position) (§)	m	10.50	10.63	10.50	10.46	10.58	10.66
	ft/in	34'6"	34'10"	34'6"	34'4"	34'8"	34'11.6"
Static tipping load** Straight (§)	kg	4759	4701	4647	4716	4663	4776
	lb	10,494	10,366	10,247	10,399	10,282	10,531
Full 35° turn (§)	kg	4418	4351	4289	4369	4316	4426
	lb	9742	9594	9457	9634	9517	9759
Breakout force* (§)	kg	7540	7048	6901	6934	6503	7082
	lb	16,626	15,541	15,217	15,289	14,339	15,616
Operating weight**	kg	7248	7296	7316	7260	7298	7227
	lb	15,982	16,089	16,132	15,986	16,092	15,936

*Measured 102 mm (4.0") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732c.
**Static tipping load and operating weight are based on standard machine configuration with 17.5 x 25, 8 PR (L-2) tires, full fuel tank, coolant, lubricants and operator.
Note: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings, denoted in the text by (§).

	Change in Operating Weight kg	Change in Operating Weight lb	Change in Articulated Static Tipping Load kg	Change in Articulated Static Tipping Load lb
Remove ROPS cab or canopy	−316	−697	−317	−699
ROPS canopy only†	+202	+445	+291	+642
15.5-25, 12 PR (L-2) tires & rims	+ 32	+ 71	+ 17	+ 38
15.5-25, Radial (L-2) tires & rims	+132	+291	+ 69	+152

†Weights include an additional counterweight.

12

Bucket Type and Ground Engaging Tools		General Purpose					Penetr.
		Bolt-on Cutting Edge	Bolt-on Teeth	Bolt-on Cutting Edge	Bolt-on Teeth & Seg.	Bolt-on Teeth	Weld-on Flush Teeth
Capacity, heaped	m^3	1.5	1.4	1.4	1.4	1.2	1.4
	yd^3	2.00	1.75	1.75	1.75	1.50	1.75
Capacity, struck (§)	m^3	1.31	1.23	1.17	1.17	1.09	1.14
	yd^3	1.71	1.61	1.53	1.53	1.43	1.49
Width (§)	mm	2395	2378	2395	2378	2378	2436.5
	ft/in	7'10.5"	7'9.5"	7'10.5"	7'9.5"	7'9.5"	8'0"
Dump clearance @ full lift and 45° discharge (§)	mm	2648	2714	2680	2680	2746	2676
	ft/in	8'8.5"	8'11"	8'9.5"	8'9.5"	9'0"	8'9.5"
Reach at 45° full lift and 45° discharge (§)	mm	928	888	889	889	850	825
	ft/in	3'0.5"	2'11"	2'11"	2'11"	2'9.5"	2'8.5"
Reach at 45° discharge angle, 2130 mm [7'0"] clearance (§)	mm	1296	1291	1275	1275	1269	1209
	ft/in	4'3"	4'3"	4'2"	4'2"	4'2"	3'11.6"
Reach with arms horizontal and bucket level	mm	2003	1931	1953	1959	1881	1931
	ft/in	6'7"	6'4"	6'5"	6'5"	6'2"	6'4"
Digging depth (§)	mm	78	53	78	78	53	53
	in	3.1"	2.1"	3.1"	3.1"	2.1"	2.1"
Overall length (§)	mm	6369	6276	6319	6319	6226	6276
	ft/in	20'10.5"	20'7"	20'9"	20'9"	20'5"	20'7"
Overall height (bucket @ full raise) (§)	mm	4602	4602	4524	4524	4524	4495
	ft/in	15'1"	15'1"	14'10"	14'10"	14'10"	14'9"
Loader clearance circle (bucket in carry position) (§)	m	10.92	11.12	10.92	11.02	11.02	11.08
	ft/in	35'10"	36'6"	35'10"	36'2"	36'2"	36'4"
Static tipping load** Straight (§)	kg	6626	6706	6684	6610	6763	6712
	lb	14,609	14,784	14,736	14,572	14,910	14,797
Full 40° turn (§)	kg	5790	5861	5845	5772	5916	5871
	lb	12,765	12,921	12,886	12,725	13,042	12,943
Breakout force* (§)	kg	8545	9347	9124	9059	10 026	9338
	lb	18,838	20,606	20,115	19,971	22,103	20,586
Operating weight**	kg	8590	8580	8554	8611	8545	8595
	lb	18,937	18,915	18,858	18,984	18,838	18,948

*Measured 102 mm (4.0") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732c.
**Static tipping load and operating weight are based on standard machine configuration with 17.5 x 25, 12 PR (L-2) tires, full fuel tank, coolant, lubricants and operator.
Note. Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings, denoted in the text by (§).

	Change in Operating Weight		Change in Articulated Static Tipping Load	
	kg	lb	kg	lb
Remove ROPS cab or canopy	−418	−922	−376	−828
Remove ROPS canopy only	−207	−457	−187	−412
15.5-25, 8 PR (L-2) tires & rims	−220	−485	−138	−304
15.5-25, 12 PR (L-2) tires & rims	−189	−417	−119	−262
15.5-25, Radial (L-2 equivalent) tires & rims	−93	−205	−58	−128
15.5-25, 12 PR (L-3) tires & rims	−122	−269	−77	−170
17.5-25, Radial (L-2 equivalent) tires & rims	+132	+291	+82	+181
Tire Ballast				
15.5-25	+384	+848	+479	+1054
17.5-25	+524	+1155	+653	+1437

Bucket Type and Ground Engaging Tools		General Purpose					Penetr.
		Bolt-on Cutting Edge	Bolt-on Teeth	Bolt-on Cutting Edge	Bolt-on Teeth & Segments	Bolt-on Teeth	Weld-on Flush Teeth
Capacity, heaped (§)	m^3	1.9	1.7	1.7	1.7	1.6	1.7
	yd^3	**2.5**	**2.25**	**2.25**	**2.25**	**2.0**	**2.25**
Capacity, struck (§)	m^3	1.68	1.59	1.45	1.45	1.37	1.48
	yd^3	**2.20**	**2.08**	**1.90**	**1.90**	**1.79**	**1.94**
Width (§)	mm	2395	2431	2395	2431	2431	2437
	ft/in	**7'10.5"**	**7'11.5"**	**7'10.5"**	**7'11.5"**	**7'11.5"**	**8'0"**
Dump clearance @ full lift and 45° discharge (§)	mm	2707	2773	2755	2755	2821	2728
	ft/in	**8'10.6"**	**9'1.2"**	**9'0.5"**	**9'0.5"**	**9'3.1"**	**8'11.4"**
Reach at full lift and 45° discharge (§)	mm	1034	986	1003	1003	963	925
	ft/in	**3'4.5"**	**3'3"**	**3'3.5"**	**3'3.5"**	**3'1.9"**	**3'0.5"**
Reach at 45° discharge angle, 2130 mm (7'0") clearance (§)	mm	1446	1350	1438	1385	1345	1259
	ft/in	**4'9"**	**4'5"**	**4'8.6"**	**4'6.5"**	**4'5"**	**4'1.6"**
Reach with arms horizontal and bucket level	mm	2183	2111	2123	2123	2061	2111
	ft/in	**7'2"**	**6'11"**	**6'11.5"**	**6'11.5"**	**6'8.5"**	**6'11"**
Digging depth (§)	mm	78	53	78	78	53	53
	in	**3.1"**	**2.1"**	**3.1"**	**3.1"**	**2.1"**	**2.1"**
Overall length (§)	mm	6712	6866	6652	6806	6806	6845
	ft/in	**22'0.3"**	**22'6.3"**	**21'9.9"**	**22'4"**	**22'4"**	**22'5.5"**
Overall height (bucket @ full raise) (§)	mm	4904	4904	4772	4772	4772	4778
	ft/in	**16'1.1"**	**16'1.1"**	**15'7.9"**	**15'7.9"**	**15'7.9"**	**15'8.1"**
Loader clearance circle (bucket in carry position) (§)	m	11.27	11.17	11.20	11.22	11.16	11.18
	ft/in	**37'0"**	**36'8"**	**36'9"**	**36'10"**	**36'7.5"**	**36'8"**
Static tipping load** Straight (§)	kg	6697	6769	6778	6708	6755	6770
	lb	**14,767**	**14,926**	**14,948**	**14,791**	**14,895**	**14,928**
Full 40° turn (§)	kg	5929	5994	6009	5938	5989	6001
	lb	**13,073**	**13,217**	**13,250**	**13,093**	**13,206**	**13,232**
Breakout force* (§)	kg	9442	10 177	10 044	10 044	10 880	10 177
	lb	**20,816**	**22,436**	**22,143**	**22,143**	**23,986**	**22,436**
Operating weight**	kg	9487	9478	9432	9489	9423	9501
	lb	**20,915**	**20,899**	**20,794**	**20,919**	**20,774**	**20,946**

*Measured 102 mm (4.0") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732c.
**Static tipping load and operating weight are based on standard machine configuration with 17.5-25, 12 PR (L-2) tires, full fuel tank, coolant, lubricants and operator.
Note: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings, denoted in the text by (§).

	Change in Operating Weight		Change in Articulated Static Tipping Load	
	kg	**lb**	**kg**	**lb**
Remove ROPS cab	−418	− 922	−389	− 858
Remove ROPS canopy only	−207	− 457	−192	− 432
17.5-25, 12 PR (L-3) tires	+ 72	+ 158	+ 46	+ 102
17.5-25, Radial (L-2) equivalent tires	+136	+ 300	+ 87	+ 193
15.5-25, 12 PR (L-2) tires & rims	−189	− 417	−122	− 269
15.5-25, 12 PR (L-3) tires & rims	126	− 278	− 80	− 177
15.5-25, Radial (L-2 equivalent) tires & rims	− 89	− 196	− 57	− 126
Tire Ballast				
17.5-25	+524	+1154	+676	+1488
15.5-25	+384	+ 848	+495	+1091

12

Bucket Type		General Purpose
Capacity, heaped	m^3	1.72
	yd^3	**2.25**
Capacity, struck (§)	m^3	1.29
	yd^3	**1.69**
Cutting edge, type		**Straight**
Width (§)	mm	2440
	ft/in	**8'0"**
Dump clearance @ full lift and 45° discharge (§)	mm	2790
	ft/in	**9'2"**
Reach at full lift and 45° discharge (§)	mm	860
	ft/in	**2'8"**
Reach at 45° discharge angle, 2130 mm (7'0") clearance (§)	mm	1350
	ft/in	**4'4"**
Overall length (§)	mm	6100
	ft/in	**20'0"**
Overall height (bucket @ full raise) (§)	mm	4830
	ft/in	**15'8"**
Loader clearance circle (bucket in carry position) (§)	mm	11 900
	ft/in	**39'0"**
Static tipping load** Straight (§)	kg	7447
	lb	**16,420**
Full 35° turn (§)	kg	6820
	lb	**15,036**
Breakout force* (§)	kg	7767
	lb	**17,104**
Operating weight**	kg	9690
	lb	**21,362**

*Measured 102 mm (4.0") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732c.

**Static tipping load and operating weight include lubricants, coolant, full fuel tank, 17.5-25, 12 PR (L-2) counterweight group and operator.

Note: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings, denoted in the text by (§).

	Change in Operating Weight		Change in Articulated Static Tipping Load	
	kg	lb	kg	lb
17.5-25, 12 PR (L-3) tires	+ 62	+ 137	+ 48	+ 106
17.5-25, 12 PR (L-3) tires with 75% $CaCl_2$	+586	+1292	+754	+1663
17.5-25, 12 PR (L-2) tires with 75% $CaCl_2$	+524	+1155	+674	+1486

	General Purpose						Penetr.
Bucket Type	**Bolt-on Cutting Edge**	**Bolt-on Adapters And Segments**	**Bolt-on Adapters**	**Bolt-on Cutting Edge**	**Bolt-on Adapters And Segments**	**Bolt-on Teeth**	**Weld-on Flush Teeth**
Capacity, heaped (§) . . . m³	2.5	2.5	2.3	2.3	2.3	2.1	2.1
yd³	3.25	3.25	3.00	3.00	3.00	2.75	2.75
Capacity, struck (§) . . . m³	2.07	2.07	1.96	1.96	1.96	1.87	1.90
yd³	2.70	2.70	2.56	2.56	2.56	2.44	2.48
Width (§) . . . mm	2664	2705	2705	2664	2705	2698	2731
ft/in	8'9"	8'10.5"	8'10.5"	8'9"	8'10.5"	8'10"	8'11.5"
Dump clearance @ full lift and 45° discharge (§)** . . . mm	2841	2736	2736	2841	2736	2738	2687
ft/in	9'4"	9'0"	9'0"	9'4"	9'0"	9'0"	8'6"
Reach at 45° full lift and 45° discharge (§)** . . . mm	987	1100	1100	987	1100	1100	1020
ft/in	3'3"	3'7"	3'7"	3'3"	3'7"	3'7"	3'4"
Reach at 45° discharge angle, 2130 mm (7'0") clearance (§)** . . . mm	1494	1543	1543	1494	1543	1543	1421
ft/in	4'11"	5'1"	5'1"	4'11"	5'1"	5'1"	4'8"
Reach with arms horizontal and bucket level . . . mm	2227	2374	2374	2227	2374	2374	2374
ft/in	7'4"	7'9.5"	7'9.5"	7'4"	7'9.5"	7'9.5"	7'9.5"
Digging depth (§) . . . mm	45	60	60	45	60	60	60
in	1.75"	2.36"	2.36"	1.75"	2.36"	2.36"	2.36"
Overall length (§)** . . . mm	7108	7255	7255	7108	7255	7255	7255
ft/in	23'4"	23'10"	23'10"	23'4"	23'10"	23'10"	23'10"
Overall height (bucket @ full raise) (§) . . . mm	5106	5106	5106	5057	5057	5057	5057
ft/in	16'9"	16'9"	16'9"	16'7"	16'7"	16'7"	16'7"
Loader clearance circle (bucket in carry position) (§) . . . m	11.92	11.92	11.88	11.92	11.92	11.88	11.91
ft/in	39'1"	39'1"	39'0"	39'1"	39'1"	39'0"	39'1"
Static tipping load Straight (§)* . . . kg	8925	8925	9020	8925	8925	9020	9051
lb	19,680	19,680	19,890	19,680	19,680	19,890	19,960
Full 40° turn (§)* . . . kg	7865	7865	7950	7865	7865	7950	7983
lb	17,340	17,340	17,530	17,340	17,340	17,530	17,600
Breakout force (§)*** . . . kg	12 920	12 920	12 993	12 920	12 920	12 993	13 094
lb	28,483	28,483	28,650	28,483	28,483	28,650	28,870
Operating weight* . . . kg	12 345	12 345	12 320	12 345	12 345	12 320	12 339
lb	27,220	27,220	27,170	27,220	27,220	27,170	27,210

*Static tipping loads and operator weight are based on standard machine configuration with 20.5 × 25, 12 PR (L-2) tires, full fuel tank, coolant, lubricants and operator.
**Dump clearance, reach and overall length dimensions for buckets equipped with teeth reflect actual dimensions. SAE J732c allows dimensions for buckets with teeth to reflect the dimension using the cutting edge. Caterpillar Inc. uses actual equipped bucket dimensions.
***Measured 102 mm (4.0") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732c.
Note: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings, denoted in the text by (§).

	Change in Operating Weight		Change in Articulated Static Tipping Load	
	kg	lb	kg	lb
20.5 × 25, 12 PR (L-2) tires standard	0	0	0	0
20.5 × 25, 12 PR (L-3) tires	+204	+ 450	+ 132	+ 292
20.5 × R25, (L-2) equivalent tires	+224	+ 494	+ 146	+ 321
17.5 × 25, 12 PR (L-2) tires & rims	−301	− 664	− 195	− 431
17.5 × 25, 12 PR (L-3) tires & rims	−229	− 505	− 149	− 328
17.5 × R25, (L-2) equivalent tires & rims	−165	− 364	− 107	− 236
Tire Ballast 20.5 × 25	+810	+1784	+1053	+2319
Tire Ballast 17.5 × 25	+524	+1154	+ 681	+1500
Canopy, ROPS	−207	− 457	− 196	− 432

NOTE: All specification conversions are rounded.

Bucket Type and Ground Engaging Tools		General Purpose						High Lift***
		Bolt-on Edges*	Teeth & Segments*	With Teeth	Bolt-on Edges	Teeth & Segments	With Teeth	All Stand. Buckets Available
Capacity, rated (§)	m³	3.1	3.1	2.9	2.9	2.9	2.7	Same
	yd³	**4.0**	**4.0**	**3.75**	**3.75**	**3.75**	**3.50**	**Same**
Capacity, struck (§)	m³	2.70	2.63	2.53	2.55	2.49	2.40	Same
	yd³	**3.53**	**3.44**	**3.31**	**3.34**	**3.26**	**3.14**	**Same**
Width (§)	mm	2777	2811	2811	1222	2811	2811	Same
	in	**109**	**111**	**111**	**48**	**111**	**111**	**Same**
Dump clearance at full lift and 45° discharge (§)	mm	2852	2882	2941	2852	2882	2941	−558
	ft/in	**9'4"**	**9'5"**	**9'8"**	**9'4"**	**9'5"**	**9'8"**	**+22.0"**
Reach at full lift and 45° discharge	mm	1160	1134	1103	1160	1134	1104	+25
	ft/in	**3'10"**	**3'9"**	**3'7"**	**3'10"**	**3'9"**	**3'7"**	**+1.0"**
Reach at 45° discharge and 2130 mm/7'0" clearance (§)	mm	1652	1626	1635	1652	1626	1635	+462
	ft/in	**5'5"**	**5'4"**	**5'4"**	**5'5"**	**5'4"**	**5'4"**	**+18.2"**
Reach with lift arm horizontal and bucket level	mm	2440	2582	2582	2440	2582	2582	+425
	ft/in	**8'0"**	**8'6"**	**8'6"**	**8'0"**	**8'6"**	**8'6"**	**+16.7"**
Digging Depth (§)	mm	52	52	22	52	52	22	+25
	in	**2.0**	**2.0**	**0.9**	**2.0**	**2.0**	**0.9**	+1.0"
Overall length (§)	mm	7548	7689	7689	7548	7689	7689	+525
	ft/in	**24'9"**	**25'2"**	**25'2"**	**24'9"**	**25'2"**	**25'2"**	**+20.7"**
Overall height with bucket at full raise (§)	mm	5386	5386	5386	5543	5543	5543	+558
	ft/in	**17'8"**	**17'8"**	**17'8"**	**18'2"**	**18'2"**	**18'2"**	**+22.0"**
Loader clearance circle with bucket in carry position (§)	mm	13 836	13 889	13 889	13 836	13 889	13 889	+237
	ft/in	**45'5"**	**45'7"**	**45'7"**	**45'5"**	**45'7"**	**45'7"**	**+9.3"**
Static tipping load*** Straight	kg	11 074	10 973	10 543	10 510	10 411	10 686	-1160
	lb	**22,414**	**24,191**	**23,243**	**23,170**	**22,952**	**23,558**	**-2557**
Full 35° turn	kg	10 155	10 062	9668	9638	9547	9799	-1100
	lb	**22,388**	**22,183**	**21,314**	**21,248**	**21,047**	**21,603**	**-2425**
Breakout Force**** (§)	kg	147	151	159	147	151	159	-8.6
	lb	**32,874**	**34,048**	**35,801**	**32,874**	**34,048**	**35,801**	**-1833**
Operating Weight*** (§)	kg	16 086	16 179	15 730	15 773	15 868	15 711	+830
	lb	**35,463**	**35,668**	**34,678**	**34,773**	**34,976**	**34,636**	**+1830**

*Requires additional 294 kg/**645 lb** counterweight.

**All buckets shown can be used on high lift arrangement. High lift column shows changes in specifications from standard lift to high lift. Add or subtract as indicated to or from specifications given for appropriate bucket to calculate high lift specifications.

***Static tipping load and operating weight shown include sound-suppressed cab and ROPS, 23.5-25 tires, full fuel tank, coolant, lubricants and operator.

****Measured 102 mm/4.0" behind tip of cutting edge with bucket hinge pin as pivot in accordance with SAE J732c.

Note: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings and are denoted in the text by (§).

	Change in Operating Weight		Change in Articulated Static Tipping Load	
	kg	lb	kg	lb
Remove cab only	−249	**− 549**	−209	**−461**
Remove ROPS canopy only	−327	**− 721**	−127	**−280**
Remove ROPS canopy and cab	−576	**−1270**	336	**−741**
23.5-R25, (L-2) equivalent	306	**675**	204	**449**
23.5-R25, (L-3) equivalent	324	**713**	215	**473**
20.5-25, 12 PR (L-2) tires and rims	−662	**−1458**	−437	**−963**
20.5-25, 16 PR (L-2) tires and rims	−630	**−1388**	−416	**−916**
20.5-25, 16 PR (L-3) tires and rims	−450	**− 991**	−297	**−654**
20.5-R25, L-2 equivalent	−454	**−1000**	300	**−661**
20.5-R25, XHA (L-3) equivalent	−355	**− 782**	−234	**−515**
Tire ballast, 20.5-25	821	**1808**		
23.5-25	1174	**2592**		

Bucket Type and Ground Engaging Tools (cont'd)		General Purpose: Bolt-on Edges	General Purpose: Teeth & Segments	General Purpose: With Teeth	Penetr. with Teeth	Rock: Bolt-on Edges	Rock: With Teeth & Segments	High Lift***: All Stand. Buckets Available
Capacity, rated (§)	m³	2.7	2.7	2.5	2.9	2.7	2.7	Same
	yd³	3.50	3.50	3.25	3.75	3.50	3.50	Same
Capacity, struck (§)	m³	2.34	2.28	2.18	2.53	2.32	2.31	Same
	yd³	3.06	2.98	2.86	3.31	3.03	3.02	Same
Width (§)	mm	2777	2811	2811	2825	2815	2815	Same
	in	109	111	111	111	111	111	Same
Dump clearance at full lift and 45° discharge (§)	mm	2919	2946	3007	2891	2851	2887	−558
	ft/in	9'7"	9'8"	9'10"	9'6"	9'4"	9'6"	+22.0"
Reach at full lift and 45° discharge	mm	1118	1092	1059	1080	1236	1197	+25
	ft/in	3'8"	3'7"	3'6"	3'5"	4'1"	3'11"	+1.0"
Reach at 45° discharge and 2130 mm/7'0" clearance (§)	mm	1640	1600	1619	1540	1717	1717	+462
	ft/in	5'5"	5'3"	5'4"	5'1"	5'8"	5'8"	+18.2"
Reach with lift arm horizontal and bucket level	mm	2358	2500	2500	2488	2493	2694	+425
	ft/in	7'9"	8'3"	8'3"	8'2"	8'2"	8'10"	+16.7"
Digging Depth (§)	mm	52	52	22	22	52	22	+25
	in	2.0	2.0	0.9	0.9	2.0	0.9	+1.0"
Overall length (§)	mm	7486	7607	7607	7596	7601	7801	+525
	ft/in	24'6"	25'0"	25'0"	24'11"	24'11"	25'7"	+20.7"
Overall height with bucket at full raise (§)	mm	5261	5261	5261	5377	5352	5352	+558
	ft/in	17'3"	17'3"	17'3"	17'8"	17'7"	17'7"	+22.0"
Loader clearance circle with bucket in carry position (§)	mm	13 794	13 847	13 847	13 822	13 894	13 905	+237
	ft/in	45'3"	45'5"	45'5"	45'4"	45'7"	45'7"	+9.3"
Static tipping load*** Straight	kg	10 500	10 475	10 741	10 608	10 486	10 441	-1160
	lb	23,148	23,093	23,680	23,389	23,117	23,018	-2557
Full 35° turn	kg	9628	9606	9849	9728	9585	9553	-1100
	lb	21,226	21,177	21,713	21,446	21,163	21,060	-2425
Breakout Force**** (§)	kg	157	163	170	159	143	143	-8.6
	lb	35,382	36,686	38,166	35,864	32,202	32,202	-1933
Operating Weight*** (§)	kg	15 724	15 816	15 662	15 882	15 836	15 767	+830
	lb	34,665	34,868	34,528	35,013	34,912	34,760	+1830

*Requires additional 294 kg/646 lb counterweight.
**All buckets shown can be used on high lift arrangement. High lift column shows changes in specifications from standard lift in high lift. Add or subtract as indicated to or from specifications given for appropriate bucket to calculate high lift specifications.
***Static tipping load and operating weight shown include sound-suppressed cab and ROPS, 23.5-25 tires, full fuel tank, coolant, lubricants and operator.
****Measured 102 mm/4.0" behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732c.
Note: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings and are denoted in the text by (§).

	Change in Operating Weight kg	Change in Operating Weight lb	Change in Articulated Static Tipping Load kg	Change in Articulated Static Tipping Load lb
Remove cab only	−249	−549	−209	−461
Remove ROPS canopy only	−327	−721	−127	−280
Remove ROPS canopy and cab	−576	−1270	−336	−741
23.5-R25, (L-2) equivalent	308	678	204	449
23.5-R25, (L-3) equivalent	324	713	215	473
20.5-25, 12 PR (L-2) tires and rims	−662	−1458	−437	−963
20.5-25, 16 PR (L-2) tires and rims	−630	−1388	−416	−916
20.5-25, 16 PR (L-3) tires and rims	−450	−991	−297	−654
20.5-R25, L-2 equivalent	−454	−1000	−300	−661
20.5-R25, XHA (L-3) equivalent	−355	−782	−234	−516
Tire ballast: 20.5-25	821	1808		
23.5-25	1174	2582		

Bucket Type		General Purpose	Rock
Capacity, heaped (§)	m^3	3.1	2.7
	yd^3	4.00	3.50
Capacity, struck (§)	m^3	2.62	—
	yd^3	3.43	
Cutting edge, type		Straight	Modified V
Width (§)	mm	2920	2870
	ft/in	9'6"	9'4"
Dump clearance @ full lift and 45° discharge (§)	mm	2959	2820
	ft/in	9'7"	9'3"
Reach @ full lift and 45° discharge (§)	mm	890	1010
	in	35"	40"
Reach @ 45° discharge angle, 2130 mm (7'0") clearance (§)	mm	1425	1490
	ft/in	4'8"	4'8"
Digging depth (§)	mm	188	189
	in	7.4"	7.4"
Overall length (§)	mm	6910	7090
	ft/in	22'7"	23'3"
Overall height (Bucket @ full raise) (§)	mm	5430	5400
	ft/in	17'9"	17'7"
Loader clearance circle (bucket in carry position) (§)	mm	13 600	13 600
	ft/in	44'7"	44'6"
Static tipping load**			
Straight (§)	kg	12 670	12 540
	lb	27,940	27,650
Full 35° turn (§)	kg	11 640	11 510
	lb	25,670	25,380
Breakout force* (§)	kg	11 750	10 120
	lb	25,910	22,315
Operating weight** (§)	kg	16 730	16 840
	lb	36,890	37,130

*Measured 102 mm (4.0") behind tip of cutting edge with bucket hinge pin as pivot point, in accordance with SAE J732c (1969)

**Machine with 23.5-25 (L-3), without ballast, full fuel tank, lubricants, operator and side mounted counterweight.

Note. Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings, denoted in the text by (§).

	Change in Operating Weight		Change in Articulated Static Tipping Load	
	kg	lb	kg	lb
23.5-25, 12 PR (L-3) tires with 75% $CaCl_2$	+1170	+2580	+1850	+4079
23.5-25, 16 PR (L-3) tires	+ 74	+ 163	+ 58	+ 128
23.5-25, 16 PR (L-3) tires with 75% $CaCl_2$	+1244	+2743	+1908	+4207
23.5-25, 16 PR (L-5) tires	+ 961	+2119	+ 764	+1685
Counterweight, Rear	+ 399	+ 880	+ 750	+1654

Bucket Type and Ground Engaging Tools		General Purpose Teeth & Segments	Bolt-on Edges	With Teeth	Teeth & Segments	Bolt-on Edges	Penetr. With Teeth	High Lift* All Stand. Buckets Available
Capacity, rated (§)	m^3	3.8	3.8	3.6	3.6	3.6	3.6	Same
	yd^3	5.0	5.0	4.75	4.75	4.75	4.75	Same
Capacity, struck (§)	m^3	3.25	3.25	3.08	3.18	3.18	3.12	Same
	yd^3	4.25	4.25	4.03	4.17	4.17	4.09	Same
Width (§)	mm	3107	3059	3107	3107	3059	3128	Same
	in	122	120	122	122	120	123	Same
Dump clearance at full lift and 45° discharge (§)	mm	2845	2981	2845	2845	2981	2769	+600
	ft/in	9'4"	9'9"	9'4"	9'4"	9'9"	9'1"	+23.6"
Reach at full lift and 45° discharge	mm	1398	1275	1398	1398	1275	1318	+37
	ft/in	4'7"	4'2"	4'7"	4'7"	4'2"	4'4"	+1.5"
Reach at 45° discharge and 2130 mm/7'0" clearance (§)	mm	1892	1832	1892	1892	1832	1774	+497
	ft/in	6'2"	6'0"	6'2"	6'2"	6'0"	5'10"	+19.6"
Reach with lift arm horizontal and bucket level	mm	2764	2583	2764	2764	2583	2786	+465
	ft/in	9'1"	8'6"	9'1"	9'1"	8'6"	9'2"	+18.3"
Digging Depth (§)	mm	82	82	52	82	82	52	Same
	in	3.2	3.2	2.0	3.2	3.2	2.0	Same
Overall length (§)	mm	8366	8163	8366	8366	8073	8351	+576
	ft/in	27'6"	26'9"	27'5"	27'5"	26'6"	27'5"	+22.7"
Overall height with bucket at full raise (§)	mm	5589	5589	5589	5589	5589	5589	+600
	ft/in	18'4"	18'4"	18'4"	18'4"	18'4"	18'4"	+23.6"
Loader clearance circle with bucket in carry position (§)	mm	14 876	14 722	14 876	14 876	14 722	14 880	+251
	ft/in	48'10"	48'4"	48'10"	48'10"	48'4"	48'10"	+9.9"
Static tipping load** Straight	kg	14 073	13 839	13 982	13 670	13 804	13 982	-1800
	lb	31,025	30,509	30,826	30,137	30,432	30,826	-3968
Full 35° turn	kg	12 825	12 628	12 838	12 458	12 673	12 671	-1700
	lb	28,274	27,840	28,305	27,465	27,939	27,934	-3748
Breakout Force*** (§)	kN	200.2	201.0	215.5	201.0	201.1	215.1	-24.5
	lb	45,007	45,187	48,446	45,187	45,208	48,356	-5511
Operating Weight** (§)	kg	20 639	20 466	20 485	20 632	20 459	20 544	+900
	lb	45,500	45,118	45,161	45,485	45,104	45,291	+1984

*All buckets shown can be used on high lift arrangement. High lift column shows changes in specifications from standard lift to high lift. Add or subtract as indicated to or from specifications given for appropriate bucket to calculate high lift specifications.
**Static tipping load and operating weight shown include sound-suppressed cab and ROPS, 26.5-25 tires, full fuel tank, coolant, lubricants and operator.
***Measured 102 mm/4.0" behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732c.
Note. Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings and are denoted in the text by (§).

	Change in Operating Weight kg	lb	Change in Articulated Static Tipping Load kg	lb
Remove cab only	-232	-511	-192	-423
Remove ROPS canopy only	-558	-1230	-557	-1228
23.5-25, 16 ply rating, L-2 tires	-497	-1096	-325	-716
23.5-25, 16 ply rating, L-3 tires	-303	-668	-197	-434
23.5 R25, XHA L-3 equivalent tires	-158	-348	-101	-223
26.5 R25, L-2 equivalent tires	254	560	170	375
Tire ballast: 23.5-25	674	1469	1245	2746
25.5-25	1516	3342	2083	4592

Bucket Type and Ground Engaging Tools (cont'd)		General Purpose				Rock		High Lift*
		With Teeth	Teeth & Segments	Bolt-on Edges	With Teeth	No Teeth	Bottom Strap Teeth	All Stand. Buckets Available
Capacity, rated (§)	m^3	3.5	3.5	3.5	3.3	3.5	3.5	Same
	yd^3	4.5	4.5	4.5	4.25	4.50	4.5	Same
Capacity, struck (§)	m^3	3.04	2.91	2.91	2.76	2.94	2.94	Same
	yd^3	3.98	3.81	3.81	3.62	4.51	4.51	Same
Width (§)	mm	3107	3107	3059	3107	3085	3085	Same
	in	122	122	120	122	121	121	Same
Dump clearance at full lift and 45° discharge (§)	mm	2845	2921	3055	2921	3016	2801	+600
	ft/in	9'4"	9'7"	10'0"	9'7"	9'11"	9'2"	+23.6"
Reach at full lift and 45° discharge	mm	1398	1352	1227	1352	1358	1523	+37
	ft/in	4'7"	4'5"	4'0"	4'5"	4'6"	5'0"	+1.5"
Reach at 45° discharge and 2130 mm/7'0" clearance (§)	mm	1892	1883	1814	1883	1930	1995	+497
	ft/in	6'2"	6'2"	5'11"	6'2"	6'4"	6'6"	+19.6"
Reach with lift arm horizontal and bucket level	mm	2764	2674	2493	2674	2616	2877	+466
	ft/in	9'1"	8'9"	8'2"	8'9"	8'7"	9'5"	+18.3"
Digging Depth (§)	mm	52	82	82	52	52	52	Same
	in	2.0	3.2	3.2	2.0	2.0	2.0	Same
Overall length (§)	mm	8366	8276	8073	8276	8171	8490	+576
	ft/in	27'5"	27'2"	26'6"	27'2"	26'10"	27'10"	+22.7"
Overall height with bucket at full raise (§)	mm	5589	5516	5515	5515	5610	5610	+600
	ft/in	18'4"	18'1"	18'1"	18'1"	18'5"	18'5"	+23.6"
Loader clearance circle with bucket in carry position (§)	mm	14 876	14 828	14 674	14 828	14 748	14 926	+251
	ft/in	48'10"	48'8"	48'2"	48'8"	48'5"	49'0"	+9.9"
Static tipping load** Straight	kg	14 000	13 764	13 958	14 138	14 082	14 006	1800
	lb	30,864	30,344	30,772	31,169	31,046	30,882	-3968
Full 35° turn	kg	13 012	12 545	12 730	12 908	12 851	12 776	-1700
	lb	28,686	27,657	28,062	28,457	28,331	28,166	-3748
Breakout Force*** (§)	kg	215.9	214.9	216.6	233.6	198.1	197.0	-24.5
	lb	48,536	48,311	48,693	52,515	44,535	44,287	-5511
Operating Weight** (§)	kg	20 470	20 579	20 406	20 425	20 502	20 568	+900
	lb	45,146	45,368	44,987	45,029	45,198	45,344	+1984

*All buckets shown can be used on high lift arrangement. High lift column shows changes in specifications from standard lift to high lift. Add or subtract as indicated to or from specifications given for appropriate bucket to calculate high lift specifications.
**Static tipping load and operating weight shown include sound-suppressed cab and ROPS, 26.5-25 tires, full fuel tank, coolant, lubricants and operator.
***Measured 102 mm/4.0" behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732c.
Note: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings and are denoted in the text by (§).

	Change in Operating Weight		Change in Articulated Static Tipping Load	
	kg	lb	kg	lb
Remove cab only	−232	− 511	−192	− 423
Remove ROPS canopy only	−558	−1230	−557	−1228
23.5-25, 16 ply rating, L-2 tires	−497	−1096	−325	− 716
23.5-25, 16 ply rating, L-3 tires	−303	− 668	−197	− 434
23.5 R25, XHA L-3 equivalent tires	−158	− 348	−101	− 223
26.5 R25, L-2 equivalent tires	254	560	170	375
Tire ballast: 23.5-25	674	1468	1245	2745
25.5-25	1516	3342	2083	4592

Bucket Type and Ground Engaging Tools		Standard Machine							
		General Purpose							
		Bolt-on Edges	Teeth & Segments	Bolt-on Edges	Teeth & Segments	With Teeth	Bolt-on Edges	Teeth & Segments	With Teeth
Capacity, heaped (§)	m³	5.3	5.3	4.9	4.9	4.7	4.5	4.5	4.2
	yd³	7.00	7.00	6.50	6.50	6.00	5.75	5.75	5.50
Capacity, struck (§)	m³	4.45	4.45	4.14	4.14	3.92	3.71	3.71	3.50
	yd³	5.82	5.82	5.41	5.41	5.13	4.86	4.86	4.58
Width (§)	mm	3357	3379	3357	3379	3379	3357	3379	3379
	in	132	133	132	133	133	132	133	133
Dump clearance at full lift and 45° discharge (§)	mm	3165	3050	3165	3050	3050	3213	3098	3098
	ft/in	10'5"	10'0"	10'5"	10'0"	10'0"	10'7"	10'2"	10'2"
Reach at full lift and 45° discharge (§)	mm	1496	1612	1496	1612	1612	1443	1559	1559
	ft/in	4'11"	5'3"	4'11"	5'3"	5'3"	4'9"	5'1"	5'1"
Reach at 45° discharge and 2130 mm/7'0" clearance (§)	mm	2114	2187	2114	2187	2187	2078	2153	2153
	ft/in	6'11"	7'2"	6'11"	7'2"	7'2"	6'10"	7'1"	7'1"
Reach with lift arm horizontal and bucket level	mm	2803	2964	2803	2964	2964	2731	2892	2892
	ft/in	9'2"	9'9"	9'2"	9'9"	9'9"	8'11"	9'6"	9'6"
Digging Depth (§)	mm	118	132	118	132	132	118	132	132
	in	4.7	5.2	4.7	5.2	5.2	4.7	5.2	5.2
Overall length (§)	mm	8982	9154	8982	9154	9154	8910	9082	9082
	ft/in	29'6"	30'0"	29'6"	30'0"	30'0"	29'3"	29'9"	29'9"
Overall height with bucket at full raise (§)	mm	6110	6110	6008	6008	6008	5873	5873	5873
	ft/in	20'1"	20'1"	19'9"	19'9"	19'9"	19'3"	19'3"	19'3"
Loader clearance circle with bucket in carry position (§)	mm	15 660	15 780	15 650	15 780	15 780	15 610	15 610	15 740
	ft/in	51'4"	51'9"	51'4"	51'9"	51'9"	51'3"	51'3"	51'8"
Static tipping load* Straight	kg	18 571	18 887	18 507	18 823	18 912	18 646	18 962	19 057
	lb	40,942	41,639	40,801	41,498	41,696	41,107	41,804	42,013
Full 35° turn	kg	16 923	16 967	16 882	16 926	17 272	17 017	17 061	17 411
	lb	37,308	37,406	37,218	37,315	38,078	37,517	37,613	38,385
Breakout Force** ** (§)	kg	23 188	23 143	23 135	23 090	24 964	24 457	24 412	26 472
	lb	51,121	51,022	51,004	50,905	55,036	53,918	53,819	58,361
Operating Weight*** (§)	kg	27 580	27 512	27 569	27 482	27 387	27 486	27 465	27 314
	lb	60,803	60,654	60,609	60,609	60,378	60,596	60,550	60,217

*Static tipping load and operating weight shown are based on standard machine configuration with 29.5-25, 22PR (L-3) tires, full fuel tank, coolant, lubricants and operator.
**Measured 102 mm/4.0" behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732c.
Note: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings and are denoted in the text by (§).

	Change in Operating Weight				Change in Articulated Static Tipping Load			
	Standard		High Lift		Standard		High Lift	
	kg	lb	kg	lb	kg	lb	kg	lb
Remove cab only	− 232	− 511	− 232	− 511	− 192	− 423	− 172	− 379
Remove ROPS canopy only	− 758	−1671	− 758	−1671	− 717	−1581	− 643	−1417
Remove ROPS canopy and cab	− 990	−2183	− 990	−2183	− 909	−2004	− 815	−1796
Tires: 26.5-25, 20 PR (L-3)	653	−1437	− 653	−1437	− 458	−1008	394	− 866
26.5-25, 20 PR (L-4)	− 51	− 112	− 51	− 112	− 36	− 79	− 31	− 68
26.5-25, 20 PR (L-5)	+ 295	+ 649	+ 295	+ 649	+ 207	+ 455	+ 178	+ 391
26.5 R25, XHA (L-3)	− 648	−1426	− 648	−1426	− 455	−1001	− 391	− 860
29.5-25, 22 PR (L-4)	+ 613	+1349	+ 613	+1349	+ 430	+ 946	+ 369	+ 813
29.5-25, 22 PR (L-5)	+1507	+3315	+1507	+3315	+1057	+2326	+ 906	+1998
29.5 R25, XHA (L-3)	− 24	− 53	− 24	− 53	− 17	− 37	− 15	− 32
Tire Ballast: 26.5-25	+1378	+3032	+1378	+3032	+1934	+4255	+1662	+3656
26.5 R25	+1563	+3439	+1563	+3439	+2194	+4826	+1885	+4147
29.5-25	+1940	+4270	+1940	+4270	+2723	+5990	+2340	+5147
29.5 R25	+2058	+4528	+2058	+4528	+2888	+6354	+2481	+5459

Bucket Type and Ground Engaging Tools (cont'd)		Standard Machine		High Lift Arrangement			
		Rock		General Purpose			Rock
		No Teeth	With Teeth	Bolt-on Edges	Teeth & Segments	With Teeth	With Teeth
Capacity, heaped (§)	m^3	4.2	4.2	4.0	4.0	3.8	3.8
	yd^3	5.50	5.50	5.25	5.25	5.00	5.00
Capacity, struck (§)	m^3	3.49	3.49	3.41	3.37	3.21	3.19
	yd^3	4.56	4.56	4.46	4.40	4.20	4.17
Width (§)	mm	3370	3370	3357	3381	3381	3370
	in	133	133	132	133	133	133
Dump clearance at full lift and 45° discharge (§)	mm	3223	3006	3714	3602	3602	3278
	ft/in	10'7"	9'10"	12'2"	11'10"	11'10"	10'9"
Reach at full lift and 45° discharge (§)	mm	1587	1754	1302	1501	1501	1528
	ft/in	5'2"	5'9"	4'6"	4'11"	4'11"	5'0"
Reach at 45° discharge and 2130 mm/7'0" clearance (§)	mm	2223	2495	2340	2427	2427	2333
	ft/in	7'4"	8'2"	7'8"	8'0"	8'0"	7'8"
Reach with lift arm horizontal and bucket level	mm	2855	3121	2905	3068	3068	3340
	ft/in	9'4"	10'3"	9'6"	10'1"	10'1"	10'11"
Digging Depth (§)	mm	84	142	109	99	69	140
	in	3.3	5.6	4.3	3.9	2.7	5.5
Overall length (§)	mm	9005	9271	9005	9344	9344	9627
	ft/in	29'6"	30'5"	29'7"	30'8"	30'8"	31'7"
Overall height with bucket at full raise (§)	mm	5846	5846	6271	6271	6271	6538
	ft/in	19'2"	19'2"	20'7"	20'7"	20'7"	21'5"
Loader clearance circle with bucket in carry position (§)	mm	15 680	15 870	15 860	15 980	15 980	15 930
	ft/in	51'6"	52'1"	52'0"	52'5"	52'5"	52'3"
Static tipping load* Straight	kg	18 924	18 615	16 908	16 951	17 286	16 808
	lb	41,720	41,039	37,275	37,370	38,108	37,055
Full 35° turn	kg	17 281	16 971	15 356	15 397	15 718	15 251
	lb	38,098	37,415	33,854	33,944	34,654	33,622
Breakout Force**** (§)	kg	23 398	22 079	26 944	27 454	29 495	23 576
	lb	51,584	48,676	59,401	60,526	65,025	57,976
Operating Weight*** (§)	kg	27 445	27 690	28 148	28 127	27 976	28 339
	lb	60,506	61,046	62,055	62,008	61,676	62,483

*Static tipping load and operating weight shown are based on standard machine configuration with 29.5-25, 22PR (L-4) tires, full fuel tank, coolant, lubricants and operator.
**Measured 102 mm/4.0" behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732c
Note: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings and are denoted in the text by (§)

	Change in Operating Weight				Change in Articulated Static Tipping Load			
	Standard		High Lift		Standard		High Lift	
	kg	lb	kg	lb	kg	lb	kg	lb
Remove cab only	232	− 511	− 232	− 511	− 192	− 423	− 172	− 379
Remove ROPS canopy only	− 758	− 1671	− 758	− 1671	717	− 1561	− 643	− 1417
Remove ROPS canopy and cab	− 990	− 2183	− 990	− 2183	− 909	− 2004	− 815	− 1796
Tires: 26.5-25, 20 PR (L-3)	− 653	− 1437	− 653	− 1437	− 457	− 1008	− 394	− 868
26.5-25, 20 PR (L-4)	− 51	− 112	− 51	− 112	− 36	− 79	31	− 68
26.5-25, 20 PR (L-5)	+ 295	+ 649	+ 295	+ 649	+ 207	+ 455	+ 178	+ 391
26.5 R25, XHA (L-3)	− 648	− 1426	− 648	− 1426	455	− 1001	− 391	− 860
29.5-25, 22 PR (L-4)	+ 613	+ 1349	+ 613	+ 1349	+ 430	+ 946	+ 369	+ 813
29.5-25, 22 PR (L-5)	+ 1507	+ 3315	+ 1507	+ 3315	+ 1057	+ 2325	+ 908	+ 1998
29.5 R25, XHA (L-3)	− 24	− 53	− 24	− 53	− 17	− 37	− 15	− 32
Tire Ballast: 26.5-25	+ 1378	+ 3032	+ 1378	+ 3032	+ 1934	+ 4265	+ 1662	+ 3656
26.5 R25	+ 1563	+ 3439	+ 1563	+ 3439	+ 2194	+ 4826	+ 1885	+ 4147
29.5-25	+ 1940	+ 4270	+ 1940	+ 4270	+ 2723	+ 5990	+ 2340	+ 5147
29.5 R25	+ 2058	+ 4528	+ 2058	+ 4528	+ 2888	+ 6354	+ 2481	+ 5459

Bucket Type and Ground Engaging Tools	General Purpose: With Bolt-on Edges	General Purpose: With Teeth	Rock – Spade Edge: With Modulok	Rock – Spade Edge: With Teeth & Seg.	Rock – Spade Edge: With Teeth	Rock – Spade Edge: Without Teeth	Rock – Straight Edge: With Teeth	Rock – Straight Edge: Without Teeth
Capacity, heaped . . . . m^3	6.3	6.0	5.5	5.5	5.4	5.4	5.4	5.4
yd^3	**8.25**	**8.00**	**7.25**	**7.25**	**7.00**	**7.00**	**7.00**	**7.00**
Capacity, struck (§) . . . . m^3	5.43	5.19	4.63	4.56	4.54	4.54	4.65	4.65
yd^3	**7.10**	**6.79**	**6.06**	**5.96**	**5.93**	**5.93**	**6.09**	**6.09**
Width (§) . . . mm	3607	3650	3645	3645	3645	3645	3645	3645
ft/in	**11'10"**	**11'11.7"**	**11'11.5"**	**11'11.5"**	**11'11.5"**	**11'11.5"**	**11'11.5"**	**11'11.5"**
Dump clearance at full lift and 45° discharge (§) . . . . mm	3551	3311	3280	3186	3186	3457	3482	3722
ft/in	**11'8"**	**10'10"**	**10'9"**	**10'5"**	**10'5"**	**11'4"**	**11'5"**	**12'2"**
Reach at full lift and 45° discharge (§) . . . . mm	1818	2041	2082	2150	2150	1953	1910	1687
ft/in	**5'11"**	**6'8"**	**6'10"**	**7'1"**	**7'1"**	**6'5"**	**6'3"**	**5'6"**
Reach at 45° discharge angle and 2130 mm (7'0") clearance (§) . . . . . . mm	2560	2722	2733	2774	2774	2668	2633	2471
ft/in	**8'4"**	**8'11"**	**9'0"**	**9'1"**	**9'1"**	**8'9"**	**8'7"**	**8'1"**
Reach with lift arm horizontal and bucket level . . . . mm	3349	3677	3742	3843	3843	3511	3463	3135
ft/in	**10'11"**	**12'0"**	**12'3"**	**12'7"**	**12'7"**	**11'6"**	**11'4"**	**10'3"**
Digging depth (§) . . . . mm	100	100	72	72	72	72	72	72
in	**3.9"**	**3.9"**	**2.8"**	**2.8"**	**2.8"**	**2.8"**	**2.8"**	**2.8"**
Overall length (§) mm	10 233	10 552	10 748	10 729	10 729	10 340	10 340	10 021
ft/in	**33'7"**	**34'7"**	**35'3"**	**35'2"**	**35'2"**	**33'10"**	**33'11"**	**32'11"**
Overall height (bucket @ full raise) (§) . . . mm	6753	6753	6952	6952	6952	6952	6520	6520
ft/in	**22'2"**	**22'2"**	**22'10"**	**22'10"**	**22'10"**	**22'10"**	**21'5"**	**21'5"**
Loader clearance circle (bucket in carry position) (§) . . . . . mm	17 184	17 396	17 224	17 224	17 224	17 076	17 208	17 058
ft/in	**56'5"**	**56'10"**	**56'6"**	**56'6"**	**56'6"**	**56'11"**	**56'5"**	**55'11"**
Static tipping load** Straight (§) . . . . kg	26 757	26 443	25 059	25 724	26 094	26 488	26 858	27 172
lb	**58,988**	**58,296**	**55,245**	**56,710**	**57,526**	**58,395**	**59,211**	**59,903**
Full 35° turn kg	24 117	23 721	22 806	23 102	23 471	23 865	24 205	24 601
lb	**53,168**	**52,295**	**50,278**	**50,930**	**51,754**	**52,612**	**53,362**	**54,235**
Breakout force* (§) . . . . kg	40 314	40 110	35 925	33 986	36 333	36 640	46 948	47 152
lb	**88,875**	**88,425**	**79,200**	**74,925**	**80,100**	**80,775**	**103,500**	**103,950**
Operating weight** . . . . kg	42 410	42 639	43 365	43 166	42 922	42 656	42 610	42 381
lb	**93,496**	**94,002**	**95,602**	**95,163**	**94,625**	**94,039**	**93,937**	**93,433**

*Measured 102 mm (4.0") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732c.
**Static tipping load and operating weight are based on standard machine configuration with 35/65-33, 24 PR (L-4) tires, full fuel tank, coolant, lubricants and operator.
Note: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings, denoted in the text by (§).

	Change in Operating Weight: kg	Change in Operating Weight: lb	Change in Articulated Static Tipping Load: kg	Change in Articulated Static Tipping Load: lb
Remove Cab only	− 298	**− 659**	**− 206**	**− 484**
Remove ROPS canopy only	− 895	**− 1973**	− 728	**− 1605**
35/65-33, 24 PR (L-4) tires with 75% $CaCl_2$	+ 2679	**+ 5906**	+ 3304	**+ 7284**
35/65-33, 24 PR (L-5) tires	+ 978	**+ 2156**	+ 603	**+ 1329**
35/65 R33 (L-5) equivalent tires	+ 575	**+ 1268**	+ 355	**+ 783**
35/65-33, 24 PR (L-5) tires with 75% $CaCl_2$	+ 3290	**+ 7253**	+ 3455	**+ 7617**
35/65 R33 (L-4) equivalent tires with 75% $CaCl_2$	+ 2873	**+ 6333**	+ 3536	**+ 7795**
35/65 R33 (L-5) equivalent tires with 75% $CaCl_2$	+ 3063	**+ 6753**	+ 3423	**+ 7546**

12

Bucket Type and Ground Engaging Tools		Rock				
		Spade Edge				Straight Edge
		With Teeth	Without Teeth	With Teeth & Segments	Modulok	With Teeth
Capacity, heaped	m³	10.7	10.7	10.7	10.7	10.7
	yd³	14.0	14.0	14.0	14.0	14.0
Capacity, struck (§)	m³	8.94	8.94	8.94	8.94	9.01
	yd³	11.7	11.7	11.7	11.7	11.8
Bucket Width (§)	mm	4750	4750	4750	4820	4750
	ft/in	15'7"	15'7"	15'7"	15'8"	15'7"
Dump clearance at full lift and 45° discharge (§)	mm	4170	4484	4170	4200	4480
	ft/in	13'8"	14'8"	13'8"	13'9"	14'8"
Reach at full lift and 45° discharge (§)	mm	2302	2090	2302	2312	2073
	ft/in	7'7"	6'10"	7'7"	7'7"	6'10"
Reach at 45° discharge angle and 2130 mm (7'0") clearance (§)	mm	3342	3189	3342	3359	3168
	ft/in	11'0"	10'6"	11'0"	11'0"	10'5"
Reach with lift arm horizontal and bucket level*	mm	4481	4109	4481	4487	4114
	ft/in	14'8"	13'6"	14'8"	14'8"	13'6"
Digging depth (bucket level) (§)	mm	58	58	93	93	58
	in	2.28"	2.28"	3.66"	3.66"	2.28"
Overall length (§)	mm	13 134	12 705	13 134	13 098	12 733
	ft/in	43'1"	41'8"	43'1"	43'0"	41'9"
Overall height (bucket at full raise) (§)	mm	8660	8660	8660	8660	8660
	ft/in	28'5"	28'5"	28'5"	28'5"	28'5"
Loader clearance circle (bucket in carry position) (§)	mm	21 722	21 511	21 722	21 754	21 730
	ft/in	71'3"	70'7"	71'3"	71'4"	71'4"
Static tipping load** Straight (§)	kg	51 156	51 710	50 425	49 570	52 130
	lb	112,778	114,000	111,167	109,280	114,920
Full 35° turn (§)	kg	46 310	46 862	45 583	44 730	47 260
	lb	102,095	103,317	100,493	98,610	104,190
Breakout force*** (§)	kg	66 285	66 808	62 267	60 930	81 500
	lb	146,132	147,280	137,274	134,326	179,672
Operating weight**	kg	87 590	87 370	88 320	88 430	87 610
	lb	193,108	192,215	194,305	194,950	193,177

*Reach is measured to tooth tip when applicable, otherwise to cutting edge.
**Static tipping load and operating weight shown include sound-suppressed cab and ROPS, 45/65-45, 38 PR (L-5) tires, full fuel tank, coolant, lubricants and operator.
***Breakout force is measured 102 mm (4.0") behind tip of cutting edge with bucket hinge as pivot point in accordance with SAE J732c.
Note: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings, denoted in the text by (§).

	Change in Operating Weight		Change in Articulated Static Tipping Load	
	kg	lb	kg	lb
Remove ROPS canopy and cab	–3066	–6759	–2542	–5604
Remove Cab only	– 299	– 660	219	– 483
Remove ROPS canopy only	–2767	–6101	–2323	–5121

Bucket Type and Ground Engaging Tools		Iron Ore		Rock				Coal	High Lift	Equipped w/
		Spade With Teeth		Spade With Teeth and Segments				Straight w/Teeth	All Stand. Bkts. Avail.	53.5/65-57 Tires
Capacity, rated (§)	m^3	10	12	14	16	18	20	30	Same	Same
	yd^3	**13**	**16**	**18**	**21**	**23**	**26**	**40**	**Same**	**Same**
Capacity, struck (§)	m^3	7.4	9.6	11.3	12.8	14.5	16.3	25.9	Same	Same
	yd^3	**9.8**	**12.6**	**14.8**	**16.8**	**19.0**	**21.3**	**33.8**	**Same**	**Same**
♦Width (§)	mm	5650	5650	5650	5650	5650	5650	5650	Same	Same
	ft/in	**18'6"**	**18'6"**	**18'6"**	**18'6"**	**18'6"**	**18'6"**	**18'6"**	**Same**	**Same**
♦Dump clearance at full lift and 45° discharge (§)	mm	6082	6082	5870	5870	5658	5658	5496	+340	+180
	ft/in	**19'11"**	**19'11"**	**19'3"**	**19'3"**	**18'7"**	**18'7"**	**18'0"**	**+1'1"**	**+7"**
♦Reach at full lift and 45° discharge	mm	1842	1842	2054	2054	2266	2266	2462	+561	−200
	ft/in	**6'1"**	**6'1"**	**6'9"**	**6'9"**	**7'5"**	**7'5"**	**8'1"**	**+1'10"**	**−8"**
♦Reach with lift arms horizontal, bucket level	mm	4487	4487	4787	4787	5087	5087	5340	+640	−200
	ft/in	**14'9"**	**14'9"**	**15'8"**	**15'8"**	**16'8"**	**16'8"**	**17'6"**	**+2'1"**	**−8"**
♦Digging depth (§)	mm	246	246	246	246	246	246	222	+14.1	−180
	in	**9.7"**	**9.7"**	**9.7"**	**9.7"**	**9.7"**	**9.7"**	**8.7"**	**+0.6"**	**−7"**
♦Overall length (§)	mm	16 047	16 047	16 347	16 347	16 647	16 647	16 882	+780	−130
	ft/in	**52'8"**	**52'8"**	**53'8"**	**53'8"**	**54'7"**	**54'7"**	**55'5"**	**+2'7"**	**−5.1"**
Overall height bucket at full lift (§)	mm	10 248	10 698	10 724	10 990	10 990	11 276	12 161	+340	+180
	ft/in	**33'7"**	**35'1"**	**35'2"**	**36'1"**	**36'1"**	**37'0"**	**39'11"**	**+1'1"**	**+7"**
Loader clearance circle bucket in carry position	mm	12 590	12 590	12 660	12 660	12 740	12 740	12 840	+360	−20
	ft/in	**41'4"**	**41'4"**	**41'6"**	**41'6"**	**41'10"**	**41'10"**	**42'2"**	**+1'2"**	**−1"**
♦Static tipping load* Straight (§)	kg	120 910	122 050	119 760	119 470	117 100	130 340	117 670	.82►	1.02►
	lb	**266,600**	**269,100**	**264,100**	**263,400**	**258,100**	**287,400**	**259,400**	**.82►**	**1.02►**
Full 40° turn (§)	kg	104 840	105 790	103 630	103 230	101 050	112 310	101 620	.90►	1.02►
	lb	**231,100**	**233,200**	**228,500**	**227,600**	**222,800**	**247,600**	**224,000**	**.90►**	**1.02►**
Breakout force** (§)	kN	1370	1370	1165	1165	1010	1010	900	.96►	1.00►
	lb	**308,000**	**308,000**	**262,000**	**262,000**	**228,000**	**228,000**	**203,000**	**.98►**	**1.00►**
♦Operating weight*	kg	174 800	174 800	175 500	176 400	177 000	177 900	177 100	+2500	+2600
	lb	**385,000**	**385,500**	**387,000**	**389,000**	**390,300**	**392,300**	**390,500**	**+5520**	**+5720**

Note: Also available 30 m^3 (35 yd^3) general purpose coal bucket spade with teeth and segments.
*Reach is measured to tooth tip when applicable, otherwise to cutting edge.
**Static tipping load and operating weight include sound-suppressed cab and ROPS, 49.5-57 (L-4) tires, full fuel tank, coolant, lubricants and operator.
***Iron ore buckets with 76 mm (3") reversible bolt on segments. All other buckets with 50 mm (2") segments.
►Multiply this factor to standard rating to obtain High Lift rating.
♦Varies with bucket tip, segment or wing configuration.
Note: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings, denoted in the text by (§)

	Change in Operating Weight		Change in Articulated Static Tipping Load	
	kg	lb	kg	lb
Remove ROPS canopy & cab	−3595	**−7930**	−2680	**−5910**
Remove Cab only	−335	**−740**	−250	**−550**
Remove ROPS canopy only	−3260	**−7190**	−2430	**−5360**

12

Performance Data
• 994 with 6220 mm (245") Bucket

Bucket Type and Ground Engaging Tools	Iron Ore		Rock				Coal	High Lift	Equipped w/
	Spade With Teeth		Spade With Teeth and Segments				Straight w/Teeth	All Stand. Bkts. Avail.	53.5/65-57 Tires
Capacity, rated (§) .... m³	11	12	14	16	18	20	30	Same	Same
yd³	**14**	**16**	**18**	**21**	**23**	**26**	**40**	**Same**	**Same**
Capacity, struck (§) .... m³	8.4	9.3	11.0	12.7	14.4	16.3	25.6	Same	Same
yd³	**11.0**	**12.2**	**14.3**	**16.6**	**18.9**	**21.3**	**33.5**	**Same**	**Same**
♦Width (§) .... mm	6220	6220	6220	6220	6220	6220	6220	Same	Same
ft/in	**20'5"**	**20'5"**	**20'5"**	**20'5"**	**20'5"**	**20'5"**	**20'5"**	**Same**	**Same**
♦Dump clearance at full lift and 45° discharge (§) ..... mm	5994	5994	5782	5782	5782	5569	5486	+340	+180
ft/in	**19'8"**	**19'8"**	**19'0"**	**19'0"**	**19'0"**	**18'3"**	**18'0"**	**+1'1"**	**+7"**
♦Reach at full lift and 45° discharge .... mm	1930	1930	2142	2142	2142	2354	2462	+561	−200
ft/in	**6'4"**	**6'4"**	**7'0"**	**7'0"**	**7'0"**	**7'9"**	**8'1"**	**+1'10"**	**−8"**
♦Reach with lift arms horizontal, bucket level .... mm	4612	4612	4912	4912	4912	5212	5340	+640	−200
ft/in	**15'2"**	**15'2"**	**16'1"**	**16'1"**	**16'1"**	**17'1"**	**17'6"**	**+2'1"**	**−8"**
♦Digging depth (§) .... mm	246	246	246	246	246	246	222	+14.1	−180
in	**9.7"**	**9.7"**	**9.7"**	**9.7"**	**9.7"**	**9.7"**	**8.7"**	**+0.6"**	**−7"**
♦Overall length (§) .... mm	16 172	16 172	16 472	16 472	16 472	16 772	16 882	+780	−130
ft/in	**53'1"**	**53'1"**	**54'1"**	**54'1"**	**54'1"**	**55'0"**	**55'6"**	**+2'7"**	**−5.1"**
Overall height bucket at full lift (§) .... mm	10 246	10 408	10 388	10 724	10 990	10 990	11 770	+340	+180
ft/in	**33'7"**	**33'7"**	**34'1"**	**35'2"**	**36'1"**	**36'1"**	**38'8"**	**+1'1"**	**+7"**
Loader clearance circle bucket in carry position .... mm	12 850	12 850	12 930	12 930	12 930	13 000	13 100	+360	−20
ft/in	**42'2"**	**42'2"**	**42'5"**	**42'5"**	**42'5"**	**42'8"**	**43'0"**	**+1'2"**	**−1"**
♦Static tipping load* Straight (§) .... kg	118 560	118 620	116 390	117 040	117 300	113 720	115 100	.82►	1.02►
lb	**261,400**	**261,500**	**256,600**	**258,000**	**258,600**	**250,700**	**253,700**	**.82►**	**1.02►**
Full 40° turn (§) .... kg	102 510	102 520	100 400	100 920	101 080	97 700	98 160	.80►	1.02►
lb	**226,000**	**226,000**	**221,300**	**222,500**	**222,800**	**215,400**	**216,600**	**.80►**	**1.02►**
Breakout force** (§) .... kN	1275	1275	1095	1095	1095	960	900	.96►	1.00►
lb	**287,000**	**287,000**	**247,000**	**247,000**	**247,000**	**216,000**	**202,000**	**.96►**	**1.00►**
♦Operating weight* .... kg	176 200	176 400	177 100	178 100	178 700	179 600	178 800	+2500	+2600
lb	**388,500**	**389,000**	**390,500**	**392,500**	**393,900**	**395,900**	**394,100**	**+5520**	**+5720**

Note: Also available 30 m³ (35 yd³) general purpose coal bucket spade with teeth and segments.
*Reach is measured to tooth tip when applicable, otherwise to cutting edge.
**Static tipping load and operating weight include sound-suppressed cab and ROPS, 49.5-57 (L-4) tires, full fuel tank, coolant, lubricants and operator.
***Iron ore buckets with 75 mm (3") reversible bolt on segments. All other buckets with 50 mm (2") segments.
►Multiply this factor to standard rating to obtain High Lift rating.
♦Varies with bucket tip, segment or wing configuration.
Note: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings, denoted in the text by (§).

	Change in Operating Weight		Change in Articulated Static Tipping Load	
	kg	lb	kg	lb
Remove ROPS canopy & cab	−3595	−7930	2680	−5910
Remove Cab only	− 335	− 740	− 250	− 550
Remove ROPS canopy only	−3260	−7190	−2430	−5360

Bucket Type and Ground Engaging Tools		988B High Lift Rock Spade Edge with Teeth	988B High Lift Rock Straight Edge without Teeth	988B High Lift General Purpose Straight Edge with Teeth	992D High Lift Rock Spade Edge with Teeth
Capacity, heaped	m³	5.0	5.0	5.0	9.6
	yd³	6.5	6.5	6.5	12.5
Capacity, struck (§)	m³	4.16	4.24	4.24	7.86
	yd³	5.43	5.54	5.54	10.3
Bucket Width (§)	mm	3645	3645	3645	4760
	ft/in	12'0"	12'0"	12'0"	15'7"
Dump clearance at full lift and 45° discharge (§)	mm	3683	4181	3937	5111
	ft/in	12'1"	13'9"	12'11"	16'9"
Reach at full lift and 45° discharge (§)	mm	2181	1760	1981	2108
	ft/in	7'2"	5'9"	6'6"	6'11"
Reach at 45° discharge angle and 2130 mm (7'0") clearance (§)	mm	3132	2844	3024	3779
	ft/in	10'3"	9'4"	9'11"	12'6"
Reach with lift arm horizontal and bucket level*	mm	4146	3499	3827	4840
	ft/in	13'7"	11'6"	12'7"	15'11"
Digging depth (bucket level) (§)	mm	119	119	119	58
	in	4.7"	4.7"	4.7"	2.3"
Overall length (§)	mm	11 126	10 478	10 807	13 586
	ft/in	36'6"	34'5"	35'5"	44'6"
Overall height (bucket at full raise) (§)	mm	7323	7391	7391	9333
	ft/in	24'0"	24'3"	24'3"	30'7"
Loader clearance circle (bucket in carry position) (§)	mm	17 619	1743	1765	2214
	ft/in	57'10"	57'2"	57'11"	72'8"
Static Tipping Load** Straight (§)	kg	22 489	23 259	22 962	47 773
	lb	49,580	51,276	50,621	105,320
Full 35° turn (§)	kg	20 160	20 917	20 619	42 971
	lb	44,445	46,113	45,457	94,735
Breakout force*** (§)	kg	37 854	47 050	46 846	66 645
	lb	83,450	103,725	103,275	146,925
Operating weight**	kg	43 457	42 983	43 212	91 700
	lb	95,804	94,759	95,264	201,741

*Reach is measured to tooth tip when applicable, otherwise to cutting edge.

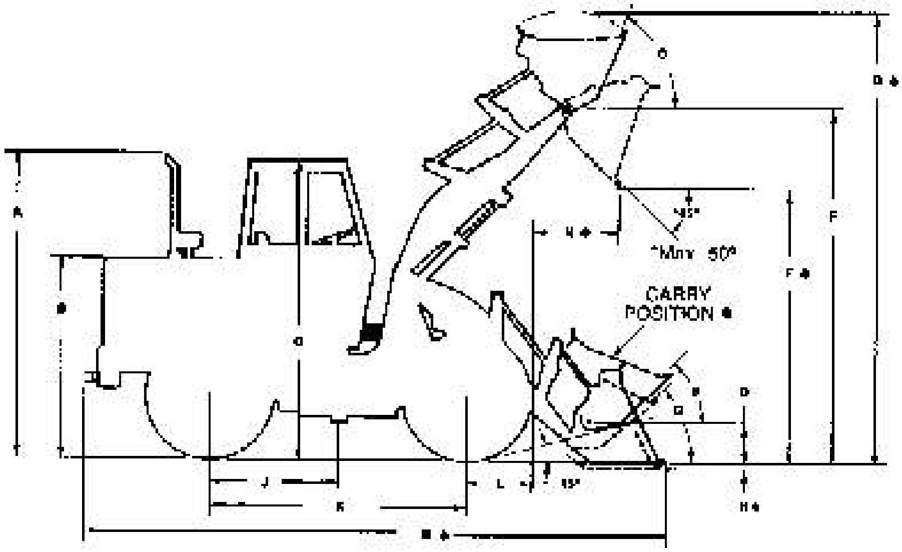
**Static tipping load and operating weight include sound-suppressed cab and ROPS, full fuel tank, coolant, lubricants and operator.
988B with 35/65-33, 24 PR (L-4) equivalent tires.
992C with 45/65-45, 38 PR (L-5) tires.

***Breakout force is measured 102 mm (4.0") behind tip of cutting edge with bucket hinge as pivot point in accordance with SAE J732c

Note: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732c and J742b govern loader ratings, denoted in the text by (§).

	Change in Operating Weight 988B HL		Change in Articulated Static Tipping Load 988B HL		992D HL	
	kg	lb	kg	lb	kg	lb
Remove ROPS canopy & cab	−1194	−2633	−822	−1812	−2214	−4882
Remove Cab only	−298	−659	−181	−399	−191	−421
Remove ROPS canopy only	−896	−1973	−641	−1413	−2023	−4461
35/65-33, 24 PR (L-4) tires†	+2679	+5906	+2852	+6287	—	—
35/65-33, 24 PR (L-5) tires	+978	+2156	+504	+1111	—	—
35/65 R33 (L-5) equivalent	+575	+1268	+299	+659	—	—
35/65-33, 24 PR (L-5) tires†	+3290	+7253	+2970	+6548	—	—
35/65 R33 (L-4) equivalent†	+2873	+6333	+3051	+6726	—	—
35/65 R33 (L-5) equivalent†	+3063	+6753	+2950	+6504	—	—

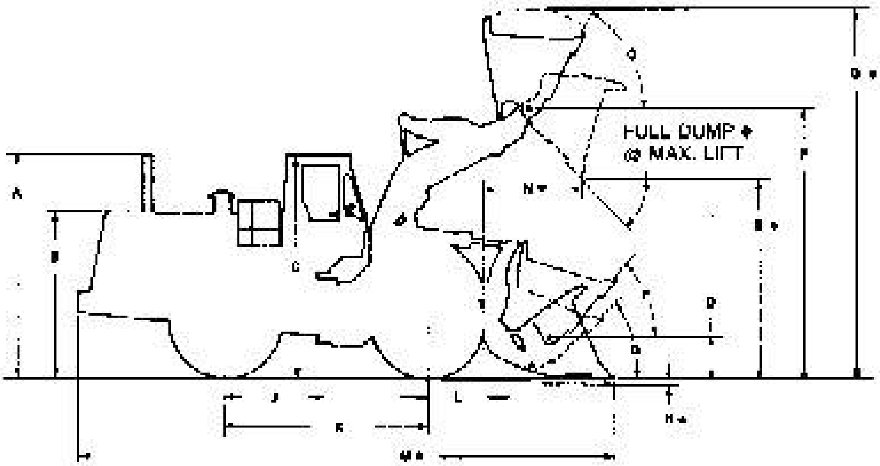
†75% fill calcium chloride ballast included for rear tires only.



Dimensions shown represent standard machine with General Purpose bucket (bolt-on cutting edge) and standard tires.

♦ Varies with Bucket Size and/or Bucket Configuration — Refer to Performance Data

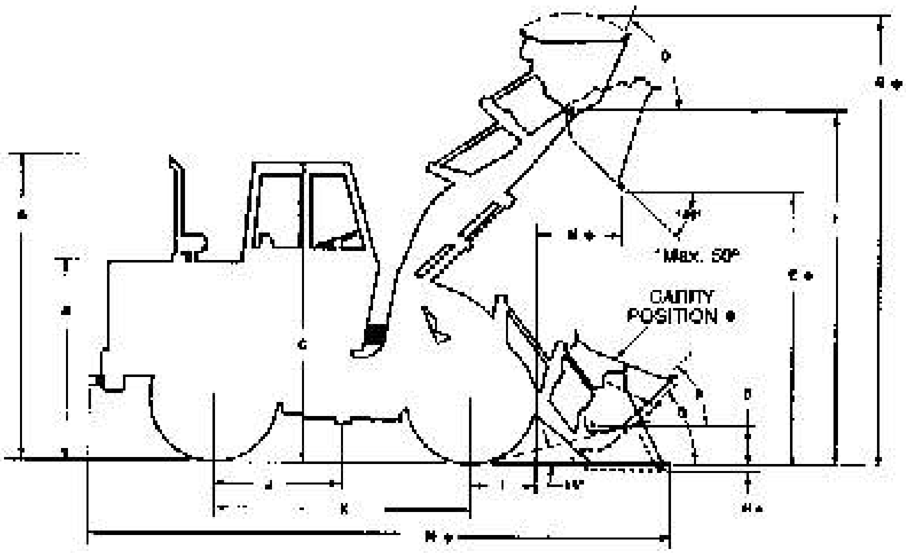
MODEL:	910E General Purpose Bolt-on edge 1.0 m³	1.25 yd³	916 General Purpose Bolt-on edge 1.5 m³	2.00 yd³	926E General Purpose Bolt-on edge 1.7 m³	2.25 yd³	930T General Purpose 1.7 m³	2.25 yd³
A Height to top of stack	2.93 m	9'7"	3.21 m	10'6.3"	3.20 m	10'6.6"	3.20 m	10'5"
B Height to top of engine compartment	1.85 m	6'1"	2.13 m	7'0"	2.13 m	7'0"	2.06 m	6'9"
C Height to top of ROPS	2.99 m	9'10"	3.15 m	10'4"	3.21 m	10'6.5"	3.14 m	10'3.1"
D Hinge pin height at carry position	374 mm	14.7"	450 mm	17.7"	483 mm	19"	376 mm	14.8"
E Dump clearance at full lift and 45° discharge angle	2.57 m	8'5"	2.65 m	8'8.5"	2.75 m	9'0.3"	2.79 m	9'0"
F Hinge pin height at full lift	3.35 m	11'0"	3.60 m	11'8"	3.64 m	11'11.5"	3.65 m	12'0"
G Maximum overall height	4.31 m	14'2"	4.61 m	15'1"	4.77 m	15'7.8"	4.03 m	15'8"
H Maximum digging depth	117 mm	4.6"	78 mm	3"	78 mm	3"	86 mm	3.4"
J Machine center point to rear axle	1.17 m	3'10"	1.35 m	4'5"	1.435 m	4'8.5"	1.32 m	4'6"
K Wheelbase	2.34 m	7'8"	2.70 m	8'10"	2.870 m	9'5"	2.75 m	9'0"
L Radius of wheel	635 mm	25"	669 mm	26.3"	669 mm	26.3"	680 mm	26.8"
M Maximum overall length	5.98 m	19'8"	6.37 m	20'10.8"	6.62 m	21'8.6"	6.27 m	20'6"
N Reach at full lift	1000 mm	39.4"	926 mm	36.5"	1003 mm	39.5"	860 mm	33.9"
O Maximum rollback at maximum lift	68.6°		59°		59.1°		65°	
P Maximum rollback at carry height	49.8°		47°		47.4°		46°	
Q Maximum rollback at ground	44.5°		40°		40.4°		40°	
Ground clearance (std. tires)	343 mm	13.5"	322 mm	12.7"	341 mm	13.5"	348 mm	13.7"
Tread width (std. tires)	1.73 m	5'8"	1.85 m	6'1"	1.85 m	6'1"	1.90 m	6'2"
Width over tires (std. tires)	2.15 m	7'0"	2.33 m	91.7"	2.33 m	91.7"	2.39 m	7'8"
Tires used for measurements	15.5 × 25 (L-2)		17.5 × 25 (L-2)		17.5 × 25 (L-2)		17.5 × 25 (L-2)	



Dimensions shown represent standard machine with General Purpose bucket (bolt-on cutting edge) and standard tires.

♦ Varies with Bucket Size and/or Bucket Configuration — Refer to Performance Data.

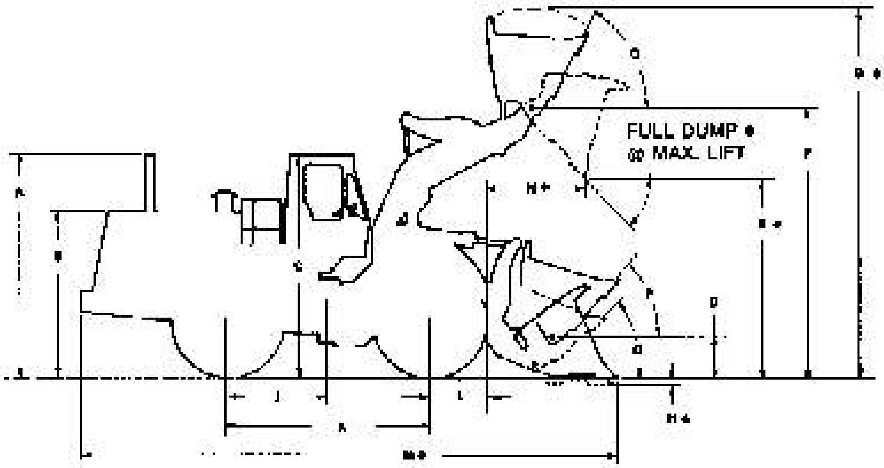
MODEL:	936F General Purpose Bolt-on edge 2.1 m³	3.0 yd³	950F General Purpose Bolt-on edge 2.9 m³	3.75 yd³	966C General Purpose 3.1 m³	4.0 yd³
A Height to top of stack	3.21 m	10'6.4"	3.27 m	10'9"	3.41 m	11'2"
B Height to top of engine compartment	2.31 m	7'7"	2.32 m	7'7"	2.33 m	7'8"
C Height to top of ROPS	3.37 m	11'0.7"	3.52 m	11'7"	3.31 m	10'9"
D Hinge pin height at carry position	475 mm	18.7"	459 mm	18"	422 mm	16.6"
E Dump clearance at full lift and 45° discharge angle	2.88 m	9'4"	2.85 m	9'4"	2.96 m	9'7"
F Hinge pin height at full lift	3.84 m	12'6"	3.96 m	13'0"	4.0 m	13'1"
G Maximum overall height	4.86 m	16'7"	5.54 m	18'2"	5.43 m	17'8"
H Maximum digging depth	45 mm	1.8"	52 mm	2"	188 mm	7.4"
J Machine center point to rear axle	1.510 m	4'11"	1.590 m	5'2.6"	1.55 m	5'1"
K Wheelbase	3.020 m	9'11"	3.180 m	10'5"	3.10 m	10'2"
L Radius of wheel	745 mm	29.3"	818 mm	32.0"	808 mm	31.8"
M Maximum overall length	7.06 m	23'4"	7.55 m	24'9"	6.91 m	22'7"
N Reach at full lift	970 mm	38"	1160 mm	45.7"	890 mm	35"
O Maximum rollback at maximum lift	59°		59°		62°	
P Maximum rollback at carry height	46°		45°		46°	
Q Maximum rollback at ground	40°		40°		41°	
Ground clearance (std. tires)	392 mm	15.4"	474 mm	18.7"	400 mm	15.7"
Tread width (std. tires)	1.90 m	6'6"	2.09 m	6'10"	2.16 m	7'1"
Width over tires (std. tires)	2.57 m	8'5"	2.76 m	9'0"	2.77 m	9'1"
Tires used for measurements	20.5 × 25 (L-2)		23.5 × 25 (L-2)		23.5 × 25 (L-2)	



Dimensions shown represent **standard machine with General Purpose bucket (bolt-on cutting edge) and standard tires.**

◆ Varies with Bucket Size and/or Bucket Configuration — Refer to Performance Data.

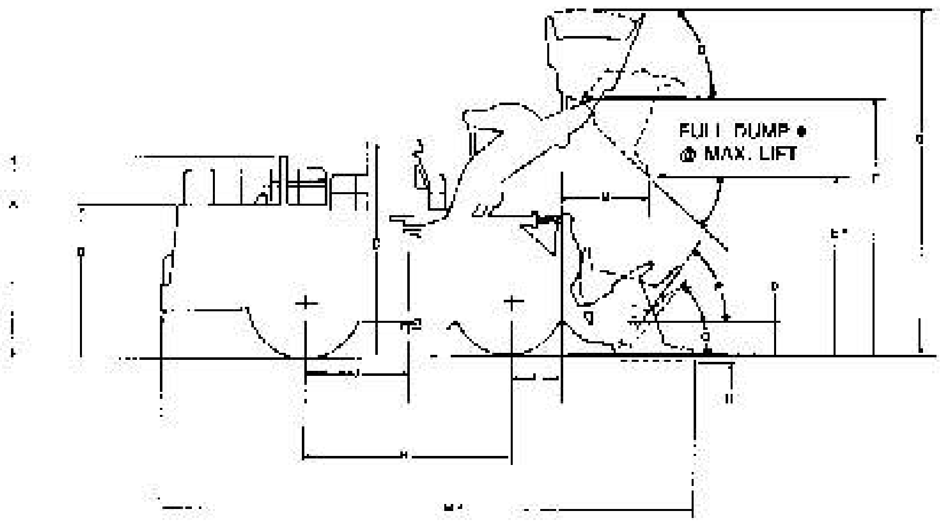
MODEL:	966F Bolt-on cutting edge 3.7 m³	4.75 yd³	980F Bolt-on cutting edge 4.3 m³	5.5 yd³	980F High Lift Bolt-on Teeth 4.0 m³	5.25 yd³
A Height to top of stack	3.4 m	11'2"	3.63 m	11'10"	3.63 m	11'11"
B Height to top of engine compartment	2.47 m	8'1"	2.60 m	8'8"	2.66 m	8'9"
C Height to top of ROPS	3.58 m	11'9"	3.90 m	12'9"	3.99 m	13'1"
D Hinge pin height at carry position	459 mm	18.1"	485 mm	19"	485 mm	19"
E Dump clearance at full lift and 45° discharge angle	2.98 m	9'9"	3.24 m	10'8"	3.60 m	11'10"
F Hinge pin height at full lift	4.12 m	13'5"	4.29 m	13'8"	4.74 m	15'6.5"
G Maximum overall height	5.59 m	18'4"	5.84 m	19'2"	6.27 m	20'7"
H Maximum digging depth	82 mm	3.2"	122 mm	4.8"	69 mm	2.7"
J Machine center point to rear axle	1.675 m	5'6"	1.77 m	5'9"	1.77 m	5'9"
K Wheelbase	3.350 m	11'0"	3.53 m	11'7"	3.53 m	11'7"
L Radius of wheel	864 mm	34.0"	928 mm	36.5"	928 mm	36.5"
M Maximum overall length	8.07 m	26'6"	8.87 m	29'0"	9.01 m	29'7"
N Reach at full lift	1275 mm	50.0"	1430 mm	56.3"	1600 mm	59"
O Maximum rollback at maximum lift	59°		59°		62°	
P Maximum rollback at carry height	44°		47.5°		50°	
Q Maximum rollback at ground	40°		40°		40°	
Ground clearance (std. tires)	476 mm	18.7"	492 mm	19.4"	492 mm	19.4"
Tread width (std. tires)	2.20 m	7'2.6"	3.67 m	12'1"	3.67 m	12'1"
Width over tires (std. tires)	2.98 m	9'9.6"	3.18 m	10'5"	3.18 m	10'5"
Tires used for measurements	26.5 x 25 (L-2)		29.5 x 25 (L-3)		29.5 x 25 (L-3)	



Dimensions shown represent standard machine with spade edge rock bucket and standard tires.

♦ Varies with Bucket Size and/or Bucket Configuration — Refer to Performance Data

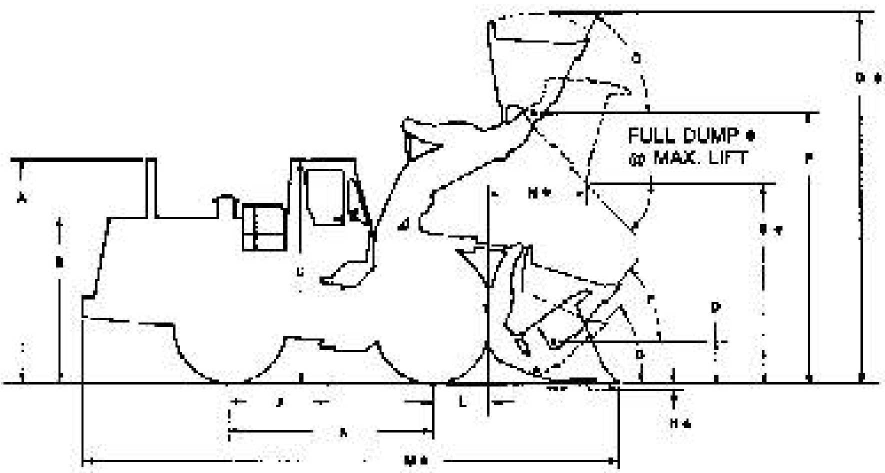
MODEL:	988B Spade Edge Rock With Teeth 6.4 m³	7.0 yd³	988B High Lift Spade Edge Rock With Teeth 6.0 m³	6.6 yd³	992D Spade Edge Rock With Teeth 10.7 m³	14.0 yd³	992D High Lift Spade Edge Rock With Teeth 9.6 m³	12.5 yd³
A Height to top of stack	4.14 m	13'7"	4.14 m	13'7"	4.76 m	15'8"	4.76 m	15'8"
B Height to top of engine compartment	2.98 m	9'9"	2.98 m	9'9"	3.50 m	11'6"	3.50 m	11'6"
C Height to top of ROPS	4.13 m	13'6"	4.13 m	13'6"	5.49 m	18'0"	5.49 m	18'0"
D Hinge pin height at carry position	787 mm	31"	787 mm	31"	741 mm	29"	741 mm	36.6"
E Dump clearance at full lift and 45° discharge angle	3.18 m	10'5"	3.68 m	12'1"	4.17 m	13'8"	5.11 m	16'9"
F Hinge pin height at full lift	4.91 m	16'1"	5.36 m	17'7"	6.26 m	20'7"	7.09 m	23'3"
G Maximum overall height	6.95 m	22'10"	7.32 m	24'0"	8.66 m	28'5"	9.33 m	30'7"
H Maximum digging depth	72 mm	2.8"	119 mm	4.7"	58 mm	2.28"	57 mm	2.2"
J Machine center point to rear axle	1.90 m	6'3"	1.90 m	6'3"	2.41 m	7'11"	2.41 m	7'11"
K Wheelbase	3.81 m	12'6"	3.81 m	12'6"	4.83 m	15'10"	4.83 m	15'10"
L Radius of wheel	1.03 m	3'4"	1.03 m	3'4"	1.37 m	4'6"	1.37 m	4'6"
M Maximum overall length	1.07 m	35'2"	11.13 m	36'6"	13.13 m	43'1"	13.57 m	44'6"
N Reach at full lift	2.15 m	7'1"	2.18 m	7'2"	2.3 m	7'7"	2.11 m	6'11"
O Maximum rollback at maximum lift	62°		63.3°		65°		65°	
P Maximum rollback at carry height	50°		50°		51°		53°	
Q Maximum rollback at ground	40°		40°		41.3°		44°	
Ground clearance (std. tires)	474 mm	18.7"	474 mm	18.7"	544 mm	21.4"	540 mm	21.25"
Tread width (std. tires)	2.59 m	8'6"	2.59 m	8'6"	3.30 m	10'10"	3.30 m	10'10"
Width over tires (std. tires)	3.55 m	11'8"	3.55 m	11'8"	4.50 m	14'9"	4.49 m	14'9"
Tires used for measurements	35/65-33 (L-4)		35/65-33 (L-4)		45/65-45 (L-5)		45/65-45 (L-5)	



Dimensions shown represent standard machine with spade edge rock bucket and standard tires.

• Varies with Bucket Size and/or Bucket Configuration — Refer to Performance Data

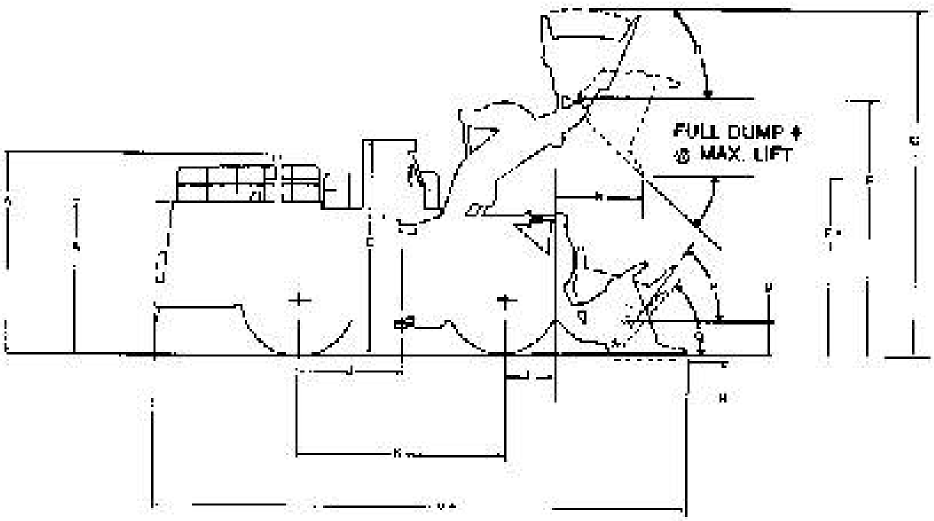
MODEL:	994 Spade-Edge Bucket With Teeth And Segments 18.0 m³	23.0 yd³	994 High Lift Spade Edge Bucket With Teeth And Segments 16.0 m³	21.0 yd³	994 Standard Linkage 222″ Spade-Edge Bucket With Teeth And Segments 16.0 m³	23.0 yd³	994 High Lift Linkage 222″ Spade-Edge Bucket With Teeth And Segments 16.0 m³	21.0 yd³
A Height to top of stack	6.30 m	20'8"	6.30 m	20'8"	6.48 m	21'3"	6.48 m	21'3"
B Height to top of engine compartment	4.66 m	15'3"	4.66 m	15'3"	4.83 m	15'10"	4.83 m	15'10"
C Height to top of ROPS	6.54 m	21'6"	6.63 m	21'5"	6.71 m	22'0"	6.71 m	22'0"
D Hinge pin height at carry position	868 mm	34"	1093 mm	43"	868 mm	34"	1093 mm	43"
• E Dump clearance at full lift and 45° discharge angle	5.67 m	18'7"	6.00 m	19'8"	5.84 m	19'2"	6.18 m	20'3"
• F Hinge pin height at full lift	8.0 m	26'2"	8.31 m	27'4"	8.16 m	26'9"	8.50 m	27'11"
• G Maximum overall height	11.00 m	36'1"	11.33 m	37'2"	11.17 m	36'8"	11.51 m	37'9"
• H Maximum digging depth	246 mm	9.7"	261 mm	10.3"	66 mm	2.6"	81 mm	3.2"
J Machine center point to rear axle	3.20 m	10'6"	3.20 m	10'6"	3.20 m	10'6"	3.20 m	10'6"
K Wheelbase	6.40 m	21'0"	6.40 m	21'0"	6.40 m	21'0"	6.40 m	21'0"
L Radius of wheel	1.80 m	5'11"	1.80 m	5'11"	2.00 m	6'7"	2.00 m	6'7"
• M Maximum overall length	16.64 m	54'7"	17.12 m	56'2"	16.51 m	54'2"	17.01 m	55'9"
• N Reach at full lift	2.27 m	7'5"	2.62 m	8'7"	2.07 m	6'9"	2.42 m	7'11"
O Maximum rollback at maximum lift	64°		64°		64°		64°	
P Maximum rollback at carry height	51°		51°		51°		51°	
Q Maximum rollback at ground	40°		40°		40°		40°	
Ground clearance (std. tires)	630 mm	24.8"	630 mm	24.8"	810 mm	31.9"	810 mm	31.9"
Tread width (std. tires)	3.9 m	12'10"	3.9 m	12'10"	3.9 m	12'10"	3.9 m	12'10"
Width over tires (std. tires)	5.2 m	17'1"	5.2 m	17'1"	5.31 m	17'5"	5.31 m	17'5"
Tires used for measurements	49.5 × 57 (L-4)		49.5 × 57 (L-4)		53.5/85 × 57 (L-5)		53.5/85 × 57 (L-5)	



Dimensions shown represent standard machine with spade edge rock bucket and standard tires.

• Varies with Bucket Size and/or Bucket Configuration — Refer to Performance Data

MODEL:	**988B** Spade Edge Rock With Teeth 5.4 m³	7.0 yd³	**988B** High Lift Spade Edge Rock With Teeth 5.0 m³	6.5 yd³	**992D** Spade Edge Rock With Teeth 10.7 m³	14.0 yd³	**992D** High Lift Spade Edge Rock With Teeth 9.6 m³	12.5 yd³
A Height to top of stack	4.14 m	13'7"	4.14 m	13'7"	4.76 m	15'6"	4.78 m	15'8"
B Height to top of engine compartment	2.98 m	9'9"	2.98 m	9'9"	3.60 m	11'6"	3.50 m	11'6"
C Height to top of ROPS	4.13 m	13'6"	4.13 m	13'6"	5.49 m	18'0"	5.49 m	18'0"
D Hinge pin height at carry position	787 mm	31"	787 mm	31"	741 mm	29"	741 mm	36.5"
E Dump clearance at full lift and 45° discharge angle	3.18 m	10'5"	3.68 m	12'1"	4.17 m	13'8"	5.11 m	16'9"
F Hinge pin height at full lift	4.91 m	16'1"	5.36 m	17'7"	6.26 m	20'7"	7.09 m	23'3"
G Maximum overall height	6.95 m	22'10"	7.32 m	24'0"	8.66 m	28'5"	9.33 m	30'7"
H Maximum digging depth	72 mm	2.8"	119 mm	4.7"	58 mm	2.28"	57 mm	2.2"
J Machine center point to rear axle	1.90 m	6'3"	1.90 m	6'3"	2.41 m	7'11"	2.41 m	7'11"
K Wheelbase	3.81 m	12'6"	3.81 m	12'6"	4.83 m	15'10"	4.83 m	15'10"
L Radius of wheel	1.03 m	3'4"	1.03 m	3'4"	1.37 m	4'6"	1.37 m	4'6"
M Maximum overall length	1.07 m	35'2"	11.13 m	36'6"	13.13 m	43'1"	13.57 m	44'6"
N Reach at full lift	2.15 m	7'1"	2.18 m	7'2"	2.3 m	7'7"	2.11 m	6'11"
O Maximum rollback at maximum lift	62°		63.3°		65°		65°	
P Maximum rollback at carry height	50°		50°		51°		53°	
Q Maximum rollback at ground	40°		40°		41.3°		44°	
Ground clearance (std. tires)	474 mm	18.7"	474 mm	18.7"	544 mm	21.4"	540 mm	21.25"
Tread width (std. tires)	2.59 m	8'6"	2.59 m	8'6"	3.30 m	10'10"	3.30 m	10'10"
Width over tires (std. tires)	3.55 m	11'8"	3.55 m	11'8"	4.50 m	14'9"	4.49 m	14'9"
Tires used for measurements	35/65-33 (L-4)		35/65-33 (L-4)		45/65-45 (L-5)		45/65-45 (L-5)	



Dimensions shown represent standard machine with spade edge rock bucket and standard tires.

◆ Varies with Bucket Size and/or Bucket Configuration — Refer to Performance Data

MODEL:	994 Spade-Edge Bucket With Teeth And Segments 18.0 m³	23.0 yd³	994 High Lift Spade Edge Bucket With Teeth And Segments 16.0 m³	21.0 yd³	994 Standard Linkage 222" Spade-Edge Bucket With Teeth And Segments 18.0 m³	23.0 yd³	994 High Lift Linkage 222" Spade-Edge Bucket With Teeth And Segments 16.0 m³	21.0 yd³
A Height to top of stack	6.30 m	20'8"	6.30 m	20'8"	6.48 m	21'3"	6.48 m	21'3"
B Height to top of engine compartment	4.66 m	15'3"	4.66 m	15'3"	4.83 m	15'10"	4.83 m	15'10"
C Height to top of HOPS	6.54 m	21'6"	6.53 m	21'5"	6.71 m	22'0"	6.71 m	22'0"
D Hinge pin height at carry position	868 mm	34"	1089 mm	43"	868 mm	34"	1089 mm	43"
◆E Dump clearance at full lift and 45° discharge angle	5.67 m	18'7"	6.00 m	19'8"	5.84 m	19'2"	6.18 m	20'3"
◆F Hinge pin height at full lift	8.0 m	26'2"	8.31 m	27'4"	8.16 m	26'9"	8.50 m	27'11"
◆G Maximum overall height	11.00 m	36'1"	11.33 m	37'2"	11.17 m	36'8"	11.51 m	37'9"
◆H Maximum digging depth	246 mm	9.7"	261 mm	10.3"	66 mm	2.6"	81 mm	3.2"
J Machine center point to rear axle	3.20 m	10'6"	3.20 m	10'6"	3.20 m	10'6"	3.20 m	10'6"
K Wheelbase	6.40 m	21'0"	6.40 m	21'0"	6.40 m	21'0"	6.40 m	21'0"
L Radius of wheel	1.80 m	5'11"	1.80 m	5'11"	2.00 m	6'7"	2.00 m	6'7"
◆M Maximum overall length	16.64 m	54'7"	17.12 m	56'2"	16.51 m	54'2"	17.01 m	55'9"
◆N Reach at full lift	2.27 m	7'5"	2.62 m	8'7"	2.07 m	6'8"	2.42 m	7'11"
O Maximum rollback at maximum lift	64°		64°		64°		64°	
P Maximum rollback at carry height	51°		51°		51°		51°	
Q Maximum rollback at ground	40°		40°		40°		40°	
Ground clearance (std. tires)	630 mm	24.8"	630 mm	24.8"	810 mm	31.9"	810 mm	31.9"
Tread width (std. tires)	3.9 m	12'10"	3.9 m	12'10"	3.9 m	12'10"	3.9 m	12'10"
Width over tires (std. tires)	5.2 m	17'1"	5.2 m	17'1"	5.31 m	17'5"	5.31 m	17'5"
Tires used for measurements	49.5 × 57 (L-4)		49.5 × 57 (L-4)		53.5/85 × 57 (L-5)		53.5/85 × 57 (L-5)	

SPECIFICATION DEFINITIONS FOR FRONT END LOADERS

Caterpillar wheel and track-type loader specifications conform to Society of Automotive Engineers (SAE) definitions as expressed in standards J732c (Jan., 1969), as follows:

Description of Specification Machine

On wheel loaders the tire inflation pressure at which specifications are taken must be described in addition to the current written basic machine description. On track loaders the type of grouser must be specified.

Hydraulic Cycle Times

a. "Raise Time" — Time in seconds required to raise the bucket from level position on the ground.
b. "Lower Time" — Time in seconds required to lower the empty bucket from the full height to a level position on the ground.
c. "Dump Time" — Time in seconds required to move the bucket from the load carrying position to maximum height to the full dump position while dumping an SAE operating load.

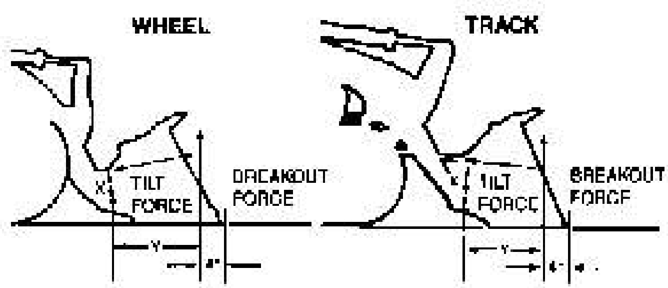
Breakout Force

"Breakout force," pounds (and kilonewtons or kilograms) — the maximum sustained vertical upward force exerted 102 mm (4.0") behind the tip of the bucket cutting edge and achieved through the ability to lift and/or rollback about the specified pivot point under the following conditions:

a. Loader on a hard level surface with transmission in neutral.
b. All brakes released.
c. Unit at standard operating weight — rear of loader not tied down.
d. Bottom of cutting edge parallel to and not more than 25.4 mm (1.0") above or below the ground line.
e. When bucket circuit is used the pivot point must be specified as the bucket hinge pin, and the unit blocked under the bucket hinge pin pivot point in order to minimize linkage movement.
f. When the lift circuit is used, the pivot point must be specified as the lift arm hinge pin. Wheel loaders shall have front axle blocked to eliminate change in position of pivot pins due to tire deflection.
g. If both circuits are used simultaneously, the dominating pivot point listed in (e) or (f) must be specified.
h. If the circuit used causes the rear of the vehicle to leave the ground, then the vertical force value required to raise the rear of the vehicle is the breakout force.
i. For irregular shaped buckets, the tip of the bucket cutting edge referred to above shall mean the farther forward point of the cutting edge.

The following are illustrations used (according to provisions of SAE J732c) to measure Caterpillar Loader breakout forces.

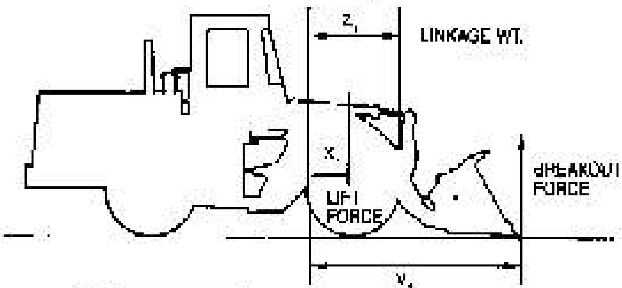
12

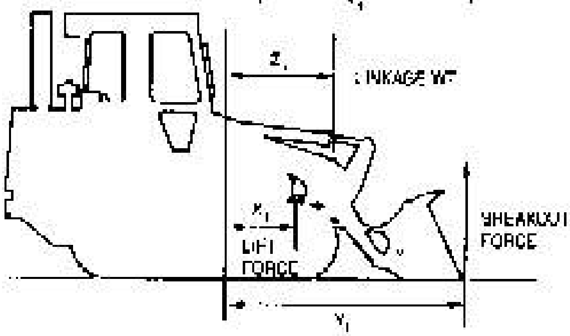


a. Breakout force resulting from rack-back:
(Tilt Force) × (Dist. "X") ÷ ("Y" Dist.) × (Breakout Force)

$$\frac{(\text{Tilt Force}) \times (\text{Dist. "X"})}{\text{"Y" Dist.}} = \text{Breakout Force}$$

b. Breakout force resulting from bucket lift:





$$(\text{Lift Force}) \times (\text{Dist. "}X_1\text{"}) = (\text{"}Y_1\text{" Dist.}) \times (\text{Breakout Force}) + (\text{Linkage Wt.}) \times (\text{Dist. "}Z_1\text{"}) + (\text{Breakout Force}) \times (\text{Linkage Mechanical Advantage}) \text{ "}V_1\text{"}$$

or

$$\text{Breakout Force} = \frac{(\text{Lift Force}) \times \text{Dist. "}X_1\text{"}) - (\text{Linkage Wt.}) \times (\text{Dist. "}Z_1\text{"})}{(\text{Dist. "}Y_1\text{"}) + (\text{Dist. "}V_1\text{"}) \times (\text{Linkage Mech. Advantage})}$$

Static Tipping Load

The minimum weight at center of gravity of "SAE Rated" load in bucket which will rotate rear of machine to a point where, on track loaders, front rollers are clear of the track and on wheel loaders, rear wheels are clear of the ground under the following conditions:

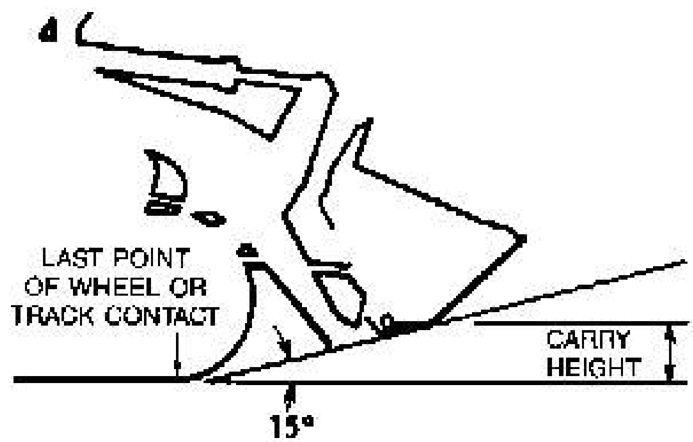
a. Loader on hard level surface and stationary.
b. Unit at standard operating weight.
c. Bucket tilted back.
d. Load at maximum forward position during raising cycle.
e. Unit with standard equipment as described in specifications unless otherwise noted under the heading.

Operating Load

In order to comply with SAE standards, the operating load of Wheel Loaders should not exceed 50% of the full turn Static Tipping load of the machine when equipped with attachments needed for the job. (For track loaders, operating load should not exceed 35% of the Static Tipping load rating.) See "Performance Data" of each machine in this handbook for increases to static tipping load by adding cab, counterweights, ripper-scarifier, etc.

Carry Position

SAE defines carry positions as: "The vertical distance from the ground to the center line of the bucket hinge pin, with the angle of approach at 15°." The sketch below illustrates this definition:



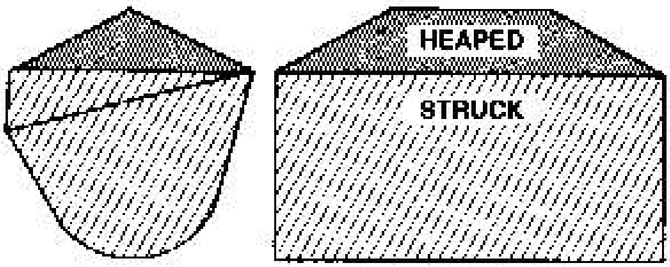
Loader Clearance Circle

SAE J732c states that "minimum turning radius (over tire)" and "loader clearance circle" should be given for wheel loaders. Both are given on Caterpillar specification sheets, including loader clearance circles for all available buckets for each machine.

Digging Depth

J732c specifies digging depth as "the vertical distance in mm (inches) from the ground line to the bottom of the bucket cutting edge at the lowest position with the bucket cutting edge horizontal."

SAE BUCKET RATING



SAE Bucket Capacities

Struck capacity is that volume contained in a bucket after a load is leveled by drawing a straight edge resting on the cutting edge and the back of the bucket.

Heaped capacity is a struck capacity *plus* that additional material that would heap on the struck load at a 2:1 angle of repose with the struck line parallel to the ground.

SAE J742 (Oct. 79) specifies that the addition of any auxiliary spill guard to protect against spillage of material which might injure the operator will not be included in bucket capacity ratings. For buckets with irregular shaped cutting edges (vee edge) the strike plane should be drawn at one-third of the distance of the protruding portion of the cutting edge. Caterpillar rock buckets are built with integral see-through rock guards. Caterpillar light material buckets come standard with bolt-on edges. These features which add to actual bucket capacity are included in published ratings.

Dump Height

SAE J732c specifies that dump height is the vertical distance from the ground to the lowest point of the cutting edge with the bucket hinge pin at maximum height and the bucket at a 45° dump angle. Dump angle is the angle in degrees that the longest flat section of the inside bottom of the bucket will rotate below horizontal.

SELECTING A MACHINE

Steps in selecting the proper size loader:

1. Determine production required or desired.
2. Determine loader cycle time and cycles per hour. A machine size must be assumed to select a basic cycle time.
3. Determine required payload per cycle in loose cubic yards and pounds (meters and kilograms).
4. Determine bucket size needed.
5. Make machine selection using bucket size and payload as criteria to meet production requirements.
6. Compare the loader cycle time used in calculations to the cycle time of the machine selected. If there is a difference, rework the process beginning at step 2.

1. Production Required

The production required of a wheel or track loader should be slightly greater than the production capability of the other critical units in the earth or material moving system. For example, if a hopper can handle 300 tons per hour, a loader capable of slightly more than 300 tons should be used. Required production should be carefully calculated so the proper machine and bucket selections can be made.

2. Loader Cycle Times

When hauling loose granular material on a hard smooth operating surface, a .45-.55 minute basic cycle time is considered reasonable for Caterpillar articulated loaders with a competent operator. This includes load, dump, four reversals of direction, full cycle of hydraulics and minimum travel.

Material type, pile height, and other factors may tend to either improve or reduce production, and should be added to or subtracted from the basic cycle time when applicable.

When hauls are involved, read the travel time portion of the cycle from the estimated travel chart (this section) for the ranges to be used for both haul and return times. Add the haul and return times to the estimated basic cycle time to obtain total cycle time.

CYCLE TIME FACTORS

A basic cycle time (Load, Dump, Maneuver) of .45-.55 minutes is average for an articulated loader [the basic cycle for large loaders, 3 m^3 (4 yd^3) and up, can be slightly longer], but variations can be anticipated in the field. The following values for many variable elements are based on normal operations. Adding or subtracting any of the variable times will give the total basic cycle time.

	Minutes added (+) or Subtracted (–) From Basic Cycle
Materials	
— Mixed	+.02
— Up to 3 mm (1/8 in)	–.02
— 3 mm (1/8 in) to 20 mm (3/4 in)	–.02
— 20 mm (3/4 in) to 150 mm (6 in)	.00
— 150 mm (6 in) and over	+.03 and Up
— Bank or broken	+.04 and Up
Pile	
Conveyor or Dozer piled 3 m (10 ft) and up	.00
— Conveyor or Dozer piled 3 m (10 ft) or less	+.01
— Dumped by truck	+.02
Miscellaneous	
— Common ownership of trucks and loaders	Up to –.04
— Independently owned trucks	Up to +.04
— Constant operation	Up to –.04
— Inconsistent operation	Up to +.04
Small target	Up to +.04
— Fragile target	Up to +.05

Using actual job conditions and the above factors, total cycle time can be estimated. Convert total cycle time to cycles per hour.

$$\textit{Cycles per hour at 100\% Efficiency} = \frac{\textit{60 min}}{\textit{Total Cycle Time in Minutes}}$$

Job efficiency is an important factor in machine selection. Efficiency is the actual number of minutes worked during an hour. Job efficiency accounts for cigarette and bathroom breaks, and other work interruptions.

$$\text{Cycles per hour at 50 minutes per hour (83\% efficiency)} = \text{Cycles per hour at 100\% efficiency} \times \frac{\text{50 min actual work time}}{\text{60 min hour}}$$

TRUCK LOADING

Average loader cycle times

910E-950E	0.45-0.50
966E-980C	0.50-0.55
988B	0.55-0.60
992D-994	0.60-0.70

3. Required Payload Per Cycle

Required payload per cycle is determined by dividing required hourly production by the number of cycles per hour.

4. Bucket Selection

After required payload per cycle has been calculated, the payload should be divided by the loose cubic yard (meter) material weight to determine number of loose cubic yards (meters) required per cycle.

The bulk of material handled does not weigh 1800 kg/m³ (3000 lb/yd³), so a reasonable knowledge of material weight is necessary for accurate production estimates. The Tables Section has average weight for certain materials when actual weights are not known.

The percentage of rated capacity a bucket carries in various materials is estimated below. The bucket size required to handle the required volume per cycle is found with the aid of the percentage of rated bucket capacity called "Bucket Fill Factor."

The bucket size needed is determined by dividing loose cubic meters (or yards) required per cycle by the bucket fill factor.

$$\textit{Bucket size} = \frac{\textit{Volume Required/Cycle}}{\textit{Bucket Fill Factor}}$$

BUCKET FILL FACTORS

The following indicates the approximate amounts of material as a percent of rated bucket capacity which will actually be delivered per bucket per cycle. This is known as "Bucket Fill Factor."

Loose Material	Fill factor
Mixed moist aggregates	95-100%
Uniform aggregates up to 3 mm (1/8 in)	95-100
3 mm (1/8 in) to 9 mm (3/8 in)	90- 95
12 mm (1/2 in) to 20 mm (3/4 in)	85- 90
24 mm (1.0 in) and over	85- 90

Blasted Rock

Well blasted	80- 95%
Average	75- 90
Poor	60 75

Other

Rock dirt mixtures	100 120%
Moist loam	100-110
Soil, boulders, roots	80-100
Cemented materials	85- 95

NOTE: Fill factors on wheel loaders are affected by bucket penetration, breakout force, rackback angle, bucket profile and ground engaging tools such as bucket teeth or bolt-on replaceable cutting edges.

Example:

12 mm (1/2 in) material and 3 m^3 (4 yd^3) bucket.
$.90 \times 3\ m^3 = 2.75$ Loose m^3 delivered per cycle.
$.90 \times 4\ yd^3 = 3.6$ Loose yd^3 delivered per cycle.

NOTE: Check the static tipping load on the specific machine to determine if bucket load is in fact a safe operating load.

Bucket Selection

$$\textit{Tons Required/Cycle} = \frac{\textit{Tons Required/Hour}}{\textit{Cycles/Hour}}$$

$$\textit{Kg (Pounds) Required/Cycle} = \textit{Tons Required/Cycle} \times 907\ kg\ (2000\ lb)$$

$$\textit{Volume Required/Cycle} = \frac{\textit{kg (Pounds)/Cycle}}{\textit{Material Weight } kg/m^3\ (lb/yd^3)}$$

Always select a machine with a greater capacity than the calculated required operating capacity. For most applications, payload above recommended and excessive counterweight can hinder machine performance and reduce dynamic stability and machine life.

For optimum performance in fast cycling situations such as truck loading, operating loads should not exceed the recommended capacity. To provide extra stability, calcium chloride ($CaCl_2$) ballast* may be desired when operating at recommended operating load, see SAE Loader rating pages in this section. For specific stability data and optional tire sizes, see the "Performance Data" pages in this section.

When selecting special application buckets, such as multi-purpose and side dump the additional bucket weight must be deducted from recommended capacity.

Specific circumstances may involve other conditions which would also affect loader capacity. Because of the greatly varied applications and conditions, your Caterpillar dealer should be contacted for guidance.

*Not recommended on 910E, an optional counterweight is available.

Example problem:

JOB CONDITIONS

Application	Truck loading
Production Required	250 metric ton (275 Tons) per hour
Material	9 mm (3/8") gravel in 6 m (20 ft) high stockpile
Density	1660 kg/m^3 (2800 lb/yd^3)

Trucks are 6-9 m^3 (8-12 yd^3) capacity and are owned by three contractors. Loading is constant. Hard level surface for loader maneuvering.

1. *PRODUCTION REQUIRED:* Given
2. *CYCLE TIME:* Assume loader size between 910E and 950F for initial choice of basic cycle.

   (Refer to Cycle Time Factors in this section)

Basic Cycle	.50 min
Material	−.02 min
Independent trucks	+.04 min
Constant operation	−.02 min
Total Cycle	.50 min

   Note: Load and carry times not required in total cycle.

   $$\text{Cycles/hr at 83\% efficiency} = 120\ \text{cycles/hr} \times \frac{50\ \text{min actual work time}}{60\ \text{min per hr}} = 100\ \text{cycles/hr}$$

3. *VOLUME REQUIRED PER CYCLE*
   (Density in tons)
   Density in this example was given. When not given, refer to Tables Section to obtain an estimated density for the material being handled.

   $$\textit{Metric: } \frac{1660\ kg/m^3}{1000\ kg/ton} = 1.66\ ton/m^3$$

   $$\textit{English: } \frac{2800\ lb/yd^3}{2000\ lb/ton} = 1.4\ tons/yd^3$$

Production Rate Required

Metric: $\dfrac{250 \text{ tons/hr}}{1.66 \text{ tons/m}^3} = 150 \text{ m}^3\text{/hr}$

English: $\dfrac{275 \text{ tons/hr}}{1.4 \text{ tons/yd}^3} = 196 \text{ yd}^3\text{/hr}$

Volume Required per Cycle

Metric: $\dfrac{150 \text{ m}^3\text{/hr}}{100 \text{ cycles/hr}} = 1.50 \text{ m}^3\text{/cycle}$

English: $\dfrac{196 \text{ yd}^3\text{/hr}}{100 \text{ cycles/hr}} = 1.96 \text{ yd}^3\text{/cycle}$

4. *DETERMINE BUCKET SIZE*

BUCKET FILL FACTOR

The volume of material required per cycle has been determined. Because of varying material fill factors, buckets do not always carry their rated load, a larger capacity bucket may be needed to carry the volume required. For fill factors, refer to Bucket Fill Factor Chart in this section.

Rated Bucket Capacity Required (Heaped)

$\dfrac{1.50 \text{ m}^3\text{/cycle}}{.95 \text{ fill factor}} \quad 1.58 \text{ m}^3$

$\dfrac{1.96 \text{ yd}^3\text{/cycle}}{.95 \text{ fill factor}} \quad 2.06 \text{ yd}^3$

A 1.7 m^3 (2.25 yd^3) bucket would provide the required capacity.

5. *MACHINE SELECTION*

The bucket size required and material density lead to the choice of a 926E with a 1.7 m^3 (2.25 yd^3) General Purpose Bucket (see bucket selection guide pages which follow.)

Finally, SAE payload criteria must be satisfied as follows:

The required operating capacity must not exceed one-half of the full turn static tipping load of the loader as equipped with a specific bucket.

The required operating capacity of the machine is determined by the volume the machine will carry per load times the density.

$1.7 \text{ m}^3 \times 1660 \text{ kg/m}^3 = 2822 \text{ kg}$
$(2.25 \text{ yd}^3 \times 2800 \text{ lb/yd}^3 = 6300 \text{ lb})$

One half of full turn static tipping load for the 926E with a 1.7 m^3 (2.25 yd^3) General Purpose Bucket is 3035 kg (6692 lb). SAE criteria is satisfied.

• • •

An Alternative Method of Machine Selection

Another method of selecting the right Wheel Loader and bucket to meet production requirements is by use of the nomographs on the following pages. The method is quicker and easier than the preceding example because it does not require as many calculations, yet the accuracy is about the same within the normal limits of input data.

Be careful when entering and reading data from the nomographs because some scales increase from bottom to top, while others are the reverse. Do not be overly concerned with the precision as affected by pencil line width or reading to the hundredth of a m^3 (yd^3). Remember that bucket fill factor, material density, and cycle time are at best close estimates.

Example problem:

A Wheel Loader must produce 230 m^3 (300 yd^3) per hour in a truck loading application. Estimated cycle time is .6 minutes, working 45 minutes per hour. Bucket fill factor is 95% and material density is 1780 kg/m^3 (3000 lb/yd^3).

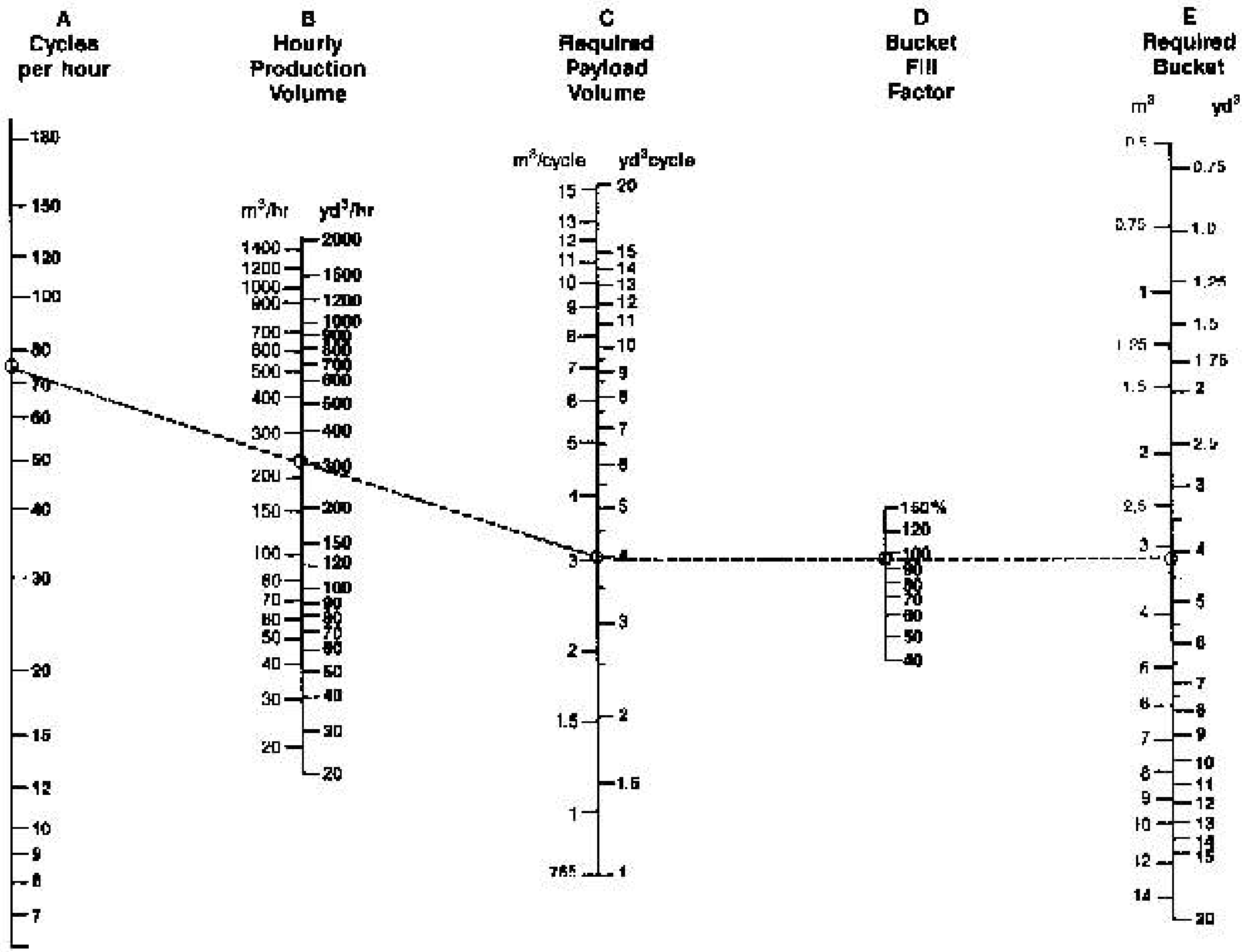
Determine bucket size and machine model.

Solution:

At full efficiency, the Wheel Loader will cycle 100 times per hour. Since only an average of 45 minutes are available, only 75 cycles will be completed.

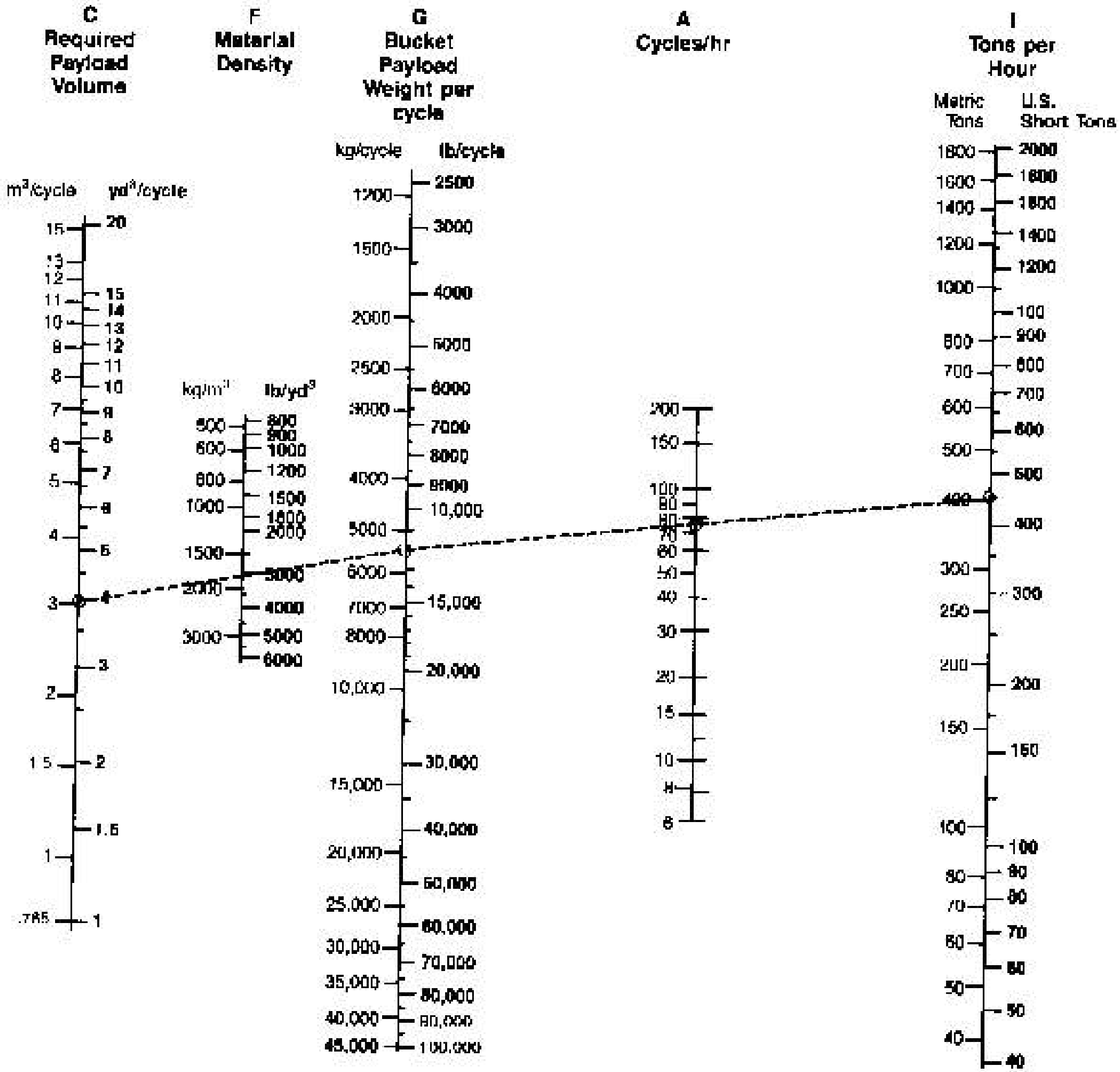
Starting on Scale A at 75 cycles per hour draw a straight line intersecting 230 m^3/hr (300 yd^3/hr) on Scale B and extending it on to Scale C giving 3 m^3/cycle (4 yd^3/cycle) required payload. Follow solution steps 1 10.

1. Enter required hourly production on Scale B 230 m³/hr (300 yd³/hr).
2. Enter cycles per hour on Scale A (60 ÷ .6 = 100 × .75 = 75 cycles/hr).
3. Connect A thru B to C. This shows a required payload of 3 m³ (4 yd³) per cycle.
4. Enter estimated bucket fill factor on Scale D (0.95).
5. Connect C thru Scale D to E for required bucket size 3 m³ (4 yd³).
6. Transfer cycles per hour Scale A and required payload Scale C to the following page.

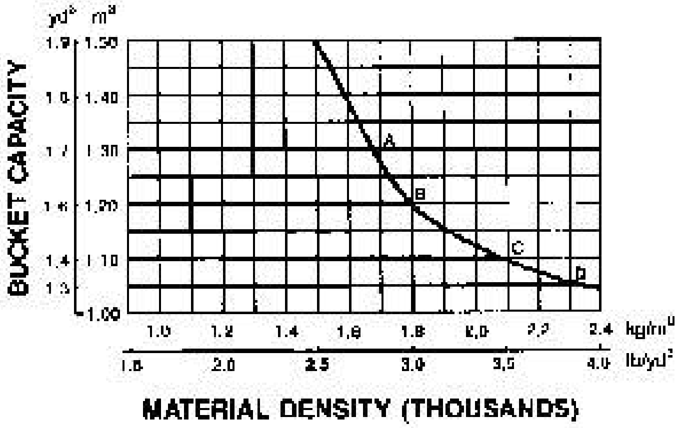


12

7. Enter material density on Scale F 1780 kg/m³ (3000 lb/yd³).
8. Connect C thru Scale F to Scale G to give payload weight per cycle 5300 kg (11,500 lb).
9. Compare Scale C quantity 5300 kg (11,500 lb) with recommended machine working range listed on the following bucket selection pages. Operating capacity for the 966F with 3.1 m³ (4 yd³) bucket is dependent on material density and bucket capacity (see bucket selection pages that follow.)
10. For hourly tonnage, draw a straight line from Scale G thru Scale A to Scale I 400 metric tons (450 U.S. tons).



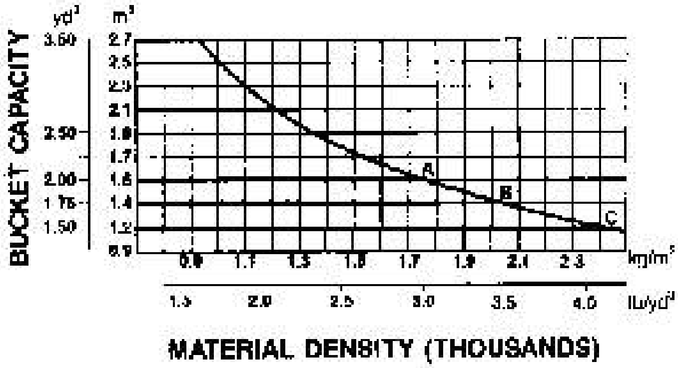
910E



KEY

A — 1.3 m³ (1.7 yd³) General Purpose Bucket, bolt-on edge
B — 1.2 m³ (1.6 yd³) General Purpose Bucket, bolt-on teeth.
1.2 m³ (1.6 yd³) Penetration Bucket, weld-on, flush-mounted teeth
C — 1.1 m³ (1.4 yd³) General Purpose Bucket, bolt-on teeth and segments.
1.1 m³ (1.4 yd³) General Bucket, bolt-on edge.
D — 1.0 m³ (1.3 yd³) General Purpose Bucket, bolt-on teeth.

916

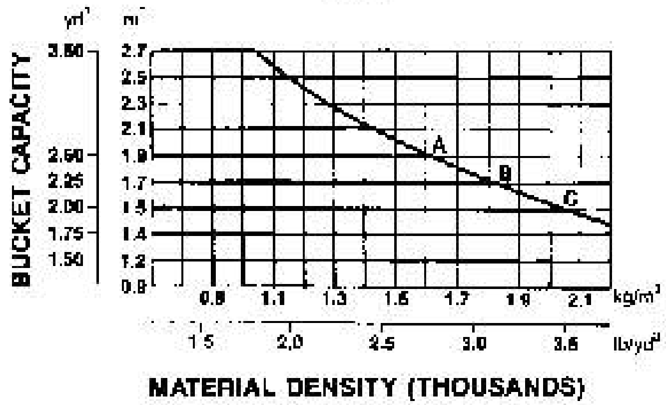


KEY

A — 1.5 m³ (2.00 yd³) General Purpose Bucket, bolt-on edge
B — 1.4 m³ (1.75 yd³) General Purpose Bucket, bolt-on teeth
1.4 m³ (1.75 yd³) General Purpose Penetration Bucket, weld-on, flush mounted teeth
1.4 m³ (1.75 yd³) General Purpose Bucket, bolt-on edge
1.4 m³ (1.75 yd³) General Purpose Bucket, bolt-on teeth and segments
C — 1.2 m³ (1.5 yd³) General Purpose Bucket, bolt-on teeth

12

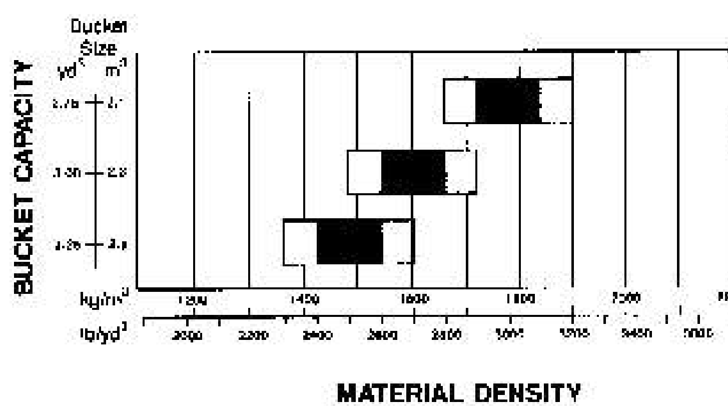
926E



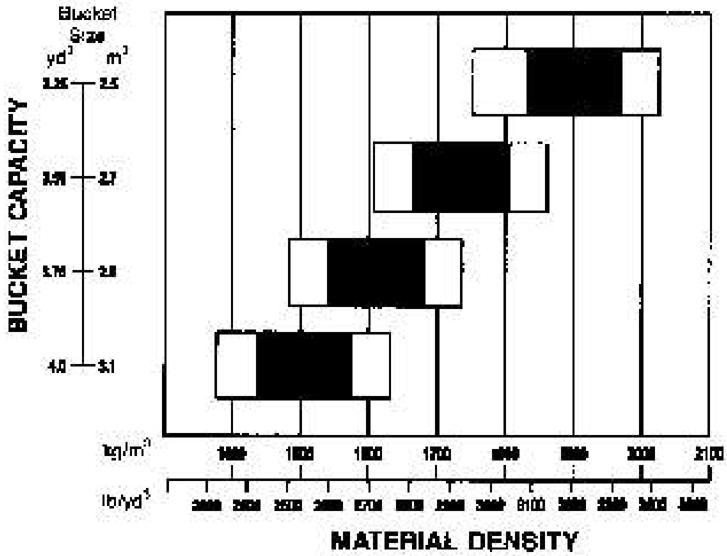
KEY

A — 1.9 m³ (2.50 yd³) General Purpose Bucket, bolt-on edge
B — 1.7 m³ (2.25 yd³) General Purpose Penetration Bucket, weld-on, flush mounted teeth
1.7 m³ (2.25 yd³) General Purpose Bucket, bolt-on edge
1.7 m³ (2.25 yd³) General Purpose Bucket, bolt-on teeth and segments
1.7 m³ (2.25 yd³) General Purpose Bucket, bolt-on teeth
C — 1.5 m³ (2.0 yd³) General Purpose Bucket, bolt-on teeth

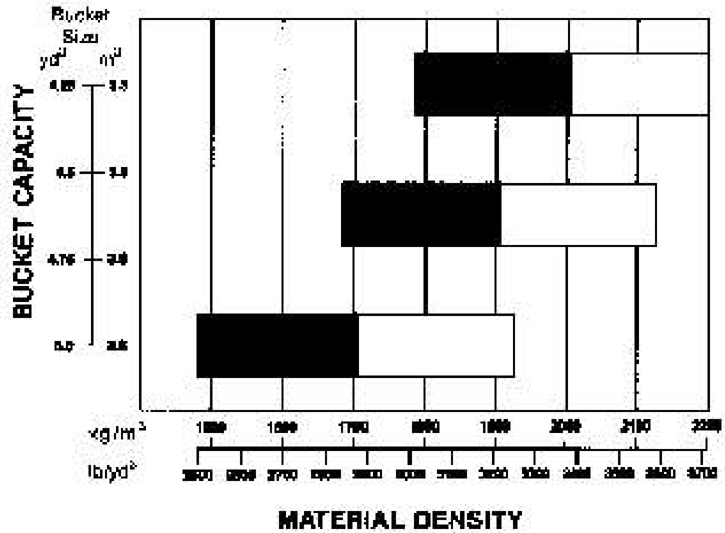
936F



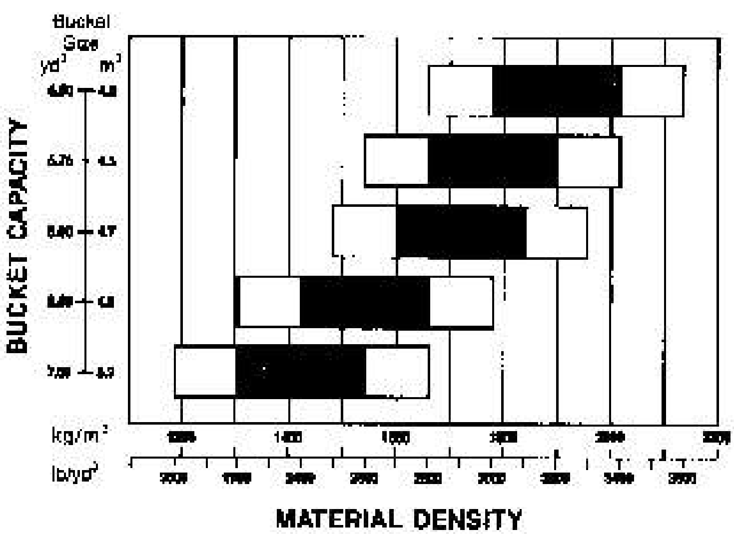
950F



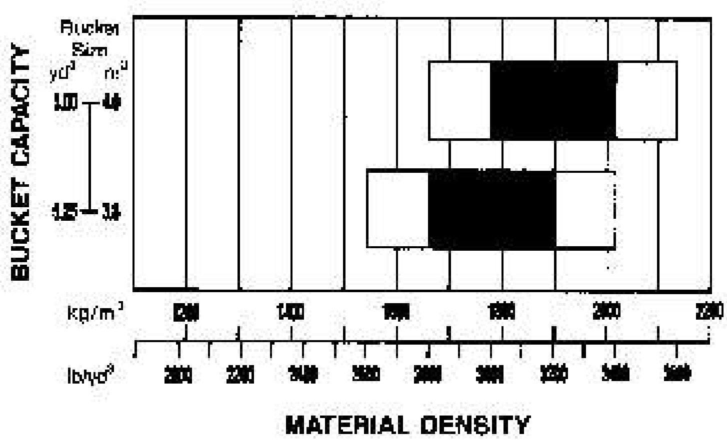
966F



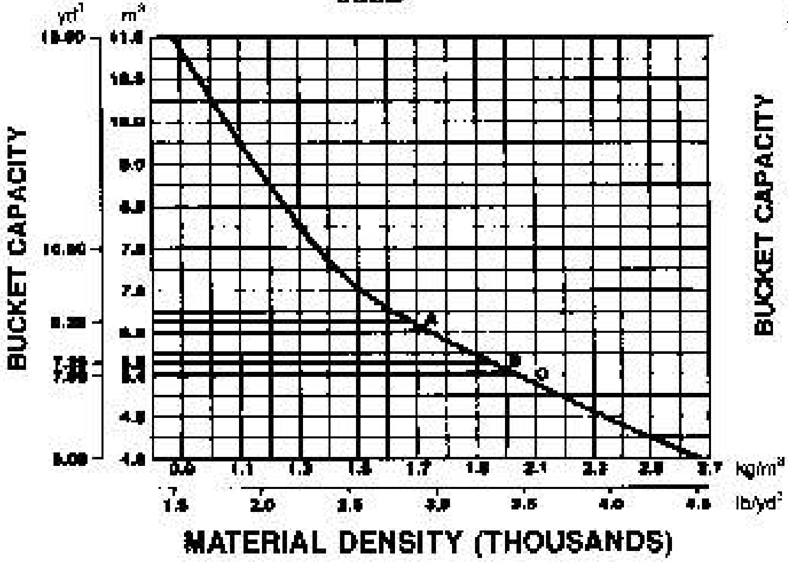
980F



980F High Lift



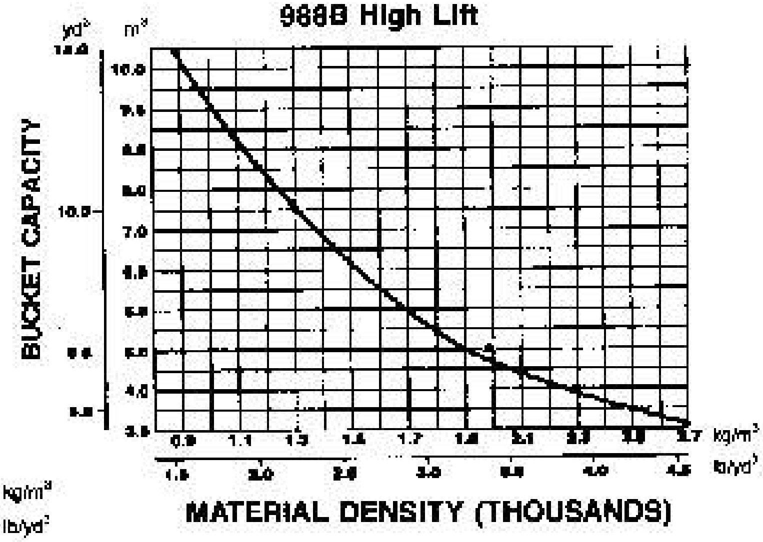
988B



KEY

A — 6.3 m³ (8.25 yd³) General Purpose Bucket bolt-on edge
6.0 m³ (8.00 yd³) General Purpose Bucket with teeth
B — 5.5 m³ (7.25 yd³) Rock Bucket Spade edge with Modulok
5.5 m³ (7.25 yd³) Rock Bucket Spade edge with teeth and segments
C 5.4 m³ (7.0 yd³) Rock Bucket Spade edge with teeth
5.4 m³ (7.0 yd³) Rock Bucket Spade edge without teeth
5.4 m³ (7.0 yd³) Rock Bucket straight edge with teeth
5.4 m³ (7.0 yd³) Rock Bucket straight edge without teeth

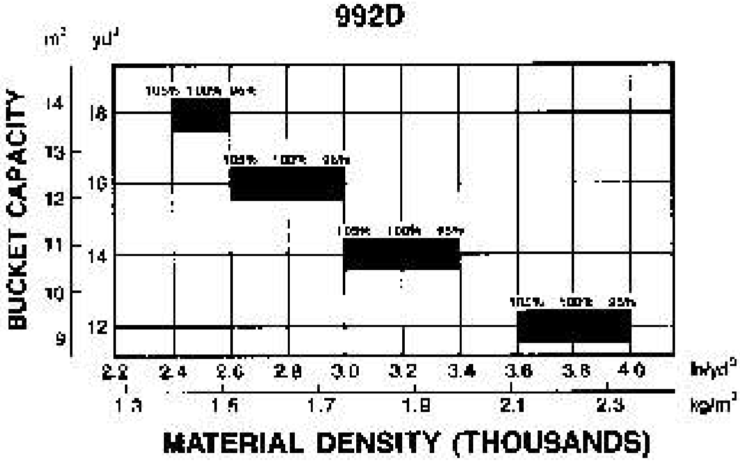
988B High Lift



KEY

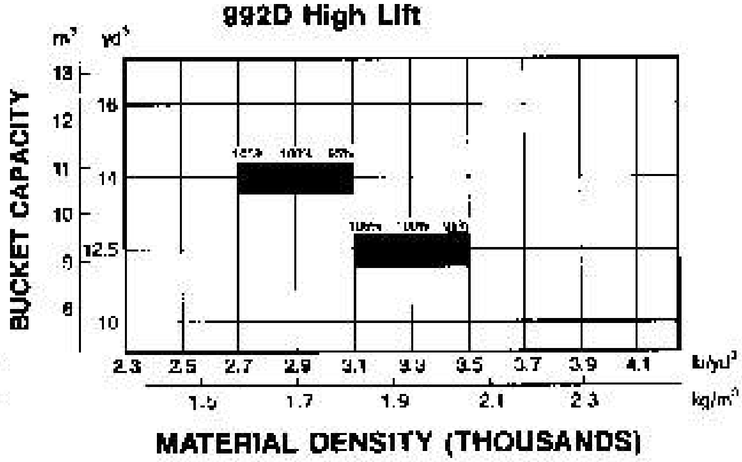
A 5.0 m³ (6.5 yd³) Rock Bucket Spade Edge with teeth
5.0 m³ (6.5 yd³) Rock Bucket Straight Edge with teeth
5.0 m³ (6.5 yd³) Rock Bucket Straight Edge without teeth

992D



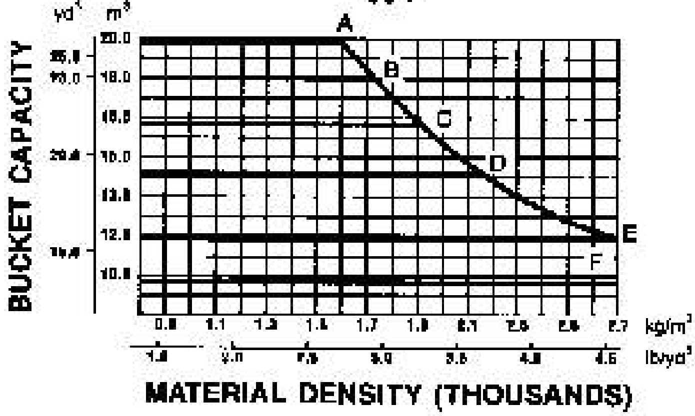
NOTE: Percentages shown represent bucket fill factors.

992D High Lift

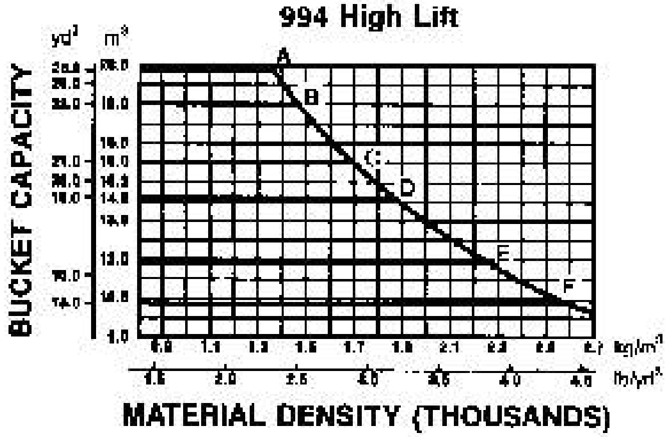


NOTE: Percentages shown represent bucket fill factors.

994



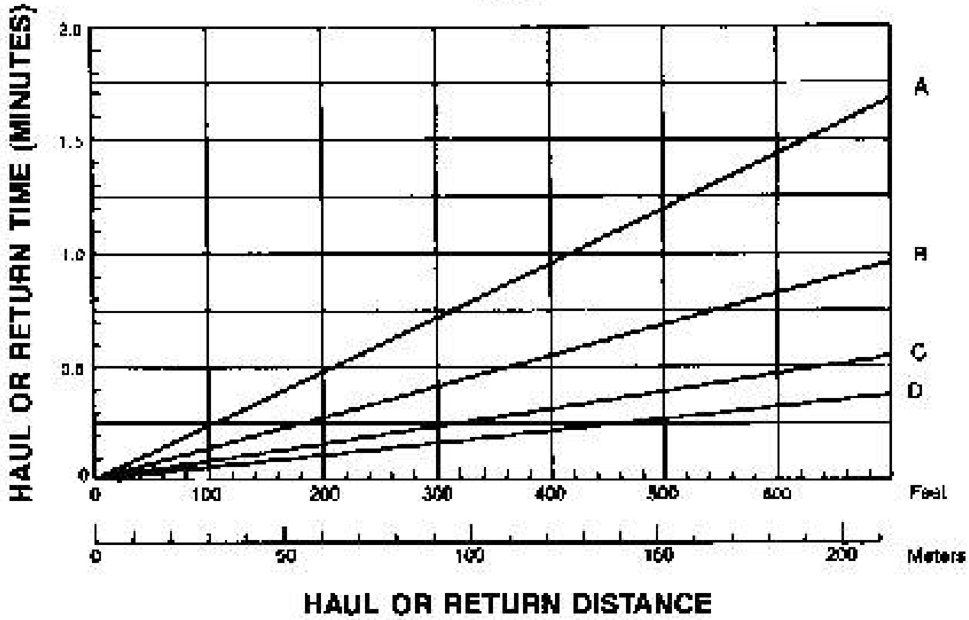
994 High Lift



KEY

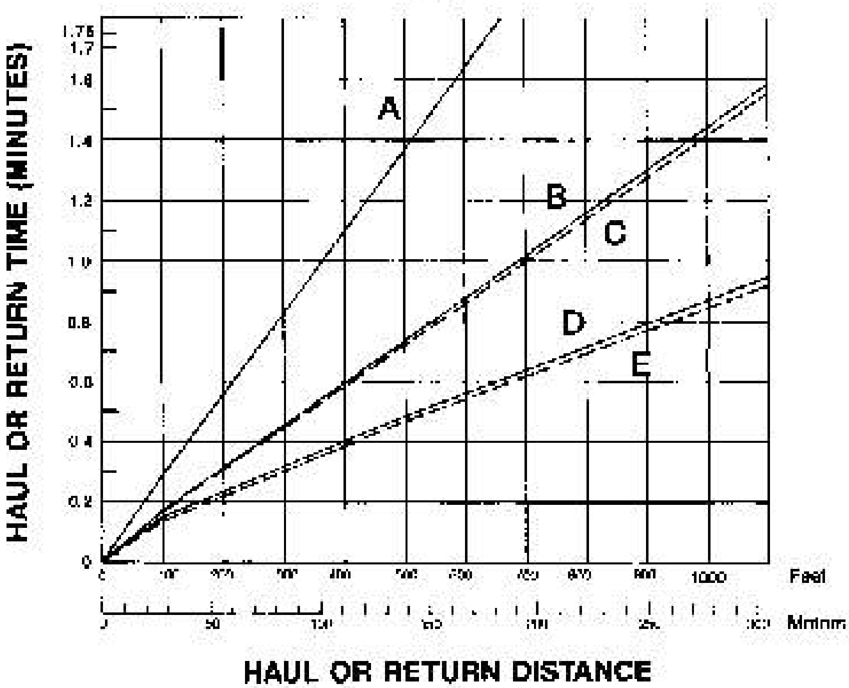
A — 20.0 m³ (26.0 yd³) Rock Bucket Spade edge with teeth
B — 18.0 m³ (23.0 yd³) Rock Bucket Spade edge with teeth
C — 16.0 m³ (21.0 yd³) Rock Bucket Spade edge with teeth and segments
D — 14.0 m³ (18.0 yd³) Rock Bucket Spade edge with teeth and segments
E — 10.0 m³ (13.0 yd³) General Purpose Bucket Spade edge with teeth

910E



KEY
A — 1st Forward & Reverse Speed
B — 2nd Forward & Reverse Speed
C — 3rd Forward & Reverse Speed
D — 4th Forward & Reverse Speed

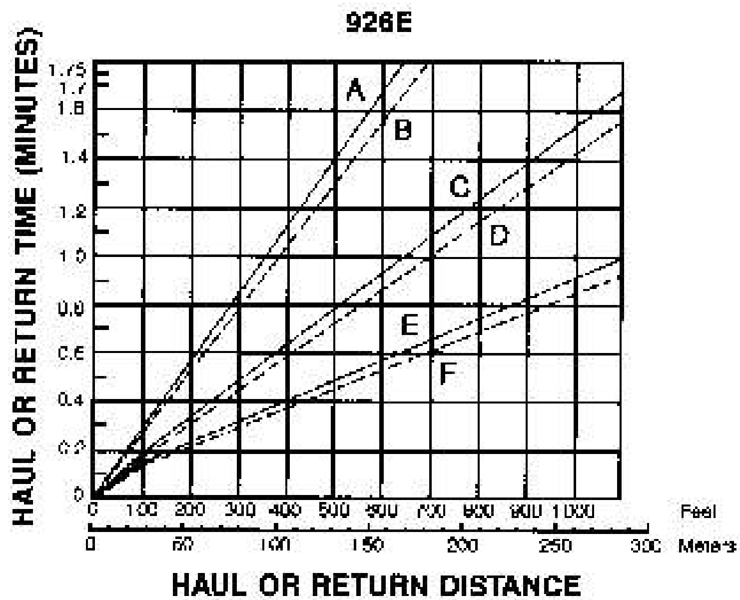
916

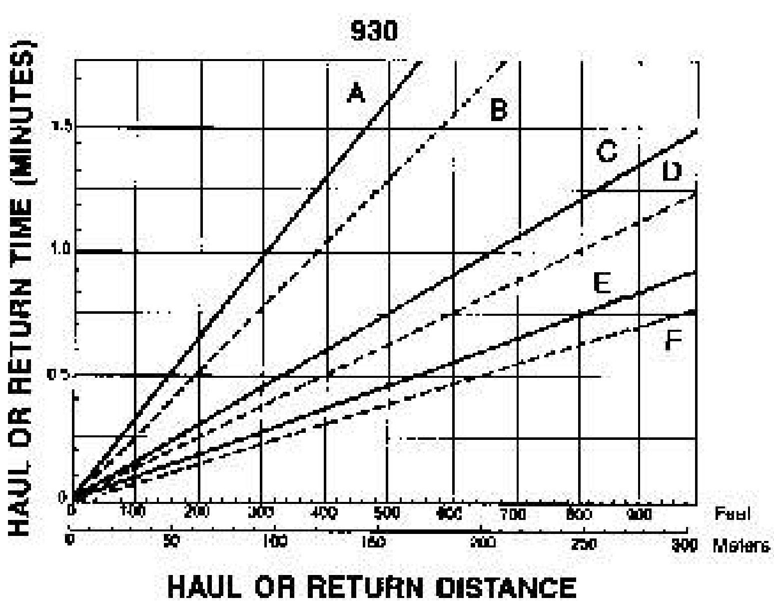


NOTE: Loader maneuver, load and dump time must be added to travel time to arrive at cycle time.

KEY
A — 1st Forward Speed
B — 2nd Forward Speed
C — 2nd Reverse Speed
D — 3rd Forward Speed
E — 3rd Reverse Speed

Estimated Haul or Return Time Charts
• 926E • 930

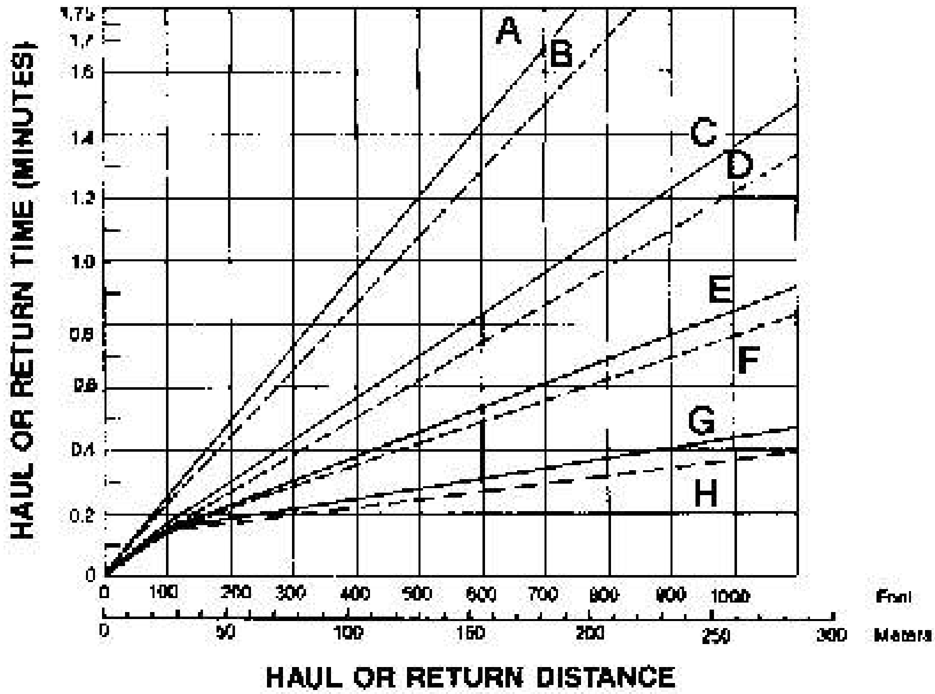




Loader maneuver, load and dump time must be added to travel time to arrive at cycle time. 4th gear curve not indicated; primarily used for transporting machine.

KEY
A — 1st Forward Speed
B — 1st Reverse Speed
C — 2nd Forward Speed
D — 2nd Reverse Speed
E — 3rd Forward Speed
F — 3rd Reverse Speed

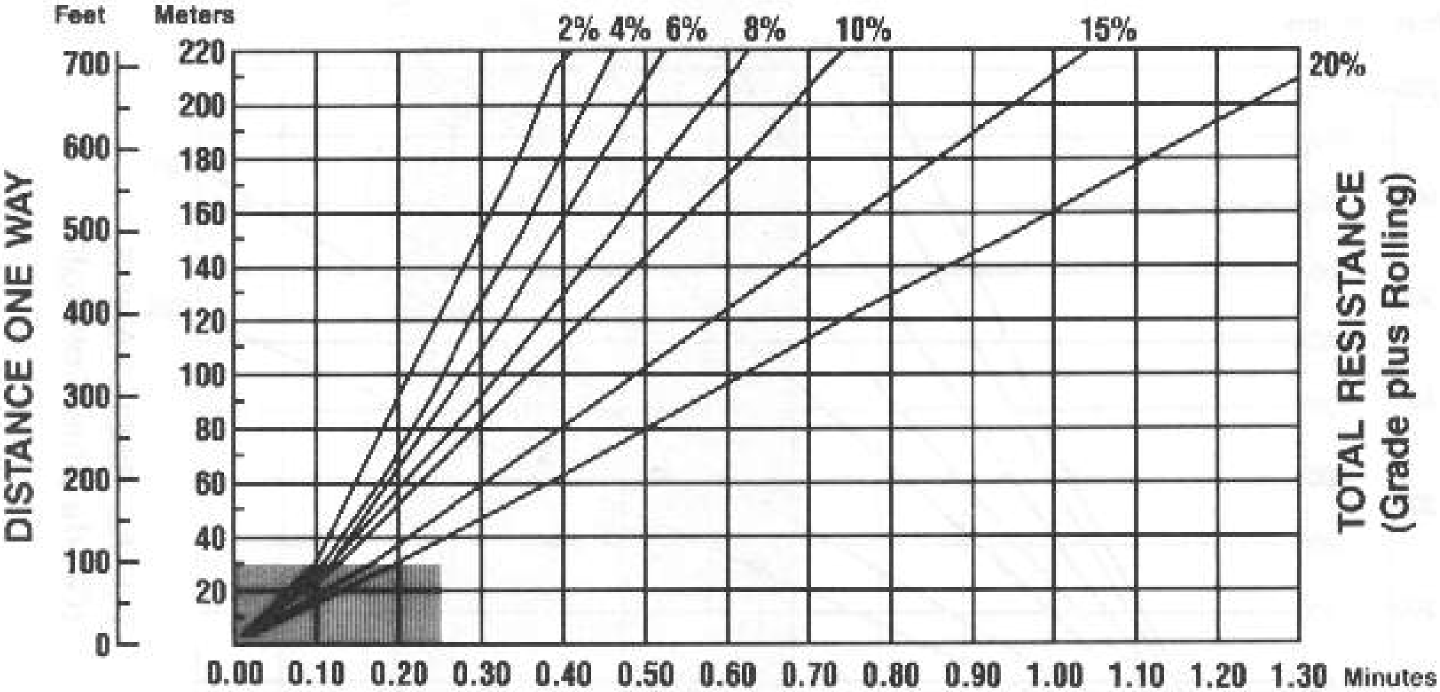
936F

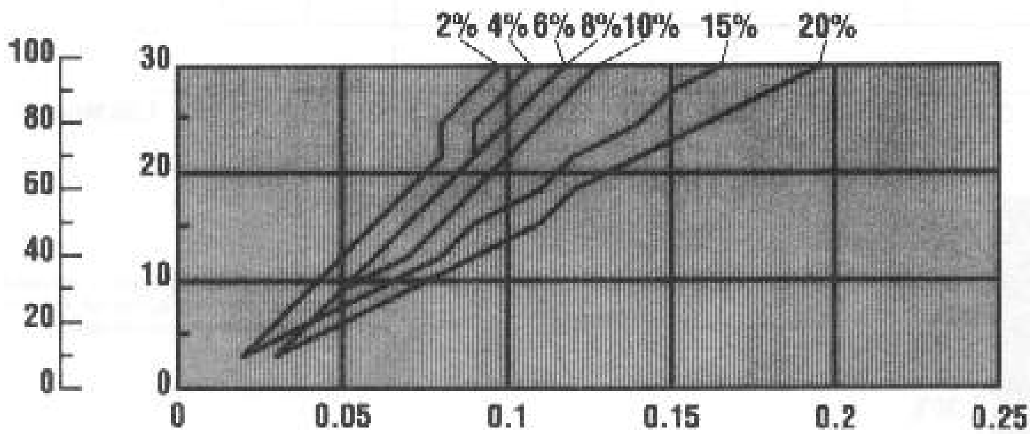


Key

A — 1st Forward Speed
B — 1st Reverse Speed
C — 2nd Forward Speed
D — 2nd Reverse Speed
E — 3rd Forward Speed
F — 3rd Reverse Speed
G — 4th Forward Speed
H — 4th Reverse Speed

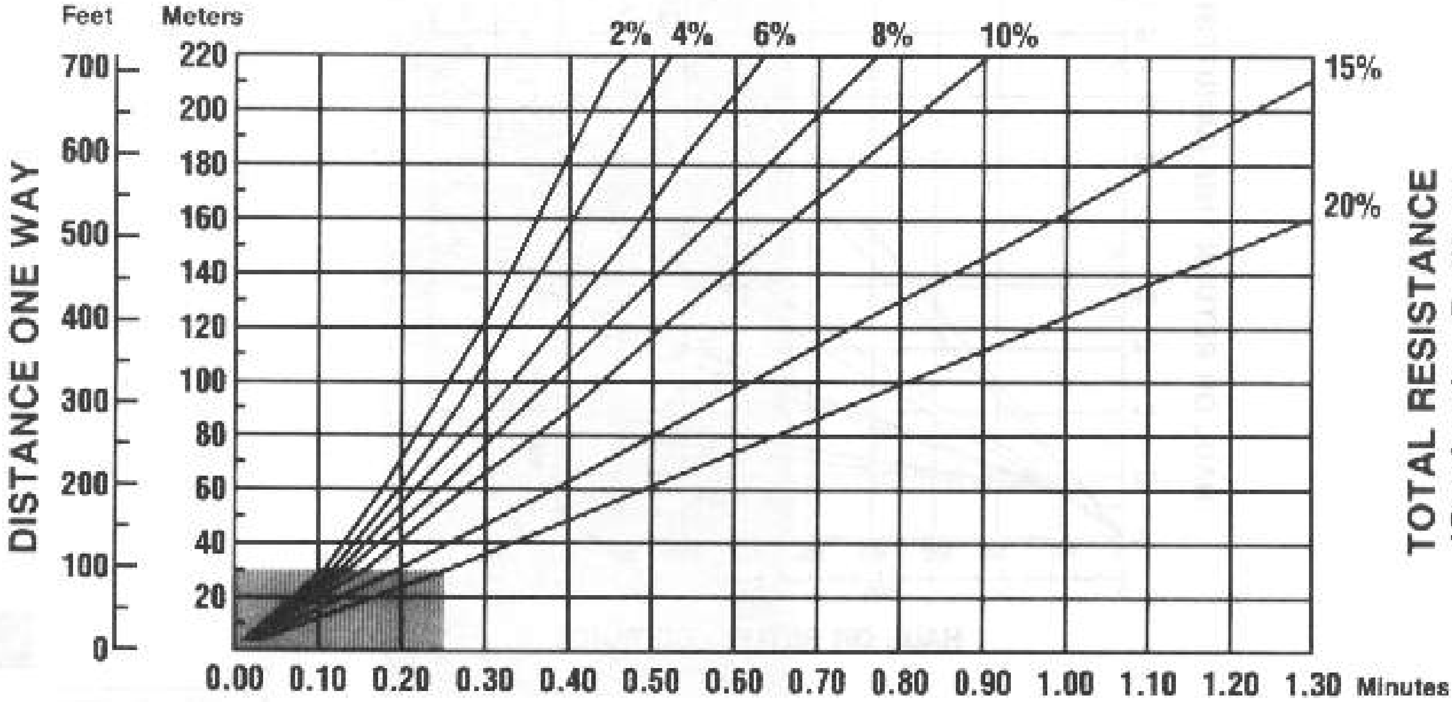
950F TRAVEL TIME — EMPTY

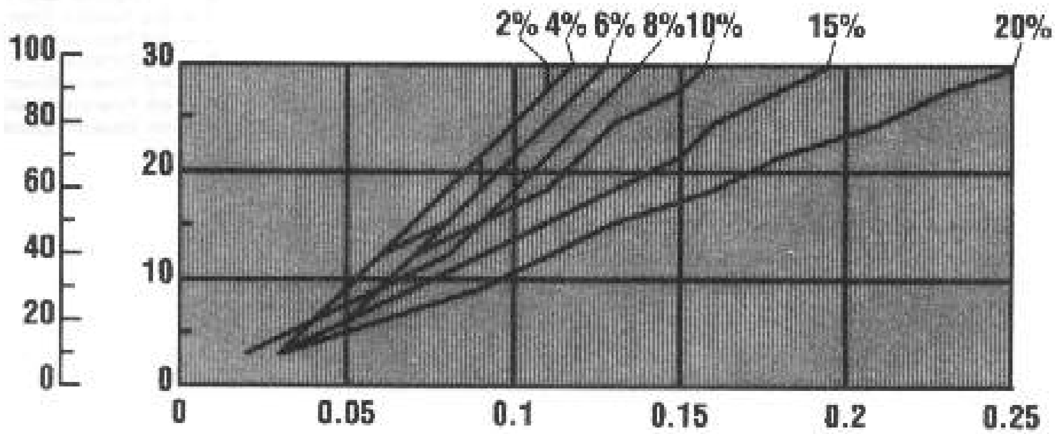




NOTE: Curves assume use of highest operating speed attainable: 4th gear for 2%-6% TR, 3rd gear for 8%-10% TR, 2nd gear for 15% TR and 1st gear for 20% TR.

950F TRAVEL TIME — LOADED

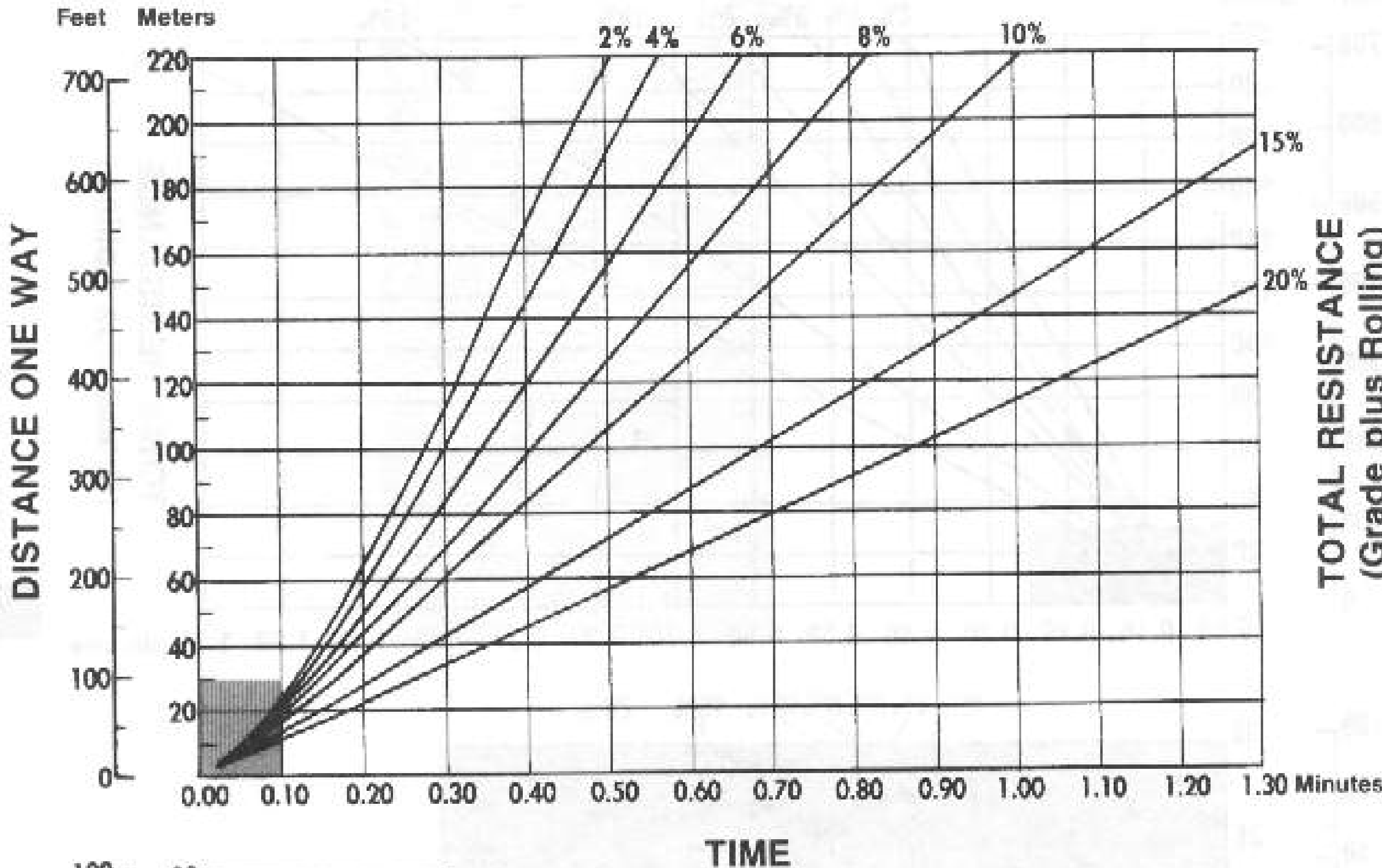


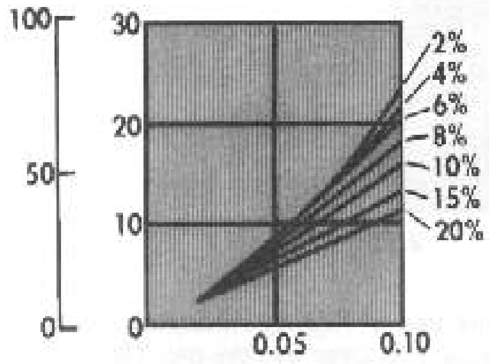


NOTE: Curves assume use of highest operating speed attainable: 4th gear for 2%-6% TR, 3rd gear for 8%-10% TR, 2nd gear for 15% TR and 1st gear for 20% TR.

In load-and-carry applications it is important to consult the tire manufacturer on Ton-MPH ratings and pressure recommendations.

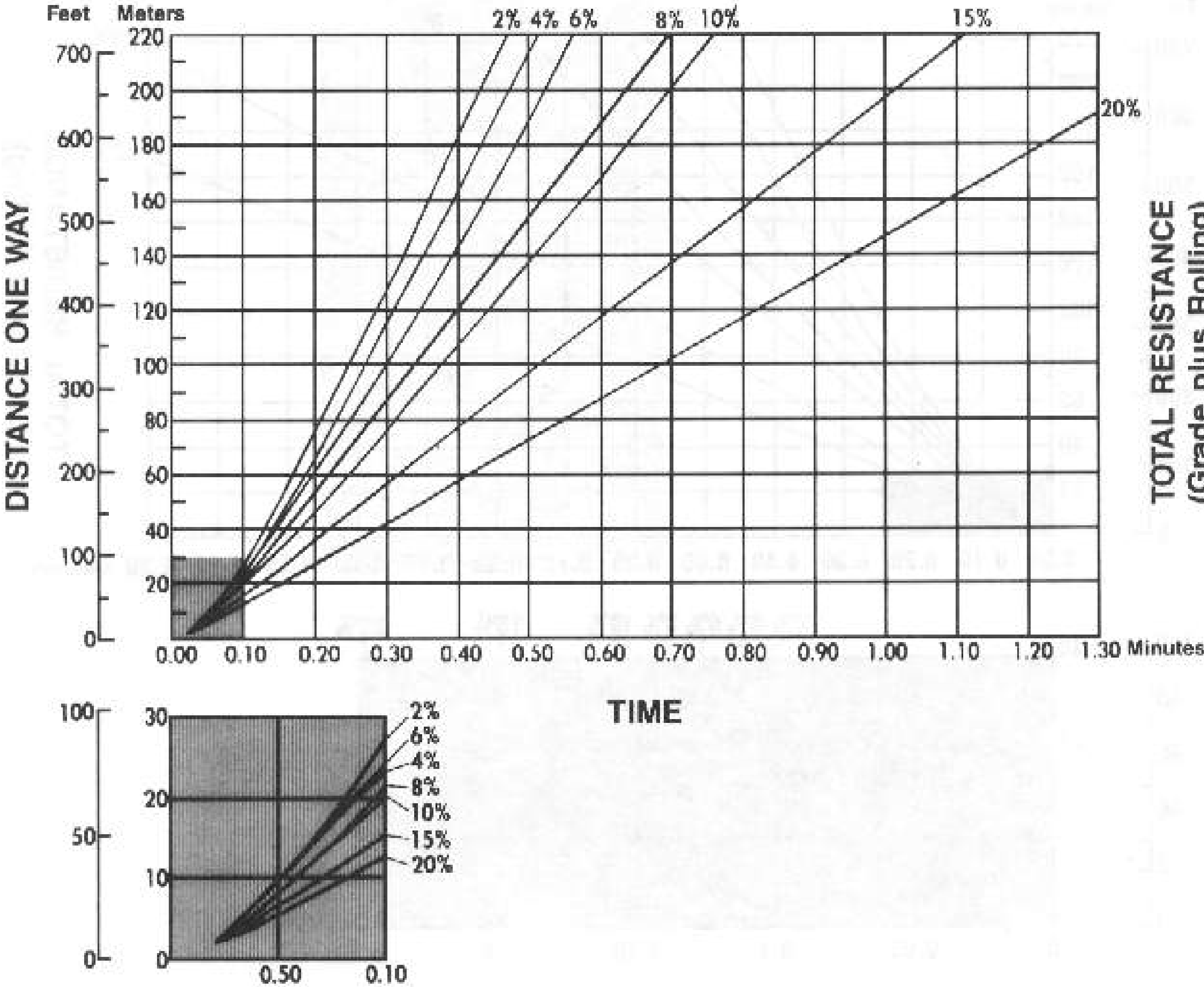
966C TRAVEL TIME — LOADED



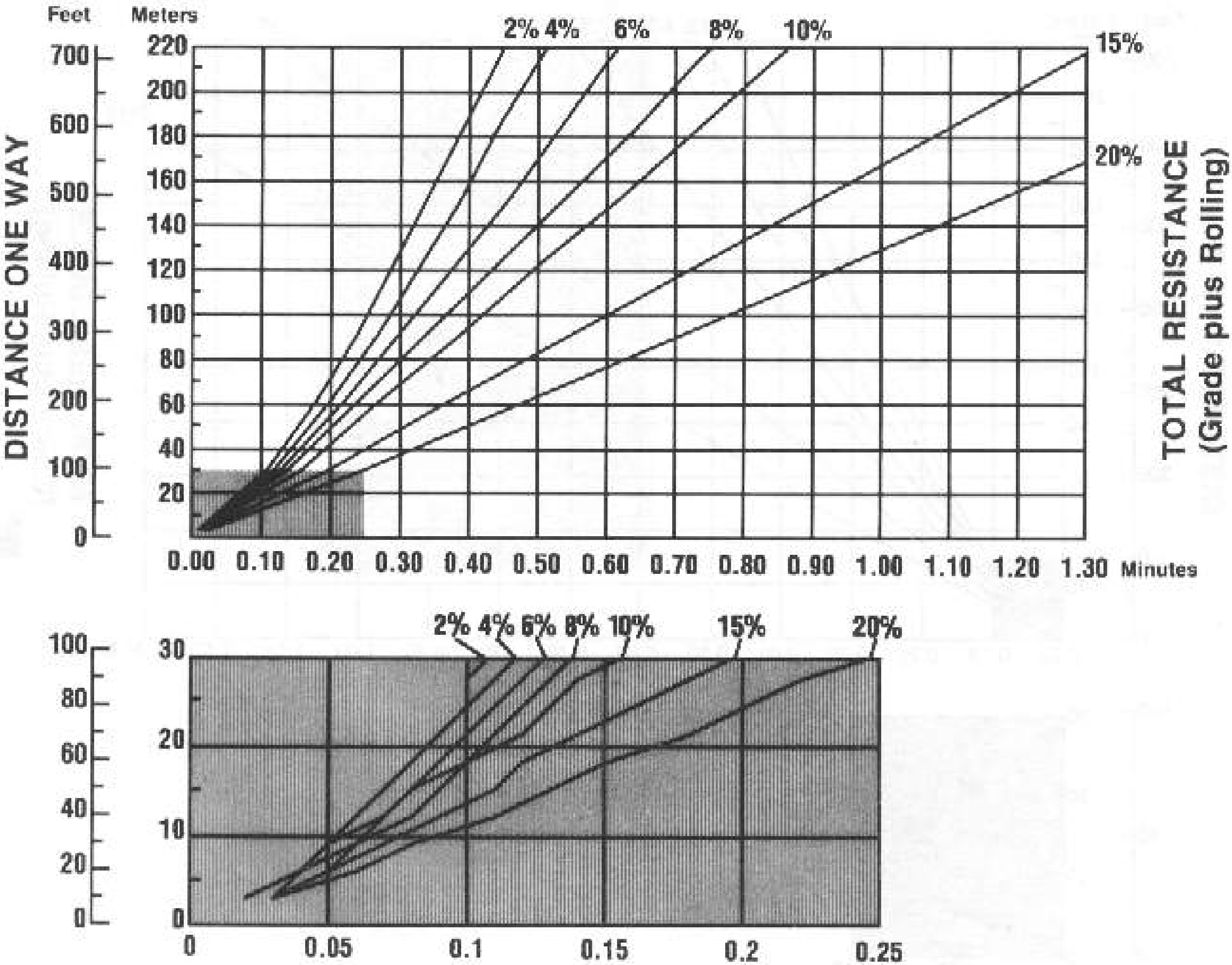


In load-and-carry applications it is important to consult the tire manufacturer on Ton-MPH ratings and pressure recommendations.

966C TRAVEL TIME — EMPTY

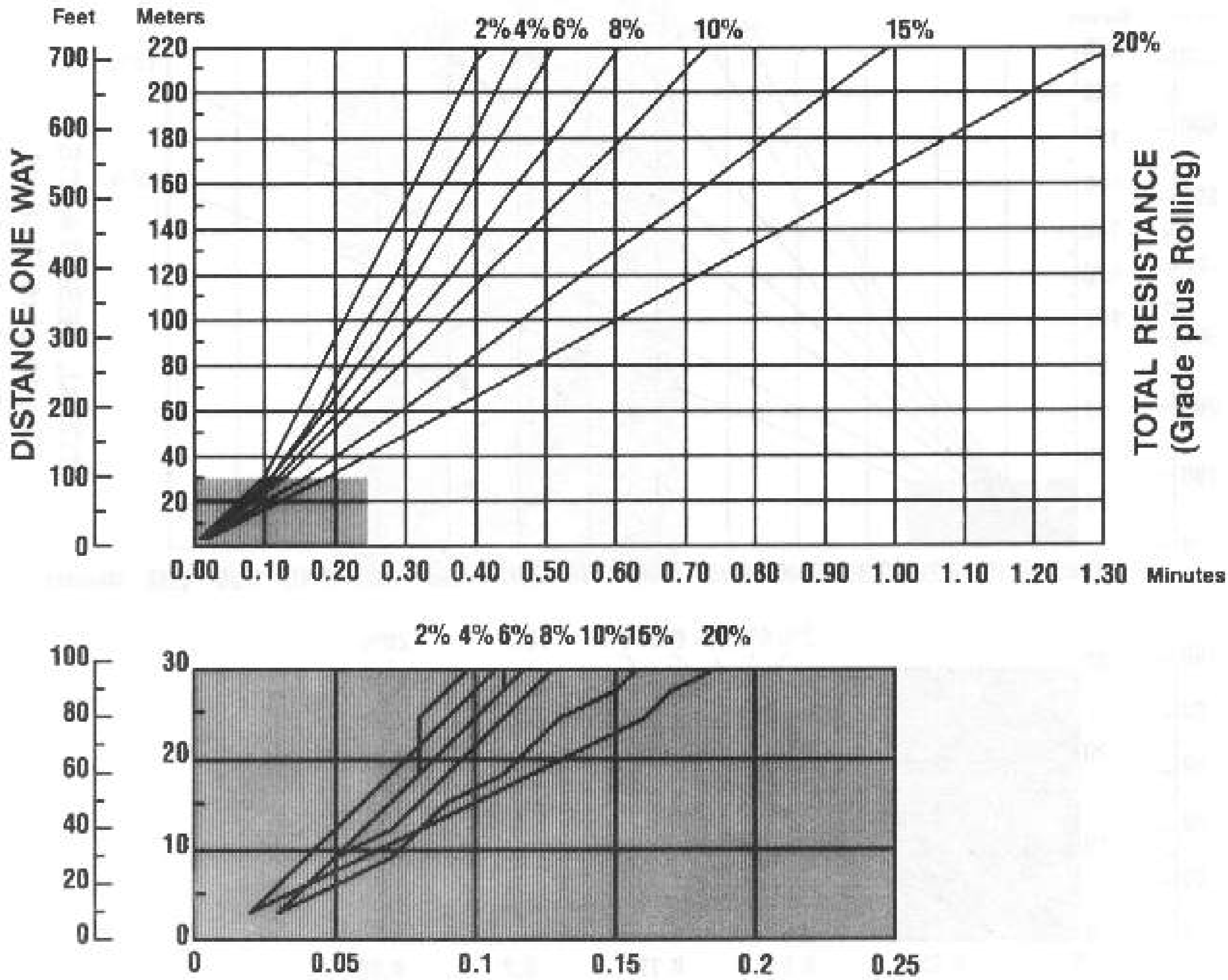


966F TRAVEL TIME — LOADED



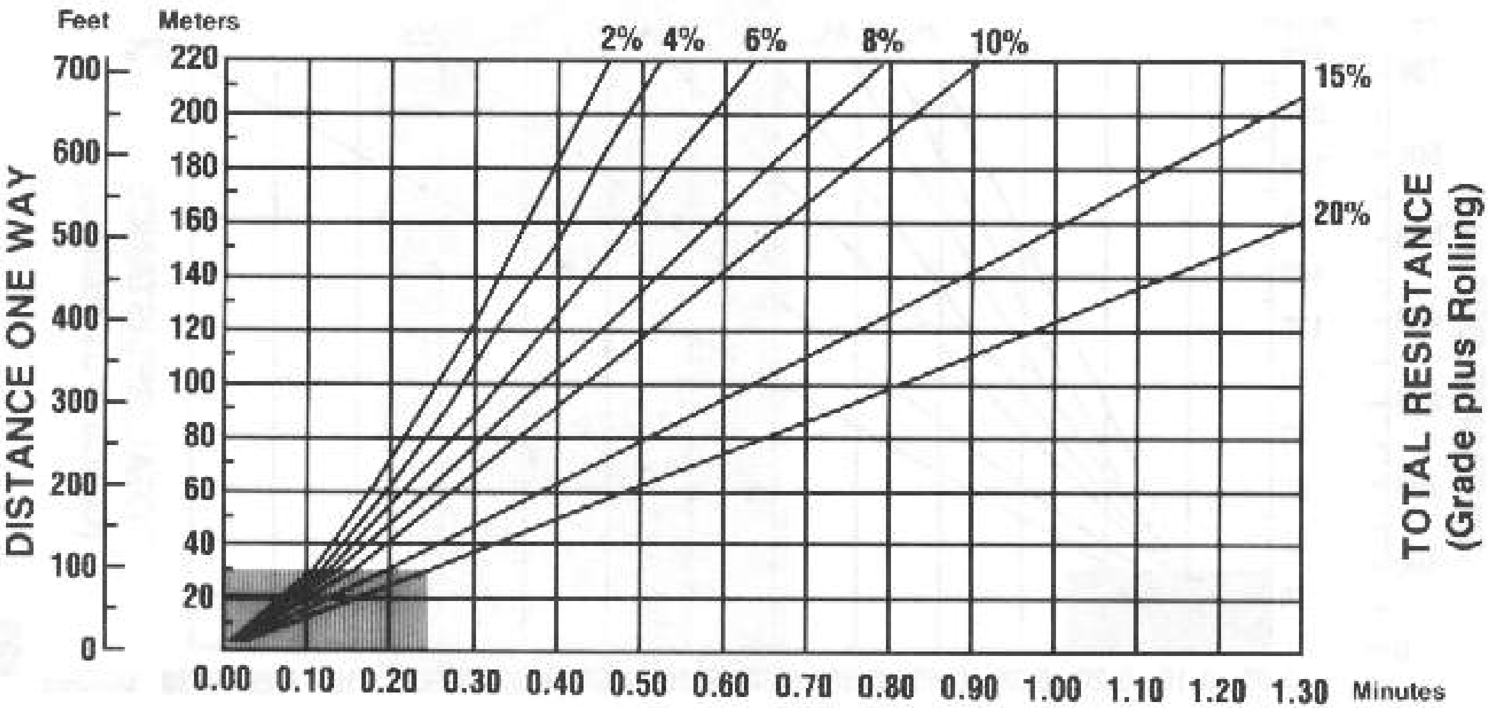
NOTE: Curves assume use of highest operating speed attainable: 4th gear for 2%-6% TR, 3rd gear for 8%-10% TR, 2nd gear for 15% TR and 1st gear for 20% TR.

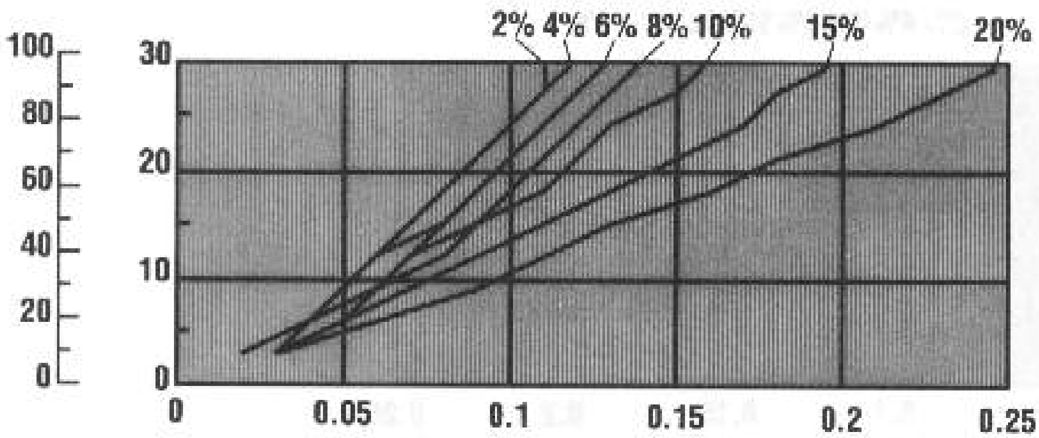
966F TRAVEL TIME — EMPTY



NOTE: Curves assume use of highest operating speed attainable: 4th gear for 2%-6% TR, 3rd gear for 8%-10% TR, 2nd gear for 15% TR and 1st gear for 20% TR.

980F TRAVEL TIME — LOADED

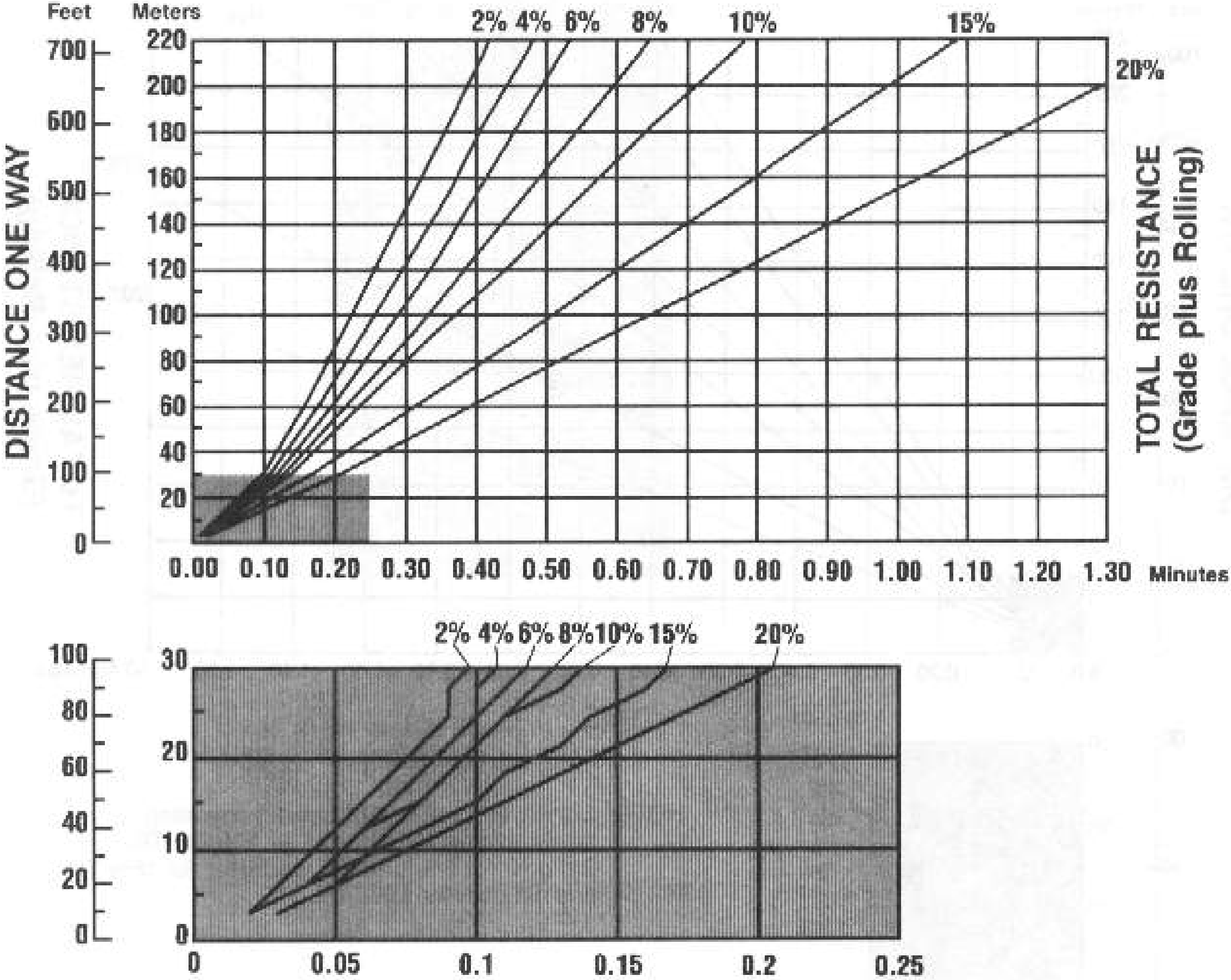




NOTE: Curves assume use of highest operating speed attainable: 4th gear for 2%-6% TR, 3rd gear for 8%-10% TR, 2nd gear for 15% TR and 1st gear for 20% TR.

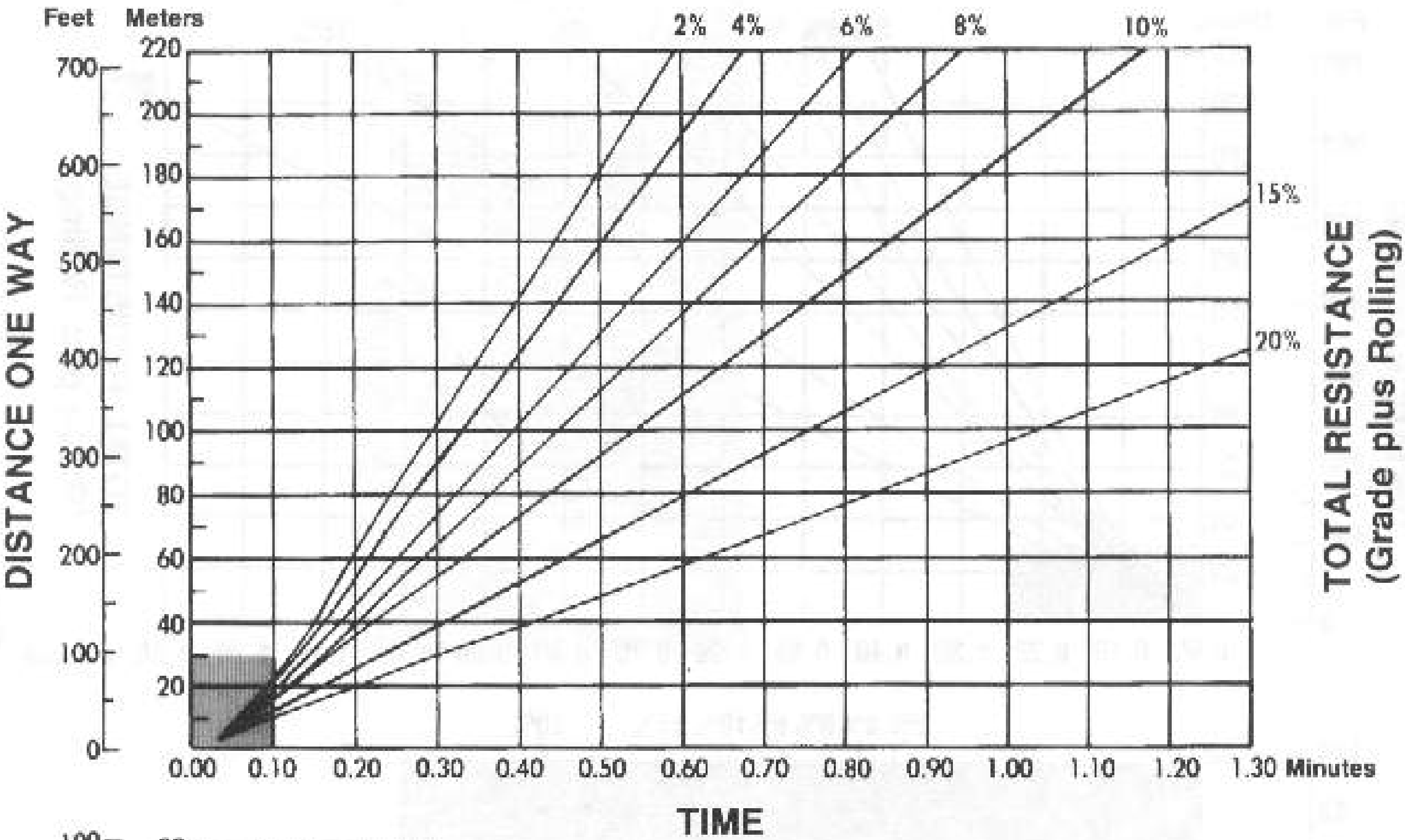
In load-and-carry applications it is important to consult the tire manufacturer on Ton-MPH ratings and pressure recommendations.

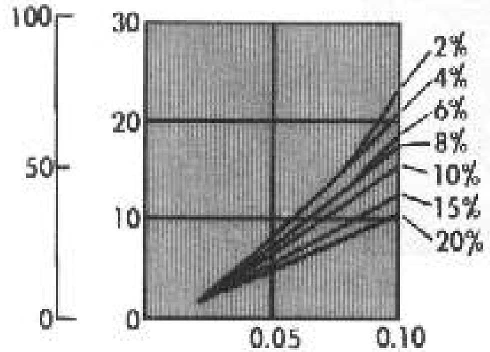
980F TRAVEL TIME — EMPTY



NOTE: Curves assume use of highest operating speed attainable: 4th gear for 2%-6% TR, 3rd gear for 8%-10% TR, 2nd gear for 15% TR and 1st gear for 20% TR.

988B TRAVEL TIME — LOADED

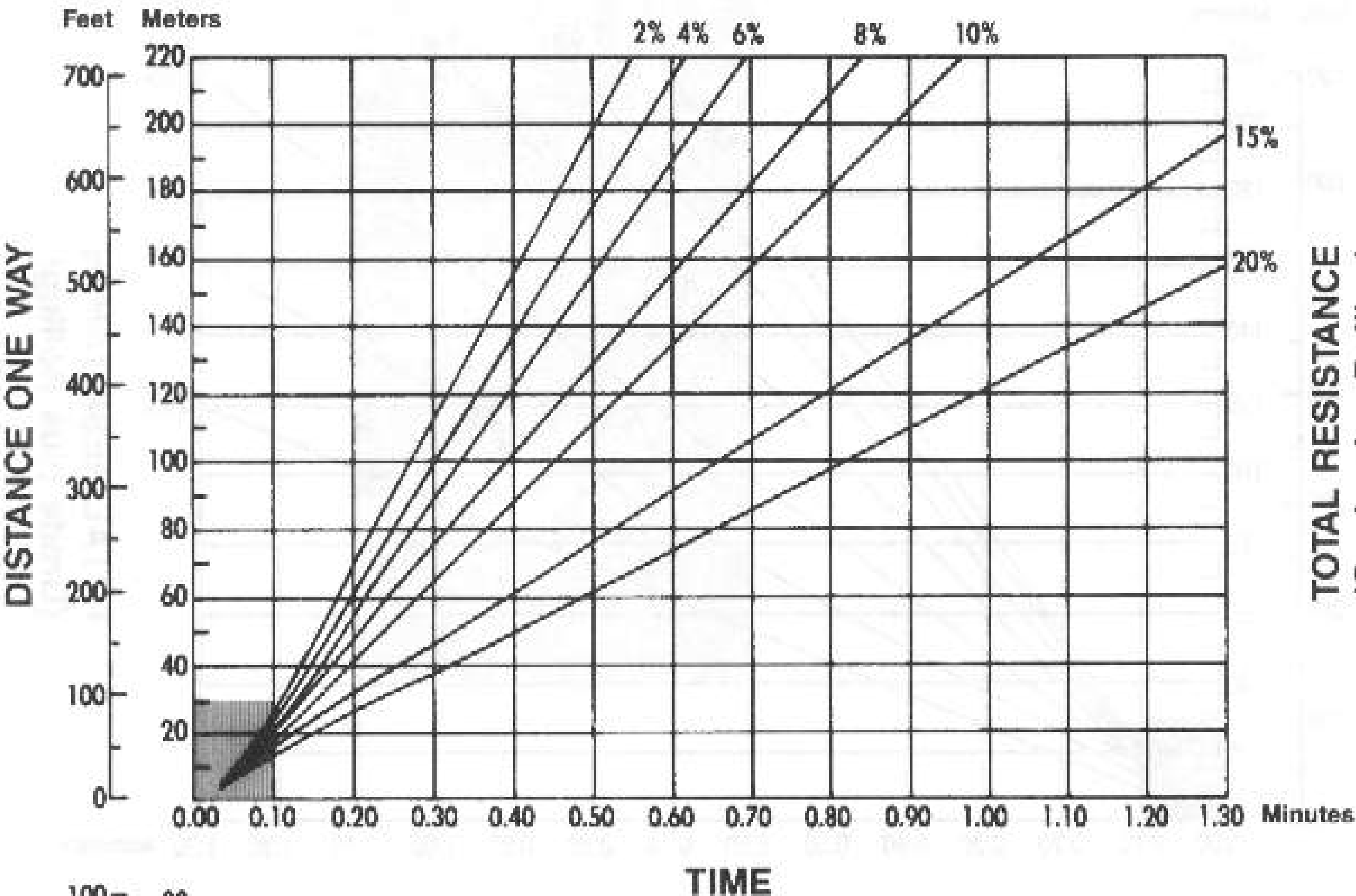


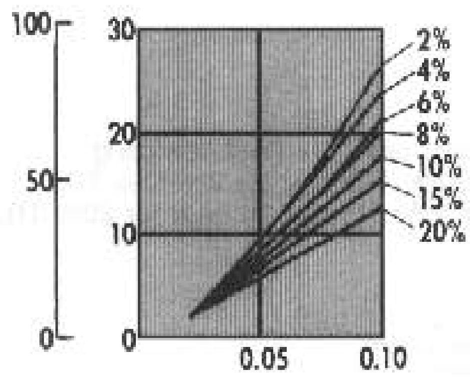


NOTE: Curves assume use of highest operating speed attainable: 4th gear for 2%-6% TR, 3rd gear for 8%-10% TR, 2nd gear for 15% TR and 1st gear for 20% TR.

In load-and-carry applications it is important to consult the tire manufacturer on Ton-MPH ratings and pressure recommendations.

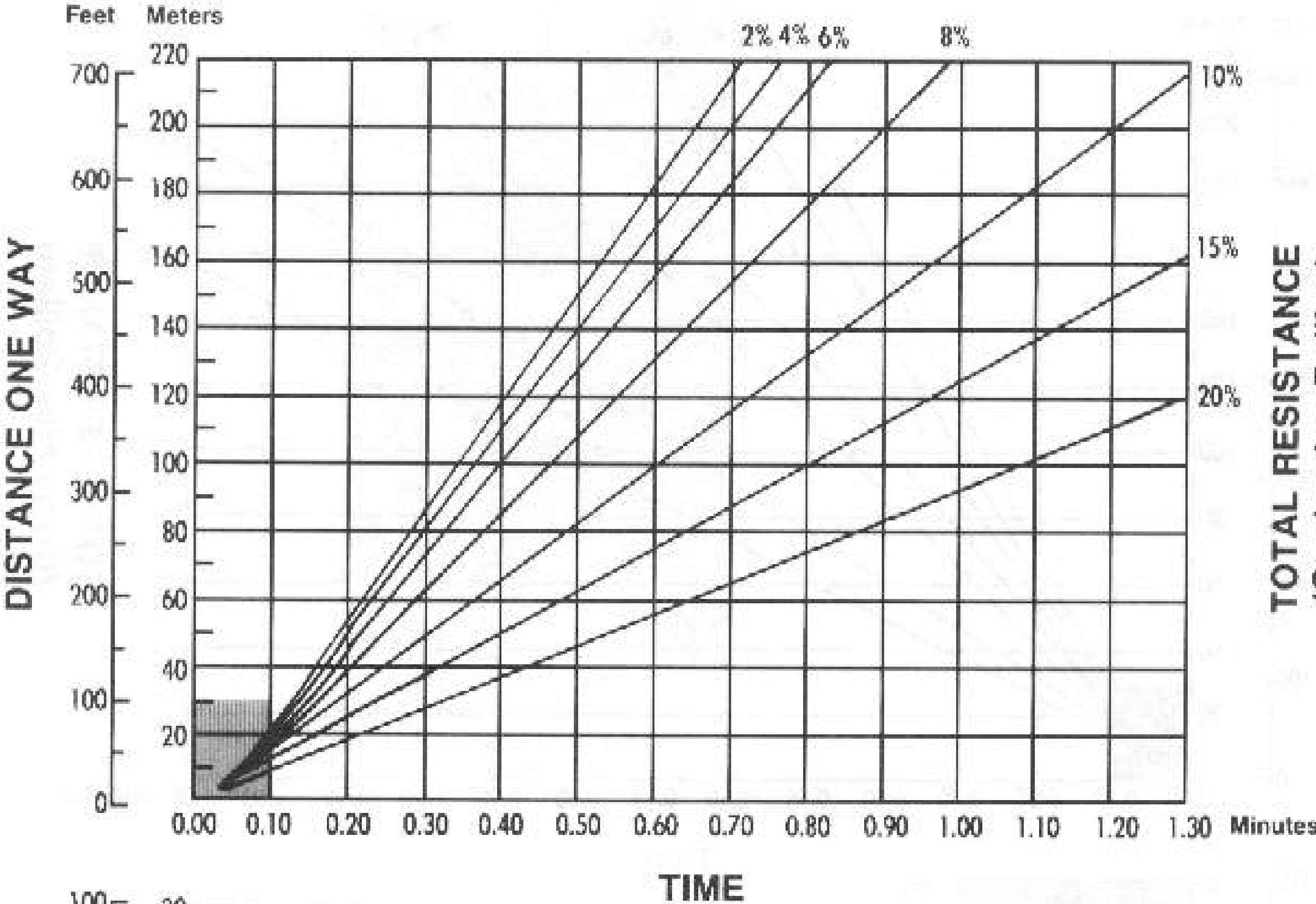
988B TRAVEL TIME — EMPTY

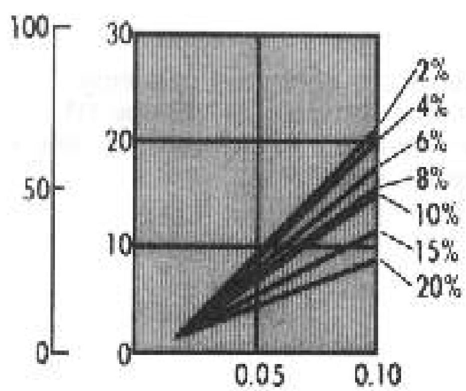




NOTE: Curves assume use of highest operating speed attainable: 4th gear for 2%-6% TR, 3rd gear for 8%-10% TR, 2nd gear for 15% TR and 1st gear for 20% TR.

992D TRAVEL TIME — LOADED

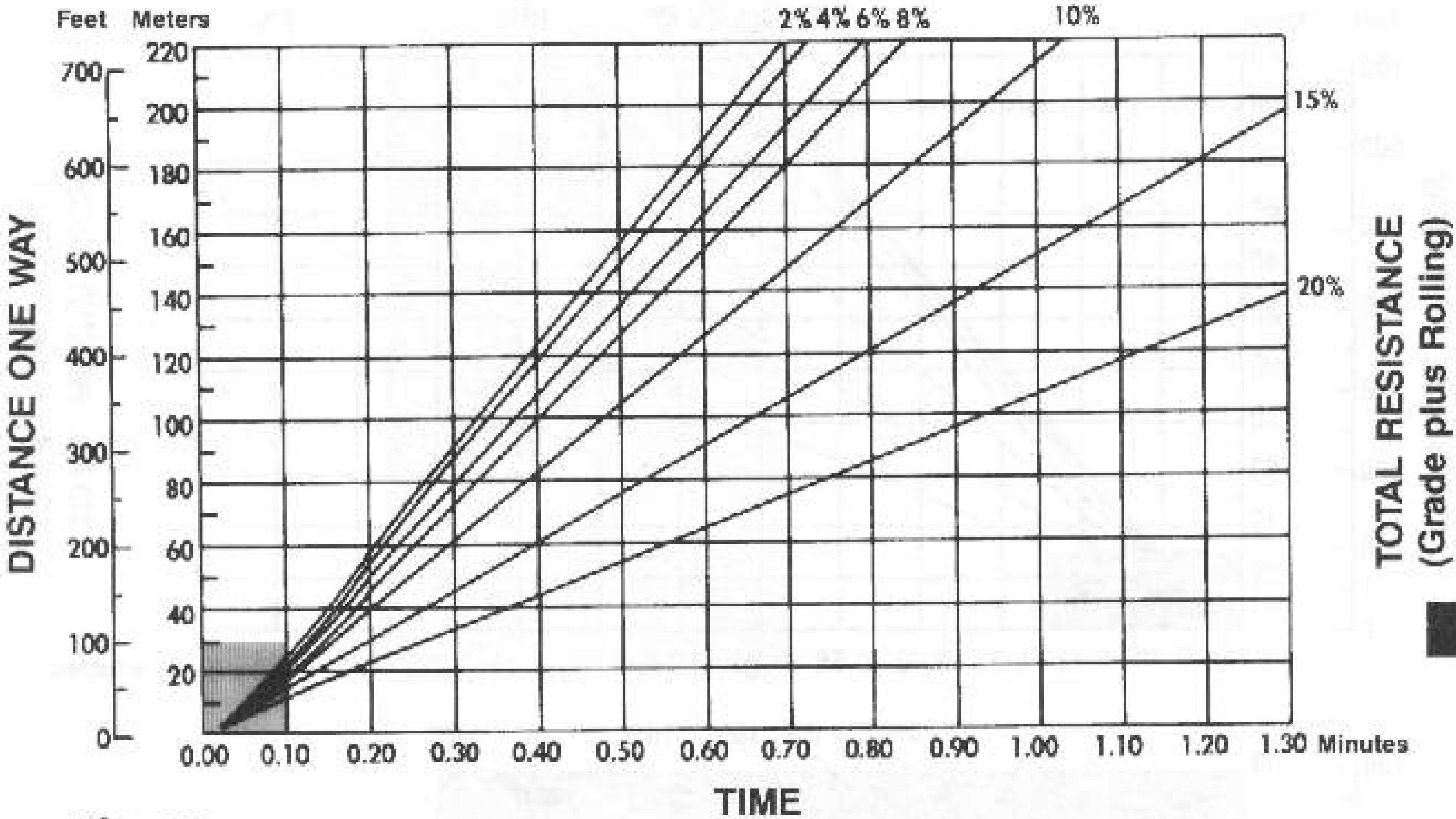


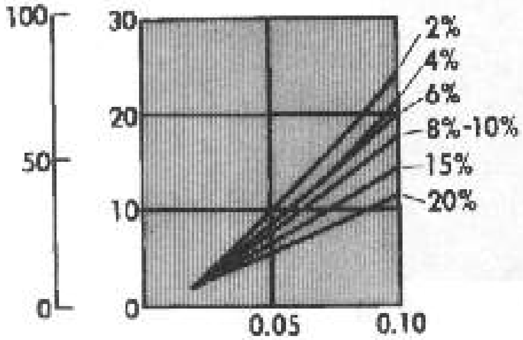


NOTE: Curves assume use of highest operating speed attainable: 3rd gear for 2%-10% TR, 2nd gear for 15% TR and 1st gear for 20% TR.

In load-and-carry applications it is important to consult the tire manufacturer on Ton-MPH ratings and pressure recommendations.

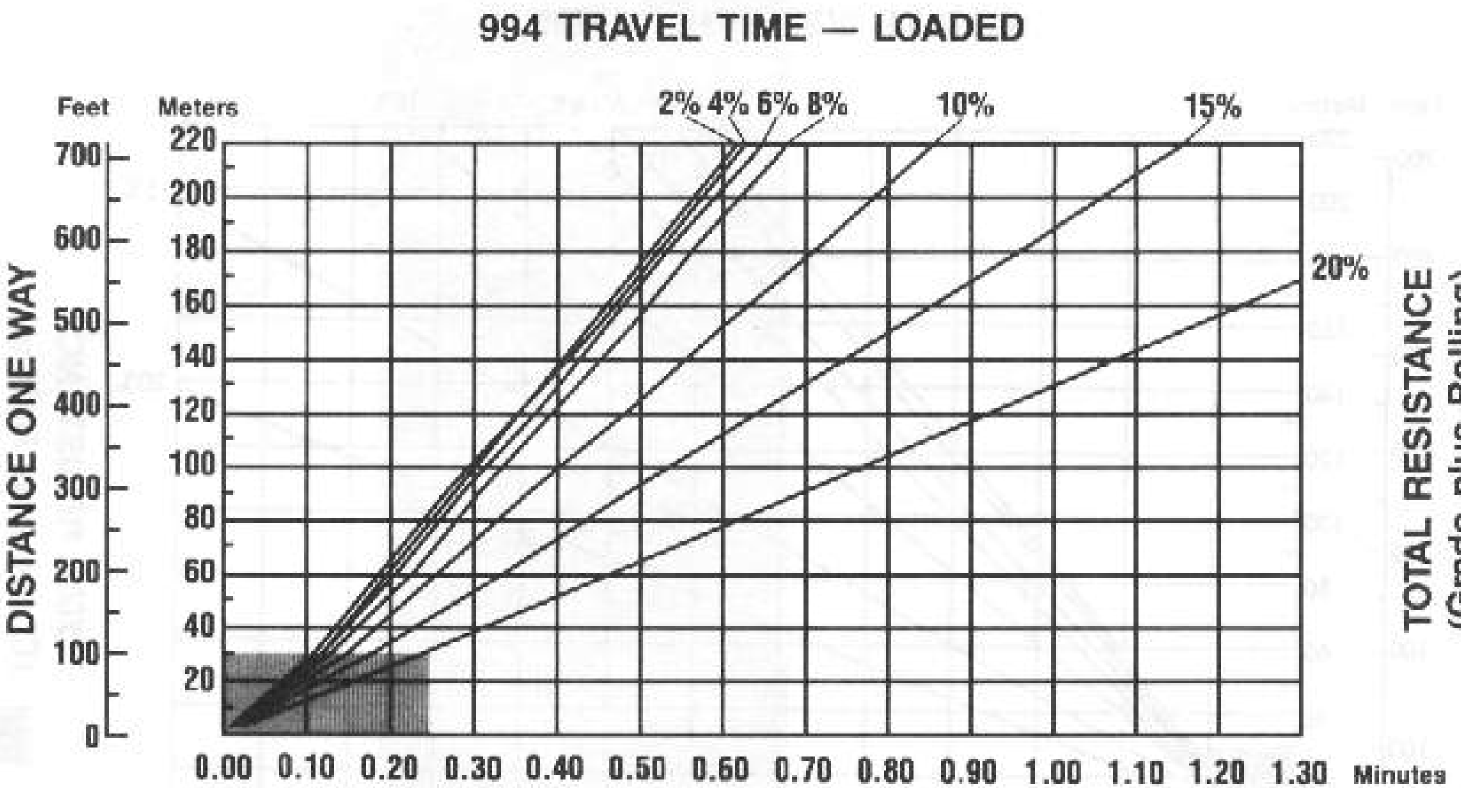
992D TRAVEL TIME — EMPTY

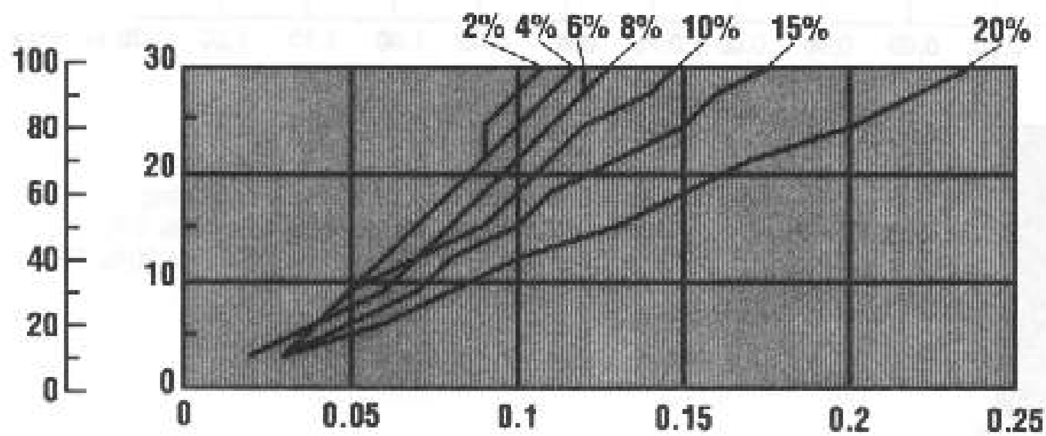




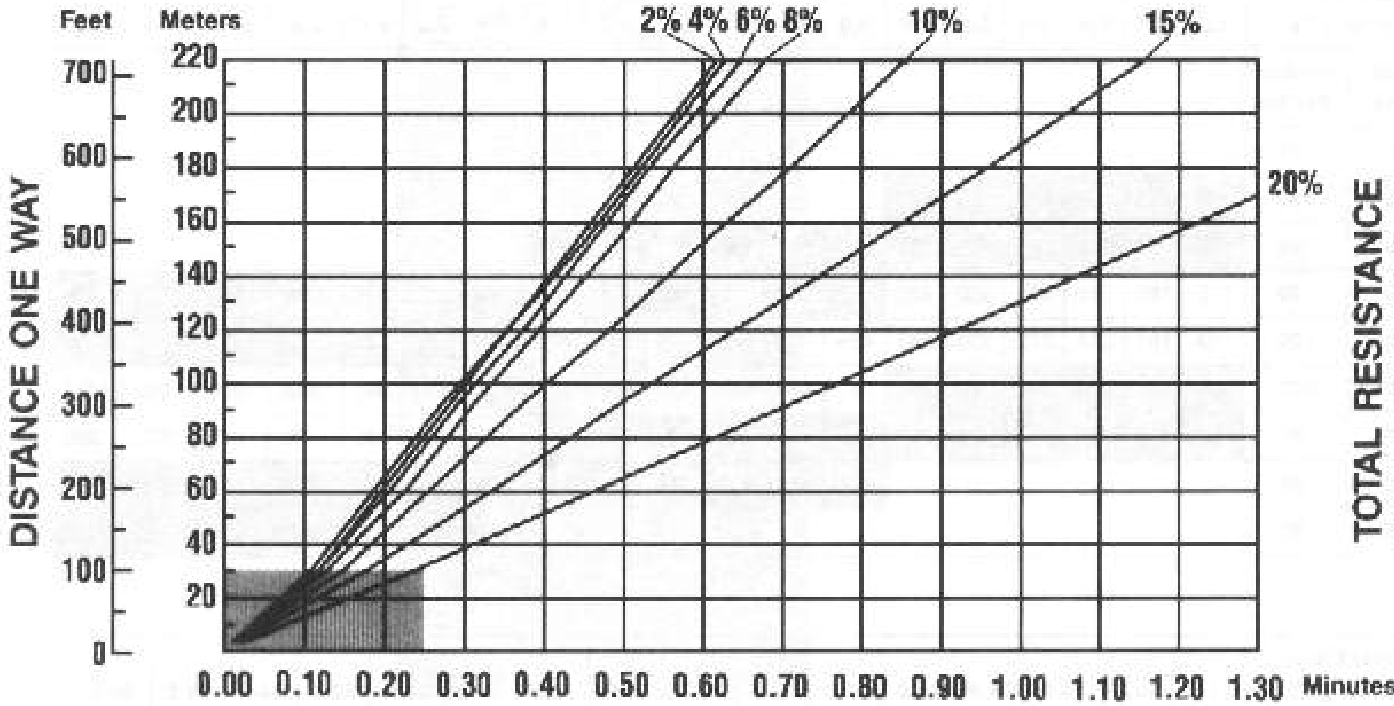
NOTE: Curves assume use of highest operating speed attainable: 3rd gear for 2%-10% TR, 2nd gear for 15% TR and 1st gear for 20% TR.

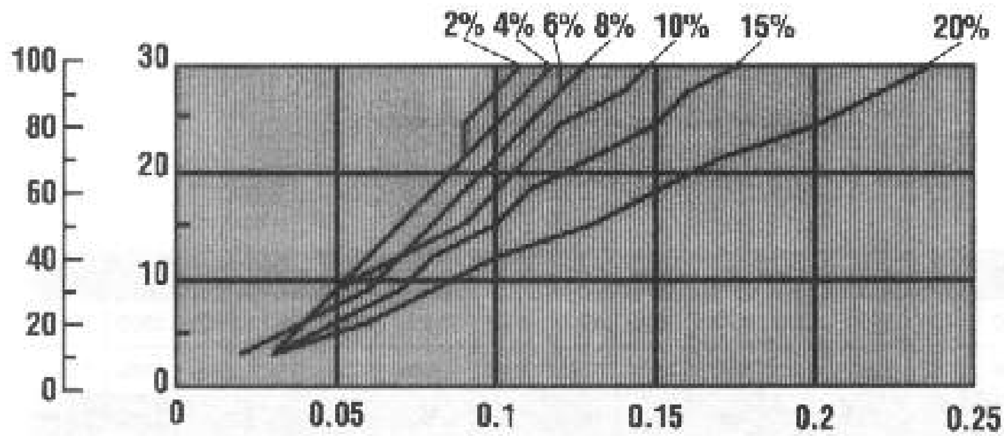
12


994 TRAVEL TIME — LOADED
Feet
Meters
DISTANCE ONE WAY
TOTAL RESISTANCE (Grade plus Rolling)
2% 4% 6% 8%
10%
15%
20%
700
600
500
400
300
200
100
0
220
200
180
160
140
120
100
80
60
40
20
0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 Minutes


2% 4% 6% 8% 10% 15% 20%
100
80
60
40
20
0
30
20
10
0
0 0.05 0.1 0.15 0.2 0.25

994 TRAVEL TIME — EMPTY





Production Estimating Table
- m^3 or yd^3/60 min. hour

Unshaded area indicates average production.

Bucket Size (m^3 or yd^3)		1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
Cycle Time	Cycles Per Hr																			
.35	171																			
.40	150	150	225	330	375	450	525													
.45	133	135	200	268	332	400	466	530	600	665	730	800	865							
.50	120	120	180	240	300	360	420	480	540	600	660	720	780	840	900	960	1003	1080	1140	1200
.55	109	109	164	218	272	328	382	436	490	545	600	655	705	765	820	870	925	980	1008	1090
.60	100	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
.65	92	92	138	184	230	276	322	368	416	460	505	555	600	645	690	735	780	830	875	920
.70	86							342	388	430	474	515	560	600	645	690	730	775	815	860
.75	80													560	600	640	680	720	760	800

Unshaded area indicates average production.

Bucket Size (m^3 or yd^3)		11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0
Cycle Time	Cycles Per Hr																
.35	171																
.40	150																
.45	133																
.50	120	1320	1440														
.55	109	1200	1310	1420	1520	1635	1740	1850	1960	2070	2180	2285	2385	2505	2615	2725	2830
.60	100	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600
.65	92	1010	1105	1195	1285	1380	1470	1560	1655	1745	1840	1930	2020	2115	2205	2300	2390
.70	86	945	1030	1120	1200	1290	1375	1460	1545	1630	1720	1805	1890	1975	2060	2150	2235
.75	80	880	960	1040	1120	1200	1280	1360	1440	1520	1600	1680	1760	1840	1920	2000	2080
.80	75			975	1050	1125	1200	1275	1350	1425	1500	1575	1650	1725	1800	1875	1950

Job Efficiency Worktime/Hr	Efficiency Factor	Bucket Load Factor
60 Min Hr	100%	Bucket Size × 1.00
55	91%	.95
50	83%	.90
45	75%	.85
40	69%	.80
—	—	.75

Metric Tons • 1600 kg Lm³ (1.6 t) density

Bucket Size m³		1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5
Cycle Time	Cycles Per Hr	Unshaded area indicates average production.																	
.40	150	240	360	480	600	720													
.45	133	213	319	426	532	638	745	851	958	1064	1170								
.50	120	192	288	384	480	576	672	768	864	960	1056	1152	1248	1344	1440	1536	1632	1730	1825
.55	109	174	262	349	436	523	610	698	785	872	959	1046	1134	1221	1308	1395	1482	1570	1655
.60	100	160	240	320	400	480	560	640	720	800	880	960	1040	1120	1200	1280	1360	1440	1520
.65	92	147	221	294	368	442	515	589	662	736	810	883	957	1030	1104	1178	1251	1325	1400
.70	86						482	550	619	688	757	826	894	963	1032	1101	1170	1238	1310
.75	80											768	832	896	960	1024	1088	1150	1215
Bucket Payload Metric Tons		1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	8.0	8.8	9.6	10.4	11.2	12.0	12.8	13.6	14.4	15.2

12

Bucket Size m³		10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0
Cycle Time	Cycles Per Hr	Unshaded area indicates average production.										
.40	150											
.45	133											
.50	120											
.55	109	1744	1918	2092	2267	2441	2616	2790	2964	3139	3313	3488
.60	100	1600	1760	1920	2080	2240	2400	2560	2720	2880	3040	3200
.65	92	1472	1619	1766	1913	2060	2208	2355	2502	2649	2798	2944
.70	86	1376	1513	1651	1788	1926	2064	2201	2339	2476	2614	2752
.75	80	1280	1408	1536	1664	1792	1920	2048	2176	2304	2432	2560
.80	75	1200	1320	1440	1560	1680	1800	1920	2040	2160	2280	2400
Bucket Payload Metric (Tons)		16	17.6	19.2	20.8	22.4	24.0	25.6	27.2	28.8	30.4	32.0

Wheel Loaders

Production Estimating Table
- Shot Rock • 60 min hour
- U.S. Tons

U.S. Tons • 2700 lb/LCY (1.35 T) density

Unshaded area indicates average production.

Cycle Time	Cycles Per Hr	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
	Bucket Size yd³	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
.40	150	203	330	420	510	615	705	810												
.45	133	180	293	360	454	545	625	720	810	905	985	1060	1170							
.50	120	162	254	324	408	492	565	650	730	815	890	970	1060	1140	1200	1300	1380	1470	1540	1620
.55	109	147	240	294	370	448	515	590	665	740	805	885	960	1030	1090	1180	1250	1330	1400	1740
.60	100	135	220	270	340	410	470	540	610	680	740	810	880	950	1000	1080	1150	1220	1280	1350
.65	92	124	200	250	314	380	435	500	560	625	680	750	810	875	920	985	1060	1120	1180	1250
.70	86								525	585	635	695	755	815	860	930	990	1050	1100	1160
.75	80													760	800	865	920	975	1030	1080
Bucket Payload (Tons)		1.35	2.2	2.7	3.4	4.1	4.7	5.4	6.1	6.8	7.4	8.1	8.8	9.5	10.0	10.8	11.5	12.2	12.8	13.5

Unshaded area indicates average production.

Cycle Time	Cycles Per Hr	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0
	Bucket Size yd³	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0
.40	150																
.45	133																
.50	120	1782	1945														
.55	109	1620	1765	1905	2060	2200	2350	2495	2645	2790	2940	3080	3235	3375	3530	3670	3825
.60	100	1485	1620	1750	1890	2020	2160	2290	2430	2560	2700	2830	2970	3100	3240	3370	3510
.65	92	1365	1490	1610	1735	1855	1985	2105	2235	2355	2480	2600	2730	2850	2980	3100	3225
.70	86	1275	1380	1505	1625	1735	1855	1965	2085	2200	2320	2430	2550	2665	2785	2895	3015
.75	80	1190	1295	1400	1510	1615	1725	1830	1940	2045	2160	2260	2375	2480	2590	2695	2805
.80	75			1310	1415	1515	1620	1715	1820	1920	2025	2120	2225	2325	2430	2525	2630
Bucket Payload (Tons)		14.9	16.4	17.5	18.9	20.2	21.6	22.9	24.3	25.6	27.0	28.3	29.7	31.0	32.4	33.7	35.1

Work Tools	992D	988B	980C	966F	950F	936F	926E	916	910E
Quick coupler	X	X	X	X	X	X	X	X	X
General purpose bucket	X	X	X	X	X	X	X	X	X
Coke bucket					X				
Coal bucket	X	X	X	X	X	X	X	X	X
Coal seam bucket	X								
Woodchip bucket		X	X	X	X	X	X	X	X
Bagasse bucket			X						
Refuse bucket			X	X	X			X	
Light material bucket	X		X	X	X	X			
Loose material bucket							X	X	
Snow bucket				X	X				
Fertilizer bucket						X	X	X	
Salt bucket		X							
Abrasive bucket			X						
Rock bucket	X	X	X	X	X	X	X		
Skeleton rock bucket		X	X	X	X				
Slag bucket	X	X	X	X					
Bonus bucket		X	X						
Multi-purpose bucket				X	X	X	X	X	
Side dump bucket				X	X	X	X	X	
Demolition bucket			X	X	X				
Control discharge bucket			X						
Bucket with top clamp						X	X	X	
Tire loader					X	X			
Material handling arm		X	X	X	X	X	X	X	X
Pallet fork	X	X	X	X	X	X	X	X	X
Pallet fork with top clamp		X	X	X	X	X	X	X	
Millyard fork		X	X	X	X	X	X		
Log/lumber fork				X	X	X	X	X	X
Logging fork		X	X	X	X				
Core fork					X	X	X		
Clean up bucket			X	X	X	X			
Railcar coupler		X	X	X	X	X	X	X	
Straight blade		X	X	X	X	X	X	X	X
Manual angle blade				X	X	X	X	X	X
Hydraulic angle blade				X	X				
Coal U-blade		X	X	X					
Woodchip U-blade			X						
Landfill U-blade					X				
V-plow			X	X	X	X	X		X
One way plow			X		X				X
Manual reverse plow			X	X	X	X	X	X	X
Hydraulic reverse plow			X	X	X	X	X	X	X
Clamp rake				X	X	X			
Clearing rake				X	X				
Loader rake				X	X	X	X	X	X
Hydraulic broom						X	X	X	X
Block handling bucket		X	X						
Block handling fork		X	X						
Breaker line		X	X						
Boom clearing rake		X	X						

Contact Balderson for specific information

TRACK LOADERS

CONTENTS

Features of 931C Series II and 935C Series II:

- **Planetary power shift transmission** with three speeds forward, three reverse. Optional three forward one reverse on 931C Series II. High torque capacity oil clutches permit fast speed and directional changes. Single stage torque converter integral with the power shift transmission.
- **Pedal steering and brakes** for easier operation.
- **Oil cooled steering clutches and brakes** extend service intervals. Optional on the 931C Series II.

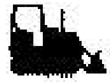
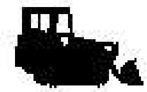
Features of 943-973

- **Rear engine location** provides both natural stability as a "working" counterweight and excellent visibility.
- **Hydrostatic drive train** offers fast acceleration and counterrotation capability for increased production.
- **Z-bar linkage** provides increased breakout force and fast dump speed.
- **Implement power requirements** have priority over track requirements automatically . . . full implement power available for maximum breakout force results in fast loading and cycle time.
- **Oscillating track roller frames** decrease ground shock, increase machine stability.
- **Sound-suppressed, air-pressurized, resiliently mounted ROPS cab** for superior working environment.

Features common to all models:

- **Sealed and Lubricated Track** reduces wear and maintenance expense.
- **Sealed loader linkage** extends lubrication intervals and reduces maintenance time.
- **Automatic bucket controls** let bucket rise to pre-set dumping height and return to pre-set digging angle for fast cycle time.

12

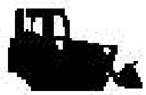
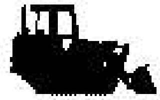
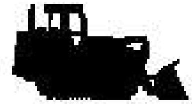
						
MODEL	**931C Series II**		**935C Series II**		**943**	
Flywheel Power	52 kW	70 HP	60 kW	80 HP	60 kW	80 HP
Operating Weight*	8047 kg	17,742 lb	8759 kg	19,311 lb	11 690 kg	25,771 lb
Engine Model	3204		3204		3204	
Rated Engine RPM	2400		2400		2400	
Bore	114 mm	4.5"	114 mm	4.5"	114 mm	4.5"
Stroke	127 mm	5"	127 mm	5"	127 mm	5"
No. Cylinders	4		4		4	
Displacement	5.2 L	318 in^3	5.2 L	316 in^3	5.2 L	316 in^3
Speeds Forward,	km/h	mph	km/h	mph	km/h	mph
1st	3.0	1.8	3.0	1.8	0-9.5	0-5.9
2nd	5.7	3.5	5.7	3.5	Infinitely	
3rd	10.5	6.5	10.5	6.5	Variable	
Reverse**						
1st	3.2	2.0	3.2	2.0	0-9.5	0-5.9
2nd	6.1	37.8	6.1	3.8	Infinitely	
3rd	11.2	6.9	11.2	6.9	Variable	
Hydraulic Cycle Time, Bucket Empty, in Seconds:						
Raise	6.0		6.0		7.2	
Dump	2.7		2.7		1.8	
Lower (Empty, Float Down)	3.1		3.1		2.2	
Total	11.8		11.8		11.0	
Track Rollers (Each Side)	5		5		6	
Width of Standard Track Shoe	356 mm	14"	355 mm	14"	360 mm	14.17"
Length of Track on Ground	1.90 m	6'2.8"	1.90 m	6'2.8"	2.149 m	7'0"
Ground Contact Area (With Std. Shoe)	1.36 m^2	2094 in^2	1.36 m^2	2094 in^2	1.55 m^2	2398 in^2
Ground Pressure	58.4 kPa	8.5 psi	63.6 kPa	9.2 psi	73.7 kPa	10.7 psi
Ground Clearance	308 mm	12.1"	308 mm	12.1"	336 mm	13.2"
Track Gauge	1.42 m	4'8"	1.42 m	4'8"	1.70 m	5'7"
Width Without Bucket	1.79 m	5'10"	1.79 m	5'10"	2.06 m	6'9"
Fuel Tank Refill Capacity	116 L	30.6 U.S. gal	116 L	30.6 U.S. gal	159 L	42 U.S. gal
Hydraulic System Refill Capacity	57 L	15 U.S. gal	57 L	15 U.S. gal	58 L	15.3 U.S. gal

	LGP		LGP		Equipped with Wide Track Shoe Option	
(Specs that differ from above)	**931C Series II**		**935C Series II**		**943**	
Operating Weight	8168 kg	18,007 lb	No		11 888 kg	26,207 lb
Width of Track Shoe	635 mm	25"	LGP		460 mm	18.11"
Ground Contact Area	2.41 m^2	3746 in^2	Model		1.98 m^2	3064 in^2
Ground Pressure	33 kPa	4.8 psi			58.4 kPa	8.5 psi
Track Gauge	1.65 m	5'5"			1.70 m	5'7"
Width Without Bucket	—				2160 mm	7'1"

See Wheel Loader section of this book for summary of S.A.E. Guidelines for Loader Specifications, to which Caterpillar adheres.

*931C Series II weights for standard and LGP models include basic machine (General Arrangement Number), lubricants, coolant, full fuel tank, operator, general purpose bucket, bucket teeth, and OROPS. Subtract 166 kg (367 lb) for 3-1 transmission. Operating weight of 931C LGP Series II (Direct Drive) is 8170 kg (18,012 lb). 935C Series II weights include basic machine (General Arrangement Number), lubricants, coolants, full fuel tank, operator, general purpose bucket and bucket teeth and OROPS.

**931C Series II with one-speed reverse: 5.1 km/h (3.16 mph)

MODEL	 953		 963		 973	
Flywheel Power	82 kW	**110 HP**	112 kW	**150 HP**	157 kW	**210 HP**
Operating Weight	14 098 kg	**31,080 lb**	18 366 kg	**40,490 lb**	24 902 kg	**54,899 lb**
Engine Model	3204		3304		3306	
Rated Engine RPM	2400		2200		2200	
Bore	114 mm	4.5"	121 mm	4.75"	121 mm	4.75"
Stroke	127 mm	5"	152 mm	6"	152 mm	6"
No. Cylinders	4		4		6	
Displacement	5.2 L	**318 in³**	7.0 L	**425 in³**	10.5 L	**638 in³**
Speeds Forward,	km/h	**mph**	km/h	**mph**	km/h	**mph**
1st	0-10.35	**0-6.4**	0-10.1	**0-6.0**	0-10.3	**0-6.4**
2nd	**Infinitely**		**Infinitely**		**Infinitely**	
3rd	**Variable**		**Variable**		**Variable**	
Reverse*						
1st	0-10.35	**0-6.4**	0-10.1	**0-6.0**	0-10.3	**0-6.4**
2nd	**Infinitely**		**Infinitely**		**Infinitely**	
3rd	**Variable**		**Variable**		**Variable**	
Hydraulic Cycle Time, Bucket Empty, in Seconds:						
Raise	**7.4**		**6.2**		**7.4**	
Dump	**1.5**		1.3		**1.4**	
Lower (Empty, Float Down)	**3.0**		**2.3**		**2.6**	
Total	**11.9**		**9.8**		**11.4**	
Track Rollers (Each Side)	6		6		7	
Width of Standard Track Shoe	380 mm	**15"**	450 mm	**17.7"**	500 mm	**19.7"**
Length of Track on Ground	2.295 m	7'6"	2.454 m	**8'1"**	2.917 m	**9'7"**
Ground Contact Area (With Std. Shoe)	1.74 m²	**2704 in²**	2.21 m²	**3423 in²**	2.92 m²	**4522 in²**
Ground Pressure	78.2 kPa	**11.3 psi**	80.9 kPa	**11.7 psi**	83.0 kPa	**12.0 psi**
Ground Clearance	377 mm	**14.8"**	439 mm	**17.0"**	458 mm	**18.0"**
Track Gauge	1.80 m	5'11"	1.85 m	**6'0.8"**	2.08 m	**6'10"**
Width Without Bucket	2.18 m	7'2"	2.30 m	**7'6"**	2.68 m	**8'8"**
Fuel Tank Refill Capacity	192 L	**51 U.S. gal**	261 L	**69 U.S. gal**	356 L	**94 U.S. gal**
Hydraulic System Refill Capacity	58 L	**15.3 U.S. gal**	60 L	**16 U.S. gal**	60 L	**16 U.S. gal**

Equipped With Wide Track Shoe Option

(Specs that differ from above)	953		963		973	
Operating Weight	14 362 kg	**31,661 lb**	18 639 kg	41,092 lb	25 534 kg	**56,293 lb**
Width of Track Shoe	500 mm	**20"**	550 mm	**21.7"**	675 mm	**26.6"**
Ground Contact Area	2.30 m²	**3558 in²**	2.70 m²	**4184 in²**	3.94 m²	**6104 in²**
Ground Pressure	60.6 kPa	**8.8 psi**	67.2 kPa	**9.7 psi**	63.0 kPa	**9.1 psi**
Track Gauge	1.80 m	5'11"	1.85 m	**6'0.8"**	2.08 m	**6'10"**
Width Without Bucket	2300 mm	**7'6"**	2400 mm	**7'10"**	2755 mm	**9'0"**

*See Wheel Loader section of this book for summary of S.A.E. Guidelines for Loader Specifications, to which Caterpillar adheres.

12

Bucket:	GENERAL PURPOSE		MULTI-PURPOSE		LGP ARRANGEMENT	
Capacity, Rated (Nominal Heaped)	0.83 m³	**1.08 yd³**	0.82 m³	**1.07 yd³**	0.81 m³	**1.06 yd³**
Struck	0.68 m³	**0.89 yd³**	0.66 m³	**0.86 yd³**	0.67 m³	**0.87 yd³**
Bucket Width*	1968 mm	**77.5"**	1968 mm	**77.5"**	2346 mm	**92.4"**
Dump Clearance at Full Lift and 45° Discharge	2619 mm	**8'7.1"**	2492 mm	**8'2.1"**	2666 mm	**8'9.0"**
Maximum Reach at Full Lift and 45° Discharge	829 mm	**32.6"**	903 mm	**35.6"**	788 mm	**31.0"**
Digging Depth	163 mm	**6.4"**	196 mm	**7.7"**	149.9 mm	**5.9"**
Overall Length	4140 mm	**13'7"**	4411 mm	**14'5.7"**	4090 mm	**13'5.0"**
Overall Height	4151 mm	**13'7.4"**	—	—	4030 mm	**13'2.7"**
Static Tipping Load	4895 kg	**10,791 lb**	4781 kg	**10,541 lb**	4808 kg	**10,600 lb**
Breakout Force**	6473 kg	**14,270 lb**	5237 kg	**11,546 lb**	7055 kg	**15,554 lb**
Operating Weight***	8047 kg	**17,742 lb**	8444 kg	**18,617 lb**	8170 kg	**18,012 lb**

*Bolt-on teeth increase bucket width by 42 mm (1.65"). Bolt-on cutting edge increases bucket width by 10 mm (.39").
**Breakout force is measured 102 mm (4.0") behind tip of cutting edge with bucket hinge pin as pivot point.
***Operating weight includes coolant, lubricants, full fuel tank, 3 forward, 3 reverse transmission, bottom guards (31D), bucket teeth, ROPS canopy and operator. 426 kg (940 lb) counterweight is also included with Multi-Purpose bucket.

Machine stability can be improved through the addition of counterweight or rear attachment. Add the following to machine operating weight and static tipping load:

	Change in Operating Weight		Change in Static Tipping Load	
	kg	lb	kg	lb
Remove ROPS canopy	− 320	− 716	− 381	− 840
Replace ROPS canopy with ROPS cab†	+ 98	+ 216	− 29	− 63
Ripper-Scarifier†	− 27	− 59	− 12	− 26
Counterweights: Remove rear mounted	− 329	− 725	− 510	− 1124
Use rear mounted	+ 426	+ 940	+ 663	+ 1462
Use rear mounted	+ 200	+ 440	+ 396	+ 873
Sprocket mounted (both sides)	+ 255	+ 562	+ 321	+ 708
Backhoe: Fixed pivot††	+ 1857	+ 4094	—	—
Side shift††	+ 2100	+ 4631	—	—
3 forward, 1 reverse transmission	− 165	− 364	− 135	− 298
Cat 53 Winch†	+ 149	+ 329	+ 282	+ 621

†Weights include removal of 329 kg (725 lb) rear counterweight.
††Weights include addition of 454 kg (1000 lb) front counterweight and 610 mm (24") backhoe bucket.

Bucket:	GENERAL PURPOSE		MULTI-PURPOSE	
Capacity, Rated (Nominal Heaped)	1.0 m³	1.30 yd³	0.82 m³	1.07 yd³
Struck	0.84 m³	1.10 yd³	0.66 m³	0.86 yd³
Bucket Width*	1968 mm	77.5"	1968 mm	77.5"
Dump Clearance at Full Lift and 45° Discharge	2590 mm	8'6.0"	2497 mm	8'2.1"
Maximum Reach at Full Lift and 45° Discharge	866 mm	34.1"	903 mm	35.6"
Digging Depth	160 mm	6.3"	196 mm	7.7"
Overall Length	4370 mm	14'4.0"	4286 mm	14'0.7"
Overall Height	4330 mm	14'2.5"	—	—
Static Tipping Load	5804 kg	12,796 lb	4861 kg	10,717 lb
Breakout Force**	6848 kg	15,096 lb	6021 kg	13,275 lb
Operating Weight***	8759 kg	19,311 lb	8573 kg	18,901 lb

*Bolt-on teeth increase bucket width by 42 mm (1.65"). Bolt-on cutting edge increases bucket width by 10 mm (.39").
**Breakout force is measured 102 mm (4.0") behind tip of cutting edge with bucket hinge pin as pivot point.
***Operating weight includes coolant, lubricants, full fuel tank, 3 forward, 3 reverse transmission, bottom guards (STD), bucket teeth, ROPS canopy and operator. 454 kg (1000 lb) rear counterweight is also removed while using Multi-Purpose bucket.

Machine stability can be improved through the addition of counterweight or rear attachment. Add the following to machine operating weight and static tipping load.

	Change In Operating Weight		Change In Static Tipping Load	
	kg	lb	kg	lb
Remove ROPS canopy	– 328	– 719	– 381	– 840
Replace ROPS canopy with ROPS cab†	+ 185	+ 408	+ 99	+ 218
Ripper-Scarifier†	+ 76	+ 168	+ 134	+ 296
Counterweights: Remove rear mounted	– 653	– 1440	– 1026	– 2263
Use rear mounted	+ 426	+ 940	+ 663	+ 1462
Use rear mounted	+ 200	+ 440	+ 305	+ 673
Sprocket mounted (both sides)	STD			
Backhoe: Fixed pivot††, †††	+ 1534	+ 3381	—	—
Side shift††, †††	+ 1776	+ 3917	—	—
3 forward, 1 reverse transmission	– 165	– 364	– 135	– 298
Cat 53 Winch†||	– 175	– 386	– 243	– 536

†Weights include removal of 227 kg (500 lb) rear counterweight.
||Weights include addition of 454 kg (1000 lb) front counterweight and 610 mm (24") backhoe bucket.
†††Weights include the removal of 653 kg (1440 lb) rear counterweight.

12

Bucket:	GENERAL PURPOSE Bolt-on Teeth		MULTI-PURPOSE Bolt-on Teeth		GENERAL PURPOSE Bolt-on Segments & Long Teeth	
Capacity, Rated (Nominal Heaped)	1.15 m^3	1.5 yd^3	1.00 m^3	1.3 yd^3	1.3 m^3	1.7 yd^3
Struck	0.95 m^3	1.25 yd^3	0.81 m^3	1.06 yd^3	1.14 m^3	1.49 yd^3
Cutting Edge, Type	Straight		Straight		Straight	
Bucket Width◄	2210 mm	87"	2256 mm	88.8"	2210 mm	87"
Teeth	8, optional, bolt-on with replaceable tips.		8, optional, bolt-on with replaceable tips.		8, optional, bolt-on with replaceable tips.	
Dump Clearance @ Full Lift and 45° Discharge	2672 mm	8'9"	2591 mm	8'6"	2604 mm	8'7"
Reach at 45° Discharge Angle 2133 mm (7') Clearance	1268 mm	4'2"	1231 mm	4'0"	1261 mm	4'2"
Reach @ Full Lift and 45° Discharge	861 mm	33.9"	872 mm	34.3"	894 mm	35.2"
Digging Depth	108 mm	4.3"	158 mm	6.2"	133 mm	5.3"
Overall Length	5426 mm	17'10"	5530 mm	18'2"	5426 mm	17'10"
Overall Height	4516 mm	14'10"	4455 mm	14'7"	4516 mm	14'10"
Static Tipping Load**	8032 kg	17,707 lb	7107 kg	15,668 lb	7922 kg	17,464 lb
Breakout Force*	9587 kg	21,139 lb	8545 kg	18,842 lb	8662 kg	19,099 lb
Operating Weight**	11 690 kg	25,771 lb	12 307 kg	27,132 lb	11 758 kg	25,922 lb

◄Bolt-on teeth increase bucket width by 52 mm (2.0"). Bolt-on cutting edge increases bucket width by 17 mm (.67").
*Breakout force is measured 100 mm (3.94") behind tip of cutting edge with bucket hinge pin as pivot point.
**Operating weight includes coolant, lubricants, full fuel tank, ROPS cab, General Purpose bucket, and 80 kg (175 lb) operator.

Machine stability can be affected by the addition of other attachments. Add or subtract the following to/from machine operating weight and static tipping load:

	Change in Operating Weight		Change in Static Tipping Load For General Purpose Bucket	
	kg	lb	kg	lb
Remove ROPS and cab	−409	− 902	− 431	− 951
ROPS canopy only (cab removed)	−183	− 403	− 191	− 422
Ripper (includes rear hydraulic arrangement)	+651	+1435	+1256	+2769
Air conditioner	+108	+ 239	+ 164	+ 361
Bumper	+139	+ 306	+ 291	+ 641
Wide track shoes	+198	+ 436	+ 125	+ 276
Long Teeth	+103	+ 228	− 135	− 298

Bucket:	MULTI-PURPOSE Bolt-on Segments & Long Teeth		GENERAL PURPOSE Bolt-on Cutting Edge		MULTI-PURPOSE Bolt-on Cutting Edge	
Capacity, Rated (Nominal Heaped)	1.15 m³	**1.5 yd³**	1.3 m³	**1.7 yd³**	1.15 m³	**1.5 yd³**
Struck	1.00 m³	**1.30 yd³**	1.14 m³	**1.49 yd³**	1.00 m³	**1.30 yd³**
Cutting Edge, Type	**Straight**		**Straight**		**Straight**	
Bucket Width◄	2256 mm	**88.8"**	2210 mm	**87"**	2256 mm	**88.8"**
Teeth	**6, optional, bolt-on with replaceable tips.**		**6, optional, bolt-on with replaceable tips.**		**6, optional, bolt-on with replaceable tips.**	
Dump Clearance @ Full Lift and 45° Discharge	2522 mm	**8'3"**	2604 mm	**8'7"**	2522 mm	**8'3"**
Reach at 45° Discharge Angle 2133 mm (7') Clearance	1221 mm	4'0"	1261 mm	4'2"	1221 mm	**4'0"**
Reach @ Full Lift and 45° Discharge	905 mm	**35.6"**	894 mm	**35.2"**	905 mm	**35.6"**
Digging Depth	183 mm	7.2"	133 mm	**5.3"**	183 mm	**7.2"**
Overall Length	5530 mm	**18'2"**	5301 mm	17'2"	5404 mm	17'9"
Overall Height	4455 mm	**14'7"**	4516 mm	**14'10"**	4465 mm	**14'7"**
Static Tipping Load**	6993 kg	**15,418 lb**	7994 kg	**17,623 lb**	7066 kg	**15,576 lb**
Breakout Force*	7763 kg	**17,118 lb**	8719 kg	**19,226 lb**	7821 kg	**17,246 lb**
Operating Weight**	12 377 kg	**27,286 lb**	11 702 kg	**25,796 lb**	12 320 kg	**27,162 lb**

◄Bolt-on teeth increase bucket width by 52 mm (2.0"). Bolt-on cutting edge increases bucket width by 17 mm (.67").
*Breakout force is measured 100 mm (3.94") behind tip of cutting edge with bucket hinge pin as pivot point.
**Operating weight includes coolant, lubricants, full fuel tank, ROPS cab, General Purpose bucket, and 80 kg (176 lb) operator.

Machine stability can be affected by the addition of other attachments.

Bucket:	GENERAL PURPOSE Bolt-on Teeth		MULTI-PURPOSE Bolt-on Teeth		GENERAL PURPOSE Bolt-on Segments & Long Teeth	
Capacity, Rated (Nominal Heaped)	1.5 m^3	**2.0 yd^3**	1.35 m^3	**1.8 yd^3**	1.75 m^3	**2.3 yd^3**
Struck	1.28 m^3	**1.68 yd^3**	1.12 m^3	**1.47 yd^3**	1.53 m^3	**2.00 yd^3**
Cutting Edge, Type	**Straight**		**Straight**		**Straight**	
Bucket Width ◄	2380 mm	**94"**	2380 mm	**94"**	2378 mm	**94"**
Teeth	**8, optional, bolt-on with replaceable tips.**		**6, optional, bolt-on with replaceable tips.**		**6, optional, bolt-on with replaceable tips.**	
Dump Clearance @ Full Lift and 45° Discharge	2894 mm	**9'6"**	2716 mm	**8'11"**	2829 mm	**9'3"**
Reach at 45° Discharge Angle 2133 mm (7') Clearance	1568 mm	**5'1"**	1442 mm	**4'9"**	1567 mm	**5'2"**
Reach @ Full Lift and 45° Discharge	1017 mm	**40.0"**	992 mm	**39.1"**	1058 mm	**41.6"**
Digging Depth	108 mm	**4.2"**	158 mm	**6.2"**	133 mm	**5.2"**
Overall Length	5887 mm	**19'3"**	6040 mm	**19'10"**	5867 mm	**19'3"**
Overall Height	4906 mm	**16'1"**	4854 mm	**15'11"**	4906 mm	**16'1"**
Static Tipping Load**	8749 kg	**19,288 lb**	7672 kg	**16,914 lb**	[illegible] kg	**18,834 lb**
Breakout Force*	11 971 kg	**26,395 lb**	10 133 kg	**22,344 lb**	10 879 kg	**23,989 lb**
Operating Weight**	14 098 kg	**31,080 lb**	14 632 kg	**32,251 lb**	14 176 kg	**31,253 lb**

◄Bolt-on teeth increase bucket width by 62 mm (2.0"). Bolt-on cutting edge increases bucket width by 17 mm (.67").
*Breakout force is measured 100 mm (3.94") behind tip of cutting edge with bucket hinge pin as pivot point.
**Operating weight includes coolant, lubricants, full fuel tank, ROPS cab, General Purpose bucket, and 80 kg (176 lb) operator.

Machine stability can be affected by the addition of other attachments. Add or subtract the following to/from machine operating weight and static tipping load:

	Change in Operating Weight		Change in Static Tipping Load For General Purpose Bucket	
	kg	lb	kg	lb
Remove ROPS and cab	−409	**− 902**	− 413	**− 911**
ROPS canopy only (cab removed)	−183	**− 403**	− 183	**− 404**
Ripper (includes rear hydraulic arrangement)	+631	**+1392**	+1201	**+2648**
Air conditioner	+108	**+ 239**	+ 155	**+ 342**
Bumper	+139	**+ 306**	+ 283	**+ 625**
Wide track shoes	+264	**+ 581**	+ 171	**+ 378**
Long Teeth	+103	**+ 228**	− 136	**− 299**

Bucket:	MULTI-PURPOSE Bolt-on Segments & Long Teeth		GENERAL PURPOSE Bolt-on Cutting Edge		MULTI-PURPOSE Bolt-on Cutting Edge	
Capacity, Rated (Nominal Heaped)	1.5 m^3	**2.0 yd^3**	1.75 m^3	**2.3 yd^3**	1.5 m^3	**2.0 yd^3**
Struck	1.34 m^3	**1.75 yd^3**	1.53 m^3	**2.00 yd^3**	1.34 m^3	**1.75 yd^3**
Cutting Edge, Type	**Straight**		**Straight**		**Straight**	
Bucket Width◄	2378 mm	**93.6"**	2380 mm	**94"**	2378 mm	**93.6"**
Teeth	**8, optional, bolt-on with replaceable tips.**		**8, optional, bolt-on with replaceable tips.**		**8, optional, bolt-on with replaceable tips.**	
Dump Clearance @ Full Lift and 45° Discharge	2649 mm	**8'8"**	2829 mm	**9'3"**	2649 mm	**8'8"**
Reach at 45° Discharge Angle 2133 mm (7') Clearance	1435 mm	**4'8"**	1567 mm	**5'2"**	1435 mm	**4'8"**
Reach @ Full Lift and 45° Discharge	1025 mm	**40.4"**	1058 mm	**41.6"**	1025 mm	**40.4"**
Digging Depth	183 mm	**7.2"**	133 mm	**5.2"**	183 mm	**7.2"**
Overall Length	6040 mm	**19'10"**	5722 mm	**18'9"**	5897 mm	**19'4"**
Overall Height	4854 mm	**15'11"**	4905 mm	**16'1"**	4854 mm	**15'11"**
Static Tipping Load**	7556 kg	**16,658 lb**	8667 kg	**19,106 lb**	7632 kg	**16,826 lb**
Breakout Force*	9299 kg	**20,505 lb**	10 941 kg	**24,124 lb**	9360 kg	**20,639 lb**
Operating Weight**	14 710 kg	**32,430 lb**	14 116 kg	**31,128 lb**	14 650 kg	**32,298 lb**

◄Bolt-on teeth increase bucket width by 52 mm (2.0"). Bolt-on cutting edge increases bucket width by 17 mm (.67").
*Breakout force is measured 100 mm (3.94") behind tip of cutting edge with bucket hinge pin as pivot point.
**Operating weight includes coolant, lubricants, full fuel tank, ROPS cab, General Purpose bucket, and 80 kg (176 lb) operator.

Machine stability can be affected by the addition of other attachments.

12

Bucket:	GENERAL PURPOSE Bolt-on Teeth		MULTI-PURPOSE Bolt-on Teeth		GENERAL PURPOSE Bolt-on Segments & Long Teeth	
Capacity, Rated (Nominal Heaped)	2.0 m^3	**2.6 yd^3**	1.7 m^3	**2.25 yd^3**	2.2 m^3	**2.9 yd^3**
Struck	1.67 m^3	**2.18 yd^3**	1.40 m^3	**1.83 yd^3**	1.92 m^3	**2.51 yd^3**
Cutting Edge, Type	**Straight**		**Straight**		**Straight**	
Bucket Width◄	2482 mm	**98"**	2482 mm	**98"**	2482 mm	**98"**
Teeth	**8, optional, bolt-on with replaceable tips.**		**8, optional, bolt-on with replaceable tips.**		**8, optional, bolt-on with replaceable tips.**	
Dump Clearance @ Full Lift and 45° Discharge	3137 mm	**10'3"**	2960 mm	**9'8"**	3080 mm	**10'1"**
Reach at 45° Discharge Angle 2133 mm (7') Clearance	1778 mm	**5'10"**	1589 mm	**5'2"**	1779 mm	**5'10"**
Reach @ Full Lift and 45° Discharge	1168 mm	**3'10"**	1045 mm	**3'5"**	1199 mm	**3'11"**
Digging Depth	95 mm	**3.7"**	177 mm	**7"**	120 mm	**4.7"**
Overall Length	6346 mm	**20'10"**	6401 mm	**21'0"**	6316 mm	**20'10"**
Overall Height	5307 mm	**17'5"**	5288 mm	**17'4"**	5307 mm	**17'5"**
Static Tipping Load**	12 322 kg	**27,166 lb**	10 857 kg	**23,935 lb**	12 150 kg	**26,787 lb**
Breakout Force*	17 337 kg	**38,227 lb**	16 009 kg	**35,300 lb**	16 167 kg	**35,649 lb**
Operating Weight**	18 336 kg	**40,490 lb**	19 041 kg	**41,979 lb**	18 447 kg	**40,668 lb**

◄Bolt-on teeth increase bucket width by 56.2 mm (2.2"). Bolt-on cutting edge increases bucket width by 33 mm (1.30").
*Breakout force is measured 100 mm (3.94") behind tip of cutting edge with bucket hinge pin as pivot point.
**Operating weight includes coolant, lubricants, full fuel tank, ROPS cab, General Purpose bucket, and 80 kg (176 lb) operator.

Machine stability can be affected by the addition of other attachments. Add or subtract the following to/from machine operating weight and static tipping load:

	Change in Operating Weight		Change in Static Tipping Load For General Purpose Bucket	
	kg	lb	kg	lb
Remove ROPS and cab	−475	**−1048**	−573	**−1264**
ROPS canopy only (cab removed)	−168	**−371**	−192	**−423**
Ripper (includes rear hydraulic arrangement)	+726	**+1600**	+1615	**+3560**
Air conditioner	+106	**+234**	+169	**+373**
Bumper	+151	**+332**	+325	**+716**
Wide track shoes	+273	**+602**	+185	**+408**
Long Teeth	+152	**+334**	−203	**−448**

Bucket:	MULTI-PURPOSE Bolt-on Segments & Long Teeth		GENERAL PURPOSE Bolt-on Cutting Edge		MULTI-PURPOSE Bolt-on Cutting Edge	
Capacity, Rated (Nominal Heaped)	1.9 m^3	**2.5 yd^3**	2.2 m^3	**2.9 yd^3**	2.0 m^3	**2.6 yd^3**
Struck	1.65 m^3	**2.16 yd^3**	1.97 m^3	**2.58 yd^3**	1.71 m^3	**2.23 yd^3**
Cutting Edge, Type	**Straight**		**Straight**		**Straight**	
Bucket Width◄	2482 mm	**96"**	2482 mm	**96"**	2482 mm	**96"**
Teeth	**8, optional, bolt-on with replaceable tips.**		**8, optional, bolt-on with replaceable tips.**		**8, optional, bolt-on with replaceable tips.**	
Dump Clearance @ Full Lift and **45° Discharge**	2899 mm	**9'6"**	3051 mm	**10'0"**	2868 mm	**9'5"**
Reach at 45° Discharge Angle 2133 mm (7') Clearance	1587 mm	**5'2.5"**	1806 mm	**5'11"**	1597 mm	**5'3"**
Reach @ Full Lift and 45° **Discharge**	1070 mm	**3'6"**	1228 mm	**4'0"**	1095 mm	**3'7"**
Digging Depth	202 mm	**8"**	125 mm	**4.9"**	207 mm	**8.2"**
Overall Length	6401 mm	**21'0"**	6208 mm	**20'4"**	6283 mm	**20'7"**
Overall Height	5288 mm	**17'4"**	5307 mm	**17'5"**	5288 mm	**17'4"**
Static Tipping Load**	10 761 kg	**23,724 lb**	12 126 kg	**26,733 lb**	10 745 kg	**23,688 lb**
Breakout Force*	14 960 kg	**32,987 lb**	15 572 kg	**34,337 lb**	14 438 kg	**31,836 lb**
Operating Weight**	19 122 kg	**42,156 lb**	18 422 kg	**40,613 lb**	19 097 kg	**42,101 lb**

◄Bolt-on teeth increase bucket width by 55.2 mm (2.2"). Bolt-on cutting edge increases bucket width by 33 mm (1.30").
*Breakout force is measured 100 mm (3.94") behind tip of cutting edge with bucket hinge pin as pivot point.
**Operating weight includes coolant, lubricants, full fuel tank, ROPS cab, General Purpose bucket, and 80 kg (176 lb) operator.

Machine stability can be affected by the addition of other attachments.

12

Bucket:	GENERAL PURPOSE Bolt-on Teeth		MULTI-PURPOSE Bolt-on Teeth		ROCK Weld-on Flush Teeth		STEEL MILL ARRANGEMENT Bare Cutting Edge	
Capacity, Rated (Nominal Heaped)	2.8 m³	3.75 yd³	2.6 m³	3.40 yd³	2.8 m³	3.75 yd³	2.5 m³	3.25 yd³
Struck	2.41 m³	3.16 yd³	2.19 m³	2.87 yd³	2.46 m³	3.21 yd³	2.03 m³	2.65 yd³
Cutting Edge, Type	Straight		Straight		Spade		Straight	
Bucket Width ◄	2854 mm	9'4"	2710 mm	8'11"	2705 mm	8'10.5"	2714 mm	8'11"
Teeth	8, optional, bolt-on with replaceable tips		8, optional, bolt-on with replaceable tips		8, optional, weld-on with replaceable tips		6, standard, weld-on with replaceable tips	
Dump Clearance @ Full Lift and 45° Discharge	3340 mm	10'11"	3044 mm	9'11"	3014 mm	9'10"	2986 mm	9'9.5"
Reach @ 45° Discharge Angle, 2.133 m (7') Clearance	2006 mm	6'7"	1859 mm	6'1"	2023 mm	6'8"	1784 mm	5'10"
Reach @ Full Lift and 45° Discharge	1328 mm	4'4"	1287 mm	4'2"	1464 mm	4'9"	1247 mm	4'1"
Digging Depth	118 mm	4.6"	211 mm	8.3"	118 mm	4.6"	118 mm	4.6"
Overall Length	7123 mm	22'4"	7318 mm	24'1"	7298 m	23'11"	7572 mm	24'10"
Overall Height	5735 mm	19'0"	5894 mm	19'4"	5778 mm	18'9"	5825 mm	19'1.3"
Static Tipping Load**	16 788 kg	37,010 lb	14 120 kg	31,130 lb	16 678 kg	36,768 lb	18 470 kg	40,720 lb
Breakout Force*	21 760 kg	47,981 lb	17 699 kg	39,028 lb	18 696 kg	41,223 lb	20 758 kg	45,765 lb
Operating Weight**	24 902 kg	54,899 lb	26 086 kg	57,510 lb	24 908 kg	54,912 lb	27 551 kg	60,740 lb

◄ Bolt-on teeth increase bucket width by 63.0 mm (2.5"). Bolt-on cutting edge increases bucket width by 19 mm (.74").
*Breakout force is measured 100 mm (3.94") behind tip of cutting edge with bucket hinge pin as pivot point.
**Operating weight includes lubricants, full fuel tank, ROPS cab, General Purpose bucket, and 80 kg (176 lb) operator.

Machine stability can be affected by the addition of other attachments. Add or subtract the following to/from machine operating weight and static tipping load.

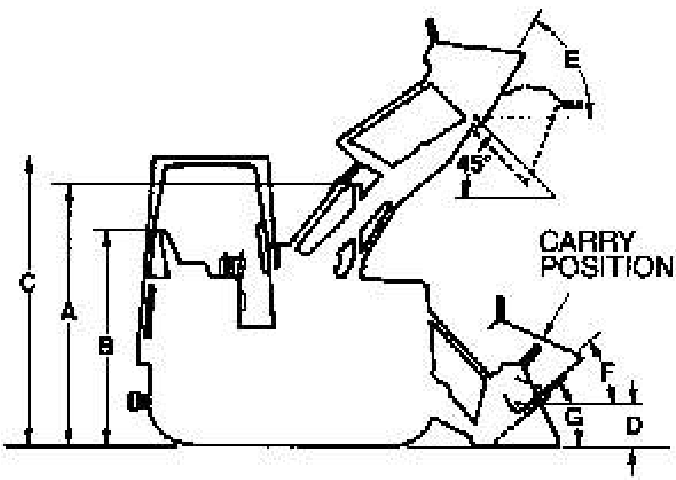
	Change in Operating Weight		Change in Static Tipping Load	
	kg	lb	kg	lb
Remove ROPS cab	− 485	−1070	− 545	−1202
ROPS canopy only (cab removed)	− 175	− 385	− 208	− 459
Ripper (includes rear hydraulic arrangement)	+1228	+2707	+2843	+6268
Air conditioner	+ 107	+ 236	+ 166	+ 366
Bumper	+ 151	+ 332	+ 345	+ 761
Wide track shoes	+ 632	+1394	+ 476	+1050
Long Teeth	+ 223	+ 492	305	− 672

Bucket:	GENERAL PURPOSE Bolt-on Segments & Long Teeth		MULTI-PURPOSE Bolt-on Segments & Long Teeth		GENERAL PURPOSE Bolt-on Cutting Edge		MULTI-PURPOSE Bolt-on Cutting Edge	
Capacity, Rated (Nominal Heaped)	3.2 m³	4.2 yd³	2.9 m³	3.8 yd³	3.2 m³	4.2 yd³	2.9 m³	3.8 yd³
Struck	2.77 m³	3.62 yd³	2.56 m³	3.34 yd³	2.77 m³	3.62 yd³	2.56 m³	3.34 yd³
Cutting Edge, Type	Straight		Straight		Straight		Straight	
Bucket Width ◄	2854 mm	9'4"	2710 mm	8'11"	2854 mm	9'4"	2710 mm	8'11"
Teeth	8, optional, bolt-on with replaceable tips		8, optional, bolt-on with replaceable tips		8, optional, weld-on with replaceable tips		8, optional, bolt-on with replaceable tips	
Dump Clearance @ Full Lift and 45° Discharge	3266 mm	10'9"	2965 mm	9'9"	3266 mm	10'9"	2965 mm	9'9"
Reach @ 45° Discharge Angle, 2.133 m (7') Clearance	2029 mm	6'8"	1861 mm	6'1"	2029 mm	6'8"	1861 mm	6'1"
Reach @ Full Lift and 45° Discharge	1375 mm	4'6"	1324 mm	4'4"	1375 mm	4'6"	1324 mm	4'4"
Digging Depth	148 mm	5.8"	241 mm	9.5"	148 mm	5.8"	241 mm	9.5"
Overall Length	7123 mm	23'4"	7316 mm	24'1"	6942 m	22'9"	7221 mm	23'8"
Overall Height	5785 mm	19'0"	5894 mm	19'4"	5785 mm	19'0"	5894 mm	19'4"
Static Tipping Load**	16 503 kg	36,383 lb	13 930 kg	30,711 lb	16 696 kg	36,809 lb	14 114 kg	31,116 lb
Breakout Force*	20 040 kg	44,188 lb	16 699 kg	36,261 lb	20 185 kg	44,507 lb	16 595 kg	36,591 lb
Operating Weight**	25 037 kg	55,198 lb	26 205 kg	57,772 lb	24 894 kg	54,882 lb	26 067 kg	57,467 lb

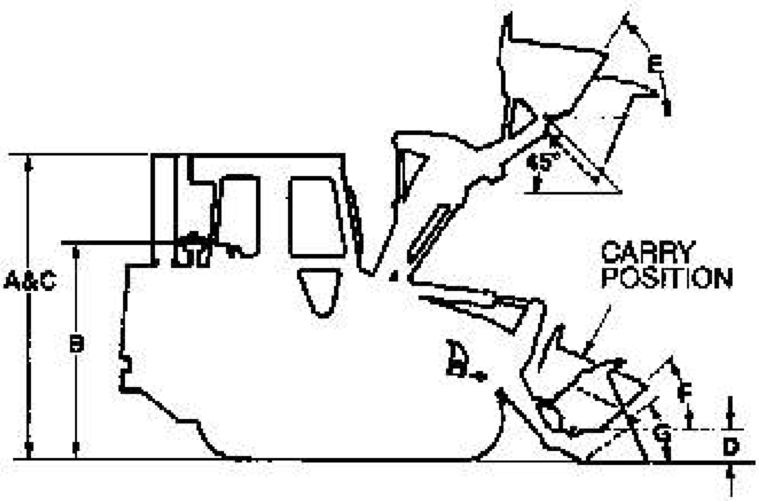
◄ Bolt-on teeth increase bucket width by 63.5 mm (2.5"). Bolt-on cutting edge increases bucket width by 19 mm (.74").
*Breakout force is measured 100 mm (3.94") behind tip of cutting edge with bucket hinge pin as pivot point.
**Operating weight includes lubricants, full fuel tank, ROPS cab, General Purpose bucket, and 80 kg (176 lb) operator.

Machine stability can be affected by the addition of other attachments.

931C Series II-935C Series II

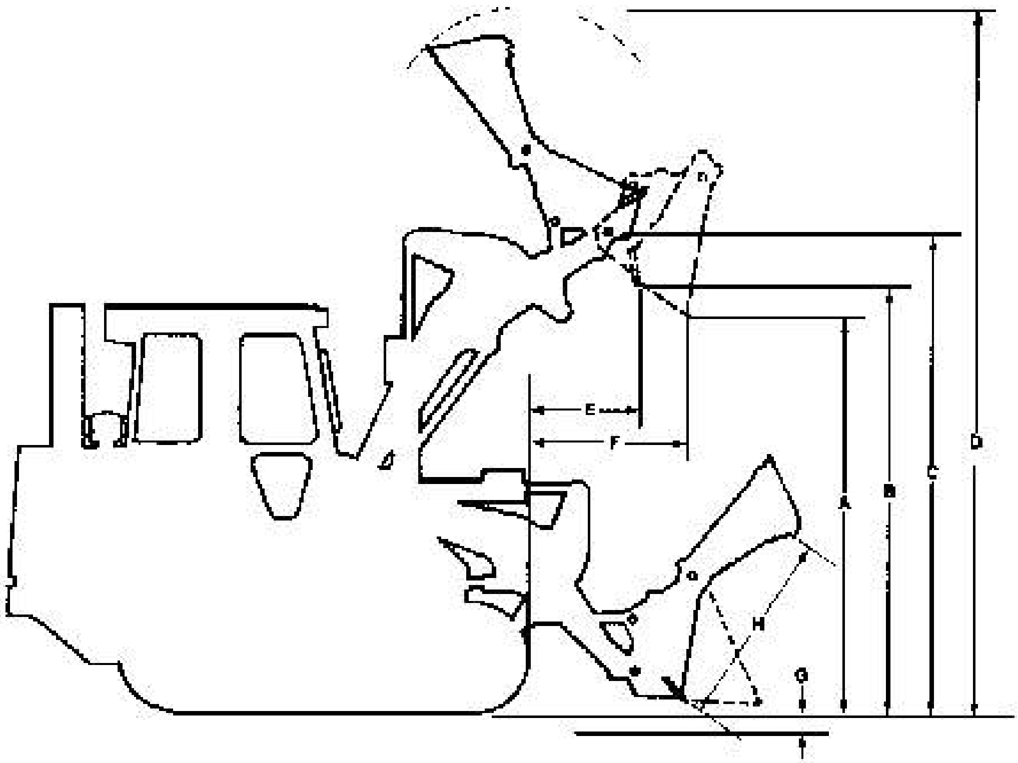


943-953-963-973



		931C Series II		935C Series II		943	
A	Height to Top of Stack	2.62 m	8'7"	2.62 m	8'7"	3.018 m	9'11"
B	Height to Top of Seat	1.99 m	6'6"	1.99 m	6'6"	2.251 m	7'5"
C	Height to Top of ROPS	2.68 m	8'10"	2.68 m	8'10"	3.018 m	9'11"
D	Hinge Pin Height at Carry Position	406 mm	15.9"	406 mm	15.9"	370 mm	14.6"
E	Rollback at Maximum Lift	63°		63°		57°	
F	Rollback at Carry Height	51°		51°		45°	
G	Rollback at Ground Level	42°		43°		39°	
	Grading Angle (Bare Edge)	—		—		74°	
	Width Without Bucket (std. track)	1.78 m	5'10"	1.79 m	5'11"	2.06 m	6'9"
	(optional track)	—	—	—	—	2.16 m	7'1"

		953		963		973	
A	Height to Top of Stack	3.078 m	10'1"	3.300 m	10'10"	3.357 m	11'0"
B	Height to Top of Seat	2.347 m	7'8"	2.557 m	8'4"	2.691 m	8'10"
C	Height to Top of ROPS	3.078 m	10'1"	3.300 m	10'10"	3.423 m	11'3"
D	Hinge Pin Height at Carry Position	424 mm	16.7"	467 mm	18.4"	492 mm	19.4"
E	Rollback at Maximum Lift	56°		59°		58°	
F	Rollback at Carry Height	48°		50°		50°	
G	Rollback at Ground Level	41°		43°		42°	
	Grading Angle (Bare Edge)	74°		68°		68°	
	Width Without Bucket (std. track)	2.18 m	7'2"	2.30 m	7'6"	2.59 m	8'6"
	(optional track)	2.30 m	7'6"	2.40 m	7'10"	2.76 m	9'0"

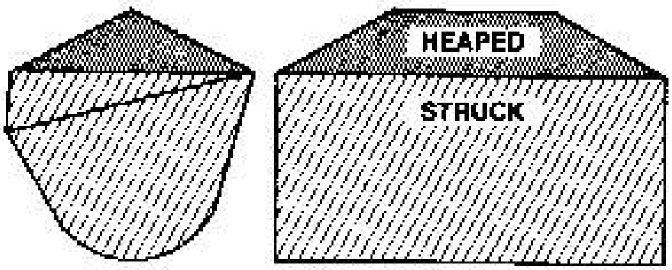


	931C Series II		935C Series II		943	
A Forward Dump Clearance*	2.50 m	8'2"	2.50 m	8'2"	2.59 m	8'6"
B Bottom Dump Clearance*	2.92 m	9'6.8"	2.92 m	9'6.8"	2.98 m	9'9"
C Hinge Pin Height*	2.84 m	9'3.9"	2.84 m	9'3.9"	3.38 m	11'1"
D Overall Height	4.80 m	15'9"	4.80 m	15'9"	5.07 m	16'8"
E Bottom Dump Reach	513 mm	20.2"	513 mm	20.2"	488 mm	19.1"
F Forward Dump Reach*	901 mm	35.5"	901 mm	35.5"	872 mm	2'10"
G Digging Depth	196 mm	7.7"	196 mm	7.7"	158 mm	6.2"
H Bucket Opening	987 mm	3'2.9"	987 mm	3'2.9"	1.13 m	3'8"
Reach at 2133 mm (7'0") Height*	1.20 m	3'11.1"	1.20 m	3'11.1"	1.23 m	4'0"
Tilt Back at Ground Level	43°		43°		40°	
Closure Force, Clamp to Cutting Edge	44.2 kN	9936 lb	50.8 kN	11,426 lb	71.6 kN	16,089 lb
Weight of Bucket and Additional Hydraulics**	695 kg	1532 lb	695 kg	1532 lb	1275 kg	2811 lb

	953		963		973	
A Forward Dump Clearance*	2.72 m	8'11"	2.98 m	9'8"	3.04 m	9'11"
B Bottom Dump Clearance*	3.16 m	10'5"	3.43 m	11'3"	3.66 m	12'0"
C Hinge Pin Height*	3.60 m	11'10"	3.92 m	12'10.4"	4.22 m	13'10"
D Overall Height	5.37 m	17'8"	5.92 m	19'5"	6.52 m	21'4"
E Bottom Dump Reach	540 mm	21.3"	612 mm	24.1"	721 mm	28.4"
F Forward Dump Reach*	992 mm	3'3"	1.04 m	3'5"	1.29 m	4'2.7"
G Digging Depth	158 mm	6.2"	177 mm	7"	211 mm	8.3"
H Bucket Opening	1.14 m	3'9"	1.26 m	4'1.5"	1.38 m	4'6"
Reach at 2133 mm (7'0") Height*	1.44 m	4'9"	1.59 m	5'2"	1.86 m	6'1"
Tilt Back at Ground Level	43°		45°		45°	
Closure Force, Clamp to Cutting Edge	71.8 kN	16,134 lb	72.3 kN	16,250 lb	89.0 kN	20,000 lb
Weight of Bucket and Additional Hydraulics	1413 kg	3116 lb	1843 kg	4064 lb	2829 kg	6237 lb

*45° Discharge and full lift.
Operator may prefer to tip bucket forward when bottom dumping.
**931C Series II gets 250 kg (564 lb) of sprocket counterweights in addition to above weight.

SAE BUCKET RATING



SAE Bucket Capacities

Struck capacity is that volume contained in a bucket after a load is leveled by drawing a straight edge resting on the cutting edge and the back of the bucket.

Heaped capacity is a struck capacity *plus* that additional material that would heap on the struck load at a 2:1 angle of repose with the struck line parallel to the ground.

SAE J742 (Oct. 79) specifies that the addition of any auxiliary spill guard to protect against spillage of material which might injure the operator will not be included in bucket capacity ratings. For buckets with irregular shaped cutting edges (vee edge) the strike plane should be drawn at one-third of the distance of the protruding portion of the cutting edge. Caterpillar rock buckets are built with integral see-through rock guards. Caterpillar light material buckets come standard with bolt-on edges. These features which add to actual bucket capacity are included in published ratings.

Dump Height

SAE J732c specifies that dump height is the vertical distance from the ground to the lowest point of the cutting edge with the bucket hinge pin at maximum height and the bucket at a 45° dump angle. Dump angle is the angle in degrees that the longest flat section of the inside bottom of the bucket will rotate below horizontal.

SELECTING A MACHINE

Steps in selecting the proper size loader:

1. Determine production required or desired.
2. Determine loader cycle time and cycles per hour. A machine size must be assumed to select a basic cycle time.
3. Determine required payload per cycle in loose cubic yards and pounds (meters and kilograms).
4. Determine bucket size needed.
5. Make machine selection using bucket size and payload as criteria to meet production requirements.
6. Compare the loader cycle time used in calculations to the cycle time of the machine selected. If there is a difference, rework the process beginning at step 2.

1. Production Required

The production required of a track loader should be slightly greater than the production capability of the other critical units in the earth or material moving system. For example, if a hopper can handle 300 tons per hour, a loader capable of slightly more than 300 tons should be used. Required production should be carefully calculated so the proper machine and bucket selections can be made.

2. Loader Cycle Times

Material type, pile height, and other factors may tend to either improve or reduce production, and should be added to or subtracted from the basic cycle time when applicable.

When hauls are involved, read the travel time portion of the cycle from the estimated travel chart (this section) for the ranges to be used for both haul and return times. Add the haul and return times to the estimated basic cycle time to obtain total cycle time.

CYCLE TIME FACTORS

A basic cycle time (Load, Dump, Maneuver) of .25-.35 minutes is average for a track loader [the basic cycle for large loaders, 3 m^3 (4 yd^3) and up, can be slightly longer], but variations can be anticipated in the field. The following values for many variable elements are based on normal operations. Adding or subtracting any of the variable times will give the total basic cycle time.

Estimating Cycle Time

Cycle time of a track loader needs to be determined to find loads per hour. Total cycle time includes the following segments:

Load Time + Maneuver Time + Travel Time + Dump Time

Load Time —

Material	Minutes
Uniform aggregates	0.03-0.05
Moist mixed aggregates	0.03-0.06
Moist loam	0.03-0.07
Soil, boulders, roots	0.04-0.20
Cemented materials	0.05-0.20

Maneuver Time — includes basic travel, four changes of direction and turning time, and will be about 0.20 minutes at full throttle with a competent operator.

Travel Time — in a load and carry operation is comprised of haul and return times which can be determined by the travel charts in this section.

Dump Time — is dictated by the size and strength of the dump target and varies from 0.00 to 0.10 minutes. Typical dump times into highway trucks are from 0.04 to 0.07 minutes.

NOTE: When comparing hydrostatic track loaders with former power shift models (using the production estimating method) two factors must be considered: (1) The hydrostatic loaders on the average outcycle power shift models by up to 10 percent due to faster machine speed and easier operation. (2) Hydrostatic loaders incorporate Z-bar linkage, which provides substantially better bucket fill factors. The degree to which each factor affects estimated production should be left to the user's judgment depending on his particular job application or job conditions.

Example: Moist loam is being excavated from a bank and loaded into trucks.

	Minutes
Load — moist loam	0.05
Maneuver Time	0.20
Travel — none required	0.00
Dump	0.05
Total Cycle	0.30 min. or 200 cycles per 60 min. hour

	Minutes added (+) or Subtracted (–) From Basic Cycle
Materials	
— Mixed	+.02
— Up to 3 mm (1/8 in)	+.02
— 3 mm (1/8 in) to 20 mm (3/4 in)	–.02
— 20 mm (3/4 in) to 150 mm (6 in)	.00
— 150 mm (6 in) and over	+.03 and Up
— Bank or broken	–.04 and Up
Pile	
— Conveyor or Dozer piled 3 m (10 ft) and up	.00
Conveyor or Dozer piled 3 m (10 ft) or less	+.01
— Dumped by truck	+.02
Miscellaneous	
— Common ownership of trucks and loaders	Up to –.04
— Independently owned trucks	Up to +.04
— Constant operation	Up to .04
— Inconsistent operation	Up to +.04
— Small target	Up to +.04
— Fragile target	Up to +.05

Using actual job conditions and the above factors, total cycle time can be estimated. Convert total cycle time to cycles per hour.

$$\textit{Cycles per hour at 100\% Efficiency} = \frac{\textit{60 Min}}{\textit{Total Cycle Time in Minutes}}$$

Job efficiency is an important factor in machine selection. Efficiency is the actual number of minutes worked during an hour. Job efficiency accounts for cigarette and bathroom breaks, and other work interruptions.

$$\text{Cycles per hour at 50 minutes per hour (83\% efficiency)} = \text{Cycles per hour at 100\% efficiency} \times \frac{\text{50 min actual work time}}{\text{60 min hour}}$$

12

Bucket Fill Factors

The following indicates the approximate amounts of material as a percent of rated bucket capacity which will actually be delivered per bucket per cycle. This is known as "Bucket Fill Factor."

Loose Material	Fill Factor
Mixed Moist Aggregates	95-110%
Uniform Aggregates	95-110
3 mm-9 mm (1/8 in-3/8 in)	90-110
12 mm-20 mm (1/2 in-3/4 in)	90-110
24 mm and over (1 in)	90-110
Blasted Rock	
Well	80-95%
Average	75-90
Poor	60-75
Other	
Rock Dirt Mixtures	100-120%
Moist Loam	100-120
Soil, Boulders, Roots	80-100
Cemented Materials	85-100

Fill factors on track loaders are affected by bucket penetration, breakout force, rackback angle, bucket profile and ground engaging tools such as bucket teeth or bolt-on replaceable cutting edges and segments.

GENERAL PURPOSE BUCKET OPERATING CAPACITIES

MODEL	GENERAL PURPOSE BUCKET SIZE m^3	GENERAL PURPOSE BUCKET SIZE yd^3	RECOMMENDED OPERATING CAPACITY kg	RECOMMENDED OPERATING CAPACITY lb
931C Series II	0.83	1.08	1430	3240
935C Series II	1.00	1.30	1770	3900
943	1.15	1.50	2040	4500
953	1.50	2.00	2720	6000
963	2.00	2.60	3540	7800
973	2.80	3.75	5100	11,250

LOADER PRODUCTION

Loader production equals quantity of material the bucket carries per load × number of bucket loads per hour.

Estimating Bucket Load

The quantity of material in a loader bucket is estimated by two methods, depending on whether the material being loaded is in a loose or bank state.

1. When the material is loose, as in a stockpile loading, the bucket load is estimated in loose meters (or cubic yards) by a Bucket Fill Factor (see Tables Section or chart following this discussion). The quantity of material is determined as follows:

   Rated Bucket Capacity × Bucket Fill Factor = Bucket Payload in Loose m^3 (yd^3)

   For example, a 973 with a 2.8 m^3 (3.75 yd^3) General-Purpose bucket loading uniform aggregate from a stockpile will carry:

   $2.8\ m^3 \times 1.0 = 2.8$ loose cubic meters
   ($3.75\ yd^3 \times 1.0 = 3.75$ loose cubic yards)

   Once the potential bucket load has been determined, check the static tipping load ratings on the specific machine to determine if bucket load is in fact a safe operating load. (Safe operating load as defined by SAE should not exceed 35% of static tipping load.)

   Productivity in many applications is measured in tons. See Tables Section for material densities if conversion to tons is desired.

2. When material is in the bank state, as in excavation, productivity is measured in bank meters (cubic yards). Bucket load in Bm^3 (BCY) is estimated by applying one of the load factors from the Tables section to convert the excavated material in the bucket from Bm^3 (BCY) to Lm^3 (LCY) to allow for the digging and carrying characteristics of the material. The quantity of excavated material a bucket carries is then determined as follows:

   Rated Bucket Capacity × Load Factor × Bucket Fill Factor = Bucket Payload in Bm^3 (BCY)

   Example: a 953 with a 1.50 m^3 (2 yd^3) General Purpose bucket loading wet loam earth from bank:

   $1.50\ m^3 \times 0.80 \times 1.15 = 1.38\ Bm^3$
   ($2\ yd^3 \times 0.80 \times 1.15 = 1.84$ BCY)

Estimating Production

Machine and job considerations include:
- Machine model and bucket size
- Material type, particle size, density and load factor (see Tables Section)
- Bucket fill factor
- Haul distance
- Underfoot conditions
- Altitude
- Dump target size, height, and type

Example:

Conditions —

Machine	953
Bucket size	1.75 m^3 (2.3 yd^3)
Material	Moist Loam
Bucket fill factor	1.15
Haul length	30 m (100 ft)
Dump target	Pile
Travel in forward speed.	

Cycle Time	Minutes
Load time	0.03 min
Maneuver time	0.20
Travel time (from curves)	0.40
Dump time	0.00
Total	0.63 min

Loads Per Hour —

$$\frac{60 \text{ min/hr}}{0.63 \text{ min/cycle}} = 95 \text{ cycles per hour @ 100\% efficiency}$$

Load Per Cycle —

1.75 m^3 x 1.15 BFF = 2.0 Lm^3 x .81 LF = 1.63 Bm^3
(2.3 yd^3 x 1.15 BFF = 2.64 LCY x .81 LF = 2.14 BCY)

Hourly Production —

1.63 Bm^3 x 95 cycles/h = 154.9 Bm^3/h
(2.14 BCY x 95 cycles/hr = 203.5 BCY/hr)

Efficiency Considerations

Loader capacity should always be matched to peak production requirements of the job. Actual "on-the-job" loader productivity will be influenced by factors such as operator skill, personal delays, job layout and other delays. Experience and knowledge of local conditions will be the best indicators of actual job efficiency.

Operation	Working Hour	Efficiency Factor
Day	50 min/Hr	.83

An Alternative Machine Selection Method

Another method of selecting the right Track Loader and bucket to meet production requirements is by use of the nomographs on the following pages. The method is quicker and easier than the preceding example because it does not require as many calculations, yet the accuracy is about the same within the normal limits of input data.

Be careful when entering and reading data from the nomographs because some scales increase from bottom to top, while others are the reverse. Do not be overly concerned with the precision as affected by pencil line width or reading to the hundredth of a m^3 (yd^3). Remember that bucket fill factor, material density, and cycle time are at best close estimates.

Example problem

A track loader must produce 115 Lm^3 (150 LCY) per hour. Estimated cycle time is .5 minutes, working 50 minutes per hour. Bucket fill factor is 100% and the material density is 1600 kg/Lm^3 (2700 lb/LCY).

Determine bucket size, machine model and hourly production in tons and yards.

Solution:

At full efficiency, it will cycle 120 times per hour. Since only an average 50 minutes are available, only 100 cycles will be completed per hour.

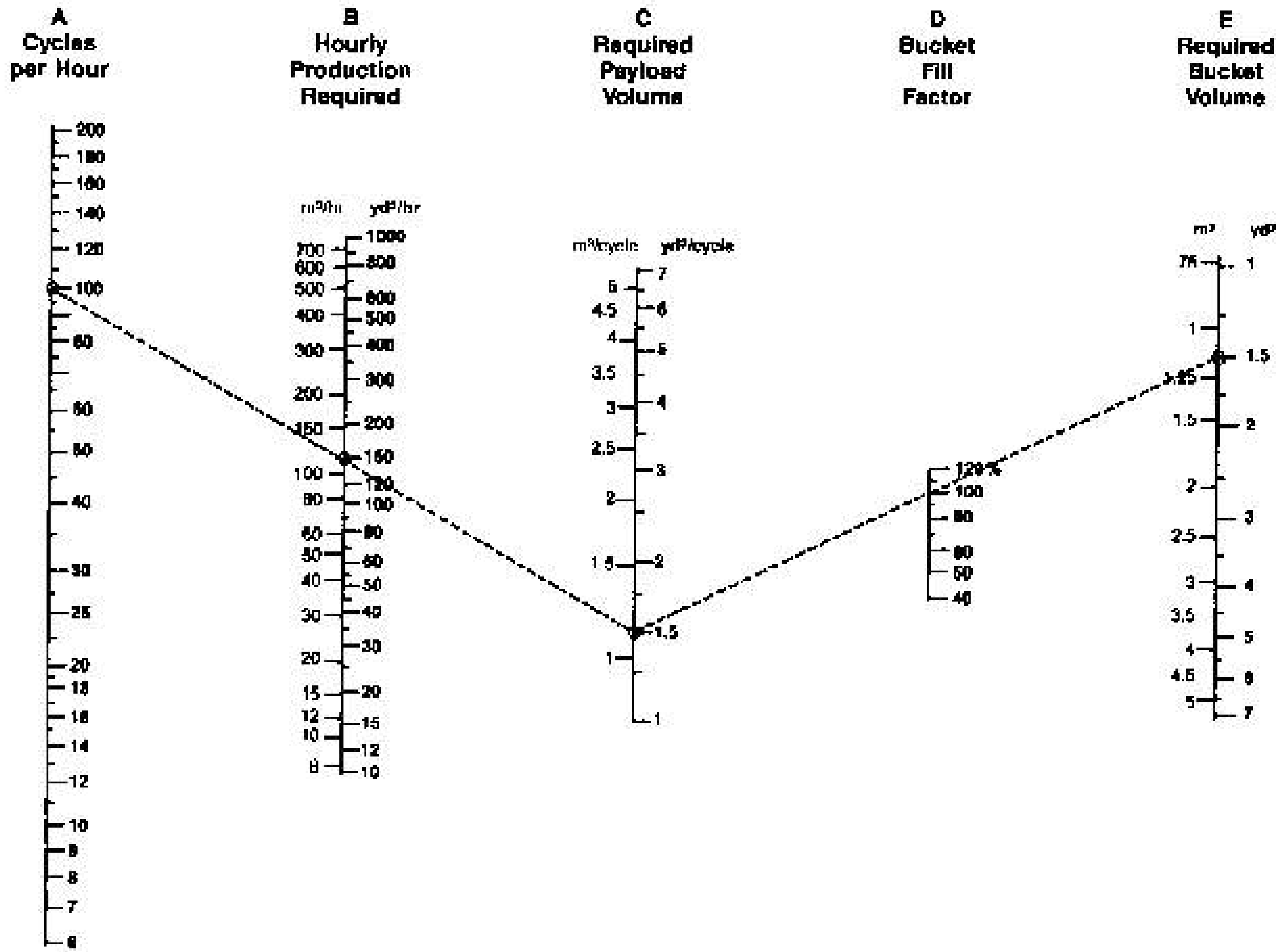
Starting on Scale A at 100 cycles per hour draw a straight line intersecting 115 m^3/hr (150 yd^3/hr) on Scale B and continuing the line on to Scale C giving 1.15 m^3 (1.50 yd^3) required payload.

Follow steps 1 through 7 on the next two pages.

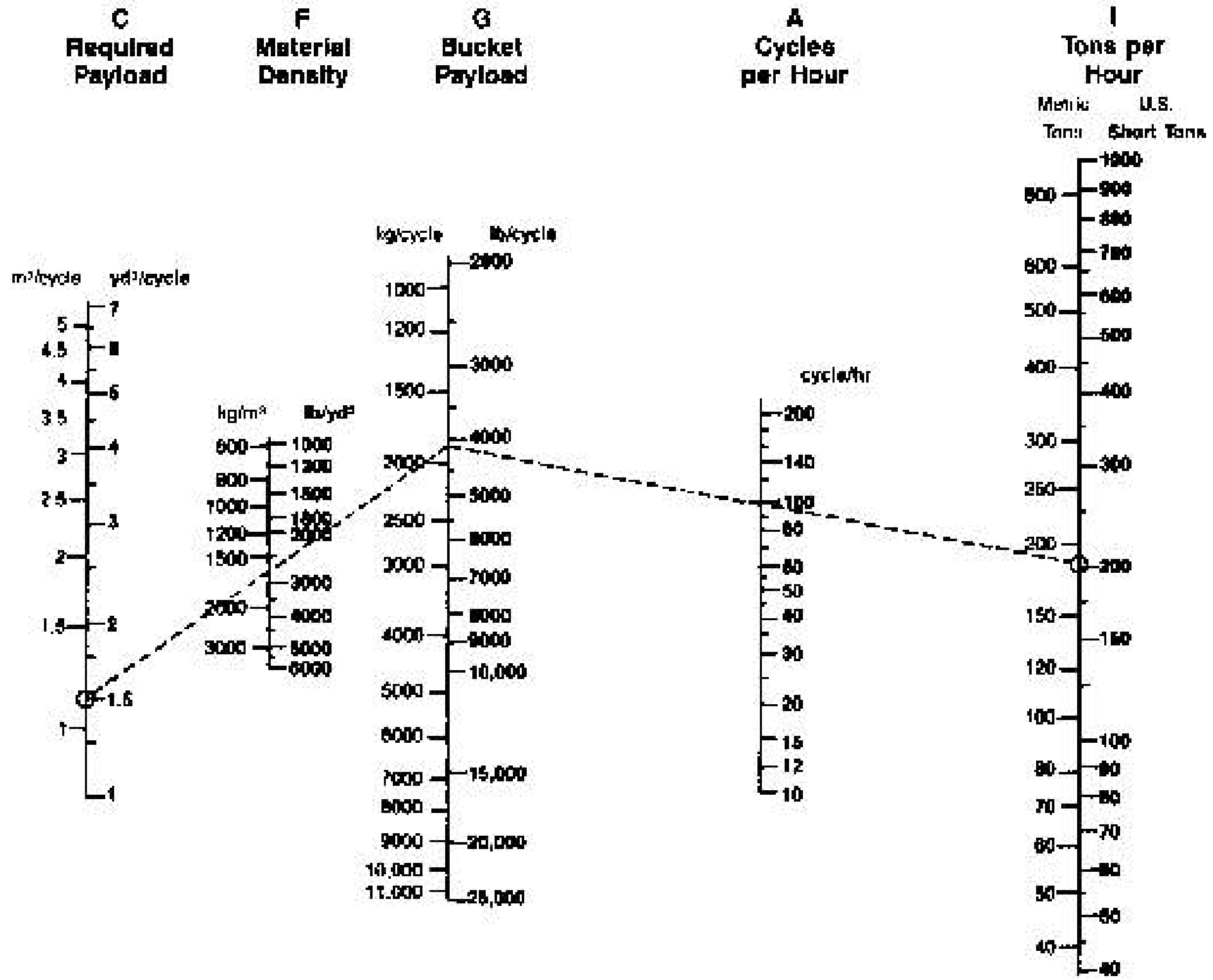
• • •

Production and Machine Selection Nomograph
• To find required bucket payload and bucket size

1) Enter Scale A cycles per hour (100) and B hourly production 115 m^3/hr (150 yd^3/hr).
2) Connect A and B and extend to C to find required payload 1.2 m^3 (1.5 yd^3).
3) Connect C to bucket fill factor on Scale D (1.0) and extend to E to find required bucket size 1.15 m^3 (1.5 yd^3).
4) Transfer Scale A and C readings to nomograph on following page.



5) Connect C 1.15 m^3 (1.5 yd^3) to F 1600 kg/m^3 (2700 lb/yd^3) and extend to G to find payload weight 1840 kg (4050 lb).
6) Compare G bucket payload weight 1840 kg (4050 lb) with recommended operating capacities table in this section to see if the 1.15 m^3 (1.5 yd^3) bucket can handle the desired payload. Table indicates the 943 with the 1.15 m^3 (1.50 yd^3) bucket has a recommended operating capacity of 2040 kg (4500 lb), therefore stability is okay.
7) Extend Scale G reading 1840 kg (4050 lb) through Scale A (100) to Scale I to find tons per hour 225 metric ton/hr (202 U.S. ton/hr).



12

TRAVEL TIME CHARTS

Conditions:

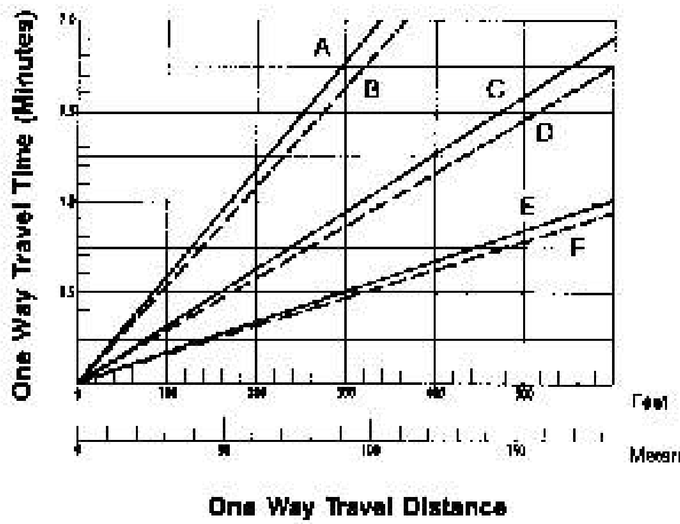
- No grades.
- Speeds loaded and empty essentially the same.
- Bucket position constant during travel.
- Travel encountered in maneuver time portion of cycle not included.
- Acceleration time accounted for in maneuver time.

Travel Time (in minutes) =

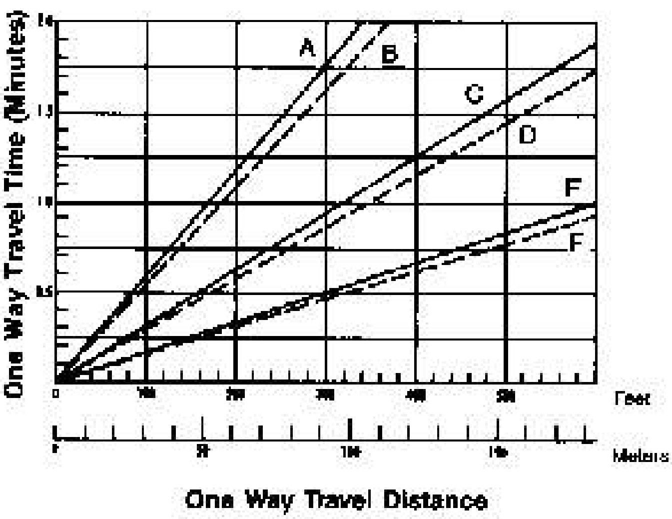
Metric $\dfrac{\text{number of meters traveled}}{\text{speed (in km/h)} \times 16.67}$

English – $\dfrac{\text{number of feet traveled}}{\text{speed (in mph)} \times 88}$

931C Series II



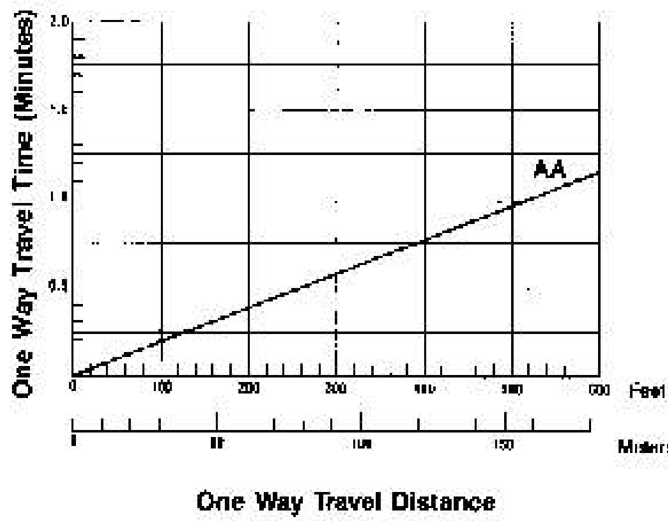
935C Series II



KEY

A — 1st forward speed
B — 1st reverse speed
C — 2nd forward speed
D — 2nd reverse speed
E — 3rd forward speed
F — 3rd reverse speed

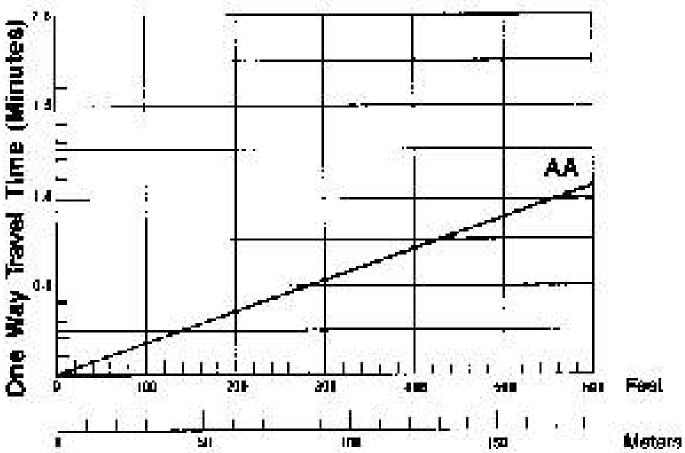
943



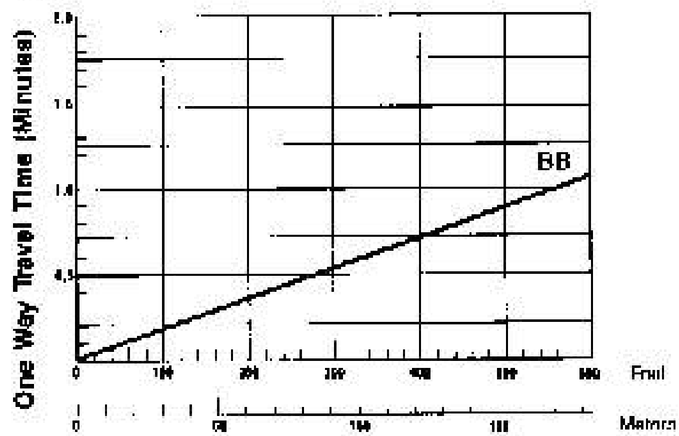
KEY

AA — Hydrostatic top speed both forward and reverse 9.5 km/h (5.9 mph)

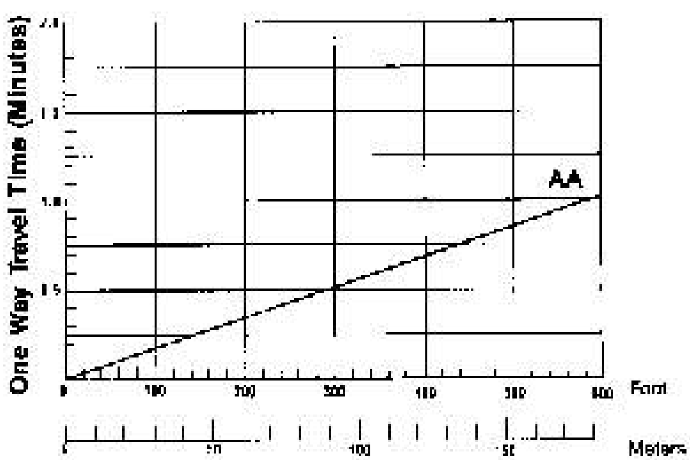
953



963



973



KEY

AA — Hydrostatic top speed both forward and reverse 10.3 km/h (6.4 mph)

BB — Hydrostatic top speed both forward and reverse 10.0 km/h (6.0 mph)

TRAVEL TIME CHARTS

Conditions:

- No grades.
- Speeds loaded and empty essentially the same.
- Bucket position constant during travel.
- Travel encountered in maneuver portion of cycle not included.
- Acceleration time accounted for in maneuver time.

Travel Time (in minutes) =

Metric $= \dfrac{\text{number of meters traveled}}{\text{speed (in km/h)} \times 16.67}$

English $\dfrac{\text{number of feet traveled}}{\text{speed (in mph)} \times 88}$

12

Track Loaders

Production Estimating Table
- m³ or yd³/60 min. hour
- Estimated bucket payload in bank m³ or yd³

Bucket Size (m³or yd³)		1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Cycle Time Hundredths of a minute	Cycles Per Hr	Unshaded area indicates average work range								
0.25	240	240	360	480	600	720	840	960		
0.30	200	200	300	400	500	600	700	800		
0.35	171	171	257	342	428	513	599	684	769	
0.40	150	150	225	300	375	450	525	600	675	750
0.45	133	133	200	268	332	400	466	530	600	665
0.50	120	120	180	240	300	360	420	480	540	600
0.55	109	109	164	218	272	328	382	436	490	545
0.60	100	100	150	200	250	300	350	400	450	500
0.65	92							368	416	460

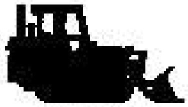
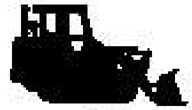
WASTE DISPOSAL TRACK LOADERS

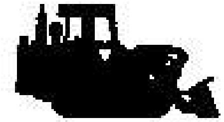
CONTENTS

Features

- **Unmatched versatility** — excavates, loads, dozes, compacts, shreds, sorts, grapples — a true all purpose machine.
- **Additional heavy duty guarding** helps protect sheet metal and machine components from damage in waste handling applications.
- **Improved serviceability** — swing open doors, guards and oil coolers give quicker access for cleaning debris and for servicing.
- **Hinged heavy duty radiator guard** with quick release "T" handles allows for easy access to the radiator for cleaning.
- **Rear Striker Bar (optional)** keeps trash from climbing the track and damaging fenders.
- **Lamp Guard Group (front and rear)** protects lamps with bolt on grid guards.
- **Single grouser trapezoidal-shaped center hole track shoes (optional)** provides maximum traction and center holes allow sprocket to punch out dirt and debris.
- **Debris Barrier Package** protects machine from material entering engine and other compartments.

12



MODEL	943 WDA		953 WDA		963 WDA		973 WDA	
Flywheel Power	60 kW	80 HP	82 kW	110 HP	112 kW	150 HP	157 kW	210 HP
Operating Weight*	13 350 kg	29,431 lb	15 656 kg	39,515 lb	20 340 kg	44,843 lb	29 268 kg	64,565 lb
Engine Model	3204		3204T		3304		3306T	
Rated Engine RPM	2400		2400		2200		2200	
Bore	114 mm	4.5"	114 mm	4.5"	121 mm	4.75"	121 mm	4.75"
Stroke	127 mm	5"	127 mm	5"	152 mm	6"	152 mm	6"
No. Cylinders	4		4		4		6	
Displacement	5.2 L	318 in³	5.2 L	318 in³	7.0 L	425 in³	10.5 L	638 in³
Speeds Forward,	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1st	0-9.5	0-5.9	0-10.35	0-6.4	0-10.1	0-6.0	0-10.3	0-6.4
2nd	Infinitely		Infinitely		Infinitely		Infinitely	
3rd	Variable		Variable		Variable		Variable	
Reverse**								
1st	0-9.5	0-5.9	0-10.35	0-6.4	0-10.1	0-6.0	0-10.3	0-6.4
2nd	Infinitely		Infinitely		Infinitely		Infinitely	
3rd	Variable		Variable		Variable		Variable	
Hydraulic Cycle Time, Bucket Empty, in Seconds:								
Raise	7.2		7.4		6.2		7.4	
Dump	1.6		1.5		1.3		1.4	
Lower (Empty, Float Down)	2.2		3.0		2.3		2.6	
Total	11.0		11.9		9.8		11.4	
Track Rollers (Each Side)	6		6		6		7	
Width of Standard Track Shoe	360 mm	14.17"	380 mm	15"	450 mm	17.7"	500 mm	19.7"
Length of Track on Ground	2.149 m	7'0"	2.295 m	7'6"	2.454 m	8'1"	2.85 m	9'6"
Ground Contact Area (With Std. Shoe)	1.55 m²	2398 in²	1.74 m²	2704 in²	2.21 m²	3426 in²	2.92 m²	4526 in²
Ground Pressure	73.7 kPa	10.7 psi	78.2 kPa	11.3 psi	80.9 kPa	11.7 psi	92.6 kPa	13.4 psi
Ground Clearance	336 mm	13.2"	377 mm	14.8"	438 mm	17.0"	456 mm	17.9"
Track Gauge	1.70 m	5'7"	1.80 m	5'11"	1.85 m	6'0.8"	2.08 m	6'10"
Width Without Bucket	2.06 m	6'9"	2.18 m	7'2"	2.30 m	7'6"	2.58 m	8'5.6"
Fuel Tank Refill Capacity	159 L	42 U.S. gal	192 L	51 U.S. gal	261 L	69 U.S. gal	356 L	94 U.S. gal
Hydraulic System Refill Capacity	58 L	15.3 U.S. gal	58 L	15.3 U.S. gal	60 L	16 U.S. gal	60 L	16 U.S. gal

*See Wheel Loader section of this book for summary of S.A.E. Guidelines for Loader Specifications, to which Caterpillar adheres.

Work Tools	973	963	953	943	935C
Quick coupler	X	X	X	X	X
General purpose bucket	X	X	X	X	X
Landfill bucket	X	X	X	X	
Skeleton rock bucket	X	X			
Slag bucket	X				
Coal bucket		X	X	X	
Woodchip bucket		X		X	X
Fertilizer bucket					X
Multi-purpose bucket	X	X	X	X	X
Sidedump bucket	X	X	X	X	
Demolition bucket	X	X	X		
Straight blade	X	X	X	X	X
Landfill U-blade		X	X	X	
Manual angle blade			X	X	X
Hydraulic angle blade			X	X	
Fork	X	X	X	X	X
Material handling arm	X	X	X	X	X
Clamp rake	X	X	X	X	X
Cleaning rake	X	X	X		X
Loader rake					X
Hi-speed disc saw		X	X		
Feller buncher			X	X	X
Hydraulic tree shear					X

Contact Baldersons for specific information

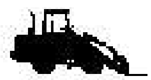
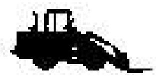
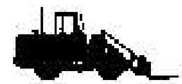
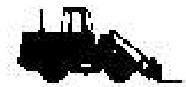
INTEGRATED TOOLCARRIERS

CONTENTS

Features:

- **Integral quick coupler** for fast tool changes.
- **Wide range of tools** available to meet many jobs.
- **Increased lift height and reach** over conventional loaders.
- **Parallel lift** from ground level to maximum height.
- **Exceptional load control** throughout lift cycle.
- **Pressure compensating valves** provide precise hydraulic "feel" (IT18B and IT28B only).
- **Transmission neutralizer lockout switch** for low speed maneuverability is standard.
- **Positive carry position** for load stability and retention.
- **Standard third valve and optional fourth function** for multiple tool functions.
- **All tools interchangeable** between Integrated Toolcarrier machines.
- **Excellent center visibility** to quick coupler.

13

								
MODEL	**IT12B**		**IT14B**		**IT16B**		**IT28B**	
Flywheel Power	56 kW	79 HP	63.4 kW	86 HP	71 kW	95 HP	82 kW	110 HP
Engine Model	3114		3114		3204		3204	
Rated Engine RPM	2400		2400		2400		2400	
Bore	105 mm	4.13"	105 mm	4.13"	114 mm	4.5"	114 mm	4.5"
Stroke	127 mm	5"	127 mm	5"	127 mm	5"	127 mm	5"
No. Cylinders	4		4		4		4	
Displacement	4.4 L	268 in³	4.4 L	268 in³	5.2 L	318 in³	5.2 L	318 in³
Speeds Forward:	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1st	6.6	4.1	7.7	4.8	7.2	4.5	6.6	4.1
2nd	12.4	7.7	14	8.7	14	8.7	12.4	7.7
3rd	22.4	13.9	26.2	16.3	26.4	16.4	21.6	13.4
4th	34	21.1	37.3	23.2	—		34.4	21.4
Speeds Reverse:								
1st	6.6	4.1	7.7	4.8	7.7	4.8	7.1	4.4
2nd	12.4	7.7	13.8	8.6	15.0	9.3	13.4	8.3
3rd	22.4	13.9	24.4	15.2	27.7	17.2	23.2	14.4
4th	—		—		—		37.2	23.1
Hydraulic Cycle Time, rated load in bucket:	Seconds		Seconds		Seconds		Seconds	
Raise	6.6		6.6		6.1		6.1	
Dump	1.6		1.6		5.2		5.2	
Lower (empty, float down)	3.0		3.0		3.6		3.6	
Total	11.2		11.2		14.9		14.9	

Note: IT18B and IT28B equipped with 17.5-25 tires.

BUCKETS

General Purpose — for most material types with choice of cutting edges and teeth.

Loose Material — designed for snow, woodchips, hay, coal, etc. Add independently controlled top clamp for materials like hay, brush, silage or compost.

Multi-purpose — versatile . . . loads, strips top soil, bulldozes, clamps pipe, cleans up debris, plus many other tasks.

High dump or "roll-out" — for extended dump height of light materials.

Side dump — dump forward or to the left . . . ideal in close quarters or to reduce turning time.

Grading — long, flat floor and straight edge for finish work in housing developments, concrete pours, landscaping and light dozing.

Claw — positive clamping jaws for garbage pickup, snow removal, debris cleanup or any loose or bundled loads.

FORKS

Log or lumber forks — with optional clamps, single, double or full-width.

Wide frame forks — adjustable for control of long pipes, culverts, etc.

Stinger fork — with long single shaft to penetrate salvage autos or round hay bales.

Utility pallet forks — for a variety of tasks, with three different tine sizes.

Pulpwood — choice of single or double top clamp for positive control of material.

Sorting — designed for durability and efficiency in stacking operations.

BLADES

Angling dozer — choice of manual or hydraulic angling 25° left or right.

Straight blade — for spreading, leveling and other utility dozing.

One-way snow blade — economical snow clearing with minimal machine effort.

V-plow — excellent for breaking up large drifts or high speed clearing operations.

Material Handling arm — carries and places pipe, prefabricated building panels and handles bulky, nonpalletized material . . . two telescopic sections extend for three position operation.

AND MORE . . .

Rotary broom — for street cleanup, snow removal, jobsite clean-up, clearing runways . . . angles left or right 30°.

Asphalt cutter — aids repair work on roads, pavements, water and sewer mains . . . cuts clean to 125 mm (5").

Hooks — for attachment to dumpsters, bins, troughs, etc., to permit quick, easy, instant movement from place to place.

Post hole auger — hydraulically digs holes from 152 mm (6") to 914 mm (36") diameter for setting posts, light standards, and foundations.

These products are available through CAT Special Attachments/Balderson or the AEM group within CAT Special Attachments.

Balderson Work Tools

Work Tools	IT28	IT18	IT14	IT12
Light Material Bucket	X	X	X	X
Fertilizer Bucket	X	X	X	X
Bucket With Top Clamp	X	X	X	X
Multi-Purpose Bucket	X	X	X	X
Side Dump Bucket	X	X	X	X
High-Dump Bucket	X	X	X	X
Pallet Fork	X	X	X	X
Log/Lumber Fork	X	X	X	X
Core Fork	X	X	X	X
Hydraulic Adjust Fork	X	X	X	X
Straight Blade	X	X	X	X
Manual Angle Blade	X	X	X	X
Hydraulic Angle Blade	X	X	X	X
Manual Reversible Plow	X	X	X	X
Hydr Reversible Plow	X	X	X	X
V-Plow	X	X	X	X
One Way Plow	X	X	X	X
Asphalt Cutter	X	X	X	X
Hydraulic Broom	X	X	X	X
Tire Loader	X	X	X	X
Loader Rake	X	X	X	X

Contact Balderson for spec information.

Operating Specifications — Buckets

	IT12B		IT14B		IT18B		IT28B	
Cutting Edge	Corner Guard or Bolt-on Edge							
Capacity, heaped	1.2 m³	1.6 yd³	1.2 m³	1.6 yd³	1.3 m³	1.75 yd³	1.7 m³	2.25 yd³
Capacity, struck	1.0 m³	1.31 yd³	1.0 m³	1.31 yd³	1.11 m³	1.45 yd³	1.5 m³	2.0 yd³
Width	2388 mm	7'10"	2388 mm	7'10"	2388 mm	7'10"	2388 mm	7'10"
Dump clearance @ full lift and 45° discharge	2740 mm	9'0"	2740 mm	9'0"	2695 mm	8'6"	2726 mm	8'11.3"
Reach at 45° discharge angle, 2130 mm/7'0" clearance	1430 mm	4'8"	1470 mm	4'10"	1509 mm	4'11"	1541 mm	5'0.7"
Reach at full lift and 45° discharge	917 mm	3'0"	917 mm	3'0"	993 mm	3'3"	1091 mm	3'7"
Reach with arms horizontal and bucket level	2227 mm	7'4"	2227 mm	7'4"	2218 mm	7'3"	2419 mm	7'11.2"
Digging depth	187 mm	7.4"	178 mm	7.0"	71 mm	2.8"	132 mm	5.2"
Overall length	6259 mm	20'6.4"	6455 mm	21'2"	6490 mm	21'4"	6886 mm	22'7.5"
Overall height (bucket @ full raise)	4606 mm	15'1.6"	4608 mm	15'1.5"	4789 mm	15'9"	4962 mm	16'3.4"
Loader clearance circle (bucket in carry position)	10.66 m	34'11.5"	10.8 m	35'5"	10.65 m	34'11"	11.16 m	36'7"
Static tipping load**								
Straight	4422 kg	9751 lb	5029 kg	11,089 lb	6470 kg	14,264 lb	7473 kg	16,475 lb
Full turn***	3901 kg	8602 lb	4338 kg	9565 lb	5640 kg	12,434 lb	6493 kg	14,315 lb
Breakout force*	6160 kg	13,583 lb	7526 kg	16,593 lb	10 500 kg	23,150 lb	10 456 kg	23,060 lb
Operating weight**								
4 forward, 3 reverse	7950 kg	17,530 lb	8339 kg	18,374 lb	—		—	
3 forward, 3 reverse	—		—		9770 kg	21,640 lb	—	
4 forward, 4 reverse	—		—		—		10 580 kg	23,325 lb

*Bucket force is measured 102 mm (4") behind tip of cutting edge with bucket hinge pin as pivot in accordance with SAE J732c.
**Operating Weight and static tipping load include lubricants, full fuel tank, ROPS cab and 80 kg (176 lb) operator.
***— IT18B also includes 17.5-25, 12 PR (L-2) tires and 524 kg (1155 lb) tire ballast.
— IT28B also includes 17.5-25, 12 PR (L-2) tires and 524 kg (1155 lb) tire ballast.
Machine stability is affected by the tire size, tire ballast and attachments.

Operating Specifications — Buckets

	IT12B		IT14B		IT18B		IT28B	
Cutting Edge	Flush Mounted Adapter with Teeth							
Capacity, heaped	1.2 m^3	**1.6 yd^3**	1.2 m^3	**1.6 yd^3**	1.3 m^3	**1.75 yd^3**	1.7 m^3	**2.25 yd^3**
Capacity, struck	1.0 m^3	**1.31 yd^3**	1.0 m^3	**1.31 yd^3**	1.11 m^3	**1.45 yd^3**	1.5 m^3	**2.0 yd^3**
Width	2430 mm	**8'0"**	2430 mm	**8'0"**	2461 mm	**8'1"**	2461 mm	**8'1"**
Dump clearance @ full lift and 45° discharge	2460 mm	**8'0.8"**	2460 mm	**8'0.8"**	2740 mm	**9'0"**	2794 mm	**9'2"**
Reach at 45° discharge angle, 2130 mm/7'0" clearance	1640 mm	**5'1"**	1580 mm	**5'2"**	1509 mm	**4'11"**	1508 mm	**4'11.4"**
Reach at full lift and 45° discharge	1028 mm	**3'4.5"**	1028 mm	**3'4.5"**	993 mm	**3'3"**	1058 mm	**3'5.7"**
Reach with arms horizontal and bucket level	2362 mm	**7'9"**	2362 mm	**7'9"**	2218 mm	**7'3"**	2347 mm	**7'8"**
Digging depth	175 mm	**6.9"**	166 mm	**6.5"**	71 mm	**2.8"**	107 mm	**4.2"**
Overall length	6405 mm	**21'0"**	6600 mm	**21'8"**	6705 mm	**22'0"**	7040 mm	**23'1.2"**
Overall height (bucket @ full raise)	4608 mm	**15'1.5"**	4608 mm	**15'1.6"**	4789 mm	**15'9"**	4962 mm	**16'3.4"**
Loader clearance circle (bucket in carry position)	10.82 m	**35'6"**	10.94 m	**35'11"**	10.75 m	**34'3"**	11.24 m	**36'11"**
Static tipping load**								
Straight	4478 kg	**9874 lb**	5085 kg	**11,212 lb**	6380 kg	**14,065 lb**	7377 kg	**16,263 lb**
Full turn***	3957 kg	**8725 lb**	4394 kg	**9689 lb**	5550 kg	**12,235 lb**	6398 kg	**14,105 lb**
Breakout force*	6722 kg	**14,822 lb**	8191 kg	**18,061 lb**	10 500 kg	**23,150 lb**	10 456 kg	**23,050 lb**
Operating weight**								
4 forward, 3 reverse	7907 kg	**17,435 lb**	8290 kg	**18,280 lb**		—		—
3 forward, 3 reverse		—		—	9840 kg	**21,700 lb**		—
4 forward, 4 reverse		—		—		—	10 655 kg	**23,490 lb**

*Bucket force is measured 102 mm (4") behind tip of cutting edge with bucket hinge pin as pivot in accordance with SAE J732c
**Operating Weight and static tipping load include lubricants, full fuel tank, ROPS cab and 80 kg (176 lb) operator
***— IT18B also includes 17.5-25, 12 PR (L-2) tires and 524 kg (1155 lb) tire ballast
— IT28B also includes 17.5-25, 12 PR (L-2) tires and 524 kg (1155 lb) tire ballast.
Machine stability is affected by the tire size, tire ballast and attachments.

13

Operating Specifications — Pallet Forks

	IT12B		IT14B		IT18B		IT28B	
Fork tine length	1067 mm	42"	1067 mm	42"	1067 mm	42"	1067 mm	42"
Ground to top of tine clearance	3532 mm	11'7"	3532 mm	11'7"	3639 mm	11'11"	3660 mm	12'0"
Reach with arms horizontal and forks level	1499 mm	4'11"	1499 mm	4'11"	1580 mm	5'2"	1553 mm	5'1"
Overall length	6508 mm	21'4"	6708 mm	22'0"	6845 mm	22'6"	7035 mm	23'1"
Static tipping load*								
Straight	3698 kg	**8154 lb**	3986 kg	**8789 lb**	5140 kg	**11,332 lb**	5988 kg	**13,201 lb**
Full turn	3297 kg	**7270 lb**	3476 kg	**7665 lb**	4530 kg	**9987 lb.**	5340 kg	**11,772 lb**
Operating weight*								
4 forward, 3 reverse	7726 kg	**17,036 lb**	8046 kg	**17,741 lb**	—		—	
3 forward, 3 reverse	—		—		9600 kg	**21,164 lb**	—	
4 forward, 4 reverse	—		—		—		10 330 kg	**22,773 lb**

	IT12B		IT14B		IT18B		IT28B	
Fork tine length	1219 mm	48"	1219 mm	48"	1219 mm	48"	1219 mm	48"
Ground to top of tine clearance	3532 mm	11'7"	3532 mm	11'7"	3639 mm	11'11"	3660 mm	12'0"
Reach with arms horizontal and forks level	1499 mm	4'11"	1499 mm	4'11"	1580 mm	5'2"	1553 mm	5'1"
Overall length	6656 mm	21'10"	6858 mm	22'6"	6985 mm	22'11"	7185 mm	23'7"
Static tipping load*								
Straight	3550 kg	**7828 lb**	3975 kg	**8765 lb**	5123 kg	**11,294 lb**	5972 kg	**13,166 lb**
Full turn	3160 kg	**6978 lb**	3465 kg	**7640 lb**	4511 kg	**9945 lb**	5325 kg	**11,740 lb**
Operating weight*								
4 forward, 3 reverse	7729 kg	**17,042 lb**	8056 kg	**17,764 lb**	—		—	
3 forward, 3 reverse	—		—		9618 kg	**21,204 lb**	—	
4 forward, 4 reverse	—		—		—		10 350 kg	**22,817 lb**

*Static tipping load and operating weight include lubricants, full fuel tank, ROPS cab and 80 kg (**176 lb**) operator.
IT18B also includes 17.5-25, 12 PR (L-2) tires and 524 kg (**1155 lb**) tire ballast
— IT28B also includes 17.5-25, 12 PR (L-2) tires and 524 kg (**1155 lb**) tire ballast
Machine stability and operating weight are affected by tire size, tire ballast and other attachments.

Operating Specifications — Pallet Forks (continued)

	IT12B		IT14B		IT18B		IT28B	
Fork tine length	1372 mm	54"	1372 mm	54"	1372 mm	54"	1372 mm	64"
Ground to top of tine clearance	3532 mm	11'7"	3632 mm	11'7"	3639 mm	11'11"	3660 mm	12'0"
Reach with arms horizontal and forks level	1490 mm	4'11"	1489 mm	4'11"	1580 mm	5'2"	1560 mm	5'2"
Overall length	6808 mm	22'4"	7009 mm	23'0"	7145 mm	23'5"	7335 mm	24'1"
Static tipping load*								
Straight	3373 kg	7437 lb	3927 kg	8659 lb	5060 kg	11,155 lb	5904 kg	13,016 lb
Full turn	3005 kg	6626 lb	3417 kg	7535 lb	4440 kg	9788 lb	5260 kg	11,596 lb
Operating weight*								
4 forward, 3 reverse	7732 kg	17,049 lb	8106 kg	17,874 lb	—		—	
3 forward, 3 reverse	—		—		9685 kg	21,351 lb		
4 forward, 4 reverse	—		—		—		10 416 kg	22,961 lb

*Static tipping load and operating weight include lubricants, full fuel tank, ROPS cab and 80 kg (176 lb) operator.
— IT18B also includes 17.5-25, 12 PR (L-2) tires and 524 kg (1155 lb) tire ballast.
— IT28B also includes 17.5-25, 12 PR (L-2) tires and 524 kg (1155 lb) tire ballast.
Machine stability and operating weight are affected by tire size, tire ballast and other attachments.

13

Operating Specifications — Material Handling Arm

Handling Arm Position	IT12B		IT14B		IT18B		IT28B	
	Retracted							
Operating load —								
Full articulation	1120 kg	**2470 lb**	1249 kg	**2754 lb**	1551 kg	**3419 lb**	1804 kg	**3977 lb**
Static tipping load*								
Straight	2515 kg	**5545 lb**	2867 kg	**6322 lb**	2964 kg	**6534 lb**	3807 kg	**8393 lb**
Full turn	2238 kg	**4934 lb**	2498 kg	**5508 lb**	2655 kg	**5853 lb**	3434 kg	**7571 lb**
Operating weight*								
4 forward, 3 reverse	7760 kg	**17,111 lb**	8052 kg	**17,755 lb**	—		—	
3 forward, 3 reverse	—		—		9560 kg	**21,076 lb**	—	
4 forward, 4 reverse	—		—		—		10 290 kg	**22,685 lb**

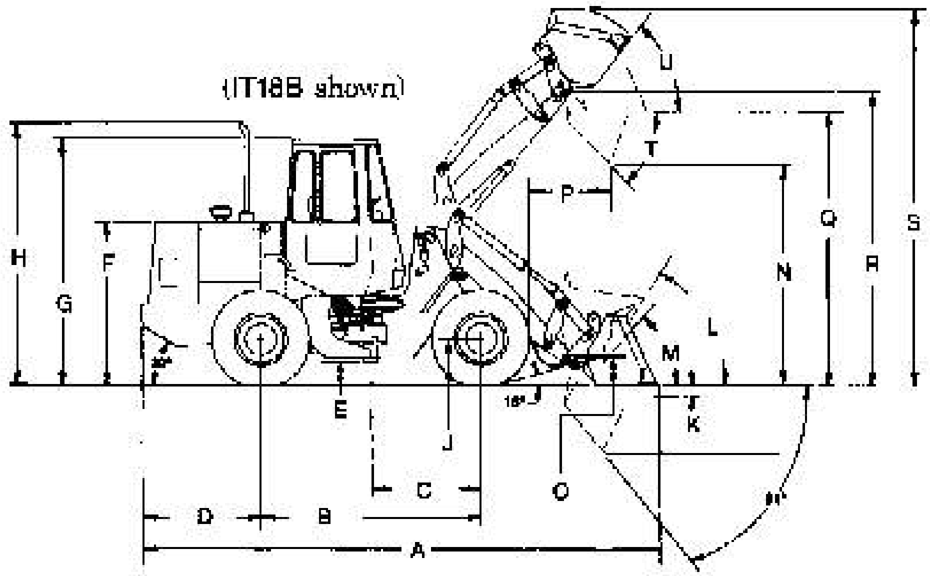
Handling Arm Position	IT12B		IT14B		IT18B		IT28B	
	Mid-position							
Operating load —								
Full articulation	890 kg	**1962 lb**	976 kg	**2152 lb**	1223 kg	**2698 lb**	1422 kg	**3134 lb**
Static tipping load*								
Straight	2004 kg	**4419 lb**	2247 kg	**4955 lb**	2341 kg	**5161 lb**	2992 kg	**6596 lb**
Full turn	1780 kg	**3925 lb**	1953 kg	**4306 lb**	2094 kg	**4616 lb**	2696 kg	**5944 lb**
Operating weight*								
4 forward, 3 reverse	7760 kg	**17,111 lb**	8052 kg	**17,755 lb**	—		—	
3 forward, 3 reverse	—		—		9560 kg	**21,076 lb**	—	
4 forward, 4 reverse	—		—		—		10 290 kg	**22,685 lb**

Handling Arm Position	IT12B		IT14B		IT18B		IT28B	
	Extended							
Operating load —								
Full articulation	680 kg	**1499 lb**	802 kg	**1768 lb**	1011 kg	**2229 lb**	1175 kg	**2590 lb**
Static tipping load*								
Straight	1637 kg	**3610 lb**	1849 kg	**4077 lb**	1934 kg	**4264 lb**	2444 kg	**5388 lb**
Full turn	1469 kg	**3239 lb**	1604 kg	**3537 lb**	1730 kg	**3814 lb**	2204 kg	**4859 lb**
Operating weight*								
4 forward, 3 reverse	7760 kg	**17,111 lb**	8052 kg	**17,755 lb**	—		—	
3 forward, 3 reverse	—		—		9560 kg	**21,076 lb**	—	
4 forward, 4 reverse	—		—		—		10 290 kg	**22,685 lb**

*Static tipping load and operating weight include lubricants, full fuel tank, ROPS cab and 80 kg (175 lb) operator.
IT18B also includes 17.5-25, 12 PR (L-2) tires and 524 kg (1155 lb) tire ballast.
IT28B also includes 17.5-25, 12 PR (L-2) tires and 524 kg (1155 lb) tire ballast.
Machine stability and operating weight are affected by tire size, tire ballast and other attachments.

Machine Dimensions
• with General Purpose Buckets and Bolt-on Cutting Edge

See rating plate on each tool. Plate shows the effect of using the same tools on different size machines and aids in machine tool selection. Each plate states capabilities of standard machine in terms of capacity. Any significant weight change of attachments can adversely affect these ratings.

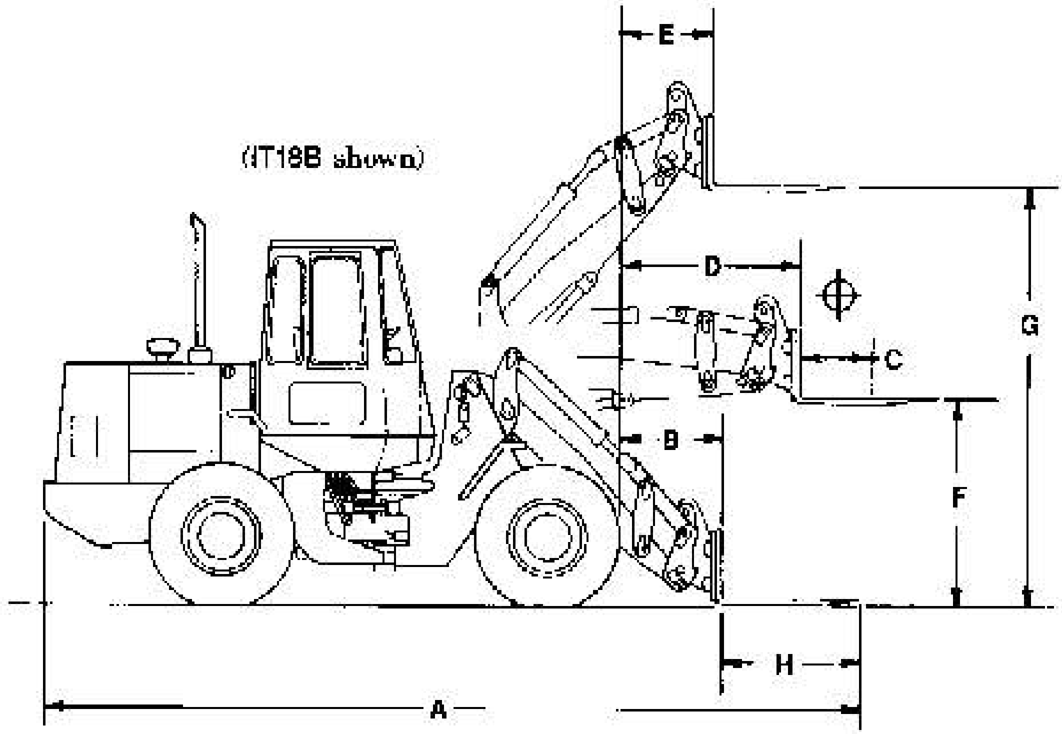


(IT18B shown)

13

MODEL	IT12B		IT14B		IT18B		IT28B	
A Maximum Overall Length*	6317 mm	20'9"	6513 mm	21'4"	6490 mm	21'4"	6895 mm	22'7.5"
B Wheel base	2337 mm	7'8"	2540 mm	8'4"	2700 mm	8'10"	2870 mm	9'6"
C Machine center point to front axle	1168 mm	3'10"	1270 mm	4'2"	1350 mm	4'5"	1435 mm	4'8"
D Rear axle to counterweight	1628 mm	5'4"	1628 mm	5'4"	1560 mm	5'1"	1562 mm	5'1.5"
E Ground clearance	343.4 mm	1'1.5"	344.4 mm	1'1.6"	324 mm	12.8"	324 mm	12.8"
F Height to top of engine compartment	1853 mm	6'1"	1893 mm	6'2.5"	2114 mm	6'11"	2124 mm	7'0"
G Height to top of ROPS	2996 mm	9'10"	2996 mm	9'10"	3134 mm	10'3"	3199 mm	10'6"
H Height to top of stack	2931 mm	9'7"	2931 mm	9'7"	3188 mm	10'6"	3184 mm	10'5"
J Tire radius (empty machine)	573 mm	22.6"	573 mm	22.6"	619 mm	24.4"	619 mm	24.4"
K Maximum Digging Depth (bucket level)	187 mm	7.4"	178 mm	7"	71 mm	2.8"	132 mm	5.2"
L Maximum rollback at carry height	56.5°		55.5°		57°		56.5°	
M Maximum rollback at ground	49.7°		49.7°		49°		53.2°	
N Dump Clearance at full lift and 45° Discharge Angle*	2690 mm	8'10"	2700 mm	8'11"	2884 mm	9'6"	2726 mm	8'11.3"
O Hinge pin Height at carry position	382 mm	15"	382 mm	15"	360 mm	14.2"	360 mm	14.2"
P Reach at full lift and 45° Dump*	958 mm	37.7"	958 mm	37.7"	993 mm	39"	1091 mm	43"
Q Clearance Level Bucket at full height	3408 mm	11'2"	3409 mm	11'2.2"	3519 mm	11'7"	3511 mm	11'6.2"
R Maximum Hinge Pin Height	3632 mm	11'11"	3622 mm	11'10.6"	3784 mm	12'5"	3796 mm	12'5.4"
S Maximum Overall Height*	4661 mm	15'3.5"	4662 mm	15'4"	4789 mm	15'9"	4962 mm	16'3.4"
T Full Dump at Maximum Lift	45°		50°		45°		50.3°	
U Maximum roll back at Maximum Lift	57.6°		57.6°		54°		53.5°	

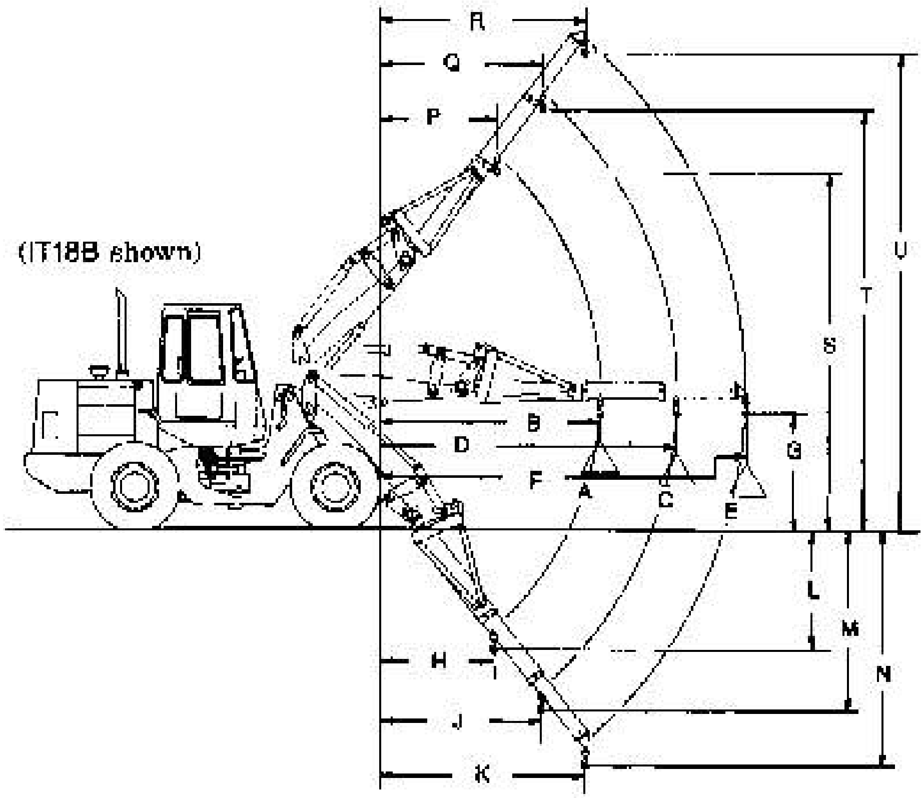
*IT12B, IT14B and IT18B equipped with 1.3 m^3 (1.75 yd^3) capacity bucket. IT28B equipped with 1.7 m^3 (2.25 yd^3) capacity bucket.
Note: IT12B and IT14B equipped with 15.5-25 tires. IT18B and IT28B equipped with 17.5-25 tires.



MODEL	IT12B		IT14B		IT18B		IT28B	
A Maximum Overall Length	6655 mm	21'10"	6858 mm	22'6"	6995 mm	22'11"	7185 mm	23'7"
B Reach with forks at ground level	844 mm	2'9"	844 mm	2'9"	863 mm	2'10"	875 mm	2'10.4"
C Load center	600 mm	2'0"	600 mm	2'0"	600 mm	2'0"	600 mm	2'0"
D Reach with arms horizontal and forks level	1494 mm	4'11"	1494 mm	4'11"	1580 mm	6'2.4"	1653 mm	5'1.4"
E Reach with fork at maximum height	649 mm	2'2"	649 mm	2'2"	823 mm	32.4"	783 mm	30.4"
F Arms horizontal & forks level	1682 mm	5'6"	1683 mm	5'6.3"	1839 mm	6'0"	1580 mm	6'2"
G Ground to top of tine at maximum height	3532 mm	11'7"	3532 mm	11'7"	3639 mm	11'11"	3658 mm	12'0"
H Fork Tine Length	1219 mm	4'0"	1219 mm	4'0"	1219 mm	4'0"	1219 mm	4'0"

Note: IT12B and IT14B equipped with 15.5-25 tires. IT18B and IT28B equipped with 17.5-25 tires.
Note: Dimensions based on 6W8632 Fork Carriage Assembly (I.S.O. class 3)
⌖ Load center

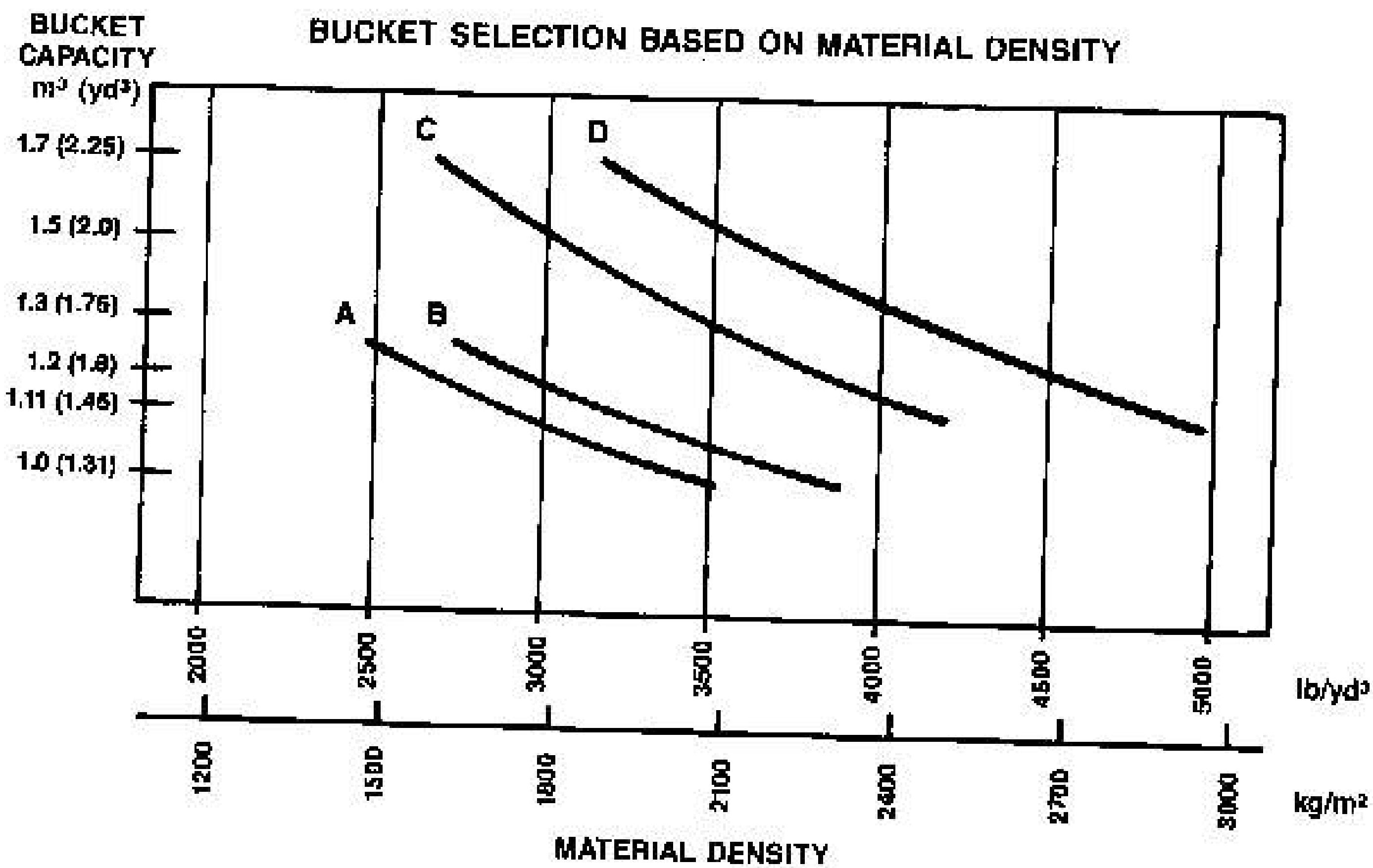
(IT18B shown)



For IT18B and IT28B machines equipped with 15.5 x 25 L-2 tires subtract 39 mm (1.5") from lift height — add 39 mm (1.5") for below ground measurements — add 42 mm (1.7") for all reach measurements.

MODEL	IT12B		IT14B		IT18B		IT28B	
A Operating load (retracted) @ full articulation	1120 kg	**2470 lb**	1249 kg	**2754 lb**	1551 kg	**3419 lb**	1804 kg	**3977 lb**
B Reach horizontal (retracted)	3217 mm	**10'7"**	3217 mm	**10'7"**	3243 mm	**10'8"**	3208 mm	**10'6"**
C Operating load (mid-position) @ full articulation	890 kg	**1962 lb**	976 kg	**2152 lb**	1223 kg	**2696 lb**	1422 kg	**3135 lb**
D Reach horizontal (mid-position)	4217 mm	**13'10"**	4217 mm	**13'10"**	4243 mm	**13'11"**	4208 mm	**13'10"**
E Operating load (extended) @ full articulation	680 kg	**1499 lb**	802 kg	**1768 lb**	1011 kg	**2229 lb**	1176 kg	**2590 lb**
F Reach horizontal (extended)	5217 mm	**17'1"**	5217 mm	**17'1"**	5243 mm	**17'2"**	5208 mm	**17'1"**
G Clearance horizontal	1484 mm	**4'10"**	1484 mm	**4'10"**	1689 mm	**5'6"**	1689 mm	**5'6"**
H Reach full down (retracted)	1680 mm	**5'6"**	1689 mm	**5'6"**	1606 mm	**5'3"**	1620 mm	**5'4"**
J Reach full down (mid-position)	1983 mm	**6'6"**	1983 mm	**6'6"**	2223 mm	**7'4"**	2223 mm	**7'4"**
K Reach full down (extended)	2483 mm	**8'2"**	2483 mm	**8'2"**	2833 mm	**9'4"**	2856 mm	**9'5"**
L Clearance full down (retracted)	1763 mm	**5'8"**	1753 mm	**5'9"**	1791 mm	**5'11"**	1771 mm	**5'10"**
M Clearance full down (mid-position)	2806 mm	**9'2.5"**	2806 mm	**9'2"**	2561 mm	**8'6"**	2556 mm	**8'5"**
N Clearance full down (extended)	3672 mm	**12'1"**	3671 mm	**12'0.5"**	3371 mm	**11'1"**	3346 mm	**11'0"**
P Reach at maximum height (retracted)	1473 mm	**4'10"**	1473 mm	**4'10"**	1763 mm	**5'9.4"**	1703 mm	**5'7"**
Q Reach at maximum height (mid-position)	2019 mm	**6'7.5"**	2019 mm	**6'7.5"**	2373 mm	**7'9.4"**	2313 mm	**7'7"**
R Reach at maximum height (extended)	2567 mm	**8'5"**	2567 mm	**8'5"**	2988 mm	**9'10"**	2923 mm	**9'7"**
S Clearance at maximum height (retracted)	5017 mm	**16'5.5"**	5018 mm	**16'6"**	5044 mm	**16'6.6"**	5068 mm	**16'8"**
T Clearance at maximum height (mid-position)	5854 mm	**19'2.5"**	5854 mm	**19'2.5"**	5534 mm	**18'2"**	5858 mm	**19'3"**
U Clearance at maximum height (extended)	6691 mm	**21'11"**	6692 mm	**22'0"**	6624 mm	**21'9"**	6654 mm	**21'10"**

Note: IT12B and IT14B equipped with 15.5-25 tires. IT18B and IT28B equipped with 17.5-25 tires



Note. Machines equipped same as those on Performance Data pages

KEY

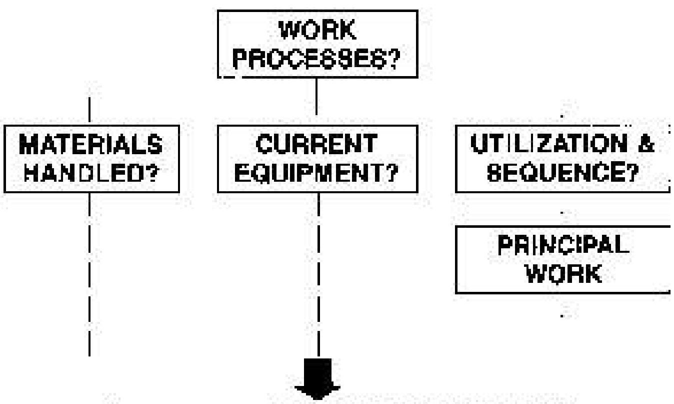
A — IT12B
B — IT14B
C - IT18B
D IT28B

MACHINE/ATTACHMENT SELECTION

The Integrated Toolcarrier's versatility and the wide range of attachments makes the "single machine fleet" concept highly attractive to an increasing number of users.

A Job Analysis helps identify applications, work requirements, material handling parameters and the current working method. Thoroughly research each element in the following chart, the gathered information will help select the proper Integrated Toolcarrier System.

JOB ANALYSIS METHOD



- **APPROPRIATE INTEGRATED TOOLCARRIER MODEL SIZE**
- **NECESSARY ATTACHMENTS**

Work Processes:

The first step in the job analysis is to identify all work processes from start to finish. Key questions outlined below will begin to indicate the required attachments and potential Integrated Toolcarrier applications.

- What kinds of work are performed: (e.g., dozing, loading, stacking, digging, sweeping, handling special materials, etc.)
  - . . . in site preparation?
  - . . . below ground level?
  - . . . at ground level?
  - . . . above ground level?
  - . . . in landscaping?
  - . . . in maintenance/ equipment yard?
  - etc.
- What work is done manually that could be done with an Integrated Toolcarrier?
- What are the work conditions?:
  - . . . underfoot?
  - . . . grades?
  - . . . tight quarters?
  - . . . time restraints?
  - . . . climate?
  - etc.

Materials Handled:

Examining the materials handled will assist in determining necessary attachments. Sizes and weights of material(s) handled will indicate the appropriate Integrated Toolcarrier model by defining lift and reach requirements. Concentrate on the material flow at the job site — the point of origin as well as the final destination for the various materials will undoubtedly have material handling requirements.

- What kinds of materials are handled (e.g. snow, earth, bricks, chemicals, pipe, logs, etc.)
- What form are the materials handled in: bulk? palletized?
- How much does each weigh?
- What are the dimensions of each?
- What are the movement parameters:
  - . . . dozed what distance?
  - . . . load and carried what distance?
  - . . . lifted how high?
  - . . . placed below ground level?
  - . . . placed what distance from machine?

Current Equipment:

If determining material weight is not possible, much information can be determined from looking at the current equipment fleet. This will suggest required performance capabilities such as lifting capacity.

- Machines currently doing the work (e.g. wheel loaders, lift trucks, sweepers, light capacity cranes, snow plows, etc.)?
- What special (maximum) capabilities does each machine have (production, lift height, load capacity, width/height dimensions, reach, turning radius, travel speed, etc.)?
- To what extent are each machine's maximum capabilities used?
- What are owning/operating costs of each?

Utilization & Sequence:

Utilization implies how often the current machines are used and what will be the utilization factors for the Integrated Toolcarrier with each individual attachment. Sequence implies what order these tasks are accomplished in and if two or more machines operate at the same time. This portion of the job analysis should assist in comparing economics of various systems. Other important considerations may be the number of operators needed, storage space, reduced maintenance requirements, etc.

- How often (what percent) is each machine used?
- How often and when does it sit idle?
- How often and when do two or more machines work at the same time?
- Can the operation be changed to permit single machine operation?

Principal Work:

Utilization and sequence will indicate the principal work the Integrated Toolcarrier will do, further assisting in attachment and model sizing and selection. The basic machine/tool package should be able to handle the toughest, most frequently performed jobs for the primary application. Secondary tools can have a little more "give and take" in their performance capabilities than the primary tool.

- What work can be accomplished by an Integrated Toolcarrier?
- What work will take up the majority of Integrated Toolcarrier time?
- What work will use the maximum static tipping capabilities of the Integrated Toolcarrier?
- What high cost (owning and operating) and/or low utilization machines can be replaced by an Integrated Toolcarrier?

Additional Tips for Tool Sizing and Selection

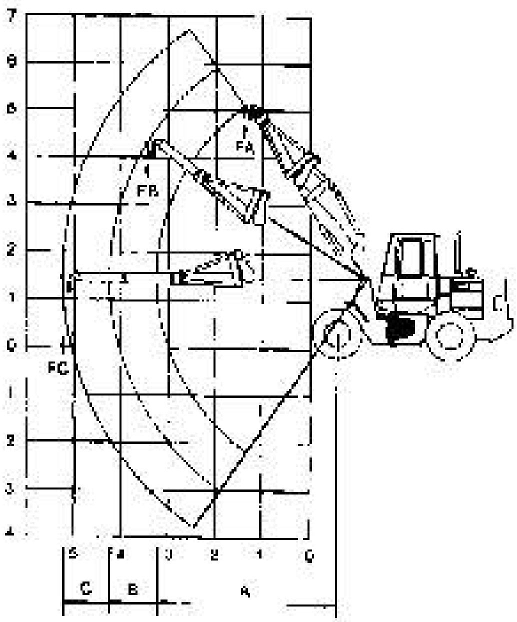
Tool selection will principally concern hydraulic power requirements and static tipping load considerations. The standard tools offered by Caterpillar can be used on any Integrated Toolcarrier machine with little difficulty. However, tools such as the hydraulic broom, claws, blades and asphalt cutter will require additional consideration before proposing a system to the customer.

Rating Plates

The Caterpillar tools have rating plates showing rated or recommended load limits for each machine in standard configuration. These rated loads are determined by structural limitations on the tool and/or hydraulic and stability criteria established for each machine. All AEM and Caterpillar tools are interchangeable between the four Integrated Toolcarrier models as they all have common attachment points at the coupler/tool interface necessitating the need for rating plates.

Shown below are the rating plates that will be found on each Caterpillar tool.

13



Material Handling Arm — Part No. 9V1795

Table indicates rated load at standard vehicle configuration. See operator's manual to determine rated load for vehicle configuration being used.

Model	Load Radius A		Rated Load FA		Load Radius B		Rated Load FB		Load Radius C		Rated Load FC	
	m	ft	kg	lb	m	ft	kg	lb	m	ft	kg	lb
IT12	3.86	12.7	1060	2330	4.85	15.9	830	1825	5.85	19.2	680	1500
IT12B	3.84	12.6	1120	2465	4.85	15.9	890	1960	5.85	19.2	680	1500
IT14B	3.84	12.6	1264	2785	4.85	15.9	1004	2210	5.85	19.2	767	1690
IT18	3.92	12.8	1255	2765	4.92	16.2	990	2180	5.92	19.5	815	1795
IT18B	3.92	12.8	1551	3420	4.92	16.2	1223	2670	5.92	19.5	1011	2230
IT28	3.88	12.7	1610	3550	4.88	16.0	1270	2800	5.88	19.3	1050	2315
IT28B	3.88	12.7	1804	3980	4.88	16.0	1422	3135	5.88	19.3	1175	2590

Fork Rating Plate

(Located on back of carriage, left side)

Part No. 6W8832

Table indicates rated pallet fork load at standard vehicle configuration at load center distance of 600 mm (24 inches), see operator manual to determine rated load for vehicle configuration being used.

Model	kg	lb	Model	kg	lb
IT12	2200	**4845**	IT12B	2200	**4845**
IT18	2540	**5598**	IT14B	2620	**5770**
IT28	3310	**7295**	IT18B	3227	**7155**
			IT28B	3815	**8412**

Bucket Rating Plate

(Located left rear of buckets)

Part No. 9V8969

Bucket capacity, SAEJ742B (nominally heaped) 1.3 m³ (1.75 yd³)

Table indicates rated load at standard vehicle configuration. See operator manual to determine rated load for vehicle configuration being used.

Model	kg	lb	Model	kg	lb
IT12	1900	**4188**	IT12B	1906	**4203**
IT18	2180	**4805**	IT14B	2119	**4672**
IT28	2815	**6207**	IT18B	2820	**6217**
			IT28B	3341	**7366**

The bucket rating plate can be used to illustrate the attachment sizing and selection process. This chart explains the maximum payload each machine can handle with the 1.3 m³ (1.75 yd³) bucket. The maximum material density would be determined by dividing the payload by the bucket capacity. If the actual material density exceeds the recommended material density, the process should be repeated to select the properly sized bucket.

A similar procedure would be used with the forks and material handling arm to determine maximum recommended lifting capacity and/or required IT model size.

Pallet Fork

The pallet fork will fulfill many material handling needs. A modified Class 3 fork carriage provides visibility to the tines for precision pallet work. This carriage with non-standard spacing accepts many Class 3 lift truck attachments.

Pallet fork tool ratings are based on a Caterpillar criteria guideline of 75% of full turn static tipping load with the load center measured 600 mm (24 in) ahead of the vertical tine face or hydraulic or structural limitations. At this time no accepted SAE criteria exist. Other local, regional or international specification guidelines may apply.

If operation is on rough ground these criteria may need modification. In this instance, the size and rating of existing equipment should be considered.

Sizing for pallet work generally consists of answering the following questions.

1. What are the average loaded pallet dimensions?
2. Lift Capacity — what capacity is required to lift and move the average pallet load? The maximum pallet load?
3. Lift Height — can the machine reach the top level of the standard pallet stack? What are the maximum reach, lift and height requirements?
4. Maneuverability — can the machine work around the current aisle configuration? In the stacking aisles? Main aisles? Intersecting aisles? Are 90° turns required in any aisle for material placement?
5. Length — what tine length is required to fit the commonly used pallets? (1219 mm [48 in] tines are standard length for most palletized material.)
6. Any machine height restrictions?
7. Any special fork configurations required?

Lift capacity, lift height, aisle configuration and tine length are the most important considerations in recommending a machine for handling pallets.

Material Handling Arm (MHA)

The rated load for the MHA is 50% of the full turn static tipping load in each position or hydraulic or structural limitations. Manually extendable telescopic sections enable maximum lifting capacity at the full retracted position, and maximum lift height and reach in the fully extended position.

Buckets

All five general purpose buckets are interchangeable on all machines due to common attachment points on the quick couplers. Bucket size selection will depend on the material density in your application to achieve the optimum match to the machine's rated load. Offering multiple sized buckets allows the user the flexibility to closely match material density and bucket size with machine capability. Equipping a machine with too large a bucket will result in unacceptable stability — too small a bucket may provide inadequate tire coverage.

Example problem:

The following example applies the job analysis method to a work situation.

Sewer & Water Contractor

Sets water lines (152 mm-610 mm [6 in-24 in] iron pipe), sanitary sewer lines (152 mm-457 mm [6 in-18 in] PVC) and storm sewer lines (610 mm-1067 mm [24 in-42 in] concrete pipe) primarily in urban areas . . . often-times across or down existing streets.

Materials

Loam/Clay:	1600 kg/m³ (2700 lb/yd³) loose density
Bedding (Gravel):	1900 kg/m³ (3200 lb/yd³) loose density
Water Pipe:	610 mm (24 in) push-on joint ductile iron, 6.1 m (20 ft) sections, 1309 kg (2885 lb) 215 kg/m (144.3 lb/ft) × 6.1 m (20 ft) See trenching pages in the Excavator backhoe section.
Storm Sewer	1067 mm (42 in). Wall B, concrete pipe, 1.5 m (5 ft) sections, 1556 kg (3430 lb) 1021 kg/m (686 lb/ft × 5 ft) See trenching pages in the Excavator backhoe section.
Manhole Boxes:	1361 kg (3000 lb)

WHAT INTEGRATED TOOLCARRIER MODEL SHOULD BE RECOMMENDED?

WHICH ATTACHMENTS?

Work Processes	**Integrated Toolcarrier Attachment Possibilities**
Bundled PVC and individual concrete/iron pipe-loaded/unloaded (yardsite) and strung along trench	Forks/Material Handling Arm
Unload, handle, set manhole boxes	Material Handling Arm
Excess excavated material truck loaded	Bucket
Bedding material handled/placed	Bucket
Trench backfilled	Bucket/Blade
Trench compaction	Compactor Wheel
Rough and finish grading	Bucket/Blade
Street cleanup	Bucket/Broom
Pavement removal	Rebar Snips/Asphalt Cutter

Current Equipment

	Utilization
Cat 225	90%
Champ CB607 lift truck, 3175 kg (7000 lb) capacity	15%
Deere 444 with 1.1 m³ (1.5 yd³) G.P. bucket	60%
Rosco D-50 sweeper	one half hour/day
Rammax 1361 kg (3000 lb) self-propelled trench compactor	25%

Machine sizing

1372 mm (54 in) Forks

Operating Load at Full Turn

Model	kg	lb
IT12B	2254	**4970**
IT14B	2563	**5651**
IT18B	3329	**7341**
IT28B	3944	**8697**

Water pipes: 1309 kg (2885 lb)	IT12B . . . 1 pipe — no problem IT14B . . . 1 pipe — no problem IT18B . . . 2 pipes no problem IT28B . . . 3 pipes — no problem
Storm sewer pipes: 1556 kg (3430 lb)	IT12B . . . 1 pipe — no problem IT14B . . . 1 pipe — no problem IT18B . . . 2 pipes — no problem IT28B . . . 2 pipes — no problem

13

Material Handling Arm

Model	Operating Load at Full Turn Retracted	Mid	Extended
IT12B	1120 kg	890 kg	680 kg
	2470 lb	**1962 lb**	**1499 lb**
IT14B	1249 kg	976 kg	802 kg
	2754 lb	**2152 lb**	**1768 lb**
IT18B*	1551 kg	1223 kg	1011 kg
	3419 lb	**2696 lb**	**2229 lb**
IT28B*	1804 kg	1422 kg	1175 kg
	3977 lb	**3135 lb**	**2590 lb**

Storm sewer pipes: 1556 kg **(3430 lb)**	IT12B . . . no IT14B . . . no IT18B . . . marginal in retracted IT28B . . . yes in retracted
Manhole boxes: 1361 kg **(3000 lb)**	IT12B . . . no IT14B . . . no IT18B . . . yes in retracted IT28B . . . yes in retracted and mid

Bucket (1900 kg/m³ **(3200 lb/yd³)** . . . 100% fill factor)

Model	Bucket	Payload	50% Full Turn Static Tipping
IT18B*	1.2 m³	2177 kg	3385 kg
	1.5 yd³	**4800 lb**	**7465 lb**
	1.3 m³	2540 kg	2820 kg
	1.75 yd³	**5600 lb**	**6217 lb**
	1.5 m³	2903 kg	2790 kg
	2.0 yd³	**6400 lb**	**6151 lb**
IT28B*	1.5 m³	2903 kg	3301 kg
	2.0 yd³	**6400 lb**	**7278 lb**
	1.7 m³	3266 kg	3247 kg
	2.25 yd³	**7200 lb**	**7156 lb**

NOTE: Metric numbers are a product of conversion.
*IT18B and IT28B equipped with 17.5 x 25 tires.

Machine/Attachment Recommendation

IT28B The greater static tipping load capabilities allow it to do a greater portion of the contractor's total work processes. With the following attachments, the IT28B could replace part or all of the specialty units, such as the wheel loader, rough terrain lift truck, street sweeper, and/or the trench compactor.

1.5 m³ **(2.0 yd³)** or 1.7 m³ **(2.25 yd³)** General Purpose Bucket
1372 mm **(54 in)** forks (handles all pipes)
Material Handling Arm — (handles pipe sizes under 1067 mm **(42 in)** concrete and manhole boxes . . . 225 would have to set 1219 mm **(48 in)** and larger concrete pipe
Broom

Optional Attachments to Consider:

24-LH compactor wheel
Rebar snips
Asphalt cutter

PAVING PRODUCTS

CONTENTS

Cold Planers

Road Reclaimer/Soil Stabilizer

Windrow Elevators

Asphalt Pavers

Smooth Drum Vibratory Soil Compactors

Padded Drum Vibratory Soil Compactors

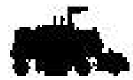
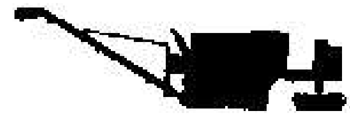
Dual Drum Vibratory Asphalt Compactors

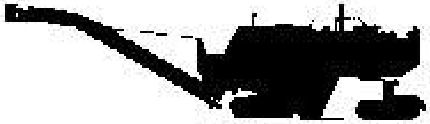
Pneumatic Tire Asphalt Compactors

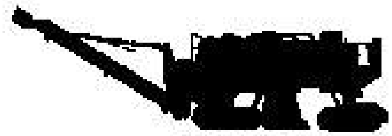
Single Drum Combination Vibratory Compactor

Cold Planer Features:

- **Cat Diesel Engines** with large piston displacement and individual adjustment-free fuel pumps and valves.
- **Up-cutting mandrels** provide cutting efficiency and improved bit life.
- **Hydraulic grade and slope system** is 100% hydraulic and produces ± 3 mm (.125 in) tolerance.
- **Short turning radii** for productivity and jobsite flexibility.
- **Rear-discharge conveyors,** available on all profilers, swing (except on PR-105) to each side of center for loadout flexibility.
- **Optimum weight-to-horsepower balance** for delivering maximum available horsepower to the cutter.
- **Auxiliary front cutter for model PR-105** permits working in less accessible places. Cutters from 88.9 mm (3.5 in) to 609.6 mm (24 in) are available for the PR-105.
- **Separate Cat Diesel Engines for rotor and ground drives** make the PR 1000C the most powerful profiler available.
- **Water spray system for dust control** and bit cooling.
- **High pressure wash down system.**

MODEL	PR-105 		PR-450C 	
Flywheel Power	67 kW	90 HP	336 kW	460 HP
Operating Weight	7711 kg	17,000 lb	28 308 kg	58,000 lb
Engine Model	3204		3408	
Rated Engine RPM	2400		2100	
No. Cylinders	4		8	
Bore	114 mm	4.5"	137 mm	5.4"
Stroke	127 mm	5"	152 mm	6"
Displacement	5.2 L	318 in³	18 L	1099 in³
Drive Systems: Rotor	Mechanical side Hydrostatic front		Mechanical	
Ground	Hydrostatic with 3 hard rubber tires 711 mm x 305 mm (28" x 12") wide		Hydrostatic with 3 track design	
Discharge Conveyor Width	—		762 mm	30"
Width of Standard Track Shoe	—		356 mm	14"
Track Length on Ground	—		1981 mm	6'6"
Ground Contact Area (w/std. shoe)	—		0.35 m²	540 in²
Operating Dimensions:				
Height	2921 mm	9'7"	3683 mm	12'1"
Width	2515 mm	8'3"	2489 mm	8'2"
Length	3581 mm	11'9"	13.28 m	43'7"
Standard Mandrel (Width of Cut)	305 mm	12"	2010 mm	79"
No. of Teeth	48		165	
Depth of Cut (max.)	152 mm	6"	254 mm	10"
Optional Mandrel Widths	76 mm to 610 mm	3" to 24"	2210 mm 1200 mm	87" 48"
Speeds: Operating (max.)	134.1 m/min	440 ft/min	53.6 m/min	176 ft/min
Travel (max.)	134.1 m/min	440 ft/min	53.6 m/min	176 ft/min
Inside Turning Radius	203 mm	8"	—	
Grade and Slope Control	Optional		Hydraulic grade and slope system	
Fuel Capacity	212 L	56 U.S. gal	757.1 L	200 U.S. gal
Water Capacity	378.5 L	100 U.S. gal	2649.8 L	700 U.S. gal





MODEL	PR-750C		PR-1000C			
			Cutter Drive		Track Drive	
Flywheel Power	559 kW	750 HP	559 kW	750 HP	186 kW	250 HP
Operating Weight	42 638 kg	94,000 lb	46 780 kg		103,130 lb	
Engine Model	3412		3412		3208	
Rated Engine RPM	2100		2100		2600	
No. Cylinders	12		12		8	
Bore	137 mm	5.4"	137 mm	5.4"	114 mm	4.5"
Stroke	165 mm	6.5"	152 mm	6.54"	127 mm	5"
Displacement	27 L	1649 in³	27 L	1649 in³	10.4 l	636 in³
Drive Systems: Cutter	Mechanical		Mechanical			
Ground	Hydrostatic with 3 track design		Hydrostatic with 3 track design			
Discharge Conveyor Width	914 mm	36"	1219 mm		48"	
Width of Standard Track Shoe	457 mm	18"	457 mm		18"	
Track Length on Ground	2070 mm	6'9"	2540 mm		8'4"	
Ground Contact Area (w/std. shoe)			0.56 m²		866 in²	
Operating Dimensions:						
Height	3734 mm	12'3"	3810 mm		12'6"	
Width	3575 mm	11'8.75"	4877 mm		16'	
Length	16.5 m	54'0"	16.59 m		54'5"	
Standard Mandrel (Width of Cut)	3048 mm	10'0"	3810 mm		12'6"	
No. of Teeth	216		264			
Depth of Cut (max.)	254 mm	10"	254 mm		10"	
Optional Mandrel Widths	Extensions available in 2'6", 1'6", and 1'0" widths		18" Extension available			
Max. Cutter Width with extensions 12'6"	3810 mm	12'6"	4270 mm		14'0"	
Speeds: Operating (max.)	22.86 m/min	75 ft/min	23 m/min		75 ft/min	
Travel (max.)	55.47 m/min	182 ft/min	55 m/min		182 ft/min	
Inside Turning Radius	—		—			
Grade and Slope Control	Hydraulic grade and slope system		Hydraulic grade and slope system			
Fuel Capacity	1230.3 L	325 U.S. gal	1514.2 L		400 U.S. gal	
Water Capacity	4542.5 L	1200 U.S. gal	378.5 L		1000 U.S. gal	

14

Speed m/min	Speed ft/min	1220 mm 48" m²	1220 mm 48" yd²	2010 mm 79" m²	2010 mm 79" yd²	2210 mm 87" m²	2210 mm 87" yd²	3050 mm 120" m²	3050 mm 120" yd²	3500 mm 138" m²	3500 mm 138" yd²	3810 mm 150" m²	3810 mm 150" yd²	4270 mm 168" m²	4270 mm 168" yd²
		Cutter/Drum Width — m²/min (yd²/min)													
3.0	10	3.7	4.4	6.1	7.3	6.7	8.0	9.3	11.1	10.7	12.8	11.6	13.9	13.0	15.5
4.6	15	5.6	6.6	9.3	11.0	10.0	12.1	13.9	16.7	16.1	19.2	17.4	20.8	19.5	23.3
6.1	20	7.5	8.8	12.3	14.6	13.4	16.1	18.6	22.2	21.4	25.5	23.3	27.8	26.0	31.1
7.6	25	9.3	11.1	15.4	18.3	16.7	20.1	23.2	27.8	26.8	31.9	29.1	34.7	32.5	38.8
9.1	30	11.1	13.3	18.4	22.0	20.1	24.2	27.9	33.3	32.1	38.3	34.9	41.7	39.0	46.7
10.7	35	13.1	15.5	21.6	25.6	23.4	28.2	32.5	38.9	37.5	44.7	40.7	48.6	45.5	54.4
12.2	40	15.0	17.8	24.6	29.3	26.8	32.2	37.1	44.4	42.8	51.1	46.5	55.5	52.0	62.2
13.7	45	16.8	20.0	27.7	33.0	30.1	36.2	41.8	50.0	48.2	57.5	52.3	62.5	58.5	70.0
15.2	50	18.7	22.2	30.7	36.6	33.5	40.3	46.4	55.5	53.5	63.9	58.1	69.4	65.1	77.8
16.8	55	20.6	24.4	33.9	40.2	36.8	44.3	51.1	61.1	58.9	70.3	63.9	76.4	71.6	85.5
18.3	60	22.5	26.7	37.0	43.9	40.1	48.3	55.7	66.7	64.2	76.7	69.8	83.3	78.1	93.3

PR-450C: 1220 mm – 2210 mm; PR-750B: 3050 mm – 3810 mm; PR-1000C: 3810 mm – 4270 mm

Speed m/min	Speed ft/min	1220 mm 48" Metric tons	1220 mm 48" U.S. tons	2010 mm 79" Metric tons	2010 mm 79" U.S. tons	2210 mm 87" Metric tons	2210 mm 87" U.S. tons	3050 mm 120" Metric tons	3050 mm 120" U.S. tons	3500 mm 138" Metric tons	3500 mm 138" U.S. tons	3810 mm 150" Metric tons	3810 mm 150" U.S. tons	4270 mm 168" Metric tons	4270 mm 168" U.S. tons
		Cutter/Drum Width — metric tons/min (U.S. tons/min)													
3.0	10	.23	.26	.38	.42	.44	.48	.58	.64	.67	.74	.73	.80	.81	.89
4.6	15	.35	.38	.57	.63	.66	.69	.87	.96	1.00	1.10	1.09	1.20	1.21	1.34
6.1	20	.46	.51	.76	.84	.88	.92	1.16	1.28	1.34	1.47	1.46	1.79	1.62	1.79
7.6	25	.58	.64	.94	1.04	1.10	1.15	1.45	1.60	1.67	1.83	1.82	1.99	2.02	2.24
9.1	30	.69	.77	1.14	1.26	1.32	1.39	1.74	1.91	2.01	2.20	2.19	2.40	2.43	2.68
10.7	35	.81	.89	1.34	1.47	1.54	1.62	2.03	2.24	2.34	2.57	2.56	2.79	2.83	3.13
12.2	40	.92	1.02	1.53	1.68	1.76	1.85	2.32	2.55	2.68	2.94	2.92	3.19	3.24	3.58
13.7	45	1.04	1.15	1.71	1.88	1.98	2.08	2.61	2.87	3.01	3.31	2.28	3.59	3.64	4.02
15.2	50	1.16	1.28	1.91	2.10	2.20	2.32	2.90	3.19	3.35	3.67	3.05	3.99	4.05	4.47
16.8	55	1.27	1.41	2.09	2.31	2.42	2.55	3.19	3.51	3.68	4.04	4.01	4.39	4.45	4.92
18.3	60	1.39	1.53	2.28	2.51	2.64	2.78	3.48	3.83	4.02	4.41	4.38	4.79	4.86	5.36

PR-450C: 1220 mm – 2210 mm; PR-750B: 3050 mm – 3810 mm; PR-1000C: 3810 mm – 4270 mm

NOTE: Above figures are based on a one inch depth of cut. For greater depths of cut, multiply the production rate by cutting depth. Based on asphalt density of 115 lb/yd², one inch thick.

MACHINE SELECTION

Prime considerations in selecting the proper cold planer model are:

- — specifics of work to be done
- — type of projects generally done by the contractor — City/Urban or Highway/Airport
- — desired production capacities

Cold Planer Characteristics (Highway/Airport)

The PR-450C, because of its highly versatile design, can work in both areas — City/Urban and Highway/Airport. But no one model can perform every application in a cost efficient way. The cold planer must be adaptable to the application. Highway/Airport work requires high-volume cold planers. Both the PR-750C and the PR-1000C have the characteristics needed for this work. Their design includes the availability of proper operating speeds, deep cutting potential (254 mm [10 in] on both), and cutting mandrels in widths that match the job whether the milling is done in a single pass or multiple passes. The PR-750C and PR-1000C are both ideal models for Highway/Airport work because they cut a full lane width in a single pass whereas the PR-450C is a half lane width cold planer. The PR-1000C also has a 559 kW (750 HP) Cat 3412 Engine fully dedicated to the cutting mandrel and a 1219 mm (48 in) wide discharge conveyor.

Cold Planer Characteristics (City/Urban)

Maneuverability has a direct effect on cold planer productivity. The PR-450C's three track suspension system permits its short turning radius and makes possible its variable swing rear discharge conveyor, two important features which increase production potential in an Urban/City environment. For high-volume profiling the PR-450C is the most versatile and cost-effectve model.

Cold Planer Characteristics (Utility and Clean-Up)

The PR-105 is highly maneuverable and designed for maximum production on a variety of utility and clean-up assignments such as cutting around manholes, drain grids etc. Thus, the PR-105 has a place in both Highway/Airport and Urban/City cold planing. The auxiliary front cutter permits easy transverse cutting of cracks or joints allowing cutting to a curb or abutment.

Working in conjunction with the larger pavement cold planers, the PR-105 can handle the work that is either impractical or impossible for the larger machines, yet too expensive to do by hand. The PR-105 is uniquely well suited to the fast growing repair and rehabilitation application.

COLD PLANING FUNDAMENTALS

Definition

Profiling is the automatically controlled cold milling of pavement to restore the surface to a specified grade and slope; to remove bumps, ruts, and other imperfections; and to leave a textured surface which can be either opened immediately to traffic or overlayed with new pavement materials.

Production and Tooth Wear

Because pavement materials vary, so do production and tooth wear. While predicting the exact production rate and the tooth wear on a particular job is difficult, general guidelines are available.

Production depends on the milling rate (the speed at which the cold planer moves forward). The machine's forward speed is determined, primarily, by aggregate type, the strength of the asphalt bond and the depth of cut. When milling asphalt pavement, the cold planer's teeth essentially are breaking the bond between asphalt-coated aggregate, not actually fracturing the aggregate itself. A pavement made with a mix containing a high percentage of fine aggregate and a high asphalt content is more difficult to mill than a pavement with a high percentage of coarse aggregate.

A dense or fine mix usually requires more power at the cutting drum, limiting the cold planer's forward speed. Decreased speed lowers production, and the tough bond between the small aggregate particles causes increased cutting-tooth wear. Lower production and higher tooth wear result in increased unit costs.

Cutting depth affects power demand at the drum and helps determine the cold planer's forward speed. However, production increases, to a point, as the depth of cut increases. For example, changing from a 25 mm (1 in) cut to a 51 mm (2 in) cut slows the machine only slightly but doubles the amount of material produced.

As the cut increases beyond the machine's peak-production depth, the reduced forward speed begins to offset the production gains of the deeper cut. For example, production at a 152 mm (6 in) cutting depth and slow speed may be no greater than cutting at a 76 mm (3 in) depth and a much faster speed.

As long as the cold planer maintains a productive forward speed, deeper cuts will yield greater production and tend to lower tooth cost. Tooth wear does not increase in direct proportion to production when the machine is working in an efficient range.

Tooth wear at various depths for a given material is affected by how long the tooth remains in the cut. Because the teeth are mounted on a circular drum, each tooth cuts through the pavement in an arc. The tooth arc at a 102 mm (4 in) cutting depth, however, is not four times longer than at a 25 mm (1 in) cutting depth, even though production may be four times greater. The cutting arc at 102 mm (4 in) is approximately twice as long as that at 25 mm (1 in).

The peak cutting depth for a particular cold planer on a specific job is best determined by examining production, and subsequent costs, of a single deep cut versus multiple passes at a shallow depth.

APPLICATIONS

Although new applications for cold planers are being discovered, most work can be classified in six general categories:

Leveling and Bonding

This application removes a layer of pavement to eliminate potholes, ruts, bumps and other surface imperfections. The cold planer leaves a level, textured surface ideal for bonding to a new, thin overlay of asphalt or concrete. The surface has an interlocking texture with double the bonding area of a conventional smooth pavement. The textured surface and overlay form a monolithic bond, eliminating the shear plane that causes pavement layers to move and separate. Thinner overlays can be used, making the technique more economical than traditional overlay methods.

Surface Refinishing

Rough pavement can also be cold planed to specified grade and slope, providing a new riding surface without adding new paving materials. This application is particularly useful when base and sub-base are in good shape, or when several layers have been added to the roadway over the years. Roads can be cold planed during cold, wet months and reopened immediately. New overlays can be added whenever weather permits. This lengthens the practical working season for many contractors. The cold planer can also be used to correct expansion joint faults and pavement cracks.

Surface Repair

This category generally requires deeper cutting than leveling. It consists of removing isolated distressed pavement sections down to subbase, if necessary, prior to adding new overlay materials. Since the cutter mandrel on Caterpillar cold planers cuts forward and upward, there's no damaging impact to the underlying base.

Pavement Removal

Pavement buildup is a problem that plagues most older streets, roads and highways. As overlays are added, curbs and drains are buried — creating drainage problems. Overhead clearances are dangerously reduced . . . and additional weight is added to overpasses and bridges. Cold planing is an economical method of curing all these problems.

Surface Texturing

Serious accidents increase when pavement becomes slick from wear. The textured surface produced by cold planing is highly skid-resistant and has dramatically reduced hydroplaning characteristics.

Pavement Mining

Cold milling has made it practical to actually "mine" deteriorated pavement materials from existing roads and streets. The cold planer produces an ideally-sized asphalt or concrete material which can be recycled in a variety of ways. Depending on type, age and condition of pavement, the largest cold planer can reclaim up to 900 tons of material per hour.

Cold-in-place Recycling (CIR)

This application converts deteriorated asphalt into rejuvenated cold asphalt mix suitable for base course material. It is used in urban and highway applications. The PR-450C and PR 750C have sizer-mixer attachments available to convert them into CIR machines. The single unit recycler processes the milled material leaving a windrow of cold mix. Normally, a windrow elevator and paver re-lay the material immediately behind the recycler. Following compaction, a finish course is required.

COLD PLANER USE BY PROJECT TYPE

Applications	Highway/Airport	City/Urban
Planing (Milling)	• To establish grade and slope. • Remove excess pavement.	• To establish proper grade and slope. • To establish new grade and slope.
Partial Removal	• For use with hot mix recycle. • Remove pavement irregularities. • Texture for skid resistance.	• To correct drainage and curb reveal. • To lower elevation at overpass. • For use with hot recycle. • Eliminate leveling course.
Full Depth Removal	• Total rebuild. RAP used for base or hot recycle. • Cold recycle. This requires additional surface treatment.	• Total rebuild. RAP used for base or hot recycle. • Cold recycle. Requires additional surface treatment
Texturing	• For skid resistance and improved bond when overlay is applied.	• For skid resistance and improved bond when overlay is applied.
Leveling		• At intersections to remove bumps, shoving and improve drainage.
Special	• Joint and crack repair. • Cut rumble grooves on shoulders of bridge approaches.	• Intersection defect repair. • Pothole repair. • Railroad crossing repair. • Tight radius profiling around manhole covers, etc. • Pavement adjustments (transitions from existing pavements to new overlays).

RR-250:

The RR-250 is a heavy duty single rotor cold in-place reclaiming machine that utilizes a cutting mandrel that pulverizes and mixes asphaltic pavement and base materials. The machine is utilized for mechanical stabilization of deteriorated road surfaces and for complete reclamation with the addition of asphaltic emulsions or other binding agents. The RR-250 can be equipped with attachments that accurately inject liquid additives directly into the mixing hood. Optional rotors can be installed to convert the RR-250 into a soil stabilizer. The internally mounted breaker bar aids in material sizing.

SS-250:

The SS-250 is a heavy duty single rotor soil stabilization machine. The machine cuts, mixes and pulverizes native in-place soils or select materials, with or without additives. It modifies and stabilizes the soil obtaining a strong base.

Both the RR & SS-250 feature automatic depth control and engine load sensing.

Features:

- **Full 2438 mm (8 ft) wide cutting drum delivers maximum production.**
- **Large hood and adjustable rear door** enable operator to generate most uniform mix.
- **Mixing depth down to 457 mm (18 in) on SS-250 and 330 mm (13 in) on RR-250.**
- **Rotor and machine travel direction are the same.** Rotor up cuts assuring maximum blending of soil materials and maximum engine and rotor drive life. Consistent mixing and blending capability reduces number of passes required to achieve specified mixing. Rotor can also be ordered in the down cut mode.
- **Interchangeable rotors** allow the machine to adapt to the job for best performance.
- **Heavy duty mechanical rotor drive** is protected with proven shear pin design.
- **Heavy duty chains on each side of rotor** are enclosed in oil and dust tight cases.
- **3-speed hydrostatic transmission** provides smooth operation and travel speeds.
- **3 usable rotor speeds** for matching materials and required gradation.
- **Automatic** depth control.
- **Engine** load sensing.
- **Optional Asphalt Spray System** available for RR-250.
- **Optional Water Spray System** available for RR-250 and SS-250.
- **Hydraulically adjusted** rear door for gradation control.
- **Optional** rear wheel steering for a 6096 mm (20 ft) turning radius.
- **Optional** light package for night applications.

MODEL	**RR-250**			**SS-250**		
Flywheel Power	250 kW		**335 HP**	250 kW		**335 HP**
Operating Weight	18 053 kg		**39,800 lb**	13 517 kg		**29,300 lb**
Engine Model		**3406B**			**3406B**	
Rated Engine RPM		**2100**			**2100**	
No. Cylinders		**6**			**6**	
Bore	137 mm		**5.4"**	137 mm		5.4"
Stroke	165 mm		6.5"	165 mm		6.5"
Displacement	14.6 L		**893 in³**	14.6 L		893 in³
Drive Systems: Rotor		**3 speed Mechanical**			**3 speed Mechanical**	
Ground		**3 speed Hydrostatic**			**3 speed Hydrostatic**	
Operating Dimensions: Height	2600 mm		8'6.5"	2600 mm		8'6.5"
Width	2921 mm		9'7"	2921 mm		9'7"
Length	8560 mm		28'1"	8560 mm		28'1"
Width of Cut	2438 mm		8'0"	2438 mm		8'0"
Depth of Cut (Max.)	305 mm		12"	457 mm		18"
Rotor Speed	**Trans**	**Drive**	**Speed**	**Trans**	**Drive**	**Speed**
	Low	Low	123 rpm	Low	Low	123 rpm
	Low	High	168 rpm	Low	High	168 rpm
	High	Low	284 rpm	High	Low	284 rpm
Minimum Turning Radius: Standard	12.19 m		40'0"	12.19 m		40'0"
with optional rear steer	6.09 m		20'0"	6.09 m		20'0"
Travel Speed (Max.)	19.3 km/h		12 mph	19.3 km/h		12 mph
Gross Gradeability (will vary with conditions)		**40%**			**30%**	
Standard Tires: Front		**23.5 x 25-16 ply Lug Type E-2**			**28.1 x 26-10 PR Lug**	
Rear		**15.5 x 25-8 ply Lug Type L-2**			**14.9 x 24-6 PR Lug**	
Fuel Capacity	416 L		**110 U.S. gal**	416 L		**110 U.S. gal**
Cooling System	61 L		**16 U.S. gal**	61 L		16 U.S. gal
Crankcase	34 L		9 U.S. gal	34 L		9 U.S. gal

14

OPTIONAL EQUIPMENT

- Roll Over Protective Structure (ROPS).
- Foot per minute indicator (available in metric).
- Working light package.
- Cab with heater and defroster.
- Automated Asphalt Metering and Injection System-(English or Metric). Includes a foot per minute indicator.
- Water spray system with 76 mm (3 in) in-line flow meter (English or Metric).
- Rear Wheel Steering for 6.1 m (20 ft) turning radius.
- Cab with Air Conditioner.

Rotor Options for RR-250 & SS-250

Rotor	Maximum Depth of Work		No. of Bits/Tools		Direction of Cut
Quick Change Tool	381 mm	15"	58		Up
Standard Mix Chopper	381 mm	15"	39 R.H.	39 L.H.	Up
Standard Mix Straight Tool	406 mm	15"	78		Up
Deep Mix Chopper	457 mm	18"	39 R.H.	39 L.H.	Down
Deep Mix Straight Tool	483 mm	18"	78		Down
RR-250 Reclamation Rotor					
Cone Tool Milldrum	330 mm	13"	188 Quick Change Carbide Tipped		Up
Breakaway Holder Rotor	330 mm	13"	188 Carbide Bits		Up

PRODUCTION ESTIMATING

The standard Cat Soil Stabilizer and Reclaimer are capable of cutting and mixing to depths of 15 in* and 13 in respectively. In addition, the cutting width of their rotors is 8 feet. The following formulas allow you to determine the production in square yards (yd²)/minute or cubic yards (yd³)/minute.

Production in square yards (yd²) per minute

$$\text{yd}^2/\text{min} = \frac{\text{FPM of travel speed}}{1.125}$$

$$\frac{9\ \text{ft}^2/\text{yd}^2}{8\ \text{ft Cutting width}} = 1.125$$ (This is a constant value for an eight foot wide rotor)

Gallons of additive (for units with pump and metering additive system)

$$\frac{\text{GPM}}{\text{yd}^2/\text{min}} = \text{gal/yd}^2$$

Or, if required additive amounts are known, you can determine necessary travel speed as shown:

$$\frac{\text{GPM}}{\text{gal/yd}^2} = \text{yd}^2/\text{min};\ \text{yd}^2/\text{min} \times 1.125 = \text{ft/min}$$

Production in Cubic Yards (yd³) per minute

$$\frac{\text{FPM of travel speed}}{1.125} \times \frac{\text{Cutting or mixing depth in inches}}{36} = \frac{\text{yd}^3}{\text{min}}$$

Production in Tons per Minute

$$\text{yd}^3/\text{min} \times \frac{\text{Wt. of Material per yd in lbs}}{2000\ \text{lb/ton}} = \text{tons/min}$$

*Optional 18 in

Abbreviations

FPM - Feet Per Minute
GPM - Gallons Per Minute

WEIGHT OF MATERIALS

Material		lbs/yd³ (LOOSE)	lbs/yd³ (IN-PLACE)
Clay	— Dry	2600	3100
	— Wet	2800	3500
Clay and Gravel	— Dry	2400	2800
	— Wet	2000	3100
Sand and Gravel	— Dry	2900	3250
	— Wet	3400	3750
Sand	— Dry	2400	2700
	— Damp	2850	3200
	— Wet	3100	3500
Earth	— Dry Packed	2550	3200
	Wet Excavated	2700	3400
	— Top Soil	1600	2300
	— Loam	2100	2600
Bituminous Concrete	— Windrowed Chunks (25% Voids)	2925	
	— Compacted		3900

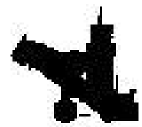
STABILIZATION/RECLAMATION PRODUCTION

To eliminate field calculations, the following chart lists production in Square Yards per Minute (yd²/min) and Cubic Yards per Minute (yd³/min). The information is based on various travel speeds and cutting depths for the Caterpillar RR-250 and SS-250 equipped with a 2438 mm (8 ft) cutting rotor.

Travel Speed FPM	6"		8"		10"		12"		13"		15"		16"		18"	
	yd²/min	yd³/min	yd²/min	yd³/min	yd²/min	yd³/min	yd²/min	yd³/min	yd²/min	yd³/min	yd²/min	yd³/min	yd²/min	yd³/min	yd²/min	yd³/min
10	8.9	1.5	8.9	2.0	8.9	2.5	8.9	3.0	8.9	3.2	8.9	3.7	8.9	4.0	8.9	4.5
20	17.8	3.0	17.8	4.0	17.8	4.9	17.8	5.9	17.8	6.4	17.8	7.4	17.8	7.9	17.8	8.9
30	26.7	4.5	26.7	5.9	26.7	7.4	26.7	8.9	26.7	9.6	26.7	11.1	26.7	11.9	26.7	13.4
40	35.6	5.9	35.6	7.9	35.6	9.9	35.6	11.9	35.6	12.8	35.6	14.8	35.6	15.8	35.6	17.8
50	44.5	7.4	44.5	9.9	44.5	12.4	44.5	14.8	44.5	16.0	44.5	18.5	44.5	19.8	44.5	22.3
60	53.4	8.9	53.4	11.9	53.4	14.8	53.4	17.8	53.4	19.3	53.4	22.2	53.4	23.7	53.4	26.7
70	62.3	10.4	62.3	13.8	62.3	17.3	62.3	20.8	62.3	22.5	62.3	25.9	62.3	27.7	62.3	31.2
80	71.2	11.9	71.2	15.8	71.2	19.8	71.2	23.7	71.2	25.7	71.2	29.6	71.2	31.6	71.2	35.6
90	80.1	13.4	80.1	17.8	80.1	22.4	80.1	26.7	80.1	28.9	80.1	33.3	80.1	35.6	80.1	40.1

Features:

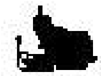
- Attaches easily to most pavers.
- Allows for fast, continuous paving operations.
- Maintains constant load of mix into hopper for continuous feeding.
- Integral quick-change towing attachment.
- Hydraulic elevation control.
- Can be used with bottom dump or end dump trailers or trucks with optional windrow box.



MODEL	WE-851B		
Rated Power (Intermittent)	108 kW		145 HP
Rated Engine RPM		2600	
Operating Weight (machine complete)	5897 kg		13,000 lb
Engine		Perkins T6.3544	
Displacement	5.8 L		354 in³
General Dimensions:			
Height (Shipping)	2.90 m		9'6"
(Operating)	3.02 m		9'11"
Length with wings folded in	3.81 m		12'6"
Overall width with wings folded in	2.90 m		9'6"
Operating width	3.35 m		11'0"
Conveyor:			
Maximum theoretical capacity	1930 (t)/hr		1900 TPH
Discharge height	1880 mm		6'2"
Width	1828 mm		6'0"
Lift	178 mm		7"
Tires: Front		6.9-9, 6PR	
Rear		8.25-15, 12PR	
Service Capacities:			
Fuel tank	89.9 L		23.75 U.S. gal

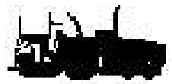
Features:

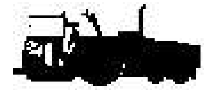
- **Variable width or fixed screeds** available for **AP-800B, AP-1000 & AP-1050.**
- **Oil-immersed disc brakes on AP-800B, AP-1000 & AP-1050** for greater reliability and lower maintenance.
- **Dual control consoles on AP-800B, AP-1000 & AP-1050** provide excellent visibility.
- **Hydrostatic pumps on AP-200B, AP-800B, AP-1000 & AP-1050** provides infinitely variable speed ranges.
- **Direct hydrostatic drives featured on the AP-1000 & AP-1050.** (Eliminates gear boxes, differentials, final drive chains & etc.)
- **Patented variable speed hydraulic augers on AP-200B** extend with wings to ensure proper material distribution.
- **Self-dumping hydraulic hoppers** are heavy-duty and high capacity.
- **Self-cleaning all-steel tracks on AP-200B** assure long life with virtually no maintenance required.



MODEL	AP-200B	
Flywheel Power	26 kW	35 HP
Rated Engine RPM	3000	
No. Cylinders	2	
Displacement	1.716 L	104.7 in³
Engine Model	Hatz Zm 40 Air-Cooled Diesel	
Operating Weight (empty)	4080 kg	9000 lb
Speeds	0-54 m/min	0-178 ft/min
Maximum theoretical capacity	609.6 (t)/hr	600 TPH
Track Assemblies:		
Width	381 mm	15"
Length on Ground	760 mm	30"
Outside to Outside	2440 mm	8'0"
General Dimensions:		
Basic Width	3000 mm	9'10"
Length	2440 mm	8'0"
Height (less exhaust stack)	1730 mm	6'8"
Wheel base	—	
Hopper Capacity	5.4 metric	6 standard tons
Screed (extendable)	2743 to 3658 mm	9'0" to 12'0"
Paving Width:		
Minimum	914 mm	3'0"
	(with optional cut-off shoes)	
Maximum	3658 mm	12'0"
Service Refill Capacities		
Cooling system	Air-cooled	
Fuel tank	39.8 L	10.5 U.S. gal
Hydraulic oil tank	75.8 L	20 U.S. gal

14



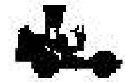


MODEL		AP-800B		AP-1000	
Flywheel Power		75 kW	102 HP	116 kW	155 HP
Rated Engine RPM		2600		2200	
No. Cylinders		4		6	
Displacement		3.86 L	236 in³	6.6 L	403 in³
Engine Model		Perkins T4.236 Turbocharged		3116	
Operating Weight:					
Tractor		10 680 kg	23,500 lb	12 020 kg	26,425 lb
Screed — Pavemaster	8 ft	1243 kg	2850 lb	—	
	10 ft	1361 kg	3000 lb	1361 kg	3000 lb
VIP	8 ft	2676 kg	5900 lb	—	
	10 ft	2948 kg	6500 lb	2948 kg	6500 lb
Speeds: Paving: 1st		39.0 m/min	128 ft/min	0-134.1 m/min	0-440 ft/min
2nd		95.1 m/min	312 ft/min	—	
Travel: 3rd		8.51 km/h	5.3 mph	—	
4th		20.91 km/h	13.0 mph	0-19.3 km/h	0-12 mph
Maximum theoretical capacity		1625.6 (t)/hr	1600 TPH	1930 (t)/hr	1900 TPH
Tires: Front (4)		22" x 12" Solid Rubber		22" x 14" Solid Rubber	
Rear (2)		16.00 x 24		16.00 x 25	
Dimensions:					
Operating Width	8 ft Screed	3296 mm	10'9.75"	—	
	10 ft Screed	3296 mm	10'9.75"	3296 mm	10'9.75"
Shipping Width	8 ft Screed	2591 mm	8'6"	—	
	10 ft Screed	3048 mm	10'0"	3022 mm	9'11"
Height (less exhaust)		2667 mm	8'9"	2693 mm	8'10"
Length (Pavemaster Screed, Osc. pushroller)		5909 mm	18'7"	6096 mm	20'0"
Turning Radius		3200 mm	10'6"	—	
Wheel base		2286 mm	7'6"	—	
Hopper Capacity		5.8 m³	206 ft³	6.0 m³	215 ft³
Auger Diameter		356 m	14"	406 mm	16"
Paving Widths:					
8 ft. Pavemaster					
Minimum w/cutoff shoes		1829 mm	6'0"	—	
Maximum w/extensions		6096 mm	20'0"	—	
10 ft Pavemaster					
Minimum w/cutoff shoes		2438 mm	8'0"	2438 mm	8'0"
Maximum w/extensions		6096 mm	20'0"	9144 mm	30'0"
8 ft VIP					
Minimum w/cutoff shoes		1829 mm	6'0"	2438 mm	8'0"
Maximum w/extensions		6096 mm	20'0"	7366 mm	24'2"
10 ft VIP					
Minimum w/cutoff shoes		2438 mm	8'0"	2438 mm	8'0"
Maximum w/extensions		6096 mm	20'0"	7366 mm	24'2"
Service Refill Capacities:					
Cooling system		20.8 L	5.5 U.S. gal	28.1 L	7.3 U.S. gal
Fuel tank		162.8 L	43 U.S. gal	230.3 L	60 U.S. gal
Hydraulic oil tank		109.8 L	29 U.S. gal	150 L	39 U.S. gal

MODEL		AP-1050		
Flywheel Power		116 kW		155 HP
Rated Engine RPM			2200	
No. Cylinders			6	
Displacement		6.6 L		403 in³
Engine Model			3116	
Operating Weight:				
Tractor		13 629 kg		29,900 lb
Screed — Pavemaster	8 ft		NA*	
	10 ft	1361 kg		3000 lb
VIP	8 ft		NA*	
	10 ft	2948 kg		6500 lb
Speeds: Paving: 1st		0-56.7 m/min		0-186 ft/min
Travel: 2nd		8 km/h		5 mph
Maximum theoretical capacity		1930 t/hr		1800 TPH
Tracks Assemblies:				
Width		356 mm		14"
Length on Ground		3077 mm		10'1"
Total Number of Track Pads			100	
Dimensions:				
Operating Width	10 ft Screed	3296 mm		10'9.75"
Shipping Width	10 ft Screed	3022 mm		9'11"
Height (less exhaust)		2693 mm		8'10"
Length (Pavemaster Screed, Osc. pushroller)		6477 mm		21'3"
Turning Radius		6477 mm		21'3"
Wheel base			NA*	
Hopper Capacity		6.0 m³		216 ft³
Auger Diameter		406 mm		16"
Paving Widths:				
10 ft Pavemaster				
Minimum w/cutoff shoes		2438 mm		8'0"
Maximum w/extensions		9144 mm		30'0"
10 ft VIP				
Minimum w/cutoff shoes		2438 mm		8'0"
Maximum w/extensions		7366 mm		24'2"
Service Refill Capacities				
Cooling system		28.1 L		7.3 U.S. gal
Fuel tank		290.3 L		80 U.S. gal
Hydraulic oil tank		150 L		39 U.S. gal

*Not Available

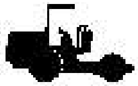
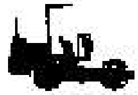
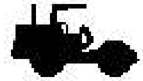
14



Features:

- **Designed with optimum horsepower-to-weight ratio** for best operating economy and peak performance.
- **Hydrostatic transmission** allows infinitely variable speeds in both forward and reverse.
- **Drum-drive units** feature a patented hydraulic flow divider valve or dual pump and circuit arrangement that delivers positive tractive effort to both drum and rear wheels, regardless of underfooting. This increases the machine's ability to maneuver in a wide variety of soil types and conditions and improves gross gradeability.
- **NoSPIN differential** is standard on all units for best traction of rear tires.
- **Routine maintenance** simplified by grouped service points and easy, ample access to service areas.
- **Operator comfort** provided by full-width padded seats or adjustable bucket seats for all day productivity. All machine controls and instrumentation are within easy sight and reach. Unobstructed visibility increases work area productivity.
- **ROPS (Roll Over Protective Structure)** standard on all units. Enclosed cabs with EROPS rating available as an option to provide all-weather comfort and productivity.
- **Flexible drum scrapers** mounted on both the front and rear of drums keep drum surface clean during forward and reverse movement.

MODEL	CS-323	
Flywheel Power	57.6 kW	77 HP
Rated Engine RPM	2300	
No. Cylinders	4	
Displacement	3.87 L	236 in³
Engine Model	Perkins 4.236	
Speeds:		
Forward	1	
Reverse	1	
Max. Speed (For./Rev.)	0-10.5 km/h	0-6.5 mph
Operating Weight	4173 kg	9200 lb
Shipping Weight	4037 kg	8900 lb
Drive	Drum/rear wheel	
Gradeability	49%	
Steering:		
Inside radius	3350 mm	11'0"
Outside radius	4570 mm	15'0"
Steering angle	±40°	
Vibratory System:		
Ecc. Weight Drive	Hydraulic	
Frequency	30 Hz	1400-1800 vpm
Amplitude Settings	1	
Centrifugal Force (Max.)	5760 kg	12,700 lb
General Dimensions:		
Overall width	1400 mm	4'7"
Drum width	1220 mm	48"
Drum diameter	970 mm	38"
Tires	9.5" x 24" 6-ply	
Overall height	2997 mm	9'10"
Wheel to drum	2390 mm	7'10"
Overall length	4240 mm	13'11"
Curb Clearance	360 mm	14"
Service Refill Capacities:		
Fuel tank	120 L	32 U.S. gal
Crankcase	7.3 L	1.9 U.S. gal
Hydraulic fluid	120 L	32 U.S. gal


MODEL	CS-431B	CS-433B	CS-563	CS-583
Flywheel Power	76.5 kW 102 HP	76.5 kW 102 HP	108 kW 145 HP	108 kW 145 HP
Rated Engine RPM	2500	2500	2200	2200
No. Cylinders	4	4	6	6
Displacement	3.87 L 236 in³	3.87 L 236 in³	6.6 L 403 in³	6.6 L 403 in³
Engine Model	Perkins T4.236	Perkins T4.236	3116	3116
Speeds:				
Forward	2	2	2	2
Reverse	2	2	2	2
Max. Speed (For./Rev.)	13.3 km/h 0-8 mph	13.3 km/h 0-8 mph	12.8 km/h 0-8 mph	12.8 km/h 8 mph
Operating Weight	6312 kg 13,915 lb	6448 kg 14,216 lb	11 130 kg 24,500 lb	15 250 kg 33,590 lb
Shipping Weight	6153 kg 13,565 lb	6288 kg 13,886 lb	10 900 kg 24,000 lb	15 040 kg 33,090 lb
Drive	Rear wheel	Drum/rear wheel	Drum/rear wheel	Drum/rear wheel
Gradeability	30%	50%	47%	47%
Steering:				
Inside radius	3050 mm 10'0"	3050 mm 10'0"	3800 mm 12'6"	3800 mm 12'6"
Outside radius	4720 mm 15'6"	4720 mm 15'6"	6170 mm 20'3"	6170 mm 20'3"
Steering angle	±37°	±37°	±32°	±30°
Vibratory System:				
Ecc. Weight Drive	Hydraulic	Hydraulic	Hydraulic	
Frequency	30 Hz 1400-1800 vpm	30 Hz 1400-1800 vpm	30 Hz 1400-1800 vpm	30 Hz 1550 vpm
Amplitude Settings	2	2	2	2
Centrifical Force				
High amplitude	11 235 kg 24,746 lb	11 235 kg 24,746 lb	22 680 kg 50,000 lb	22 680 kg 50,000 lb
Low amplitude	8777 kg 19,333 lb	8777 kg 19,333 lb	15 900 kg 35,000 lb	15 900 kg 35,000 lb
General Dimensions				
Overall width	1905 mm 6'3"	1905 mm 6'3"	2438 mm 8'0"	2438 mm 8'0"
Drum width	1680 mm 5'6"	1680 mm 5'6"	2130 mm 7'0"	2130 mm 7'0"
Drum diameter	1220 mm 4'0"	1220 mm 4'0"	1520 mm 5'0"	1520 mm 5'0"
Tires	14.9" x 24" 6-ply	14.9" x 24" 6-ply	23.1" x 26" 8-ply	23.1" x 26" 8-ply
Overall height	3050 mm 10'0"	3050 mm 10'0"	2997 mm 9'10"	2946 mm 9'8"
Wheel to drum	2591 mm 8'4"	2591 mm 8'4"	2740 mm 9'0"	2740 mm 9'0"
Overall length	4864 mm 15'11.5"	4864 mm 15'11.5"	5258 mm 17'3"	5258 mm 17'3"
Curb clearance	346 mm 13.5"	346 mm 13.5"	483 mm 19"	483 mm 19"
Service Refill Capacities:				
Fuel tank	144 L 38 U.S. gal	144 L 38 U.S. gal	254 L 67 U.S. gal	254 L 67 U.S. gal
Crankcase	7.7 L 2.03 U.S. gal	7.7 L 2.03 U.S. gal	15.1 L 4 U.S. gal	15.1 L 4 U.S. gal
Hydraulic fluid	144 L 38 U.S. gal	144 L 38 U.S. gal	132 L 35 U.S. gal	132 L 35 U.S. gal

14

MODEL AND MACHINE PASSES		AVERAGE SPEED MPH	COMPACTED LIFT THICKNESS 150 mm m³/hr	6 in yd³/hr	200 mm m³/hr	8 in yd³/hr	250 mm m³/hr	10 in yd³/hr	300 mm m³/hr	12 in yd³/hr
CS-323	3	2.5	249.5	326.0	332.7	434.7	415.8	543.3	499.0	652.0
	3	3.0	299.4	391.2	399.2	521.6	499.0	652.0	598.8	782.4
	3	3.5	349.3	456.4	465.8	608.5	582.2	760.7	698.7	912.8
	3	4.0	399.2	521.6	532.3	695.5	665.4	869.3	798.5	1043.2
	4	2.5	187.1	244.5	249.5	326.0	311.9	407.5	374.3	489.0
	4	3.0	224.6	293.4	299.4	391.2	374.3	489.0	449.1	586.8
	4	3.5	262.0	342.3	349.3	456.4	436.7	570.5	524.0	684.6
	4	4.0	299.4	391.2	399.2	521.6	499.0	652.0	598.8	782.4
	5	2.5	149.7	195.6	199.6	260.8	249.5	326.0	299.4	391.2
	5	3.0	179.7	234.7	239.5	313.0	299.4	391.2	359.3	469.4
	5	3.5	209.6	273.8	279.5	365.1	349.3	456.4	419.2	547.7
	5	4.0	239.5	313.0	319.4	417.3	399.2	521.6	479.1	625.9
CS-431B	3	2.5	343.1	448.3	457.5	597.7	571.8	747.1	686.2	896.5
	3	3.0	411.7	537.9	548.9	717.2	686.2	896.5	823.4	1075.8
	3	3.5	480.3	627.6	640.4	836.7	800.5	1045.9	960.7	1255.1
	3	4.0	548.9	717.2	731.9	956.3	914.9	1195.3	1097.9	1434.4
	4	2.5	257.3	336.2	343.1	448.3	428.9	560.3	514.6	672.4
	4	3.0	308.8	403.4	411.7	537.9	514.6	672.4	617.6	806.9
	4	3.5	360.2	470.7	480.3	627.6	600.4	784.4	720.5	941.3
	4	4.0	411.7	537.9	548.9	717.2	686.2	896.5	823.4	1075.8
	5	2.5	205.9	269.0	274.5	358.6	343.1	448.3	411.7	537.9
	5	3.0	247.0	322.7	329.4	430.3	411.7	537.9	494.1	645.5
	5	3.5	288.2	376.5	384.3	502.0	480.3	627.6	576.4	753.1
	5	4.0	329.4	430.3	439.2	573.8	548.9	717.2	658.7	860.6
CS-493B	3	2.5	343.1	448.3	457.5	597.7	571.8	747.1	686.2	896.5
	3	3.0	411.7	537.9	548.9	717.2	686.2	896.5	823.4	1075.8
	3	3.5	480.3	627.6	640.4	836.7	800.5	1045.9	960.7	1255.1
	3	4.0	548.9	717.2	731.9	956.3	914.9	1195.3	1097.9	1434.4
	4	2.5	257.3	336.2	343.1	448.3	428.9	560.3	514.6	672.4
	4	3.0	308.8	403.4	411.7	537.9	514.6	672.4	617.6	806.9
	4	3.5	360.2	470.7	480.3	627.6	600.4	784.4	720.5	941.3
	4	4.0	411.7	537.9	548.9	717.2	686.2	896.5	823.4	1075.8
	5	2.5	205.9	269.0	274.5	358.6	343.1	448.3	411.7	537.9
	5	3.0	247.0	322.7	329.4	430.3	411.7	537.9	494.1	645.5
	5	3.5	288.2	376.5	384.3	502.0	480.3	627.6	576.4	753.1
	5	4.0	329.4	430.3	439.2	573.8	548.9	717.2	658.7	860.6
CS-563	3	2.5	436.7	570.5	582.2	760.7	727.8	950.8	873.3	1141.0
	3	3.0	524.0	684.6	698.7	912.8	873.3	1141.0	1048.0	1369.2
	3	3.5	611.3	798.7	815.1	1064.9	1018.9	1331.2	1222.6	1597.4
	3	4.0	698.7	912.8	931.5	1217.1	1164.4	1521.3	1397.3	1825.8
	4	2.5	327.5	427.9	436.7	570.5	545.8	713.1	655.0	855.8
	4	3.0	393.0	513.5	524.0	684.6	655.0	855.8	786.0	1026.9
	4	3.5	458.5	599.0	611.3	798.7	764.2	998.4	917.0	1198.1
	4	4.0	524.0	684.6	698.7	912.8	873.3	1141.0	1048.0	1369.2
	5	2.5	262.0	342.3	349.3	456.4	436.7	570.5	524.0	684.6
	5	3.0	314.4	410.8	419.2	547.7	524.0	684.6	628.8	821.5
	5	3.5	366.8	479.2	489.1	639.0	611.3	798.7	733.6	958.4
	5	4.0	419.2	547.7	558.9	730.2	698.7	912.8	838.4	1095.4

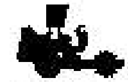
MODEL AND MACHINE PASSES		AVERAGE SPEED KM/H	COMPACTED LIFT THICKNESS*								
			200 mm	300 mm	400 mm	500 mm	600 mm	700 mm	800 mm	900 mm	1000 mm
CS 583	2	3.0	660.0	990.0	1320.0	1650.0	1980.0	2310.0	2640.0	2970.0	3300.0
	2	4.0	880.0	1320.0	1760.0	2200.0	2640.0	3080.0	3520.0	3960.0	4400.0
	2	5.0	1100.0	1650.0	2200.0	2750.0	3300.0	3850.0	4400.0	4950.0	5500.0
	2	6.0	1320.0	1980.0	2640.0	3300.0	3960.0	4620.0	5280.0	5940.0	6600.0
	2	7.0	1540.0	2310.0	3080.0	3850.0	4620.0	5390.0	6160.0	6930.0	7700.0
	4	3.0	330.0	495.0	660.0	825.0	990.0	1155.0	1320.0	1485.0	1650.0
	4	4.0	440.0	660.0	880.0	1100.0	1320.0	1540.0	1760.0	1980.0	2200.0
	4	5.0	550.0	825.0	1100.0	1375.0	1650.0	1925.0	2200.0	2475.0	2750.0
	4	6.0	660.0	990.0	1320.0	1650.0	1980.0	2310.0	2640.0	2970.0	3300.0
	4	7.0	770.0	1155.0	1540.0	1925.0	2310.0	2695.0	3080.0	3465.0	3850.0
	6	3.0	220.0	330.5	440.0	550.0	660.0	770.0	880.0	990.0	1100.0
	6	4.0	293.3	440.0	586.7	733.3	880.0	1026.7	1173.3	1320.0	1466.7
	6	5.0	366.7	550.0	733.3	916.7	1100.0	1283.3	1466.7	1650.0	1833.3
	6	6.0	440.0	660.0	880.0	1100.0	1320.0	1540.0	1760.0	1980.0	2200.0
	6	7.0	513.0	770.0	1026.7	1283.3	1540.0	1796.7	2053.3	2310.0	2566.7
	8	3.0	165.0	247.5	330.0	412.5	495.0	577.5	660.0	742.5	825.0
	8	4.0	220.0	330.0	440.0	550.0	660.0	770.0	880.0	990.0	1100.0
	8	5.0	275.0	412.5	550.0	687.5	825.0	962.5	1100.0	1237.5	1375.0
	8	6.0	330.0	495.0	660.0	825.0	990.0	1155.0	1320.0	1485.0	1650.0
	8	7.0	385.0	577.5	770.0	962.5	1155.0	1347.5	1540.0	1732.5	1925.0
	10	3.0	132.0	198.0	264.0	330.0	396.0	462.0	528.0	594.0	660.0
	10	4.0	176.0	264.0	352.0	440.0	528.0	616.0	704.0	792.0	880.0
	10	5.0	220.0	330.0	440.0	550.0	660.0	770.0	880.0	990.0	1100.0
	10	6.0	264.0	396.0	528.0	660.0	792.0	924.0	1056.0	1188.0	1320.0
	10	7.0	308.0	462.0	616.0	770.0	924.0	1078.0	1232.0	1386.0	1540.0

*Production in cubic meters per hour (m^3/hr)

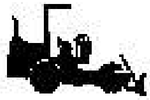
14

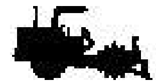
Features:

- **Designed with optimum horsepower-to-weight ratio** for best operating economy and peak performance.
- **All units feature a patented hydraulic flow divider valve** or dual pump and circuit arrangement that delivers positive tractive effort to both drum and rear wheels, regardless of underfooting. This increases the machine's ability to maneuver in a wide variety of soil types and conditions and improves gross gradeability.
- **NoSPIN differential** is standard on all units for best traction of rear tires.
- **Optional Heavy-duty front-mounted blade** with reversible cutting edge is available to allow backfilling and leveling during compaction.
- **Routine maintenance** simplified by grouped service points and easy access to service areas.
- **Operator comfort** provided by full-width padded seats or adjustable bucket seats for all day productivity. All machine controls and instrumentation are within easy sight and reach. Unobstructed visibility increases work area productivity.
- **ROPS (Roll Over Protective Structure)** standard on all units. Enclosed cabs with EROPS rating available as an option to provide all-weather comfort and productivity.
- **Adjustable cleaner bars** keep drums clean between pads during forward and reverse movement.



MODEL	CP-323	
Flywheel Power	57.5 kW	77 HP
Rated Engine RPM	2300	
No. Cylinders	4	
Displacement	3.87 L	236 in³
Engine Model	Perkins 4.236	
Speeds:		
Forward	1	
Reverse	1	
Max. Speed (For./Rev.)	10.5 km/h	0-6.6 mph
Operating Weight	4218 kg	9300 lb
Shipping Weight	4082 kg	9000 lb
Drive	Drum/rear wheel	
Gradeability	49%	
Steering:		
Inside radius	3350 mm	11'0"
Outside radius	4570 mm	15'0"
Steering angle	±40°	
Vibratory System:		
Ecc. Weight Drive	Hydraulic	
Frequency	30 Hz	1400-1800 vpm
Amplitude Settings	1	
Centrifical Force (Max.)	5760 kg	12,700 lb
General Dimensions:		
Overall width w/blade	1680 mm	5'6"
Overall width w/o blade	1400 mm	4'7"
Drum width	1220 mm	48"
Drum diameter over pads	810 mm	32"
Tires	9.5" x 24" 6-ply	
Overall height	2770 mm	9'1"
Wheel to drum	2390 mm	7'10"
Overall length	4470 mm	14'8"
Curb Clearance	360 mm	14"
Service Refill Capacities:		
Fuel Tank	120 L	32 U.S. gal
Crankcase	7.3 L	1.9 U.S. gal
Hydraulic fluid	120 L	32 U.S. gal





MODEL	CP-433B		CP-563	
Flywheel Power	76.5 kW	102 HP	108 kW	145 HP
Rated Engine RPM	2500		2200	
No. Cylinders	4		6	
Displacement	3.87 L	236 in³	6.6 L	403 in³
Engine Model	Perkins T4.236		3116	
Speeds:				
Forward	2		2	
Reverse	2		2	
Max. Speed (For./Rev.)	13.3 km/h	0-8 mph	12.8 km/h	0-8 mph
Operating Weight	6660 kg	14,700 lb	11 580 kg	25,860 lb
Shipping Weight	6509 kg	14,350 lb	11 380 kg	25,600 lb
Drive	Drum/rear wheel		Drum/rear wheel	
Gradeability	50%		47%	
Steering:				
Inside radius	3050 mm	10'0"	3800 mm	12'6"
Outside radius	4720 mm	15'6"	6170 mm	20'3"
Steering angle	±37°		±32°	
Vibratory System:				
Ecc. Weight Drive	Hydraulic		Hydraulic	
Frequency	29.5 Hz	1400-1800 vpm	30 Hz	1400-1800 vpm
Amplitude Settings	2		2	
Centrifical Force				
Low amplitude	9938 kg	21,890 lb	22 680 kg	50,000 lb
High amplitude	12 712 kg	28,000 lb	15 800 kg	35,000 lb
General Dimensions:				
Overall width w/blade	2007 mm	6'7"	2740 mm	9'0"
Overall width w/o blade	1906 mm	6'3"	2440 mm	8'0"
Drum width	1680 mm	5'6"	2130 mm	7'0"
Drum diameter over pads	1220 mm	4'0"	1549 mm	5'1"
Tires	14.9" x 24" 6-ply		23.1" x 26" 8-ply	
Overall height	3050 mm	10'0"	2997 mm	9'10"
Wheel to drum	2591 mm	8'4"	2740 mm	9'0"
Overall length	4864 mm	15'11.5"	5258 mm	17'3"
Curb clearance	346 mm	13.5"	483 mm	19"
Service Refill Capacities:				
Fuel tank	144 L	38 U.S. gal	254 L	67 U.S. gal
Crankcase	7.7 L	2.03 U.S. gal	15.1 L	4 U.S. gal
Hydraulic fluid	144 L	38 U.S. gal	132 L	35 U.S. gal

14

Padded Drum Vibratory Soil Compactors | Production Table

MODEL AND MACHINE PASSES		AVERAGE SPEED MPH	COMPACTED LIFT THICKNESS							
			150 mm m³/hr	6 in yd³/hr	200 mm m³/hr	8 in yd³/hr	250 mm m³/hr	10 in yd³/hr	300 mm m³/hr	12 in yd³/hr
CP-323	3	2.5	249.5	326.0	332.7	434.7	415.8	543.3	499.0	652.0
	3	3.0	299.4	391.2	399.2	521.6	499.0	652.0	598.8	782.4
	3	3.5	349.3	456.4	465.8	608.5	582.2	760.7	698.7	912.8
	3	4.0	399.2	521.6	532.3	695.6	665.4	869.3	798.5	1043.2
	4	2.5	187.1	244.5	249.5	326.0	311.9	407.5	374.3	489.0
	4	3.0	224.6	293.4	299.4	391.2	374.3	489.0	449.1	586.8
	4	3.5	262.0	342.3	349.3	456.4	436.7	570.5	524.0	684.6
	4	4.0	299.4	391.2	399.2	521.6	499.0	652.0	598.8	782.4
	5	2.5	149.7	195.6	199.6	260.8	249.5	326.0	299.4	391.2
	5	3.0	179.7	234.7	239.5	313.0	299.4	391.2	359.3	469.4
	5	3.5	209.6	273.8	279.5	365.1	349.3	456.4	419.2	547.7
	5	4.0	239.5	313.0	319.4	417.3	399.2	521.6	479.1	625.9
CP-433B	3	2.5	343.1	448.3	457.5	597.7	571.8	747.1	686.2	896.5
	3	3.0	411.7	537.9	548.9	717.2	686.2	896.5	823.4	1075.8
	3	3.5	480.3	627.6	640.4	836.7	800.5	1045.9	960.7	1255.1
	3	4.0	548.9	717.2	731.9	956.3	914.9	1195.3	1097.9	1434.4
	4	2.5	257.3	336.2	343.1	448.3	428.9	560.3	514.6	672.4
	4	3.0	308.8	403.4	411.7	537.9	514.6	672.4	617.6	806.9
	4	3.5	360.2	470.7	480.3	627.6	600.4	784.4	720.5	941.3
	4	4.0	411.7	537.9	548.9	717.2	686.2	896.5	823.4	1075.8
	5	2.5	205.9	269.0	274.5	358.6	343.1	448.3	411.7	537.9
	5	3.0	247.0	322.7	329.4	430.3	411.7	537.9	494.1	645.5
	5	3.5	288.2	376.6	384.3	502.0	480.3	627.6	576.4	753.1
	5	4.0	329.4	430.3	439.2	573.8	548.9	717.2	658.7	860.6
CP-563	3	2.5	436.7	570.6	582.2	760.7	727.8	950.8	873.3	1141.0
	3	3.0	524.0	684.6	698.7	912.8	873.3	1141.0	1048.0	1369.2
	3	3.5	611.3	798.7	815.1	1064.9	1018.9	1331.2	1222.6	1597.4
	3	4.0	698.7	912.8	931.5	1217.1	1164.4	1521.3	1397.3	1825.6
	4	2.5	327.6	427.9	436.7	570.5	545.8	713.1	655.0	855.8
	4	3.0	393.0	513.5	524.0	684.6	655.0	855.8	786.0	1026.9
	4	3.5	458.5	599.0	611.3	798.7	764.2	998.4	917.0	1198.1
	4	4.0	524.0	684.6	698.7	912.8	873.3	1141.0	1048.0	1369.2
	5	2.5	262.0	342.3	349.3	456.4	436.7	570.5	524.0	684.6
	5	3.0	314.4	410.8	419.2	547.7	524.0	684.6	628.8	821.5
	5	3.5	366.8	479.2	489.1	639.0	611.3	798.7	733.6	958.4
	5	4.0	419.2	547.7	558.9	730.2	698.7	912.8	838.4	1095.4

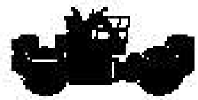
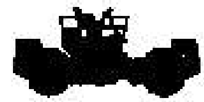
Features:

- **Direct hydrostatic drive to both drums** provides dependable, responsive propulsion effort and maximum gradeability.
- **On larger units, vibration automatically ceases before machine comes to a stop** to help produce a smooth, flawless mat surface.
- **Flexible gear coupling between the vibratory motor and shaft** increase motor life.
- **Larger units** feature multiple operator positions with operator positioned away from engine noise and heat.
- **Exhaust systems** direct fumes away from operator.
- **Smaller units** feature padded seats and unobstructed visibility of all rolling edges.
- **Clean frame design and close side clearances** allow compactors to work close to curbs, walls and other obstructions.
- **External plumbing of all motors and brakes** makes maintenance easy. All servicing is possible from ground level.
- **Large, rust-proof water tanks and pressure spray system** provide hours of reliable operation between fill-ups.

MODEL	**CB-214B**	
Flywheel Power	24.5 kW	33 HP
Rated Engine RPM	2600	
No. Cylinders	2	
Displacement	1.72 L	104.7 in³
Engine Model	Hatz 2M40	
Speeds:		
Forward	2	
Reverse	2	
Max. Speed (For./Rev.)	10.5 km/h	0-6.5 mph
Operating Weight	2300 kg	5072 lb
Shipping Weight	2250 kg	4980 lb
Drive	Hydraulic	
Gradeability	36%	
Operator Position(s)	Single/bucket seat	
Steering:		
Inside radius	2525 mm	8'3"
Outside radius	3525 mm	11'7"
Steering angle	±32°	
Vibratory System:		
Ecc. Weight Drive	Hydraulic	
Frequency	50 Hz	3000 vpm
Amplitude Settings	1	
Centrifical Force per drum (Max.)	2018 kg	4450 lb
General Dimensions:		
Overall width	1090 mm	3'7"
Drum width	1000 mm	39.4"
Drum diameter	700 mm	27.6"
Overall height	1640 mm	5'4"
Wheelbase	1700 mm	5'6.9"
Overall length	2400 mm	7'10.5"
Curb clearance	400 mm	15.75"
Ground clearance	250 mm	10"
Service Refill Capacities:		
Fuel tank	53 L	14.0 U.S. gal
Crankcase	4.5 L	1.19 U.S. gal
Hydraulic fluid	40 L	10.5 U.S. gal
Sprinkler water	165 L	43.5 U.S. gal

Dual Drum Vibratory Asphalt Compactors

Specifications

								
MODEL	**CB-224B**		**CB-434**		**CB-534**		**CB-614**	
Flywheel Power	24.5 kW	**33 HP**	60 kW	**80 HP**	92 kW	**126 HP**	115 kW	**155 HP**
Rated Engine RPM	**2600**		**2250**		**2200**		**2400**	
No. Cylinders	**2**		**4**		**4**		**6**	
Displacement	1.72 L	**104.7 in³**	3.87 L	**236 in³**	7.0 L	**427 in³**	10.4 L	**638 in³**
Engine Model	**Hatz 2M40**		**3114**		**3304**		**3208**	
Speeds:								
Forward	**2**		1		**2**		1	
Reverse	**2**		1		**2**		1	
Max. Speed (For./Rev.)	10.5 km/h	**0-6.5 mph**	11.6 km/h	**0-7.2 mph**	11 km/h	**0-7 mph**	11.3 km/h	**0-7 mph**
Operating Weight	2450 kg	**5402 lb**	6065 kg	**13,360 lb**	9117 kg	**20,100 lb**	11 340 kg	**25,000 lb**
Shipping Weight	2400 kg	**5291 lb**	5534 kg	**12,200 lb**	8500 kg	**18,700 lb**	10 251 kg	**22,600 lb**
Drive	**Hydraulic**		**Hydraulic**		**Hydraulic**		**Hydraulic**	
Gradeability	**35%**		**45%**		**30%**		**30%**	
Operator Position(s)	**Single/bucket seat**		**Swivel/bucket seat**		**Swivel/bucket seat**		**Dual/bucket seats**	
Steering:								
Inside radius	2425 mm	**7'11.5"**	3410 mm	**11'2.25"**	4165 mm	**13'8"**	5321 mm	**17'5.6"**
Outside radius	3625 mm	**11'10"**	4832 mm	**15'10.25"**	5865 mm	**19'2"**	7303 mm	**23'11.5"**
Steering angle	±32°		**±38°**		**±35°**		**±35°**	
Vibratory System:								
Ecc. Weight Drive	**Hydraulic**		**Hydraulic**		**Hydraulic**		**Hydraulic**	
Frequency	50 Hz	**3000 vpm**	48 Hz	**2900 vpm**	42 Hz	**2550 vpm**	38 Hz	**2300 vpm**
Amplitude Settings	**1**		**3**		**3**		**2**	
Centrifical Force per drum (Max.)	2450 kg	**5400 lb**	7640 kg	**16,800 lb**	11 000 kg	**26,018 lb**	9526 kg	**21,000 lb**
General Dimensions:								
Overall width	1280 mm	**4'3"**	1575 mm	**5'3.5"**	1850 mm	**6'1"**	2426 mm	**7'11.5"**
Drum width	1200 mm	**47.2"**	1422 mm	**4'8"**	1700 mm	**5'7"**	1981 mm	**6'6"**
Drum diameter	700 mm	**27.6"**	1100 mm	**43.5"**	1300 mm	**4'3"**	1372 mm	**4'6"**
Overall height	1640 mm	**6'4"**	2337 mm	**7'8"**	2320 mm	**7'7"**	2540 mm	**8'4"**
Wheelbase	1700 mm	**5'6.8"**	2616 mm	**8'7"**	3140 mm	**10'4"**	3861 mm	**12'8"**
Overall length	2400 mm	**7'10.5"**	4191 mm	**13'9"**	4940 mm	**16'2.5"**	5588 mm	**18'4"**
Curb clearance	400 mm	**15.75"**	381 mm	**15"**	380 mm	**15"**	387 mm	**15.25"**
Ground clearance	250 mm	**10"**	381 mm	**15"**	380 mm	**15"**	387 mm	**15.25"**
Service Refill Capacities:								
Fuel tank	53 L	**14.0 U.S. gal**	144 L	**38 U.S. gal**	190 L	**50 U.S. gal**	303 L	**80 U.S. gal**
Crankcase	4.5 L	**1.19 U.S. gal**	7.3 L	**1.9 U.S. gal**	19 L	**5 U.S. gal**	11.3 L	**3 U.S. gal**
Hydraulic fluid	40 L	**10.5 U.S. gal**	57 L	**15 U.S. gal**	90 L	**24 U.S. gal**	170.3 L	**45 U.S. gal**
Sprinkler water	166 L	**43.5 U.S. gal**	666 L	**176 U.S. gal**	1000 L	**264 U.S. gal**	1022 L	**270 U.S. gal**

ASPHALT COMPACTION PRODUCTION RATES

Formula for Compacted Cubic Yards (yd^3) Per Hour:

$$\frac{W \times S \times L \times 16.3 \times .83}{P} = yd^3/hr$$

W = Effective width of compaction per pass in feet (See NOTE below)
S = Average speed in MPH
L = Compacted Lift in Inches
16.3 = Constant
.83 = Efficiency Rate (50 minute hour)
P = Number of passes required to achieve compaction

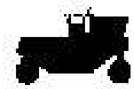
NOTE: In calculating the effective width of the compactor, the width of the laydown lane in relation to the roller width must be taken into consideration.

Example: A CB-614 with a 1981 mm (78 in) drum width takes two roller widths to cover a 3658 mm (12 ft) lane, therefore the effective rolling width is 1829 mm (6 ft). A CB-534 with a 1702 mm (67 in) drum width requires 3 passes to cover the 3658 mm (12 ft) lane, so effective rolling width is 1219 mm (4 ft). The CB 434, with 1422 mm (56 in) drum width, requires three passes to cover the 3658 mm (12 ft) lane, so also has an effective rolling width of 1219 mm (4 ft) per pass.

Actual production rate will vary depending on many variables including the following:

Asphalt mix
Temperature of mix
Ambient temperature
Lift thickness
Percent of density required
Operator technique

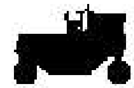
14



Features:

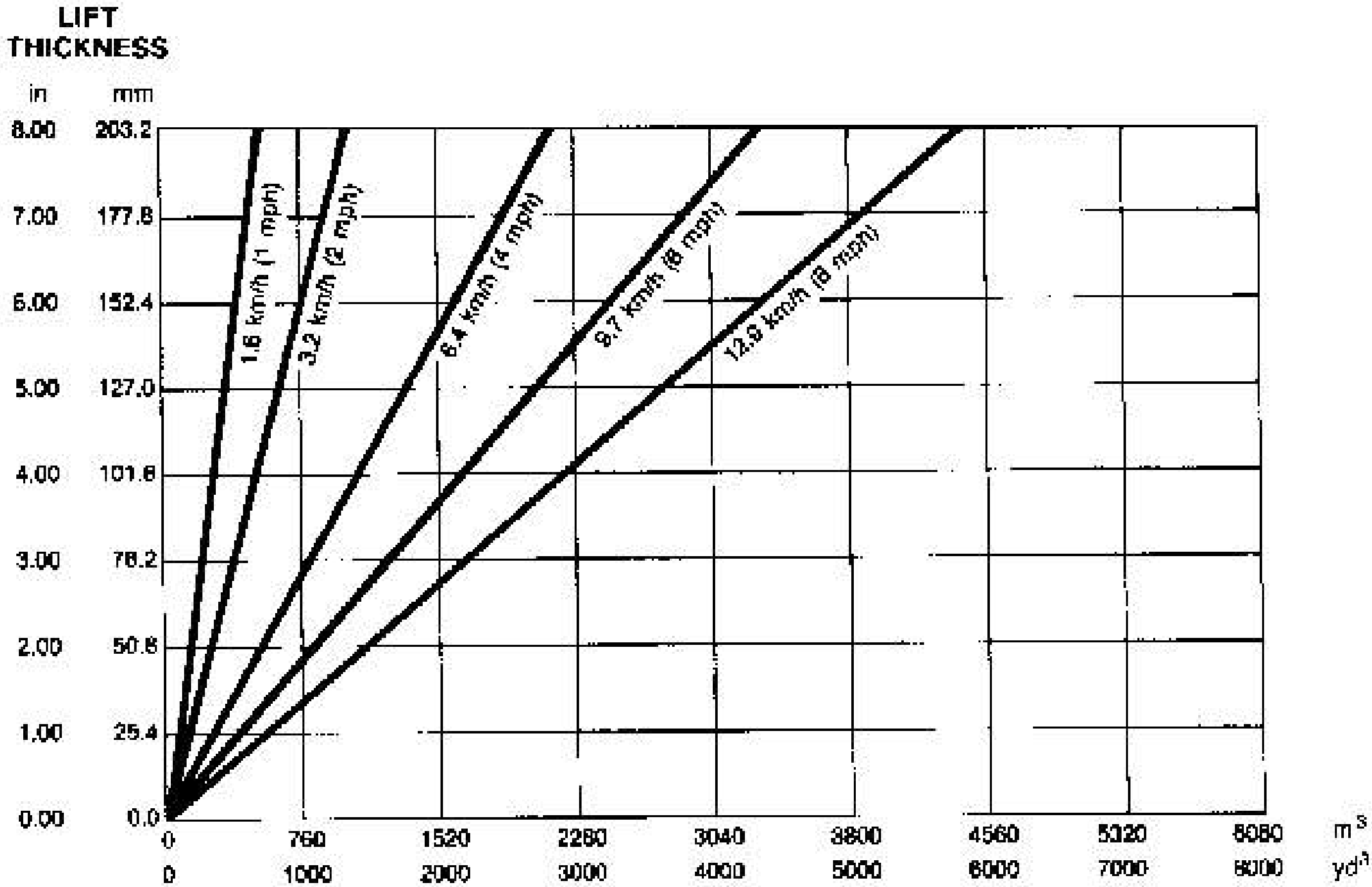
- **Designed for high density compaction** of any hot or cold mix or surface seal applications
- **Tire positions overlap** to provide full width compaction in a single pass.
- **Wheel oscillation** eliminates bridging of low spots.
- **Single-lever fingertip control of forward and reverse movement** makes smooth shuttle rolling easy.
- **Heavy-duty mechanical 4-speed transmission** allows infinitely variable travel speeds up to 38.6 km/h (24 mph), forward or reverse.
- **Hydraulic full-power steering** makes for effortless steering.
- **Ballast compartments** are easily accessible for quick loading and are located to provide a balanced wheel/weight ratio. Large side covers provide for fast, convenient unloading.
- **Gravity-feed water spray system with nylon tire scrapers (cocoa mat scrapers optional)** keep tires clean and resistant to pick-up during compaction.

MODEL	PS-11D	
Flywheel Power	57 kW	77 HP
Rated Engine RPM	2300	
No. Cylinders	4	
Displacement	3.9 L	236 in³
Engine Model	Perkins 4.236	
Speeds:		
Forward	4	
Reverse	4	
Max. Speed (For./Rev.)	38.6 km/h	24 mph
Wheel Configuration	6 front/8 rear	
Tires	7.5" x 15" 6 ply	
Operating Weight Empty (no ballast)	4206 kg	9270 lb
Operating Weight Full (max. ballast)	12 500 kg	27,550 lb
Maximum Weight per Wheel	1134 kg	2500 lb
Steering:		
Inside radius	3988 mm	13'1"
Outside radius	6121 mm	20'1"
General Dimensions:		
Overall width	2134 mm	7'0"
Rolling width	2134 mm	7'0"
Overall height	2489 mm	8'2"
Wheelbase	3353 mm	11'0"
Overall length	4140 mm	13'7"
Ground clearance	270 mm	10.5"
Service Refill Capacities:		
Fuel tank	128 L	34 U.S. gal
Crankcase	4.7 L	3.5 U.S. gal
Sprinkler water	380 L	100 U.S. gal

MODEL	**PS-130**		**PS-180**	
Flywheel Power	57 kW	**77 HP**	57 kW	**77 HP**
Rated Engine RPM	**2300**		**2300**	
No. Cylinders	**4**		**4**	
Displacement	3.9 L	**236 in³**	3.9 L	**236 in³**
Engine Model	**Perkins 4.236**		**Perkins 4.236**	
Speeds:				
Forward	**4**		**4**	
Reverse	**4**		**4**	
Max. Speed (For./Rev.)	38.6 km/h	**24 mph**	38.6 km/h	**24 mph**
Wheel Configuration	**5 front/4 rear**		**5 front/4 rear**	
Tires	**7.5" x 15" 6 ply**		**7.5" x 15" 10 ply**	
Operating Weight Empty (no ballast)	4133 kg	**9110 lb**	5421 kg	**11,950 lb**
Operating Weight Full (max. ballast)	12 427 kg	**27,390 lb**	16 420 kg	**36,200 lb**
Maximum Weight per Wheel	1380 kg	**3043 lb**	1814 kg	**4000 lb**
Steering:				
Inside radius	4191 mm	**13'9"**	4191 mm	**13'9"**
Outside radius	5918 mm	**19'5"**	5918 mm	**19'5"**
General Dimensions:				
Overall width	1854 mm	**6'1"**	1854 mm	**6'1"**
Rolling width	1728 mm	**5'8"**	1727 mm	**5'8"**
Overall height	2489 mm	**8'2"**	2641 mm	**8'8"**
Wheelbase	3353 mm	**11'0"**	3353 mm	**11'0"**
Overall length	4140 mm	**13'7"**	4140 mm	**13'7"**
Ground Clearance	267 mm	**10.5"**	278 mm	**10.5"**
Service Refill Capacities:				
Fuel tank	128 L	**34 U.S. gal**	128 L	**34 U.S. gal**
Crankcase	4.7 L	**3.5 U.S. gal**	4.7 L	**3.5 U.S. gal**
Sprinkler water	380 L	**100 U.S. gal**	380 L	**100 U.S. gal**

14

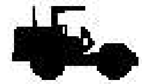


m³(yd³) per hour per pass

$$\text{Production Rate } [m^3(yd^3)] = \frac{m^3(yd^3)/\text{hr per pass}}{\text{No. of passes required}}$$

Features:

- **Designed with optimum horsepower-to-weight ratio** for best operating economy and peak performance.
- **Hydrostatic, two-speed transmissions allow infinitely variable speeds in both forward and reverse.**
- **Hydraulic flow divider valve** delivers positive tractive effort to both drum and rear wheels, regardless of underfooting. This increases the machine's ability to maneuver in a wide variety of soil types and conditions and improves gross gradeability.
- **Routine maintenance** simplified by grouped service points and easy, ample access to service areas.
- **Operator comfort** provided by adjustable bucket seat for all day productivity. All machine controls and instrumentation are within easy sight and reach. Unobstructed visibility increases work area productivity.
- **ROPS (Roll Over Protective Structure) or Non-ROPS canopies and enclosed cabs** available as options to provide all-weather comfort and productivity.
- **Drum scrapers mounted on both the front and rear of drums** keep drum surface clean during forward and reverse movement.



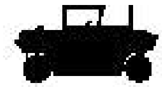
Model	CS-573	
Flywheel Power	108 kW	145 HP
Rated Engine RPM	2200	
No. Cylinders	6	
Displacement	6.6 L	403 in³
Engine Model	3116	
Speeds:		
Forward	2	
Reverse	2	
Max. Speed (For./Rev.)	12.8 kmh	8 mph
Operating Weight	13 700 kg	30,200 lb
Shipping Weight	13 540 kg	29,850 lb
Drive	Drum/rear wheels	
Gradeability	N/A	
Steering:		
Inside radius	3800 mm	12'6"
Outside radius	6170 mm	20'3"
Steering angle	±32°	
Vibratory System:		
Ecc. Weight Drive	Hydraulic	
Frequency	30 Hz	1550 vpm
Amplitude Settings	1	
Dynamic Force (Max.)	22 189 kg	48,830 lb
General Dimensions:		
Overall width	2440 mm	8'0"
Drum width	2130 mm	7'0"
Drum diameter	1520 mm	5'0"
Tires	23.1" x 26" 8-ply	
Overall height	3000 mm	9'10"*
Wheel to drum	2740 mm	9'0"
Overall length	5260 mm	17'3"
Curb clearance	483 mm	19"
Service Refill Capacities:		
Fuel tank	254 L	67 U.S. gal
Crankcase	15.1 L	4 U.S. gal
Hydraulic fluid	132 L	35 U.S. gal

*With cab.

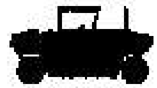
14

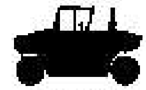
Features:

- **Designed for high density compaction of any hot or cold mix or surface seal applications.**
- **Tire positions overlap to** provide full width compaction in a single pass.
- **Wheel suspension on PS models** eliminates bridging of low spots.
- **Single-lever fingertips control of forward and reverse movement** makes smooth shuttle rolling easy.
- **Heavy-duty 3-speed powershift transmission** allows infinitely variable travel speeds up to 26.5 km/h **(16.5 mph)**, forward or reverse.
- **Hydraulic full-power steering** makes for effortless steering.
- **Ballast compartments are easily accessible for quick loading and are located** to provide a balanced wheel/weight ratio.
- **Electric pump water spray system with cleaner mats on all wheels** keep tires clean and resistant to pick-up during compaction.



MODEL	PF-300	
Flywheel Power	77 kW	103 HP
Rated Engine RPM	2500	
No. Cylinders	6	
Displacement	5.67 L	345 in³
Engine Model	Deutz F6L 912	
Speeds:		
Forward	3	
Reverse	3	
Max. Speed	26.5 km/h	16.5 mph
Wheel Configuration	3 front/4 rear	
Tires	13.80 — 20/E20	
Operating Weight Empty (no ballast)	9000 kg	19,835 lb
Operating Weight Full (max. ballast)	21 000 kg	46,285 lb
Maximum Weight per Wheel	3000 kg	6612 lb
Steering:		
Inside radius	4800 mm	15'9"
Outside radius	7700 mm	25'3"
General Dimensions:		
Overall width	2050 mm	6'9"
Rolling width	1900 mm	6'3"
Overall height	3000 mm	9'10"
Wheelbase	4030 mm	13'3"
Overall length	5700 mm	18'8"
Ground clearance	250 mm	9.8"
Service Refill Capacities:		
Fuel tank	160 L	42 U.S. gal
Crankcase	12 L	3.2 U.S. gal
Sprinkler water	360 L	92 U.S. gal

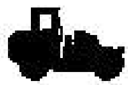


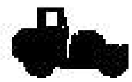


MODEL	**PS-300**		**PS-500**	
Flywheel Power	77 kW	**103 HP**	138 kW	**185 HP**
Rated Engine RPM	**2500**		**2600**	
No. Cylinders	**6**		**8**	
Displacement	5.67 L	**345 in³**	10.4 L	**636 in³**
Engine Model	**Deutz F6L 912**		**3208**	
Speeds				
Forward	**3**		**3**	
Reverse	**3**		**3**	
Max. Speed	26.5 km/h	**16.5 mph**	25 km/h	**15.5 mph**
Wheel Configuration	**3 front/4 rear**		**3 front/4 rear**	
Tires	**13.80 — 20/E20**		**15.00 R 24**	
Operating Weight Empty (no ballast)	14 000 kg	**30,860 lb**	19 000 kg	**41,876 lb**
Operating Weight Full (max. ballast)	21 000 kg	**46,285 lb**	35 000 kg	**77,140 lb**
Maximum Weight per Wheel	3000 kg	**6612 lb**	5000 kg	**11,020 lb**
Steering:				
Inside radius	4800 mm	**15'9"**	5150 mm	**16'11"**
Outside radius	7700 mm	**25'3"**	8550 mm	**28'1"**
General Dimensions:				
Overall width	2050 mm	**6'9"**	2500 mm	**8'2"**
Rolling width	1900 mm	**6'3"**	2420 mm	**7'11"**
Overall height	3000 mm	**9'10"**	3630 mm	**11'11"**
Wheelbase	4030 mm	**13'3"**	4465 mm	**14'8"**
Overall length	5700 mm	**18'8"**	6270 mm	**20'7"**
Ground clearance	250 mm	**9.8"**	360 mm	**14.2"**
Service Refill Capacities:				
Fuel tank	160 L	**42 U.S. gal**	310 L	**82 U.S. gal**
Crankcase	12 L	**3.2 U.S. gal**	12.5 L	**3.3 U.S. gal**
Sprinkler water	350 L	**92 U.S. gal**	350 L	**92 U.S. gal**

Features:

- **Hydrostatic, 3-speed transmissions** allow infinitely variable speeds in both forward and reverse.
- **Routine maintenance simplified by** grouped service points and easy, ample access to service areas.
- **Operator comfort** provided by adjustable bucket seats for all day productivity. All machine controls and instrumentation are within easy sight and reach. Unobstructed visibility increases work area productivity.
- **Open standard canopy or safety cabin are available as options** to provide all-weather comfort and productivity.
- **Large, rust-proof water tanks and pressure spray system** provide hours of reliable operation between fill-ups. Programmer provides preset intermittent or continuous spraying cycles.

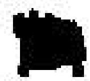
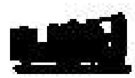
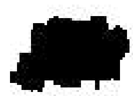
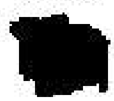




MODEL	CB-525B		CB-523B	
Flywheel Power	58 kW	79 HP	58 kW	79 HP
Rated Engine RPM	2150		2150	
No. Cylinders	5		5	
Displacement	4.7 L	287 in³	4.7 L	287 in³
Engine Model	Deutz F5L 912		Deutz F5L 912	
Speeds:				
Forward	3		3	
Reverse	3		3	
Max. Speed (For./Rev.)	12.4 km/h	7.7 mph	12.4 km/h	7.7 mph
Operating Weight	13 300 kg	29,108 lb	8900 kg	19,625 lb
Shipping Weight	12 900 kg	28,445 lb	8500 kg	18,740 lb
Drive	Drum/rear wheels		Drum/rear wheels	
Steering:				
Inside radius	4570 mm	15'0"	4570 mm	15'0"
Outside radius	6470 mm	21'3"	6470 mm	21'3"
Steering angle	±31°		±31°	
Vibratory System:				
Ecc. Weight Drive	Hydraulic		Hydraulic	
Frequency	32 Hz	1920 vpm	32 Hz	1920 vpm
Amplitude Settings	3		3	
Centrifical Force (Max.)	9800 daN	22,275 lb	9900 daN	22,275 lb
No. of rear wheels	3		2	
Weight per wheel	2833 kg	6246 lb	1900 kg	4490 lb
General Dimensions:				
Overall width	1960 mm	6'5"	1960 mm	6'5"
Drum width	1700 mm	5'7"	1700 mm	5'7"
Drum diameter	1300 mm	4'3"	1300 mm	4'3"
Tires	17/80 R 24		17/80 R 24	
Overall height	3000 mm	9'10"	3000 mm	9'10"
Wheel to drum	3045 mm	10'0"	3045 mm	10'0"
Overall length	5000 mm	16'5"	5000 mm	16'5"
Curb clearance	340 mm	13.4"	340 mm	13.4"
Service Refill Capacities:				
Fuel tank	100 L	26 U.S. gal	100 L	26 U.S. gal
Crankcase	12 L	3.2 U.S. gal	12 L	3.2 U.S. gal
Hydraulic fluid	95 L	25 U.S. gal	95 L	25 U.S. gal
Sprinkler water	500 L	132 U.S. gal	500 L	132 U.S. gal
Emulsion for tires	100 L	26 U.S. gal	100L	26 U.S. gal

ENGINES

CONTENTS

	TYPE	NO. OF MODELS	RANGE
INDUSTRIAL 	Diesel	13	65 to 4920 kW 87 to 6600 HP
	Spark-Ignited	8	40 to 3506 kW 54 to 4700 HP
GENERATOR SETS 	Diesel	19	50 HZ-kV•A w/fan Prime-90 to 4986 Standby-100 to 5440 60 HZ-kW w/fan Prime 113 to 4400 Standby-125 to 4910
	Spark-Ignited	12	50 HZ-kV•A w/o fan Continuous 88 to 3385 60 HZ-kW w/fan Continuous-85 to 3050
MARINE 	Propulsion	13	63 to 5420 kW 85 to 7270 HP
	Generator Sets	13	50 HZ kV•A 69 to 6500 Prime 60 HZ-65 to 4840 Prime
TRUCK 	Diesel	4	129 to 343 kW 170 to 460 HP (EPA certified)

15

DESIGN DATA

Diesel Engines

Bearings — Precision-type steel-backed aluminum alloy with lead-tin overlay copper bonded to bearing surface. High load carrying ability and exceptional fatigue strength.

Block — Cast from high tensile strength grey iron. Internal ribbing provides added strength.

Cooling — Built-in, gear driven centrifugal pump (belt driven for 3116 and 3208) circulates jacket water through engine at all times. Water temperature is thermostatically controlled. Heat exchangers and radiators are available.

Crankshaft — Forged steel, dynamically balanced, heat treated and superfinished.

Cylinder Liners - Internal surface induction hardened (1.7 L, 3300, 3400, 3500 and 3600 Families) for excellent wear life. Full-length watercooled for efficient heat transfer.

Fuel System — Adjustment free for reduced engine maintenance, individual fuel injection pumps have built-in calibration — no adjustment required after fuel nozzle replacement (1.7 L, 3500 and 3600 families have unit injectors).

Governor — Hydra-mechanical (Woodward 3161 on 3500 and 3600 Families) for reliability, good response and smooth, stable load changes.

Lubrication — Positive displacement gear pump maintains continuous flow of lubricant under pressure to all moving parts. Full-flow filtration is provided by replaceable cellulose filters. Water-cooled oil cooler maintains proper oil temperature.

Pistons — Three-ring design (two-ring on 3208) reduces friction, provides excellent oil control, and increases engine efficiency.

Starting — Electric and air starting systems are offered for most models.

Valves — Hardened steel alloy. Valves rotate 3° each time they lift to seat in a new position and allow even heat distribution (except for 3116).

Spark-Ignited Engines

Combustion System — The piston design and compression ratios available provide the ability to utilize a wide variety of gaseous fuels as well as provide low emission output (below 2.0 grams/bhp-hr No_x).

Fuel System — Heavy duty, industrial-type carburetors designed to maintain optimum air-fuel ratio at all loads and speeds.

Ignition System — Caterpillar Spark-Ignited Engines employ a low tension magneto, together with an ignition transformer (one at each cylinder), to provide up to 34kV to spark plugs.

RATING EXPLANATIONS

All engine ratings listed include such standard accessories as air cleaner and fuel, lube, and jacket water pumps. Power required for auxiliaries such as cooling fans, air compressors, charging alternators, special pumps, etc., must be deducted to arrive at the net power available to drive the load (except as noted). Other ratings are available for specific application and customer requirements, i.e., locomotive, oil field, fire pump, irrigation, etc. Consult your Caterpillar Dealer.

Rating Conditions

Performance is based on SAE J1349 standard conditions of 100 kPa (29.61 in Hg) and 25° C (77° F). Performance also applies at ISO 3046/1 (except for Spark Ignited Engines), DIN 6271 and BS 5514 standard conditions of 100 kPa (29.61 in Hg), 27° C (81° F) and 60% relative humidity.

Fuel consumption is based on fuel oil having an LHV of 42 780 kJ/kg (18,390 Btu/lb) and weighing 838.9 g/liter (7.001 lb/U.S. gal). All ratings are based on distillate fuel.

Altitude and Temperature Capabilities

Industrial Diesel Engines — Most intermittent and continuous ratings are applicable to at least 1520 m (5,000 ft) elevation without derating. Consult factory for specific applications.

Spark-Ignited Engines — Ratings for turbocharged and aftercooled engines are generally applicable to 1500 m (5000 ft). Naturally aspirated engines are applicable to 150 m (500 ft).

Diesel Truck Engines — Refer to specification sheets for altitude capability of individual truck engine ratings.

Engine Model	Intermittent kW	Intermittent hp	Intermittent rpm	Continuous kW	Continuous hp	Continuous rpm
3054 NA	65	87	2800	56	76	2400
3304B NA	75	100	2200	63	85	2000
3054 T	83	111	2800	72	96	2400
3056 NA	96	129	2800	85	114	2400
3116 T	97	130	2000	90	120	2000
3306B NA	112	150	2200	93	125	2000
3056 T	118	158	2400	105	140	2400
3304B T	123	165	2200	93	125	2000
3116 T	127	170	2800	105	140	2400
3116 TA	134	180	2000	119	160	2000
3056 TA	135	181	2800	119	160	2400
3208 NA	157	210	2800	112	150	2400
3116 TA	172	230	2800	142	190	2400
3306B T	187	250	2200	142	190	2000
3208 T	194	260	2800	156	210	2400
3406B TA	199	267	1300	199	267	1300
3306B TA	224	300	2200	194	260	2000
3406B T	242	325	2100	186	249	1800
3406B TA	261	350	1200	238	319	1200
3406B TA	300	402	2100	240	322	1800
3408B T	317	425	2100	186	249	1800
3408B TA	375	503	2100	300	402	1800
3412 TA	399	535	1200	317	425	1200
3412 T	485	650	2100	336	450	1800
3412 TA	560	750	2100	465	624	1800
3508 TA	612	820	1300	507	680	1200
3508 TA	746	1000	1800	638	855	1800
3512 TA	858	1150	1300	781	1020	1200
3512 TA	1119	1500	1800	955	1280	1800
3516 TA	1242	1665	1300	1011	1355	1200
3606 TA	—	—	—	1490	1998	750
3516 TA	1492	2000	1800	1275	1710	1800
3606 TA	—	—	—	1560	2090	800
3606 TA	—	—	—	1730	2320	900
3606 TA	—	—		1850	2481	1000
3608 TA	—	—	—	1980	2655	750
3608 TA	—	—		2080	2789	800
3608 TA	—	—	—	2300	3084	900
3608 TA	—	—		2460	3299	1000
3612 TA	—	—	—	3120	4180	750
3612 TA	—	—	—	3460	4640	900
3616 TA	—	—	—	3700	4962	1000
3616 TA	—	—	—	3960	5310	750
3616 TA	—	—	—	4160	5579	800
3616 TA	—	—	—	4600	6169	900
3616 TA	—	—	—	4920	6598	1000

NA Naturally Aspirated
T Turbocharged
TA — Turbocharged Aftercooled
PC — Precombustion Chamber

Rating Definitions:

Intermittent is the horsepower and speed capability of the engine which can be utilized for about one hour, followed by an hour of operation at or below the continuous rating.

Continuous is the horsepower and speed capability of the engine which can be used without interruption or load cycling.

NOTE: The ratings listed are for a standard engine equipped without fan, but with fuel, lubricating oil and jacket water pump.

15

Engine Model	Compression Ratio	1800 rpm		1600 rpm		1500 rpm		1400 rpm		1200 rpm		1000 rpm	
		BKW	BHP	BKW	BHP	BKW	BHP	BKW	BHP	BKW	BHP	BKW	BHP
3304 NA	L	62	85	54	75	—	—	47	65	—	—		—
3304 NA	H	71	95	65	85	—	—	57	75	—	—		
3306 NA	L	93	125	02	110	—	—	71	95		—		—
3306 NA	H	108	145	97	130	—	—	85	115			—	—
3306 TA[1]	L	145	195	130	175	—	—	113	150		—	—	—
3306 TA[2]	H	164	220	146	195	—	—	128	170	—	—	—	—
3406 TA[1]	L	—	—	—	—		—	187	250	160	215	134	180
3406 TA[2]	L	—	—	—	—		—	209	280	183	245	153	205
3406 TA[1]	L	242	325	216	290	201	270	—	—	—	—	—	—
3406 TA[2]	L	272	365	242	325	228	305	—	—	—	—	—	—
3406 NA	H		—	—	—	—	—	131	175	112	150	93	125
3406 TA[1]	H	—	—	—	—	—	—	187	250	160	215	134	180
3406 TA[2]	H	—	—	—	—	—	—	209	280	183	245	153	205
3406 NA	H	160	215	149	200	138	185	—	—	—	—		—
3406 TA[1]	H	227	305	216	290	201	270	—	—		—	—	—
3406 TA[2]	H	257	345	242	325	228	305	—	—			—	—
3408 TA[1]	L	—	—	—	—	—	—	223	300	193	260	160	215
3408 TA[2]	L	—	—	—	—	—	—	248	330	212	285	175	235
3408 NA	H	—	—	—	—		—	157	210	131	175	108	145
3408 TA[1]	H	—	—	—	—			231	310	198	265	160	225
3408 TA[2]	H	—	—		—		—	261	350	224	300	187	250
3408 NA	H	190	255	175	235	168	225	—	—	—	—	—	—
3408 TA[1]	H	298	400	265	355	250	335	—	—	—	—	—	—
3408 TA[2]	H	336	460	298	400	280	375	—	—	—	—	—	—
3412 TA[1]	L	—	—	—	—	—	—	335	450	287	385	238	320
3412 TA[2]	L	—	—	—	—	—	—	369	495	317	425	261	350
3412 TA[1]	L	447	600	399	535	373	500	—	—	—	—		
3412 TA[2]	L	503	675	447	600	424	565	—	—		—		—
3412 NA	H	—	—	—	—	—	—	235	315	206	275	175	235
3412 TA[1]	H	—	—	—	—	—	—	347	465	298	400	250	335
3412 TA[2]	H	—	—	—	—	—	—	397	525	336	450	280	375
3412 NA	H	272	365	254	340	242	325	—	—	—	—	—	—
3412 TA[1]	H	448	600	399	535	373	500	—	—	—	—	—	—
3412 TA[2]	H	504	675	448	600	421	565	—	—	—	—	—	—

NA — Naturally Aspirated
TA — Turbocharged-Aftercooled

[1] 54°C/130°F or lower temperature water to the aftercooler
[2] 32°C/90°F or lower temperature water to the aftercooler

Rating Definition:

Continuous: Output available without varying load for an unlimited time. Continuous power in accordance with ISO8528, ISO3046/1, AS2789, DIN6271, and BS5514.

Engine Model	Compression Ratio	1200 rpm BKW	1200 rpm BHP	1100 rpm BKW	1100 rpm BHP	1000 rpm BKW	1000 rpm BHP	900 rpm BKW	900 rpm BHP
3508 NA	L	231	**310**	213	**285**	194	**260**		
3508 TA[1]	L	391	**525**	361	**485**	328	**440**		
3508 TA[2]	L	408	**545**	373	**500**	335	**450**		
3512 NA	L	391	**525**	361	**485**	328	**440**		
3512 TA[1]	L	589	**790**	540	**725**	492	**660**		
3512 TA[2]	L	607	**815**	555	**745**	504	**675**		
3512 TA[1,3]	H	604	**810**	555	**745**	504	**675**		
3512 TA[2,3]	H	641	**860**	589	**790**	537	**720**		
3516 NA	L	492	**660**	466	**625**	436	**585**		
3516 TA[1]	L	783	**1050**	719	**965**	652	**875**		
3516 TA[2]	L	809	**1085**	742	**995**	675	**905**		
3516 TA[1,3]	H	809	**1085**	742	**995**	671	**900**		
3516 TA[2,3]	H	858	**1150**	783	**1050**	712	**955**		
3606[2,3]						1317	**1765**	1186	**1590**
3606[1,3]						1242	**1665**	1119	**1500**
3608[2,3]						1753	**2350**	1582	**2120**
3608[1,3]						1660	**2225**	1492	**2000**
3612[2,3]						2633	**3530**	2372	**3180**
3612[1,3]						2488	**3335**	2238	**3000**
3616[2,3]						3506	**4700**	3163	**4240**
3616[1,3]						3320	**4450**	2984	**4000**

NA — Naturally Aspirated
TA — Turbocharged-Aftercooled

[1] 54°C/130°F or lower temperature water to the aftercooler.
[2] 32°C/90°F or lower temperature water to the aftercooler.
[3] Low emission engine.

Rating Definition:

Continuous: Output available without varying load for an unlimited time. Continuous power in accordance with ISO8528, ISO3046/1, AS2789, DIN6271, and BS5514.

15

50 Hz Prime Set Engine W/Fan EkW	50 Hz Prime Set Engine W/O Fan Brake HP	50 Hz Standby Set Engine W/Fan EkW	50 Hz Standby Set Engine W/O Fan Brake HP	Generator Frame Size	Motor Starting kv•A for 30% Dip Prime	Motor Starting kv•A for 30% Dip Standby	RPM	Model	Cylinders & Aspiration		Displacement L	Displacement in³	Engine Generator & Radiator Prime Dry Weight kg	Engine Generator & Radiator Prime Dry Weight lb	Engine Generator & Radiator Standby Dry Weight kg	Engine Generator & Radiator Standby Dry Weight lb
90	139	100	154	368	207	287	1500	3304	I-4	T	7.0	425	1680	3700	1680	3700
120	185	—	—	445	371	—	1500	3208	V-8	T	10.4	636	1737	3830	—	—
—	—	140	217	443	—	290	1500	3208	V-8	T	10.4	636	—	—	1689	3725
—	—	160	240	444	—	334	1500	3208	V-8	ATAAC	10.4	636		—	1780	3925
180	272	200	298	447	464	471	1500	3306	I-6	TA	10.5	638	2370	5230	2345	5170
195	296	220	316	447	506	514	1500	3306	I-6	ATAAC	10.6	638	2505	5530	2485	5480
220	327	—	—	448	630	—	1500	3406	I-6	T	14.6	893	3091	6815	2803	6180
256	381	280	417	449	655	665	1500	3406	I-6	TA	14.6	893	3175	7000	2900	6390
292	428	320	464	460	727	711	1500	3406	I-6	TA	14.6	893	3256	7180	2939	6480
364	644	400	598	586	955	955	1500	3412	V-12	T	27.0	1649	4220	9300	4220	9300
400	686	440	646	588	1337	1337	1500	3412	V-12	TT	27.0	1649	4490	9900	4490	9900
472	703	520	775	589	1337	1337	1500	3412	V-12	TTA	27.0	1649	4535	10,000	4535	10,000
508	760	560	839	589	1337	1337	1500	3508	V-8	TA	34.5	2105	7535	16,620	7535	16,620
560	854	620	928	681	1261	1261	1500	3508	V-8	TA	34.5	2105	7900	17,420	7900	17,420
580	878	640	968	681	1261	1261	1500	3508	V-8	TA	34.5	2105	7990	17,620	8175	18,020
—	—	720	1049	685	1759	1759	1500	3508	V-8	TA	34.5	2105	—	—	8400	18,520
728	1078	800	1167	685	1759	1759	1500	3508	V-8	TA	34.5	2105	8400	18,520	8400	18,520
800	1159	880	1286	687	2674	2674	1500	3512	V-12	TA	51.8	3158	10 670	23,530	10 670	23,530
920	1328	1000	1444	689	2907	2907	1500	3512	V-12	TA	51.8	3158	10 670	23,530	10 670	23,530
1020	1462	1120	1601	805	2388	2388	1500	3512	V-12	TA	51.8	3158	11 125	24,525	11 125	24,525
1096	1558	1200	1715	806	3039	3039	1500	3516	V-16	TA	68.0	4210	12 850	28,330	12 850	28,330
1200	1749	1280	1830	807	3715	3715	1500	3516	V-16	TA	69.0	4210	13 205	29,120	12 630	27,855
1280	1864	1400	1997	807	3715	3715	1500	3516	V-16	TA	69.0	4210	13 205	29,120	13 205	29,120
1460	2095	1600	2300	808	4077	4077	1500	3516	V-16	TA	69.0	4210	14 660	32,320	14 660	32,320
—	—	1800	2573	809	—	5666	1500	3516	V-16	TA	69.0	4210	—	—	14 740	32,500

T — Turbocharged
TT — Dual Turbocharged
TA — Turbocharged-Aftercooled
ATAAC — Air to Air Aftercooled

Rating Definitions:

Standby: Output available with varying load for the duration of the interruption of the normal source power.*

Prime: Output available with varying load for an unlimited time.**

*Fuel stop power in accordance with ISO3046/1, AS2789, DIN6271, and BS5514.

**Prime power in accordance with ISO8528, overload power in accordance with ISO3046/1, AS2789, DIN6271, and BS5514.

50 Hz Prime Set Engine W/Fan EkW	50 Hz Prime Set Engine W/O Fan Brake HP	50 Hz Standby Set Engine W/Fan EkW	50 Hz Standby Set Engine W/O Fan Brake HP	Generator Frame Size	Motor Starting kV•A for 30% Dip Prime	Motor Starting kV•A for 30% Dip Standby	RPM	Model	Cylinders & Aspiration		Displacement L	Displacement in³	Engine Generator & Radiator Prime Dry Weight kg	Engine Generator & Radiator Prime Dry Weight lb	Engine Generator & Radiator Standby Dry Weight kg	Engine Generator & Radiator Standby Dry Weight lb
150	227			583	429	--	1000	3406	I-6	TA	14.6	893	3355	7400	—	—
205	308	—	--	586	484		1000	3408	V-8	TA	18.0	1099	4155	9160	-	—
280	417	—	—	587	643	—	1000	3412	V-12	TA	27.0	1649	4700	10,360		—
400	595	420	628	683	696	696	1000	3508	V-8	TA	34.5	2105	7825	17,250	7825	17,250
600	861	650	966	687	1238	1238	1000	3512	V-12	TA	51.8	3158	10 160	22,400	10 160	22,400
685	1004	760	1129	806	1337	1337	1000	3512	V-12	TA	51.8	3158	11 305	24,930	11 305	24,930
935	1379	1040	1522	809	2371	2371	1000	3516	V-16	TA	69.0	4210	13 575	29,930	13 575	29,930
W/O Fan BkW	**Brake HP**	**W/O Fan BkW**	**Brake HP**													
1510*	2025	1680*	2253	—	—	—	750	3606	I-6	TA	111.0	6756	32 700	71,940	32 700	71,940
1845*	2474	2045*	2769	—	—	—	1000	3606	I-6	TA	111.0	6756	32 700	71,940	32 700	71,940
1990*	2669	2200*	2950	—	—	—	750	3608	I-8	TA	148.0	9008	38 182	84,000	38 182	84,000
2485*	3332	2720*	3640	—	—	—	1000	3608	I-8	TA	148.0	9008	38 182	84,000	38 182	84,000
3020*	4050	3360*	4506	—	—	—	750	3612	V-12	TA	222.0	13,512	49 896	110,000	49 896	110,000
3690*	4948	4060*	5444	—	—	—	1000	3612	V-12	TA	222.0	13,512	49 896	110,000	49 896	110,000
3980*	5337	4400*	5900	—	—	—	750	3616	V-16	TA	296.0	18,016	59 968	130,000	59 968	130,000
4965*	6658	5440*	7295	—	—	—	1000	3616	V-16	TA	296.0	18,016	59 968	130,000	59 968	130,000

*3600 Ratings shown are engine flywheel kW without fan. Customer supplies generator.

TA — Turbocharged-Aftercooled

Rating Definitions:

Standby: Output available with varying load for the duration of the interruption of the normal source power.*

Prime: Output available with varying load for an unlimited time.**

*Fuel stop power in accordance with ISO3046/1, AS2789, DIN6271, and BS5514.

**Prime power in accordance with ISO8528, overload power in accordance with ISO3046/1, AS2789, DIN6271, and BS5514.

15

60 Hz Prime Set Engine W/Fan EkW	60 Hz Prime Set Engine W/O Fan Brake HP	60 Hz Standby Set Engine W/Fan EkW	60 Hz Standby Set Engine W/O Fan Brake HP	Generator Frame Size	Motor Starting kv•A for 30% Dip Prime	Motor Starting kv•A for 30% Dip Standby	RPM	Model	Cylinders & Aspiration		Displacement L	Displacement in³	Engine Generator & Radiator Prime Dry Weight kg	Engine Generator & Radiator Prime Dry Weight lb	Engine Generator & Radiator Standby Dry Weight kg	Engine Generator & Radiator Standby Dry Weight lb
113	174	125	192	368	343	343	1800	3304	I-4	T	7.0	425	1680	3700	1680	3700
160	241	—	—	445	476	—	1800	3208	V-8	T	10.4	636	1737	3830	—	—
—	—	175	263	443		372	1800	3208	V-8	ATAAC	10.4	636	—	—	1689	3725
—	—	200	299	444		429	1800	3208	V-8	ATAAC	10.4	636	—	—	1780	3925
205	307			446	671	—	1800	3306	I-6	TA	10.5	638	2277	5020	—	—
225	339		—	447	649	—	1800	3306	I-6	ATAAC	10.5	638	2505	5530	—	—
—	—	250	377	446	—	649	1800	3306	I-6	ATAAC	10.5	638	—	—	2440	5380
225	339	250	377	446	621	604	1800	3306	I-6	ATAAC	10.5	638	2505	5530	2440	5380
275	405	300	443	448	809	809	1800	3406	I-6	TA	14.6	893	3090	6815	2850	6280
320	475	350	519	449	840	840	1800	3406	I-6	TA	14.6	893	3205	7070	2895	6380
365	536	400	587	450	932	912	1800	3406	I-6	TA	14.6	893	3266	7180	2939	6480
455	665	500	742	588	1224	1224	1800	3412	V-12	T	27.0	1649	4220	9300	4220	9300
545	813	600	894	589	1714	1714	1800	3412	V-12	TTA	27.0	1648	4535	10,000	4535	10,000
650	963	700	1025	589	1714	1714	1800	3508	V-8	TA	34.5	2105	7855	17,320	7790	17,170
680	1014	750	1098	681	1617	1617	1800	3508	V-8	TA	34.5	2105	8210	18,100	8210	18,100
725	1094	800	1177	681	1617	1617	1800	3508	V-8	TA	34.5	2105	8210	18,100	8210	18,100
870	1226	900	1344	686	2256	2256	1800	3508	V-8	TA	34.5	2105	8490	18,720	8490	18,720
910	1325	1000	1466	685	2256	2256	1800	3512	V-12	TA	51.8	3158	10 215	22,520	10 215	22,520
1000	1447	1100	1592	687	3429	3429	1800	3512	V-12	TA	51.8	3158	10 700	23,600	10 700	23,600
1135	1662	1250	1801	689	3727	3727	1800	3512	V-12	TA	51.8	3158	10 820	23,850	10 820	23,850
1275	1830	1400	2036	805	3061	3061	1800	3516	V-16	TA	69.0	4210	12 750	28,120	12 480	27,525
1360	1969	1500	2167	806	3896	3896	1800	3516	V-16	TA	69.0	4210	13 600	29,985	12 850	28,330
1600	2304	1750	2518	807	4762	4762	1800	3516	V-16	TA	69.0	4210	13 800	30,420	13 205	29,120
—	—	2000	2947	808	—	5226	1800	3516	V-16	TA	69.0	4210	—	—	14 650	32,320

T — Turbocharged
TT — Dual Turbocharged
TA — Turbocharged-Aftercooled
ATAAC — Air-to-Air Aftercooled

Rating Definitions:

Standby: Output available with varying load for the duration of the interruption of the normal source power.*

Prime: Output available with varying load for an unlimited time.**

*Fuel stop power in accordance with ISO3046/1, AS2789, DIN6271, and BS5514.

**Prime power in accordance with ISO8528, overload power in accordance with ISO3046/1, AS2789, DIN6271, and BS5514.

60 Hz Prime Set Engine W/Fan EkW	60 Hz Prime Set Engine W/O Fan Brake HP	60 Hz Standby Set Engine W/Fan EkW	60 Hz Standby Set Engine W/O Fan Brake HP	Generator Frame Size	Motor Starting kv•A for 30% Dip Prime	Motor Starting kv•A for 30% Dip Standby	RPM	Model	Cylinders & Aspiration		Displacement L	Displacement in³	Engine Generator & Radiator Prime Dry Weight kg	Prime Dry Weight lb	Standby Dry Weight kg	Standby Dry Weight lb
170	255	—	—	583	549	—	1200	3406	I-6	TA	14.6	893	3355	7400	—	—
225	338	—	—	585	621	—	1200	3408	V-8	TA	18.0	1099	4155	9160	—	—
325	483	—	—	587	824	—	1200	3412	V-12	TA	27.0	1649	4700	10,360	—	—
425	628	465	687	683	893	893	1200	3508	V-8	TA	34.5	2105	7825	17,250	7825	17,250
550	803	615	905	686	1071	1071	1200	3508	V-8	TA	34.5	2105	7825	17,250	7825	17,250
660	951	700	1026	687	1587	1587	1200	3512	V-12	TA	51.8	3158	10 160	22,400	10 160	22,400
830	1220	925	1344	806	1714	1714	1200	3512	V-12	TA	51.8	3158	11 305	24,930	11 305	24,930
900	1322	975	1430	806	1714	1714	1200	3516	V-16	TA	69.0	4210	13 575	29,930	13 575	29,930
1100	1615	1250	1790	809	3040	3040	1200	3516	V-16	TA	69.0	4210	13 575	29,930	13 575	29,930
W/O Fan BkW	**W/O Fan Brake HP**	**W/O Fan BkW**	**W/O Fan Brake HP**													
1375*	1944	1525*	2146	—	—	—	720	3606	I-6	TA	111.0	6756	32 700	71,940	32 700	71,940
1650*	2320	1830*	2581	—	—	—	900	3606	I-6	TA	111.0	6756	32 700	71,940	32 700	71,940
1825*	2575	2025*	2843	—	—	—	720	3608	I-8	TA	148.0	9008	38 182	84,000	38 182	84,000
2200*	3084	2440*	3406				900	3608	I-8	TA	148.0	9008	38 182	84,000	38 182	84,000
2750*	3889	3060*	4291	—	—		720	3612	V-12	TA	222.0	13,612	49 896	110,000	49 896	110,000
3300*	4626	3660*	5109	—	—	—	900	3612	V-12	TA	222.0	13,612	49 896	110,000	49 896	110,000
3690*	5149	4075*	5086	—	—	—	720	3616	V-16	TA	296.0	18,016	58 968	130,000	58 968	130,000
4400*	6169	4910*	6006	—	—	—	900	3616	V-16	TA	296.0	18,016	58 968	130,000	58 968	130,000

**Continuous 50 Hz 1500 RPM Set Engine W/Fan kW	50 Hz 1500 RPM W/O Fan Brake HP	60 Hz 1800 RPM Set Engine W/Fan kW	60 Hz 1800 RPM W/O Fan Brake HP	Generator Frame Size 50 Hz	Generator Frame Size 60 Hz	Motor Starting kv•A for 30% Dip 50 Hz	Motor Starting kv•A for 30% Dip 60 Hz	Model	Cylinders & Aspiration		Displacement L	Displacement in³	Engine Generator & Radiator 50 Hz Dry Weight kg	50 Hz Dry Weight lb	60 Hz Dry Weight kg	60 Hz Dry Weight lb
500	775	570	845	589	589	1337	1714	3508	V-8	TA	34.5	2105	7540	16,620	7755	17,100
540	825	585	884	681	589	1261	1714	3508	V-8	TA	34.5	2105	7900	17,470	7755	17,100
650	958	660	868	686	681	1769	1617	3508	V-8	TA	34.5	2105	8400	18,520	8396	18,505
800	1155	890	1281	687	685	2674	2258	3512	V-12	TA	51.8	3158	10 710	23,620	10 360	22,820
965	1381	1010	1475	805	687	2386	3429	3512	V-12	TA	51.8	3158	11 125	24,525	10 715	23,620
1080	1545	1195	1723	805	805	2386	3061	3516	V-16	TA	69.0	4210	12 165	26,820	12 165	26,820
1280	1864	1450	2079	807	807	3714	4762	3516	V-16	TA	69.0	4210	13 205	29,120	13 795	30,420

*3600 Ratings shown are engine flywheel kW without fan. Customer supplies generator.
****Continuous:** Output available without varying load for an unlimited time.
TA — Turbocharged-Aftercooled

Rating Definitions:

Standby: Output available with varying load for the duration of the interruption of the normal source power.
Prime: Output available with varying load for an unlimited time.

Fuel stop power in accordance with ISO3046/1, AS2789, DIN6271, and BS5514.
Prime power in accordance with ISO8528, overload power in accordance with ISO3046/1, AS2789, DIN6271, and BS5514.
Continuous power in accordance with ISO8528, ISO3046/1, AS2789, DIN6271, and BS5514.

15

Gas Generator Set Ratings

Gen Set Model	1500 rpm	1800 rpm	Compression Ratio
	Without Fan		
	50 Hz ekW	60 Hz ekW	
G3304 NA	45	55	L
G3304 NA	55	65	H
G3306 NA	70	85	L
G3306 NA	85	100	H
G3306 TA[2]	125	150	H
G3406 NA	125	150	H
G3406 TA[1]	185	210	H
G3406 TA[2]	210	240	H
G3406 TA[3]	185	—	L
G3406 TA[1]	195	225	L
G3406 TA[2]	210	250	L
G3408 NA	150	175	H
G3408 TA[1]	225	270	H
G3408 TA[2]	255	310	H
G3408 TA[3]	225	—	L
G3408 TA[1]	240	270	L
G3408 TA[2]	265	310	L
G3412 NA	220	250	H
G3412 TA[1]	345	420	H
G3412 TA[2]	390	475	H
G3412 TA[3]	345		L
G3412 TA[1]	370	420	L
G3412 TA[2]	390	475	L
G3508 NA[4]	240	—	L
G3508 TA[3,4]	450	—	H
G3508 TA[1,4]	475		H
G3508 TA[2,4]	505	—	H
G3512 NA[4]	435	—	L
G3512 TA[3,4]	675	—	H
G3512 TA[1,4]	720		H
G3512 TA[2,4]	760	—	H
G3516 NA[4]	555	—	L
G3516 TA[3,4]	910	—	H
G3516 TA[1,4]	965		H
G3516 TA[2,4]	1020	—	H

Gen Set Model	1000 rpm	1200 rpm	Compression Ratio
	Without Fan		
	50 Hz ekW	60 Hz ekW	
G3508 NA	170	210	L
G3508 TA[1]		365	L
G3508 TA[2]	—	375	L
G3508 TA[1,4]	—	375	H
G3508 TA[2,4]	—	395	H
G3512 NA	300	365	L
G3512 TA[3]	430	—	L
G3512 TA[1]	460	555	L
G3512 TA[2]	475	570	L
G3512 TA[3,4]	445	—	H
G3512 TA[1,4]	475	570	H
G3512 TA[2,4]	500	600	H
G3516 NA	395	465	L
G3516 TA[3]	580	—	L
G3516 TA[1]	620	750	L
G3516 TA[2]	635	770	L
G3516 TA[3,4]	600	—	H
G3516 TA[1,4]	635	770	H
G3516 TA[2,4]	675	820	H

Gen Set Engine Only	1000 rpm	900 rpm	Compression Ratio
	Without Fan		
	60 Hz ekW	60 Hz ekW	
G3606 TA[3,4]	1120	—	L
G3606 TA[1,4]	1190	1070	L
G3606 TA[2,4]	1200	1135	L
G3608 TA[3,4]	1495		L
G3608 TA[1,4]	1590	1430	L
G3608 TA[2,4]	1680	1515	L
G3612 TA[3,4]	2255	—	L
G3612 TA[1,4]	2400	2160	L
G3612 TA[2,4]	2540	2290	L
G3616 TA[3,4]	3000	—	L
G3616 TA[1,4]	3195	2880	L
G3616 TA[2,4]	3385	3050	L

NA — Naturally Aspirated
TA — Turbocharged-Aftercooled
H — High compression ratio
L — Low compression ratio
ekW — Generator output

[1] 54°C/130°F or lower water temperature to the aftercooler.
[2] 32°C/90°F or lower water temperature to the aftercooler.
[3] 70°C/160°F or lower water temperature to the aftercooler.
[4] Low emission

Rating Definitions:

Continuous: Output available without varying load for an unlimited time. Continuous power in accordance with ISO8528, ISO3046/1, AS2789, DIN6271, and BS5514

MOTOR STARTING — ESTIMATED

If SKV•A loading of motor is unknown, use six times the motor horsepower as an estimate.

If reduced voltage starting is used, use the following.

Type	Multiply SKVA By
Resistor, Reactor, Impedance	
80% Tap	0.80
65% Tap	0.65
50% Tap	0.50
45% Tap	0.45
Autotransformer	
80% Tap	0.68
65% Tap	0.46
50% Tap	0.29
Y Start, Run	0.33

Solid state: adjustable, usually 300% of full load KVA.

For more complete multi-motor analysis use the Cat Electric Power Generation Designer computer program. Contact Caterpillar Engine Division.

Engine Model	A			B			C			D			E		
	bkW	bhp	rpm	bkW	bhp	rpm	bkW	bhp	rpm	bkW	bhp	rpm	bkW	bhp	rpm
3304B NA	63	**85**	2000	—	—	—	75	**100**	2200	—	—			—	—
3304B T	93	**125**	2000	104	**140**	2000	123	**165**	2200	134	**180**	2200	142	**190**	2200
3208 NA	112	**150**	2400	134	**180**	2400	157	**210**	2800	157	**210**	2800	157	**210**	2800
3306B T	142	**190**	2000	164	**220**	2000	186	**250**	2200	—	—	—	209	**280**	2200
3116 TA	153	**205**	2400	153	**205**	2400	172	**230**	2600	187	**250**	2600	224	**300**	2800
3208 T	160	**215**	2400	190	**255**	2400	216	**290**	2800	224	**300**	2800	239	**320**	2800
3306B TA	160	**215**	2000	175	**235**	2000	201	**270**	2200	235	**315**	2200	261	**350**	2200
3306B SCAC	175	**235**	2000	186	**250**	2000	209	**280**	2200	250	**335**	2200	265	**355**	2200
3208 TA	175	**235**	2400	205	**275**	2400	235	**315**	2800	254	**340**	2800	317	**425**	2800
3406B T	186	**250**	1800	224	**300**	1800	260	**348**	2100	—	—		300	**402**	2100
3406B TA	205	**275**	1200	231	**310**	1350	—	—	—	—	—	—	—	—	—
3406B TA	240	**322**	1800	272	**365**	1800	300	**402**	2100	366	**490**	2100	402	**540**	2100
3406 TA	—	—	—	283	**380**	1800	—	—		—	—	—	—	—	—
3408 TA	261	**350**	1250	—	—	—	—	—	—		—		597	**800**	2300
3408B TA	280	**375**	1300	294	**394**	1350	—	—	—	—	—	—	—	—	
3408B TA	300	**402**	1800	350	**470**	1800	380	**510**	2100	399	**535**	2100	436	**585**	2100
3412 TA	317	**425**	1200	354	**475**	1200			—	—	—	—	—	—	—
3412 T	375	**503**	1800	403	**540**	1800	403	**540**	1800	—	—		403	**540**	1800
3508 TA	447	**600**	1200	—	—	—	—	—	—	—	—	—	—	—	
3508 TA	578	**775**	1800	—	—	—	634	**850**	1800	—	—	—	—	—	—
3412 TA	465	**624**	1800	500	**671**	1800	670	**784**	2100	619	**830**	2100	641	**860**	2100
3508 TA	526	**705**	1200	600	**805**	1300	611	**820**	1300		—	—	—	—	—
3412 TA	—	—	—	—	—	—	—	—	—	—	—		895	**1200**	2300
3508 TA	638	**855**	1600	675	**905**	1600	701	**940**	1600	—	—	—	—	—	—
3508 TA	638	**855**	1800	716	**960**	1800	746	**1000**	1800	858	**1150**	1800	—	—	—
3512 TA	671	**900**	1200	—	—			—	—	—	—	—	—	—	—
3512 TA	790	**1060**	1200	902	**1210**	1300	932	**1250**	1300		—		—	—	—
3512 TA	876	**1175**	1000	—	—	—	—	—	—	—	—	—	—	—	
3512 TA	876	**1175**	1800		—	—	969	**1300**	1800	—	—	—	—	—	—
3516 TA	895	**1200**	1200	—	—	—			—	—	—	—	—	—	—
3512 TA	954	**1280**	1600	1014	**1360**	1600	1051	**1410**	1600		—	—	—	—	—
3512 TA	954	**1280**	1800	1078	**1445**	1800	1119	**1500**	1800	1305	**1750**	1800		—	
3516 TA	1051	**1410**	1200	1200	**1610**	1300	1242	**1665**	1300	—	—	—	—	—	—
3516 TA	1156	**1550**	1800		—		—	—	—	—	—	—	—	—	—
3516 TA	1156	**1550**	1800	—	—	—	1268	**1700**	1800		—	—	—	—	—
3516 TA	1275	**1710**	1600	1350	**1810**	1600	1398	**1875**	1600	—	—			—	—
3516 TA	1275	**1710**	1800	1432	**1920**	1800	1491	**2000**	1800	1641	**2200**	1800	—	—	

NA — Naturally Aspirated
T — Turbocharged
TA — Turbocharged-Aftercooled

SCAC — Separate Circuit Aftercooled
bhp — brake horsepower
bkW — metric equivalent of brake horsepower

(Continued on next page)

Rating Definitions:

A: For use with little load cycling in oceangoing displacement hulls such as freighters, tugboats and bottom-drag trawlers, and deep river towboats.

B: For use in midwater trawlers, purse seiners, crew and supply boats, ferry boats with trips longer than one hour, and towboats in rivers where locks, sandbars, curves or traffic dictate frequent slowing.

C: For use in yachts with displacement hulls, as well as ferries with trips less than one hour, fish boats with higher speed journey out and back (e.g., some lobster, crayfish and tuna), and short trip coastal freighters.

D: For use in patrol, customs, police, and some fire boats.

E: For use in pleasure craft with planing hulls, as well as for patrol, pilot and harbor master boats.

Engine Model	Continuous Service			Maximum Continuous		
	bkW	bhp	rpm	bkW	bhp	rpm
3606 TA	1490	**2000**	750	1640	**2200**	750
3606 TA	1560	**2080**	800	1720	**2310**	800
3606 TA	1730	**2320**	800	1900	**2550**	900
3606 TA	1850	**2480**	1000	2030	**2720**	1000
3608 TA	1980	**2660**	750	2180	**2920**	750
3608 TA	2080	**2790**	800	2290	**3070**	800
3608 TA	2300	**3080**	900	2530	**3390**	900
3608 TA	2460	**3300**	1000	2710	**3630**	1000
3612 TA	2980	**4000**	750	3280	**4400**	760
3612 TA	3120	**4180**	800	3440	**4610**	800
3612 TA	3460	**4640**	900	3800	**5100**	900
3612 TA	3700	**4960**	1000	4060	**5440**	1000
3616 TA	3960	**5310**	750	4360	**5850**	750
3616 TA	4160	**5580**	800	4580	**6140**	800
3616 TA	4600	**6170**	900	5060	**6790**	900
3616 TA	4920	**6600**	1000	5420	**7270**	1000

TA — Turbocharged-Aftercooled

Maximum Continuous Rating is generally used for vessel applications involving varying loads. The engine power actually produced is limited by application guidelines, leaving a power reserve for unusual operating conditions.

Continuous Service Rating is suitable for continuous duty applications, including dredges, for operation without interruption or load cycling.

Engine Model	50 Hertz 1500 rpm kV•A	50 Hertz 1000 rpm kV•A	50 Hertz 750 rpm kV•A	60 Hertz* 1800 rpm kW	60 Hertz* 1200 rpm kW	60 Hertz* 900 rpm kW	60 Hertz* 720 rpm kW
3304B NA	63	—	—	65	—	—	—
3304B T	106	—	—	105	—	—	—
3306B T	156	—	—	165	—	—	—
3306B TA	—	—	—	180	—	—	—
3306B T	181	-	—	—	—	—	—
3406B T	200			210	190		
3406B T	250	—	—	260	-	—	.
3406B TA	288	188	—	280	—	—	—
3408B TA	350	238	—	350	245	—	—
3412 T	430	—	—	—	—	—	—
3412 T	500	—	—	—	—	—	—
3412 TA	—	—	—	435	310	—	—
3412 TA	—	—	—	500	450	—	—
3508 TA	631	500	—	560	—	—	—
3508 TA	788	519	—	715	560	—	—
3512 TA	950	725	—	850	700	—	—
3512 TA	1208	888	—	1070	845	—	—
3516 TA	1281	968		1135	925		-
3516 TA	1606	1150		1440	1080		
3606 TA**	—	2425	1960	—	—	1820	1525
3608 TA**	—	3230	2600	—	—	2420	2020
3612 TA**	—	4850	3920	—	—	3640	3050
3616 TA**	—	6500	5200	—	—	4840	4040

*@ .8 power factor
**Cat does not manufacture a generator for these engine models. KW and KV•A are assumed using generators ranging in efficiency from 95.4 to 97.9
NA — Naturally Aspirated
T — Turbocharged
TA — Turbocharged-Aftercooled

Rating Definition:

For continuous electrical service with 10% overload capability for one hour in 12 in accordance with ISO 3046/1, DIN 6271, BS 5514.

Engine Model	Rating kW/HP kW	HP	@ RPM	Peak Torque N•m	lb-ft	@ RPM	Torque Rise (%)	Weight kg	lb	Certification 50-State* Mechanical
3116										
ATAAC	123	**170**	2600	569	**420**	1560	22%	544	**1198**	X
ATAAC	138	**185**	2800	671	**495**	1560	32%	544	**1198**	X
ATAAC	138	**185**	2800	705	**520**	1560	39%	544	**1198**	X
ATAAC	160	**215**	2600	820	**605**	1560	39%	544	**1198**	X
ATAAC	187	**250**	2600	881	**650**	1500	29%	544	**1198**	X

*Certification rating for EPA and CARB approved for use in all 50 states and Canada.
ATAAC — Air-to-Air Aftercooled

15

Engines

Truck Diesel
- 3176 (Economy)
- 3176 (Vocational)

Engine Model	Rating kW	HP	@ RPM	Peak Torque N•m	lb-ft	@ RPM	Torque Rise (%)	Weight kg	lb	Certification 50-State* Electronic
3176 (Economy)										
ATAAC	205	275	1800	1424	1050	1100	31%	882	1945	X
ATAAC	224	300	1800	1559	1150	1100	31%	882	1945	X
ATAAC	242	325	1900	1661	1225	1200	38%	882	1945	X
ATAAC	261	350	1800	1836	1350	1200	32%	882	1945	X
(Vocational)										
ATAAC	205	275	2100	1424	1050	1300	53%	882	1945	X
ATAAC	224	300	2100	1559	1150	1300	53%	882	1945	X
ATAAC	242	325	2100	1661	1225	1300	51%	882	1945	X
ATAAC	261	350	1900	1836	1350	1200	39%	882	1945	X

*Certification rating for EPA and CARB approved for use in all 50 states and Canada.
ATAAC — Air-to-Air Aftercooled

Rating Definitions:

Economy: Medium operating range, high torque rise for virtually all highway uses.

Vocational: Wide operating range, very high torque rise for specialty or maximum flexibility applications.

Engine Model	Rating kW	HP	@ RPM	Peak Torque N•m	lb-ft	@ RPM	Torque Rise (%)	Weight kg	lb	Certification 50-State* Mechanical
3306C (Economy)										
ATAAC	213	**285**	1800	1423	**1100**	1200	26%	896	1975	X
ATAAC	224	**300**	1800	1423	**1100**	1200	20%	896	**1975**	X
(Vocational)										
ATAAC	213	**285**	2000	1491	**1100**	1200	40%	896	**1975**	X
ATAAC	224	**300**	**2000**	1491	**1100**	1200	33%	896	**1975**	X

*Certified rating for EPA and CARB approved for use in all 50 states and Canada.
ATAAC — Air-to-Air Aftercooled

Rating Definitions:

Economy: Medium operating range, high torque rise for virtually all highway uses.

Vocational: Wide operating range, very high torque rise for specialty or maximum flexibility applications.

Engines

Truck Diesel
- 3406C (Economy)
- 3406C (Vocational)

Engine Model	Rating kW	Rating HP	Rating @ RPM	Peak Torque N•m	Peak Torque lb-ft	Peak Torque @ RPM	Torque Rise (%)	Weight kg	Weight lb	Certification 50-States Mechanical	Certification 50-States Electronic
3406C											
(Economy)											
ATAAC	209	**280**	1600	1559	**1150**	1100	25%	1272	**2805**	X	
ATAAC	224	**300**	1800	1559	**1150**	1200	31%	1272	**2805**	X	
ATAAC	231	**310**	1800	1559	**1150**	1100	27%	1275	**2810**		X
ATAAC	231	**310***	1800	1831	**1350**	1100	49%	1275	**2810**		X
ATAAC	239	**320**	1800	1695	**1250**	1200	34%	1272	**2805**	X	
ATAAC	239	**320**	1800	1695	**1250**	1100	34%	1275	**2810**		X
ATAAC	246	**330**	1600	1831	**1350**	1100	25%	1272	**2805**	X	
ATAAC	261	**350**	1800	1831	**1350**	1100	32%	1275	**2810**		X
ATAAC	261	**350***	1800	1972	**1450**	1100	42%	1275	**2810**		X
ATAAC	261	**350**	1800	1831	**1350**	1200	32%	1272	**2805**	X	
ATAAC	272	**365**	1800	1831	**1350**	1100	27%	1275	**2810**		X
ATAAC	272	**365***	1800	1966	**1450**	1100	36%	1275	**2810**		X
ATAAC	280	**375**	1800	1904	**1400**	1200	28%	1272	**2805**	X	
ATAAC	298	**400**	1800	1938	**1425**	1200	22%	1272	**2805**	X	
(Vocational)											
ATAAC	298	**400**	2000	1898	**1400**	1200	33%	1275	**2810**		X
ATAAC	298	**400**	1800	1898	**1400**	1200	20%	1275	**2810**		X
ATAAC	317	**425**	2000	1966	**1450**	1250	30%	1272	**2805**	X	
ATAAC	317	**425**	2000	2102	**1550**	1200	39%	1272	**2805**	X	
ATAAC	317	**425**	2000	1966	**1450**	1200	30%	1275	**2810**		X
ATAAC	317	**425**	2000	2102	**1550**	1200	39%	1275	**2810**		X
ATAAC	343	**460**	1900	2297	**1650**	1200	30%	1275	**2810**		X

*Multi-torque rating
— 50 state: EPA and CARB approved for use in all 50 states, and Canada.
ATAAC — Air-to-Air Aftercooled

Rating Definitions:

Economy: Medium operating range, high torque rise for virtually all highway uses.

Vocational: Wide operating range, very high torque rise for specialty or maximum flexibility applications.

Machine Model	Engine Model
Track-Type Tractors	
Standard Models	
D3C Series II	3204
D4C Series II	3204
D4E	3304
D5C	3204
D4H Series II	3204
D4H XL Series III	3204
D5E	3306
D5H Series II	3304
D5H XL Series II	3304
D6D	3306
D6E	3306
D6H Series II	3306
D7G	3306
D7H Series II	3306
D8N	3406
D8L	3408
D9N	3408
D10N	3412
D11N	3508
Low Ground Pressure	
D3C LGP Series II	3204
D4C LGP Series II	3204
D5C LGP	3204
D3C LGP-S Series II	3204
D4H LGP Series III	3204
D5H LGP Series II	3304
D6D LGP	3306
D6H LGP Series II	3306
D7H LGP Series II	3306
D8N LGP	3406
D8L LGP	3408

Machine Model	Engine Model
Track Skidders	
D4H TSK Series III	3304
D5H TSK Series II	3304
Agricultural Tractors	
D3C SA	3204
D4E SR	3304
D5H SA	3306
D6E SR	3306
D8L SA	3408
AG6	3306
Challenger 65B	3306
Challenger 75	3176
Waste Disposal Arrangements	
D6E WDA	3306
D6H WDA Series II	3306
D7H WDA Series II	3306
D8N WDA	3406
D9N WDA	3408
D8L WDA	3408
943 WDA	3204
953 WDA	3204
963 WDA	3304
973 WDA	3306
Motor Graders	
120G	3304
130G	3304
12G	3306
140G	3306
140G AWD	3306
14G	3306
16G	3406

Machine Model	Engine Model
Excavators	
E70B	4D32*
E110B	3114
E120B	3114
E140	6D14*
211B LC	3114
213B LC	3116
206B FT	3114
212B FT	3114
214B/214D FT	3116
224B	3116
320/320 L	3066**
320/320 L/320 N	3116***
E240B	3116
EL240B	3116
325/325 L	3116**
325 LN	3116***
231D	3208
231D LC	3208
330	3306
330 L	3306
330 N	3306
235D	3306
E450	6D22TC*
245D	3406
E650	S6B-TA*
235D ME	3306
245D ME	3406
235D Front Shovel	3306
245D Front Shovel	3406
E450 Front Shovel	6D22TC*
E650 Front Shovel	S6B-TA*

Machine Model	Engine Model
Backhoe Loaders	
416B	3054
426B	3054
436B	3054
446	3114
428B	3054
438B	3054
Skidders	
518 Cable	3304
518 Grapple	3304
528B	3306
530B	3306
Pipelayers	
571G	3306
572G	3306
578	3406
589	3408
Wheel Tractor-Scrapers	
621E	3406
621S	3306
631E	3408
651E	3412
627E	3406 Tr 3306 Sc
637E	3408 Tr 3306 Sc
657E	3412 Tr 3408 Sc
613C	3208
615C	3306
623E	3406

*Mitsubishi Engine.
**Akashi Sourced
***Gosselies Sourced

15

Engines used in Caterpillar Products
• By Machine Model

Machine Model	Engine Model
Off-Highway Trucks	
769C	3408
771C	3408
773B	3412
775B	3412
777B	3508
785	3512
789	3516
793	3516
Off-Highway Tractors	
768C	3408
772B	3412
776B	3508
784	3512
Articulated Trucks	
D20D	3116
D25D	3306
D30D	3306
D40D	3406
D250D	3116
D300D	3306
D350D	3306
D400D	3406
Wheel-Type Tractors	
814B	3306
824C	3406
834B	3408
Soil Compactors	
815B	3306
825C	3406

Machine Model	Engine Model
Landfill Compactors	
936 Landfill Compactor	3304
518 Landfill Compactor	3304
816B	3306
826C	3406
Wheel Loaders	
910E	3114
916	3204
926E	3204
930T	3304T
936F	3304
950F	3304
966D	3306
966F	3306
980F	3406
988B	3408
992C	3412
994	3516
Track Loaders	
931C Series II	3204
935C Series II	3204
943	3204
953	3204
963	3304
973	3306
Integrated Toolcarriers	
IT12B	3114
IT14B	3114
IT18B	3204
IT28B	3204

Machine Model	Engine Model
Logging & Forest Products	
FB518	3304
FB227	3208
231D LC Log Loader	3208
235C LC Log Loader	3306
Paving Products	
Cold Planers	
PR-105	3204
PR-450C	3408
PR-750B	3412
PR-1000C	3412/3208
Road Reclaimer	
RR-250	3406
Soil Stabilizer	
SS-250	3406
Windrow Elevators	
WE-851B	Perkins T6.3544
Asphalt Pavers	
AP-200B	Hatz 2M40
AP-800B	Perkins T4.236
AP-1000	3116
AP-1050	3116
Compactors	
Smooth Drum-Soil	
CS-323	Perkins 4.236
CS-431B	Perkins T4.236
CS-433B	Perkins T4.236
CS-563	3116
CS-583	3116

Machine Model	Engine Model
Padded Drum-Soil	
CP-323	Perkins 4.236
CP-433B	Perkins T4.236
CP-563	3116
Dual Drum-Asphalt	
CB-214B	Hatz 2M40
CB-224B	Hatz 2M40
CB-434	3114
CB-534	3304
CB-614	3208
Pneumatic Tire-Asphalt	
PS-110	Perkins 4.236
PS-130	Perkins 4.236
PS-180	Perkins 4.236
Compactors (Overseas)	
Smooth Drum-Soil	
CS-573	3116
Dual Drum-Asphalt	
CB-624	3208
Pneumatic Tire-Asphalt	
PF-300	Deutz F6L 912
PS-300	Deutz F6L 912
PS-500	3208
Single Drum-Combination	
CB-523	Deutz F5L 912
CB-525	Deutz F5L 912

Engine Model and (Cylinders)	Machine	Aspiration	Fuel Injection System	Bore × Stroke mm	Bore × Stroke in	Displacement L	Displacement in³
3054 (I-4)	416B, 426B, 428B, (416D), (426D), (428B), 436B, 438B	NA T (optional)	DI DI	100 × 127	3.94 × 5.0	4.0	243
3066	320*, 320 L*	T	DI	105 × 127	4.1 × 5.0	6.4	391
3114 (I-4)	211B LC, 206B FT, 212B FT, E110B, E120B, 446, 910E, IT12B, IT14B	T	DI	105 × 127	4.1 × 5.0	4.4	266.5
3116 (I-6)	213B LC, 214B, 214B FT, 224B, E200B, EL200B, E240B, EL240B, AP1000, CS-563 AP 1050, CP 563, CS-573, 320**, 320 L**, 320 LN**	T	DI	105 × 127	4.1 × 5.0	6.6	403
	D20D, D250D, 325, 325 L, 325 LN	TA	DI				
3176 (I-6)	Challenger 75	TA*	DI	125 × 140	4.92 × 5.5	10.2	629
3204 (I-4)	D3C Series II, D4C Series II, D3C LGP Series II, D3C LGP-S Series II, D4C LGP Series II, 931C Series II, 935C Series II, 943, PR-105	NA	DI	114 × 127	4.5 × 5	5.2	318
	D4H Series II, D4H LGP Series III, D3C SA, 508 Cable, 508 Grapple, 916, 926E, 953, IT18B IT28B	T	DI				
3208 (V-8)	225D LC, CB-614, CB-624, PS-500	NA	DI	114 × 127	4.5 × 5	10.4	636
	231D, 231D LC, 613C, FB227, 231D LC Log Loader, PR-1000C (Track Drive)	T	DI				
3304 (I-4)	930	NA	PC	121 × 152	4.75 × 6	7	425
	D4E, 930T, D4H TSK Series III	NA	DI				
	D5H TSK Series II, D5H Series II, D5H LGP Series II, D4E SR, 120G, 130G, 215D LC, 219D, 219D LC, 225D, 518 Cable, 518 Grapple, 936 Landfill Compactor, 618 Landfill Compactor, 936E, 950E, 963, FB518, FB219, CS-563, CB-634	T	DI				

PC — Precombustion
DI — Direct Injection
T — Turbocharged

TA — Turbocharged and Aftercooled
*TA — Turbocharged and Air/Air Aftercooled
NA — Naturally Aspirated

*Japan sourced
**Belgium sourced

NOTE: Materials and specifications subject to change without notice. Component commonality of Cat Engines for all applications does not imply complete interchangeability. Contact your Caterpillar Dealer for specific information.

15

Engine Model and (Cylinders)	Machine	Aspiration	Fuel Injection System	Bore x Stroke mm	Bore x Stroke in	Displacement L	Displacement in³
3306 (I-6)	D5B, D5B SA, 12G, 960R	NA	DI	121 x 152	4.75 x 6	10.5	638
	966C	T	PC				
	D6H Series II, D6H LGP Series II, D6H WDA Series II, D7H Series II, D7H LGP Series II, D7H WDA Series II, D6D, D6D LGP, D6E, D6E SR, D6E WDA, D7G, 140G, 140G AWD, 14G, 235C, 235C ME, 235C FS, 235C LC Log Loader, E300B, FB300B, 528B, 530B, 571G, 572G, 627E Sc., 814B, 815B, 816B, 988F, 973	T	DI				
	AC6, Challenger 65B, 615C, D2HD, D30D, D300D, D350D, 637E Sc., 330, 330 L, 330 LN	TA	DI				
3406 (I-6)	D8N, D8N WDA, 16G, 578, 624C, 825C, 826C, 980C	T	DI	137 x 165	5.4 x 6.5	14.6	893
	245B Series II, 245B ME Series II, 245B FS Series II, 621E, 623E, 627E Tr., D40D, D400D, RR-250, SS-250	TA	DI				
3408 (V-8)	988B	T	DI	137 x 152	5.4 x 6	18	1099
	D9N, D9N WDA, D8L, D8L LGP, D8L WDA, D8L SA, 589, 631E-II, 637E-II Tr., 657E Sc., 771C, 776C, 768C, 834B, PR-450	TA	DI				
3412 (V-12)	D10N, 651E, 657E Tr., 773B, 772B, 992C, PR-750B, PR-1000C (Cutter Drive)	TA	DI	137 x 152	5.4 x 6	27	1649
3508 (V-8)	D11N, 777C, 776B, 775B	TA	DI	170 x 190	6.7 x 7.5	34.5	2105
3512 (V-12)	785	TA	DI	170 x 190	6.7 x 7.5	51.8	3158
3516 (V-16)	789, 793, 994	TA	DI	170 x 190	6.7 x 7.5	69.1	4211

PC — Precombustion
DI — Direct Injection
T — Turbocharged
TA — Turbocharged and Aftercooled
NA — Naturally Aspirated

NOTE: Materials and specifications subject to change without notice. Component commonality of Cat Engines for all applications does not imply complete interchangeability. Contact your Caterpillar Dealer for specific information.

Engine Model and (Cylinders)	Machine	Aspiration	Fuel Injection System	Bore × Stroke mm	in	Displacement L	in³
Mitsubishi 4D32 (4)	E70B	NA	DI	100 × 105	3.9 × 4.1	3.30	201
Mitsubishi 6D14 (6)	E140	NA	DI	110 × 115	4.3 × 4.5	6.56	400
Mitsubishi 6D22TC (6)	E450, E450 FS	T	DI	130 × 140	5.1 × 5.5	11.15	680
Mitsubishi S6B 1A (6)	E650, E650 FS	TA	DI	135 × 150	5 × 6	12.88	786
Perkins 4.236 (4)	PR-75, CS-323, CP-323, PS-110, PS-130, PS-160	NA	DI	98.4 × 127	3.9 × 5	3.88	236
Perkins T4.236 (4)	WE-801B, AP 800B, CS 431B, CS-433B, CP-433B	T	DI	98.4 × 127	3.9 × 5	3.88	235
Perkins T6.3544 (6)	WE 851B	T	DI	98.4 × 127	3.9 × 5	5.8	353.8
Deutz F2L 511 (2)	AP-200	NA	DI	100 × 120	3.93 × 4.7	1.624	114
Deutz BF6L 913	224	TA	DI	102 × 125	4 × 4.9	6.13	374
Deutz F4L 912 (4)		NA	DI	100 × 120	3.93 × 4.7	3.77	230
Deutz F5L 912 (5)	CB-525	NA	DI	100 × 120	3.93 × 4.7	4.71	287
Deutz F6L 912 (6)	PF-300, PS-300	NA	DI	100 × 120	3.93 × 4.7	5.65	345
GM3-53N (3)	CB-514	Blower Loop Scavenged	DI	98.4 × 1143	3.875 × 4.5	2.61	159
Hatz 2M40 (2)	CB-214B, CB-224B, AP200B	NA	DI	102 × 105	4 × 4.13	1.716	105

PC — Precombustion
DI — Direct Injection
T — Turbocharged
TA — Turbocharged and Aftercooled
NA — Naturally Aspirated

NOTE: Materials and specifications subject to change without notice. Component commonality of Cat Engines for all applications does not imply complete interchangeability. Contact your Caterpillar Dealer for specific information.

15

FORMER MODELS

TRACK-TYPE TRACTORS

Model	Product Ident. No. Prefix	Years Built	Horse-power FW/ Drawbar	Approx. Machine Weight kg (lb)	Gauge m (ft) and Width m (ft)	Length m (ft) and Height m (ft)	Trans-mission	Rated Drawbar Pull — kg (lb) and Forward Speed — km/h (mph) 1st	2nd	3rd	4th	5th	6th
D2	4U	47-58	43/38	3258 (7,175)	1.02 (3'4") 1.42 (4'8")	2.74 (9'0") 1.57 (5'2")	DD	3609 (7,950) 2.9 (1.8)	2588 (5,700) 4.4 (2.7)	2061 (4,540) 5.2 (3.2)	1634 (3,600) 6.3 (3.9)	1067 (2,350) 8.9 (5.5)	
D2	4U	47-58	42/35	3258 (7,175)	1.02 (3'4") 1.57 (5'2")	2.74 (9'0") 1.57 (5'2")	DD	3609 (7,950) 2.7 (1.7)	2588 (5,700) 4.0 (2.5)	2061 (4,540) 4.8 (3.0)	1634 (3,600) 5.8 (3.6)	1067 (2,350) 8.2 (5.1)	
D2	5U	57-58	38/32	3118 (6,870)	1.27 (4'2") 1.42 (4'8")	2.74 (9'0") 1.57 (5'2")	DD	3033 (6,680) 2.7 (1.7)	2463 (5,420) 4.0 (2.5)	2007 (4,420) 4.8 (3.0)	1703 (3,570) 5.8 (3.6)	1035 (2,280) 8.2 (5.1)	
D2	5U	57-58	43/38	3373 (7,430)	1.27 (4'2") 1.67 (5'6")	2.74 (9'0") 1.57 (5'2")	DD	3609 (7,950) 2.9 (1.8)	2588 (5,700) 4.4 (2.7)	2061 (4,540) 5.2 (3.2)	1634 (3,600) 6.3 (3.9)	1067 (2,350) 8.9 (5.5)	
D3	78U	72-79	62/—	4812 (10,610)	1.42 (4'8") 1.78 (5'10")	2.77 (9'1") 1.70 (5'7")	PS	3.1 (1.9)	5.6 (3.5)	11.3 (7.0)			
D3 LGP	6N	72-79	62/—	5410 (11,926)	1.86 (6'5") 2.29 (7'6")	2.97 (9'10") 1.70 (5'7")	PS	3.1 (1.9)	5.6 (3.5)	11.3 (7.0)			
D3B	23Y	79-87	65	6719 (14,812)	1.42 (4'8") 1.78 (5'10")	2.77 (9'1") 2.67 (8'9")	PS	3.1 (1.9)	5.6 (3.5)	11.4 (7.1)			
D3B	27Y	79-87	65	6877 (15,160)	1.42 (4'8") 1.78 (5'10")	2.77 (9'1") 2.67 (8'9")	PS	3.1 (1.9)	5.9 (3.7)	10.6 (6.6)			
D3B LGP	24Y	79-87	65	7479 (16,488)	1.65 (5'5") 2.29 (7'6")	2.99 (9'10") 2.67 (8'9")	PS	3.1 (1.9)	5.6 (3.5)	11.4 (7.1)			
D3B LGP	28Y	79-87	65	7637 (16,836)	1.65 (5'5") 2.29 (7'6")	2.99 (9'10") 2.67 (8'9")	PS	3.1 (1.9)	5.9 (3.7)	10.7 (6.7)			

Note: Power Shift models do not show drawbar pull figures. Only speed figures are given.

16

Track-Type Tractors (cont'd)

Model	Product Ident. No. Prefix	Years Built	Horse-power FW/ Drawbar	Approx. Machine Weight kg (lb)	Gauge m (ft) and Width m (ft)	Length m (ft) and Height m (ft)	Trans-mission	Rated Drawbar Pull — kg (lb) and Forward Speed — km/h (mph)					
								1st	2nd	3rd	4th	5th	6th
D3B	3YC	85-87	65	6718 (14,812)	1.42 (4'8") 1.78 (5'10")	2.77 (9'1") 2.67 (8'9")	DD	5593 (12,330) 2.48 (1.5)	3993 (8,802) 3.40 (2.1)	2694 (5,940) 4.68 (2.9)	1830 (4,034) 6.45 (4.0)	1326 (2,925) 8.27 (5.1)	
D3B LGP	6MC	85-87	65	7479 (16,486)	1.65 (5'5") 2.29 (7'6")	2.99 (9'10") 2.67 (8'9")	DD	5595 (12,330) 2.48 (1.5)	3993 (8,802) 3.40 (2.1)	2694 (5,940) 4.68 (2.9)	1830 (4,094) 6.45 (4.0)	1326 (2,925) 6.27 (5.1)	
D3C	5KG	87-90	67	7084 (15,618)	1.42 (4'7") 1.79 (5'10.6")	2.8 (9'4") 2.66 (8'6.9")	PS	3.1 (1.9)	5.8 (3.7)	10.8 (6.7)			
D3C LGP	1PJ	87-90	67	7786 (17,170)	1.65 (5'4") 2.28 (7'6")	3.0 (9'10.1") 2.66 (8'6.9")	PS	3.1 (1.9)	5.9 (3.7)	10.8 (6.7)			
D3C SA	7JF	87-90	101	7202 (15,846)	1.52 (5'0") 1.84 (6'4")	3.68 (12'1") 2.71 (8'11")	DD	5562 (12,250) 4.1 (2.5)	4521 (9,960) 5.0 (3.1)	3827 (8,450) 5.7 (3.6)	3235 (7,130) 6.5 (4.0)	2755 (6,070) 7.6 (4.7)	
D4	6U	47-59	48/43	4629 (10,186)	1.12 (3'8") 1.58 (5'2")	3.07 (11'0") 1.54 (5'1")	DD	4531 (9,980) 2.7 (1.7)	3496 (7,700) 4.2 (2.4)	2656 (5,850) 4.8 (3.0)	2089 (4,600) 6.0 (3.7)	1339 (2,950) 8.7 (5.4)	
D4	6U	47-59	60/48	4847 (10,675)	1.12 (3'8") 1.58 (5'2")	3.16 (10'5") 1.54 (5'1")	DD	4858 (10,700) 3.1 (1.9)	3498 (7,700) 4.3 (2.7)	2724 (6,000) 5.5 (3.4)	2093 (4,610) 6.8 (4.2)	1326 (2,920) 9.8 (6.1)	
D4	6U	47-59	63/50	4844 (10,675)	1.12 (3'8") 1.58 (5'2")	3.18 (10'6") 1.76 (5'10")	DD	4858 (10,700) 3.1 (1.9)	3528 (7,770) 4.3 (2.7)	2724 (6,000) 5.5 (3.4)	2093 (4,610) 6.8 (4.2)	1326 (2,920) 9.8 (6.1)	
D4	7U	59	63/50	5067 (10,970)	1.52 (5'0") 1.98 (6'6")	3.16 (10'5") 1.76 (5'10")	DD	4858 (10,700) 3.1 (1.9)	3528 (7,770) 4.3 (2.7)	2724 (6,000) 5.5 (3.4)	2093 (4,610) 6.8 (4.2)	1326 (2,920) 9.8 (6.1)	
D4B	2XF	87	75	7450 (16,420)	1.42 (4'8") 1.78 (5'10")	2.78 (9'1") 2.67 (8'9")	PS	3.2 (2.0)	6.0 (3.7)	11.1 (6.9)			
D4B LGP	1SG	87	75	7800 (17,200)	1.65 (5'5") 2.29 (7'6")	2.99 (9'10") 2.67 (8'9")	PS	3.2 (2.0)	6.0 (3.7)	11.1 (6.9)			
D4C	39A	59-63	65/52	5064 (11,155)	1.12 (3'8") 1.58 (5'2")	3.06 (10'1") 1.76 (5'10")	DD	4858 (10,700) 3.1 (1.9)	3528 (7,770) 4.3 (2.7)	2724 (6,000) 5.5 (3.4)	2093 (4,610) 6.8 (4.2)	1321 (2,910) 9.8 (6.1)	
D4C	40A	59-63	65/52	4881 (10,750)	1.52 (5'0") 1.98 (6'6")	3.05 (10'1") 1.76 (5'10")	DD	4858 (10,700) 3.1 (1.9)	3528 (7,770) 4.3 (2.7)	2724 (6,000) 5.5 (3.4)	2093 (4,610) 6.8 (4.2)	1321 (2,910) 9.8 (6.1)	

Note: Power Shift models do not show drawbar pull figures. Only speed figures are given.

Track-Type Tractors (cont'd)

Model	Product Ident. No. Prefix	Years Built	Horse-power FW/ Drawbar	Approx. Machine Weight kg (lb)	Gauge m (ft) and Width m (ft)	Length m (ft) and Height m (ft)	Trans-mission	Rated Drawbar Pull — kg (lb) and Forward Speed — km/h (mph) 1st	2nd	3rd	4th	5th	6th
D4C	1RJ	67-90	78	7581 (16,714)	1.42 (4'7") 1.83 (6'0")	3.00 (9'10.1") 2.68 (8'8.9")	PS	3.1 (1.9)	5.9 (3.7)	11.1 (6.9)			
D4C LGP	2CJ	67-90	78	7905 (17,427)	1.65 (5'4") 2.29 (7'6")	3.00 (9'10.1") 2.65 (8'8.9")	PS						
D4D	78A	63-68	65/52	5900 (13,000)	1.52 (5'0") 1.98 (6'6")	3.35 (11'0") 2.41 (7'11")	DD	5300 (11,690) 2.7 (1.7)	3700 (8,160) 3.9 (2.4)	2560 (5,640) 5.5 (3.4)	1880 (4,150) 7.1 (4.4)	1350 (2,980) 9.3 (5.8)	
D4D SA	20J	66-68	—/68	6750 (14,900)	1.52 (5'0") 1.98 (6'6")	3.35 (11'0") 2.44 (8'0")	DD	4590 (10,120) 4.0 (2.5)	3928 (8,660) 4.7 (2.9)	3098 (6,830) 5.6 (3.5)	2631 (5,800) 6.4 (4.0)	2232 (4,920) 7.4 (4.6)	
D4D	22C	67-68	65/—	5900 (13,100)	1.52 (5'0") 1.98 (6'6")	3.38 (11'1") 2.41 (7'11")	PS	3.2 (2.0)	5.8 (3.6)	9.3 (5.8)			
D4D SA	84J	66	—/68	6470 (14,270)	1.52 (5'0") 1.98 (6'6")	3.35 (11'0") 2.67 (8'9")	DD	4880 (10,750) 4.0 (2.5)	4170 (9,200) 4.7 (2.9)	3310 (7,300) 5.6 (3.5)	2840 (6,260) 6.4 (4.0)	2420 (5,330) 7.4 (4.6)	
D4D	82J	63	—/65	7910 (17,440)	1.52 (5'0") 1.98 (6'6")	3.38 (11'1") 2.67 (8'9")	DD	6150 (13,560) 2.7 (1.7)	4150 (9,140) 4.0 (2.5)	2820 (6,210) 5.4 (3.4)	2030 (4,480) 7.2 (4.5)	1420 (3,120) 9.4 (5.9)	
D4D	80J	67-71	—/65	8270 (18,240)	1.52 (5'0") 1.98 (6'6")	3.38 (11'1") 2.67 (8'9")	PS	3.2 (2.0)	5.7 (3.6)	9.3 (5.8)			
D4D	83J	72-77	—/75	5900 (13,100)	1.52 (5'0") 1.98 (6'6")	3.38 (11'1") 2.67 (8'9")	DD	6150 (13,560) 2.7 (1.7)	4150 (9,140) 4.0 (2.5)	2820 (6,210) 5.4 (3.4)	2030 (4,480) 7.2 (4.5)	1420 (3,120) 9.4 (5.9)	
D4E	27X	77-84	80/—	9010 (19,820)	1.52 (5'0") 2.44 (8'0")	3.86 (12'8") 2.72 (8'11")	DD	6495 (14,320) 2.8 (1.7)	4425 (9,756) 4.0 (2.5)	3018 (6,654) 5.5 (3.4)	2172 (4,788) 7.2 (4.5)	1509 (3,327) 9.5 (5.9)	
D4E	28X	77-84	80/—	9090 (20,040)	1.52 (5'0") 2.44 (8'0")	3.86 (12'8") 2.72 (8'11")	PS	3.3 (2.1)	5.9 (3.7)	9.5 (5.9)			
D4E SA	29X	77-84	—/74	7585 (16,722)	1.52 (5'0") 1.83 (6'0")	3.35 (11'0") 2.72 (8'11")		5802 (12,791) 4.1 (2.5)	4986 (10,993) 4.7 (2.9)	4007 (8,835) 5.8 (3.6)	3814 (8,408) 6.6 (4.1)	2896 (6,384) 7.6 (4.7)	

Note. Power Shift models do not show drawbar pull figures. Only speed figures are given.

16

Track-Type Tractors (cont'd)

Model	Product Idcnt. No. Prefix	Years Built	Horsepower FW/ Drawbar	Approx. Machine Weight kg (lb)	Gauge m (ft) and Width m (ft)	Length m (ft) and Height m (ft)	Transmission	Rated Drawbar Pull — kg (lb) and Forward Speed — km/h (mph) 1st	2nd	3rd	4th	5th	6th
D5 SA	21J	67-67	—/90	8300 (20,400)	1.88 (6'2") 2.38 (7'10")	3.88 (12'9") 2.64 (8'8")	DD	6620 (14,580)	5160 (11,360)	3990 (8,740)	3080 (6,790)	2290 (5,030)	
D5	81H	67-67	93/75	8300 (18,200)	1.52 (5'0") 2.02 (6'8")	3.89 (12'9") 2.00 (8'7")	DD	7870 (17,330) 3.8 (2.3)	4910 (10,820) 4.7 (2.9)	3330 (7,320) 5.8 (3.6)	2230 (4,920) 7.1 (4.4)	1440 (3,170) 8.9 (5.5)	
D5	82H	67-67	93/75	8400 (18,600)	1.88 (6'2") 2.38 (7'10")	3.89 (12'9") 2.00 (8'7")	DD	7870 (17,330) 2.7 (1.7)	4910 (10,820) 4.2 (2.6)	3330 (7,320) 5.8 (3.6)	2230 (4,920) 8.0 (5.0)	1440 (3,170) 11.1 (6.9)	
D5	83H	67-67	93/	8500 (18,800)	1.52 (5'0") 2.02 (6'8")	3.89 (12'9") 2.64 (8'8")	PS	2.7 (1.7)	4.2 (2.6)	5.8 (3.6)	8.0 (5.0)	11.1 (6.9)	
D5	84H	67-67	93/—	8700 (19,200)	1.88 (6'2") 2.38 (7'10")	3.89 (12'9") 2.64 (8'8")	PS	3.6 (2.2)	6.1 (3.8)	10.1 (6.3)			
D5 SA	98J	67-77	—/90	9660 (21,300)	1.88 (6'2") 2.38 (7'10")	3.89 (12'8") 2.95 (9'8")	DD	6170 (13,600) 3.7 (2.3)	5180 (11,410) 4.6 (2.9)	4110 (9,050) 5.8 (3.6)	3840 (7,620) 7.1 (4.4)	2950 (6,500) 8.8 (5.5)	2260 (4,970)
D5	98J	67-77	105	11 290 (24,400)	1.52 (5'0") 2.02 (6'8")	3.89 (12'9") 2.74 (9'0")	DD	8770 (19,340) 4.0 (2.5)	5500 (12,130) 4.8 (3.0)	3750 (8,270) 5.6 (3.5)	2540 (5,610) 6.4 (4.0)	1660 (3,660) 7.4 (4.6)	9.0 (5.6)
D5	99J	67-77	105	11 290 (24,400)	1.52 (5'0") 2.02 (6'8")	3.89 (12'9") 2.74 (9'0")	DD	8770 (19,340) 2.7 (1.7)	5500 (12,130) 4.2 (2.6)	3750 (8,270) 5.8 (3.6)	2540 (5,610) 8.0 (5.0)	1660 (3,660) 11.1 (6.9)	
D5	94J	66-77	105	11 390 (25,100)	1.88 (6'2") 2.38 (7'10")	3.89 (12'9") 2.74 (9'0")	DD	8770 (19,340) 2.7 (1.7)	5500 (12,130) 4.2 (2.6)	3750 (8,270) 5.8 (3.6)	2540 (5,610) 8.0 (5.0)	1660 (3,660) 11.1 (6.9)	
D5	95J	66-77	105	11 290 (24,900)	1.52 (5'0") 2.02 (6'8")	3.89 (12'9") 2.74 (9'0")	PS						
D5	96J	66-77	105	11 600 (25,600)	1.88 (6'2") 2.38 (7'10")	3.89 (12'9") 2.74 (9'0")	PS						

Note: Power Shift models do not show drawbar pull figures. Only speed figures are given.

Track-Type Tractors (cont'd)

Model	Product Ident. No. Prefix	Years Built	Horse-power FW/ Drawbar	Approx. Machine Weight kg (lb)	Gauge m (ft) and Width m (ft)	Length m (ft) and Height m (ft)	Trans-mission	Rated Drawbar Pull — kg (lb) and Forward Speed — km/h (mph) 1st	2nd	3rd	4th	5th	6th
D5B	25X	77-84	105/—	11619 (25,615)	1.88 (6'2") 3.15 (10'4")	4.60 (15'1") 2.77 (9'1")	PS	3.5 (2.2)	6.1 (3.8)	10.1 (6.3)			
D5B	23X	77-82	105/—	11283 (24,875)	1.88 (6'2") 3.15 (10'4")	4.60 (15'1") 2.77 (9'1")	DD	8060 (17,770) 2.7 (1.7)	5030 (11,100) 4.2 (2.6)	3410 (7,520) 5.8 (3.6)	2280 (5,060) 8.0 (5.0)	1480 (3,260) 11.1 (6.9)	
D5B SA	26X	77-84	—/90		1.88 (6'2") 2.36 (7'9")	3.88 (12'9") 2.77 (9'1")	DD	6409 (14,130) 4.0 (2.5)	5384 (11,870) 4.7 (2.9)	4323 (9,530) 5.6 (3.5)	3688 (8,130) 6.6 (4.1)	3180 (7,010) 7.4 (4.6)	2486 (5,480) 9.0 (5.6)
D5B SA	22X	77-82	105/—	11283 (24,875)	1.52 (5'0") 2.44 (8'0")	4.60 (15'1") 2.77 (9'1")	DD	8060 (17,770) 2.7 (1.7)	5030 (11,100) 4.2 (2.6)	3410 (7,520) 5.8 (3.6)	2280 (5,060) 8.0 (5.0)	1480 (3,260) 11.1 (6.9)	
D5B SA	24X	77-84	105/—	11619 (25,615)	1.52 (5'0") 2.44 (8'0")	4.60 (15'1") 2.77 (9'1")	PS	3.5 (2.2)	6.1 (3.8)	10.1 (6.3)			
D6	4R	47-59	85	8042 (17,730)	1.88 (6'2") 1.52 (5'0")	3.75 (12'4") 1.91 (6'3")	DD	8618 (19,000) 2.7 (1.7)	5534 (12,200) 4.2 (2.6)	3837 (8,460) 5.8 (3.6)	2617 (5,770) 8.0 (5.0)	1842 (4,060) 10.6 (6.6)	
D6	9U	47-59	93/75	8153 (17,975)	1.88 (6'2") 1.52 (5'0")	3.75 (12'4") 1.91 (6'3")	DD	8618 (19,000) 2.7 (1.7)	5534 (12,200) 4.2 (2.6)	3837 (8,460) 5.8 (3.6)	2617 (5,770) 8.0 (5.0)	1842 (4,060) 10.6 (6.6)	
D6B	37A	59-67	93/75	8130 (17,930)	1.52 (5'0") 2.02 (6'8")	3.88 (12'9") 1.91 (6'3")	DD						

Note: Power Shift models do not show drawbar pull figures. Only speed figures are given.

16

Track-Type Tractors (cont'd)

Model	Product Ident No. Prefix	Years Built	Horse-power FW/ Drawbar	Approx. Machine Weight kg (lb)	Gauge m (ft) and Width m (ft)	Length m (ft) and Height m (ft)	Trans-mission	Rated Drawbar Pull — kg (lb) and Forward Speed — km/h (mph): 1st	2nd	3rd	4th	5th	6th
D6B	44A	59-67	93/75	8300 (18,300)	1.88 (6'2") 2.38 (7'10")	3.85 (12'9") 1.91 (6'3")	DD	7820 (16,240) 2.7 (1.7)	4940 (10,900) 4.2 (2.6)	3220 (7,090) 6.0 (3.7)	2120 (4,670) 8.4 (5.2)	1450 (3,190) 10.9 (6.8)	
D6C	74A	63-67	120	10 400 (23,000)	1.88 (6'2") 2.38 (7'9")	3.95 (13'0") 1.92 (6'4")	DD	12 050 (26,540) 2.4 (1.5)	8020 (17,670) 3.4 (2.1)	5300 (11,680) 4.8 (3.0)	3360 (7,400) 6.8 (4.2)	2030 (4,470) 9.5 (5.9)	
D6C	76A	63-67	120	10 700 (23,500)	1.88 (6'2") 2.38 (7'9")	3.95 (13'0") 1.92 (6'4")	PS						
D6C	10K	67-76	140	13 880 (30,600)	1.88 (6'2") 2.38 (7'9")	3.73 (12'3") 2.87 (9'5")	PS	4.0 (2.5)	6.9 (4.3)	10.8 (6.7)			
D6 LGP	69U	72-77	140	17 010 (37,500)	2.11 (6'11") 3.02 (9'11")	3.94 (12'11") 2.97 (9'9")	PS						
D6C	99J	67-76	140	14 243 (31,400)	1.88 (6'2") 2.38 (7'9")	3.73 (12'3") 2.87 (9'5")	DD	11 500 (25,360) 2.7 (1.7)	7750 (17,090) 4.0 (2.5)	5180 (11,420) 5.6 (3.5)	3350 (7,390) 7.9 (4.9)	2090 (4,610) 11.1 (6.9)	
D6C SA	17H	70-76	140	13 064 (28,800)	1.88 (6'2") 2.38 (7'9")	3.95 (13'0") 2.67 (8'9")	DD	850 (18,750) 4.0 (2.5)	6970 (15,370) 4.8 (3.0)	5880 (12,780) 5.6 (3.5)	4810 (10,610) 6.4 (4.0)	4080 (9,000) 7.4 (4.6)	3190 (7,030) 8.8 (5.5)
D6C LGP	69U	72-77	140	13 835 (30,500)	2.11 (6'11") 3.02 (9'11")	2.97 (9'9") 3.94 (12'11")	PS						
D6D	3X	77-86	140	14 290 (31,500)	1.88 (6'2") 2.36 (7'9")	3.73 (12'3") 3.06 (10'0")	DD	11 500 (25,360) 1.7 (2.7)	7750 (17,090) 4.0 (2.5)	5180 (11,420) 5.6 (3.5)	3350 (7,390) 7.9 (4.9)	2090 (4,610) 11.1 (6.9)	
D6D	4X	77-86	140	14 290 (31,500)	1.88 (6'2")	3.73 (12'3")	PS	4.0 (2.5)	6.9 (4.3)	10.8 (6.7)			
D6D LGP	8X	77-86	140	17 370 (38,300)	2.1 (6'11") 3.02 (9'11")	3.94 (12'1") 3.06 (10'0")	PS	4.0 (2.5)	6.9 (4.3)	10.8 (6.7)			

Note: Power Shift models do not show drawbar pull figures. Only speed figures are given.

Track-Type Tractors (cont'd)

Model	Product Ident. No. Prefix	Years Built	Horse-power FW/ Drawbar	Approx. Machine Weight kg (lb)	Gauge m (ft) and Width m (ft)	Length m (ft) and Height m (ft)	Trans-mission	Rated Drawbar Pull — kg (lb) and Forward Speed — km/h (mph) 1st	2nd	3rd	4th	5th	6th	Remarks
D7	3T	54-55	108/90	11 770 (25,925)	1.88 (6'2") 2.64 (8'1")	4.27 (14'0") 2.06 (6'10")	DD							
D7C	17A	55-59	128/102	11 954 (26,355)	1.88 (6'2") 2.64 (8'1")	4.26 (14'0") 2.06 (6'10")	DD	11 758 (25,900) 2.4 (1.5)	8045 (17,720) 3.5 (2.2)	4521 (11,960) 5.2 (3.2)	3428 (7,550) 7.4 (4.6)	2397 (5,280) 9.5 (5.9)		
D7D	17A	59-61	140/112	12 058 (26,568)	1.88 (6'2") 2.64 (8'1")	4.26 (14'0") 2.06 (6'10")	DD	12 300 (27,100) 2.4 (1.5)	8600 (18,900) 3.5 (2.2)	5700 (12,650) 5.2 (3.2)	3650 (8,080) 7.4 (4.6)	2600 (5,720) 9.5 (5.9)		
D7E	47A	61-66	160/128	14 787 (32,590)	1.98 (6'6") 2.56 (8'5")	4.47 (14'8") 2.30 (7'7")	DD	14 741 (32,500) 2.4 (1.5)	10 296 (22,700) 3.5 (2.2)	6803 (15,000) 4.9 (3.1)	4259 (9,390) 7.4 (4.6)	3070 (6,770) 9.4 (5.9)		
D7E	48A	61-66	160/128	14 787 (32,580)	1.98 (6'6") 2.56 (8'5")	4.47 (14'8") 2.30 (7'7")	PS	3.3 (2.1)	5.7 (3.6)	9.3 (5.8)				
D7E	47A	66-69	180/144	15 200 (33,500)	1.98 (6'6") 2.58 (8'6")	4.47 (14'8") 2.18 (7'2")	DD	17 140 (37,750) 2.4 (1.5)	11 350 (25,000) 3.5 (2.2)	7420 (16,340) 5.0 (3.1)	4540 (9,990) 7.4 (4.6)	3180 (7,010) 9.5 (5.9)		
D7E	48A	66-69	180	15 500 (34,000)	1.98 (6'6") 2.56 (8'5")	4.47 (14'8") 2.18 (7'2")	PS	3.7 (2.3)	6.4 (4.0)	10.1 (6.3)				
D7F	94N	69-74	180	14 700 (32,400)	1.98 (6'6") 2.56 (8'5")	4.15 (13'8") 2.26 (7'5")	PS	3.5 (2.2)	6.3 (3.9)	9.6 (5.9)				
D7F	93N	69-74	180	14 700 (32,400)	1.98 (6'6") 2.56 (8'5")	4.15 (13'8") 2.26 (7'5")	DD	17 100 (37,600) 2.4 (1.5)	11 360 (25,000) 3.5 (2.2)	7460 (16,400) 5.0 (3.4)	4580 (10,000) 7.4 (4.6)	3240 (7,140) 9.5 (5.9)		
D7G	92V	77-86	200	20 090 (44,300)	1.98 (6'6") 2.62 (8'7")	4.19 (13'9") 3.35 (11'0")	PS	3.7 (2.3)	6.4 (4.0)	10.0 (6.2)				
D7G	91V	77-86	200	20 090 (44,300)	1.98 (6'6") 2.62 (8'7")	4.19 (13'9") 3.35 (11'0")	DD	17 690 (39,010) 2.5 (1.6)	11 730 (25,860) 3.7 (2.3)	7680 (16,940) 5.3 (3.3)	4700 (10,370) 7.8 (4.9)	3320 (7,320) 10.1 (6.3)		
D7G LGP	77W	77-86	200	22 630 (52,100)	2.18 (7'2") 3.3 (10'11")	4.22 (13'9") 3.28 (10'9")	PS	3.7 (2.3)	6.4 (4.0)	10.0 (6.2)				

Note: Power Shift models do not show drawbar pull figures. Only speed figures are given.

16

Track-Type Tractors (cont'd)

Model	Product Ident. No. Prefix	Years Built	Horsepower FW/ Drawbar	Approx. Machine Weight kg (lb)	Gauge m (ft) and Width m (ft)	Length m (ft) and Height m (ft)	Transmission	Rated Drawbar Pull — kg (lb) and Forward Speed — km/h (mph) 1st	2nd	3rd	4th	5th	6th	Remarks
D8	1H	36-41	110/95	14 790 (32,600)	1.98 (6'6") 2.64 (8'8")	4.64 (15'3") 2.28 (7'6")	*	9690 (21,350) 2.7 (1.7)	6870 (15,150) 3.8 (2.4)	5720 (12,610) 4.5 (2.8)	4800 (10,580) 5.1 (3.2)	3860 (8,520) 6.3 (3.9)	2740 (6,050) 8.5 (5.3)	RD-8 with 78" gauge
D8	8R	41-45	131/113	15 490 (34,180)	1.98 (6'6") 2.64 (8'8")	4.84 (15'3") 1.85 (6'1")	**	13 060 (28,800) 2.5 (1.6)	9750 (21,500) 3.5 (2.2)	7940 (17,500) 4.2 (2.6)	6800 (15,000) 4.8 (3.0)	5620 (12,400) 5.8 (3.6)	3990 (8,800) 7.9 (4.9)	Horsepower increase
D8	2U	46-53	148/130	16 470 (36,310)	1.98 (6'6") 2.64 (8'8")	4.85 (15'10") 2.18 (7'2")	DD	13 560 (29,900) 2.5 (1.6)	9840 (21,700) 3.7 (2.3)	7120 (15,700) 4.6 (2.9)	5400 (11,900) 5.9 (3.7)	3900 (8,600) 7.7 (4.8)		HP increase. DD transmission
D8	13A	53-55	185/150	16 856 (37,150)	1.98 (6'6") 2.64 (8'8")	4.88 (16'1") 2.18 (7'2")	DD	20 338 (44,840) 3.1 (1.9)	12 930 (28,500) 4.3 (2.7)	8626 (18,680) 5.6 (3.5)	6956 (15,320) 7.2 (4.5)	4926 (10,870) 9.3 (5.8)		
D8D, G	15A	55-57	191/155	16 310 (35,925)	1.98 (6'6") 2.58 (8'6")	5.23 (17'2") 2.23 (7'4")	TC	5.8 (3.6)	8.5 (5.3)	11.9 (7.4)				
D8E, F	14A	55-57	191/155 Belt	17 734 (39,060)	1.98 (6'6") 2.64 (8'8")	4.88 (16'1") 2.26 (7'5")	DD	20 438 (45,020) 2.4 (1.5)	16 136 (35,540) 3.1 (1.9)	10 984 (24,150) 4.5 (2.8)	7378 (16,240) 6.1 (3.8)	4958 (10,810) 8.3 (5.2)		
D8H	35A	58-61	235	20 874 (46,032)	2.13 (7'0") 2.87 (9'1")	5.20 (17'1") 2.39 (7'10")	TC	5.6 (3.5)	8.2 (5.1)	12.2 (7.6)				
D8H	36A	58-66	235/185	21 400 (47,180)	2.13 (7'0") 2.87 (9'1")	5.20 (17'1") 2.39 (7'10")	DD	19 958 (44,400) 2.4 (1.5)	15 648 (34,500) 3.0 (1.9)	10 931 (24,100) 4.3 (2.7)	8051 (17,750) 5.6 (3.5)	5889 (13,000) 7.4 (4.6)	3832 (8,450) 10.1 (6.3)	
D8H	46A	58-74	270	21 863 (48,210)	2.13 (7'0") 2.07 (9'1")	5.20 (17'1") 2.39 (7'10")	PS	3.8 (2.4)	6.7 (4.2)	10.4 (6.5)				
D8K	76V	74-82	300	31 980 (69,300)†	2.13 (7'0") 3.05 (10'0")	5.26 (17'3") 2.44 (8'0")	DD	25 400 (56,000) 2.7 (1.7)	18 930 (41,740) 3.5 (2.2)	12 990 (28,640) 4.8 (3.0)	9370 (20,650) 6.3 (3.9)	6610 (14,580) 8.2 (5.1)	4090 (9,010) 11.3 (7.0)	Turbocharged, Sealed and Lubricated Track
D8K	77V	74-82	300	31 490 (70,500)*	2.13 (7'0") 3.05 (10'0")	5.26 (17'3") 2.44 (8'0")	PS	4.0 (2.5)	7.1 (4.4)	10.9 (6.8)				Turbocharged, Sealed and Lubricated Track
D8L	53Y	82-86	335	37 306 (82,243)	2.2 (7'3") 2.84 (9'4")	4.95 (16'2") 3.79 (12'5")	PS	3.9 (2.4)	6.8 (4.2)	11.9 (7.4)				

*Power transmitted through dry type flywheel clutch to selective type sliding spur gear set.
**Power transmitted through flexible and over center engagement, dry flywheel clutch with metallic friction surfaces. Selective type change speed gear set.
†Approximate operating weight. Includes lubricants, coolant, full fuel tank, hydraulic control, 8S Bulldozer, ROPS canopy and operator.
All other weights listed in this column are shipping weights.
Note. Power Shift models do not show drawbar pull figures. Only speed figures are given.

Track-Type Tractors (cont'd)

Model	Product Ident. No. Prefix	Years Built	Horse-power FW/ Drawber	Approx. Machine Weight kg (lb)	Gauge m (ft) and Width m (ft)	Length m (ft) and Height m (ft)	Trans-mission	1st	2nd	3rd	4th	5th	6th	Remarks
								Rated Drawbar Pull — kg (lb) and Forward Speed — km/h (mph)						
D9D	18A	55-56	286/230	25 772 (56,765)	2.29 (7'6") 3.03 (10'0")	5.46 (17'11") 2.67 (8'9")	DD	27 631 (60,880) 2.6 (1.6)	21 207 (46,710) 3.4 (2.1)	15 423 (33,970) 4.7 (2.9)	10 706 (23,580) 6.3 (3.9)	7658 (16,870) 8.1 (5.0)	4958 (10,920) 10.9 (6.8)	
D9D	18A	56-59	320/260	26 125 (57,543)	2.29 (7'6") 3.03 (10'0")	5.46 (17'11") 2.67 (8'9")	DD	28 603 (63,000)	23 835 (52,500)	16 617 (36,600)	12 167 (26,800)	9171 (20,200)	6106 (13,450)	
D9D	19A	55-56	286/230	25 729 (56,670)	2.29 (7'6") 3.03 (10'0")	5.46 (17'11") 2.67 (8'9")	TC	6.6 (4.1)	9.0 (5.6)	12.6 (7.8)				
D9D	19A	56-59	320/260	26 238 (57,990)	2.29 (7'6") 3.03 (10'0")	5.46 (17'11") 2.69 (8'9")	TC	6.6 (4.1)	9.5 (5.9)	13 (8.1)				
D9E	50A	59-60	335	27 018 (59,606)	2.29 (7'6") 3.03 (10'0")	5.50 (18'1") 2.70 (8'11")	TC	6.8 (4.2)	9.7 (6.0)	13.2 (8.2)				
D9D	34A	59-61	335	27 167 (59,837)	2.29 (7'6") 3.03 (10'0")	5.50 (18'1") 2.70 (8'11")	PS	4.2 (2.6)	7.2 (4.5)	11.2 (7.0)				
D9E	49A	59-60	335/268	26 957 (59,837)	2.29 (7'6") 3.03 (10'0")	5.50 (18'1") 2.70 (8'11")	DD	2.7 (1.7)	3.5 (2.2)	4.8 (3.0)	6.4 (4.0)	8.2 (5.1)	11.4 (7.1)	
D9G	66A	61-74	385	31 072 (68,500)	2.29 (7'6") 3.10 (10'0")	5.50 (18'1") 2.10 (8'7")	PS	3.9 (2.4)	6.8 (4.2)	10.5 (6.6)				

Note. Power Shift models do not include drawbar pull figures. Only speed figures are given.
*Approximate operating weight. Includes lubricants, coolant, full fuel tank, hydraulic control, 9S Bulldozer, ROPS canopy and operator. All other weights listed in this column are shipping weights.

16

Track-Type Tractors (cont'd)

Model	Product Ident. No. Prefix	Years Built	Horse-power FW/ Drawbar	Approx. Machine Weight kg (lb)	Gauge m (ft) and Width m (ft)	Length m (ft) and Height m (ft)	Trans-mission	Rated Drawbar Pull — kg (lb) and Forward Speed — km/h (mph) 1st	2nd	3rd	4th	5th	6th	Remarks
S x S D9G	29N 30N	69-74	770	[illegible]* kg (180,000 lb)	5.8* (19'0") 7.3** (24'0")	8.0◄ (26'0") 2.8◄◄ (9'2")	PS PS	3.9 (2.4)	6.8 (4.2)	10.0 (6.2)				L.H. of S x S D9G R.H. of S x S D9G
Dual D9G	90J 91J	69-74	770	79 470* kg (175,200 lb)	2.3* (7'6") 3.3** (10'9")	12.9◄ (42'6") 3.1◄◄ (9'11")	PS PS	3.9 (2.4)	6.8 (4.2)	10.5 (6.5)				Front of Dual D9G Rear of Dual D9G
S x S D9H	99V 12U	74-77	820	83 400* kg (183,900 lb)	6.8* (18'0") 7.3** (24'0")	9.0◄ (25'1") 2.9◄◄ (9'6")	PS PS	4.0 (2.5)	6.9 (4.3)	10.8 (6.7)				L.H. of S x S D9H R.H. of S x S D9H
Dual D9H	97V 98V	74-80	820	81 100* kg (178,800 lb)	2.3* (7'6") 3.3** (10'9")	12.9◄ (42'6") 3.1◄◄ (9'11")	PS PS	4.0 (2.5)	6.9 (4.3)	10.8 (6.7)				Front of S x S D9H Rear of Dual D9H
D9H	90V	74-81	410	32 840 kg (72,400 lb)	2.3* (7'6") 3.0 (9'11")	5.6 (18'5") 2.7◄◄ (8'10")	PS	4.0 (2.5)	6.9 (4.3)	10.8 (6.7)				Standard Model
D9L	14Y	80-86	460	52 055 kg (114,856 lb)	2.5 (8'2") 3.11 (10'2")	5.32 (17'5") 4.41 (14'6")		3.9 (2.4)	7.2 (4.5)	12.4 (7.7)				
D10	84W 76X	78-86	700	79 619 kg (175,526 lb)	2.89 (9'6") 3.61 (11'11.5")	5.92 (19'8") 3.48◄◄ (11'5")	PS PS	3.9 (2.4)	6.9 (4.3)	11.9 (7.4)				

Note: Power Shift models do not include drawbar pull figures. Only speed figures are given.

*Approximate weight of both machines plus Bulldozer, hydraulic controls, coolant and 5% fuel.

*Gauge of both tractors combined.

**Width to outside of dozer blade.

◄Length including dozer blade.

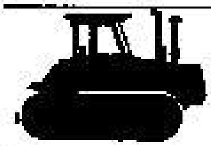
◄◄Overall height excluding stack and canopy.

TRACK-TYPE TRACTORS MANUFACTURED OUTSIDE U.S.A.

Source	Model	Product Ident. No. Prefix	Years Built	Horsepower Flywheel/ Drawbar	Transmission	Gauge m (ft)
U.K.	D4C	24A	60-64	63/50	DD	1.52 (5'0")
	D4D	88A	64-67	65/52	DD	1.52 (5'0")
	D6C	82A	64-68	120/93	DD	1.88 (6'2")
	D6C	83A	64-68	120/—	PS	1.88 (6'2")
	D6C	46J	71-77	140/	DD	1.88 (6'2")
	D6C	47J	71-77	140/—	PS	1.88 (6'2")
	D8H	52A	59-61	235/—	PS	2.13 (7'0")
	D8H	22A	59-66	235/105	DD	2.13 (7'0")
	D8H	68A	60-66	235/—	PS	2.13 (7'0")
	D8K	66V	74-82	300/—	PS	2.13 (7'0")
Brazil	D4D	97F	69-78	75/—	DD	1.52 (5'0")
	D4D	74U	71-78	75/	PS	1.52 (5'0")
	D6C	24U	71-77	120/93	PS	1.88 (6'2")
	D6C	23U	73-77	120/93	DD	1.88 (6'2")
Australia	D4	29A	59-61	63/50	DD	1.12 (3'8")
	D4	30A	59-60	63/50	DD	1.52 (5'0")
	D4C	54A	60-62	63/52	DD	1.12 (3'8")
	D4C	55A	60-62	65/52	DD	1.52 (5'0")
	D4D	85A	63-68	65/52	DD	1.52 (5'0")
	D5	51H	68-68	93/75	DD	1.88 (6'2")
	D5	52H	68-69	93/—	PS	1.88 (6'2")
	D6	31A	58-60	93/75	DD	1.52 (5'0")
	D6	32A	58-60	93/75	DD	1.18 (6'2")
	D6B	56A	60-66	90/73	DD	1.52 (5'0")
	D6B	57A	60-68	90/73	DD	1.88 (6'2")
	D6C	71A	63-68	120/93	DD	1.88 (6'2")
	D6C	73A	63-68	120/—	PS	1.88 (6'2")
	D6C	55J	69-72	125/—	DD	1.88 (6'2")
	D6C	56J	69-72	125/—	PS	1.88 (6'2")

TRACK-TYPE TRACTORS MANUFACTURED OUTSIDE U.S.A.

Source	Model	Product Ident. No. Prefix	Years Built	Horsepower Flywheel/ Drawbar	Transmission	Gauge m (ft)
France	D4C	69A	61-63	63/50	DD	1.52 (5'0")
	D4D	86A	63-68	65/52	DD	1.52 (5'0")
	D4D LGP	18J	66-68	65/52	DD	1.79 (5'10")
	D4D	58J	67-68	65/—	PS	1.52 (5'0")
	D4E	68X	78-86	80/—	DD	1.52 (5'0")
	D4E	69X	78-85	80/—	PS	1.52 (5'0")
	D4E LGP	71X	78-85	80/	DD	1.77 (5'10")
	D4E LGP	72X	78-86	80/—	PS	1.77 (5'10")
	D5	82J	69-77	105/—	DD	1.88 (6'2")
	D5	83J	69-77	105/—	PS	1.88 (6'2")
	D5 LGP	6R	70-77	105/—	PS	2.06 (6'9")
	D5 LGP	12R	70-77	105/—	DD	2.06 (6'9")
	D5B	43X	77-85	105/—	DD	1.88 (6'2")
	D5B	44X	77-86	105/—	PS	1.88 (6'2")
	D5B LGP	45X	77-86	105/—	DD	2.06 (6'9")
	D5B LGP	46X	77-86	105/—	PS	2.06 (6'9")
	D5B	8MB	84-86	105/—	PS	1.52 (5'0")
Glasgow	D6H	7PC	86-87	165/—	PS	1.88 (6'2")
	D6H LGP	8YC	86-87	165/—	PS	2.23 (7'4")
Japan	D3	79U	73-79	62/—	PS	1.42 (4'8")
	D3	82U	73-78	62/—	PS	1.42 (4'8")
	D3 LGP	6N	73-79	62/—	PS	1.65 (5'5")
	D3 LGP	83U	73-79	62/—	PS	1.65 (5'5")
	D3B	23Y	79-87	65/—	PS	1.42 (4'8")
	D3B LGP	24Y	79-87	65/—	PS	1.65 (5'5")
	D3B	27Y	79-87	65/—	PS	1.42 (4'8")
	D3B LGP	28Y	79-87	65/	PS	1.65 (5'5")
	D3B	3YC	86-87	65/	DD	1.42 (4'8")
	D3B LGP	6MC	86-87	65/—	DD	1.65 (5'5")
	D4D LGP	67A	65-68	65/52	DD	1.79 (5'10")
	D4D	91A	65-68	65/52	DD	1.52 (5'0")
	D4E	50X	77-86	80/—	DD	1.52 (5'0")
	D4E	51X	77-86	80/—	PS	1.52 (5'0")
	D4E LGP	52X	77-86	80/	DD	1.77 (5'10")
	D5	37J	67-68	93/75	DD	1.88 (6'2")
	D5 LGP	98A	67-68	93/75	DD	2.06 (6'9")
	D5	67J	68-77	105/—	DD	1.88 (6'2")
	D5	97J	71-76	105/—	PS	1.88 (6'2")
	D5 LGP	68J	68-77	105/—	DD	2.06 (6'9")
	D5B	47X	77-86	105/—	DD	1.88 (6'2")
	D5B	48X	77-86	105/	PS	1.88 (6'2")
	D5B LGP	49X	77-86	105/—	DD	2.06 (6'9")
	D6B	97H	66-67	93/75	DD	1.88 (6'2")
	D6B LGP	38H	66-67	93/75	DD	2.06 (6'9")
	D6C	41A	66-68	120/93	DD	1.88 (6'2")
	D6C	96A	66-68	120/93	PS	1.88 (6'2")
	D6C	26K	68-77	125/	DD	1.88 (6'2")
	D6C	89C	68-77	125/—	PS	1.88 (6'2")
	D6C LGP	90B	71-77	140/—	DD	2.11 (6'11")

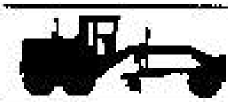


AGRICULTURAL TRACTORS

Model	Product Ident. No. Prefix	Years Built	Horse-power FW/ Drawbar	Approx. Machine Weight kg (lb)	Height m (ft) Gauge m (ft)	Rated Drawbar Pull kg (lb)* and Forward Speed km/h (mph) 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Challenger 65	7YC	87-90	256/205	14 061 (31,000)	3.28 (10.75) 2.15 (7.05)	14 626 (32,684) 4.2 (2.6)	10 393 (22,912) 6.4 (4.0)	8880 (18,677) 7.5 (4.7)	7701 (16,878) 8.6 (5.3)	6656 (14,674) 9.8 (6.1)	5706 (12,683) 11.3 (7.0)	4950 (10,812) 13.0 (8.1)	4245 (9,358) 14.9 (9.3)	2858 (6,300) 19.3 (12.0)	1725 (3,803) 29.3 (18.1)
D3H SA	2PC	85-87	101	6650 (14,670)	2.71 (8.9)	7634 (16,830) 4.1 (2.5)	6225 (13,725) 5.0 (3.1)	5306 (11,700) 5.7 (3.5)	4531 (9990) 6.5 (4.0)	3888 (8573) 7.6 (4.7)					
D4E SA	7PB 2CB	04-09 84-91	97	7600 (16,760)	2.71 (8.9)	5901 (13,102) 3.4 (2.1)	5148 (11,349) 4.6 (2.8)	5833 (12,859) 5.5 (3.5)	5002 (11,027) 6.4 (4.0)	4433 (9773) 8.3 (5.1)					
D6D SR	7XF	89-91	140	15 200 (33,500)	2.87 (9.5)	14 358 (31,645) 2.0 (1.2)	12 429 (27,394) 2.9 (1.8)	11 721 (25,833) 4.1 (2.5)	7067 (15,578) 6.6 (4.0)	6096 (13,436) 7.4 (4.6)	4931 (10,868) 8.9 (5.5)				
D6D SA 123-161kW (165-215HP)	36C	83-91	165	14 500 (32,000)	2.87 (9.5)	10 090 (22,243) 4.5 (2.8)	8510 (18,744) 5.3 (3.3)	9210 (20,287) 6.1 (3.8)	7789 (17,156) 7.1 (4.4)	6732 (14,828) 8.2 (5.1)	5456 (12,017) 9.8 (6.1)				
D6D SA 123-179kW (165-240HP)	19B	83-91	165	14 500 (32,000)	2.87 (9.5)	10 098 (22,243) 4.5 (2.8)	8510 (18,744) 5.3 (3.3)	7161 (15,817) 6.1 (3.8)	8732 (19,234) 7.1 (4.4)	7560 (16,651) 8.2 (5.1)	6144 (13,532) 9.8 (6.1)				
D7G SA std. trans			250	18,462 (40,700)	3.2 (10.5)	19 101 (42,110) 3.5 (2.2)	13 622 (30,030) 4.8 (3.0)	11 356 (25,040) 5.6 (3.5)	10 015 (22,080) 6.4 (4.0)	8627 (19,020) 7.2 (4.5)	7584 (16,720) 8.2 (5.1)				
D7G SA sep. trans. 168-186kW (225-250HP)		77-86	250	18,462 (40,700)	3.2 (10.5)	16 990 (37,424) 3.5 (2.2)	12 090 (26,631) 4.8 (3.0)	11 356 (25,040) 5.6 (3.5)	10 015 (22,080) 6.4 (4.0)	8627 (19,020) 7.2 (4.5)	7584 (16,720) 8.2 (5.1)				

NOTE: Drawbar pull figures for the Challenger 65 is at max. power as found in University of Nebraska Tractor Test no. 1258. This test was performed on concrete. Therefore, useable drawbar pull may be less depending upon soil conditions.
*Drawbar pull figures for SA and SR models are max. at lug

16



MOTOR GRADERS

Model	Product Ident. No. Prefix*	Years Built	Horse-power, Rated	Approx. Ship Wt.** kg (lb)	Wheel-base m (ft)	Length m (ft)	Width m (ft)	Mold-board Length m (ft)	Turning Radius m (ft)	Controls	Maximum Speed km/h (mph) Forward	Maximum Speed km/h (mph) Rev.
212TD	79C	54-57	50	6030 (13,290)	5.03 (16'6")	6.68 (21'11")	2.07 (6'10")	3.05 (10'0")	11.10 (36'5")	Mech.	18.1 (11.2)	4.2 (2.6)
112	3U	47-59	70	8770 (19,330)	5.72 (18'9")	7.59 (24'11")	2.39 (7'10")	3.66 (12'0")	10.87 (35'8")	Mech.	25.7 (16.0)	6.4 (4.0)
112	61C	55-50	75	9435 (20,805)	5.72 (18'9")	7.59 (24'11")	2.39 (7'10")	3.66 (12'0")	10.74 (35'3")	Mech.	25.7 (16.0)	6.4 (4.0)
112	82F	60-64	100	9600 (21,020)	5.72 (18'9")	7.62 (25'0")	2.36 (7'9")	3.66 (12'0")	10.80 (35'5")	Mech.	29.3 (18.2)	9.3 (5.8)
112F	46D	64-68	100	9800 (21,600)	5.72 (18'9")	7.82 (25'8")	2.36 (7'9")	3.66 (12'0")	10.70 (35'3")	Mech.	29.9 (18.6)	9.7 (6.0)
112F	89J	68-74	100	9800 (21,600)	5.72 (18'9")	7.82 (25'8")	2.36 (7'9")	3.66 (12'0")	10.74 (35'3")	Mech.	29.9 (18.6)	9.7 (6.0)
120	89G	64-67	115	10 480 (23,100)	5.71 (18'9")	7.62 (25'0")	2.36 (7'9")	3.66 (12'0")	10.74 (35'3")	Mech	32.2 (20.0)	10.3 (6.4)
120	14K	67-69	125	10 600 (23,500)	5.71 (18'9")	7.80 (25'8")	2.36 (7'9")	3.66 (12'0")	10.74 (35'3")	Mech.	32.2 (20.0)	41.5 (25.8)
120	10R	69-74	125	10 700 (23,700)	5.85 (19'2")	7.95 (26'1")	2.36 (7'9")	3.66 (12'0")	10.90 (35'9")	Mech.	32.2 (20.0)	6.6 (4.1)
120	13U	71-74	125	11 000 (24,300)	5.85 (19'2")	7.95 (26'1")	2.36 (7'9")	3.66 (12'0")	10.90 (35'9")	Mech.	32.2 (20.0)	6.6 (4.1)
120B	64U	72-89	125	12 000 (26,460)	5.85 (19'2")	7.92 (26'0")	2.36 (7'9")	3.66 (12'0")	10.90 (35'9")	Mech.	35.4 (22.0)	23.8 (14.8)
12	6M	39-42	68	9440 (20,820)	5.72 (18'9")	7.62 (25'0")	2.39 (7'10")	3.66 (12'0")	10.87 (35'8")	Mech.	24.5 (15.2)	6.1 (3.8)
12	9K	38-45	70	9600 (21,140)	5.72 (18'9")	7.62 (25'0")	2.39 (7'10")	3.66 (12'0")	10.87 (35'8")	Mech.	24.5 (15.2)	6.1 (3.8)
12	7T	45-47	75	9750 (21,500)	5.72 (18'9")	7.62 (25'0")	2.39 (7'10")	3.66 (12'0")	10.87 (35'8")	Mech.	24.5 (15.2)	6.1 (3.8)
12	8T	47-55	100	10 100 (22,375)	5.72 (18'9")	7.62 (25'0")	2.39 (7'10")	3.66 (12'0")	10.87 (35'8")	Mech.	31.1 (19.3)	6.6 (4.1)
12	70D-71D & 80C	55-59	115	10 200 (22,410)	5.72 (18'9")	7.62 (25'0")	2.37 (7'10")	3.66 (12'0")	10.87 (35'8")	Mech.	31.1 (19.3)	10.1 (6.3)
12E	99E	59-65	115	11 100 (24,400)	5.72 (18'9")	8.03 (26'4")	2.36 (7'9")	3.66 (12'0")	10.90 (35'9")	Mech.	32.0 (19.9)	22.2 (13.8)
12F	73G	65-67	115	12 973 (24,600)	6.0 (19'8")	8.20 (26'10")	2.36 (7'9")	3.66 (12'0")	11.40 (37'5")	Hyd. Mech.	32.0 (19.9)	22.2 (13.8)
12F	13K	67-73	125	12 973 (28,600)	6.0 (19'8")	8.20 (26'10")	2.36 (7'9")	3.65 (12'0")	11.40 (37'5")	Hyd. Mech.	34.3 (21.3)	41.5 (25.8)
140	11R	70-74	150	13 109 (28,900)	5.84 (19'2")	7.95 (26'1")	2.44 (8'0")	3.66 (12'0")	10.97 (36'0")	Mech.	38.8 (24.1)	47.0 (29.2)
140H	32C 99X	79-80	150	13 620 (30,003)	6.14 (20'2")	8.07 (26'5")	2.39 (7'10")	3.96 (13'0")	11.60 (38'0")	Mech.	37.6 (23.4)	25.6 (15.9)
14B	78E & 64C	58-58	150	13 300 (29,280)	5.84 (19'2")	8.03 (26'4")	2.44 (8'0")	3.66 (12'0")	10.97 (36'0")	Mech.	34.8 (21.6)	11.3 (7.0)
14C	36F	59-61	150	12 973 (28,600)	5.84 (19'2")	8.03 (26'4")	2.44 (8'0")	3.66 (12'0")	10.97 (36'0")	Mech.	34.8 (21.6)	11.3 (7.0)
14D	90F	61-65	150	13 700 (30,300)	6.15 (20'2")	8.33 (27'4")	2.44 (8'0")	3.96 (13'0")	11.58 (38'0")	Mech.	34.1 (21.2)	23.6 (14.6)
14E	99G	65-68	150	13 699 (30,200)	6.15 (20'2")	8.33 (27'4")	2.44 (8'0")	3.96 (13'0")	11.58 (38'0")	Hyd. Mech.	36.4 (22.6)	24.9 (15.5)
14E	12K	68-73	150	14 300 (31,600)	6.10 (20'2")	8.30 (27'4")	2.44 (8'0")	3.96 (13'0")	11.60 (38'0")	Hyd. Mech.	39.1 (24.3)	47.3 (29.4)
16	49G	63-73	225	22 499 (49,600)	6.86 (22'6")	9.50 (31'2")	3.00 (9'10")	4.27 (14'0")	13.56 (44'6")	Hyd. Mech.	49.7 (30.9)	49.7 (30.9)

*U.S. built machines

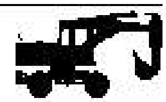
**Without cab

HYDRAULIC EXCAVATORS (Track)

Model	Product Ident. No. Prefix COSA (US)	Years Built	Flywheel Horsepower	Approx. Operating Weight kg (lb)	Track Gauge m (ft)	Height* m (ft)	Length* m (ft)	Width m (ft)	Max. Reach** m (ft)	Lift Capacity*** kg (lb)
213 LC	3ZC	83-86	102	17 300 (38,140)	2.08 (6'10")	3.08 (10'1")	8.34 (27'4")	2.49 (8'2")	10.30 (33'9.5")	5127 (11,305)
215	96L 57Z (14Z)	76-80 79-84	85 90	17 450 (38,480)	1.92 (6'4")	3.10 (10'1")	8.94 (29'4")	2.47 (8'0")	9.25 (30'4")	5090 (11,200)
215 SA	57Y (14Z)	82-84	90	19 440 (42,860)	2.18 (7'2")	3.22 (10'6")	8.94 (29'4")	2.73 (8'11")	9.23 (30'3")	5130 (11,300)
215B LC	9YB	84-87	105	18 510 (40,806)	1.92 (6'4")	3.10 (10'2")	8.94 (29'4")	2.44 (8'0")	9.25 (30'4")	5760 (12,700)
215C LC	(9YB)	84-87	115	19 570 (43,150)	1.92 (6'4")	3.1 (10'2")	8.94 (29'4")	2.42 (7'11")	9.29 (30'6")	7070 (15,200)
215C LC	(4HG)	87-89	115	19 570 (43,150)	1.92 (6'4")	3.1 (10'2")	8.94 (29'4")	2.42 (7'11")	9.29 (30'6")	7070 (15,200)
219	(6CF)	87-89	130	21 120 (46,560)	2.18 (7'2")	3.12 (10'3")	8.94 (29'4")	2.73 (8'11")	10.390 (34'1")	7080 (15,300)
219 LC	(6CH)	87-89	130	22 020 (48,560)	2.18 (7'2")	3.12 (10'3")	8.94 (29'4")	2.73 (8'11")	10.390 (34'1")	7080 (15,300)
225LC	(51U)	72-88	136	23 900 (52,700)	2.64 (8'8")	3.17 (10'6")	9.83 (32'3")	2.99 (9'10")	9.58 (31'6")	7300 (16,600)
225 SA	(51U)	77-88	136	27 126 (59,800)	2.64 (8'8")	3.17 (10'6")	9.83 (32'3")	3.35 (11')	9.55 (31'4")	7340 (15,700)
225B	(2ZD)	86-89	145	24 960 (55,030)	2.44 (8'0")	3.170 (10'5")	9.830 (32'3")	2.990 (9'10")	10.16 (33'4")	11 040 (26,100)
225B	(3YD)	87-89	145	24 960 (55,030)	2.44 (8'0")	3.170 (10'5")	9.830 (32'3")	2.990 (9'10")	10.16 (33'4")	11 040 (26,100)
225B LC	(2ZD)	86-89	145	26 140 (58,230)	2.44 (8'0")	3.170 (10'5")	9.830 (32'3")	2.990 (9'10")	10.16 (33'4")	11 040 (26,100)
225B LC	(3YD)	87-89	145	26 140 (58,230)	2.44 (8'0")	3.170 (10'5")	9.830 (32'3")	2.990 (9'10")	10.16 (33'4")	11 040 (26,100)
229	(1GF)	86-89	145	29 140 (64,830)	2.64 (8'8")	3.380 (11'1")	9.830 (32'3")	3.45 (11'4")	10.11 (33'2")	—
229	(1AF)	86-89	145	29 140 (64,830)	2.64 (8'8")	3.380 (11'1")	9.830 (32'3")	3.45 (11'4")	10.11 (33'2")	—
229 LC Custom 180	(1GF)	86-89	180	33 540 (73,940)	2.64 (8'8")	3.380 (11'1")	11.020 (36'2")	3.45 (11'4")	11.36 (37'3")	7940 (17,100)
229 LC Custom 180	(1AF)	86-89	180	33 540 (73,940)	2.64 (8'8")	3.380 (11'1")	11.020 (36'2")	3.45 (11'4")	11.36 (37'3")	7940 (17,100)
235 (64R)	(32K)	73-86	195	39 320 (86,700)	2.69 (8'10")	3.40 (11'2")	11.27 (37'0")	3.45 (11'4")	11.23 (36'10")	7050 (17,300)
235B	(7WC) 9PC	86-88	215	40 960 (89,700)	2.69 (8'10")	3.40 (11'2")	11.27 (37'0")	3.45 (11'4")	11.23 (36'10")	8934 (21,900)
245	(82X) 84X	74-88	325	65 745 (144,941)	3.24 (10'7")	4.62 (15'2")	13.18 (43'3")	3.71 (12'2")	14.02 (46'0")	14 930 (32,920)

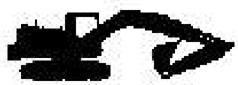
*When shipped with medium stick and bucket curled under
**Maximum reach at ground level, one-piece boom, longest stick
***Lift capacity at 4.6 m (15') over front, one-piece boom, longest stick.

16



HYDRAULIC EXCAVATORS (Wheel)

Model	Product Ident. No. Prefix (USA)	Years Built	Flywheel Horsepower	Approx. Operating Weight kg (lb)	Height* m (ft)	Length* m (ft)	Width m (ft)	Max. Reach** m (ft)	Lift Capacity*** kg (lb)	Standard Tire Size
206	(2RC) (3CC)	84-89	Deutz-67 Perkins-71	12 185 (26,863)	3.11 (10'2")	7.38 (24'2.5")	2.40 (7'10")	8.14 (26'9")	3360 (7,400)	Dual 9.00-20 12PR
212	(3JC) (5DC)	84-89	Deutz-84 Perkins-94	13 700 (30,423)	3.15 (10'4")	8.00 (25'3")	2.49 (8'2")	9.86 (32'4")	3850 (8,490)	Dual 10.00-20 12PR
214	(9MB) (1KB)	84 89	Deutz-101 Perkins 102	15 600 (34,175)	3.08 (10'0")	8.28 (27'2")	2 49 (8'2")			Dual 10.00-20 12PR
224	(2JC) (5TC)	84-89	Deutz-143 Perkins-124	19 000 (41,890)	3.42 (11'3")	8.98 (29'6")	2.48 (8'2")	10.61 (34'10")	4800 (10,600)	Dual 10.00-20 12PR



HYDRAULIC EXCAVATORS (Track)

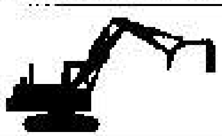
Model	Product Ident. No. Prefix COSA (US)	Years Built	Flywheel Horsepower	Approx. Operating Weight kg (lb)	Track Gauge m (ft)	Height* m (ft)	Length* m (ft)	Width m (ft)	Reach** m (ft)	Capacity*** kg (lb)
206LC	(3HC) (4DC)	84 88	Deutz-87 Perkins-71	13 136 (28,957)	1.896 (6'2.5")	3.00 (9'10")	7.30 (23'11")	2.40 (7'10")	8.17 (26'10")	3290 (7,300)
205B	52F	80-92	80	12 900 (28,443)	1.885 (6'2.5")	2.976 (9'9")	7.67 (25'2")	2.485 (8'2")	8.9 (29'2")	3740 (8250)
211LC	(4EC) (5CC)	84-89	Deutz-84 Perkins-94	15 540 (34,260)	2.06 (6'9.9")	3.02 (9'11")	8.01 (26'3")	2.49 (8'2")	9.88 (32'5")	4240 (9,340)
E70	3GB	87-89	52	6500 (14,300)	1.65 (5'5")	2.59 (8'6")	6.02 (19'9")	2.25 (7'5")	6.67 (21'10")	1300 (2,750)
E70	3CG	87-89	52	6500 (14,300)	1.65 (5'5")	2.59 (8'6")	6.02 (19'8")	2.25 (7'5")	6.67 (21'10")	1300 (2,750)
E110	3FG	87-89	74	10 700 (23,600)	1.9 (6'3")	2.73 (8'11")	7.345 (24'0")	2.5 (8'2")	7.93 (26'0")	2700 (5,750)
E110	3GG	87-89	74	10 700 (23,600)	1.9 (6'3")	2.73 (8'11")	7.345 (24'1")	2.5 (8'2")	7.93 (26'0")	2700 (5,750)
E120	1LF(OSJ)	87-89	84	12 200 (26,800)	1.99 (6'6")	2.775 (9'1")	7.66 (25'1")	2.490 (8'2")	8.58 (28'2")	3850 (8,300)
E120	1MF(JPN)	87-89	84	12 200 (26,800)	1.99 (6'6")	2.775 (9'1")	7.66 (25'1")	2.490 (8'2")	8.58 (28'2")	3850 (8,300)
E200B	6KF(OSJ)	87-91	118	18 800 (41,400)	2.20 (7'3")	2.97 (9'9")	9.48 (31'1")	2.83 (9'4")	10.63 (34'10")	8100 (17,350)
E200B	4SG(JPN)	87-91	118	18 800 (41,400)	2.20 (7'3")	2.97 (9'9")	9.48 (31'1")	2.83 (9'4")	10.63 (34'10")	8100 (17,350)
EL200B	7DF(OSJ)	87-91	118	20 100 (44,300)	2.38 (7'10")	2.97 (9'9")	9.48 (31'1")	3.18 (10'5")	10.63 (34'10")	8150 (17,800)
EL200B	5EG(JPN)	87-91	118	20 100 (44,300)	2.38 (7'10")	2.97 (9'9")	9.48 (31'1")	3.18 (10'5")	10.63 (34'10")	8150 (17,800)
E240	1FG(OSJ)	87-89	148	23 000 (50,700)	2.39 (7'10")	3.02 (9'11")	9.73 (31'11")	3.19 (10'6")	10.6 (34'9")	9800 (21,600)
E240	2HF(JPN)	87-89	148	23 000 (50,700)	2.39 (7'10")	3.02 (9'11")	9.73 (31'11")	3.19 (10'6")	10.6 (34'9")	9800 (21,600)
EL240	4JF(OSJ)	87-89	148	23 600 (52,000)	2.58 (8'6")	3.02 (9'11")	9.73 (31'11")	3.38 (11'1")	10.6 (34'9")	11 300 (24,300)
EL240	4MH(JPN)	87 89	148	23 600 (52,000)	2.58 (8'6")	3.02 (9'11")	9.73 (31'11")	3.38 (11'1")	10.6 (34'9")	11 300 (24,300)

*When shipped with medium stick and bucket curled under.
**Maximum reach at ground level, one-piece boom, longest stick.
***Lift capacity at 4.6 m (15') over front, one-piece boom, longest stick.

Hydraulic Excavators (Track) (cont'd)

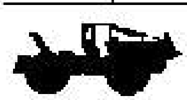
Model	Product Ident. No. Prefix COSA (US)	Years Built	Flywheel Horsepower	Approx. Operating Weight kg (lb)	Track Gauge m (ft)	Height* m (ft)	Length* m (ft)	Width m (ft)	Reach** m (ft)	Capacity*** kg (lb)
E300	2CF(OSJ)	87-89	187	30 500 (67,300)	2.6 (8'6")	3.22 (10'7")	10.94 (35'11")	3.4 (11'2")	11.84 (38'9")	12 550 (27,650)
E300	1KG(JPN)	87-89	187	30 500 (67,300)	2.6 (8'6")	3.22 (10'7")	10.94 (35'11")	3.4 (11'2")	11.84 (38'9")	12 550 (27,650)
E300B	1WJ(OSJ)	90-91	206	30 200 (66,580)	2.6 (8'6")	3.22 (10'7")	10.94 (35'11")	3.4 (11'2")	11.84 (38'9")	12 450 (26,850)
E300B	2HJ(JPN)	90-91	206	30 200 (66,580)	2.6 (8'6")	3.22 (10'7")	10.94 (35'11")	3.4 (11'2")	11.84 (38'9")	12 450 (26,850)
EL300	4NF(OSJ)	87-89	187	31 600 (69,700)	2.6 (8'6")	3.22 (10'7")	10.94 (35'11")	3.4 (11'2")	11.84 (38'9")	12 550 (27,650)
EL300	4SF(JPN)	87-89	187	31 600 (69,700)	2.6 (8'6")	3.22 (10'7")	10.94 (35'11")	3.4 (11'2")	11.84 (38'9")	12 650 (27,650)
EL300B	3FJ(OSJ)	90-91	206	31 200 (68,780)	2.6 (8'6")	3.22 (10'7")	10.94 (35'11")	3.4 (11'2")	11.84 (38'9")	12 450 (26,850)
EL300B	1CK(JPN)	90-91	206	31 200 (68,780)	2.6 (8'6")	3.22 (10'7")	10.94 (35'11")	3.4 (11'2")	11.84 (38'9")	12 450 (26,850)

*When equipped with medium stick and bucket curled under.
**Maximum reach at ground level, one piece boom, longest stick.
***Lift capacity at 4.6 m (15') over front, one-piece boom, longest stick.



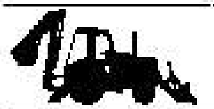
LOGGING AND FOREST PRODUCT MACHINES

Model	Product Ident. No. Prefix	Year Built	Flywheel Horsepower	Overall Track Length m (ft)	Overall Length m (ft)	Overall Width m (ft)	Operating Weight kg (lb)
FB221	8XD	1986	197	4.47 (14'8")	9.78 (32'1")	3.20 (10'6")	28 180 (62,000)
DL221	8YD	1987	132	4.47 (14'8")	—	—	22 816 (50,300)
LL218	8JD	1986	128	—	10.70 to 11.23 (35'1" to 36'10")	2.64 (8'8")	17 577 (38,750)
LL228	8MD	1986	176	—	9.7 to 11.6 (32' to 38')	2.62 (8'7")	30 391 (67,000)
LL231	8PD	1986	235	5.03 (16'6")	10.6 to 11.6 (35' to 38')	3.56 (11'8")	39 146 (86,300)



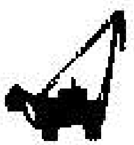
SKIDDERS

Model	Product Ident. No. Prefix	Year Built	Flywheel Horsepower kW (HP)	Operating Weight kg (lb)	Ground Clearance mm (in)	Wheel Base m (ft/in)
508 cable	9NC	87-89	71 (95)	7770 (17,130)	521 (20.5)	2.8 (9'2")
508 grapple	2HD	87-89	71 (95)	8766 (19,308)	521 (20.5)	2.8 (9'2")
518FB	8ZC	86-89	96 (130)	11 612 (25,600)	587 (23.1)	3.25 (10'8")



BACKHOE LOADERS

Model	Product Ident. No. Prefix	Year Built	Flywheel Horsepower kW (HP)	Operating Weight kg (lb)	Digging Depth mm (ft/in)	GP Bucket Capacity m³ (yd³)	MP Bucket Capacity m³ (yd³)
416	5PC	85-90	46 (62)	6156 (13,700)	5636 (18'6")	0.76 (1.0)	0.76 (1.0)
416 Series II	5PC	90-92	46 (62)	6217 (13,700)	5636 (18'6")	0.76 (1.0)	0.76 (1.0)
426	7BC	86-90	52 (70)	6549 (14,626)	6004 (19'8")	0.96 (1.25)	0.76 (1.0)
426 Series II	7BC	90-92	52 (70)	7315 (16,126)	4973 (16'4")	0.96 (1.25)	0.76 (1.0)
428	6TC	86-90	57 (76)	6963 (15,350)	6021 (19'9")	1.0 (1.38)	0.92 (1.12)
428 Series II	6TC	90-92	57 (76)	7143 (15,750)	6000 (19'8")	1.0 (1.375)	0.92 (1.2)
436	5KF	88-90	57 (77)	6831 (15,168)	6023 (19'9")	1.0 (1.38)	0.76 (1.0)
436 Series II	5KF	90-92	57 (77)	6878 (15,168)	6023 (19'9")	1.0 (1.375)	0.76 (1.0)
438	3DJ	88-90	61.6 (83)	7900 (17,420)	6060 (19'10")	1.0 (1.38)	0.92 (1.20)
438 Series II	3DJ	90-92	62 (83)	7364 (16,237)	6063 (19'10")	1.0 (1.375)	0.92 (1.2)

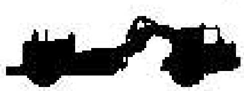


PIPELAYERS

Model	Tractor Product Ident. No. Prefix	Years Built	Engine HP	Approx. Weight kg (lb)	Counter-weight kg (lb)	Max. Lift Capacity 1.2 m (4') Overhang kg (lb)	Speed Range km/h (mph)		Ground Clearance mm (in)	Ground Contact m² (sq. in.)
							Forward	Reverse		
MD6	9U/39C	52-57	93	12 375 (27,520)	1590 (3,500)	12 035 (26,530)	2.7—10.6 (1.7—6.6)	3.2—10.0 (2.0—6.2)	321 (13")	1.77 (2744)
561H	62A	59-66	90	14 560 (32,100)	2270 (5,000)	17 500 (38,800)	2.7—10.8 (1.7—6.8)	1.8—9.9 (2.0—6.2)	267 (11")	2.02 (3130)
561B	62A	66-67	93	14 350 (31,637)	2270 (5,000)	17 600 (38,800)	2.7—10.8 (1.7—6.8)	3.4—10.3 (2.1—6.4)	267 (11")	2.02 (3130)
561C	65H	66-67	93	14 700 (32,500)	2450 (5,400)	18 000 (40,000)	2.7—11.1 (1.7—6.9)	3.4—10.1 (2.1—6.3)	395 (15")	2.02 (3130)
561C	92J	67-77	105	14 700 (32,500)	2450 (5,400)	18 100 (40,000)	2.7—11.1 (1.7—6.9)	3.4—10.1 (2.1—6.3)	395 (15")	2.02 (3130)
561D	54X	78-89	105	15 800 (35,000)	2990 (6,600)	18 100 (40,000)	3.5—10.1 (2.2—6.3)	4.2—12.2 (2.6—7.6)	396 (16")	2.02 (3130)
571E PS	64A	61-67	180	22 680 (50,000)	2360 (5,200)	27 480 (60,600)	3.7—10.3 (2.3—6.4)	4.3—12.1 (2.7—7.5)	400 (16")	3.04 (4710)
571E PS	64A	66-72	180	23 100 (51,000)	2360 (5,200)	27 500 (60,600)	3.7—10.1 (2.3—6.3)	4.3—11.9 (2.7—7.4)	400 (16")	3.04 (4710)
571F	95N	72-74	180	22 800 (50,300)	4350 (9,600)	27 500 (60,600)	3.5—9.7 (2.2—6.0)	4.2—11.4 (2.6—7.1)	400 (16")	3.04 (4710)

Pipelayers (cont'd)

Model	Tractor Product Ident. No. Prefix	Years Built	Engine HP	Approx. Weight kg (lb)	Counter-weight kg (lb)	Max. Lift Capacity 1.2 m (4') Overhang kg (lb)	Speed Range km/h (mph) Forward	Speed Range km/h (mph) Reverse	Ground Clearance mm (in)	Ground Contact m² (sq. in.)
MD7	17A	51-57	140	16,200 (35,815)	3400 (7,500)	24 585 (54,200)	2.4—9.5 (1.5—5.9)	2.9—8.7 (1.8—5.4)	394 (16")	3.12 (4840)
572C	21A	57-61	128	26 200 (57,820)	4720 (10,405)	39 000 (86,000)	3.2—7.7 (2.0—4.8)	3.9—6.1 (2.4—3.8)	483 (19")	3.30 (5109)
572D	21A	59	140	26 500 (58,520)	4940 (10,900)	39 000 (86,000)	4.2—9.7 (2.6—6.0)	4.8—7.7 (3.0—4.8)	483 (19")	3.30 (5109)
572E PS	65A	61-69	180	28 000 (62,000)	6000 (13,000)	40 800 (90,000)	3.7—10.1 (2.3—6.3)	4.3—11.9 (2.7—7.4)	480 (19")	3.45 (5345)
572F PS	96N	70-74	180	27 600 (61,000)	6440 (14,200)	40 800 (90,000)	3.5—9.7 (2.2—6.0)	4.2—11.4 (2.6—7.1)	480 (19")	3.45 (5345)
583C	16A	55-56	190	35 440 (78,132)	8470 (18,676)	58 970 (130,000)	3.9—8.7 (2.4—5.4)	3.9—8.7 (2.4—5.4)	533 (21")	4.24 (6580)
583H TC	38A	59-60	235	38 000 (83,840)	9030 (19,900)	62 140 (137,000)	4.5—10.3 (2.8—6.4)	4.5—10.3 (2.8—6.4)	537 (22")	4.66 (7220)
583H PS	61A	60-74	191	35 600 (78,500)	8470 (18,676)	58 970 (130,000)	3.9—8.7 (2.4—5.4)	3.9—8.7 (2.4—5.4)	533 (21")	4.55 (7050)
583H PS	61A	60-67	225	38 200 (84,270)	9000 (19,900)	62 140 (137,000)	4.1—11.1 (2.5—6.9)	4.6—12.8 (6.9—8.0)	537 (22")	4.66 (7220)
583H PS	61A	61	235	38 900 (85,720)	10 400 (22,880)	62 140 (137,000)	3.9—10.1 (2.4—6.3)	4.8—12.6 (3.0—7.8)	537 (22")	4.66 (7220)
583H	61A	74	270	40 600 (89,600)	10 300 (22,700)	63 500 (140,000)	3.9—10.5 (2.4—6.5)	4.8—13.0 (3.0—8.1)	533 (21")	4.65 (7220)
583K	78V	74-88	300	40 960 (90,300)	7840 (17,290)	63 500 (140,000)	4.0—10.8 (2.5—6.8)	5.0—13.5 (3.1—8.4)	530 (21")	4.66 (7220)
591			388	89 630 (197,000)	10 400 (24,000)	158 760 (350,000)	3.9—11.9 (2.4—7.4)	4.6—13.8 (2.9—8.6)	649 (25.5")	8.64 (13,390.9)
594	62H	74	385	55 400 (122,000)	12 600 (27,800)	90 700 (200,000)	3.9—10.5 (2.4—6.5)	4.8—12.7 (3.0—7.9)	640 (25")	5.72 (8865)
594H	96V	74-82	410	56 065 (123,600)	12 555 (27,680)	90 700 (200,000)	4.0—10.8 (2.5—6.7)	5.0—13.2 (3.1—8.2)	630 (25")	6.48 (10,050)



WHEEL TRACTOR-SCRAPERS

Model	Product Ident. No. Prefix	Years Built	Horse-power Max/ Rated	Capacity Struck/ Heaped m³ (yd³)	Approx. Shipping Weight kg (lb)	Dimensions m (ft) Length	Dimensions m (ft) Width	Dimensions m (ft) Height	Dimensions m (ft) Width of Tread	Tire Size (Standard) & ply rating Tractor & Scraper	Approx. % Weight on Drivers Loaded/ Empty	Turning Circle m (ft)
DW10 Tractor	1N	41-46	100/*	—	6550 (14,350)	4.57 (15'0")	2.24 (7'4")	1.93 (6'4")	1.73 (5'8")	10.0×20-12 18.0×24-16	—	—
DW10 Tractor	6V	46-47	100/*	—	6850 (15,100)	4.57 (15'0")	2.24 (7'4")	1.93 (6'4")	1.73 (5'8")	10.0×20-12 18.0×24-16	—	—
DW10 Tractor	1V	47-53	115/*	—	7540 (16,610)	4.70 (15'5")	2.34 (7'8")	1.93 (6'4")	1.79 (5'10")	12.0×20-14 21.0×25-20	—	—
DW10 & No. 10 Scraper	1V 3C	47-51	115/*	6.7/8.4 (8.7/11)	15 980 (35,240)	11.23 (37'0")	3.02 (9'11")	2.69 (8'10")	1.88 (6'2")	12.0×20-14 21.0×25-20	39/44	7.92 (26'0")
DW10 & No. 10 Scraper	1V 19C	52-53	115/*	5.3/6.9 (7/9)	15 190 (33,365)	10.72 (35'2")	2.87 (9'5")	2.36 (7'9")	1.80 (5'11") Scraper —	12.0×20-14 21.0×25-20 18.0×21-20	42/46	11.28 (37'0")

*Maximum HP only available

Wheel Tractor-Scrapers (cont'd)

Model	Product Ident. No. Prefix	Years Built	Horse-power Max/ Rated	Capacity Struck/ Heaped m³ (yd³)	Approx. Shipping Weight kg (lb)	Dimensions m (ft) Length	Width	Height	Width of Tread	Tire Size (Standard) & ply rating Tractor & Scraper	Approx. % Weight on Drivers Loaded/ Empty	Turning Circle m (ft)
DW15 & No. 10 Scraper	45C 19C	54-55	/150	5.3/6.9 (7/9)	15 960 (35,180)	11.10 (36'5")	2.87 (9'5")	2.36 (7'9")	1.80 (5'11") Scraper —	12.0 x 20-14 21.0 x 25-20 16.0 x 21-20	42/48	10.36 (34'0")
DW15 & No. 16 Scraper	45C 4W	54-55	/150	7.7/9.2 (10/12)	9400 (20,720)	11.84 (38'10")	3.18 (10'5")	2.69 (8'10")	1.93 (6'4")	12.0 x 20-14 21.0 x 25-20	40/42	11.23 (37'0")
DW15 Tractor	45C	54-55	/150	—	9510 (20,960)	5.08 (16'8")	2.39 (7'10")	2.69 (8'10")	1.98 (6'6")	12.0 x 20-14 21.0 x 25-20	—	—
DW15C & No. 15 Scraper	58C or 70C	55-57	186/*	7.7/9.5 (10/12.5)	19 220 (42,370)	11.84 (38'10")	3.18 (10'5")	2.69 (8'10")	1.98 (6'6")	12.0 x 12-14 21.0 x 25-20	40/42	10.36 (34'0")
DW15E & No. 428 Scraper	75D or 76D	57-59	200/172	10/14 (13/18)	20 280 (44,711)	12.22 (40'1")	3.30 (10'10")	3.05 (10'0")	1.98 (6'6")	12.0 x 20-14 26.5 x 25-20	37/41	—
DW15F & No. 428 Scraper	75D or 76D	58-59	200/172	10/14 (13/18)	20 280 (44,711)	12.22 (40'1")	3.30 (10'10")	3.05 (10'0")	1.98 (6'6")	12.0 x 20-14 26.5 x 25-20	37/41	—
DW20 & No. 20 Scraper	21C 11C	51-55	225/*	14/7.6 (18/23)	12 750 (28,100)	13.23 (43'5")	3.53 (11'7")	3.10 (10'2")	2.29 (7'6")	24.0 x 29-4	37/41	11.23 (37'0")
DW20 Tractor (For W20 Wagon)	6W	51-56	225/*	—	11 620 (25,610)	5.39 (17'8")	2.79 (8'2")	2.41 (7'11")	2.18 (7'2")	14.0 x 24-16 24.0 x 29-24		
DW20E & No. 456 Scraper	57C 67C	55-57	300/*	14/19 (18/25)	26 040 (57,400)	13.36 (43'10")	3.58 (11'9")	3.45 (11'4")	2.24 (7'4")	14.0 x 24-16 29.5 x 29-22	34/42	11.58 (38'0")
DW20F & No. 456 Scraper	87E 88E	58-60	320/*	14/19 (18/25)	26 870 (59,240)	13.36 (43'10")	3.58 (11'9")	3.45 (11'4")	2.24 (7'4")	14.0 x 24-16 29.5 x 29-22	38/42	11.58 (38'0")
DW20G & No. 456 Scraper	87E 88E	58-60	345/*	15/21 (19.5/27)	27 200 (59,960)	13.36 (43'10")	3.58 (11'9")	3.45 (11'4")	2.24 (7'4")	14.0 x 24-16 29.5 x 29-28	38/42	11.58 (38'0")
DW20G & No. 482 Scraper	87E 88E	58-60	345/*	18.6/26 (24/34)	31 070 (68,500)	14.05 (46'1")	3.91 (12'10")	3.81 (12'6")	2.39 (7'10")	14.0 x 24-16 29.5 x 29-28	37/40	11.58 (38'0")
DW21 & No. 21 Scraper	8W 8	51-55	225/*	11.5/15 (15/20)	24 790 (54,650)	12.37 (40'7")	3.53 (11'7")	3.28 (10'9")	2.13 (7'0")	24.0 x 29-24	—	10.67 (35'0")
DW21C & No. 470 Scraper	58C 69C	55-58	300/*	14/19 (18/25)	26 610 (58,670)	12.67 (41'7")	3.58 (11'9")	3.35 (11'0")	2.24 (7'4")	29.5 x 29-22	46/33	11.00 (36'0")
DW21D & No. 470 Scraper	86F 86E	58-58	320/*	14/19 (18/25)	26 310 (58,010)	12.78 (41'11")	3.58 (11'9")	3.35 (11'0")	2.24 (7'4")	29.5 x 29-22	52/67	11.00 (36'0")
DW21G & No. 470 Scraper	85E 86E	58-60	345/*	14.9/20.6 (19.5/27)	27 210 (59,980)	12.78 (41'11")	3.58 (11'8")	3.48 (11'5")	2.24 (7'4")	29.5 x 29-28	52/67	11.00 (36'0")
613A	71M	69-76	/150	8.4 (11)	13 334 (29,395)	9.67 (31'9")	2.44 (8'0")	2.85 (9'4.5")	1.89 (6'2.5")	18.0 x 25-12	49/69	9.01 (29'6")
613B	38W	76-84	/150	8.4 (11)	14 155 (31,210)	9.78 (32'1")	2.44 (8'0")	2.85 (9'4.5")	1.89 (6'2.5")	18.0 x 25-12	49/64	8.94 (29'4")
615	46Z	81-87	/260	17 23 (18)	28 400 (61,580)	11.6 (38'1")	3.048 (10'0")	3.590 (11'8")	2.210 (7'3")	28.5-25, 26 PR (E-2)	65/35	9.63 (31'7")
619B DD DD	89E 90E	59-60	/225							Turbocharged, Electric start Turbocharged, Gas start		
619C PS DD	61F 62F	60-66	280/250	10.8/14 (14/18)	21 550 (47,500)	11.05 (36'3")	3.30 (10'11")	3.76 (12'2")	2.00 (6'7")	26.5 x 29-22	56/69	9.14 (30'0")
619**	43F	64-65	/250	15.3/12.6 (20/16.5)	27 400 (60,390)	11.89 (40'0")	3.60 (11'10")	3.45 (11'4")	2.30 (7'7")	26.5 x 29-26	53/65.8	10.20 (33'6")
621	43H	66-72	/300	16.5/ (21.5/—)	28 400 (62,600)	12.00 (39'5")	3.60 (11'10")	3.45 (11'4")	2.19 (7'3")	29.5 x 29-22	53/65	11.50 (37'8")
621	23H	65-74	/300	10.6/15.3 (14/20)	24 900 (55,000)	11.60 (38'1")	3.60 (11'7")	3.40 (11'2")	2.10 (6'10")	29.5 x 29-22	66	13.00 (42'6")
621B	45P	73-86	/330	10.7/15.3 (14/20)	30 205 (66,590)	12.7 (41'7")	3.45 (11'4")	3.63 (11'11")	2.21 (7'3")	29.5-29, 20 PR (E-3)	56/70	11.10 (36'6")

*Maximum HP only available
**Johnson Manufacturing Company built the J619 Elevating Scraper for Caterpillar in 1964.

Wheel Tractor-Scrapers (cont'd)

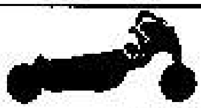
Model	Product Ident. No. Prefix	Years Built	Horsepower Max/ Rated	Capacity Struck/ Heaped m³ (yd³)	Approx. Shipping Weight kg (lb)	Dimensions m (ft) Length	Width	Height	Width of Tread	Tire Size (Standard) & ply rating Tractor & Scraper	Approx. % Weight on Drivers Loaded/ Empty	Turning Circle m (ft)
623	62U	72-74	/300	16.8 (22)	29 800 (66,000)	11.90 (39'0")	3.50 (11'7")	3.70 (12'1")	2.20 (7'3")	29.5 × 29 28	63	13.70 (44'11")
623E	6CB	86-88	1330	16.8 (22)	33 317 (73,450)	12.61 (41'4")	3.55 (11'8")	3.81 (12'6")	2.21 (7'3")	29.5-29 34 PR (E-2)	52/65	10.9 (35'9")
623B	46P	73-86	/330	16.8 (22)	32 546 (71,750)	12.5 (41'1")	3.55 (11'8")	3.81 (12'6")	2.18 (7'2")	29.5-29, 28 PR (E-2)	49/63	8.90 (29'4")
627	54K	68-74	/450	10.6/15.3 (14/20)	29 900 (66,000)	12.00 (38'8")	3.50 (11'7")	3.60 (11'8")	2.20 (7'3")	29.5 × 29-28	49	13.30 (43'9")
627B	14S	73-88	T/225 S/225	10.7/15.3 (14/20)	34 810 (76,300)	13.3 (43'8")	3.45 (11'4")	3.63 (11'11")	2.18 (7'2")	29.5-29, 28 PR (E-3)	49/59	11.10 (38'8")
627E	6EB	86-90	T/225 S/225	10.7/15.3 (14/20)	34 670 (76,435)	12.88 (42'3")	3.47 (11'4")	3.71 (12'2")	2.21 (7'3") 2.18 (7'2")	33.25-29 26 PR (E-3)	68/48	10.90 (35'9")
627B/PP	15S	73-86	T/225 S/225	/15.3 (20)	35 660 (78,620)	14.91 (48'11")	3.45 (11'4")	3.63 (11'11")	2.18 (7'2")	29.5-29, 28 PR (E-3)	51/60	11.1 (36'6")
627E/PP	6GB	86-89	T/225 S/225	10.7/15.3 (14/20)	36 130 (79,655)	12.89 (42'3")	3.47 (11'4")	3.71 (12'2")	2.21 (7'3") 2.18 (7'2")	33.25-29 26 PR (E-3)	60/49	10.90 (35'9")
630A & 482C Scraper	62F	60-62	420/335	21/27 (27/35)	35 830 (79,000)	14.63 (48'0")	3.91 (12'10")	4.01 (13'2")	2.39 (7'10") Scraper	16.0 × 25-16 29.5 × 35 28 33.5 × 33-28	37/42	11.89 (39'0")
630A	52F	60-62	420/335	16/21.4 (21/28)	31 430 (69,300)	13.82 (45'4")	3.58 (11'9")	3.73 (12'3")	2.21 (7'3")	16.0 × 25-16 29.5 × 35-28	39/45	11.89 (39'0")
630B	14G	62-63	420/335	16/23 (21/30)	33 520 (73,900)	14.12 (46'4")	3.81 (12'6")	3.71 (12'2")	2.41 (7'11")	16.0-25, 16 29.5-35, 28	39/42	13.36 (43'10")
630B	14G	63-66	400/360	16/23 (21/30)	33 570 (74,000)	14.30 (46'11")	3.81 (12'6")	3.94 (12'11")	2.41 (7'11")	16.0-25, 16 29.5-35, 34	37/42	13.36 (43'10")
630B	10G	62-69	/400	16/23 (21/30)	36 760 (78,800)	14.35 (47'1")	3.81 (12'6")	3.94 (12'11")	2.40 (7'10")	16.0-25, 16 29.5-35, 34	38/44	13.36 (43'10")
631A	51F	60-62	420/335	16/21.4 (21/28)	30 250 (66,700)	12.88 (42'3")	3.58 (11'9")	3.56 (11'8")	2.21 (7'3")	29.5-35, 28	54/68	11.00 (36'0")
631B	13C	62-62	420/335	16/23 (21/30)	31 620 (69,700)	13.05 (42'10")	3.81 (12'6")	3.45 (11'5")	2.39 (7'10")	29.5-35, 28	51/67	11.31 (37'5")
631B	13G	62-66	420/360	16/23 (21/30)	31 840 (70,200)	13.29 (43'7")	3.81 (12'6")	3.63 (11'11")	2.41 (7'11")	29.5-35, 34	51/67	11.31 (37'5")
631C	67M	69-75	/415	16/23 (21/30)	36 360 (80,150)	13.54 (44'5")	3.45 (11'4")	3.91 (12'10")	2.39 (7'10")	29.5-35, 34	53/69	11.45 (37'7")
631D	24W	75-85	450	16/23.7 (21/31)	42 370 (93,410)	14.26 (46'9")	3.96 (13')	4.17 (13'8")	2.46 (8'1")	33.25-35, 38 PR (E-3)	/69	12.2 (40'1")
631E	1AB	85-91	473/450	16.1/23.7 (21/31)	43 365 (95,600)	14.28 (46'10")	3.94 (12'11")	4.29 (14'1")	2.46 (8'1")	37.25-35, 30	53/67	12.2 (40'1")
632	14G	62-63	420/335	21.4/29 (28/38)	37 650 (83,000)	15.21 (49'11")	4.04 (13'3")	4.00 (13'1")	2.44 (8'0")	16.0-25, 16 29.5-35, 34	36/40	13.36 (43'10")
632	14G	63-66	420/360	21.4/29 (28/38)	39 420 (86,910)	15.30 (50'2")	4.04 (13'3")	4.00 (13'1")	2.44 (8'0")	16.0-25, 16 29.5-35, 34	41/62	13.36 (43'10")
633C	66M	68-75	/415	24.5 (32)	41 750 (92,050)	13.36 (43'10")	3.45 (11'4")	3.96 (13'0")	2.39 (7'10")	33.2-35, 32	53/67	11.78 (38'8")
633D	25W	75-85	450	26 (34)	47 570 (104,870)	14.40 (47'3")	3.96 (13')	4.24 (13'11")	2.46 (8'1")	33.25-35, 38 PR (E-3)	/67	12.4 (40'7")

16

Wheel Tractor-Scrapers (cont'd)

Model	Product Ident. No. Prefix	Years Built	Horse-power Max/ Rated	Capacity Struck/ Heaped m³ (yd³)	Approx. Shipping Weight kg (lb)	Dimensions m (ft) Length	Width	Height	Width of Tread	Tire Size (Standard) & ply rating Tractor & Scraper	Approx. % Weight on Drivers Loaded/ Empty	Turning Circle m (ft)
637	65M	70-75	*640	16/23 (21/30)	41 300 (91,050)	13.66 (44'9.5")	3.46 (11'4")	3.93 (12'11")	2.39 (7'10")	33.25-35, 32	51/62	11.68 (38'4")
637/PP	79P	70-75	*640	16/23 (21/30)	43 700 (96,350)	15.82 (51'11")	3.45 (11'4")	3.93 (12'11")	2.39 (7'10")	33.25-35, 32	51/63	11.68 (38'4")
637D	28W	75-85	450 S250	16.1/23.7 (21/31)	46 987 (103,590)	14.8 (48'8")	3.96 (13')	4.17 (13'8")	2.46 (8'1")	33.25-35, 38 PR (E-3)	50/61	12.2 (40'1")
637D/PP	27W	75-85	450 S250	16.1/23.7 (21/31)	48 531 (106,990)	14.8 (48'8")	3.96 (13')	4.17 (13'8")	2.46 (8'1")	33.25-35, 38 PR (E-3)	50/61	12.2 (40'1")
637E	1FB	85-91	473/450	16.1/23.7 (21/31)	49 940 (110,100)	14.28 (46'10")	3.94 (12'11")	4.29 (14'1")	2.46 (8'1")	37.25-35, 30	49/59	12.2 (40'1")
637E PP	1FB	85-91	473/450	16.1/23.7 (21/31)	51 485 (113,500)	15.88 (52'1")	3.94 (12'11")	4.29 (14'1")	2.46 (8'1")	37.25-35, 30	50/60	12.2 (40'1")
639D	99X	79-84	/450	26 (34)	55 030 (121,316)	14.53 (47'8")	3.96 (13'0")	4.06 (13'4")	2.46 (8'1")	37.25-35, 42 37.25-35, 42	51/59	12.4 (40'7")
641	64F	62-66	560/450	21.4/29 (28/38)	43 200 (95,300)	14.73 (48'4")	4.04 (13'3")	4.00 (13'1")	2.44 (8'0")	33.5-39, 38	51/66	12.68 (41'7")
641B	65K	69-81	/550	21.4/29 (28/38)	53 070 (117,000)	14.86 (49'1")	4.04 (13'3")	4.24 (13'11")	2.55 (8'4")	37.5-39, 36	54/69	13.00 (42'9")
650	63F	62-64	560/450	24.5/33.6 (32/44)	45 130 (99,500)	16.31 (53'6")	4.24 (13'11")	4.01 (13'2")	2.54 (8'4")S	18.0-25, 20 33.5-39, 32 37.5-39, 36	36/40	13.87 (45'6")
650B	22G	62-72	/550	24.5/33.6 (32/44)	46 100 (101,700)	17.00 (55'10")	3.80 (12'6")	4.30 (14'1")	2.65 (8'9")S	18.0-25, 20 37.5-39, 28 37.5-30, 36	52/65	14.00 (46'0")
651	33G	62-68	560/450	24.5/33.6 (32/44)	43 730 (96,400)	14.93 (49'0")	4.24 (13'11")	4.01 (13'2")	2.54 (8'4")	37.5-39, 36	51/65	13.29 (43'7")
651B	67K	69-84	/550	24.5/33.6 (32/44)	56 340 (124,200)	15.34 (51'4")	4.32 (14'2")	4.29 (14'1")	2.72 (8'11")S	37.5-39, 36 37.5-39, 36	52/67	13.5 (44'2")
657	31G	62-68	T560/450 S420/335	24.5/33.6 (32/44)	56 550 (124,700)	15.39 (50'6")	4.24 (13'11")	4.09 (13'5")	2.62 (8'7")	37.5-39, 4	46/56	13.29 (43'7")
657	46M	68-69	T—/500 S420/360	24.5/33.6 (32/44)	56 820 (125,155)	15.39 (50'6")	4.24 (13'11")	4.09 (13'5")	2.67 (8'8")	37.5-39, 44	46/55	14.57 (47'10")
657B	68K	69-84	T—/550 S—/400	24.5/33.6 (32/44)	63 100 (139,100)	15.7 (51'8")	4.32 (14'2")	4.21 (13'10")	2.67 (8'9")S	37.5-39, 44 37.5-39, 44	40/59	13.7 (45'1")
660	90F	62-64	560/450	30.6/41.3 (40/54)	49 130 (108,300)	17.04 (55'11")	4.24 (13'11")	4.37 (14'4")	2.59 (8'6") Scraper —	18.0 × 25-20 37.5 × 39-28 37.5 × 51-36	37/41	13.87 (45'6")
660B	58K	70-78	/550	30.6/41.3 (40/54)	59 875 (132,000)	17.27 (56'8")	3.81 (14'2")	4.37 (14'4")		18.0 × 25-20 37.5 × 39-28	41/46	14.00 (46'0")
666	77F	63-69	F460/450 R420/335	30.6/41.3 (40/54)	56 700 (125,000)	17.04 (55'11")	4.24 (13'11")	4.37 (14'4")	2.59 (8'6") Scraper —	18.0 × 25-20 37.5 × 39-28 37.5 × 51-36	34/35**	13.87 (45'6")
666	64H	67-69	F—/500 R420/360	30.6/41.3 (40/54)	58 800 (129,645)	17.27 (56'8")	4.24 (13'11")	4.37 (14'4")	2.59 (8'6") Scraper —	18.0 × 25-20 37.5 × 39-28 37.5 × 51-51	35/36**	13.87 (45'6")
666B	66K	69-78	/950	30.6/41.3 (40/54)	67 630 (149,500)	17.27 (56'8")	4.31 (14'4")	4.37 (14'4")	2.59 (8'9")	18.0 × 25-20 37.5 × 39-28	39/36	14.00 (46'0")

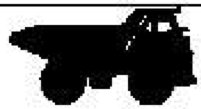
*Maximum HP only available
**Tractor & Scraper Combined



TRACTOR-TOWED SCRAPERS

Model	Product Ident. No. Prefix	Years Built	Capacity Struck/ Heaped m³ (yd³)	Weight kg (lb)	Width m (ft)	Length m (ft)	Height m (ft)	Width of Cut m (ft)
40	1W	49-59	2.8/3.4 (3.6/4.5)	3348 (7,380)	2.27 (7'6")	6.40 (21'0")	1.68 (5'6")	1.82 (6'0")
60	1D	47 63	4.6/6.1 (6.0/8.0)	5579 (12,300)	2.65 (8'9")	8.43 (27'8")	2.36 (7'9")	2.13 (7'0")
60	2W	52-72	5.4/7 (7.0/9.0)	6100 (13,500)	2.86 (9'5")	8.62 (28'3")	2.38 (7'9")	2.40 (7'11")
70	8C	46-53	6.7/8.4 (8.7/11.0)	8527 (18,800)	3.02 (10'0")	9.50 (31'2")	2.56 (8'5")	2.43 (8'0")
70	3W	51-57	7.8/9.9 (10.2/13.0)	9140 (20,150)	3.16 (10'5")	9.53 (31'4")	2.61 (8'7")	2.59 (8'6")
80	2D	48-62	10.3/13.8 (13.6/18)	11 793 (26,000)	3.38 (11'2")	10.82 (35'6")	2.92 (9'7")	2.74 (9'0")
80	5W	50-56	11.5/15.3 (15/20)	13 533 (29,836)	3.50 (11'6")	10.82 (35'0")	3.09 (10'2")	2.89 (9'6")
90	9V	51-55	16.2/20.6 (21.2/27)	17 208 (37,937)	3.65 (12'0")	12.19 (40'0")	3.20 (10'6")	3.04 (10'0")
435C	45D	56-61	9.9/13.6 (13.0/18.0)	10 659 (23,500)	3.28 (10'10")	10.16 (33'4")	3.01 (9'11")	2.84 (9'4")
435D	46D	59 61	11.5/14.5 (15.0/19.0)	11 521 (25,400)	3.29 (10'10")	10.16 (33'4")	3.01 (9'11")	2.84 (9'4")
435E	85F	61-72	9.2/13 (12.0/17.0)	10 400 (22,900)	3.29 (10'10")	10.08 (33'1")	3.07 (10'1")	2.84 (9'4")
435F	45D	62-72	10.7/13.8 (14.0/18.0)	11 300 (24,900)	3.29 (10'10")	10.06 (33'1")	3.02 (9'11")	2.84 (9'4")
435G	27G	63-73	9.2/13 (12.0/17.0)	10 400 (22,900)	3.27 (10'9")	10.08 (33'1")	2.97 (9'9")	2.84 (9'4")
463	62C	56 60	13.8/29.1 (18/25)	14 061 (31,000)	3.58 (11'9")	11.58 (38'0")	3.39 (11'2")	3.15 (10'4")
463C	62C	58-60	16.8/21.4 (22/28)	15 785 (34,800)	3.58 (11'9")	11.58 (38'0")	3.39 (11'2")	3.15 (10'4")
463E	86F	60-71	13.8/20.0 (18.0/26.0)	15 600 (34,400)	3.58 (11'9")	11.65 (38'3")	3.28 (10'10")	3.15 (10'4")
463F	62C	63-71	16/21.4 (21.0/28.0)	15 700 (34,600)	3.58 (11'9")	11.65 (38'3")	3.28 (10'10")	3.15 (10'4")
463G	28G	63 71	13.8/20 (18.0/26.0)	13 200 (29,200)	3.58 (11'9")	11.52 (37'10")	3.14 (10'4")	3.15 (10'4")
491	98C	56-64	20.6/26 (27.0/34.0)	16 964 (37,400)	3.66 (12'0")	12.13 (39'10")	3.96 (13'0")	3.16 (10'5")
491B	9A	61-63	20.6/26.8 (27.0/35.0)	20 902 (46,080)	3.91 (12'10")	12.49 (41'0")	3.96 (13'0")	3.30 (10'10")
491C	47E	63-70	20.6/26.8 (27.0/35.0)	21 600 (47,500)	3.91 (12'10")	12.64 (41'6")	3.96 (13'0")	3.30 (10'10")

16



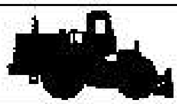
CONSTRUCTION & MINING TRUCKS/TRACTORS

Model	Product Ident. No. Prefix	Years Built	Flywheel Kilowatts (Horsepower)	Capacity Metric Tons (U.S. Tons)	Approx. Weight kg (lb)	Dimensions m (ft) Width	Length	Height	Loading Height	Dumping Height (65°)	Turning Circle	Tire Size
769B	79S	71-78	309 (415)	— —	22 000 (48,500)	3.61 (11'10")	6.55 (21'6")	3.48 (11'5")	— —	— —	18.0 (59'1")	18.00 x 33—24 PR
769	99F	62-67	298 (400)	31.8 (35)	25 365 (55,870)	3.63 (11'11")	7.64 (25'1")	4.05 (13'4")	3.07 (10'1")	7.18 (26'7")	16.50 (54'5")	18.00 x 25—32 PR
769B	99F	67-78	309 (415)	32 (35)	28 000 (61,600)	3.64 (11'11.5")	7.85 (25'8")	3.89 (12'9")	3.15 (10'4")	7.24 (23'8")	18.0 (59'1")	18.00 x 25—32 PR E-3
772	80S	71-78	447 (600)	— —	32 100 (70,600)	4.06 (13'4")	7.11 (23'4")	3.68 (12'1")	—	—	22.1 (72'6")	24.00 x 35—36 PR
773	63G	70-78	447 (600)	45.4 (50)	37 800 (83,380)	4.06 (13'4")	8.71 (28'7")	4.27 (14'0")	3.61 (11'10")	8.36 (27'5")	22.1 (72'6")	21.00 x 35—32 PR E-3
776	14I	75-84	649 (870)	— —	49 686 (109,540)	3.51 (11'6")	8.06 (26'5.5")	3.40 (11'2")	— —	— —	26.8 (88'0")	27.00 x 49—36 PR E-3
776B	6JC	84-92	649 (870)	— —	49 896 (110,000)	3.51 (11'6")	8.06 (26'6")	3.40 (11'2")	— —	— —	25.8 (84'6")	27.00 x 49—36 PR E-3
777	84A	74-84	649 (870)	77.1 (85T)	58 886 (129,820)	5.463 (17'11")	9.78 (32'1")	4.90 (16'1")	4.14 (13'7")	9.29 (30'6")	26.8 (88'0")	30.00 x 51—52 PR E-4
777B	4YC	84-92	649 (870)	86.2 (95)	60 056 (132,422)	5.463 (17'11")	9.79 (32'1")	4.87 (16'4")	4.17 (13'8")	9.42 (30'11")	25.8 (84'6")	21.00 x 49—46 PR E-3

ARTICULATED TRUCKS (DJB Models)

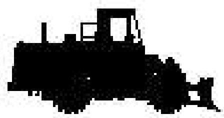
Model	Product Ident. No. Prefix	Years Built	Flywheel Kilowatts (Horse-power)	Capacity Metric Tons (U.S. Tons)	Approx. Weight kg (lb)	Dimensions in (ft): Width	Length	Height	Loading Height	Dumping Height (55°)	Turning Circle	Tire Size
D22	*	80-82	175 (235)	20.0 (22.0)	17 700 (39,000)	3.00 (9'10")	7.85 (25'9")	3.09 (10'2")	2.44 (8'0")	5.03 (16'6")	7.87 (25'10")	26.5 x 25
D25	*	80	175 (235)	22.7 (25.0)	17 300 (38,000)	3.00 (9'10")	7.85 (25'9")	3.09 (10'2")	2.44 (8'0")	5.03 (16'6")	7.87 (25'10")	26.5 x 25
D25B	*	80-83	190 (255)	22.7 (25.0)	17 900 (39,400)	3.00 (9'10")	7.99 (26'2")	3.25 (10'8")	2.44 (8'0")	5.03 (16'6")	7.87 (25'10")	26.5 x 25
D25C	9YC	85-89	194 (260)	22.7 (25.0)	19 230 (42,400)	3.00 (9'10")	8.73 (28'8")	3.27 (10'9")	2.56 (8'5")	5.28 (17'4")	16.14 (52'11")	26.5 x 25
D30C	7ZC	85-89	194 (260)	27.2 (30.0)	21 320 (47,000)	3.30 (10'10")	8.86 (29'1")	3.33 (10'11")	2.85 (9'4")	5.46 (17'11")	16.33 (53'7")	29.5 x 25
D35	*	81-83	190 (255)	31.8 (35.0)	20 000 (44,000)	3.27 (10'8")	8.44 (27'8")	3.25 (10'8")	2.91 (9'7")	5.46 (17'11")	7.87 (25'10")	26.5 x 25 33.25 x 29
D35C	2GD	85-89	194 (260)	31.8 (35.0)	23 860 (52,600)	3.50 (11'6")	9.44 (31'0")	3.34 (10'11")	2.93 (9'7")	5.32 (17'5")	16.00 (52'5")	Front 29.5 x 25 Rear 33.5 x 29
D35 HP	3FD	85-89	287 (385)	31.8 (35.0)	24 950 (55,000)	3.50 (11'6")	9.80 (32'2")	3.51 (11'6")	2.93 (9'7")	5.32 (17'5")	15.78 (51'9")	Front 29.5 x 25 Rear 33.5 x 29
D44	*	81-86	336 (450)	40.0 (44.0)	28 000 (61,800)	3.66 (12'0")	10.05 (33'0")	3.86 (12'8")	2.90 (9'6")	6.35 (20'10")	9.96 (32'8")	33.25 x 29
D44B	4LD	86-87	343 (460)	30.8 (44.0)	32 296 (71,200)	3.73 (12'3")	10.05 (33'0")	3.98 (13'1")	2.98 (9'9")	6.40 (21'0")	9.08 (29'9")	33.25 x 29
D250	*	75-78	175 (235)	25.0 (27.5)	18 500 (40,700)	2.66 (8'9")	8.82 (29'0")	3.04 (10'0")	2.61 (8'7")	6.22 (20'5")	7.67 (25'2")	23.5 x 25
D250B	5WD	85-91	163 (218)	22.7 (25)	17 963 (39,600)	2.50 (8'2.5")	9.60 (31'8.5")	3.18 (10'5")	2.55 (8'4.5")	6.23 (20'5")	7.65 (25'1")	20.5 R25
D275	*	78-80	175 (235)	25.0 (27.5)	18 700 (41,000)	2.66 (8'9")	8.82 (29'0")	3.17 (10'7")	2.61 (8'7")	6.22 (20'5")	7.75 (25'3")	23.5 x 25
D275B	*	80-82	190 (255)	25.0 (27.5)	19 200 (42,400)	2.66 (8'9")	8.98 (29'5")	3.21 (10'7")	2.61 (8'7")	6.22 (20'5")	7.75 (25'5")	23.5 x 25
D300	*	76-78	190 (255)	30.0 (33.0)	18 500 (42,900)	2.80 (9'2")	8.82 (29'0")	3.04 (10'0")	2.68 (8'10")	6.22 (20'5")	7.67 (25'2")	23.5 x 25
D300B	4SD	85-91	194 (260)	27.2 (30)	19 800 (43,520)	2.50 (8'2.5")	9.60 (31'8.5")	3.18 (10'5")	2.55 (8'4.5")	6.23 (20'5")	7.78 (25'6")	23.5 R25
D330	*	78-80	190 (255)	30.0 (33.0)	20 000 (43,000)	2.80 (9'2")	8.82 (28'11")	3.17 (10'5")	2.68 (8'9")	6.22 (20'5")	7.80 (25'7")	23.5 x 25
D330B	*	80-83	190 (255)	30.0 (33.0)	20 200 (44,400)	2.76 (9'1")	9.08 (29'9")	3.25 (10'8")	2.68 (8'9")	6.33 (20'9")	7.92 (26'0")	23.5 x 25
D350	*	78-80	190 (255)	31.8 (35.0)	21 000 (46,000)	3.00 (9'10")	8.95 (29'4")	3.21 (10'7")	2.82 (9'3")	6.35 (20'10")	7.95 (26'1")	26.5 x 25
D350B	*	80-83	190 (255)	31.8 (35.0)	21 400 (47,200)	3.00 (9'10")	9.09 (29'10")	3.25 (10'8")	2.85 (9'4")	6.40 (21'0")	7.95 (26'1")	26.5 x 25
D350C	9XC	85-89	194 (260)	31.8 (35.0)	23 315 (51,400)	3.0 (9'10")	9.93 (32'7")	3.27 (10'9")	2.91 (9'6")	6.52 (21'5")	16.16 (53'0")	26.5 x 25
D400	1MD	85-89	287 (385)	36.3 (40.0)	25 765 (56,800)	3.0 (9'10")	10.42 (34'2")	3.45 (11'4")	3.00 (9'10")	6.53 (21'5")	16.07 (52'9")	26.5 x 25
D550	*	78-86	336 (450)	50.0 (55.0)	37 800 (83,400)	3.66 (12'0")	11.36 (37'3")	3.86 (12'8")	3.30 (10'10")	7.88 (25'8")	9.65 (31'8")	33.25 x 29
D550B	6SD	86-87	343 (460)	50.0 (55.0)	40 370 (89,000)	3.72 (12'2.5")	11.74 (38'6")	3.97 (13'0")	3.22 (10'6")	8.28 (27'2")	8.79 (28'8")	33.25 x 29

*Information not available



WHEEL TRACTORS

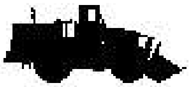
Model	Product Ident. No. Prefix	Years Built	Flywheel Kilowatts (Horsepower)	Approx. Oper. Wt. kg (lb)	Length (Dozer on ground) m (ft)	Tread m (ft)	Wheelbase m (ft)	Ground Clearance mm (in)	Transmission	Maximum Speeds Fwd. km/h (mph)	Maximum Speeds Rev. km/h (mph)	
814B	90P	70-81	127 (170)	18 780 (41,400)	6.49 (21'3")	2.16 (7'1")	3.10 (10'2")	356 (14")	PS 4F-4R	32.7 (20.3)	39.3 (24.4)	*
824	29G	63-65	224 (300)	31 700 (70,000)	7.04 (23'1")	2.37 (7'10")	3.35 (11'0")	470 (18.2")	PS 3F-3R	34.1 (21.2)	34.1 (21.2)	
824B	36H	65-78	224 (300)	33 330 (73,480)	7.40 (24'3.5")	2.32 (7'7.5")	3.56 (11'8")	490 (19.4")	PS 3F-3R	29.8 (18.5)	29.8 (18.5)	
834	43E	63-74	298 (400)	40 300 (88,800)	7.75 (25'5")	2.54 (8'4")	3.80 (12'6")	510 (20.0")	PS 3F-3R	32.8 (20.4)	35.7 (22.2)	



COMPACTORS

Model	Product Ident. No. Prefix	Years Built	Flywheel Kilowatts (Horsepower)	Approx. Oper. Wt. kg (lb)	Drum Width m (ft)	Articulated Steering Angle, Maximum	Transmission	Maximum Speeds Fwd. km/h (mph)	Maximum Speeds Rev. km/h (mph)	
815	91P	70-81	127 (170)	17 300 (38,200)	.97 (3'2")	44° Either Side	Power Shift 4F-4R	30.1 (18.7)	35.7 (22.2)	*
816	57U	72-81	127 (170)	18 550 (40,800)	1.02 (3'4")	44° Either Side	Power Shift 4F-4R	30.1 (18.6)	36.7 (22.4)	**
825B	43N	70-78	224 (300)	30 075 (66,300)	1.13 (3'8.5")	44° Either Side	Power Shift	29.8 (18.5)	29.8 (18.5)	
835	44N	70-74	298 (400)	35 900 (79,100)	1.22 (4'0")	44° Either Side	Power Shift 3F-3R	32.2 (20.0)	34.8 (21.6)	

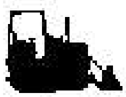
*Turbocharged, Articulated Steering
**Turbocharged, ROPS Cab, Sleeve Metering Fuel System



WHEEL LOADERS

Model	Product Ident. No. Prefix	Years Built	Flywheel Horse-power	Approx. Shipping Wt. kg (lb)	Rated Capacity m^3 (yd^3)	Breakout Force kg (lb)	Width Over Tires m (ft)	Ground Clearance mm (in)	Max. Reach at max height mm (in)	Dump Clearance at max height m (ft)	Maximum Speeds km/h (mph) Fwd.	Rev.	Remarks
910	80V	73-79	66	6100 (13,400)	1.0 (1.25)	4680 (10,000)	2.07 (6'10")	406 (16")	860 (34")	2.46 (8'1")	24.1 (15.0)	10.6 (6.6)	
910	40Y	79-89	65	6658 (14,679)	1.0 (1.25)	5838 (12,870)	2.07 (6'10")	405 (16")	930 (36.6")	2.40 (7'10")	23.8 (14.8)	10.6 (6.6)	
910	41Y	79-89	65	6658 (14,679)	1.0 (1.25)	5838 (12,870)	2.07 (6'10")	405 (16")	930 (36.6")	2.40 (7'10")	23.5 (14.6)	24.9 (15.5)	
920	62K	69-84	80	8440 (18,600)	1.2 (1.5)	7901 (17,419)	2.18 (7'1")	335 (13")	740 (29.0")	2.77 (9'1")	43.8 (27.2)	23.2 (14.4)	
922A	58A	60-62	80	7350 (16,200)	0.96 (1.25)	6860 (15,100)	2.12 (7'0")	386 (15")	665 (26")	2.60 (8'7")	30.4 (18.9)	32.8 (20.4)	
922B	60J	62-68	80	7670 (16,900)	1.15 (1.50)	9000 (19,900)	2.25 (7'5")	390 (16")	680 (27")	2.60 (8'7")	33.6 (20.9)	42.9 (26.7)	
926	94Z	84-87	105	8800 (19,400)	1.21 (1.75)	5070 (11,179)	2.33 (7'8")	341 (13.5")	924 (36")	2.67 (8'9")	30.3 (18.8)	32.3 (20.0)	
930	41K	68-85	100	9660 (21,300)	1.7 (2.25)	7900 (17,410)	2.39 (7'10")	348 (13.7")	1.35 (4'5")	2.79 (9'2")	44.2 (27.5)	23.3 (14.5)	3304 Engine 8 Bar Linkage
936	33Z	83-87	125	11 884 (26,200)	2.1 (2.75)	12 614 (28,708)	2.58 (8'4.6")	329 (13")	1055 (3'8")	2.80 (9'2")	34.4 (21.4)	38.4 (23.9)	
936E	33Z	87-92	135	12 300 (27,000)	2.3 (3.00)	12 920 (28,483)	2.56 (8'5")	379 (14.9")	1026 (3'5")	2.87 (9'2")	40.6 (25.2)	46.3 (28.2)	
944	87J	59-68	100	10 100 (22,000)	1.53 (2.0)	9800 (21,700)	2.40 (7'10")	450 (18")	905 (36")	2.96 (9'9")	38.5 (23.9)	46.6 (28.9)	
950	81J	68-81	130	12 930 (28,500)	1.53 (2.07)	10 320 (22,760)	2.41 (7'11")	381 (15")	740 (29")	2.82 (9'3")	35.9 (22.3)	42.5 (26.4)	Articulated Steering. 4 Wheel Drive
950B	22Z	81-87	155	14 650 (32,300)	2.6 (3.75)	16 680 (36,886)	2.67 (8'8")	477 (16.8")	1175 (3'8")	2.96 (8'8")	36.4 (22.6)	39.4 (24.6)	7 Bar Linkage
950E	22Z	87-91	160	15 856 (34,883)	3.1 (4.0)	13 586 (29,925)	2.76 (9.0')	400 (15.7")	1160 (3'10")	2.85 (9'4")	36.2 (22.4)	39.8 (24.7)	
966A	33A	60-63	140	13 060 (28,800)	2.10 (2.75)	13 470 (29,700)	2.70 (8'10")	450 (18")	900 (36")	2.95 (9'8")	43.0 (26.7)	51.5 (32.3)	
966B	75A	63-68	150	14 300 (31,500)	2.29 (3.0)	14 000 (31,000)	2.70 (8'10")	400 (16")	900 (36")	2.95 (9'8")	38.5 (23.8)	46.3 (28.8)	
966C	76J	68-81	170	16 730 (36,880)	3.1 (4.0)	11 600 (25,578)	2.77 (9'1")	400 (15.7")	1.42 (4'8")	2.95 (9'8")	38 (23.6)	45.1 (28)	3306 Engine
966D	99Y	80-87	200	19 730 (43,500)	3.3 (4.25)	20 972 (46,150)	2.86 (9'4.8")	451 (17.8")	1227 (48")	3.14 (10'3.5")	34.3 (21.3)	38.1 (23.7)	3306 Engine Z Bar Linkage
966E	99Y	87-90	216	20 324 (44,767)	3.8 (5.0)	18 939 (41,715)	2.94 (9'8")	476 (18.7")	1285 (4'3")	2.97 (9'9")	38.2 (23.7)	43.6 (27.0)	
980	42H	66-70	235	20 000 (44,000)	3.06 (4.0)	18 860 (41,570)	2.87 (9'5")	399 (16")	1.19 m (3'11")	3.07 (10'1")	42.0 (26.1)	26.7 (16.6)	
980B	89P	70-78	260	23 360 (51,500)	3.44-4.21 (4.5-5.5)	16 400 (36,100)	3.11 (10'2")	—	1.12 m (3'8")	3.20 (10'6")	43.0 (26.7)	27.4 (17.0)	
980C	63X	79-91	270	27,559 (60,756)	5.2 (6.75)	23.188 (51,121)	3.15 (10'4")	417 (16.4")	1476 (4'10")	3.19 (10'6")	34.6 (21.5)	39.6 (24.5)	Dual Z Bar Linkage
988	87A	63-76	325	35 800 (79,000)	4.6-5.4 (6.0-7.0)	21 380 (47,130)	3.20 (10'7")	570 (22.5")	1.45 m (4'9")	3.33 (10'11")	30.6 (19.0)	30.6 (19.0)	
992	25K	68-73	550	47 670 (105,100)	7.65 (10.0)	36 900 (81,360)	3.93 (12'11")	530 (21")	2.82 m (8'3")	4.52 (14'10")	35.6 (22.1)	36.5 (23.6)	
992B	25K	73-77	650	64 320 (141,800)	7.66 (10.0)	29 380 (64,660)	—	—	1.93 m (6'4")	4.34 (14'3")	40.2 (25.0)	43.6 (27.1)	
992C	97X	77-84	690	85 640 (188,800)	9.6 (12.5)	66 240 (146,030)	4.55 (14'11")	533 (21")	2.31 (7'7")	4.17 (13'8")	21.1 (13.1)	23.8 (14.6)	3412 Engine Z Bar Linkage

16



TRACK LOADERS

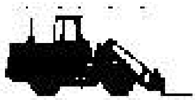
Model	Product Ident. No. Prefix	Years Built	Flywheel Horsepower	Approx. Operating Weight kg (lb)	Rated Capacity m^3 (yd^3)	Dimensions Length** m (ft)	Width m (ft)	Height m (ft)	Remarks
931	78U	72-79	62	6840 (15,300)	0.77 (1.0)	2.74 (9'0")	1.78 (5'10")	1.96 (6'5")	
931 LGP	10N	75-79	62	7498 (16,530)	1.15 (1.50)	2.74 (9'0")	2.29 (7'6")	1.98 (6'6")	
931B	29Y	79-88	65	7362 (16,230)	0.8 (1.0)	4.13 (13'9")	1.84 (6'0.5")	2.68 (8'10")	
931B LGP	30Y	79-88	65	8088 (17,834)	0.8 (1.0)	3.84 (12'7")	2.41 (7'11")	2.68 (8'10")	
931C	2BJ1 7HF		67	7595 (16,743)	0.77 (1.0)	2.74 (9'0")	1.78 (5'10")	1.96 (6'5")	
931C LGP	6RF1 6AF		67	8170 (18,012)	0.77 (1.0)	2.74 (9'0")	1.78 (5'10")	1.96 (6'5")	
933C	11A	55-58	50	7030 (15,500)	0.77 (1.0)	4.22 (13'10")	1.77 (5'10")	1.91 (6'4")	Integral loader.
933E	11A	58-65	50	7640 (16,850)	0.77 (1.0)	4.22 (13'10")	1.77 (5'10")	1.40 (6'3")	Integral loader.
933G	42A	65-68	60	7900 (17,500)	0.86 (1.125)	4.31 (14'2")	1.77 (5'10")	2.16 (7'1")	Patented Sealed Track.
935B	30F	87-88	75	7899 (17,414)	1.0 (1.25)	4.18 (13'9")	1.96 (6'5")	2.69 (8'10")	
935C	8CF		78	8205 (18,089)	1.0 (1.30)	4.19 (3'9")	1.96 (6'5")	2.68 (6'5")	
941	80H	68-72	70	8900 (19,700)	0.96 (1.25)	4.50 (14'10")	1.86 (6'1")	2.75 (9'0")*	Electric Start
941B	80H	68-81	80	11 294 (24,900)	1.16 (1.60)	4.60 (14'10")	1.98 (6'6")	2.76 (9'0")*	HP Increase, Hydraulic Track Adjusters
951B	79H	67-71	85	10 025 (22,100)	1.14 (1.50)	4.70 (15'6")	1.98 (6'6")	2.75 (9'0")*	Pedal Steering
951C	86J	71-81	95	12 338 (27,200)	1.34 (1.75)	4.77 (15'8")	1.98 (6'6")	2.75 (9'0")*	HP Increase, Sealed & Lubricated Track.
HT4	7U	50-55	54	2607 (5,748)	0.96 (1.25)	4.32 (14'2")	2.03 (6'8")	1.83 (6'0")	
955C	12A	55-60	70	9590 (21,145)	1.15 (1.50)	4.60 (15'2")	2.03 (6'8")	2.06 (6'11")	Integral loader.
955E	12A	58-60	70	10 160 (22,400)	1.15 (1.50)	4.60 (15'2")	2.03 (6'8")	2.09 (6'11")	Improved undercarriage
955H	60A	60-66	100	11 320 (24,960)	1.34 (1.75)	4.79 (15'9")	1.90 (6'3")	2.65 (8'8")*	Power shift, Turbo, oil cooled brakes.
955K	81H	66-71	115	12 700 (28,000)	1.34 (1.75)	5.00 (16'6")	2.06 (6'9")	2.80 (9'3")*	Horsepower and bucket capacity increase.
955L	85J	71-75	130	15 330 (33,800)	1.53 (2.00)	5.30 (16'1")	2.18 (7'2")	2.95 (9'8")*	ROPS Cab, Sealed & Lubricated Track
955L	13X	75-81	130	15 853 (34,950)	1.72 (2.25)	5.26 (17'3")	2.18 (7'2")	2.95 (9'8")	

*Height to top of stack. Others to top of seat back.
**Overall length to tip of smallest General Purpose bucket.

Track Loaders (cont'd)

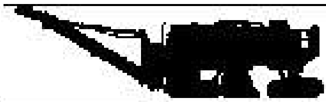
Model	Product Ident. No. Prefix	Years Built	Flywheel Horsepower	Approx. Operating Weight kg (lb)	Rated Capacity m³ (yd³)	Dimensions Length** m (ft)	Dimensions Width m (ft)	Dimensions Height m (ft)	Remarks
No. 6	10A	53-55	80	13 228 (29,165)	1.72 (2.25)	4.90 (16'1")	2.44 (8'1")	2.11 (6'11")	
977D	20A	55-60	100	14 430 (31,795)	1.72 (2.25)	5.19 (18'0")	2.44 (8'0")	2.22 (7'4")	
977E	20A	58-60	100	15 850 (34,910)	1.72 (2.25)	5.19 (18'0")	2.44 (8'0")	2.29 (7'7")	Improved undercarriage.
977H	53A	60-66	150	17 000 (37,500)	1.90 (2.50)	5.28 (17'4")	2.44 (8'0")	2.29 (7'7")	Power shift, Turbo, oil cooled brakes.
977K	46H	66-78	170	19 100 (42,000)	1.90 (2.50)	5.50 (18'0")	2.38 (7'10")	3.05 (10'0")*	Walk-through compartment, longer roller frame.
977L	14X	78-82	190	21 780 (48,010)	2.10 (2.75)	5.59 (18'4")	2.38 (7'10")	3.32 (10'11")*	Horsepower and bucket capacity increase
983	38K	69-78	275	34 480 (75,980)	3.82 (5.0)	6.78 (22'3")	2.90 (9'6")	2.79 (11'10")*	
983H	58X	78-82	275	35 620 (78,530)	3.82 (5.00)	6.78 (22'3")	2.90 (9'6")	3.68 (12'1")*	DI engine

*Height to top of stack. Others to top of seat back.
**Overall length to lip of smallest General Purpose bucket.



INTEGRATED TOOLCARRIERS

Model	Product Ident. No. Prefix	Years Built	Flywheel Horsepower	Approx. Operating Weight kg (lb)	Rated Capacity m³ (yd³)	Breakout Force kg (lb)	Width Over Tires m (ft)	Ground Clearance mm (in)	Max Reach at Max Height mm (in)	Dump Clearance at Max Height m (ft)	Maximum Speeds km/h (mph) Fwd.	Maximum Speeds km/h (mph) Rev.
IT12	2YC	84-89	65	7399 (16,299)	1.0 (1.25)	7193 (15,858)	2.3 (7'6")	405 (15.9")	873 (34")	2.84 (9'4")	23.8 (14.8)	24.9 (15.4)
IT18	9NB	84-86	85	8680 (19,092)	1.2 (1.6)	9105 (20,108)	2.4 (7'10")	286 (11.2")	990 (39")	2.84 (9'6")	25 (15.5)	25 (15.5)
IT28	2KC	84-88	106	9580 (21,076)	1.5 (2.0)	9505 (20,955)	2.4 (7'10")	285 (11.2")	1044 (41")	2.82 (9'3")	30.8 (18.8)	32.3 (20.0)

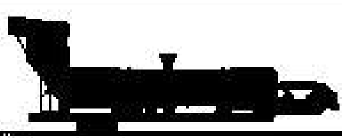


PAVING PRODUCTS — COLD PLANERS

Model	Product Ident. No. Prefix	Years Built	kW Flywheel (Horsepower)	Approximate Operating Weight kg (lb)	General Dimensions (Shipping)		
					Height mm (ft)	Length mm (ft)	Width mm (ft)
PR-75		85-92	52 (77)	5900 (13,000)	2690 (8'10")	3050 (10'0")	2130 (7'0")
PR-275	6RC	—	201 (270)	17 237 (38,000)	2896 (9'6")	5740 (18'10")	2438 (8')
PR-450		85-92	336 (450)	28 308 (68,000)	4270 (14'0")	13 280 (43'6")	2870 (9'5")

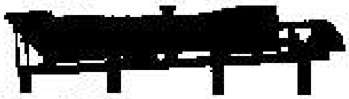
PAVING PRODUCTS — UNITIZED VENTURI-MIXERS & UNITIZED DRUM-MIXERS

	Drum Dimensions			Performance	
Model	Diameter mm (ft)	Length m (ft)	Gross Volume m^3 (ft^3)	Production Range/hr. metric tons (tons)	Air Flow m^3/min (ft^3/min)
UVM-500	1829/1524 (6'0"/5'0")	7.9 (26'0")	14.17 (500)	68-109 (75-120)	300-481 (10600-17000)
UDM-600	1829 (6'0")	6.7 (22'0")	17.00 (600)	82 (89)	354.25 (12500)
UDM-900	2134/1829 (7'0"/6'0")	9.1 (30'0")	25.48 (900)	68-227 (75-250)	311 793 (11000-28000)
UVM-1000	2134 (7'0")	9 754 (32'0")	28.34 (1000)	82-272 (90-300)	425-1076 (15000-38000)
UVM-1400	2286 (7'6")	10.973 (36'0")	39.64 (1400)	100-358 (110-395)	481-1274 (17000-45000)
UVM-1700	2591 (8'6")	11.582 (38'0")	48.14 (1700)	122-408 (135-450)	651-1614 (23000-57000)



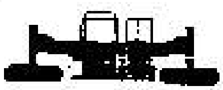
PAVING PRODUCTS — PORTABLE VENTURI-MIXERS

	Drum Dimensions			Performance	
Model	Diameter mm (ft)	Length m (ft)	Gross Volume m^3 (ft^3)	Production Range/hr. metric tons (tons)	Air Flow m^3/min (ft^3/min)
PVM-1100	2134 (7'0")	10.97 (36'0")	31.15 (1100)	82-295 (90-325)	425-1133 (15000-40000)
PVM-1500	2286 (7'6")	12.19 (40'0")	42.48 (1500)	100-363 (110-400)	510-1274 (18000-45000)
PVM-2000	2591 (8'6")	12.80 (42'0")	56.64 (2000)	122-454 (135-500)	680-1699 (24000-60000)
PVM-2500	2896 (9'6")	12.80 (42'0")	70.79 (2500)	136-499 (150-550)	793-2110 (28000-74500)
PVM-2900	3048 (10'0")	13.41 (44'0")	82.12 (2900)	169-553 (186-610)	906-2265 (32000-80000)
PVM-3300	3200 (10'6")	13.41 (44'0")	93.45 (3300)	181-612 (200-675)	991-2464 (35000-87000)



PAVING PRODUCTS — STATIONARY VENTURI-MIXERS

	Drum Dimensions			Performance	
Model	Diameter mm (ft)	Length m (ft)	Gross Volume m^3 (ft^3)	Production Range/hr. metric tons (tons)	Air Flow m^3/min (ft^3/min)
SVM-1100	2134 (7'0")	10.97 (36'0")	31.15 (1100)	82-295 (90-325)	425-1133 (15000-40000)
SVM-1500	2286 (7'6")	12.19 (40'0")	42.48 (1500)	100-363 (110-400)	510-1274 (18000-45000)
SVM 2000	2591 (8'6")	12.80 (42'0")	56.64 (2000)	122-454 (135-500)	680-1699 (24000-60000)
SVM-2500	2896 (9'6")	12.80 (42'0")	70.79 (2500)	136 499 (150-550)	793-2110 (28000-74500)
SVM-2900	3048 (10'0")	13.41 (44'0")	82.12 (2900)	168-553 (185-610)	906-2266 (32000-80000)
SVM-3600	3200 (10'6")	14.63 (48'0")	101.94 (3600)	190-623 (210-685)	1020-2565 (36000-90000)



PAVING PRODUCTS — SLIPFORM PAVERS

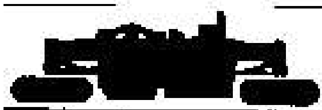
Model	Product Ident. No. Prefix	Years Built	Flywheel Horsepower	Approx. Operating Weight kg (lb)	Standard Paving Width m (ft)	Shipping Dimensions (Min.) Length m (ft)	Width m (ft)	Height m (ft)	Remarks
SF-175	5ZC	—	142	9072 (20,000)	2.1 (7')	6.6 (21'6")	2.4 (8')	2.8 (9'4")	
SF-250	6XC	—	208	24 494 (54,000)	3.6 (12')	3.0 (10')	3.7 (12')		
SF-250B			250	27 216 (60,000)	3.7-7.3 (12'-24')	1.5 (5'0")	3.66 (12'0")	3.20 (10'6")	
SF-350	—	—	280	40 824 (90,000)	3.6-7.3 (12'-24')	1.04 (3'5")	3.0 (10')	2.9 (8'8")	
SF-450	7GC	73-80	400	43 546* (96,000) 53 525** (118,000)	3.66-7.62 (12'-25')	9.35 (30'8")	3.05 (10')	2.90 (9'6")	
SF-500	8DC	—	400	52 164 (115,000)	7.6 (25')	8.9 (28'2½")	3.0 (10')	3.0*** (10'2")	
SF-550	5PD	—	400	52 164 (115,000)	5.5-8.5 (18'-28')	7 (23')	3.7 (12')	2.8 (9'8")	

*Weight of 25' machine
**Weight of 38' machine
***Machine legs and track shipped separately

16

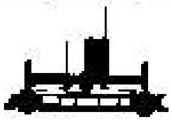
Former Models

Paving Products
- Placer-Spreader-Trimmer
- Belt Placer
- Tube Finisher
- Texturing/Curing
- Trimmer Reclaimer
- Asphalt Pavers



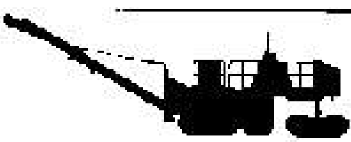
PAVING PRODUCTS — PLACER-SPREADER-TRIMMER, BELT PLACER

Model	Product Ident. No. Prefix	Years Built	Flywheel Horsepower	Approximate Operating Weight kg (lb)	General Dimensions Height m (ft)	Length m (ft)	Width m (ft)
PST-300	8EC	—	250	30 193 (84,200)	2.64 (8'8")	10.57 (34'8")	9.02 (29'7")
BP-100	1EF	—	102	11 340 (22,000)	3.27 (10'9")	2.49 (8'2")	2.49 (8'2")



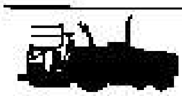
PAVING PRODUCTS — TUBE FINISHER, TEXTURING/CURING

Model	Product Ident. No. Prefix	Years Built	Flywheel Horsepower	Approximate Operating Weight kg (lb)	General Dimensions (Shipping) Height mm (ft)	Length mm (ft)	Width mm (ft)
TF-250	6YC	—	62	5897 (13,000)	2489 (8'2")	8484 (27'10")	2438 (8')
TC-260	7HC	—	56	5897 (13,000)	2489 (8'2")	8484 (27'10")	2438 (8')



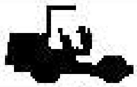
PAVING PRODUCTS — TRIMMER-RECLAIMER

Model	Product Ident. No. Prefix	Years Built	Flywheel Horsepower	Approximate Operating Weight kg (lb)	General Dimensions (Shipping) Height mm (ft)	Length m (ft)	Width mm (ft)
TR-225B	6WC	—	250	21 319 (47,000)	3200 (10'6")	13.9 (45'9.5")	2896 (9'6")
TR-500	8CC		375	46 267 (102,000)	3099 (10'2")	8.9 (29'2¾")	3048 (10')



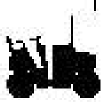
PAVING PRODUCTS — ASPHALT PAVERS & WINDROW ELEVATORS

Model	Product Ident. No. Prefix	Years Built	Flywheel kW (hp)	Approx. Op. Weight kg (lb)	Drive	Screed Width mm (ft)	Hopper Capacity m^3 (ft^3)	Maximum Op. Speed km/h (mph)
AP-1200	2JD	85-89	108 (145)	13 608 (30,000)	Wheel	3048 (10')	6.2 (220)	21.4 (13.3)
WE601B	1EC	85-91	76 (102)	3856 (8500)	NA	1624* (5.0')	NA	NA
AP-200		85-91	26 (35)	4080 (9000)	Track	2743 (9'0")	5.4 (6)	0-54 m/min. 0-778 ft/min.



PAVING PRODUCTS — SOIL VIBRATORY COMPACTORS

Model	Product Ident. No. Prefix	Years Built	Flywheel kW (hp)	Approx. Op. Weight kg (lb)	Drive	Drum Width mm (in)	Dynamic Force kg (lb)	Maximum Op. Speed km/h (mph)
CS-431	6MD	85-87	52 (70)	6110 (13,480)	Wheel	1680 (66")	7260 (16,000)	21 (13)
CS-433	6ND	85-87	60 (80)	6720 (14,820)	Wheel/ Drum	1524 (60")	7260 (16,000)	10 (6)
CP-433	6NP	85-87	60 (80)	6750 (14,870)	Wheel/ Drum	1524 (60")	7260 (16,000)	10 (6)
CS-551	6ZD 8AD	85-89	115 (155)	10 428 (22,990)	Wheel	2130 (84")	18 150 (40,000)	12.1 (7.5)
CS-553	7AD	85-89	115 (155)	10 782 (23,770)	Wheel/ Drum	2130 (84")	18 150 (40,000)	10.5 (6.5)
CP-553	7BD	85-89	115 (155)	12 247 (27,000)	Wheel/ Drum	2130 (84")	22 680 (50,000)	10.5 (6.5)
CS-643	7FD	85-87	100 (134)	14 900 (32,865)	Wheel/ Drum	2200 (86")	16 800 (37,044)	15.5 (9.6)
CP-643	7GD	85-87	100 (134)	16 900 (36,842)	Wheel/ Drum	2200 (86")	12 600 (27,783)	16.6 (9.8)
CS-653	7HD	85-91	100 (134)	17 100 (37,690)	Wheel/ Drum	2200 (7'3")	22 230 (48,995)	16.6 (9.6)
CP-653	7JD	85-91	100 (134)	18 500 (40,774)	Wheel/ Drum	2200 (7'3")	22 230 (48,995)	15.5 (9.6)
TSF-54	7KD	85-88	26 (35)	2131 (4700)	Towed	1370 (54")	6810 (15,000)	Towed
TSM-54	7LD	86-88	26 (35)	2160 (4760)	Towed	1370 (54")	6810 (15,000)	Towed



PAVING PRODUCTS — ASPHALT VIBRATORY COMPACTORS

Model	Product Ident. No. Prefix	Years Built	Flywheel kW (hp)	Approx. Op. Weight kg (lb)	Drive	Drum Width mm (in)	Dynamic Force kg (lb)	Maximum Op. Speed km/h (mph)
CB-214	6FD	85-88	24 (33)	2300 (5070)	Drum (2)	1000 (39.4")	2041 (4500)	10.6 (6.6)
CB-224	6GD	85-88	24 (33)	2450 (5400)	Drum (2)	1200 (47.2")	2450 (5400)	10.6 (6.6)
CB-314	6HD	85-89	41 (55)	3357 (7400)	Drum	1120 (44")	2770 (6100)	8 (6)
CB-414	6KD	85-89	52 (70)	5760 (12,750)	Drum	1397 (55")	6350 (14,000)	13.7 (8.5)
CB-424	6JD	85-89	54 (73.5)	6220 (13,710)	Drum (2)	1397 (55")	4485 (9885)	11.0 (6.8)
CB-514	6YD	85-88	68 (91)	9730 (21,450)	Drum (2)	1730 (68")	9073 (20,000)	11 (7)
CB-521	6RD	85-87	61 (82)	8800 (19,404)	Wheel	1700 (67")	5300 (11,687)	15 (9.3)
CB-522	6SD	85-87	45 (62)	10 100 (22,271)	Drum (2)	1700 (67")	10 350 (22,822)	8 (5)
CB-523	6TD	85-87	61 (82)	8800 (19,404)	Wheel/ Drum	1700 (67")	5300 (11,687)	13 (8)
CB-524	6WD	85-87	61 (82)	9500 (20,948)	Drum (2)	1700 (67")	10 350 (22,822)	11 (6.8)
PP-200		85-92	49 (66)	7000 (15,430)	Wheel Pneumatic	1700 (67")	NA	24 (14.9)

16

ESTIMATING OWNING & OPERATING COSTS

CONTENTS

General

Machine users must balance Productivity and Costs to achieve optimum performance . . . that is, achieve the desired production at the lowest possible cost. The approach most often used to measure machine performance is this simple equation:

$$\frac{\textit{Lowest Possible Hourly Costs}}{\textit{Highest Possible Hourly Productivity}} = \textit{Top Machine Performance}$$

Most sections of this Handbook deal with the productivity of Caterpillar machines. This section considers the cost aspect of performance.

Hourly Owning and Operating Costs for a given machine can vary widely because they are influenced by many factors: the type of work the machine does, local prices of fuel and lubricants, shipping costs from the factory, interest rates, etc. No attempt is made in this handbook to provide precise hourly costs for each model. Users must be able to estimate with a reasonable degree of accuracy what a machine will cost per hour to own and operate in a given application and locality. Therefore, this section provides a suggested method of estimating hourly owning and operating costs as well as data on Caterpillar-built machines which, when coupled with local conditions, will permit accurate estimates.

The method suggested follows several basic principles:

- No prices are provided for any items. For reliable estimates, these must always be obtained locally.
- Calculations are based on the complete machine. Separate estimates are not necessary for the basic machine, dozer, control, etc.
- The multiplier factors provided will work equally well in any currency expressed in decimals.
- Because of different standards of comparison, what may seem a severe application to one machine owner may appear only average to another. Therefore, to better describe machine use, operating conditions and applications are defined in zones.
- Unless otherwise specified, the word "hour" when used in this section means clock or operating hours, not Service Meter Units.

17

HOURLY OWNING AND OPERATING COST ESTIMATE

DATE ____________

	(1)	(2)
Machine Designation	______	______
Estimated Ownership Period (Years)	______	______
Estimated Usage (Hours/Year)	______	______
Ownership Usage (Total Hours)	______	______

OWNING COSTS

	(1)	(2)
1. a. Delivered Price (including attachments)	______	______
b. Less Tire Replacement Cost if desired	______	______
c. Delivered Price Less Tires	______	______
2. Less Residual Value at Replacement (See subsection 2A on back)	(___%) ______	(___%) ______
3. a. Value to be recovered through work (line 1c less line 2)	______	______
b. Cost Per Hour: $\frac{\text{Value}}{\text{Hours}}$ (1) ______ (2) ______	______	______

4. Interest Costs $\frac{\frac{N+1}{2N} \times \text{Del. Price} \times \text{Simple Int. \% Rate}}{\text{Hours/Year}} =$

N = No. Yrs.

(1) $\frac{\frac{\_\_+1}{\_\_} \times \_\_\_\_ \times \_\_\%}{\_\_\_\_ \text{ Hours/Yr.}} =$ ______ (2) $\frac{\frac{\_\_+1}{\_\_} \times \_\_\_\_ \times \_\_\%}{\_\_\_\_ \text{ Hours/Yr.}} =$ ______

5. Insurance $\frac{\frac{N+1}{2N} \times \text{Del. Price} \times \text{Insurance \% Rate}}{\text{Hours/Year}} =$

N = No. Yrs.

(1) $\frac{\frac{\_\_+1}{\_\_} \times \_\_\_\_ \times \_\_\%}{\_\_\_\_ \text{ Hours/Yr.}} =$ ______ (2) $\frac{\frac{\_\_+1}{\_\_} \times \_\_\_\_ \times \_\_\%}{\_\_\_\_ \text{ Hours/Yr.}} =$ ______

Or

$______ Per Yr. ÷ ______ Hours/Yr. =

CATERPILLAR FORM NO. 01-065419-01 (52 00)

6. Property Tax $\frac{N+1}{2N}$ × Del. Price × Tax Rate % / Hours/Year = (1) (2)
N = No. Yrs.

(1) ____ +1 / ____ × ______ × ____ % / ____ Hours/Yr. = (2) ____ +1 / ____ × ______ × ____ % / ____ Hours/Yr. = ______ ______

Or

$______ Per Yr. ÷ ______ Hours/Yr. =

7. TOTAL HOURLY OWNING COST
(add lines 3b, 4, 5, and 6) . . . . ______ ______

OPERATING COSTS

8. Fuel: Unit Price × Consumption

(1) ______ × ______ = ______ ______

(2) ______ × ______ =

9. Lube Oils, Filters, Grease:
(See subsection 9A on back) . . . . ______ ______

10. a. Tires: Replacement Cost ÷ Life in Hours

$\frac{\text{Cost}}{\text{Life}}$ (1) ______ (2) ______ . . . . ______ ______

b. Undercarriage
(Impact + Abrasiveness + Z Factor) × Basic Factor

(1) (______ + ______ + ______) = ______ × ______ = ______ ______

(2) (______ + ______ + ______) = ______ × ______ =
(Total) (Factor)

11. Repair Reserve
(Extended Use Multiplier × Basic Repair Factor)

(1) ______ × ______ = (2) ______ × ______ = ______ ______

12. Special Wear Items: Cost ÷ Life . . . . ______ ______
(See subsection 12A on back)

13. TOTAL OPERATING COSTS
(add lines 8, 9, 10a (or 10b), 11 and 12) . . . . ______

14. MACHINE OWNING PLUS OPERATING
(add lines 7 and 13) . . . . ______ ______

15. OPERATOR'S HOURLY WAGE (include fringes) . . . . ______ ______

16. TOTAL OWNING AND OPERATING COST . . . . ______ ______

17

SUBSECTION 2A: Residual Value at Replacement

	(1)	(2)
Gross Selling Price	(1) (___%)________	(2) (___%)________
Less: a. Commission	________	________
b. Make-ready costs	________	________
c. Inflation during ownership period*		
Net Residual Value (Enter on line 2)	________ (%)	(%) of original delivered price

*When used equipment auction prices are used to estimate residual value, the effect of inflation during the ownership period should be removed to show in constant value what part of the asset must be recovered through work.

SUBSECTION 9A: Lube Oils, Filters, Grease

	Unit Price	×	Consumption	=	Cost/Hour		Unit Price	×	Consumption	=	Cost/Hour
Engine	(1) ____	×	____	=	____	(2)	____	×	____	=	____
Transmission	____	×	____	=	____		____	×	____	=	____
Final Drives	____	×	____	=	____		____	×	____	=	____
Hydraulics	____	×	____	=	____		____	×	____	=	____
Grease	____	×	____	=	____		____	×	____	=	____
Filters	____	×	____	=	____		____	×	____	=	____
			Total		(1) ____	(2) ____					

(Enter total on line 9 or use Quick Estimator Tables)

SUBSECTION 12A: Special Items
(cutting edges, ground engaging tools, bucket teeth, excavator stick repair, etc.)

(1)	Cost		Life		Cost/Hour	(2)	Cost		Life		Cost/Hour
1.	____	÷	____	=	____	1.	____	÷	____	=	____
2.	____	÷	____	=	____	2.	____	÷	____	=	____
3.	____	÷	____	=	____	3.	____	÷	____	=	____
4.	____	÷	____	=	____	4.	____	÷	____	=	____
5.	____	÷	____	=	____	5.	____	÷	____	=	____
6.	____	÷	____	=	____	6.	____	÷	____	=	____
			Total		(1) ____	(2) ____					

(Enter total on line 12)

REPAIR RESERVE CONVERSION FACTORS (line 11)

For use in countries outside the United States where parts and service costs might differ from those used in charts and tables:

Labor Rate Ratio (1) ________ (2) ________

Parts Cost Ratio (1) ________ (2) ________

1-7 ESTIMATING OWNING COSTS

(Line Items 1 through 7)

To protect his equipment investment and be able to replace it, the machine owner must recover over the machine's useful life an amount equal to the loss in resale value plus the other costs of owning the equipment including interest, insurance and taxes.

The machine owner, for accounting purposes, estimates resale value loss in advance, and recovers his original equipment investment by establishing depreciation schedules according to the various uses of the equipment. Proper financial and tax assistance is highly recommended when establishing depreciation schedules.

The machine depreciation method suggested in this handbook is not based on or related to any tax considerations, but rather is a simple straight line write-off based solely on the number of years or hours the owner expects to use the machine gainfully. Considering today's economic conditions worldwide and the trend toward larger, more expensive equipment, many users choose to keep these units on the job well after they have been fully depreciated for tax purposes. On the other hand, tax incentives in many areas may favor trading a machine well before it approaches the limits of its useful life.

Accordingly, it is imperative that careful consideration be given the selection of depreciation periods, and that for owning and operating cost calculations they be based on useful life rather than tax write-off life. The table of machine operating conditions (next page) only suggests such useful life periods in clock or operating hours. Recognize, however, that factors other than operating conditions can influence machine depreciation periods — an owner's wish to accelerate recovery of his investment, purchase of a machine for a job of specific duration, local customs, local economic conditions, availability of foreign exchange to buy a replacement, and many others.

Maintenance practices are not considered in this table but play an important part in determining economic machine life. For example, operating conditions may suggest a 12,000 hour depreciation period for a machine, but poor maintenance could make it uneconomical to retain the unit beyond 10,000 hours. Good, regular maintenance often can extend economical machine life.

Therefore, a knowledge of the intended use, operating conditions and maintenance practices, plus any special factors, is essential in establishing expected machine life for depreciation purposes.

GUIDE FOR SELECTING OWNERSHIP PERIOD BASED ON APPLICATION AND OPERATING CONDITIONS

	ZONE A Moderate	ZONE B Average	ZONE C Severe
TRACK-TYPE TRACTORS	Pulling scrapers, most agricultural drawbar, stockpile, coalpile. No impact. Intermittent full throttle operation.	Production dozing in clays, sands, gravels. Pushloading scrapers, borrow pit ripping, most landclearing and skidding applications. Medium impact conditions. Production landfill work.	Heavy rock ripping. Tandem ripping. Pushloading and dozing in hard rock. Work on rock surfaces. Continuous high impact conditions.
D3-D7	12,000 Hr	10,000 Hr	8,000 Hr
D8-D11	22,000 Hr	18,000 Hr	15,000 Hr
AGRICULTURAL TRACTORS	Pulling combines, grain wagons and grain carts.	Pulling field cultivators, moldboard plows, chisel plows, discing, primary and finishing tillage.	Pulling layer scrapers, used in construction applications, ripping, dozing
CHALLENGER 65B	12,000 Hr	10,000 Hr	8,000 Hr
CHALLENGER 75	12,000 Hr	10,000 Hr	8,000 Hr
'SA' TRACTORS	14,000 Hr	12,000 Hr	10,000 Hr
MOTOR GRADERS	Light road maintenance. Finishing. Plant and road mix work. Light snowplowing. Large amounts of traveling.	Haul road maintenance. Road construction, ditching. Loose fill spreading. Landforming, landleveling. Summer road maintenance with medium to heavy winter snow removal. Elevating grader use	Maintenance of hard packed roads with embedded rock. Heavy fill spreading. Ripping-scarifying of asphalt or concrete. Continuous high load factor. High impact.
	20,000 Hr	15,000 Hr	12,000 Hr
EXCAVATORS	Utility construction, low density material, rehandling and scrap handling applications.	Continuous digging in sandy clay/sandy gravel, site development and lumber yard applications.	Continuous digging in rock/natural bed clay, high impact, using hammer, working in forests or quarries.
206B FT, 211B LC, 212B, 213B LC, 214B/214B FT, 224B, E70B, E110B, E120B, E140	8,000 Hr	6,000 Hr	4,000 Hr
EXCAVATORS	Shallow depth utility construction where excavator sets pipe and digs only 3 or 4 hours/shift. Free flowing, low density material and little or no impact. Most scrap handling arrangements	Mass excavation or trenching where machine digs all the time in natural bed clay soils. Some traveling and steady, full throttle operation. Most log loading applications.	Continuous trenching or truck loading in rock or shot rock soils. Large amount of travel over rough ground. Machine continuously working on rock floor with constant high load factor and high impact.
231D-245D, 320, E240C, 325, 330, E450, E650	12,000 Hr	10,000 Hr	8,000 Hr
FRONT SHOVELS	Continuous loading in loose banks or stockpile. Good underfoot conditions. (Might be considered similar to "normal" wheel loader conditions.)	Continuous loading in well-shot rock or fairly tight bank. Good underfoot conditions; dry floor, little impact or sliding on undercarriage	Continuous loading in poorly shot rock, virgin or lightly-blasted tight banks e.g., shales, cemented gravels, caliches, etc. Adverse underfoot conditions; rough floors; high impact sliding on undercarriage.
235D, 245D, E450, E650	18,000 Hr	15,000 Hr	10,000 Hr

	ZONE A Moderate	ZONE B Average	ZONE C Severe
FELLER BUNCHERS	Continuous felling and stacking in good underfoot conditions. Flat ground uniform trees below 305 mm (12 inches). 18,000 Hr	Continuous cycling in good underfoot conditions. Rolling terrain, some trees up to 500 mm (20 inches) or some hardwoods. 15,000 Hr	Continuous cycling in steep terrain over stumps and fallen trees. Most trees 500 mm (20 inches) or larger hardwoods. 10,000 Hr
BACKHOE LOADERS	Light duty utility applications in light to medium soil. Trenching depths less 1.83 m (6 ft.) 12,000 Hr	Utility applications in medium to heavy soil. Occasional use of constant flow implements. Dig depths to 3.05 m (10 ft.) 10,000 Hr	Production applications or digging in rock. Regular use of constant flow implements. Dig depths over 3.05 m (10 ft.) 5,000 Hr
SKIDDERS	Intermittent skidding for short distances, no decking. Good underfoot conditions: level terrain, dry floor, few if any stumps. 12,000 Hr	Continuous turning, steady skidding for medium distances with moderate decking. Good underfooting: dry floor with few stumps and gradual rolling terrain. 10,000 Hr	Continuous turning, steady skidding for long distances with frequent decking. Poor underfoot conditions: wet floor, steep slopes and numerous stumps. 8,000 Hr
PIPELAYERS	Little or no use in mud, water or on rock. Use on level, regular surfaces. 15,000 Hr	Typical pipelayer use in operating conditions ranging from very good to severe. 13,000 Hr	Continuous use in deep mud or water or on rock surfaces. 10,000 Hr
WHEEL TRACTOR-SCRAPERS	Level or favorable hauls on good haul roads. No impact. Easy-loading materials.	Varying loading and haul road conditions. Long and short hauls. Adverse and favorable grades. Some impact. Typical road-building use on a variety of jobs	High impact condition, such as loading ripped rock. Overloading. Continuous high total resistance conditions. Rough haul roads.
613C, 615C	12,000 Hr	10,000 Hr	8,000 Hr
E and E Series II	22,000 Hr	17,000 Hr	12,000 Hr
CONSTRUCTION & MINING TRUCKS & TRACTORS	Continuous operation at an average gross vehicle weight* less than recommended. Excellent haul roads. No overloading, low load factor. (See Hourly Fuel Consumption section for definition).	Continuous operation at an average gross vehicle weight* approaching recommended. Minimal overloading, good haul roads, moderate load factor. (See Hourly Fuel Consumption section for definition).	Continuous operation at or above maximum recommended gross vehicle weight*. Overloading, poor haul roads, high load factor. (See Hourly Fuel Consumption section for definition). Note — Continual loading beyond recommended maximum gross vehicle weight will further reduce Zone C hours.
769-777C	30,000 Hr	20,000 Hr	15,000 Hr
784/785/789/793	60,000 Hr	50,000 Hr	40,000 Hr

*Empty vehicle weight + payload

17

	ZONE A Moderate	ZONE B Average	ZONE C Severe
ARTICULATED TRUCKS	Earthmoving and stockpile use with well matched loading equipment. Short to medium hauls on well-maintained level haul roads. Free flowing material. Few impact loads. 15,000 Hr	Varying load and haul road conditions. High rolling resistance and poor traction during part of the job. Some adverse grades. Some impact loads. Typical use in road-building, dam construction, open-pit mining, etc. 10,000 Hr	Continuous use on very poorly maintained haul roads, high rolling resistance and poor traction. Frequent adverse grades and high impact loads. Poorly-matched loading equipment with continuous over-loading. 8,000 Hr
WHEEL TRACTORS & COMPACTORS	Light utility work. Stockpile work. Pulling compactors. Dozing loose fill. No impact. 15,000 Hr	Production dozing, pushloading in clays, sands, silts, loose gravels. Shovel clean-up. 12,000 Hr	Production dozing in rock. Push-loading in rocky, bouldery borrow pits. High impact conditions. Land-fill compactor work. 8,000 Hr
WHEEL LOADERS	Intermittent truck loading from stockpile, hopper charging on firm, smooth surfaces. Free flowing, low density materials. Utility work in governmental and industrial applications. Light snowplowing. Load and carry on good surface for short distances with no grades.	Continuous truck loading from stockpile. Low to medium density materials in properly sized bucket. Hopper charging in low to medium rolling resistance. Loading from bank in good digging. Load and carry on poor surfaces and slight adverse grades.	Loading shot rock (large loaders). Handling high density materials with counterweighted machine. Steady loading from very tight banks. Continuous work on rough or very soft surfaces. Load and carry in hard digging; travel longer distances on poor surfaces with adverse grades.
910E-966F	12,000 Hr	10,000 Hr	8,000 Hr
980F-992C	15,000 Hr	12,000 Hr	10,000 Hr
994	60,000 Hr	50,000 Hr	40,000 Hr
TRACK LOADERS	Intermittent truck loading from stockpile. Minimum traveling, turning. Free flowing, low density materials with standard bucket. No impact, backfilling and grading. 12,000 Hr	Bank excavation, intermittent ripping, basement digging of natural bed clays, sands, silts, gravels. Some traveling. Steady full throttle operation. 10,000 Hr	Loading shot rock, cobbles, glacial till, caliche. Steel mill work. High density materials in standard bucket. Continuous work on rock surfaces. Large amount of ripping of tight, rocky materials. High impact conditions. 8,000 Hr.
INTEGRATED TOOLCARRIERS	Intermittent truck loading from stockpile, hopper charging on firm, smooth surfaces. Free flowing, low density materials. Utility work in governmental and industrial applications. Light snow-plowing. Load and carry on good surface for short distances with no grades. 12,000 Hr	Continuous truck loading from stockpile. Low to medium density materials in properly sized bucket. Hopper charging in low to medium rolling resistance. Loading from bank in good digging. Load and carry on poor surfaces and slight adverse grades. 10,000 Hr	Loading shot rock (large loaders). Handling high density materials with counterweighted machine. Steady loading from very tight banks. Continuous work on rough or very soft surfaces. Load and carry in hard digging; travel longer distances on poor surfaces with adverse grades. 8,000 Hr.

	ZONE A Moderate	ZONE B Average	ZONE C Severe
FELLER BUNCHERS	Continuous felling and stacking in good underfoot conditions. Flat ground uniform trees below 305 mm (12 inches).	Continuous cycling in good underfoot conditions. Rolling terrain, some trees up to 508 mm (20 inches) or some hardwoods.	Continuous cycling in steep terrain over stumps and fallen trees. Most trees 508 mm (20 inches) or larger hardwoods.
	18,000 Hr	15,000 Hr	10,000 Hr
BACKHOE LOADERS	Light duty utility applications in light to medium soil. Trenching depths less 1.83 m (6 ft.)	Utility applications in medium to heavy soil. Occasional use of constant flow implements. Dig depths to 3.05 m (10 ft.)	Production applications or digging in rock. Regular use of constant flow implements. Dig depths over 3.05 m (10 ft.)
	12,000 Hr	10,000 Hr	5,000 Hr
SKIDDERS	Intermittent skidding for short distances, no decking. Good underfoot conditions: level terrain, dry floor, few if any stumps.	Continuous turning, steady skidding for medium distances with moderate decking. Good underfooting: dry floor with few stumps and gradual rolling terrain.	Continuous turning, steady skidding for long distances with frequent decking. Poor underfoot conditions: wet floor, steep slopes and numerous stumps.
	12,000 Hr	10,000 Hr	8,000 Hr
PIPELAYERS	Little or no use in mud, water or on rock. Use on level, regular surfaces.	Typical pipelayer use in operating conditions ranging from very good to severe.	Continuous use in deep mud or water or on rock surfaces.
	15,000 Hr	13,000 Hr	10,000 Hr
WHEEL TRACTOR-SCRAPERS	Level or favorable hauls on good haul roads. No impact. Easy-loading materials.	Varying loading and haul road conditions. Long and short hauls. Adverse and favorable grades. Some impact. Typical road-building use on a variety of jobs.	High impact condition, such as loading ripped rock. Overloading. Continuous high total resistance conditions. Rough haul roads.
613C, 615C	12,000 Hr	10,000 Hr	8,000 Hr
E and E Series II	22,000 Hr	17,000 Hr	12,000 Hr
CONSTRUCTION & MINING TRUCKS & TRACTORS	Continuous operation at an average gross vehicle weight* less than recommended. Excellent haul roads. No overloading, low load factor. (See Hourly Fuel Consumption section for definition).	Continuous operation at an average gross vehicle weight* approaching recommended. Minimal overloading, good haul roads, moderate load factor. (See Hourly Fuel Consumption section for definition).	Continuous operation at or above maximum recommended gross vehicle weight*. Overloading, poor haul roads, high load factor. (See Hourly Fuel Consumption section for definition). Note — Continual loading beyond recommended maximum gross vehicle weight will further reduce Zone C hours.
769-777C	30,000 Hr	20,000 Hr	15,000 Hr
784/785/789/793	60,000 Hr	50,000 Hr	40,000 Hr

*Empty vehicle weight + payload.

17

	ZONE A Moderate	ZONE B Average	ZONE C Severe
ARTICULATED TRUCKS	Earthmoving and stockpile use with well matched loading equipment. Short to medium hauls on well-maintained level haul roads. Free flowing material. Few impact loads. 15,000 Hr	Varying load and haul road conditions. High rolling resistance and poor traction during part of the job. Some adverse grades. Some impact loads. Typical use in road-building, dam construction, open-pit mining, etc. 10,000 Hr	Continuous use on very poorly maintained haul roads, high rolling resistance and poor traction. Frequent adverse grades and high impact loads. Poorly-matched loading equipment with continuous over-loading. 8,000 Hr
WHEEL TRACTORS & COMPACTORS	Light utility work. Stockpile work. Pulling compactors. Dozing loose fill. No impact. 15,000 Hr	Production dozing, pushloading in clays, sands, silts, loose gravels. Shovel clean-up. 12,000 Hr	Production dozing in rock. Push-loading in rocky, bouldery borrow pits. High impact conditions. Land-fill compactor work. 8,000 Hr
WHEEL LOADERS	Intermittent truck loading from stockpile, hopper charging on firm, smooth surfaces. Free flowing, low density materials. Utility work in governmental and industrial applications. Light snowplowing. Load and carry on good surface for short distances with no grades.	Continuous truck loading from stockpile. Low to medium density materials in properly sized bucket. Hopper charging in low to medium rolling resistance. Loading from bank in good digging. Load and carry on poor surfaces and slight adverse grades.	Loading shot rock (large loaders). Handling high density materials with counterweighted machine. Steady loading from very tight banks. Continuous work on rough or very soft surfaces. Load and carry in hard digging; travel longer distances on poor surfaces with adverse grades.
910E-966F	12,000 Hr	10,000 Hr	8,000 Hr
980F-992C	15,000 Hr	12,000 Hr	10,000 Hr
994	60,000 Hr	50,000 Hr	40,000 Hr
TRACK LOADERS	Intermittent truck loading from stockpile. Minimum traveling, turning. Free flowing, low density materials with standard bucket. No impact, backfilling and grading. 12,000 Hr	Bank excavation, intermittent ripping, basement digging of natural bed clays, sands, silts, gravels. Some traveling. Steady full throttle operation. 10,000 Hr	Loading shot rock, cobbles, glacial till, caliche. Steel mill work. High density materials in standard bucket. Continuous work on rock surfaces. Large amount of ripping of tight, rocky materials. High impact conditions. 8,000 Hr
INTEGRATED TOOLCARRIERS	Intermittent truck loading from stockpile, hopper charging on firm, smooth surfaces. Free flowing, low density materials. Utility work in governmental and industrial applications. Light snow-plowing. Load and carry on good surface for short distances with no grades. 12,000 Hr	Continuous truck loading from stockpile. Low to medium density materials in properly sized bucket. Hopper charging in low to medium rolling resistance. Loading from bank in good digging. Load and carry on poor surfaces and slight adverse grades. 10,000 Hr	Loading shot rock (large loaders). Handling high density materials with counterweighted machine. Steady loading from very tight banks. Continuous work on rough or very soft surfaces. Load and carry in hard digging; travel longer distances on poor surfaces with adverse grades. 8,000 Hr

AGRICULTURAL TRACTOR DEPRECIATION AND REPAIR COSTS

Unlike construction tractors which often are depreciated over 10,000 hours, the expected useful life of a Caterpillar steel tracked tractor in agriculture can range up to and beyond 20,000 hours (about eighteen years). The Challenger Tractor Line expected life is about 10,000 hours.

The tractor's decline in value is always a significant portion of the machinery cost in farming. The actual market value of any tractor is determined by many variables . . . machine age and condition, rate of change in size and farm operations in the area, popularity of given makes of tractors in the community, etc.

Whatever the variables, the decline in value is greater the first year than the second, greater the second year than the third, etc. The shorter the machine's work life, the higher the percentage of its value lost in a year.

Although the percentage of loss each year depends on the life of the machine, it's a general rule that 40 to 50% of the value will be lost in the first quarter of the machine's life. By the halfway point of lifetime, from 70 to 75% of value will be lost.

The sum of digits is a common, easily used method for predicting the farm tractor's depreciation value.

Assume a machine's total life is 18 years. Assign each of those years a value, beginning with 18 for the first year, 17 for the second, 16 for the third, etc. The sum of all 18 digits is 171 which when divided into the initial new machine value, will give a specific monetary figure. The first year, 18 units of value are written off, 17 the second year, etc.

The resale value loss for the first four-year's of machine life progresses as follows:

End of Year	Largest Remaining Digit	Loss of Value in Year	Loss of Value To Date	Remaining Value
1	18	18/171 or 10.5%	10.5%	89.5%
2	17	17/171 or 9.9%	(10.5 + 9.9) 20.4%	79.6%
3	16	16/171 or 9.3%	(20.4 + 9.3) 29.7%	70.3%
4	15	15/171 or 8.7%	(29.7 + 8.7) 38.4%	61.6%

Repairs — The reverse of the sum of digits formula can be used to predict repair costs for agricultural tractors.

Again, assuming an 18-year life, the sum of the digits would be 171. But the digit assigned the first year would be 1, the second year 2, etc.

(Note: The digital method applied to depreciation yields an eventual 100% of the purchase price. The American Society of Agricultural Engineers recommends repair costs for crawler tractors be figured at 78% and wheel tractors at 120% of purchase price.)

1 DELIVERED PRICE

(Line Item 1a, b and c)

Delivered price should include all costs of putting a machine on the user's job including transportation and any applicable sales taxes.

On rubber tired machines, tires are considered a wear item and covered as an operating expense. Accordingly, some users may wish to deduct tire costs from the delivered price particularly for larger machines.

2 RESIDUAL VALUE AT REPLACEMENT

(Line Item 2 and Subsection 2A)

Any piece of earthmoving machinery will have some residual value at trade-in. While many owners prefer to depreciate their equipment to zero value, others recognize the residual resale or trade-in value. This is at the estimator's option, but as in the discussion of depreciation, today's higher equipment costs almost dictate that resale value be considered in determining the net depreciable investment. And if machines are traded early for tax incentive purposes, resale value becomes even more significant.

For many owners, potential resale or trade-in value is a key factor in their purchasing decisions, since this is a means of reducing the investment they must recover through depreciation charges. The high resale value of Caterpillar built machines can reduce hourly depreciation charges, lower total hourly owning costs and improve the owner's competitive position.

When resale or trade-in value is used in estimating hourly owning and operating costs, local conditions must be considered, as used equipment values vary widely around the world. However, in any given used equipment business, factors which have greatest influence on resale or trade-in value are the number of hours on the machine at the time of sale or trade, the type of jobs and operating conditions in which it worked, and the physical condition of the machine. Your local Cat Dealer is your best source for determining current used equipment values.

Subsection 2A can be used to calculate the estimated residual value. If recent auction prices for used machines are used as a guide, then the value (or percentage) should be adjusted downward to remove the effect of inflation. Governmental indices on construction equipment costs or Dealer price records can be used to calculate the amount of inflation for the appropriate useful life. Another way to estimate residual value is comparing the current used machine value to the current new machine price provided major product changes haven't occured.

3 VALUE TO BE RECOVERED THROUGH WORK

(Line Item 3a and b)

The delivered price less the estimated residual value results in the value to be recovered through work, divided by the total usage hours, gives the hourly cost to protect the asset's value.

4 INTEREST

(Line Item 4)

Many owners charge interest as part of hourly owning and operating costs, others consider it as general overhead in their overall operation. When charged to specific machines, interest is usually based on the owner's average annual investment in the unit.

Interest is considered to be the cost of using capital. The interest on capital used to purchase a machine must be considered, whether the machine is purchased outright or financed.

If the machine will be used for N years (where N is the number of years of use), calculate the average annual investment during the use period and apply the interest rate and expected annual usage:

$$\frac{\left[\frac{N+1}{2N} \times \text{Delivered Price}\right] \times \text{Simple Interest \% rate}}{\text{hours/year}}$$

5-6 INSURANCE AND TAXES

(Line Items 5 and 6)

Insurance cost and property taxes can be calculated in one of two ways. If the specific annual cost is known this figure should be multiplied by the estimated usage (hours/years) and used. However, when the specific interest and tax costs for each machine are not known, the following formulas can be applied:

$$\frac{\text{Insurance}}{N = \text{No. Years}}$$

$$\frac{\left[\frac{N+1}{2N} \times \text{Delivered Price}\right] \times \text{Insurance rate \%}}{\text{hours/year}}$$

$$\frac{\text{Property Tax}}{N = \text{No. Years}}$$

$$\frac{\left[\frac{N+1}{2N} \times \text{Delivered Price}\right] \times \text{Tax rate \%}}{\text{hours/year}}$$

8-13 ESTIMATING OPERATING COSTS

(Line Items 8 through 13)

8 FUEL CONSUMPTION

(Line Item 8)

Fuel consumption can be closely measured in the field. However, if no opportunity exists to do this, consumption can be predicted when the machine application is known.

Application determines engine load factor which in turn controls engine fuel consumption. An engine continuously producing full rated horsepower is operating at a load factor of 1.0. Earthmoving machines may reach a 1.0 load factor intermittently, but seldom operate at this level for extended periods of time. Periods spent at idle, dozer and pusher travel in reverse, haul units traveling empty, close maneuvering at part throttle and operating downhill are examples of conditions which reduce load factor.

The following tables provide hourly fuel consumption estimates at various load factors for Caterpillar built machines. Since machine uses vary, application guides are also provided to aid in estimating load factor.

To estimate hourly fuel cost, select the load factor based on application and find hourly consumption. Then:

Hourly consumption × Local Unit Price of Fuel = Hourly Fuel Cost

When using these tables, keep in mind the many variables which can affect fuel consumption. Two operators of different temperament or attitude operating identical machines side by side in the same material can have as much as 10-12% difference in their consumption rates. However, the ranges shown should be applicable across a wide spectrum of conditions. Your Caterpillar dealer representative can help select the most reasonable estimate for your specific situation; we suggest you call on him.

Keep in mind also that a fuel consumption study measured over a short period of operation will give higher fuel consumption than shown here because: (1) the study will be at 100% efficiency, without breaks or idle time, and (2) the operators will know they're "under the gun" to produce and look good. On the other hand, these tables allow for "normal" inefficiencies in the working cycle and will more closely relate to "normal" day to day operation.

FUEL CONSUMPTION TABLES & LOAD FACTOR GUIDES . . .

TRACK-TYPE TRACTORS

Model	Low		Medium		High	
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal
D3C & LGP	4-7½	1-2	7½-11	2-3	9½-13	2½-3½
D4C & LGP	5½-9½	1½-2½	9½-13	2½-3½	11-15	3-4
D5C & LGP	5½-9½	1½-2½	9½-13	2½-3½	11-15	3-4
D4E	5½-9½	1½-2½	9½-13	2½-3½	11-15	3-4
D4H Series II & LGP	6-10½	1½-3	10½-14½	3-4	12½-17	3½-4½
D5B	9½-13	2½-3½	11-17	3-4½	15-21	4-5½
D5H Series II & LGP	11-15	3-4	12½-18½	3½-5	17-24	4½-6½
D6D & LGP	11-19	3-5	15-21	4-5½	21-26	5½-7
D6H Series II & LGP	13-22½	3½-6	17½-25	4½-6½	25-30½	6½-8
D7G Series II*	19-25	5-6½	26-34	7-9	32-40	8½-10½
D7H Series II & LGP	19-23	5-6	25-28	6½-7½	32-36	8½-9½
D8L & LGP	28-38	7½-10	40-45	10½-12	51-57	13½-15
D8N & LGP	22½-28	6-7½	28-38	7½-10	38-51	10-13½
D9N	30-42	8-11	44-53	11½-14	52-69	14½-18
D10N	46-51	12½-13½	62-66	16½-17½	77-82	20-22
D11N	62-70	16½-18½	85-93	22½-24½	108-115	28½-30½

*D7G fuel consumption data is based on a precombustion chamber equipped engine. Fuel consumption for a direct injection equipped D7G should be approximately 10% less.

AGRICULTURAL TRACTORS

Model	Low		Medium		High	
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal
D3C SA**	—	—	—	—	—	—
D4E SR	5½-9½	1½-2½	9½-13	2½-3½	11-15	3-4
D5B SA	13-19	3½-5	17-23	4½-6	21-26	5½-7
D6E SR	11-19	3-5	15-21	4-5½	21-26	5½-7
D8L SA	44-57	11½-15	53-70	14-18½	64-83	17-22
AC6	24½-32	6½-8½	32-40	8½-10½	40-48	10½-12½
Challenger 65B	30½-38	8-10	38-46	10-12	46-53	12-14
Challenger 75	34-41½	9-11	41½-49	11-13	49-57	13-15

**Insufficient data

LOAD FACTOR GUIDE

High: Steady ripping, shuttle pushloading. Agricultural drawbar work at full throttle, engine lugged to max. power most of the time; Little or no idling or travel in reverse.

Medium: Production dozing, pulling scrapers, most pushloading. Agricultural drawbar work at full throttle but not always lugging engine. Some idling and some travel with no load.

Low: Considerable idling or travel with no load.

MOTOR GRADERS

Model	Low		Medium		High	
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal
120G	9½-13	2½-3½	15-17	4-4½	19-23	5-6
130G	11-15	3-4	15-19	4-5	21-25	5½-6½
12G	11-15	3-4	15-19	4-5	23-26	6-7
140G	13-16	3½-4	19-23	5-6	25-28	6½-7½
14G	16-18	3½-5	21-28	5½-7	28-32	7½-8½
16G	19-25	5-6½	26-32	7½-9	38-44	10½-12

LOAD FACTOR GUIDE

High: Ditching, fill spreading, spreading base material, ripping, heavy road maintenance, snow plowing.

Medium: Average road maintenance, road mix work, scarifying, snow plowing.

Low: Finish grading, light maintenance, road travel.

EXCAVATORS & FELLER BUNCHERS

Model	Low		Medium		High	
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal
E70B	3-5	¾-1¼	5-8	1½-2	7-10	1¾-2½
E110B	4-7	1-1¾	7-10	1¾-2½	10-12	2½-3¼
E120B	4-8	1-2	8-11	2-2¾	11-13	2¾-3½
E140	4-8	1-2	8-11	2-2¾	11-13	2¾-3½
208B FT, 211B LC	5¼-8½	1½-2¼	8½-11	2¼-3	11-14	2¾-3¾
212B FT, 213B LC	6¼-8½	1¾-2½	9½-16	2½-4¼	14-17	3¾-4½
214B FT, 224B	8-11½	2-3	15-16½	4-4½	18-22	4¾-5¾
320	8-12	2-3½	12-14	3½-3¾	14-17	3¾-4½
E240C	11-14	2¾-3¼	16-19	4¼-5	23-25	6-6½
325	12-16	3¼-4	17-20	4½-5¼	24-26	6¼-6¾
231D, FB227	11-13	3-3½	21-26	5½-6½	25-28	6½-7½
330	16-22	4¼-5¾	22-28	5¾-7¼	32-36	8½-9½
235D	15-20	4-5¼	27-34	7-8	38-49	10-13
E450	20-25	5½-6½	30-35	7¾-8¼	40-45	10½-11¾
245D	23-28	6-7½	38-44	10-11½	55-61	14½-16
E650	30-35	7¾-9¼	40-45	10½-11¾	60-65	15¾-17

LOAD FACTOR GUIDE

High: Most pipeline applications in hard rocky material. Digging 90-55% of the daily work schedule.

Medium: Most residential sewer applications in natural bed clay. Digging 60-85% of the daily work schedule. Most log loading applications.

Low: Most utility, urban applications in sandy loam. Digging less than 50% of the daily work schedule. Scrap handling applications.

17

⑧ Hourly Fuel Consumption Tables
- Front Shovels • Pipelayers
- Wheel Tractor-Scrapers

FRONT SHOVELS

Model	Low		Medium		High	
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal
235D	15-26	4-5¼	34-44	9-11½	41-51	11-13½
245D	26-30	7-8	48-55	13-14½	59-64	15½-17
E450	20-25	5½-6¾	33-38	8¾-10	45-50	11¾-13¼
E650	30-36	7¾-8¼	45-50	11¾-13¼	60-70	15¾-16½

LOAD FACTOR GUIDE

High: Steady cycling in hard to dig material.

Medium: Steady cycling with frequent periods at idle.

Low: Light easy work. Considerable idling.

PIPELAYERS

Model	Low		Medium		High	
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal
571G	7½-11	2-3	13-17	3½-4½	17-21	4½-5½
572G	7½-11	2-3	13-17	3½-4½	17-21	4½-5½
578	9½-13	2½-3½	16½-20	4½-5½	22½-26	6½-7½
589	17-21	4½-5½	26-30	7-8	34-40	9-10½

LOAD FACTOR GUIDE

Pipelayer load factor depends largely on amount of time spent at idle speed.

WHEEL TRACTOR-SCRAPERS

Model	Low		Medium		High	
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal
613C	15-19	4-5	21-25	5½-6½	27½-34	7½-9
615C	23-26	6-7	30-36	8-9½	42-47½	11-12½
621E	27-32	7-8½	38-44	10-11½	49-57	13-15
623E	30-36	8-9½	40-46	10½-12	53-59	14-15½
627E	45½-51	12-13½	64-70	17-18½	85-88½	22½-23½
631E Series II	40-45	10½-12	53-59	14-15½	72-78	19-20½
637E Series II	64-70	17-18½	87-93	23-24½	113½-121	30-32
651E	47-57	12½-15	66-75	17½-20	87-95	23-25
657E	87-98	23-26	116-125½	30½-33	153-163	40½-43

LOAD FACTOR GUIDE

High: Continuous high total resistance conditions with steady cycling.

Medium: Typical road building use.

Low: Average use but with considerable idling, favorable grades, low rolling resistance and easy loading material.

BACKHOE LOADERS

Model	Low		Medium		High	
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal
416B	5.7-7.6	**1.5-2.0**	7.6-9.5	**2.0-2.5**	9.5-11.4	**2.5-3.0**
426B	6-8.3	**1.6-2.2**	8.3-10.2	**2.2-2.7**	10.2-13.2	**2.7-3.5**
428B	6-8.3	**1.6-2.2**	8.3-10.2	**2.2-2.7**	10.2-13.2	**2.7-3.5**
436B	6-8.3	**1.6-2.2**	8.3-10.5	**2.2-2.8**	10.5-14	**2.8-3.7**
438B	6-8.3	**1.6-2.2**	8.3-10.5	**2.2-2.8**	10.5-14	**2.8-3.7**
446*	—	—	—	—	—	—

*Insufficient data.

LOAD FACTOR GUIDE

High: Production work with long cycles and/or constant flow implements.

Medium: General work with regular cycles in medium applications.

Low: Utility work with intermittent cycles in light to medium applications.

SKIDDERS

Model	Low		Medium		High	
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal
518 Series II Cable	7½-11	**2-3**	11-15	**3-4**	15-19	**4-5**
518 Series II Grapple	9½-13	**2½-3½**	13-17	**3½-4½**	17-23	**4½-6**
528B	13-17	**3½-4½**	19-23	**5-6**	23-28	**6-7½**
530B	15-19	**4-5**	21-25	**5½-6½**	25-30	**6½-8**

LOAD FACTOR GUIDE — 518 Series II

High: Skidding larger timber loads (over 6800 kg ~ 15,000 lb) in steep terrain (over 10%) with high skidding resistance.

Medium: Skidding medium size timber loads (up to 6800 kg ~ 15,000 lb) in moderate terrain (5-10%) with average skidding resistance.

Low: Skidding small timber loads (less than 4500 kg ~ 10,000 lb) in flat terrain (0-5%) with low skidding resistance.

LOAD FACTOR GUIDE — 528B and 530B

High: Skidding large timber loads (over 11 300 kg ~ 25,000 lb) in steep terrain (over 10%) with high skidding resistance.

Medium: Skidding medium size timber loads (up to 11 300 kg ~ 25,000 lb) in moderate terrain (5-10%) with average skidding resistance.

Low: Skidding smaller timber loads (less than 6800 kg ~ 15,000 lb) in flat terrain (0-5%) with low skidding resistance.

17

⑥ Hourly Fuel Consumption Tables
- Construction & Mining Trucks & Tractors
- Articulated Dump Trucks

CONSTRUCTION & MINING TRUCKS & TRACTORS

Model	Low		Medium		High	
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal
768C	28.4-37.9	7½-10	37.9-51.1	10-13½	51.1-60.6	13½-16
769C	18.9-28.4	5-7½	28.4-37.9	7½-10	37.9-51.1	10-13½
771C	20.8-30.3	5½-8	30.3-39.7	8-10½	39.7-53.0	10½-14
772B	37.9-54.9	10-14½	54.9-71.9	14½-19	71.9-87.1	19-23
773B	26.5-37.9	7-10	37.9-54.9	10-14½	54.9-71.9	14½-19
775B	30.3-41.6	8-11	41.6-56.8	11-15	56.8-73.8	15-19½
776D	53.0-73.8	14-19½	73.8-96.5	19½-25½	96.5-117.3	25½-31
777C	36.0-53.0	9½-14	53.0-73.8	14-19½	73.8-96.5	19½-25½
784/785	53.0-79.5	14-21	79.5-109.8	21-29	109.8-145.7	29-38½
789	68.1-102.2	18-27	102.2-141.9	27-37½	141.9-185.5	37½-48
793	83.3-121.1	22-32	121.1-170.3	32-45	170.3-223.3	45-59

LOAD FACTOR GUIDE

Low — High: Increasing — Rolling resistance, gross vehicle weight (empty vehicle weight plus payload) and vertical lift.

Decreasing — Idle time (delays, loading, operator breaks, etc.) and downhill hauls.

ARTICULATED TRUCKS

Model	Low		Medium		High	
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal
D20D	6.4	1.7	11.7	3.1	16.7	4.4
D25D	8.0	2.1	14.0	3.7	20.0	5.3
D30D	9.5	2.5	17.0	4.5	23.0	6.1
D40D	14.0	3.7	28.0	7.4	38.0	10.0
D250D	6.4	1.7	11.7	3.1	16.7	4.4
D300D	9.5	2.5	17.0	4.5	23.0	6.1
D350D	11.5	3.0	20.5	5.4	27.0	7.1
D400D	14.0	3.7	29.0	7.7	38.5	10.2

LOAD FACTOR GUIDE

High: Long haul time with frequent adverse grades. Continuous use on very poorly maintained haul roads with high rolling resistance.

Medium: Normal load and haul time. Varying load and haul road conditions. Some adverse grades. Some high rolling resistance.

Low: Large amount of idling. Short to medium hauls on well maintained level haul roads. Minimum total resistance.

WHEEL TRACTORS & COMPACTORS

Model	Low		Medium		High	
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal
814B	21-25	6¼-6½	28-30	7-8	36-40	9½-10½
815B	26-30	7-8	36-42	9½-11	44-47	11½-12½
816B	26-30	7-8	36-42	9½-11	44-47	11½-12½
824C	28-32	7½-8½	38-44	10-11½	51-57	13½-15
825C	36-42	9½-11	51-57	13½-15	60-66	16-17½
826C	36-42	9½-11	51-57	13½-15	60-66	16-17½
834B	40-45	10½-12	53-59	14-15½	72-78	19-20½

LOAD FACTOR GUIDE

High: Heavy dozing, compacting heavy material. Heavy landfill work.

Medium: Production dozing, most pushloading, shovel cleanup, normal compaction.

Low: Considerable idling or travel with no load.

17

⑨ Hourly Fuel Consumption Tables
- Wheel Loaders & Integrated Toolcarriers
- Track Loaders

WHEEL LOADERS & INTEGRATED TOOLCARRIERS

Model	Low		Medium		High	
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal
910E, IT12B	4-7½	1-2	5½-9½	1½-2½	7½-13	2-3½
IT14B	4-7½	1-2	7½-11	2-3	9½-13	2½-3½
916, IT18B	5½-7½	1½-2	9½-12	2½-3	13-15	3½-4
926E, IT28B	7½-11	2-3	11-15	3-4	15-19	4-5
930, 930R	9½-13	2½-3½	13-17	3½-4½	19-23	5-6
936F	9½-13	2½-3½	13-17	3½-4½	19-23	5-6
950F	11-15	3-4	17-21	4½-5½	23-28	6-7½
966C	17-21	4½-5½	23-28	6-7½	32-38	8½-10
966F	17-21	4½-5½	23-28	6-7½	32-38	8½-10
980F	23-26	6-7	30-36	8-9½	42-47	11-12½
988B	32-38	8½-10	44-49	11½-13	60-68	16-17½
992C	54-60	14½-16	75-81	20-21½	104-113	27½-30
994	102-109½	27-29	136-147½	36-39	189-208	50-55

LOAD FACTOR GUIDE
High: Steady cycling on basic loader cycle.

Medium: Steady cycling but over haul distances or work on basic loader cycle with frequent periods at idle.

Low: Light utility work. Considerable idling.

TRACK LOADERS

Model	Low		Medium		High	
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal
931C	5½-9½	1½-2½	7½-11	2-3	11-15	3-4
935C	5½-9½	1½-2½	7½-11	2-3	11-15	3-4
943	5½-9½	1½-2½	9½-13	2½-3½	13-17	3½-4½
953	9½-13	2½-3½	16-19	4-5	19-23	5-6
963	13-17	3½-4½	21-25	5½-6½	25-30	6½-8
973	19-23	5-6	28-34	7½-9	36-42	9½-11

LOAD FACTOR GUIDE
High: Continuous excavating and loading from bank. Land clearing.

Medium: Bank or stockpile loading with idling periods. Load and carry.

Low: Large amounts of idling in any application.

⑨ LUBE OILS, FILTERS, GREASE

(Line Item 9 and Subsection 9A)

Hourly costs of lube oils and grease can be approximately estimated by taking consumptions from the table below and applying local prices.

See the page following this table for instructions on how to estimate local hourly filter costs.

For quick estimating, *approximate* hourly costs in U.S. dollars for the total lube oils, filters and grease for each machine are shown in the last table in this area.

APPROXIMATE HOURLY CONSUMPTION OF LUBRICANTS

(When operating in heavy dust, deep mud or water, increase the quantities by 25%.)

Model	Crankcase		Transmission		Final Drives		Hydraulic Control		Lubricant Changes*	Grease Fittings**
	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal		
Track-Type Tractors										
D3C/D4C Series II	.045	.012	.011	.003	.009	.002	.015	.004	16	8
D5C	.046	.012	.011	.003	.012	.003	.015	.004	16	8
D4E	.038	.010	.039	.010	.018	.005	.011	.003	11	864
D4H Series II	.038	.010	.038	.010	.018	.005	.011	.003	13	0
D5B	.054	.014	.076	.020	.022	.006	.024	.006	9	916
D5H Series II	.054	.014	.076	.020	.022	.006	.024	.006	13	0
D6D	.109	.029	.045	.012	.038	.010	.024	.006	13	428
D6H Series II	.109	.029	.045	.012	.038	.010	.024	.006	13	16
D7G	.109	.029	.070	.018	.068	.018	.046	.012	13	444
D7H Series II	.109	.029	.070	.018	.068	.018	.045	.012	12	36
D8L	.181	.048	.166	.044	.022	.006	.035	.009	11	516
D8N	.144	.038	.129	.034	.016	.004	.042	.011	13.5	52
D9N	.181	.048	.166	.044	.022	.006	.035	.009	12	516
D10N	.242	.064	.177	.047	.018	.006	.054	.014	12	516
D11N	.424	.112	.242	.064	.019	.005	.125	.033	14	496
Agricultural Tractors										
D3C SA***	—	—	—	—	—	—	—	—	—	—
D4E SR	.038	.010	.039	.010	.018	.005	.011	.003	11	864
D5B SA	.054	.014	.076	.020	.022	.006	.024	.006	9	916
D6E SR	.108	.029	.045	.012	.038	.010	.024	.006	13	428
D8L SA***	—	—	—	—			—	—	—	—
AG6	.109	.029	.045	.012	.030	.010	.045	.012	14	—
Challenger 65B	.109	.029	.053	.014	.101	.027	.045	.012	16	2012
Challenger 75	.109	.028	.053	.014	.101	.027	.045	.012	16	2012
Motor Graders										
120G	.084	.022	.068	.018	.049	.013	.034	.009	12	636
130G	.084	.022	.079	.021	.064	.017	.034	.009	12	636
12G	.058	.015	.079	.021	.064	.017	.038	.010	9	636
140G	.117	.031	.080	.021	.064	.017	.038	.010	12	636
14G	.116	.031	.151	.040	.098	.026	.061	.015	12	636
16G	.120	.032	.197	.052	.121	.032	.057	.015	12	636

*Total number of lubricant changes (crankcase, transmission, final drives and hydraulic) over a 2000 hour period. Total may vary depending upon the sulfur content of your diesel fuel. Always consult your machine's Lube and Maintenance Guide.

**The number shown here refers to the total number of grease fittings you can expect to service over a 2000 hour period. Total can vary depending upon how your machine is equipped.

***Insufficient data

NOTE: These figures are based upon machines operating in ideal conditions without loss of lubricants. They were computed by dividing recommended change intervals (in hours) into tank capacity. Make-up quantities are not included in these computations.

Model	Crankcase		Transmission†		Final Drives††		Hydraulic Control		Lubricant Changes*	Grease Fittings**
Excavators & Feller Bunchers	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal		
206B FT◄	.040	.010	.008	.002	.004	.001	.060	.016	10	6200
211B LC	.040	.010	—	—	.004	.001	.060	.016	10	4280
212B FT◄	.040	.010	.008	.002	.004	.001	.060	.016	10	6200
213B LC	.060	.010	—	—	.004	.001	.132	.035	11	1600
214B/214B FT◄	.060	.010	.008	.002	.005	.001	.132	.035	14	2080
224B◄	.060	.016	.008	.002	.005	.001	.150	.039	15	5240
231D	.076	.020		—	.017	.004	.159	.042	10	800
235D◄◄	.110	.029	—	—	.017	.004	.160	.044	10	848
245D◄◄	.152	.038		...	.017	.004	.202	.053	10	856
E70B	.041	.011	—	—	.005	.002	.08	.02	10	400
E110B	.052	.014	—	—	.008	.002	.11	.03	10	480
E120B	.088	.023	—	—	.008	.002	.11	.03	10	460
E140	.088	.023	—	—	.080	.002	.11	.03	10	500
320	.095	.025	—	—	.015	.004	.13	.03	10	550
E240C	.097	.026	—	—	.017	.004	.15	.04	10	600
325	.097	.026	—	—	.017	.004	.15	.04	10	600
330	.138	.036	.003	.001	.018	.005	.20	.05	14	650
E450	.187	.048	.007	.002	.064	.016	.29	.08	19	700
E650	.357	.094	.007	.002	.068	.018	.43	.11	19	750
E450 Front Shovel	.187	.048	.007	.002	.064	.016	.29	.08	19	1400
E650 Front Shovel	.357	.094	.007	.002	.068	.018	.43	.11	19	1400
Backhoe Loaders										
416B	.028	.007	.010	.003	.0185	.0049	.019	.005	13	8820
426B	.028	.007	.010	.003	.0185	.0049	.019	.005	13	8820
428B	.028	.007	.010	.003	.0185	.0049	.019	.005	13	8820
436B	.028	.007	.010	.003	.0185	.0049	.019	.005	13	8820
438B	.028	.007	.010	.003	.0185	.0049	.019	.005	13	8820
446	.044	.012	.026	.007	.003	.008	.023	.007	13	—
Skidders										
518 Series II	.078	.020	.032	.008	.027	.007	.014	.004	12	580
528B	.113	.030	.032	.008	.032	.008	.023	.006	12	584
530B	***	***	***	***	***	***	***	***	***	***
Pipelayers										
571G	.109	.029	.070	.018	.068	.018	—	—	12	5508
572G	.132	.035	.117	.031	.072	.019	.018	.005	13	5130
578***	—	—	—	—	—	—			—	—
589	.171	.045	.167	.044	.086	.023	.085	.023	16	2464
Wheel-Tractor-Scrapers										
613C	.049	.013	.026	.007	.018	.004	.048	.013	12	6840
615C	.094	.025	.034	.009	.030	.008	.078	.020	12	7560
621E	.136	.036	.083	.022	.079	.021	.055	.014	12	2569
623E	.136	.036	.083	.022	.079	.021	.055	.014	12	8785
627E	.219	.058	.155	.041	.104	.027	.068	.017	22	2861
631E Series II	.182	.048	.127	.033	.092	.024	.085	.022	12	717
637E Series II	.290	.077	.185	.049	.164	.043	.085	.022	22	717
651E	.272	.072	.138	.036	.098	.026	.094	.025	12	1568
657E	.454	.120	.257	.046	.182	.048	.094	.025	24	1584

◄Wheeled Models equipped with front and rear outriggers.
◄◄The 235D Front Shovel has 6848 grease fittings over a 2000 hour period. The 245D Front Shovel has 6856
*Total number of lubricant changes (crankcase, transmission, final drives and hydraulic) over a 2000 hour period. Total may vary depending upon the sulfur content of your diesel fuel. Always consult your machine's Lube and Maintenance Guide.
**The number shown here refers to the total number of grease fittings you can expect to service over a 2000 hour period. Total can vary depending upon how your machine is equipped.
***Insufficient data
†Includes hydraulic pump drive (Excavators)
††Includes travel drives and swing drive (Excavators)

The following are the minimum number of recommended changes for the E Series over a 2000 interval:
Crankcase 8 changes 250 Hr. Interval
Pump Drive 2 changes 1000 Hr. Interval
Travel Drive 1 change 1000 Hr. Interval
Swing Drive 2 changes 1000 Hr. Interval
Hydraulic 1 change 2000 Hr. Interval

NOTE: Lubricant changes shown for the tandem powered 627E, 637E Series II and 657E include both tractor and scraper engines.

Model	Crankcase		Transmission		Final Drives†		Hydraulic†† Control		Lubricant Changes*	Grease Fittings**
Construction & Mining Trucks & Tractors	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal	liter	U.S. gal		
768C	.182	.048	.101	.027	.083	.022	.447	.118	16	900
769C	.182	.048	.101	.027	.083	.022	.447	.118	16	586
771C	.182	.048	.101	.027	.083	.022	.447	.118	16	580
772B	.273	.072	.101	.027	.078	.021	.475	.126	15	906
773B	.273	.072	.101	.027	.078	.021	.475	.126	15	586
775B	.273	.072	.101	.027	.078	.021	.475	.126	15	596
776C	.363	.096	.138	.037	.165	.044	.526	.139	15	1056
777C	.363	.096	.138	.037	.165	.044	.526	.139	15	728
784	.546	.144	.248	.066	.218	.058	.392	.104	13	1128
785	.546	.144	.248	.066	.218	.058	.392	.104	13	1128
789	.864	.266	.224	.059	.291	.077	.661	.174	13	1128
793	.864	.266	.224	.059	.331	.088	.796	.210	13	1360
Articulated Trucks										
D20D	.136	.036	.034	.010	.120	.031	.100	.027	13	3200
D25D	.136	.036	.034	.010	.136	.036	.100	.027	13	2248
D30D	.136	.036	.034	.010	.136	.036	.100	.027	13	2248
D40D	.120	.032	.100	.027	.150	.039	.100	.027	13	2248
D250D	.136	.036	.034	.010	.120	.031	.100	.027	13	3200
D300D	.136	.036	.034	.010	.120	.031	.100	.027	13	3200
D350D	.136	.036	.034	.010	.138	.036	.100	.027	13	3280
D400D	.120	.032	.100	.027	.034	.010	.100	.027	13	3508
Wheel Tractors & Compactors										
814B	.113	.030	.060	.016	.051	.013	.043	.011	12	192
815B	.113	.030	.060	.016	.051	.013	.043	.011	12	192
816B	.113	.030	.060	.016	.051	.013	.043	.011	12	192
824C	.113	.030	.060	.016	.073	.019	.043	.011	12	200
825C	.113	.030	.060	.016	.096	.025	.043	.011	12	200
826C	.113	.030	.060	.016	.096	.025	.043	.011	12	200
834B	.166	.044	.102	.027	.102	.027	.121	.032	12	318
Wheel Loaders & Integrated Toolcarriers										
910E	.038	.010	.023	.006	.009	.002	.036	.009	14	848
IT12B	.038	.010	.023	.006	.009	.002	.036	.009	14	648
IT14B	.038	.010	.023	.006	.009	.002	.036	.009	14	848
916	.055	.014	.030	.008	.010	.003	.026	.007	13	442
IT18B	.055	.014	.030	.008	.010	.003	.026	.007	13	644
IT28B	.058	.015	.024	.006	.015	.004	.026	.007	15	664
926E	.058	.015	.024	.006	.015	.004	.026	.007	15	444
930, 930R	.110	.030	.040	.010	.080	.020	.150	.040	12	384
936F	.089	.023	.038	.010	.015	.004	.038	.010	13	452
950F	.090	.024	.034	.009	.018	.005	.038	.010	13	392
966C, 966R	.113	.030	.045	.012	.050	.013	.070	.018	12	452
966F	.114	.030	.045	.012	.025	.007	.070	.019	13	432
980F	.138	.036	.062	.017	.042	.011	.063	.017	15	720
988B	.180	.048	.066	.018	.051	.014	.150	.039	15	408
992C	.288	.076	.136	.036	.191	.050	.270	.070	13	3670
994	.787	.208	.276	.073	.442	.117	.435	.115	18	3694
Track Loaders										
931C (3F-3R)	.048	.012	.014	.004	.008	.002	.026	.007	14	720
935C	.049	.013	.015	.004	.008	.002	.026	.007	14	720
943	.060	.016	.013	.003	.009	.002	.026	.007	11	324
953	.060	.016	.021	.006	.015	.004	.026	.007	11	324
963	.075	.020	.031	.008	.011	.003	.040	.010	11	244
973	.098	.026	.034	.009	.013	.003	.036	.009	11	364

*Total number of lubricant changes (crankcase, transmission, final drives and hydraulic) over a 2000 hour period. Total may vary depending upon the sulfur content of your diesel fuel. Always consult your machine's Lube and Maintenance Guide.

**The number shown here refers to the total number of grease fittings you can expect to service over a 2000 hour period. Total can vary depending upon how your machine is equipped.

†Includes differential (Construction & Mining Trucks/Tractors)

††Includes brakes/converter/hoist system and steering system (Construction & Mining Trucks/Tractors)

GUIDE FOR ESTIMATING LOCAL HOURLY COST OF FILTERS

The approximate hourly filter costs at right were determined by using the following formula:

Filters	Change Interval*	#Filters	Cost**	#Filters/ 2000 hr.	Total Cost
Engine	250 hr.		$	____	$____
Transmission	500		____	____	____
Hydraulic	500	____	____	____	____
Fuel — primary	2000	____	____	____	____
— final	500	____	____	____	____
Air — primary	2000	____	____	____	____
— secondary	1000	____	____	____	____

Total Filter Cost/2000 hr. = $

Total Cost $_____ ÷ 2000 hr. = $_____ Hourly Filter Cost.

*Recommended change interval may vary with machine and sulfur content of diesel fuel. Always consult Lube & Maintenance Guide.

**Cost of filter is suggested consumer list price. For the small excavators and the 613C, we assumed an average of $6.50 per filter.

NOTE: The approximate hourly filter costs at right do *not* include labor. To determine your labor cost you can apply your hourly labor rate to 5 minutes per each filter change. For example, if your labor rate is $20.00 per hour then your labor cost for one filter change would be $1.66.

Model	Approx. Hourly Filter Cost	Filters◄
Track-Type Tractors		
D3C (3F-3R)		
D4C Series II	.08	23
D5C	.08	23
D4E	.08	23
D4H Series II	.12	27
D6B	.11	26
D5H Series II	.12	27
D6D	.12	27
D6H Series II	.12	27
D7G	.12	27
D7H Series II	.09	23
D8L	.22	32
D8N	.21	53
D9N	.26	42
D10N	.29	46
D11N	.32	43
Agricultural Tractors		
D4E SR	.09	23
D6D SA	.12	27
D6D SR	.12	27
D8L SA	.22	32
AG6	.12	27
Challenger 65B	.24	30
Challenger 75	.34	30
Motor Graders		
120G	.10	27
130G	.11	27
12G	.09	23
140G	.11	27
14G	.12	27
16G	.14	27
Feller Bunchers		
FB219	.06	19
FB227	.09	19
Backhoe Loaders		
416B	.1373	18
426B	.1373	18
428B	.1373	18
436B	.1373	18
438B	.1373	18
446	***	
Skidders		
518 Series II Cable & Grapple	.09	24
528B	.10	24
530B	***	***
Pipelayers		
571G	.10	23
572G	.11	27
578***		
589	.28	43
Wheel Tractor-Scrapers		
613C	.12	31
615C	.12	27
621E	.16	28
623E	.16	28
627E	.26	47
631E Series II	.25	40
637E Series II	.34	58
651E	.27	44
657E	.52	80
Construction & Mining Trucks & Tractors		
768C, 769C, 771C	.496	56
772B, 773B, 775B	.516	60
776C, 777C	.468	47
784	.717	64
785	.706	63
789	.934	75
793	1.580	80
Articulated Trucks		
D20D	.16	52
D25D	.16	52
D30D	.16	52
D40D	.24	40
D250D	.16	52
D300D	.16	52
D350D	.16	52
D400D	.24	40
Wheel Tractors & Compactors		
814B	.13	28
815B, 816B	.14	28
824C, 825C 826C	.18	28
834B	.26	36
Wheel Loaders & Integrated Toolcarriers		
910E	.14	34
IT12B	.14	34
IT14B	.14	34
916	.15	35
IT18B	.15	35
926E	.14	35
IT28B	.14	35
930C, 930R	.11	35
936F	.14	37
950F	.14	34
966C	.17	36
966F	.18	46
980F	.26	46
988B	.39	50
992C	.55	72
994	1.15	82
Track Loaders		
931C (3F-3R)	.08	28
935C	.08	30
943	.10	20
953	.09	20
963	.09	19
973	.08	20

***Insufficient data to estimate.

◄Total number of filters changed over a 2000 hour period. Includes engine crankcase, transmission, hydraulic, fuel (primary and final) and air (primary and secondary). Some models include coolant conditioner and air filters.

GUIDE FOR ESTIMATING LOCAL HOURLY COST OF FILTERS

The approximate hourly filter costs at right were determined by using the following formula:

Filters	Change Interval*	#Filters	Cost**	#Filters/ 2000 hr.	Total Cost
Engine	250 hr.		$		$
Transmission	500				
Hydraulic	500	____	____	____	____
Fuel — primary	2000	____	____	____	____
— final	500	____	____	____	____
Air — primary	2000	____	____	____	____
secondary	1000	____	____	____	____

Total Filter Cost/2000 hr. = $______

Total Cost $______ ÷ 2000 hr. = $______ Hourly Filter Cost.

*Recommended change interval may vary with machine and sulfur content of diesel fuel. Always consult Lube & Maintenance Guide.
**Cost of filter is suggested consumer list price.

NOTE: The approximate hourly filter costs at right do *not* include labor. To determine your labor cost you can apply your hourly labor rate to 5 minutes per each filter change. For example, if your labor rate is $20.00 per hour then your labor cost for one filter change would be $1.66.

Model	Filters◄	Model	Filters◄
206B FT	20	E70B	18
211B LC	20	E110B	22
212B FT	20	E120B	22
213B LC	20	E140	22
214B/214B FT	20	300	28
224B	20	E240C	28
231D, FB227	19	325	32
235D Front Shovel	19	330	32
245D Front Shovel	19	E450	40
		E650	40

◄Total number of filters changed over a 2000 hour period. Includes engine crankcase, transmission, hydraulic, fuel (primary and final) and air (primary and secondary).

TOTAL NUMBER OF FILTERS CHANGED OVER 2000 Hr (PIECES × CHANGE)

Filter \ Model	E70B	E110B	E120B	E140	320	E240C	325	330	E450	E650
Engine										
Fuel	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4	1 × 8	1 × 8	1 × 4	1 × 4
Oil	1 × 4	1 × 4	1 × 4	1 × 4	1 × 8	1 × 8	1 × 8	1 × 8	1 × 8	1 × 8
Air Cleaner	1 × 2	1 × 2	1 × 2	1 × 2	2 × 2	2 × 2	2 × 2	2 × 2	2 × 2	2 × 2
Hydraulic										
Return	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4	—	—
Drain	—	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4	2 × 4	2 × 4
By-Pass	—	—	—	—	—	—	—	—	—	—
Pilot	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4	1 × 4
Full-Flow	—	—	—	—	—	—	—	—	3 × 4	3 × 4
Total Number Change	18	22	22	22	28	28	32	32	40	40

17

QUICK ESTIMATOR TABLE

- *Approximate* hourly cost ($ U.S.) of lube oils, filters and grease (materials).
- *Approximate* hourly cost ($ U.S.) of lube oils, filters and grease (labor).

Computed over 2000 hour period.

FACTORS USED (Labor)

For the labor figure shown we assumed an hourly labor rate of $40.00. This rate was applied to the assumed labor times of:

- 30 minutes per lube oil change
- 5 minutes per filter change
- 1 minute per grease fitting

FACTORS USED (Materials)

- Lube oils at U.S. $3.50 per U.S. gallon. (Capacities and change intervals from each model's Lube and Maintenance Guide.)
- Filters at suggested U.S. consumer's list prices. (See previous page for filter computation formula.)
- Grease at $.04 per fitting. (See consumption tables for each model's total number of fittings over 2000 hour period.)

Model	Approx. Cost Per Hour Materials	Approx. Cost Per Hour Labor
Track-Type Tractors		
D3C (3F-3R)	.15	.08
D3C/D4C Series II	.15	.08
D5C	.20	.08
D4H Series II	.31	.10
D5H Series II	.34	.11
D6D	.31	.16
D6H Series II	.33	.09
D7G	.31	.15
D7H Series II	.30	.08
D8L	.61	
D8N	.53	.10
D9N	.65	.10
D10N	.76	.11
D11N	.71	.17
Agricultural Tractors		
D4E SR	.20	.20
D5B SA	.35	.16
D6E SR	.31	.16
D8L SA	.61	
AG6	.31	.16
Challenger 65B	.61	.28
Challenger 75	.61	.28
Motor Graders		
120G	.33	.18
130G	.36	.18
12G	.32	.18
140G	.39	.18
14G	.52	.18
16G	.61	.18
Excavators & Feller Bunchers		
206	.30	.77
211 LC	.32	.67
212	.35	.77
213B LC	.31	.80
214B	.34	.82
FB219	.21	.18
FB227	.33	.20
235D	.39	.20
235D Front Shovel	.46	1.20
245D	.46	.20
245D Front Shovel	.55	1.20
E70B	.22	.12
E110B	.28	.14
E120B	.31	.14
E140	.32	.14
320	.41	.18
E240C	.41	.18
325	.50	.26
330	.57	.28
E450	.78	.35
E450 Front Shovel	.82	.35
E650	1.10	.36
E650 Front Shovel	1.14	.36
Backhoe Loaders		
416B	.43	.86
426B	.43	.86
428B	.43	.86
436B	.43	.86
438B	.43	.80
446	*	*
Skidders		
518 Series II	.24	.17
528B	.30	.17
530B	.33	.17
Pipelayers		
571G	.41	.97
572G	.51	.91
578*	—	
589	.83	.64
Wheel Tractor-Scrapers		
613C	.37	1.20
615C	.44	1.32
621E	.53	.49
623E	.59	1.27
627E	.79	.60
631E Series II	.88	.27
637E Series II	1.02	.33
651E	.85	.34
657E	1.45	.49
Construction & Mining Trucks & Tractors		
768C	1.17	.53
769C	1.17	.42
771C	1.17	.42
772B	1.29	.53
773B	1.28	.42
775B	1.28	.53
776C	1.51	.56
777C	1.51	.45
784	1.89	.59
785	1.89	.69
789	2.55	.61
793	3.46	.63
Articulated Trucks		
D20D	.48	.47
D25D	.48	.47
D30D	.48	.47
D40D	.49	.47
D250D	.48	.47
D300D	.48	.47
D350D	.50	.64
D400D	.67	.68
Wheel Tractors & Compactors		
814B	.38	.10
815B	.39	.10
816B	.39	.10
824C	.45	.10
825C	.47	.10
826C	.47	.10
834B	.72	.19
Wheel Loaders & Integrated Toolcarriers		
910 (3F-3R)	.19	.13
IT12	.18	.17
916	.28	.13
IT18B	.26	.15
926E	.30	.13
IT28B	.30	.16
930C, 930R	.28	.13
936F	.35	.34
950F	.31	.31
966C	.45	.18
966F	.44	.36
980F	.52	.46
988B	.71	.37
992C	1.22	.69
994	2.82	.92
Track Loaders		
931C(3F-3R)	.22	.15
935C	.28	.18
943	.20	.11
953	.21	.11
963	.24	.09
973	.24	.12

*Insufficient data to estimate costs

Note: These figures are based upon machines operating in ideal conditions with normal lubricant usage. Keep in mind they are approximate hourly costs. Your figures can vary depending upon condition, application severity and local labor rates. By using prices more common in your region, and with the assistance of your Caterpillar dealer representative, you can estimate a more accurate hourly cost for lube oils, filters and grease.

(10a) TIRES

(Line Item 10a)

Tire costs are an important part of the hourly cost of any wheel machine. The best estimate of this item is obtained when tire life figures based on experience are used with prices the machine owner actually pays for the replacement tires.

For cases in which tire experience is not available, use the following tire life estimator curves.

Tire Life Estimators

- Curves do not allow for additional life from recapping. They assume new tires run to destruction, but this is not necessarily recommended.
- Based on standard machine tires. Optional tires will shift these curves either up or down.
- Sudden failure (blow out) due to exceeding Ton-MPH (tkm/h) limitations is not considered. Nor are premature failures, due to puncture by stumps or sharpened tree limbs (Skidders) or rocks (Trucks, Loaders, etc.).
- Application Zones:

  Zone A: almost all tires actually wear through the tread from abrasion.

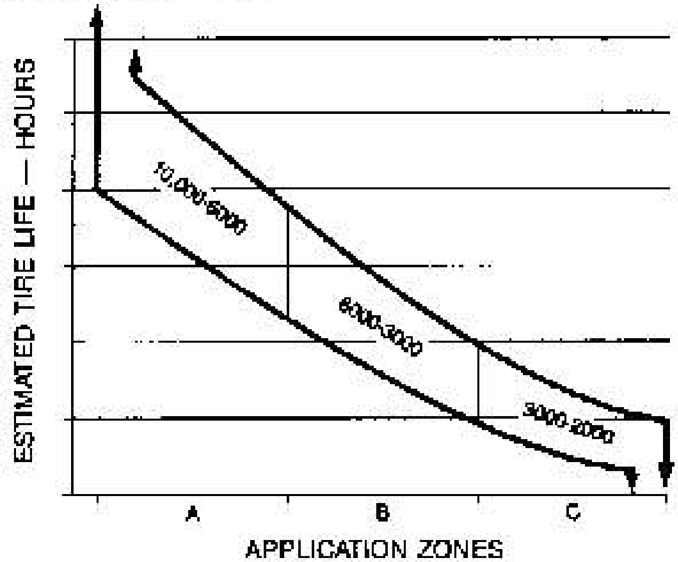
  Zone B: tires wear out but others fail prematurely due to rock cuts, rips and non-repairable punctures.

  Zone C: few if any tires ever wear through the tread before having to be discarded, usually from rock cuts.

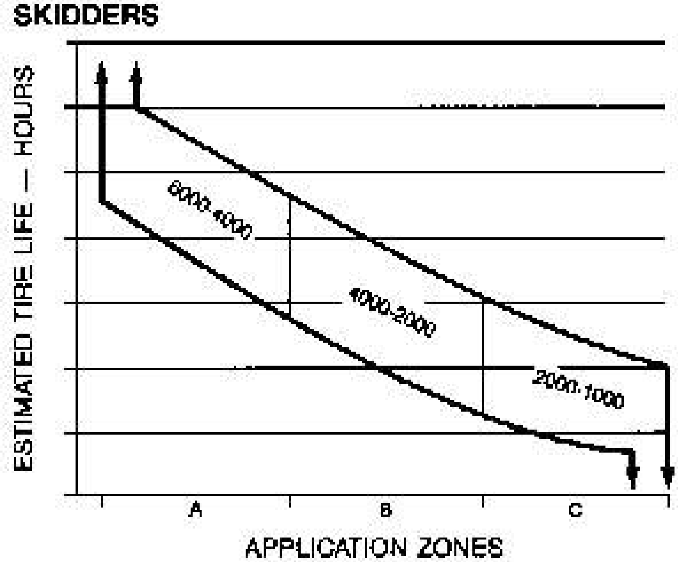
NOTE: Tire life can often be increased by using extra tread and extra deep tread tires.

NOTE: Premature failure could occur at any time due to puncture by stumps or sharpened tree limbs.

MOTOR GRADERS



SKIDDERS



Key:

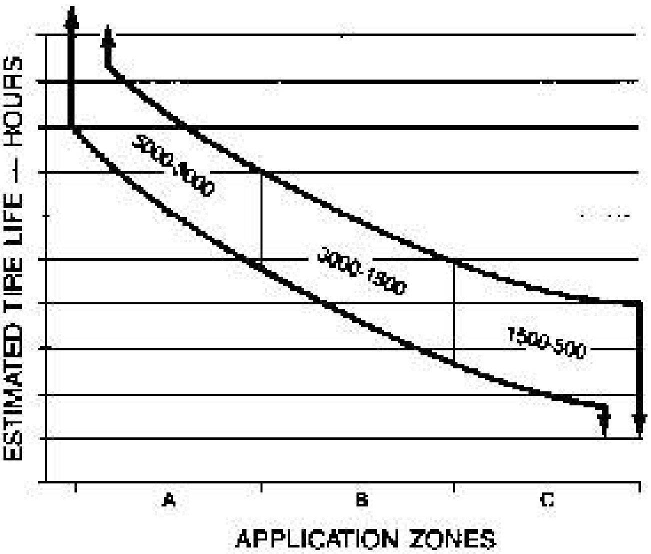
Zone A — Almost all tires actually wear through the tread due to abrasion.

Zone B — Tires wear out normally but others fail prematurely due to rock cuts, rips and non-repairable punctures.

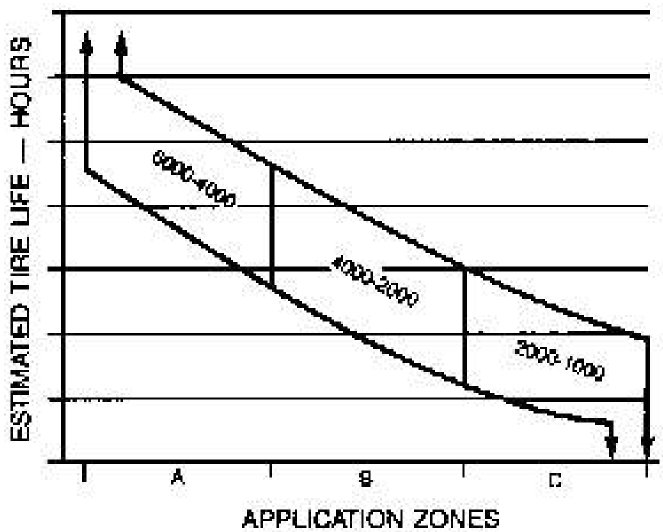
Zone C — Few, if any, tires wear through the tread before nonrepairable damages, usually from rock cuts and continuous overloading, necessitates write-off.

17

WHEEL TRACTOR-SCRAPERS



CONSTRUCTION & MINING TRUCKS



Key:

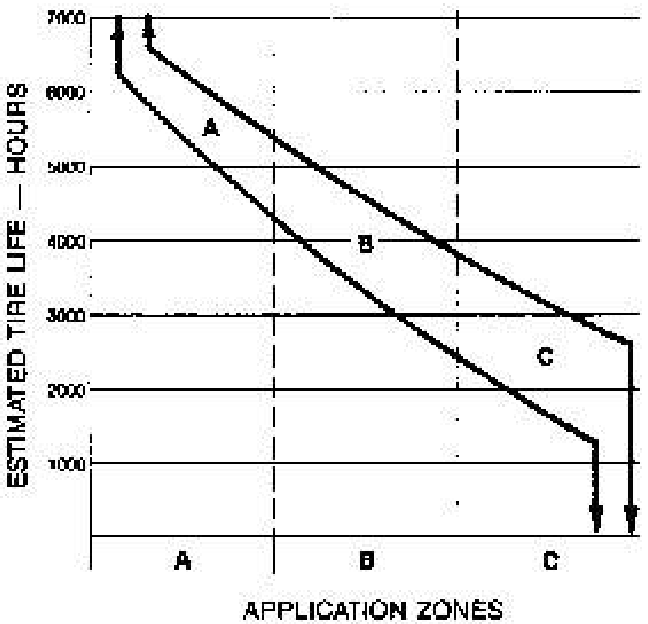
Zone A Almost all tires actually wear through the tread due to abrasion.

Zone B — Tires wear out normally but others fail prematurely due to rock cuts, rips and non-repairable punctures.

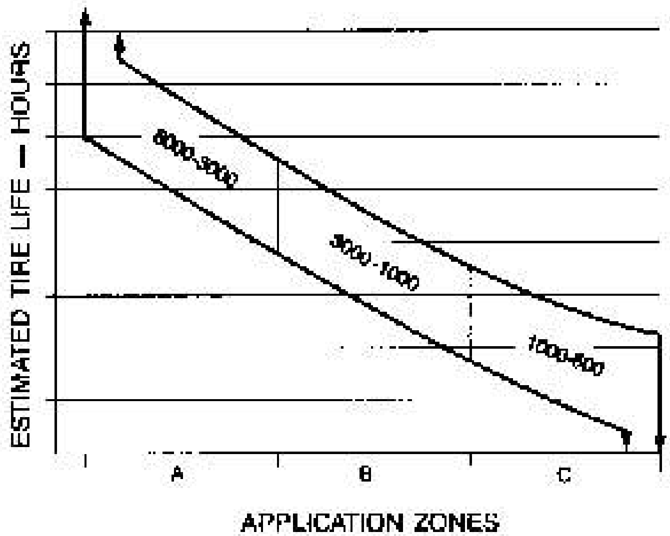
Zone C — Few, if any, tires wear through the tread before nonrepairable damages, usually from rock cuts and continuous overloading, necessitates write-off.

The estimated tire life for . . . TRACTORS/WAGONS is
Zone A — 8000 to 12,000 hrs.
Zone B — 4000 to 8000 hrs.
Zone C — 2000 to 4000 hrs.

ARTICULATED TRUCKS



WHEEL TRACTORS
WHEEL LOADERS



Key:

Zone A — Almost all tires actually wear through the tread due to abrasion.

Zone B — Tires wear out normally but others fail prematurely due to rock cuts, rips and nonrepairable punctures.

Zone C — Few, if any, tires wear through the tread before nonrepairable damages, usually from rock cuts and continuous overloading, necessitates write-off.

GOODYEAR LIFE ESTIMATING SYSTEM

As an additional assist in estimating *hauling unit* tire life, Goodyear Tire and Rubber Co. has furnished the following information which is included here with their permission. READ THE PREAMBLE CAREFULLY.

". . . at present, there is no completely accurate, fool-proof method of forecasting tire life. Tire engineers have many theoretical methods . . . but these generally are so involved and time consuming that they are impractical for field use.

"However, the tire industry has made many surveys of tire performance and arrived at a system which can give rough *estimates* of tire life. Studies done by the major tire companies and by at least two major equipment manufacturers are in close agreement.

"The table [which follows] shows how to apply this system . . ."

ESTIMATED TIRE SERVICE LIFE OF HAULING UNITS (Trucks & Scrapers)

No.	Condition	Factor
I	**Maintenance**	
	Excellent	1.090
	Average	.981
	Poor	.763
II	**Speeds (Maximum)**	
	10 mph ~ 16 km/h	1.090
	20 mph ~ 32 km/h	.872
	30 mph ~ 48 km/h	.763
III	**Surface Conditions**	
	Soft Earth — No Rock	1.090
	Soft Earth — Some Rock	.981
	Well Maintained — Gravel Road	.981
	Poorly Maintained — Gravel Road	.763
	Blasted — Sharp Rock	.654
IV	**Wheel Positions**	
	Trailing	1.090
	Front	.981
	Driver (Rear Dump)	.872
	(Bottom Dump)	.763
	(Self Propelled Scraper)	.654
V	**Loads** (See No. VIII note)	
	T&RA/ETRTO* Recommended Loading	1.090
	20% Overload	.872
	40% Overload	.545
VI	**Curves**	
	None	1.090
	Medium	.981
	Severe	.872
VII	**Grades** (Drive Tires Only)	
	Level	1.090
	5% Max.	.981
	15% Max.	.763
VIII	**Other Miscellaneous Combinations** (See note below)	
	None	1.090
	Medium	.981
	Severe	.872

Condition VIII is to be used when overloading is present in combination with one or more of the primary conditions of maintenance, speeds, surface conditions and curves. The combination of severe levels in these conditions, together with an overload, will create a new and more serious condition which will contribute to early tire failure to a larger extent than will the individual factors of each condition.

* Tire and Rim Association/European Tire and Rim Technical Organization.

Type of Tire	Base Average Life Hours	Miles	km
E-3 Std. Bias Belted	2510	25,100	40 400
E-4 Xtra Tread	3510	35,100	56 500
Radial RL4 Xtra Tread	4200	42,000	67 600

Using Base Hours (or Miles), multiply by the appropriate factor for *each* condition to obtain approximate estimated hours (or miles) as the final product.

Example: An off-highway truck equipped with E-4 drive tires running on a well maintained haul road having easy curves and minimum grades and receiving "average" tire maintenance attention but being 20% overloaded:

Condition:	I	II	III	IV	V	VI	VII	VIII
Factor:	.981 ×	.872 ×	.981 ×	.872 ×	.872 ×	.981 ×	.981 ×	.981

× 3510 base hours = 2114 hours (say 2100 hours)

As can be seen, this system requires the careful application of strictly subjective judgments, and can be expected to result in conservative estimates. Keep in mind, however, **that the system is offered only as an aid in estimating and not as a rigid set of rules.**

On the other hand, if tire life on a given job is considered less than satisfactory, an analysis of these factors may point to conditions which can be improved to the betterment of tire life.

Replacement tire prices should always be obtained from local tire company sources.

Since tires are considered a wear item in this method of estimating owning and operating costs, total tire replacement cost is deducted from machine delivered price to arrive at a net figure for depreciation purposes. Outlay for tires is then included as an item in operating costs:

$$\text{Hourly Tire Cost} = \frac{\text{Replacement Cost of Tires}}{\text{Estimating Tire Life in Hours}}$$

Recapping can sometimes lower hourly tire cost. Considerations are availability of molds, local recapping costs, and experience with recap life.

(10B) UNDERCARRIAGE

(Line Item 10b)

Undercarriage expense can be a major portion of the operating costs for track-type machines, and these costs can vary *independently* of basic machine costs. That is, the undercarriage can be employed in an extremely abrasive, high-wear environment while the basic machine may be in an essentially easy application, and vice versa. For that reason, it is recommended that the hourly cost of undercarriage be calculated separately as a wear item rather than being included in the repair reserve for the basic machine. Notice that the repair reserves (Line Item 11) DO NOT include provision for undercarriage replacement.

Three primary conditions affect probable life-expectancy of track type undercarriage:

1. **Impact.** The most measurable effect of impact is structural — that is bending, chipping, cracking, spalling, roll-over, etc., and problems with hardware and pin and bushing retention.

   Impact ratings:
   High — Non-penetrable hard surfaces with 150 mm (6") or higher bumps.
   Moderate — Partially penetrable surfaces and bumps of 75-150 mm (3-6") height.
   Low — Completely penetrable surfaces (which provide full shoe plate support) with few bumps.

2. **Abrasiveness.** The tendency of the underfoot materials to grind away the wear surfaces of track components.

   Abrasiveness ratings:
   High — Saturated wet soils containing a high proportion of hard, angular or sharp sand or rock particles.
   Moderate — Slightly or intermittently damp soils containing a low proportion of hard, angular or sharp particles.
   Low — Dry soils or rock containing a low proportion of hard, angular or sharp sand or rock chip particles.

   Impact and abrasiveness in combination can accelerate wear rates beyond their individual effects when considered alone, thus further reducing component life. This should be taken into account in determining impact and abrasiveness ratings or, if preferred, the combination can be included in selecting the "Z" factor.

3. **"Z" factor.** Represents the combined effect on component life of the many intangible environmental, operational and maintenance considerations on a given job.

   Environment and Terrain. Earth which may not be abrasive itself can pack in sprocket teeth, causing interference and high stress as the teeth engage the bushings. Corrosive chemicals in the materials being moved or in the natural soil can affect wear rates, while moisture and temperature can exaggerate the effect. Temperature alone can play its own role — hot slag and hard frozen soils being but the extremes. Constant sidehill work can increase wear on the downhill sides of components.

Operation. Some operator practices tend to increase track wear and cost if not controlled on the job. Such practices include high-speed operation, particularly in reverse; tight turns or constant corrections in direction; and stalling the tractor under load forcing the tracks to slip.

Maintenance. Good maintenance — proper track tension, daily cleaning when working in sticky materials, etc. — combined with periodic wear measurement and timely attention to recommended services (CTS) can extend component life and lower costs by minimizing the effects of these and other adverse conditions.

While impact and abrasion should not be too difficult to judge, selection of the proper "Z" factor will require careful analysis of job conditions such as weather, tendency for soil packing, side-hill loading, corrosive environment, etc.; operational factors such as high-speed reverse, tight turns, track slippage under overload, etc.; and maintenance considerations such as proper tensioning, use of Custom Track Service, etc.

Selection of the "Z" multiplier is strictly a matter of judgement and common sense, but its effect on cost can be the difference between profit on a controlled job and heavy loss where control is allowed to slip. To assist in arriving at an appropriate value for the "Z" factor, consider that proper maintenance — or the lack thereof — will represent about 50% of its effect, environment and terrain 30%, and operator practices 20%. Thus, even a good operator working under good field conditions can be counterbalanced by poor maintenance practices to yield a fairly high "Z" factor. On the other hand, close attention to maintenance, tension and alignment can more than offset a bad underfoot condition resulting in severe sprocket packing, and lead to selection of a moderate to low "Z" factor. Obviously, flexibility in selection of a "Z" factor has been built into the system, and use of this flexibility is encouraged. Further, a considerable measure of control can be maintained over the "Z" factor, and any reduction of its effects is money in the bank. Your Caterpillar Dealer CTS man can be invaluable in this endeavor as well as helping you establish a comprehensive undercarriage cost control program.

Estimating Undercarriage Cost

The guide below gives a basic factor for the various track-type machines and a series of conditions multipliers to modify the basic cost according to the anticipated impact, abrasive and miscellaneous ("Z") conditions under which the unit will be operating.

Step 1. Select machine and its corresponding basic factor.
Step 2. Determine range for impact, abrasiveness and "Z" conditions.
Step 3. *Add* selected conditions multipliers and apply sum to basic factor.

The result will be the estimated hourly cost for undercarriage in that application.

Undercarriage Basic Factors

Model	Basic Factor
D11N	17.5
D10N	12.0
D9N	9.5
D8N	8.5
973, 589, D7 LGP	9.0
D7, 963, 578, D6 LGP, D8 SA	8.0
D6, 953, 572, D5 LGP, D7 SA	6.2
D5, 943, 571, 227, D4 LGP, D6 SA,	5.0
D4, 931, 561, D3 LGP, D5 SA	3.7
D3, D4 SA	2.6

Conditions Multipliers

	Impact	Abrasiveness	"Z"
High	0.3	0.4	1.0
Moderate	0.2	0.2	0.5
Low	0.1	0.1	0.2

Example: D10N in high impact, non-abrasive material with a moderate "Z" factor.

D10N Basic Factor = 12.0
Multipliers: I = 0.3
A = 0.1
Z = 0.5

Hourly undercarriage cost = 12.0 (0.3 + 0.1 + 0.5) =
$10.80/hour

NOTE: 1. Conditions Multipliers may be selected in any combination. Thus, a multiplier of 0.4 (all low-range multipliers) represents the best of the best, while 1.7 (all high range multipliers) would be the worst of the worst conditions.

2. The hourly undercarriage cost estimate resulting from this method will be made up of *approximately* 70% parts cost and 30% labor charges. The cost of undercarriage components is based on published U.S. Consumers List Prices and may be adjusted as needed for import duties, exchange rates, etc. outside the United States. Labor has been figured at $40.00 (U.S.) per shop hour.

3. For further information and guidance, refer to the current issue of the Caterpillar Custom Track Service Handbook.

4. This formula for estimating undercarriage cost should *not* be used for tractors working in stockpile coal handling applications. Undercarriage costs are nominal in stockpile coal handling, and using this formula will result in estimating cost substantially above actual costs.

⑪ REPAIR RESERVE

(Line Item 11)

Repairs are normally the largest single item in operating costs and include all parts and direct labor (except operator's wages) chargeable to the machine. Shop overhead can be absorbed in general overhead or charged to machines as a percent of direct labor cost, whichever is the owner's normal practice.

Hourly repair costs for a single machine normally follow an upward stairstep pattern since major outlays for repairs usually come in spurts. However, when broad averages are considered, the stairstep becomes a smooth, upward curve. Since this hourly repair cost curve starts low and gradually rises over time, hourly operating costs must be adjusted upward as the unit ages. Alternatively an average repair cost can be used which provides a straight line graph. Most owners prefer the average method, and it is the one suggested here.

Since repair costs are low initially and rise gradually, averaging them produces extra funds at first which are reserved to cover future higher costs.

Machine applications, operating conditions and maintenance attention determine repair costs. In any specific application, actual cost experience on similar work provides the best basis for establishing the hourly repair reserve. When local records are inadequate or not available, the hourly repair reserve charts following this discussion may be used. Turn for a moment to these charts and examine their general format.

These guidelines result from an extensive study by Caterpillar. They were derived from actual user cost records in a wide variety of applications and working conditions. Naturally, good cost records were more readily available on some machines than on others.

These average costs are taken from a variety of applications and every attempt was made to assure accuracy. Recognize that any one application may very considerably from these averages. They are only marginally useful in predicting costs since few jobs are 'average'. The use of these averages would be especially questioned when special attachments such as rippers are used, and when a machine is moving from job to job. For these reasons, we suggest the use of these averages for comparative purposes and gross estimates only. Your Caterpillar dealer has the ability to make more accurate repair cost estimates and we suggest you use his experience and expertise if you need help in estimating operating costs.

Applying these basic factors and multipliers will result in the average hourly cost over the entire period. This should produce an excess in the early hours (or a "sinking fund") to cover normal increases in actual repair costs as the machine ages.

The cost applies to the machine as described in each individual chart, but does not cover the following:

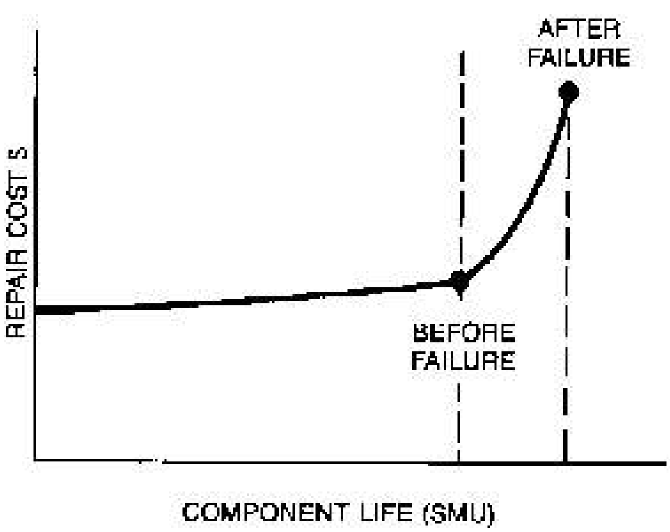
- Dozer blade (although hydraulics are included)
- Bucket (although hydraulics are included)
- Ground engaging tools
- Undercarriage
- Tires, Chopper Blades or Tamping Feet Assemblies and Rims

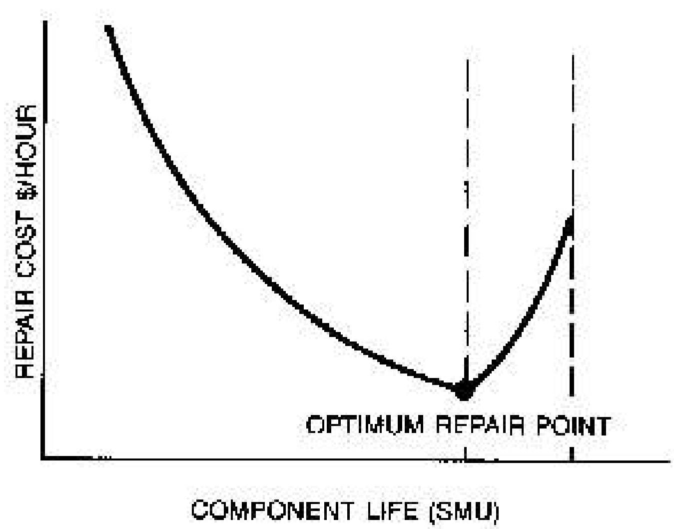
- Labor for daily and periodic maintenance
- Material/supply items for daily and periodic maintenance
- Fuel, oil and grease
- Service truck mileage costs
- Serviceman's travel costs
- Machine transportation to and from shop
- Cost of performing Technical Analysis or Scheduled Oil Sampling
- Operator
- Risk or insurance
- Parts and labor price escalation
- Attachments

The basic repair factors are based on the first 10,000 hours of service, parts at published U.S. Consumers List Prices, and labor at a total selling price of $40.00 (U.S.) per hour. Extended use multipliers are given for those cases where a machine is to be used beyond 10,000 hours; the adjusted cost-per hour will apply to the *entire* use period, not just the additional hours. For applications outside the United States where import duties and other expenses have a large effect on parts prices, and for other areas where labor charges (remember to include shop and tool overhead in addition to mechanic's wages) differ greatly from the $40.00 base, an approximate breakdown of the total factor by percentages for parts and labor also are given. This breakdown should permit easy adjustment to local conditions.

As stated, repair costs are affected by application, operation, maintenance, and age of the equipment. The most significant effects on cost will be those factors affecting major component life. A second significant factor is whether the repair is performed before or after catastrophic failure. Repair before a major component fails can be one-third of an after failure repair with only a moderate sacrifice in life (see graphs). Repairing a major component just prior to failure achieves optimum cost per hour. Oil analysis and other diagnostic tools, maintenance inspections and indicators, and operator notes are vital to determine the optimum repair point and thereby achieving lower hourly repair costs. Maintenance practices are significant because they affect component longevity and the percentage of scheduled, before failure repairs.

Another important factor in using repair reserve estimates is the Service Meter Unit (SMU) or hour basis. The cost estimate should be flexed depending on the machine's duty cycle. Fuel consumption is often a good indicator of duty cycle, and this factor may override the application zone. All of these factors are significant in estimating repair costs. Weigh them carefully prior to using the repair reserve tables.





INSTRUCTIONS — To estimate hourly repair costs, enter the chart for the machine in question and determine the basic factor for the applicable job conditions. Operating conditions zones for each bar are:

A B C

These generally conform to the definitions given earlier in the section on depreciation. If the unit is to be used more than 10,000 hours, apply the Extended-life Multiplier for that period.

Example:

1 — A 988B Wheel Loader loading well-shot rock on a hard, level quarry floor will be used for seven years or about 15,000 hours.

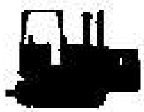
Basic Repair Factor = 9.50
Extended-life Multiplier = 1.10
Estimated Repair Cost = 9.50 × 1.10 = **$10.45**/Hour

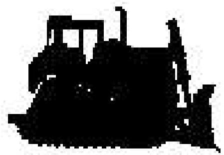
2 — A D6H is used about 1600 hours per year on general utility and clean-up work for a contractor who does not baby his equipment, but does insist on careful operation, and has an excellent preventive maintenance program. He intends to trade at the end of five years. He can be considered to be at the lower end of the "normal" or B zone, if not slightly less.

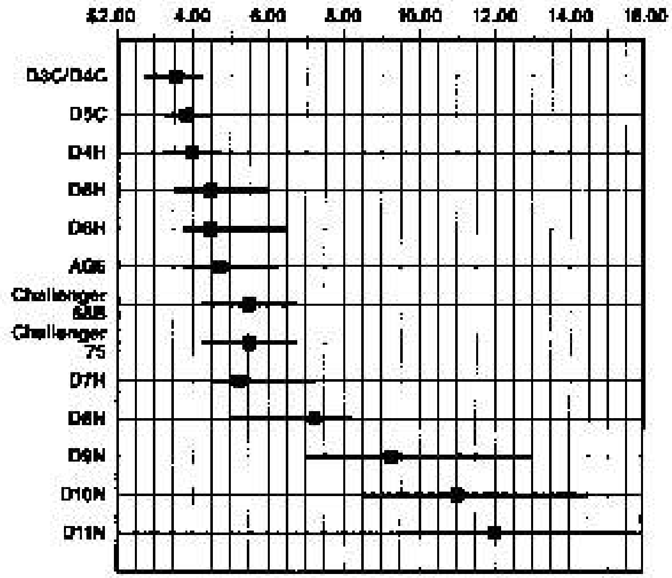
Basic Repair Factor = 4.50
Total Use: 5 years @ 1600 hr/yr = 8,000 hours
Extended-use Multiplier = 1.0
Estimated Repair Cost = 4.50 × 1.0 = **$4.50**/Hour

Repair Reserve charts follow . . . ►

TRACK-TYPE TRACTORS





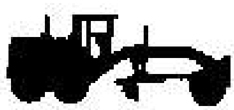


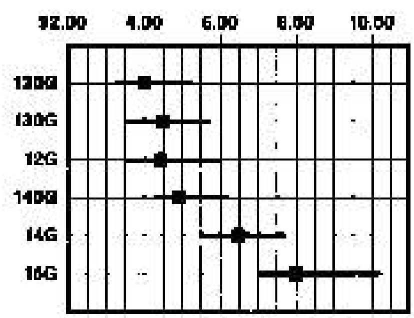
Cost distribution			**Extended-life Multipliers**	
D3 to D7 —	60% Parts		0-10,000 hours	1.0
	40% Labor		0-15,000	1.1
D8 to D11 —	70% Parts		0-20,000	1.3
	30% Labor			

Includes basic tractor equipped with ROPS canopy, straight bulldozer and hydraulic control.

Note: Repair time may be less on Elevated Sprocket Tractors due to modular design of power train components.

MOTOR GRADERS

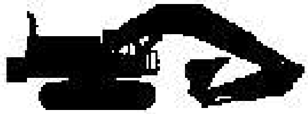


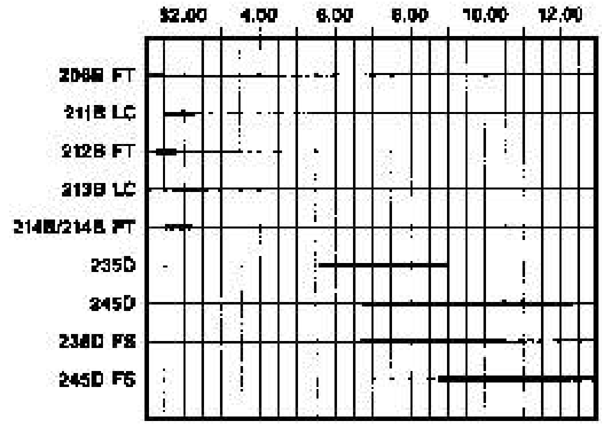


Cost distribution	**Extended-life Multipliers**	
55% Parts	0-10,000 hours	1.0
45% Labor	0-15,000	1.06
	0-20,000	1.21

Includes basic motor grader equipped with ROPS cab.

EXCAVATORS



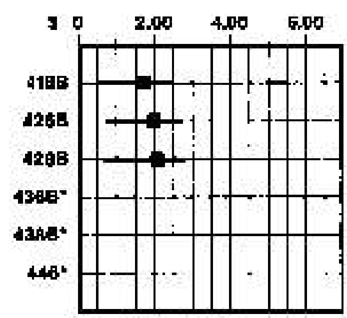


Cost distribution
50% Parts
50% Labor

Extended-life Multipliers
(Not available)

Includes basic excavator equipped with largest bucket, one-piece boom and medium stick. Logger with standard feller buncher.

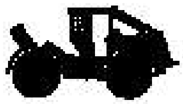
BACKHOE LOADERS



*Insufficient data

17

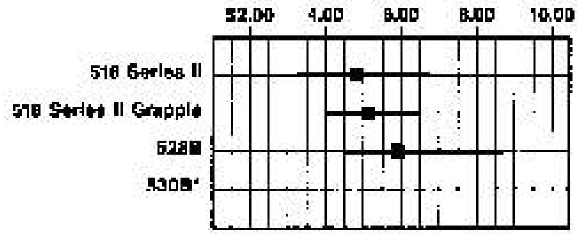
SKIDDERS



Cost distribution
55% Parts
45% Labor

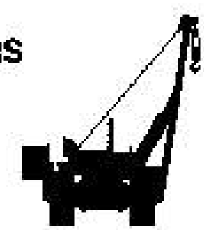
Extended-life Multipliers
(Not available)

Includes basic skidder equipped with ROPS canopy, arch, fairlead and winch. 518 Grapple skidders with Cat grapple, 528 Grapple skidder with AEM grapple.



*Insufficient data

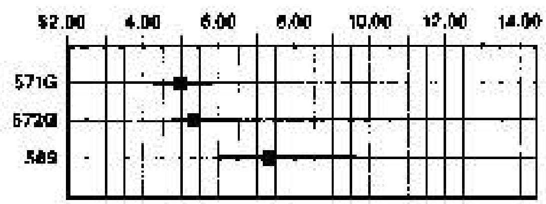
PIPELAYERS



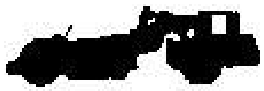
Cost distribution
60% Parts
40% Labor

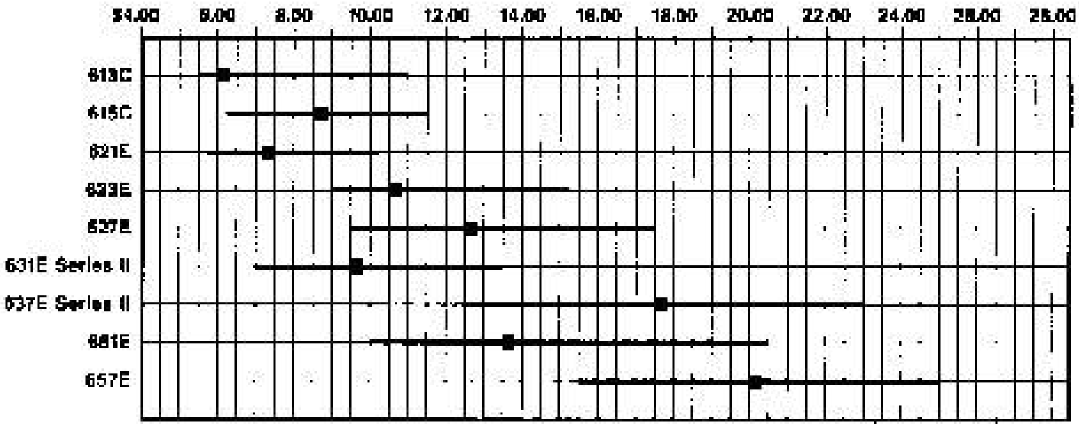
Extended-life Multipliers
(Not available)

Includes basic pipelayer equipped with counterweight and boom.



WHEEL-TRACTOR SCRAPERS

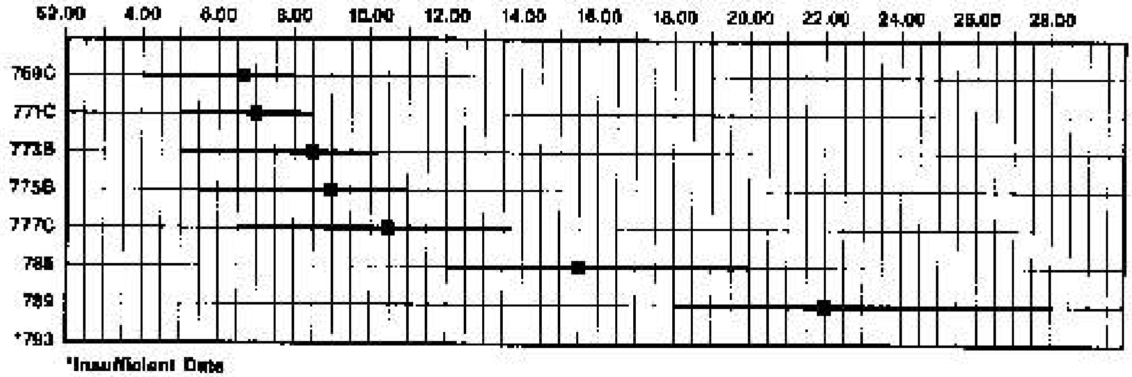




Cost distribution:	**Extended-life Multipliers:**		
55% Parts	Period	Single-engine	Tandem & Elevator
45% Labor	0-10,000	1.0	1.0 (1.03 for Push-Pull)
	1-15,000	1.06	1.08
	0-20,000	1.21	1.24

Includes standard wheel tractor equipped with standard scraper.

CONSTRUCTION & MINING TRUCKS

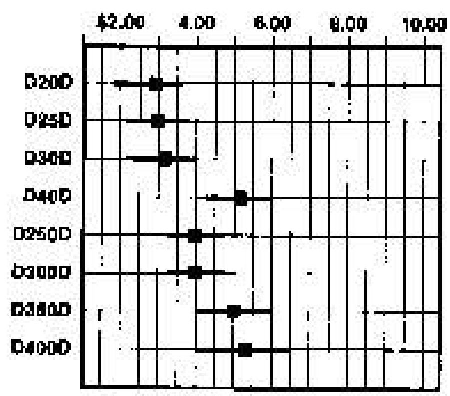


Cost distribution	Extended-life Multipliers	
769-777		
55% Parts	0-10,000 hours	1.0
45% Labor	0-15,000	1.04
785-793	0-20,000	1.10
75% Parts	0-30,000	1.23
25% Labor	0-40,000	1.40

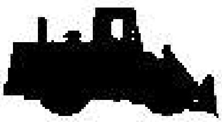
Includes basic truck equipped with standard earth body (785/789 — Option I Body) without liners. Off-highway tractors' hourly repair costs are approximately 9% less than trucks.

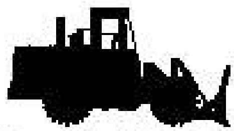
ARTICULATED TRUCKS

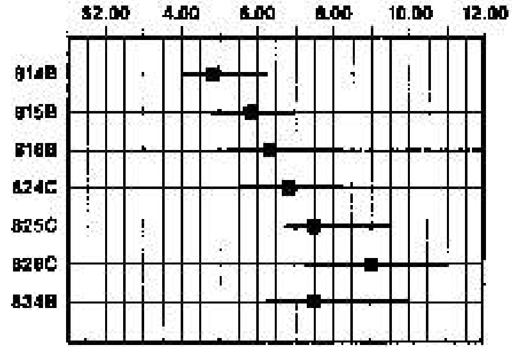
Cost distribution	Extended-life Multiplier	
55% Parts	0-10,000 hours	1.0
45% Labor	0-15,000	1.06
	0-20,000 Not Available	



WHEEL TRACTORS & SOIL/LANDFILL COMPACTORS





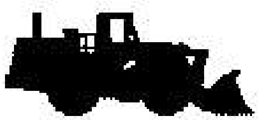


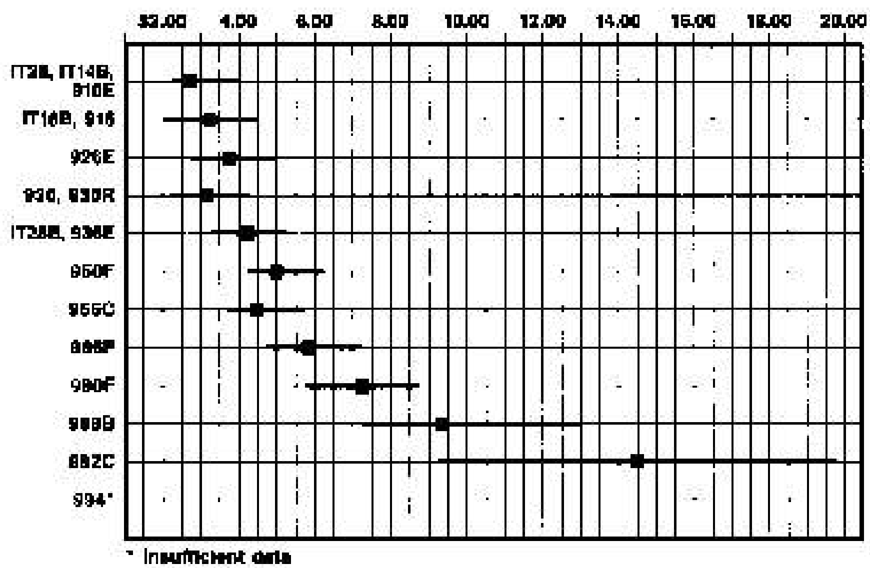
Cost distribution
60% Parts
40% Labor

Extended-life Multipliers
(Not available)

Includes: 814B, 824C & 834B — Basic tractor equipped with ROPS canopy and bulldozer.
815B & 825C — Basic compactor equipped with ROPS canopy and fill-spreading bulldozer.
816B & 826C — Basic Landfill Compactor equipped with ROPS cab and landfill bulldozer.

WHEEL LOADERS & INTEGRATED TOOLCARRIERS



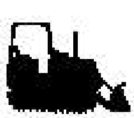


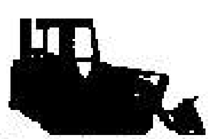
Cost distribution	Extended-life Multipliers	
910-992		
60% Parts	0-10,000 hours	1.0
40% Labor	0-15,000	1.10
994		
75% Parts	0-20,000	1.30
25% Labor		

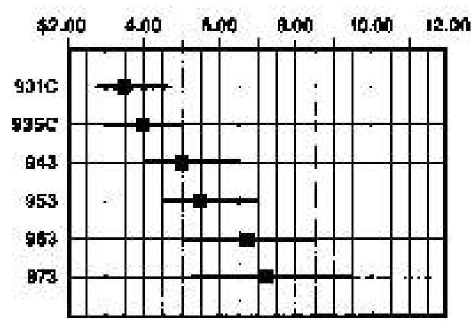
Includes basic wheel loader equipped with ROPS cab and General Purpose bucket (988 and 992 with Spade nose rock bucket).

Note: Bar zones shown for 936E are estimates.

TRACK LOADERS







Cost distribution
55% Parts
45% Labor

Extended-life Multipliers
0-10,000 hours 1.0
0-15,000 1.13

Includes basic track loader equipped with ROPS canopy and General Purpose bucket.

Note: Bar zones shown for 935B are estimates.

17

12 SPECIAL WEAR ITEMS

(Line Item 12 and Subsection 12A)

All costs for high-wear items such as cutting edges, ripper tips, bucket teeth, body liners, router bits, etc., and welding costs on booms and sticks should be included here. These costs will vary widely depending on applications, materials and operating techniques. Consult your Caterpillar Dealer Parts Department for estimated life under your job conditions.

15 OPERATOR'S HOURLY WAGE

(Line Item 15)

This item should be based on local wage scales and should include the hourly cost of fringe benefits.

EXAMPLES OF FIGURING OWNING AND OPERATING COSTS

Example I: ESTIMATING HOURLY OWNING AND OPERATING COSTS OF A TRACK-TYPE TRACTOR

Assume a power shift track type tractor with straight bulldozer, hydraulic control, tilt cylinder and three-shank ripper, is purchased by a contractor for $135,000, delivered price at job site.

Application will be production dozing of bank gravel. Minimal ripping will be required to loosen material.

In the following calculations, refer as necessary to the source material already reviewed.

OWNING COSTS —

To Determine Residual Value at Replacement

Enter delivered price, $135,000, in space (A). (See example form at end of this discussion.) Since the machine being considered is a track-type tractor, no tires are involved. This particular owner's experience is that at trade-in time, the tractor will be worth approximately 35% of its original value. This $47,250 trade-in value is entered in space (B) leaving a net of $87,750 to be recovered through work. Enter the value to be recovered through work in space (C).

Indicated ownership period is 7 years with annual usage of 1200 hours per year or 8400 hours of total ownership usage.

Divide the Net Value from space (C), $87,750, by Ownership Usage, 8400 hours, and enter result $10.45 in space (D).

Interest, Insurance Taxes

In this example, local rates are assumed as follows:

Interest	16%
Insurance	1%
Taxes	1%
	18%

Using the following formula:

N = 7:

$$\frac{\left[\frac{7+1}{2\times 7}\times \$135{,}000\right]\times 0.16}{1{,}200} = \$10.29$$

Enter $10.29 in space (E).

Insurance and property taxes can also be calculated using the same formula as shown for the interest cost, and entering them on lines 5 and 6.

Items 3b, 4, 5 and 6 can now be added and the result, $22.02 entered in space (H) Total Hourly Owning Costs.

OPERATING COSTS —

Fuel

See fuel consumption tables. The intended application, production dozing, indicates a medium load factor. Assume that the estimated fuel consumption from the table is 18.1 liter/hr (4.8 U.S. gal/hr). Cost of fuel in this locality is $0.34/liter ($1.25/U.S. gal.).

Consumption		Unit Cost		Total
18 liter/hr	×	$0.34 liter	=	$6.12
5 gal/hr	×	$1.25 gal.	=	$6.25

Enter this figure in space (I).

Lube Oils, Filters, Grease

For these items, you can use the lubricants consumption tables and the filter cost calculator for a detailed estimate, or you can obtain an estimate of the total of these items from the Quick Estimator table. We will assume local prices in this example are about the same as those used for the Quick Estimate Table and use this method. Assume the table shows an approximate hourly cost for lube oils, filters and grease (materials and labor) for this tractor of $0.46. Enter this figure in space (J).

Tires

Since this example considers a track-type tractor, space (K) is left blank.

Undercarriage

Our estimating reference gives an undercarriage cost Basic Factor of 6.2 for this tractor. It is anticipated that with some ripping on the job, impact loadings of the track components will be medium, indicating an "I" multiplier of 0.1. The gravel-sand mix in the bank, being dry, should be only moderately abrasive for an "A" multiplier of 0.1. In analyzing the miscellaneous conditions: there is enough clay in the bank to produce some packing of the sprockets; the operator is careful, but is forced into some tight turns because of space limitations; there is good drainage in the pit; track tension is checked weekly; and all track-type equipment on the job is enrolled in the Custom Track Service program. Accordingly, the "Z" multiplier is judged to be somewhat greater than low level — 0.3 in this case.

It should be noted that in applying particularly the "Z" factor, rather wide latitude for flexibility is provided and was used in the above example. Such flexibility is intended and its use encouraged.

Then:

Cost per hour = Basic Factor × (I + A + Z)
Basic Factor = 6.2
Conditions Multipliers: I = 0.1
A = 0.1
Z = 0.3
Cost per hour 6.2 (0.1 + 0.1 + 0.3) = $3.10 which is entered in space (L).

Repairs

In determining the depreciation period, we established the intended use of the machine as a Zone B application. The Repair Reserve graph for track-type tractors indicates that the mid-range for our tractor is approximately 4.50 on the basis of 10,000 hours of use. The tractor is to be used over 8400 hours, so the Extended-life Multiplier in this case is 1.0.

Therefore, Repair Reserve = 1.0 × 4.50 = $4.50 per hour, which is entered in space (M).

Special Items

Assuming the tractor is equipped with a three-shank ripper and an "S" dozer, allowance must be made for ripper tips, shank protectors, and dozer cutting edges.

Assume your knowledge of the operation indicates the ripper will be used only about 20% of total tractor operating time. Estimated tip life while in use is 30 hours. Therefore, tips will be replaced:

$$\frac{30 \text{ Hours}}{.20} = \text{each 150 hours of tractor operation}$$

Shank protector life is estimated at three times tip life or 450 hours of tractor operation. In this medium duty application, no shank replacement is expected in the 8400 hour depreciation period of the tractor.

Cutting edge life is estimated to be 500 hours.

Using local prices for these items, hourly costs are estimated as follows:

$$\text{Tips: } \frac{3 \text{ @ } \$35.00 \text{ ea.}}{150 \text{ hr.}} = \$0.70 \text{ per hour}$$

$$\text{Shank Protectors: } \frac{3 \text{ @ } \$55.00 \text{ ea.}}{450 \text{ hr.}} = \$0.37 \text{ per hour}$$

$$\text{Cutting Edges: } \frac{\$125 \text{ per set}}{500 \text{ hr.}} = \$0.25 \text{ per hour}$$

The total of these, $1.32; is entered in space (N).

Items 8, 9, 10b, 11 and 12 can now be added and the result, $15.63, is entered in space (O), Total Hourly Operating Costs.

Operator's Hourly Wage

Assume this is $20.00 including fringe benefits. This figure is entered in space (P).

Total Owning Costs, Total Operating Costs and Operator's Hourly Wage are now added together and the result, $57.65, is entered in space (Q). The itemized estimate of Hourly Owning and Operating Costs is now complete.

Example II: ESTIMATING HOURLY OWNING AND OPERATING COSTS OF A WHEELED VEHICLE

With only a few simple changes, owning and operating costs for a wheeled vehicle are calculated using the same format as that used for the Track-Type Tractor. Only the differences will be explained as we look at example calculations for a wheel loader.

OWNING COSTS —

To Determine Residual Value at Replacement

Enter delivered price in space (A). The cost of tires is deducted since they will be treated as a wear item. For purposes of illustration, the Wheel Loader is estimated to have a potential 48% trade-in value (B) at the end of the 5 year/7500 hour ownership usage, leaving a net value to be recovered through work of $34,320 (C).

Interest, Insurance, Taxes

Refer to the formulas using the same rates as before and 1500 operating hours per year. The factor 4.22 is applied to the interest cost (E).

Insurance and property taxes can also be calculated using the same formula as shown for the interest cost.

The sum of lines 3b, 4, 5 and 6 gives the total hourly owning cost, line 7.

OPERATING COSTS —

Fuel

See the fuel consumption tables and apply the actual cost of purchasing fuel in the project area (I).

Lube Oils, Filters, Etc.

Use either the item-by-item worksheet or the summary tables. Enter the total item in space (J) on line 9.

Tires

Use the tire replacement cost and the best estimate of tire life based on experience and anticipated job conditions.

Repairs

Find the applicable basic repair factor for Zone B application from the bar charts (4.00). Again, the use period for the Wheel Loader is 7500 hours, so the Extended-life Multiplier is 1.0.

Therefore, Repair Reserve = 1.0 × 4.00 = $4.00 per hour.

Special Items

Ground engaging tools, welding, etc. are covered here. Use current costs for cutting edges and similar items. Use your best estimate of the hours of life which can be expected from them based on previous experience in like materials. Enter the total on line 12.

The total of lines 8 through 13 represents hourly operating costs.

Operator's Wages

To give a true picture of operator cost, include fringe benefits as well as direct hourly wages (line 15).

TOTAL O&O

The total of lines 7, 13 and 15 is the total hourly owning and operating cost of the machine. Keep in mind that this is an estimate and can change radically from project to project. For the greatest accuracy, the hourly cost reflected in actual on-the-job cost records should be used.

• • •

HOURLY OWNING AND OPERATING COST ESTIMATE

DATE ____________

	(1)		(2)
Machine Designation	Track-type Tractor		Wheel Loader
Estimated Ownership Period (Years)	7		5
Estimated Usage (Hours/Year)	1200		1500
Ownership Usage (Total Hours)	8400		7500

OWNING COSTS

		(1)		(2)
1. a. Delivered Price (including attachments)		135,000 (A)		70,000
b. Less Tire Replacement Cost if desired				4000
c. Delivered Price Less Tires		135,000		66,000
2. Less Residual Value at Replacement (See subsection 2A on back)	(35 %)	47,250 (B)	(48 %)	31,680
3. a. Value to be recovered through work (line 1c less line 2)		87,750 (C)		34,320

b. Cost per Hour:

$\frac{\text{Value}}{\text{Hours}}$ (1) $\frac{87{,}750}{8400}$ (2) $\frac{34{,}320}{7500}$ .... 10.45 (D) | 4.58

4. Interest Costs
N = No. Yrs.

$$\frac{\frac{N+1}{2N} \times \text{Del. Price} \times \text{Simple Int. \% Rate}}{\text{Hours/Year}} =$$

(1) $\frac{\frac{7+1}{14} \times 135{,}000 \times 16\ \%}{1200\ \text{Hours/Yr.}} =$ (2) $\frac{\frac{5+1}{10} \times 66{,}000 \times 16\ \%}{1500\ \text{Hours/Yr.}} =$ 10.29 (E) | 4.22

5. Insurance
N = No. Yrs.

$$\frac{\frac{N+1}{2N} \times \text{Del. Price} \times \text{Insurance \% Rate}}{\text{Hours/Year}} =$$

(1) $\frac{\frac{7+1}{14} \times 135{,}000 \times 1\ \%}{1200\ \text{Hours/Yr.}} =$ (2) $\frac{\frac{5+1}{10} \times 66{,}000 \times 1\ \%}{1500\ \text{Hours/Yr.}} =$ .64 (F) | .26

Or
$______ Per Yr. ÷ ______ Hours/Yr. =

Estimating form continues next page

17

	(1)	(2)
6. Property Tax $\dfrac{\frac{N+1}{2N} \times \text{Del. Price} \times \text{Tax Rate \%}}{\text{Hours/Year}}$ = N = No. Yrs. (1) $\dfrac{\frac{7+1}{14} \times 135{,}000 \times 1\ \%}{1200\ \text{Hours/Yr.}}$ = (2) $\dfrac{\frac{5+1}{10} \times 66{,}000 \times 1\ \%}{1500\ \text{Hours/Yr.}}$ = Or $____ Per Yr. ÷ ____ Hours/Yr. =	.64 (G)	.28
7. TOTAL HOURLY OWNING COST (add lines 3b, 4, 5, and 6)	22.02 (H)	9.32

OPERATING COSTS

	(1)	(2)
8. Fuel: Unit Price × Consumption (1) 1.25 × 5 = (2) 1.25 × 4 =	6.25 (I)	5.00
9. Lube Oils, Filters, Grease: (See subsection 9A on back)	.46 (J)	.43
10. a. Tires: Replacement Cost ÷ Life in Hours $\frac{\text{Cost}}{\text{Life}}$ (1) ____ (2) $\frac{4000}{3500}$	(K)	1.14
b. Undercarriage (Impact + Abrasiveness + Z Factor) × Basic Factor (1) (.1 + .1 + .3) = .5 × 6.2 = (2) (____ + ____ + ____) = ____ (Total) × ____ (Factor) =	3.10 (L)	
11. Repair Reserve (Extended Use Multiplier × Basic Repair Factor) (1) 1.0 × 4.5 = (2) 1.0 × 4.00 =	4.50 (M)	4.00
12. Special Wear Items: Cost ÷ Life (See subsection 12A on back)	1.32 (N)	.60
13. TOTAL OPERATING COSTS (add lines 8, 9, 10a (or 10b), 11 and 12)	15.63 (O)	11.17
14. MACHINE OWNING PLUS OPERATING (add lines 7 and 13)	37.65	20.49
15. OPERATOR'S HOURLY WAGE (include fringes)	20.00 (P)	20.00
16. TOTAL OWNING AND OPERATING COST	57.65 (Q)	40.49

SUBSECTION 2A: Residual Value at Replacement

	(1)		(2)	
Gross Selling Price	(%) ______		(%) ______	
Less: a. Commission				
b. Make-ready costs	______			
c. Inflation during ownership period*	______		______	
Net Residual Value (Enter on line 2)	47,250	(35 %)	31,680	(48 %) of original delivered price

*When used equipment auction prices are used to estimate residual value, the effect of inflation during the ownership period should be removed to show in constant value what part of the asset must be recovered through work.

SUBSECTION 9A: Lube Oils, Filters, Grease

	Unit Price	x Consumption	= Cost/Hour	Unit Price	x Consumption	= Cost/Hour
	(1)			(2)		
Engine	______	x ______	= ______	______	x ______	= ______
Transmission	______	x ______	= ______	______	x ______	= ______
Final Drives	______	x ______	= ______	______	x ______	= ______
Hydraulics	______	x ______	= ______	______	x ______	= ______
Grease	______	x ______	= ______	______	x ______	= ______
Filters	______	x ______	= ______	______	x ______	= ______
		Total	(1) ______	(2) ______		

(Enter total on line 9 or use Quick Estimator Tables)

SUBSECTION 12A: Special Items
(cutting edges, ground engaging tools, bucket teeth, excavator stick repair, etc.)

(1)	Cost		Life		Cost/Hour	(2)				
1.	105	÷	150	=	.70	1.	______	÷	______	= ______
2.	165	÷	450	=	.37	2.	______	÷	______	= ______
3.	125	÷	500	=	.25	3.	______	÷	______	= ______
4.	______	÷	______	=	______	4.	______	÷	______	= ______
5.	______	÷	______	=	______	5.	______	÷	______	= ______
6.	______	÷	______	=	______	6.	______	÷	______	= ______
			Total	(1)	$1.32	(2) ______				

(Enter total on line 12)

REPAIR RESERVE CONVERSION FACTORS (line 11)

For use in countries outside the United States where parts and service costs might differ from those used in charts and tables:

Labor Rate Ratio (1) ______________ (2) ______________
Parts Cost Ratio (1) ______________ (2) ______________

QUICK ESTIMATOR HOURLY OWNING AND OPERATING COSTS

NOTE: Hourly Owning and Operating Costs for a given model of machinery vary widely because they are influenced by many factors: the type of work the machine does, local prices for fuel and lubricants, shipping costs from the factory, interest rates, operator's wages, tire or track life, rock versus earth, hours per year, etc. Use the following figures as QUICK GUIDELINES ONLY. When precise owning & operating cost estimates are required, calculate them using the format on the preceding pages and your particular conditions.

Quick estimator figures shown are based on the following assumptions:

- List prices f.o.b. factory.
- Machines equipped as indicated (certain attachments included may not be normal in some areas).
- Ownership period: Guide for selecting ownership period based on application and operating conditions.
- The basic repair factors are based on the first 10,000 hours of service.
- Parts at published U.S. Consumers List Prices.
- Labor for repairs at a total selling price of $40.00 (U.S.) per hour.
- MODERATE: Zone A, or moderate job conditions. Typical U.S.A. Auction Results for the machine used in computing resale and depreciation.
- AVERAGE: Zone B, or average job conditions. Typical U.S.A. Auction Results for the machine used in computing resale and depreciation.
- SEVERE: Zone C, or severe job conditions. Typical U.S.A. Auction Results for the machine used in computing resale and depreciation and is adjusted for machine condition.
- Lubricants and hydraulic oil at $3.50 per U.S. Gal. plus labor.
- Grease at $.36 per fitting (includes labor).
- Filters at U.S. Consumer's List Prices plus labor.
- Fuel at $.90 per U.S. Gal.
- Figures include average tire costs at 50% list price.
- ALL FIGURES EXCLUDE INTEREST, INSURANCE, TAXES AND OPERATOR (due to wide variance around the world).

Track-Type Tractors *Example equipment:* straight bulldozer with tilt cylinder, hydraulic control, ROPS canopy, crankcase and track roller guards, front pull hook, light system, and vandalism protection.

	O&O/hr.		
	Moderate	**Average**	**Severe**
D3C	$ 7.00	$ 11.00	$ 18.00
D4C	9.00	13.00	20.00
D5C	10.00	13.00	20.00
D4E	10.00	13.00	20.00
D4H Series II	16.00	20.00	24.00
D4H TSK Series III	23.00	28.00	34.00
D5B	14.00	17.00	28.00
D5H Series II	20.00	25.00	30.00
D5H TSK Series II	26.00	32.00	40.00
D6D	18.00	23.00	38.00
D6H Series II	22.00	28.00	35.00
D7G	26.00	33.00	51.00
D7H Series II	29.00	37.00	45.00
D8L	39.00	48.00	73.00
D8N	36.00	46.00	56.00
D9N	51.00	62.00	80.00
D10N	65.00	86.00	105.00
D11N	100.00	118.00	159.00
Agricultural Tractors			
D3C SA	$ 7.00	$ 10.00	$ 13.00
D4E SR	12.00	16.00	24.00
D6E SR	18.00	23.00	36.00
D8L SA	41.00	50.00	80.00
AG6	19.00	26.00	35.00
Challenger 65B	17.00	21.00	29.00
Challenger 75	18.00	22.00	30.00

Motor Graders *Example equipment:* hydraulic sideshift with tip, ROPS cab, heater, front lights, vandalism protection.

	O&O/hr.		
	Moderate	**Average**	**Severe**
120G	$12.00	$16.00	$27.00
130G	14.00	16.00	29.00
12G	13.00	18.00	30.00
140G	15.00	19.00	32.00
14G	20.00	27.00	45.00
16G	27.00	36.00	56.00

Excavators, Feller Bunchers and Front Shovels *Example equipment:* largest undercarriage (or standard tires), largest bucket or standard feller buncher, medium stick, one-piece boom.

	Moderate	O&O/hr. Average	Severe
FB227	21.50	27.00	47.50
235D	27.00	33.00	58.00
245D	43.00	53.00	88.00
235D Front Shovel	29.00	39.00	63.00
245D Front Shovel	46.00	60.00	93.00
320	15.00	16.00	27.50
E240C	18.50	22.50	36.00
325	19.00	23.00	37.00
330	21.50	26.00	40.50

Backhoe Loaders

	Moderate	O&O/hr. Average	Severe
416B*	–		
426B*	—	—	—
428B*	—	—	—
436B*	—	—	—
438B*	—	—	—
446*			—

*Insufficient data to estimate

Skidders *Example equipment:* vandalism protection, front wheel disc brakes.

	Moderate	O&O/hr. Average	Severe
518 Series II Cable	$13.00	$19.00	$32.00
518 Series II Grapple	14.00	20.00	34.00
528B	19.00	27.00	46.00
530B*	—	—	—

*Insufficient data to estimate

Pipelayers *Example equipment:* front pull hook, lighting system and standard vandalism protection.

	Moderate	O&O/hr. Average	Severe
571G	$22.00	$26.00	$30.00
572C	24.00	29.00	43.00
578*	—	—	—
589*	—		

*Insufficient data to estimate

Wheel-Tractor Scrapers *Example equipment:* Standard tractor, standard scraper, standard tires.

	Moderate	O&O/hr. Average	Severe
613C	$28.00	$ 35.00	$ 49.00
615C	41.00	51.00	70.00
621E	36.00	48.00	75.00
623E	46.00	58.00	88.00
627E	49.00	64.00	94.00
627PP	50.00	66.00	97.00
631E Series II	53.00	72.00	114.00
637E Series II	79.00	108.00	161.00
637PP	81.00	108.00	165.00
651E	59.00	78.00	121.00
657E	86.00	116.00	173.00
657PP	88.00	119.00	178.00

Construction & Mining Trucks and Tractors *Example equipment:* body liners on trucks, downshift inhibitor, standard E-3 tires, standard body (Option I — 785/789) with liners and standard tires. Tractors do not include trailer.

	Moderate	O&O/hr. Average	Severe
768C	$30.00	$ 39.00	$ 55.00
769C	26.00	36.00	47.00
771C	26.00	36.00	48.00
772B	39.00	51.00	76.00
773B	34.00	48.00	65.00
775B	34.00	48.00	66.00
776C	45.00	66.00	95.00
777C	46.00	64.00	87.00
784*	—	—	—
785	61.00	82.00	119.00
789	81.00	108.00	159.00
793*			

Insufficient data to estimate

Articulated Trucks

		Moderate	O&O/hr. Average	Severe
D20D	(est.)	$17.00	$21.00	$24.00
D25D	(est.)	19.00	23.00	26.00
D30D	(est.)	23.00	28.00	32.00
D40D	(est.)	31.00	39.00	48.00
D250D	(est.)	19.00	22.00	25.00
D300D	(est.)	22.00	26.00	30.00
D350D	(est.)	26.00	31.00	36.00
D400D	(est.)	30.00	36.00	46.00

Wheel-Type Tractors *Example equipment:* straight bulldozer, ROPS canopy, lighting system, vandalism protection, standard tires.

	Moderate	O&O/hr. Average	Severe
814B	$22.00	$26.00	$38.00
824C	27.00	33.00	56.00
834B	41.00	46.00	74.00

Compactors *Example equipment:* fill spreading bulldozer, ROPS canopy, lighting system, vandalism protection.

	Moderate	O&O/hr. Average	Severe
815B	$22.00	$27.00	$42.00
816B	26.00	30.00	42.00
825C	26.00	33.00	47.00
826C	38.00	45.00	66.00

Wheel Loaders *Example equipment:* 980 and up, ROPS sound suppressed cab, heater and air conditioner. 966 and down, standard ROPS cab, standard tires and smallest bucket with teeth.

	Moderate	O&O/hr. Average	Severe
910E	$12.00	$15.00	$17.00
IT12B	12.00	15.00	17.00
IT14B	12.00	16.00	19.00
916	11.00	14.00	19.00
IT18B	12.00	16.00	20.00
926E	13.00	17.00	22.00
IT28B	14.00	19.00	24.00
930*, 930R*		—	—
936F	16.00	20.00	27.00
950F	19.00	25.00	33.00
966C*	—	—	—
966F	25.00	33.00	50.00
980F	30.00	43.00	60.00
988B	48.00	59.00	87.00
992C	84.00	108.00	145.00
994	120.00	157.00	203.00

*Insufficient data to estimate

Track Loaders *Example equipment:* canopy, track roller guards, front pull hook, lighting system, vandalism protection and GP bucket with teeth and segments.

	Moderate	O&O/hr. Average	Severe
931C	$10.00	$ 14.00	$ 21.00
935C	11.00	15.00	22.00
943	14.00	20.00	27.00
953	17.00	24.00	33.00
963	21.00	30.00	42.00
973	29.00	40.00	54.00

Paving Compactors *Example equipment:* Standard equipment with working lights and all CP models equipped with leveling blades.

	Moderate	O&O/hr. Average	Severe
CB-214	$ 4.00	$ 6.00	$ 9.00
CB-224	6.00	9.00	14.00
CB-434	12.00	16.00	19.00
CB-534	14.00	19.00	21.00
CB-614	16.00	21.00	28.00
CS-323	9.00	14.00	18.00
CS-431	12.00	15.00	19.00
CS-433	13.00	18.00	25.00
CS-563	11.00	23.00	29.00
CP-323	13.00	18.00	24.00
CP-433	14.00	23.00	28.00
CP-563	20.00	26.00	34.00
PS-110	5.00	9.00	14.00
PS-130	5.00	9.00	14.00
PS-180	6.00	11.00	14.00

Road Reclaimer *Example equipment:* Standard equipment with mill drum rotor. **Pavement Profilers** *Example Equipment:* Standard equipment with stated rotor size.

	Moderate	O&O/hr. Average	Severe
RR-250	$155.00	$173.00	$203.00
PR-450C (79" rotor)	230.00	281.00	331.00
PR-750B (150" rotor)	342.00	435.00	527.00
PR-1000C (150" rotor)	394.00	486.00	579.00

TIRES

CONTENTS

SELECTION, APPLICATION, MAINTENANCE

The proper tire selection, application and maintenance continues to be one of the most important factors in earthmoving economics. Wheel tractors, loaders, scrapers, wagons, trucks, motor graders, etc. are earthmoving equipment whose productivity and payload unit cost may depend more on tire performance than any other factor.

Off-the-road tires must operate under a wide variety of conditions ranging from dry "potato dirt" through wet severe shot rock. Speed conditions vary from less than 1 mph average to 72 km/h (45 mph). Gradients may vary from 75% favorable to 30% adverse. Climatic conditions, operator skills, maintenance practices, etc. all may have a profound effect on tire life and unit costs.

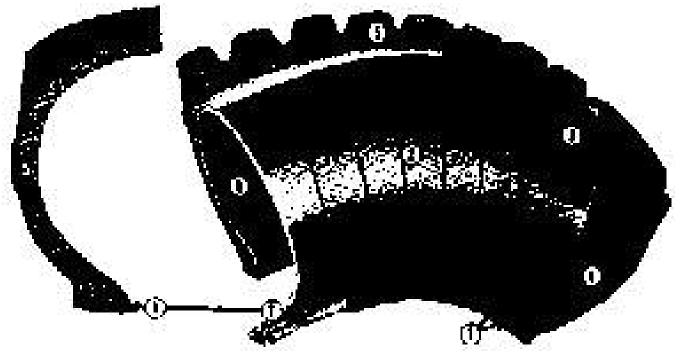
No one tire construction can meet all requirements on any one machine and, in many instances, not even on one job. The many differences in tire requirements on earthmoving machines have resulted in a wide variety of tread and carcass designs being made available. The optimum tire selection for a specific machine on a given job should be a joint decision between the user and tire supplier. Several tire manufacturers have technical and application representatives in the field for proper guidance in tire selection.

When job conditions change, it may be desirable to select a different tire configuration to meet the new requirements.

TIRE CONSTRUCTION

The pneumatic tire is essentially a flexible pressure vessel utilizing structural members (nylon, steel cable, etc.) to contain the hoop tension resulting from the inflation pressure. Rubber is utilized as a protective coating and sealant over the structural members and also makes up the tread pattern which provides the wearing medium at the ground interface. In order to assist you in the selection of tires for your specific application, the following is a brief explanation of the various tire constructions available.

Two distinct tire constructions approved on all Caterpillar machines are the BIAS PLY and RADIAL PLY tires. The following is a brief explanation of the principal features of these two constructions.

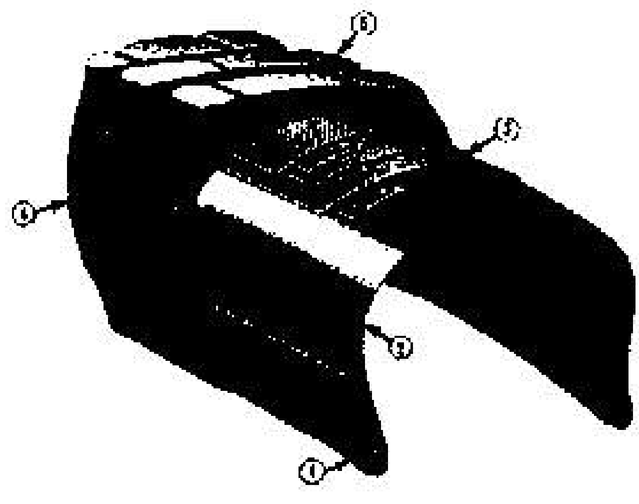


Bias Ply Construction

Bias Ply

1. *Beads* — The tire beads consist of bundles of steel wire (3 or 4 in larger tires) which are forced laterally by tire inflation pressure to wedge the tire firmly on the rim's tapered bead seat. The nylon plies tie into the bead bundles. The forces inherent in the tire are transmitted from the rim through the bead bundles into the nylon.
2. *Body plies* — Layers of rubber-cushioned nylon cord comprise the carcass of the tire. Alternating plies of cord cross the tread centerline at an angle (bias). The term "ply rating" is an index of tire strength and is not the actual number of plies in the tire.
3. *Breakers or tread plies* — These, if used, are confined to the tread area of the tire and are intended to improve carcass strength and provide additional protection to the body plies. Some "work" tires employ steel breakers or belts to give further protection to the carcass.
4. *Sidewalls* — These are the protective layers of rubber covering the body plies in the sidewall areas.
5. *Tread* — The wearing part of the tire which contacts the ground. It must transmit the machine weight to the ground as well as provide traction and flotation.
6. *Inner liner* — This is the sealing medium which retains the air in the tire and, combined with the "O" ring seal and rim base, eliminates the need for inner tubes and flaps.
7. *Tubes and flaps* — There are a few applications where tire life may be improved by the use of tubes and flaps (not shown).
8. *Undertread* - Protective cushion of rubber lying between tread and the body ply.

Radial Ply



Radial Ply Construction

1. *Beads* — A single bead bundle of steel cables or steel strip (spiraled like a clock spring) comprise the bead at each rim interface.
2. *Radial carcass* — This consists of a single layer or ply of steel cables laid archwise (on the radian) bead to bead.
3. *Belts* — Several layers or plies of steel cable form the belts which underlie the tread area around the tire circumference. The cable in each belt crosses the tread centerline at an angle with the angle being reversed from the preceding belt.
4. *Sidewalls.*
5. *Tread.*
6. *Undertread* — Protective cushion of rubber lying between tread and the steel belts.

TIRE TYPES

Off-the road tires are classified by application in one of the following three categories:

1. *Transport tire* — For earthmoving machines in transporting material.
2. *Work tire* — Normally applied to tractive type earthmoving machines such as wheel type tractors and loaders.
3. *Load and carry* — Wheel loaders engaged in transporting as well as digging.

In actual practice there are many instances where it is necessary to apply a type of tire in an application not originally intended by the tire designer. An example would be the extra deep tread WORK TIRE compounded for shot rock and, as a result, very limited in speed capability. Despite the speed limitation, a transport machine in severely abrasive conditions may find this work tire to be the most economical alternative.

TIRE SIZE NOMENCLATURE

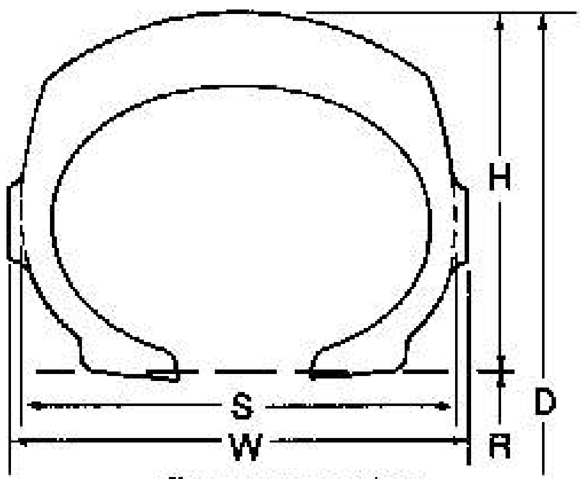
Tire size nomenclature is derived from the approximate cross section width and rim diameter with various systems being available:

1. A wide base tire, for example, is designated as a 29.5-35 with the approximate cross section width being the first number (inches) and the rim diameter the second number (inches). Industry standards permit this tire's width to be a maximum of 824 mm (32.45") in service.
2. A standard base tire, for example, is designated as a 24.00-35 with the approximate cross section width being the first number (inches) and the rim diameter the second number (inches). Industry standards permit this tire width to be a maximum 718 mm (28.27") in service.
3. A low profile tire, for example, is designated as a 40/65-39 (formerly 65/40-39 or 40-39) with the approximate cross section width being the first (40) number (inches) and the rim diameter the third (39) number (inches). The second number (65 actually is .65) is the aspect ratio (section height divided by section width).

   If designated 40/65 R39, then the R denotes radial construction. One manufacturer designates his radial tire as a 40/65 R-39.

The wide base tire has an aspect ratio of approximately .83 and the standard base .95. The "low profile tire" has an aspect ratio of .65.

When comparing a wide base tire to a standard base tire, it must be remembered a larger first number on a wide base tire with the same rim diameter does not mean the wide base is larger in overall diameter. For example, the 18.00-25 standard base tire is larger in diameter than the 20.5-25 wide base. It is comparable in overall diameter to the 23.5-25 wide base.



Tire cross-section

D = Tire Overall Diameter
R = Nominal Rim Diameter
H = Tire Section Height
S = Tire Section Width
W = Tire Width (includes ornamental ribs)
$\frac{H}{S}$ = Aspect Ratio

CODE IDENTIFICATION FOR OFF-HIGHWAY TIRES

The tire industry has adopted a code identification system to be used for off-the-road tires. This identification system will reduce the confusion caused by the trade names for each type of tire offered by each tire manufacturer. The industry code identification is divided into six main categories by types of service as follows:

C — Compactor Service
E — Earthmover Service
G — Grader Service
L — Loader & Dozer Service
LS — Log-Skidder Service
ML — Mining & Logging Service

The sub-categories are designated by numerals, as follows:

Code Identification

Compactor
C-1 Smooth
C-2 Grooved
Earthmover
E-1 Rib
E-2 Traction
E-3 Rock
E-4 Rock Deep Tread
E-7 Flotation
Grader
G-1 Rib
G-2 Traction
G-3 Rock
G-4 Rock Deep Tread
Loader & Dozer
L-2 Traction
L-3 Rock
L-4 Rock Deep Tread
L-5 Rock Extra Deep Tread
L-3S Smooth
L-4S Smooth Deep Tread
L-5S Smooth Extra Deep Tread
L-5/L-5S Half Tread Extra Deep
Mining & Logging
ML-1 Rib
ML-2 Traction
ML-3 Rock
ML-4 Rock Deep Tread
Log-Skidders
LS-1 Regular Tread
LS-2 Intermediate Tread
LS-3 Deep Tread

Tire and Rim Assoc. Code	Tread Type	FIRESTONE	GENERAL	GOODYEAR	BRIDGESTONE	MICHELIN
Compactor						
C-1	Smooth Compactor	Plain Tread Roller	Compactor Smooth Roller	Smooth Compactor	Road Roller	X LISSE
C-2	Grooved Compactor	Compactor		All Weather Compactor		
Earthmover						
E-1	Rib	Rib Excavator	Rock Rib LCM	Hard Rock RIB	W-Rib	XRIB
E-2	Traction	Super Ground Grip	All Duty DTL TL100	Earthmover Sure Grip Sure Grip Lug	Fast Grip, G-Lug V-Grip	XV, XL
E-3	Rock	Rock Grip Excavator Super Rock Grip E67	ND LCM CM 100 SL 100 XG-3 LCM	Hard Rock Lug Hard Rock Lug-6 Super Hard Rock Lug Super Hard Rock Lug-6 HRL-3F	R-Lug, W-Lug E-Lug, VE Block	XK, XR XRDN XH
E-4			ND Super LCM Super LCM CM 150 CRL 150 XG-4	HRL-4B	R-Lug S, E-Lug S R-Lug S2, E Lug S2	XHD1, XRD1 XKD1
E-7	Flotation	All Non-Skid EM Sand Champion Sand & Highway	Super Sand Flotation	Sand Rib Earthmover All-Weather	Alligator, Sand Clipper S-Lug	XS XRIB
Grader						
G-1	Rib	Rib Road Builder		Rib Grader	Rib Grader	
G-2	Traction	Ground Grip Road Builder Super Ground Grip Road Builder	Loader Grader	Sure Grip Grader All Weather Grader	Fast Grip, G-Lug	XGL
G-3	Rock	Rock Grip Road Builder	ND LCM Grader	Rock Grader	R-Lug, W-Lug	XR, XRDN, XH
G-4				SGG-4B		XRD1

18

Tire and Rim Assoc. Code	Tread Type	FIRESTONE	GENERAL	GOODYEAR	BRIDGESTONE	MICHELIN
Log-Skidder						
LS-1	Regular			Logger Special Steelguard		
LS-2	Intermediate	Forestry Special	Timber Skid	Logger Lug	Timber Grip S	
LS-3	Deep	Champion Spade Grip Logger				
Loader & Dozer						
L-2	Traction	Super Ground Grip L-D	LD Loader Grader LD All Duty	Sure Grip Loader Sure Grip Lug D&L	Fast Grip G-Lug V-Grip	XGL
L-3	Rock	Super Rock Grip L-D	LD ND LCM LD 100	Super Hard Rock Loader Super Hard Rock Lug D&L Super Hard Rock Lug S-D&L	R-Lug	XK, XRDN, XH
L-4	Rock Deep Tread	Super Rock Grip Deep Tread L-D	LD-150 CRB LD 150 Belted	Super Hard Rock Lug Xtra Tred D&L HRL D/L-5A Nylosteel NRL D/L-4A Belted	R-Lug S R-Lug S2 N-Lug	XRD1, XKD1, XMINE D1
L-5	Rock Extra Deep Tread	Super Deep Tread L-D	LD 250 CRB LD-250 Belted	Super Xtra Tred D&L Nylosteel NRL D/L-5A Belted	D-Lug M-Lug	XRD2, XMINE D2
L-4S	Smooth Deep Tread			SMO D/L-4A	Smooth Tread M	
L-5S	Smooth Extra Deep Tread	Plain Tread L-D	LD 250 Super Smooth CRB LD-250 Super Smooth Belted	SMO D/L-5A	Smooth Tread MS	
L-5/L-5S	Half Smooth	Half Tread L-D	LD-250 Half Trac CRB LD-250 Half Trac Belted	DRL D/L-5A		

RADIAL TIRE IDENTIFICATION

Code Identification for Michelin Tires

All Michelin earthmover tires are of radial construction, designated by the "X" marking. They contain a single steel radial ply with a series of steel belts placed around the circumference of the tire which reinforce and stabilize the tread area.

There are eleven tread designs currently available, XGL, XRD (XRDN, XRD1, XRD2) XK (XK, XKD1), XH (XHA, XHAD, XHD1), XMINE (XMINE D1, XMINE D2), XV, XL, XLISSE, XS, XRIB with differing internal constructions depending on the application, as follows:

Type A — Cut resistant tread compound with reinforced sidewalls for work machines, mine vehicles, and slow moving transport machines on ground where there is danger of cuts, penetration, etc.

Type B Wear and heat resistant construction for use on most transport machines.

Type C For use on the highest speed transport machines.

The current combinations of tread patterns, construction, and tread depths offered, and primary TRA codes are:

	Type A	Type B	Type C	Primary TRA Codes
XGL	x	—	—	G-2, L-2
XH	x	—	—	L3, G3
XRD1	x	—	—	G-4, L-4
XRD2	x	—	—	L-5
XK	x	x	—	L-3, E-3
XKD1	x	x	—	E-4
XHD1	x	x		E-4
XMINE D1	x	·		L 4
XMINE D2	x	—	—	L-5
XV	—	—	x	E-2
XL	—	x	—	E-2
XLISSE	x	—	—	C-1
XS	—	x	—	E-7
XRIB	—	x	—	E-7

Since Michelin radial tires contain a single steel casing ply, they do not utilize the industry method of designating tire strength in terms of multiple ply ratings. Their system consists of a one star, two star, and three star rating as an indication of the tire's carrying capacity. The one star is the lightest construction, generally used on work and slow moving transport machines. Two star tires are used on most medium and high speed transport machines. Three star construction provides the greatest carrying capacity for a given size and is only available in small standard base tires.

This combination of tread designs and types of construction provides a range of radial tires which cover most earthmoving applications. We recommend that in applying steel radial tires to your machines you provide all data to the tire manufacturer. Obtain his recommendations as to which tire will provide the most economical operation.

Code Identification for Goodyear Radial Tires

All Goodyear steel radial earthmover tires have been designated *Unisteel* followed by a three or four digit alpha-numeric code that identifies the particular tread. The currently active codes are:

RL-2+	E2 and L2	RL 4	GL
RL 2F	E2 and L2	RL-4H	E4
RL 3	E3 and L3	RL-4J	E4
RL-3+	E3	RL-5K	L5
RL-3F	E3	GP-2B	
RL-3J	E3 and L3	SG-2A	GL

The RL stands for Rock Lug and indicates that the upper sidewall has rock protection. The number in the code corresponds to the tire industry identification system (2-traction, 3-rock, etc). The fourth digit, if any, is used to designate tread design differences for the same basic tread type (F-directional tread).

The carcass strength is indicated by a star rating system instead of the ply rating system. These symbols indicate the recommended inflation for a particular tire load.

Following the star rating code is Goodyear's Custom Compound and Construction code. For a tire designated "2S" the 2 indicates a heat resistant compound and the S indicates standard construction. The higher the number the greater the abrasion and cut resistance with a corresponding lower T-km/h (TON-mph) rating.

Code Identification for Firestone Radial Tires

The Firestone Steel Radial earthmover tire is designated as the Giant Steel Radial (GSR). This tire contains a single steel radial ply with a series of steel tread belts around the circumference of the tire to reinforce and stabilize the tread area.

Using a single steel casing ply eliminates the tire industry's method of designating tire strength in terms of multiple ply ratings. Instead the carcass strength is indicated by a one or two star rating system, which indicates the recommended inflation for a particular tire load capacity.

The 25" wide base tires are available as E3/L3, which designates the tire compound. The larger earthmoving haul truck sizes are available in E3 & E4 tread depths.

We recommend a complete review of all pertinent tire requirements with your local Firestone representative, prior to installing GSR.

Code Identification for Bridgestone Radial Tires

The Bridgestone steel radial earthmover has been designated as V-Steel. The current nomenclature is:

V-Steel K-Traction	(VKT)	E2 and L2
V-Steel F-Traction	(VFT)	E2
V-Steel E-Lug	(VEL)	E3
V-Steel E-Lug S	(VELS)	E4
V-Steel W-Traction S	(VWTS)	E4
V-Steel R-Lug S	(VRLS)	E4
V-Steel Jamal	(VSJ)	E7
V-Steel A-Lug	(VAL)	L3
V-Steel A-Lug	(VALS)	L4

Bridgestone has multiple compounds, with the three most commonly used being: 1A, 2A, 3A. The number indicates the type of compound; 1 = standard, 2 = cut resistant, 3 = heat resistant. The letter indicates the casing construction types; A = standard, V = steel belted.

TON-MILES PER HOUR

Tire selection and machine operating practices have, in some cases, become the critical factors in the over-all success of earthmoving ventures. The most serious problems occur when tires are operated at temperatures above their capabilities. Separation and related failures occur. To help you avoid temperature related failures, Caterpillar has been instrumental in developing the *Ton-Miles Per Hour* (Ton-MPH) method of rating tires.

Heat and Tire Failure

Tire manufacturing requires heat in the vulcanizing process converting crude rubber and additives into a homogeneous compound. The heat required is above 132°C (270°F).

A tire also generates heat as it rolls and flexes. Heat generated faster than it can be radiated into the atmosphere gradually builds within the tire and reaches maximum level at the outermost ply or belt.

Over time, enough heat can develop from overflexing to actually reverse the vulcanizing process or "revert" the rubber causing ply separation and tire failure. Only a brief time at reversion temperature initiates the failure. Experience shows that few pure heat separation cases occur. Most so-called heat separations are in tires operating below the reversion level.

As a tire's operating temperature increases the rubber and textiles within significantly lose strength. The tire becomes more susceptible to failures from cornering, braking, impact, cut through, fatigue and heat separation. If operating tires at higher temperatures is absolutely necessary, it is essential the machines be operated so as to reduce the probability of premature tire failure. No hard cornering without superelevation, no panic braking, etc.

The Ton-MPH formula was developed to predict tire temperature buildup. The system is a method of rating tires in proportion to the amount of work they can do from a temperature standpoint. It utilizes the product of *load* x *speed* to derive an index of the tire temperature buildup. Maximum tire level-off temperatures of 107° C (225° F) for fabric cord tires and 93° C (200° F) for steel wire tires are the limits Caterpillar recommends. Even at these temperatures, failures may be initiated by overstressing the tires. Some tire companies rate fabric cord tires at 111° C (232° F) and on occasion as high as 118° C (250° F). These higher temperature levels are questionable under average field conditions.

It is possible through the use of a needle type pyrometer to measure temperature at any desired point within the tire carcass. However, the instrumentation and the technique does not lend itself to general field usage. The greatest difficulty is encountered in locating the thickest (therefore the hottest) tread bar in any given tire and involves the use of giant calipers. The tire must then be drilled along the centerline of this bar from shoulder to shoulder at 52 mm (2") intervals. These 3.18 mm (1/8") diameter holes extend down through the tread and undertread rubber to the topmost reinforcement. This procedure is fully described under SAE Recommended practice J1015.

The Ton-MPH rating system as given in this SAE specification is approved by most tire manufacturers. Michelin, in addition to providing Ton-MPH ratings has developed their own speed/load carrying rating system and we recommend that Michelin be consulted where high tire temperature cycles with Michelin tires might be a problem.

Heat generation in a specific tire at recommended pressure depends on three factors:

- the weight the tire is carrying (flex per revolution),
- the speed the tire is traveling over the ground (flexures over a period of time), and
- the temperature of the air surrounding the tire (ambient temperature) and road surface temperature.

Once a tire manufacturer has determined a tire's temperature characteristics and expressed them in Ton-MPH, the above listed specific job conditions can be used to determine any tire's maximum work capacity. These conditions provide on site ability to predict and avoid costly tire separations.

Ton-Mile-Per-Hour Rating System

The tire TMPH can be matched to the site TMPH as well as compared with TMPH values of different makes and types of tires.

TMPH Job Rate

Average Tire Load × Average Speed for the shift

Average Tire Load

$$\frac{\text{"Empty" tire load} + \text{"loaded" tire load}}{2}$$

Average Speed

$$\frac{\text{Round trip distance in miles} \times \text{number of trips}}{\text{Total Hours (in the shift)}}$$

For excessive haul length (20 miles or more) consult your tire representative for modification to the TMPH value.

To use in the metric system, change miles to kilometers and use metric tons.

It should be noted that prolonged operation at high carcass temperatures can fatigue the nylon at the flex points in the sidewalls.

The following are the most recent (January 1990) Ton-MPH ratings as made available by Goodyear, and Michelin and are subject to change on their part at any time. Other tire manufacturers' Ton-MPH ratings will be included in future handbook editions when and if made available. For latest Ton-MPH ratings, consult specific tire manufacturer at time of machine and/or tire purchase.

Load-and-Carry T-km/h (Ton-MPH)

The wheel loader, when used in load-and-carry applications, may encounter temperature problems similar to those normally associated only with tires on scrapers, trucks and wagons. **Do not place the vehicle in load-and-carry applications without first obtaining T-km/h (Ton-MPH) ratings and pressure recommendations from the tire manufacturer.**

Conventional and Radial Steel Cord Tire Options

Tire options now provide types to operate in conditions ranging from rock and abrasive materials, to jobs with high speed hauls in good materials.

The best tire type can be different for the drive tires than for other tires on the same machine. T-km/h (Ton-MPH) should be calculated for all tires.

Tire Drive-Away Recommendations

Heat separation can be a problem during machine delivery and moving machines from one job to another. Whenever roading earthmoving machines, *check your supplier for the tire manufacturer's recommended speed limitations on the specific tires involved.*

Some tire manufacturers also recommend that vehicles equipped with extra tread depth or special compounded tires should not be roaded without their specific approval. Our tests support this recommendation, especially for L-3, L-4 and L-5 tires.

T-km/h (TON-MPH)
AT 38° C (100° F) AMBIENT TEMPERATURE
For Hauls of 20 Miles or Less One Way

Because of the variance between specific tires it is recommended that at the time of purchase you check with your tire supplier for the manufacturer's specific T-km/h (Ton MPH) ratings for the tires purchased.

GOODYEAR BIAS PLY CONSTRUCTION CONVENTIONAL SIZES

Industry Code	E-1		E-2	E-3		E-4				E-7
Tread Design	Hard Rock Rib HRR-1A		Sure Grip SGL-2A	Hard Rock Lug HRL-3A Hard Rock Lug-8 HRL-3B		Hard Rock Lug XT HRL-4A Hard Rock Lug XT-8 HRL-4B			Hard Rock Lug XT-6M MRL-4B	Sand Rib SRB-7A
Custom Code	2S	4S	4S	2S	4S	2S	4S	6S	4S	4S
14.00-25		102 70			73 50		66 45			
16.00-25	182 125	131 90			102 70	131 90	95 65			
18.00-25	212 145	146 100	146 100	182 125	131 90		117 80		102 70	234 160
18.00-33				219 150	161 110		146 100	124 85		
18.00-49					190 130		168 115			
21.00-25			204 140				175 120			270 185
21.00-35	336 230			292 200	212 145	263 180	190 130	161 110	168 115	
21.00-49					248 170		234 160			
24.00-35					255 175		234 160	204 140	204 140	
24.00-43							270 185			
24.00-49					292 200		277 190	241 165	241 165	
27.00-49					380 260	460 315	328 225	277 190		
30.00-51				620 425	445 305		387 265		358 245	
33.00-51							441 300			
36.00-51					540 370	679 465	489 335		474 325	628 430
40.00-57						803 550	606 415			

T-km/h (TON-MPH) RATINGS
AT 38° C (100° F) AMBIENT TEMPERATURE

For Haul Lengths of 20 Miles or Less One Way

GOODYEAR BIAS PLY CONSTRUCTION WIDE BASE SIZES

Industry Code	E-2	E-3				E-7
Tread Design	**Sure Grip Lug SGL-2A**	**Super Hard Rock Lug HRL-3A**		**Super Hard Lug 8 HRL-3B**	**HRL-3F**	**Sand Rib SRB-7A**
Custom Code	**4S**	**2S**	**4S**	**4S**	**3S**	**4S**
20.5-25	110 **75**		95 **65**			
23.5-25	131 **90**		102 **70**			
26.5-25	153 **105**		131 **90**			
26.5-29	175 **120**		161 **110**			
29.5-25	182 **125**		168 **115**			248 170
29.5-29	197 **135**	255 **175**	182 **126**	190 **130**		
29.5-35	248 170		212 **145**	234 **160**		
33.25-29				204 **140**		
37.25-35				248 **170**	234 **160**	
33.5-33	263 **180**			248 **170**	234 **160**	
33.5-39				307 **210**		
33.25-35				321 **220**	307 **210**	
37.5-33	321 **220**		299 **205**	321 **220**	307 **210**	
37.5-39				350 **240**	328 **225**	
37.5-51				446 **305**		

BRIDGESTONE BIAS PLY CONSTRUCTION

Tire Size	Standard Tread Type 1A E-3	Extra Tread Type 1A E-4
18.00-25	182 **125**	161 **110**
18.00-33	219 **150**	190 **130**
21.00-35	270 **185**	226 **155**
24.00-35	338 **230**	292 **200**
24.00-49	431 **295**	358* 367** **246 266**
27.00-49	526 **360**	431 **295**
30.00-51		511* 540** **350 370**
23.5-25	131 **90**	
26.5-29	190 **130**	
29.5-29	204 **140**	
29.5-35	255 **175**	
33.25-35	292 **200**	
37.25-35	349 **245**	
33.5-39	292 **200**	
37.5-39	372 **255**	
33.00-51		386
36.00-51		436
20.5-25		65
33.5-33		195

*RLS
**ELS

T-km/h (TON-MPH) RATINGS AT 38° C (100° F) AMBIENT TEMPERATURE

For Haul Lengths of 20 Miles or Less One Way

GOODYEAR RADIAL PLY CONSTRUCTION CONVENTIONAL SIZES

Industry Code	E-2		E-3		E-4											
Tread Design	**RL-2F**		**RL-3+**		**RL-4**		**RL-4F**			**RL-4H**			**RL-4J**			
Custom Code	**2S**	**4S**	**2S**	**4S**	**2S**	**4S**	**2S**	**4S**	**6S**	**2S**	**4S**	**6S**	**2S**	**4S**	**6S**	
14.00R25	161 **110**	124 **65**											124 **85**	95 **66**		
16.00R25	190 **130**	146 **100**	168 **115**	124 **85**												
18.00R25	248 **170**	190 **130**	226 **155**	168 **115**	182 **125**	139 **95**							190 **130**	146 **100**		
18.00R33	292 **200**	219 **150**	263 **180**	197 **135**	219 **150**	167 **115**	204 **140**	153 **105**	124 **85**				226 **155**	175 **120**	131 **90**	
21.00R35	401 **275**	306 **210**	357 **245**	270 **185**			292 **200**	219 **150**	175 **120**				313 **215**	240 **165**	189 **130**	
24.00R35	489 **375**	321 **220**	438 **300**	336 **230**			357 **245**	270 **185**	212 **145**				394 **270**	299 **205**	234 **160**	
24.00R49			547 **375**	409 **280**		380 **260**							467 **320**	358 **245**	277 **190**	
27.00R49			628 **430**	474 **325**	584 **400**	445 **305**							547 **375**	423 **290**	328 **225**	
30.00R51										628 **430**	474 **325**	286 **195**	628 **430**	474 **325**	285 **195**	
33.00R51			1000 **685**	751 **515**						715 **490**	540 **370**	321 **220**	715 **490**	540 **370**	321 **220**	
36.00R51			854 **585**	642 **440**						788 **540**	598 **410**	358 **245**	788 **540**	598 **410**	358 **245**	
37.00R57										1022 **700**	781 **535**	460 **315**	1095 **750**	730 **500**	490 **335**	
40.00R57										1146 **785**	876 **600E**	518 **355**				

T-km/h (TON-MPH) RATINGS
AT 38° C (100° F) AMBIENT TEMPERATURE
For Haul Lengths of 20 Miles or Less One Way

GOODYEAR
RADIAL PLY CONSTRUCTION
WIDE BASE SIZES

Industry Code	E-2						E-3		
Tread Design	AT-2A	RL-2+		RL-2F		GP-2B	RL-3	RL-3F	RL-3J
Custom Code	2S	2S	4S	2S	4S	4S	4S	4S	4S
15.5R25				146 100	109 75				
17.5R25	190 130	146 100	109 75	182 125	136 95	151 105			124 85
20.5R25		175 120	131 90	212 145	153 105	168 115			146 100
23.5R25		197 135	146 100	234 160	175 120	197 135			160 110
26.5R25		226 155	168 115	263 180	197 135	226 155			
26.5R29				285 195	211 145				
29.5R25		270 185	204 140	321 220	233 160	270 185			
29.5R29		306 210	239 160	378 260	284 195		270 185		
33.25R29				401 275	306 210				
33.25R35		386 265	282 200	474 325	357 245		306 210	306 210	336 230
37.25R35				547 375	416 285				379 260
37.5R39				613	460 420				430 295
40.5/75R39						445 305			
22/65R25	284 195								
25/65 25/65R25								182 125	

18

T-km/h (TON-MPH) RATINGS AT 38° C (100° F) AMBIENT TEMPERATURE

For Haul Lengths Greater than 3 Miles (Round Trip)

MICHELIN RADIAL PLY CONSTRUCTION STANDARD BASE TIRES

Industry Code	E3		E-2	E-3		E-4			
Tread Design	XR		XV	XK		XHDI		XKDI	
Type	A	B	C	A	B	A	B	A	B
14.00R24***	102 **70**	143 **98**	204 140					70 **48**	
16.00R24**		180 **123**							
13.00R25***	86 **59**								
14.00R25***		143 **98**				90 **62**	122 **84**		
16.00R25**	128 **88**	180 **123**	257 176		165 113	113 **77**	154 **106**		123 **84**
18.00R25**	163 **112**	228 **156**	326 **223**		209 **143**	143 **98**	195 **134**	111 **76**	157 **107**
21.00R25**		289 **205**							
18.00R33**	192 **131**	268 **184**	384 **263**		246 **168**	169 116	231 **158**	130 **89**	184 **126**
21.00R35**		357 **245**	510 **349**		326 **224**	224 **154**	306 **209**	173 **119**	245 **167**
24.00R36**		456 **312**	651 **446**		417 **286**	287 **196**	391 **268**	171 **117**	312 **214**
24.00R49**		537 **368**	767 **525**		491 **336**	338 **231**	460 **315**	260 **179**	369 **253**
27.00R49**		671 **460**	959 **657**		614 **421**	422 **290**	578 **394**	326 **224**	460 **315**
30.00R51**		825 **565**	1179 **806**		755 **517**	519 **356**	708 **486**	401 **275**	566 **387**
33.00R51**						600 **411**	818 **561**		
36.00R51**		1140 **781**			1042 **714**			554 **379**	781 **535**
37.00R57**								635 **435**	895 **613**

NOTE: For cycle lengths of 3 Miles or less (round trip), multiply the T km/h (or Ton MPH) value in this table by 1.14.
NOTE: Asterisks represent size & ply rating or strength index.

T-km/h (TON-MPH) RATINGS AT 38° C (100° F) AMBIENT TEMPERATURE

For Haul Lengths Greater than 3 Miles (Round Trip)

MICHELIN RADIAL PLY CONSTRUCTION WIDE BASE SIZES

Industry Code	E-3			
Tread Design	**XR**		**XRDN**	
Type	**A**	**B**	**A**	**B**
20.5R25**	128 88	180 123		
23.5R25**	163 112	228 156		
26.5R25**	202 139	283 194	187 128	268 183
29.5R25**	246 169	346 237		
26.5R29**	220 150	308 211		
29.5R29**	264 181	370 253	243 166	348 238
33.25R29**		456 312	299 205	429 294
33.5R33**	352 241	493 338		
37.5R33**	428 293	598 410		
29.5R35**	282 193	394 270		
33.25R35**	352 241	493 338	324 222	465 319
37.25R35**		582 399	382 261	548 377
37.5R39**	453 311	634 435	417 286	598 410
40.5/75R39**			470 322	674 462

NOTE: For cycle lengths of 3 Miles or less (round trip), multiply the T-km/h (or Ton-MPH) value in this table by 1.14.
NOTE: Asterisks represent size & ply rating or strength index.

18

TIRE AND RIM ASSOCIATION RATINGS

While the T-km/h (Ton-MPH) Rating System provides a method for determining the work capacity of the tire, Tire and Rim Association Ratings provide a guide for evaluating the structural capacity of the tire. These two rating systems should be used in conjunction to evaluate tire performance.

TIRE SELECTION

The selection and application of the optimum tire for a given job is particularly critical for earthmoving. The machines have the capability of outperforming the tires and, unless proper practices are observed, very costly premature tire failures may occur. Job conditions also vary greatly throughout the world, as well as within any given job site, and selection of the optimum tire requires careful consideration of all factors involved. In general, the tire manufacturer should be consulted before making the selection for any given application. In some cases, the tire manufacturer is in a position to fabricate tires specifically tailored for a given job site.

For those applications where wear is extremely slow, especially as a result of only occasional operation throughout the year, the cheapest lightweight tire needs to be given strong consideration.

As job conditions become severe, the following factors should be evaluated in selecting a tire:

Transport or Load-and-carry —

- T-km/h (Ton-MPH) (primary consideration)
- Minimum approved ply rating or greater
- Largest optional size
- Thickest tread commensurate with T-km/h (Ton-MPH)
- Largest practical bar to gap ratio
- Most cut resistant tread commensurate with T-km/h (Ton-MPH)
- Belted construction

Loader or Dozer —

- Minimum approved ply rating or greater
- Largest optional size
- Thickest tread
- Thickest available undertread
- Buttressed shoulder
- Most cut resistant tread
- Largest practical bar to gap ratio
- Belted construction
- Lowest aspect ratio

All tires should be operated at the lowest inflation pressure that the tire manufacturer will approve for a given application. Inflation pressure should be checked every working day with an accurate Bourden-tube type gauge. This gauge should be checked against a known standard such as a dead weight tester at least once a month.

If you must operate with excess load and increased tire pressure, follow the number given below:

	Excess Load	Pressure*
Bias Ply	15%	30%
Radial Ply	7%	14%

*When excess loads are encountered, cold inflation pressure must be increased to compensate for higher loads. For each 1% increase in load, the inflation pressure must be increased by 2%.

The above loads will result in reduced tire performance and must be approved by the tire manufacturer.

The use of chains is difficult to justify except under a few conditions. Chains are very costly and heavy, and require more maintenance than most operations can provide. On some models sufficient clearance does not exist for chains with all tire combinations. Extensive modifications may be required if chains are needed for the job.

Foam filling of tires is normally not recommended due to high cost and lack of local filling facilities. Its use should be confined to loader and dozer applications where penetrations occur almost daily. If foam is used be sure to adhere to recommended equivalent pressures of nitrogen.

TIRE SELECTION GUIDE

Material	Road or ground condition	Treads: Wheel Tractor-Scrapers	Treads: Wheel-Type Tractors or Wheel Loaders
Silt and clay, No Rock, High moisture content.	Good varying to poor. High rolling resistance	Traction Type (E-2).	Traction Type (L-2).
Silt and Clay, Some rock, Variable moisture content.	Good varying to poor.	Rock-type (E-3) best unless traction is a problem — then use traction tires (E-2). Rock-type offers more resistance to cutting.	Rock-type (L-3, L-4 or L-5) best unless traction is a problem — then use traction (L-2) tires. Rock-type offers more resistance to cutting.
Silty or clayey gravel and sand, Low moisture content.	Excellent to good. Firm surface.	Rock-type (E-3) offers better wear.	Rock-type (L-3, L-4 or L-5) offers better wear.
Silty or clayey gravel and sand, High moisture content.	Poor, rutted, pot holes.	Rock-type (E-3).	Rock-type (L-3, L-4 or L-5).
Blasted rock	Hard surface, rough.	Rock-type (E-3 or L-3 and L-4 if possible).	Rock-type (L-5 or L-5S).
Sand Very low silt or clay content.	Good to fair surface.	Rock-type (E-3 or L-3S and L-4S if possible) with low pressure. Creates minimum soil disturbance resulting improved flotation.	Rock-type (L-3 or L-3S) with low pressure. Creates minimum soil disturbance resulting in improved flotation.

18

TIRE SUPPLIER RECOMMENDED COLD INFLATION PRESSURES

The following tables present Caterpillar and the *tire suppliers'* recommended cold inflation pressures for tires on Caterpillar machines. An asterisk (*) indicates the standard tire size and ply rating.

The inflation pressure is based on a ready-to-work vehicle weight with no attachments, rated payload, and average operating conditions. Pressures for each application may need to be varied from those shown and should always be obtained from your tire supplier.

Pressures for all tires apply to rib, traction, rock, deep tread, and super deep tread tires.

EXCAVATORS — Bias Ply

For complete tire data and inflation pressures, see the Excavator section in this handbook.

MOTOR GRADERS — Bias Ply

Model	Tire Size	Ply Rating	Pressure Front kPa	Pressure Front psi	Pressure Rear kPa	Pressure Rear psi
120G	13.00-24TG*	8*, 10, 12	241	35	241	35
	14.00-24TG	10, 12	241	35	241	35
	15.5-25	8	241	35	241	35
130G	13.00-24TG*	8*, 10, 12	241	35	241	35
	14.00-24TG	10, 12	241	35	241	35
12G	13.00-24TG*	10*, 12	241	35	310	45
	14.00-24TG	10, 12	241	35	241	35
	15.5-25	8, 12	241	35	276	40
140G	14.00-24TG*	10*, 12	241	35	241	35
	17.5-25	12	241	35	241	35
14G	16.00-24TG*	12	241	35	241	35
	20.5-25	12	241	35	241	35
16G	18.00-25*	12	241	35	276	40
	23.5-25	12	241	35	241	35

*Standard tire and ply rating.

NOTE. Caterpillar now recommends using dry nitrogen (N_2) gas for both tire inflation and pressure adjustments on all current and past production machines.

MOTOR GRADERS — Michelin and Goodyear Radial Ply

Model	Tire Size	Strength Rating	Michelin Front kPa	Michelin Front psi	Michelin Rear kPa	Michelin Rear psi	Goodyear Front kPa	Goodyear Front psi	Goodyear Rear kPa	Goodyear Rear psi
120G	13.00R24	TG 1	310	45	310	45	310	45	310	45
	14.00R24	TG 1	310	45	310	45	310	45	310	45
	15.5R25		310	45	310	45	310	45	310	45
130G	13.00R24	TG 1	310	45	310	45	310	45	310	45
	14.00R24	TG 1	310	45	310	45	310	45	310	45
12G	13.00R24	TG 1	310	45	310	45	310	45	380	55
	14.00R24	TG 1	310	45	310	45	310	45	310	45
	15.5R25		310	45	310	45	310	45	345	50
140G	14.00R24	TG 1	310	45	310	45	310	45	310	45
	17.5R25		310	45	310	45	310	45	310	45
14G	16.00R24	TG 1	310	45	310	45	310	45	310	45
	20.5R25		310	45	310	45	310	45	310	45
16G	18.00R25		310	45	310	45	310	45	345	50
	23.5R25		310	45	310	45	310	45	310	45

SKIDDERS — Bias Ply

Model	Tire Size	Ply Rating	Pressure Front kPa	Pressure Front psi	Pressure Rear kPa	Pressure Rear psi
518 Series II Cable	18.4-34	10	172	25	172	25
	23.1-26*	10*, 14	138	20	138	20
	28L-26	12, 14	138	20	138	20
	24.5-32	12, 16	172	25	172	25
	30.5L-32	12, 16	138	20	138	20
518 Series II Grapple	23.1-26*	10*, 14	138	20	138	20
	28L-26	12, 14	138	20	138	20
	24.5-32	12, 16	172	25	172	25
	30.5L-32	12, 16	138	20	138	20
528B	24.5-32*	16	172	25	172	25
	30.5L-32	16	138	20	138	20
530B	24.5-32	16	172	25	172	25
	30.5L-32*	16	138	20	138	20

BACKHOE LOADERS — Bias Ply

Model	Tire Size	Ply Rating	Description	Pressure Front kPa	Front psi	Rear kPa	Rear psi
416B (2WD)	11L-16*	10	LABORER	360	52		
	11L-16	12	LABORER	440	64		
	16.9-24*	8	IND SG			190	28
	16.9-24	10	IND SG			220	32
	19.5L-24	8	IND TOR			160	24
	19.5L-24	10	IND TOR			190	28
(AWD)	10.5-20*	10	IND SG	430	62		
	12.5/80-18	10	SG LUG	310	45		
	12.5/80-18	10	SG IMP	310	45		
	19.5L-24*	8	IND TOR			160	24
	19.5L-24	10	IND TOR			190	28
(E-STICK)	11L-16	10	LABORER	360	52		
	11L-16	12	LABORER	440	64		
	16.9-24	10	IND SG			220	32
	19.5L-24	10	IND TOR			190	28
426B (2WD)	11L-16	10	LABORER	360	52		
	11L-16*	12	LABORER	440	64		
	16.9-24*	8	IND SG			190	28
	16.9-24	10	IND SG			220	32
	19.5L-24	8	IND TOR			160	24
	19.5L-24	10	IND TOR			190	28
(AWD)	10.5-20*	10	IND SG	430	62		
	12.5/80-18	10	SG LUG	310	45		
	12.5/80-18	10	SG IMP	310	45		
	19.5L-24	8	IND TOR			160	24
	19.5L-24*	10	IND TOR			190	28
(E-STICK)	11L-16	10	LABORER	360	52		
	11L-16	12	LABORER	440	64		
	16.9-24	10	IND SG			220	32
	19.5L-24	10	IND TOR			190	28
436B (2WD)	11.0-16*	12	MULTI RIB	440	60		
	19.5L-24*	10	IND TOR			160	24
(AWD)	19.5L-24	10	IND TOR			190	28
	12.5/80-18*	10	SG LUG	310	45		
	19.5L-24*	10	IND TOR			190	28
428B (2WD)	9-16*	10	SUP RIB	410	60		
	10.5-20	10	IND SG	430	62		
	11L-16	10	LABORER	360	52		
	11L-16	12	LABORER	440	64		
	16.9-28*	10	IND SG			220	32
	16.9-28	12	IND SG			260	38
	16.9/14-28	12	TRAC. SG			230	34
(4WD)	10.5-20*	10	IND SG	430	62		
	12.5/80-18	10	SG LUG	310	45		
	12.5/80-18	10	SG IMP	310	45		
	16.9-28*	10	IND SG			220	32
	16.9-28	10	IND SG			260	38
	16.9-28	12	IND SG			260	38
	16.9/14-28	12	TRAC. SG			230	34
(E-STICK)	16.9-24	10	IND SG			220	32
	16.9-28	12	IND SG			190	28

Model	Tire Size	Ply Rating	Description	Pressure Front kPa	Front psi	Rear kPa	Rear psi
438B (AWD)	12.5/80-18*	10	SG LUG	310	45		
	12.5/80-18	10	SG IMP	310	45		
	18.4/15-26*	12	SG IMP			250	36
(E-STICK)	18.4/15-26	12	SG IMP			250	36
446 (2WD)	14.5/75-16.1*	10	LABORER	280	40		
	21L-24*	12	IND TOR			220	32
(AWD)	12.5-20*	10	IND SG	350	51		
	21L-24*	12	IND TOR			220	32
(E-STICK)	21L-24	12	IND TOR			220	32

*Standard tire.
(E-STICK) — Any combination (include AWD Standard and AWD Optional tires).

WHEEL TRACTOR-SCRAPERS — Bias Ply

Model	Tire Size	Ply Rating	Pressure Front kPa	Front psi	Rear kPa	Rear psi
613C	18.00-25*	16	345	50	380	55
	23.5-25	16	275	40	275	40
615C	26.5-25*	26	413	60	345	50
	29.5-25	22	310	45	240	35
621E	33.25-29*	26	380	55	310	45
	29.5-29	34	413	60	310	45
	29.5-35	28	380	55	275	40
623E	29.5-29*	34	450	65	345	50
	29.5-35	28	413	60	310	45
627E	33.25-29*	26	413	60	345	50
	29.5-29	34	413	60	450	65
	29.5-35	28	345	50	380	55
631E	37.25-35*	30	380	55	310	45
637E	37.25-25*	30	380	55	380	55
651E	37.5-39	52	660	80	413	80
657E	37.5-39	52	660	80	660	80

*Standard tire and ply rating.

18

WHEEL TRACTOR-SCRAPERS — Radial Ply

Model	Tire Size	Strength Index	Pressure: Michelin Front kPa	Michelin Front psi	Michelin Rear kPa	Michelin Rear psi	Goodyear Front kPa	Goodyear Front psi	Goodyear Rear kPa	Goodyear Rear psi	Firestone Front kPa	Firestone Front psi	Firestone Rear kPa	Firestone Rear psi	Bridgestone Front kPa	Bridgestone Front psi	Bridgestone Rear kPa	Bridgestone Rear psi
613C	18.00R25	★	413	60	413	60	413	60	450	65		—	—	—	—	—	—	—
	23.5R25	★	310	45	345	50	345	50	345	50	—	—	—	—	—	—	—	—
615C	26.5R25	★★	485	70	380	55	485	70	413	60	—	—	—	—	—	—	—	—
	29.5R25	★★	345	50	310	45	380	55	310	45	—	—	—	—	—	—	—	—
621E	29.5R29	★★	450	65	380	55	517	75	380	55	—	—	—	—	—	—	—	—
	29.5R35	★★	450	65	380	55	—	—	—	—	—	—	—	—	—	—	—	—
	33.25R29	★★	413	60	345	50	380	55	310	45	—	—	—	—	413	60	345	50
623E	29.5R29	★★	485	70	413	60	550	80	413	60	—	—	—	—	—	—	—	—
	29.5R35	★★	450	65	380	55	—	—	—	—	—	—	—	—	—	—	—	—
627E	29.5R29	★★	413	60	413	60	450	65	517	75	—	—	—	—	—	—	—	—
	29.5R35	★★	413	60	413	60	—	—	—	—	—	—	—	—	—	—	—	—
	33.25R29	★★	380	55	380	55	345	50	380	55	—	—	—	—	413	60	413	60
631E	33.25R35	★★	550	80	517	75	550	80	485	70	551	80	517	75	551	80	517	75
	37.25R35	★★	517	75	413	60	450	65	380	55	—	—	—	—	—	—		—
637E	33.25R35	★★	550	80	550	80	585	85	585	85	586	85	517	75	551	80	551	80
	37.25R35	★★	517	75	517	75	450	65	450	65	—	—		—		—		—
651E	37.5R39	★★	620	90	550	80	620	90	485	70	551	80	517	75		—		—
	40.5/75R39	★★	517	75	450	65	517	75	415	60	—	—	—	—	—	—	—	—
657E	37.5R39	★★	690	100	690	100	620	90	620	90	586	85	620	90	—	—	—	—
	40.5/75R39	★★	517	75	517	75	517	75	515	75	—	—	—	—	—	—	—	—

PAVING PRODUCTS — Bias Ply

PS-110	7.50-15	6*, 10, 14	415	60	415	60
PS-130	7.50-15	6*, 10, 14	415	60	415	60
PS-180	7.50-15	10*, 14	620	90	620	90
CS-323	9.5-24	6	—	—	165	24
CP-323	9.5-24	6	—	—	205	30
CS-431	14.9-24	6	—	—	138	20
CS-433	14.9-24	6	—	—	138	20
CP-433	14.9-24	6	-	—	138	20
CS-563	23.1-26	8		—	83	12
CP-563	23.1-26	8		—	110	16
RR-250	23.5-25	16	310	45		
	15.5-25	8	—	—	205	30
SS-250	28.1-26	10	165	24	—	—
	14.9-24	6	—	—	124	18
AP-800B	16.00-24	12	—	—	241	35

*Standard tire and ply rating.

CONSTRUCTION & MINING TRUCKS & TRACTORS — Bias Ply

Model	Tire Size	Ply Rating	Pressure Front		Pressure Rear	
			kPa	psi	kPa	psi
768C	18.00-33*	24	620	90	620	90
	18.00-33	28	620	90	620	90
769C	18.00-33*	28	620	90	620	90
	18.00-33	32	620	90	620	90
772B	24.00-35*	30	415	60	415	60
	24.00-35	36	415	60	415	60
773B	21.00-35*	32	655	95	655	95
	21.00-35	36	655	95	655	95
	24.00-35	30	515	75	515	75
776B	27.00-49*	42	485	70	485	70
777B	24.00-49*	48	690	100	690	100
	27.00-49	36	550	80	485	70
	27.00-49	42	550	80	485	70
785	33.00-51*	50	620	90	655	95
	33.00-51	58	620	90	655	95
789	36.00-51	58	690	100	690	100
793	40.00-57	68	655	95	690	100

ARTICULATED TRUCK

Model	Tire Size	Ply Rating	Pressure Front		Pressure Center		Pressure Rear	
			kPa	psi	kPa	psi	kPa	psi
D20D	23.5R25	★★	351	51		—	427	62
D250D	26.5-25	★★	400	58		—	400	58
D30D	29.5-25	★★	296	43		—	448	65
D40D	F: 29.5-25	★★	351	51	—	—	—	—
	R: 33.25-29	★★	—	—	—	—	600	87
D250D	20.5R25*	★★	351	51	503	73	503	73
	23.5R25	★★	227	33	324	47	324	47
D300D	23.5R25	★★	324	47	380	55	380	55
D350D	26.5-25*	★★	351	51	351	51	351	51
	29.5-25	★★	303	44	303	44	303	44
D400D	26.5-25	★★	400	58	400	58	400	58
	29.5-25*	★★	331	48	331	48	331	48

CONSTRUCTION & MINING TRUCKS & TRACTORS — Radial Ply

Model	Tire Size	Strength Index	Michelin Front		Michelin Rear		Goodyear Front		Goodyear Rear		Firestone Front		Firestone Rear		Bridgestone Front		Bridgestone Rear	
			kPa	psi	kPa	psi	kPa	psi	kPa	psi	kPa	psi	kPa	psi	kPa	psi	kPa	psi
768C	18.00R33	★★	585	85	585	85	690	100	690	100	—	—	—	—	689	100	689	100
769C	18.00R33	★★	655	95	655	95	690	100	690	100	—	—	—	—	689	100	689	100
771C	18.00R33	★★	760	110	760	110	800	116	800	116	—	—	—	—	—	—	—	—
772B	24.00R35	★★	485	70	485	70	690	100	690	100	—	—	—	—	—	—	—	—
773B	21.00R35	★★	690	100	690	100	690	100	690	100	689	100	689	100	689	100	689	100
	24.00R35	★★	515	75	515	75	485	70	485	70		—		—		—	—	—
775B	24.00R35	★★	585	85	585	85	585	85	655	95	—	—	—	—	—	—	—	—
776B	27.00R49	★★	585	85	585	85	550	80	550	80	—	—	—	—	—	—	—	—
777B	24.00R49	★★	725	105	725	105	760	110	760	110	—	—	—	—	—	—	—	—
	27.00R49	★★	585	85	585	85	550	80	550	80	—	—	—	—	—	—	—	—
784	36.00R51	★★	655	95	655	95	690	100	690	100	—	—	—	—	—	—	—	—
785	33.00R51	★★	725	105	725	105	690	100	725	105	—	—	—	—	—	—	—	—
789	37.00R57*	★★	620	90	620	90	725	105	725	105	—	—	—	—	—	—	—	—
793	47.00R57	★★	—	—	—	—	725	105	760	110	—	—	—	—	—	—	—	—

*Standard tire and ply rating.

18

WHEEL TRACTORS — Bias Ply

Model	Tire Size	Ply Rating or Strength Index	Pressure Front kPa	Front psi	Rear kPa	Rear psi
814B	23.5-25*	12	207	30	207	30
	26.5-25	14	172	25	172	25
824C	29.5-25*	16	241	35	241	35
834B	35/65-33*	24	241	35	241	35

WHEEL TRACTOR — Radial Ply

814B	23.5R25	★	276	40	276	40
	26.5R25	★	241	35	241	35
824C	29.5R25	★	345	50	345	50
834B	35/65R33	★	345	50	345	50

WHEEL LOADERS — Bias and Bias Belted

910E	13.00-24TG	10	241	35	241	35
	14.00-24TG	8	207	30	207	30
	15.5-25*	8*, 12	241	35	207	30
	16.9-24	10	241	35	241	35
916	14.00-24	12	276	40	276	40
	15.5-25*	8*, 12	241	35	207	30
	17.5-25	12	241	35	207	30
926E	15.5-25	12	345	50	207	30
	17.5-25*	12	241	35	207	30
930T	17.5-25*	12	345	50	241	35
936F	17.5-25	12, 16	414	60	241	35
	20.5-25*	12*, 16	241	35	241	35
950F	20.5-25	12, 16, 20	345	50	241	35
	23.5-25*	12*, 16, 20	241	35	241	35
966C	23.5-25*	12	241	35	241	35
966F	23.5-25	16, 20, 24	345	50	241	35
	26.5-25*	14*, 20	241	35	241	35

WHEEL LOADERS — Bias and Bias Belted

980F	26.5-25	20, 26	515	75	345	50
	29.5-25*	22*, 28	414	60	345	50
988B	35/65-33*	24*, 30	414	60	275	40
992D	45/65-45*	38*, 46	448	65	275	40
994	40.5-57*	68	517	75	345	50

*Standard tire, ply rating, and inflation pressures.

WHEEL LOADERS — Radial Ply — Michelin

Model	Tire Size	Pressure Front kPa	Front psi	Rear kPa	Rear psi
910E	15.5-25	207	30	172	25
916	15.5-25	241	35	172	25
	17.5-25	207	30	172	25
926E	15.5-25	345	50	172	25
	17.5-25	241	35	172	25
936F	17.5-25	379	55	172	25
	20.5-25	241	35	172	25
950F	20.5-25	345	50	172	25
	23.5-25	207	30	207	30
966F	23.5-25	311	45	207	30
	26.5-25	273	40	207	30
980F	26.5-25	414	60	207	30
	29.5-25	345	50	207	30
988B	35/65-33	448	65	207	30
992D	45/65-45	448	65	276	40

WHEEL LOADERS — Radial Ply — Goodyear

Model	Tire Size	Pressure Front kPa	Front psi	Rear kPa	Rear psi
910E	15.5-25	241	35	172	25
916	15.5-25	241	35	172	25
	17.5-25	241	35	172	25
926E	15.5-25	414	60	207	30
	17.5-25	310	45	172	25
936F	17.5-25	448	65	241	35
	20.5-25	310	45	172	25
950F	20.5-25	414	60	241	35
	23.5-25	276	40	172	25
966F	23.5-25	414	60	241	35
	26.5-25	310	45	172	25
980F	26.5-25	483	70	276	40
	29.5-25	345	50	207	30
988B	35/65-33	—	—	—	—
992D	45/65-45	—	—	—	—

*Standard tire and ply rating.

Note: For Bridgestone L-5 tires on the front axle of wheel loaders increase the inflation pressure 103 kPa (15 psi).

LOG LOADERS — Bias and Bias Belted

Model	Tire Size	Ply Rating or Strength Index	Pressure Front kPa	Front psi	Rear kPa	Rear psi
916	15.5-25	12	345	50	207	30
926E	17.5-25	12	345	50	207	30
	23.1-26	10	172	25	172	25
936F	17.5-25	16	448	65	241	35
	20.5-25	16	345	50	241	35
950F	20.5-25	20	448	65	241	35
	23.5-25	16	310	45	241	35
966F	23.5-25	24	482	70	241	35
	26.5-25	20	345	50	241	35
980F	29.5-25	22, 28	482	70	241	35
988B	35/65-33	30	586	85	310	45

LOG LOADERS — Radial Ply — Michelin

Model	Tire Size	Pressure Front kPa	Front psi	Rear kPa	Rear psi
916	15.5-25	276	40	172	25
926E	17.5-25	310	45	172	25
936F	17.5-25	517	75	172	25
	20.5-25	310	45	172	25
950F	20.5-25	448	65	172	25
	23.5-25	276	40	207	30
966F	23.5-25	448	65	207	30
	26.5-25	379	55	207	30
980F	29.5-25	448	65	207	30
988B	35/65-33	665	95	276	40

LOG LOADERS — Radial Ply — Goodyear

Model	Tire Size	Pressure Front kPa	Front psi	Rear kPa	Rear psi
916	15.5-25	345	50	207	30
926E	17.5-25	345	50	207	30
936F	17.5-25	552	80	310	45
	20.5-25	379	55	207	30
950F	20.5-25	517	75	276	40
	23.5-25	345	50	207	30
966F	23.5-25	552	80	276	40
	26.5-25	414	60	207	30
980F	29.5-25	483	70	241	35
988B	35/65-33	—	—	—	—

INTEGRATED TOOLCARRIERS — Bias and Bias Belted

Model	Tire Size	Ply Rating or Strength Index	Pressure Front kPa	Front psi	Rear kPa	Rear psi
IT12B	13.00-24TG	10	241	35	241	35
	14.00-24TG	8	207	30	207	30
	15.5-25*	8*, 12	241	35	207	30
	16.9-24	10	241	35	207	30
IT14B	13.00-24TG	10	241	35	241	35
	14.00-24TG	8	241	35	241	35
	15.5-25*	8*, 12	276	40	207	30
	16.9-24	10	241	35	207	30
	17.5-25	12	241	35	207	30
IT18B	15.5-25*	12	345	50	207	30
	17.5-25	12	276	40	207	30
IT28B	15.5-25*	12*	379	55	207	30
	17.5-25	12	310	45	207	30

INTEGRATED TOOL CARRIERS — Radial Ply — Michelin

Model	Tire Size	Pressure Front kPa	Front psi	Rear kPa	Rear psi
IT12B	15.5-25	241	35	172	25
IT14B	15.5-25	276	40	172	25
	17.5-25	207	30	172	25
IT18	15.5-25	276	40	172	25
	17.5-25	207	30	172	25
IT28B	15.5-25	345	50	172	25
	17.5-25	276	40	172	25

INTEGRATED TOOL CARRIERS — Radial Ply — Goodyear

Model	Tire Size	Pressure Front kPa	Front psi	Rear kPa	Rear psi
IT12B	15.5-25	310	45	172	25
IT14B	15.5-25	345	50	172	25
	17.5-25	276	40	172	25
IT18	15.5-25	345	50	207	30
	17.5-25	276	40	172	25
IT28B	15.5-25	448	65	276	40
	17.5-25	345	50	207	30

*Standard tire and ply rating.

18

Liquid Ballasting* Table
• 75% Fillage**

	BIAS PLY TIRES						RADIAL PLY TIRES					
	WEIGHT INCREASE PER TIRE		MIXING PROPORTIONS				WEIGHT INCREASE PER TIRE		MIXING PROPORTIONS			
			CaCl***		Water				CaCl***		Water	
	kg	lb	kg	lb	liter	gal	kg	lb	kg	lb	liter	gal
13.00-24TG	188	**414**	55	**122**	132	**35**	185	**407**	57	**125**	128	**34**
14.00-24TG	215	**475**	63	**140**	151	**40**	266	**586**	79	**173**	179	**47**
16.5-25	192	**423**	56	**125**	136	**36**	224	**493**	69	**161**	156	**41**
16.00-24TG	333	**736**	98	**217**	234	**62**	355	**783**	109	**240**	246	**65**
17.5-25	262	**577**	77	**170**	185	**49**	311	**686**	95	**210**	216	**57**
18.00-25	454	**1002**	134	**296**	322	**85**	502	**1107**	154	**340**	348	**92**
18.4-34	417	**919**	123	**272**	295	**78**	—	—	—	—	—	—
20.5-25	405	**892**	119	**263**	284	**75**	446	**987**	137	**303**	310	**82**
23.1-26	522	**1151**	154	**340**	367	**97**	—	—	—	—	—	—
23.5-25	585	**1291**	173	**382**	412	**109**	633	**1396**	194	**428**	430	**114**
24.5-32	703	**1549**	207	**456**	496	**131**	—	—	—	—		—
26.5-25	758	**1671**	224	**494**	533	**141**	841	**1853**	258	**568**	583	**154**
26.5-29	762	**1668**	222	**490**	530	**140**	928	**2046**	284	**627**	644	**170**
28L-26	709	**1563**	209	**462**	500	**132**	—	—	—	—	—	—
29.5-25	970	**2138**	286	**632**	685	**181**	1073	**2368**	328	**723**	745	**197**
29.5-29	1050	**2315**	310	**684**	738	**195**	1190	**2623**	365	**804**	825	**218**
29.5-35	1159	**2556**	344	**758**	821	**217**	1286	**2835**	394	**869**	892	**236**
30.5L-32	874	**1928**	258	**570**	617	**163**	—	—	—	—	—	—
33.25-35	1485	**3275**	439	**968**	1048	**277**	1592	**3506**	487	**1074**	1105	**292**
37.25-35	1712	**3775**	505	**1115**	1211	**320**	2128	**4692**	653	**1439**	1476	**390**
38-39	1870	**4123**	552	**1218**	1317	**348**	—	—	--	—		—
35/65-33	1339	**2953**	396	**873**	942	**249**	1430	**3152**	438	**967**	992	**262**
40/65-39	2077	**4580**	614	**1353**	1466	**387**	2194	**4836**	673	**1483**	1522	**402**

*Ballast weight for bias ply tires from Goodyear data, radial ply weights from Michelin data. Contact your tire supplier for additional information. Under abnormal tire wear conditions, ballasting of rear tires may be desirable. Ballasting of front tires also should only be done where extremely rapid tire wear rates are encountered. Excessive weight will reduce machine performance.

**Fillage beyond 75% of tire enclosed volume is not recommended. With liquid ballasting, inflation pressure must be checked at least once per day.

***1.6 kg (3½ lb) Calcium Chloride per gallon water. Solution weighs 4.6 kg (10.15 lb) per gallon.

MINING AND EARTHMOVING

CONTENTS

INTRODUCTION

This section explains the earthmoving principles used to determine machine productivity. It shows how to calculate production on-the-job or estimate production off-the-job.

Machine performance is usually measured on an hourly basis in terms of machine productivity and machine owning and operating cost. Optimum machine performance can be expressed as follows:

$$\text{Lowest cost per ton} = \frac{\text{Highest Possible Hourly Productivity}}{\text{Lowest Possible Hourly Costs}}$$

ELEMENTS OF PRODUCTION

Production is the hourly rate at which material is moved. Production can be expressed in various units:

Metric

Bank Cubic Meters — BCM — bank m^3
Loose Cubic Meters — LCM — loose m^3
Compacted Cubic Meters — CCM — compacted m^3
Tonnes

English

Bank Cubic Yards — BCY — bank yd^3
Loose Cubic Yards — LCY — loose yd^3
Compacted Cubic Yards — CCY — compacted yd^3
Tons

For most earthmoving and material handling applications, production is calculated by multiplying the quantity of material (load) moved per cycle by the number of cycles per hour.

$$\text{Production} = \text{Load/cycle} \times \text{cycles/hour}$$

The load can be determined by
1) load weighing
2) load estimating based on machine rating
3) surveyed volume divided by load count

Generally, earthmoving and overburden removal for coal mines are calculated by volume (bank cubic meters or bank cubic yards). Metal mines and aggregate producers usually work in weight (tons or tonnes).

19

Volume Measure — Material volume is defined according to its state in the earthmoving process. The three measures of volume are:

BCM (BCY) — one cubic meter (yard) of material as it lies in the natural bank state.

LCM (LCY) — one cubic meter (yard) of material which has been disturbed and has swelled as a result of movement.

CCM (CCY) — one cubic meter (yard) of material which has been compacted and has become more dense as a result of compaction.

(For simplicity, the following discussion is confined to English system units. Metric system equivalents may be directly substituted.)

In order to estimate production, the relationships between bank measure, loose measure, and compacted measure must be known.

Swell — Swell is the percentage of original volume (cubic meters or cubic yards) that a material increases when it is removed from the natural state. When excavated, the material breaks up into different size particles that do not fit together, causing air pockets or voids to reduce the weight per volume. For example to hold the same weight of one cubic unit of bank material it takes 30% more volume (1.3 times) after excavation. (Swell is 30%.)

$$1 + \text{Swell} = \frac{\text{Loose cubic volume for a given weight}}{\text{Bank cubic volume for the same given weight}}$$

$$\text{Bank} = \frac{\text{Loose}}{(1 + \text{Swell})}$$

$$\text{Loose} = \text{Bank} \times (1 + \text{Swell})$$

Example Problem:

If a material swells 20%, how many loose cubic meters (loose cubic yards) will it take to move 1000 bank cubic meters (1308 bank cubic yards)?

Loose = Bank × (1 + Swell) =
1000 BCM × (1 + .2) = 1200 LCM
1308 BCY × (1 + .2) = 1570 LCY

How many bank cubic meters (yards) were moved if a total of 1000 loose cubic meters (1308 yards) have been moved? Swell is 25%.

Bank = Loose ÷ (1 + Swell) =
1000 LCM ÷ (1 + .25) = 800 BCM
1308 LCY ÷ (1 + .25) = 1046 BCY

Load Factor — Assume one bank cubic yard of material weighs 3000 lb. Because of material characteristics, this bank cubic yard swells 30% to 1.3 loose cubic yards when loaded, with no change in weight. If this 1.0 bank cubic yard or 1.3 loose cubic yards is compacted, its volume may be reduced to 0.8 compacted cubic yard, and the weight is still 3000 lbs.

Instead of dividing by 1 + Swell to determine bank volume, the loose volume can be multiplied by the load factor.

If the percent of material swell is known, the load factor (L.F.) may be obtained by using the following relationship:

$$\text{L.F.} = \frac{100\%}{100\% + \%\ \text{swell}}$$

Load factors for various materials are listed in the Tables Section of this handbook.

To estimate the machine payload in bank cubic yards, the volume in loose cubic yards is multiplied by the load factor:

$$\text{Load (BCY)} = \text{Load (LCY)} \times \text{L.F.}$$

The ratio between compacted measure and bank measure is called shrinkage factor (S.F.):

$$\text{S.F.} = \frac{\text{Compacted cubic yards (CCY)}}{\text{Bank cubic yards (BCY)}}$$

Shrinkage factor is either estimated or obtained from job plans or specifications which show the conversion from compacted measure to bank measure. Shrinkage factor should not be confused with percentage compaction (used for specifying embankment density, such as Modified Proctor or CBR).

Material Density — Density is the weight per unit volume of a material. Materials have various densities depending on particle size, moisture content and variations in the material. The denser the material the more weight there is per unit of equal volume. Density estimates are provided in the Tables Section of this handbook.

$$\text{Density} = \frac{\text{Weight}}{\text{Volume}} = \frac{\text{kg (lbs)}}{\text{m}^3\ (\text{yd}^3)}$$

$$\text{Weight} = \text{Volume} \times \text{Density}$$

A given material's density changes between bank and loose. One cubic unit of loose material has less weight than one cubic unit of bank material due to air pockets and voids. To correct between bank and loose use the following equations.

$$1 + \text{Swell} = \frac{\text{kg/BCM}}{\text{kg/LCM}} \text{ or } \frac{\text{lbs/BCY}}{\text{lbs/LCY}}$$

$$\text{lbs/LCY} = \frac{\text{lb/BCY}}{(1 + \text{Swell})}$$

$$\text{lbs/BCY} = \text{lbs/LCY} \times (1 + \text{Swell})$$

Fill Factor — The percentage of an available volume in a body, bucket, or bowl that is actually used is expressed as the fill factor. A fill factor of 87% for a hauler body means that 13% of the rated volume is not being used to carry material. Buckets often have fill factors over 100%.

Example problem:

A 14 cubic yard (heaped 2:1) bucket has a 105% fill factor when operating in a shot sandstone (4125 lbs/BCY and a 35% swell).

a) What is the loose density of the material?
b) What is the usable volume of the bucket?
c) What is the bucket payload per pass in BCY?
d) What is the bucket payload per pass in tons?

a) lb/LCY = lb/BCY ÷ (1 + Swell) = 4125 ÷ (1.35) = 3056 lb/LCY
b) LCY = rated LCY × fill factor = 14 × 1.05 = 14.7 LCY
c) lbs/pass = volume × density lb/LCY = 14.7 × 3056 = 44,923 lbs
   BCY/pass = weight ÷ density lb/BCY = 44,923 ÷ 4125 = 10.9 BCY
   or bucket LCY from part b ÷ (1 + Swell) = 14.7 ÷ 1.35 = 10.9 BCY
d) tons/pass = lbs ÷ 2000 lbs/ton = 44,923 ÷ 2000 = 22.5 tons

Example problem:

Construct a 10,000 compacted cubic yard (CCY) bridge approach of dry clay with a shrinkage factor (S.F.) of 0.80. Haul unit is rated 14 loose cubic yards struck and 20 loose cubic yards heaped.

a) How many bank yards are needed?
b) How many loads are required?

a) $\text{BCY} = \frac{\text{CCY}}{\text{S.F.}} = \frac{10{,}000}{0.80} = 12{,}500 \text{ BCY}$

b) Load (BCY) = Capacity (LCY) × Load factor (L.F.) = 20 × 0.81 = 16.2 BCY/Load

(L.F. of 0.81 from Tables)

$$\text{Number of loads required} = \frac{12{,}500 \text{ BCY}}{16.2 \text{ BCY/Load}} = 772 \text{ Loads}$$

• • •

Soil Density Tests — There are a number of acceptable methods that can be used to determine soil density. Some that are currently in use are:

Nuclear density moisture gauge
Sand cone method
Oil method
Balloon method
Cylinder method

All these except the nuclear method use the following procedure:

1. Remove a soil sample from bank state.
2. Determine the volume of the hole.
3. Weigh the soil sample.
4. Calculate the density kg/BCM (lb/BCY).

The nuclear density moisture gauge is one of the most modern instruments for measuring soil density and moisture. A common radiation channel emits either neutrons or gamma rays into the soil. In determining soil density, the number of gamma rays absorbed and back scattered by soil particles is *indirectly* proportional to the soil density. When measuring moisture content, the number of moderated neutrons reflected back to the detector after colliding with hydrogen particles in the soil is *directly* proportional to the soil's moisture content.

All these methods are satisfactory and will provide accurate densities when performed correctly. Several repetitions are necessary to obtain an average.

FIGURING PRODUCTION ON-THE-JOB

Load Weighing — The most accurate method of determining the actual load carried is by weighing. This is normally done by weighing the haul unit one wheel or axle at a time with portable scales. Any scales of adequate capacity and accuracy can be used. While weighing, the machine should be relatively level to reduce error caused by weight transfer. Enough loads should be weighed to provide a good average. Machine weight is the sum of the individual wheel or axle weights.

The weight of the load can be determined using the empty and loaded weight of the unit.

Weight of load = Gross vehicle weight – empty weight

To determine the bank cubic measure carried by a machine, the load weight is divided by the bank-state density of the material being hauled.

$$\text{BCY} = \frac{\text{Weight of load}}{\text{Bank density}}$$

Times Studies — To estimate production, the number of complete trips a unit makes per hour must be determined. First obtain the unit's cycle time with the help of a stop watch. Time several complete cycles to arrive at an average cycle time. By allowing the watch to run continuously, different segments such as load time, wait time, etc. can be recorded for each cycle. Knowing the individual time segments affords a good opportunity to evaluate the balance of the spread and job efficiency. The following is an example of a scraper load time study form. Numbers in the white columns are stop watch readings; numbers in the shaded columns are calculated:

[illegible]	Arrive Cut	[illegible]	Begin Load	[illegible]	End Load	Begin Delay	[illegible]	End Delay
[illegible]	0.00	[illegible]	0.30	[illegible]	0.80		[illegible]	
[illegible]	3.50	[illegible]	3.80	[illegible]	4.45		[illegible]	
[illegible]	7.50	[illegible]	7.85	[illegible]	8.56	9.95	[illegible]	10.95
[illegible]	12.50	[illegible]	12.92	[illegible]	13.60		[illegible]	

This may be easily extended to include other segments of the cycle such as haul time, dump time, etc. Similar forms can be made for pushers, loaders, dozers, etc. *Wait Time* is the time a unit must wait for another unit so that the two can function together (haul unit waiting for pusher). *Delay Time* is any time, other than wait time, when a machine is not performing in the work cycle (scraper waiting to cross railroad track).

To determine trips-per-hour at 100% efficiency, divide 60 minutes by the average cycle time less all wait and delay time. Cycle time may or may not include wait and/or delay time. Therefore, it is possible to figure different kinds of production: measured production, production without wait or delay, maximum production, etc. For example:

Actual Production: includes all wait and delay time.

Normal Production (without delays): includes wait time that is considered normal, but no delay time.

Maximum Production: to figure maximum (or optimum) production, both wait time and delay time are eliminated. The cycle time may be further altered by using an optimum load time.

Example (English)

A job study of a Wheel Tractor-Scraper might yield the following information:

Average wait time	= 0.28 minute
Average load time	= 0.65
Average delay time	= 0.25
Average haul time	= 4.26
Average dump time	= 0.50
Average return time	= 2.09
Average total cycle	= 8.03 minutes
Less wait & delay time	– 0.53
Average cycle 100% eff.	– 7.50 minutes

Weight of haul unit empty — 48,650 lb

Weights of haul unit loaded —

Weighing unit #1 — 93,420 lb
Weighing unit #2 — 89,770 lb
Weighing unit #3 — 88,760 lb
271,950 lb;
average = 90,650 lb

1. Average load weight = 90,650 lb – 48,650 lb = 42,000 lb
2. Bank density = 3125 lb/BCY
3. $\text{Load} = \dfrac{\text{Weight of load}}{\text{Bank density}} = \dfrac{42{,}000 \text{ lb}}{3125 \text{ lb/BCY}} = 13.4 \text{ BCY}$
4. Cycles/hr = $\dfrac{60 \text{ min/hr}}{\text{Cycle time}} = \dfrac{60 \text{ min/hr}}{7.50 \text{ min/cycle}} = 8.0$ cycles/hr
5. Production = Load/cycle × cycles/hr
(less delays) = 13.4 BCY/cycle × 8.0 cycles/hr
= 107.2 BCY/hr

Example (Metric)

A job study of a Wheel Tractor-Scraper might yield the following information:

Average wait time	= 0.28 minute
Average load time	= 0.65
Average delay time	= 0.25
Average haul time	= 4.26
Average dump time	= 0.50
Average return time	= 2.09
Average total cycle	= 8.03 minutes
Less wait & delay time	= 0.53
Average cycle 100% eff.	= 7.50 minutes

Weight of haul unit empty 22 070 kg
Weights of haul unit loaded —
Weighing unit #1 — 42 375 kg
Weighing unit #2 — 40 720 kg
Weighing unit #3 — 40 260 kg
123 355 kg;
average = 41 120 kg

1. Average load weight = 41 120 kg − 22 070 kg = 19 050 kg
2. Bank density = 1854 kg/BCM
3. $\text{Load} = \dfrac{\text{Weight of load}}{\text{Bank density}} = \dfrac{19\,050 \text{ kg}}{1854 \text{ kg/BCM}} = 10.3 \text{ BCM}$
4. Cycles/hr = $\dfrac{60 \text{ min/hr}}{\text{Cycle time}} = \dfrac{60 \text{ min/hr}}{7.50 \text{ min/cycle}} = 8.0 \text{ cycles/hr}$
5. Production (less delays) = Load/cycle × cycles/hr = 10.3 BCM/cycle × 8.0 cycles/hr = 82 BCM/hr

■ ■ ■

ESTIMATING PRODUCTION OFF-THE-JOB

It is often necessary to estimate production of earthmoving machines which will be selected for a job. As a guide, the remainder of the section is devoted to discussions of various factors that may affect production. Some of the figures have been rounded for easier calculation.

Rolling Resistance (RR) is a measure of the force that must be overcome to roll or pull a wheel over the ground. It is affected by ground conditions and vehicle load — the deeper a wheel sinks into the ground, the higher the rolling resistance. Internal friction and tire flexing also contribute to rolling resistance. Experience has shown that for every metric or (U.S.) ton of weight (on wheels) a minimum resistance of 20 kg (40 lb) must be overcome to move the machine. [Use 15 kg (30 lb) for radial tires or dual tired trucks.] It has also been found that for each 2.5 cm (inch) of tire penetration an additional 15 kg (30 lb) of resistance must be overcome for every metric or (U.S.) ton of weight. These two values are combined to give the Rolling Resistance Factor which is expressed in kg/metric ton or lb/U.S. ton.

Rolling Resistance Factor
= 20 kg/ton + (15 kg/ton/cm x cm)
= 40 lb/ton + (30 lb/ton/inch x inches)

Rolling resistance is then calculated using the Rolling Resistance Factor (expressed in kg or lb per ton) and the gross vehicle weight (GVW) in tons.

RR = RR Factor x GVW

Rolling resistance is expressed in kg (lb).

Another method of calculating rolling resistance is use of percentages of machine weight. This method is based on the relationships that minimum resistance is approximately equal to 2% (1.5% for radial tires or dual tired trucks) of the gross vehicle weight (on tires) and that resistance due to tire penetration is approximately equal to 1.5% of the gross vehicle weight for each inch of tire penetration (0.6% for each cm of tire penetration). Thus rolling resistance can be calculated using these relationships in the following manner:

RR = 2% of GVW + 0.6% of GVW per cm tire penetration
RR = 2% of GVW + 1.5% of GVW per inch tire penetration

It's *not* necessary for the tires to actually penetrate the road surface for rolling resistance to increase above the minimum. If the road surface flexes under load, the effect is nearly the same — the tire is always running "uphill". Only on very hard, smooth surfaces with a well compacted base will the rolling resistance approach the minimum.

When actual penetration takes place, some variation in rolling resistance can be noted with various inflation pressures and tread patterns.

NOTE: When figuring "pull" requirements for track-type tractors, rolling resistance applies only to the trailed unit's *weight on wheels*. Since track-type tractors utilize steel wheels moving on steel "roads", a tractor's rolling resistance is relatively constant and is accounted for in the Drawbar Pull rating as shown on the tractor specification sheet.

Estimating Production Off-the-Job
- Grade Resistance
- Total Resistance
- Traction

Grade Resistance is a measure of the force that must be overcome to move a machine over unfavorable grades (uphill). Grade assistance is a measure of the force that assists machine movement on favorable grades (downhill).

Grades are generally measured in percent slope, which is the ratio between vertical rise or fall and the horizontal distance in which the rise or fall occurs. For example, a 1% grade is equivalent to a 1 m (ft) rise or fall for every 100 m (ft) of horizontal distance; a rise of 4.6 m (15 ft) in 53.5 m (175 ft) equals an 8.6% grade.

$$\frac{4.6 \text{ m (rise)}}{53.3 \text{ m (horizontal distance)}} = 8.6\% \text{ grade}$$

$$\frac{15 \text{ ft (rise)}}{175 \text{ ft (horizontal distance)}} = 8.6\% \text{ grade}$$

Uphill grades are normally referred to as adverse grades and downhill grades as favorable grades. Grade resistance is usually expressed as a positive (+) percentage and grade assistance is expressed as a negative (–) percentage.

It has been found that for each 1% increment of adverse grade an additional 10 kg (20 lb) of resistance must be overcome for each metric (U.S.) ton of vehicle weight. This relationship is the basis for determining the Grade Resistance Factor which is expressed in kg/metric ton (lb/U.S. ton):

Grade Resistance Factor = 10 kg/m ton × % grade
= 20 lb/U.S. ton × % grade

Grade resistance (assistance) is then obtained by multiplying the Grade Resistance Factor by the machine weight (GVW) in metric (U.S.) tons.

Grade Resistance = GR Factor × GVW in metric (U.S.) tons

Grade resistance may also be calculated using percentage of gross weight. This method is based on the relationship that grade resistance is approximately equal to 1% of the gross vehicle weight for 1% of grade.

Grade Resistance = 1% of GVW × % grade

Grade resistance (assistance) affects both wheel and track-type machines.

Total Resistance is the combined effect of rolling resistance (wheel vehicles) and grade resistance. It can be computed by summing the values of rolling resistance and grade resistance to give a resistance in kilogram (pounds) force.

Total Resistance = Rolling Resistance + Grade Resistance

Total resistance can also be represented as consisting completely of grade resistance expressed in per cent grade. In other words, the rolling resistance component is viewed as a corresponding quantity of additional adverse grade resistance. Using this approach, total resistance can then be considered in terms of percent grade.

This can be done by converting the contribution of rolling resistance into a corresponding percentage of grade resistance. Since 1% of adverse grade offers a resistance of 10 kg (20 lb) for each metric or (U.S.) ton of vehicle weight, then each 10 kg (20 lb) of resistance per ton of vehicle weight can be represented as an additional 1% of adverse grade. Rolling resistance in percent grade and grade resistance in percent grade can then be summed to give Total Resistance in percent or Effective Grade. The following formulas are useful in arriving at Effective Grade.

Rolling Resistance (%) = 2% + 0.6% per cm tire penetration
= 2% + 1.5% per inch tire penetration

Grade Resistance (%) = % grade

Effective Grade (%) = RR (%) + GR (%)

Effective grade is a useful concept when working with Rimpull-Speed-Gradeability curves, Retarder curves, Brake Performance curves, and Travel Time curves.

Traction — is the driving force developed by a wheel or track as it acts upon a surface. It is expressed as usable Drawbar Pull or Rimpull. The following factors affect traction: weight on the driving wheel or tracks, gripping action of the wheel or track, and ground conditions. The coefficient of traction (for any roadway) is the ratio of the maximum pull developed by the machine to the total weight on the drivers.

$$\text{Coeff. of traction} = \frac{\text{Pull}}{\text{weight on drivers}}$$

Therefore, to find the usable pull for a given machine:

Usable pull = Coeff. of traction × weight on drivers

Example: Track-Type Tractor

What usable drawbar pull (DBP) can a 26 800 kg (59,100 lb) Track-type Tractor exert while working on firm earth? on loose earth? (See table section for coefficient of traction.)

Answer:

Firm earth — Usable DBP =
0.90 × 26 800 kg = 24 120 kg
(0.90 × 59,100 lb = 53,190 lb)

Loose earth—Usable DBP =
0.60 × 26 800 kg = 16 080 kg
(0.60 × 59,100 lb = 35,460 lb)

If a load required 21 800 kg (48,000 lb) pull to move it, this tractor could move the load on firm earth. However, if the earth were loose, the tracks would spin.

NOTE: D8N through D11N Tractors may attain higher coefficients of traction due to their suspended undercarriage design.

Example: Wheel Tractor-Scraper

What usable rimpull can a 621E size machine exert while working on firm earth? on loose earth? The total loaded weight distribution of this unit is:

Drive unit	Scraper unit
wheels: 23 600 kg (52,000 lb)	wheels: 21 800 kg (48,000 lb)

Remember, use weight on drivers only.

Answer:

Firm earth — 0.55 × 23 600 kg = 12 980 kg
(0.55 × 52,000 lb = 28,600 lb)

Loose earth— 0.45 × 23 600 kg = 10 620 kg
(0.45 × 52,000 lb = 23,400 lb)

On firm earth this unit can exert up to 12 980 kg (28,600 lb) rimpull without slipping. However, on loose earth the drivers would slip if more than 10 620 kg (23,400 lb) rimpull were developed.

• • •

Altitude — Specification sheets show how much pull a machine can produce for a given gear and speed when the engine is operating at rated horsepower. When a standard machine is operated in high altitudes, the engine may require derating to maintain normal engine life. This engine deration will produce less drawbar pull or rimpull.

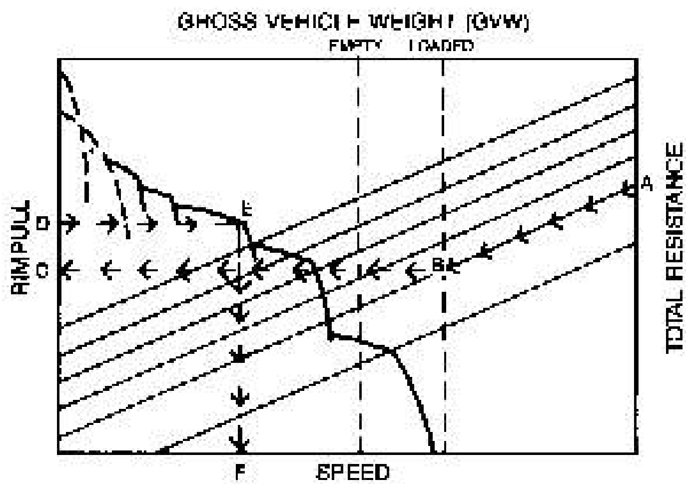
The Tables Section gives the altitude deration in percent of flywheel horsepower for current machines. It should be noted that some turbocharged engines can operate up to 3050 m (10,000 ft) before they require derating. Most machines are engineered to operate up to 1520 m (5000 ft) before they require deration.

The horsepower deration due to altitude must be considered in any job estimating. The amount of power deration will be reflected in the machine's gradeability and in the load, travel, and dump and load times (unless loading is independent of the machine itself).

The example job problem that follows indicates one method of accounting for altitude deration: by increasing the appropriate components of the total cycle time by a percentage equal to the percent of horsepower deration due to altitude. (i.e., if the travel time of a hauling unit is determined to be 1.00 minute at full HP, the time for the same machine derated to 90% of full HP will be 1.10 min.) This is an approximate method that yields reasonably accurate estimates up to 3000 m (10,000 feet) elevation.

Travel time for hauling units derated more than 10% should be calculated as follows using Rimpull-Speed-Gradeability charts.

1) Determine total resistance (grade plus rolling) in percent.



2) Beginning at point A on the chart follow the total resistance line diagonally to its intersection, B, with the vertical line corresponding to the appropriate gross vehicle weight. (Rated loaded and empty GVW lines are shown dotted.)

3) Using a straight-edge, establish a horizontal line to the left from point B to point C on the rimpull scale.

4) Divide the value of point C as read on the rimpull scale by the percent of total horsepower available after altitude deration from the Tables Section. This yields rimpull value D higher than point C.

5) Establish a horizontal line right from point D. The farthest right intersection of this line with a curved speed range line is point E.

6) A vertical line down from point E determines point F on the speed scale.

7) Multiply speed in km/h by 16.7 (mph by 88) to obtain speed in m/min (ft/min). Travel time in minutes for a given distance in feet is determined by the formula:

$$\text{Time (min)} = \frac{\text{Distance in m (ft)}}{\text{Speed in m/min (ft/min)}}$$

The Travel Time Graphs in sections on Wheel Tractor-Scrapers and Off-Highway Trucks can be used as an alternative method of calculating haul and/or return times.

Job Efficiency is one of the most complex elements of estimating production since it is influenced by factors such as operator skill, minor repairs and adjustments, personnel delays, and delays caused by job layout. An approximation of efficiency, if no job data is available, is given below.

Operation	Working Hour	Efficiency Factor
Day	50 min/hr	0.83
Night	45 min/hr	0.75

These factors do not account for delays due to weather or machine downtime for maintenance and repairs. You must account for such factors based on experience and local conditions.

• • • • • • • • • • • • • • • • •

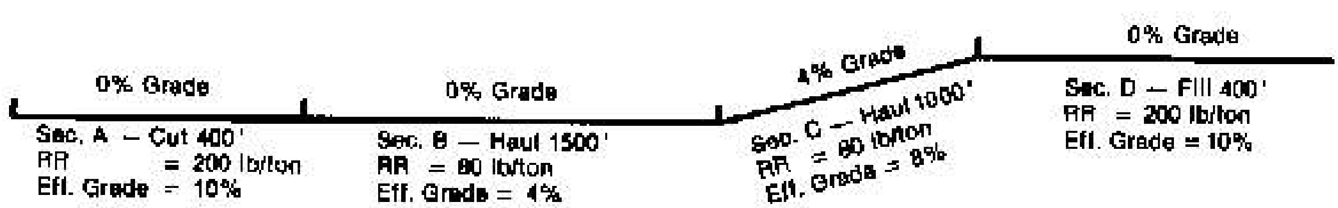
Example problem (English)

A contractor is planning to put the following spread on a dam job. What is the estimated production and cost/BCY?

Equipment:
11 — 631E Wheel Tractor-Scrapers
2 — D9N Tractors with C-dozers
2 — 12G Motor Graders
1 — 825C Tamping Foot Compactor

Material:
Description — Sandy clay; damp, natural bed
Bank Density — 3000 lb/BCY
Load Factor — 0.80
Shrinkage Factor — 0.85
Traction Factor — 0.50
Altitude — 7500 ft

Job Layout — Haul and Return:



Total Effective Grade = RR (%) ± GR (%)
Sec. A: Total Effective Grade = 10% + 0% = 10%
Sec. B: Total Effective Grade = 4% + 0% = 4%
Sec. C: Total Effective Grade = 4% + 4% = 8%
Sec. D: Total Effective Grade = 10% + 0% = 10%

1. Estimate Payload:
Est. load (LCY) × L.F. × Bank Density = payload
31 LCY × 0.80 × 3000 lb/BCY = 74,400 lb payload

2. Establish Machine Weight:
Empty Wt. — 88,000 lb or 44 tons
Wt. of Load — 74,400 lb or 37.2 tons
Total (GVW) — 162,400 lb or 81.2 tons

3. Calculate Usable Pull (traction limitation):
Loaded: (weight on driving wheels = 54%) (GVW)
Traction Factor × Wt. on driving wheels =
0.50 × 162,400 lb × 54% = 43,848 lbs
Empty: (weight on driving wheels = 69%) (GVW)
Traction Factor × Wt. on driving wheels =
0.50 × 88,000 lbs × 69% = 30,360 lbs

4. Derate for Altitude:
Check power available at 7500 ft from altitude deration table in the Tables Section.
631E — 100% 12G — 85%
D9N — 100% 825C — 94%

Then adjust if necessary:

Load Time — controlled by D9N, at 100% power, no change.

Travel, Maneuver and Spread time — 631E, no change.

5. Compare Total Resistance to Tractive Effort on haul:

Grade Resistance —

GR = lb/ton × tons × adverse grade in percent
Sec. C: = 20 lb/ton × 81.2 tons × 4% grade = 6496 lb

Rolling Resistance

RR = RR Factor (lb/ton) × GVW (tons)
Sec. A: = 200 lb/ton × 81.2 tons = 16,240 lb
Sec. B: = 80 lb/ton × 81.2 tons = 6,496 lb
Sec. C: = 80 lb/ton × 81.2 tons = 6,496 lb
Sec. D: = 200 lb/ton × 81.2 tons = 16,240 lb

Total Resistance —

TR = RR + GR
Sec. A: = 16,240 lb + 0 = 16,240 lb
Sec. B: = 6,496 lb + 0 = 6,496 lb
Sec. C: = 6,496 lb + 6,496 lb = 12,992 lb
Sec. D: = 16,240 lb + 0 = 16,240 lb

Check usable pounds pull against maximum pounds pull required to move the 631E.

Pull usable . . . 43,848 lb loaded

Pull required . . . 16,240 lb maximum total resistance

Estimate travel time for haul from 631E (loaded) travel time curve; read travel time from distance and effective grade.

Travel time (from curves):
Sec. A: 0.60 min
Sec. B: 1.00
Sec. C: 1.20
Sec. D: 0.60
3.40 min

NOTE: This is an estimate only; it *does not account for all the acceleration and deceleration time,* therefore it is not as accurate as the information obtained from a computer program.

6. Compare Total Resistance to Tractive Effort on return:

Grade Assistance

GA = 20 lb/ton × tons × negative grade in percent
Sec. C: 20 lb/ton × 44 tons × 4% grade
3520 lbs

Rolling Resistance —

RR = RR Factor × Empty Wt (tons)
Sec. D: = 200 lb/ton × 44 tons = 8800 lb
Sec. C: = 80 lb/ton × 44 tons = 3520 lb
Sec. B: = 80 lb/ton × 44 tons = 3520 lb
Sec. A: = 200 lb/ton × 44 tons = 8800 lb

Total Resistance —

TR = RR − GA
Sec. D: = 8,800 lb − 0 = 8,800 lb
Sec. C: = 3,520 lb − 3,520 lb = 0
Sec. B: = 3,520 lb − 0 = 3,520 lb
Sec. A: = 8,800 lb − 0 = 8,800 lb

Check usable pounds pull against maximum pounds pull required to move the 631E.

Pounds pull usable . . . 30,360 lb empty

Pounds pull required . . . 8800 lb

Estimate travel time for return from 631E empty travel time curve.

Travel time (from curves):
Sec. D: 0.40 min
Sec. C: 0.55
Sec. B: 0.80
Sec. A: 0.40
2.15 min

7. Estimate Cycle Time:

Total Travel Time (Haul plus Return)	= 5.55 min
Adjusted for altitude: 100% × 5.55 min	= 5.55 min
Load Time	0.7 min
Maneuver and Spread Time	0.7 min
Total Cycle Time	6.95 min

8. Check pusher-scraper combinations:

Pusher cycle time consists of load, boost, return and maneuver time. Where actual job data is not available, the following may be used.

Boost time = 0.10 minute
Return time = 40% of load time
Maneuver time = 0.15 minute
Pusher cycle time = 140% of load time + 0.25 minute
Pusher cycle time = 140% of 0.7 min + 0.25 minute
= 0.98 + 0.25 = 1.23 minute

Scraper cycle time divided by pusher cycle time indicates the number of scrapers which can be handled by each pusher.

$$\frac{6.95 \text{ min}}{1.23 \text{ min}} = 5.65$$

19

Each push tractor is capable of handling five plus scrapers. Therefore the two pushers can adequately serve the eleven scrapers.

9. Estimate Production:

Cycles/hour	= 60 min ÷ Total cycle time
	= 60 min/hr ÷ 6.95 min/cycle
	= 8.6 cycles/hr
Estimated load	= Heaped capacity × L.F.
	= 31 LCY × 0.80
	= 24.8 BCY
Hourly unit production	= Est. load × cycles/hr
	24.8 BCY × 8.6 cycles/hr
	213 BCY/hr
Adjusted production	= Efficiency factor × hourly production
	= 0.83 (50 min hour) × 213 BCY
	= 177 BCY/hr
Hourly fleet production	= Unit production × No. of units
	= 177 BCY/hr × 11
	= 1947 BCY/hr

10. Estimate Compaction:

Compaction requirement	= S.F. × hourly fleet production
	0.85 × 1947 BCY/hr
	1655 CCY/hr

Compaction capability (given the following):

Compacting width, 7.4 ft	(W)
Average compacting speed, 6 mph	(S)
Compacted lift thickness, 7 in	(L)
No. of passes required, 3	(P)

825C production =

$$\text{CCY/hr} = \frac{W \times S \times L \times 16.3 \text{ (conversion constant)}}{P}$$

$$= \frac{7.4 \times 6 \times 7 \times 16.3}{3}$$

$$= 1688 \text{ CCY/hr}$$

Given the compaction requirement of 1655 CCY/hr, the 825C is an adequate compactor match-up for the rest of the fleet. However, any change to job layout that would increase fleet production would upset this balance.

11. Estimate Total Hourly Cost:

631E	@ $65.00/hr ×	11 units	$715.00
D9N	@ 75.00/hr ×	2 units	150.00
12G	@ 15.00/hr ×	2 units	30.00
825C	@ 40.00/hr ×	1 unit	40.00
Operators	@ 20.00/hr ×	16 men	320.00
Total Hourly Owning and Operating Cost			$1,255.00

12. Calculate Performance:

$$\text{Cost per BCY} = \frac{\text{Total cost/hr}}{\text{Production/hr}} = \frac{\$1{,}255.00}{1947 \text{ BCY/hr}} = 64¢/\text{BCY}$$

NOTE: Ton-MPH calculations should be made to judge the ability of the tractor scraper tires to operate safely under these conditions.

13. Other Considerations:

If other equipment such as rippers, water wagons, discs or other miscellaneous machines are needed for the particular operation, then these machines must also be included in the cost per BCY.

• • •

Example problem (Metric)

A contractor is planning to put the following spread on a dam job. What is the estimated production and cost/BCM?

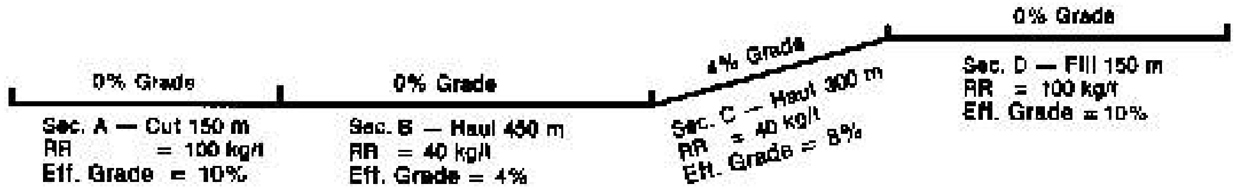
Equipment:

11 — 631E Wheel Tractor Scrapers
2 — D9N Tractors with C-dozers
2 — 12G Motor Graders
1 — 825C Tamping Foot Compactor

Material:

Description — Sandy clay; damp, natural bed
Bank Density — 1770 kg/BCM
Load Factor — 0.80
Shrinkage Factor — 0.85
Traction Factor — 0.50
Altitude — 2300 meters

Job Layout — Haul and Return:



Total Effective Grade = RR (%) ± GR (%)

Sec. A: Total Effective Grade = 10% + 0% = 10%
Sec. B: Total Effective Grade = 4% + 0% = 4%
Sec. C: Total Effective Grade = 4% + 4% = 8%
Sec. D: Total Effective Grade = 10% + 0% = 10%

1. Estimate Payload:

Est. load (LCM) × L.F. × Bank Density = payload
24 LCM × 0.80 × 1770 kg/BCM = 34 000 kg payload

2. Machine Weight:

Empty Wt. — 40 000 kg or 40 metric tons
Wt. of Load — 34 000 kg or 34 metric tons
Total (GVW) 74 000 kg or 74 metric tons

3. Calculate Usable Pull (traction limitation):

Loaded: (weight on driving wheels = 54%) (GVW)
Traction Factor × Wt. on driving wheels =
0.50 × 74 000 kg × 54% = 19 980 kg

Empty: (weight on driving wheels = 69%) (GVW)
Traction Factor × Wt. on driving wheels =
0.50 × 40 000 kg × 69% = 13 800 kg

4. Derate for Altitude:

Check power available at 2300 m from altitude deration table in the Tables Section.

631E — 100% 12G — 85%
D9N — 100% 825C — 94%

Then adjust if necessary:

Load Time — controlled by D9N, at 100% power, no change.

Travel, Maneuver and Spread time — 631E, no change.

5. Compare Total Resistance to Tractive Effort on haul:

Grade Resistance —

GR = 10 kg/metric ton × tons × adverse grade in percent

Sec. C: = 10 kg/metric ton × 74 metric tons × 4% grade = 2960 kg

Rolling Resistance —

RR = RR Factor (kg/mton) × GVW (metric tons)

Sec. A: = 100 kg/metric ton × 74 metric tons = 7400 kg
Sec. B: = 40 kg/metric ton × 74 metric tons = 2960 kg
Sec. C: = 40 kg/metric ton × 74 metric tons = 2960 kg
Sec. D: = 100 kg/metric ton × 74 metric tons = 7400 kg

Total Resistance

TR = RR + GR

	RR		GR		TR
Sec. A:	7400 kg	+	0	=	7400 kg
Sec. B:	2960 kg	+	0	=	2960 kg
Sec. C:	2960 kg	+	2960 kg	=	5920 kg
Sec. D:	7400 kg	+	0	=	7400 kg

Check usable kilogram force against maximum kilogram force required to move the 631E.

Force usable . . . 19 980 kg loaded

Force required . . . 7400 kg maximum total resistance

Estimate travel time for haul from 631E (loaded) travel time curve; read travel time from distance and effective grade.

Travel time (from curves):

Sec. A: 0.60 min
Sec. B: 1.00
Sec. C: 1.20
Sec. D: 0.60
3.40 min

NOTE: This is an estimate only; it *does not account for all the acceleration and deceleration time,* therefore it is not as accurate as the information obtained from a computer program.

6. Compare Total Resistance to Tractive Effort on return:

Grade Assistance —

GA = 10 kg/mton × metric tons × negative grade in percent

Sec. C: = 10 kg/metric ton × 40 metric ton × 4% grade = 1600 kg

Rolling Resistance —

RR = RR Factor × Empty Wt.

Sec. D: = 100 kg/metric ton × 40 metric tons = 4000 kg

Sec. C: = 40 kg/metric ton × 40 metric tons = 1600 kg

Sec. B: = 40 kg/metric ton × 40 metric tons = 1600 kg

Sec. A: = 100 kg/metric ton × 40 metric tons = 4000 kg

Total Resistance —

TR = RR − GA

	RR		GA		TR
Sec. D: =	4000 kg	−	0	=	4000 kg
Sec. C: =	1600 kg		1600 kg	=	0
Sec. B: =	1600 kg		0	=	1600 kg
Sec. A: =	4000 kg		0	=	4000 kg

Check usable kilogram force against maximum force required to move the 631E.

Kilogram force usable . . . 13 800 kg empty

Kilogram force required . . . 4000 kg

Estimate travel time for return from 631E empty travel time curve.

Travel time (from curves):

Sec. D: 0.40 min
Sec. C: 0.55
Sec. B: 0.80
Sec. A: 0.40

2.15 min

7. Estimate Cycle Time:

Total Travel Time (Haul plus Return) =	5.55 min
Adjusted for altitude: 100% × 5.55 min =	5.55 min
Load Time	0.7 min
Maneuver and Spread Time	0.7 min
Total Cycle Time	6.95 min

8. Check pusher-scraper combinations:

Pusher cycle time consists of load, boost, return and maneuver time. Where actual job data is not available, the following may be used.

Boost time = 0.10 minute
Return time = 40% of load time
Maneuver time = 0.15 minute
Pusher cycle time = 140% of load time + 0.25 minute
Pusher cycle time = 140% of 0.7 min + 0.25 minute
= 0.98 + 0.25 = 1.23 minute

Scraper cycle time divided by pusher cycle time indicates the number of scrapers which can be handled by each pusher.

$$\frac{6.95 \text{ min}}{1.23 \text{ min}} = 5.65$$

Each push tractor is capable of handling five plus scrapers. Therefore the two pushers can adequately serve the eleven scrapers.

9. Estimate Production:

Cycles/hour = 60 min ÷ Total cycle time
= 60 min/hr ÷ 6.95 min/cycle
= 8.6 cycles/hr

Estimated load = Heaped capacity × L.F.
= 24 LCM × 0.80
= 19.2 BCM

Hourly unit production = Est. load × cycles/hr
= 19.2 BCM × 8.6 cycles/hr
= 165 BCM

Adjusted production = Efficiency factor × hourly production
= 0.83 (50 min hour) × 165 BCM
= 137 BCM/hour

Hourly fleet production = Unit production × No. of units
= 137 BCM/hr × 11 units
= 1507 BCM/hr

10. Estimate Compaction:

Compaction requirement = S.F. × hourly fleet production
= 0.85 × 1507 BCM/hr
= 1280 CCM/hr

Compaction capability (given the following):

Compacting width, 2.26 m		(W)
Average compacting speed, 9.6 km/h		(S)
Compacted lift thickness, 18 cm		(L)
No. of passes required, 3		(P)

825C production –

$$\text{CCM/h} = \frac{W \times S \times L \times 10}{P} \quad \text{(conversion factor)}$$

$$= \frac{2.26 \times 9.6 \times 18 \times 10}{3}$$

$$= 1302$$

Given the compaction requirement of 1280 CCM/h, the 825C is an adequate compactor match-up to the fleet. However, any change to job layout increasing fleet production would upset this balance.

11. Estimate Total Hourly Cost:

631E	@ \$65.00/hr × 11 units	\$715.00
D9N	@ 75.00/hr × 2 units	150.00
12G	@ 15.00/hr × 2 units	30.00
825C	@ 40.00/hr × 1 unit	40.00
Operators	@ 20.00/hr × 16 men	320.00
Total Hourly Owning and Operating Cost		\$1,255.00

12. Calculate Performance:

$$\text{Cost per BCM} = \frac{\text{Total cost/hr}}{\text{Production/hr}}$$

$$= \frac{\$1,255.00}{1507\ \text{BCM/hr}}$$

$$= 83¢/\text{BCM}$$

NOTE: Ton-km/h calculations should be made to judge the ability of the tractor-scraper tires to operate safely under these conditions.

13. Other Considerations:

If other equipment such as rippers, water wagons, discs or other miscellaneous machines are needed for the particular operation, then these machines must also be included in the cost per BCM.

SYSTEMS

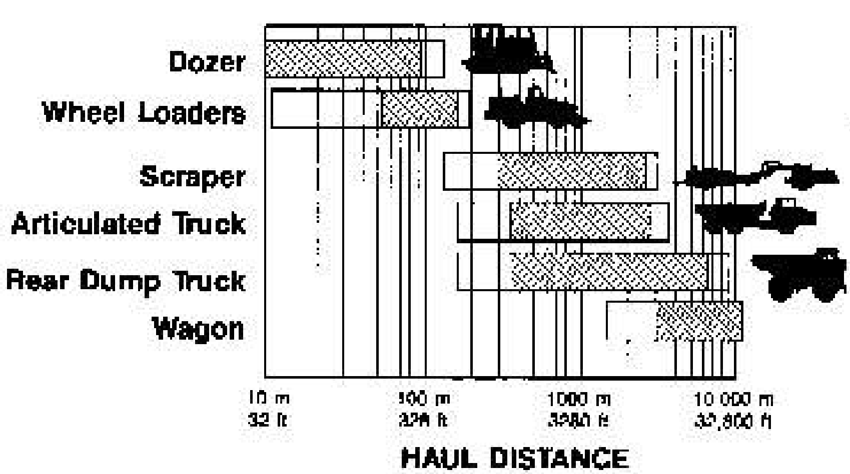
Caterpillar offers a variety of machine for different applications and jobs. Many of these separate machines function together in mining and earthmoving systems.

- Bulldozing with track-type tractors
- Load-and-Carry with wheel loaders
- Scrapers self-loading with elevator, auger, or push-pull configurations, or push-loaded by track-type tractors
- Articulated trucks loaded by excavators, track loaders or wheel loaders
- Off-highway trucks loaded by shovels, excavators or wheel loaders

Economic Haul Distances — Mobile equipment systems for construction or mining jobs operate in generalized economic application zones. These zones vary by machine with distance, underfoot conditions, grades, material type, production rate and operator skill. Of these factors, distance provides the best initial basis for system selection. The following table provides general rules of thumb for systems application based on distance. These haul ranges will vary by application.

• • •

GENERAL HAUL DISTANCES FOR MOBILE SYSTEMS



Loading Match — Loading tools have a production range that varies with material, bucket configuration, target size, operator skill and load area conditions. The loader/truck matches given in the following table are with the typical number of passes and production range.

Your Cat Dealer can provide advice and estimates based on your specific conditions.

FUEL CONSUMPTION AND PRODUCTIVITY

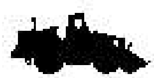
Fuel efficiency is the term used to relate fuel consumption and machine productivity. It is expressed in units of material moved per volume of fuel consumed. Common units are cubic meters or tonnes per liter of fuel (cubic yards or tons/gal). Determining fuel efficiency requires measuring both fuel consumption and production.

Measuring fuel consumption involves tapping into the vehicle's fuel supply system — without contaminating the fuel. The amount of fuel consumed during operation is then measured on a weight or volumetric basis.

Primary Match

Extended Match

LOADING TOOL MATCH



Tons/50 min. Hr. 83% Operator Eff.	2700/3100	2700/3100	1300/1700	1300/1700	700/900	700/900	500/700	500/700	300/500	1100/1500	600/800	200/400
Loading Tool	994	994 High Lift	992	992D High Lift	988F	988F High Lift	980F	980F High Lift	966F		245D	235D
793		[illegible]										
789	[illegible]	[illegible]										
785	[illegible]	[illegible]		[illegible]								
777C			4	4						[illegible]		
775B			3							[illegible]		
773B			[illegible]		[illegible]	[illegible]				4	[illegible]	
771C					4			[illegible]		[illegible]	6	10
769C					4			[illegible]			6	[illegible]
D40D D400D					[illegible]		[illegible]	[illegible]	[illegible]			
D35D D350D					[illegible]		[illegible]		[illegible]			
D25D D250D							[illegible]		[illegible]			

FORMULAS AND RULES OF THUMB

Production, hourly = Load (BCM) cycle × cycles/hr
= Load (BCY) cycle × cycles/hr

Load Factor (L.F.) $= \dfrac{100\%}{100\% + \%\ \text{swell}}$

Load (bank measure) = Loose cubic meters (LCM) × L.F.
= Loose cubic yards (LCY) × L.F.

Shrinkage Factor (S.F.) $= \dfrac{\text{Compacted cubic meters (or yards)}}{\text{Bank cubic meters (or yards)}}$

Density = Weight/Unit Volume

Load (bank measure) $= \dfrac{\text{Weight of load}}{\text{Bank density}}$

Rolling Resistance Factor
= 20 kg/t + (6 kg/t/cm × cm)
= 40 lb/ton + (30 lb/ton/inch × inches)

Rolling Resistance
= RR Factor (kg/t) × GVW (tons)
= RR Factor (lb/ton) × GVW (tons)

Rolling Resistance
= 2% of GVW + 0.6% of GVW per cm tire penetration
= 2% of GVW + 1.5% of GVW per inch tire penetration

% Grade $= \dfrac{\text{vertical change in elevation (rise)}}{\text{corresponding horizontal distance (run)}}$

Grade Resistance Factor = 10 kg/t × % grade
= 20 lb/ton × % grade

Grade Resistance = GR Factor (kg/t) × GVW (tons)
= GR Factor (lb/ton) × GVW (tons)

Grade Resistance = 1% of GVW × % grade

Total Resistance
= Rolling Resistance (kg or lb) + Grade Resistance (kg or lb)

Total Effective Grade (%) = RR (%) + GR (%)

Usable pull (traction limitation) = Coeff. of traction × weight on drivers
= Coeff. of traction × (Total wt. × % on drivers)

Pull required = Rolling Resistance + Grade Resistance
= Total Resistance

Total Cycle Time = Fixed time + Variable time

Fixed time: See respective machine production section.

Variable time = Total haul time + Total return time

Travel Time $= \dfrac{\text{Distance (m)}}{\text{Speed (m/min)}} = \dfrac{\text{Distance (ft)}}{\text{Speed (fpm)}}$

Cycles per hour $= \dfrac{60\ \text{min/hr}}{\text{Total cycle time (min/cycle)}}$

Adjusted production = Hourly production × Efficiency factor

No. of units required $= \dfrac{\text{Hourly production required}}{\text{Unit hourly production}}$

No. of scrapers a pusher will load $= \dfrac{\text{Scraper cycle time}}{\text{Pusher cycle time}}$

Pusher cycle time (min) = 1.40 Load time (min) + 0.25 min

Grade Horsepower $= \dfrac{\text{GVW (kg)} \times \text{Total Effective Grade} \times \text{Speed (km/h)}}{273.75}$

$= \dfrac{\text{GVW (lb)} \times \text{Total Effective Grade} \times \text{Speed (mph)}}{375}$

LOGGING AND FOREST PRODUCTS
Feller Bunchers
Log Loaders

CONTENTS

Introduction

This chapter gives information for estimating performance of Cat machines in logging. The chapters on Earthmoving and Owning and Operating Costs should be understood before applying this chapter. Because of variations in conditions, actual experience should be considered whenever it is available.

ESTIMATING WHEEL AND TRACK SKIDDER PRODUCTION

1. Determine the weight of the average log and multiply log loads expected to be skidded. If average weights or volumes are not available from local timber cruise or log scale data, they can be estimated using the following procedure:

— Determine length and both end diameters of the average size log to be skidded. Then determine its volume using tables in this section.

— Determine average log weight based on its estimated volume and green density for the species being skidded as shown in the tables later in this section.

2. Determine operating weight of machines being considered for use on the job. If one end of the logs will be suspended by a cable arch or hydraulic grapple, estimate the percent of the log weight that will be transferred to the machine. Then determine total machine plus load transferred weight for log loads. Weight transfer of small diameter logs with substantial taper may be as high as two-thirds when skidded with large end ahead and as low as one-third with small end ahead. Large diameter logs with little taper will have weight transfer closer to 50% of their weight.

3. Determine the average percent grade on the proposed skid trails. Then determine the grade resistance or assistance for the haul and return portions of the cycle for each machine considered. If there are significant differences in grade along the proposed trails, the grade resistance or assistance must be determined for each section of the trails. For the haul portion of the cycle, grade resistance must be determined for log loads.

Grade Resistance in Kilograms = % Grade × 10 kg/metric ton × GVW in tons

Grade Resistance in Pounds = % Grade × 20 lb/U.S. ton × GVW in tons

4. Determine the average rolling resistance for each wheel-type machine being considered based on expected tire penetration or on typical rolling resistance factors shown in the Tables Section. If there are significant differences in underfoot conditions and tire penetration along the proposed skid trails, rolling resistance must also be determined for machines with and without loads.

RR Factor in kg/metric ton = 20 kg/t + (6 kg/t/cm × tire penetration in cm)

RR Factor in lb/U.S. ton = 40 lb/ton + (30 lb/ton/inch × tire penetration in inches)

Total Rolling Resistance in Kilograms = RR Factor in kg/t × GVW in metric tons

Total Rolling Resistance in Pounds = RR Factor in lb/U.S. ton × GVW in tons

5. Determine skidding resistance for log loads on each machine using the tables on the next page. For log weights and grades not shown, skidding resistance must be determined by interpolation. The arch skidding tables must be used when one end of the logs will be suspended by a cable arch or hydraulic grapple. The ground skidding tables are used when logs are not suspended. If there are significant differences in grade along the proposed trails, then skidding resistance must be determined for each section.

6. Determine the total resistance or pull required to overcome the total of grade, rolling, and skidding resistance. Total resistance must be determined for each machine and skid trail section on both haul and return portions of the cycles.

Total Resistance on Return = Grade Resistance + Rolling Resistance

Total Resistance on Haul = Grade Resistance + Rolling Resistance + Skidding Resistance

7. Determine the traction limitations or usable pull for each machine with and without loads if one end of the logs will be suspended. Usable pull is estimated using the approximate coefficient of traction factors for the soil conditions shown in Tables Section.

Usable Pull in Kilograms = Coefficient of Traction × GVW in Kilograms

Usable Pull in Pounds = Coefficient of Traction × GVW in Pounds

8. Determine maximum return and haul travel speeds for each machine and skid trail section on those loads whose total resistance (required pull) estimated in step 6 is less than the usable pull estimated in step 7. Travel speeds for track-type tractors are estimated from the drawbar pull graphs in the Tractor Section. Wheel skidder travel speeds are estimated from the rimpull graphs in the Skidder Section.

9. Determine return and haul travel times for each machine, load and segment based on the length of each skid trail segment and the speeds determined in step 8.

Travel Time in Minutes = Distance in meters ÷ [(speed in km/h) (16.7)]

Travel Time in Minutes = Distance in feet ÷ [(speed in mph) (88)]

10. Determine fixed times to maneuver machines and to hook, unhook and deck logs based on local experience.

11. Determine total cycle time and cycles per hour for each machine with log loads on each skid trail.

Cycle Time = Return Time + Haul Time + Fixed Time

Cycles/Hour = 60 ÷ cycle time in minutes

12. Determine production for each machine on each skid trail at the expected job efficiency in the desired units, such as number of logs, weight of logs, cubic volume, board feet, cords, etc., using the appropriate conversion factors.

Units/Hour = Cycles/Hour × Unit/Cycle × Job Efficiency

DRAWBAR KILOGRAMS PULL Required To Overcome Log Skidding Resistance

GROUND SKIDDING — Log Lengths

	Load Weight (kg)									
	500	1000	1500	2000	2500	3000	3500	4000	4500	5000
*Grade	Drawbar Kilograms Required									
30% Upgrade	603	1205	1808	2410	3013	3615	4218	4820	5423	6025
20% Upgrade	550	1100	1650	2200	2750	3300	3850	4400	4950	5500
10% Upgrade	498	995	1493	1990	2488	2985	3483	3980	4478	4975
Level	445	890	1335	1780	2225	2670	3115	3560	4005	4450
10% Downgrade	392	784	1176	1568	1960	2352	2744	3136	3528	3920
20% Downgrade	340	679	1091	1358	1698	2037	2377	2718	3056	3395
30% Downgrade	287	574	861	1148	1435	1722	2009	2298	2583	2870

ARCH SKIDDING — Log Lengths

	500	1000	1500	2000	2500	3000	3500	4000	4500	5000
30% Upgrade	603	864	1246	1527	1809	2090	2377	2653	2935	3216
20% Upgrade	513	760	987	1224	1461	1698	1935	2172	2409	2646
10% Upgrade	343	535	728	920	1113	1305	1498	1690	1883	2076
Level	167	317	468	618	769	919	1070	1220	1371	1521
10% Downgrade	—	105	207	313	417	521	625	729	833	937
20% Downgrade	—	—	—	—	30	100	170	239	310	380

DRAWBAR POUNDS PULL Required To Overcome Log Skidding Resistance

GROUND SKIDDING — Log Lengths

	Load Weight (lb)									
	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
*Grade	Drawbar Pounds Pull Required									
30% Upgrade	1205	2410	3615	4820	6025	7230	8435	9640	10845	12050
20% Upgrade	1100	2200	3300	4400	5500	6600	7700	8800	9900	11000
10% Upgrade	995	1990	2985	3980	4975	5970	6965	7960	8955	9950
Level	890	1780	2670	3560	4450	5340	6230	7120	8010	8900
10% Downgrade	784	1568	2352	3136	3920	4704	5488	6272	7056	7840
20% Downgrade	679	1358	2037	2716	3395	4074	4753	5432	6111	6790
30% Downgrade	574	1148	1722	2296	2870	3444	4018	4592	5166	5740

ARCH SKIDDING — Log Lengths

	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
30% Upgrade	1205	1928	2491	3054	3617	4180	4753	5306	5869	6432
20% Upgrade	1025	1499	1973	2447	2921	3395	3869	4343	4817	5291
10% Upgrade	665	1070	1455	1840	2225	2610	2996	3380	3765	4150
Level	333	634	935	1236	1537	1838	2139	2440	2741	3042
10% Downgrade	—	208	414	625	833	1041	1249	1457	1665	1873
20% Downgrade	—	—		—	59	199	339	479	619	759

Data taken on dry, smooth, clay loam slopes. Resistances are less on wet soil.

Source — Central States Forest Experiment Station, U.S. Forest Service.

$$\text{*\% Grade} = \frac{\text{Vertical Rise}}{\text{Horizontal Distance}} \times 100\%$$

Example problem (Metric)

Determine the production capabilities in logs per hour of a 518 Series II grapple skidder and a D4H TSK Series III grapple skidder in a thinning application. Operating weights are 12 020 kilograms for the 518 Series II with grapple and 15 065 kilograms for the D4H TSK Series III with grapple. The timber is Radiata pine with the average log being 18 meters long with a butt diameter of 350 millimeters and a top diameter of 100 millimeters.

The average skid trail is 150 meters long with a 5% average adverse skidding grade of 75 millimeters average tire penetration. The coefficient of traction is estimated to be 0.5 for wheels and 0.8 for tracks.

The logs will be bunched in groups of 6 logs for the 518 and in groups of 9 logs for the D4H TSK. Maneuver time for a log hook-up averages 0.3 minutes and hook-up time averages 0.2 minutes. Landing maneuver, decking, and unhook time average a total of 1.0 minute.

1. **Average Load Size:**

   Volume/Log = (1.73 + .14)/2 = .935 m^3

   Density of Radiata Pine = 865 kg/m^3

   Weight/Log = 865 × .935 = 809 kg

   Six Log Load = 809 × 6 = 4853 kg

   Nine Log Load = 809 × 9 = 7279 kg

2. **Gross Vehicle Weights:**

   518 Empty GVW = 12 020 kg = 12.2 Metric tons

   D4H TSK Empty GVW = 14 932 kg = 14.93 Metric tons

   518 Load Weight Transferred = 0.6 × Load Weight

   D4H TSK Load Weight Transferred = 0.6 × Load Weight

   518 Loaded:
   12 020 + 0.6 × 4853 = 14 932 kg = 14.93 Metric tons

   D4H TSK Loaded:
   14 932 + 0.6 × 7279 = 19 432 kg = 19.43 Metric tons

3. **Grade Resistance/Assistance:**

   Grade Assistance: Return = 5 × 10 kg/T × GVW in tons

   Grade Resistance: Haul = 5 × 10 kg/T × GVW in tons

	518	D4H TSK
Assistance:		
Return Empty	(-601 kg)	(-753 kg)
Resistance:		
Haul Load	747 kg	972 kg

4. **Rolling Resistance — 518:**

   RR Factor = 20 kg/ton + (6 kg/ton/cm × 7.5 cm) = 65

   RR = 65 × GVW in tons

   Resistance:
   Return = 65 × 12.02 = 781 kg
   Haul = 65 × 15.07 = 971 kg

5. **Skidding Resistance** (derived from tables in this section):

   Skid Resistance/Log = 450 kg

   Skid Resistance — Six Logs = 2700 kg
   Skid Resistance — Nine Logs = 4050 kg

6. **Total Resistance — Required Pull:**

   518 Return Empty = (-601) + 781 = 180.3 kg
   518 Haul Load = 747 + 971 + 2700 = 4417 kg

   D4H TSK Return Empty = (-753) kg
   D4H TSK Haul Load = 972 + 4050 = 5022 kg

7. **Usable Pull:**

   518 Return Empty = 0.5 × 12 020 = 6010 kg
   518 Haul Load = 0.5 × 14 932 = 7466 kg

   D4H TSK Return Empty = 0.8 × 15 065 = 12 052 kg

   D4H TSK Haul Load = 0.8 × 19 432 = 15 546 kg

8. **Travel Speeds:** from rimpull/drawbar pull graphs

	518	D4H TSK
Return Empty	11.3 km/h*	8.05 km/h*
Haul Load	4.03 km/h	2.01 km/h

*Depending upon haul road conditions and job site factors, a slower speed may be preferred for a safer return.

9. **Travel Times:**

Travel Time = 150 m/16.7/(speed in km/h)

	518	D4H TSK
Return Empty	0.79 min.	1.12 min.
Haul Load	2.23	4.47

10. **Fixed Times:**

Total Fixed Time = 0.3 + 0.2 + 1.0 = 1.5 min.

11. **Cycles per Hour:**

Cycles/hr = (60 min/hr)/(Total Cycle Time in min)

	518	D4H TSK
Total Cycle Time	4.52 min.	7.08 min.
Cycles per Hour	13.3 min.	8.47 min.

12. **Production per Hour:**

Logs/Hour = Cycles/hr × Logs/cycle

	518	D4H TSK
Logs/cycle	6	9
Logs/hour	79.6	76.2

Example problem (English)

Determine the production capabilities in logs per hour of a 518 Series II grapple skidder and a D4H TSK Series III grapple skidder in a thinning application. Operating weights are 26,500 pounds for the 518 Series II with grapple and 33,211 pounds for the D4H TSK Series III with grapple. The timber is Loblolly pine with the average log being 60 feet long with a butt diameter of 14 inches and a top diameter of 4 inches.

The average skid trail is 500 feet long with a 5% average adverse skidding grade and 3 inches average tire penetration. The coefficient of traction is estimated to be 0.5 for wheels and 0.8 for tracks.

The logs will be bunched in groups of 6 logs for the 518 Series II and in groups of 9 logs for the D4H TSK Series III. Maneuver time for a log hook up averages 0.3 minutes and hook-up time averages 0.2 minutes. Landing maneuver, decking, and unhook time average a total of 1.0 minute.

1. **Average Load Size:**

   Volume/Log = (64 + 5.2)/2 = 34.6 ft^3
   Density of Loblolly Pine = 62 lb/ft^3
   Weight/Log = 62 × 34.6 = 2145 lb
   Six Log Load = 2145 × 6 = 12,871 lb
   Nine Log Load = 2145 × 9 = 19,306 lb

2. **Gross Vehicle Weights:**

   518 Series II Empty GVW = 26,500 lb = 13.25 tons
   D4H TSK Series III Empty GVW = 33,211 lb = 16.61 tons
   518 Series II Load Weight Transferred = 0.6 × Load Weight
   D4H TSK Series III Load Weight Transferred = 0.6 × Load Weight
   518 Series II Loaded:
   26,500 + 0.6 × 12,871 = 34,223 lb = 17.11 tons
   D4H TSK Series III Loaded:
   33,211 + 0.6 × 19,306 = 44,795 lb = 22.40 tons

3. **Grade Resistance/Assistance:**

   Grade Assistance: Return = 5 × 20 lb/T × GVW in tons
   Grade Resistance: Haul = 5 × 20 lb/T × GVW in tons

	518 Series II	D4H TSK Series III
Assistance:		
Return Empty	(-1325 lb)	(-1660 lb)
Resistance:		
Haul Load	1711 lb	2240 lb

4. **Rolling Resistance — 518 Series II:**

   RR Factor = 40 lb/ton + (30 lb/ton/in x 3 in) = 130 lb/T

   RR = 130 × GVW in tons

   Resistance:
   Return = 130 × 17.11 = 1723 lb
   Haul = 130 × 22.40 = 2224 lb

5. **Skidding Resistance** (derived from tables in this section):

   Skid Resistance/Log = 1169 lb

   Skid Resistance — Six Logs = 7014 lb
   Skid Resistance — Nine Logs = 10,521 lb

6. **Total Resistance — Required Pull:**

   518 Series II Return Empty (-1325) + 1723 = 398 lb
   518 Series II Haul Load = 1661 + 2160 + 7104 10,949 lb
   D4H TSK Series III Return Empty = (-1660) lb
   D4H TSK Series III Haul Load = 2165 + 10,521 = 12,760 lb

7. **Usable Pull:**

   518 Series II Return Empty = 0.5 × 26,500 = 13,250 lb
   518 Series II Haul Load = 0.5 × 34,222 = 17,111 lb

   D4H TSK Series III Return Empty = 0.8 × 33,211 26,568 lb
   D4H TSK Series III Haul Load = 0.8 × 44,795 = 35,836 lb

8. **Travel Speeds:** from rimpull/drawbar pull graphs

	518 Series II	D4H TSK Series III
Return Empty	7mph*	5 mph*
Haul Load	2.5 mph	1.25 mph

*Depending upon haul road conditions and job site factors, a slower speed may be required for a safer return.

9. **Travel Times:**

   Travel Time = 500 ft × (60 min/hr)/(5280 ft/mi)(speed in mph)

	518 Series II	D4H TSK Series III
Return Empty	0.81 min	1.14 min
Haul Load	2.27 min	4.55 min

10. **Fixed Times:**

    Total Fixed Time = 0.3 + 0.2 + 1.0 = 1.5 min

11. **Cycles per Hour:**

    Cycles/hr = (60 min/hr)/(Total Cycle Time in min)

	518 Series II	D4H TSK Series III
Total Cycle Time	4.58 min	7.18 min
Cycles per Hour	13.1 min	8.35 min

12. **Production per Hour:**

    Logs/hr = Cycles/hr × Logs/cycle

	518 Series II	D4H TSK Series III
Logs/cycle	6	9
Logs/hour	78.5	75.2

• • •

LOAD CAPACITY CURVES FOR WHEEL LOADERS, INTEGRATED TOOLCARRIERS AND TRACK LOADERS EQUIPPED WITH FORKS

Definitions:

Hydraulic Capacity: Weight that the hydraulic system will lift with the rear of the loader anchored and the load center of gravity midway on the fork tines. Hydraulic capacity is not increased by counterweighting.

Tipping Load: The loaded weight positioned as described above, which will lift the rear wheels off the ground with the machine in a static condition. Static tipping load curves for wheel loaders equipped with log or lumber forks are based on full machine articulation.

Tipping load capacities are affected by counterweight and distance of the load center of gravity from the front axle and degree of articulation. Fork center of gravity and fork weight can also affect tipping load.

Maximum Operating Load: Maximum operating load should be based on static tipping load ratings (tines level) and requires a firm, smooth, well-maintained operating area. Maximum operating loads can be affected by:

- Underfoot conditions.
- Position or height the load is carried.
- Fork position or attitude.
- Degree machine is articulated during maneuvering.

• • •

Example problem:

Wheel Loader Selection 966F vs 950F

Optimum millyard performance depends on efficient and proper use of wheel loaders performing unloading, sorting and decking applications. The following steps will aid in the proper wheel loader selection.

Step 1: Determine the basic mill requirements (job description).

EXAMPLE:

Logs arrive at the mill on trucks equipped with double bunk trailers. Logs are a variety of hard woods, but white oak makes up the majority of wood received. The trucks must be off-loaded by a wheel loader equipped with log forks.

In addition to the off loading, a primary loader requirement is to supply the mill with raw material in a load-and-carry operation. The loader must also sort logs by species, grade and size, and transport the excess logs from the unloading area to the storage decks.

- Maximum sawmill requirements — 544 metric tons/8 hr. day (600 U.S. tons).
- Maximum wood received — 30 truckloads/8 hr. day.
- Average number of logs per truckload — 20.
- Average log specifications:
  - length 4.9 m (16 ft.).
  - butt diameter 660 mm (26").
  - top diameter 430 mm (17").
- Maximum truck stake height — 3.98 m (13'1").
- Maximum haul distance (one way) from log storage deck to the mill — 153 m (500 ft).
- Haul and return to mill in 2nd forward — 10% effective grade.
- Fixed times — load forks 0.7 min.
  - — maneuver and dump 0.5 min.
  - — truck unloading 1.0 min.
- Average log weight = 1180 kg/log (2600 lb/log) Refer to Weights and Measure section of this handbook to obtain appropriate log volume and density information.

Step 2: Determine the basic machine options and capacities.

Refer to Capacity curves in the Performance Handbook under Logging and Forest Products section. For other fork configurations not listed contact the Forest Machinery Unit for performance curves. Also refer to attachment adaptability section for information needed for performance curves.

EXAMPLE:

Consider a 950F vs. 966F. 950F equipped with Balderson 8961C2 Logging Fork. 966F equipped with a Medford 42J100 Logging Fork.

950F	
Static Tipping Load	10,000 kg (22,000 lb)
Hydraulic Lift Capacity	11,600 kg (25,520 lb)
Maximum Operating Load	10,000 kg (22,000 lb)
966F	
Static Tipping Load	13,500 kg (29,700 lb)
Hydraulic Lift Capacity	14,500 kg (31,900 lb)
Maximum Operating Load	13,500 kg (29,700 lb)

Step 3: Determine cycle times.

Refer to Production Travel Time Charts in the Wheel Loader section of the Performance Handbook.

20

EXAMPLE:
(Supplying the mill)

Description	Time (950F)	Time (966F)
Haul and return	1.16 min	1.14 min
Load Forks*	0.7 min	0.7 min
Maneuver and dump*	0.5 min	0.5 min
TOTAL	2.36 min	2.34 min
Cycles/45-min hr =	19.06	19.23

(Off-loading trucks)

Description	Time (950F)	Time (966F)
Truck unloading*	1.0 min	1.0 min
Load Forks*	0.7 min	0.7 min
Maneuver and dump*	0.5 min	0.5 min
TOTAL	2.2 min	2.2 min
Cycles/45-min hr =	20.45	20.45

*Fixed times which should be based on local experience.

Step 4: Calculate Production

EXAMPLE:

Mill requirements:

950F

$$\frac{\text{544 320 kg (1,200,000 lb)/8 hr/day}}{\text{10,000 kg (22,000 lb)/loader cycle}} = \frac{\text{55 loader cycles}}{\text{8 hr day}}$$

$$\frac{\text{55 loader cycles/8 hr day}}{\text{19.06 cycles/45-min hr}} \quad \text{2.88 hr/day required to supply mill}$$

— 966F

$$\frac{\text{544 320 kg (1,200,000 lb)/8 hr/day}}{\text{13,500 kg (29,700 lb)/loader cycle}} = \frac{\text{41 loader cycles}}{\text{8 hr day}}$$

$$\frac{\text{41 loader cycles/8 hr day}}{\text{19.23 cycles/45-min hr}} = \text{2.13 hr/day required to supply mill}$$

Off-Load Requirements:

— 950F

20 logs/truck × 30 truckloads/day = 600 logs/day

600 logs/day × 1180 kg (2600 lb)/log = 707 616 kg/day or 1,560,000 lbs/day Incoming Wood

$$\frac{\text{707 616 kg (1,560,000 lb)/8 hr day}}{\text{10,000 kg (22,000 lb)/loader cycle}} = \frac{\text{71 loader cycles}}{\text{8 hr day}}$$

$$\frac{\text{71 loader cycles/8 hr day}}{\text{20.45 cycles/hr}} = \text{3.47 hr/day required to off-load wood}$$

— 966F

20 logs/truck × 30 truckloads/day = 600 logs/day

600 logs/day × 1180 kg (2600 lb)/log = 707 616 kg/day or 1,560,000 lbs/day Incoming Wood

$$\frac{\text{707 616 kg (1,560,000 lb)/8 hr day}}{\text{13,500 kg (29,700 lb)/loader cycle}} = \frac{\text{53 loader cycles}}{\text{8 hr day}}$$

$$\frac{\text{53 loader cycles/8 hr day}}{\text{20.45 cycles/hr}} = \text{2.59 hr/day required to off-load wood}$$

Total Production Required:

— 950F = 2.88 hr/day to supply mill
3.47 hr/day to off-load
6.35 hr/day total time

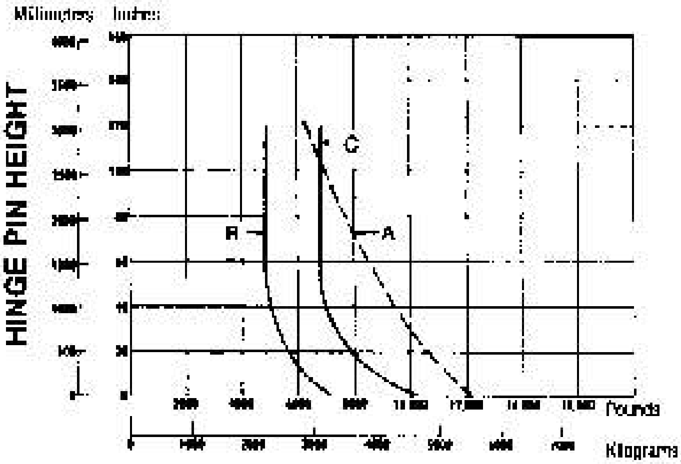
966F — 2.13 hr/day to supply mill
2.59 hr/day to off-load wood
4.72 hr/day total time

Step 5: Determine Wheel Loader selection.

Example:

From the production study completed and assuming 100% efficiency it appears both machines are capable of handling the maximum daily production. The 950F and 966F will have 1.65 hrs/day and 3.28 hrs/day respectively to handle unscheduled activities such as sorting, storage and yard clean-up. However, after comparing the maximum hinge pin height for the two machines, the 950F is not capable of clearing the stakes with a load. This leaves the 966F as the machine to recommend, since it can handle all restrictions and production requirements.

910E with Balderson Log and Lumber Fork



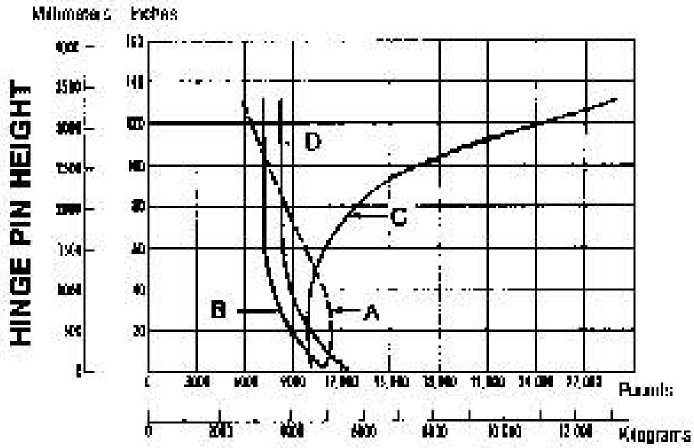
CAPACITY IN FULL TURN NO CLAMP

KEY
A — Hydraulic Lift Capacity
B — Static Tipping Load Fork Level
C — Static Tipping Load Fork Racked

Curves based on machine with full fuel tank, operator, 15.5-25, 8 PR (L-2) tires and Balderson lumber/log fork with 1220 mm (48") tines weighing 578 kg (1275 lb). Total operating weight, 6318 kg (13,930 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

	Change in Operating Weight	Change in Articulated Static Tipping Load Racked	Change in Articulated Static Tipping Load Level
Add ROPS canopy	+317 kg (+ 700 lb)	+309 kg (+682 lb)	+233 kg (+515 lb)
Add ROPS canopy and cab	+527 kg (+1163 lb)	+388 kg (+856 lb)	+345 kg (+762 lb)

916 with Balderson Log and Lumber Fork



CAPACITY IN FULL TURN NO CLAMP

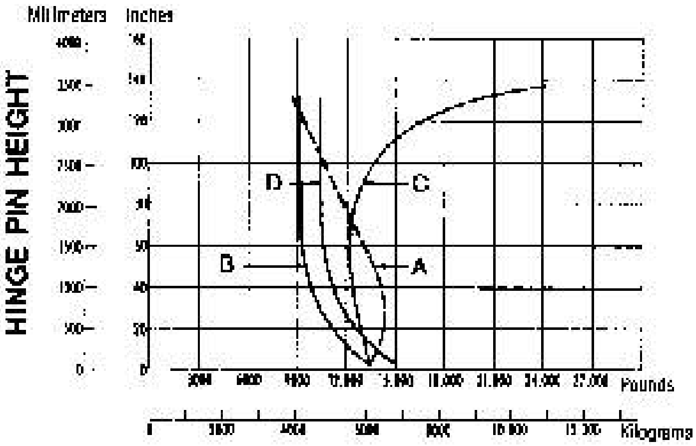
KEY
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 40° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

Curves based on machine with full fuel tank, operator, 15.5-25, 12 PR (L-2) tires and Balderson lumber fork with 1220 mm (48") tines weighing 635 kg (1400 lb). Total operating weight, 8963 kg (19,760 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

	Change in Operating Weight	Change in Articulated Static Tipping Load Level
Without ROPS canopy and cab (platform only)	−418 kg (−922 lb)	−258 kg (−569 lb)
Without cab (ROPS/platform)	−207 kg (−456 lb)	−128 kg (−282 lb)

NOTE: Logging forks and top clamps are not available from Caterpillar. Other manufacturers supply these attachments through Caterpillar Dealers.

926E with Balderson Log Fork



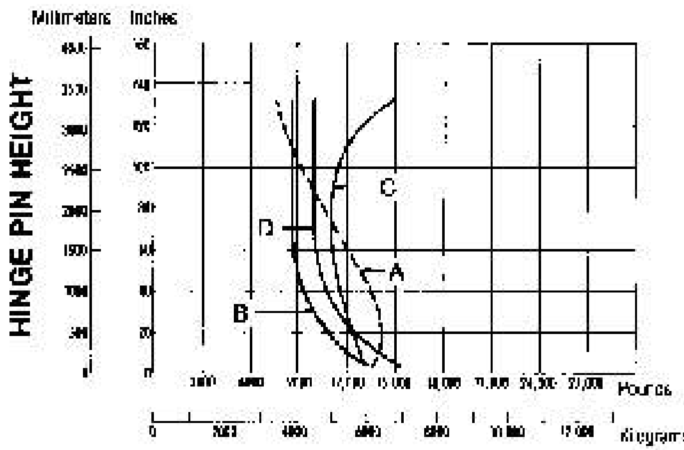
**CAPACITY IN FULL TURN
NO CLAMP**

KEY
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 40° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

Curves based on machine with full fuel tank, operator, ROPS cab, 17.5-25, 12 PR L-2 tires, 506 kg (1115 lb) counterweight, Balderson lumber/log fork with 1220 mm (48") tines (1750 kg (3858 lb) combined weight). Total operating weight, 10 655 kg (23,490 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

	Change in Operating Weight	Change in Articulated Static Tipping Load Level
Without ROPS canopy and cab (platform only)	−418 kg (− 922 lb)	−285 kg (−628 lb)
Without cab (ROPS/ platform)	−207 kg (−456 lb)	−141 kg (−311 lb)

926E with Craig Log Fork



CAPACITY IN FULL TURN

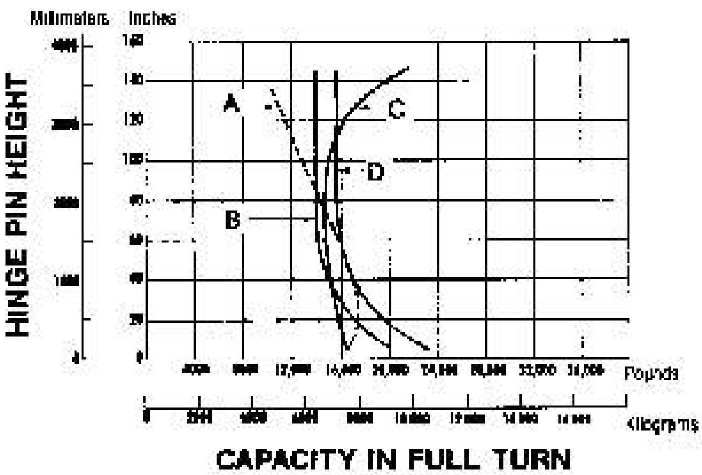
KEY
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 40° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

Curves and operating weight are based on machine equipped with 17.5-25, 12 PR (L-2) tires, 506 kg (1115 lb) counterweight, full fuel tank, operator, Craig log fork with 1220 mm (48") tines and top clamp (1086 kg (2394 lb) combined weight). Total operating weight, 9991 kg (22,026 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

	Change in Operating Weight	Change in Articulated Static Tipping Load Level
Without ROPS canopy and cab (platform only)	−418 kg (−922 lb)	−263 kg (−580 lb)
Without cab (ROPS/ platform)	−207 kg (−456 lb)	−131 kg (−289 lb)

NOTE: Logging forks and top clamps are not available from Caterpillar. Other manufacturers supply these attachments through Caterpillar Dealers.

936F with Weldco-Beales Tree Length Fork

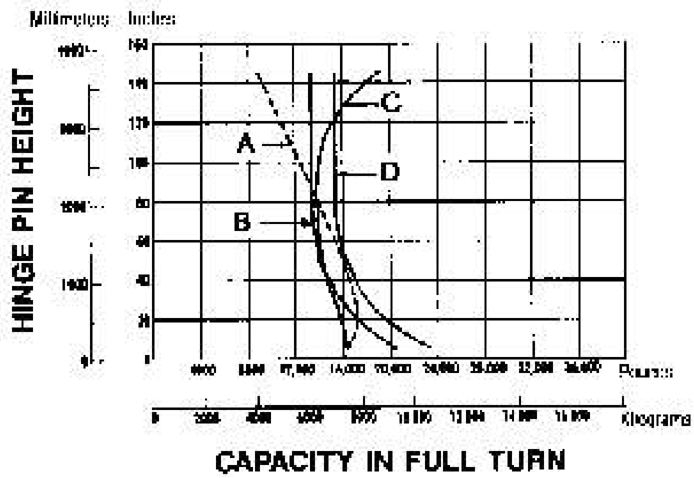


KEY
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 40° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

Curves and operating weight are based on machine equipped with 20.5-25, 16 PR (L-2) tires, 352 kg (776 lb) counterweight, 819 kg (1806 lb) ballast in rear tires, full fuel tank, operator, Weldco FLT 52-85 log fork with 1320 mm (52") tines and top clamp (1352 kg (2980 lb) combined weight). Total operating weight, 13 470 kg (29,696 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

	Change in Operating Weight	Change in Articulated Static Tipping Load Level
Without ROPS canopy and cab (platform only)	−353 kg (−778 lb)	−241 kg (−531 lb)
Without cab (ROPS/platform)	−151 kg (−333 lb)	−103 kg (−227 lb)

936F with Balderson Millyard Fork



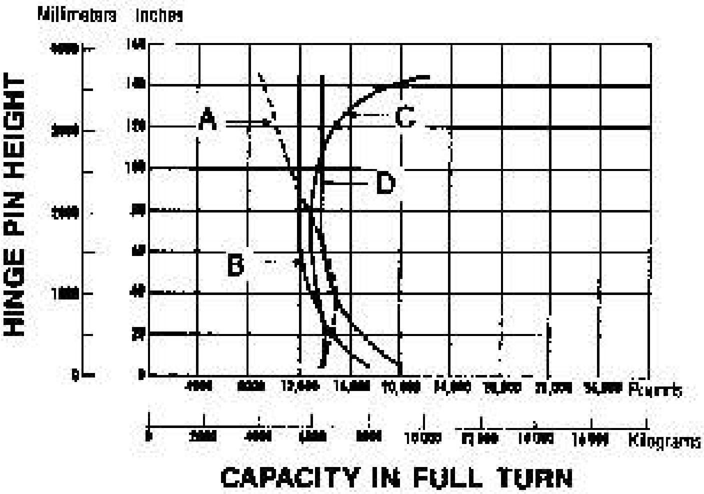
KEY
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 40° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

Curves and operating weight are based on machine equipped with 20.5-25, 16 PR (L-2) tires, 352 kg (776 lb) iron counterweight, 819 kg (1806 lb) ballast in rear tires, full fuel tank, operator, Balderson BMV936 log fork with 1372 mm (54") tines and top clamp (1625 kg (3580 lb) combined weight). Total operating weight, 13 774 kg (30,366 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

	Change in Operating Weight	Change in Articulated Static Tipping Load Level
Without ROPS canopy and cab (platform only)	−353 kg (−778 lb)	−246 kg (−542 lb)
Without cab (ROPS/platform)	−151 kg (−333 lb)	−105 kg (−232 lb)

Load Capacity Curves
- 936F — 1676 mm (66") tines
- 950F — 1400 mm (54") tines

936F with Medford Peeler Block Fork

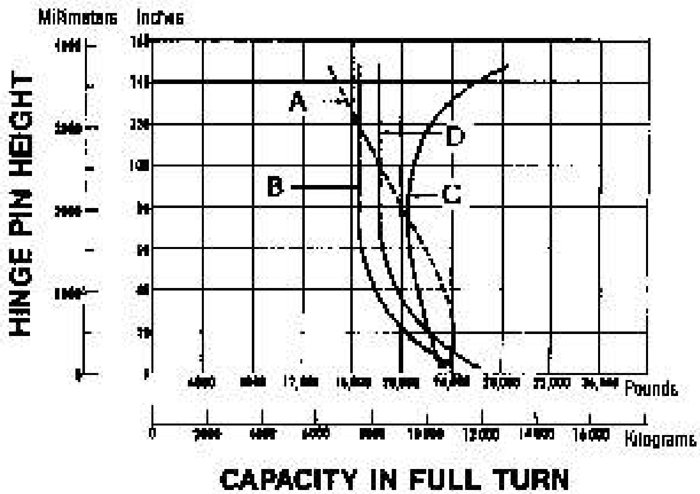


KEY
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 40° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

Curves and operating weight are based on machine equipped with 20.5-25, 16 PR (L-2) tires, 352 kg (776 lb) iron counterweight, 819 kg (1806 lb) ballast in rear tires, full fuel tank, operator, Medford 14J1100 Peeler Block fork with 1676 mm (66") tines and top clamp (1860 kg (4100 lb) combined weight). Total operating weight 13 980 kg (30,817 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

	Change in Operating Weight	Change in Articulated Static Tipping Load Level
Without ROPS canopy (platform) only)	−353 kg (−788 lb)	−223 kg (−492 lb)
Without cab (ROPS/ platform)	−151 kg (−333 lb)	−96 kg (−211 lb)

950F with Medford Log Fork

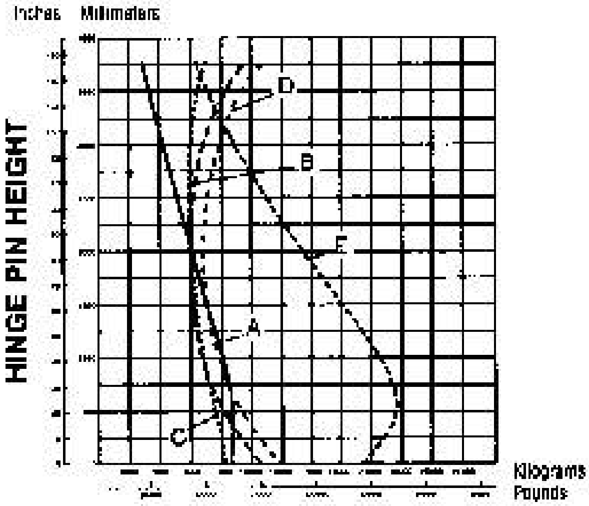


KEY
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 35° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

Curves and operating weight are based on machine equipped with 20.5-25, 20 PR (L-3) tires, 734 kg (1618 lb) iron counterweight, 805 kg (1775 lb) ballast in rear tires, full fuel tank, operator, Medford 30J80 Series log fork with 1400 mm (54") tines and top clamp (1720 kg (3791 lb) combined weight). Total operating weight, 17 263 kg (37,979 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

	Change in Operating Weight	Change in Articulated Static Tipping Load Level
Without ROPS canopy and cab	−559 kg (−1233 lb)	−350 kg (−772 lb)
Without cab	−232 kg (−511 lb)	−150 kg (−331 lb)
Without ROPS canopy only	−327 kg (−721 lb)	−200 kg (−441 lb)

950F with Balderson Log Fork



CAPACITY IN FULL TURN

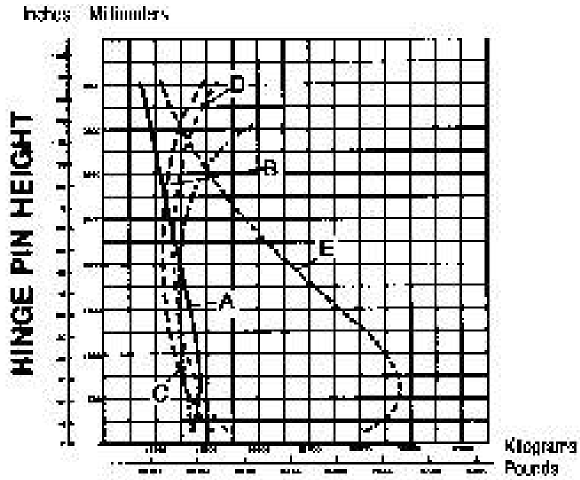
KEY

A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 35° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level
E — Hydraulic Tilt Capacity Fork Level

Curves and operating weight on chart are based on machine equipped with 23.5-25, 16 PR (L-3) tires, counterweight, 1244 kg (2743 lb) ballast in rear tires, full fuel tank, operator, Balderson 8961C2 (BLF 950 ED TC) log fork with 1416 mm (55.7") tines and top clamp, 2018 kg (4450 lb) combined weight. Total operating weight, 18 190 kg (40,100 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar dealer for additional information.

	Change in Operating Weight	Change in Tip Load
Remove ROPS canopy and cab	−576 kg (−1270 lb)	−336 kg (−741 lb)
Remove cab only	−249 kg (−549 lb)	−209 kg (−461 lb)
Remove ROPS canopy only	−327 kg (−721 lb)	−127 kg (−280 lb)
Remove rear tire ballast	−1244 kg (−2743 lb)	— —

966F with Balderson Log Fork



CAPACITY IN FULL TURN

KEY

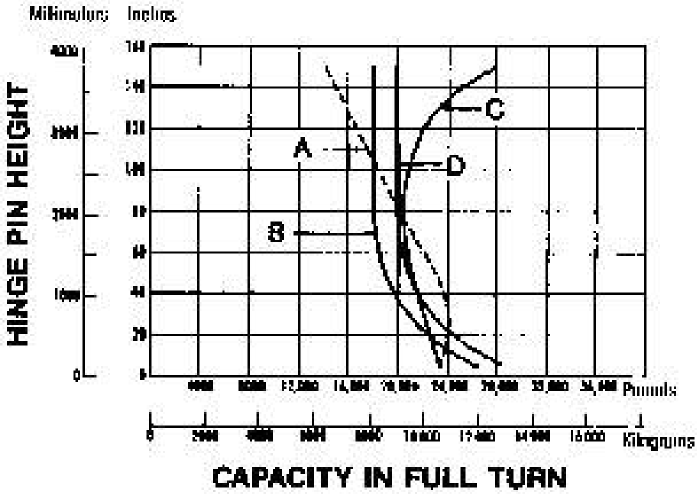
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 35° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level
E — Hydraulic Tilt Capacity Fork Level

Curves and operating weight on chart are based on machine equipped with 26.5-25, 20 PR (L-3) tires, counterweight, 1380 kg (3042 lb) ballast in rear tires, full fuel tank, operator, Balderson 5831C1 (BMY-966D) log fork with 1676 mm (66") tines and top clamp, 2313 kg (5100 lb) combined weight. Total operating weight, 22 966 kg (50,630 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar dealer for additional information.

	Change in Operating Weight	Change in Tip Load
Remove ROPS canopy and cab	−558 kg (−1230 lb)	−415 kg (−914 lb)
Remove cab only	−232 kg (−512 lb)	−148 kg (−327 lb)
Remove ROPS canopy only	−326 kg (−719 lb)	−267 kg (−587 lb)
Remove rear tire ballast	−1242 kg (−2738 lb)	— —

Load Capacity Curves
- 950F — 1400 mm (54") tines (Larger Tires)
- 966F — 1600 mm (63") tines (Larger Tires)

950F with Medford Log Fork

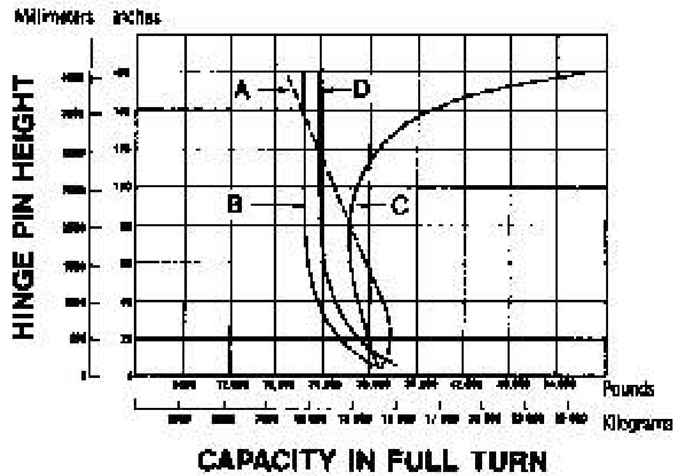


KEY
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 35° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

Curves and operating weight are based on machine equipped with 23.5-25, 16 PR (L-3) tires, 558 kg (1230 lb) counterweight, 1244 kg (2743 lb) ballast in rear tires, full fuel tank, operator, Medford 30J60 Series log fork with 1400 mm (54") tines and top clamp (1720 kg (3791 lb) combined weight). Total operating weight, 17 520 kg (38,544 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

	Change in Operating Weight	Change in Articulated Static Tipping Load Level
Without ROPS canopy	−559 kg (−1233 lb)	−350 kg (−772 lb)
Without cab	−232 kg (−511 lb)	−150 kg (−331 lb)
Without ROPS canopy only	−327 kg (−721 lb)	−200 kg (−441 lb)

966F with Medford Log Fork

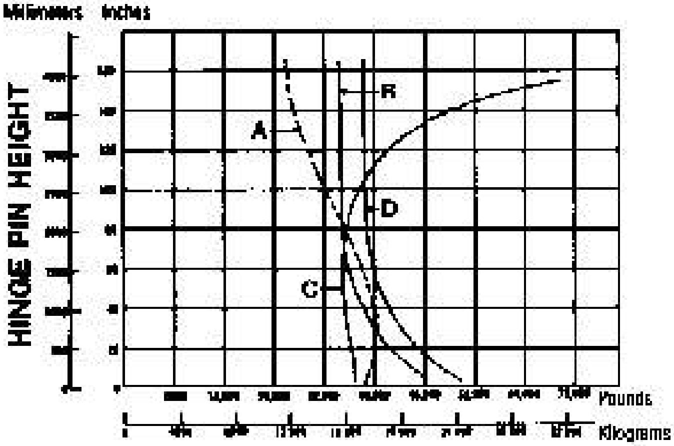


KEY
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 35° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

Curves and operating weight are based on machine equipped with 26.5-25, 20 PR L-3 tires, 768 kg (1693 lb) counterweight, 1380 kg (3042 lb) ballast in rear tires, full fuel tank, operator, Medford 42J100 Series log fork with 1600 mm (63") tines and top clamp (2100 kg (4628 lb) combined weight). Total operating weight 22 803 kg (50,281 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

	Change in Operating Weight	Change in Articulated Static Tipping Load Level
Without ROPS canopy and cab	−558 kg (−1230 lb)	−415 kg (−914 lb)
Without cab	−232 kg (−511 lb)	−148 kg (−327 lb)
Without ROPS canopy only	−326 kg (−719 lb)	−267 kg (−587 lb)

980F with Medford Log Fork



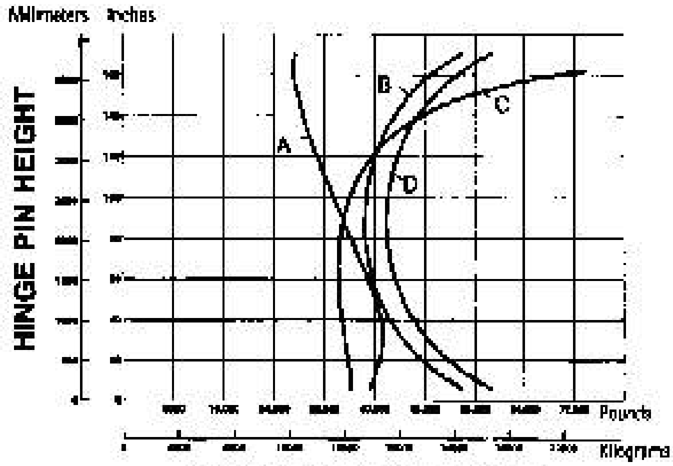
CAPACITY IN FULL TURN

KEY
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 35° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

Curves based on machine with full fuel tank, operator, ROPS cab, 29.5-25, 22 PR L-3 tires, with 1940 kg (4278 lb) ballast in rear tires, 3292 kg (7257 lb) counterweight, Medford log forks with 1830 mm (72") tines and top clamp (2477 kg (5460 lb) combined weight). Total operating weight, 31 105 kg (68,571 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

	Change in Operating Weight	Change in Articulated Static Tipping Load Level
Without ROPS canopy	−671 kg (−1480 lb)	−411 kg (−906 lb)
Without cab	−232 kg (−511 lb)	−126 kg (−277 lb)

980F with Balderson Millyard Fork



CAPACITY IN FULL TURN

KEY
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 35° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

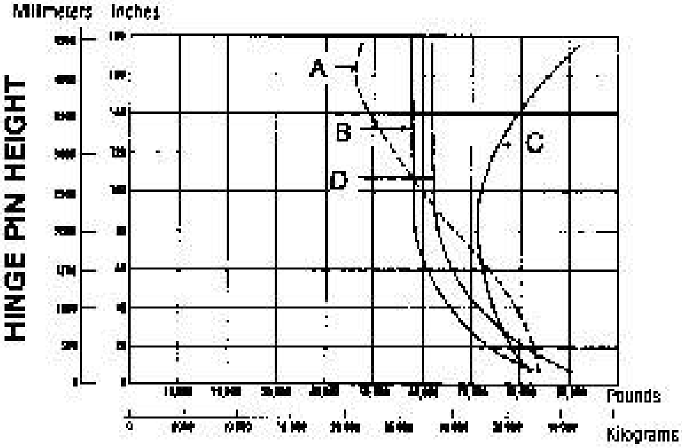
Curves based on machine with full fuel tank, operator, ROPS cab, 29.5-25, 22 PR L-3 tires, with 1940 kg (4278 lb) ballast in rear tires, 3292 kg (7257 lb) counterweight, Balderson Millyard forks with 1830 mm (72") tines and top clamp (3107 kg (6850 lb) combined weight). Total operating weight, 32 847 kg (71,491 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

	Change in Operating Weight	Change in Articulated Static Tipping Load Level
Without ROPS canopy	−758 kg (−1671 lb)	−411 kg (−906 lb)
Without cab	−232 kg (−511 lb)	−126 kg (−277 lb)

20

Load Capacity Curves
- 988B — 2290 mm (90") tines
- IT12B

988B with Medford Log Fork



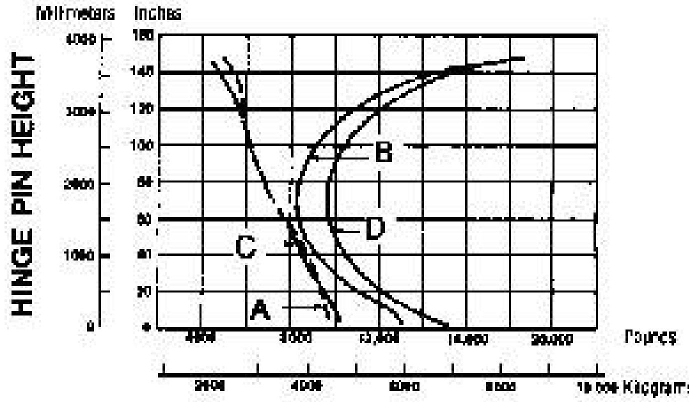
CAPACITY IN FULL TURN

KEY
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 30° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

Curves based on machine with full fuel tank, operator, ROPS, 35/65-33, 30 PR L-4 tires, with 2677 kg (5900 lb) ballast in rear tires, 5685 kg (12,530 lb) counterweight, Medford log fork with 2290 mm (90") tines and top clamp (4349 kg (9585 lb) combined weight). Total operating weight, 49 738 kg (109,623 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

	Change In Operating Weight	Change In Articulated Static Tipping Load	
		Racked	Level
Without ROPS canopy	−894 kg (−1970 lb)	−687 kg (−1514 lb)	−551 kg (−1214 lb)

IT12B with Balderson Log Fork

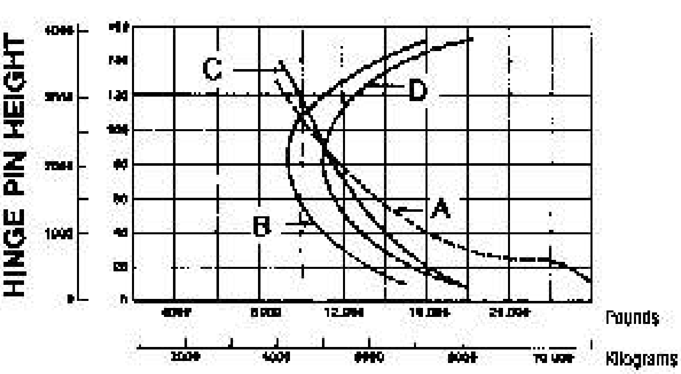


CAPACITY IN FULL TURN

KEY
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 40° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

Curves and operating weight are based on machine equipped with 15.5 x 25, 8PR (L-2) tires, 274 kg (603 lb) counterweight, full fuel tank, 80 kg (176 lb) operator, Balderson lumber and log fork with 1220 mm (48") tines and full width top clamp weighing 1220 kg (2690 lb). Total operating weight 8775 kg (19,305 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

IT18B with Balderson Log Fork



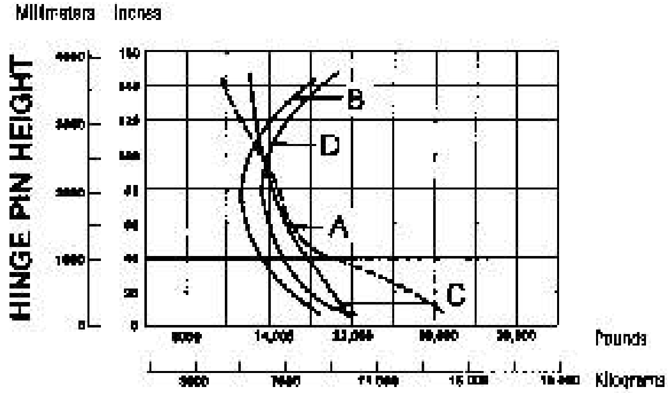
CAPACITY IN FULL TURN

KEY

A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 40° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

Curves and operating weight are based on machine equipped with 17.5 x 25, 12 PR (L-2) tires, 500 kg (1100 lb) counterweight, 524 kg (1153 lb) ballast in rear tires, full fuel tank, 80 kg (176 lb) operator, Balderson lumber and log fork with 1220 mm (48") tines and full width top clamp weighing 1200 kg (2650 lb). Total operating weight 10 374 kg (22,823 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

IT28B with Balderson Log Fork



CAPACITY IN FULL TURN

KEY

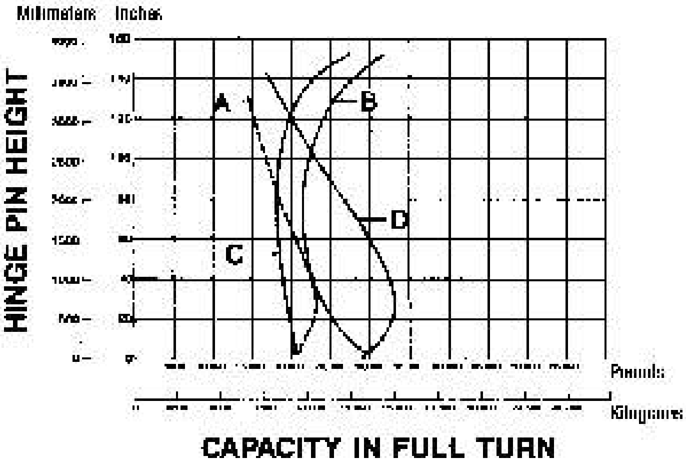
A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Full 40° Turn Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Static Tipping Load Machine Straight Fork Level

Curves and operating weight are based on machine equipped with 17.5 x 25, 12 PR (L-2) tires, 500 kg (1100 lb) counterweight, 524 kg (1153 lb) ballast in rear tires, full fuel tank, 80 kg (176 lb) operator, Balderson lumber and log fork with 1220 mm (48") tines and full width top clamp weighing 1200 kg (2650 lb). Total operating weight 11 103 kg (24,427 lb). Forks of other dimensions or weight may affect machine capacity. Consult your Caterpillar Dealer for additional fork data.

Load Capacity Curves

- 963 — 1400 mm (54") tines
- 973 — 1600 mm (63") tines

963 with Medford Log Fork

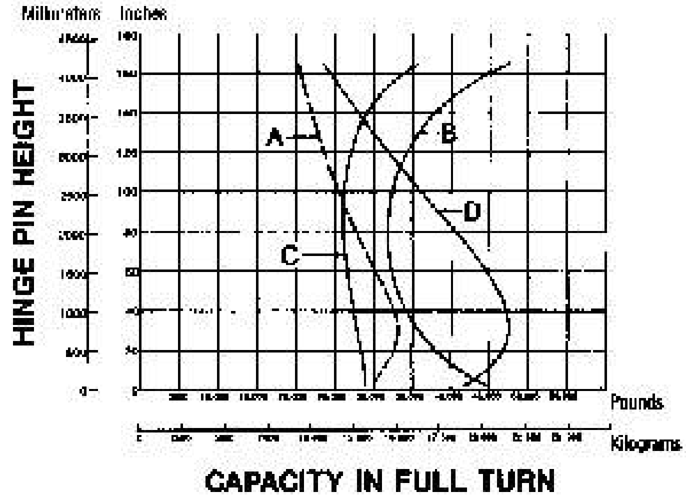


KEY

A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Tilt Capacity Fork Level

Curves based on machine with full fuel tank, operator, no ROPS or cab, 1850 mm (72.8") wide gauge, 1130 kg (2500 lb) counterweight and Medford log fork with 1400 mm (54") tines. Consult your Caterpillar Dealer for additional information.

973 with Medford Log Fork



KEY

A — Hydraulic Lift Capacity Fork Racked
B — Static Tipping Load Fork Level
C — Hydraulic Lift Capacity Fork Level
D — Tilt Capacity Fork Level

Curves based on machine with full fuel tank, operator, ROPS cab, standard gauge, 2410 kg (5310 lb) counterweight and Medford log fork with 1600 mm (63") tines. Consult your Caterpillar Dealer for additional information.

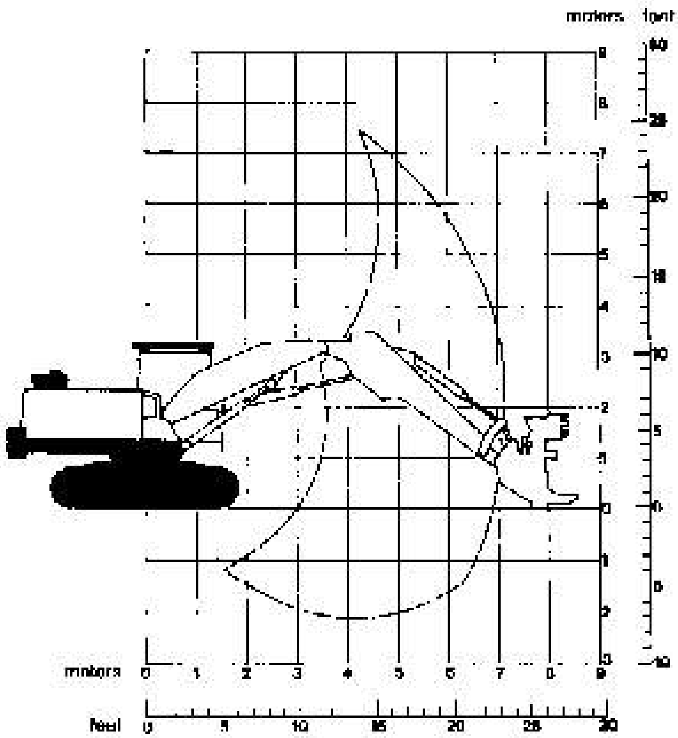


MODEL	FB227		EL200B		E110B	
Flywheel Power	101 kW	135 HP	101 kW	135 HP	59 kW	79 HP
Operating weight*	31 746 kg	69,892 lb	25 864 kg	57,020 lb	16 636 kg	30,000 lb
Engine Model	3208		3116T		3114	
Rated Engine RPM	2000		2200		1800	
No. of Cylinders	8		6		4	
Bore	114 mm	4.5"	105 mm	4.1"	105 mm	4.1"
Stroke	127 mm	5"	127 mm	5"	127 mm	5"
Displacement	10.4 L	636 in^3	6.6 L	403 in^3	4.4 L	268 in^3
Hydraulic Pump Output @ rated Engine RPM	2 x 210 L/min	2 x 55.5 gpm	2 x 178 L/min	2 x 47 gpm	2 x 107 L/min	2 x 28 gpm
Main Relief Valve Settings:						
Implement Circuits	24 800 kPa	3600 psi	31 350 kPa	4550 psi	27 460 kPa	3980 psi
Travel Circuits	28 958 kPa	4200 psi	31 350 kPa	4550 psi	29 420 kPa	4270 psi
Swing Circuit	17 237 kPa	2500 psi	23 010 kPa	3340 psi	23 050 kPa	3340 psi
Pilot Circuit	2310 kPa	335 psi	2960 kPa	430 psi	3430 kPa	500 psi
Head Circuit	19 305 kPa	2800 psi	20 000 kPa	2900 psi	20 000 kPa	2900 psi
Maximum Travel Speed @ Rated RPM	2.6 km/h	1.6 mph	5.0 km/h	3.1 mph	5.0 km/h	3.11 mph
Drawbar Pull	234.7 kN	52,773 lb	169.5 kN	38,100 lb	86 kN	19,333 lb
Width of Standard Shoe	710 mm	28"	800 mm	32"	500 mm	20"
Ground Contact Area	5.49 m^2	8503 in^2	6.07 m^2	9400 in^2	2.86 m^2	4430 in^2
Ground Pressure	56.8 kPa	8.11 psi	37.86 kPa	5.46 psi	31.0 kPa	4.5 psi
Maximum Reach to Center of Head	8.84 m	29'0"	7.72 m	25'4"	7.3 m	23'11"
Minimum Reach to Center of Head	5.24 m	17'2"	3.65 m	12'0"	3.5 m	11'4"
Fuel Tank Capacity	400 L	105 U.S. gal	280 L	74 U.S. gal	250 L	66 U.S. gal
General Dimensions:						
Overall Track Length	4.55 m	14'11"	4445 mm	14'7"	3320 mm	10'11"
Overall Length	11.883 m	39'0"	10.40 m	34'1"	9.44 m	31'10"
Overall Width	3.353 m	11'0"	3251 mm	10'8"	—	
Height to top of ROPS	3.476 m	11'5"	3.12 m	10'3"	3.02 m	9'11"
Ground Clearance	593 mm	23.35"	636 mm**	25"**	466 mm	18.3"

FB227 Custom 180 with 180 HP available.

*Includes lubricants, coolant, fuel, operator, standard triple grouser shoes, boom, arm and felling head.
**Includes high/wide carbody option.

20



Note: Range diagram (above) shows envelope traced by pin at the end of the arm. Maximum reach to center of blades is 8.84 m (29'0"). Minimum reach to center of blades is 5.24 m (17'2").

Lift Capacity — Over Front
Radius of Load from Swing Centerline

Minimum Reach		Maximum Reach	
Without Head At Arm Pin	With Head C/L Tree	Without Head At Arm Pin	With Head C/L Tree
12 163 kg **26,816 lb***	3453 kg **7,612 lb***	5230 kg **11,531 lb***	2005 kg **4,420 lb***

Lift Capacity — Over Side
Radius of Load from Swing Centerline

Minimum Reach		Maximum Reach	
Without Head At Arm Pin	With Head C/L Tree	Without Head At Arm Pin	With Head C/L Tree
12 163 kg **26,816 lb***	3453 kg **7,612 lb***	5230 kg **11,531 lb***	2005 kg **4,420 lb***

*Load limited by hydraulic capacity rather than tipping.

Note: Arm pin ratings are compatible with Power Crane and Shovel Association — Standard No. 3. All rated loads do not exceed 87% of hydraulic capacity or 75% of tipping.

Features (231D LC):

- **Log Loading Front** — Provides 11.6 m (38') horizontal reach. Hydraulic cylinder locations offer additional application versatility by providing a wider working range and higher lift capabilities.
- **Elevated Logging Cab** — One piece cab and riser with reverse slope windshield and integral overhead guard elevates the operator platform 1220 mm (48") for optimum visibility.
- **Machine Guarding** — Includes heavy duty walkways, featuring wrap around bottom house guards, heavy duty track motor guards, heavy duty swivel guard, and full length ski-type, shoe support track roller guards.
- **Fuel Tank** — Large 720 liter (190 U.S. gallon) capacity (approx.) to reduce refueling in multiple-shift operations and remote locations. Provides approximately 25 hours of operation without refueling.

MODEL	231D LC Log Loader	
Flywheel Power	149 kW	200 HP
Operating weight*	39 460 kg	87,000 lb
Engine Model	3208	
Rated Engine RPM	2200	
No. of Cylinders	8	
Bore	114 mm	4.5"
Stroke	127 mm	5.0"
Displacement	10.4 L	636 in³
Hydraulic Pump Output @ rated Engine RPM	2 × 229 L/min	2 × 60.5 gpm
Main Relief Valve Settings:		
Implement Circuits	29 650 kPa	4300 psi
Travel Circuits	32 100 kPa	4600 psi
Swing Circuit	16 203 kPa	2350 psi
Pilot Circuit	2310 kPa	335 psi
Maximum Travel Speed @ Rated RPM	5.5 km/h	3.4 mph
Width of Standard Shoe	711 mm	28"
Ground Contact Area	5.49 m²	8510 in²
Ground Pressure	70.3 kPa	10.2 psi
Fuel Tank Capacity	720 L	190 U.S. gal
General Dimensions:		
Overall Track Length	5.23 m	17'2"
Overall Length	14.68 m	48'2"
Overall Width	3.78 m	12'6"
Height to top of ROPS**	4.60 m	15'1.26"
Ground Clearance	580 mm	22.7"

*Includes base machine, full fuel tank, operator, log loader arrangement and grapple.
**With 1220 mm (48") cab riser.

LIFT CAPACITY FOR TC 52 HP

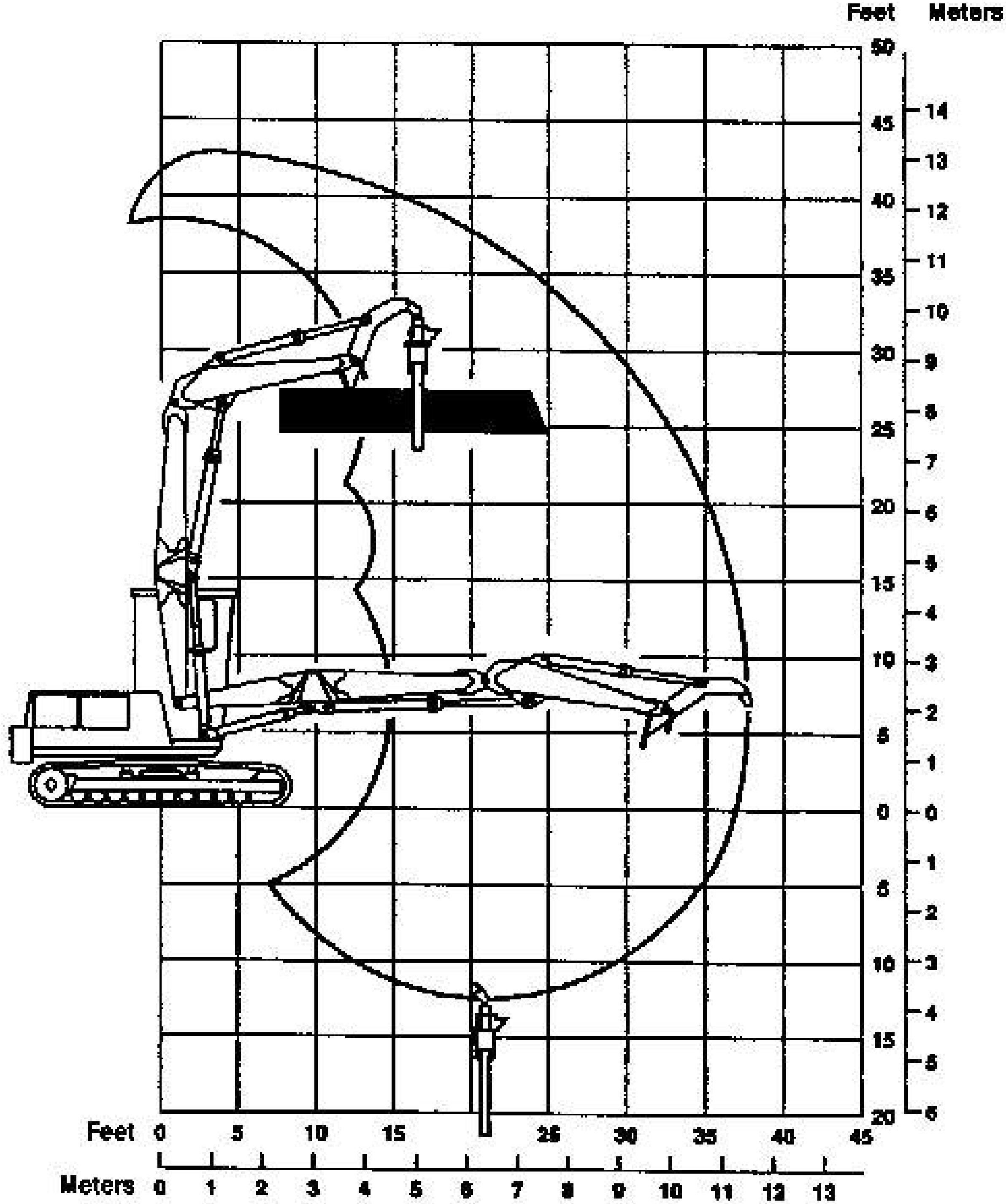
1. Capacities are based on machine equipped as follows:
   - 29,649 kPa (**4300 psi**) operating pressure
   - 165 mm (**6.5" dia.**) boom hoist cylinder
   - Material handler adjustable wide carbody
   - 5690 kg (**12,540 lb**) total counterweight
   - 39 460 kg (**87,000 lb**) total machine weight (approx.)
   - 711 mm (**28"**) double-grouser track shoes
   - Guarding package
2. Capacities are gross figures, weight of grapple must be subtracted.
3. Capacities shown are based on SAE standard J1097. Rated loads do not exceed 87% of hydraulic lifting capacity or 75% of tipping capacity.

TC 52 HP for 231D LC Excavator**

LOAD POINT HEIGHT		LOAD RADIUS 3.0 m/10.0 ft		4.6 m/15.0 ft		6.1 m/20.0 ft		7.6 m/25.0 ft		9.1 m/30.0 ft		10.7 m/35.0 ft	
		OVER FRONT	OVER SIDE	OVER FRONT	OVER SIDE	OVER FRONT	OVER SIDE	OVER FRONT	OVER SIDE	OVER FRONT	OVER SIDE	OVER FRONT	OVER SIDE
12.2 m	kg	19 660*	19 660*	13 880*	13 880*								
40.0 ft	lb	**43,340***	**43,340***	**30,610***	**30,610***								
10.7 m	kg			12 620*	12 620*	10 480*	10 480*						
35.0 ft	lb			**27,820***	**27,820***	**23,100***	**23,100***						
9.1 m	kg			11 930*	11 930*	9920*	9920*	8930*	8160				
30.0 ft	lb			**26,310***	**26,310***	**21,870***	**21,870***	**19,680***	**18,000**				
7.6 m	kg			11 980*	11 980*	9840*	9840*	8830*	7360	7880*	6050		
25.0 ft	lb			**26,400***	**26,400***	**21,690***	**21,690***	**19,470***	**16,230**	**17,380***	**13,300**		
6.1 m	kg			9220*	9220*	10 350*	10 350*	9030*	8260	7980*	6000	6850*	4620
20.0 ft	lb			**20,330***	**20,330***	**22,810***	**22,810***	**19,910***	**18,200**	**17,590***	**13,220**	**15,100***	**10,190**
4.6 m	kg			8550*	8550*	11 290*	11 290*	9470*	8110	8110*	5960	6830*	4600
15.0 ft	lb			**18,840***	**18,840***	**24,900***	**24,900***	**20,880***	**17,880**	**17,880***	**13,150**	**15,060***	**10,140**
3.0 m	kg			13 880*	13 880*	12 400*	11 190	9970*	7870	8260*	5870	6740*	4550
10.0 ft	lb			**30,610***	**30,610***	**27,340***	**24,670**	**21,970***	**17,350**	**18,200***	**12,930**	**14,850***	**10,030**
1.5 m	kg			17 440*	16 900	13 190*	10 670	10 270*	7620	8230*	5750	6450*	4510
5.0 ft	lb			**38,450***	**37,250**	**29,080***	**23,530**	**22,640***	**16,790**	**18,150***	**12,670**	**14,210***	**9940**
Ground	kg			11 680*	11 680*	13 200*	10 280	10 110*	7410	7830*	5650	5800*	4490
Line	lb			**25,760***	**25,760***	**29,090***	**22,670**	**22,280***	**16,340**	**17,260***	**12,450**	**12,780***	**9890**
−1.5 m	kg	3180*	3180*	6900*	6900*	12 140*	10 090	9220*	7300	6920*	5610	4480*	4480*
−5.0 ft	lb	**7010***	**7010***	**15,210***	**15,210***	**26,770***	**22,240**	**20,330***	**16,090**	**15,260***	**12,370**	**9870***	**9870***
−3.0 m	kg			13 300*	13 300*	10 460*	10 010	7960*	7250				
−10.0 ft	lb			**29,320***	**29,320***	**23,060***	**22,070**	**17,540***	**15,980**				

*Indicates the load is limited by hydraulic capacity rather than tipping capacity.
**231D Equipped with:
LC Undercarriage 5230 mm (17'2")
Gauge 2997 mm (9'10")

RANGE DIAGRAM FOR TC 52 HP ON CAT 231D LC



Features (235D LC):

- **Log Loading Front** — Provides 14 m (46') horizontal reach. Hydraulic cylinder locations offer additional application versatility by providing a wider working range and higher lift capabilities.
- **Elevated Logging Cab** — One piece cab and riser with reverse slope windshield and integral overhead guard elevates the operator platform 1220 mm (48") for optimum visibility.
- **Machine Guarding** — Includes heavy duty walkways, featuring wrap around bottom house guards, heavy duty track motor guards, heavy duty swivel guard, and full length ski-type, shoe support track roller guards.
- **Fuel Tank** — Large 1135 liter (300 U.S. gallon) capacity to reduce refueling in multiple shift operations and remote locations. Provides approximately 25 to 30 hours of operation without refueling.

MODEL	235D LC Log Loader	
Flywheel Power	186.5 kW	250 HP
Operating weight*	55 112 kg	121,500 lb
Engine Model	3306	
Rated Engine RPM	2000	
No. of Cylinders	6	
Bore	121 mm	4.75"
Stroke	152 mm	6.0"
Displacement	10.5 L	638 in³
Hydraulic Pump Output @ rated Engine RPM	2 × 360 L/min	2 × 95 gpm
Main Relief Valve Settings:		
Implement Circuits	29 660 kPa	4300 psi
Travel Circuits	32 100 kPa	4800 psi
Swing Circuit	16 203 kPa	2350 psi
Pilot Circuit	2310 kPa	335 psi
Maximum Travel Speed @ Rated RPM	3.5 km/h	2.2 mph
Width of Standard Shoe	760 mm	30"
Ground Contact Area	6.6 m²	10,230 in²
Ground Pressure	81.4 kPa	11.8 psi
Fuel Tank Capacity	1135 L	300 U.S. gal
General Dimensions:		
Overall Track Length	5.03 m	16'6"
Overall Length	17.55 m	57'9"
Overall Width	3.61 m	11'10"
Height to top of ROPS**	4.67 m	15'4"
Ground Clearance	559 mm	22"

*Includes base machine, full fuel tank, operator, log loader arrangement and grapple.
**With 1220 mm (48") cab riser.

LIFT CAPACITY FOR TC 60 HP

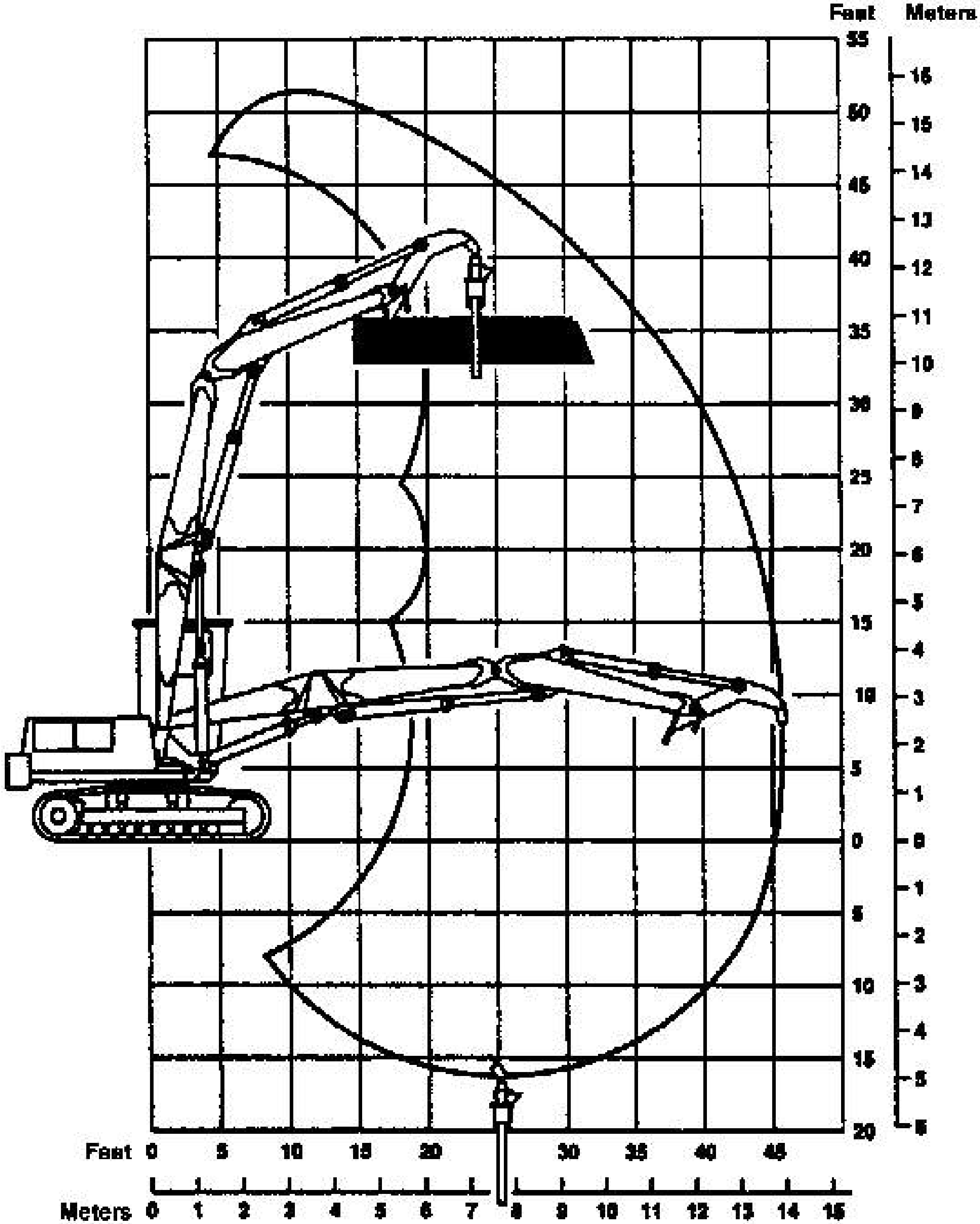
1. Capacities are based on machine equipped as follows:
   - 29,649 kPa (4300 psi) operating pressure
   - 184 mm (7.25" dia.) boom hoist cylinder
   - Material handler adjustable wide carbody
   - 9980 kg (22,000 lb) total counterweight
   - 64 092 kg (119,250 lb) machine weight without grapple
   - 760 mm (30") double-grouser track shoes
   - Guarding package
2. Capacities are gross figures, weight of grapple must be subtracted.
3. Capacities shown are based on SAE standard J1097. Rated loads do not exceed 87% of hydraulic lifting capacity or 75% of tipping capacity.

TC 60 HP for 235D LC Excavator**

LOAD POINT HEIGHT		LOAD RADIUS															
		3.0 m/10.0 ft		4.6 m/15.0 ft		6.1 m/20.0 ft		7.6 m/25.0 ft		9.1 m/30.0 ft		10.7 m/35.0 ft		12.2 m/40.0 ft		13.7 m/45.0 ft	
		OVER FRONT	OVER SIDE	OVER FRONT	OVER SIDE	OVER FRONT	OVER SIDE	OVER FRONT	OVER SIDE	OVER FRONT	OVER SIDE	OVER FRONT	OVER SIDE	OVER FRONT	OVER SIDE	OVER FRONT	OVER SIDE
15.2 m	kg	28 290*	28 290*	16 850*	16 850*												
50.0 ft	lb	62,370*	62,370*	37,140*	37,140*												
13.7 m	kg			22 600*	22 600*	15 670*	15 670*	11 410*	11 410*								
45.0 ft	lb			49,810*	49,810*	34,540*	34,540*	25,150*	25,150*								
12.2 m	kg					17 030*	17 030*	14 120*	13 530	10 890*	9950						
40.0 ft	lb					37,540*	37,540*	31,120*	29,830	24,000*	21,930						
10.7 m	kg					23 700	19 500	13 890*	13 760	12 070	10 000	9300	7660				
35.0 ft	lb					52,250	43,000	30,630*	30,340	26,610	22,040	20,510	16,880				
9.1 m	kg					14 410*	14 410*	13 760*	13 760*	12 170	10 090	9290	7650	8250*	6040		
30.0 ft	lb					31,770*	31,770*	30,340*	30,340*	26,830	22,250	20,490	16,870	18,180*	13,310		
7.6 m	kg					11 400*	11 400*	13 000*	13 000*	12 070	10 080	9230	7580	7370	6010		
25.0 ft	lb					25,130*	25,130*	28,650*	28,650*	26,620	22,220	20,340	16,720	16,250	13,250		
6.1 m	kg					8650*	8650*	13 010*	13 010*	11 990	9920	9190	7540	7300	5940		
20.0 ft	lb					19,070*	19,070*	28,680*	28,680*	26,440	21,870	20,260	16,630	16,090	13,100		
4.6 m	kg					10 810*	10 810*	14 540*	13 000	11 710	9640	9050	7410	7200	5850	5950	4790
15.0 ft	lb					23,830*	23,830*	32,050*	28,670	25,810	21,260	19,950	16,340	15,870	12,890	13,120	10,570
3.0 m	kg					17 120*	17 120*	15 150	12 400	11 360	9310	8860	7230	7100	5750	5910	4750
10.0 ft	lb					37,740*	37,740*	33,390	27,340	25,040	20,520	19,540	15,940	15,650	12,670	13,020	10,480
1.5 m	kg					20 920*	16 910	14 540	11 820	11 010	8970	8670	7040	7020	5670	5840	4720
5.0 ft	lb					46,130*	37,270	32,050	26,050	24,280	19,780	19,120	15,530	15,470	12,490	12,880	10,410
Ground line	kg					19 860	15 890	14 060	11 360	10 730	8700	8520	6890	6960	5620	5860	4710
	lb					43,780	35,030	30,990	25,040	23,660	19,180	18,780	15,200	15,350	12,380	12,930	10,390
−1.5 m	kg					15 700*	15 300	13 770	11 080	10 550	8520	8430	6810	6950	5610		
−5.0 ft	lb					34,600*	33,730	30,360	24,430	23,260	18,790	18,580	15,010	15,330	12,360		
−3.0 m	kg	3300*	3300*	5680*	5680*	14 300*	14 300*	13 310*	10 990	10 490	8460	8410	6790	6450*	5590		
−10.0 ft	lb	7280*	7280*	12,520*	12,520*	31,530*	31,530*	29,340*	24,220	23,120	18,650	18,530	14,970	14,220*	12,330		
−4.6 m	kg					14 620*	14 620*	11 640*	10 840	9260*	8400						
−15.0 ft	lb					32,240*	32,240*	25,660*	23,890	20,420*	18,510						

*Indicates the load is limited by hydraulic capacity rather than tipping capacity.
**235D Equipped with:
LC Undercarriage 5230 mm (17'2")
Gauge 3269 mm (10'9")

RANGE DIAGRAM FOR TC 60 HP ON CAT 235D LC



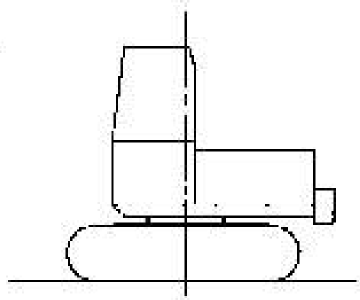
Lift Capacity For Pierce Model HLB-15/32

1. Capacities are based on:
   - 100% Stability Governed by:
     H = Hoist Cyl. (2) — 139.7 mm (5.5 in) Dia.
     S = Stick Cyl. (1) — 152.4 mm (6.0 in) Dia.
     *Stability over End
     **Stability over Side
2. Hydraulic Pressure — 31 349.5 kPa (4550 psi)
3. Efficiency = 100%
4. Reach from C/L of Rotation = 9.6 m (31 ft 7 in)
5. Counterweight is Caterpillar 3708 kg (8159 lb) with 1860.8 kg (8000 lb) Added — total = 5061.7 kg (11,159 lb)
6. Level Log Height, Ground to the C/L of log 609.6 mm (24 in dia) = 7.5 m (24 ft 9.5 in)
7. Estimated Weight As a Logger (Grapple not included) 22 906.8 kg (50,500 lb)

PIERCE MODEL HLB-15/32 For Cat EL200B Excavator

Height	10'	15'	20'	25'	30'
30'–25'		H = 25300 *41300 **25400			
25'–20'		H = 23330 *42390 **26310	H = 20720 *25200 **16160		
20'–15'		S = 23710 *42470 **26380	H = 20630 *25400 **16340	H = 18300 *17240 **11070	
15'–10'		S = 22490 *41700 **25730	H = 21630 *25110 **16080	H = 18600 *17250 **11070	S = 12670 *12660 **8010
10'–5'		S = 28160 *40700 *24480	H = 23150 *24470 **15620	H = 18960 *17010 **10860	H = 15180 *12690 **7940
5'–0'		H = 32530 *36280 **22880	H = 24350 *23700 **14840	H = 19140 *16680 **10550	H = 14380 *12510 **7880
0'–−5'	S = 13800 *82610 **40350	H = 33230 *36820 **21660	H = 24230 *23060 **14270	H = 18350 *16400 **10300	H = 12890 *12480 **7840
−5'–−10'	S = 12670 *82560 **40190	H = 29730 *36210 **21160	H = 21840 *22730 **13900	H = 15880 *16270 **10170	

Calculations, weights and machine models are subject to change without notice.



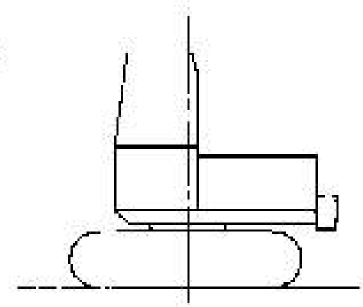
Lift Capacity For Pierce Model HLB-23/35

1. Capacities are based on:
   - 100% Stability Governed by:
     H = Hoist Cyl. (2) — 165.1 mm (6.5 in) Dia.
     S = Stick Cyl. (1) — 165.1 mm (6.5 in) Dia.
     *Stability over End
     **Stability over Side
2. Hydraulic Pressure = 27 394.6 kPa (3976 psi)
3. Efficiency = 100%
4. Reach from C/L of Rotation 10.5 m (34 ft 6 in)
5. Counterweight is Caterpillar 4504 kg (9923 lb) with 1814.4 kg (4000 lb) Added — total — 6315.4 kg (13,923 lb)
6. Level Log Height; Ground to the C/L of log 762 mm (30 in dia) = 7.5 m (24 ft 6.25 in)
7. Estimated Weight As a Logger (Grapple not included) 28 304.6 kg (62,400 lb)

PIERCE MODEL HLB-23/35 For Cat EL240B Excavator

Calculations, weights and machine models are subject to change without notice.

	10'	15'	20'	25'	30'
35'–30'		S-28250 *52070 **34650			
30'–25'			H=23700 *32510 **22260		
25'–20'			H=22870 *33130 **22820	H=21100 *22210 **16260	
20'–15'			H=23600 *32930 **22690	H=21150 *22340 **15380	S=16230 *15980 **10790
15'–10'		S-21640 *54010 **35610	H-25450 *32250 **22030	H-21950 *22050 **15110	H-19200 *16060 **10860
10'–5'		S-34300 *51430 **33420	H-27850 *31070 **20970	H=23020 *21510 **14610	H=18440 *15880 **10690
5'–0'		H=39390 *48180 **30670	H=29860 *29770 **19810	H=23810 *20890 **14040	H=18390 *15620 **10450
0'–-5'		H=41360 *45920 **28750	H=30480 *28730 **18870	H=23720 *20380 **13560	H=18490 *15410 **10260
-5'–-10'	S=11450 *10460 **64380	S=33530 *45080 **28020	H=28890 *28150 **18850	H=22050 *20070 **13290	H=18400 *15310 **10150
-10'–-15'			H-25200 *27670 **17920		



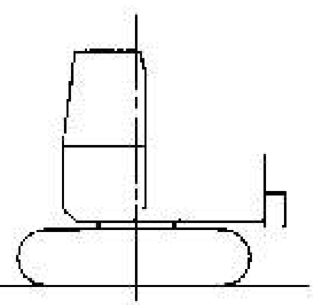
Lift Capacity For Pierce Model HLB-15/32

1. Capacities are based on:
   - 100% Stability Governed by:
     H = Hoist Cyl. (2) — 139.7 mm (5.5 in) Dia.
     S = Stick Cyl. (1) — 152.4 mm (6.0 in) Dia.
     *Stability over End
     **Stability over Side
2. Hydraulic Pressure = 31 349.5 kPa (4550 psi)
3. Efficiency = 100%
4. Reach from C/L of Rotation = 9.6 m (31 ft 7 in)
5. Counterweight is Caterpillar 3708 kg (8159 lb) with 1360.8 kg (3000 lb) Added — total = 5061.7 kg (11,159 lb)
6. Level Log Height; Ground to the C/L of log 609.6 mm (24 in dia) = 7.5 m (24 ft 9.5 in)
7. Estimated Weight As a Logger (Grapple not included) 22 906.8 kg (50,500 lb)

PIERCE MODEL HLB-15/32 For Cat EL200B Excavator

	10′	15′	20′	25′	30′
30′					
25′		H = 25300 *41300 **25400			
20′		H = 23330 *42390 **26310	H = 20720 *25200 **16160		
15′		S = 23710 *42470 **26380	H = 20630 *25400 **16340	H = 18300 *17240 **11070	
10′		S = 22490 *41700 **25730	H = 21630 *25110 **16080	H = 18600 *17250 **11070	S = 12570 *12660 **8010
5′		S = 28160 *40700 **24480	H = 23150 *24470 **15520	H = 18960 *17010 **10860	H = 15180 *12690 **7940
0′		H = 32530 *38280 **22880	H = 24350 *23700 **14840	H = 19140 *18680 **10660	H = 14380 *12510 **7880
−5′	S = 13800 *82810 **40350	H = 33230 *36820 **21860	H = 24230 *23060 **14270	H = 18350 *16400 **10300	H = 12890 *12480 **7840
−10′	S = 12670 *82580 **40190	H = 29730 *36210 **21160	H = 21840 *22730 **13960	H = 15880 *16270 **10170	

Calculations, weights and machine models are subject to change without notice.



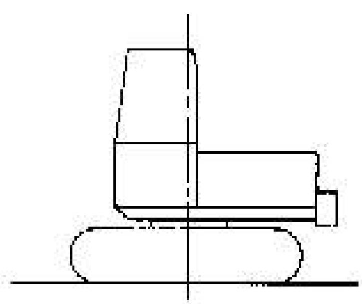
Lift Capacity For Pierce Model HLB-23/35

1. Capacities are based on:
   - 100% Stability Governed by:
     H = Hoist Cyl. (2) — 165.1 mm (6.5 in) Dia.
     S = Stick Cyl. (1) — 165.1 mm (6.5 in) Dia.
     *Stability over End
     **Stability over Side
2. Hydraulic Pressure = 27 394.6 kPa (3976 psi)
3. Efficiency = 100%
4. Reach from C/L of Rotation = 10.5 m (34 ft 6 in)
5. Counterweight is Caterpillar 4504 kg (9923 lb) with 1814.4 kg (4000 lb) Added — total = 6315.4 kg (13,923 lb)
6. Level Log Height: Ground to the C/L of log 762 mm (30 in dia) — 7.5 m (24 ft 6.25 in)
7. Estimated Weight As a Logger (Grapple not included) 28 304.6 kg (62,400 lb)

PIERCE MODEL HLB-23/35 For Cat EL240B Excavator

Calculations, weights and machine models are subject to change without notice.

	10'	15'	20'	25'	30'
35' – 30'		S – 28250 *52870 **34850			
30' – 25'			H = 23700 *32510 **22200		
25' – 20'			H = 22870 *33130 **22820	H = 21100 *22210 **15780	
20' – 15'			H = 23600 *32990 **22890	H = 21150 *22340 **15380	S – 18230 *15990 **10790
15' – 10'		S = 21840 *54010 **35610	H = 25450 *32250 **22030	H – 21950 *22050 **15110	H – 19200 *16060 **10860
10' – 5'		S – 34300 *51430 **33420	H – 27850 *31070 **20970	H = 23020 *21510 **14610	H = 19440 *15880 **10680
5' – 0'		H – 39390 *48180 **30670	H = 29880 *29770 **19010	H = 23810 *20880 **14040	H = 18380 *16820 **10450
0' – -5'		H = 41360 *45920 **29750	H = 30480 *28730 **18870	H = 23720 *20980 **13660	H = 18490 *15410 **10260
-5' – -10'	S = 11460 *10460 **54380	S = 33530 *46080 **28020	H = 28690 *28150 **18360	H = 22050 *20070 **13290	H – 16400 *15310 **10150
-10' – -15'			H = 25200 *27670 **17920		



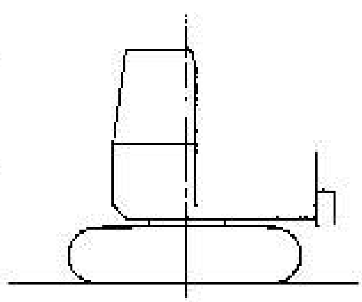
Lift Capacity For Pierce Model HLB-25/41

1. Capacities are based on:
   - 100% Stability Governed by:
     H = Hoist Cyl. (2) — 177.8 mm (7.0 in) Dia.
     S = Stick Cyl. (1) — 196.85 mm (7.75 in) Dia.
     *Stability over End
     **Stability over Side
2. Hydraulic Pressure – 31 349.5 kPa (4550 psi)
3. Efficiency — 100%
4. Reach from C/L of Rotation = 12.5 m (41 ft 0 in)
5. Counterweight is Caterpillar 5606 kg (12,348 lb) with 2812.12 kg (6200 lb) Added — total = 8413.3 kg (18,548 lb)
6. Level Log Height; Ground to the C/L of log 762 mm (30 in dia) – 9.45 m (31 ft .05 in)
7. Estimated Weight As a Logger (Grapple not included) 40 597.8 kg (89,500 lb)

PIERCE MODEL HLB-25/41 For Cat EL300B Excavator

Calculations, weights and machine models are subject to change without notice.

	10'	15'	20'	25'	30'	35'	40'
40' – 35'		H = 46410 *84120 **61240	H = 35080 *52170 **38680				
35' – 30'			H = 33630 *52640 **40110	H = 29760 *36290 **27950	S = 21160 *26770 **20680		
30' – 25'			H – 33220 *53340 **40750	H – 29030 *36900 **28510	H – 26430 *26970 **20770		
25' – 20'			H – 33760 *53610 **41000	H – 29260 *37080 **28660	H – 26470 *27080 **20670	H – 23590 *20900 **15890	
20' – 15'			S = 30060 *53400 **40810	H = 30420 *36700 **28330	H = 26900 *27030 **20030	H = 23710 *20760 **15850	
15' – 10'			S = 30870 *51860 **39390	H = 32130 *36880 **27570	H = 27840 *28680 **20480	H = 23860 *20570 **15680	S = 17800 *16660 **12600
10' – 5'			H = 41880 *49710 **37420	H = 33840 *34820 **26570	H = 28320 *28120 **19970	H = 23800 *20370 *15480	H = 19360 *16670 **12620
5' – 0'			H = 44200 *47570 **35470	H = 34860 *33720 **25540	H = 28490 *25550 **19420	H = 23210 *20130 **15250	H = 18130 *16490 **12460
0' – -5'		S – 26450 *73690 **52140	H – 44110 *45980 **34010	H – 34490 *32840 **24710	H – 27630 *25080 **18980	H – 21540 *19940 **15080	H – 15870 *16460 **12440
-5' – 10'	S = 8730 *17260 **10390	S = 18250 *72240 **50800	H = 41070 *45140 **33240	H = 32150 *32320 **24230	H = 25160 *24820 **18730	H = 18520 *19920 **15060	
10' – -15'		S = 32040 *71750 **50450	H = 36180 *44780 **32910	H = 28400 *32080 **24010	H = 22390 *24670 **18590		



20

WHEEL TRACTOR MODEL	814B		824C		834B	
Balderson Models:						
Replaces "S" Blade	BD814US-14'		BD824US-15'6"		BD834US-20'	
Blade:						
Capacity	16.74 m³	21.9 yd³	24.2 m³	31.7 yd³	29.8 m³	39.0 yd³
Length (cutting width)	4.3 m	14'2"	4.8 m	15'8"	6.09 m	20'0"
Height	1.88 m	74"	2.24 m	88"	2.24 m	88"
Wing angle	30°		30°		30°	
Weight, Installed (without hydraulics)						
BD (S) Dozer	1973 kg	4,350 lb	3697 kg	7,800 lb	4627 kg	9,470 lb

WHEEL TRACTOR MODEL	814B		824C		834B	
Balderson Models:						
Replaces "S" Blade	B14-20S		B24-30S		B34-40S	
Chip Scoop:						
Lift and Carrying Capacity*	15.3 m³	20.0 yd³	20.6 m³	27.0 yd³	34.4 m³	39.5 yd³
Dozing Capacity	30.4 m³	40 yd³	41.0 m³	54 yd³	49.4 m³	65 yd³
Width	3.73 m	12'3"	4.0 m	13'2"	4.83 m	15'10"
Height	2.54 m	8'3"	2.54 m	8'3"	2.25 m	7'4"
Depth	2.5 m	8'1"	3.0 m	9'8"	3.02 m	9'11"
Overall length	7.9 m	26'0"	10.0 m	32'9"	11.0 m	36'0"
Weight	5486 kg	12,095 lb	7561 kg	16,670 lb	11 105 kg	24,480 lb
Dump Clearance	1.0 m	2'10"	1.4 m	4'7"	1.0 m	2'4"

Note: For specifications of Woodchip Dozers used on track-type tractors, see the Bulldozer section in this handbook.

SPECIFICATIONS

Caterpillar Model	953		963	
Balderson Model	**BFS953**		**BFS963**	
Saw Disc				
Blade diameter	1397 mm	**55.0 in**	1397 mm	**55.0 in**
Weight	312 kg	**688 lb**	312 kg	**688 lb**
Saw kerf	51 mm	**2.0 in**	51 mm	**2.0 in**
Blade speed	1300 RPM		1300 RPM	

Replaceable carbide inserts for teeth and rakers

Cat Bucket Control Group — Lift Arm Pin at 1219 mm (48.0 in)

Caterpillar Model	953	963
Dump Angle	42°	70°
Rack Back Angle	21°	45°

Balderson Lift Arms and Cat Tilt Cylinder

Caterpillar Model	953	963
Dump Angle	64°	—
Rack Back Angle	30°	—

NOTE: The 953 requires machine modification by dealer for higher horsepower.

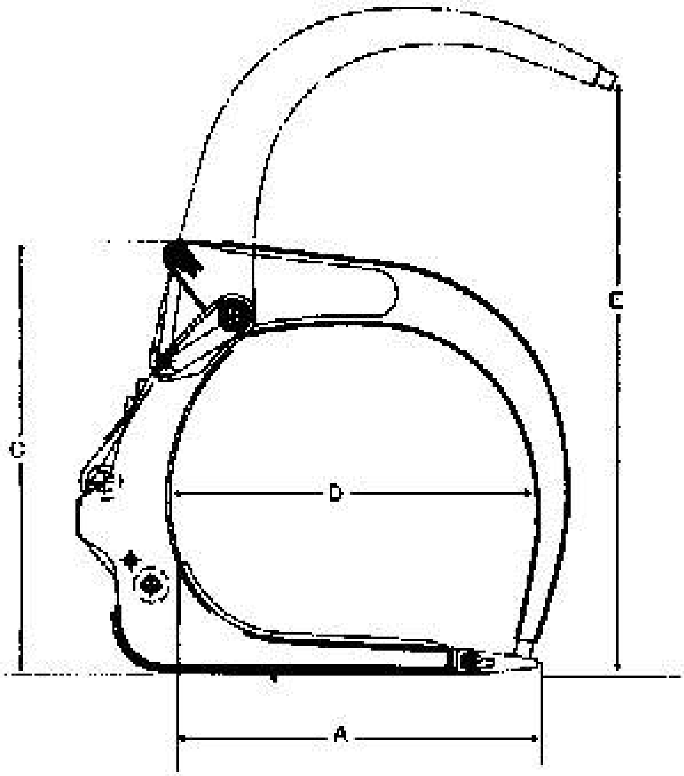
20

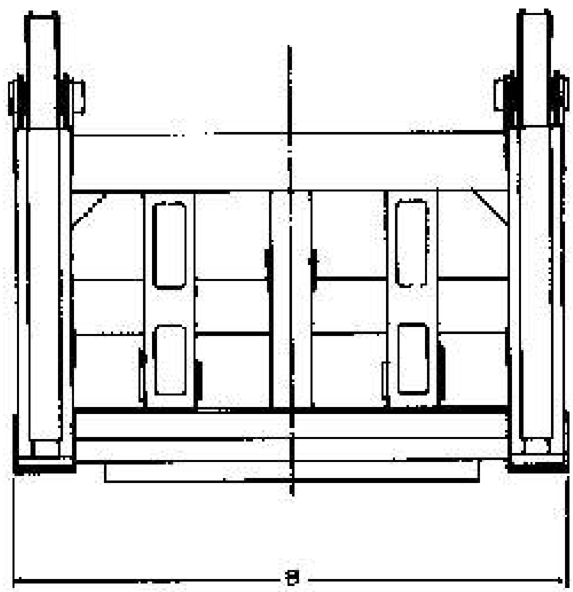
SPECIFICATIONS

Caterpillar Model	FB227		EL200B Feller Buncher	
Balderson Model	**BFS227**		**BFS200**	
Group Number	**8525**		**8784**	
Overall Height	3658 mm	**144.0 in**	2743 mm	**108.0 in**
Overall Width	1626 mm	**64.0 in**	1473 mm	**58.0 in**
Overall Depth	2135 mm	**84.0 in**	2032 mm	**80.0 in**
Overall Weight	2765 kg	**6100 lb**	2315 kg	**5100 lb**
Tree Size Capacity (nominal — hardwood or softwood)	559 mm	**22.0 in**	508 mm	**20.0 in**
Backcut Capacity	813 mm	**32.0 in**	660 mm	**26.0 in**
Disc Saw Blade				
Overall Diameter	1397 mm	**55.0 in**	1219 mm	**48.0 in**
Thickness	25 mm	**1.0 in**	25 mm	**1.0 in**
Weight, Lbs	310 kg	**688 lb**	255 kg	**560 lb**
Blade Speed (average)	**1300 RPM**		**1450 RPM**	
Cutting Kerf	51 mm	**2 in**	51 mm	**2 in**
Number of Teeth	***60**		**24**	
Offset for mill quality cut	**30 top/30 bottom**		**12 top/12 bottom**	

*Disc can be operated with 30 teeth, 15 top and 15 bottom simply remove every other tooth form disc body.

Logging Forks
• 988B • 980F • 966F • 966C • 950F





Caterpillar Model	988B		988B		980F		966F	
Balderson Model	BFHC988DTC		BLF988DTC		BLF980DTC		BLF966DTC	
Group Number								
Logging Arrangement	8956		8965		9349		9209	
Bucket Arrangement	—		8965*		9210		9209	
A — Tine Length	2438 mm	96.0 in	2347 mm	92.4 in	1829 mm	72.0 in	1610 mm	63.4 in
B — Overall Width	2743 mm	108.0 in	2743 mm	108.0 in	2743 mm	108.0 in	2362 mm	93.0 in
C — Back Height	3505 mm	138.0 in	2974 mm	117.1 in	2040 mm	80.3 in	1899 mm	74.75 in
D — Minimum Opening	2540 mm	100.0 in	2370 mm	93.3 in	1828 mm	71.96 in	1624 mm	63.95 in
E — Maximum Clamp Opening	4596 mm	180.9 in	3713 mm	146.2 in	2990 mm	117.0 in	2539 mm	99.95 in
Weight, Approximate	4765 kg	10,500 lb	4080 kg	9000 lb	2880 kg	6350 lb	2495 kg	5500 lb

Caterpillar Model	966C		950F	
Balderson Model	BLF966DTC		BLF950DTC	
Group Number				
Logging Arrangement	8983		8961	
Bucket Arrangement	8983		8961	
A — Tine Length	1416 mm	55.75 in	1416 mm	55.75 in
B — Overall Width	2362 mm	93.0 in	2362 mm	93.0 in
C — Back Height	1822 mm	71.75 in	1822 mm	71.75 in
D — Minimum Opening	1359 mm	53.5 in	1359 mm	53.5 in
E — Maximum Clamp Opening	2500 mm	98.45 in	2500 mm	98.4 in
Weight, Approximate	2155 kg	4750 lb	2155 kg	4750 lb

*BLF988DTC with bucket arrangement — must order Balderson Link Assembly #137519

NOTE: Third valve required. Counterweight recommended.
Logging forks with millyard style clamps are available where logging application requires clamp to close between tines.
Contact your Caterpillar Dealer or Balderson for more information.

20

USE OF LOG VOLUME TABLES

The tabulated volumes on these pages were calculated with no taper in log diameter from base to top. Therefore each value listed in the table represents the volume of a true cylinder. In practice this may occur only in short sections of large diameter trees. To obtain the volume of solid wood logs, excluding bark:

1. Establish the base diameter of the log inside the bark and above the butt flare (extreme end taper).
2. Repeat the procedure for the top (small end) of log.
3. Enter log volume table at each of the two established diameters. Move horizontally to the vertical column closest to the length of the log being measured.
4. Establish the volume figures for each end of the log, add the two together and divide by two to obtain average log volume.

METRIC LOG VOLUMES (in Cubic Meters)

Log Diameter (cm)	LOG LENGTH (METERS)														
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
10	0.016	0.031	0.047	0.063	0.078	0.094	0.12	0.13	0.14	0.16	0.17	0.19	0.20	0.22	0.24
15	0.035	0.071	0.11	0.14	0.18	0.21	0.25	0.28	0.32	0.35	0.39	0.42	0.46	0.49	0.53
20	0.06	0.13	0.19	0.25	0.31	0.38	0.44	0.50	0.57	0.63	0.69	0.75	0.82	0.88	0.94
25	0.10	0.20	0.30	0.39	0.49	0.59	0.69	0.79	0.88	0.98	1.08	1.18	1.28	1.37	1.47
30	0.14	0.28	0.42	0.57	0.71	0.85	0.99	1.13	1.27	1.42	1.56	1.70	1.84	1.98	2.12
35	0.19	0.38	0.58	0.7	0.96	1.15	1.35	1.54	1.73	1.93	2.12	2.31	2.50	2.89	2.88
40	0.25	0.50	0.75	1.01	1.26	1.51	1.77	2.02	2.27	2.52	2.78	3.02	3.27	3.51	3.77
45	0.32	0.64	0.95	1.27	1.59	1.91	2.22	2.54	2.86	3.18	3.50	3.82	4.13	4.45	4.77
50	0.39	0.79	1.18	1.57	1.96	2.36	2.75	3.16	3.54	3.94	4.34	4.71	5.10	5.49	5.89
55	0.48	0.95	1.43	1.90	2.38	2.85	3.33	3.80	4.28	4.75	5.23	5.70	6.18	6.65	7.12
60	0.57	1.13	1.70	2.26	2.83	3.39	3.96	4.52	5.09	5.65	6.22	6.78	7.35	7.92	8.48
65	0.66	1.33	1.99	2.66	3.32	3.98	4.65	5.31	5.98	6.64	7.30	7.96	8.62	9.29	9.95
70	0.77	1.54	2.31	3.08	3.85	4.62	5.40	6.15	6.93	7.70	8.48	9.23	10.0	10.77	11.54
75	0.88	1.77	2.65	3.53	4.42	5.30	6.19	7.06	7.95	8.84	9.72	10.60	11.49	12.37	13.25
80	1.01	2.01	3.02	4.02	5.03	6.03	7.05	8.05	9.07	10.08	11.09	12.10	13.10	14.10	15.10
85	1.13	2.27	3.40	4.54	5.67	6.81	7.94	9.08	10.20	11.32	12.47	13.62	14.75	15.89	17.02
90	1.27	2.54	3.82	5.09	6.36	7.63	8.90	10.17	11.43	12.71	13.99	15.27	16.54	17.81	19.10
95	1.42	2.84	4.75	5.67	7.09	8.51	9.92	11.33	12.76	14.18	15.60	17.01	18.43	19.85	21.26
100	1.57	3.14	4.71	6.28	7.85	9.42	11.0	12.58	14.16	15.72	17.30	18.85	20.42	22.0	23.56
125	2.45	4.90	7.36	9.82	12.27	14.73	17.18	19.6	22.1	24.5	27.0	29.5	32.0	34.4	36.8
150	3.53	7.1	10.6	14.1	17.7	21.2	24.7	28.3	31.8	35.3	38.8	42.4	45.9	49.5	53.0
175	4.8	9.6	14.5	19.2	24.0	28.9	33.7	38.5	43.3	48.1	53.0	57.7	62.6	67.3	72.2
200	6.3	12.6	18.8	25.1	31.4	37.7	44.0	50.3	56.5	62.8	69.1	75.4	81.7	88.0	94.2

ENGLISH MEASURE LOG VOLUMES (In Cubic Feet)

Log Diameter (inches)	LOG LENGTH (FEET) 8	12	16	20	24	28	32	36	40	44	48	52	56	60	70	80	90	100
4	0.7	1	1.4	1.7	2.1	2.4	2.8	3.1	3.5	3.8	4.2	4.5	4.9	5.2	6.1	7	7.8	8.7
6	1.6	2.4	3.1	3.9	4.7	5.5	6.3	7.1	7.8	8.6	9.4	10	11	12	13	16	18	20
8	2.8	4.2	5.6	7	8.4	9.8	11	13	14	15	17	18	19	21	24	28	31	35
10	4.4	6.5	8.7	11	13	15	17	20	22	24	26	28	31	33	38	44	49	55
12	6.3	9.4	13	16	19	22	25	28	31	35	38	41	44	47	55	63	71	79
14	8.5	13	17	21	26	30	34	39	43	47	51	56	60	64	74	86	96	107
16	11	17	22	28	34	39	45	50	56	61	67	73	78	84	98	112	126	140
18	14	21	28	35	42	49	57	64	71	78	85	92	99	106	124	141	159	177
20	17	26	35	44	52	61	70	79	87	96	105	113	122	131	153	175	196	218
22	21	32	42	53	63	74	85	95	106	116	127	137	148	158	185	211	238	264
24	25	38	50	63	75	88	101	113	126	138	151	163	176	189	220	251	283	314
26	29	44	59	74	88	103	118	133	147	162	177	192	207	221	258	295	332	369
28	34	51	68	86	103	120	137	154	171	188	205	222	240	256	299	342	385	428
30	39	59	79	98	118	137	157	177	196	216	236	255	275	295	344	393	442	491
32	45	67	89	112	134	156	179	201	223	246	268	290	313	335	391	447	503	559
34	50	76	101	126	151	177	202	227	252	277	303	328	353	378	441	504	567	631
36	57	85	113	141	170	198	226	255	282	311	339	368	396	424	495	566	637	707
38	63	95	126	158	189	220	252	284	315	347	378	410	441	473	551	630	709	788
40	70	105	140	175	210	244	279	314	349	384	419	454	489	524	611	698	785	873
50	109	164	218	273	327	382	436	491	545	600	655	709	764	818	955	1091	1227	1364
60	157	236	314	393	471	550	628	707	785	864	943	1021	1100	1178	1374	1571	1767	1964
70	214	321	428	535	642	748	856	962	1069	1176	1283	1389	1497	1604	1871	2138	2405	2673
80	279	419	559	698	838	977	1117	1257	1396	1536	1676	1815	1955	2094	2443	2793	3142	3491

20

WEIGHTS OF COMMERCIALLY IMPORTANT WOODS

Species	kg/m^3 (Green)	lb/ft^3 (Green)
A. Temperate Zone*		
Alder, Red	737	46
Ash, White	769	48
Aspen	689	43
Baldcypress	817	51
Basswood	673	42
Beech	865	54
Birch, Paper	801	50
Yellow	929	58
Cedar, Alaska	577	36
Incense	721	45
Northern, White	449	28
Port-Orford	897	56
Western Red	433	27
Cherry, Black	721	45
Cottonwood, Eastern	785	49
Douglas Fir, (Coast)	881	55
(Inland Empire)	577	36
Elm, American	865	54
Fir, Alpine	449	28
Balsam	721	45
Nobel	481	30
Red	769	48
Silver	577	36
White	753	47
Gum, Black	721	45
Blue	1121	70
Red	801	50
Tupulo	897	56
Hemlock, Eastern	801	50
Western	961	60
Hickory, Pecan	993	62
True	1009	62
Larch, Western	769	48
Locust, Black	929	58
Magnolia, Cucumber	785	49
Maple, Big Leaf	753	47
Black	865	54
Red	801	50
Silver	721	46
Sugar	897	56
Oak, Black	1009	63
Chestnut	977	61
Red	1009	63
Red, Swamp	1073	67
Swamp Chestnut	1041	65
White	993	62
White, Swamp	1105	69
Pine, Jack	801	50
Loblolly	993	62
Lodgepole	625	39
Long Leaf	993	62
Norway (Red)	673	42
Short Leaf	993	62
Slash	993	62
Sugar	817	51
Western Yellow, (Ponderosa)	721	46
White (Western)	561	35
White (Eastern)	577	36
Poplar, Yellow	609	38
Redwood	801	50
Spruce, Black	513	32
Engleman	625	39
Red	545	34
Sitka	529	33
White	545	34
Sweetgum	801	50
Sycamore	833	52
Tamarack	753	47
Walnut, Black	929	58
Willow, Black	801	50

*NOTE: Weights taken from U.S. Dept. of Agriculture handbook No. 72. Wood Handbook.

Species	kg/m³ (Green)	lb/ft³ (Green)
B. Southeast Asia		
Apitong	961	60
Bintangor	865	54
Chumprak	929	58
Ebony	1746	109
Geronggang	721	45
Jelutong	641	40
Kapur (Borneo Camphorwood)	1073	67
Keruing	1121	70
Krabak	817	51
Kruen	1121	70
Lumbayau	929	58
Mahogany, Philippine		
(Red Luan)	753	47
(White Luan)	769	48
(Yellow Luan)	769	48
Mahoni	913	57
Alayan Kauri (Damar Minyak)	817	51
Melantai	705	44
Melapi	849	53
Mangkulang	929	58
Meranti Bakau	849	53
Meranti, Dark Red	753	47
White	769	48
Yellow	769	48
Mersawa	817	51
Nyatoh	897	56
Palosapis	817	51
Pulai	545	34
Ramin	1073	67
Rosewood (Sonokeling)	1314	82
Seraya, Dark Red	753	47
Yellow	769	48
White	769	48
Teak	1073	67

Species	kg/m³ (Green)	lb/ft³ (Green)
C. West Africa		
Abura	850	53.06
Ako	800	49.94
Azobe	1300	81.16
Aniegre (Mukali)	950	59.31
Bolo	900	56.19
Bosse	900	56.19
Bubinga	1000	62.43
Dibetau	750	46.82
Douka (Makore)	950	59.31
Doussie	1200	74.91
Framire	850	53.06
Fromager	550	34.34
Ilomba	750	46.82
Iroko	1200	74.91
Kokrodua (Afrormosia)	1000	62.43
Kosipo	900	56.19
Limba	750	46.82
Mahogany	750	46.82
Moabi	1100	68.67
Niangon	900	56.19
Okoume	650	40.57
Ozigo	900	56.19
Padouk	1000	62.43
Samba (Obeche)	650	40.58
Sapelli	900	56.19
Sipo	800	49.94
Tchitola	850	53.06
Tiama	900	56.19
Tola	850	53.06

Weights of Commercially Important Woods
- Australia
- New Zealand
- Papua New Guinea

Species	kg/m³ (Green)	lb/ft³ (Green)
D. Australia		
Ash Alpine	1041	65
Mountain	1009	63
Silvertop	1330	83
Black Butt	1121	70
Box Long Leaf	993	62
Yellow	1105	69
Black	1105	69
Brownbarrel	1073	67
Candle Bark	667	41
Gum Grey	1217	76
Manna	1121	70
Mountain	1169	73
Mountain Grey	1057	66
River Red	1137	71
Forest Red	1201	75
Southern Blue	1217	76
Spotted	1201	75
Sydney Blue	1153	72
Iron Bark Gray	1330	83
Narrowleaved	1330	83
Red	1330	83
Jarrah	1169	73
Karri	1168	73
Mahogany Red	1153	72
White	1282	80
Myrtle	1169	73
Peppermint	1120	70
Pine Radiata	865	54
Monterey	865	54
Celerytop	1057	66
Stringy Bark Brown	1233	77
Messmate	1169	73
Yellow	1217	76
White	1121	70
Tallowwood	1201	75
Wandoo	1282	80

Species	kg/m³ (Green)	lb/ft³ (Green)
E. New Zealand		
Exotic Softwoods		
Radiata Pine	1000	62
Douglas Fir	734	45
Corsican Pine	985	61
Redwood	1016	63
Larch	960	60
Indigenous Softwoods		
Matai	1120	70
Rimu	1130	70
Exotic Hardwoods		
Eucaliptus Botryoides	893	56
Eucaliptus Saligna	1200	75
Indigenous Hardwoods		
Beech — Silver	920	57
Beech — Red	1200	75
Tawa	1022	64

Species	kg/m³ (Green)	lb/ft³ (Green)
F. Papua New Guinea		
Pine, Hoop	520	32
Kauri	480	30
Klinki	510	31
Kwila	800	50
Erima	380	24
Taun	680	42
Walnut, PNG	560	35
Cedar, Pencil	720	50
Mersawa	650	40
Celtis, Hard	780	48
Rosewood, PNG	600	37
Beech, PNG	830	51
Oak, PNG	650	40
Ebony, PNG Black	1115	69
PNG White	720	50
Hardwood, Yellow	780	48
Hopea, Heavy	960	60
Light	710	44
Podocarp, Black	410	26
Terminalia, Brown	450	28

ESTIMATING NUMBER OF TREES PER HECTARE

Spacing (Meters)	Spacing (Meters) 1	2	3	4	5	6	7	8
1	10,000	5,000	3,333	2,500	2,000	1,667	1,428	1,250
2	5,000	2,500	1,667	1,250	1,000	834	714	625
3	3,333	1,667	1,111	834	667	556	477	417
4	2,500	1,250	834	625	500	417	357	313
5	2,000	1,000	667	500	400	330	286	250
6	1,667	834	556	417	333	278	238	208
7	1,428	714	477	357	286	238	204	179
8	1,250	625	417	313	250	208	179	156

ESTIMATING NUMBER OF TREES PER ACRE

Spacing (Feet)	Spacing (Feet) 5	6	7	8	9	10	11	12
5	1,742	1,452	1,244	1,089	968	871	792	726
6	1,452	1,210	1,037	907	806	726	660	605
7	1,244	1,037	888	777	691	622	565	518
8	1,089	907	777	680	605	544	495	453
9	868	806	691	605	537	484	440	403
10	871	726	622	544	484	435	396	363
11	792	660	565	495	440	396	360	330
12	726	605	518	453	403	363	330	302
13	671	558	470	418	372	335	304	279
14	622	518	444	390	346	311	283	259
15	580	484	415	363	323	290	264	242

COMPARISON OF LOG RULES • Board Foot Values for 16-Foot Logs

Diameter at Small End, Inside Bark, Inches	International 1/4 Inch	Scribner	Scribner Decimal	Spaulding	Doyle
4	5	10	10	—	—
6	20	18	20	—	4
8	40	32	30	—	16
10	65	54	60	50	36
12	95	79	80	77	64
14	135	114	110	114	100
16	180	159	160	161	144
18	230	213	210	216	196
20	290	280	280	276	256
22	355	334	330	341	324
24	425	404	400	412	400
26	500	500	500	488	484
28	585	582	580	569	576
30	675	657	660	656	676
32	770	736	740	748	784
34	875	800	800	845	900
36	980	923	920	950	1024
38	1095	1068	1070	1064	1156
40	1220	1204	1200	1185	1296

UNIT OF MEASUREMENT DEFINITIONS

1 board foot	= 1/12 ft^3 of solid wood (1′ × 1′ × 1″)
1000 board feet	= 83.33 ft^3 of solid wood
1 cunit of wood	= 100 solid ft^3
	= 1200 board feet
	= 2.83^3
1 cord of wood	= 128 ft^3 of stacked logs
	= 3.62 m^3
1 unit of wood	= 200 ft^3 of loose chips
	= 5.66 m^3
1 cord of wood	= .85 units
1 Hoppus Ton	= 50 ft^3 (assumed)
	= 63.65 ft^3 (actual)
	= 600 board feet
	= 763.8 BF Brereton
	= 1.8 M^3 actual
	= 1.4 M^3 assumed
1 cubic meter	= 35.32 ft^3
	= 424 board feet
	= 333 board feet Hoppus tons
	= 0.555 Hoppus Tons
1 MBF Brereton	= 2.36 m^3
	= 785.4 board feet Hoppus
1 MBF Hoppus	= 1273 board feet-Brereton
MBF	= Thousand board feet
1 Super Foot	= 1 board foot
100 Super Feet	= 1000 board foot
	= 0.236 m^3
600 Super Feet	= 50 ft^3
1 lb/ft^3	= 16.0185 kg/m^3

CUBIC FEET OF SOLID WOOD PER CORD

Length of	Diameter at Small End		
Sticks-Ft.	1.0″-2.5″	2.5″-5.5″	Over 5.5″
2	65	84	91
4	64	82	89
8	59	77	84
12	54	71	78

RULE OF THUMB CONVERSIONS

1 cunit of wood = 1.117 cords = 1.25 units of chips = 250 ft^3 of chips = 7.08 m^3
1 cord of wood = 85 ft^3 of solid wood = 1.06 units of chips = 2.41 m^3
1 unit of chips = 80 ft^3 of solid wood = 2.27 m^3
1 cord of wood = 500 board feet = 1.18 m^3
2000 pounds of chips = 500 pounds of pulp
1 cord = 212 ft^3 of chips = 6.00 m^3

STOCKPILE COAL HANDLING

CONTENTS

INTRODUCTION

Efficient methods have been developed for handling and storing coal with mobile equipment. Generally, a power plant or other industrial facility which uses coal, meets its daily requirements with incoming coal shipments and will maintain an emergency stockpile or deadpile. The deadpile is designed to meet the burn requirements during any interruption of coal shipments. Interruptions may include inclement weather, carrier strikes, scheduling problems, etc.

The deadpile will contain approximately a 90 day supply of coal and is constructed by thoroughly compacting lifts, or layers, of coal approximately 15 cm (6 in) thick. Thorough compaction of the entire stockpile, including the sides, eliminates air spaces, reducing the possibility of spontaneous combustion.

Reclaiming the deadpiled coal is critical when incoming shipments are not able to satisfy the burn requirements. Four basic types of mobile equipment are available for stockpiling and reclaiming coal — track type tractors, wheel type tractors, wheel loaders, and wheel tractor scrapers. Each type has its own specific advantages. The equipment selected must be able to meet the maximum hourly burn rate.

MACHINE SELECTION

Track-Type Tractors

Track-type tractors continue to be the most widely used machines for coal handling operations. Equipped with a U-shaped coal dozer, they are suitable for meeting high production requirements over dozing distances of less than 152 m (500 ft). Their tractive capabilities and gradeability permit them to operate on the sides of the stockpile and surge pile which often prove inaccessible to other types of equipment. They can also remove snow and frost penetrated coal from the stockpile surface so that rubber-tired equipment can work efficiently.

Wheel Tractors

These machines, with their long wheel base, low center of gravity, and articulated design, offer good stability and maneuverability. They have the ability to travel at a higher speed than the track type tractor, moving easily from one area of operation to another, and provide greater compactive effort with fewer passes. They are capable of performing some utility functions. However, their coefficient of traction is less than that of track-type tractors. The most efficient dozing distance for the wheel-type tractor is usually less than 152 m (500 ft).

Coal scoops are also available for wheel-type tractors and may improve production under certain operating conditions.

Wheel Loaders

As dozing and hauling distances increase, wheel loaders are able to effectively move coal in load-and-carry operations. Since coal is a relatively light material, the loaders should be equipped with larger buckets sized for coal density. Versatility and mobility allow them to perform a variety of tasks, both on and off the stockpile. They can load trucks or railcars, dig out bottom ash and boiler slag from the ash storage areas, and move railcars within the vicinity of the power plant. Generally wheel loaders are more efficient than track or wheel-type tractors at distances of 122 m (400 ft) or more.

Coal Scrapers

Tandem powered coal scrapers are generally used when large volumes and long haul distances [over 152 m (500 ft)] are involved. They are able to effectively self-load coal, and have the advantage of being able to provide both high speed and large capacity; in addition, scrapers provide the greatest compactive effort. Coal scrapers are even more effective when top loading systems and drive-over reclaiming hoppers are used.

HOW TO EQUIP

Counterweighting

While larger blades or buckets allow for greater production, counterweighting is often necessary to improve the machine's balance and handling capability. For track-type tractors, a rear counterweight is recommended. Wheel machines use various methods to add weight. For example, scoop dozers use front counterweights, and wheel machines often use tire ballast. Below is a weight comparison of the Caterpillar standard U-blade to the Balderson Coal Dozer, along with the recommended counterweight for D11N, D10N, D9N, D8N, and 834B.

COAL STOCKPILE BLADE WEIGHT COMPARISON/ COUNTERWEIGHTING

Model	Caterpillar U-Blade kg	Caterpillar U-Blade lb	Balderson Coal Dozer/ Scoop kg	Balderson Coal Dozer/ Scoop lb	Counterweight kg	Counterweight lb
D11N	11 608	25,590	10 115	22,300	4989	11,000
D10N	6188	13,643	6620	14,600	2928	6,456
D9N	4179	9,214	4490	9,900	3142	6,926
D8N	2825	6,228	3265	7,200	2749	6,060
834B	2994	6,600	4070	8,975	75% $CaCl_2$ in all tires — 5360	11,816
*834B with Balderson Scoop			8700	19,180		

Both Caterpillar and Balderson weights include blade or scoop only. The change in machine weight is determined by adding or subtracting the difference between the Caterpillar and Balderson blade. Counterweight or ballast may also need to be considered.

Track Shoe Width

Track shoes are an important consideration since shoe width determines tractive capability and compaction. Depending on the coal being stockpiled, the utility company will often have a strong preference concerning track shoe width. Basically, utilities stock-piling low rank or sub-bituminous rank lignite coal usually prefer the standard shoe width for maximum compactive effort in order to reduce the possibility of spontaneous combustion.

Utilities burning medium or high rank bituminous coals are not as concerned with the problem of spontaneous combustion and sometimes prefer a wider shoe that allows for increased tractive capability on loose or less densely compacted coal stockpiles.

Tires

Many utility companies have established a tire preference for wheel machines. Normally a radial tire allows for the maximum tire print in the stockpile surface providing the best traction.

Tire pressure may be of equal importance to tire selection. Tests with hydro-inflated (liquid ballasting) tires indicate that inflation pressure of approximately 275 kPa (40 psi) improves machine performance over higher inflation pressure. Lower than 275 kPa (40 psi) is not recommended for hydro-inflated tires. (For more hydro-inflation information see the Tire section.)

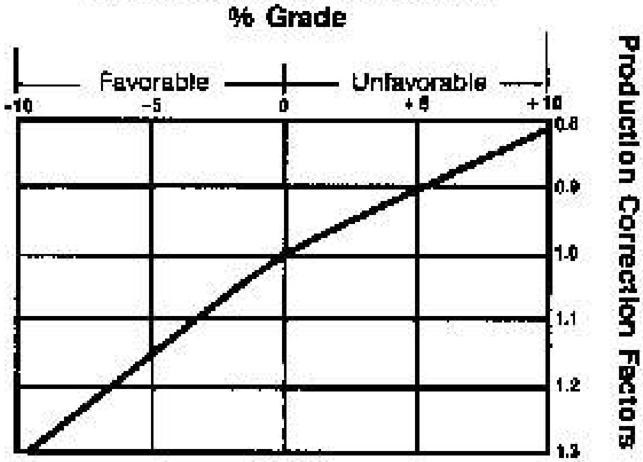
Other

The 834B's performance may be improved in the varying underfoot conditions of a coal stockpile with the use of a Detroit NoSPIN differential. This differential provides added tractive capability on all coal piles, particularly loose coal.

PRODUCTION FACTORS

1. *The effect of grade* — dozer production will increase 3% for each 1% of favorable grade and decrease 2% for each 1% of adverse grade up to grades of 10%. The graph below exemplifies this point.

Effect of Grade on Production
% Grade



As a rule of thumb, track type tractors can negotiate grades of about 60% in *loose* coal. Wheel type tractor dozers can negotiate grades up to 25% on fairly well *compacted* coal.

2. *Slot dozing,* which consists of dozing repeatedly in the same tracks, will increase production. The deeper the slot, the greater the increase in production. Obviously this will disrupt the surface of the pile; however it does provide maximum production.

Slot Condition	Slot Depth	Increase in Production
Slight	60 cm ~ 2 ft	10%
Consistent	60-1.5 cm ~ 2-5 ft	25%
Very Consistent	Over 1.5 m ~ Over 5 ft	30% +

3. *Relative traction* — machines will provide greater tractive effort as the compaction beneath them increases.

Condition:	Machine	Coefficient of Traction
Well Compacted Coal	Track-type	*0.75-0.80
	Wheel-type	0.40-0.50
Loose Coal	Track-type	*0.60
	Wheel-type	0.30-0.40

*D11N, D10N, D9N and D8N will often achieve a higher coefficient of traction due to their suspended undercarriage.

4. *Rolling Resistance* of rubber tired equipment will decrease as the compaction of the coal beneath the machines increases. Here are total rolling resistances on various surfaces.

	kg/Metric Ton	lb/U.S. Ton
• Main travel area from loading area to stockpile traveled and maintained.	29	65
• Travel over the compacted deadpile.	36	80
• Travel over thin lifts of uncompacted coal on the deadpile.	54	120
• Travel on loose piles under stacking conveyor or on a windrow.	90-136	200-300

5. *The degree of compaction required* — for medium and high rank bituminous coal, track-type tractors will normally provide ample compaction to prevent fires. For low rank coals, such as sub-bituminous and lignite, rubber tired machines, pneumatic compactors or sealing may be required to prevent fires. The following table illustrates the compaction that is possible if the coal is spread in thin lifts and the machine makes a sufficient number of passes over the entire lift surface.

Machine	kg/m^3	lb/ft^3	lb/yd^3
Track-type Tractors	960-1160	60-72	1620-1950
Wheel-type Tractors	1040-1200	65-75	1750-2030
Wheel Loaders	1040-1250	65-78	1760-2110
Wheel Tractor-Scrapers	1100-1280	68-80	1840-2160

ESTIMATING HOURLY PRODUCTION

The following graphs may be used for estimating the hourly production of machines handling mixed bituminous coal. The black lines on the graphs are based on 100% machine efficiency under normal job conditions and average operator; they do not take into account adverse grades, downtime, wait time, poor traction, etc. The shaded areas represent the production ranges achievable considering various job conditions, favorable or unfavorable. These production estimates should be evaluated in light of individual job conditions and efficiency. Moreover, a job efficiency correction factor should be applied to the production estimate shown when using these graphs.

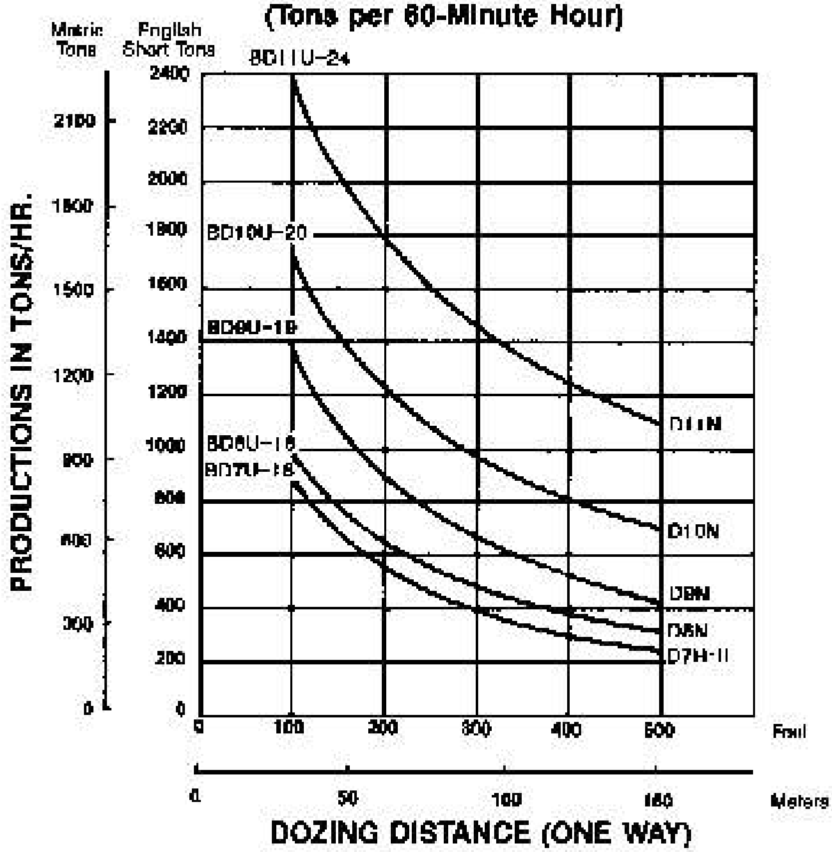
To estimate travel times for a specific machine refer to the performance graphs or charts in the appropriate model section of this book.

Note: Capacities and production curves on the next pages are based on bituminous coal with a density of 890 kg/m^3 or 1500 lb/yd^3 or 55 lb/ft^3. For sub-bituminous coal with a density of 800 kg/m^3 or 1350 lb/yd^3 or 50 lb/ft^3 multiply tonnage figure by .90. For lignite with an average density of 710 kg/m^3 or 1200 lb/yd^3 or 45 lb/ft^3 multiply tonnage figure by .80.

Track-Type Tractors Estimated Production with Balderson U-Blade (Coal Dozer)

Factors:
- **Mixed Bituminous Coal**
- **Storage and Reclamation**
- **0% Grade**
- **.60 Coefficient of Traction**

(Tons per 60-Minute Hour)



NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

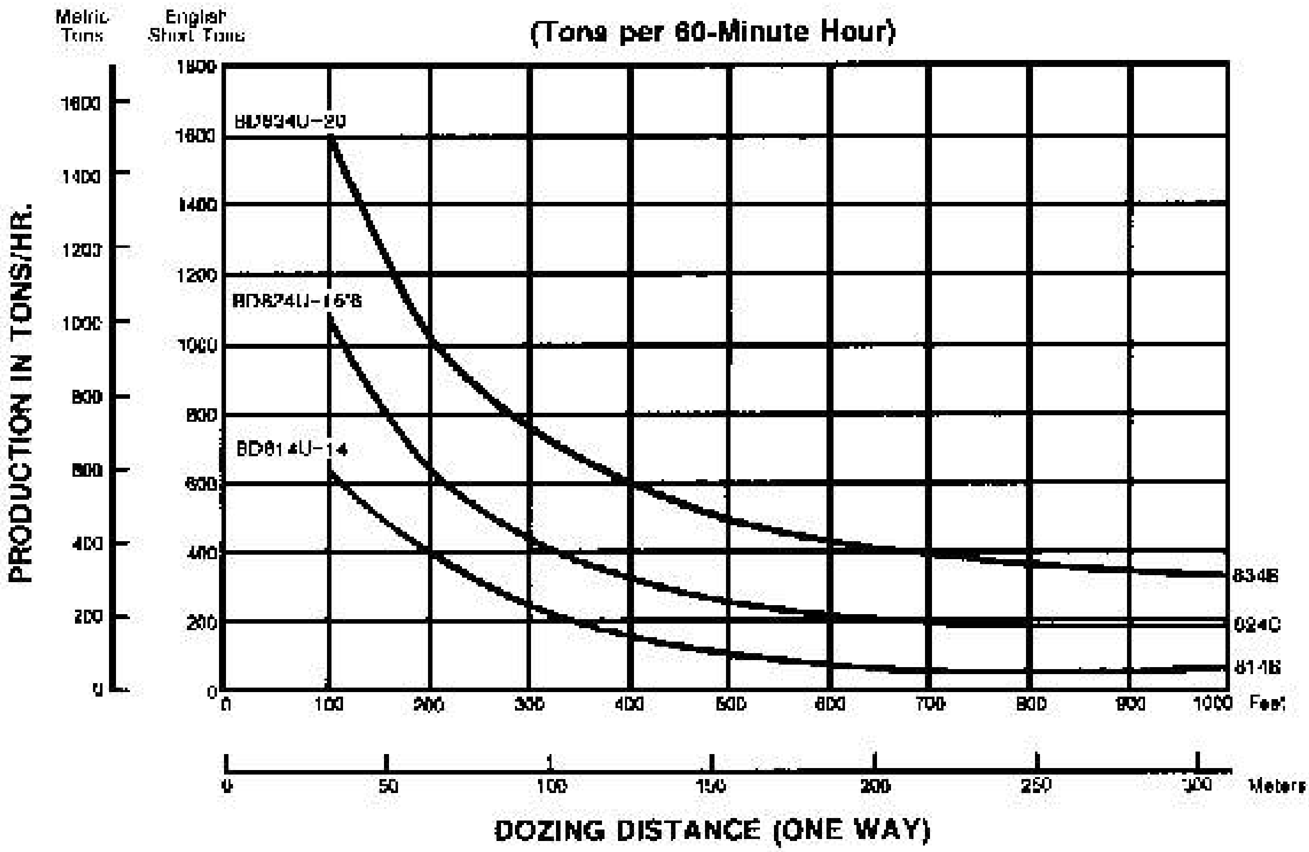
Tractor	Balderson U-Blade Model	m	ft	Blade Capacities Metric tons	U.S. tons	m³	yd³
D11N	BD11U-24	7.32	24'	64.0	70.5	71.9	94
D10N	BD10U-20	6.10	20'	40.85	45	45.9	60
D9N	BD9U-19	5.79	19'	27.3	30.0	30.6	40
D8N	BD8U-18	5.49	18'	19.0	21.0	21.4	28
D7H Series II	BD7U-16	4.88	16'	14.29	15.75	16.05	21.0

Refer to Track-Type Tractor/Bulldozer section for additional special attachments specifications

Wheel Tractors Estimated Production with Balderson U-Blade (Coal Dozer)

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

Factors:
- **Mixed Bituminous Coal**
- **Storage and Reclamation**
- **0% Grade**
- **.80 Coefficient of Traction**



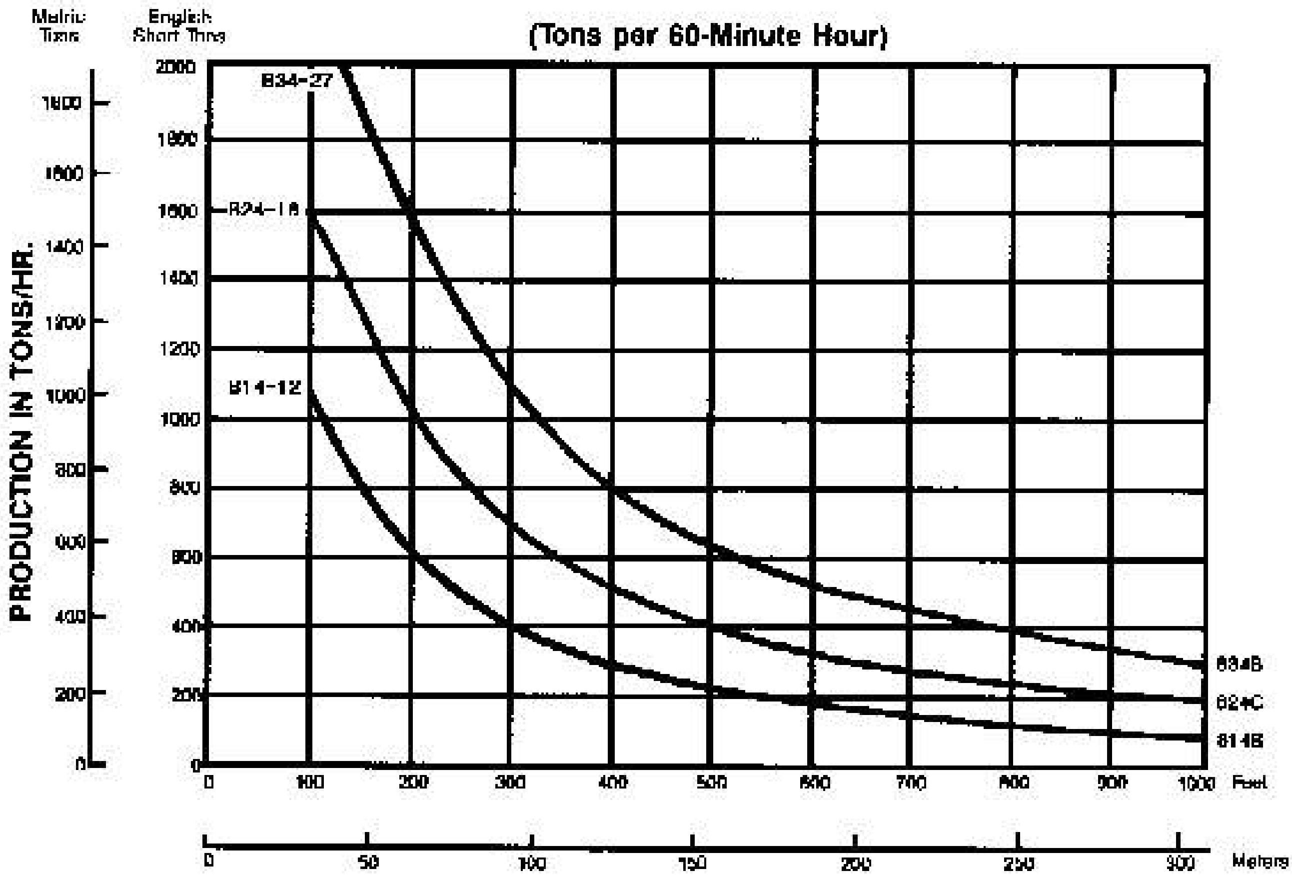
Tractor	Balderson U-Blade			Blade Capacities			
	Model	m	ft	Metric tons	U.S. tons	m^3	yd^3
834B	BD834U-20	6.17	20'3"	18.8	20.8	21.2	27.7
824C	BD824U-15'6	4.77	15'6"	14.3	15.8	16.13	21.1
814B	BD814U-14	4.32	14'2"	9.4	10.3	10.6	13.8

Note: Blade capacities in tons figured using weight of coal at 890 kg/m^3 (1500 lb/yd^3).

Refer to Track-Type Tractor/Bulldozer section for additional special attachment specifications.

Wheel Tractors Estimated Production with Balderson Coal Scoop

Factors:
- **Mixed Bituminous Coal**
- **Storage and Reclamation**
- **0% Grade**
- **.80 Coefficient of Traction**



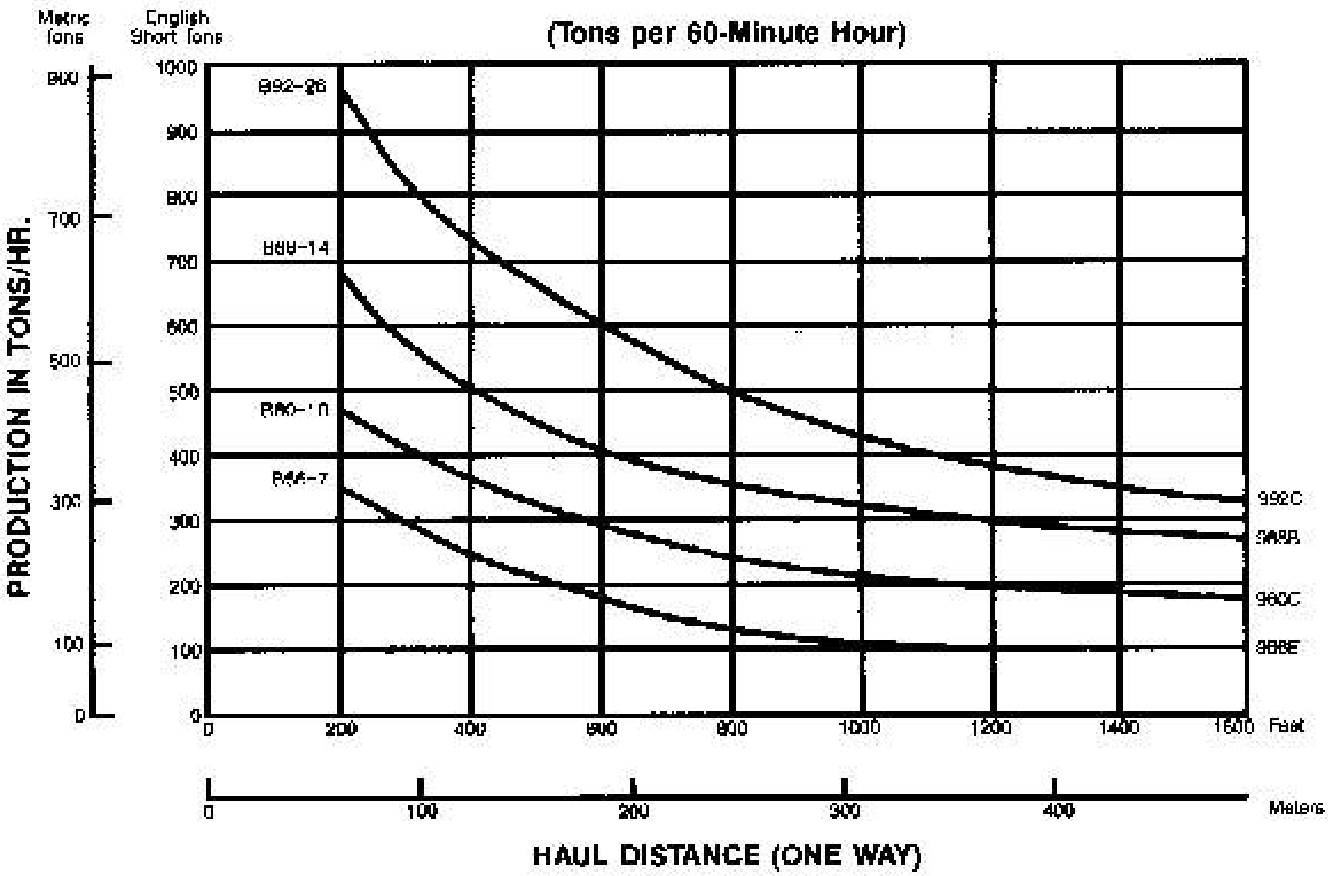
Tractor	Balderson Coal Scoop: Model	m	ft	Scoop Capacities (Lift and Carry): Metric tons	U.S. tons	m^3	yd^3	Doze Capacities: Metric tons	U.S. tons	m^3	yd^3
834B	B34-26	5.3	17'4"	18.3	20.2	19.9	26	37.5	41.25	37.5	49
824C	B24-17	4.0	13'2"	12.3	13.5	13.0	17	24.5	27.0	26.0	34
814B	B14-15	3.7	12'3"	8.2	9.0	11.6	15	16.3	18.0	19.1	25

*The coal scoop production curves are based on calculated data provided by Balderson.

Refer to Track-Type Tractor/Bulldozer section for additional special attachment specifications

Wheel Loaders Estimated Production
with Balderson Coal Bucket

Factors:
- **Mixed Bituminous Coal**
- **Storage and Reclamation**
- **0% Grade**
- **.80 Coefficient of Traction**

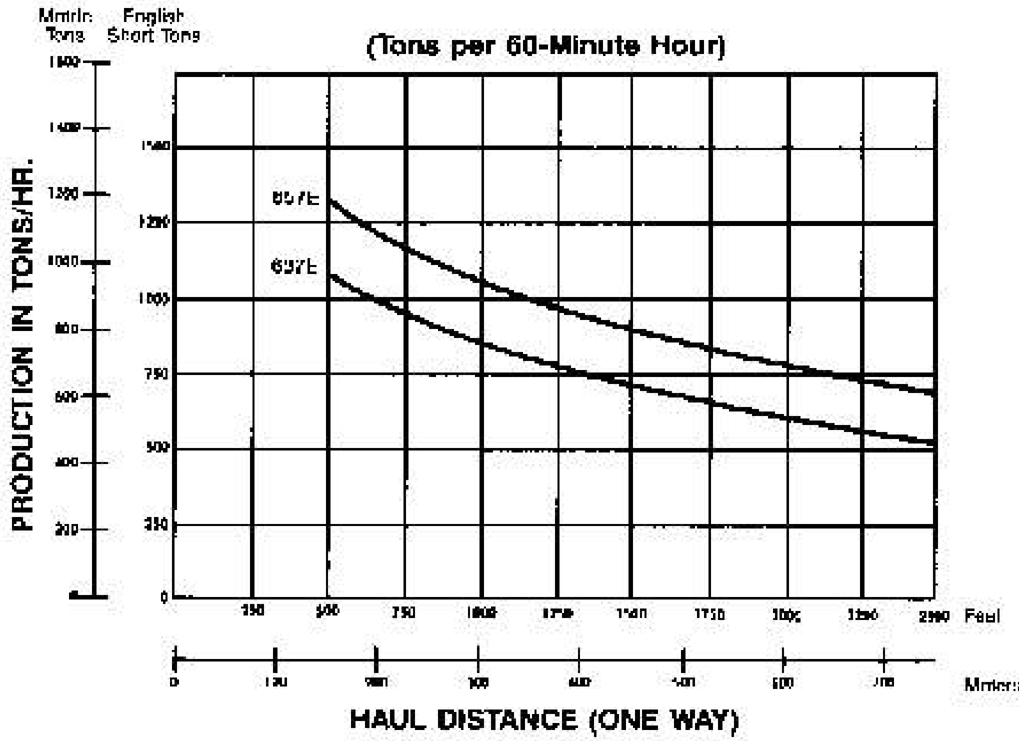


Loader	Balderson Coal Bucket Model	Blade Capacities			
		Metric tons	U.S. tons	m³	yd³
992C	B92-25	17.8	19.6	19.3	25.25
988B	B88-14	9.4	10.4	10.3	13.5
980C	B80-10	6.9	7.6	7.8	10.25
966F	B66-7	4.8	5.3	5.5	7.25

Note: Bucket capacities include bottom cutting edge in tons figured using weight of coal at 890 kg/m³ (1500 lb/yd³).

Wheel Tractor-Scrapers Estimated Production

Factors:
- **Mixed Bituminous Coal**
- **Storage and Reclamation**
- **0% Grade**
- **.50 Coefficient of Traction**



Coal Scraper	Metric tons	U.S. tons	Struck m³	Struck yd³	1:1 m³	1:1 yd³	2:1 m³	2:1 yd³	3:1 m³	3:1 yd³
			Bowl Capacities							
657E	49.9	55	45	59	56	73	50	65	47	62
637E	34.5	38	31	41	38	50	34	45	37	44

Average fixed time to load, maneuver and dump:
657E — 1.12 min.
637E — 1.10 min.

NOTE:
- The 657E Coal Scraper is 1049 mm (41.3") longer and bowl sides and apron are 1080 mm (42.5") higher than its earthmoving counterpart.
- The 637E Coal Scraper is 762 mm (30") longer and bowl sides, apron and ejector are 915 mm (36") higher than its earthmoving counterpart.
- The rimpull, travel times, and retarder performance for the coal scrapers are the same as for the standard machines. See Wheel Tractor-Scrapers section for charts and graphs.

Example Problem

A coal fired utility company has a coal requirement of approximately 315 metric tons (350 tons) per hour. Specify the coal handling machine that will satisfy this demand.

Conditions:

Lignite Coal 710 kg/m^3 (1200 lb/yd^3)
90 m (300 ft) push distance
5% adverse grade
50 minute hour operation efficiency

Solution:

Calculate the D9N's production equipped with the Balderson BD9U-19 Coal U-Blade by using the D9N production curve. Start at 90 m (300 ft) and read up to the D9N production line, then over to the left to determine its maximum hourly production of 612 metric tons (675 tons).

Since the graphs are based on a 890 kg/m^3 (1500 lb/yd^3) coal density, this production figure has to be adjusted to reflect lignite coal:

Coal density correction factor = 710/890 (1200/1500) = 0.8.

Obtain the production correction factor for the 5% adverse grade from the chart: 0.9.

The correction factor for the 50 minute hour is 50/60 = .83.

Now calculate the adjusted D9N hourly production using the correction factors:

Metric	612×.8×.9×.83 = 366 tons/hour
English	675×.8×.9×.83 = 403 tons/hour

The D9N falls in the required production range. For short periods of peak power capacity, production could be increased by slot dozing.

Production for the D10N, 824C and 834B can be calculated using the same method.

D10N

Metric	850×.8×.9×.83 = 508 tons/hour
English	935×.8×.9×.83 = 559 tons/hour

824C

Metric	400×.8×.9×.83 = 239 tons/hour
English	440×.8×.9×.83 = 263 tons/hour

834B

Metric	689×.8×.9×.83 = 412 tons/hour
English	760×.8×.9×.83 = 454 tons/hour

Therefore, the D9N or 834B could most economically satisfy the production requirements.

Example Problem

A utility company must decide on the type and size dozer that is required to meet its hourly stockpiled coal requirement of 180 metric tons/hour (200 tons/hour). The purchasing department is considering a 160 kW (215 HP) track-type tractor and a 224 kW (300 HP) wheel dozer.

Conditions:

Average Operator
Dozing distance, 45 m (150 ft)
5% Adverse Grade
Loose Stockpile Coal, Density=842 kg/m³ (1420 lb/yd³)
24 Hour Operation with dusty conditions in dry season and rain/snow in wet season.
40-Minute/hour operation efficiency

Step I:

Using the production graphs, the maximum hourly production estimated for the D7H Series II and 824C equipped with Balderson U-Blades is:

D7H Series II — 544 metric tons/hour
600 tons/hour

824C — 771 metric tons/hour
850 tons/hour

Step II:

Apply correction factors to hourly production figures.

	Density* kg/m³	Density* lb/yd³	Coefficient of** Traction	% Grade ***	Time	Visibility ****
D7H Series II Graph	890	1500	.60	0	60 Min-Hr	—
Given	842	1420	.80	+ 5	40 Min-Hr	24 Hr (dusty, rain, snow)
Correction Factor	0.95		0.75	0.90	0.67	0.70

D7H Series II:

544 metric tons/hr × .95 × .75 × .90 × .67 × .70 = **163 metric tons/hr**

600 tons/hr × .95 × .75 × .90 × .67 × .70 = **180 tons/hr**

	Density* kg/m³	Density* lb/yd³	Coefficient of** Traction	% Grade ***	Time	Visibility ****
824C Graph	890	1500	.50	0	60 Min-Hr	—
Given	842	1420	.35	+ 5	40 Min-Hr	24 Hr (dusty, rain, snow)
Correction Factor	0.95		0.70	0.90	0.67	0.70

824C:

771 metric tons/hr × .95 × .70 × .90 × .67 × .70 = **216 metric tons/hr**

850 tons/hr × .95 × .70 × .90 × .67 × .70 = **239 tons/hr**

Therefore, the 824C equipped with a Balderson U-Blade (Coal Dozer) would meet production requirements.

*842 kg/m³ ÷ 890 kg/m³ = 0.95 (1420 lb/yd³ ÷ 1500 lb/yd³ = 0.95)
**Refer to relative traction chart, for D7H Series II 0.60 ÷ 0.80 = 0.75
for 824C: 0.35 ÷ 0.50 = 0.70
***Refer to effect of grade on production graph.
****Refer to job condition correction factors, Bulldozer Section.

LAND CLEARING

CONTENTS

Land clearing must be treated more as an art than a science because production rates and methods vary greatly from one area to another. This section deals with the many variables in clearing and includes methods, equipment and procedures to determine rates of productivity.

VARIABLES AFFECTING CLEARING OPERATIONS

Vegetative Growth — Factors affecting production and therefore cost, include the number of trees, size of trees, wood density, root systems, vines and undergrowth. These factors can be estimated by a "tree-count" as discussed under "Job Survey."

End Use of Land — Since different end uses require different degrees of clearing (i.e. highways, dams, tree crops, row crops, etc.), this is one of the most important factors to consider in choosing the clearing method and equipment to be used.

Soil Conditions or Bearing Capacity — Factors affecting clearing operations include depth of topsoil, soil type, moisture content, and the presence of rocks and stones.

Topography — Grade and terrain factors such as steep slopes, ditches, swampy areas, boulders and even ant hills greatly affect the normal operation of some equipment.

Rainfall and Climate — Usually all phases of land clearing from cutting to burning are concerned to some degree with temperature changes and the amount of rain that falls during the clearing operation.

Job Specifications — Specifications dictate the degree of clearing to be done, area size, completion dates, method of debris disposal, soil conservation and other factors which affect method and equipment selection.

22

JOB SURVEYS

Knowledge of rainfall and climate, end use of the land, and job specifications can be obtained from records, survey and engineering studies, and written specifications. However, a personal survey of the area should be conducted to gain other necessary knowledge of the area to be cleared.

The survey should include a study of general topography and soil conditions. You should note such problem factors as hills, rocks, or swamps which would significantly affect production or which would require special treatment.

Cruise the area to be cleared and determine the acreage of each vegetative type (i.e. upland woods, low timberlands, swamps). Make at least three tree counts at random for each vegetation type. To conduct these counts, randomly locate two points 100 meters (328 feet) apart. Count and measure vegetative growth along a straight line between these points for a width of about 5 meters (16 feet) on both sides. This gives the population of 1/10 hectare (1/4 acre). Note:

1. Density of vegetation less than 30 cm (12 in) diameter
   - Dense — 1480 trees/hectare or more (600 trees/acre)
   - Medium — 990-1480 trees/hectare (400-600 trees/acre)
   - Light — less than 990 trees/hectare (400 trees/acre)
2. Presence of hardwoods expressed in percent
3. Presence of heavy vines
4. Average number of trees per hectare (2.47 acres) in each of the following ground level diameter size ranges:
   - Less than 30 cm (1 ft)
   - 31 cm-60 cm (1-2 ft)
   - 61 cm-90 cm (2-3 ft)
   - 91 cm-120 cm (3-4 ft)
   - 121 cm-180 cm (4-6 ft)
5. Sum of diameter of all trees per hectare (2.47 acres) above 180 cm (6 ft) in diameter at ground level.

CLEARING METHODS AND EQUIPMENT

Methods for Initial Felling — There are several methods indicating the degree of clearing for initial felling and several types of equipment for use with each method. Equipment use in different size vegetation and different size areas is summarized in the table on the next page. This information should serve only as a rough guideline in selecting equipment. The economical land area for each type of equipment will vary with the capital cost of equipment and moving cost. It is also affected by whether there are alternate uses for equipment such as using tractors for other construction work or tillage.

Land Clearing Machines — Job size, severity of job such as tree size, and time limit to complete will influence machine selection. Some machines, such as the D6H Series II, D7H Series II and D8N are more suited for this type work than others, but imagination and resourcefulness can allow the use of other types of machines in specific applications. For example, loaders are used more today in raking and piling operations than ever before.

Operator Protection and Machine Guarding — Daily production has been estimated to increase 20% when cab guards are used. Cabs designed specifically for clearing are available from Rome and other auxiliary equipment manufacturers.

The radiator, engine, and underside of the tractor must be well protected. Perforated hoods, screens and crankcase guards as well as hydraulic cylinder guards are generally recommended.

Generally speaking, lower cost clearing can be done with larger tractors if the amount of clearing involved is sufficient to merit the initial investment in the bigger machine. Because of the need for constant direction change in most clearing work, a power shift transmission should be standard equipment. The direct drive transmission tractor is recommended when the tractor is used principally in constant drawbar work such as chaining or pulling a disc harrow. In most applications, a winch should also be considered on one of every three tractors in a fleet.

EQUIPMENT SELECTION TABLE

	UPROOTING	CUTTING AT OR ABOVE GROUND LEVEL	KNOCKING TO THE GROUND	INCORPORATING INTO THE SOIL
LIGHT CLEARING — Vegetation up to 5 cm (2 in) diameter				
Small areas 4.0 hectares (10 acres)	Bulldozer blade, axes, grub hoes and mattocks	Axes, machetes, brush hooks, grub hoes and mattocks, wheel-mounted circular saws	Bulldozer blade	Moldboard plows, disc plows, disc harrows
Medium acres 40 hectares (100 acres)	Bulldozer blade	Heavy-duty sickle mowers [up to 3.7 cm (1 ½ in) diameter] tractor-mounted circular saws, suspended rotary mowers	Bulldozer blade, rotary mowers; flail-type rotary cutters; rolling brush cutters	Moldboard plows; disc plows, disc harrows
Large areas 400 hectares (1,000 acres)	Bulldozer blade, root rake, grubber, root plow, anchor chain drawn between two crawler tractors; rails	—	Rolling brush cutter; flail-type cutter; anchor chain drawn between two crawler tractors; rails	Undercutter with disc; moldboard plows; disc plows; disc harrows
INTERMEDIATE CLEARING — Vegetation 5 to 20 cm (2 to 8 in) diameter				
Small areas 4.0 hectares (10 acres)	Bulldozer blade	Axes, crosscut saws, power chain saws, wheel mounted circular saws	Bulldozer blade	Heavy-duty disc plow; disc harrow
Medium areas 40 hectares (100 acres)	Bulldozer blade	Power chain saws, tractor-mounted circular saws, single scissor type tree shears	Bulldozer blade, rolling brush cutter [up to 12 cm (5 in) diameter], rotary mower [up to 10 cm (4 in) diameter]	Heavy-duty disc plow; disc harrow
Large areas 400 hectares (1,000 acres)	Shearing blade, angling (tilted) bulldozer blade, rakes, anchor chain drawn between two crawler tractors, root plow	Shearing blade (angling or V-type)	Bulldozer blade, flail-type rotary cutter, anchor chain	Bulldozer blade with duty harrow
LARGE CLEARING — Vegetation 20 cm (8 in) diameter or larger				
Small areas 4.0 hectares (10 acres)	Bulldozer blade	Axes, crosscut saws, power chain saws	Bulldozer blade	—
Medium areas 40 hectares (100 acres)	Shearing blade, angling (tilted), knockdown beam, rakes, tree stumper	Shearing blade (angling or V-type), tree shear [up to 70 cm (26 in) softwood; 35 cm (14 in) hardwood], shearing blade — power saw combination	Bulldozer blade	—
Large areas 400 hectares (1,000 acres)	Shearing blade, angling (tilted), tree pusher, rakes, tree stumper, anchor chain with ball drawn between two crawler tractors	Shearing blade (angling or V-type), shearing blade — power saw combination	Anchor chain with ball drawn between two crawler tractors. [Use dozer blade for trees over 18 cm (7 in).]	—

NOTE The most economical size area for each type of equipment will vary with the relative cost of capital equipment versus labor. It is also affected by whether there are alternate uses for equipment such as using tractors for tillage.

22

PRODUCTION ESTIMATING

GENERAL — CONSTANT SPEED OPERATIONS

Production is the hourly rate of clearing usually expressed in hectares or acres.

For many land clearing operations, production is calculated by multiplying the speed of the tractor by the width of cut of the tool and converting to hectares or acres per hour.

Metric system:

The base formula is:

$$\frac{\text{Width of cut (meters)} \times \text{speed (km/h)}}{10} = \text{hectares/h}$$

When an efficiency of 82.5% is used, the formula becomes:

$$\frac{\text{Width of cut (m)} \times \text{speed (km/h)} \times .825}{10} = \text{hectares/h}$$

English measure:

$$\frac{\text{Width of cut (ft)} \times 5280\ \text{(ft/min)} \times \text{speed (mph)}}{43{,}560\ (\text{ft}^2)} = \text{acres/hr}$$

The American Society of Agricultural Engineers formula for estimating hourly production of a constant speed operation is based on 82.5% efficiency. With this efficiency, the formula becomes:

$$\frac{\text{Width of cut (ft)} \times \text{speed (mph)}}{10} = \text{acres/hr}$$

Width of cut is the effective working width of the equipment and may not be the same as its rated width. Working width should be measured on the job but can be estimated when necessary.

The actual speed of a machine can be determined by measuring the amount of time to travel a given distance. When using the metric system, the time to travel 16.7 meters or a multiple thereof, can be converted into kilometers per hour.

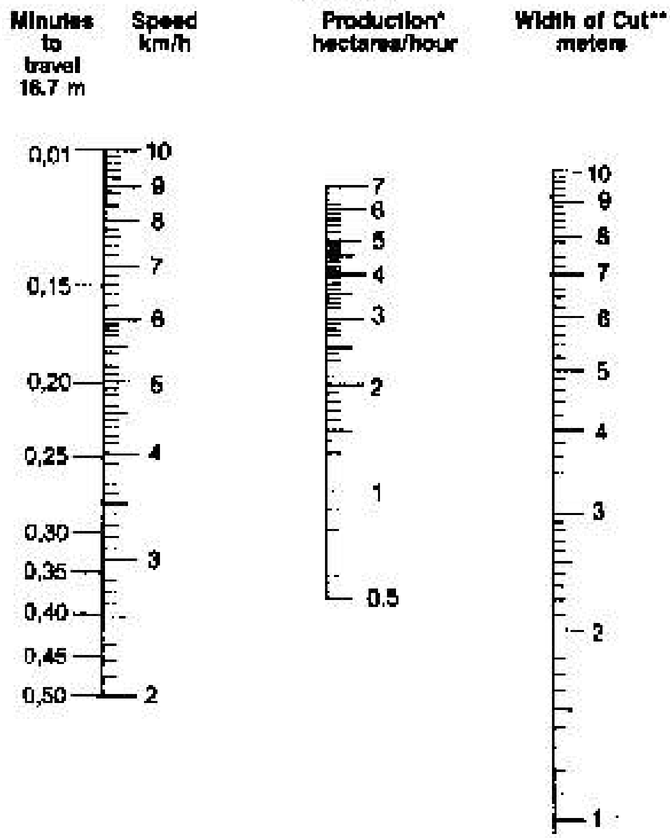
$$\frac{1.0}{\text{(Time in min. to travel 16.7 meters)}} = \text{speed (km/h)}$$

Since 88 ft/min. equals one mph, the lapsed time to travel 88 ft, or a multiple of 88 ft, can easily be converted into miles per hour.

$$\frac{1.0}{\text{(Time in min. to travel 88 ft)}} = \text{speed (mph)}$$

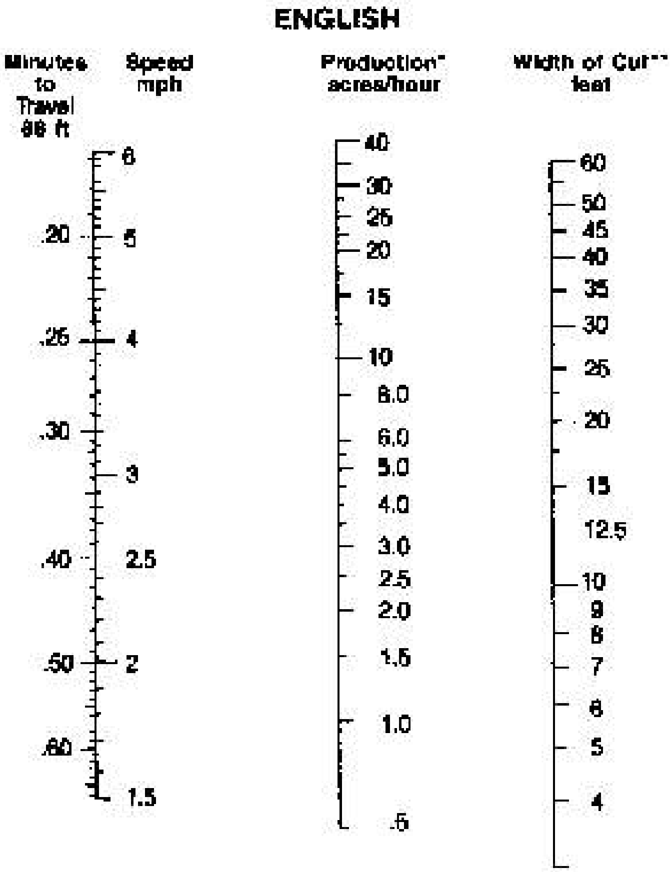
The following nomographs in both the Metric and English systems convert speed and width of cut directly into acres or hectares per hour at 82.5% efficiency without the need for calculations.

METRIC



*Based on 82.5% efficiency

**When width of cut exceeds 10 meters, use a multiple of the width of cut and increase production proportionately.



*Based on 62.5% efficiency
**When width of cut exceeds 60 feet, use a multiple of the width of cut and increase production proportionately.

CUTTING PRODUCTION ESTIMATING

Most land clearing operations such as bulldozing, cutting, grubbing, raking and piling are not performed at constant speed. Because off-the-job production is difficult to estimate for these operations, Rome Industries has developed formulas for estimating cutting and piling time. These formulas take into consideration variable prime mover speeds through a factor, "B", the base time for each tractor to cover one hectare (2.47 acres) of light material.

To estimate **tractor cutting time per hectare** (2.47 acres) on a specific land clearing job, apply the factors shown in the table on the next page, together with data obtained from the job survey, in the formula:

$$T = X\,[A/B) + M_1N_1 + M_2N_2 + M_3N_3 + M_4N_4 + DF]$$

where

T — Time per hectare (2.47 acres) in minutes
X — Hardwood or density factor affecting total time
A — Density or vine presence factor affecting base time
B = Base time for each tractor per hectare (2.47 acres)
M = Minutes per tree in each diameter range
N = Number of trees per hectare (2.47 acres) in each diameter range obtained from field survey
D = Sum of diameter in 30 cm (1 ft) increments of all trees per hectare (2.47 acres) above 180 cm (6 ft) in diameter at ground level obtained from field survey
F — Minutes per 30 cm (1 ft) of diameter for trees above 180 cm (6 ft) in diameter.

Hardwoods affect over-all or total time as follows:
75-100% hardwoods: Add 30% to total time (X=1.3)
25-75% hardwoods: No change (X=1.0)
0-25% hardwoods: Subtract 30% from total time (X=0.7)

Production Factors for Felling with Rome KG Blades

Tractor	Base Minutes per hectare (2.47 acres) "B"	Diameter Range 30-60 cm (1-2 ft) "M_1"	60-90 cm (2-3 ft) "M_2"	90-120 cm (3-4 ft) "M_3"	120-180 cm (4-6 ft) "M_4"	Dia. above 180 cm per 30 cm (6' per foot) "F"
165 HP	85	0.7	3.4	6.8	—	—
215 HP	58	0.6	1.7	3.3	10.2	3.3
335 HP	45	0.2	1.3	2.2	6	1.8
460 HP	39	0.1	0.4	1.3	3	1.0

Explanation of columns in table:

Tractor — Based on current model tractors (power shift when applicable) working on reasonably level terrain (below 10% grade) with good footing and no stones in average mixture of soft and hard woods. Tractor is in proper operating condition, blade is sharp, and properly adjusted.

Base Minutes — The base figures represent the number of minutes required for each tractor to cover a hectare (2.47 acres) of light material where no trees require splitting or other individual treatment. Time required is affected by the density of the material less than 30 cm (1 ft) in diameter and the presence of vines.

a. dense — 1480 trees/hectare (600 or more trees/acre): Add 100% to base time (A=2.0)
b. medium — 990-1480 trees/hectare (400-600 trees/acre): No change (A=1.0)
c. light — less than 990 trees/hectare (400 trees/acre): Subtract 30% from total time (X=0.7)

22

Presence of heavy vines: Add 100% to base time (A = 2.0). *Very* heavy vines add 300% to base time. (A = 3.0)

Dia. Range — M_1 represents minutes required to cut trees from 31-60 cm (1-2 ft) in diameter at ground level.

M_2 same for trees 61-90 cm (2-3 ft) diameter.

M_3 same for trees 91-120 cm (3-4 ft) diameter.

M_4 same for trees 121-180 cm (4-6 ft) diameter.

For Dia. above 180 cm (6 ft) — The figures in this column represent for each tractor size the number of minutes required per 30 cm (1 ft) of diameter to cut trees above 180 cm (6 ft) in diameter. Thus, to fell a 240 cm (8 ft) diameter tree would require 8×1.8 or approximately 14.4 minutes with a D8L.

Example problem:

Calculate the felling production of a D8L with K/G Blade in these conditions: reasonably level terrain, firm ground, well drained, 85% hardwoods with heavy vines and the following average tree count per hectare (2.47 acre):

Diameter Range	Less than 30 cm (1 ft) "B"	31-60 cm (1-2 ft) "N_1"	61-90 cm (2-3 ft) "N_2"	91-120 cm (3-4 ft) "N_3"	121-180 cm (4-6 ft) "N_4"	Sum Dia's Above 180 cm (6 ft) "D"
Number of Trees	1100	35	6	6	4	488 cm (16 ft)

Solution:

$$T = X\,[A\,(B) + M_1N_1 + M_2N_2 + M_3N_3 + M_4N_4 + DF]$$

$$T = 1.3\,[2.0\,(45) + 0.2\,(35) + 1.3\,(6) + 2.2\,(6) + 6\,(4) + 16\,(1.8)]$$

$$= 1.3\,(90+7+7.8+13.2+24+28.8)$$

$$= 1.3\,(170.8)$$

$$= 222 \text{ minutes/hectare (90 min/acre)}$$

• • •

Where the job requires removal of trees and stumps greater than 30 cm (1 ft) in diameter by grubbing at the same time the trees are sheared, use the same basic procedure as defined above including the variables for the presence of hardwoods. After time per hectare (acre) in minutes has been determined, increase the over-all or total time by 25%.

Where the job requires re-entering the area (after all trees have been sheared) to remove stumps with a tilted shearing blade or stumper, increase the over-all or total time by 50%.

PILING PRODUCTION ESTIMATING

A procedure has also been developed for estimating piling production for a tractor equipped with a KG blade or rake.

To estimate tractor hours per hectare (acre) on a specific land clearing job, apply the factors shown in the table below, together with data obtained from the job survey in the field, in the formula:

$$T = B + M_1N_1 + M_2N_2 + M_3N_3 + M_4N_4 + DF$$

where

T = Time per hectare (2.47 acre) in minutes.

B = Base time for each tractor per hectare (2.47 acre).

M = Minutes per tree in each diameter range.

N = Number of trees per hectare (2.47 acre) in each diameter range obtained from field cruise.

D = Sum of diameter in 30 cm (1 ft) increments of all trees per hectare (2.47 acre) above 180 cm (6 ft) in diameter at ground level obtained from field cruise.

F = Minutes per 30 cm (1 ft) of diameter for trees above 180 cm (6 ft) in diameter.

Production Factors for Piling in Windrows*

Tractor	Base Minutes per hectare (2.47 acres) "B"	Diameter Range: 30-60 cm (1-2 ft) "M_1"	60-90 cm (2-3 ft) "M_2"	90-120 cm (3-4 ft) "M_3"	120-180 cm (4-6 ft) "M_4"	Dia. above 180 cm per 30 cm (6 in per foot) "F"
165 HP	157	0.5	1.0	4.2	—	—
215 HP	125	0.4	0.7	2.5	5.0	—
335 HP	111	0.1	0.5	1.8	3.6	0.9
460 HP	97	0.08	0.1	1.2	2.1	0.3

*May be used with most types of raking tools and angled shearing blade. Windrows to be spaced approximately 61 meters (200 feet) apart.

Explanation of columns in table:

Tractor — Production with tractor working alone based on current model tractors (power shift when applicable) working on reasonably level (below 10% grade) terrain with good footing and no stones in average mixture of soft and hard woods. The tractor is in proper operating condition. Decrease total time by 25-50% depending on the number and size of trees when using three or more tractors in combination.

Base Minutes — The base figures represent the number of minutes required for each tractor to cover a hectare (2.47 acres) of light material.

Dia. Range — M_1 represents minutes required to pile trees from 31-60 cm (1-2 ft) diameter at ground level. M_2 same for trees in 61-90 cm (2-3 ft) diameter range. M_3 same for 91-120 cm (3-4 ft) diameter range. M_4 same for 121-180 cm (4-6 ft) diameter range.

For Dia. above 180 cm (6 ft) — The figures in this column represent for each tractor size the number of minutes required per 30 cm (1 ft) of diameter to pile trees above 180 cm (6 ft) in diameter. Thus, to pile a 240 cm (8 ft) diameter tree would require 8×0.9 or approximately 7.2 minutes with a D8L tractor.

Where the job requires piling of grubbed trees and stumps greater than 30 cm (1 ft) in diameter, use the same basic procedure defined above and then increase over-all or total time by 25%.

In dense small diameter brush with few or no large trees, or when cutting is vine entangled, reduce the base time by 30%.

Example problem:

Calculate the windrow piling production of a D7H Series II with Balderson M/A Rake in level terrain, no grubbing, and average mixture of hardwoods and softwoods where the average tree count per hectare (2.47 acres) is:

Diameter Range	Less than 30 cm (1 ft) "B"	31-60 cm (1-2 ft) "N_1"	61-90 cm (2-3 ft) "N_2"	91-120 cm (3-4 ft) "N_3"	121-180 cm (4-6 ft) "N_4"	Sum Dia's Above 180 cm (6 ft) "D"
Number of Trees	1100	35	6	8	2	0

Solution:

$$T = B + M_1N_1 + M_2N_2 + M_3N_3 + M_4N_4 + DF$$
$$125 + 0.4\,(35) + 0.6\,(6) + 2.5\,(6) + 5.0\,(2) + [DF = 0]$$
$$42.6$$
$$= 177.6 \text{ minutes/hectare (72 min/acre)}$$

• • •

To find the number of machines required for each operation, use the formula:

Hr/hectare (acre) × number of hectares (acres) = number of machines needed*

(*Average machine production for all operation in hr/hectare (acre).

To estimate cost of each method or phase of operation, use this calculation:

Owning and Operating cost/hr × hr/hectare (acre) × number of hectares (acres) = cost

Because of the many variables that increase or decrease production, these formulas should be considered only as guidelines in arriving at a rough estimate of production. This estimate should be tempered by personal judgment based on past experience and personal knowledge of the area.

BALDERSON V-TREE CUTTERS

Tractor Model	D5H Series II		D6H Series II		D7H Series II		D8N				D8L			
Balderson Model	BVT5		BVT6		BVT7		BVT8							
Cutting Width	3.05 m	10'0"	3.05 m	10'0"	3.30 m	10'10"	3.63 m	11'11"	4.27 m	14'0"	3.66 m	12'0"	4.27 m	14'0"
Overall Height	1.12 m	3'8"	1.12 m	3'8"	1.24 m	4'1"	1.30 m	4'3"	1.30 m	4'3"	1.30 m	4'3"	1.30 m	4'3"
Splitter Extension	762 mm	30"	762 mm	30"	1067 mm	42"	—	—	—	—	1.22 m	4'0"	1.22 m	4'0"
Weight	2245 kg	4950 lb	2809 kg	6200 lb	3777 kg	8335 lb	5470 kg	12,060 lb	5550 kg	12,230 lb	5602 kg	12,350 lb	5760 kg	12,700 lb

BALDERSON TREE PUSHERS (Full Width, Dozer Mounted)

Tractor Model	D5H Series II	D6H Series II		D7H Series II		D8N				D8L			
Maximum Height	Not avail.	3.81 m	12'6"	5.03 m	16'6"	5.49 m	18'0"	5.18 m	17'0"	5.49 m	18'0"	5.18 m	17'0"
Minimum Height		2.95 m	9'8"	3.51 m	11'6"	3.50 m	11'6"	4.00 m	13'0"	3.50 m	11'6"	4.00 m	13'0"
Weight		1446 kg	3190 lb	2449 kg	5400 lb	3630 kg	8000 lb	3630 kg	8000 lb	3875 kg	8540 lb	4320 kg	9520 lb

BALDERSON TREE PUSHERS (Single Beam, Dozer Mounted)

Tractor Model	D5H Series II	D6H Series II		D7H Series II		D8N				D8L		
Maximum Height	Not avail.	4.27 m	14'0"	4.95 m	16'3"	—		6.10 m	20'0"	—	6.10 m	20'0"
Minimum Height	—	1.98 m	6'6"	2.74 m	9'0"	—		3.66 m	12'0"	—	3.66 m	12'0"
Weight	—	1346 kg	2970 lb	1964 kg	4335 lb	3022 kg	6660 lb	3022 kg	6660 lb	—	2858 kg	6300 lb

ROME K/G BLADES

Tractors Equipped with CAT C-Frame — Tractors Equipped with Rome C-Frame

Tractor Model		D5H Series II	D6H Series II	D7H Series II	D8K & D8N	D8L	D5H LGP Series II	D6H LGP Series II	D6H Series II	D7H LGP Series II	D7H* Series II	D7H Series II	D8K*	D8K
Blade Model		KGBA5H	KGBA6H	KGBA7H	KGBA8	KGBA8L	KB5HLGP	KGB6HLGP	KGB6CH	KGB7HLGP	KGB7HTCA	KGB7H	KGB8KTC	KGB8K
Overall Width, Mounted	m	3.29	3.29	3.40	3.76	3.88	3.88	3.89	3.16	3.96	3.40	3.40	3.76	3.76
	ft	10'9.5"	10'9.5"	11'2"	12'4"	12'9"	12'9"	12'9"	10'4.5"	13'0"	11'2"	11'2"	12'4"	12'4"
Weight	kg	1600	1600	2364	3090	3157	2140	2140	2282	3770	3572	3420	5320	5160
	lb	3520	3520	5200	6820	6960	4708	4708	5030	8310	7880	7530	11,730	11,380

*Equipped with Caterpillar Tilt Cylinder

BALDERSON MULTI-APPLICATION RAKES

Tractor Model & Dozer		D4H Series II 4A	4S	D5H Series II 5A	5S	5SLGP	D6H Series II 6A	6S	6SLGP	D7H Series II 7A	7S	7SLGP	D8N 8A	8S	D8L 8A	8S
Raking	m	2.44	2.21	3.12	2.85	3.45	3.28	3.05	3.56	3.56	3.48	3.86	3.43	3.43	3.86	3.63
	ft	8'0"	7'3"	10'3"	9'4"	11'4"	10'9"	10'0"	11'8"	11'8"	11'5"	12'8"	11'3"	11'3"	12'8"	11'11"
Opening at Tooth tips	mm	305	229	279	241	279	305	266	305	330	330	330	305	305	363	330
	in	12"	9"	11"	9.5"	11"	12"	10.5"	12"	13"	13"	13"	12"	12"	14.3"	13"
Tooth Penetration	mm	356	356	482	482	482	508	508	508	660	660	660	686	686	686	686
	in	14"	14"	19"	19"	19"	20"	20"	20"	26"	26"	26"	27"	27"	27"	27"
Total Weight	kg	871	600	1420	1315	1601	1543	1749	1810	2272	2830	3005	2930	3095	3115	3170
	lb	1920	1325	3135	2900	3535	3405	3860	3995	5015	6245	6620	6465	6820	6862	6984

BALDERSON BLADE RAKES

Tractor Model & Dozer		D3C Series II 3APAT	3SLGP	D4H Series II 4A	4S	4LGP	4PAT	D5H Series II 5A	5S	5LGP	5PAT	D6H Series II 6A	6S	6SLGP	D7H Series II 7A	7S	7SLGP	D8N 8A	8S
Raking Width	m	2.23	2.46	2.77	2.29	3.02	2.23	3.35	2.64	3.10	2.74	3.25	2.62	3.56	3.72	3.20	3.86	3.96	2.79
	ft	7'1"	8'1"	8'1"	7'6"	9'11"	7'3"	11'0"	8'8"	10'2"	9'0"	10'8"	8'6"	11'8"	12'3"	10'6"	12'8"	13'0"	9'2"
Opening at Tooth tips	mm	279	279	305	290	335	241	360	271	306	288	356	305	381	406	356	356	432	330
	in	11"	11"	12"	11.4"	13.2"	9.5"	14.2"	10.7"	12"	11.3"	14"	12"	15"	16"	14"	14"	17"	13"
Tooth Penetration	mm	356	356	381	381	381	356	406	406	406	406	432	457	406	559	559	559	559	559
	in	14"	14"	15"	15"	15"	14"	16.0"	16"	16"	16"	17"	18"	16"	22"	22"	22"	22"	22"
Total Weight	kg	220	245	365	340	410	365	575	525	630	544	718	675	825	1144	1097	1119	1275	1080
	lb	485	540	800	750	900	800	1270	1160	1385	1200	1585	1490	1820	2525	2420	2470	2810	2380

BALDERSON ROCK AND ROOT RAKES

Tractor Model & Dozer		D3C Series II 3P/3A	D4H Series II 4P	4S	4SLGP	D5H Series II 5P	5S	5SLGP	D6H Series II 6A	6S	6SLGP	D7H Series II 7A	7S	7SLGP	D8N 8A	8S	D8L 8A	8S
Raking Width	m	2.03	2.44	2.21	2.87	2.47	2.82	3.36	3.28	3.02	3.56	3.56	3.23	3.89	3.43	3.43	3.86	3.63
	ft	6'8"	8'0"	7'2"	8'6"	8'10"	9'3"	11'	10'9"	9'11"	11'8"	11'8"	10'7"	12'9"	11'3"	11'3"	12'8"	11'11"
Opening at Tooth tips	mm	330	305	229	279	279	254	305	305	254	305	330	305	330	305	305	365	337
	in	13"	12"	9"	11"	11"	10"	12"	12"	10"	12"	13"	12"	13"	12"	12"	14.4"	13.3"
Tooth Penetration	mm	381	356	356	356	584	584	584	533	533	533	711	711	711	711	711	711	711
	in	15"	14"	14"	14"	23"	23"	23"	21"	21"	21"	28"	28"	28"	28"	28"	28"	28"
Total Height with Brush Rack	m	1.25	1.73	1.73	1.73	1.78	1.78	1.78	1.83	1.83	1.83	1.88	1.88	1.88	1.88	1.88	2.13	2.13
	ft	4'1"	5'8"	5'8"	5'8"	5'10"	5'10"	5'10"	6'0"	6'0"	6'0"	6'2"	6'2"	6'2"	6'6"	6'6"	7'0"	7'0"
Total Weight	kg	526	871	610	680	1508	1380	1414	1218	1470	1409	1898	2120	2084	2680	2775	2990	3045
	lb	1160	1920	1360	1500	3325	3075	3120	2690	3250	3110	4185	4680	4600	5910	6120	6590	6710

BALDERSON RAKES FOR WHEEL LOADERS

Wheel Loader Model and Rake type		910E Clearing Rake	910E Stacker Rake	916 Stacker Rake	926E Stacker Rake	936E Stacker Rake	950E Clearing Rake	950E Stacker Rake	966E Clearing Rake	966E Stacker Rake
Raking Width	m	2.11	2.11	2.49	2.74	3.11	2.87	2.87	2.83	2.83
	ft	6'11"	6'11"	8'0"	9'0"	10'4"	9'4"	9'4"	9'3"	9'3"
Tooth length Below frame	mm	610	787	762	787	914	610	889	610	889
	in	24"	31"	30"	31"	36"	24"	35"	24"	35"
Opening at Tooth tips	mm	267	267	356	349	305	241	273	241	273
	in	10.5"	10.5"	14"	13.8"	12"	9.5"	10.75"	9.5"	10.75"
Rake Weight	kg	623	778	760	1050	1258	1438	1533	1996	2093
	lb	1375	1715	1675	2400	2770	3170	3380	4400	4615

BALDERSON RAKES FOR TRACK LOADERS

Track-type Loader Model and Rake type		931C Series II Clearing Rake	931C Series II Stacker Rake	953 Clearing Rake	953 Stacker Rake	963 Clearing Rake	963 Stacker Rake	973 Clearing Rake	973 Stacker Rake
Raking Width	m	2.11	2.11	2.53	2.53	2.53	2.53	3.14	3.14
	ft	6'11"	6'11"	8'4"	8'4"	8'4"	8'4"	10'4"	10'4"
Tooth Length Below Frame	m	610	787	610	860	610	860	610	889
	in	24"	31"	24"	34"	24"	34"	24"	35"
Opening at Tooth tips	mm	267	267	254	254	305	279	274	274
	in	10.5"	10.5"	10"	10"	12"	11"	10.8"	10.8"
Rake Weight	kg	623	778	1188	1320	1599	1653	1837	2007
	lb	1375	1725	2620	2910	3525	3645	4050	4425

WASTE DISPOSAL

CONTENTS

INTRODUCTION

An increasing volume of refuse is generated by every person, commercial entity and household day after day . . . 365 days of the year. The disposal of this waste is a major problem around the world. Increased governmental legislation designed to protect the environment and rising transportation and land acquisition costs have made waste disposal a significant user of earthmoving and specialty mobile equipment.

The most commonly accepted disposal method is burying refuse in a sanitary landfill. A sanitary landfill is an engineered method of disposing of solid wastes on land in a manner that protects the environment by placing it into a cell. The process of building a cell involves spreading the waste in thin layers, compacting it to the smallest practical volume, covering it with soil by the end of each working day, and compacting the cover material. Proper equipment selection and operating technique can maximize refuse and cover compaction and thereby extend the operational life of the landfill.

LANDFILL METHODS

There are three basic landfill methods:

In the *area* method, waste is usually deposited at the toe of the previously compacted cell and then spread and compacted. This method is attractive for landfills receiving over 450 metric tons (500 tons) of refuse per day to reduce truck unloading congestion problems. Cover material is normally handled by wheel tractor-scrapers from nearby borrow sites.

The *trench* method is normally found at smaller landfills where the ground water table is deep. A trench is excavated and refuse is deposited and compacted within it. Excavated material becomes the cover material. Since the working face of the trench is narrow, congestion of trucks waiting to dump can occur. This method is usually attractive to landfills receiving under 450 metric tons (500 tons) per day of refuse.

The *ramp* method combines the characteristics of both area and trench designs. Refuse is dumped, spread and compacted on existing slopes and covered with material excavated directly in front of the working face. The excavated area becomes part of the next cell. This is a good way for a landfill to begin operation with a minimum of equipment expenditures.

EQUIPMENT SELECTION

The largest single cost of a landfill's daily operation will be purchasing, operating and maintaining the mobile equipment. Undersized, inadequate or unreliable equipment will result in breakdowns, higher operational costs and improper landfill operation.

Landfill equipment performs three distinct functions:

1. Waste handling and compaction equipment dispose of the waste. Track-type tractors, track loaders, and steel-wheeled landfill compactors are the primary machines.
2. Cover material handling machines provide daily cover requirements. If supplying cover material is a machine's sole function at a landfill, it can be selected on the basis of normal earthmoving considerations, such as material characteristics, distance to borrow areas, volume to be transported, and other basic earthmoving principles, i.e., maximizing earth movement in the least amount of time at the lowest cost per yard.
3. Support equipment includes motor graders, hydraulic excavators, water trucks, air compressors, service vehicles, water pumps, generators and any other necessary equipment.

Track-Type Tractors

The track-type tractor is the most popular and versatile machine on a sanitary landfill. They not only spread and compact refuse and cover material, they also prepare the site, rip cover material, build haul roads, knock down trees, remove stumps, and work in virtually all weather conditions. They are well-suited for all three landfill methods (area, ramp, and trench).

The crawler tractor can achieve compaction densities of 475 to 590 kg/m^3 (800-1000 lb/yd^3). Maximum compaction is achieved when it works on a 3:1 slope, permitting the grousers to rip and tear while pushing and compacting waste up-slope. Economic limit of cover or waste movement by a track-type tractor is normally under 90 m (300 ft).

Track-Type Loaders

Track loaders have a high degree of versatility allowing them to perform many applications. Small landfills under 135 metric tons (150 tons) per day generally utilize a minimum amount of equipment. Track loaders can serve both the waste handling and cover material functions.

The track-type loader is an ideal machine for the trench method operation. Since the bucket does not extend outside the tracks, it is able to obtain full compaction to the walls of the trench. Rippers can be attached to handle frozen cover material. Compaction densities are similar to or slightly higher than the track-type tractor — 475 to 590 kg/m^3 (800-1000 lb/yd^3). Many people believe track-type loaders equipped with single grouser shoes provide maximum demolition and compaction densities. To achieve higher densities, the bucket can be loaded to achieve higher machine weight for the compaction passes.

Track loaders have been equipped with multi-purpose buckets to increase the versatility of the machine in single machine applications, allowing the operator to selectively grapple items out of the working face.

Landfill Compactors (Steel-Wheeled)

Landfill compactors are specialized pieces of equipment effective in spreading and compacting large volumes of incoming waste. Compactors offer higher operational speeds on the refuse than track machines. This is the recommended machine if more than one spreading and compaction machine is needed and waste does not have to be pushed more than 90 m (300 ft).

Landfill compactors over 20 410 kg (45,000 lb) operating weight achieve the highest compaction levels — from 710 to 950 kg/m^3 (1200-1600 lb/yd^3).

Landfill compactors normally operate on slopes no steeper than 4:1 due to reduced compaction and operational safety considerations. Compactors should not be used to excavate cover material.

Wheel Loaders

Although not recommended as a waste handling and compaction machine, wheel loaders are used by those communities sharing a single machine which travels from landfill to landfill. Versatility and mobility are the primary wheel loader advantages. In landfills over 272 metric tons (300 tons) per day, wheel loaders will sometimes be used to perform general clean-up tasks. Wheel loaders are also popular units in transfer stations to load and separate refuse. Special foam-filled tires should be considered due to the constant threat of tire failure by puncture. However, foam filled tires will have reduced ton-mile-per hour capabilities.

Wheel loaders can achieve compaction densities of 530 to 650 kg/m³ (900-1100 lb/yd³). A disadvantage of wheel loaders is that they can leave ruts in the refuse, requiring extra cover material.

Wheel Tractor-Scrapers

A scraper can be used to excavate trenches for site preparation, but usually performs a cover operation at a landfill and is most economical at distances over 185 m (600 ft). A scraper should be selected as if it were performing a typical earthmoving job.

Preferably, the scraper unloads the cover material close to the working face, either at the base or top. The cover material is then spread by the machine(s) working on the refuse. This reduces the possibility of tire damage occuring from driving over the refuse. Foam filled tires are not recommended for scrapers due to the high travel speeds involved. Since excavating and transporting cover material is a major expense at a landfill, scrapers with work alone capability have been the most popular.

Machine Selection Factors

Selecting the type, size, quantity, and combination of machines required to spread, compact, and cover varying daily volumes of refuse is determined by the following parameters:

1. Amount and type of waste to be handled (daily tonnage)
2. Amount and type of soil cover to be handled
3. Distance cover material to be transported
4. Weather conditions
5. Compaction requirements
6. Landfill method utilized
7. Supplemental tasks
8. Budget
9. Growth

A. *Daily tonnage and type of waste* — Amount of waste produced by a community is the major variable in selecting the appropriate size machine. The chart serves as a guideline in sizing a landfill machine. For example, if a community generates approximately 180 metric tons (200 tons) of refuse per day, a D6 or 963 and a 518 Landfill Compactor should be considered.

WASTE EQUIPMENT SELECTION BASED UPON POPULATION AND DAILY REFUSE TONNAGE

Population	Metric Tons/ Day	U.S. Tons/ Day	Machine(s) Required
0-20,000	0-45	0-50	D3 or 931 or 936 LFC
20,000-60,000	45-136	50-150	D4 or 943 or 518 LFC or 936 LFC
60,000-100,000	136-226	150-250	D5 or D6 or 953 and 518 LFC
100,000-140,000	226-317	250-350	D6 or D7 or 963 and 816
140,000-200,000	317-453	350-500	D7 or D8 or 973 and 816
200,000-300,000	453-680	500-750	D8 or D9 and 826
300,000-more	680-more	750-more	D9 and 826/variety of support equipment

Note: Daily tonnage figures are based on 2.26 kg (5.0 lb) of residential refuse per person per day. The amount of waste/person/day can vary depending on the community and should be adjusted to the individual community.

Type of waste to be handled will strongly influence machine selection. The major solid waste components for a community should be identified and the proper machine chosen based on the type of waste materials to be handled and the compaction desired. For example, if the site receives a high proportion of noncompactible heavy industrial waste (rocks, bricks, concrete, reinforcing rod, etc.) a compactor might not achieve normal compaction densities and the pushing and tractive ability of a track-type tractor may be needed. However, a small track-type tractor has more difficulty compacting bulk waste such as washing machines and telephone poles than a landfill compactor.

Waste varies from location to location, even within a community; however, the following figures are representative in the U.S.:

Characterization of Domestic — Household Waste

Component	Percent by Weight
Paper	42
Food	16
Glass	14
Metal	12
Plastics	5
Wood	5
Rubber and Leather	4
Textiles	2

Note: Moisture content can have a significant effect on weight characteristics. Field tests have indicated moisture content can vary from 10-50% during dry and wet seasons.

B. *Amount and type of cover material to be handled* Although landfill size and type will vary, a rule of thumb for estimating the amount of needed cover material is one cubic meter (cubic yard) of cover material for every four cubic meters (or cubic yards) of in-place compacted waste. That is, about 20-25% of a sanitary landfill's volume consists of soil used for cover (including daily and final covering). On smaller landfills, the percentage of soil could be as high as 50% to meet reasonable cover requirements.

It is important to remember that cover material also occupies landfill space reducing the amount of volume available for refuse. For example a landfill with 1 900 000 m^3 (2,500,000 yd^3) of *total volume* would provide for disposing of 1 520 000 m^3 (2,000,000 yd^3) of refuse and allow 380 000 m^3 (500,000 yd^3) of cover material. This example considers one cubic yard of cover for every 4 cubic yards of in place compacted waste.

The type of cover material can also be important. If the material is sandy or highly abrasive, a rubber tired wheel loader or scraper might be considered rather than a track-type unit.

C. *Distance cover material is to be transported* will have a large effect on cover equipment selection. The following economic limits or guidelines are recommended for cover material movement. The quantity of material to be moved as well as the time available must be considered when using these guidelines.

Track-type tractor	0-90 m	(0-300 ft)
Track-type loader	0-152 m	(0-500 ft)
Wheel loader	0-185 m	(0-600 ft)
Wheel tractor-scraper	over 185 m	(over 600 ft)

D. *Weather conditions* — when working in inclement weather, the tractive capability of a track-type machine may be necessary for poor underfoot conditions or to rip frozen cover material.

E. *Compaction requirements* — are becoming critical as extended landfill life is sought. If high density is desired, then a compactor may be necessary.

REFUSE DENSITIES

Generally, loose residential and commerical refuse weighs 150-180 kg/m^3 (250-300 lb/yd^3). A refuse collection vehicle will increase this density to 237-415 kg/m^3 (400-700 lb/yd^3). In-place landfill density can vary from 355 890 kg/m^3 (600-1500 lb/yd^3), depending on the compactive effort applied to the refuse. Landfill sites that accept a high percentage of demolition waste can have densities up to 1485 kg/m^3 (2500 lb/yd^3). Cover material will generally raise fill densities 60-120 kg/m^3 (100 200 lb/yd^3) over the figures given above.

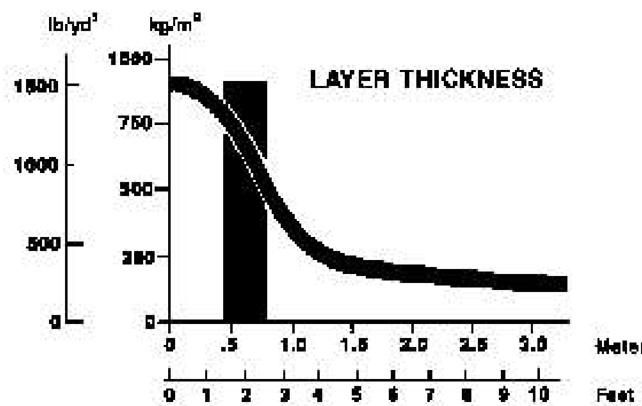
Weight of Refuse

	kg/m^3	lb/yd^3
Loose Refuse:	148-178	250-300
Packer Truck	237-415	400-700
Fill Density:	356-890	600-1500
Refuse and Cover:	415-1009	700-1700

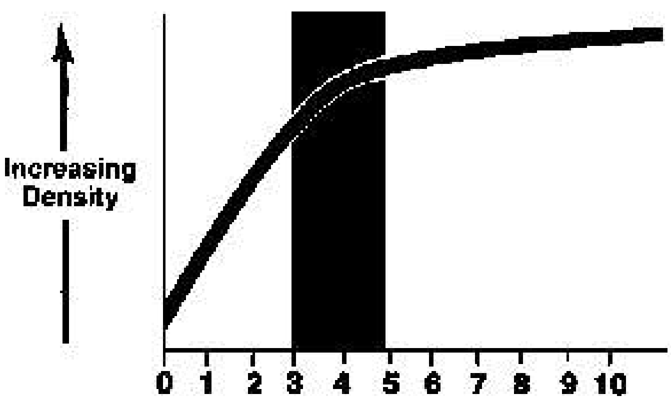
FACTORS GOVERNING COMPACTION

Assuming equal machine weight, regardless of the type of machine, the following factors (1-4) affect compaction:

1. Refuse Layer Thickness — The depth of each compacted layer is perhaps the single most important controllable factor influencing density. To obtain maximum density, waste should be spread and compacted in layers not exceeding a depth of 610 mm (2 ft). Thicker layers will reduce the density that a machine can develop in a given number of passes. (Density figures shown do not include cover material.)



2. Number of passes made over the refuse also affects density. Regardless of the *type* of machine used, the unit should make 3-5 passes to achieve optimum density. The following graph illustrates that more than five passes result in little additional compactive effort. The added expense of additional passes is *not* justified by the incremental increase in density.



3. Slope — Maximum compactive effort by a track-type unit is achieved by working the waste on a slope of 3:1. Track-type machines achieve higher densities by grinding and shredding the refuse into smaller pieces as they climb a slope.

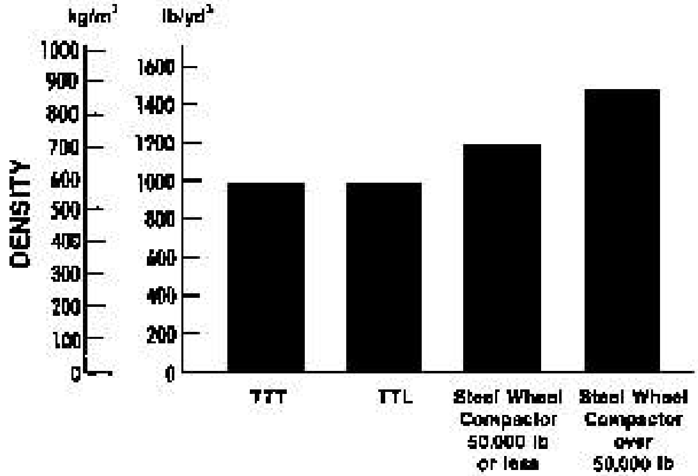
   Just the opposite is true for the landfill compactor. The flatter the slope, the better the compaction. This is because the weight of the landfill compactor is more efficiently utilized and concentrated when working on a flat surface.

4. Moisture Content — has been shown to have a significant effect on compacted density. It is believed that water tends to weaken the bridging characteristics of refuse, particularly paper such as large pieces of cardboard, etc., thereby allowing tighter consolidation. The water may also act as a lubricant — much as it does for soils. A minimum amount of moisture can increase refuse compaction density by 10%.

   The optimum moisture content for maximum compaction of household refuse appears to be around 50% by weight. Field tests show actual moisture contents varying from 10-80% during dry and wet seasons. Although higher moisture content can provide higher in-place densities, the chance of leachate formation also increases.

COMPACTION COMPARISON

The following graph may be used as a rule of thumb for the compactive ranges of various types of equal weight landfill machines if proper operating technique is employed.



EXAMPLE OF INCREASED COMPACTION ON POTENTIAL LANDFILL LIFE

Landfill refuse capacity	1 530 000 m³ (2,000,000 yd³)
Operating days	260
Daily volume	365 metric tons (400 tons)
Yearly volume	94 328 metric tons (104,000 tons)

Compaction		Landfill Life	Gain
590 kg/m³	**1000 lb/yd³**	9.6 years	0
710 kg/m³	**1200 lb/yd³**	11.5 years	1.9 years
830 kg/m³	**1400 lb/yd³**	13.4 years	3.8 years
950 kg/m³	**1600 lb/yd³**	15.3 years	5.7 years

In this example, each 120 kg (200 lb) increase in refuse density results in an additional 1.9 years of landfill life. Also this example is exclusive of cover requirements.

F. *Landfill method utilized* — will impact on the type of equipment needed. The area method, which is generally suited for flat or gradual sloping surfaces will get maximum compaction effort with a compactor. The trench method, in turn, may require the use of a track-type loader due to its excavating and tractive capabilities.

G. *Supplemental tasks* — should be reviewed before selecting a landfill machine. Will the machine be required for site clearing, maintaining access roads, excavating, etc.? Auxiliary duties may require additional machine capability and/or attachments. If versatility is the key consideration, a track-type machine again becomes the logical choice.

H. *Budget* — Smaller landfill operations with limited budgets may have to consider single machine versatility ahead of specialized machines or multiple units.

I. *Growth* — Future increases in refuse volume must be considered to properly size machines.

LANDFILL ESTIMATING

Example Problem #1

A professional engineer has developed a small, rural sanitary landfill master plan. The local legislative regulatory agency has approved the plan and site.

Assume:

Topography: flat

Land availability:

area has several suitable sites at nominal price

Population served: 30,000

Projected population in 3 years: 40,000

Current daily refuse volume: ?

Type of refuse: mostly household, some commercial

Operation: propose 8 hours/day, 5½ days/week

Present equipment: none — new site

What would your comments and recommendations be on the following:?

a. Probable amount of refuse generated daily?
b. Type of machine for the proposed SLF?
c. Size of machine for the proposed SLF?

Solution

a. At three year projected population — 2.26 kg/day (5.0 lb/day) per person × 40,000 people = 90.4 metric tons (100 tons) daily.

b. Track-type loader — excavating ability, single machine application based on tonnage requirements.

c. 943, handle current amount of refuse, 953 for extra capacity for future growth. Small compactor if additional compaction is required.

Example Problem #2

Existing sanitary landfill operation has been in operation for several years.

Assume:

Type of operation: area fill

Cover material: suitable material within 90 m (300 ft).

Current daily refuse volume: 500 metric tons (550 tons)

Anticipated daily refuse volume in 3 years: 680 metric tons (750 tons)

Type of refuse: household, commercial, large amount of brush and building demolition debris

Land availability: limited, very expensive

Available Refuse Volume: 3 249 125 m^3 (4,250,000 yd^3)

Operation: 8 hours/days, 5½ days/week

Present equipment: D8K (3 years old)

What would your comments and recommendations be on the following:

a. What range of in-place densities could be expected using a track-type tractor; a Cat steel-wheeled landfill compactor?
b. What effect does machine selection have on site life?
c. What are the advantages and limitations of steel wheeled landfill compactors?
d. What are the advantages and limitations of track-type units?
e. How many machines should be used on the site?
f. What type should they be?
g. What size should they be?

Solution

a. The Track-Type Tractor will achieve 475 to 595 kg/m^3 (800 to 1,000 lb/yd^3) in-place density. The Cat steel wheeled landfill compactor will achieve 595 to 830 kg/m^3 (1,000 to 1,400 lb/yd^3) in-place density.

b. There are 3 249 125 m^3 (4,250,000 yd^3) available. 500 metric tons (550 tons) per day is how many m^3 (yd^3)? Assume a minimum density of 475 kg/m^3 (800 lb/yd^3).

$$500 \text{ metric tons/day} \times \frac{1000 \text{ kg/metric ton}}{475 \text{ kg/m}^3} = 1052 \text{ m}^3 \text{ day}$$

$$550 \text{ tons/day} \times \frac{2000 \text{ lb/ton}}{800 \text{ lb/yd}^3} = 1{,}375 \text{ yd}^3\text{/day}$$

5.5 days/week × 52 weeks/year = 286 days/year

Yearly volume: $1{,}052 \times 286 = 300\,872 \text{ m}^3$
$1{,}375 \times 286 = 393{,}250 \text{ yd}^3$

Landfill life at this density:

$$\frac{3\,250\,000 \text{ m}^3}{300\,872 \text{ m}^3\text{/year}} = \frac{4{,}250{,}000 \text{ yd}^3}{393{,}250 \text{ yd}^3\text{/year}} = 10.8 \text{ years}$$

Similar calculations are performed to generate the following tables.

500 METRIC TONS/DAY (550 TONS/DAY)

Density kg/m³	Density lb/yd³	Landfill Life (years)
475	800	10.8
595	1000	13.5
715	1200	16.2
835	1400	18.9
950	1600	21.6

680 METRIC TONS/DAY (750 TONS/DAY)

Density kg/m³	Density lb/yd³	Landfill Life (years)
475	800	7.9
595	1000	9.9
715	1200	11.9
835	1400	13.9
950	1600	15.9

From the tables we determine that a track-type tractor, at 500 metric tons per day (550 tons/day), will provide 13.5 landfill life years at 595 kg/m³ (1,000 lb/yd³). Compaction will extend that life 5.4 years to 18.9 years at 835 kg/m³ (1,400 lb/yd³).

Proper compaction techniques are necessary to achieve the higher refuse densities for increasing landfill life.

c. Advantages: Provides highest compaction densities extending landfill life.

Limitations: Specialty unit designed to spread and compact — does not excavate virgin material economically, but can handle stockpile cover material.

d. Advantages: most versatile unit, well suited to site preparation, site finishing, and construction and maintenance of access roads; all weather machines with excellent tractive ability. Limitation: compaction — cannot achieve the in-place densities of refuse that the specialized landfill compactors do.

e. Minimum of two. Additional equipment would depend on supplemental tasks.

f. Track-type tractor — for earthmoving and refuse spreading work; steel-wheeled compactor-quantity of refuse and land cost would justify.

g. D8 — keeping existing unit; D9 — when new tractor is necessary; 826C — with large amount of demolition debris and brush and projected increase in tonnage would justify 826C over 816B.

TABLES

SWELL — VOIDS — LOAD FACTORS

SWELL (%)	VOIDS (%)	LOAD FACTOR
5	4.8	.952
10	9.1	.909
15	13.0	.870
20	16.7	.833
25	20.0	.800
30	23.1	.769
35	25.9	.741
40	28.6	.714
45	31.0	.690
50	33.3	.667
55	35.5	.645
60	37.5	.625
65	39.4	.606
70	41.2	.588
75	42.9	.571
80	44.4	.556
85	45.9	.541
90	47.4	.526
95	48.7	.513
100	50.0	.500

BUCKET FILL FACTORS

Loose Material	Fill Factor
Mixed Moist Aggregates	95-100%
Uniform Aggregates up to 3 mm (1/8")	95-100
3 mm-9 mm (1/8"-3/8")	90-95
12 mm-20 mm (1/2"-3/4")	85-90
24 mm and over (1")	85-90
Blasted Rock	
Well Blasted	80-95%
Average Blasted	75-90
Poorly Blasted	60-75
Other	
Rock Dirt Mixtures	100-120%
Moist Loam	100-110
Soil, Boulders, Roots	80-100
Cemented Materials	85-95

NOTE: Loader bucket fill factors are affected by bucket penetration, breakout force, rackback angle, bucket profile and ground engaging tools such as bucket teeth or bolt-on replaceable cutting edges.

NOTE: For bucket fill factors for hydraulic excavators, see bucket payloads in the hydraulic excavator section.

TYPICAL ROLLING RESISTANCE FACTORS

UNDERFOOTING	kg/ Metric t	lb/ U.S. ton	EQUIVALENT % GRADE
A hard, smooth, stabilized surfaced roadway without penetration under load, watered, maintained	20	40	2%
A firm, smooth, rolling roadway with dirt or light surfacing, flexing slightly under load or undulating, maintained fair-regularly, watered	32.5	65	3%
Snow, Packed	25	50	2.5%
Loose	45	90	4.5%
A dirt roadway, rutted, flexing under load, little if any maintenance, no water, 25 mm (1") or 50 mm (2") tire penetration	50	100	5%
Rutted dirt roadway, soft under travel, no maintenance, no stabilization, 100 mm (4") to 150 mm (6") tire penetration	75	150	7.5%
Loose sand or gravel	100	200	10%
Soft, muddy, rutted roadway, no maintenance	100 to 200	200 to 400	10-20%

Various tire sizes and inflation pressures will greatly reduce or increase the above figures. The quantities given are sufficiently accurate for estimating purposes when specific information on performance of particular equipment on given soil conditions is not available. See Earthmoving Section for additional information.

ANGLE OF REPOSE OF VARIOUS MATERIALS

MATERIAL	ANGLE BETWEEN HORIZONTAL AND SLOPE OF HEAPED PILE	
	Ratio	Degrees
Coal, Industrial	1.4:1—1.3:1	35-38
Common earth, Dry	2.8:1—1.0:1	20-45
Moist	2.1:1—1.0:1	25-45
Wet	2.1:1—1.7:1	25-30
Gravel, Round to angular	1.7:1—0.9:1	30-50
Sand & clay	2.8:1—1.4:1	20-35
Sand, Dry	2.8:1—1.7:1	20-30
Moist	1.8:1—1.0:1	30-45
Wet	2.8:1—1.0:1	20-45

ROUND REINFORCED CONCRETE PIPE APPROXIMATE WEIGHT PER FOOT

INSIDE DIAMETER		WEIGHT PER FT.	
mm	in	kg	lb
305	12	42	93
380	15	58	127
460	18	76	168
530	21	97	214
610	24	120	265
685	27	146	322
760	30	174	384
840	33	205	452
915	36	238	524
1070	42	311	686
1220	48	393	867
1370	54	485	1069
1525	60	588	1296
1675	66	699	1542
1830	72	821	1811
1980	78	952	2100
2135	84	1089	2409
2285	90	1242	2740
2440	96	1402	3090
2590	102	1578	3480
2740	108	1753	3865

NOTE: Table courtesy of American Concrete Pipe Assn. A more detailed table can be found in the excavator section of this handbook.

SPEED CONVERSION

km/h Equivalents in m/min				MPH Equivalents in FPM			
km/h	m/min	km/h	m/min	mph	fpm	mph	fpm
1	16.7	21	350.0	1	88	21	1848
2	33.3	22	366.7	2	176	22	1936
3	50.0	23	383.3	3	264	23	2024
4	66.7	24	400.0	4	352	24	2112
5	83.3	25	416.7	5	440	25	2200
6	100.0	26	433.3	6	528	26	2288
7	116.7	27	450.0	7	616	27	2376
8	133.3	28	466.7	8	704	28	2464
9	150.0	29	483.3	9	792	29	2552
10	166.7	30	500.0	10	880	30	2640
11	183.3	31	516.7	11	968	31	2728
12	200.0	32	533.3	12	1056	32	2816
13	216.7	33	550.0	13	1144	33	2904
14	233.3	34	566.7	14	1232	34	2992
15	250.0	35	583.3	15	1320	35	3080
16	266.7	36	600.0	16	1408	36	3168
17	283.3	37	616.7	17	1496	37	3256
18	300.0	38	633.3	18	1584	38	3344
19	316.7	39	650.0	19	1672	39	3432
20	333.3	40	666.7	20	1760	40	3520

NOTE: Since 1 km/h equals 16.7 m/min (1000 ÷ 60), to interpolate add 1.67 m/min for each 0.1 km/h.

NOTE: Since 1 mph equals 88 fpm (5280 ÷ 60), to interpolate add 8.8 fpm for every 0.1 mph.

1 mph = 26.8 m/min.

COEFFICIENT OF TRACTION FACTORS

MATERIAL	TRACTION FACTORS: Rubber Tires	TRACTION FACTORS: Tracks
Concrete	.90	.45
Clay loam, dry	.55	.90
Clay loam, wet	.45	.70
Rutted clay loam	.40	.70
Dry sand	.20	.30
Wet sand	.40	.50
Quarry pit	.65	.55
Gravel road (loose not hard)	.36	.50
Packed snow	.20	.27
Ice	.12	.12
Semi-skeleton shoes		
Firm earth	.55	.90
Loose earth	.45	.60
Coal, stockpiled	.45	.60

NOTE: The elevated sprocket design Track-type Tractors (D11N, D10N, D9N and D8N), with their suspended undercarriage, provide up to 15% more efficient tractive effort than rigid track roller Track-type Tractors.

BEARING POWERS

MATERIAL	BEARING POWER: Bar	lb/in²	Metric t/m²	U.S. tons/ft²
Rock (semi-shattered)	4.8	70	50	5
Rock (solid)	24.1	350	240	24
Clay, dry	3.8	55	40	4
medium dry	1.9	27	20	2
soft	1.0	14	10	1
Gravel, cemented	7.6	110	80	8
Sand, compact dry	3.8	55	40	4
clean dry	1.9	27	20	2
Quicksand & alluvial soil	0.5	7	5	0.5

CURVE SUPERELEVATION
PER 3.1 M (10 FEET) ROAD WIDTH — MILLIMETERS (INCHES)

When negotiating curves, it is possible to generate high lateral forces in the tires which can contribute to ply separation and high wear. To eliminate these lateral forces, superelevation of the curve is necessary. The amount of superelevation will depend on the radius of the curve and the speed at which it is taken.

The following table is a guide for providing proper superelevation:

TURN RADIUS m (ft)	8 km/h 5 mph	16 km/h 10 mph	24 km/h 15 mph	32 km/h 20 mph	40 km/h 25 mph	48 km/h 30 mph	56 km/h 35 mph	64 km/h 40 mph	72 km/h 45 mph
15.2 **50**	103.6 **4.08**	408.4 **16.08**	920.5 **36.24**	— —	— —	— —	— —	— —	— —
30.4 **100**	51.8 **2.04**	204.2 **8.04**	475.5 **18.72**	816.9 **32.16**	— —	— —	— —	— —	— —
60.0 **200**	29.5 **1.16**	103.6 **4.08**	237.7 **9.36**	408.4 **16.08**	637.0 **25.08**	920.5 **36.24**	— —	— —	— —
91.4 **300**	18.3 **.72**	67.1 **2.64**	158.5 **6.24**	270.2 **10.64**	426.7 **16.80**	612.6 **24.12**	835.1 **32.88**	1011.9 **39.84**	— —
122.0 **400**	12.2 **.48**	51.8 **2.04**	118.9 **4.68**	204.2 **8.04**	320.0 **12.60**	460.2 **18.12**	624.8 **24.60**	816.9 **32.16**	1033.3 **40.68**
152.0 **500**	9.1 **.36**	39.6 **1.56**	94.5 **3.72**	164.6 **6.48**	256.0 **10.08**	368.8 **14.52**	499.8 **19.68**	652.3 **25.68**	826.0 **32.52**
183.0 **600**	9.1 **.36**	33.5 **1.32**	79.2 **3.12**	137.2 **5.40**	213.4 **8.40**	304.8 **12.00**	417.6 **16.44**	545.6 **21.48**	688.8 **27.12**
213.3 **700**	6.1 **.24**	30.5 **1.20**	41.7 **1.64**	115.8 **4.56**	182.9 **7.20**	262.1 **10.32**	356.6 **14.04**	466.3 **18.36**	591.3 **23.28**
243.0 **800**	6.1 **.24**	29.5 **1.16**	57.9 **2.28**	103.6 **4.08**	158.5 **6.24**	228.6 **9.00**	313.9 **12.36**	408.4 **16.08**	518.2 **20.40**
274.3 **900**	6.1 **.24**	21.3 **.84**	51.8 **2.04**	91.4 **3.60**	143.3 **5.64**	204.2 **8.04**	277.4 **10.92**	362.7 **14.28**	460.2 **18.12**
304.8 **1000**	6.1 **.24**	21.3 **.84**	48.8 **1.92**	82.3 **3.24**	128.0 **5.04**	182.9 **7.20**	249.9 **9.84**	326.1 **12.84**	414.5 **16.32**

A transition "spiral" may be necessary at higher speeds when entering or departing from a superelevated turn.

Superelevated turns present a danger when slippery. Unless full and proper speed is maintained, matching the elevation of the curve, a vehicle may slide off the lower edge of the roadway. For safety, superelevated curves should be maintained in good, tractive condition.

24

WEIGHT* OF MATERIALS	LOOSE kg/m³	LOOSE lb/yd³	BANK kg/m³	BANK lb/yd³	LOAD FACTORS
Basalt	1960	3300	2970	5000	.67
Bauxite, Kaolin	1420	2400	1900	3200	.75
Caliche	1250	2100	2260	3800	.55
Carnotite, uranium ore	1630	2750	2200	3700	.74
Cinders	560	950	860	1450	.66
Clay — Natural bed	1660	2800	2020	3400	.82
Dry	1480	2500	1840	3100	.81
Wet	1660	2800	2080	3500	.80
Clay & gravel Dry	1420	2400	1660	2800	.85
Wet	1540	2600	1840	3100	.85
Coal Anthracite, Raw	1190	2000	1600	2700	.74
Washed	1100	1850			.74
Ash, Bituminous Coal	530-650	900-1100	590-890	1000-1500	.93
Bituminous, Raw	950	1600	1280	2150	.74
Washed	830	1400			.74
Decomposed rock —					
75% Rock, 25% Earth	1960	3300	2790	4700	.70
50% Rock, 50% Earth	1720	2900	2280	3850	.75
25% Rock, 75% Earth	1570	2650	1960	3300	.80
Earth — Dry packed	1510	2550	1900	3200	.80
Wet excavated	1600	2700	2020	3400	.79
Loam	1250	2100	1540	2600	.81
Granite — Broken	1660	2800	2730	4600	.61
Gravel — Pitrun	1930	3250	2170	3650	.89
Dry	1510	2550	1690	2850	.89
Dry 6-50 mm (1/4"-2")	1690	2850	1900	3200	.89
Wet 6-50 mm (1/4"-2")	2020	3400	2260	3800	.89
Gypsum Broken	1810	3050	3170	5350	.57
Crushed	1600	2700	2790	4700	.57
Hematite, iron ore, high grade	1810-2450	4000-5400	2130-2900	4700-6400	.85
Limestone — Broken	1540	2600	2610	4400	.59
Crushed	1540	2600	—	—	—
Magnetite, iron ore	2790	4700	3260	5500	.85
Pyrite, iron ore	2580	4350	3030	5100	.85
Sand — Dry, loose	1420	2400	1600	2700	.89
Damp	1690	2850	1900	3200	.89
Wet	1840	3100	2080	3500	.89
Sand & clay — Loose	1600	2700	2020	3400	.79
Compacted	2400	4050			
Sand & gravel — Dry	1720	2900	1930	3250	.89
Wet	2020	3400	2230	3750	.91
Sandstone	1510	2550	2520	4250	.60
Shale	1250	2100	1660	2800	.75
Slag — broken	1750	2950	2940	4950	.60
Snow Dry	130	220			
Wet	520	860			
Stone — crushed	1600	2700	2670	4500	.60
Taconite	1630-1900	3600-4200	2360-2700	5200-6100	.58
Top Soil	950	1600	1370	2300	.70
Traprock — broken	1750	2950	2610	4400	.67
Wood Chips**	—	—	—	—	—

*Varies with moisture content, grain size, degree of compaction, etc. Tests must be made to determine exact material characteristics.

**Weights of commercially important wood species can be found in the last pages of the Logging & Forest Products section. To obtain wood weights use the following equations: lb/yd³ = (lb/ft³) × .4 × 27
kg/m³ = (kg/m³) × .4

ALTITUDE DERATION

PERCENT FLYWHEEL HORSEPOWER* AVAILABLE AT SPECIFIED ALTITUDES

MODEL	0-760 m (0-2500')	760-1500 m (2500-5000')	1500-2300 m (5000-7500')	2300-3000 m (7500-10,000')	3000-3800 m (10,000-12,500')	3800-4600 m (12,500-15,000')
D3C Series II	100	100	100	100	96	88
D4C Series II	100	100	97	88	81	74
D5C	100	100	100	100	**	**
D3C SA	100	100	100	100	93	85
D4H Series II	100	100	100	100	94	87
D4E — DD	100	100	100	96	88	81
D4E — PS	100	100	100	96	89	82
D4E SR	100	100	100	94	87	80
D5H Series II	100*	100*	100*	100*	99*	91*
D5H LGP Series II	100	100	100	100	96	88
D5B	100	100	94	87	80	73
D5B SA	100	100	96	88	81	75
D6H Series II	100*	100*	100*	100	94	87
D6H LGP Series II	100	100	100	100	95	87
D6H Series II (DIFF STR)	100	100	100	100	100	95
D6H LGP Series II (DIFF STR)	100	100	100	100	99	92
D6D	100*	100*	100*	100*	94*	87*
D6E	100	100	100	100	94	87
D7H Series II	100*	100*	100*	93*	86*	79*
D7H Series II (DIFF STR)	100	100	95	88	81	75
D7G	100*	100*	100*	94	86	80
D8L	100	100	100	100	93	85
D8L SA	100	100	100	100	93	85
AG6	100	100	100	100	94	87
Challenger 65B	100*	100*	99	92*	85*	78*
Challenger 75	100	100	100	95	88	81
D8N	100	100	100	100	98	90
D9N	100	100	100	96	89	82
D10N	100	100	100	94	87	80
D11N	100	100	100	93	86	79
120G	100*	100*	100*	100*	96	88
130G	100*	100*	100*	96	89	82
12G	100*	100*	96*	90*	84*	76*
140G	100*	100*	100*	100*	94*	86*
14G	100*	100*	100*	94*	87*	80*
16G	100	100	100	100	100	100

*Refer to "Captive Vehicle Engine Fuel Specifications" microfiche at your local dealer.
**Information not available at time of printing.

ALTITUDE DERATION (Continued)

MODEL	0-760 m (0-2500')	760-1500 m (2500-5000')	1500-2300 m (5000-7500')	2300-3000 m (7500-10,000')	3000-3800 m (10,000-12,500')	3800-4600 m (12,500-15,000')
E70B MMC	100	100	**	**	**	**
E110B	100	100	100	100	97	89
E120B	100	100	100	98	90	83
F140 MMC	100	100	**	**	**	**
211B LC	100	100	100	98	87	82
213B LC	100	100	100	100	92	85
206B FT	100	100	100	96	87	82
212B FT	100	100	99	92	85	78
214B	100	100	100	100	92	85
214B FT	100	100	100	100	100	93
224B	100	100	100	100	100	93
320	**	**	**	**	**	**
320L	**	**	**	**	**	**
320N	**	**	**	**	**	**
F240B	100*	100*	100	98	88	82
EL240B	100	100	100	98	88	82
325	100	100	100	**	**	**
325L	100	100	100	**	**	**
325LN	100	100	100	**	**	**
231D	100	100	100	100	92	85
231D LC	100	100	100	100	92	85
330	**	**	**	**	**	**
330L	**	**	**	**	**	**
330N	**	**	**	**	**	**
235D	100*	100*	100*	98*	91*	83*
235D Trench	100*	100*	100*	98*	91*	83*
F450 MMC	100	100	100	*	*	*
245D	100	100	100	94	87	80
245D Deep Trench	100	100	100	94	87	80
245D HL Trench	100	100	100	94	87	80
E650 MHI	100	100	100	93	86	79
416B	100	100	**	**	**	**
416B (Turbo)	100	100	**	**	**	**
426B	100	100	100	**	**	**
426B (Turbo)	100	100	100	**	**	**
436B	100	100	100	**	**	**
428B	100	100	**	**	**	**
428B (Turbo)	100	100	**	**	**	**
438B	100	100	100	**	**	**
446	100	100	97	91	83	77

*Refer to "Captive Vehicle Engine Fuel Specifications" microfiche at your local dealer.
**Information not available at time of printing.

ALTITUDE DERATION (Continued)

MODEL	0-760 m (0-2500')	760-1500 m (2500-5000')	1500-2300 m (5000-7500')	2300-3000 m (7500-10,000')	3000-3800 m (10,000-12,500')	3800-4600 m (12,500-15,000')
518 Cable	100*	100*	100*	100*	94	87*
518 Grapple	100*	100*	100*	100*	94	87
528 Cable	100*	100*	99	92	85*	78*
530	100*	100*	**	**	**	**
571G	100*	100*	100*	94	86	80
572G	100*	100*	100*	94	86	80
578	100	100	100	100	99	91
589	100	100	94	87	80	73
621E	100	100	94	87	80	74
621S	100	100	100	93	86	79
631E	100	100	96	88	82	75
651E	100	100	100	95	87	80
627E Tractor	100*	100*	100*	96	89	82
Scraper	100*	100*	100*	92	86	79*
637E Tractor	100	100	98	88	83	76
Scraper	100*	100*	100	86	87	80
657E Tractor	100	100	100	94	88	81
Scraper	100	100	100	95	90	84
613C	100	100	100	100	95	87
615C	100*	100*	95	88	81	74
623E	100	100	94	87	80	74
769C	100	100	100	97	89	82
771C	100	100	**	**	**	**
773B	100	100	100	100	98	92
775B	100	100	**	**	**	**
777C	100	100	100	93	86	79
785	100	100	100	93	86	79
789	100	100	100	93	86	79
793	100	100	100	100	100	**
768C	100	100	100	97	89	82
772B	100	100	100	100	96	92
776C	100	100	100	93	86	79
784	100	100	100	93	86	79
D20D	100	100	100	95	88	81
D25C	100	98	91	84	77	71
D30D	100	99	92	85	78	72
D40D	100	100	100	97	91	83
D250D	100	100	92	86	79	73
D300D	100	98	91	84	77	71
D350D	100	99	92	85	78	72
D400D	100	100	100	97	91	83

*Refer to "Captive Vehicle Engine Fuel Specifications" microfiche at your local dealer
**Information not available at time of printing

ALTITUDE DERATION (Continued)

MODEL	0-760 m (0-2500')	760-1500 m (2500-5000')	1500-2300 m (5000-7500')	2300-3000 m (7500-10,000')	3000-3800 m (10,000-12,500')	3800-4600 m (12,500-15,000')
814B	100*	100*	99	92	85	78
824C	100	100	100	100	91	85
834B	100	100	100	92	85	79
815B	100*	100*	99	92	85	78
825C	100	100	100	100	91	85
836 Landfill Compactor	100	100	100	98	90	83
816 Landfill Compactor	100	100	100	100	94	87
816B	100*	100*	99	92	85	78
826C	100	100	100	100	92	86
910E	100	100	100	100	94	87
916	100	100	100	100	97	88
926E	100	100	100	94	87	80
930	100*	100*	94*	87*	80*	73*
930T	100	100	94	87	80	73
936F	100	100	100	98	90	83
950F	100	100	100	93	86	79
966C	100*	100*	100*	100*	100	98
966E	100	100	100	93	86	79
966R	100	100	100	100	97	94
980F	100	100	100	100	100	100
988B	100	100	100	100	93	86
992C	100	100	100	94	87	80
994	100	100	100	**	**	**
931C Series II	100	100	100	100	96	88
935C Series II	100	100	97	88	81	74
943	100	100	95	88	80	75
953	100	100	98	90	83	77
963	100*	100*	94	87	80	74
973	100*	100*	100*	94	87	80
IT12B	100	100	100	100	94	87
IT14B	100	100	100	95	88	81
IT18B	100	100	100	100	100	93
IT28B	100	100	100	94	87	80

*Refer to "Captive Vehicle Engine Fuel Specifications" microfiche at your local dealer.
**Information not available at time of printing.

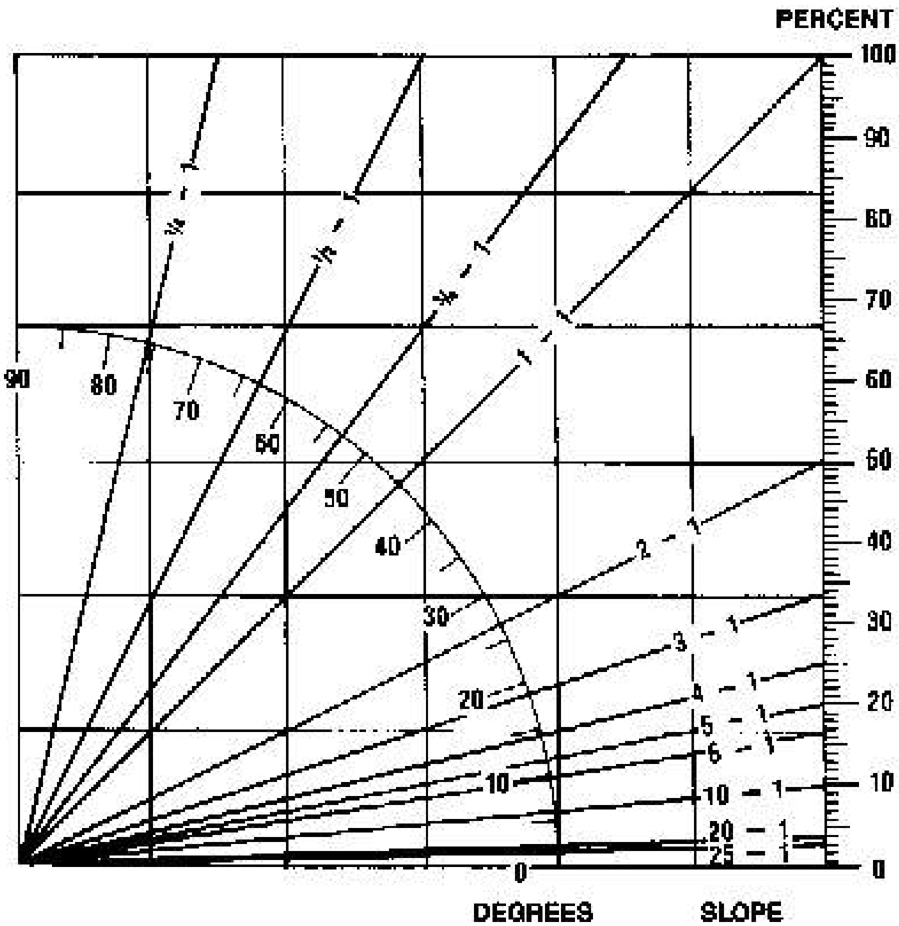
ALTITUDE DERATION (Continued)

MODEL	0-750 m (0-2500')	750-1500 m (2500-5000')	1500-2300 m (5000-7500')	2300-3000 m (7500-10,000')	3000-3800 m (10,000-12,500')	3800-4600 m (12,500-15,000')
PR-75	100	100	100	94	92	89
PR 105	100	100	**	**	**	**
PR 450C	100	100	100	96	89	82
PR-750C	100	100	100	92	85	78
PR-1000C (CUTTER)	100	100	100	94	87	80
PR-1000C (TRACK)	**	**	**	**	**	**
RR-250	100	100	100	100	100	100
SS-250	100	100	100	100	100	100
WE-651B	100	100	100	96	93	89
AP-200B	100◄	**	**	**	**	**
AP-800B	100	100	100	[illegible]	93	88
AP-1000	100	100	100	100	95	88
AP 1050	100	100	100	100	100	92
CS-323	100	100	100	94	92	89
CS-431B	100	100	100	96	93	86
CS-433B	100	100	100	96	93	88
CS-503	100	100	100	100	95	88
CS-583	100	100	100	100	95	88
CP-323	100	93	88	79	72	62
CP-433B	100	100	100	96	93	88
CP-563	100	100	100	**	**	**
CB-214B	**	**	**	**	**	**
CB 224B	**	**	**	**	**	**
CB-434	100	100	100	100	100	100
CB-534	100	100	100	100	100	94
CB-614	100	100	100	92	85	78
PS-110	100	93	88	79	72	62
PS-130	100	93	88	79	72	62
PS-160	100	93	88	79	72	62
CS-573	100	100	100	100	100	100
CB-624	100	100	100	100	**	**
PF-300	**	**	**	**	**	**
PS-300	**	**	**	**	**	**
PS-500	100	100	100	100	**	**
CR 575	**	**	**	**	**	**
FB518	100	100	100	92	85	78
FB217B	**	**	**	**	**	**
FB227	100	100	100	95	90	82

*Refer to "Custive Vehicle Engine Fuel Specifications" microfiche at your local dealer.
**Information not available at time of printing.
◄100% up to 305 m (1000 ft)

24

GRADE COMPARISON CHART
DEGREES — PERCENT — SLOPE



GRADE IN DEGREES AND PERCENTS

DEGREES	PERCENT
1	1.8
2	3.5
3	5.2
4	7.0
5	8.8
6	10.5
7	12.3
8	14.0
9	15.8
10	17.6
11	19.4
12	21.3
13	23.1
14	24.9
15	26.8
16	28.7
17	30.6
18	32.5
19	34.4
20	36.4
21	38.4
22	40.4
23	42.4
24	44.5
25	46.6
26	48.8
27	51.0
28	53.2
29	55.4
30	57.7
31	60.0
32	62.5
33	64.9
34	67.4
35	70.0
36	72.7
37	75.4
38	78.1
39	81.0
40	83.9
41	86.9
42	90.0
43	93.3
44	96.6
45	100.0

CONVERSION FACTORS

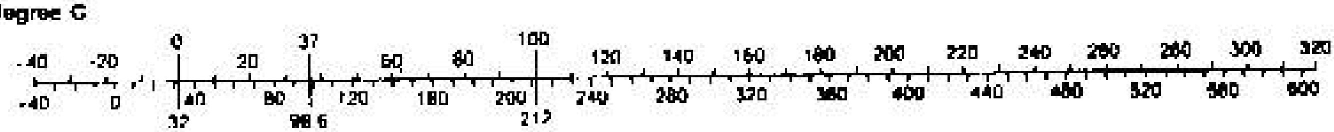
Multiply Metric Unit	By	To Obtain English Unit
kilometer (km)	.6214	mile
meter (m)	1.0936	yard
centimeter (cm)	.0328	foot
millimeter (mm)	.03937	inch
sq kilometer (km^2)	.3861	square mile
hectare (ha)	2.471	acre
sq meter (m^2)	10.764	square foot
sq meter (m^2)	1550	square inch
sq centimeter (cm^2)	.1550	square inch
cu centimeter (cm^3)	.061	cubic inch
cu meter (m^3)	1.308	cubic yard
liter (L)	61.02	cubic inch
liter (L)	.001308	cubic yard
km/h	.621	mph
liter (L)	.2642	U.S. gallon
liter (L)	.22	Imperial gallon
metric ton (t)	.984	long ton
metric ton (t)	1.102	short ton
kilogram (kg)	2.205	pound, avdp.
gram (g or gr)	.0353	ounce, avdp.
kilonewton (kN)	225	pound
newton (N)	225	pound
cu centimeter (cm^3)	.0338	fluid ounce
kilograms/cu meter	1.686	pounds/cu. yd.
kilograms/cu meter	.062	pounds/cu. ft.
kilograms/sq cm (kg/cm^2)	14.225	pounds/sq in
kilocalorie (kcal)	3.968	Btu
kilogram-meter (kg•m)	7.233	foot-pound
meter-kilogram (m•kg)	7.233	pound-foot
metric horsepower (CV)	.9863	hp
kilowatt (kW)	1.341	hp
kilopascal (kPa)	.145	psi
bar	14.5	psi
tons/m^3	1692	pounds/cu yd

Multiply English Unit	By	To Obtain Metric Unit
mile, statute (m)	1.609	kilometer
yard (yd)	.9144	meter
foot (ft)	.3048	meter
inch (in)	25.4	millimeter
sq mile ($mile^2$)	2.590	sq kilometer
acre	.4047	hectare
sq foot (ft^2)	.0929	sq meter
sq inch (in^2)	.000645	sq meter
cu yard (yd^3)	.7646	cu meter
cu inch (in^3)	16.387	cu centimeter
cu foot (ft^3)	.0283	cu meter
cu inch (in^3)	.0164	liter
cubic yard (yd^3)	764.55	liter
mph	1.61	km/h
Ton — mph	1.459	tkm/h
U.S. gallon (US Gal)	3.785	liter
U.S. gallon	.833	Imperial gallon
long ton (lg ton)	1.016	metric ton
short ton (sh ton)	.907	metric ton
pound (lb)	.4536	kilogram
ounce (oz)	28.35	gram
pound (lb)	.00445	kilonewton
pound (lb)	4.45	newton
fluid oz (fl oz)	28.57	cu centimeter
lb/cu ft (lb/ft^3)	16.018	kg/cu meter
lb/cu yd (lb/yd^3)	.5933	kg/cu meter
pounds/sq. in.	.0703	kilogram/sq cm
psi	.0689	bar
psi	6.89	kilopascal
Btu	.2520	kilogram-calorie
foot-pound (ft-lb)	.1383	kilogram-meter
horsepower (hp)	1.014	metric horsepower
horsepower (hp)	.7457	kilowatt
pounds/cu yd	.0005928	tons/m^3
pounds (No. 2 diesel fuel)	.1413	U.S. gallon

NOTE: Some of the above factors have been rounded for convenience. For exact conversion factors please consult International System of Units (SI) table.

Temperature conversion

Degree C



Degree F

$$°C = (°F - 32) \div 1.8$$

$$°F = (°C \times 1.8) + 32$$

METRIC UNIT EQUIVALENTS

1 km	=	1000 m
1 m	=	100 cm
1 cm	=	10 mm
1 km^2	=	100 ha
1 ha	=	10,000 m^2
1 m^2	=	10,000 cm^2
1 cm^2	=	100 mm^2
1 m^3	=	1000 liters
1 liter	=	1000 cm^3
1 metric ton	=	1000 kg
1 quintal	=	100 kg
1 N	=	0.10197 kg
1 kg	=	1000 g
1 g	=	1000 mg
1 bar	=	14.504 psi
1 cal	=	427 kg•m
	=	0.0016 cv•h
	=	0.00116 kw•h
torque unit		
1 CV	=	75 kg•m/s
1 kg/cm^2	=	0.97 atmosph.

POWER UNIT EQUIVALENTS

kW	=	Kilowatt
HP	=	Horsepower
CV	=	Cheval Vapeur (Steam Horsepower) French Designation For **Metric** Horsepower
PS	=	Pferdestärke (Horse Power) German Designation For **Metric** Horsepower

1 HP	=	1.014 CV = 1.014 PS
	=	.7457 KW
1 PS	=	1 CV = .9863 HP
	=	.7355 KW
1 kW	=	1.341 HP
	=	1.359 CV
	=	1.359 PS

ENGLISH UNIT EQUIVALENTS

1 mile	=	1760 yd
1 yd	=	3 ft
1 ft	=	12 in
1 sq mile	=	640 acres
1 acre	=	43,560 sq ft
1 sq ft	=	144 sq in
1 cu ft	=	7.48 gal liq
1 gal	=	231 cu in
	=	4 quarts liq
1 quart	=	32 fl oz
1 fl oz	=	1.80 cu in
1 sh ton	=	2000 lb
1 lg ton	=	2240 lb
1 lb	=	16 oz, avdp
1 Btu	=	778 ft lb
	=	0.000393 hph
	=	0.000293 kwh
1 hp	=	550 ft-lb/sec
1 atmosph.	=	14.7 lb/in^2