

Caterpillar Performance Handbook

Edition 29



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WHEEL TRACTORS

Flywheel power 164 to 597 kW (220 to 800 hp)



814F



824G



834B



844



854G

LANDFILL COMPACTORS

Flywheel power 164 to 353 kW (220 to 473 hp)



816F



826G



836



815F



825G

SOIL COMPACTORS

Flywheel power 164 to 235 kW (220 to 315 hp)

WHEEL LOADERS

Bucket Capacity (Heaped) 1.2 to 30 m³ (1.6 to 40 yd³)

* High lift arrangement available.



902



906



914G



924F



928G



938G*



950G



962G



966F Series II*



970F



980G*



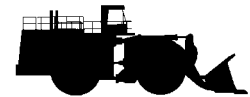
988F Series II*



990 Series II



992G



994*

TRACK LOADERS

Bucket Capacity (Heaped)** 1.0 to 3.6 m³ (1.3 to 4.2 yd³)

*Wide track arrangements available.

**General Purpose Bucket.



933C*



939C



953C*



963B*



973*

INTEGRATED TOOLCARRIERS

Bucket Capacity (Heaped)* 1.3 to 3.1 m³ (1.7 to 4.0 yd³)

*General Purpose Bucket.



IT14G



IT24F



IT28G



IT38G



IT62G



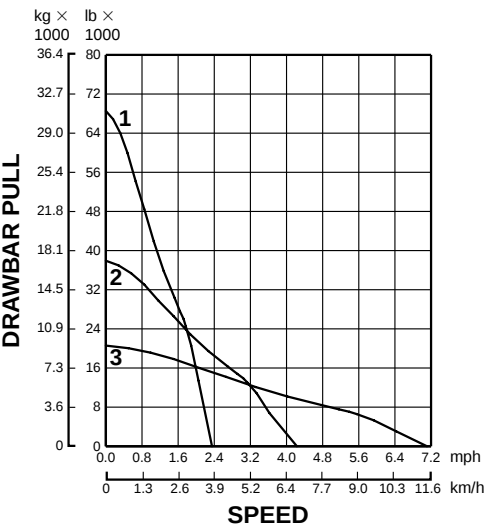
MODEL	D5C LGP Series III		D5C LGP Series III Hystat		D5M XL		D5M LGP	
Flywheel Power: Power Shift	67.1 kW	90 hp	67.1 kW	90 hp	82 kW	110 hp	82 kW	110 hp
Direct Drive	—	—	—	—	—	—	78 kW	105 hp
Operating Weight:* Power Shift	8913 kg	19,649 lb	8972 kg	19,780 lb	11 700 kg	25,800 lb	12 600 kg	27,800 lb
Direct Drive	—	—	—	—	—	—	12 050 kg	26,600 lb
Engine Model		3046		3046		3116T		3116T
Rated Engine RPM		2400		2400		2100		2100
No. of Cylinders		6		6		6		6
Bore	94 mm	3.7"	94 mm	3.7"	105 mm	4.1"	105 mm	4.1"
Stroke	120 mm	4.7"	120 mm	4.7"	127 mm	5"	127 mm	5"
Displacement	5.0 L	305 in³	5.0 L	305 in³	6.6 L	403 in³	6.6 L	403 in³
Track Rollers (Each Side)		6		6		7		7
Width of Standard Track Shoe	660 mm	2'2"	660 mm	2'2"	560 mm	1'10"	760 mm	2'6"
Length of Track on Ground	2145 mm	7'0.4"	2145 mm	7'0.4"	2390 mm	7'10"	2600 mm	8'7"
Ground Contact Area (W/Std. Shoe)	2.83 m ²	4389 in²	2.83 m ²	4389 in²	2.67 m ²	4144 in²	3.96 m ²	6133 in²
Track Gauge	1727 mm	5'8"	1727 mm	5'8"	1770 mm	5'10"	2000 mm	6'7"
GENERAL DIMENSIONS:								
Height (Stripped Top)**	1.75 m	5'9"	1.75 m	5'9"	2.22 m	7'3"	2.26 m	7'5"
Height (To Top of ROPS Canopy)	2.74 m	9'0"	2.74 m	9'0"	3.00 m	9'10"	3.04 m	10'0"
Height (To Top of ROPS Cab)	—	—	—	—	3.00 m	9'10"	3.05 m	10'0"
Overall Length (With P Blade)***	4.07 m	13'4"	4.07 m	13'4"	4.56 m	14'11"	5.13 m	16'10"
(Without Blade)	3.00 m	9'10"	3.00 m	9'10"	3.54 m	11'8"	3.73 m	12'3"
Width (W/O Trunnion — Std. Shoe)	2.38 m	7'10"	2.39 m	7'10"	2.33 m	7'8"	2.76 m	9'1"
Ground Clearance	384 mm	15.1"	384 mm	15.1"	385 mm	15.2"	437 mm	17.2"
Blade Types and Widths:								
Straight	—	—	—	—	—	—	—	—
Angle	—	—	—	—	—	—	—	—
"P" Straight	3.30 m	10'10"	3.30 m	10'10"	—	—	—	—
Angled	3.00 m	9'10"	3.00 m	9'10"	—	—	—	—
UPAT	—	—	—	—	3.08 m	10'1"	3.36 m	11'0"
Fuel Tank Refill Capacity	157 L	41.4 U.S. gal	157 L	41.4 U.S. gal	218 L	57.5 U.S. gal	218 L	57.5 U.S. gal

*Operating Weight includes ROPS canopy, operator, lubricants, coolant, full fuel tank, hydraulic controls and fluids, P blade, rigid drawbar, front towing device, standard service crankcase guards, engine enclosures and suspension seat.

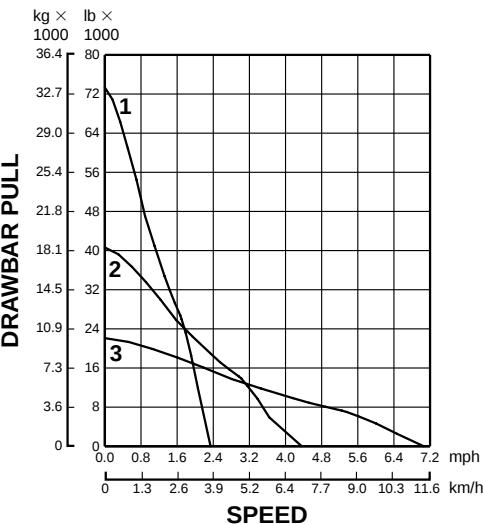
**Height (stripped top) — without ROPS canopy, exhaust, pre-cleaner, seat back or other easily removed encumbrances.

***D5M XL, D5M LGP with UPAT blade.

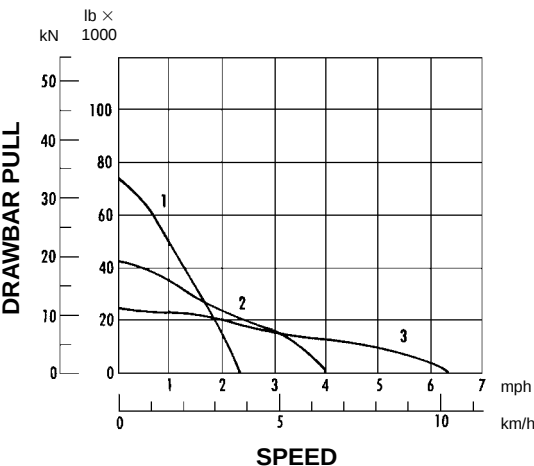
D6R LGP
Steering Clutches & Brakes (FTC)



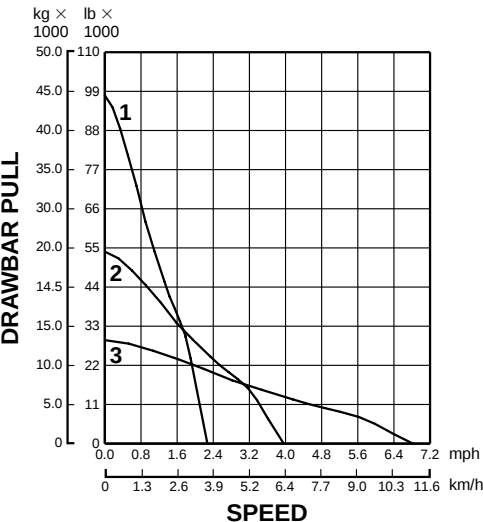
D6R LGP
Differential Steering



D7G



D7R Standard/XR/LGP (FTC)



- KEY**
- 1 — 1st Gear
 - 2 — 2nd Gear
 - 3 — 3rd Gear

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



MODEL	D8R WHA		D9R WHA		D10R WHA	
Flywheel Power	228 kW	305 hp	302 kW	405 hp	425 kW	570 hp
Operating Weight (PS)*	37 594 kg	82,880 lb	47 913 kg	105, 630 lb	65 764 kg	144,986 lb
Engine Model	3406C		3408E		3412	
Rated Engine RPM	2100		1900		1900	
No. of Cylinders	6		8		12	
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	27 L	1649 in ³
Track Rollers (Each Side)	8		8		8	
Width of Standard Track Shoe	560 mm	1'10"	610 mm	2'0"	610 mm	2'0"
Length of Track on Ground	3.21 m	10'6.5"	3.47 m	11'5"	3.88 m	12'9"
Ground Contact Area (W/Std. Shoe)	3.58 m ²	5544 in ²	4.24 m ²	6569 in ²	4.70 m ²	7326 in ²
Track Gauge	2.08 m	6'10"	2.25 m	7'5"	2.55 m	8'4"
GENERAL DIMENSIONS:						
Height (Stripped Top)**	2.67 m	8'9"	3.00 m	9'10"	3.27 m	10'9"
Height (To Top of Cab ROPS)	3.51 m	11'6"	3.99 m	13'1"	4.36 m	14'3"
Overall Length (Blade)	6.39 m	21'0"	6.84 m	22'5"	7.76 m	25'5"
(W/O Blade)	4.88 m	16'2"	5.18 m	17'0"	5.59 m	18'4"
Width (Over Trunnion)	3.05 m	10'0"	3.30 m	10'10"	3.72 m	12'2"
(W/O Trunnion)	2.70 m	8'8"	2.93 m	9'8"	3.16 m	10'4"
Ground Clearance	585 mm	1'11"	585 mm	1'11"	615 mm	2'0.2"
Blade Types and Widths:						
Semi-Universal	3.94 m	12'11"	4.31 m	14'2"	—	—
Universal	4.26 m	14'0"	4.66 m	15'3.4"	5.26 m	17'3"
Fuel Tank Refill Capacity	625 L	165 U.S. gal	818 L	216 U.S. gal	1109 L	293 U.S. gal

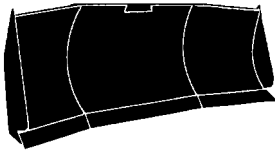
*Operating Weight includes lubricants, coolant, full fuel tank, hydraulic controls, and ROPS — FOPS canopy. Also included are special radiator core and ejector fan, draw-bar, engine enclosures, fuel tank guard, extreme service crankcase guard, HD hinged radiator guard, higher prescreener, front & rear striker bars and operator.

— D8R 8S blade with 762 mm (2'6") trash rack and 660 mm (2'2") track shoes

— D9R 9SU blade with 914 mm (3'0") trash rack and 685 mm (2'3") track shoes

— D10R 10SU blade with 1107 mm (3'8") trash rack and 610 mm (2'0") track shoes.

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

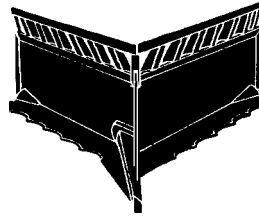


“U-Blades” — Balderson offers a variety of U-blades for use in a wide range of applications. They provide high volume movement of light non-cohesive

materials such as coal and woodchips. Heavier U-blades are also offered for production dozing and reclamation work.

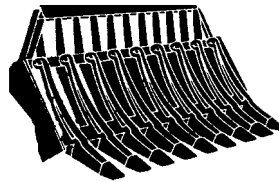
“Landfill” — Caterpillar and Balderson offer versions of the landfill or fill spreading dozer. Designed to handle refuse and cover material. Open trash screen on top of blade allows good visibility and protects radiator. Curved moldboard keeps cover material rolling evenly.

“Two-Way Dozer” — Designed for use inside ship holds to move cargo such as grain, salt, iron ore, coal and chips. These blades can scrape material off walls and doze to center of hold. They can doze material forward or pull material.



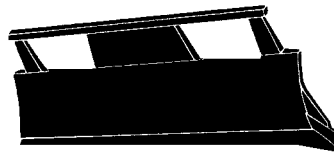
“V-Tree Cutter” — Rimco and Rome offer this clearing blade for shearing trees, stumps and brush at ground level. A sharp angle or “V”, formed by two cutting blades, utilizes tractor weight and horsepower through the center-

line of the cutter. Utilization of tractor force allows most growth to be cut at a steady pace and cast to the sides.



“Rakes” — Balderson, Rimco 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.



“K/G” — Offered by Rimco and 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.

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:

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

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.

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

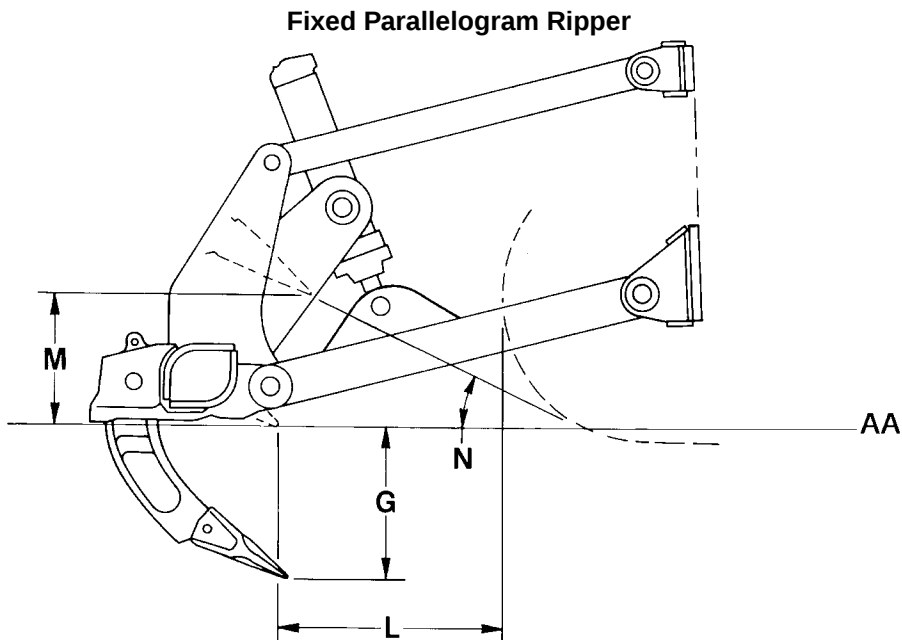
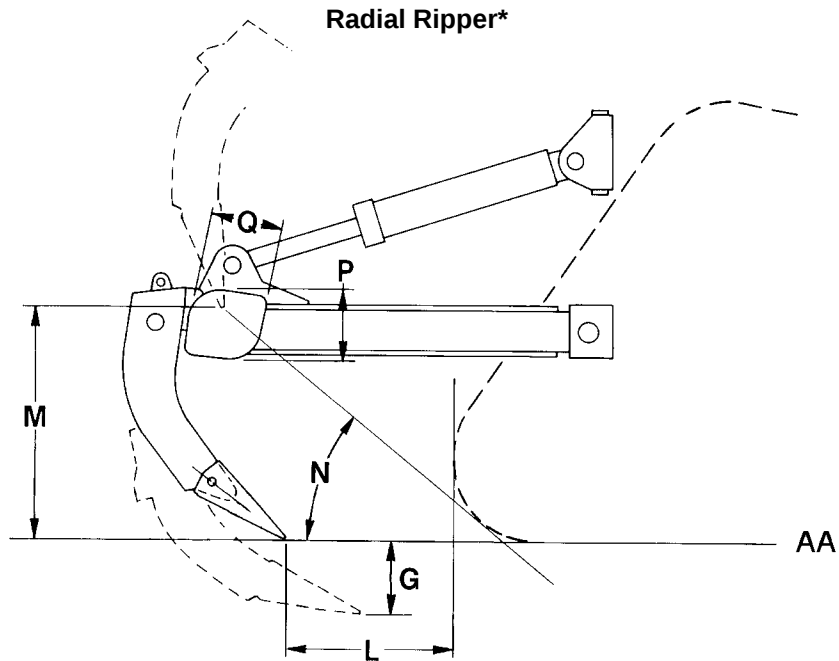
*Coefficient of traction assumed to be at least 0.4. While poor traction affects both track and wheel vehicles, causing them to take smaller blade loads, wheeled units are affected more severely and production falls much more rapidly. While no fixed rules can predict this production loss, a rough rule 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.

Rippers

Specification Diagrams

- Radial Ripper
- Fixed Parallelogram Ripper



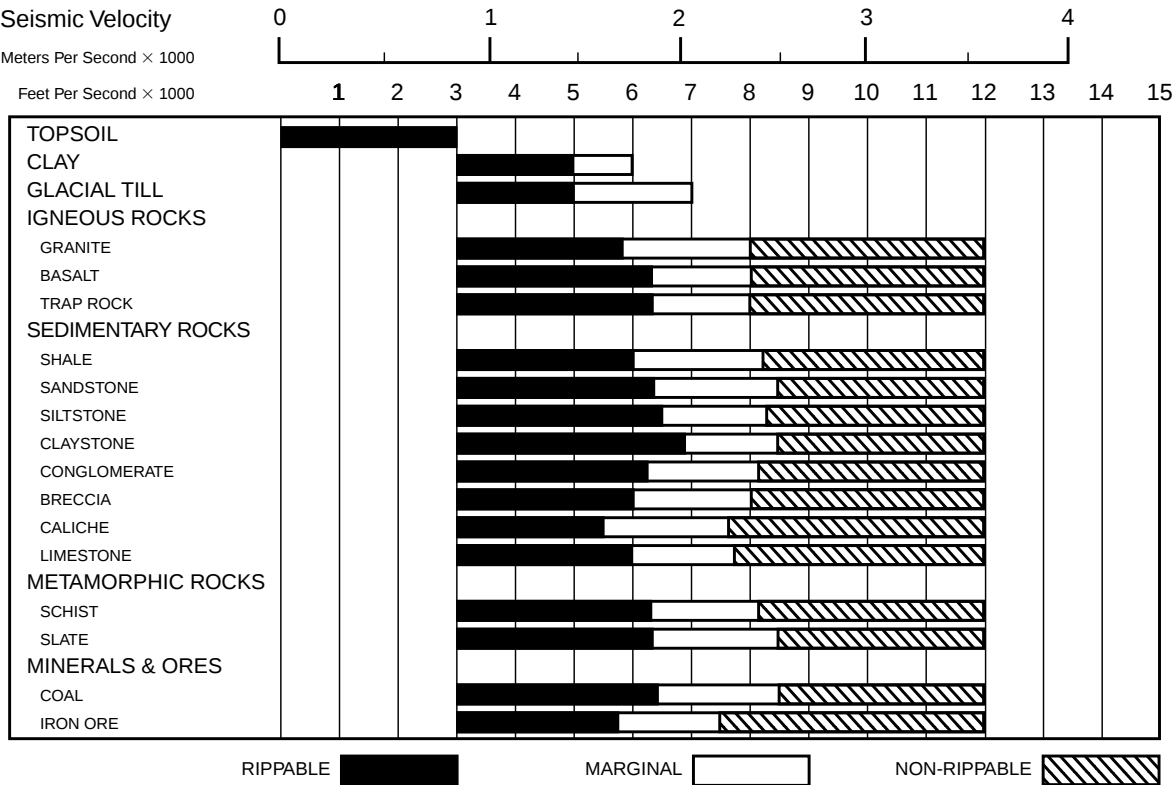
NOTE: Letters correspond to ripper specifications on pages that follow.

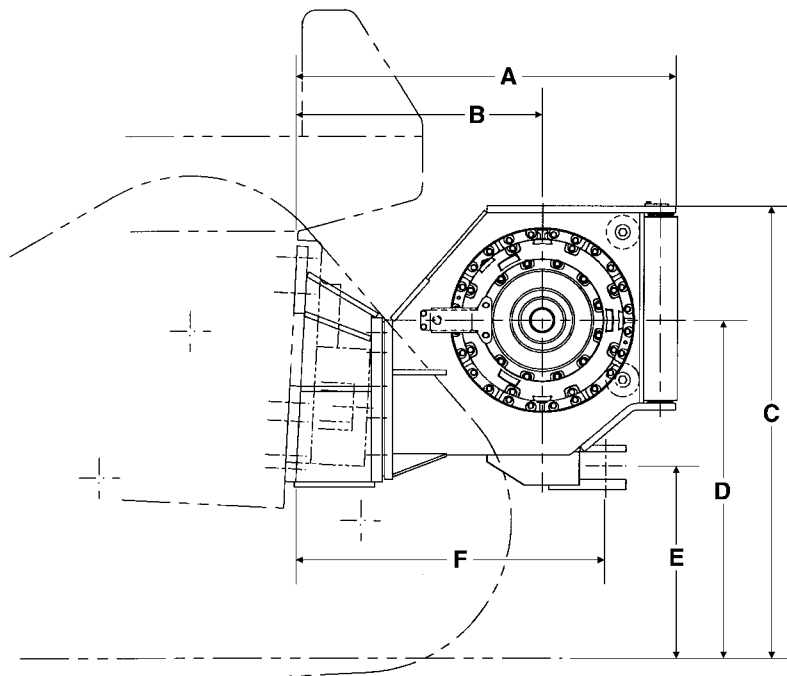
KEY

AA — Ground Line
* — Tip Standard

D8R

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





WINCH MODEL	PA58VS		PA59VS		59	
TRACTOR MODEL	D8R		D9R		D10R	
A Tractor to rear of winch	1435 mm	4'8.5"	1552 mm	5'1.1"	1247 mm	4'1.1"
B Tractor to drum centerline	940 mm	3'1"	1041 mm	3'5"	942 mm	3'1.1"
C Ground to top of winch	1712 mm	5'7.4"	1738 mm	5'8.4"	1787 mm	5'10.4"
D Ground to drum centerline	1273 mm	4'2.1"	1298 mm	4'3.1"	1480 mm	4'10.3"
E Ground to center of hitch	721 mm	2'4.4"	747 mm	2'5.4"	892 mm	2'11.1"
F Tractor to pin centerline	1216 mm	3'11.9"	1282 mm	4'2.5"	1000 mm	3'3.4"
Overall width (not shown)	1158 mm	3'9.6"	1158 mm	3'9.6"	1564 mm	5'1.6"
Drum diameter (not shown)	318 mm	12.5"	318 mm	12.5"	330 mm	13"
Weight*	1790 kg	3950 lb	1860 kg	4100 lb	2184 kg	4805 lb
Oil refill capacity	15 L	4 U.S. gal	15 L	4 U.S. gal	70 L	18.5 U.S. gal
Wire rope diameter:						
Recommended	29 mm	1.13"	29 mm	1.13"	29 mm	1.13"
Optional	32 mm	1.25"	32 mm	1.25"	32 mm	1.25"
Drum capacity:						
Recommended rope	84 m	276'0"	84 m	276'	69 m	226'
Optional rope	59 m	193'0"	59 m	193'	55 m	180'
Wire rope ferrule size (OD 3 length)	60 × 70 mm	2.38 × 2.75"	60 × 70 mm	2.38 × 2.75"	60 × 70 mm	2.38 × 2.75"

*Operating weight includes pump and operator controls.

Threshing:

- Exclusive Accelerated Pre-Separation (APS) system separates out up to 30% of the grain before it moves to the threshing cylinder.
- At 1706 mm (67") the threshing cylinder is the widest in the industry.

Separation:

- LEXION 460 and 465 combines have six high-performance straw walkers (most competitive combines have only five).
- LEXION 480 and 485 combines use dual-rotor separation — a gentle, centrifugal-force system that produces high quality grain.

Cleaning:

- The long preparation pan, dual ventilation, and remote electric adjustment of the upper chaffer and lower sieve are exclusive to the LEXION.
- The optional 3-D sieve system compensates for slopes of up to 20%.
- Turbine fans are sectional, providing even air flow across the entire width of the cleaning area.

Engines:

- LEXION 460 and 465 combines feature the Cat 3126 engine — a 7.2 liter (439 cu. in.) engine producing 216 kW (290 hp). Power reserve of 222 kW (298 hp) is available at 2000 rpm.
- LEXION 480 and 485 combines are powered by the Cat 3176C engine — a 10.3 liter (629 cu. in.) engine producing 272 kW (365 hp). Power reserve of 280 kW (375 hp) is available at 2000 rpm.

Tracks and Tires:

- LEXION 465 and 485 combines feature Caterpillar's exclusive Mobil-trac™ undercarriage that provides greater flotation, sidehill stability and reduced soil compaction.
- LEXION 460 and 480 combines are available with a number of different tire options to fit all applications.
- A powered rear axle is available on all four combines.

SUPER RURAL TRACTORS

- **Cat diesel Engines** with large piston displacement and individual adjustment-free fuel pumps and valves. High drawbar power for all day hard work, season after season.
- **Sealed and Lubricated Track** greatly reduces internal pin and bushing wear for lower undercarriage maintenance costs.
- **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.
- **Variable horsepower arrangements** are available for increased production in high speed tillage operations.

Row-Crop

Gauge (Track) Spacing	Spacer Quantity (per side)	Spacer Size
1524 mm (60") Base Tractor	No spacers	
1575 mm (62")	1	25.4 mm (1") [max. belt width 457 mm (18")]
1626 mm (64")	1	50.8 mm (2") [max. belt width 508 mm (1'8")]
1676 mm (66")	1	76.2 mm (3") [max. belt width 508 mm (1'8")]
1727 mm (68")	1	101.6 mm (4") [max. belt width 635 mm (2'1")]
1778 mm (70")	1 plus	101.6 mm (4") [max. belt width 635 mm (2'1")]
1829 mm (72")	1	25.4 mm (1")
1880 mm (74")	1	152.4 mm (6") [max. belt width 635 mm (2'1")]
1930 mm (76")	1 plus	152.4 mm (6") 25.4 mm (1")
1981 mm (78")	1	203.2 mm (8")
2032 mm (80")	1 plus	203.2 mm (8") 25.4 mm (1")
2083 mm (82")	1	254 mm (10")
2134 mm (84")	1 plus	254 mm (10") 25.4 mm (1")
2184 mm (86")	1 plus	254 mm (10") 50.8 mm (2")
2235 mm (88")	1	254 mm (10") 76.2 mm (3")
2286 mm (90")	1	355.6 mm (14")

Gauge (Track) Spacing	Spacer Quantity (per side)	Spacer Size
2032 mm (80") Base Tractor	No spacers	
2083 mm (82")	1	25.4 mm (1")
2134 mm (84")	1	50.8 mm (2")
2184 mm (86")	1	76.2 mm (3")
2235 mm (88")	1	101.6 mm (4")
2286 mm (90")	1 plus	101.6 mm (4") 25.4 mm (1")
2337 mm (92")	1	152.4 mm (6")
2389 mm (94")	1 plus	152.4 mm (6") 25.4 mm (1")
2438 mm (96")	1	203.2 mm (8")
2489 mm (98")	1 plus	203.2 mm (8") 25.4 mm (1")
2540 mm (100")	1	254 mm (10")
2591 mm (102")	1 plus	254 mm (10") 25.4 mm (1")
2642 mm (104")	1 plus	254 mm (10") 50.8 mm (2")
2692 mm (106")	1 plus	254 mm (10") 76.2 mm (3")
2743 mm (108")	1	355.6 mm (14")
2794 mm (110")	1 plus	355.6 mm (14")
2845 mm (112")	1 plus	355.6 mm (14") 50.8 mm (2")
2896 mm (114")	1 plus	355.6 mm (14") 76.2 mm (3")
2946 mm (116")	1 plus	355.6 mm (14") 101.6 mm (4")
2997 mm (118")	1 plus	355.6 mm (14") 25.4 mm (1")
3048 mm (120")	1 plus	101.6 mm (4") 508 mm (1'8")

NOTE: The chart reflects the recommended spacer combinations, although others are possible.



MODEL	140H		143H		160H		163H	
Net Flywheel Power	123 kW	165 hp	123 kW	165 hp	134 kW	180 hp	134 kW	180 hp
Variable horsepower: Gears 4-8▲	138 kW	185 hp	138 kW	185 hp	149 kW	200 hp	149 kW	200 hp
Operating Weight*	14 724 kg	32,460 lb	15 023 kg	33,120 lb	15 586 kg	34,360 lb	16 538 kg	36,460 lb
Engine Model	3306 DIT		3306 DIT		3306 DIT		3306 DITA	
Rated Engine RPM	1900		1900		1900		1900	
No. of Cylinders	6		6		6		6	
Displacement	10.45 L	638 in³	10.45 L	638 in³	10.45 L	638 in³	10.45 L	638 in³
Max. Torque Rise	30%		30%		30%		33.5%	
No. of Speeds Forward/Reverse	8/6		8/6		8/6		8/6	
Top Speed Forward	41.1 km/h	25.5 mph	41.1 km/h	25.5 mph	40.7 km/h	25.3 mph	40.7 km/h	25.3 mph
Reverse	32.4 km/h	20.2 mph	32.4 km/h	20.2 mph	32.1 km/h	20.0 mph	32.1 km/h	20.0 mph
Std. Tires — Front & Rear	14.00-24 (10 PR) (G-2)		14.00-24 (10 PR) (G-2)		14.00-24 (12 PR) (G-2)		14.00-24 (12 PR) (G-2)	
Front Axle/Steering:								
Oscillation Angle	32°		32°		32°		32°	
Wheel Lean Angle	18°		18°		18°		18°	
Steering Angle	50°		50°		50°		50°	
Articulation Angle	20°		20°		20°		20°	
Minimum Turning Radius**	7.4 m	24'3"	7.4 m	24'3"	7.4 m	24'3"	7.4 m	24'3"
Front Frame Section Modulus:								
Min.	2083 cm³	127 in³	2083 cm³	127 in³	2083 cm³	127 in³	2083 cm³	127 in³
Max.	4785 cm³	291 in³	4785 cm³	291 in³	4785 cm³	291 in³	4785 cm³	291 in³
No. Circle Support Shoes	6		6		6		6	
Hydraulics: Pump Type	Axial Piston		Axial Piston		Axial Piston		Axial Piston	
Max. Pump Flow	206 L/min	54.4 gpm	206 L/min	54.4 gpm	206 L/min	54.4 gpm	206 L/min	54.4 gpm
System Capacity	80 L	20.8 U.S. gal	98 L	25.5 U.S. gal	80 L	20.8 U.S. gal	98 L	25.5 U.S. gal
Implement Pressure: Max.	24 150 kPa	3500 psi	24 150 kPa	3500 psi	24 150 kPa	3500 psi	24 150 kPa	3500 psi
Min.	3100 kPa	450 psi	3100 kPa	450 psi	3100 kPa	450 psi	3100 kPa	450 psi
Interior Sound Level***	75 dBA		77 dBA		75 dBA		77 dBA	
Electrical:								
System Size	24V		24V		24V		24V	
Std. Battery CCA @ 0° F	750		950		750		950	
Std. Alternator	50 amp		50 amp		50 amp		50 amp	
GENERAL DIMENSIONS:								
Height (to top of ROPS)	3.12 m	10'3"	3.12 m	10'3"	3.12 m	10'3"	3.12 m	10'3"
Height (stripped top)****	3.04 m	10'0"	3.04 m	10'0"	3.04 m	10'0"	3.04 m	10'0"
Overall Length	8.60 m	28'3"	8.60 m	28'3"	8.60 m	28'3"	8.60 m	28'3"
With Ripper & Pushplate	10.01 m	32'10"	10.01 m	32'10"	10.01 m	32'10"	10.01 m	32'10"
Wheelbase	6.09 m	20'0"	6.09 m	20'0"	6.09 m	20'0"	6.09 m	20'0"
Blade Base	2.57 m	8'5"	2.57 m	8'5"	2.52 m	8'3"	2.52 m	8'3"
Overall Width (at top of front tires)	2.46 m	8'1"	2.55 m	8'6"	2.48 m	8'2"	2.55 m	8'6"
Standard Blade: Length	3.66 m	12'0"	3.66 m	12'0"	4.27 m	14'0"	4.27 m	14'0"
Height	610 mm	2'0"	610 mm	2'0"	686 mm	2'3"	686 mm	2'3"
Thickness	22 mm	0.87"	22 mm	0.87"	25 mm	1"	25 mm	1"
Lift Above Ground	480 mm	18.9"	480 mm	18.9"	452 mm	17.8"	452 mm	17.8"
Max. Shoulder Reach:◀								
Frame Straight	1.97 m	6'6"	1.97 m	6'6"	1.96 m	6'5"	1.96 m	6'5"
Articulated Position	2.91 m	9'7"	2.91 m	9'7"	2.90 m	9'6"	2.90 m	9'6"
Fuel Tank Capacity	341 L	90 U.S. gal	341 L	90 U.S. gal	341 L	90 U.S. gal	341 L	90 U.S. gal

*Operating Weight — based on standard machine configuration with full fuel tank, coolant, lubricants and operator.

**Minimum Turning Radius — combining the use of articulated frame steering, front wheel steer and unlocked differential.

***SAE J919.

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

◀Applicable for the standard blade with hydraulic sideshift and tip control. Maximum shoulder reach is obtainable to the right.

▲Power is automatically increased in gears 4F-8F and 3R-6R.



MODEL	318B L		318B L		318B LN		318B LN	
Sourcing	Japan		France		Japan		France	
Flywheel Power	86 kW	115 hp	86 kW	115 hp	86 kW	115 hp	86 kW	115 hp
Operating Weight*	18 410 kg	40,590 lb	17 700 kg	39,028 lb	18 020 kg	39,730 lb	17 160 kg	37,838 lb
Bucket Capacity	0.45-	0.59-	0.41-	0.53-	0.45-	0.59-	0.41-	0.53-
Range (heaped)	0.8 m ³	1.05 yd³	1.35 m ³	1.75 yd³	0.8 m ³	1.05 yd³	1.35 m ³	1.75 yd³
Engine Model	3046T		3046T		3046T		3046T	
Rated Engine RPM	2100		2100		2100		2100	
No. of Cylinders	6		6		6		6	
Bore	94 mm	3.7"	94 mm	3.7"	94 mm	3.7"	94 mm	3.7"
Stroke	120 mm	4.7"	120 mm	4.7"	120 mm	4.7"	120 mm	4.7"
Displacement	5 L	305 in³	5 L	305 in³	5 L	305 in³	5 L	305 in³
Max. Implement								
Hydraulic Pump								
Output at Rated	2 × 150	2 × 40	2 × 150	2 × 40	2 × 150	2 × 40	2 × 150	2 × 40
RPM	L/min	gpm	L/min	gpm	L/min	gpm	L/min	gpm
Relief Valve Settings:								
Implement Circuits	34 320 kPa	4980 psi	35 000 kPa	5075 psi	34 320 kPa	4980 psi	35 000 kPa	5075 psi
Travel Circuits	34 320 kPa	4980 psi	34 300 kPa	4973 psi	34 320 kPa	4980 psi	34 300 kPa	4973 psi
Swing Circuits	23 050 kPa	3340 psi	26 500 kPa	3842 psi	23 050 kPa	3340 psi	26 500 kPa	3842 psi
Pilot Circuits	3930 kPa	570 psi	4000 kPa	580 psi	3930 kPa	570 psi	4000 kPa	580 psi
Maximum Drawbar								
Pull	176 kN	39,550 lb	154 kN	34,650 lb	176 kN	39,550 lb	154 kN	34,650 lb
Maximum Travel	Two Speed Travel		Two Speed Travel		Two Speed Travel		Two Speed Travel	
Speed at	Lo: 2.5 km/h	1.6 mph	Lo: 2.8 km/h	1.7 mph	Lo: 2.5 km/h	1.6 mph	Lo: 2.8 km/h	1.7 mph
Rated RPM	Hi: 3.9 km/h	2.4 mph	Hi: 5.5 km/h	3.4 mph	Hi: 3.9 km/h	2.4 mph	Hi: 5.5 km/h	3.4 mph
Width of Standard								
Track Shoe	600 mm	2'0"	600 mm	2'0"	500 mm	1'8"	500 mm	1'8"
Overall Track Length	4075 mm	13'4"	4075 mm	13'4"	4075 mm	13'4"	4075 mm	13'4"
Ground Contact Area								
with Std. Shoe	4.26 m ²	6600 in²	3.92 m ²	6073 in²	3.55 m ²	5500 in²	3.26 m ²	5061 in²
Track Gauge	2200 mm	7'3"	2200 mm	7'3"	1990 mm	6'6"	1995 mm	6'6.5"
Fuel Tank Refill								
Capacity	280 L	74 U.S. gal	280 L	74 U.S. gal	280 L	74 U.S. gal	280 L	74 U.S. gal
Hydraulic System								
(includes tank)	188 L	49.7 U.S. gal	188 L	49.7 U.S. gal	188 L	49.7 U.S. gal	188 L	49.7 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	5130B ME		5230 ME	
Sourcing	U.S.		U.S.	
Flywheel Power	597 kW	800 hp	1095 kW	1470 hp
Operating Weight*	182 000 kg	401,000 lb	316 600 kg	698,000 lb
Bucket Capacity Range (heaped)	8.5-18.3 m ³	11-24 yd ³	13-27.5 m ³	17-36 yd ³
Engine Model	3508B EUI		3516 EUI	
Rated Engine RPM	1750		1750	
No. of Cylinders	8		16	
Bore	170 mm	6.7"	170 mm	6.7"
Stroke	190 mm	7.5"	190 mm	7.5"
Displacement	34.5 L	2105 in ³	69 L	4210 in ³
Max. Hydraulic Pump Output at Rated RPM: Implement	4 × 372 L/min	4 × 99 gpm	6 × 372 L/min	6 × 99 gpm
Swing	1 × 464 L/min	1 × 123 gpm	2 × 464 L/min	2 × 123 gpm
Relief Valve Settings:				
Implement Circuits	31 000 kPa	4550 psi	31 000 kPa	4550 psi
Travel Circuits	35 000 kPa	5080 psi	35 000 kPa	5080 psi
Swing Circuits: Accelerate	35 000 kPa	5080 psi	35 000 kPa	5080 psi
Decelerate	25 000 kPa	3620 psi	25 000 kPa	3620 psi
Pilot Circuits	4000 kPa	580 psi	4000 kPa	580 psi
Maximum Drawbar Pull	872 kN	196,000 lb	1545 kN	340,875 lb
Maximum Travel Speed at Rated RPM	3.3 km/h	2.1 mph	2.5 km/h	1.6 mph
Overall Track Length	5.55 m**	18'3"***	6.26 m**	20'6"***
Width of Standard Track Shoe	800 mm	2'8"	1300 mm	4'4"
Ground Contact Area with Std. Shoe	9.8 m ²	15,200 in ²	18 m ²	27,900 in ²
Track Gauge	4.72 m	15'6"	5.2 m	17'
Fuel Tank Refill Capacity	2600 L	687 U.S. gal	5330 L	1386 U.S. gal

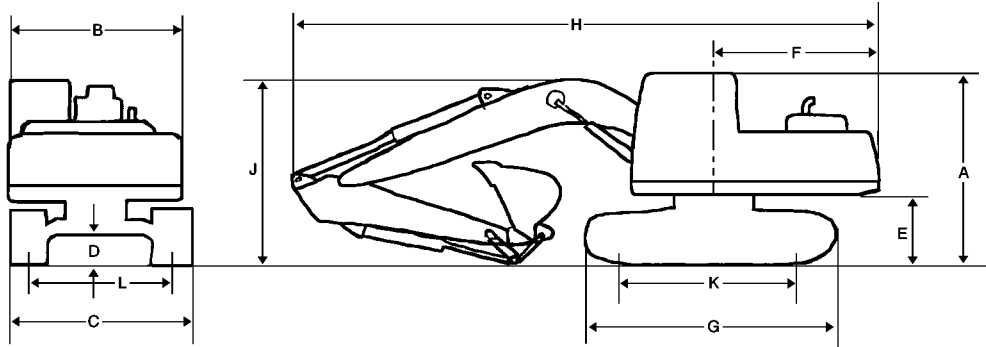
* Operating weight includes coolant, lubricants, full fuel tank, one-piece boom, medium stick, bucket, standard counterweight and operator 75 kg (165 lb).

** Measured from center of driver to center of idler.

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.



	345B Reach		345B Mass		345B L – FIX Reach		345B L – FIX Mass		345B L – VG Reach		345B L – VG Mass	
	mm	ft	mm	ft	mm	ft	mm	ft	mm	ft	mm	ft
A	3245	10'8"	3245	10'8"	3245	10'8"	3245	10'8"	3405	11'2"	3405	11'2"
B	2995	9'10"	2995	9'10"	2995	9'10"	2995	9'10"	2995	9'10"	2995	9'10"
C	3340	10'11"	3340	10'11"	3490	11'5"	3490	11'5"	2990	9'10"	2990	9'10"
D	510	1'8"	510	1'8"	510	1'8"	510	1'8"	740	2'5"	740	2'5"
E	1290	4'3"	1290	4'3"	1290	4'3"	1290	4'3"	1460	4'9"	1460	4'9"
F	3610	11'10"	3610	11'10"	3610	11'10"	3610	11'10"	3610	11'10"	3610	11'10"
G	5030	16'6"	5030	16'6"	5360	17'7"	5360	17'7"	5330	17'6"	5330	17'6"
H	11 730	38'6"	11 380	37'4"	11 770	38'7"	11 380	37'4"	11 740	38'6"	11 380	37'4"
J*	3480	11'5"	3680	12'1"	3660	12'0"	3690	12'1"	3680	12'1"	3850	12'8"
K	4030	13'3"	4030	13'3"	4360	14'4"	4360	14'4"	4340	14'3"	4340	14'3"
L	2740	9'0"	2740	9'0"	2740	9'0"	2740	9'0"	**2390	7'10"	**2390	7'10"

*Varies with stick length.

**Transport position.

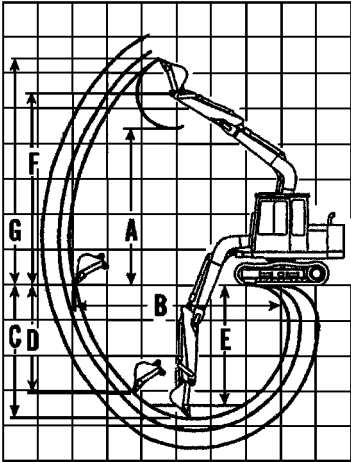
NOTE: 600 mm shoes are available for 345B.
750 mm shoes are available for 345B L.
Medium stick is available all models.
Undercarriage is retracted.

	350 Reach		350 Mass		350 L Reach		350 L Mass	
	mm	ft	mm	ft	mm	ft	mm	ft
A	3500	11'6"	3500	11'6"	3500	11'6"	3500	11'6"
B	3170	10'5"	3170	10'5"	3170	10'5"	3170	10'5"
C	3200	10'6"	3200	10'6"	3300	10'10"	3300	10'10"
D	730	2'5"	730	2'5"	730	2'5"	730	2'5"
E	1420	4'8"	1420	4'8"	1420	4'8"	1420	4'8"
F	3580	11'9"	3580	11'9"	3580	11'9"	3580	11'9"
G	5110	16'9"	5110	16'9"	5570	18'3"	5570	18'3"
H	12 200	40'0"	11 750	38'7"	12 200	40'0"	11 750	38'7"
J*	3750	12'4"	3980	13'1"	3750	12'4"	3980	13'1"
K	4040	13'3"	4040	13'3"	4490	14'9"	4490	14'9"
L	2550	8'4"	2550	8'4"	2550	8'4"	2550	8'4"

*Varies with stick length.

NOTE: 600 mm shoes are available for 350.
750 mm shoes are available for 350 L.
Medium stick is available all models.
Undercarriage is retracted.

- 312B ● 312B L
- Japan Sourced ● France Sourced



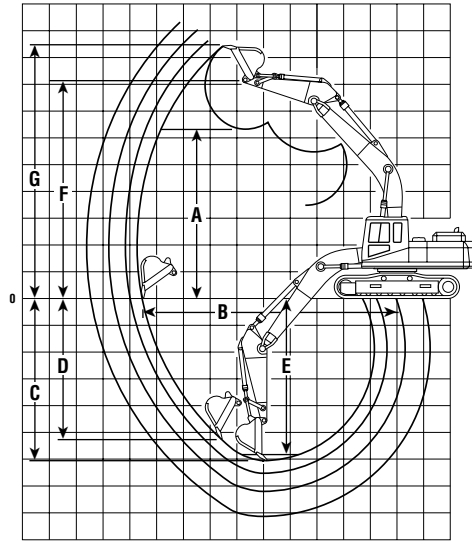
**One-Piece Boom
Digging Envelope**

- 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 (8'0") level bottom (straight clean up)
- F** Maximum bucket hinge pin height
- G** Maximum height, to bucket teeth at highest arc

Japan Sourced			312B, 312B L			France Sourced			312B, 312B L			
Stick	2.1 m	6'11"	2.5 m	8'2"	3 m	9'10"	2.1 m	6'11"	2.5 m	8'2"	3 m	9'10"
	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft
A	5.86	19'3"	6.11	20'1"	6.34	20'10"	5.83	19'1"	6.03	19'9"	6.31	20'8"
B	7.79	25'7"	8.17	26'10"	8.62	28'3"	7.81	25'7"	8.19	26'10"	8.64	28'4"
C	5.13	16'10"	5.53	18'2"	6.03	19'9"	5.15	16'11"	5.55	18'2"	6.05	19'10"
D	4.43	14'6"	4.89	16'1"	5.25	17'3"	4.62	15'2"	5.01	16'5"	5.52	18'1"
E	4.83	15'10"	5.24	17'2"	5.75	18'10"	4.91	16'1"	5.34	17'6"	5.87	19'3"
F	7.07	23'2"	7.32	24'0"	7.55	24'9"	7.07	23'2"	7.32	24'0"	7.56	24'9"
G	8.23	27'0"	8.48	27'10"	8.70	28'6"	8.27	27'1"	8.52	27'11"	8.75	28'8"



One-Piece Boom Digging Envelope

- Standard shoes and undercarriage

KEY:

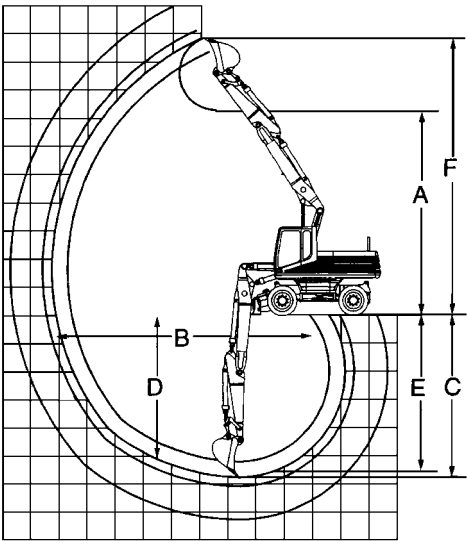
- A** Maximum loading height of bucket with teeth
- B** Maximum reach at ground level
- C** Maximum digging depth
- D** Maximum vertical wall
- E** Maximum depth of cut for 2.44 m (8'0") level bottom (straight clean up)
- F** Maximum bucket hinge pin height
- G** Maximum height, to bucket teeth at highest arc

**325B L, 325B LN with
6.15 m (20'2") Reach Boom**

Stick	3.2 m	10'6"	2.65 m	8'8"	2 m	6'7"	2.5 m	8'2"	2 m	6'7"
	m	ft	m	ft	m	ft	m	ft	m	ft
A	7.05	23'2"	6.84	22'5"	6.31	20'8"	6.09	20'0"	5.89	19'4"
B	10.57	34'8"	10.07	33'0"	9.53	31'3"	9.35	30'8"	8.89	29'2"
C	7.15	23'5"	6.59	21'7"	6.06	19'11"	6.02	19'9"	5.52	18'1"
D	5.18	17'0"	4.78	15'8"	4.13	13'7"	4.11	15'6"	3.65	12'0"
E	6.98	22'11"	6.40	21'1"	5.83	19'2"	5.82	19'1"	5.29	17'4"
F	—	—	—	—	—	—	—	—	—	—
G	9.95	32'8"	9.75	32'0"	9.39	30'10"	9.17	30'1"	8.97	29'5"

**325B L, 325B LN with
5.66 m (18'7") VA Boom**

Stick	2.5 m	8'2"	2 m	6'7"
	m	ft	m	ft
A	7.89	25'11"	7.51	24'8"
B	9.75	32'0"	9.28	30'5"
C	5.89	19'4"	5.40	17'9"
D	4.13	13'7"	3.67	12'0"
E	5.78	19'0"	5.28	17'4"
F	—	—	—	—
G	11.21	36'9"	10.83	35'6"



**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
- E** Maximum depth of cut for 2.44 m (8'0") level bottom
- F** Maximum height, to bucket teeth at highest arc

M318

Stick	1.8 m	5'11"	2.4 m	7'9"	2.8 m	9'2"	4 m	13'1"
	m	ft	m	ft	m	ft	m	ft
A	6.78	22'3"	7.18	23'7"	7.38	24'3"	7.99	26'3"
B	8.43	27'8"	9.00	29'6"	9.35	30'8"	10.55	34'7"
C	5.20	17'1"	5.79	19'0"	6.18	20'3"	7.44	24'5"
D	3.17	10'5"	4.43	14'6"	4.73	15'6"	5.72	18'9"
E	5.08	16'8"	5.69	18'8"	6.15	20'2"	7.14	23'5"
F	9.38	30'9"	9.84	32'3"	10.02	32'10"	10.79	35'5"

M320

Stick	1.9 m	6'3"	2.5 m	8'2"	2.9 m	9'6"	4.2 m	13'9"
Bucket	1.05 m ³	1.37 yd ³	0.9 m ³	1.18 yd ³	0.81 m ³	1.06 yd ³	0.55 m ³	0.72 yd ³
	m	ft	m	ft	m	ft	m	ft
A	6.66	21'10"	7.04	23'1"	7.10	23'4"	7.90	25'11"
B	8.82	28'11"	9.38	30'9"	9.67	31'9"	10.96	35'11"
C	5.42	17'9"	6.01	19'9"	6.38	20'11"	7.68	25'2"
D	2.46	8'1"	3.85	12'8"	3.64	11'11"	5.28	17'4"
E	5.00	16'5"	5.62	18'5"	6.00	19'8"	7.36	24'2"
F	9.37	30'9"	9.79	32'1"	9.74	31'11"	10.63	34'11"

M315 ● 4-Point Outriggers Down ● 1100 mm (3'7") Bucket ● One-Piece Boom

Stick		3 m 10'0"		4.5 m 15'0"		6 m 20'0"		7.5 m 25'0"		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
1700 mm 5'10"	kg lb	—	—	6700* 14,770*	6400 14,110	4800* 10,580*	4100 9040	—	—	2600* 5730*	2600* 5730*
2100 mm 6'11"	kg lb	—	—	6700* 14,770*	6500 14,330	4800* 10,580*	4100 9040	—	—	1700* 3740*	1700* 3740*
2400 mm 7'10"	kg lb	2500* 5510*	2500* 5510*	6700* 14,770*	6500 14,330	4800* 10,580*	4100 9040	2900* 6390*	2900* 6390*	1500* 3300*	1500* 3300*
2600 mm 8'6"	kg lb	2700* 5950*	2700* 5950*	6700* 14,770*	6500 14,330	4800* 10,580*	4100 9040	3300* 7270*	2900* 6390*	1300* 2860*	1300* 2860*

M315 ● Free On Wheels ● 1100 mm (3'7") Bucket ● One-Piece Boom

Stick		3 m 10'0"		4.5 m 15'0"		6 m 20'0"		7.5 m 25'0"		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
1700 mm 5'10"	kg lb	—	—	4700 10,360	2600 5730	3100 6830	1700 3740	—	—	2000 4410	1100 2420
2100 mm 6'11"	kg lb	—	—	4800 10,580	2700 5950	3100 6830	1700 3740	—	—	1700* 3740*	1000 2200
2400 mm 7'10"	kg lb	2500* 5510*	2500* 5510*	4800 10,580	2700 5950	3100 6830	1700 3740	2200 4850	1200 2640	1500* 3300*	1000 2200
2600 mm 8'6"	kg lb	2700* 5950*	2700* 5950*	4800 10,580	2700 5950	3100 6830	1700 3740	2200 4850	1200 2640	1300* 2860*	900 1980

M315 ● 4-Point Outriggers Down ● 1100 mm (3'7") Bucket ● VA Boom

Stick		3 m 10'0"		4.5 m 15'0"		6 m 20'0"		7.5 m 25'0"		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
1700 mm 5'10"	kg lb	9500* 20,940*	9500* 20,940*	6600* 14,550*	6600* 14,550*	4700* 10,360*	4300 9430	—	—	2400* 5290*	2400* 5290*
2100 mm 6'11"	kg lb	8900* 19,620*	8900* 19,620*	6600* 14,550*	6500 14,330	4700* 10,360*	4300 9480	3000* 6610*	2900 6390	1600* 3520*	1600* 3520*
2400 mm 7'10"	kg lb	8300* 18,300*	8300* 18,300*	6500* 14,330*	6500* 14,330	4700* 10,360*	4300 9480	3000* 6610*	2900 6390	1400* 3080*	1400* 3080*
2600 mm 8'6"	kg lb	8500* 18,740*	8500* 18,740*	6500* 14,330*	6500* 14,330*	4600* 10,140*	4200 9260	3000* 6610*	2900 6390	1300* 2860*	1300* 2860*

M315 ● Free On Wheel ● 1100 mm (3'7") Bucket ● VA Boom

Stick		3 m 10'0"		4.5 m 15'0"		6 m 20'0"		7.5 m 25'0"		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
1700 mm 5'10"	kg lb	9500* 20,940*	5800 12,780	5200 11,460	3200 7050	3200 7050	1800 3960	—	—	1900 4180	1000 2200
2100 mm 6'11"	kg lb	8900* 19,620*	5900 13,000	5200 11,460	3200 7050	3300 7270	2000 4410	2200 4850	1200 2640	1600* 3520*	1000 2200
2400 mm 7'10"	kg lb	8300* 18,300*	6000 13,230	5200 11,460	3200 7050	3400 7490	2000 4410	2200 4850	1200 2640	1400* 3080*	900 1980
2600 mm 8'6"	kg lb	8500* 18,740*	5800 12,780	5200 11,460	3300 7270	3400 7490	2000 4410	2200 4850	1200 2640	1300* 2860*	900 1980

*Load limited by hydraulic capacity rather than tipping.

Japan/U.S. Sourced

325B L ● Reach Boom ● 800 mm (2'8") Track Shoes

Stick	Bucket	3 m 10'0"		4.5 m 15'0"		6 m 20'0"		7.5 m 25'0"		9 m 30'0"		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
2000 mm 6'7"	D1520MX 5'0" kg lb	—	—	14 100 31,100	8500 18,300	8950 19,150	5500 11,800	6250 13,400	3850 8300	—	—	4750 10,450	2950 6450
2650 mm 8'8"	C1440MX 4'9" kg lb	—	—	15 100 32,350	9050 19,450	9300 20,000	5850 12,600	6550 14,050	4150 8950	—	—	4100* 9050*	2900 6300
3200 mm 10'6"	C1470X 4'10" kg lb	4250* 9800*	4250* 9800*	15 200 32,500	9100 19,550	9350 20,050	5900 12,650	6550 14,050	4150 8950	4900 10,450	3100 6600	3250* 7150*	2600 5750

325B L ● Mass Boom ● 800 mm (2'8") Track Shoes

Stick	Bucket	3 m 10'0"		4.5 m 15'0"		6 m 20'0"		7.5 m 25'0"		9 m 30'0"		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
2000 mm 6'7"	D1700MX 5'7" kg lb	—	—	15 000 32,050	8850 19,000	9150 19,600	5650 12,150	—	—	—	—	5450 12,000	3400 7450
2500 mm 8'2"	D1520MX 5'0" kg lb	—	—	15 100 32,300	8950 19,200	9200 19,700	5700 12,200	6350 13,600	3950 8450	—	—	4700* 10,300*	3100 6750

Belgium Sourced

325B L ● Reach Boom ● 800 mm (2'8") Track Shoes

Stick	Bucket	3 m 10'0"		4.5 m 15'0"		6 m 20'0"		7.5 m 25'0"		9 m 30'0"		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
2 m 6'7"	1.45 m³ 1.89 yd³ kg lb	—	—	14 070* 31,020*	8730 19,240	9160 20,190	5630 12,410	6410 14,130	3970 8750	—	—	4790 10,560	2960 6520
2.65 m 8'8"	1.45 m³ 1.9 yd³ kg lb	—	—	15 080* 33,250*	9270 20,440	9530 21,010	6000 13,230	6690 14,750	4260 9390	—	—	3930* 8660*	2890 6370
3.2 m 10'6"	1.15 m³ 1.5 yd³ kg lb	4180* 9210*	4180* 9210*	15 460* 34,080*	9320 20,550	9560 21,070	6020 13,270	6700 14,770	4260 9390	5000 11,020	3160 6960	3130* 6900*	2630 5790

325B L ● Mass Boom ● 800 mm (2'8") Track Shoes

Stick	Bucket	3 m 10'0"		4.5 m 15'0"		6 m 20'0"		7.5 m 25'0"		9 m 30'0"		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
2 m 6'7"	1.7 m³ 2.22 yd³ kg lb	—	—	15 290 33,710	9030 19,910	9340 20,590	5770 12,720	—	—	—	—	5460 12,030	3390 7470
2.5 m 8'2"	1.5 m³ 1.96 yd³ kg lb	—	—	15 400 33,950	9120 20,100	9360 20,630	5790 12,760	6470 14,260	4010 8840	—	—	4450* 9810*	3070 6760

325B L ● VA Boom ● 800 mm (2'8") Track Shoes

Stick	Bucket	3 m 10'0"		4.5 m 15'0"		6 m 20'0"		7.5 m 25'0"		9 m 30'0"		At Max. Reach	
		Front	Side	Front	Side	Front	Side	Front	Side	Front	Side	Front	Side
2 m 6'7"	1.7 m³ 2.22 yd³ kg lb	—	—	13 040* 28,750*	8500 18,740	9040 19,930	5440 11,990	6290 13,860	3800 8370	—	—	4800* 10,580*	2950 6500
2.5 m 8'2"	1.45 m³ 1.89 yd³ kg lb	—	—	14 000* 30,870*	8610 18,980	9100 20,060	5490 12,100	6310 13,910	3820 8420	—	—	4240* 9340*	2700 5950

*Load limited by hydraulic capacity rather than tipping.

Japan Sourced

350 L Heavy Lift ● Reach Boom ● 750 mm (2'6") Triple Grousers

Stick	Bucket		3 m 10'0"		4.5 m 15'0"		6 m 20'0"		7.5 m 25'0"	
			Front	Side	Front	Side	Front	Side	Front	Side
4800 mm 15'9"	F1218T 4'0"	kg lb	6350* 14,400*	6350* 14,400*	17 650* 41,000*	17 650* 40,800*	16 050* 34,700*	12 100 25,950	12 300* 26,550*	8550 18,300
3600 mm 11'10"	F1410T 4'8"	kg lb	—	—	14 850* 34,400*	14 850* 34,400*	17 150* 37,050	11 950 25,650	13 100* 28,350*	8450 18,200
3100 mm 10'2"	F1735X 5'3"	kg lb	—	—	13 350* 31,150*	13 350* 31,150*	17 250* 37,300*	11 750 25,300	13 200* 28,600*	8350 17,950

Stick	Bucket		9 m 30'0"		10.5 m 35'0"		At Max. Reach	
			Front	Side	Front	Side	Front	Side
4800 mm 15'9"	F1218T 4'0"	kg lb	10 000* 21,600*	6350 13,550	8150 17,500	4850 10,300	3300* 7200*	3300* 7200*
3600 mm 11'10"	F1410T 4'8"	kg lb	10 550 22,600	6350 13,550	8100* 13,800*	4850 10,400	4300* 9400*	4100 9050
3100 mm 10'2"	F1735X 5'3"	kg lb	10 450 22,450	6250 13,400	—	—	5950* 13,050*	4400 9700

350 L Heavy Lift ● Mass Boom ● 750 mm (2'6") Triple Grousers

Stick	Bucket		3 m 10'0"		4.5 m 15'0"		6 m 20'0"		7.5 m 25'0"	
			Front	Side	Front	Side	Front	Side	Front	Side
3700 mm 12'2"	F1735X 5'8"	kg lb	7450* 16,950*	7450* 16,950*	21 100* 49,050*	19 000 40,750	16 950* 36,660*	12 000 25,750	13 000* 28,100*	8450 18,100
2950 mm 9'8"	G1770X 5'10"	kg lb	—	—	19 800 46,100*	18 450 39,550	16 950* 36,700*	11 600 24,900	12 950* 28,000*	8100 17,400
2400 mm 7'10"	G1895M 6'3"	kg lb	—	—	19 350* 45,250*	18 200 39,050	16 950* 36,650*	11 450 24,600	13 000* 28,050*	8050 17,250

Stick	Bucket		9 m 30'0"		10.5 m 35'0"		At Max. Reach	
			Front	Side	Front	Side	Front	Side
3700 mm 12'2"	F1735X 5'8"	kg lb	10 450 22,450	6250 13,350	—	—	3200* 7050*	3200* 7050*
2950 mm 9'8"	G1770X 5'10"	kg lb	10 200 21,850	5950 12,750	—	—	5000* 10,950*	4600 10,050
2400 mm 7'10"	G1895M 6'3"	kg lb	—	—	—	—	7250* 15,950*	5050 11,150

*Load limited by hydraulic capacity rather than tipping.

**Japan Sourced
320B**

Boom		Reach Boom			
Stick		R1.9C	R2.5B	R2.9B	R3.9B
Bucket Tip Radius	mm	1487	1409	1480	1480
	ft	4'10.5"	4'7"	4'10.2"	4'10.2"
Bucket Curling Forces	kN	159	132	125	125
	lb	35,750	29,700	28,100	28,100
Stick Crowd Forces	kN	144	113	98	83
	lb	32,400	25,400	22,050	18,650
Boom		Mass Boom			
Stick		M1.9C		M2.4C	
Bucket Tip Radius	mm	1487		1487	
	ft	4'10.5"		4'10.5"	
Bucket Curling Forces	kN	159		160	
	lb	35,750		36,000	
Stick Crowd Forces	kN	144		126	
	lb	32,400		28,300	

**Belgium Sourced
320B**

Boom		Reach Boom		
Stick		R1.9C	R2.5B	R2.9B
Bucket Tip Radius	mm	1550	1410	1410
	ft	5'1"	4'7.5"	4'7.5"
Bucket Curling Forces	kN	153	132	132
	lb	34,400	29,700	29,700
Stick Crowd Forces	kN	144	113	99
	lb	32,400	25,400	22,200
Boom		Mass Boom		
Stick		M1.9C		M2.4C
Bucket Tip Radius	mm	1550		1550
	ft	5'1"		5'1"
Bucket Curling Forces	kN	153		154
	lb	34,400		34,600
Stick Crowd Forces	kN	144		125
	lb	32,400		28,100
Boom		VA Boom*		
Stick		M1.9C		M2.4C
Bucket Tip Radius	mm	1550		1550
	ft	5'1"		5'1"
Bucket Curling Forces	kN	153		132
	lb	34,400		29,700
Stick Crowd Forces	kN	144		113
	lb	32,400		25,400

*Preliminary information.

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
318B L, 318B LN	Heavy Duty	B	625	24.0"	1563	61.5"	450	0.59	600	1320
		B	775	30.0"	1563	61.5"	560	0.73	685	1510
		B	932	36.0"	1563	61.5"	800	1.05	785	1730
		B	1082	42.0"	1563	61.5"	1000	1.31	850	1870
		B	1230	48.0"	1551	61.0"	1200	1.57	955	2100
	Excavation and Excavation Quick Coupling		600	24.0"	1410	55.5"	410	0.54	473	1043
			750	30.0"	1410	55.5"	550	0.72	525	1158
			1000	39.0"	1410	55.5"	800	1.05	654	1442
			1250	49.0"	1410	55.5"	1050	1.37	753	1660
			1400	55.0"	1410	55.5"	1200	1.57	833	1837
	Extreme Excavation and Extreme Excavation Quick Coupling		1500	59.1"	1410	55.5"	1350	1.77	872	1923
			600	24.0"	1410	55.5"	410	0.54	519	1144
			750	30.0"	1410	55.5"	550	0.72	562	1239
			1000	39.0"	1410	55.5"	800	1.05	702	1548
			1250	49.0"	1410	55.5"	1050	1.37	819	1806
	Utility and Utility Light		1400	55.0"	1410	55.5"	1200	1.57	878	1936
			1400	55.0"	1410	55.5"	605	0.79	620	1367
			1600	63.0"	1410	55.5"	700	0.92	680	1499
			1800	71.0"	1410	55.5"	790	1.03	740	1632
			2000	79.0"	1410	55.5"	880	1.15	800	1764
	Ditch Cleaning		1800	71.0"	1410	55.5"	490	0.64	545	1202
			2000	79.0"	1410	55.5"	550	0.72	585	1290
	Rock and Rock Quick Coupling		600	24.0"	1410	55.5"	410	0.54	547	1206
			750	30.0"	1410	55.5"	550	0.72	645	1422
			1000	39.0"	1410	55.5"	810	1.06	751	1656
			1250	49.0"	1410	55.5"	1050	1.37	875	1929

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
330B	General Purpose	D	775	30.0"	1854	73.0"	800	1.12	947	2083
		D	925	36.0"	1854	73.0"	1100	1.50	1024	2253
		D	1098	42.0"	1854	73.0"	1400	1.88	1116	2455
		D	1246	48.0"	1854	73.0"	1700	2.25	1146	2521
		D	1400	55.0"	1854	73.0"	2000	2.62	1192	2622
		D	1540	60.0"	1854	73.0"	2200	3.00	1400	3080
	Excavation	D	1345	53.0"	1660	65.4"	1300	1.70	1115	2460
		D	1430	56.0"	1660	65.4"	1400	1.83	1195	2640
		D	1500	59.0"	1660	65.4"	1500	1.96	1160	2560
		D	750	29.5"	1660	65.4"	660	0.86	924	2040
		D	1000	39.4"	1660	65.4"	1000	1.31	1015	2240
		D	1150	45.3"	1660	65.4"	1300	1.70	1120	2470
		D	1300	51.2"	1660	65.4"	1450	1.90	1150	2540
		D	1350	53.1"	1660	65.4"	1500	1.96	1214	2680
		D	1500	59.1"	1660	65.4"	1700	2.22	1307	2880
		D	1650	65.0"	1660	65.4"	1900	2.49	1390	3065
		E	1470	58.0"	1845	72.1"	1700	2.22	1470	3240
		E	1600	63.0"	1845	72.1"	1900	2.49	1545	3410
		E	1400	55.1"	1780	70.0"	1700	2.22	1490	3285
		E	1500	59.1"	1780	70.0"	1900	2.49	1590	3505
		E	1650	65.0"	1780	70.0"	2100	2.75	1730	3815
	Extreme Service Excavation	D	775	30.0"	1764	69.4"	700	1.00	955	2100
		D	925	36.0"	1764	69.4"	900	1.25	1045	2310
		D	1098	42.0"	1764	69.4"	1200	1.50	1185	2610
		D	1246	48.0"	1764	69.4"	1400	1.88	1335	2950
		D	1400	55.0"	1764	69.4"	1600	2.12	1435	3170
		D	1540	60.0"	1764	69.4"	1800	2.50	1565	3450
		D	1695	66.0"	1764	69.4"	2000	2.62	1650	3640
		D	1820	72.0"	1764	69.4"	2200	2.88	1800	3970
		D	750	29.5"	1660	65.4"	660	0.86	924	2040
		D	1000	39.4"	1660	65.4"	1000	1.31	1108	2440
		D	1150	45.3"	1660	65.4"	1300	1.70	1260	2780
		D	1250	49.2"	1660	65.4"	1500	1.96	1370	3020
		D	1500	59.1"	1660	65.4"	1700	2.22	1480	3260
		D	1650	65.0"	1660	65.4"	1900	2.49	1571	3460
		E	1400	55.1"	1780	70.0"	1700	2.22	1490	3285
		E	1500	59.1"	1780	70.0"	1900	2.49	1590	3505
		E	1650	65.0"	1780	70.0"	2100	2.75	1730	3815
	Mass Excavation	D	1520	60.0"	1660	65.4"	1600	2.09	1330	2930
		D	1700	67.0"	1660	65.4"	1900	2.49	1325	2920
		E	1735	68.0"	1845	72.1"	2100	2.75	1710	3770

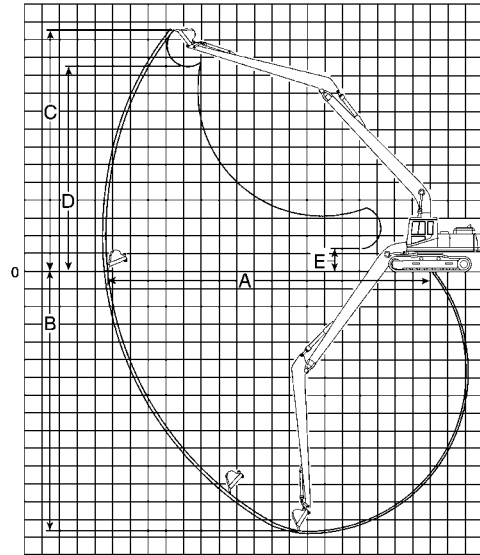
- Introduction
- Range Dimensions
- Bucket Information

INTRODUCTION

Ditch cleaning excavators are designed specifically for those jobs requiring maximum reach well beyond the range of normal excavators. Those machines are designed to drag a small bucket at about 90 degrees over the side of the tracks towards the excavator; they are not suited for digging work. Caterpillar offers the Long Reach excavators for light digging applications with a much larger digging envelope than normal excavators. Ditch cleaning excavators are suited for ditch cleaning, slope finishing, river conservation and other work formerly reserved to draglines.

Caterpillar's ditch cleaning hydraulic excavators use purpose-built booms and sticks designed by Caterpillar for maximum performance and durability in dragging applications.

Ditch Cleaning Fronts include: boom, stick, linkage cylinders (boom, stick, and bucket), hydraulic lines and additional counterweight for stability while working over the side. Dimensions include ditch cleaning bucket.



Long Reach Model	320B L		320B L		322B L		325B L	
	m	ft	m	ft	m	ft	m	ft
Source	Japan		Belgium		Japan		Belgium	
A Maximum Reach at Ground Level	15.60	51'2"	15.59	51'2"	18.30	60'0"	18.30	60'0"
B Maximum Digging Depth	11.75	38'7"	11.75	38'7"	14.60	47'11"	15.60	51'2"
C Maximum Cutting Height	13.24	43'5"	13.32	43'8"	14.19	46'7"	13.60	44'7"
D Maximum Dumping Height	11.14	36'7"	11.14	36'7"	12.14	39'10"	11.60	38'1"
E Minimum Loading Height	2.10	6'10"	2.09	6'10"	1.49	4'11"	1.32	4'4"

320B L • Ditch Cleaning • Japan/U.S. Sourced

Bucket Type	Bucket Width		Tip Radius		SAE Heaped Cap.		Bucket Weight		No. of Teeth	Bucket Curl Force		Stick Crowd Force	
	mm	ft/in	mm	ft/in	L	yd³	kg	lb		kN	lb	kN	lb
General Purpose	810	2'8"	1220	4'0"	450	0.59	340	750	5	60.5	13,600	46.0	10,340
Ditch Cleaning	1140	3'9"	1090	3'7"	600	0.78	290	640	0	54.1	12,170	46.6	10,470

322B L • Ditch Cleaning • Japan/U.S. Sourced

General Purpose	700	2'4"	1220	4'0"	380	0.50	335	740	4	54.1	12,170	50.1	11,270
General Purpose	810	2'8"	1220	4'0"	450	0.59	340	750	5	54.1	12,170	50.1	11,270
Ditch Cleaning	965	3'2"	1090	3'7"	480	0.63	265	580	0	60.5	13,600	50.6	11,380
Ditch Cleaning	1140	3'9"	1090	3'7"	600	0.78	290	640	0	60.5	13,600	50.6	11,380

320 L/325 L • Ditch Cleaning • Belgium Sourced

	810	2'8"	—	—	450	0.59	350	770	—	—	—	—	—
	1800	5'11"	—	—	600	0.78	400	880	—	—	—	—	—

FOR USE WITH 1-PIECE BOOM — UNIQUE M312/M315 BUCKETS

Bucket Bite Width	mm ft/in	450 17.7"	600 1'11.6"	700 2'3.6"	900 2'11.4"	1000 3'3.4"	1100 3'7.3"	1100 3'7.3"	1200 3'11.2"	1200* 3'11.2"
ISO Bucket Capacity	m³ yd³	0.24 0.31	0.33 0.43	0.40 0.52	0.54 0.70	0.61 0.79	0.68 0.88	0.68 0.88	0.75 0.98	0.86 1.12
Bucket Tip Radius	mm ft/in	1240 4'0.8"	1240 4'0.8"	1240 4'0.8"	1240 4'0.8"	1240 4'0.8"	1240 4'0.8"	1220 4'0"	1220 4'0"	1318 4'3.9"
Number of Tips		3	3	4	5	5	6	6	6	5
Weight with Tips	kg lb	271 596	304 669	340 748	365 803	410 902	438 964	472 1038	458 1008	592 1305
Bucket Type¹		T	T	T	X	X	X	EX	X	EX
Longest Acceptable Stick:										
Dozer Only — Up (FOW²)	m ft/in	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	2.6 8'6"	2.6 8'6"	2.4 7'11"	2.4 7'11"
Dozer Only — Down	m ft/in	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	2.6 8'6"	2.6 8'6"
Rear Outriggers — Down	m ft/in	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"
2 Sets Outriggers — Down	m ft/in	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"
Dozer/Outriggers — Down	m ft/in	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"

FOR USE WITH VA BOOM — UNIQUE M312/M315 BUCKETS

Bucket Bite Width	mm ft/in	450 17.7"	600 1'11.6"	700 2'3.6"	900 2'11.4"	1000 3'3.4"	1100 3'7.3"	1100 3'7.3"	1200 3'11.2"	1200* 3'11.2"
ISO Bucket Capacity	m³ yd³	0.24 0.31	0.33 0.43	0.40 0.52	0.54 0.70	0.61 0.79	0.68 0.88	0.68 0.88	0.75 0.98	0.86 1.12
Bucket Tip Radius	mm ft/in	1220 4'0"	1220 4'0"	1220 4'0"	1220 4'0"	1220 4'0"	1220 4'0"	1220 4'0"	1220 4'0"	1318 4'3.9"
Number of Tips		3	3	4	5	5	6	6	6	5
Weight with Tips	kg lb	271 596	304 669	340 748	365 803	410 902	438 964	472 1038	458 1008	592 1305
Bucket Type¹		T	T	T	X	X	X	EX	X	EX
Longest Acceptable Stick:										
Dozer Only — Up (FOW²)	m ft/in	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	2.6 8'6"	2.4 7'11"	2.4 7'11"	2.1 6'11"	1.7 5'7"
Dozer Only — Down	m ft/in	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	2.6 8'6"	2.6 8'6"	2.6 8'6"
Rear Outriggers — Down	m ft/in	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"
2 Sets Outriggers — Down	m ft/in	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"
Dozer/Outriggers — Down	m ft/in	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"	3.1 10'2"

*Requires J300 tips. All other buckets require J250 tips.

¹T = Trenching

X = Excavation

EX = Extreme Service Excavation

²Free on wheels

EQUIPMENT FOR ...	M312		M315		M318		M320	
Undercarriage:								
Wheeled	●		●		●		●	
Booms:								
One-piece	●		●		●		●	
VA	●		●		●		●	
Backhoe Sticks:	mm	ft	mm	ft	mm	ft	mm	ft
Short	1600	5'3"	1700	5'7"	1800	5'11"	1900	6'3"
Medium	2000	6'6"	2100	6'9"	2400	7'9"	2500	8'2"
Medium Long	2300	7'5"	2400	7'9"	—	—	—	—
Long	2600	8'5"	2600	8'5"	2800	9'2"	2900	9'6"
Extra Long	3000	9'9"	3100	10'1"	4000	13'1"	4200	13'9"
Material Handling Stick	—		—		3200 10'6"		—	
Buckets (No. of)	13		13		8		14	
Teeth:								
Abrasion	●		●		●		●	
Long (G.P.)	●		●		●		●	
Short (Rock)	●		●		●		●	
Penetration	●		●		●		●	
Wide	—		—		—		●	
Sharp	—		—		—		●	
Side Cutters:								
One-Piece Blade	●		●		●		—	
Tires:								
	Tires: Duals 10.00-20 11.00-20		Tires: Duals 10.00-20 11.00-20		Tires: Duals 10.00-20 11.00-20		Tires: Duals 11.00-20 10.00-20 Solid	
	Singles 18-19.5		Singles 18-19.5 18R-22.5XF		Singles 18-19.5 18-22.5		Singles 18R-19.5XF 18R-22.5XF	

NOTE: Number of buckets shown includes general purpose, rock and trenching. Not included are ditch cleaning, ditch grading and trapezoidal ditching.

Work Tools	M312	M315	M318	M320
Clamshell*	X	X	X	
Ditch Cleaning Bucket	X	X	X	X
Grapples*	X	X	X	
Hammer Installation Kit	X	X	X	

*With hydraulic rotator.

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 — $1.6 \text{ BCY/ft} \times 1.25 = 2.0 \text{ LCY/ft}$

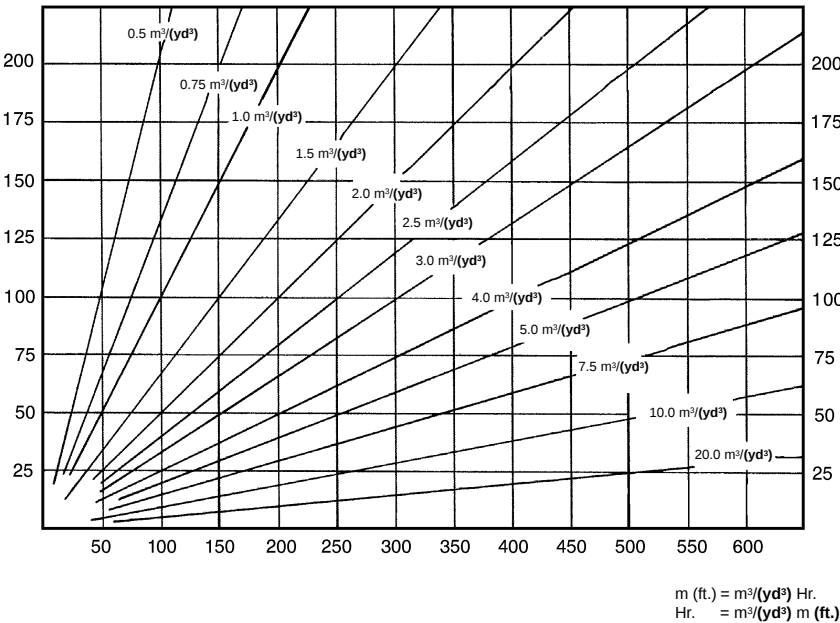
Enter vertical axis of trenching conversion chart at 100 ft/hr and travel over to diagonal line representing 2.0 yd³/ft. Next move down to horizontal axis and read answer of 200 LCY/50 min hr.

Convert 200 LCY/50 min hr to LCY/60 min hr = $\frac{200}{0.83} = 241 \text{ LCY/60 min hr}$

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.

Adjustments to Standard Operating Weight

Track	5130B	650 mm Track 800 mm Track 1000 mm Track	–2050 kg 0 kg +2270 kg
	5230	1100 mm Track 1300 mm Track 1500 mm Track	–2320 kg 0 kg +5370 kg
Buckets	5130B	Rock (10.5 m³) High Density (8.5 m³) Excavation (10.5 m³) Coal (13.6 m³) Coal (18.3 m³)	0 kg –1079 kg –500 kg –800 kg –130 kg
	5230	Rock (16.0 m³) High Density (13.0 m³) Rock (18.0 m³) Coal (27.5 m³)	0 kg –2000 kg +1800 kg –1140 kg

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 materialLonger bucket fill and dump time.

Greater swing angleLonger swing times.

Operator abilityAffects total cycle time.

Loading from the top downMay improve swing time.

MODEL	5080	5130B	5230
Bucket Size	5.2 m ³ 6.8 yd ³	11.1 m ³ 14.5 yd ³	17.0 m ³ 22.2 yd ³
Soil Type	Shot rock	Shot rock	Shot rock
Swing Angle	90°	90°	90°
Load Area	No Obstructions	No Obstructions	No Obstructions
Operator Ability	Average	Average	Average
Load Bucket	0.16 Min.	0.18 Min.	0.20 Min.
Swing Loaded	0.09 Min.	0.13 Min.	0.14 Min.
Dump Bucket	0.03 Min.	0.04 Min.	0.05 Min.
Swing Empty	0.09 Min.	0.10 Min.	0.10 Min.
Total Cycle Time	0.37 Min.	0.45 Min.	0.49 Min.

Lift Capacities

Equipped with Caterpillar material handling arrangement.

Includes purpose built material handling boom and stick, wiring and connecting hydraulics, hydraulic cylinders and heavier counterweight. Boom cylinder — 140 mm (5.5") diameter stick cylinder — 150 mm (5.9") diameter.

Capacities are measured at the bare stick tip, and are expressed in kg.

Capacities are based on level machine equipped as follows:

- Total machine weight including base machine, material handling front, 1.2 m fixed cabriser, wide gage undercarriage, counterweight, lubricants, full fuel tank and operator.
- 600 mm (2'0") triple grouser shoes.

320B MH — Heavy Duty Square Undercarriage configuration

Maximum reach, height and lift capacity (6.65 m boom and 5.4 m stick)

		3 m		4.5 m		6 m		7.5 m		Max. Reach
Height		Front	Side	Front	Side	Front	Side	Front	Side	Radius
12.0 m	kg	—	—	—	—	6233*	6233*	—	—	6.46 m
10.5 m	kg	—	—	—	—	7627*	7627*	6161*	6161*	8.37 m
9.0 m	kg	—	—	—	—	—	—	6979*	6531	9.69 m
7.5 m	kg	—	—	—	—	—	—	6972*	6511	10.63 m
6.0 m	kg	—	—	—	—	8164*	8164*	7173*	6390	11.29 m
4.5 m	kg	—	—	9215*	9215*	8848*	8848*	7070	6186	11.73 m
3.0 m	kg	—	—	12 551*	12 551*	9652*	8390	6803	5927	11.96 m
1.5 m	kg	—	—	13 903*	12 366	9166	7894	6524	5657	12.00 m
Ground	kg	—	—	11 336*	11 336*	8746	7491	6285	5425	11.84 m
–1.5 m	kg	3656*	3656*	8933*	8933*	8484	7239	6122	5266	11.49 m
–3.0 m	kg	4990*	4990*	9408*	9408*	8375	7135	6047	5194	10.52 m
–4.5 m	kg	—	—	—	—	6295*	6295*	4887*	4887*	7.68 m

		9 m		10.5 m		At Max. Reach		Max. Reach
Height		Front	Side	Front	Side	Front	Side	Radius
12.0 m	kg	—	—	—	—	5124*	5124*	6.46 m
10.5 m	kg	—	—	—	—	4190*	4190*	8.37 m
9.0 m	kg	5418	4755	—	—	3741*	3741*	9.69 m
7.5 m	kg	5451	4786	4043*	3612	3494*	3494*	10.63 m
6.0 m	kg	5392	4728	4153	3626	3362*	3159	11.29 m
4.5 m	kg	5274	4614	4101	3576	3308*	2939	11.73 m
3.0 m	kg	5123	4466	4021	3497	3255	2818	11.96 m
1.5 m	kg	4964	4311	3933	3411	3212	2778	12.00 m
Ground	kg	4824	4175	3859	3338	3255	2813	11.84 m
–1.5 m	kg	4728	4080	3816	3296	3195*	2934	11.49 m
–3.0 m	kg	4692	4045	3326*	3308	3297*	3297*	10.52 m
–4.5 m	kg	—	—	—	—	4716*	4716*	7.68 m

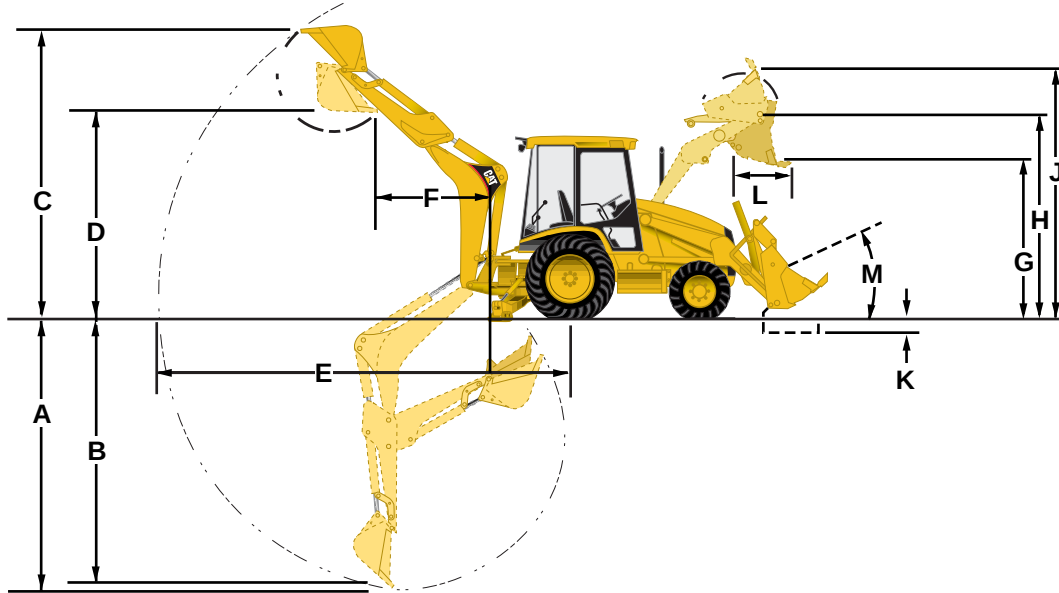
*Limited by hydraulic rather than tipping load.

The above loads are in compliance with hydraulic excavator lift capacity ratings standard ISO 10567, they do not exceed 87% of hydraulic lifting capacity or 75% of tipping capacity. Weight of all lifting accessories must be deducted from the above lifting capacities.



MODEL	416C		426C		436C	
Flywheel Power (Gross)	59 kW	78 hp	63 kW	84 hp	66 kW	89 hp
Flywheel Power (Net)	56 kW	75 hp*	60 kW	80 hp	63 kW	85 hp
Operating Weight	6300 kg	13,890 lb	7010 kg	15,450 lb	7075 kg	15,600 lb
Engine Model	3054 DINA		3054 DIT		3054 DIT	
Rated Engine RPM	2200		2200		2200	
No. of Cylinders	4		4		4	
Bore	100 mm	3.94 in	100 mm	3.94 in	100 mm	3.94 in
Stroke	127 mm	5 in	127 mm	5 in	127 mm	5 in
Displacement	4 L	243 in ³	4 L	243 in ³	4 L	243 in ³
Speeds Forward	km/h	mph	km/h	mph	km/h	mph
1st	5.8	3.6	5.8	3.6	6.0	3.7
2nd	9.3	5.8	4.3	5.8	9.6	6.0
3rd	17.9	11.1	17.9	11.1	19.9	12.4
4th	34.0	21.1	34.0	21.1	33.7	20.9
Speeds Reverse						
1st	5.8	3.6	5.8	3.6	6.0	3.7
2nd	9.3	5.8	9.3	5.8	9.6	6.0
3rd	17.9	11.1	17.9	11.1	19.9	12.3
4th	34.0	21.1	34.0	21.1	33.7	20.9
Turning Circle Wall to Wall	10 670 mm	35'0"	10 800 mm	35'5"	10 859 mm	35'7"
All Wheel Steer Wall to Wall						
Two Wheel Steer	—		10 800 mm	35'5"	10 800 mm	35'5"
Circle Steer	—		10 400 mm	34'1"	10 400 mm	34'1"
Independent Rear	—		9500 mm	31'2"	9500 mm	31'2"
Tires, Single-Tilt, Front						
Standard, 2WD	11LX16, 10 PR, F3		11LX16, 10 PR, F3		11L-16, 12 PR, F3	
Standard, AWD	12.5/80-18, 10 PR, SG		12.5/80-18, 10 PR, SG		12.5/80-18, 10 PR, SG	
Tires, Single-Tilt, Rear						
Standard, 2WD	16.9X24, 8 PR, R4		16.9X24, 8 PR, R4		19.5L-24, 10 PR, IT525	
Standard, AWD	19.5LX24, 8 PR, IT525		19.5L-24, 8 PR, IT525		19.5L-24, 10 PR, IT525	
Standard, AWS	—		19.5L-24, 10 PR, IT525		19.5L-24, 10 PR, IT525	
Tire, Parallel Lift, Front						
Standard, 2WD	11LX16, 12 PR, F3		11LX16, 12 PR, F3		11L-16, 12 PR, F3	
Standard, AWD	12.5/80-18, 10 PR, SG		12.5/80-18, 10 PR, SG		12.5/80-18, 10 PR, SGI	
Tires, Parallel Lift, Rear						
Standard, 2WD	16.9X24, 8 PR, R4		16.9X24, 8 PR, R4		—	
Standard, AWD	19.5L-24, 8 PR, IT525		19.5L-24, 8 PR, IT525		19.5L-24, 10 PR, IT525	
Standard, AWS	—		19.5L-24, 10 PR, IT525		19.5L-24, 10 PR, IT525	
Hydraulic System, closed center	LSPC		LSPC		LSPC	
Pump capacity:	162 L/min @ 2200 rpm @ 20 700 kPa (43 gpm @ 2200 rpm @ 3000 psi)		162 L/min @ 2200 rpm @ 20 700 kPa (43 gpm @ 2200 rpm @ 3000 psi)		162 L/min @ 2200 rpm @ 20 700 kPa (43 gpm @ 2200 rpm @ 3000 psi)	
Fuel Tank Capacity	128 L	34 U.S. gal	128 L	34 U.S. gal	128 L	34 U.S. gal

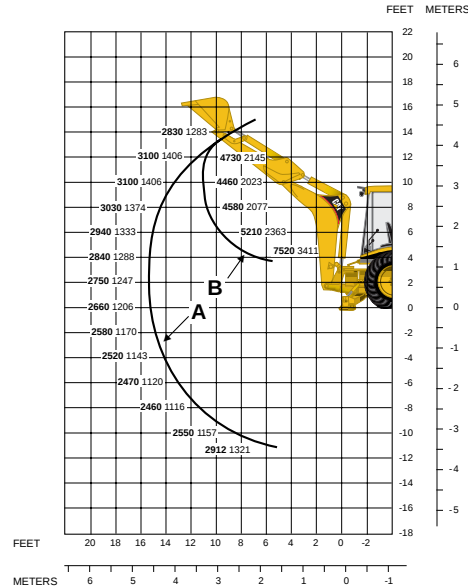
*With turbocharger 60 kW (80 hp).



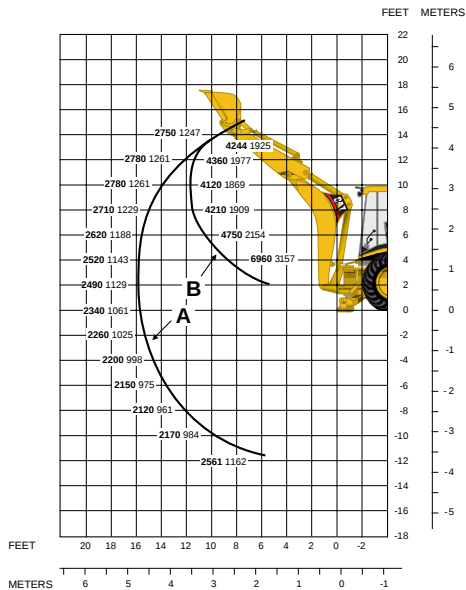
MODEL	416C									
Loader	Single Tilt						IT Loader with QC			
Bucket	General Purpose		General Purpose		Multi-Purpose		General Purpose		Multi-Purpose	
Bucket capacity	0.76 m ³	1 yd ³	0.96 m ³	1.25 yd ³	0.96 m ³	1.25 yd ³	0.96 m ³	1.25 yd ³	0.96 m ³	1.25 yd ³
Width	2262 mm	7'5"	2262 mm	7'5"	2262 mm	7'5"	2262 mm	7'5"	2262 mm	7'5"
Lift capacity at max height	2622 kg	5780 lb	2486 kg	5480 lb	2368 kg	5220 lb	3250 kg	7166 lb	2981 kg	6570 lb
Breakout force	40 kN	9030 lb	38.3 kN	8606 lb	42 kN	9490 lb	47.1 kN	10,600 lb	46.6 kN	10,485 lb
G) Dump height @ max dump angle	2650 mm	8'8"	2575 mm	8'5"	2640 mm	8'8"	2495 mm	8'2"	2560 mm	8'5"
H) Hinge pin height	3290 mm	10'10"	3290 mm	10'10"	3290 mm	10'10"	3290 mm	10'10"	3290 mm	10'10"
J) Max operating height	4020 mm	13'2"	4170 mm	13'8"	4200 mm	13'9"	4170 mm	13'8"	4200 mm	13'9"
K) Digging depth	105 mm	4"	105 mm	4"	105 mm	4"	105 mm	4"	135 mm	5"
Grading angle	110°		106°		110°		107°		111°	
Width of dozer cutting edge	—	—	—	—	2406 mm	7'11"	—	—	2262 mm	7'11"
Clam opening — maximum	—	—	—	—	790 mm	2'7"	—	—	790 mm	2'7"
L) Reach @ full height max dump angle	730 mm	2'5"	810 mm	2'8"	700 mm	2'4"	840 mm	2'9"	730 mm	2'5"
M) Maximum rollback @ groundline	40°		40°		40°		40°		41°	
Weight	380 kg	838 lb	428 kg	944 lb	659 kg	1453 lb	466 kg	983 lb	659 kg	1453 lb

KEY

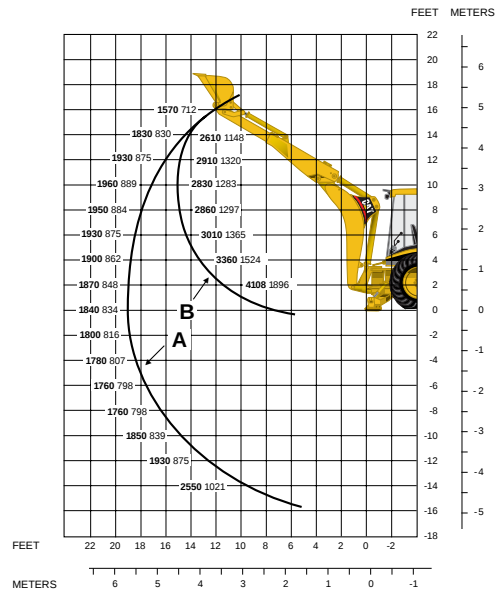
A — Boom lift **lb kg**
B — Stick lift **lb kg**



Standard Stick



Extendable Stick —
Retracted

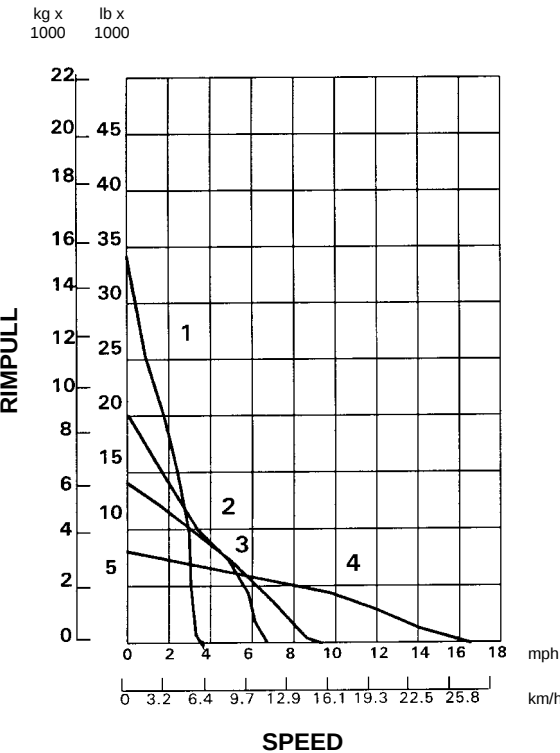


Extendable Stick —
Extended

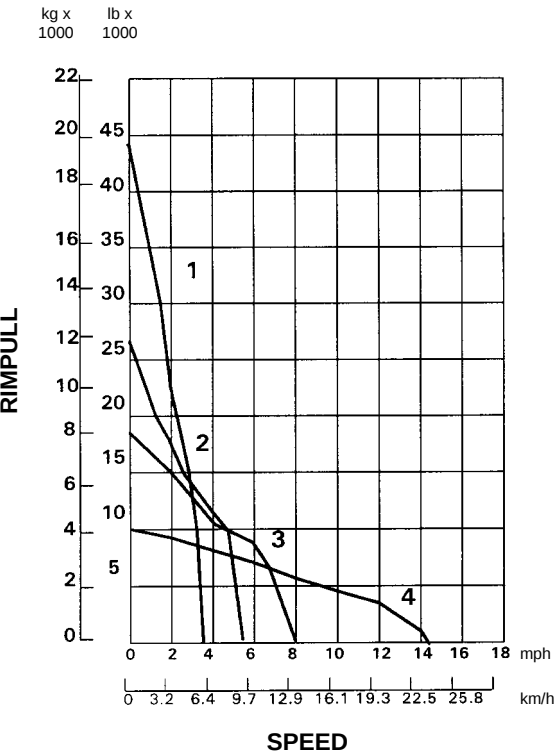
NOTE: Boom at 65°.

Machine configuration includes 16.9X24, 8PR, R4 rear and 11LX16, 10PR, F3 front tires, open ROPS, two wheel drive, single tilt loader, 0.76 m³ (1 yd³) GP bucket, 610 mm (2'0") standard duty bucket, base counterweight 145 kg (320 lb).

515 Skidder



525 Skidder



KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear

	1st	2nd	3rd	4th
Forward, km/h	6.21	10.63	15.00	27.15
mph	3.86	6.61	9.32	16.87
Reverse, km/h	6.21	10.63	19.22	—
mph	3.86	6.61	11.95	—

	1st	2nd	3rd	4th
Forward, km/h	5.37	9.2	12.97	23.5
mph	3.34	5.72	8.06	14.6
Reverse, km/h	5.37	9.2	16.64	—
mph	3.34	5.72	10.34	—

Usable rimpull depends on traction, tire size and equipped weight of loaded machines. Grapple weights may vary.
NOTE: Rimpull shown with 28L-26 tires. Consult your Caterpillar Dealer for further information.

GRAPPLES

Fixed boom Grapples for Cat 517 and 527 Skidders are built and supplied by Caterpillar. Swing boom grapples are built by independent manufacturers of auxiliary equipment (AEMS) to Caterpillar specifications. The following contains information on some of the available models, which are presented here to suggest a range of grapple possibilities.

Reach (A, B) — The horizontal distance from the vertical center of the rear idler to the vertical center of the grapple fore and aft pivot.

- A) With the grapple in its lowest fully extended position.
- B) With the grapple in its highest fully retracted position.

Lift (C, E) — The vertical distance from the ground to the center of the grapple fore and aft pivot.

- C) With the grapple in its lowest fully extended position.
- E) With the grapple in its highest fully retracted position.

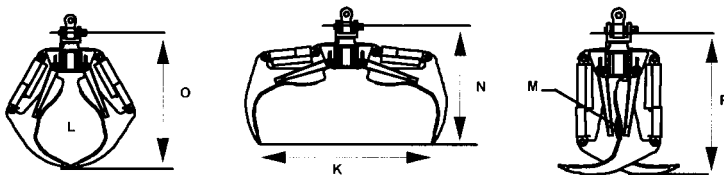
Maximum Grapple Opening (K) — The horizontal distance between the tips of the grapple arms when grapple is fully open.

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.

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.

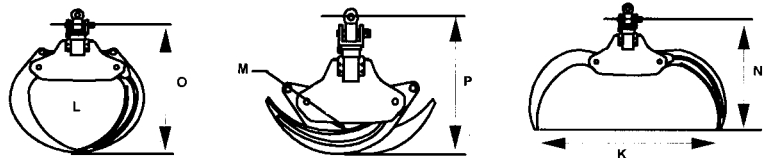


Sorting Grapple

- Used for 305 mm (12") or larger diameter trees.
- Designed to pick up individual or several stems for quick cycles.

Bunching Grapple

- Used for 305 mm (12") or smaller diameter trees.
- Designed to gather bundle of stems and maximize grapple loads.



Grapples for 517		K	M	N	O	P	L
84" Sorting	mm	2130	76	1680	1980	1740	0.74 m ²
	in	84	3	66	78	68.5	8 ft ²
90" Sorting	mm	2290	102	1640	1920	1310	0.74 m ²
	in	90	4	64	75	51	8 ft ²
Grapples for 527		K	M	N	O	P	L
100" Sorting	mm	2540	76	1560	2040	1830	0.84 m ²
	in	100	3	61.5	80.5	72	9 ft ²
102" Bunching	mm	2590	76	1780	2020	136	0.93 m ²
	in	102	3	70	79.5	53.5	10 ft ²

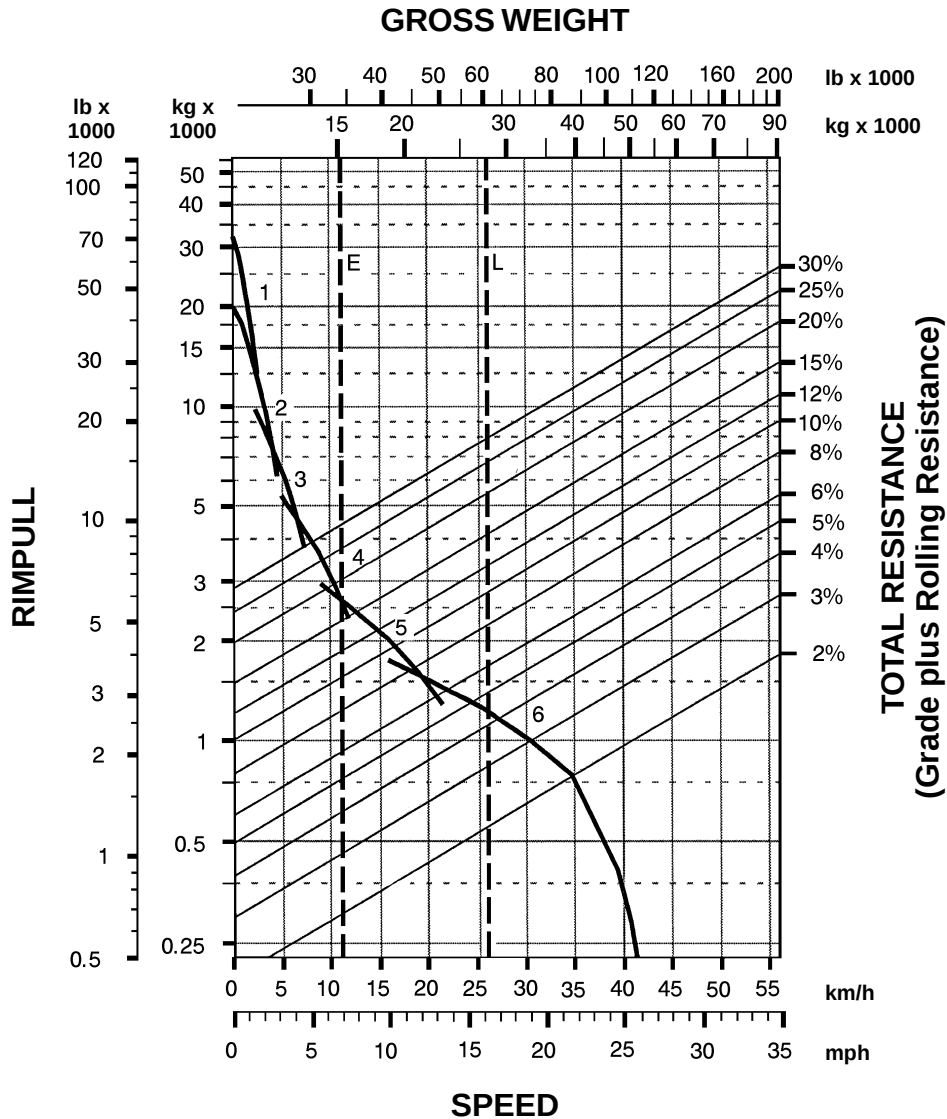
- Specifications
- Tandem Powered
- Push-Pull

Wheel Tractor-Scrapers



MODEL	627F		637E Series II		657E	
Flywheel Power: Tractor	246.2 kW	330 hp	335/365 kW	450/490 hp	410/452 kW	550/605 hp
Scraper	168 kW	225 hp	187 kW	250 hp	298/328 kW	400/440 hp
Approx. Operating Weight (Empty)◀	37 060 kg	81,640 lb	50 990 kg	112,320 lb	70 670 kg	155,650 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: Front	60%		59%		60%	
Rear	40%		41%		40%	
Weight Distribution — Loaded: Front	49%		49%		51%	
Rear	51%		51%		49%	
Engine Model: Tractor	3406C		3408		3412	
Scraper	3306		3306		3408	
Rated Engine RPM: Tractor	1900		2000		1900	
Scraper	2200		2200		1900	
Displacement: Tractor	14.6 L	893 in³	18 L	1099 in³	27 L	1649 in³
Scraper	10.5 L	638 in³	10.5 L	638 in³	18 L	1099 in³
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	33.25R29★★E2/E3		37.25R35★★E2/E3		40.5/75R39	
Scraper	33.25R29★★E2/E3		37.25R35★★E2/E3		40.5/75R39	
Width of Cut	3.02 m	9'11"	3.51 m	11'6"	3.85 m	12'8"
Maximum Depth of Cut	333 mm	13.1"	437 mm	17"	470 mm	18.5"
Maximum Depth of Spread	522 mm	1'8.6"	480 mm	18.9"	533 mm	1'9"
Fuel Tank Refill Capacity: Tractor	—		—		—	
Scraper	992 L	262 U.S. gal	1272 L	336 U.S. gal	1772 L	468 U.S. gal
GENERAL DIMENSIONS:						
Height to Top of Scraper	3.81 m	12'2"	4.29 m	14'1"	4.71 m	15'5"
Wheelbase	7.72 m	25'4"	8.77 m	28'9"	9.97 m	32'9"
Overall Length	12.93 m	42'5"	14.56 m	47'9"	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"	2.81 m	9'3"
Tractor Tread	2.21 m	7'3"	2.46 m	8'1"	2.64 m	8'8"
PUSH-PULL GENERAL DIMENSIONS:						
Operating Weight (Empty)◀	38 103 kg	84,000 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"	18.01 m	59'1"
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.



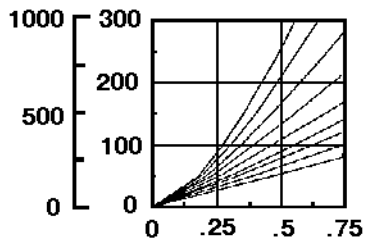
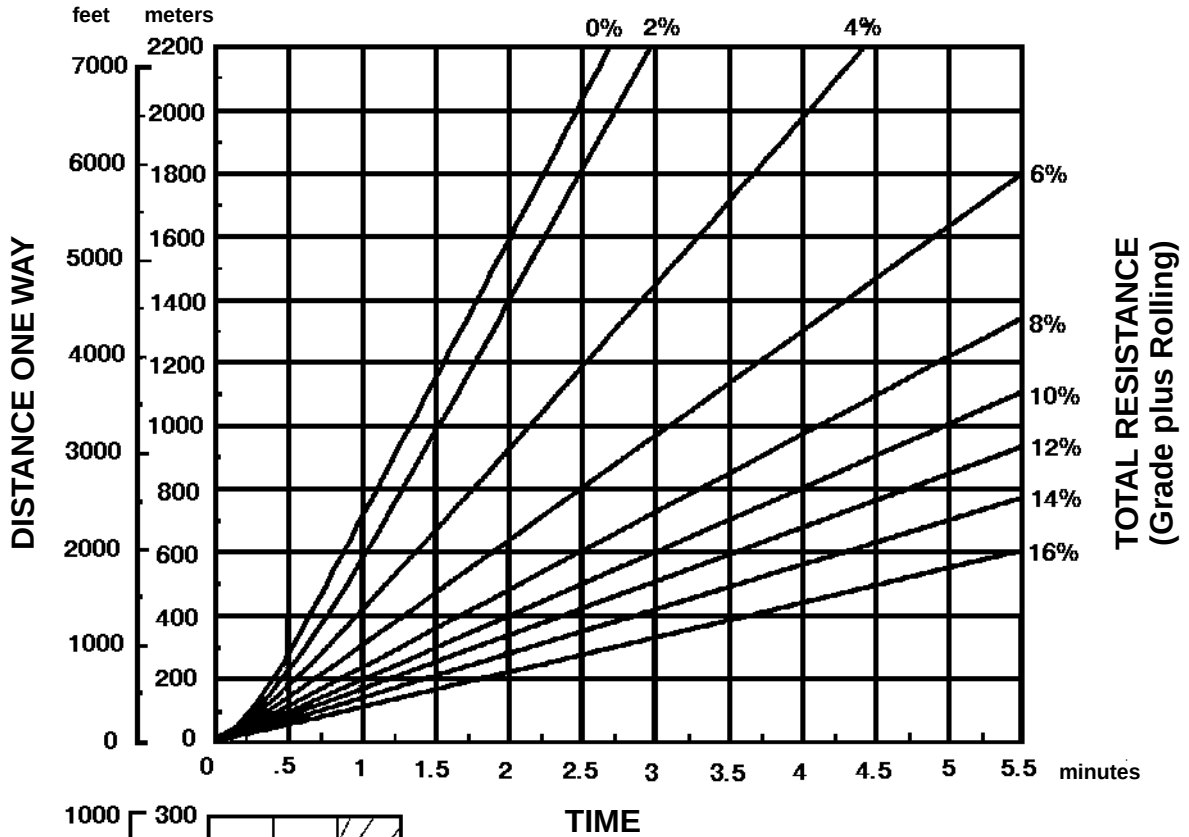
KEY

- 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

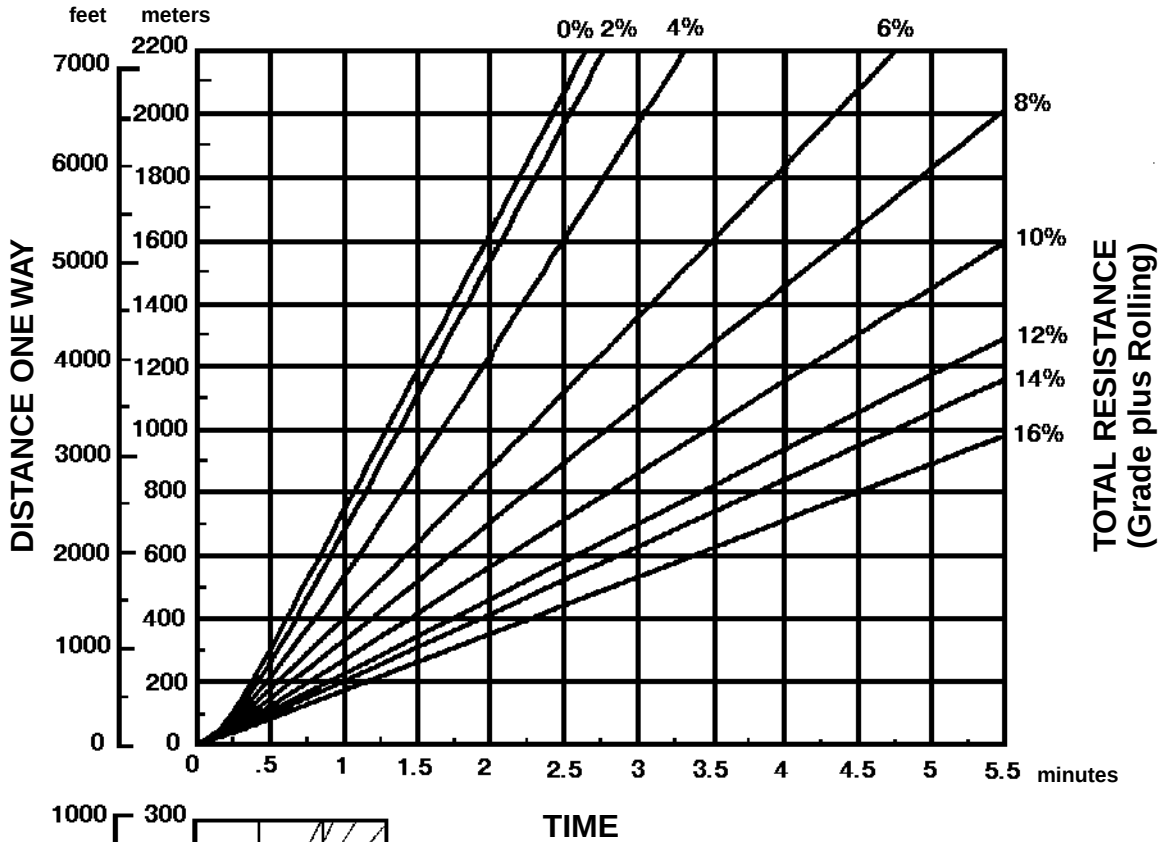
- E — Empty 15 265 kg (33,650 lb)
- L — Loaded 27 240 kg (60,050 lb)

LOADED



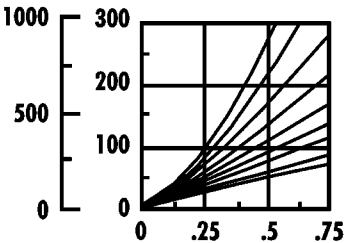
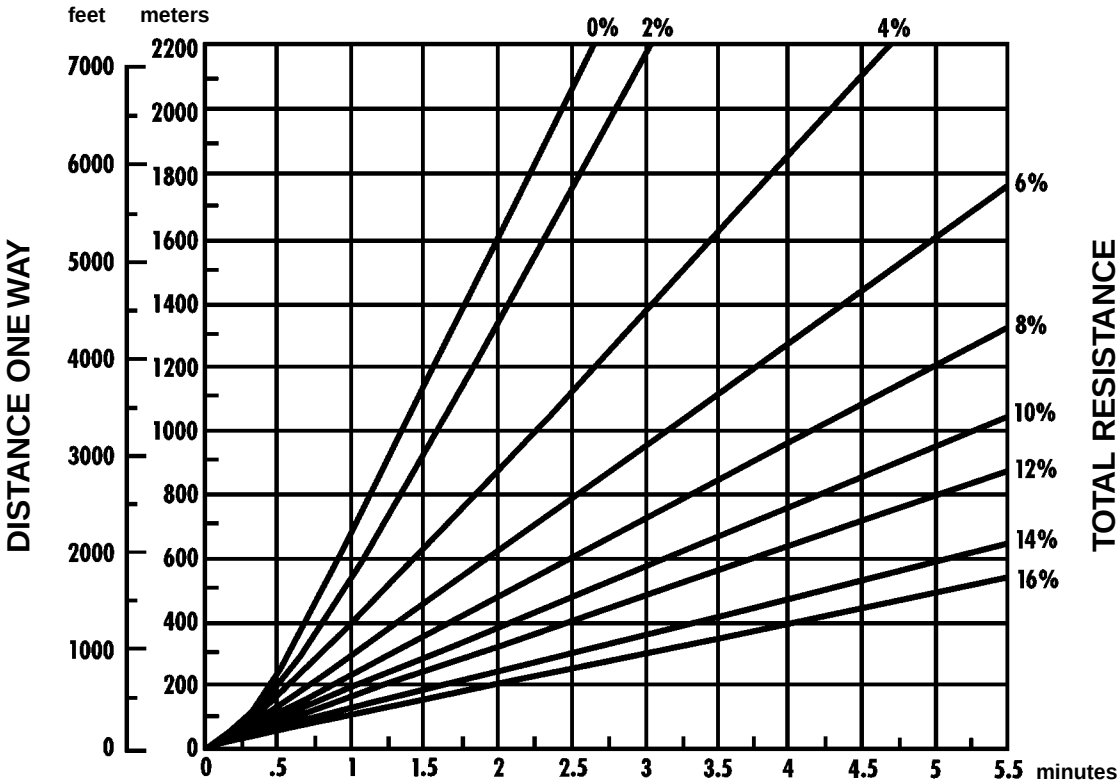
Empty weight: 37 762 kg (83,250 lb)
 Payload: 21 775 kg (48,000 lb)

LOADED



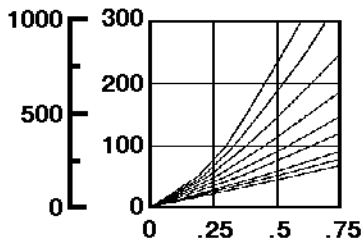
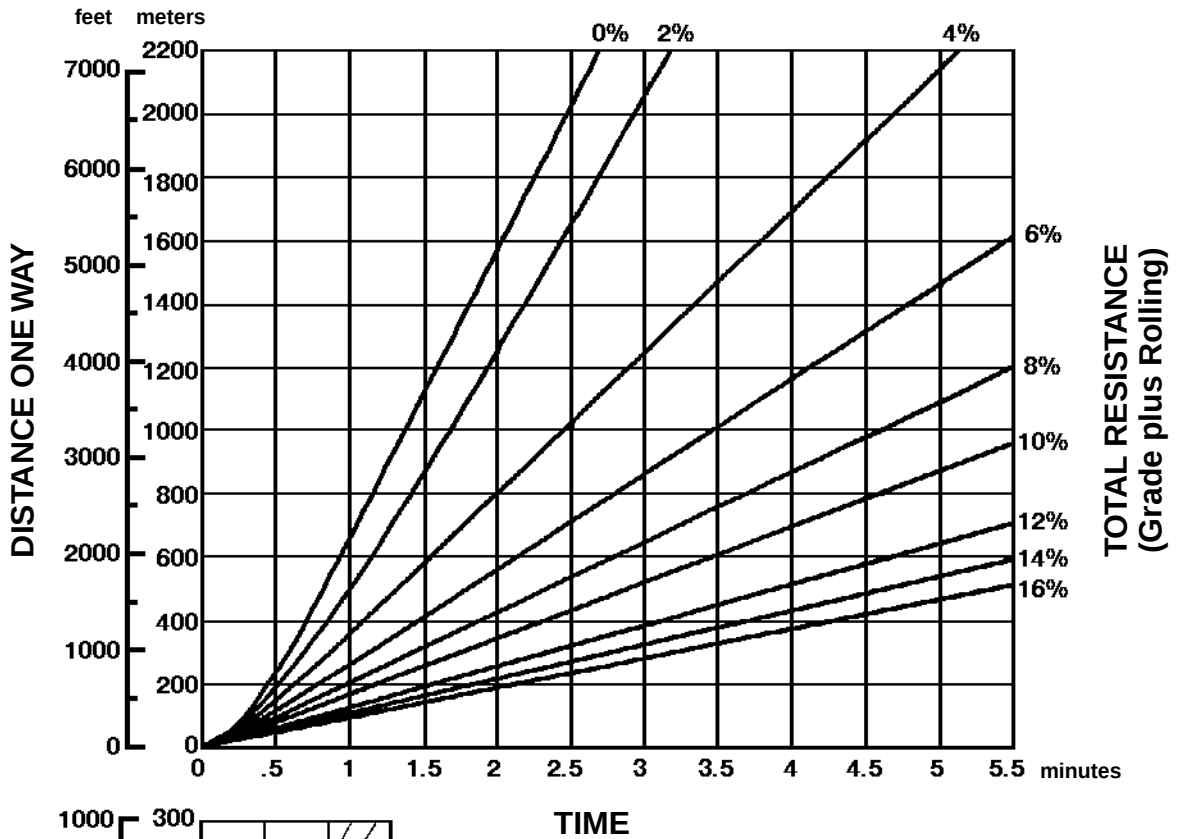
Empty weight: 42 230 kg (93,100 lb)
 Payload: 21 775 kg (48,000 lb)

LOADED



Empty weight: 51 100 kg (112,670 lb)
Payload: 37 200 kg (82,000 lb)

LOADED



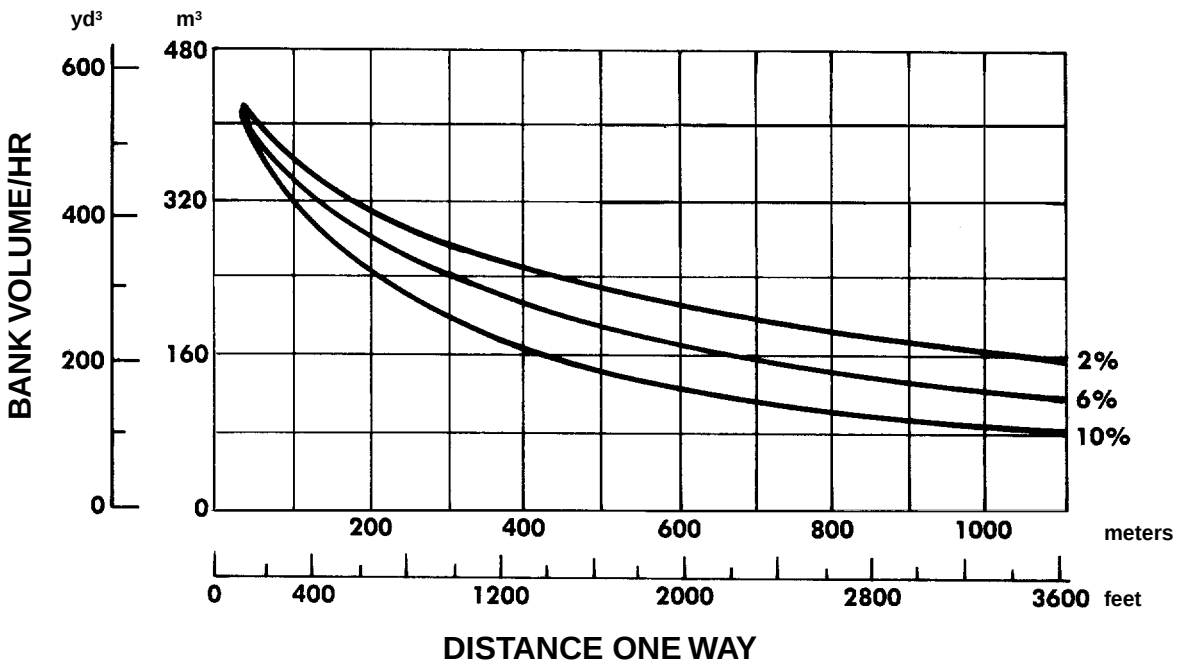
Empty weight: 66 575 kg (146,770 lb)
 Payload: 47 175 kg (104,000 lb)

DISTANCE vs. PRODUCTION

CONDITIONS: Flat haul. Percentages shown are rolling resistance only.

100% efficiency (60 min hour).

- Material: 1780 kg/m³ (3000 lb/yd³).
- Payload: 21 770 kg, 12.2 Bm³ (48,000 lb, 16 BCY).
- Empty weight: 32 070 kg (70,700 lb).
- Fixed time: 1.4 min.



- Bm^3 (BCY)/hr
- All Models
- 100% Efficiency

Wheel Tractor-Scrapers

HOURLY PRODUCTION vs. CYCLE TIME

VEHICLE CAPACITY:

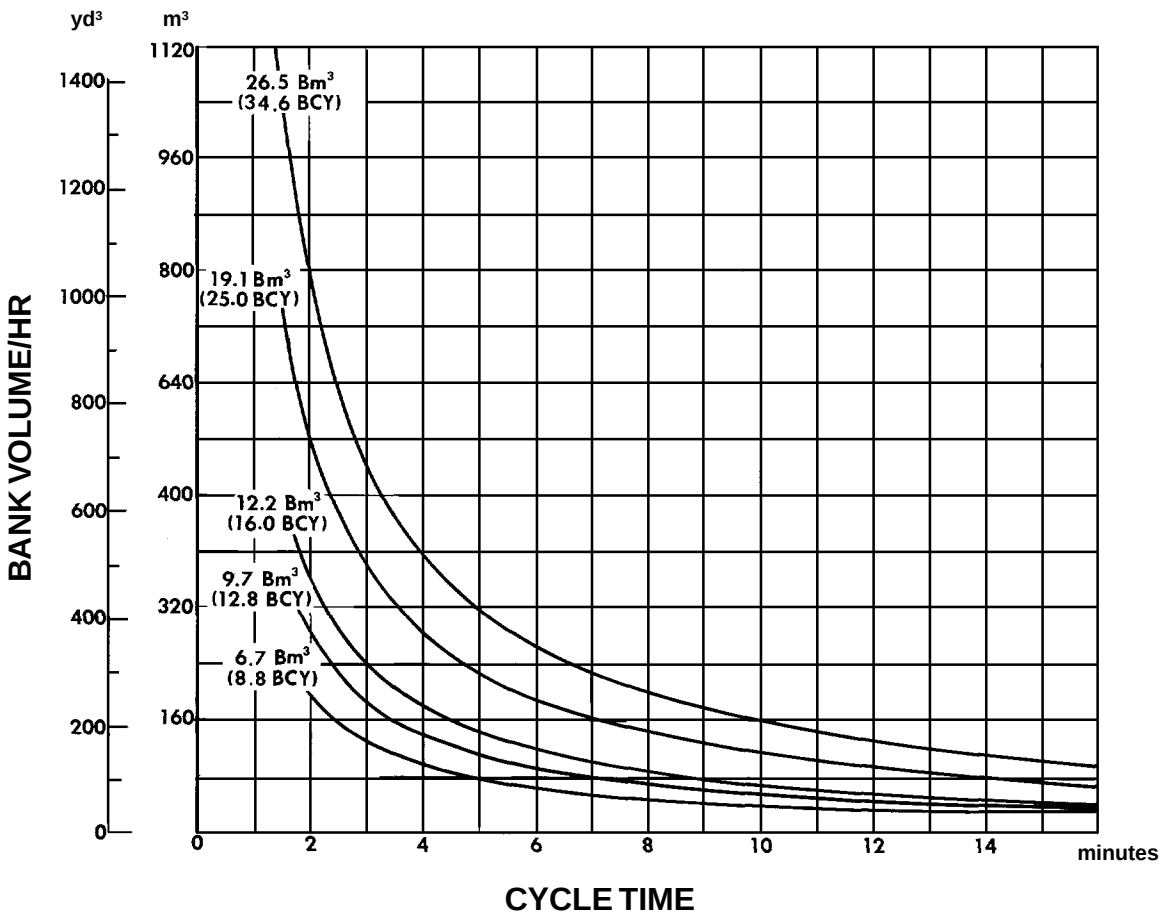
613C Series II @ $6.7 \text{ Bm}^3/\text{trip}$ (8.8 BCY)

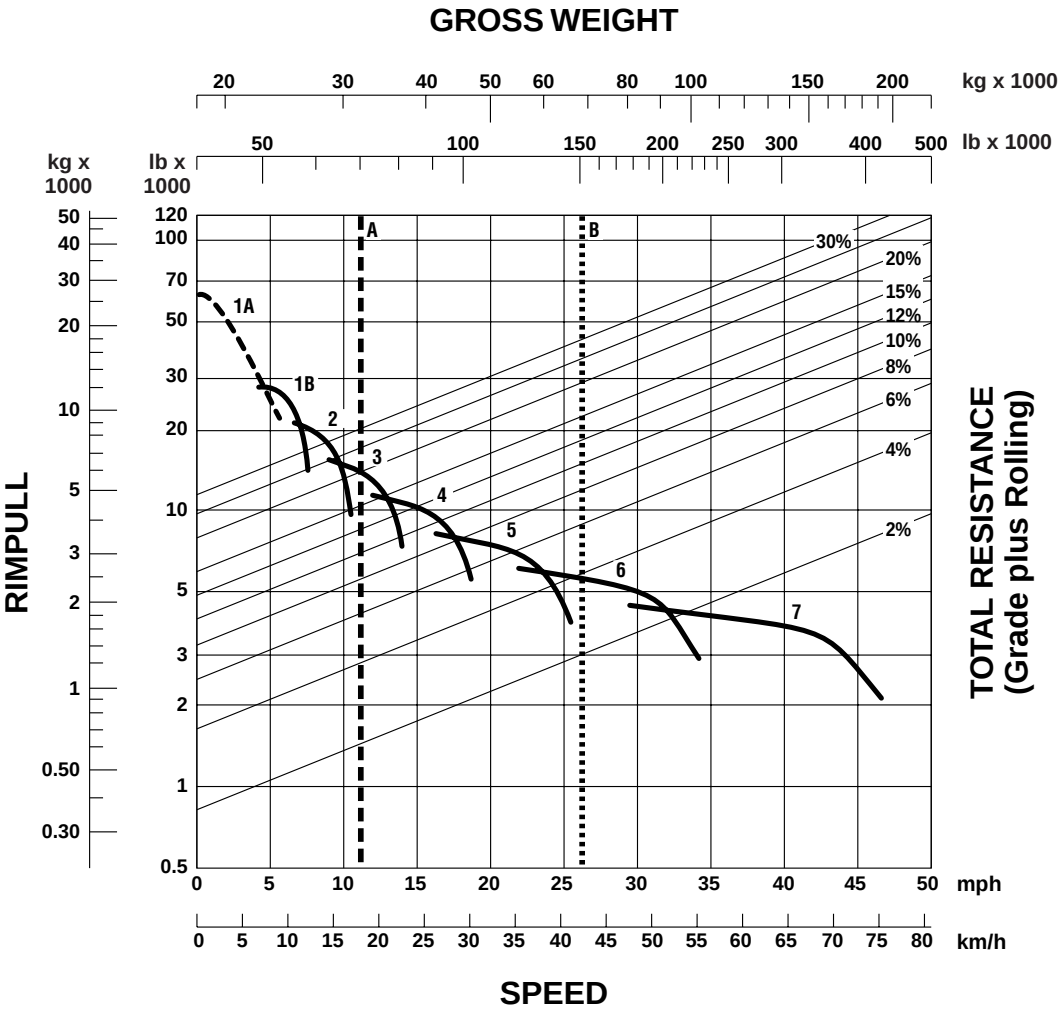
615C Series II @ $9.7 \text{ Bm}^3/\text{trip}$ (12.8 BCY)

621F, 623F, 627F @ $12.2 \text{ Bm}^3/\text{trip}$ (16 BCY)

631E Series II, 633E Series II, 637E Series II @ $19.1 \text{ Bm}^3/\text{trip}$ (25 BCY)

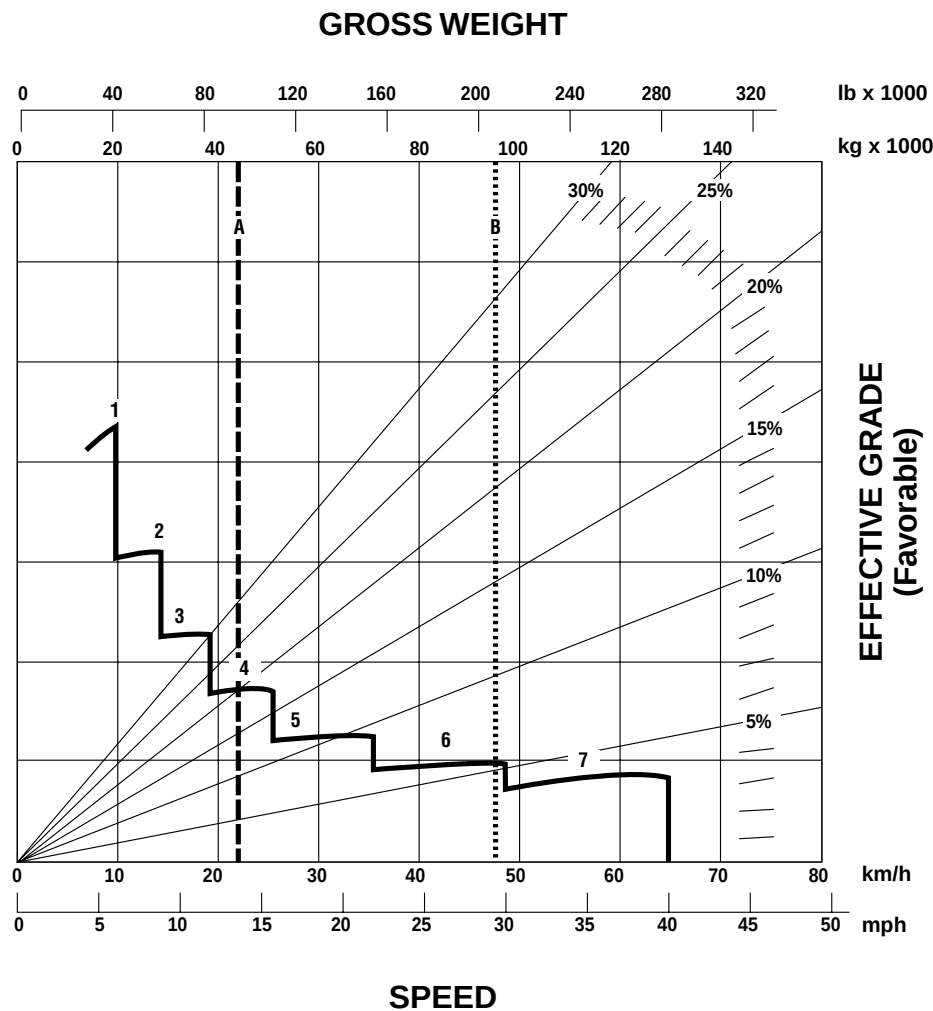
651E, 657E @ $26.5 \text{ Bm}^3/\text{trip}$ (34.6 BCY)





- 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 31 250 kg (68,900 lb)
 - B — Max GMW 68 182 kg (150,000 lb)



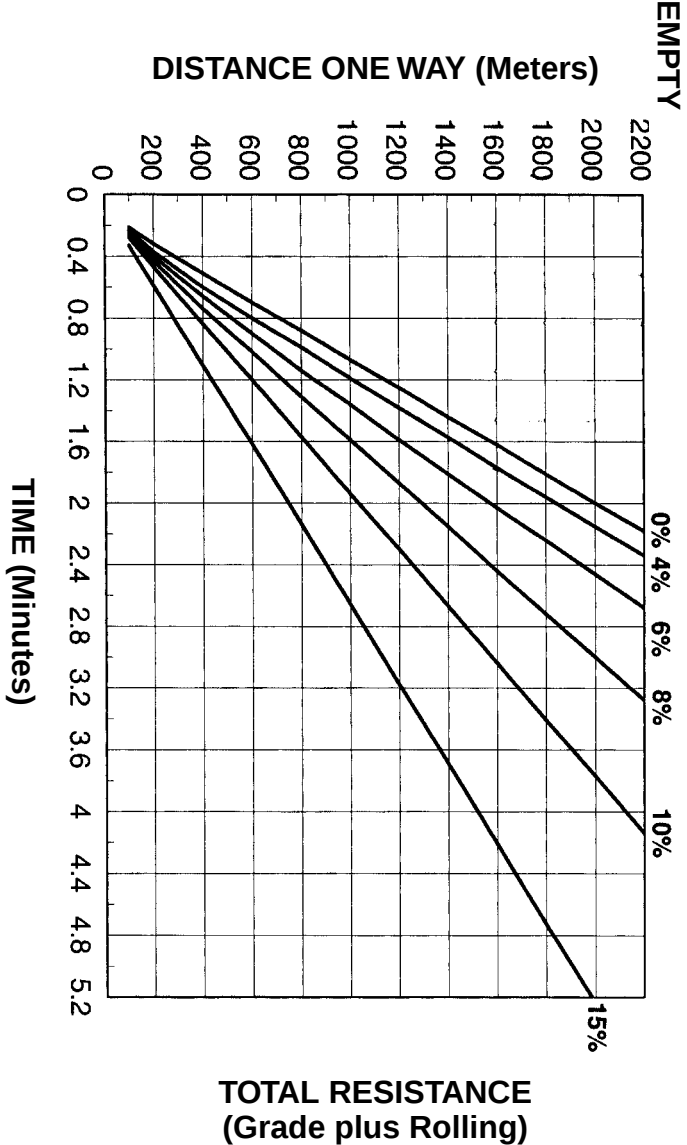
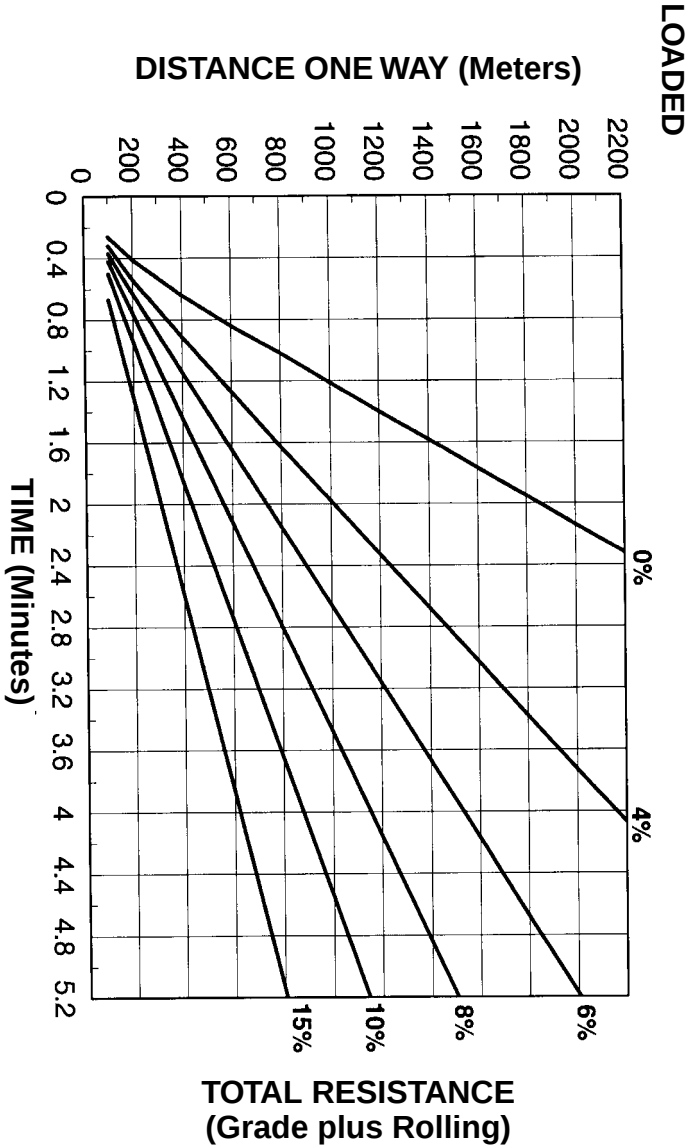
CONTINUOUS GRADE LENGTH

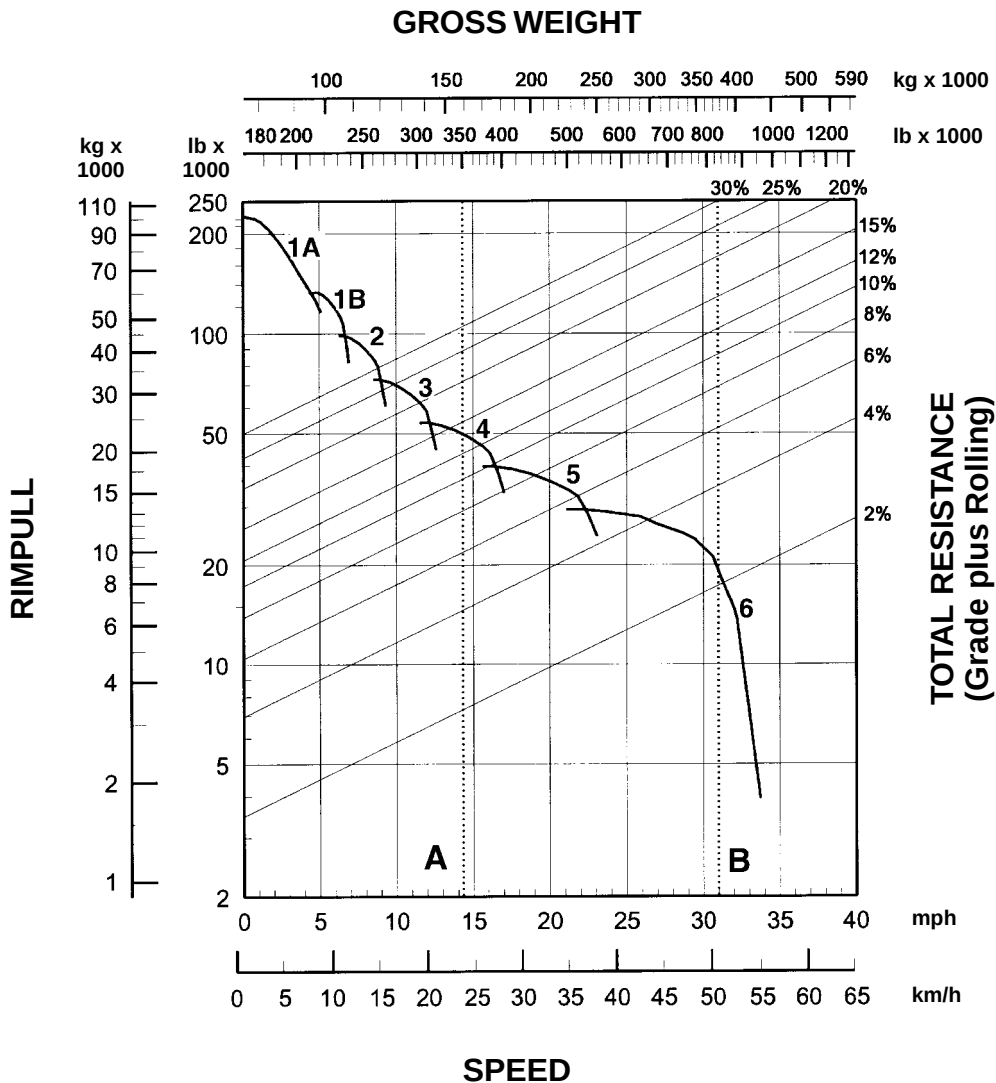
KEY

- 1 — 1st Gear
- 2 — 2nd Gear
- 3 — 3rd Gear
- 4 — 4th Gear
- 5 — 5th Gear
- 6 — 6th Gear
- 7 — 7th Gear

KEY

- A — Empty 40 188 kg (88,600 lb)
- B — Max GMW 92 534 kg (204,000 lb)





KEY

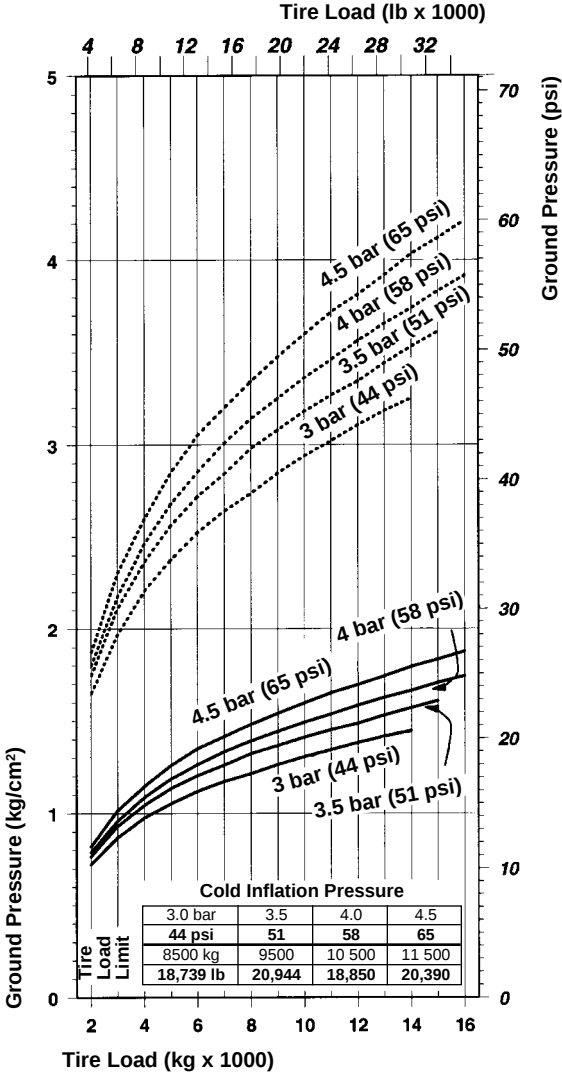
- 1A— 1st Gear (Torque Converter)
- 1B— 1st Gear
- 2 — 2nd Gear
- 3 — 3rd Gear
- 4 — 4th Gear
- 5 — 5th Gear
- 6 — 6th Gear

KEY

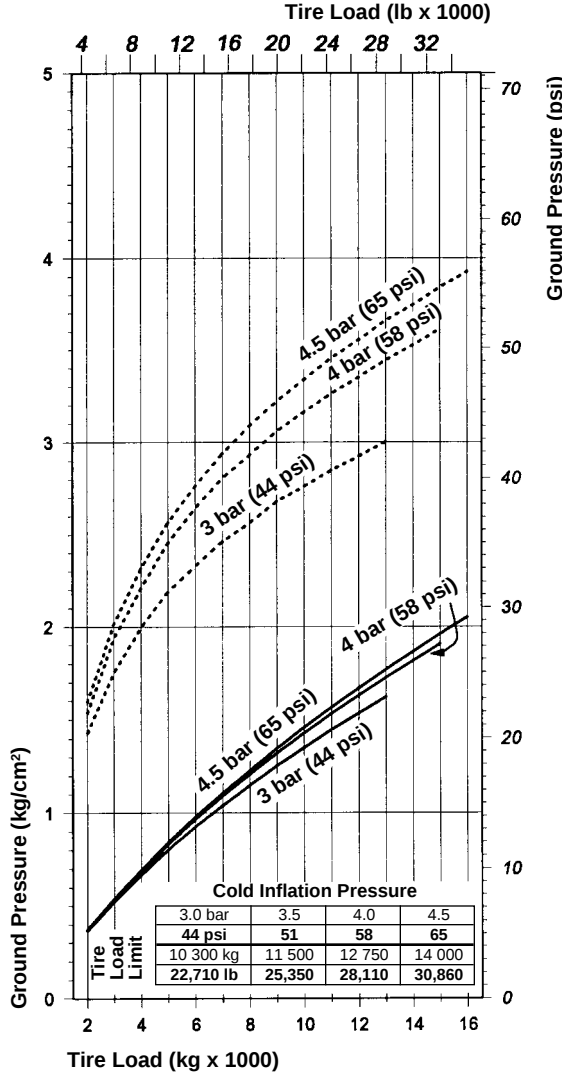
- A — Est. Field Empty Weight 158 760 kg (350,000 lb)*
- B — Max GMW 376 488 kg (830,000 lb)

*Truck equipped with sideboards and liners.

26.5R25 Tires*



29.5R25 Tires*



KEY

----- Zero Penetration (Flat Plate)

———— 76 mm (3") Penetration

*Charts based on Michelin XADN tire characteristics. Results may differ for other tread patterns and/or brands. Charts are to be used to calculate ground pressure. To determine the inflation as a function of load and conditions or when loads exceed tire load limit, contact your tire manufacturer representative.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

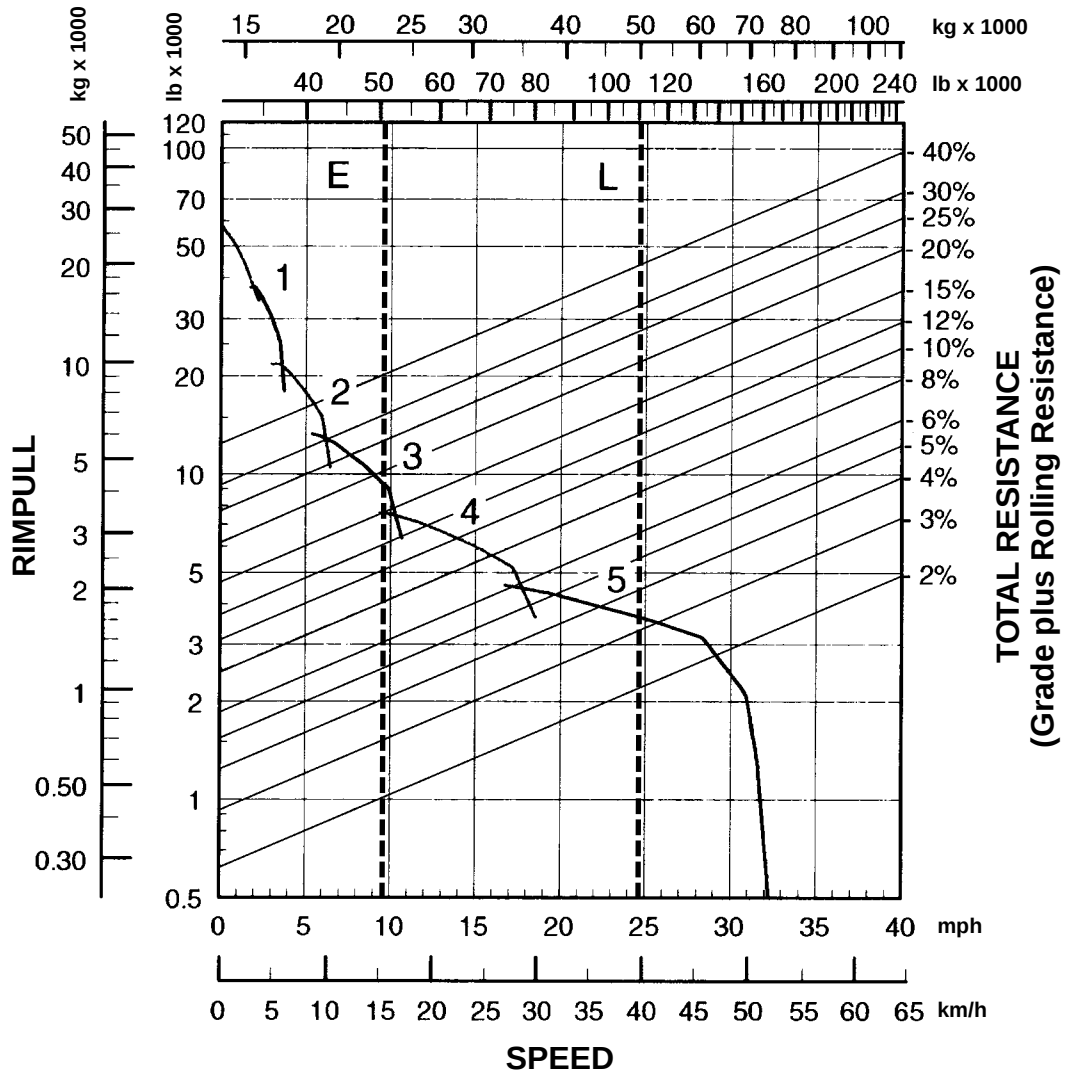
- Thank you very much for reading the preview of the manual.
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- Please note: If there is no response to **CLICKING** the link, please download this PDF first and then click on it.

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Preliminary Information
GROSS WEIGHT



KEY

- 1 — 1st Gear
- 2 — 2nd Gear
- 3 — 3rd Gear
- 4 — 4th Gear
- 5 — 5th Gear

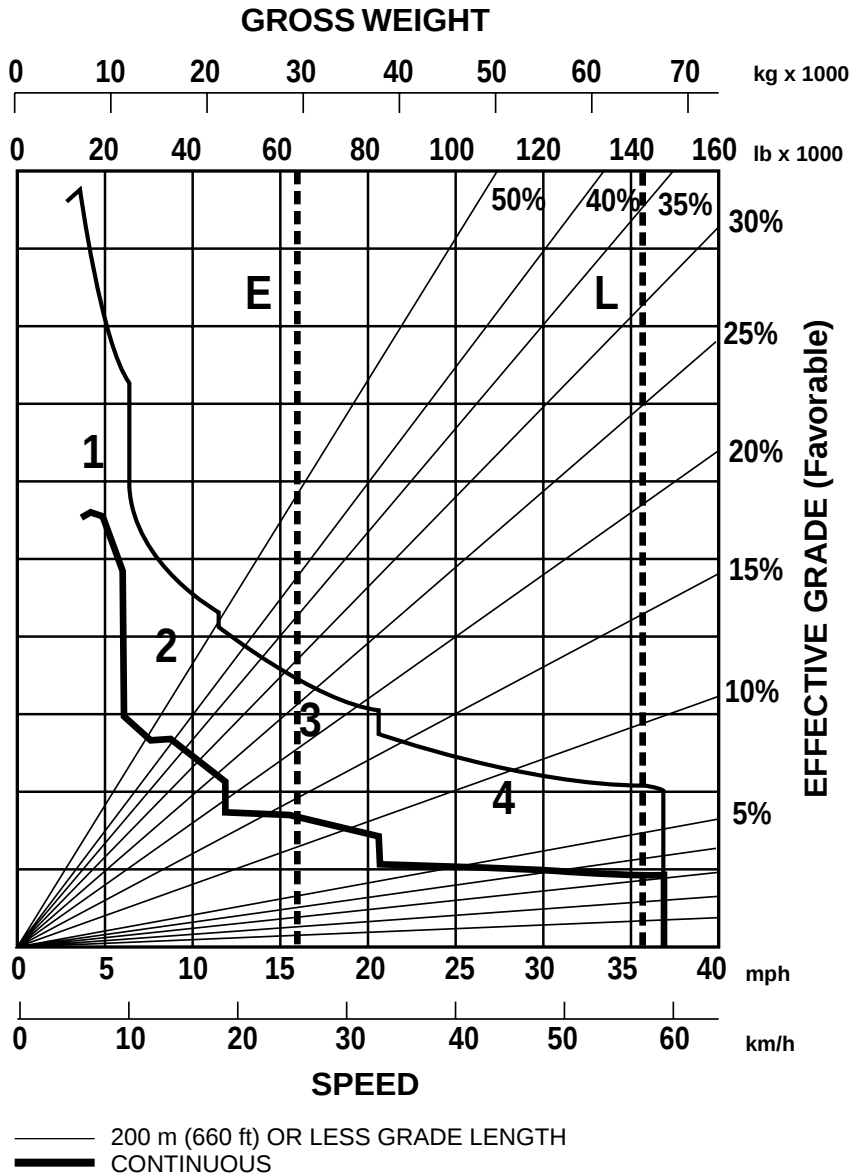
KEY

- E — Empty 22 890 kg (50,460 lb)
- L — Loaded 50 100 kg (110,460 lb)

D400E Brake/Retarder Performance Curve

● 29.5R25 Tires

Articulated Trucks



- KEY
- 1 — 1st Gear
 - 2 — 2nd Gear
 - 3 — 3rd Gear
 - 4 — 4th Gear

- KEY
- E — Empty 29 260 kg (64,510 lb)
 - L — Loaded 65 560 kg (144,500 lb)

**BALDERSON
COAL U-BLADE**

	814F		824G		834B	
Balderson Models	BD814U-14		BD824U-15'9"		BD834U-20	
Replaces "S" Blade						
Blade:						
Capacity	10.55 m ³	13.8 yd³	16.1 m ³	21.0 yd³	21.18 m ³	27.7 yd³
Length (Cutting Width)	4318 mm	14'2"	4788 mm	15'8.5"	6198 mm	20'4"
Height, wing section (tapered down)	1473 mm	4'10"	1783 mm	5'10"	1803 mm	5'11"
Wing Angle	25°		30°		30°	
Weight, Installed (Without Hydraulics)	1810 kg	3985 lb	3085 kg	6800 lb	3560 kg	7850 lb

**BALDERSON
WOODCHIP U-BLADE**

	814F		824G		834B	
Balderson Models	BD814US-14		BD824US-15'9"		BD834US-20	
Replaces "S" Blade						
Blade:						
Capacity	16.7 m ³	21.9 yd³	23.9 m ³	31.4 yd³	29.8 m ³	39.0 yd³
Length (Cutting Width)	4318 mm	14'2"	4775 mm	15'8"	6096 mm	20'0"
Height, wing section	1880 mm	6'2"	2253 mm	7'4.7"	2235 mm	7'4"
Wing Angle	30°		30°		30°	
Weight	1975 kg	4350 lb	3630 kg	8000 lb	4295 kg	9470 lb

**BALDERSON
COAL SCOOP WITH TILT**

	814F		824G		834B	
Balderson Models	B14-15		B24-17		B34-26	
Replaces "S" Blade						
Scoop:						
Lift and Carrying Capacity	11.5 m ³	15.0 yd³	12.9 m ³	17.0 yd³	19.9 m ³	26.0 yd³
Dozing Capacity	19.1 m ³	25.0 yd³	25.8 m ³	34.0 yd³	37.5 m ³	49.0 yd³
Width	3734 mm	12'3"	4013 mm	13'2"	5283 mm	17'4"
Height	1626 mm	5'4"	—	—	2083 mm	6'10"
Depth	2083 mm	6'10"	—	—	2540 mm	8'4"
Overall length	7.3 m	24'0"	—	—	11.0 m	36'0"
Weight	5216 kg	11,500 lb	8400 kg	18,500 lb	8700 kg	19,180 lb
Dump Clearance	1041 mm	3'5"	—	—	1448 mm	4'9"

**BALDERSON
CHIP SCOOP WITH TILT**

	814F		824G		834B	
Balderson Models	B14-20S		B24-27S		B34-40S	
Replaces "S" Blade						
Scoop:						
Capacity/Lift & Carry	15.3 m ³	20.0 yd³	20.6 m ³	27.0 yd³	30.2 m ³	39.5 yd³
Capacity/Dozing	30.6 m ³	40.0 yd³	41.3 m ³	54.0 yd³	49.7 m ³	65.0 yd³
Width	3734 mm	12'3"	4026 mm	13'2.5"	4826 mm	15'10"
Height	2286 mm	7'6"	2794 mm	9'2"	2248 mm	7'4.5"
Depth	2464 mm	8'1"	2946 mm	9'8"	3023 mm	9'11"
Weight	5390 kg	11,880 lb	11 420 kg	19,125 lb	11 105 kg	24,480 lb

MODEL	816F		826G		836	
Type	Land Fill Spreading		Land Fill Spreading		Land Fill Spreading	
Capacity**						
Earth	2.90 m³	3.79 yd³	3.68 m³	4.81 yd³	5.0 m³	6.56 yd³
Refuse	10.48 m³	13.70 yd³	12.74 m³	16.66 yd³	18.9 m³	24.66 yd³
Weight, Dozer*	2107 kg	4645 lb	2739 kg	6038 lb	3290 kg	7250 lb
General Dimensions: (Tractor & Dozer)						
Length	7.79 m	25'7"	8.38 m	27'6"	10.17 m	33'4"
Width	3.65 m	12'0"	4.50 m	14'9"	5.18 m	17'0"
Blade Dimensions:						
Width, End Bits	3.65 m	12'0"	4.50 m	14'9"	5.18 m	17'0"
Height, Trash Rack	1915 mm	6'3"	1935 mm	6'4"	2210 mm	7'3"

*Total Bulldozer Arrangement.

**Blade capacities determined by SAE recommended practice J1265.

BALDERSON U-BLADE	816F		826G		836	
Balderson Model:	BD816UL-12		BD826UL-14		BD836UL-17	
Type	U-Blade		U-Blade		U-Blade	
Blade:					Semi-U-Blade	
Capacity (Refuse)	11.9 m³	15.5 yd³	16.7 m³	21.9 yd³	25.2 m³	33 yd³
(Earth)	8.3 m³	10.8 yd³	12.2 m³	16 yd³	7.74 m³	10.13 yd³
Length (Cutting Width)	3658 mm	12'0"	4369 mm	14'4"	5182 mm	17'0"
Height	1857 mm	6'1.1"	2007 mm	6'7"	2210 mm	7'3"
Wing Angle	25°		25°		25°	
Max. lift above ground	889 mm	2'11"	864 mm	2'10"	864 mm	2'10"
Weight, Installed					—	
(Without Hydraulics)	1680 kg	3700 lb	2100 kg	4625 lb	4310 kg	9500 lb
					3355 kg	7400 lb

BALDERSON W-BLADE	816F		826G		836	
Balderson Model:	BD816WL-12		BD826WL-14		BD836WL-17	
Replaces "S" Blade						
Blade:						
Capacity (Refuse)	11.9 m³	15.5 yd³	16.8 m³	22.0 yd³	23.9 m³	31.3 yd³
Length (Cutting Width)	3658 mm	12'0"	4420 mm	14'6"	5207 mm	17'1"
Moldboard Height	1857 mm	6'1.1"	2057 mm	6'9"	2210 mm	7'3"
Weight, Installed						
(Without Hydraulics)	2070 kg	4560 lb	2975 kg	6600 lb	4515 kg	9950 lb

BALDERSON TILT STRAIGHT BLADE	816F		826G	
Balderson Model:	BDI816SL-12'T		BDI826SL-14'8"T	
Blade:				
Capacity (Refuse)	10.7 m³	14.0 yd³	13.0 m³	17.0 yd³
Length (Cutting Width)	3647 mm	11'11.6"	4375 mm	14'4.3"
Weight, Installed	2225 kg	4500 lb	3530 kg	7780 lb

Bucket Type		Light Material		Stone Sieve		
Ground Engaging Type		Bare	Bolt-on Edge	Bare	Bolt-on Edge	Bolt-on Teeth
Rated bucket capacity (\$)	m³	1.2	1.2	0.7	0.7	0.7
	yd³	1.57	1.57	0.92	0.92	0.92
Struck capacity (\$)	m³	1.0	1.0	0.5	0.6	0.5
	yd³	1.31	1.31	0.65	0.78	0.65
Width	mm	1950	1970	1880	1880	1880
	ft/in	6'5"	6'6"	6'2"	6'2"	6'2"
Dump clearance at full lift and 43° discharge (\$)	mm	2281	2247	2425	2391	2425
	ft/in	7'6"	7'4"	7'11"	7'10"	7'11"
Reach at full lift and 43° discharge (\$)	mm	982	995	829	842	903
	ft/in	3'3"	3'3"	2'9"	2'9"	3'0"
Reach at 43° discharge and 2130 mm (7'0") clearance (\$)	mm	1090	1068	1070	1054	1082
	ft/in	3'7"	3'6"	3'6"	3'5"	3'7"
Reach with lift arms horizontal and bucket level	mm	2122	2155	1912	1945	2014
	ft/in	7'0"	7'1"	6'3"	6'5"	6'7"
Digging depth (\$)	mm	84	100	84	100	84
	in	3.31	3.94	3.31	3.94	3.31
Overall length	mm	5520	5565	5310	5355	5412
	ft/in	18'1"	18'3"	17'5"	17'7"	17'9"
Overall height with bucket at full raise (\$)	mm	4314	4314	4037	4037	4037
	ft/in	14'2"	14'2"	13'3"	13'3"	13'3"
Loader clearance circle with bucket in carry position	mm	8506	8556	8328	8358	8328
	ft/in	27'11"	28'11"	27'4"	27'5"	27'4"
Static tipping load, straight* (\$)	kg	3327	3263	3353	3286	3335
	lb	7330	7190	7390	7240	7350
Static tipping load, full turn* (\$)	kg	2864	2802	2892	2828	2874
	lb	6310	6170	6370	6230	6330
Breakout force (\$)	kN	34.5	33	45.3	43	45.1
	lb	7760	7420	10,190	9670	10,140
Operating weight*	kg	5178	5216	5149	5188	5164
	lb	11,420	11,500	11,350	11,440	11,390

*Static tipping load and operating weights shown are with implements, ROPS cab, 12.5-20 tires, full fuel tank, operator and 80 kg (176 lb) counterweight.
NOTE: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers (SAE). SAE Standards J732 JUN92 and J742 FEB85 govern loader rating, denoted in the text by (\$).

	Change in Operating Weight		Change in Articulated Static Tipping Load	
	kg	lb	kg	lb
Limited slip rear axle	0	0	0	0
Enclosed ROPS (Comfort)	+ 2	+ 4	+ 1	+ 2
Enclosed ROPS (Deluxe)	+ 5	+ 11	+ 4	+ 9
Boom with load check valves	+ 12	+ 26	+ 2	+ 4
Third valve hydraulics	+ 11	+ 24	- 1	- 2
Counterweight (standard) removed	- 80	- 176	- 112	- 247
Counterweight 150 kg (330 lb)	+ 150	+ 331	+ 151	+ 333
Wheel chock	+ 5	+ 11	+ 2	+ 4
Tool roll	+ 4	+ 9	+ 4	+ 9

Bucket Type	General Purpose						Penetration	High Lift*
		Bolt-on Edges	Teeth & Segments	Teeth	Bolt-on Edges	Teeth & Segments	Teeth	All Stand. Buckets Available
Ground Engaging Tools								
Capacity, rated (\$)	m³ yd³	3.8 5	3.8 5	3.6 4.75	3.6 4.75	3.6 4.75	3.6 4.75	Same Same
Capacity, struck (\$)	m³ yd³	3.25 4.26	3.25 4.26	3.04 3.95	3.18 4.17	3.18 4.17	3.12 4.09	Same Same
Width (\$)	mm ft/in	3059 10'0"	3107 10'2"	3107 10'2"	3059 10'0"	3107 10'2"	3128 10'3"	Same Same
Dump clearance at full lift and 45° discharge (\$)	mm ft/in	2987 9'9"	2851 9'4"	2851 9'4"	2987 9'9"	2851 9'4"	2775 9'1"	+606 +1'11.6"
Reach at full lift and 45° discharge	mm ft/in	1277 4'2"	1400 4'7"	1400 4'7"	1277 4'2"	1400 4'7"	1320 4'4"	+37 +1.5"
Reach at 45° discharge and 2130 mm (7'0") clearance (\$)	mm ft/in	1834 6'0"	1894 6'2"	1894 6'2"	1834 6'0"	1894 6'2"	1776 5'10"	+497 +1'7.6"
Reach with lift arm horizontal and bucket level	mm ft/in	2585 8'6"	2766 9'1"	2766 9'1"	2585 8'6"	2766 9'1"	2788 9'2"	+465 +18.3"
Digging depth (\$)	mm in	76 3"	76 3"	46 1.8"	76 3"	76 3"	46 1.8"	Same Same
Overall length (\$)	mm ft/in	8303 27'3"	8506 27'11"	8506 27'11"	8213 26'11"	8506 27'11"	8491 27'10"	+576 +1'10.7"
Overall height with bucket at full raise (\$)	mm ft/in	5595 18'4"	5595 18'4"	5595 18'4"	5595 18'4"	5595 18'4"	5595 18'4"	+600 +1'11.8"
Loader clearance circle with bucket in carry position (\$)	mm ft/in	14 722 48'4"	14 876 48'10"	14 876 48'10"	14 722 48'4"	14 876 48'10"	14 880 48'10"	+251 +9.9"
Static tipping load, straight**	kg lb	14 539 32,044	14 781 32,577	14 684 32,364	14 503 31,965	14 369 31,669	14 593 32,163	-468 -1030
Static tipping load, full 40° turn**	kg lb	13 230 29,172	13 433 29,620	13 363 29,465	13 184 29,093	13 060 28,797	13 274 29,269	-554 -1220
Breakout force*** (\$)	kN lb	201 45,187	200.2 45,007	215.5 48,446	201.1 45,209	201 45,187	215.1 48,356	-24.5 -5511
Operating weight** (\$)	kg lb	21 293 46,951	21 466 47,333	21 312 46,993	21 286 46,936	21 459 47,317	21 371 47,123	+1202 +2645

*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") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732 JUN92.

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732 JUN92 and J742 FEB85 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, ROPS remains	-177	- 390	- 150	- 331
26.5-25, 20 PR (L-3)	-211	- 465	- 142	- 313
26.5-R25, GP-2B, (L-2/3) radial	- 35	- 77	- 24	- 53
26.5-25, 14 PR (L-2)	-561	-1237	- 376	- 829
23.5-25, 16 PR (L-2)	-980	-2161	- 657	-1449
23.5-25, 16 PR (L-3)	-818	-1804	- 548	-1208
23.5-25, 24 PR (L-3)	-691	-1524	- 464	-1023
23.5-R25, GP-2B (L-2/3) radial	-664	-1464	- 445	- 981
23.5-R25, XHA (L-3) radial	-580	-1279	- 389	- 858
Tire ballast: 23.5-25 bias ply tires	+191	+ 421	+ 631	+1391
Tire ballast: 26.5-25 bias ply tires	+995	+2105	+1656	+3652

Wheel Loaders

Performance Data

● 994 with 6220 mm (20'5") Bucket

Bucket Type		Iron Ore***		Rock				Coal	High Lift	Equipped w/
Ground Engaging Tools		Spade With Teeth		Spade With Teeth				Straight w/Teeth	All Stand. Bkts. Avail.	53.5/85-57 Tires
Capacity, rated (\$)	m ³ yd ³	11 14	12 16	14 18	16 21	18 23	20 26	30 40	Same Same	Same Same
Capacity, struck (\$)	m ³ yd ³	8.4 11	9.3 12.2	11 14.3	12.8 16.8	14.3 18.7	16.3 21.3	25.6 33.5	Same Same	Same Same
◆Width (\$)	mm ft/in	6220 20'5"	6220 20'5"	6220 20'5"	6220 20'5"	6220 20'5"	6220 20'5"	6220 20'5"	Same Same	Same Same
◆Dump clearance at full lift and 45° discharge (\$)	mm ft/in	5994 19'8"	5994 19'8"	5782 19'0"	5508 18'1"	5402 17'9"	5569 18'3"	5496 18'0"	+340 +1'1"	+180 +7"
◆Reach at full lift and 45° discharge	mm ft/in	1930 6'4"	1930 6'4"	2142 7'0"	2310 7'7"	2416 7'11"	2354 7'9"	2462 8'1"	+561 +1'10"	-200 -8"
◆Reach with lift arms horizontal, bucket level*	mm ft/in	4612 15'2"	4612 15'2"	4912 16'1"	5224 17'2"	5374 17'6"	5212 17'1"	5340 17'6"	+640 +2'1"	-200 -8"
◆Digging depth (\$)	mm in	246 9.7"	246 9.7"	246 9.7"	248 9.8"	248 9.8"	246 9.7"	222 8.7"	+14.1 +0.6"	-180 -7"
◆Overall length (\$)	mm ft/in	16 172 53'1"	16 172 53'1"	16 472 54'1"	16 839 55'3"	16 989 55'9"	16 772 55'0"	16 882 55'5"	+780 +2'7"	-130 -5.1"
Overall height bucket at full lift (\$)	mm ft/in	10 246 33'7"	10 406 33'7"	10 388 34'1"	10 507 34'6"	10 598 34'9"	10 990 36'1"	11 770 38'8"	+340 +1'1"	+180 +7"
Loader clearance circle with bucket in carry position	m ft/in	25.70 84'4"	25.70 84'4"	25.87 84'10"	25.5 83'8"	25.6 84'0"	26.00 85'4"	26.21 86'0"	+720 mm +2'4"	-40 mm -2"
◆Static tipping load, straight** (\$)	kg lb	118 560 261,400	118 620 261,500	116 390 256,600	116 460 256,200	115 160 253,900	113 720 250,700	115 100 253,700	0.82▶ 0.82▶	1.02▶ 1.02▶
◆Static tipping load, full 40° turn** (\$)	kg lb	102 510 226,000	102 520 226,000	100 400 221,300	100 340 220,700	98 940 217,700	97 700 215,400	99 160 218,600	0.80▶ 0.80▶	1.02▶ 1.02▶
Breakout force (\$)	kN lb	1275 287,000	1275 287,000	1095 247,000	956 215,000	903 203,000	960 216,000	900 202,000	0.96▶ 0.96▶	1.00▶ 1.00▶
◆Operating weight**	kg lb	176 200 388,500	176 400 389,000	177 100 390,500	179 000 393,000	180 000 396,000	179 600 395,900	178 800 394,100	+2500 +5520	+2600 +5720

*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: Also available 30 m³ (35 yd³) general purpose coal bucket spade with teeth and segments.

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers. SAE Standards J732 JUN92 and J742 FEB85 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

Wheel Loaders

- Machine Selection
- Truck Loading
 - Bucket Fill Factors

	<i>Minutes added (+) or Subtracted (-) From Basic Cycle</i>
<i>Machine</i>	
— Material handler	-.05
<i>Materials</i>	
— 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
<i>Pile</i>	
— 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
<i>Miscellaneous</i>	
— 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.

<i>Cycles per hour at 100% Efficiency</i>	$= \frac{60 \text{ min}}{\text{Total Cycle Time in Minutes}}$	
Job efficiency is an important factor in machine selection. Efficiency is the actual number of minutes worked during an hour. Job efficiency accounts for bathroom breaks and other work interruptions.		
Cycles per hour at 50 minutes per hour (83% efficiency)	Cycles per hour at 100% efficiency	50 min × actual work time 60 min hour

TRUCK LOADING

<i>Average loader cycle times</i>	
914G-962G	0.45-0.50
966F Series II-980G	0.50-0.55
988F-990	0.55-0.60
992G-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.

$$\text{Bucket size} = \frac{\text{Volume Required/Cycle}}{\text{Bucket Fill Factor}}$$

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."

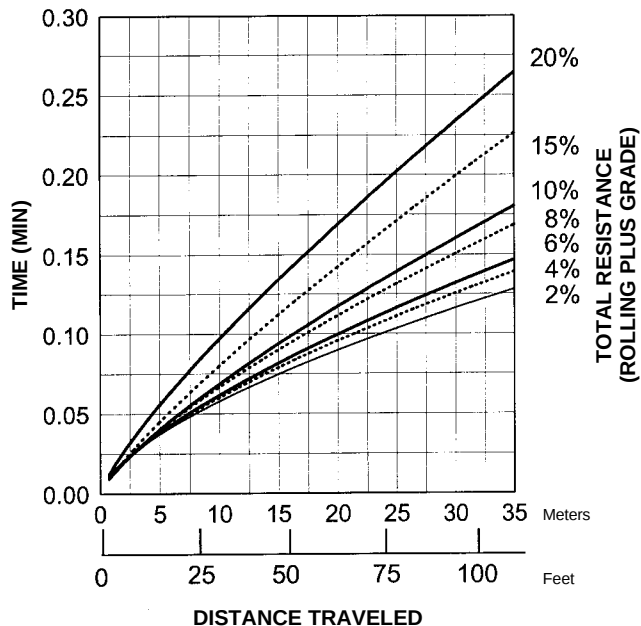
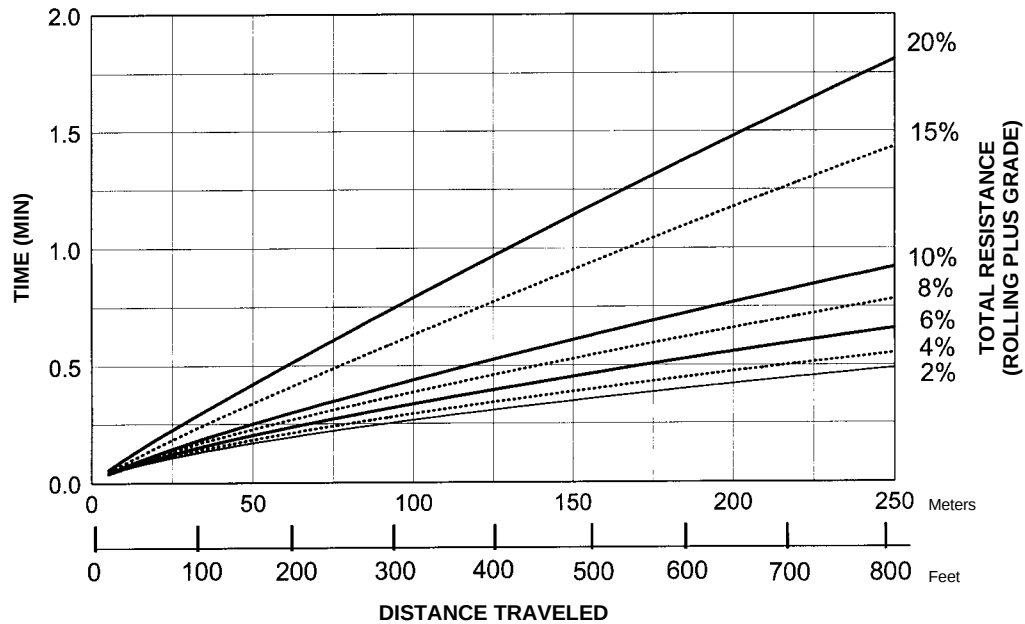
<i>Loose Material</i>	<i>Fill factor</i>
Mixed moist aggregates	95-100%
Uniform aggregates up to 3 mm (1/8 in)	95-100
3 mm (1/8 in) to 9 mm (3/8 in)	90-95
12 mm (1/2 in) to 20 mm (3/4 in)	85-90
24 mm (1.0 in) and over	85-90

Wheel Loaders

Travel Time — Loaded

- 938G
- 20.5R-25 Tires

938G 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.

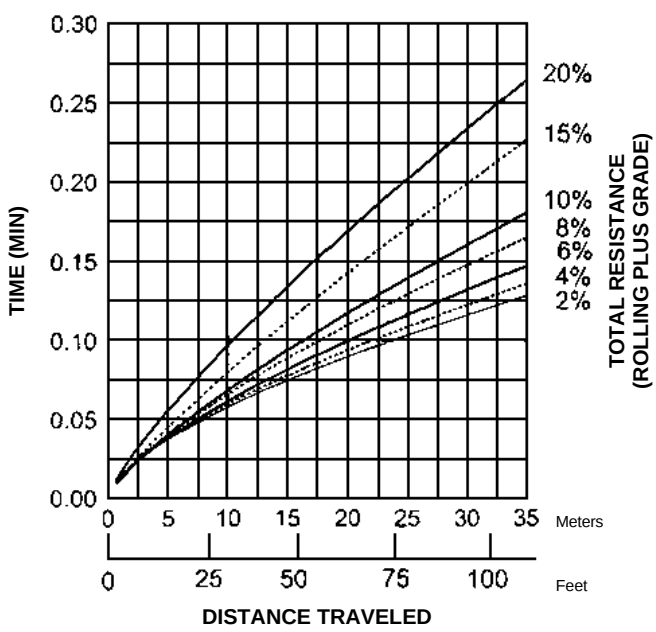
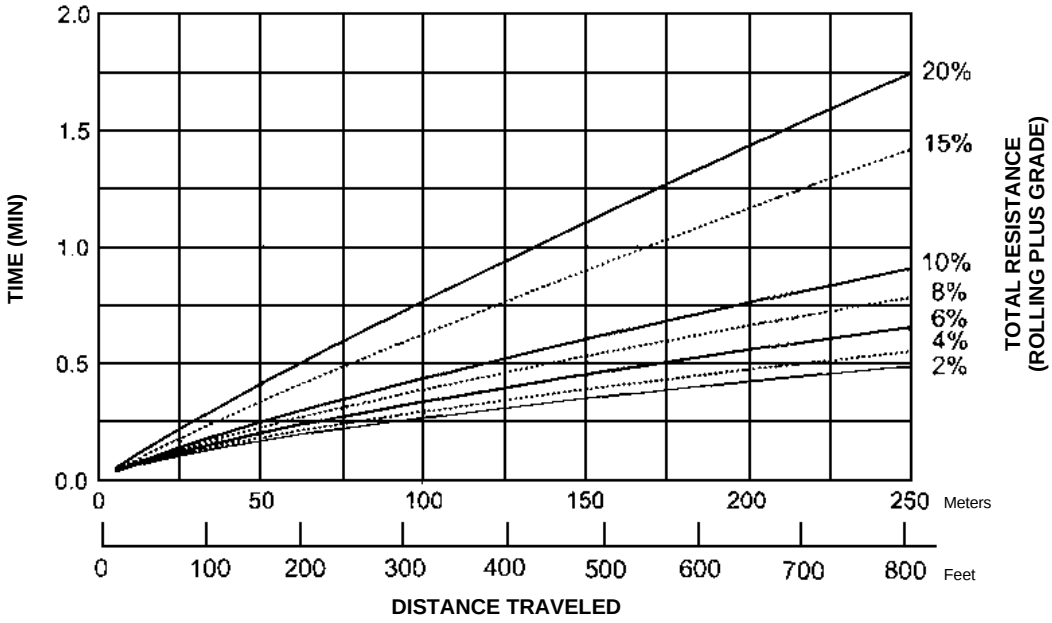
In load and carry applications it is important to consult the tire manufacturer on Ton-MPH ratings and pressure recommendations.

Wheel Loaders

Travel Time — Loaded

- 980G
- 29.5-25 Tires

980G 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.

Wheel Loaders

Production Estimating Table

● m³ or yd³/60 min. hour

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	Unshaded area indicates average production.																		
0.35	171																			
0.40	150	150	225	330	375	450	525													
0.45	133	135	200	268	332	400	466	530	600	665	730	800	865							
0.50	120	120	180	240	300	360	420	480	540	600	660	720	780	840	900	960	1003	1080	1140	1200
0.55	109	109	164	218	272	328	382	436	490	545	600	655	705	765	820	870	925	980	1008	1090
0.60	100	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
0.65	92	92	138	184	230	276	322	368	416	460	505	555	600	645	690	735	780	830	875	920
0.70	86							342	386	430	474	515	560	600	645	690	730	775	815	860
0.75	80													560	600	640	680	720	760	800

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	Unshaded area indicates average production.															
0.35	171																
0.40	150																
0.45	133																
0.50	120	1320	1440														
0.55	109	1200	1310	1420	1520	1635	1740	1850	1960	2070	2180	2285	2395	2505	2615	2725	2830
0.60	100	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600
0.65	92	1010	1105	1195	1285	1380	1470	1560	1655	1745	1840	1930	2020	2115	2205	2300	2390
0.70	86	945	1030	1120	1200	1290	1375	1460	1545	1630	1720	1805	1890	1975	2060	2150	2235
0.75	80	880	960	1040	1120	1200	1280	1360	1440	1520	1600	1680	1760	1840	1920	2000	2080
0.80	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

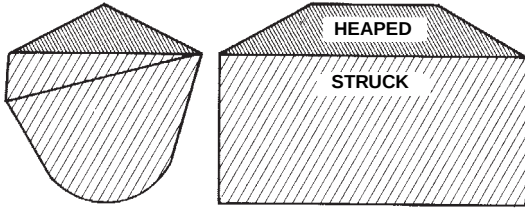
BUCKET	General Purpose		Multi-Purpose	
Capacity, Rated (Nominal Heaped)	1.15 m ³	1.5 yd ³	1.15 m ³	1.5 yd ³
Struck	0.95 m ³	1.25 yd ³	0.95 m ³	1.25 yd ³
Bucket Width*	2160 mm	7'1"	2160 mm	7'1"
Dump Clearance at Full Lift and 45° Discharge	2667 mm	8'9"	2604 mm	8'6.5"
Maximum Reach at Full Lift and 45° Discharge	866 mm	2'10.1"	877 mm	2'10.5"
Digging Depth	127 mm	5"	165 mm	6.5"
Overall Length	4359 mm	14'3.6"	4411 mm	14'6"
Overall Height	4384 mm	14'4.6"	4384 mm	14'4.6"
Static Tipping Load	6607 kg	14,565 lb	6396 kg	14,100 lb
Breakout Force**	89.9 kN	20,200 lb	92 kN	20,690 lb
Operating Weight***	9480 kg	20,910 lb	10 030 kg	22,110 lb

*Bolt-on teeth increase bucket width by 42 mm (1.65"). Bolt-on cutting edge increases bucket width by 10 mm (0.39").
**Breakout force is measured 102 mm (4") behind tip of cutting edge with bucket hinge pin as pivot point.
***Operating weight includes coolant, lubricants, full fuel tank, 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 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
Cab, ROPS	+204	+450	+266	+586
Bucket teeth (long) & segments	+118	+260	-150	-330
Air Conditioner	+ 77	+170	+ 88	+194
Ripper with 3 teeth (includes removal of 295 kg (650 lb) rear counterweight)	+ 17	+ 37	+ 49	+108
Rear counterweight (per plate)	+115	+255	+203	+448

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. Buckets with irregular shaped cutting edges (vee edge) the strike plane should be drawn at one-third 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 J732 JUN92 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.

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 under the following conditions:

- Loader on hard level surface and stationary.
- Unit at standard operating weight.
- Bucket at maximum rollback position.

- Load at maximum forward position during raising cycle.
- Unit with standard equipment as described in specifications unless otherwise noted under the heading.

Operating Load

In order to comply with SAE standard J818 MAY87, the operating load for track loaders 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.

SELECTING A MACHINE

Steps in selecting the proper size loader:

- Determine production required or desired.
- Determine loader cycle time and cycles per hour. A machine size must be assumed to select a basic cycle time.
- Determine required payload per cycle in loose cubic yards and pounds (meters and kilograms).
- Determine bucket size needed.
- Make machine selection using bucket size and payload as criteria to meet production requirements.
- 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 are made.

2. Loader Cycle Times

Material type, pile height, and other factors may improve or reduce production, and should be added to or subtracted from the basic cycle time when applicable.

When hauls are involved, obtain haul and return portions of the cycle from the estimated travel chart (this section). Add the haul and return times to the estimated basic cycle time to obtain total cycle time.



MODEL	953C WHA		963B WHA		973 WHA	
Flywheel Power	90 kW	121 hp	119 kW	160 hp	157 kW	210 hp
Operating Weight	15 840 kg	34,920 lb	21 269 kg	46,898 lb	29 266 kg	64,585 lb
Engine Model	3116T		3116TA		3306T	
Rated Engine RPM	2200		2200		2200	
Bore	105 mm	4.13"	105 mm	4.13"	121 mm	4.75"
Stroke	127 mm	5"	127 mm	5"	152 mm	6"
No. Cylinders	6		6		6	
Displacement	6.6 L	403 in ³	6.6 L	403 in ³	10.5 L	638 in ³
Speeds Forward,	km/h	mph	km/h	mph	km/h	mph
1st	0-10	0-6.2	0-10.1	0-6	0-10.3	0-6.4
2nd	Infinitely		Infinitely		Infinitely	
3rd	Variable		Variable		Variable	
Reverse						
1st	0-10	0-6.2	0-10.1	0-6	0-10.3	0-6.4
2nd	Infinitely		Infinitely		Infinitely	
3rd	Variable		Variable		Variable	
Hydraulic Cycle Time, Bucket Empty, in Seconds:						
Raise	6.7		6.2		7.4	
Dump	1.4		1.3		1.4	
Lower (Empty, Float Down)	3		2.3		2.6	
Total	11.1		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	1'7.7"
Length of Track on Ground	2.295 m	7'6"	2.454 m	8'1"	2.85 m	9'6"
Ground Contact Area (With Std. Shoe)	1.74 m ²	2704 in ²	2.21 m ²	3426 in ²	2.92 m ²	4526 in ²
Ground Pressure	89 kPa	12.9 psi	96.2 kPa	13.7 psi	100.2 kPa	14.3 psi
Ground Clearance	377 mm	14.8"	439 mm	17"	456 mm	17.9"
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	7'6.5"	2.58 m	8'5.6"
Fuel Tank Refill Capacity	241 L	63.6 U.S. gal	296 L	78 U.S. gal	356 L	94 U.S. gal
Hydraulic System Refill Capacity	65 L	17.2 U.S. gal	68 L	18 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.

Operating Specifications — Material Handling Arm The rated operating load for a machine with material handling arm is 50% of full turn static tipping load, or the hydraulic/structural limit.

	IT14G		IT24F		IT28G		IT38G		IT62G	
Handling Arm Position	Retracted									
Operating load — Full articulation	1292 kg	2842 lb	1576 kg	3475 lb	2528 kg	5574 lb	2049 kg	4508 lb	3085 kg	6795 lb
Static tipping load*										
Straight	2981 kg	6558 lb	3605 kg	7949 lb	5055 kg	11,146 lb	4746 kg	10,441 lb	7095 kg	15,548 lb
Full turn	2585 kg	5678 lb	3151 kg	6948 lb	4407 kg	9717 lb	4098 kg	9016 lb	6170 kg	13,590 lb
Operating weight*										
4 forward, 3 reverse	7600 kg	16,720 lb	9473 kg	21,483 lb	11 440 kg	25,220 lb	12 380 kg	27,200 lb	—	—
4 forward, 4 reverse	—	—	—	—	—	—	—	—	17 506 kg	38,583 lb

	IT14G		IT24F		IT28G		IT38G		IT62G	
Handling Arm Position	Mid-position									
Operating load — Full articulation	1015 kg	2233 lb	1245 kg	2745 lb	1747 kg	3852 lb	1729 kg	3804 lb	2626 kg	5783 lb
Static tipping load*										
Straight	2345 kg	5159 lb	2852 kg	6289 lb	4011 kg	8844 lb	4009 kg	8820 lb	6017 kg	13,253 lb
Full turn	2031 kg	4486 lb	2490 kg	5490 lb	3494 kg	7704 lb	3457 kg	7605 lb	5251 kg	11,565 lb
Operating weight*										
4 forward, 3 reverse	7600 kg	16,720 lb	9473 kg	21,483 lb	11 440 kg	25,220 lb	12 380 kg	27,200 lb	—	—
4 forward, 4 reverse	—	—	—	—	—	—	—	—	17 506 kg	38,583 lb

	IT14G		IT24F		IT28G		IT38G		IT62G	
Handling Arm Position	Extended									
Operating load — Full articulation	837 kg	1841 lb	1031 kg	2273 lb	1449 kg	3195 lb	1492 kg	3282 lb	2288 kg	5040 lb
Static tipping load*										
Straight	1936 kg	4259 lb	2362 kg	5208 lb	3327 kg	7336 lb	3463 kg	7619 lb	5240 kg	11,484 lb
Full turn	1675 kg	3685 lb	2062 kg	4547 lb	2898 kg	6390 lb	2983 kg	6563 lb	4576 kg	10,080 lb
Operating weight*										
4 forward, 3 reverse	7600 kg	16,720 lb	9473 kg	21,483 lb	11 440 kg	25,220 lb	12 380 kg	27,200 lb	—	—
4 forward, 4 reverse	—	—	—	—	—	—	—	—	17 506 kg	38,583 lb

*Static tipping load and operating weight include lubricants, full fuel tank, ROPS cab and 80 kg (176 lb) operator.

— IT14G includes high speed version, standard counterweight and 17.5R25 tires.

— IT24F includes 17.5-25, 12 PR tires.

— IT28G includes 20.5-25, 12 PR tires and optional counterweight.

— IT38G includes 20.5R25 XTLA (L-2) tires.

Machine stability and operating weight are affected by tire size, tire ballast and other attachments.

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 22590%
Champ CB607 lift truck,
3175 kg (7000 lb) capacity15%
Deere 444 with 1.1 m³ (1.5 yd³)
G.P. bucket60%
Rosco D-50 sweeperone half hour/day
Rammax 1361 kg (3000 lb) self-propelled
trench compactor25%

Machine sizing

1350 mm (53 in) Forks

Operating Load at Full Turn*

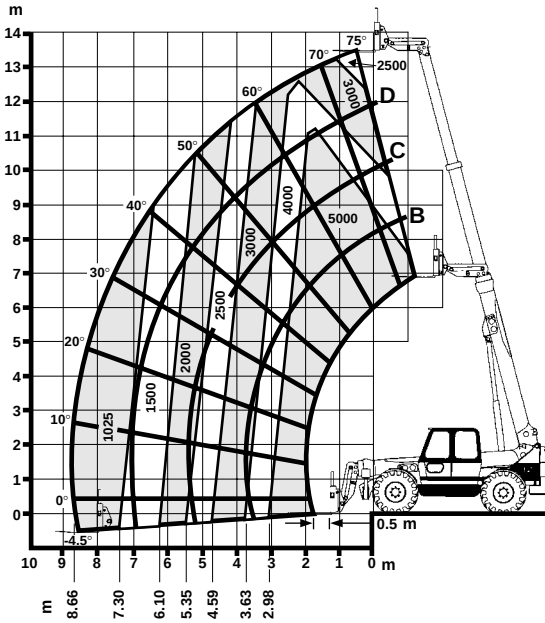
Model	kg	lb
IT14G	1735	3817
IT24F	2146	4722
IT28G	2931	6463
Water pipes: 1309 kg (2885 lb)		IT14G ... 1 pipe — no problem IT24F ... 1 pipe — no problem IT28G ... 1 pipe — no problem
Storm sewer pipes: 1556 kg (3430 lb)		IT14G ... 1 pipe — no problem IT24F ... 1 pipe — no problem IT28G ... 1 pipe — no problem

*Note that the most conservative operating load (SAE J1197 FEB91) is used here. The rated operating load for some competitive machines with pallet forks will be based upon European standard CEN 474-3, **assuming operation on firm and level ground** (i.e. using 80% of full turn static tipping load).

- Performance Data
- Standard Forks and Carriage
- Non-U.S. Version

Telescopic Handlers

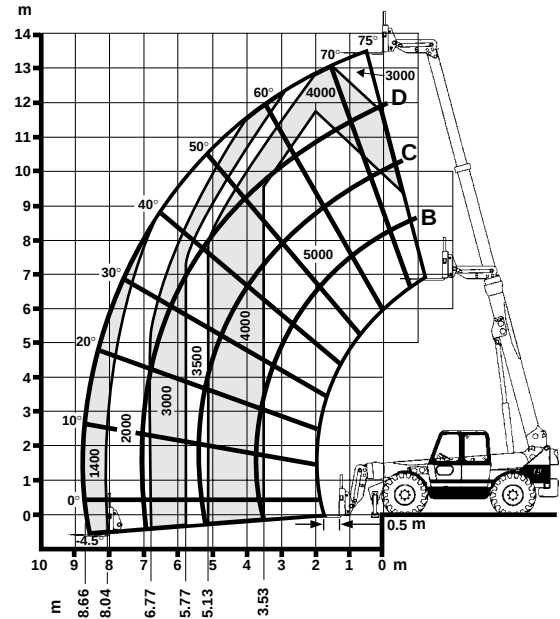
TH103
Stabilizers Up



Numbers in chart measured in kilograms.

Maximum lift capacity	5000 kg	11,025 lb
Maximum lift height	13.5 m	44'0"
Load at maximum height	2500 kg	5513 lb
Maximum forward reach	8.66 m	28'4"
Load at maximum reach	1025 kg	2260 lb

TH103
Stabilizers Down



Numbers in chart measured in kilograms.

Maximum lift capacity	5000 kg	11,025 lb
Maximum lift height	13.5 m	44'0"
Load at maximum height	3000 kg	6615 lb
Maximum forward reach	8.66 m	28'4"
Load at maximum reach	1400 kg	3087 lb

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 seven 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.

Specifications
• Barber-Greene
• Rubber Tired Models

Asphalt Pavers



MODEL		BG-210B		BG-230	
Flywheel Power		80 kW	107 hp	80 kW	107 hp
Rated Engine RPM		2200		2200	
No. Cylinders		4		4	
Displacement		4 L	243 in ³	4 L	243 in ³
Engine Model		3054DIT		3054DIT	
Operating Weight:					
Tractor		8786 kg	19,395 lb	12 202 kg	26,900 lb
Pavemaster B Screed	8 ft	1374 kg	3030 lb	1374 kg	3030 lb
	10 ft	1656 kg	3650 lb	1656 kg	3650 lb
Extend-A-Mat B	8 ft	2994 kg	6600 lb	2994 kg	6600 lb
	10 ft	—	—	—	—
Extend-A-Mat B (wide plates)	10 ft	—	—	—	—
Speeds: Paving		0-83.9 mpm	0-275 fpm	0-76 mpm	0-250 fpm
Travel		0-21.7 kmph	0-13.5 mph	0-19 kmph	0-12 mph
Maximum theoretical capacity		1222 (t)/hr	1203 TPH	1801 (t)/hr	1773 TPH
Tires:					
Front (4) (Solid Rubber)		305 mm × 559 mm	12" × 22"	330 mm × 559 mm	13" × 22"
Rear (2)		14:00 × 24		16:00 × 24 sand rib	
Dimensions:					
Operating Width	8 ft Screed	3226 mm	10'7"	3269 mm	10'9"
	10 ft Screed	—	—	3327 mm	10'11"
Shipping Width*	8 ft Screed	2502 mm	8'2.5"	2438 mm	8'0"
	10 ft Screed	—	—	3048 mm	10'0"
Height (less exhaust)		2578 mm	8'5.5"	2620 mm	8'7½"
Length (Extend-A-Mat B, pushroller)		5842 mm	19'2"	6477 mm	21'3"
Turning Radius		3048 mm	10'0"	2896 mm	9'6"
Wheelbase		2007 mm	6'7"	2336 mm	7'8"
Hopper Capacity		4.8 m ³	170 ft ³	5.5 m ³	195 ft ³
Auger Diameter		357 mm	14"	406 mm	16"
Paving Widths:					
8 ft Pavemaster B Screed					
Minimum w/cutoff shoes		1828 mm	6'0"	1828 mm	6'0"
Maximum w/extensions		4877 mm	16'0"	6096 mm	20'0"
10 ft Pavemaster B Screed					
Minimum w/cutoff shoes		—	—	—	—
Maximum w/extensions		—	—	—	—
8 ft Extend-A-Mat B Screed					
Minimum w/cutoff shoes		1828 mm	6'0"	1828 mm	6'0"
Maximum w/extensions		4724 mm	15'6"	4724 mm	15'6"
10 ft Extend-A-Mat B Screed					
Minimum w/cutoff shoes		—	—	2438 mm	8'0"
Maximum w/extensions		—	—	6147 mm	20'2"
Service Refill Capacities:					
Cooling system		19 L	5 U.S. gal	19 L	5 U.S. gal
Fuel tank		189 L	50 U.S. gal	189 L	50 U.S. gal
Hydraulic oil tank		178 L	47 U.S. gal	189 L	50 U.S. gal

*Shipping width with hoppers raised and without end gates.

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
CS-323C	3	2.5	249.5	326.0	332.7	434.7	415.9	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-431C	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-433C	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-533C	3	2.5	436.7	570.5	582.2	760.7	727.8	950.8	873.3	1141.0
CS-563C	3	3.0	524.0	684.6	698.7	912.8	873.3	1141.0	1048.0	1369.2
CS-573C	3	3.5	611.3	798.7	815.1	1064.9	1018.9	1331.2	1222.6	1597.4
CS-583C	3	4.0	698.7	912.8	931.5	1217.1	1164.4	1521.3	1397.3	1825.6
	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



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.
- **All wheel oscillation.** Front and rear seek out low spots and provide even wheel loads.
- **High drive propel system:** Completely hydrostatic with drive motors and brakes located in main-frame away from contamination and damage.
- **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.

MODEL

PS-150B

Flywheel Power	60 kW	80 hp
Rated Engine RPM	2300	
No. Cylinders	4	
Displacement	3.9 L	243 in ³
Engine Model	3054	
Speeds:		
Forward	2	
Reverse	2	
Max. Speed (For./Rev.)	25.6 km/h	15.9 mph
Wheel Configuration	5 front/6 rear	
Tires	7.5" × 15" 6 ply	
Operating Weight Empty (no ballast)	4885 kg	10,775 lb
Operating Weight Full (max. ballast)	12 940 kg	28,535 lb
Maximum Weight per Wheel	1438 kg	3173 lb
Steering:		
Inside radius	4846 mm	15'3"
Outside radius	6375 mm	20'11"
General Dimensions:		
Overall width	1750 mm	5'9"
Rolling width	1727 mm	5'8"
Overall height	3000 mm	9'10"
Wheelbase	3352 mm	11'0"
Overall length	4299 mm	14'1"
Ground clearance	267mm	10.5"
Service Refill Capacities:		
Fuel tank	173 L	45.7 U.S. gal
Crankcase	7.3 L	1.9 U.S. gal
Sprinkler water	394 L	104 U.S. gal



MODEL	R1300		R1600	
Bucket Size Minimum	2.4 m ³	3 yd ³	4.2 m ³	5 yd ³
Bucket Size Maximum	3.4 m ³	4 yd ³	5.9 m ³	8 yd ³
Tramming Capacity	6500 kg	14,330 lb	10 200 kg	22,490 lb
Length	8650 mm	28'5"	9710 mm	31'10"
Width Bucket	2000 mm	6'7"	2600 mm	8'6"
Width over Tires	1900 mm	6'3"	2400 mm	7'10"
Height	2000 mm	6'7"	2400 mm	7'10"
Operating Weight	19 000 kg	41,900 lb	29 800 kg	65,710 lb
Engine Power	123 kw	165 hp	201 kW	270 hp
Engine Model	Cat 3306 DITA		Cat 3176C ATAAC	
Tire Size	17.5x25 20 Ply L5 STMS		18x25 28 Ply STMS	
Outer Turning Radius	5575 mm	18'3"	6540 mm	21'5"
Inner Turning Radius	2972 mm	9'9"	3305 mm	10'10"
Articulation Angle	42.5°		42.5°	
Oscillation Angle	±10°		±10°	
Bucket Raise Time	5		7.6	
Bucket Lower Time	2.3		1.6	
Bucket Tip Time	2		2	
Bucket Total Time	9.3		11.2	
Travel Speeds	km/h	mph	km/h	mph
Forward 1	4.2	2.6	5.5	3.4
2	7.6	4.7	9.8	6.1
3	13.8	8.6	17.5	10.9
4	24.1	15	30.6	19
Reverse 1	3.7	2.3	6.2	3.9
2	6.8	4.2	11.2	7
3	12.4	7.7	19.8	12.3
4	21.7	13.5	34	21.1
Maximum Bucket Pin Height	2900 mm	9'6"	3752 mm	12'4"
Maximum Bucket Dump Angle	43°		45°	
Break Out Force Tilt SAE	12 020 kg	26,500 lb	19 500 kg	43,000 lb
Static Tipping (Tramming)	22 615 kg	49,870 lb	33 350 kg	73,540 lb
Emergency Brake	S.A.F.R. Inboard Spring Applied Fluid Released, Enclosed Wet Disc @ All Wheels, Front and Rear Circuits		S.A.F.R. Inboard Spring Applied Fluid Released, Enclosed Wet Disc @ All Wheels, Front and Rear Circuits	
Service Brake	Hydraulically Applied Spring Released, Enclosed Wet Disc @ All Wheels, Front and Rear Circuits		Fluid Applied Spring Released, Wet Disc	
Park Brake	S.A.F.R. Inboard Spring Applied Fluid Released, Enclosed Wet Disc @ All Wheels, Front and Rear Circuits		S.A.F.R. Inboard Spring Applied Fluid Released, Enclosed Wet Disc @ All Wheels, Front and Rear Circuits	
Fuel Capacity	260 L	69 U.S. gal	400 L	106 U.S. gal

Hammer Applications

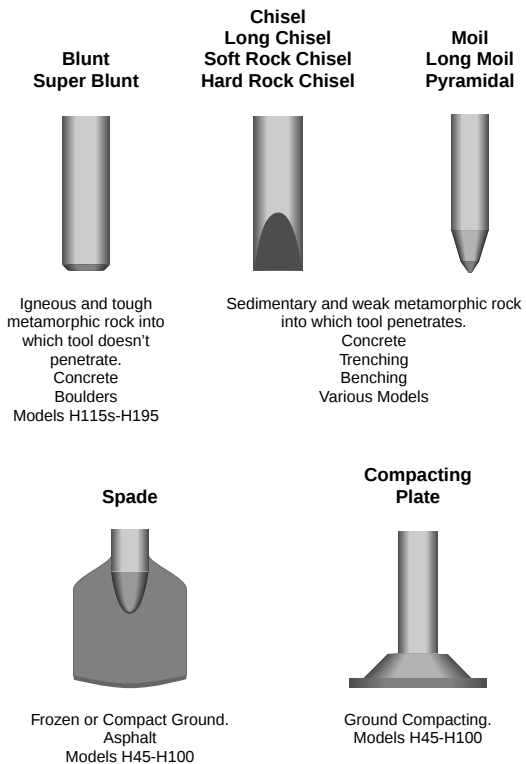
- **Sewer and Water** — The hammer can be used on pockets of rock that slow down production. Also good for breaking up old concrete pipes, manholes, etc.
- **Road Construction** — An essential tool during improvements and upgrading. The hammer works well on removing existing curbs, traffic islands, ramps, 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 amoil 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 Hydraulic Hammer productivity graphs 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.

Choosing the Tool



CONCRETE PULVERIZERS

Features:

- Hydraulic cylinder rod is protected. When activated the cylinder barrel is pushed out and the rod remains protected by the housing at all times.
- Large diameter slewing ring powered by a hydraulic motor constitutes a rugged and fast 360 degree rotation system.
- P16 and P25 Pulverizers provide the optimum reach configuration. Fifteen replaceable teeth and two square shaped cutting knives.
- P20, P28, P40 and P60 provide the optimum productivity configuration. Twenty-one replaceable teeth with six replaceable square cutting knives.
- Patented staggered tooth design enhances crushing effectiveness of the jaws.
- Long powerful rebar cutters.

Applications:

Primary and secondary demolition in one operation. Ideal for reinforced concrete found in bridge decks, parking garages, support columns and abutments.

Matching Guide

Stick Mounted/Reach Boom

Pulverizer Model	Cat Excavator	Stick Range	
		mm	ft
P16	320B L	1900-2900	6'3"-9'7"
	322B L	2000-3600	6'7"-11'10"
	325B L	2000-4200	6'7"-13'9"
P20	322B L	2000-3600	6'7"-11'10"
	325B L	2000-4200	6'7"-13'9"
P25	325B L	2000-3200	6'7"-10'6"
	330B L	2150-4800	7'1"-15'9"
	345B L	3900-4800	12'10"-15'9"
	350 L	4050-4800	13'3"-15'9"
P28	330B L	2150-3300	7'1"-10'10"
	345B L	3900-4800	12'10"-15'9"
	350 L	4050-4800	13'3"-15'9"
P40	345B L	3900-4800	12'10"-15'9"
	350 L	3100-3700	9'6"-12'2"
	375 L	4400-5500	14'5"-18'1"
P60	375	2900-4400	9'6"-14'5"
	375*	2900-4400	9'6"-14'5"

*GP Boom.

Cat Engines for Fire Pump Packages

Engine Model	Cycl.	Disp.		1460 rpm		1750 rpm		1900 rpm		2100 rpm		2200 rpm	
		L	cu in	kW	hp	kW	hp	kW	hp	kW	hp	kW	hp
3208 NA	V8	10.4	636	75	101	90	121	97	130	105	141	108	145
3208 NA	V8	10.4	636	91	122	105	141	112	150	123	165	127	170
3208 T	V8	10.4	636	108	145	146	196	157	211	175	235	183	245
3306 T	I-6	10.5	638	145	195	172	231	184	247	199	267	—	—
3306 TA	I-6	10.5	638	183	245	198	266	207	278	214	287	—	—
3406 T	I-6	14.6	893	184*	247	218	292	233*	312	246	330	—	—
3406 TA	I-6	14.6	893	224	300	313	420	317	425	321	430	—	—
3406 T	I-6	14.6	893	242†	325	276†	370	280†	375	280†	375	—	—
3406 TA	I-6	14.6	893	—	—	343†	460	343†	460	360†	483	—	—
3408 TA	V8	18.0	1099	—	—	359	481	369	495	378	507	—	—
3408 TA	V8	18.0	1099	—	—	380†	510	392†	525	392†	525	—	—
3412 T	V12	27.0	1649	—	—	401	538	—	—	427	572	—	—
3412 TA	V12	27.0	1649	—	—	476	638	551	739	551	739	—	—
3412 T	V12	27.0	1649	466†	625	492†	660	507†	680	522†	700	—	—
3412 TA	V12	27.0	1649	—	—	597†	800	642†	860	649†	870	—	—
3508 TA	V8	34.5	2105	709*	950	794*	1065	—	—	—	—	—	—
3512 TA	V12	51.8	3158	1067*	1430	1193*	1600	—	—	—	—	—	—
3516 TA	V16	69.0	4210	1417*	1900	1480*	1985	—	—	—	—	—	—

Engine Model	Cycl.	Disp.		2300 rpm		2400 rpm		2600 rpm		2800 rpm		3000 rpm	
		L	cu in	kW	hp	kW	hp	kW	hp	kW	hp	kW	hp
3208 NA	V8	10.4	636	112	150	116	156	119	160	123	165	119	160
3208 NA	V8	10.4	636	131	176	134	180	136	182	139	187	138	185
3208 T	V8	10.4	636	187	251	190	255	194	260	201	270	—	—
3306 T	I-6	10.5	638	203	272	—	—	—	—	—	—	—	—
3306 TA	I-6	10.5	638	212	284	—	—	—	—	—	—	—	—
3406 T	I-6	14.6	893	261†	350	—	—	—	—	—	—	—	—
3406 TA	I-6	14.6	893	339†	455	—	—	—	—	—	—	—	—
3408 TA	V8	18.0	1099	380†	510	—	—	—	—	—	—	—	—
3412 T	V12	27.0	1649	466†	625	—	—	—	—	—	—	—	—
3412 TA	V12	27.0	1649	649†	870	—	—	—	—	—	—	—	—

*This rating is not listed or approved by ULI or FM, but it meets the same standards as the listed or approved ratings.

†These ratings are for engines with dry shielded exhaust manifolds and turbocharges.

T — Turbocharged

NA — Naturally Aspirated

TA — Turbocharged-Aftercooled

Rating Definition:

Standby: Fire pump engine ratings represent the output which may be utilized to drive stationary fire pumps where the pumping equipment has been sized according to ULI and FM procedures.

Cat Engines for Marine Propulsion Applications

Engine Model	CS			MC		
	kW	hp	rpm	kW	hp	rpm
3606 TA	1490	2000	750	1640	2200	750
3606 TA	1560	2090	800	1720	2310	800
3606 TA	1730	2320	900	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	750
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

Engine Model	Fast commercial vessel rating			Military fast vessel rating		
	kW	hp	rpm	kW	hp	rpm
3612	4250	5700	1000	4500	6035	1000
3616	5650	7575	1000	6000	8050	1000
3618	7200	9655	1050	—	—	—

TA — Turbocharged-Aftercooled

RATING DEFINITIONS: (3600s)

CS: Continuous Service is suitable for continuous duty applications, including dredges, for operation without interruption or load cycling.

MC: Maximum Continuous 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.

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)	Transmission	Rated Drawbar Pull — kg (lb) and Forward Speed — km/h (mph)					
								1st	2nd	3rd	4th	5th	6th
D5H (FR)	8RC*	85-90	120/—	12 144 (26,772)	1.8 (5'11") 2.21 (7'3")	3.6 (11'10") 2.93 (9'7")	PS	— 3.3 (2.1)	— 5.9 (3.7)	— 10.0 (6.2)			
D5H (FR)	8RC	91-96	120/—	13 250 (29,200)	1.8 (5'11") 2.31 (7'7")	3.6 (11'10") 3.0 (9'10")	DD	3.3 (2.1)	5.9 (3.7)	10.0 (6.2)			
D5H (FR)	7NC*	85-90	120/—	12 212 (26,922)	1.8 (5'11") 2.21 (7'3")	3.6 (11'10") 2.93 (9'7")	DD	9140 (20,150)	7005 (15,440)	5190 (11,440)	3835 (8450)	2785 (6140)	1950 (4300)
D5H (FR)	7NC	91-96	120/—	13 250 (29,200)	1.8 (5'11") 2.31 (7'7")	3.6 (11'10") 3.0 (9'10")	DD	9140 (20,150)	7005 (15,440)	5190 (11,440)	3835 (8450)	2785 (6140)	1950 (4300)
D5H LGP (FR)	1DD*	86-90	120/—	14 685 (32,380)	2.16 (7'1") 3.02 (9'11")	4.129 (13'7") 3.069 (10'1")	PS	3.3 (2.1)	5.9 (3.7)	10.0 (6.2)			
D5H LGP (FR)	1DD	91-96	130/—	16 200 (35,700)	2.16 (7'1") 3.02 (9'11")	4.133 (13'7") 3.135 (10'3")	PS	3.3 (2.1)	5.9 (3.7)	10.0 (6.2)			
D5H LGP (FR)	9HC*	85-90	120/—	14 878 (32,800)	2.16 (7'1") 3.02 (9'11")	4.129 (13'7") 3.069 (10'1")	DD	9140 (20,150)	7005 (15,440)	5190 (11,440)	3835 (8450)	2785 (6140)	1950 (4300)
D5H LGP (FR)	9HC	91-96	130/—	16 200 (35,700)	2.16 (7'1") 3.02 (9'11")	4.133 (13'7") 3.135 (10'3")	DD	10 061 (22,181)	7725 (17,031)	5738 (12,650)	4256 (9384)	3109 (6855)	2195 (4840)
D5H (JPN)	3MD*	86-90	120/—	12 144 (26,772)	1.8 (5'11") 2.21 (7'3")	3.6 (11'10") 2.93 (9'7")	PS	3.3 (2.1)	5.9 (3.7)	10.0 (6.2)			
D5H (JPN)	3MD	91-96	120/—	13 250 (29,200)	1.8 (5'11") 2.31 (7'7")	3.6 (11'10") 3.0 (9'10")	PS	3.3 (2.1)	5.9 (3.7)	10.0 (6.2)			
D5H (JPN)	1YD*	86-90	120/—	12 212 (26,922)	1.8 (5'11") 2.21 (7'3")	3.6 (11'10") 2.93 (9'7")	DD	9140 (20,150)	7005 (15,440)	5190 (11,440)	3835 (8450)	2785 (6140)	1950 (4300)
D5H (JPN)	1YD*	91-96	120/—	13 250 (29,200)	1.8 (5'11") 2.31 (7'7")	3.6 (11'10") 3.0 (9'10")	DD	9140 (20,150)	7005 (15,440)	5190 (11,440)	3835 (8450)	2785 (6140)	1950 (4300)

*D5H models prior to Series II. Product identification number prefix still in use for current product.

NOTE: Power Shift models show speeds only, not drawbar pull.

NOTE: Track-Type Tractor weights do not include blades until 1967.

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)	Transmission	Rated Drawbar Pull — kg (lb) and Forward Speed — km/h (mph)						Remarks
								1st	2nd	3rd	4th	5th	6th	
S × S D9G	29N	69-74	770	86 200* (190,000)	5.8* (19'0")	8.0◄ (25'0")	PS	3.9 (2.4)	6.8 (4.2)	10.0 (6.2)				L.H. of S × S D9G
	30N				7.3** (24'0")	2.8◄◄ (9'2")								R.H. of S × S D9G
Dual D9G	90J	69-74	770	79 470* (175,200)	2.3* (7'6")	12.9◄ (42'6")	PS	3.9 (2.4)	6.8 (4.2)	10.5 (6.5)				Front of Dual D9G
	91J				3.3** (10'9")	3.1◄◄ (9'11")								Rear of Dual D9G
S × S D9H	99V	74-77	820	83 400* (183,900)	5.8* (19'0")	9.0◄ (26'1")	PS	4.0 (2.5)	6.9 (4.3)	10.8 (6.7)				L.H. of S × S D9H
	12U				7.3** (24'0")	2.9◄◄ (9'6")								R.H. of S × S D9H
Dual D9H	97V	74-80	820	81 100* (178,800)	2.3* (7'6")	12.9◄ (42'6")	PS	4.0 (2.5)	6.9 (4.3)	10.8 (6.7)				Front of Dual D9H
	98V				3.3** (10'9")	3.1◄◄ (9'11")								Rear of Dual D9H
D9H	90V	74-81	410	32 840 (72,400)	2.3* (7'6")	5.6 (18'5")	PS	4.0 (2.5)	6.9 (4.3)	10.8 (6.7)				Standard Model
					3.0 (9'11")	2.7◄◄ (8'10")								
D9L	14Y	80-87	460	52 055 (114,656)	2.5 (8'2")	5.32 (17'5")								
					3.11 (10'2")	4.41 (14'6")		3.9 (2.4)	7.2 (4.5)	12.4 (7.7)				
D9N	1JD	86-94	370	42 816 (96,196)	2.55 (7'5")	5.17 (16'11.5")	PS	3.9 (2.4)	6.9 (4.3)	12.1 (7.5)				
	6XJ				2.43 (9'7")	3.91 (12'10")								
D10	84W	78-86	700	79 619 (175,526)	2.89 (9'6")	5.92 (19'8")	PS	3.9 (2.4)	6.9 (4.3)	11.9 (7.4)				
	76X				3.61 (11'11.5")	3.48◄◄ (11'5")								
D10N	2YD	87-93	520	66 400 (147,405)	2.55 (8'4")	5.89 (18'4")	PS							
	3SK				3.30 (10'10")	4.45 (14'7")		4.0 (2.5)	7.1 (4.4)	12.5 (7.7)				
D11N	74Z	86-93	770	97 454 (214,847)	2.90 (9'6")	6.16 (20'3")	PS							
	4HK				3.65 (12'0")	4.56 (14'11")		3.9 (2.4)	6.8 (4.4)	11.6 (7.2)				
D11R	8ZR	96-97	770	98 413 (216,963)	2.90 (9'6")	6.16 (20'3")	PS	3.9 (2.4)	6.8 (4.4)	11.6 (7.2)				Electronic Finger Tip Control Steering
					3.60 (11'10")	4.67 (15'3")								

* Gauge of both tractors combined.

**Width to outside of dozer blade.

* Approximate weight of both machines plus Bulldozer, hydraulic controls, coolant and 5% fuel.

NOTE: Power Shift models show speeds only, not drawbar pull.

NOTE: Track-Type Tractor weights do not include blades until 1967.

◄ Length including dozer blade.

◄◄ Overall height excluding stack and canopy.

Hydraulic Excavators (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)	Max. Reach** m (ft)	Lift Capacity*** kg (lb)
E140	1PF(JPN) 1NF(OSJ)	87-94	89	13 970 (30,800)	1.99 (6'6")	2.89 (9'6")	8.29 (27'6")	2.55 (8'4")	5.49 (18'0")	4380 (9650)
E200B	6KF(OSJ) 4SG(JPN)	87-91 87-91	118	18 800 (41,400)	2.20 (7'3")	2.97 (9'9")	9.48 (31'11")	2.83 (9'4")	10.63 (34'10")	8100 (17,350)
EL200B	7DF(OSJ) 5EG(JPN)	87-91 87-91	118	20 100 (44,300)	2.38 (7'10")	2.97 (9'9")	9.48 (31'11")	3.18 (10'5")	10.63 (34'10")	8150 (17,600)
E240	1FG(OSJ) 2HF(JPN)	87-89 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)
E240B	8SF(OSJ) 9PF(JPN)	89-92	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)
E240C	2RL(OSJ) 8MK(JPN)	92-93	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) 4MF(JPN)	87-89 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)
EL240B	5WG(OSJ) 6MG(JPN)	89-92	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")	10 320 (22,750)
EL240C	9PK(OSJ) 9NK(JPN)	92-93	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")	10 320 (22,750)
E300	2CF(OSJ) 1KG(JPN)	87-89 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) 2HJ(JPN)	90-91 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) 4SF(JPN)	87-89 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)
EL300B	3FJ(OSJ) 1GK(JPN)	90-91 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)
E450	3HG(OSJ) 3JG(JPN)	87-93 87-93	276	46 000 (101,430)	2.89 (9'6")	3.49 (11'5")	11.96 (39'3")	3.15 (10'4")	13.08 (42'11")	10 900 (23,500)
E650	3KG(OSJ) 3LG(JPN)	87-92 87-92	375	62 600 (138,000)	3.25 (10'8")	4.84 (15'11")	14.0 (45'11")	3.49 (11'5")	13.33 (43'9")	15 850 (34,000)
307	2WM 2PM(OSJ) 9ZL(JPN)	94-97	54	7600 (16,760)	1.75 (5'9")	2.9 (9'6")	6.3 (20'8")	2.4 (7'10")	6.38 (20'11")	2450 (5390)
311	9LJ(OSJ) 5PK(JPN)	93-96 93-96	79	11 100 (24,400)	1.99 (6'6")	2.76 (9'1")	7.25 (23'9")	2.49 (8'2")	8.10 (26'7")	3100 (6650)
312	6GK(OSJ) 7DK(JPN)	93-96 93-96	84	12 600 (27,910)	1.99 (6'6")	2.76 (9'1")	7.6 (24'11")	2.49 (8'2")	8.63 (28'4")	4200 (9260)
312	6BL	93-97	84	12 600 (27,780)	1.99 (6'6")	2.76 (9'1")	7.6 (24'11")	2.49 (8'2")	8.63 (28'3")	4200 (9260)
312B	6SW 9NW(blade)	98	84	13 000 (28,665) 13 785 (30,395)	1.99 (6'6") 1.99 (6'6")	2.91 (9'6") 2.91 (9'6")	7.59 (24'11") 7.59 (24'11")	2.49 (8'2") 2.49 (8'2")	8.30 (27'3") 8.30 (27'3")	4590 (10,120) 4940 (10,890)
312B L	9FS 2KW(blade)	97	84	13 270 (29,260) 14 055 (30,990)	1.99 (6'6") 1.99 (6'6")	2.91 (9'6") 2.91 (9'6")	7.59 (24'11") 7.59 (24'11")	2.59 (8'6") 2.59 (8'6")	8.30 (27'3") 8.30 (27'3")	5000 (11,025) 5050 (11,135)

*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 (15'0") over front, one-piece boom, longest stick.

Former Models

Wheel Tractor-Scrapers Construction & Mining Trucks/Tractors

Tractor-Towed Scrapers (cont'd)

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)
90	9V	51-55	16.2/20.6 (21.2/27.0)	17 208 (37,937)	3.65 (12'0")	12.19 (40'0")	3.20 (10'6")	3.04 (10'0")
435C	45D	56-61	9.9/13.8 (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	45D	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	9.2/13.0 (12.0/17.0)	10 400 (22,900)	3.29 (10'10")	10.06 (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	9.2/13.0 (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	55-60	13.8/29.1 (18.0/25.0)	14 061 (31,000)	3.58 (11'9")	11.58 (38'0")	3.39 (11'2")	3.15 (10'4")
463C	62C	59-60	16.8/21.4 (22.0/28.0)	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	16.0/21.4 (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	13.8/20.0 (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	20.6/26.0 (27.0/34.0)	16 964 (37,400)	3.65 (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 (46,060)	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")



CONSTRUCTION & MINING TRUCKS/TRACTORS

Model	Product Ident. No. Prefix	Years Built	Flywheel Kilowatts (Horse-power)	Capacity Metric Tons (U.S. Tons)	Approx. Weight kg (lb)	Dimensions m (ft)						Tire Size
						Width	Length	Height	Loading Height	Dumping Height (55°)	Turning Circle	
768B	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 × 33—24 PR
768C	02X	78-95	336 (450)	— (—)	24 624 (54,285)	4.70 (15'5")	8.00 (26'3")	3.56 (11'8")	— (—)	— (—)	18.5 (60'8")	18.00R33 E-4
769	99F	62-67	298 (400)	31.8 (35.0)	25 365 (55,870)	3.63 (11'11")	7.64 (25'1")	4.05 (13'4")	3.07 (10'1")	7.18 (26'7")	16.5 (54'5")	18.00 × 25—32 PR
769B	99F	67-78	309 (415)	32.0 (35.0)	28 000 (61,800)	3.64 (11'11.5")	7.85 (25'9")	3.89 (12'9")	3.15 (10'4")	7.24 (23'9")	18.0 (59'1")	18.00 × 25—32 PR E-3
769C	01X	78-95	336 (450)	36.9 (40.6)	30 675 (67,855)	4.70 (15'5")	8.00 (26'3")	3.85 (12'8")	3.24 (10'7")	7.68 (25'2")	18.5 (60'8")	18.00R33 E-4
771C	3BJ	92-95	336 (450)	40.0 (44.0)	34 170 (75,345)	4.74 (15'7")	8.20 (26'11")	4.00 (13'1")	3.30 (10'10")	7.68 (25'2")	18.5 (60'8")	18.00R33 E-4
772	80S	71-78	447 (600)	— (—)	32 100 (70,800)	4.06 (13'4")	7.11 (23'4")	3.68 (12'1")	— (—)	— (—)	22.1 (72'6")	24.00 × 35—36 PR
772B	64W	78-95	485 (650)	— (—)	32 909 (72,550)	4.86 (15'11")	9.12 (29'11")	4.52 (14'10")	— (—)	— (—)	23.5 (77'0")	24.00R35 E-4



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 (10,600-17,000)
UDM-600	1829 (6'0")	6.7 (22'0")	17.00 (600)	82 (89)	354.25 (12,500)
UDM-900	2134/1829 (7'0"/6'0")	9.1 (30'0")	25.48 (900)	68-227 (75-250)	311-793 (11,000-28,000)
UVM-1000	2134 (7'0")	9.754 (32'0")	28.34 (1000)	82-272 (90-300)	425-1076 (15,000-38,000)
UVM-1400	2286 (7'6")	10.973 (36'0")	39.64 (1400)	100-358 (110-395)	481-1274 (17,000-45,000)
UVM-1700	2591 (8'6")	11.582 (38'0")	48.14 (1700)	122-480 (135-450)	651-1614 (23,000-57,000)



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 (15,000-40,000)
PVM-1500	2286 (7'6")	12.19 (40'0")	42.48 (1500)	100-363 (110-400)	510-1274 (18,000-45,000)
PVM-2000	2591 (8'6")	12.80 (42'0")	56.64 (2000)	122-454 (135-500)	680-1699 (24,000-60,000)
PVM-2500	2896 (9'6")	12.80 (42'0")	70.79 (2500)	136-499 (150-550)	793-2110 (28,000-74,500)
PVM-2900	3048 (10'0")	13.41 (44'0")	82.12 (2900)	168-553 (185-610)	906-2265 (32,000-80,000)
PVM-3300	3200 (10'6")	13.41 (44'0")	93.45 (3300)	181-612 (200-675)	991-2464 (35,000-87,000)

SUBSECTION 2A: Residual Value at Replacement

Gross Selling Price	(1) (____%) _____	(2) (____%) _____
Less: a. Commission	_____	_____
b. Make-ready costs	_____	_____
c. Inflation during ownership period*	_____	_____
Net Residual Value	_____ (____%)	_____ (____%) of original delivered price
(Enter on line 2)		

*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				
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)
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) _____

Owning & Operating Costs

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
5080	36-42	10-11	46-53	12-14	62-74	18-20
5130B	91-95	24-25	110-114	29-30	129-132	34-35
5230	163-193	43-51	193-204	51-54	208-227	55-60

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
561M	4-7½	1-2	7½-11	2-3	9½-13	2½-3½
572R	7½-11	2-3	13-17	3½-4½	17-21	4½-5½
583R	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 Series II	15-19	4-5	21-25	5½-6½	27½-34	7¼-9
615C Series II	23-26	6-7	30-36	8-9½	42-47½	11-12½
621F	27-32	7-8½	38-44	10-11½	49-57	13-15
623F	30-36	8-9½	40-46	10½-12	53-59	14-15½
627F	45½-51	12-13½	64-70	17-18½	85-89½	22½-23½
631E Series II	40-45	10½-12	53-59	14-15½	72-78	19-20½
633E Series II	45-49	12-13	56-62	15-16½	78-81	20½-21½
637E Series II	64-70	17-18½	87-93	23-24½	113½-121	30-32
651E	47-57	12½-15	66-76	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.

APPROXIMATE HOURLY CONSUMPTION OF LUBRICANTS

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		
Articulated Trucks										
D25D	0.110	0.029	0.065	0.017	0.080	0.021	0.135	0.036	16	2488
D30D	0.110	0.029	0.065	0.017	0.085	0.022	0.135	0.036	16	3688
D250E	0.110	0.029	0.060	0.016	0.093	0.025	0.100	0.026	20	1664
D300E	0.110	0.029	0.060	0.016	0.105	0.028	0.100	0.026	20	1664
D350E	0.136	0.036	0.130	0.034	0.193	0.051	0.133	0.035	20	4504
D400E	0.136	0.036	0.130	0.034	0.193	0.051	0.133	0.035	20	4504
Wheel Tractors & Compactors										
814F	0.113	0.030	0.060	0.016	0.051	0.013	0.043	0.011	12	192
815F	0.113	0.030	0.060	0.016	0.051	0.013	0.043	0.011	12	192
816F	0.113	0.030	0.060	0.016	0.051	0.013	0.043	0.011	12	192
824G	0.113	0.030	0.060	0.016	0.073	0.019	0.043	0.011	12	200
825G	0.113	0.030	0.060	0.016	0.096	0.025	0.043	0.011	12	200
826G	0.113	0.030	0.060	0.016	0.096	0.025	0.043	0.011	12	200
834B	0.166	0.044	0.102	0.027	0.102	0.027	0.121	0.032	12	318
836	***	***	***	***	***	***	***	***	***	***
844	0.288	0.075	0.070	0.018	0.218	0.057	0.152	0.040	15	266
854G	0.408	0.108	0.169	0.045	0.353	0.093	0.243	0.054	15	76
Wheel Loaders & Integrated Toolcarriers										
902	***	***	***	***	***	***	***	***	***	***
906	***	***	***	***	***	***	***	***	***	***
914G	0.014	0.004	0.069	0.018	0.013	0.004	—	—	7	600
IT14G	0.014	0.004	0.069	0.018	0.013	0.004	—	—	7	600
924F	0.040	0.010	0.023	0.006	0.020	0.006	0.026	0.007	12	404
IT24F	0.040	0.010	0.023	0.006	0.020	0.006	0.026	0.007	12	584
928G	0.080	0.021	0.034	0.009	0.026	0.007	0.035	0.009	12	444
IT28G	0.080	0.021	0.034	0.009	0.026	0.007	0.035	0.009	12	784
938G	0.081	0.021	0.026	0.008	0.030	0.008	0.023	0.006	13	444
IT38G	0.081	0.021	0.026	0.008	0.030	0.008	0.150	0.006	13	444
950G	0.120	0.032	0.034	0.009	0.030	0.008	0.038	0.010	13	392
962G, IT62G	0.160	0.043	0.034	0.009	0.036	0.010	0.038	0.010	13	392
966F Series II	0.114	0.030	0.045	0.012	0.050	0.014	0.070	0.019	13	432
970F	0.116	0.031	0.046	0.013	0.050	0.014	0.070	0.019	13	432
980G	0.136	0.036	0.058	0.016	0.084	0.022	0.100	0.028	15	714
988F Series II	0.168	0.044	0.070	0.018	0.136	0.035	0.118	0.031	14	198
990 Series II	0.288	0.075	0.070	0.018	0.218	0.057	0.152	0.040	15	266
992G	0.408	0.108	0.169	0.045	0.353	0.093	0.243	0.054	15	76
994	0.800	0.208	0.291	0.076	0.621	0.164	0.450	0.119	17	3694
Telehandlers										
TH62	0.031	0.008	0.012	0.003	0.011	0.003	0.095	0.025	17	1032
TH63	0.031	0.008	0.012	0.003	0.011	0.003	0.095	0.025	17	1032
TH82	0.031	0.008	0.012	0.003	0.011	0.003	0.095	0.025	17	1032
TH83	0.031	0.008	0.012	0.003	0.011	0.003	0.095	0.025	17	1032
Track Loaders										
933C	0.048	0.012	0.014	0.004	0.008	0.002	0.026	0.007	14	720
939C	0.049	0.013	0.015	0.004	0.008	0.002	0.026	0.007	16	720
953C	0.084	0.022	0.033	0.007	0.015	0.004	0.033	0.009	8	832
963B	0.084	0.022	0.036	0.009	0.014	0.004	0.034	0.009	8	828
973	0.110	0.029	0.031	0.008	0.029	0.008	0.030	0.008	8	828

*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 differential (Construction & Mining Trucks/Tractors, Wheel Loaders and Articulated Trucks).

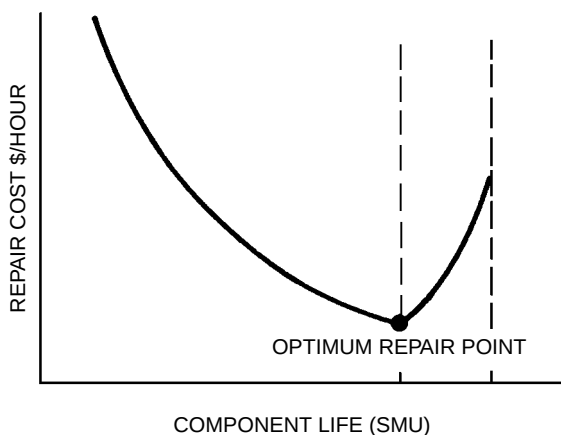
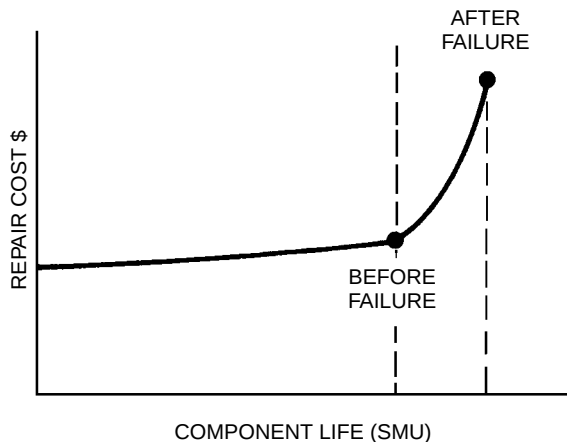
††Includes brakes, converter hoist system and steering system (Construction & Mining Trucks/Tractors).

- 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.



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 = $1.0 \times 4.00 = \$4.00$ 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

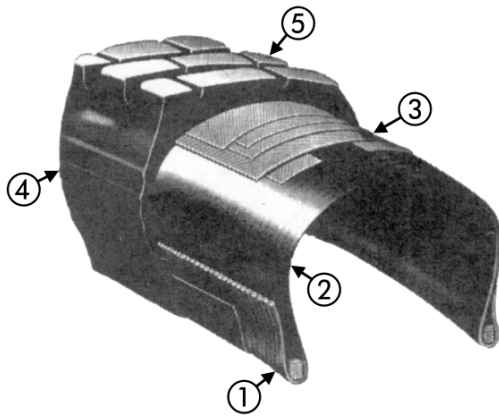
To give a true picture of operator cost, include fringe benefits as well as direct hourly wages (line 15).

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.



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 rubber cushion lying between tread and 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 that transport material such as trucks and wheel tractors.
2. *Work tire* — Normally applied to slow moving earth-moving machines such as graders and loaders.
3. *Load and carry* — Wheel loaders engaged in transporting as well as digging.

In actual practice there are few instances where it is necessary to apply a type of tire in an application not originally intended by the tire designer. More tires are now being designed for a wide range of applications.

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 0.65) is the aspect ratio (section height divided by section width).

If designated 40/65 R39, then the R denotes radial construction.

The wide base tire has an aspect ratio of approximately 0.83 and the standard base 0.95. The "low profile tire" has an aspect ratio of 0.65.

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.

T-km/h (Ton-MPH) RATINGS
 AT 38° C (100° F) AMBIENT TEMPERATURE

For Haul Lengths of 32 k (20 Miles) or Less One Way
 Maximum Speed Not to Exceed 48 k (30 Miles) per Hour

BRIDGESTONE BIAS WIDE BASE SIZES

22

Industry Code		E-2			E-3			E-4		
Tread Design		FG			RL and VL2			RLS		
Custom Code		E2A	E1A	E3A	E2A	E1A	E3A	E2A	E1A	E3A
20.5-25	TKPH	109			88	95				
	TMPH	75			60	65				
23.5-25	TKPH		161		117	131		88		
	TMPH		110		80	90		60		
26.5-25	TKPH				139	161				
	TMPH				95	110				
29.5-25	TKPH				168	190	234			
	TMPH				115	130	160			
26.5-29	TKPH					190				
	TMPH					130				
29.5-29	TKPH		234		182	204		124	139	
	TMPH		160		125	140		85	95	
33.5-33	TKPH				248	285				
	TMPH				170	195				
37.5-33	TKPH					343				
	TMPH					235				
29.5-35	TKPH					255				
	TMPH					175				
33.25-35	TKPH				255	292	380			
	TMPH				175	200	260			
37.25-35	TKPH					358	467			
	TMPH					245	320			
37.5-39	TKPH				325	372	489			
	TMPH				223	255	335			

MOTOR GRADERS — Bias Ply

Model	Tire Size	Ply Rating	Pressure			
			Front		Rear	
			kPa	psi	kPa	psi
120H	13.00-24TG*	10*, 12	241	35	241	35
	14.00-24TG	10, 12	241	35	241	35
	15.5-25	10, 12	241	35	241	35
	17.5-25	12	241	35	241	35
135H	13.00-24TG*	10*, 12	241	35	241	35
	14.00-24TG	10, 12	241	35	241	35
	15.5-25	12	276	40	276	40
	17.5-25	12	241	35	241	35
12H	13.00-24TG*	12	310	45	310	45
	14.00-24TG	10, 12	241	35	241	35
	15.5-25	12	241	35	241	35
	17.5-25	12	276	40	276	40
140H	14.00-24TG*	10*, 12	241	35	241	35
	17.5-25	12	241	35	241	35
143H	14.00-24TG*	10*, 12	241	35	241	35
	17.5-25	12	241	35	241	35
160H	14.00-24TG*	10, 12*	241	35	241	35
	17.5-25	12	241	35	241	35
163H	14.00-24TG*	12	241	35	241	35
	17.5-25	12	241	35	241	35

*Standard tire and ply rating.

MOTOR GRADERS — Bias Ply (continued)

Model	Tire Size	Ply Rating	Pressure			
			Front		Rear	
			kPa	psi	kPa	psi
14H	16.00-24TG*	16	310	45	310	45
	20.5-25	16	241	35	241	35
16H	18.00-25*	16	241	35	241	35
	23.5-25	16	241	35	241	35

*Standard tire and ply rating.

WHEEL TRACTORS — Bias Ply

Model	Tire Size	Ply Rating or Strength Index	Pressure			
			Front		Rear	
			kPa	psi	kPa	psi
814F	23.5-25*	12	207	30	207	30
	26.5-25	14	172	25	172	25
824G	29.5-25*	22	241	35	241	35
834B	35/65-33*	24	241	35	241	35

WHEEL TRACTOR — Radial Ply

814F	23.5R25	★	276	40	276	40
	26.5R25	★	241	35	241	35
824G	29.5R25	★	345	50	345	50
834B	35/65R33	★	345	50	345	50

*Standard tire, ply rating, and inflation pressures.

MOTOR GRADERS — Michelin, Goodyear and Bridgestone/Firestone Radial Ply

Model	Tire Size	Strength Rating	Michelin Pressure				Goodyear Pressure				Bridgestone Pressure			
			Front		Rear		Front		Rear		Front		Rear	
			kPa	psi	kPa	psi	kPa	psi	kPa	psi	kPa	psi	kPa	psi
120H	13.00R24TG	★	310	45	310	45	310	45	310	45	310	45	310	45
	14.00R24TG	★	310	45	310	45	310	45	310	45	310	45	310	45
	15.5R25	★	310	45	310	45	310	45	310	45	310	45	310	45
135H	13.00R24TG	★	310	45	310	45	310	45	310	45	310	45	310	45
	14.00R24TG	★	310	45	310	45	310	45	310	45	310	45	310	45
	15.5R25	★	310	45	310	45	310	45	310	45	310	45	310	45
12H	13.00R24TG	★	310	45	310	45	310	45	310	45	310	45	310	45
	14.00R24TG	★	310	45	310	45	310	45	310	45	310	45	310	45
	15.5R25	★	310	45	310	45	310	45	310	45	310	45	310	45
140H	14.00R24TG	★	310	45	310	45	310	45	310	45	310	45	310	45
	17.5R25	★	310	45	310	45	310	45	310	45	310	45	310	45
160H	14.00R24TG	★	310	45	310	45	310	45	310	45	310	45	310	45
	17.5R25	★	310	45	310	45	310	45	310	45	310	45	310	45
143H	14.00R24TG	★	310	45	310	45	310	45	310	45	310	45	310	45
	17.5R25	★	310	45	310	45	310	45	310	45	310	45	310	45
163H	14.00R24TG	★	310	45	310	45	310	45	310	45	310	45	310	45
	17.5R25	★	310	45	310	45	310	45	310	45	310	45	310	45
14H	16.00R24TG	★	310	45	310	45	310	45	310	45	310	45	310	45
	20.5R25	★	310	45	310	45	310	45	310	45	310	45	310	45
16H	18.00R25	★	310	45	310	45	310	45	310	45	310	45	310	45
	23.5R25	★	310	45	310	45	310	45	310	45	310	45	310	45

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).

- What is the loose density of the material?
 - What is the usable volume of the bucket?
 - What is the bucket payload per pass in BCY?
 - What is the bucket payload per pass in tons?
- $\text{lb/LCY} = \text{lb/BCY} \div (1 + \text{Swell}) = 4125 \div (1.35) = 3056 \text{ lb/LCY}$
 - $\text{LCY} = \text{rated LCY} \times \text{fill factor} = 14 \times 1.05 = 14.7 \text{ LCY}$
 - $\text{lbs/pass} = \text{volume} \times \text{density lb/LCY} = 14.7 \times 3056 = 44,923 \text{ lbs}$
 $\text{BCY/pass} = \text{weight} \div \text{density lb/BCY} = 44,923 \div 4125 = 10.9 \text{ BCY}$
 or bucket LCY from part b $\div (1 + \text{Swell}) = 14.7 \div 1.35 = 10.9 \text{ BCY}$
 - $\text{tons/pass} = \text{lbs} \div 2000 \text{ lbs/ton} = 44,923 \div 2000 = 22.5 \text{ tons}$

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.

- How many bank yards are needed?
- How many loads are required?

$$\text{a) } \text{BCY} = \frac{\text{CCY}}{\text{S.F.}} = \frac{10,000}{0.80} = 12,500 \text{ BCY}$$

$$\begin{aligned} \text{b) } \text{Load (BCY)} &= \text{Capacity (LCY)} \\ &\times \text{Load factor (L.F.)} = 20 \times 0.81 \\ &= 16.2 \text{ BCY/Load} \end{aligned}$$

(L.F. of 0.81 from Tables)

$$\begin{aligned} \text{Number of} \\ \text{loads required} &= \frac{12,500 \text{ BCY}}{16.2 \text{ BCY/Load}} = 772 \text{ Loads} \end{aligned}$$



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.

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:

$$\begin{aligned} \text{Cost per BCM} &= \frac{\text{Total cost/hr}}{\text{Production/hr}} \\ &= \frac{\$1,255.00}{1507 \text{ BCM/hr}} \\ &= 83¢/\text{BCM} \end{aligned}$$

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

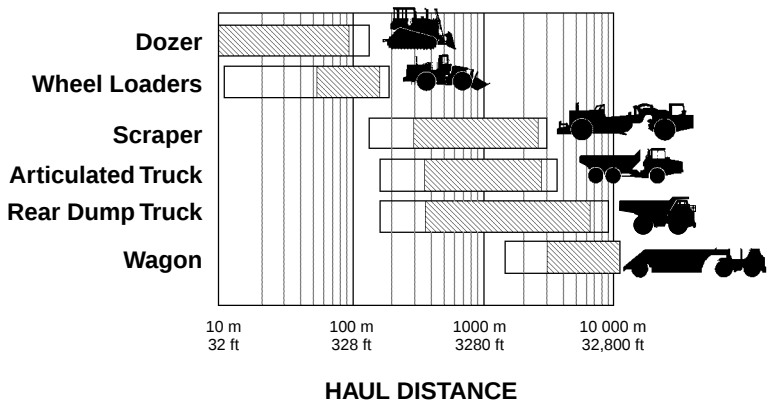
Caterpillar offers a variety of machines for different applications and jobs. Many of these separate machines function together in mining and earthmoving systems.

- 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.

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GENERAL HAUL DISTANCES FOR MOBILE SYSTEMS



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:

$$\begin{aligned} & \text{— 950F} \\ & \frac{544\,320 \text{ kg (1,200,000 lb)}/8 \text{ hr/day}}{10\,000 \text{ kg (22,000 lb)}/\text{loader cycle}} = \\ & \quad \frac{55 \text{ loader cycles}}{8 \text{ hr/day}} \\ & \frac{55 \text{ loader cycles}/8 \text{ hr/day}}{19.06 \text{ cycles}/45\text{-min hr}} = 2.88 \text{ hr/day} \\ & \quad \text{required to supply mill} \end{aligned}$$

$$\begin{aligned} & \text{— 966F} \\ & \frac{544\,320 \text{ kg (1,200,000 lb)}/8 \text{ hr/day}}{13\,500 \text{ kg (29,700 lb)}/\text{loader cycle}} = \\ & \quad \frac{41 \text{ loader cycles}}{8 \text{ hr/day}} \\ & \frac{41 \text{ loader cycles}/8 \text{ hr/day}}{19.23 \text{ cycles}/45\text{-min hr}} = 2.13 \text{ hr/day} \\ & \quad \text{required to supply mill} \end{aligned}$$

Off-Load Requirements:

$$\begin{aligned} & \text{— 950F} \\ & 20 \text{ logs/truck} \times 30 \text{ truckloads/day} = \\ & \quad 600 \text{ logs/day} \\ & 600 \text{ logs/day} \times 1180 \text{ kg (2600 lb)}/\text{log} = \\ & \quad 707\,616 \text{ kg/day} \\ & \quad \text{or} \\ & \quad 1,560,000 \text{ lbs/day} \\ & \quad \text{Incoming Wood} \end{aligned}$$

$$\begin{aligned} & \frac{707\,616 \text{ kg (1,560,000 lb)}/8 \text{ hr/day}}{10,000 \text{ kg (22,000 lb)}/\text{loader cycle}} = \\ & \quad \frac{71 \text{ loader cycles}}{8 \text{ hr/day}} \\ & \frac{71 \text{ loader cycles}/8 \text{ hr/day}}{29.45 \text{ cycles/hr}} = 3.47 \text{ hr/day} \\ & \quad \text{required to off-load wood} \end{aligned}$$

$$\begin{aligned} & \text{— 966F} \\ & 20 \text{ logs/truck} \times 30 \text{ truckloads/day} = \\ & \quad 600 \text{ logs/day} \\ & 600 \text{ logs/day} \times 1180 \text{ kg (2600 lb)}/\text{log} = \\ & \quad 707\,616 \text{ kg/day} \\ & \quad \text{or} \\ & \quad 1,560,000 \text{ lbs/day} \\ & \quad \text{Incoming Wood} \end{aligned}$$

$$\begin{aligned} & \frac{707\,616 \text{ kg (1,560,000 lb)}/8 \text{ hr/day}}{13,500 \text{ kg (29,700 lb)}/\text{loader cycle}} = \\ & \quad \frac{53 \text{ loader cycles}}{8 \text{ hr/day}} \\ & \frac{53 \text{ loader cycles}/8 \text{ hr/day}}{20.45 \text{ cycles/hr}} = 2.59 \text{ hr/day} \\ & \quad \text{required to off-load wood} \end{aligned}$$

Total Production Required:

$$\begin{aligned} & \text{— 950F} = 2.88 \text{ hr/day to supply mill} \\ & \quad 3.47 \text{ hr/day to off-load} \\ & \quad 6.35 \text{ hr/day total time} \\ & \text{— 966F} = 2.13 \text{ hr/day to supply mill} \\ & \quad 2.59 \text{ hr/day to off-load wood} \\ & \quad 4.72 \text{ hr/day total time} \end{aligned}$$

Step 5: Determine Wheel Loader selection.

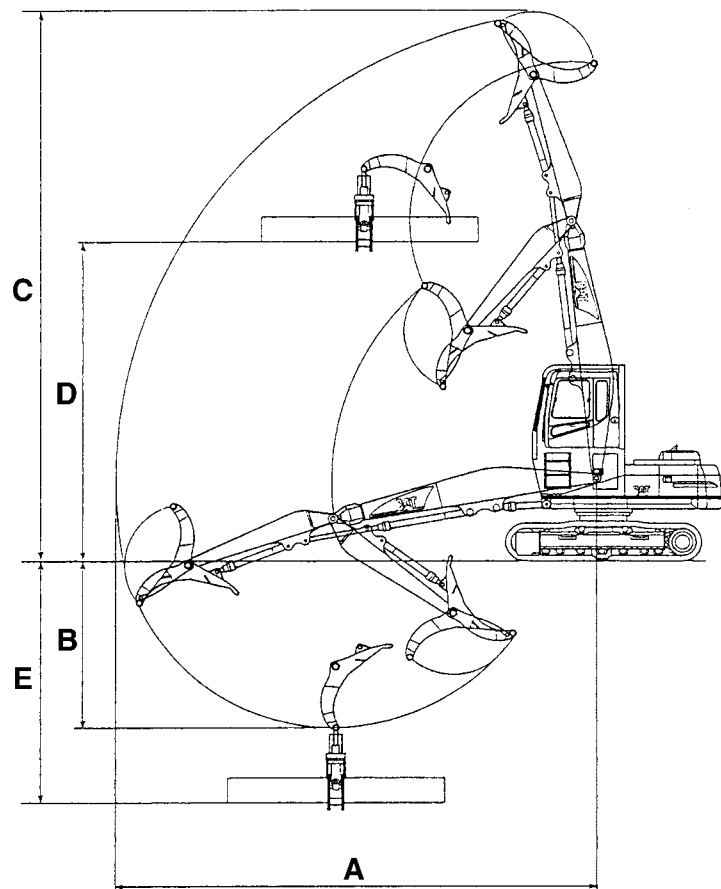
EXAMPLE:

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.

- Introduction
- Range Dimensions

Introduction

Caterpillar forestry machines are specifically designed for tough forest work. Each model uses purpose built booms and sticks designed by Caterpillar for maximum performance and durability.

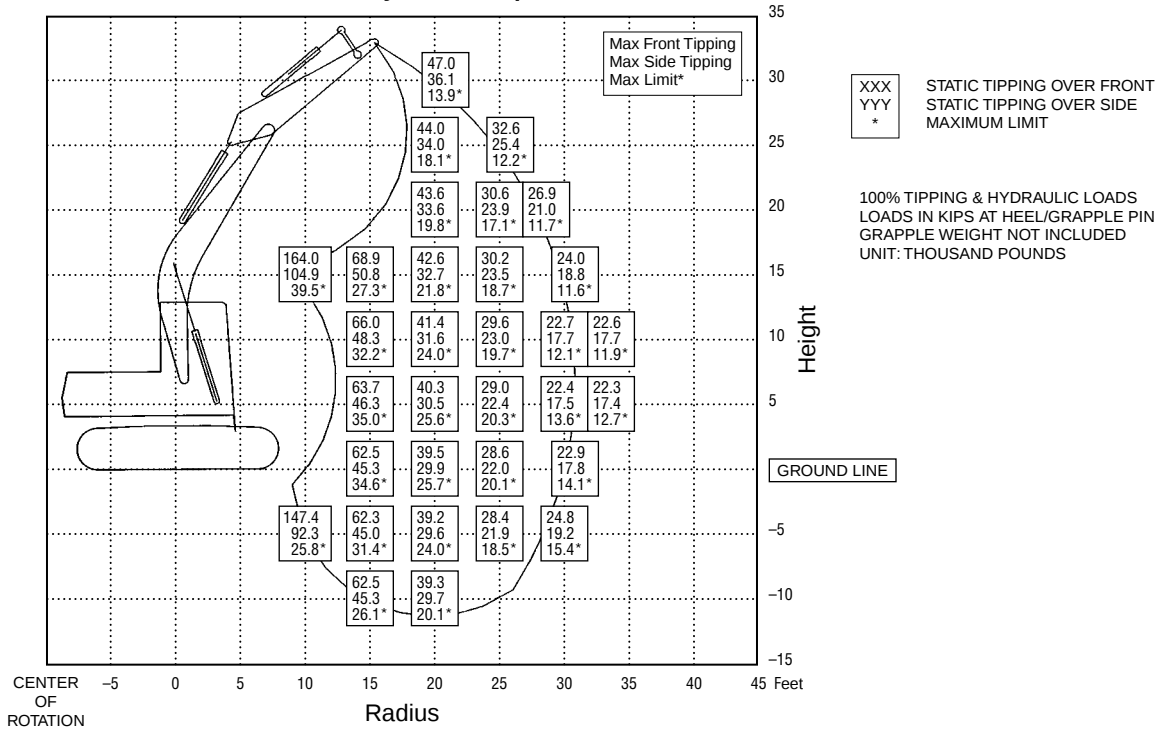


Working Envelope

	320B FM w/high wide carbody		320B FM w/reinforced carbody	
	m	ft	m	ft
A Max. Reach	10.98	36'0"	10.98	36'0"
B Max. Depth	4	13'1"	4.17	13'8"
C Max. Height	12.63	41'5"	12.46	40'10"
D Max. Deck Height	7.37	24'2"	7.20	23'7"
E Max. Deck Depth	5.68	18'8"	5.85	19'2"

LIFT AND RANGE DIAGRAM

325B High Wide Forest Machine with Hoist Cylinder Adapter

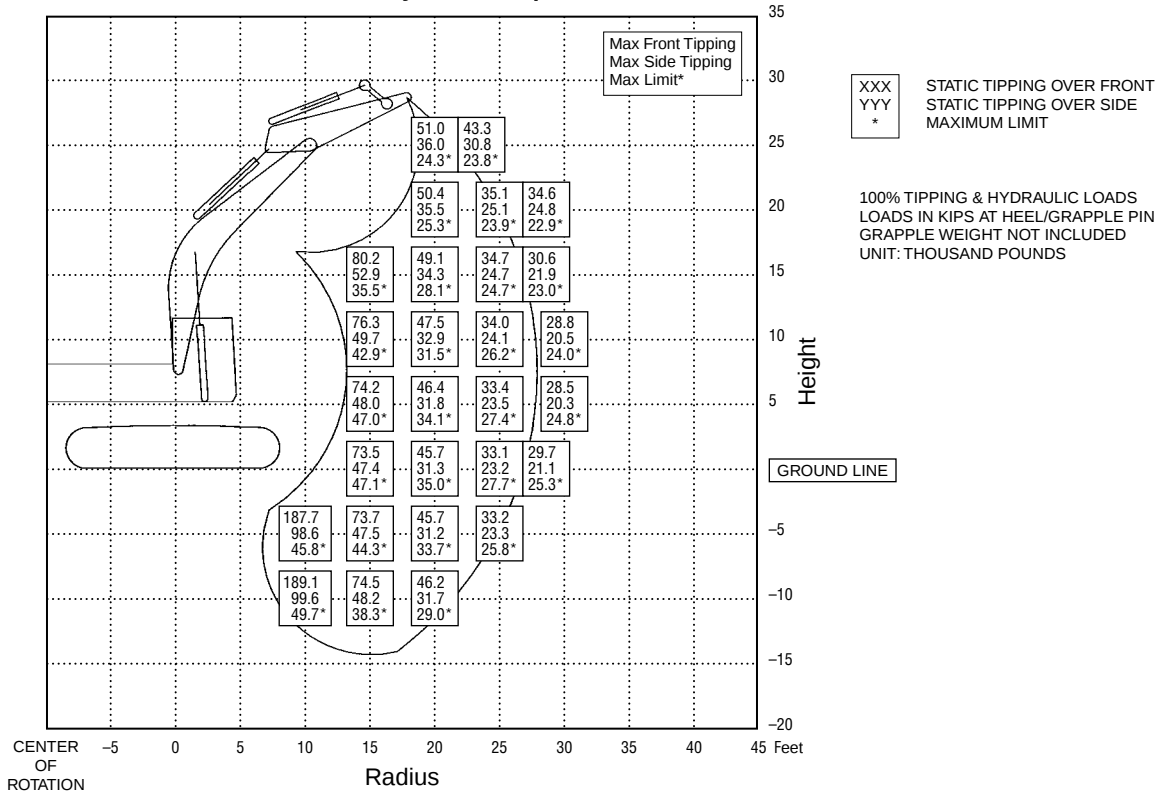


- Undercarriage — long, extended gauge
- Excavator Front — Caterpillar 325B LL with hoist cylinder adapter, heavy counterweight, R-Boom, R-Stick, 9450 mm (31'0") maximum reach
- Capacity, lbs., (thousands)
 Top Number: Tipping over front
 Middle Number: Tipping over side
 Bottom Number: Hydraulic capacity

- All capacities are 100% stability and 100% hydraulic with no deration for friction (100% efficiency)
 - Grapple weight is not included
- Calculations, weights and machine specifications are subject to change at any time without notice.

LIFT AND RANGE DIAGRAM

330B Forest Machine without Hoist Cylinder Adapter



- Undercarriage — long, standard gauge
- Excavator Front — Caterpillar 330B LL without hoist cylinder adapter, M-Boom, M-Stick, 8530 mm (28'0") maximum reach
- Capacity, lbs., (thousands)
Top Number: Tipping over front
Middle Number: Tipping over side
Bottom Number: Hydraulic capacity

- All capacities are 100% stability and 100% hydraulic with no deration for friction (100% efficiency)
 - Grapple weight is not included
- Calculations, weights and machine specifications are subject to change at any time without notice.

WEIGHTS OF COMMERCIALY IMPORTANT WOODS

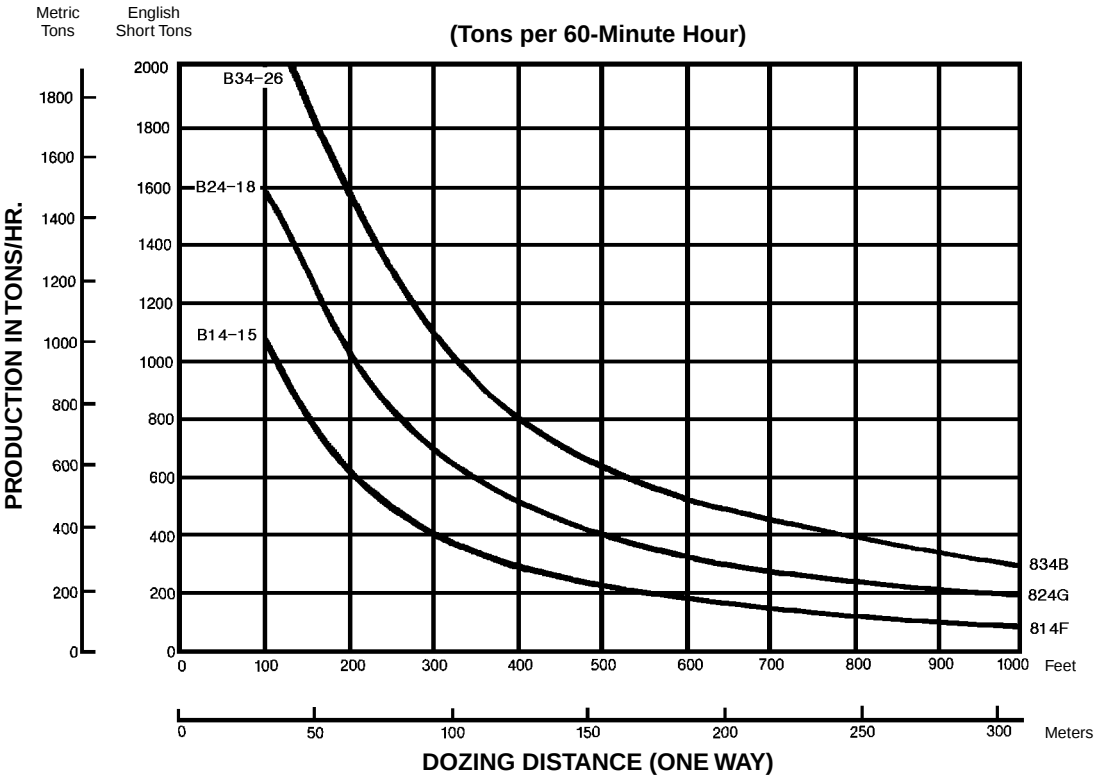
Species	kg/m ³ (Green)	lb/ft ³ (Green)
A. Temperate Zone*		
Alder, Red	737	46
Ash, White	769	48
Aspen	689	43
Baldcypress	817	51
Basswood	673	42
Beech	865	54
Birch, Paper	801	50
Yellow	929	58
Cedar, Alaska	577	36
Incense	721	45
Northern, White	449	28
Port-Orford	897	56
Western Red	433	27
Cherry, Black	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
Tupelo	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

Species	kg/m ³ (Green)	lb/ft ³ (Green)
Maple, Big Leaf	753	47
Black	865	54
Red	801	50
Silver	721	45
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	45
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.

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			Scoop Capacities (Lift and Carry)				Doze Capacities			
	Model	m	ft	Metric tons	U.S. tons	m³	yd³	Metric tons	U.S. tons	m³	yd³
834B	B34-26	5.3	17'4"	18.3	20.2	19.9	26	37.5	41.25	37.5	49
824G	B24-17	4.0	13'2"	12.3	13.5	13.0	17	24.5	27.0	26.0	34
814F	B14-15	3.7	12'3"	8.2	9.0	11.5	15	16.3	18.0	19.1	25

Refer to Track-Type Tractor/Bulldozer section for additional special attachment specifications.

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 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 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 D7R Series II with Balderson 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	6	2	0

Solution:

$$\begin{aligned} T &= B + M_1 N_1 + M_2 N_2 + M_3 N_3 + M_4 N_4 + DF \\ &= 125 + 0.4 (35) + 0.6 (6) + 2.5 (6) + 5.0 (2) + [DF=0] \\ &= 42.6 \\ &= 177.6 \text{ minutes/hectare (72 min/acre)} \end{aligned}$$

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To find the number of machines required for each operation, use the formula:

$$\text{Hr/hectare (acre)} \times \text{number of hectares (acres)} = \text{number of machines needed}^*$$

*Average machine production for all operation in hr/hectare (acre).

To cost estimate each method or phase of operation, use this calculation:

$$\text{Owning and Operating cost/hr} \times \text{hr/hectare (acre)} \times \text{number of hectares (acres)} = \text{cost}$$

Because of the many variables that increase or decrease production, these formulas should be considered only as guidelines in arriving at a rough production estimate. This estimate should be tempered by personal judgment based on past experience and personal knowledge of the area.

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 (1") and over	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

Various tire sizes and inflation pressures will greatly reduce or increase the rolling resistance. The values in this table are approximate, particularly for the track and track + tire machines. These values can be used for estimating purposes when specific performance information on particular equipment and given soil conditions is not available. See Mining and Earthmoving Section for more detail.

UNDERFOOTING	ROLLING RESISTANCE, PERCENT*			
	Tires Bias	Tires Radial	Track **	Track +Tires
A very hard, smooth roadway, concrete, cold asphalt or dirt surface, no penetration or flexing	1.5%*	1.2%	0%	1.0%
A hard, smooth, stabilized surfaced roadway without penetration under load, watered, maintained	2.0%	1.7%	0%	1.2%
A firm, smooth, rolling roadway with dirt or light surfacing, flexing slightly under load or undulating, maintained fairly regularly, watered	3.0%	2.5%	0%	1.8%
A dirt roadway, rutted or flexing under load, little maintenance, no water, 25 mm (1") tire penetration or flexing	4.0%	4.0%	0%	2.4%
A dirt roadway, rutted or flexing under load, little maintenance, no water, 50 mm (2") tire penetration or flexing	5.0%	5.0%	0%	3.0%
Rutted dirt roadway, soft under travel, no maintenance, no stabilization, 100 mm (4") tire penetration or flexing	8.0%	8.0%	0%	4.8%
Loose sand or gravel	10.0%	10.0%	2%	7.0%
Rutted dirt roadway, soft under travel, no maintenance, no stabilization, 200 mm (8") tire penetration and flexing	14.0%	14.0%	5%	10.0%
Very soft, muddy, rutted roadway, 300 mm (12") tire penetration, no flexing	20.0%	20.0%	8%	15.0%

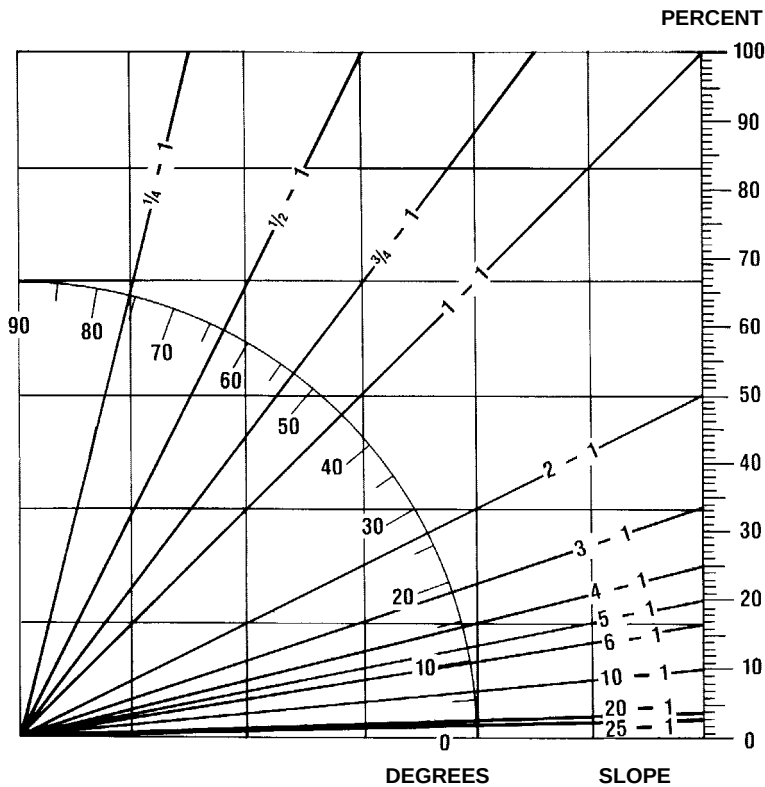
*Percent of combined machine weight.

**Assumes drag load has been subtracted to give Drawbar Pull for good to moderate conditions. Some resistance added for very soft conditions.

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

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

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