651

Wheel Tractor-Scraper

Technical Specifications

Configurations and features may vary by region. Please consult your Cat® dealer for availability in your area.

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651 Wheel Tractor-Scraper Specifications

Engine

Engine Model:		
Tractor	Cat® C18	
Rated Engine Speed:		
Tractor	2,000 rpm	
Engine Power (ISO 14396:2002):		
Tractor	469 kW	629 hp

Meets U.S. EPA Tier 4 Final/EU Stage V emission standards.

Safety Criteria Compliance Standards

Rollover Protective Structure (ROPS)	ISO 3471:2008 for up to 26 600 kg (58,643 lb)
Falling Objects Protective Structure (FOPS)	ISO 3449:2005 Level II
Brakes	ISO 3450:2011
Steering System	ISO 5010:2019
Seat Belt	ISO 6683:2005, SAE J386
Forward Horn and Reverse Alarm	ISO 9533:2010
Exterior Sound Power Level for Standard Machine	ISO 6395:2008 is 116 dB(A)
Interior Sound Pressure Level for Standard Machine	ISO 6396:2008 is 75 dB(A)

Implement Cycle Times

Apron Lower	4.1 seconds
Apron Raise	4.4 seconds
Bail Lower	1.9 seconds
Bail Raise	1.7 seconds
Bowl Lower	4.5 seconds
Bowl Raise	4.2 seconds
Ejector Extend	9.2 seconds
Ejector Retract	7.8 seconds

Transmission

Forward 1	5.7 km/h	3.5 mph
Forward 2	10.5 km/h	6.5 mph
Forward 3	12.5 km/h	7.8 mph
Forward 4	17.0 km/h	10.6 mph
Forward 5	22.8 km/h	14.2 mph
Forward 6	30.9 km/h	19.2 mph
Forward 7	41.4 km/h	25.7 mph
Forward 8	56.1 km/h	34.9 mph
Reverse	10.8 km/h	6.7 mph

Service Refill Capacities

Crankcase	52.0 L	13.7 gal
Transmission System	136.0 L	35.9 gal
Cooling System	88.6 L	23.4 gal
Fuel Tank	860 L	227.0 gal
Hydraulic System	150.0 L	39.6 gal
Diesel Exhaust Fluid (DEF)	30.5 L	8.1 gal
Differential	136.0 L	35.9 gal
Final Drive (each)	24.0 L	6.3 gal
Rear Wheels (each)	9.0 L	2.4 gal
Brake Disc Oil (Scraper)	70.0 L	48.5 gal
Windshield Washer Fluid	5.0 L	1.3 gal

General Data

Shipping (Split Configuration):		
Tractor Width	3.90 m	12.8 ft
Tractor Height	4.52 m	14.8 ft
Scraper Width	4.08 m	13.4 ft
Scraper Height	3.90 m	12.8 ft
Scraper Capacity:		
Struck	24.5 m^3	32.0 yd^3
Heaped	33.6 m^3	44.0 yd^3
Rated Load	47 174 kg 46.4 tonnes	104,000 lb 52.0 tons
Width of Cut	3.8 m	12.5 ft
Maximum Depth of Cut (Cushion Hitch Locked)	417 mm	16.4 ft
Maximum Depth of Spread	660 mm	26.0 ft
Top Speed (Loaded)	56.1 km/hr	34.9 mph
180° Curb-to-Curb Turning Width (Right)	13.85 m	45.4 ft
Tire Size	40.5/75 R39 ** E-3	
Operating Weight (Michelin Tires, Full Fuel, Without Operator)		
Unloaded	65 770 kg	145,000 lb
With Rated Load	112 945 kg	249,000 lb
Overall Length	16.3 m	53.5 ft

Sound Performance

The exterior sound power level for the standard machine (ISO 6395:2008) is 116 dB(A).

The interior sound pressure level for the standard machine (ISO 6396:2008) is 75 dB(A).

- The operator sound pressure level was measured according to ISO 6396:2008.The measurement was conducted at 100% of the maximum engine cooling fan speed.
- The machine sound power level was measured according to ISO 6395:2008.The measurement was conducted at 100% of the maximum engine cooling fan speed.
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in a noisy environment.

Air Conditioning System

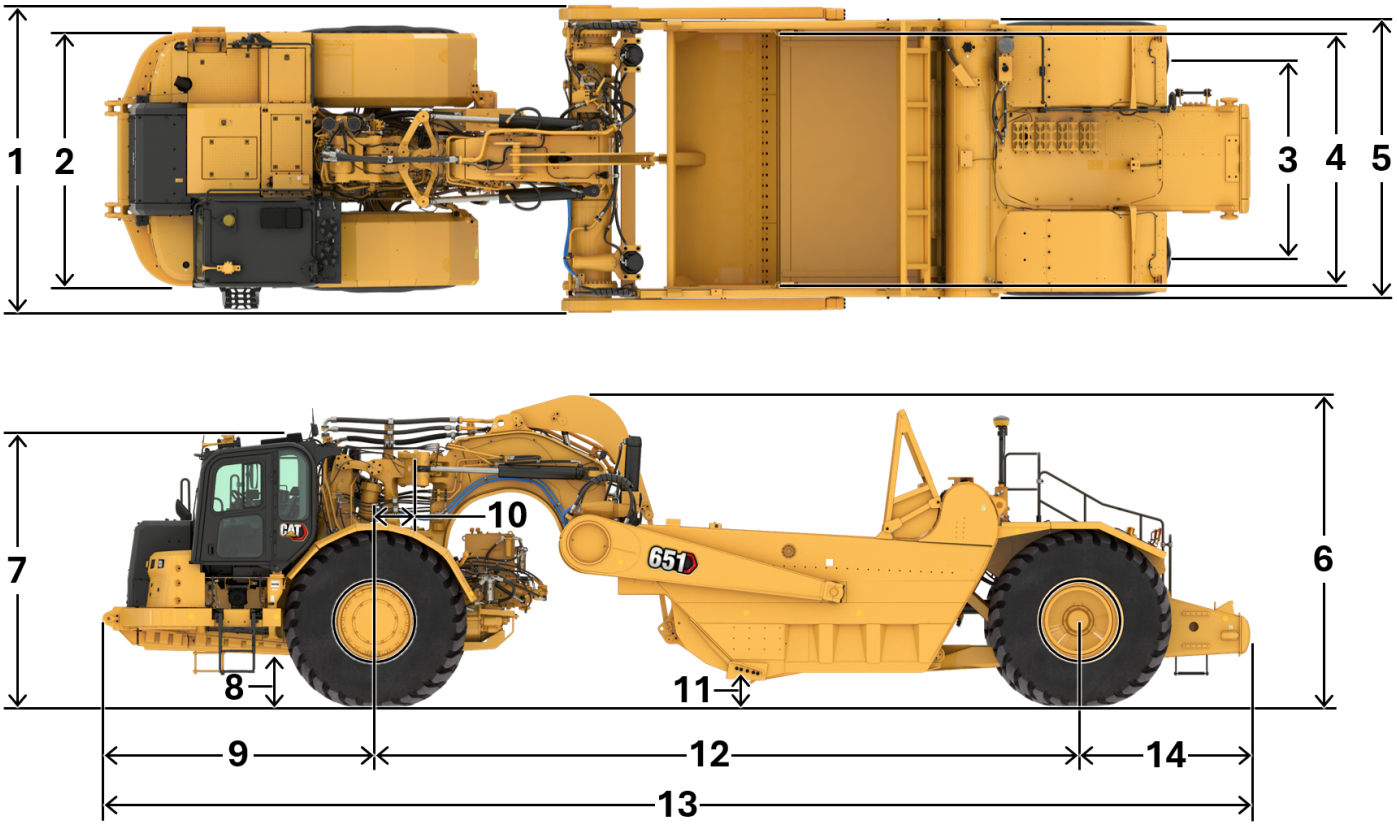
The air conditioning system on this machine contains the fluorinated greenhouse gas refrigerant R134a or R1234yf. Refer to the machine labeling for identification of the gas.

- If equipped with R134a (Global Warming Potential = 1430), the system contains 1.9 kg (4.2 lb) of refrigerant which has a CO_2 equivalent of 2.71 metric tonnes (2.99 tons).
- If equipped with R1234yf (Global Warming Potential = 0.501), the system contains 1.85 kg (4.1 lb) of refrigerant which has a CO_2 equivalent of 0.001 metric tonnes (0.001 tons).

651 Wheel Tractor-Scraper Specifications

Dimensions

All dimensions are approximate.



		651	
1	Overall Machine Width	4.36 m	14.30 ft
2	Tractor Width	3.62 m	11.88 ft
3	Rear Tire Centers Width	2.81 m	9.23 ft
4	Inside of Bowl Width	3.68 m	12.07 ft
5	Outside Bowl Width	3.91 m	12.84 ft
6	Overall Machine Height	4.42 m	14.49 ft
7	Height to Top of Cab	3.89 m	12.77 ft
8	Tractor Ground Clearance	0.70 m	2.30 ft
9	Front of Tractor to Front Axle	3.88 m	12.72 ft
10	Axle to Vertical Hitch Pin	0.55 m	1.80 ft
11	Cutting Edge Height – Maximum	0.66 m	2.17 ft
12	Wheelbase	9.96 m	32.68 ft
13	Overall Machine Length	16.30 m	53.46 ft
14	Rear Axle to Rear of Machine	2.46 m	8.06 ft

Rimpull-Speed-Gradeability Curves: Example Tutorial

USE OF RIMPULL-SPEED-GRADEABILITY CURVES

The following explanation applies to Rimpull-Speed-Gradeability curves for wheel tractor-scrapers, construction and mining trucks/tractors, and articulated trucks.

Maximum speed attainable, gear range, and available rimpull can be determined from curves on the following pages when machine weight and total effective grade (or total resistance) are known.

Rimpull is the force (in kg, lb, or kN) available between the tire and the ground to propel the machine (limited by traction).

Weight is defined as gross machine weight (kg or lb) = machine + payload

Total effective grade (or total resistance) is grade resistance plus rolling resistance expressed as percent grade.

Grade is measured or estimated.

Rolling resistance is estimated (see tables section for typical values).

10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade

Example:

With a 6% grade and a rolling resistance of 40 kg/metric ton (80 lb/U.S. ton), find total resistance.

Rolling resistance = 40 kg/t ÷ 10 = 4% effective grade (English: 80 lb ÷ 20 = 4%)

Total resistance = 4% rolling + 6% grade = 10%

Altitude Derating

Rimpull force and speed must be derated for altitude similar to flywheel horsepower. The percentage loss in rimpull force approximately corresponds to the percentage loss in flywheel horsepower. See tables section for altitude derations.

Rimpull-Speed-Gradeability

To determine gradeability performance: Read from gross weight down to the % of total resistance. [Total resistance equals actual % grade plus 1% for each 10 kg/metric ton (20 lb/U.S. ton) of rolling resistance.] From this weight-resistance point, read horizontally to the curve with the highest obtainable speed range, then down to the maximum speed. Usable rimpull depends upon traction and weight on drive wheels.

Example Problem:

A 637 with an estimated payload of 37 013 kg (81,600 lb) is operating on a total effective grade of 10%. Find the available rimpull and maximum attainable speed.

Empty weight + payload = gross weight

47 628 kg + 37 013 kg = 84 641 kg

(105,002 lb + 81,600 lb = 186,602 lb)

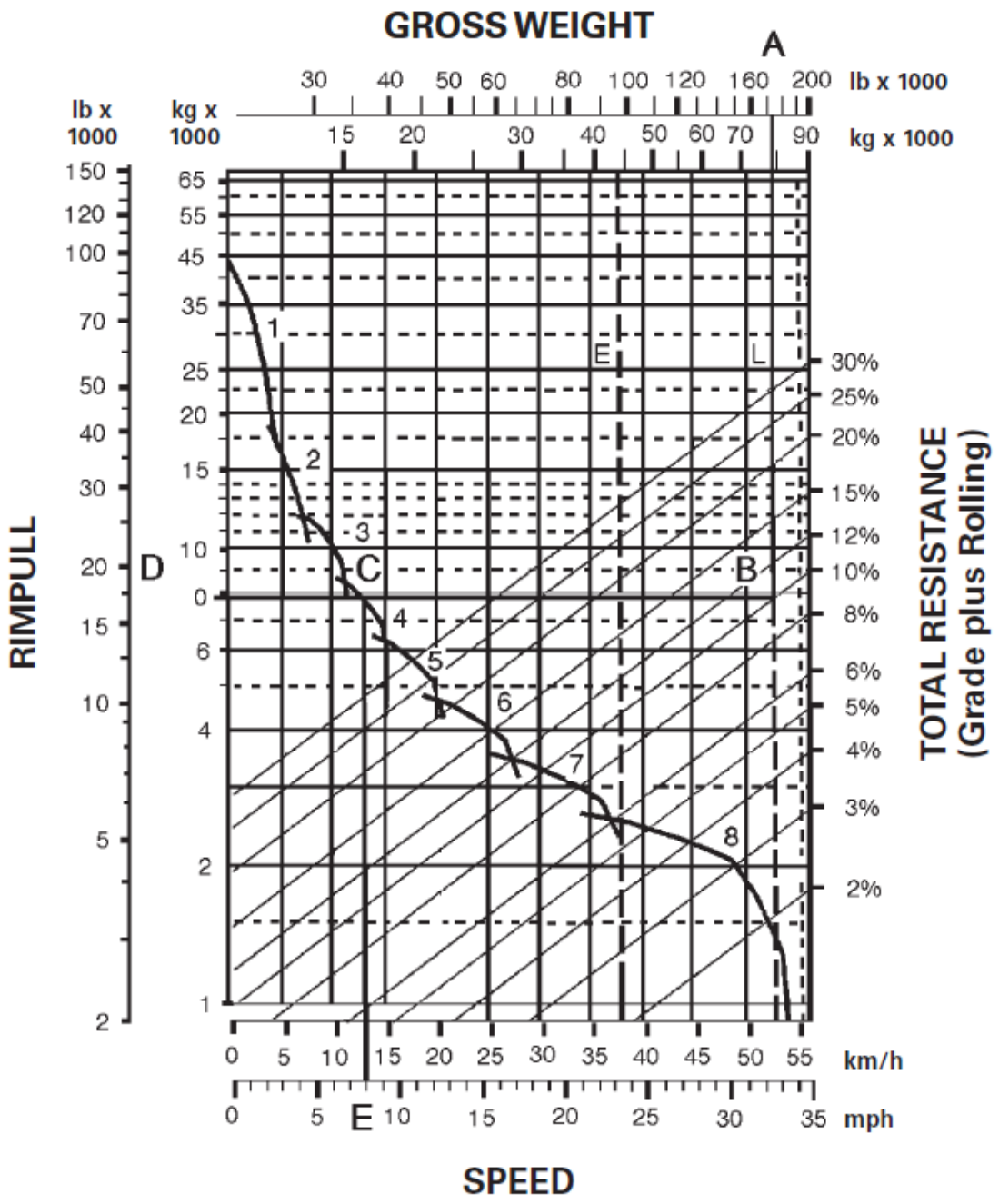
Solution: Using graph on the next page, read from 84 641 kg (186,602 lb) (point A) on top of gross weight scale down the line to the intersection of the 10% total resistance line (point B).

Go across horizontally from B to the rimpull scale on the left (point D). This gives the required rimpull: 7756 kg (17,100 lb).

Where the line cuts the speed curve (point C), read down vertically (point E) to obtain the maximum speed attainable for the 10% effective grade: 12.9 km/h (8 mph).

Answer: The machine will climb the 10% effective grade at a maximum speed of 12.9 km/h (8 mph) in 4th gear. Available rimpull is 7756 kg (17,100 lb).

Rimpull-Speed-Gradeability Curves: Example Tutorial



KEY

1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

A — Loaded 84 641 kg (186,602 lb)
B — Intersection with 10% total resistance line
C — Intersection with rimpull curve (4th gear)
D — Required rimpull 7756 kg (17,100 lb)
E — Speed 12.9 km/h (8 mph)

Retarder Curves: Example Tutorial

USE OF RETARDER CURVES

The following explanation applies to retarder curves for Wheel Tractor-Scrapers and Articulated Trucks.

The speed that can be maintained (without use of service brake) when the machine is descending a grade with retarder fully on can be determined from the retarder curves in this section if gross machine weight and total effective grade are known.

Total Effective Grade (or Total Resistance) is grade assistance minus rolling resistance.

10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade

Example:

15% favorable grade with 5% rolling resistance. Find Total Effective Grade.

Total Effective Grade = 15% Grade Assistance – 5%

Rolling Resistance = 10% Total Effective Grade Assistance

Example Problem:

A 651 with an estimated payload of 47 175 kg (104,000 lb) descends a 10% total effective grade. Find constant speed and gear range with maximum retarder effort. Find travel time if the slope is 610 m (2,000 ft) long.

Empty weight + payload = Gross Weight = 60 950 kg + 47 175 kg = 108 125 kg (134,370 lb + 104,000 lb = 238,370 lb)

Retarder Curves: Example Tutorial

Solution: Using the retarder curve below, read from 108 125 kg (238,370 lb) (point A) on top of Gross Weight scale down the line to the intersection of the 10% Effective Grade line (point B).

Go across horizontally from point B to the intersection of the retarder curve (point C). Point C intersects at the 5 (5th gear) range.

Where point C intersects the retarder curve, read down vertically to point D on the bottom scale to obtain the constant speed: 21.7 km/h (13.5 mph).

Answer: The 651 will descend the slope at 21.7 km/h (13.5 mph) in 5th gear. Travel time is 1.68 minutes.

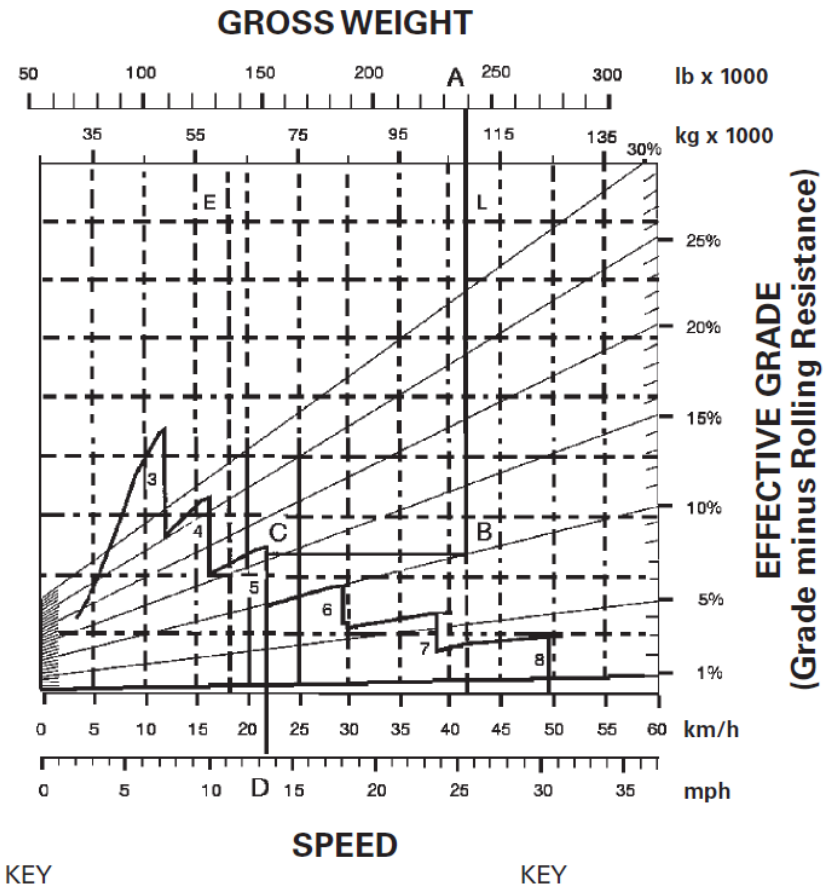
$$\frac{610 \text{ m}}{363 \text{ m/min}} = 1.68 \text{ min}$$

$$\frac{2000 \text{ ft}}{13.5 \text{ mph} \times 88^*} = 1.68 \text{ min}$$

* (mph x 88 = F.P.M.)

$$\frac{60 \times 610}{21.7 \times 1000} = T = (1.68)$$

Note: The basic Distance-Speed-Time formula is 60 D ÷ S = T (or "60 D Street"), where 60 is minutes, D is distance, S is speed, and T is time. In the above problem, 60 × 610 m ÷ 21.7 km/h × 1000 = T.



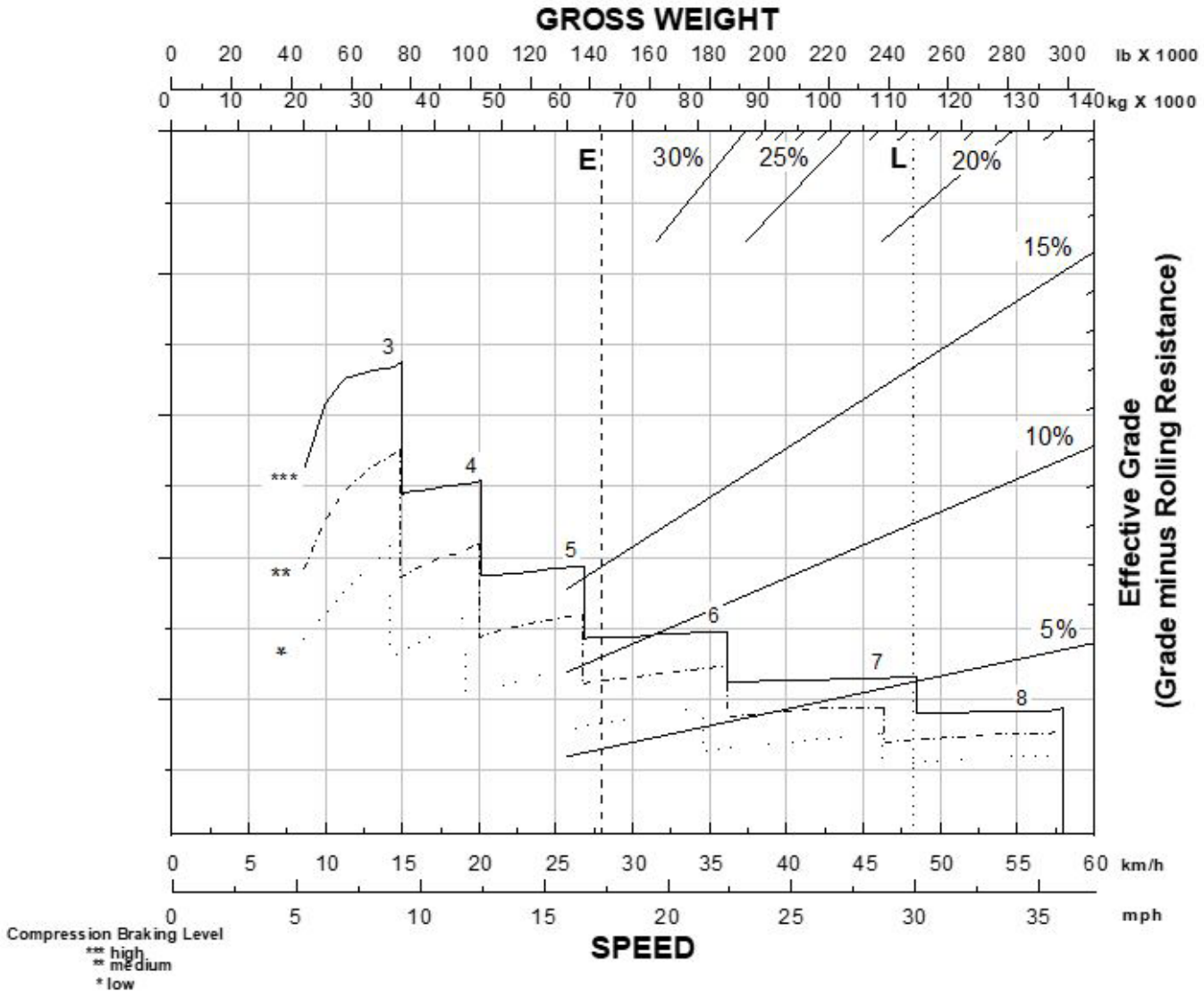
KEY

3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

A — Loaded 108 125 kg (238,370 lb)
B — Intersection with 10% effective grade line
C — Intersection with retarder curve (5th gear)
D — Constant speed 21.7 km/h (13.5 mph)

Retarder Curves-37.25R35 Tires



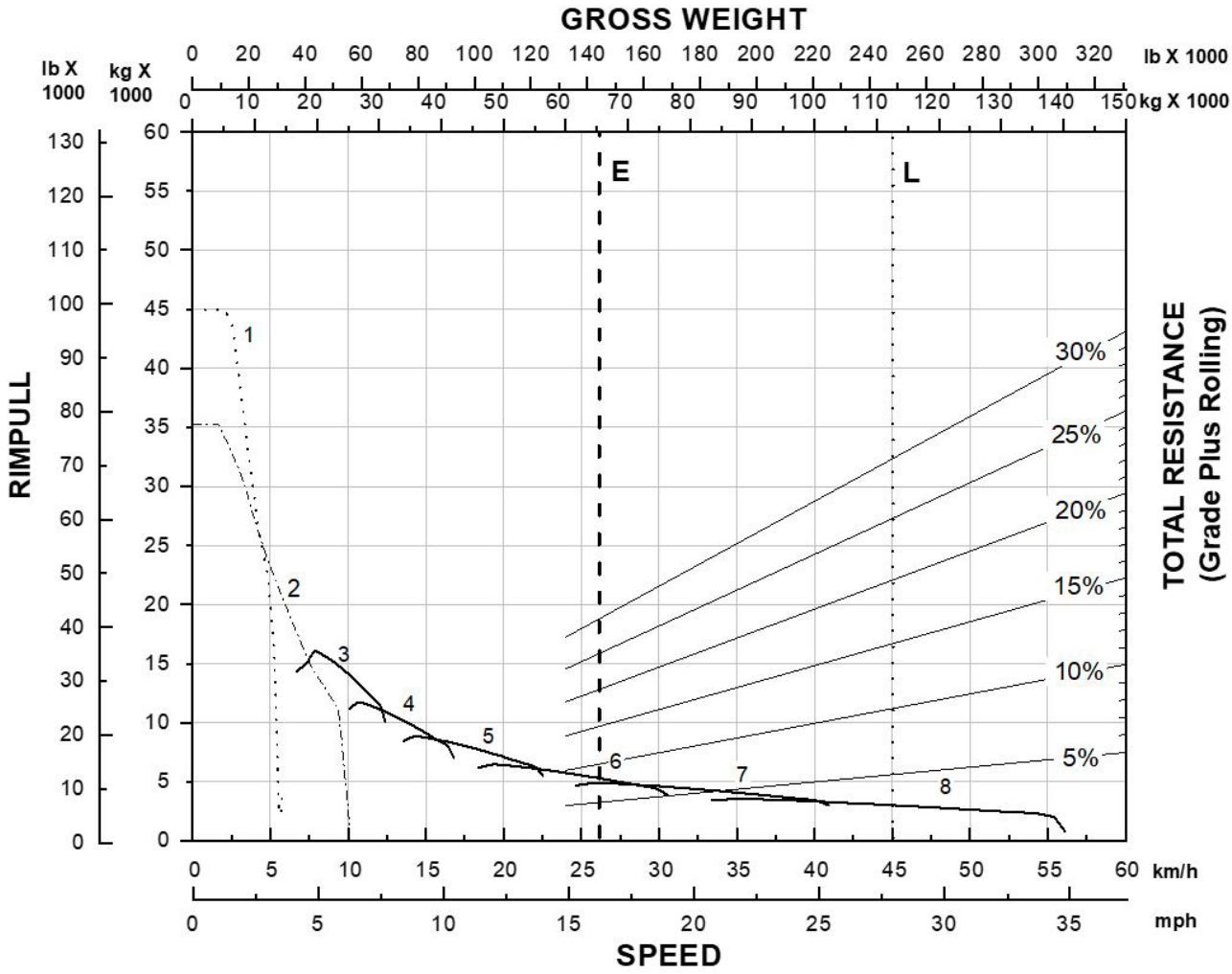
KEY

3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

E – Empty 65 770 kg (145,000 lb)
L – Loaded 112 945 kg (249,000 lb)

Rimpull-Speed-Gradeability Curves -37.25R35 Tires



*at sea level

KEY

1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
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6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

E — Empty 65 770 kg (145,000 lb)
L — Loaded 112 945 kg (249,000 lb)

Standard Equipment and Optional Attachments

Standard equipment and optional attachments may vary. Consult your Cat® dealer for details.

	Standard	Optional
POWERTRAIN – TRACTOR		
Cat® C18 engine (Meets U.S. EPA Tier 4 Final and EU Stage V emission standards)	✓	
Cat engine brake	✓	
Differential Lock	✓	
Electric start, 24V	✓	
Fan, hydraulic	✓	
Ground-level engine shutdown	✓	
Guard, crankcase	✓	
Starting aid, ether	✓	
Braking system: primary and secondary, wet disc, hydraulic; parking, hydraulic released, spring-applied	✓	
Transmission: 8-speed planetary powershift, Electronic Clutch Pressure Control (ECPC), Advanced Productivity Electronic Control Strategy (APECS) software, programmable top gear selection, transmission hold, guard – powertrain, ground speed control, machine speed limit	✓	
POWERTRAIN – SCRAPER		
Braking system: primary and secondary, wet disc, hydraulic	✓	
ELECTRICAL – TRACTOR		
Alternator, 115 amp	✓	
Batteries (4), 12V, 1,000 CCA, maintenance-free	✓	
Electrical system, 24V	✓	
Lighting system: LED headlights low beam and high beam, flood lights, cutting edge, and bowl lights are LED.	✓	
Starting/charging receptacle	✓	
ELECTRICAL – SCRAPER		
Alarm, backup	✓	
Lighting system: LED brake/turn indicators	✓	
OPERATOR ENVIRONMENT - TRACTOR		
HVAC powered air precleaner	✓	
HVAC system, heat, AC, defrost	✓	
Thermostat control of HVAC system	✓	
Coat hook	✓	
Lunchbox platform with holding strap	✓	
Diagnostic connection	✓	
12V power ports (2)	✓	
Dome courtesy light	✓	
Horn, electric	✓	
T-Handle implement control	✓	
254 mm (10 in) touchscreen information display	✓	
Radio ready	✓	
Rollover protective structure/falling objects protective structure (ROPS/FOPS) cab, pressurized	✓	

	Standard	Optional
OPERATOR ENVIRONMENT – TRACTOR (CONTINUED)		
Keypad switches: throttle lock, wipers/washers, hazard lights, retarding level select, work lights on/off, information mode on the touchscreen display	✓	
Seat belt, static two-piece	✓	
Steering wheel, tilt, telescoping, padded	✓	
Windows, right side emergency egress	✓	
Work Area Vision (3) Camera System	✓	
Powered access ladder	✓	
Seat – Cat Advanced Ride Management (ARM), Cat Comfort Series III, rotates 30 degrees	✓	
FLUIDS		
Extended life coolant to -37°C (-34°F)	✓	
OTHER STANDARD EQUIPMENT – TRACTOR		
Accumulators (brake and cushion hitch) with Canadian Registration Number (CRN)	✓	
Fast oil change (engine)	✓	
Vandalism locks	✓	
Steering locks	✓	
Secondary Steering (ground driven)	✓	
Heater, engine coolant 120V	✓	
OTHER STANDARD EQUIPMENT – SCRAPER		
Bowl: 24.5 m^3 (32.0 yd^3) - struck, 33.6 m^3 (44.0 yd^3) - heaped	✓	
Hydraulic Position Sensing Cylinders (Bowl lift and apron)	✓	
Fast-fill fuel tank	✓	
Fenders-Scraper	✓	
Overflow guard	✓	
Scraper Push-Frame Guards	✓	
OTHER ATTACHMENTS		
Cab beacon with air horn		✓
INTEGRATED TECHNOLOGIES		
Sequence Assist and Cat Payload	✓	
Cat Grade		✓
Product Link		✓
SERVICE INSTRUCTIONS		
Film arrangement – U.S. (ANSI)		✓
Film arrangement – International (ISO)		✓

651 Environmental Declaration

The following information applies to the machine at the time of final manufacture as configured for sale in the regions covered in this document. The content of this declaration is valid as of the date issued; however, content related to machine features and specifications are subject to change without notice. For additional information, please see the machine's Operation and Maintenance Manual.

For more information on sustainability in action and our progress, please visit https://www.caterpillar.com/en/company/sustainability.

Engine

- The Cat® C18 engine meets U.S. EPA Tier 4 Final and EU Stage V emission standards..
- Cat U.S. EPA Tier 4 and EU Stage V engines are required to use ULSD (ultra-low sulfur diesel fuel with 15 ppm of sulfur or less) and are compatible* with ULSD blended with the following lower-carbon intensity fuels** up to:
  - ✓ 20% biodiesel FAME (fatty acid methyl ester)***
  - ✓ 100% renewable diesel, HVO (hydrotreated vegetable oil) and GTL (gas-to-liquid) fuels

** While Caterpillar engines are compatible with these alternative fuels, some regions may not allow their use.*

*** Tailpipe greenhouse gas emissions from lower-carbon intensity fuels are essentially the same as traditional fuels.*

**** Engines with no aftertreatment devices are compatible with higher blends, up to 100% biodiesel (for use of blends higher than 20% biodiesel, consult your Cat dealer).*

Air Conditioning System

The air conditioning system on this machine contains the fluorinated greenhouse gas refrigerant R134a or R1234yf. Refer to the machine labeling for identification of the gas.

- If equipped with R134a (Global Warming Potential = 1430), the system contains 1.9 kg (4.2 lb) of refrigerant which has a CO_2 equivalent of 2.71 metric tonnes (2.99 tons).
- If equipped with R1234yf (Global Warming Potential = 0.501), the system contains 1.85 kg (4.1 lb) of refrigerant which has a CO_2 equivalent of 0.001 metric tonnes (0.001 tons).

Paint

- Based on best available knowledge, the maximum allowable concentration, measured in parts per million (PPM), of the following heavy metals in paint are:
  - – Barium < 0.01%
  - – Cadmium < 0.01%
  - – Chromium < 0.01%
  - – Lead < 0.01%

Sound Performance

The exterior sound power level for the standard machine (ISO 6395:2008) is 116 dB(A).

The interior sound pressure level for the standard machine (ISO 6396:2008) is 75 dB(A).

- The operator sound pressure level was measured according to ISO 6396:2008.The measurement was conducted at 100% of the maximum engine cooling fan speed.
- The machine sound power level was measured according to ISO 6395:2008.The measurement was conducted at 100% of the maximum engine cooling fan speed.
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in a noisy environment.

Oils and Fluids

- Caterpillar factory fills with ethylene glycol coolants. Cat Diesel Engine Antifreeze/Coolant (DEAC) and Cat Extended Life Coolant (ELC) can be recycled. Consult your Cat dealer for more information.
- Cat Bio HYDO™ Advanced is an EU Ecolabel approved biodegradable hydraulic oil.

Additional fluids are likely to be present, please consult the Operations and Maintenance Manual or the Application and Installation guide for complete fluid recommendations and maintenance intervals.

Features and Technology

- The following features and technology may contribute to fuel savings and/or carbon reduction. Features may vary. Consult your Cat dealer for details.
  - – Ground speed control helps lower fuel burn by allowing the operator to set the desired top speed and the machine will find the optimal gear for the engine and transmission
  - – Standard Sequence Assist automates repetitive tasks, such as loading, hauling and dumping, to help reduce operator fatigue and rework caused during manual operation and to help reduce fuel burn and greenhouse gas emissions
  - – Advanced Productivity Electronic Control System (APECS) allows the engines and transmission to communicate on a high level to better utilize the power and torque
  - – Optional Cat Grade helps operators of all skill levels avoid costly rework, wasteful fuel burn and greenhouse gas emissions to execute the design plan with greater speed and accuracy
  - – On-demand hydraulic fan helps reduce fuel consumption and under-hood heat for longer component life
  - – Improve jobsite efficiency with lower operating costs with Product Link™ and VisionLink™ insights

For more complete information on Cat products, dealer services, and industry solutions, visit us on the web at **www.cat.com.**

Materials and specifications are subject to change without notice. Featured machines in photos may include additional equipment. See your Cat dealer for available options.

AEXQ3297-03 (11-2025)
Replaces: AEXQ3297-02
Build Number: 11
(Global, excluding Japan)