WHEEL DOZERS
SOIL COMPACTORS

CONTENTS

WHEEL DOZERS

Features:

- **Reliable Cat power train:** four-stroke-cycle diesel with adjustment-free fuel system ... full power shift with single lever on-the-go shifting.
- **Articulated frame steering** with hinge point midway between front and rear axles ... short turning radius, long wheelbase ... rear and front wheels track at all times.
- **Machine balance** ... equal weight distribution on axles when blading.
- **All dozer functions,** including tip and tilt, hydraulically controlled from operator's seat.



MODEL	814F2		824H		834H	
Flywheel Power	173 kW	**232 hp**	264 kW	**354 hp**	372 kW	**498 hp**
Operating Weight*	21 713 kg	**47,877 lb**	28 724 kg	**63,325 lb**	47 106 kg	**103,849 lb**
Engine Model	**C9 ACERT**		**C15 ACERT**		**C18 ACERT**	
Rated Engine RPM	**2100**		**1800**		**1800**	
No. Cylinders	**6**		**6**		**6**	
Displacement	8.8 L	**537 in³**	15.2 L	**928 in³**	18.1 L	**1104 in³**
Speeds:						
Forward	**4**		**4**		**4**	
Reverse	**4**		**4**		**3**	
Top Speed Forward	30.9 km/h	**19.2 mph**	32.1 km/h	**20 mph**	38.5 km/h	**23.9 mph**
Turning Circle with Blade	7.17 m	**23'6"**	14.6 m	**48'0"**	17.6 m	**57'9"**
Standard Tire Size	**23.5-25, 12 PR (L-2)**		**29.5R25 (L-3)**		**35/65-R33, 24 PR (L-4)**	
Fuel Tank Refill Capacity	446 L	**118 U.S. gal**	672 L	**178 U.S. gal**	793 L	**209 U.S. gal**
GENERAL DIMENSIONS:						
Height (to top of ROPS)	3.3 m	**10'8"**	3.7 m	**12'1"**	4.09 m	**13'5"**
Height (stripped top)**	2.4 m	**7'9"**	2.6 m	**8'5"**	3.15 m	**10'4"**
Wheel Base	3.35 m	**11'0"**	3.7 m	**12'1"**	4.55 m	**14'11"**
Overall Length with Dozer	6.9 m	**22'8"**	8.2 m	**27'0"**	10.42 m	**34'2"**
Width (over standard tires)	2.8 m	**9'2"**	3.28 m	**10'9"**	3.47 m	**11'5"**
Ground Clearance	366 mm	**14.4"**	400 mm	**15.7"**	540 mm	**21"**
STRAIGHT BULLDOZER:						
Width	3.6 m	**11'8"**	4.51 m	**14'8"**	5.07 m	**16'8"**
Height	1.1 m	**3'6"**	1.23 m	**4'0"**	1.46 m	**4'9"**
Capacity	2.73 LCM	**3.6 LCY**	4.67 LCM	**6.11 LCY**	7.87 LCM***	**10.3 LCY*****
Ground Clearance Below Skid Shoe	718 mm	**2'4"**	955 mm	**3'1.6"**	1390 mm	**4'7"**
Depth of Cut	528 mm	**20.8"**	430 mm	**16.9"**	455 mm	**17.9"**
Tilt Adjustment	795 mm	**2'6"**	1.18 m	**3'9"**	1.48 m	**4'10"**
Tip Adjustment	**15°**		**22.4°**		**21°**	
Lift Speed	0.4 m/sec	**1.3 ft/sec**	0.46 m/sec	**1.46 ft/sec**	0.81 m/sec	**2.66 ft/sec**

*Operating Weight includes straight dozer, (U-blade on 834H) lubricants, coolant, ROPS cab, full fuel tank and operator. 75% $CaCl_2$ in all tires adds the following weight to each model: 814F2 — 2342 kg **(5164 lb)**, 824H — 4296 kg **(9472 lb)**, 834H — 5719 kg **(12,608 lb)**.

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

***Capacity of 834H U-Blade is 11.16 LCM **(14.6 LCY)**.

MODEL	844H		854K	
Flywheel Power	468 kW	**627 hp**	597 kW	**801 hp**
Operating Weight*	70 815 kg	**156,120 lb**	98 100 kg	**216,273 lb**
Engine Model	**C27**		**C32 ACERT**	
Rated Engine RPM	**2000**		**1750**	
No. Cylinders	**12**		**12**	
Displacement	27.1 L	**1666 in³**	32.1 L	**1959 in³**
Speeds:				
Forward	**3**		**3**	
Reverse	**3**		**3**	
Top Speed Forward	21 km/h	**13 mph**	21.2 km/h	**13.2 mph**
Turning Circle with Blade	21.73 m	**71'4"**	23.4 m	**76'9"**
Standard Tire Size	**45/65-R39, PR (L-4)**		**45/65-R45 (L-4)**	
Fuel Tank Refill Capacity	1016 L	**268 U.S. gal**	1562 L	**413 U.S. gal**
GENERAL DIMENSIONS:				
Height (to top of ROPS)	5.023 m	**16'6"**	5590 mm	**18'3"**
Height (stripped top)**	3.8 m	**12'6"**	5234 mm	**17'2"**
Wheel Base	4.6 m	**15'1"**	5890 mm	**19'3"**
Overall Length with Dozer	10.94 m	**35'9"**	13 405 mm	**44'0"**
Width (over standard tires)	4.37 m	**14'4"**	3556 mm	**11'8"**
Ground Clearance	431 mm	**1'5"**	691 mm	**27"**
SEMI-U DOZER:				
Width	5.278 m	**17'4"**	6321 mm	**20'8"**
Height	1.877 m	**6'2"**	5590 mm	**18'3"**
Capacity	16.1 m³	**21.1 yd³**	25.4 m³	**33.1 yd³**
Ground Clearance Below Skid Shoe	1372 mm	**4'6"**	691 mm	**27"**
Depth of Cut	466 mm	**18"**	398 mm	**1'3"**
Tilt Adjustment	830 mm	**2'9"**	1165 mm	**3'8"**
Tip Adjustment	**13°**		**15°**	
Lift Speed	0.353 m/sec	**1.2 ft/sec**	0.310 m/sec	**1.05 ft/sec**

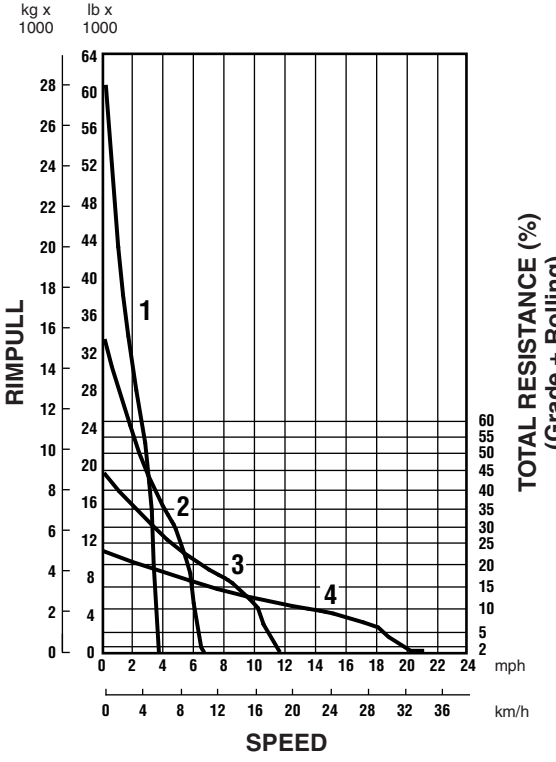
*Operating Weight includes Semi-U, coolant, ROPS cab, full fuel tank and operator. If 75% $CaCl_2$ is added to all four tires, the weight increases by 11 112 kg **(24,500 lb)** on the 844H and 12 144 kg **(26,770 lb)** on the 854K.

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

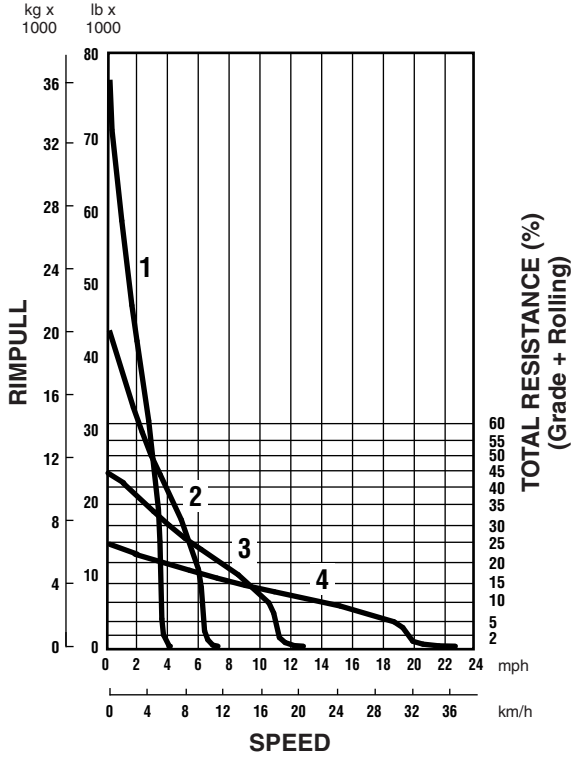
MODEL	814F2		824H		834H*		844H*		854K*	
FORWARD GEAR	km/h	**mph**	km/h	**mph**	km/h	**mph**	km/h	**mph**	km/h	**mph**
1	5.7	**3.6**	6.1	**3.8**	6.8	**4.2**	7.0	**4.4**	7.1	**4.4**
2	10.2	**6.4**	10.5	**6.5**	11.6	**7.2**	12.2	**7.6**	12.4	**7.7**
3	17.9	**11.2**	18.3	**11.4**	20.3	**12.6**	21.0	**13.0**	21.1	**13.1**
4	31.0	**19.3**	32.1	**20.0**	35.4	**22.0**	—		—	
REVERSE GEAR										
1	6.5	**4.1**	6.9	**4.3**	6.8	**4.2**	7.7	**4.6**	7.7	**4.8**
2	11.6	**7.3**	12.0	**7.5**	12.2	**7.6**	13.4	**8.4**	13.5	**8.4**
3	20.4	**12.7**	20.8	**13.0**	21.4	**13.3**	23.0	**14.3**	23.5	**14.6**
4	34.9	**21.8**	36.6	**22.7**	—		—		—	

*2% rolling resistance.

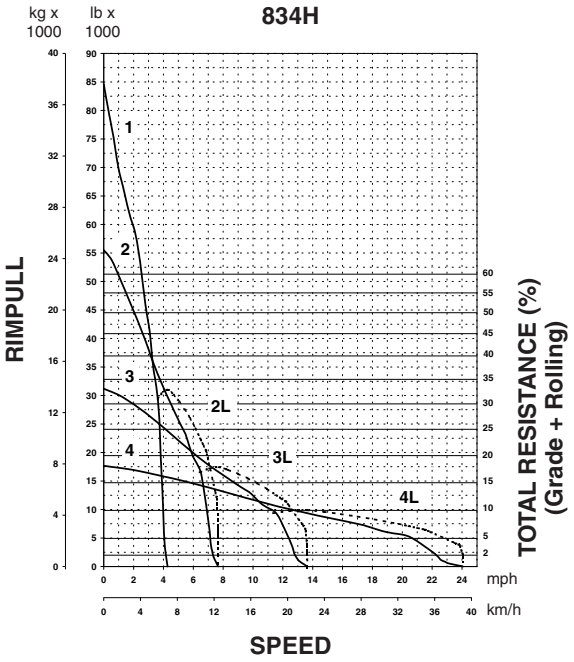
814F2



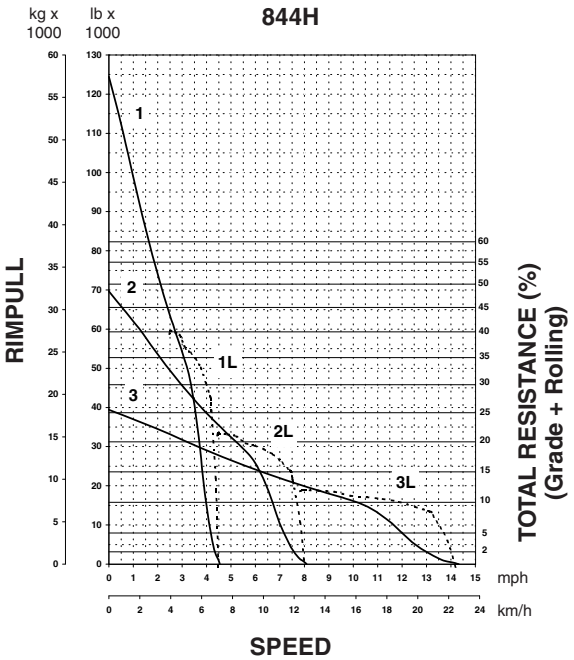
824H

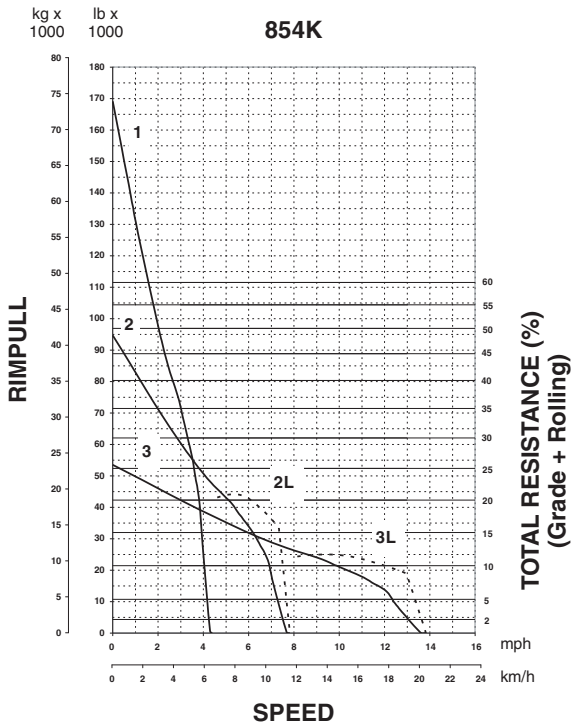


KEY
1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear
4 – 4th Gear



KEY
1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear
4 – 4th Gear
Direct Drive
Torque Converter





11

CONSIDERATIONS IN MACHINE SELECTION

The following factors should be considered when comparing wheels vs. tracks:

Traction

You can figure coefficient of traction, depending on underfoot conditions, from the Table Section in this book.

Wheels — up to 0.65 (in quarry pit with good floor)

Track — up to 0.90 (in soils permitting grouser penetration)

Usable Rimpull = Machine Weight × Coefficient of Traction

Speed

Wheels — travel speeds up to three times higher than track.

Maneuverability

Articulated steering and good visibility give wheel tractors high maneuverability.

Cost

See Owning and Operating Costs section. Tire vs. undercarriage costs can often be the deciding factor in selecting wheels or tracks.

Compaction

Ground Pressure:

Wheels — from 241 kPa (35 psi) to 310 kPa (45 psi)

Tracks — from 82 kPa (12 psi) to 97 kPa (14 psi)

Application

Utility … mobility, maneuverability and good speed suit wheel tractors for yard and stockpile work and for clean-up around shovels. Lower maintenance costs may be realized in certain soils that can be highly abrasive to track-type undercarriages.

Coal pile … recommend wheel tractors in this application when following conditions are present:
— Long push distances
— Need for good material spread
— High degree of compaction desired

Production Dozing … a wheel tractor should be considered in the following conditions:
— Long push distances
— Loose soils, little or no rock
— Level or downhill work
— Good underfoot conditions

Pushloading Scrapers … a wheel tractor should be considered in the following conditions:
— Thin scraper cut
— Good underfoot conditions — no rock
— Higher push speeds

Chip and Coal Scoops … may adversely affect performance and/or reliability, particularly when adverse grades are encountered.

COUNTERWEIGHTS AND BALLAST

For each specific application, there is a correct machine weight for proper balancing of traction, flotation, mobility and response.

- Low machine weight may increase tire slipping and wear, but improves flotation, mobility and machine response.
- High machine weight increases traction, but decreases mobility and response.

The machine weight is optimum for the operating conditions when wheel slipping barely occurs in the gear being used. Weight distribution under operating conditions should then be approximately equal between the wheels to balance power to each axle.

Application

Lower machine weight is usually required for typical second gear applications, such as fill spreading, stockpiling, road maintenance, towing compactors and shovel cleanup.

Higher machine weight is usually required for such typical first gear applications as heavy dozing and pushloading.

Tire Ballast

A solution of calcium chloride and water is recommended for tire ballast. It has the advantage of low cost with simple quick adjustment to suit working conditions.

TIRE SELECTION & MAINTENANCE

Requirements of traction, flotation and tire life are met by a choice of tire size, tread design and inflation pressure.

Tire Width

For good conditions with little rolling resistance on surfaces where flotation is no problem, a narrower tire may be most economical. It may also be considered in muddy conditions in which the mud can be penetrated to reach firm earth underneath.

Where flotation problems and increased rolling resistance are encountered, wider tires are recommended. The greater contact area and shallower penetration increases flotation.

Tire Size

Larger optional tires will also improve flotation in soft conditions. With larger diameter, rimpull will be reduced which may be desirable to help control wheel spin.

Traction Tread (L-2) tire's penetration ability provides improved traction under some soil conditions.

Rock Tread (L-3) offers improved traction and a more cut resistant rubber compound than the L-2. It provides more rubber at the ground with the same footprint and reduces tire penetration under abrasive conditions. Recommended on any hard smooth surface such as rock, concrete or compacted earth.

Rock — Deep Tread (L-4) provides 50% more tread depth, thicker undertread and sidewall with increased tire life when compared to the L-3 tire. Recommended in rock conditions where sharp fragments cause high tire wear or sudden failures.

Rock — Extra Deep Tread (L-5) provides 150% more tread depth when compared to the L-3 tire. Intended for severe rock conditions with extreme penetration hazards.

Chains should be considered in severe applications where extra tread tires still give unsatisfactory life. Operating costs vary greatly depending on application, underfoot conditions, wheel spin and chain maintenance. Under normal rock operating conditions (short cycle, low average speed and minimum wheel spin) the maximum estimated chain life is about 2000 hours. Before installing chains, carefully weigh their overall economics against known tire costs. Chains are not recommended with new rock extra tread tires but can extend the life of a used tire. Always check clearance around tires before using chains.

Major applications where chains can be considered include:

— stripping rock or rocky soils
— clean-up work around rock loading shovels
— any application where underfoot conditions cause excessive tire wear.

Inflation Pressure

In average operating conditions the recommended inflation pressure prevents excessive deflection and minimizes tire rollover on side slopes.

Over-inflation

Reduces amount of tread contact with ground and provides less flotation. Over-inflation causes center of tread to wear faster and increases the chance of cuts and impact breaks.

Under-inflation

Can cause permanent tire damage in the form of flex breaks, radial cracks, and tread or ply separation. On jobs where wrinkling and bead rollover *are not* apparent, inflation pressure may be reduced to a minimum of:

Bias Ply — 170 kPa (25 psi) on 35/65-33
170 kPa (25 psi) on 29.5-25
170 kPa (25 psi) on 26.5-25
170 kPa (25 psi) on 23.5-25

Radial — 310 kPa (45 psi) on 35/65-R33
310 kPa (45 psi) on 29.5-R25
205 kPa (30 psi) on 26.5-R25
240 kPa (35 psi) on 23.5-R25

Reduced pressure will:

Increase flotation and traction in sand.
Improve envelopment characteristics to reduce sudden death failure on rock jobs.
Provide better tread wear by reducing contact pressure between tire and ground.

Consult your tire manufacturer before changing tire pressures.

MODEL	814F2		824H		824H	
Type	Straight		Straight		SU-Blade	
Capacity**	2.66 m^3	**3.5 yd^3**	4.67 m^3	**6.11 yd^3**	6.88 m^3	**9.0 yd^3**
Weight, Dozer*	3740 kg	**8245 lb**	5136 kg	**11,323 lb**	—	
General Dimensions (Tractor & Dozer)						
Length	6.9 m	**22'6"**	8.2 m	**26'9"**	—	
Width	3.6 m	**11'8"**	4.51 m	**14'8"**	4.44 m	**14'7"**
Blade:						
Width (including std. end bits)	3.6 m	**11'8"**	4.51 m	**14'8"**	4.44 m	**14'7"**
Height	1100 mm	**3'6"**	1229 mm	**4'0"**	1584 mm	**5'2"**
Max. Digging Depth	528 mm	**20.8"**	430 mm	**16.9"**	542 mm	**21"**
Ground Clearance @ Full Lift Under Skid Plate	718 mm	**2'4"**	955 mm	**3'1.6"**	996 mm	**3'3"**
Tilt Adjust. from Horizontal	795 mm	**2'6"**	1180 mm	**3'9"**	1166 mm	**3'10"**
Total Tip Adjustment	**15°**		**22.4°**		—	

MODEL	824H		824H		834H	
Type	U-Blade		Extreme Service U-Blade		Straight	
Capacity**	6.88 m^3	**9.0 yd^3**	6.88 m^3	**9.0 yd^3**	7.9 m^3	**10.33 yd^3**
Weight, Dozer*	—		—		6880 kg	**15,170 lb**
General Dimensions (Tractor & Dozer)						
Length	—		—		10.42 m	**34'2"**
Width	4.34 m	**14'3"**	4.34 m	**14'3"**	5.07 m	**16'7"**
Blade:						
Width (including std. end bits)	4.34 m	**14'3"**	4.34 m	**14'3"**	5.07 m	**16'7"**
Height	1365 mm	**4'6"**	1365 mm	**4'6"**	1466 mm	**4'9"**
Max. Digging Depth	518 mm	**20"**	518 mm	**20"**	455 mm	**17.9"**
Ground Clearance @ Full Lift Under Skid Plate	956 mm	**3'2"**	956 mm	**3'2"**	1324 mm	**4'7"**
Tilt Adjust. from Horizontal	1139 mm	**3'9"**	1139 mm	**3'9"**	1270 mm	**4'2"**
Total Tip Adjustment	—		—		**20.5°**	

MODEL	834H		834H		844H		854K	
Type	U-Blade		SU-Blade		Semi-U		Semi-U	
Capacity**	11.13 m^3	**14.56 yd^3**	10.13 m^3	**13.25 yd^3**	15.9 m^3	**20.7 yd^3**	25.4 m^3	**33.1 yd^3**
Weight, Dozer*	8470 kg	**18,670 lb**	—		15 670 kg	**34,520 lb**	21 910 kg	**48,270 lb**
General Dimensions (Tractor & Dozer)								
Length	10.42 m	**34'2"**	—		10.94 m	**35'9"**	13.405 m	**44'0"**
Width	5.15 m	**16'11"**	4.69 m	**15'5"**	5.42 m	**17'8"**	6.321 m	**20'7"**
Blade:								
Width (including std. end bits)	5.15 m	**16'11"**	4.69 m	**15'5"**	5.42 m	**17'8"**	6.321 m	**20'7"**
Height	1437 mm	**4'9"**	1779 mm	**5'10"**	1834 mm	**5'9"**	2179 mm	**7'1"**
Max. Digging Depth	442 mm	**17.4"**	507 mm	**20.0"**	466 mm	**18.3"**	398 mm	**15.7"**
Ground Clearance @ Full Lift Under Skid Plate	1338 mm	**4'4"**	1352 mm	**4'5"**	1372 mm	**4'6"**	1540 mm	**5'.04"**
Tilt Adjust. from Horizontal	1270 mm	**4'2"**	1270 mm	**2'2"**	830 mm	**2'8.7"**	1165 mm	**3'8"**
Total Tip Adjustment	**22°**		**22°**		**13°**		**15°**	

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

COAL U-BLADE	814F2		824H		834H	
Model:	**Coal U-Blade**		**Coal U-Blade**		**Coal U-Blade**	
Replaces "S" Blade						
Blade:						
Capacity	11 m^3	**14 yd^3**	16.1 m^3	**21 yd^3**	22.3 m^3	**29 yd^3**
Length (Cutting Width)	4318 mm	**14'2"**	4801 mm	**15'9"**	5680 mm	**18'7"**
Height, wing section (tapered down)	1473 mm	**4'10"**	1803 mm	**5'11"**	1960 mm	**6'5"**
Wing Angle		**25°**		**30°**		**30°**
Weight, Installed (Without Hydraulics)	1950 kg	**4300 lb**	3193 kg	**7040 lb**	5020 kg	**11,300 lb**

	844H		854K	
Model:	**Coal U-Blade**		**Coal U-Blade**	
Replaces "S" Blade				
Blade:				
Capacity	30.7 m^3	**40.2 yd^3**	44.7 m^3	**58.2 yd^3**
Length (Cutting Width)	5846 mm	**19'2"**	7200 mm	**23'7"**
Height, wing section (tapered down)	2024 mm	**6'8"**	2500 mm	**8'2"**
Wing Angle		**30°**		**30°**
Weight, Installed (Without Hydraulics)	6237 kg	**13,830 lb**	10 333 kg	**22,780 lb**

WOODCHIP U-BLADE	824H		834H	
Model:	**Woodchip U-Blade**		**Woodchip U-Blade**	
Replaces "S" Blade				
Blade:				
Capacity	24 m^3	**31 yd^3**	30.1 m^3	**40 yd^3**
Length (Cutting Width)	4775 mm	**15'8"**	5700 mm	**18'8"**
Height, wing section	2261 mm	**7'5"**	2350 mm	**7'8"**
Wing Angle		**30°**		**30°**
Weight	3515 kg	**7750 lb**	5155 kg	**11,600 lb**

COAL SCOOP WITH TILT	814F2		824H		834H	
Model:	**Coal Scoop with Tilt**		**Coal Scoop with Tilt**		**Coal Scoop with Tilt**	
Scoop:						
Lift and Carrying Capacity	11.5 m^3	**15 yd^3**	13.4 m^3	**17.5 yd^3**	22.9 m^3	**30 yd^3**
Dozing Capacity	19.1 m^3	**25 yd^3**	26.8 m^3	**35 yd^3**	45.8 m^3	**60 yd^3**
Width	3734 mm	**12'3"**	4058 mm	**13'4"**	4880 mm	**15'11"**
Height	1626 mm	**5'4"**	1839 mm	**6'1"**	2382 mm	**7'10"**
Overall Length	7.3 m	**24'0"**	5.3 m	**17'6"**		—
Weight	5216 kg	**11,500 lb**	6763 kg	**14,913 lb**	9501 kg	**20,949 lb**
Dump Clearance	1041 mm	**3'5"**	1398 mm	**4'7"**	1524 mm	**5'0"**

CHIP SCOOP WITH TILT	814F2		824H		834H	
Model:	**Chip Scoop with Tilt**		**Chip Scoop with Tilt**		**Chip Scoop with Tilt**	
Scoop:						
Lift and Carrying Capacity	15.3 m^3	**20 yd^3**	20.6 m^3	**27 yd^3**	26.7 m^3	**35 yd^3**
Dozing Capacity	30.6 m^3	**40 yd^3**	41.3 m^3	**54 yd^3**	53.5 m^3	**70 yd^3**
Width	3734 mm	**12'3"**	4039 mm	**13'3"**	4876 mm	**16'0"**
Height	2286 mm	**7'6"**	2489 mm	**8'2"**	2692 mm	**8'10"**
Weight	5390 kg	**11,880 lb**	11 420 kg	**19,125 lb**	9711 kg	**21,410 lb**

Notes —

SOIL COMPACTORS

CONTENTS

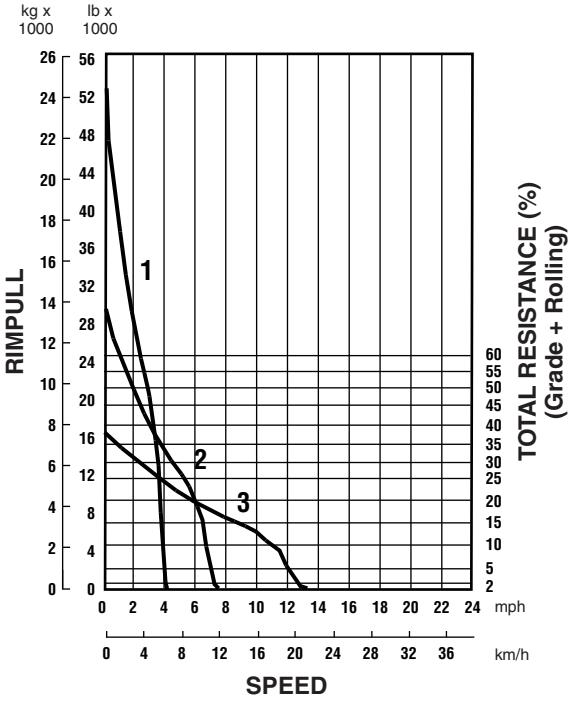
Features:

- **Dozing, filling and compacting versatility.**
- **High speed operation** with responsive Cat diesel engine, single-lever planetary power shift transmission, and all-wheel drive.
- **Articulated frame** makes maneuvering quick and easy. Long wheel base for stability.
- **Wheels with tamping foot design and chevron pattern** give traction, penetration and compaction needed for high production. Foot pattern reversed on trailing drums to prevent overprinting lead drums.
- **Rear drums track front** for double compactive effort. Drum spacing covers mid-axle strip on return pass.
- **Rear axle oscillation** keeps all drums on ground for traction and stability.
- **Cleaner bars** keep drums free of carry over earth regardless of rolling direction. Adjustable, replaceable.
- **Optional fill spreading dozer** has single lever control for raise, lower, hold and float. (Blade tilt optional.)

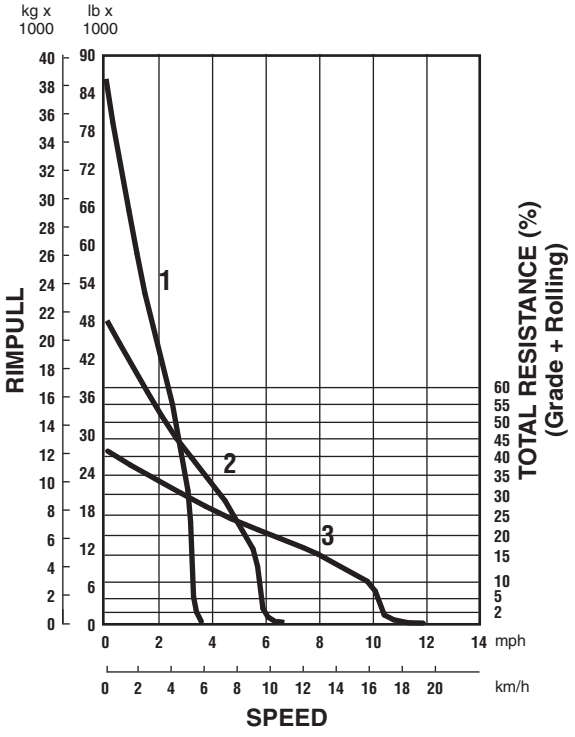
MODEL	815F2		825H	
Flywheel Power	173 kW	**232 hp**	264 kW	**354 hp**
Operating Weight*	20 755 kg	**45,765 lb**	32 734 kg	**72,164 lb**
Engine Model	**C9 ACERT**		**C15 ACERT**	
Rated Engine RPM	**2100**		**1800**	
No. Cylinders	**6**		**6**	
Displacement	8.8 L	**537 in³**	15.1 L	**928 in³**
Speeds:				
Forward	**3**		**3**	
Reverse	**3**		**3**	
Turning Radius — outside Corner of Blade	6.45 m	**21'3"**	7.4 m	**24'0"**
Fuel Tank Refill Capacity	446 L	**118 U.S. gal**	603 L	**159 U.S. gal**
TAMPING FOOT WHEELS:				
Each Drum Width	991 mm	**3'3"**	1125 mm	**3'8"**
Diameters, over feet	1.42 m	**4'8"**	1.68 m	**5'5"**
over drum	1.03 m	**3'5"**	1.29 m	**4'3"**
Feet per Wheel	**60**		**65**	
Feet per Row	**12**		**13**	
Rows of Feet	**5**		**5**	
Foot Length	191 mm	**7.5"**	188 mm	**7.4"**
End Area Per Foot	134 cm²	**20.8 in²**	192 cm²	**29.75 in²**
Width of Two Pass Coverage	4.2 m	**13'9"**	5.3 m	**17'4"**
GENERAL DIMENSIONS:				
Height (top of ROPS)	3.34 m	**11'0"**	3.75 m	**12'3"**
Height (stripped top)**	2.39 m	**7'10"**	2.69 m	**8'10"**
Wheel Base	3.35 m	**11'0"**	3.7 m	**12'1"**
Overall Length with Dozer	6.80 m	**23'6"**	8.43 m	**27'8"**
Width over Drums	3.24 m	**10'8"**	3.65 m	**12'0"**
Ground Clearance	390 mm	**15.4"**	414 mm	**16"**
STRAIGHT BULLDOZER:				
Width over End Bits	3.76 m	**12'4"**	4.62 m	**15'1"**
Height with Cutting Edge	860 mm	**2'10"**	1030 mm	**3'4"**

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

815F2



825H



KEY
1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear

11

COMPACTION FUNDAMENTALS

The following discussion applies to soil compaction only. For information on refuse compaction, see Waste Disposal section of this book.

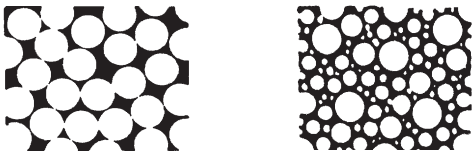
Definition

Compaction is the process of physically densifying or packing the soil … resulting in increased weight per unit volume. It is generally accepted that the strength of a soil can be increased by densification. Three important factors affect compaction.

— Material gradation
— Moisture content
— Compactive effort

Material Gradation — refers to the distribution (% by weight) of the different particle sizes within a given soil sample. A sample is *well-graded* if it contains a good, even distribution of particle sizes. A sample composed of predominantly one size particle, is said to be *poorly-graded*. In terms of compaction, a well-graded soil will compact more easily than one that is poorly-graded. In well-graded material the smaller particles tend to fill the empty spaces between the larger particles, leaving fewer voids after compaction.

MATERIAL GRADATION



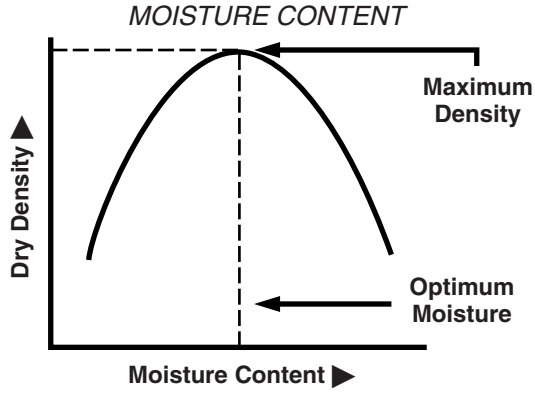
Poorly-graded Well-graded

Moisture Content — or the amount of water present in a soil, is very important to compaction. Water lubricates soil particles thus helping them slide into the most dense position. Water also creates clay particle bonding, giving cohesive materials their sticky qualities.

OPTIMUM MOISTURE

Heavy clay	17.5%
Silty clay	15.0%
Sandy clay	13.0%
Sand	10.0%
Gravel, sand, clay mix (pit run)	7.0%

Experience has shown that it is very difficult, if not impossible, to achieve proper compaction in materials that are too dry or too wet. Soil experts have determined that in practically every soil there is an amount of water, called optimum moisture content, at which it is possible to obtain maximum density with a given amount of compactive effort. The curve below shows this relationship between dry density and moisture content. It is called a compaction curve, moisture-density curve or Proctor curve.



Compactive Effort — refers to the method employed by a compactor to impart energy into the soil to achieve compaction. Compactors are designed to use one or a combination of the following types of compactive effort.

— Static weight (or pressure)
— Kneading action (or manipulation)
— Impact (or sharp blow)
— Vibration (or shaking)

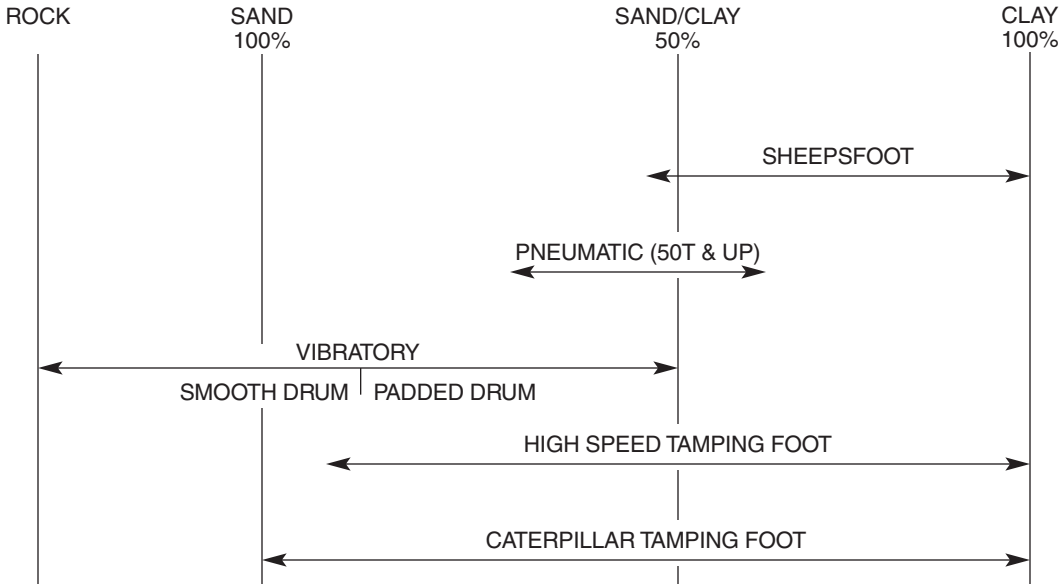
COMPACTOR TYPES

Compaction equipment can be grouped generally into the following classifications:
sheepsfoot
vibratory
pneumatic
high speed tamping foot
chopper wheels (see Landfill Compactor section)

Combinations of these types are also available, such as a vibrating smooth steel drum.

For ease of comparison, the compactors have been placed on the Zones of Application Chart shown below. This chart contains a range of material moistures from 100% clay to 100% sand, plus a rock zone. Each type has been positioned in what is considered to be its most effective and economical zone of application. However, it is not uncommon to find them working out of their zones. Exact positioning of the zones can vary with differing material conditions.

RANGES OF SOIL TYPES FOR SOIL COMPACTION EQUIPMENT



COMPACTOR PRODUCTION

Compactor production is expressed in compacted cubic meters (Cm^3) or compacted cubic yards (CCY) per hour. Material in its natural or bank state is measured in bank cubic meters or yards (Bm^3 or BCY). When it is removed or placed in a fill, it is measured in loose cubic meters or yards (Lm^3 or LCY).

When the loose material is worked into a compacted state, the relationship of *compacted material to bank material* is shown as the shrinkage factor (SF).

$$SF = \frac{\text{Compacted cubic meters } (Cm^3)}{\text{Bank cubic meters } (Bm^3)}$$

$$SF = \frac{\text{Compacted cubic yards (CCY)}}{\text{Bank cubic yards (BCY)}}$$

The construction industry has developed the following formula for use in estimating compactor production. This formula gives the material volume a given machine can compact in a 60-minute hour.

Metric Method

$$Cm^3 = \frac{W \times S \times L}{P}$$

W = Compacted width per pass, in meters. (For Cat Compactors it is recommended that W = Twice the width of one wheel.)

S = Average speed, in kilometers per hour.

L = Compacted thickness of lift, in millimeters.

P = Number of machine passes to achieve compaction **(can only be determined by testing the compacted material density on-the-job).**

English Method

$$CCY/hr = \frac{W \times S \times L \times 16.3}{P}$$

W = Compacted width per pass, in feet. (For Cat Compactors it is recommended that W = Twice the width of one wheel.)

S = Average speed, in miles per hour.

L = Compacted thickness of lift, in inches.

16.3 = Conversion constant, equals 5280 feet ÷ 12 inches ÷ 27 cubic feet

P = Number of machine passes to achieve compaction **(can only be determined by testing the compacted material density on-the-job).**

Example problem (Metric)

Determine production for an 815F2 operating under the following conditions:

P = 5, S = 10 km/h, L = 100 mm

Refer to 815F2 in the production table on the next page. Read down the first column until reaching section for 5 passes. Within this section in the second column, find the speed closest to 10 km/h. Read across this line to the 100 mm compacted lift. Read the production figure given.

Answer: 377 Cm^3/h. (Since the machine's speed of 10 km/h is slightly faster than the 9.5 of the table, production may be interpolated slightly higher — say 395 Cm^3/h.)

Example problem (English)

Determine production for an 825H operating under the following conditions:

P = 4, S = 8 mph, L = 6 inches

Refer to the production estimating table on the next page. This table contains estimates for the 815F2 and 825H Compactors using various speeds, lift thicknesses and number of passes. These figures were calculated using the formula discussed on this page. The figures represent 100% efficiency. W = Twice the width of one wheel.

In the 825H portion of this table, read down the first column until reaching the section for four passes. Within this section in the second column, find the line for 8 mph. Read across this line to the lift thickness column for 6 inches. Read the production figure given.

Answer: 1444 CCY/hr.

● ● ●

PRODUCTION TABLE

MODEL AND MACHINE PASSES*		AVERAGE SPEED km/h	mph	COMPACTED LIFT THICKNESS 100 mm m³/h	4 in yd³/hr	150 mm m³/h	6 in yd³/hr	200 mm m³/h	8 in yd³/hr	250 mm m³/h	10 in yd³/hr
815F2	3	6.5	**4**	419	**548**	628	**822**	837	**1095**	—	
		9.5	**6**	628	**822**	942	**1232**	1256	**1643**	—	
		13.0	**8**	837	**1095**	1256	**1643**	1675	**2191**	—	
	4	6.5	**4**	314	**411**	471	**616**	628	**822**	—	
		9.5	**6**	471	**616**	706	**924**	942	**1232**	—	
		13.0	**8**	628	**822**	942	**1232**	1256	**1643**	—	
	5	6.5	**4**	251	**329**	377	**493**	502	**657**	—	
		9.5	**6**	377	**493**	565	**739**	754	**986**	—	
		13.0	**8**	502	**657**	754	**986**	1005	**1314**	—	
	6	6.5	**4**	286	**274**	314	**411**	419	**548**	—	
		9.5	**6**	314	**411**	471	**616**	628	**822**	—	
		13.0	**8**	419	**548**	628	**822**	837	**1095**	—	
825H	3	6.5	**4**	488	**642**	731	**962**	975	**1283**	1219	**1604**
		9.5	**6**	713	**962**	1069	**1444**	1425	**1925**	1781	**2406**
		13.0	**8**	975	**1283**	1463	**1925**	1950	**2566**	2438	**3208**
	4	6.5	**4**	366	**481**	534	**722**	731	**962**	914	**1203**
		9.5	**6**	534	**722**	802	**1083**	1069	**1444**	1336	**1804**
		13.0	**8**	731	**962**	1097	**1444**	1463	**1925**	1828	**2406**
	5	6.5	**4**	293	**385**	439	**577**	585	**770**	731	**962**
		9.5	**6**	428	**577**	641	**866**	855	**1155**	1069	**1444**
		13.0	**8**	585	**770**	878	**1155**	1170	**1540**	1463	**1925**
	6	6.5	**4**	244	**321**	366	**481**	488	**642**	609	**802**
		9.5	**6**	356	**481**	534	**722**	713	**962**	891	**1203**
		13.0	**8**	488	**642**	731	**962**	975	**1283**	1219	**1604**

*The number of machine passes required is dependent on soil type, moisture content, desired compaction and machine weight.

MODEL	815F2		825H	
Type	**Fill Spreading**		**Fill Spreading**	
Capacity**				
Earth	2.16 m³	**2.82 yd³**	3.79 m³	**4.95 yd³**
Refuse	—		—	
Weight, Dozer*	1460 kg	**3220 lb**	2831 kg	**6241 lb**
General Dimensions: (Tractor & Dozer)				
Length	6.82 m	**22'5"**	8.24 m	**27'5"**
Width	3.76 m	**12'4"**	4.6 m	**15'1"**
Blade Dimensions:				
Width, End Bits	3.76 m	**12'4"**	4.6 m	**15'1"**
Height, Moldboard	860 mm	**2'10"**	1.03 m	**3'4"**
Height, Trash Rack	—		—	
Max. Digging Depth	215 mm	**8.5"**	312 mm	**12.3"**
Ground Clearance @ Full Lift	814 mm	**2'8"**	932 mm	**3'0.7"**
Tilt Adjust. from Horizontal	328 mm	**12.9"**	797 mm	**31.4"**

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

815F2 and 825H
Ground Contact Pressure/Soil Compactors

815F2 Tip	Weight Front Axle 9376 kg (20,674 lb) Ground Contact Pressure		Weight Rear Axle 11 460 kg (25,269 lb) Ground Contact Pressure		Contact Area Four Wheels	
Tip Penetration	**kPa**	**psi**	**kPa**	**psi**	**cm²**	**in²**
12.5 mm **(0.5 in)**	4727.05	**685.6**	6989.35	**706.7**	425.81	**66**
25 mm **(1.0 in)**	1347.92	**195.5**	1827.94	**215.7**	1445.16	**224**
38 mm **(1.5 in)**	902.52	**130.9**	1094.20	**156.8**	2077.42	**322**
50 mm **(2.0 in)**	658.45	**95.5**	872.95	**97.7**	3064.51	**475**

825H Standard Tip	Weight Front Axle 14 919.98 kg (32,892.93 lb) Ground Contact Pressure		Weight Rear Axle 16 819.98 kg (37,081.71 lb) Ground Contact Pressure		Contact Area Four Wheels	
Tip Penetration	**kPa**	**psi**	**kPa**	**psi**	**cm²**	**in²**
12.7 mm **(0.5 in)**	7178.41	**1041.14**	8092.55	**1173.73**	407.65	**63.19**
25 mm **(1.0 in)**	2609.39	**378.46**	2941.72	**426.66**	1121.55	**173.84**
38 mm **(1.5 in)**	1411.35	**204.70**	1591.10	**230.77**	2073.54	**321.40**
50 mm **(2.0 in)**	704.99	**102.25**	794.76	**115.27**	4150.96	**643.40**
75 mm **(3.0 in)**	610.19	**88.50**	687.89	**99.77**	4795.60	**743.32**
100 mm **(4.0 in)**	421.68	**61.16**	475.39	**68.95**	6939.86	**1075.68**
125 mm **(5.0 in)**	382.52	**55.48**	431.27	**62.55**	7650.04	**1185.76**
150 mm **(6.0 in)**	324.33	**47.04**	365.63	**53.03**	9022.18	**1398.44**
175 mm **(7.0 in)**	311.09	**45.12**	350.74	**50.87**	9405.66	**1457.88**
200 mm **(8.0 in)**	139.55	**20.24**	157.34	**22.82**	20 965.89	**3249.72**

825H Heavy Duty Tip	Weight Front Axle 14 919.98 kg (32,892.93 lb) Ground Contact Pressure		Weight Rear Axle 16 819.98 kg (37,081.71 lb) Ground Contact Pressure		Contact Area Four Wheels	
Tip Penetration	**kPa**	**psi**	**kPa**	**psi**	**cm²**	**in²**
12.7 mm **(0.5 in)**	7615.41	**1104.52**	8585.20	**1245.18**	96.07	**14.89**
25 mm **(1.0 in)**	6199.83	**899.21**	6989.35	**1013.72**	472.00	**73.16**
38 mm **(1.5 in)**	3614.20	**524.19**	1915.27	**277.79**	430.61	**66.74**
50 mm **(2.0 in)**	1621.44	**235.17**	1827.94	**265.12**	1804.64	**279.72**
75 mm **(3.0 in)**	970.64	**140.78**	1094.20	**158.70**	3014.96	**467.32**
100 mm **(4.0 in)**	774.28	**112.30**	872.95	**126.61**	3779.35	**585.80**
125 mm **(5.0 in)**	570.89	**82.80**	643.56	**93.34**	5126.18	**794.56**
150 mm **(6.0 in)**	443.13	**64.27**	499.59	**72.46**	6603.60	**1023.56**
175 mm **(7.0 in)**	417.06	**60.49**	470.22	**68.20**	7016.24	**1087.52**
200 mm **(8.0 in)**	389.07	**56.43**	438.64	**63.62**	7520.76	**1165.72**
225 mm **(9.0 in)**	381.07	**55.27**	429.61	**62.31**	7678.95	**1190.24**
250 mm **(10.0 in)**	128.59	**18.65**	145.00	**21.03**	22 753.76	**3526.84**