MICHIGAN

L320

MICHIGAN L320 – HIGH PRODUCTIVITY, HIGH TECHNOLOGY

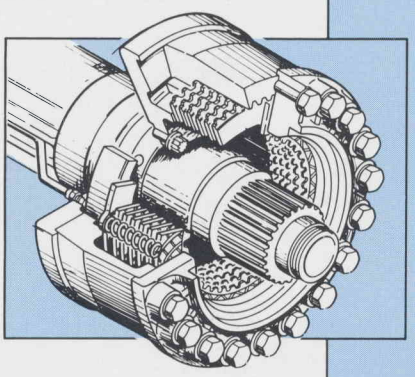
The Michigan L320 combines years of loader experience and know-how with state-of-the-art technology. At 417 horsepower the L320 weighs approximately 44 915 kg (99,020 lb) and has bucket capacities from 5,7 m³ (7.5 yd³) to 11,5 m³ (15.0 yd³) depending on job conditions, material weight and customer requirements. Off-highway truck loading, load-and-carry, stockpiling and feeding hoppers, crushing and screening plants are good examples of where the L320 comes into its own.

Off-highway trucks up to 45 Mt (50 tons) can be loaded effectively, and a choice between two different boom lengths enables the L320 to match existing truck fleets or other operations.

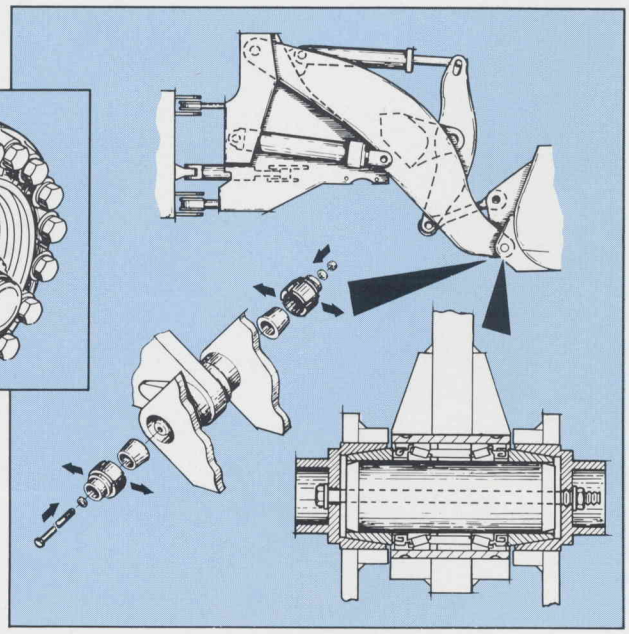
The Michigan L320 has proven its productivity, reliability and durability. The hydraulic system is designed to use only the amount of power needed at any given time. This power-saving hydraulic system is balanced with the engine and transmission so that the end result is low fuel consumption and maximum engine power available for traction.

The operator controls the L320 from a quiet, comfortable cab using state-of-the-art technology. A separate ROPS structure provides safety for the operator that complements the comfort provided by the cab.

HYDRAULICALLY ACTUATED OIL-COOLED BRAKES

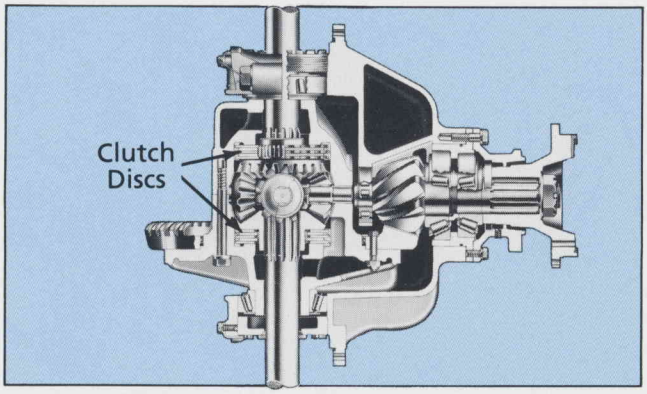


Service brakes are outboard-mounted wet-type disc brakes. Brake actuation is hydraulic. A separate cooling system provides the brakes with cooled and filtered oil. Brakes meet SAE and ISO guidelines for secondary braking with split systems for front and rear axles. A dry disc parking brake is mounted on the front axle input shaft. It is spring applied and hydraulic-released. When the engine is running, a safety interlock will apply the service brakes if the unit is put into forward or reverse when the parking brake is applied.



BUCKET HINGE

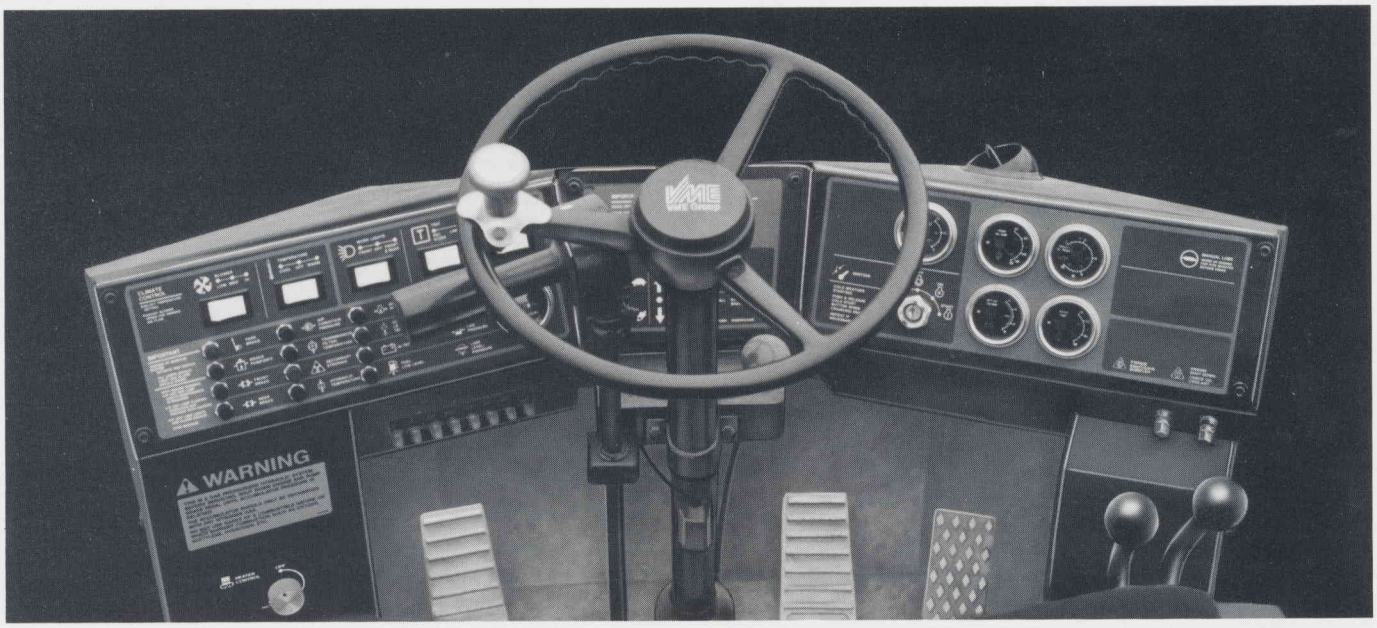
The bucket hinge pins are permanently sealed with tapered roller bearings. A solid pin and bushing, non-roller bearing is available as an option for slag operations.



LIMITED SLIP DIFFERENTIALS

Limited slip differentials are standard in both axles.

By automatically transferring driving torque to the wheel with the best traction, they provide maximum tractive effort under all conditions while minimizing wheel slip.



CAB AND COCKPIT

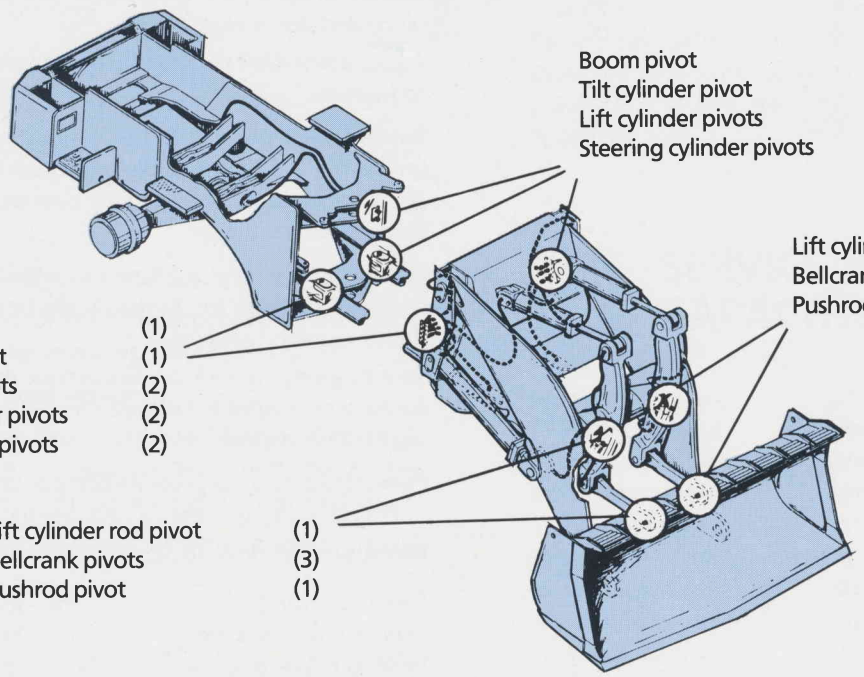
The cab features a flat-floored cockpit and is iso-mounted at six points to reduce machine vibration and sound transfer to the operator. Fully insulated and sound suppressed, the soft cab mounts to the cockpit with a flat perimeter seal to isolate cab interior from dust and noise. Cab has pressurized heater, defroster and air conditioner with filter as standard equipment. Cab has dual access doors with sliding windows and hold-open struts. Sound level in cab is 82 dB (A) with doors and windows closed.

Operator sits in standard fully adjustable suspension seat facing controls and instruments mounted on the free-standing console. All controls and instruments are ergonomically designed for easy operation and viewing. Steering wheel has standard spinner knob.

STANDARD BOOM – LONG BOOM

The L320 is available with a standard boom or long boom (additional cost) to match worksite conditions. The long boom is suitable for jobs that require extra dump height and reach. Both booms provide excellent machine stability and load-carrying ability to match all job conditions and requirements. Booms are high-grade alloy steel. Boom and bucket cylinders give smooth, coordinated lifting action and the most efficient use of hydraulic and crowding forces. All pins are sealed to retain lubricant and protect against dirt for longer service life.

Service is simplified by four ground level lube manifolds and lubrication intervals of 100 hours.



Boom pivot	(1)
Tilt cylinder pivot	(1)
Lift cylinder pivots	(2)
Steering cylinder pivots	(2)
Rear axle cradle pivots	(2)

Lift cylinder rod pivot	(1)
Bellcrank pivots	(3)
Pushrod pivot	(1)

Boom pivot	(1)
Tilt cylinder pivot	(1)
Lift cylinder pivots	(2)
Steering cylinder pivots	(2)

Lift cylinder rod pivot	(1)
Bellcrank pivots	(3)
Pushrod pivot	(1)

ENGINE

Direct-injected, turbocharged and after-cooled 6 cylinder, inline, 4-cycle diesel.

Make			Cummins	
Model			KTA 19C	
Max. rating* at	rps	**rpm**	35	**2100**
SAE J1349 (ISO 1585)	kW	**hp**	336	**450**
Flywheel rating** at	rps	**rpm**	35	**2100**
SAE J1349 (ISO 1585)	kW	**hp**	311	**417**
DIN 70020/6271	kW	**hp**	311	**417**
Max. torque at	rps	**rpm**	25	**1500**
SAE J1349 (ISO 1585)	Nm	**lbf ft**	2165	**1597**
DIN 70020/6271	Nm	**lbf ft**	2165	**1597**
Number of cylinders			**6**	
Displacement, total	dm^3,l	**in^3**	18,9	**1150**
Bore	mm	**in**	158,8	**6.25**
Stroke	mm	**in**	158,8	**6.25**

Air cleaners

1. Cyclone precleaner with automatic dust ejector.
2. Paper filter with indicator.
3. Replaceable safety filter.

*__Max. rating__ – Rating of engine equipped only with components essential for engine function, such as injection pump, oil pump, and water pump.

**__Flywheel rating__ – Net rating measured with fan, intake and exhaust system, cooling system, and alternator mounted.

DRIVETRAIN

Torque converter: Clark, high-efficiency single-stage.

Transmission: Clark countershaft-type powershift transmission with directional clutch modulation.

Axles: Clark fully-floating axle shafts with planetary-type hub reductions. Single-piece cast axle housing. Fixed front axle and oscillating rear axle.

Differential: Clark limited slip differentials in front and rear axles.

Hub reduction: Clark planetary drive with low-friction roller bearings in each wheel hub.

Tires: Tubeless with nylon cord body. Other tires available for different applications.

Torque converter make, model			**Clark, C-8612-48**	
Torque multiplication			**2.536:1**	
Transmission make, model			**Clark, 6421-1**	
Speeds, forward/reverse				
1	km/h	**mph**	6,9	**4.3**
2	km/h	**mph**	12,1	**7.5**
3	km/h	**mph**	20,6	**12.8**
4	km/h	**mph**	34,0	**21.1**
Measured with tires			**35/65-33 (30PR) L-4**	
Front axle make, model			**Clark, D-75930**	
Rear axle make, model			**Clark, D-75930**	
Rear axle oscillation, total	deg		24	
	mm	**in**	279	**11**

ELECTRICAL SYSTEM

The electrical system is well protected by circuit breakers. Pre-wired for optional equipment.

Voltage	V	24
Alternator	A	100
Batteries (12 volt)		4
Battery capacity, total	CCA	1250
Cranking capacity, ea.	CCA	625

BRAKE SYSTEM

(SAE J1152) (ISO 3450)

Service brakes: Full hydraulic system with outboard, wet, oil-cooled disc brakes.

Application of left pedal switches transmission from forward to neutral.

Secondary: Dual circuit axle-by-axle system. Actuated by service brake pedal. Audible and visual low pressure alarm. Dead engine braking capability provided by two nitrogen-charged accumulators.

Parking brake: Dry disc type mounted on front axle input shaft. Spring applied, hydraulically released; actuated by dash-mounted hand valve.

Transmission interlock applies service brakes if shifted into forward or reverse to prevent moving machine when parking brake is applied.

Pump: Piston pump, pressure compensated for brake actuation. Cooling system uses a separate gear pump.

Filtration: Full flow, 10 micron filter.

Pressure setting	MPa	**psi**	20,7	**3000**
Service brake, disc dia.	mm	**in**	453	**17.82**
Parking brake, disc dia.	mm	**in**	457	**18**
thickness	mm	**in**	12,7	**0.5**

STEERING SYSTEM

Articulated frame. Fully hydraulic steering system with speed sensor hydraulics.

Pump: Tandem gear-type, mounted on the torque converter.

Supply system: The system is served by a large pump section and a smaller secondary main/steer pump section which is rpm sensitive and feeds either the main hydraulic or the steering system.

Cylinders: Two double acting cushioned cylinders with chrome plated piston rods.

Steering cylinders, number			2	
Bore	mm	**in**	127	**5.0**
Stroke	mm	**in**	497	**19.56**
Relief pressure	MPa	**psi**	19,7	**2850**
Primary pump				
output	dm^3,l/min	**US gal/min**	250	**66**
at pressure	MPa	**psi**	69	**1000**
and engine speed	rps	**rpm**	35	**2100**
Secondary pump				
output	dm^3,l/min	**US gal/min**	148	**39**
at pressure	MPa	**psi**	69	**1000**
and engine speed	rps	**rpm**	25	**1500**

HYDRAULIC SYSTEM

Closed and pressurized pressure-sensing system with a sturdy plate-steel tank. Hydraulic oil is fully filtered and cooled. An access hole is provided in the tank for easy cleaning. An in-tank magnet provides extra protection.

Pump: Tandem gear-type, mounted on the torque converter.

Supply system: Main pump pressure sensitive system. Can use one or both sections, depending on requirements. Second section of steer pump can feed main hydraulic system also.

Valve: Split-spool valve with built-in pressure relief valve. Actuated by a pilot valve, it is mounted on front frame for easy access.

Lift function: The valve has four positions: Raise, hold, lower and float. An automatic kickout detent is adjustable for any position between maximum reach and full lift height.

Tilt function: The valve has three positions: Rollback, hold and dump. Automatic, proximity switch controlled bucket positioner adjustable to any desired loading angle.

Cylinders: Double-acting.

Filters: Full-flow 10 micron return filter (with two elements), located in hydraulic oil tank.

Relief pressure	MPa	**psi**	20	**2900**
Output	l/min	**US gal/min**	462	**122**
at	MPa	**psi**	6,9	**1000**
and engine speed	rps	**rpm**	35	**2100**
Lift cylinders, no.			**2**	
Bore	mm	**in**	229	**9.0**
Stroke	mm	**in**	1168	**46.0**
Tilt cylinders, no.			**2**	
Bore	mm	**in**	191	**7.5**
Stroke	mm	**in**	808	**31.8**
Raising time (with load)	s		**9.0**	
Dumping time (with load)	s		**2.1**	
Lowering time (empty)	s		**5.4**	
Total cycle time	s		**16.5**	

CAB

Cab (non-ROPS) with two lockable doors. Sliding self-locking windows. Tinted safety glass.

ROPS canopy: Approved separately.

Heater and defroster: Heater provides filtered (10 microns) fresh air and has a three-speed fan and a defroster for the front and side windows. Air conditioning is standard.

Operator's seat: Fully adjustable suspension seat with seat belt (SAE #J386).

Noise level in cab, max.	dBA		**82**	
Heating capacity	kW	**BTU/h**	11	**37,500**
Air conditioning	kW	**BTU/h**	5,9	**20,000**

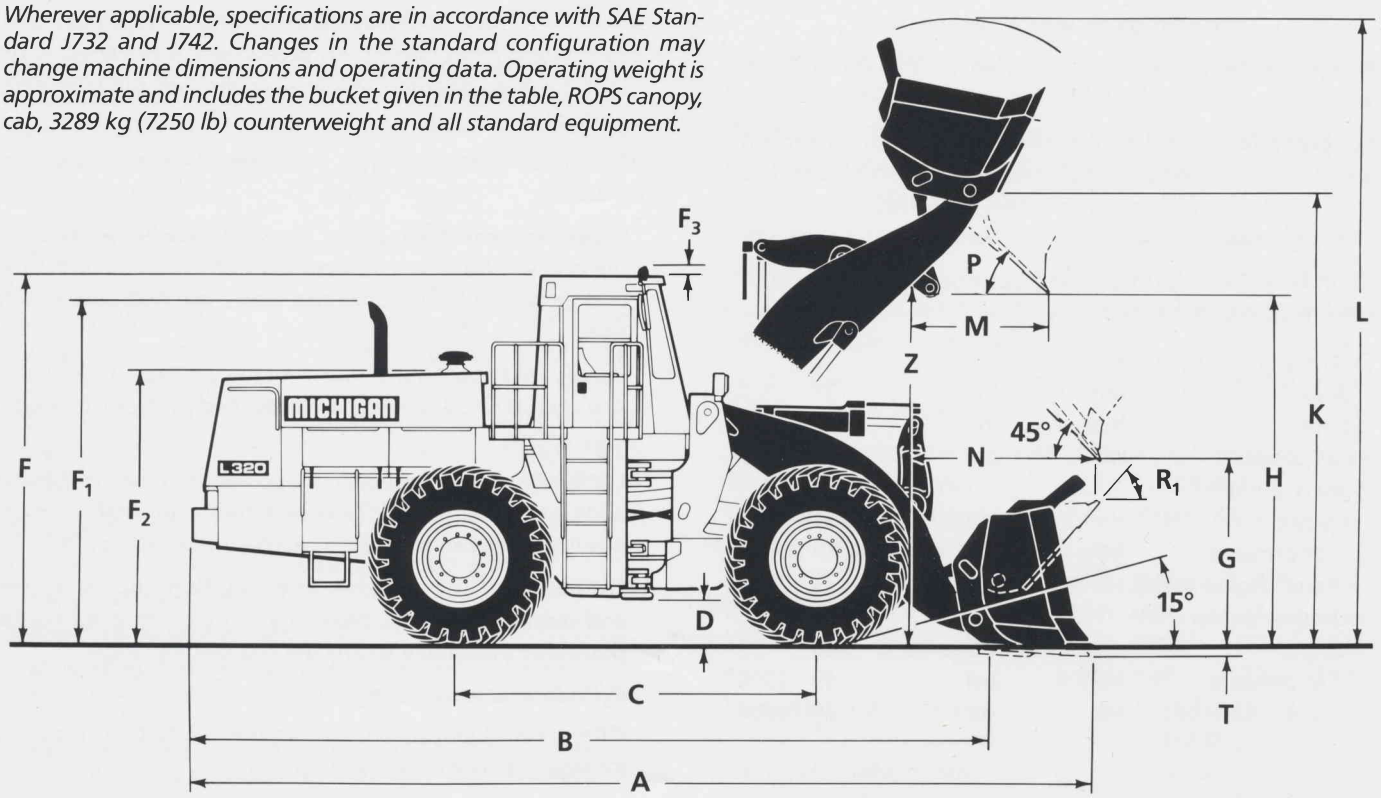
SERVICE REFILL CAPACITIES

Crankcase	dm^3,l	**US gal**	51,1	**13.5**
Fuel tank (usable)	dm^3,l	**US gal**	791	**209.0**
Fuel tank (total)	dm^3,l	**US gal**	803	**212.0**
Cooling system	dm^3,l	**US gal**	132,5	**35.0**
Transmission, total	dm^3,l	**US gal**	68,1	**18.0**
Differential, each	dm^3,l	**US gal**	68,1	**18.0**
Wheel hub, each	dm^3,l	**US gal**	9,8	**2.6**
Midmount bearing	dm^3,l	**US gal**	5,3	**1.4**
Hydraulic tank	dm^3,l	**US gal**	344	**91.0**

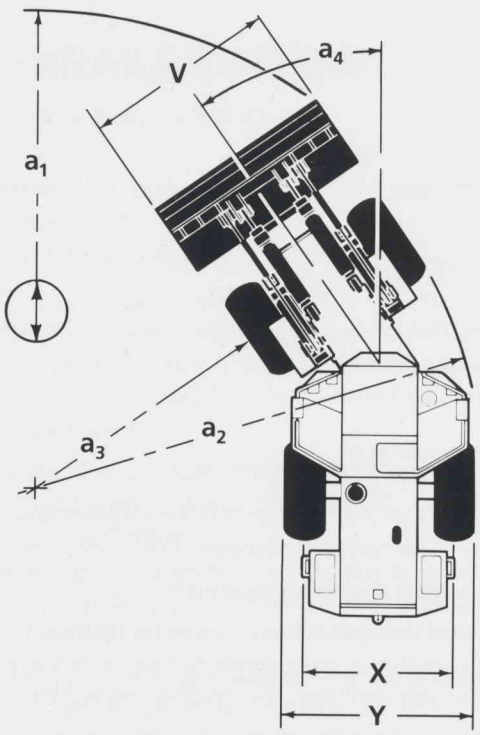
DIMENSIONS – MICHIGAN L320 (Standard Boom)

Tires: 35/65-33 (30PR) L-4

Wherever applicable, specifications are in accordance with SAE Standard J732 and J742. Changes in the standard configuration may change machine dimensions and operating data. Operating weight is approximate and includes the bucket given in the table, ROPS canopy, cab, 3289 kg (7250 lb) counterweight and all standard equipment.



MACHINE DIMENSIONS THAT DO NOT CHANGE REGARDLESS OF CONFIGURATION				
C	mm	ft in	4060	13'3.8"
F_3	mm	ft in	129	0'5.1"
G	mm	ft in	2134	7'0"
P	deg		45°	
X	mm	ft in	2717,8	8'11"
a_2	mm	ft in	8306	27'3"
a_3	mm	ft in	4597	15'1"
a_4	deg		35°	



BUCKETS		
Straight edge rock	6,1 m³	**8.0 yd³**
Spade-nose rock	6,1 m³	**8.0 yd³**
Material handling	6,9 m³	**9.0 yd³**
BUCKET TEETH AND CUTTING EDGE WEAR CAPS		
Model 47	263 kg	**580 lbs.**
Model 57	422 kg	**930 lbs.**
Cutting Edge Wear Caps	227 kg	**500 lbs.**

STANDARD BOOM

MACHINE INFORMATION			BUCKET TYPE					
			Straight Edge Rock		Spade-Nose Rock		Material Handling	
Volume, heaped	m^3	yd^3	6,1	**8.0**	6,1	**8.0**	6,9	**9.0**
struck	m^3	yd^3	5,2	**6.85**	5,6	**7.34**	6,0	**7.88**
Material weight	kg/m^3	lb/yd^3	1780	**3000**	1780	**3000**	1580	**2665**
Bucket weight	kg	lb	3992	**8800**	4287	**9450**	4287	**9450**
Operating capacity	kg	lb	10 886	**24,000**	10 886	**24,000**	10 880	**23,985**
Static tipping load, straight	kg	lb	30 767	**67,829**	29 710	**65,499**	29 710	**65,499**
Full turn	kg	lb	27 388	**60,380**	26 418	**58,240**	26 418	**58,240**
Breakout force	kN	lbf	452,1	**101,600**	372,0	**83,600**	413,5	**92,960**
A	mm	ft in	10 452	**34'3.5"**	10 770	**35'4"**	10 592	**34'9"**
B	mm	ft in	8966	**29'5"**	8966	**29'5"**	8966	**29'5"**
D	mm	ft in	559	**1'10"**	559	**1'10"**	559	**1'10"**
F	mm	ft in	4191	**13'9"**	4191	**13'9"**	4191	**13'9"**
F_1	mm	ft in	3912	**12'10"**	3912	**12'10"**	3912	**12'10"**
F_2	mm	ft in	3073	**10'1"**	3073	**10'1"**	3073	**10'1"**
H	mm	ft in	3785⊖	**12'5"**	3581⊖	**11'9"**	3696⊖	**12'1.5"**
K	mm	ft in	5055	**16'7"**	5055	**16'7"**	5055	**16'7"**
L	mm	ft in	7137	**23'5"**	7137	**23'5"**	6909	**22'8"**
M	mm	ft in	1689⊕	**5'6.5"**	1930⊕	**6'4"**	1778⊕	**5'10"**
N	mm	ft in	2476⊕	**8'1.5"**	2667⊕	**8'9"**	2540⊕	**8'4"**
R_1		deg		**51°**		**51°**		**51°**
T	mm	ft in	81	**0'3.2"**	81	**0'3.2"**	91	**0'3.6"**
V	mm	ft in	3962	**13'0"**	3962	**13'0"**	3962	**13'0"**
Y	mm	ft in	3632	**11'11"**	3632	**11'11"**	3632	**11'11"**
Z	mm	ft in	4127	**13'6.5"**	4127	**13'6.5"**	4127	**13'6.5"**
a_1 Turning circle (over bucket) (bucket in carry position)	mm	ft in	18 009	**59'1"**	18 034	**59'2"**	18 009	**59'1"**
Operating weight	kg	lb	44 915	**99,020**	45 210	**99,670**	45 210	**99,670**

⊖ Deduct 234 mm (9.2 in) for bucket teeth

⊕ Add 361 mm (14.2 in) for bucket teeth

DIMENSIONS AFFECTED BY TIRE SIZE

MACHINE DIMENSIONS			35/65R33 XRDNAT		35/65-33 (24PR) L-4 (30PR) L-4	35/65-33 (24PR) L-5 (30PR) L-5		35/65R33 XRD1AT XRD2AT RL5E	
D	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+13	**+0.5"**
F	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+13	**+0.5"**
F_1	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+13	**+0.5"**
F_2	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+13	**+0.5"**
H	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+13	**+0.5"**
K	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+13	**+0.5"**
L	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+13	**+0.5"**
M	mm	ft in	+19	**+0.75"**	0	−13	**−0.5"**	−13	**−0.5"**
N	mm	ft in	+19	**+0.75"**	0	−13	**−0.5"**	−13	**−0.5"**
T	mm	ft in	+19	**+0.75"**	0	−13	**−0.5"**	−13	**−0.5"**
Y	mm	ft in	0	**0**	0	0	**0**	0	**0**
Z	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+ 0.5	**+0.5"**

STANDARD BOOM

SUPPLEMENTAL OPERATING DATA		Change in operating weight		Change in static tipping load straight		Change in static tipping load at full turn	
Bucket Teeth, Model 47	kg lb	+263	**+580**	−330	**−728**	−289	**−637**
Bucket Teeth, Model 57 (Heavy duty)	kg lb	+422	**+930**	−529	**−1167**	−463	**−1021**
Cab Removal	kg lb	−386	**−850**	−276	**−609**	−275	**−606**
Counterweight	kg lb	+1161	**+2560**	+2454	**+5410**	+2155	**+4750**
Cutting Edge Wear Caps	kg lb	+227	**+500**	−286	**−627**	−249	**−549**
Fenders, Front	kg lb	+159	**+350**	+45	**+100**	+45	**+100**
Fenders, Rear with Steps	kg lb	+454	**+1000**	+735	**+1620**	+653	**+1440**
3rd Hydraulic Control	kg lb	+52	**+115**	+42	**+93**	+41	**+90**
Secondary Steering	kg lb	+45	**+100**	+64	**+142**	+58	**+128**
Alternative tires (Loader):							
35/65-33 (24PR) L-4	kg lb	−640	**−1412**	−449	**−990**	−408	**−900**
35/65-33 (24PR) L-5	kg lb	+334	**+744**	+236	**+520**	+218	**+480**
35/65-33 (30PR) L-5	kg lb	+662	**+1460**	+467	**+1030**	+422	**+930**
35/65R33, XRDNAT★	kg lb	−802	**−1769**	−562	**−1240**	−512	**−1130**
35/65R33, XRD1AT★	kg lb	−628	**−1384**	−440	**−970**	−399	**−880**
35/65R33, XRD2AT★	kg lb	−513	**−1131**	−363	**−800**	−326	**−720**
35/65R33, RL5E	kg lb	+78	**+172**	+54	**+120**	+50	**+110**

DIMENSIONS – MICHIGAN L320 (Long Boom)

Tires: 35/65-33 (30PR) L-4

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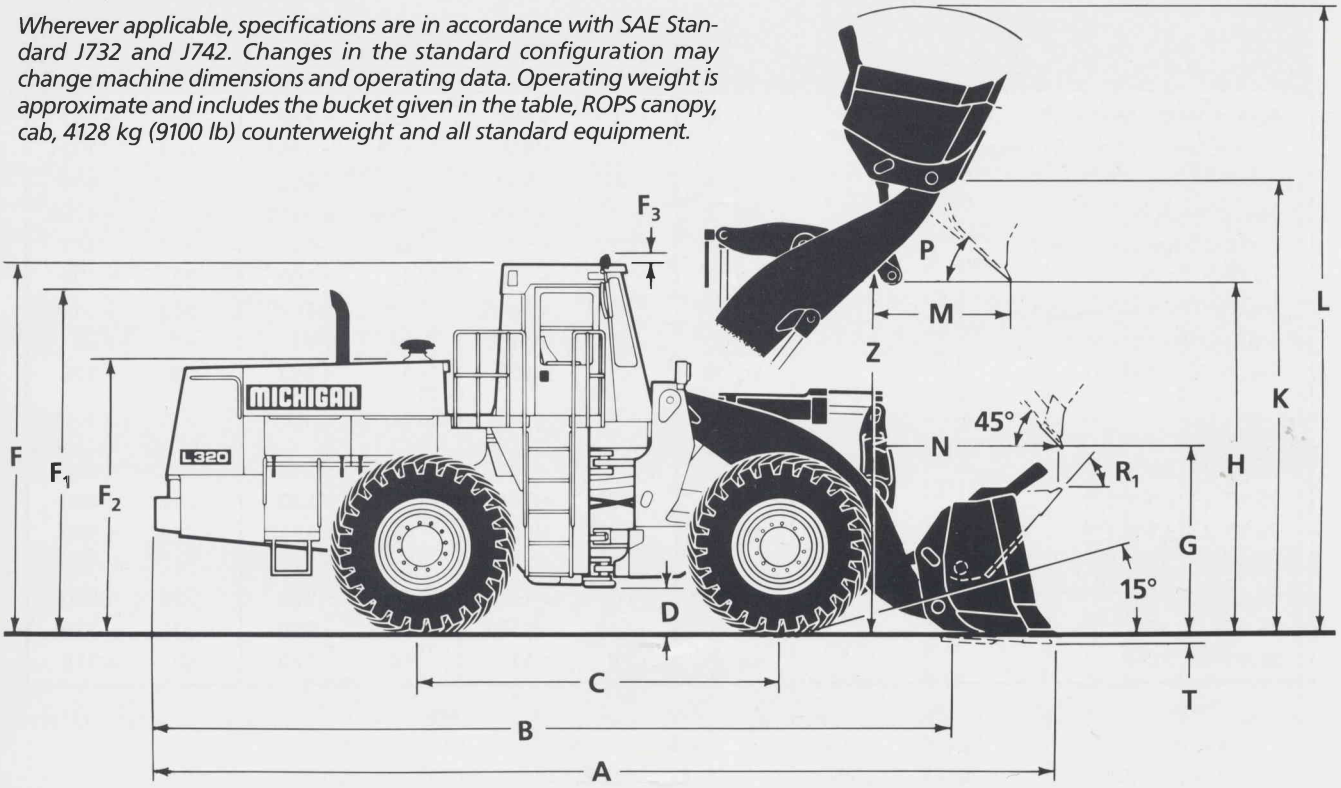

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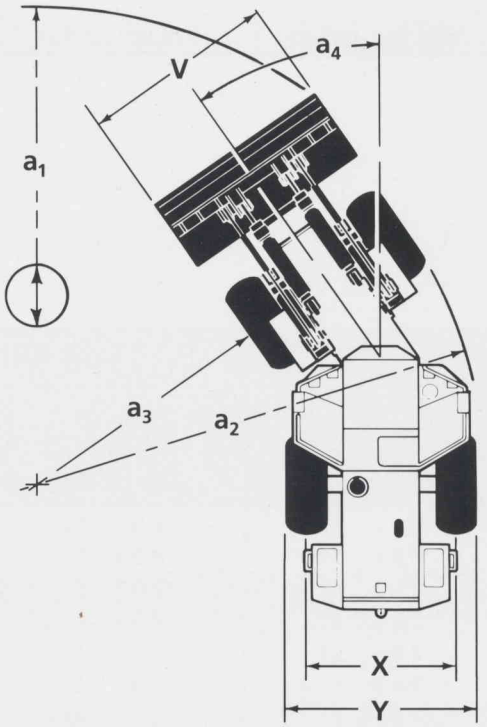
P	deg		45°	
X	mm	ft in	2717,8	8'11"
a_2	mm	ft in	8306	27'3"
a_3	mm	ft in	4597	15'1"
a_4	deg		35°	



BUCKETS		
Straight edge rock	5,7 m^3	**7.5 yd^3**
Spade nose rock	5,7 m^3	**7.5 yd^3**
Light materials	11,5 m^3	**15.0 yd^3**
BUCKET TEETH AND CUTTING EDGE WEAR CAPS		
Model 47	263 kg	**580 lbs.**
Model 57	422 kg	**930 lbs.**
Cutting Edge Wear Caps	227 kg	**500 lbs.**

LONG BOOM

MACHINE INFORMATION			BUCKET TYPE					
			Straight Edge Rock		Spade-Nose Rock		Light Materials	
Volume, heaped	m^3	yd^3	5,7	**7.5**	5,7	**7.5**	11,5	**15.0**
struck	m^3	yd^3	4,8	**6.31**	5,2	**6.77**	9,6	**12.55**
Material weight	kg/m^3	lb/yd^3	1780	**3000**	1780	**3000**	890	**1500**
Bucket weight	kg	lb	4037	**8900**	4332	**9550**	4681	**10,320**
Operating capacity	kg	lb	10 206	**22,500**	10 206	**22,500**	10 206	**22,500**
Static tipping load, straight	kg	lb	30 391	**67,000**	29 284	**64,560**	29 770	**65,630**
Full turn	kg	lb	27 016	**59,560**	25 996	**57,310**	26 390	**58,180**
Breakout force	kN	lbf	490,4	**110,200**	400,5	**90,000**	389,6	**87,600**
A	mm	ft in	10 757	**35'3.5"**	11 074	**36'4"**	11 125	**36'6"**
B	mm	ft in	9347	**30'6"**	9347	**30'6"**	9347	**30'6"**
D	mm	ft in	559	**1'10"**	559	**1'10"**	559	**1'10"**
F	mm	ft in	4191	**13'9"**	4191	**13'9"**	4191	**13'9"**
F_1	mm	ft in	3912	**12'10"**	3912	**12'10"**	3912	**12'10"**
F_2	mm	ft in	3073	**10'1"**	3073	**10'1"**	3073	**10'1"**
H	mm	ft in	4204	**13'9.5"⊖**	4001	**13'1.5"⊖**	3962	**13'0"**
K	mm	ft in	5436	**17'10"**	5436	**17'10"**	5436	**17'10"**
L	mm	ft in	7493	**24'7"**	7493	**24'7"**	7976	**26'2"**
M	mm	ft in	1714	**5'7.5"⊕**	1956	**6'5"⊕**	1968	**6'5.5"**
N	mm	ft in	2730	**8'11.5"⊕**	2921	**9'7"⊕**	2934	**9'7.5"**
R_1		deg		**51°**		**51°**		**51°**
T	mm	ft in	84	**0'3.3"**	84	**0'3.3"**	107	**0'4.2"**
V	mm	ft in	3962	**13'0"**	3962	**13'0"**	4446	**14'7"**
Y	mm	ft in	3632	**11'11"**	3632	**11'11"**	3632	**11'11"**
Z	mm	ft in	4318	**14'2"**	4318	**14'2"**	4318	**14'2"**
a_1 Turning circle (over bucket) (bucket in carry position)	mm	ft in	18 313	**60'1"**	18 313	**60'1"**	18 872	**61'11"**
Operating weight	kg	lb	45 537	**100,390**	45 832	**101,040**	46 181	**101,810**

⊖ Deduct 234 mm (9.2 in) for bucket teeth ⊕ Add 274 mm (10.8 in) for bucket teeth

DIMENSIONS AFFECTED BY TIRE SIZE

MACHINE DIMENSIONS			35/65R33 XRDNAT		35/65-33 (24PR) L-4 (30PR) L-4	35/65-33 (24PR) L-5 (30PR) L-5		35/65R33 XRD1AT XRD2AT RL5E	
D	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+13	**+0.5"**
F	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+13	**+0.5"**
F_1	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+13	**+0.5"**
F_2	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+13	**+0.5"**
H	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+13	**+0.5"**
K	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+13	**+0.5"**
L	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+13	**+0.5"**
M	mm	ft in	+19	**+0.75"**	0	−13	**−0.5"**	−13	**−0.5"**
N	mm	ft in	+19	**+0.75"**	0	−13	**−0.5"**	−13	**−0.5"**
T	mm	ft in	+19	**+0.75"**	0	−13	**−0.5"**	−13	**−0.5"**
Y	mm	ft in	0	**0**	0	0	**0**	0	**0**
Z	mm	ft in	−19	**−0.75"**	0	+13	**+0.5"**	+ 0.5	**+0.5"**

LONG BOOM

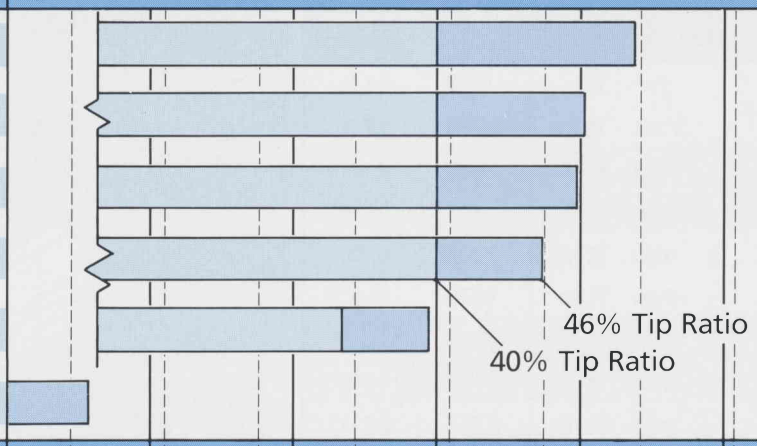
SUPPLEMENTAL OPERATING DATA		Change in operating weight		Change in static tipping load straight		Change in static tipping load at full turn	
Bucket Teeth, Model 47	kg lb	+263	**+580**	−334	**−735**	−297	**−655**
Bucket Teeth, Model 57 (Heavy duty)	kg lb	+422	**+930**	−535	**−1180**	−476	**−1050**
Cab Removal	kg lb	−386	**−850**	−268	**−590**	−236	**−520**
Counterweight	kg lb	+1161	**+2560**	+2318	**+5110**	+2037	**+4490**
Cutting Edge Wear Caps	kg lb	+227	**+500**	−287	**−634**	−256	**−565**
Fenders, Front	kg lb	+159	**+350**	+45	**+100**	+41	**+90**
Fenders, Rear with Steps	kg lb	+454	**+1000**	+712	**+1570**	+650	**+1390**
3rd Hydraulic Control	kg lb	+52	**+115**	+41	**+90**	+36	**+80**
Secondary Steering	kg lb	+45	**+100**	+63	**+140**	+54	**+120**
Alternative tires (Loader):							
35/65-33 (24PR) L-4	kg lb	−640	**−1412**	−426	**−940**	−385	**−850**
35/65-33 (24PR) L-5	kg lb	+334	**+744**	+222	**+490**	+204	**+450**
35/65-33 (30PR) L-5	kg lb	+662	**+1460**	+440	**+970**	+399	**+880**
35/65R33, XRDNAT★	kg lb	−802	**−1769**	−531	**−1170**	−485	**−1070**
35/65R33, XRD1AT★	kg lb	−628	**−1384**	−417	**−920**	−381	**−840**
35/65R33, XRD2AT★	kg lb	−513	**−1131**	−340	**−750**	−308	**−680**
35/65R33, RL5E	kg lb	+78	**+172**	+50	**+110**	+45	**+100**

BUCKET SELECTION

MATERIAL WEIGHT	kg/m³	lb/yd³
Ashes, coal	496-662	**835-1115**
Basalt	1960	**3300**
Bauxite	1420	**2400**
Caliche	1250	**2100**
Cinders	560	**950**
Clay, natural bed	1660	**2800**
dry	1480	**2500**
wet	1660	**2800**
Clay & gravel, dry	1420	**2400**
wet	1540	**2600**
Coal, anthracite	1190	**2000**
bituminous	950	**1600**
Copper ore	1660	**2800**
Earth, dry, packed	1510	**2550**
wet, excavated	1600	**2700**
loam	1250	**2100**
Granite, broken	1660	**2800**
Gravel, pitrun	1930	**3250**
dry	1510	**2550**
dry, 6-50 mm (¼-2 in)	1690	**2850**
wet, 6-50 mm (¼-2 in)	2020	**3400**
Gypsum, crushed	1600	**2700**
Iron ore, hematite	3204	**5400**
limonite	2462	**4150**

MATERIAL WEIGHT	kg/m³	lb/yd³
Iron ore, magnetite	2790	**4700**
pyrite	2580	**4350**
taconite	2137-2493	**3600-4200**
Lead ore	3630-5935	**8000-10,000**
Limestone, broken	1540	**2600**
crushed	1540	**2600**
Sand, dry, loose	1420	**2400**
damp	1690	**2850**
wet	1840	**3100**
Sand & clay, loose	1600	**2700**
compacted	2400	**4050**
Sand & gravel, dry	1720	**2900**
wet	2020	**3400**
Sandstone	1480	**2500**
Shale	1250	**2100**
Slag, solid	1922-2160	**3240-3640**
crushed	1127	**1900**
furnace, granulated	848	**1430**
Snow, dry	130	**220**
wet	520	**860**
Stone, crushed	1600	**2700**
Woodchips, soft wood	215	**475**
hard wood	245	**540**

BUCKET CAPACITY		BUCKET TYPE*	BOOM
5,7 m³	**7.5 yd³**	1	Long
5,7 m³	**7.5 yd³**	2	Long
6,1 m³	**8.0 yd³**	1	Std.
6,1 m³	**8.0 yd³**	2	Std.
6,9 m³	**9.0 yd³**	4	Std.
11,5 m³	**15.0 yd³**	5	Long



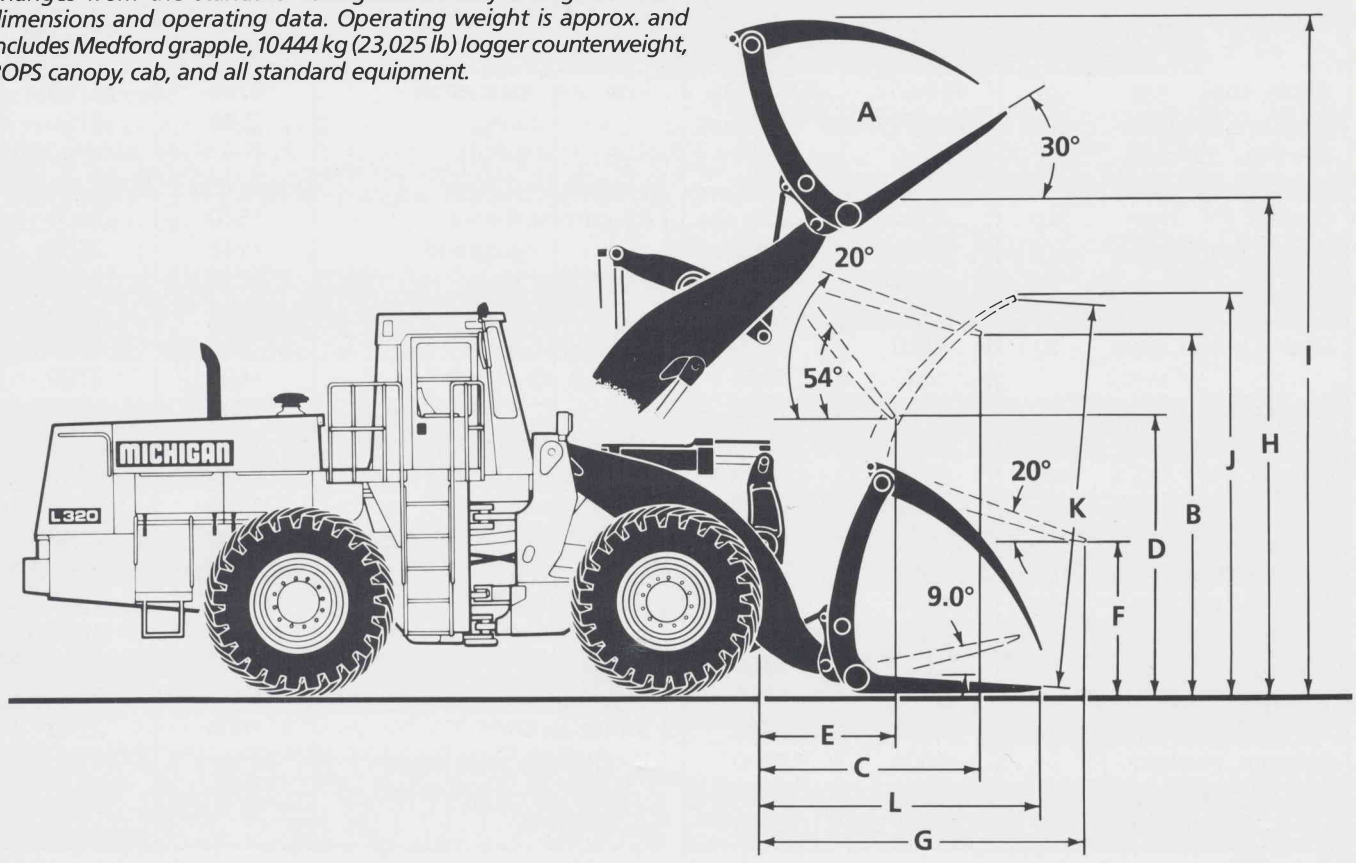
MATERIAL DENSITY (in thousands)								
lb/yd³	**1.5**		**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	
kg/m³		1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4

*1. Straight Edge Rock 2. Spade Nose Rock 3. General Purpose 4. Material Handling 5. Light Material

DIMENSIONS – MICHIGAN L320 LOG GRAPPLE

Tires: 35/65-33 (36PR) L-4

Changes from the standard configuration may change machine dimensions and operating data. Operating weight is approx. and includes Medford grapple, 10444 kg (23,025 lb) logger counterweight, ROPS canopy, cab, and all standard equipment.

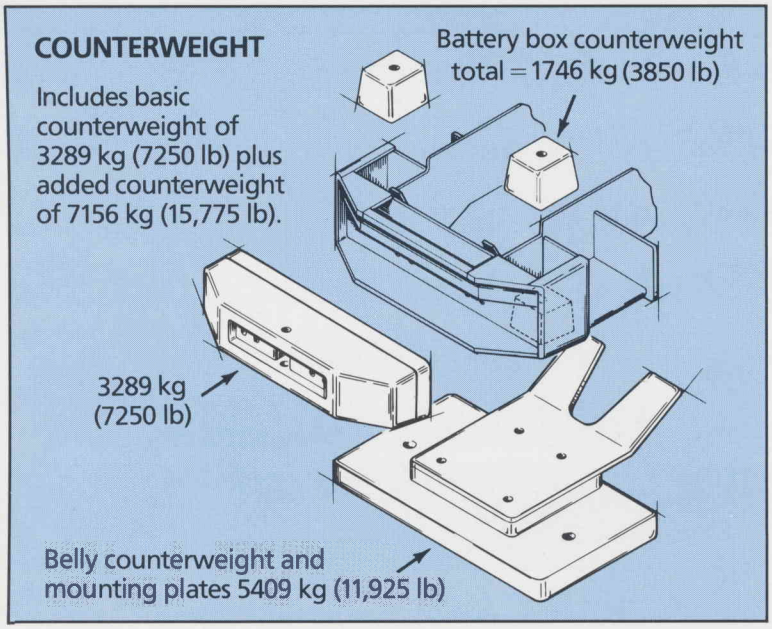


LOG GRAPPLE

MACHINE DIMENSIONS			35/65-33 (36PR) L-4	
A	m^2	ft^2	5,67	**61.0**
B	mm	ft in	3988	**13'1"**
C	mm	ft in	2845	**9'4"**
D	mm	ft in	2997	**9'10"**
E	mm	ft in	1905	**6'3"**
F	mm	ft in	1626	**5'4"**
G	mm	ft in	3683	**12'1"**
H	mm	ft in	5105	**16'9"**
I	mm	ft in	8255	**27'1"**
J	mm	ft in	4470	**14'8"**
K	mm	ft in	4267	**14'0"**
L	mm	ft in	3226	**10'7"**

COUNTERWEIGHT

Includes basic counterweight of 3289 kg (7250 lb) plus added counterweight of 7156 kg (15,775 lb).



LOG GRAPPLE

MACHINE INFORMATION				
Grapple, make			Medford	
model			90x108x108	
weight	kg	lb	4445	9800
Overall width	mm	ft in	2743	9'0"
Tine, length (top surface level)	mm	ft in	2286	7'6"
width	mm	ft in	267	10.5"
centers	mm	ft in	2477	8'1.5"
Minimum closure	mm	ft in	2273	7'5.5"
Turn. circle over tines, (grapple in carry pos.)	mm	ft in	9017	29'7"
Logger counterweight	kg	lb	10444	23,025
Operating wt. (approx.)	kg	lb	52386	115,490

CALCULATED HYDRAULIC SPEEDS, EMPTY, SEC				
Raise	Lower	Dump	Close	Open
8.7	6.8	5.0	3.5	3.1

Contact your Michigan dealer for availability of alternate grapples.

LOAD INFORMATION				
MAX. RECOMMENDED LOAD: 22 680 kg 50,000 lb				
MAX. HEIGHT – FORKS ROLLED BACK				
*Tip load, straight	kg	lb	62425	137,621
*Tip load, full turn	kg	lb	55599	122,573
Hyd. lifting force	kg	lb	22581	49,783
MAX. REACH – FORKS LEVEL				
*Tip load, straight	kg	lb	35447	78,146
*Tip load, full turn	kg	lb	31371	69,161
Hyd. lifting force	kg	lb	31745	69,985
GROUND POSITION – FORKS LEVEL				
*Tip load, straight	kg	lb	44249	97,550
*Tip load, full turn	kg	lb	39263	86,560
Hyd. lifting force	kg	lb	43302	95,463

*Static tip loads are based on estimated load center of gravity

SUPPLEMENTAL OPERATING DATA			Change in operating weight		Change in static tipping load straight		Change in static tipping load at full turn	
Belly Guard, Front	kg	lb	+54	+120	+14	+31	+14	+31
Fenders, Front	kg	lb	+159	+350	+35	+78	+35	+78
Fenders, Rear with Steps	kg	lb	+454	+1000	+573	+1264	+515	+1135
Grille Guard	kg	lb	+136	+300	+234	+515	+205	+452
Secondary Steering	kg	lb	+45	+100	+50	+111	+46	+101
Transmission Guard	kg	lb	+159	+350	+125	+277	+119	+261
Windshield Guard	kg	lb	+136	+300	+56	+124	+56	+124

LOG VOLUME & WEIGHTS TABLES

To determine the estimated weight of logs to be handled, first, determine the volume of the logs, then, multiply the volume by the lb/ft³ figure of the specie involved from the "Weights of Wood" table. To determine the volume of the logs:

1. Measure the diameter of large end of log, above flare taper.
2. Measure the diameter of small end of log.
3. Pick out length of log across top of table, closest to the length to be handled.
4. Drop down the column to the horizontal lines from the two diameters.
5. Add these two values together, then, divide by two for the average log volume.

LOG VOLUMES (in Cubic Feet*)

Log Diameter (Inches)	LOG LENGTH (FEET)														
	8	12	16	20	24	28	32	36	40	50	60	70	80	90	100
8	2.8	4.2	5.6	7	8.4	9.8	11	13	14	16	21	24	28	31	35
10	4.4	6.5	8.7	11	13	15	17	20	22	27	33	38	44	49	55
12	6.3	9.4	13	16	19	22	25	28	31	39	47	55	63	71	79
14	8.5	13	17	21	26	30	34	39	43	53	64	74	86	96	101
16	11	17	22	28	34	39	45	50	56	70	84	98	112	126	140
18	14	21	28	35	42	49	57	64	71	88	106	124	141	159	177
20	17	26	35	44	52	61	70	79	87	109	131	153	175	196	218
22	21	32	42	53	63	74	85	95	106	132	158	185	211	238	264
24	25	38	50	63	75	88	101	113	126	157	189	220	251	283	314
26	29	44	59	74	89	103	118	133	147	184	221	258	295	332	369
28	34	51	68	86	103	120	137	154	171	213	256	299	342	385	428
30	39	59	79	98	118	137	157	177	196	245	295	344	393	442	491
32	45	67	89	118	134	156	179	201	223	279	335	391	447	503	559
34	50	76	101	126	151	177	202	227	252	315	378	441	504	567	631
36	57	85	113	141	170	198	226	255	282	353	424	495	566	637	707
38	63	95	126	158	189	220	252	284	315	394	473	551	630	709	788
40	70	105	140	175	210	244	279	314	349	436	524	611	698	785	873
50	109	164	218	273	327	382	436	491	545	677	818	955	1091	1227	1364
60	157	234	314	393	471	550	628	707	785	982	1178	1374	1571	1767	1964
70	214	321	428	535	642	748	855	962	1069	1336	1604	1871	2138	2405	2673
80	279	420	559	698	838	977	1117	1257	1396	1745	2095	2441	2293	3142	3491

*Metric conversion: Cubic ft. x 0.028317 = cubic meter.

WEIGHTS OF WOOD (Green)

SPECIES	kg/m³	lb/ft³
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**

SPECIES	kg/m³	lb/ft³
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	**63**
Larch, Western	769	**48**
Locust, Black	929	**58**
Magnolia, Cucumber	785	**49**
Maple, Big Leaf	753	**47**
Black	865	**54**
Red	801	**50**
Silver	721	**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**

SPECIES	kg/m³	lb/ft³
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**

STANDARD EQUIPMENT

AIR CLEANER, DRY TYPE,
  DUAL ELEMENT WITH EXHAUST
    ASPIRATED PRECLEANER
ALTERNATOR, 24V, 100 AMP
BATTERY DISCONNECT, LOCKABLE
BOOM AND BUCKET CONTROLS
  FINGER TIP, CONSOLE MODEL
BOOM KICKOUT, AUTOMATIC
BRAKES, 4-WHEEL HYDRAULIC
  WET DISC, LIQUID COOLED, WITH
    TRANSMISSION INTERLOCK
BRAKE SYSTEM, SECONDARY
BUCKET LEVELER, AUTOMATIC
CAB ACCESS STEPS AND
  HANDRAILS, (SAE J185)
CAB, Non-ROPS
  Acoustical Lining
  Airducting, Built-In
  Doors (2); Lockable with Self-
    Locking, Sliding Glass Windows
  Door Hold-Open Struts (2)
  Electrical System: 24V,
    Circuit Breaker Protection
    Pre-wired for Optional
      Accessories
  Environmental Control:
    Air Conditioner 5,9 kW
      (20,000 Btu/hr)
    Heater/Defroster/Pressurizer
      11 kW (37,500 Btu/hr) with
      Three-Speed Blower Fan,
      Filtered Air
  Floor Mat
  Interior Lights, Red and White
  Interior Rearview Mirror
  Safety Glass, Tinted
  Seat Belt (SAE J386)
  Seat, Suspension, 6-way adjustable
  Steering Wheel Spinner Knob
  Sun Visor
  Windshield Washers & Wipers,
    Front & Rear
COLD START AID, ETHER
DIFFERENTIALS, LIMITED SLIP,
  FRONT & REAR
DRAWBAR WITH PIN
DRIVESHAFT GUARD
FRAME BOTTOM ENCLOSURES WITH
  REMOTE DRAINS FOR ENGINE OIL,
    COOLANT & TRANS. FLUID
GRILLE, REAR SWING-OUT
HYDRAULIC FLUID TO AIR COOLER
HYDRAULIC PRESSURE TEST PORTS,
  QUICK CONNECT
INSTRUMENTS/GAUGES:
  Air Cleaner Restriction Indicator
  Engine Coolant Temperature
    Gauge
  Engine Oil Pressure Gauge
  Fuel Gauge
  Hourmeter
  Sight Gauges:
    Engine Coolant Level
    Hydraulic Fluid Level
    Transmission Fluid Level
  Transmission/Torque Converter
    Fluid Temperature Gauge
  Voltmeter
ISOLATION MOUNTS:
  Cockpit
  Engine
  Radiator
  Transmission
LIGHTS:
  Work Lights, Front, Halogen (70W)
    2 Spots (200,000 Candlepower)
    4 Floods (40,000 Candlepower)
  Work Lights, Rear
    4 (150W)
  Stop and Tail combination, 2 Rear
LUBRICATION SYSTEM, MANIFOLD
  TYPE, GROUND ACCESSIBLE
MIRRORS, REARVIEW (2), EXTERIOR
NEUTRAL START FEATURE
ROPS CANOPY (SAE J1040) (ISO 3471)
SIDE PANELS, ENGINE HOOD
STEERING FRAME LOCK
TIRES: 33/65-33 (30PR) L-4 (General)
TRANSMISSION: SINGLE LEVER CONTROL,
  POWERSHIFT, WITH DIRECTIONAL
    CLUTCH MODULATION
TRANSMISSION DECLUTCH
VANDALISM LOCK, PROVISION FOR:
  Batteries
  Engine Coolant
  Fuel
  Hydraulic Fluid
  Transmission/Torque Converter Fluid
WARNING ALARMS:
  Horn, Electric
  Reverse Alarm (SAE J994)
WARNING & MONITORING LIGHTS:
  Air Conditioner Malfunction
  Alternator Malfunction
  Brake Pump/Differential Pressure
  Brake System, Front
  Brake System, Rear
  Engine Coolant Temperature
  Engine Oil Pressure
  Hydraulic Fluid Temperature
  Low Fuel Level
  Parking Brake Applied
  Transmission Filter Restriction
  Transmission Temperature

OPTIONAL EQUIPMENT

Accessory Power Kit, 12V/6 Amp
Air Conditioner (Delete)
Beacon, Amber Rotating
Cab (Delete)
Cold Starting Aid, Engine
  Water & Oil Pre-heater (220V)
Counterweight, 1161 kg (2560 lb)
Coupler, Fast Fuel (Wiggins)
Engine Shutdown to Idle Kit
  For High Coolant Temp. &
  Low Engine Oil Pressure
Fan, Reversible
Fenders, Front
Fenders, Rear with Steps
Grille Guard
Hydraulic Fluid Fill & Evacuation
Long Boom
Lubrication System, Automatic
Lubrication System, Manual,
  Single Point
Mud Flaps (2), Front,
  Use with Front Fenders
Radiator, L&M
Radiator Sand Grid
Radiator Shutter Kit with
  Reversible Fan
ROPS Canopy (SAE J1040) (ISO 3471) (Delete)
Secondary Steering (Electrical)
Warning & Monitor Lights
  Coolant Level
  Hydraulic Filter Restriction Indicator
    with Low Hydraulic Fluid Level Warning
Worklights (2), Extra Hood Mounted
Tires
  35/65-33 (24PR) L-4
  35/65-33 (24PR) L-5
  35/65-33 (30PR) L-5
  35/65R33 XRDNAT★
  35/65R33 XRD1AT★
  35/65R33 XRD2AT★
  35/65R33 RL5E

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