

Service Manual

EP16, EP18, EP20, EP25, EP30 Chassis with MicroCommand II™ Controller

For 36/48V Trucks

EP16 & EP18	E1EP1-60001 & up
EP20 & EP25	E1EP2-60001 & up
EP30	E1EP3-60001 & up

For 72/80V Trucks

EP16 & EP18	E1EP1-80001 & up
EP20 & EP25	E1EP2-80001 & up
EP30	E1EP3-80001 & up

Product: Caterpillar EP16,EP18,EP20,EP25,EP30 Chassis with MicroCommand II? Controller Forklifts Service Repair Work
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Foreword

This service manual has instructions and procedures for the subject on the front cover. The information, specifications, and illustrations used in this manual are based on information that was current at the time this issue was written.

Correct servicing will give these lift trucks a long, productive life. Before attempting to start a test, repair or rebuild job, be sure you have studied the respective sections of this manual, and know all the components you will work on.

Safety is not only your concern but everybody's concern. Safe working habits cannot be bought or manufactured; they must be learned through the job you do. By learning what CAUTION or WARNING symbol emphasizes, know what is safe — what is not safe. Consult your foreman, if necessary, for specific instructions on a job, and the safety equipment required.

NOTES, CAUTIONS and WARNINGS

NOTES, CAUTIONS and WARNINGS are used in this manual to emphasize important and critical instructions. They are used for the following conditions.

NOTE

An operating procedure, condition, etc., essential to highlight.



CAUTION

Operating procedures, practices, etc. which, if not strictly observed, will result in damage to or destruction of the engine.



WARNING

Operating procedures, practices, etc., which, if not correctly followed, will result in serious injury or loss of life.



WARNING



WARNING

The proper and safe lubrication and maintenance for this machine, recommended by Catapillar, are outlined in the **OPERATION & MAINTENANCE MANUAL** for these machines.

Improper performance of lubrication or maintenance procedures is dangerous and could result in injury or death. Read and understand the OPERATION & MAINTENANCE MANUAL before performing any lubrication or maintenance.

The service mechanic may be unfamiliar with many of the systems on this machine. This makes it important to use caution when performing service work. A knowledge of the system and/or components is important before the removal or disassembly of any component.

Because of the size of some of the machine components, the service mechanic should check the weights noted in this manual. Use proper lifting procedures when removing any components.

Following is a list of basic precautions that should always be observed.

1. Read and understand all warning plates and decals on the machine before operating, lubricating or repairing the product.
2. Always wear protective glasses and protective shoes when working around machines. In particular, wear protective glasses when pounding on any part of the machine or its attachments with a hammer or sledge. Use welder's gloves, hood goggles, apron and other protective clothing appropriate to the welding job being performed. Do not wear loose-fitting or torn clothing. Remove all rings from fingers when working on machinery.
3. Do not work on any machine that is supported only by lift jacks or a hoist. Always use blocks or jack stands to support the machine before performing any disassembly.
4. Lower the forks or other implements to the ground before performing any work on the machine. If this cannot be done, make sure the forks or other implements are blocked correctly to prevent them from dropping unexpectedly.



WARNING

Do not operate this machine unless you have read and understand the instructions in the OPERATOR'S MANUAL. Improper machine operation is dangerous and could result in injury or death.

5. Use steps and grab handles (if applicable) when mounting or dismounting a machine. Clean any mud or debris from steps, walkways or work platforms before using. Always face machine when using steps, ladders and walkways. When it is not possible to use the designed access system, provide ladders, scaffolds, or work platforms to perform safe repair operations.
6. To reduce the risk of back injury, use a hoist when lifting components which weigh 23 kg (50lb.) or more. Make sure all chains, hooks, slings, etc., are in good condition and are of the correct capacity. Be sure hooks are positioned correctly. Lifting eyes are not to be side loaded during a lifting operation.
7. To reduce the risk of burns, be alert for hot parts on machines which have just been stopped and hot fluids in lines, tubes and compartments.
8. Be careful when removing cover plates. Gradually back off the last two bolts or nuts located at opposite ends of the cover or device and pry cover loose to relieve any spring or other pressure before removing the last two bolts or nuts completely.
9. Be careful when removing filler caps, breathers and plugs on the machine. Hold a rag over the cap or plug to prevent being sprayed or splashed by liquids under pressure. The danger is even greater if the machine has just been stopped because fluids can be hot.
10. Always use tools that are in good condition and be sure you understand how to use them before performing any service work.
11. Reinstall all fasteners with same part number. Do not use a lesser quality fastener if replacements are necessary. Do not mix metric fasteners with standard nuts and bolts.

12. If possible, make all repairs with the machine parked on a level, hard surface. Block machine so it does not roll while working on or under machine.
 13. Disconnect battery and discharge any capacitors before starting to work on machine. Hang "Do Not Operate" tag in the Operator's Compartment.
 14. Repairs, which require welding, should be performed only with the benefit of the appropriate reference information and by personnel adequately trained and knowledgeable in welding procedures. Determine type of metal being welded and select correct welding procedure and electrodes, rods or wire to provide a weld metal strength equivalent at least to that of parent metal.
 15. Do not damage wiring during removal operations. Reinstall the wiring so it is not damaged nor will it be damaged in operation by contacting sharp corners, or by rubbing against some object or hot surface. Do not connect wiring to a line containing fluid.
 16. Be sure all protective devices, including guards and shields, are properly installed and functioning correctly before starting a repair. If a guard or shield must be removed to perform the repair work, use extra caution.
 17. Always support the mast and carriage to keep carriage or attachments raised when maintenance or repair work is performed, which requires the mast in the raised position.
 18. Loose or damaged hydraulic lines, tubes and hoses can cause fires. Do not bend or strike high pressure lines or install ones which have been bent or damaged. Inspect lines, tubes and hoses carefully. Do not check for leaks with your hands. Pin hole (very small) leaks can result in a high velocity oil stream that will be invisible close to the hose. This oil can penetrate the skin and cause serious injury. Use cardboard or paper to locate pin hole leaks.
 19. Tighten connections to the correct torque. Make sure all heat shields, clamps and guards are installed correctly to avoid excessive heat, vibration or rubbing against other parts during operation. Shields that protect against oil spray onto hot components in event of a line, tube or seal failure must be installed correctly.
 20. Relieve all pressure in air, oil or water systems before any lines, fittings or related items are disconnected or removed. Always make sure all raised components are blocked correctly and be alert for possible pressure when disconnecting any device from a system that utilizes pressure.
 21. Do not operate a machine if any rotating part is damaged or contacts any other part during operation. Any high speed rotating component that has been damaged or altered should be checked for balance before reusing.
 22. Caution should be used to avoid breathing dust that may be generated when handling components containing asbestos fibers. If this dust is inhaled, it can be hazardous to your health.
- If dust which may contain asbestos is present, there are several common sense guidelines that should be followed.
- a. Never use compressed air for cleaning.
 - b. Avoid brushing or grinding of asbestos containing materials.
 - c. For clean up, use wet methods or a vacuum equipped with a high efficiency particulate air (HEPA) filter.
 - d. Use exhaust ventilation on permanent machining jobs.
 - e. Wear an approved respirator if there is no other way to control the dust.
 - f. Comply with applicable rules and regulations for the work place.
 - g. Follow environmental rules and regulations for disposal of asbestos.
 - h. Avoid areas where asbestos particles may be in the air.

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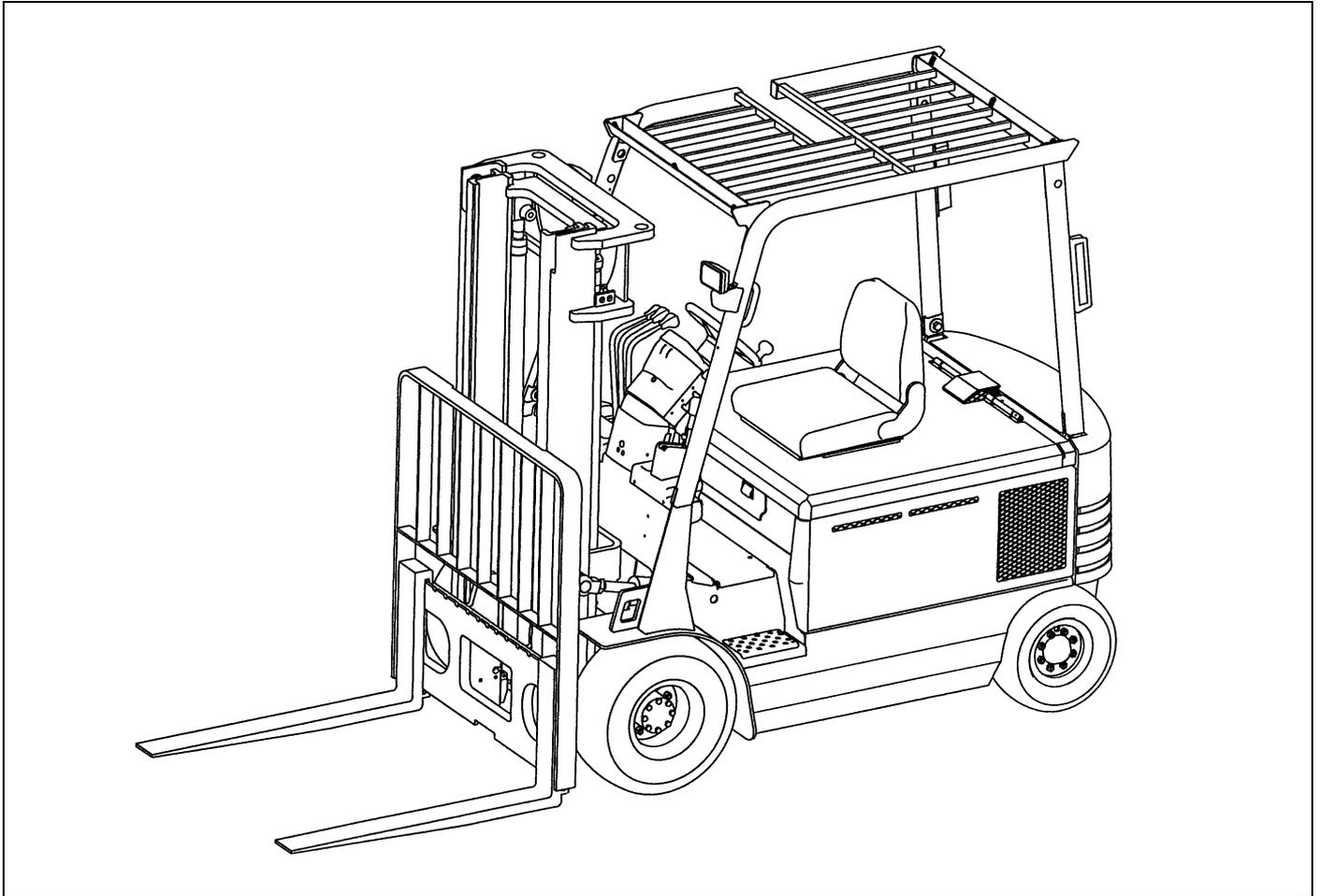
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Scope

This service manual deals with all components or systems of the Caterpillar® Lift Trucks, except for the electrical system, which is covered in a separate manual.



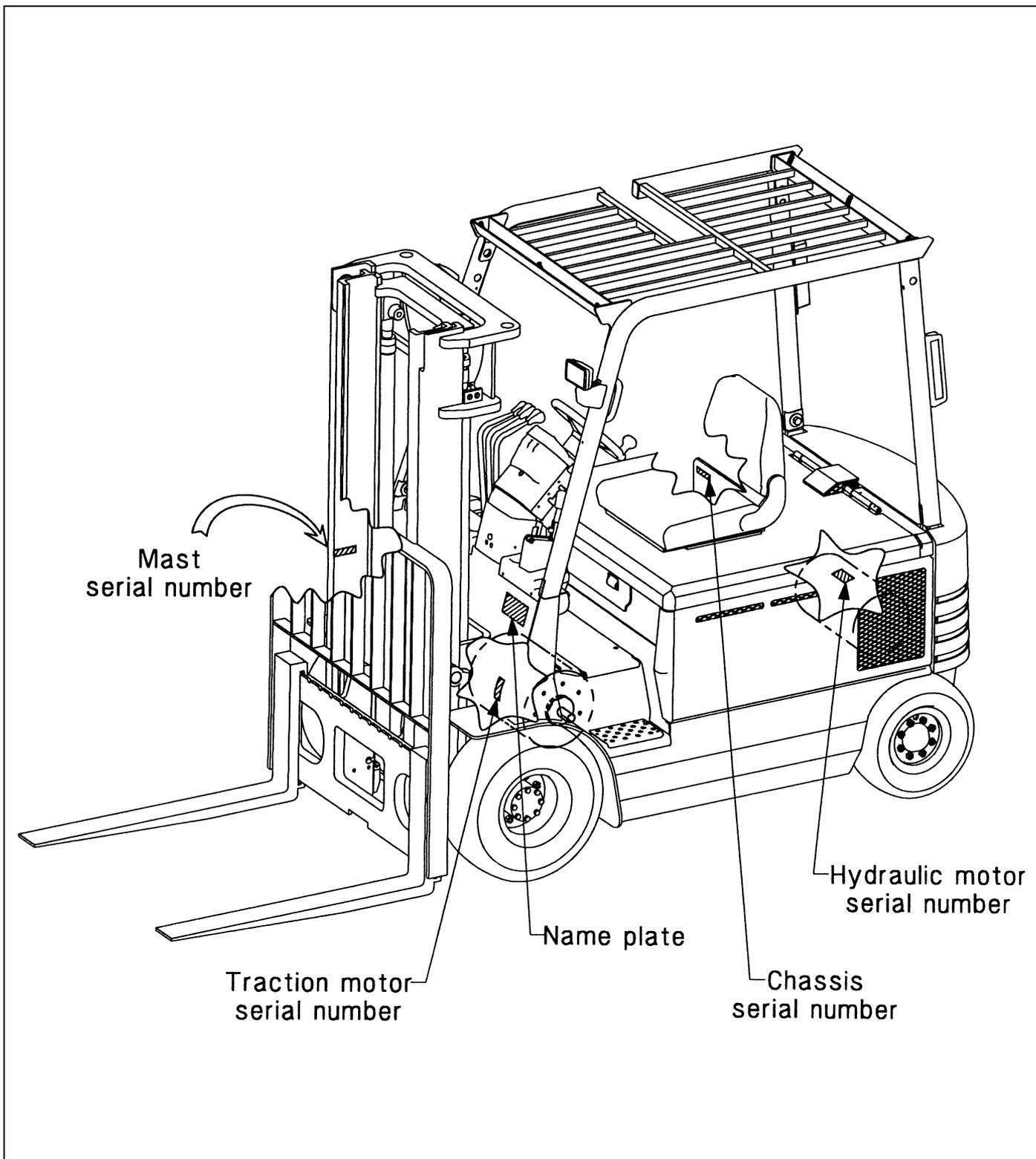
Truck Models Covered

This service manual furnishes service and maintenance information for the following trucks.

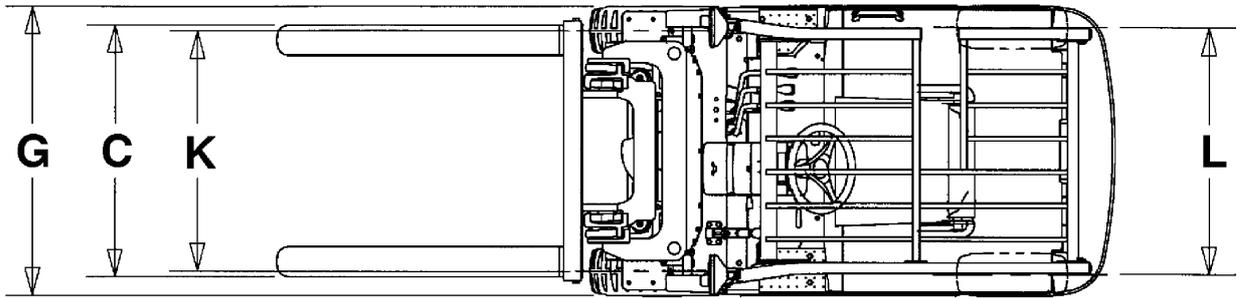
Truck Model	Serial Number
Serial Numbers for Trucks with Voltages 36V or 48V	
EP16, EP18	E1EP1-60001 & UP
EP20, EP25	E1EP2-60001 & UP
EP30	E1EP3-60001 & UP
Serial Numbers for Trucks with Voltages 72V or 80V	
EP16, EP18	E1EP1-80001 & UP
EP20, EP25	E1EP2-80001 & UP
EP30	E1EP3-80001 & UP

GENERAL INFORMATION: PLATES

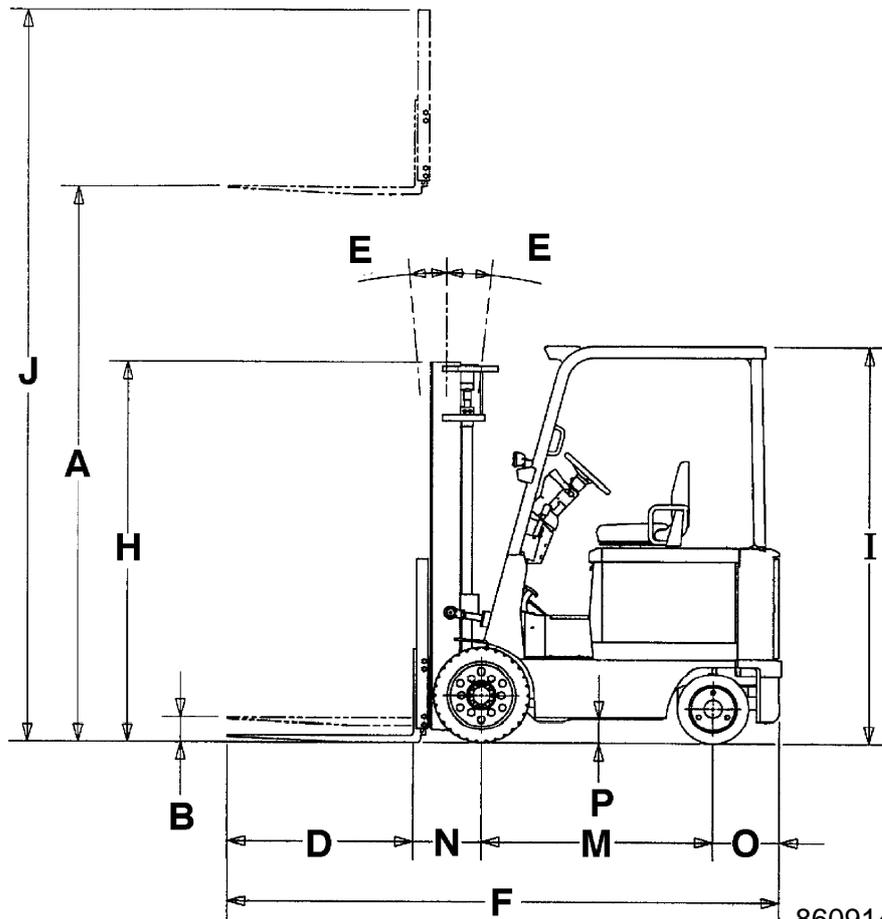
Nameplate and Serial Number Locations



Dimensions



860142



8609143

GENERAL INFORMATION: DIMENSIONS

Dimensions Chart

Ref#	Truck Model	EP16	EP18	EP20	EP25	EP30
A	Maximum Lift	3335 (131.3)	3335 (131.3)	3340 (131.5)	3340 (131.5)	3245 (127.8)
B	Free Lift	115 (4.5)	115 (4.5)	142 (5.6)	142 (5.6)	150 (5.9)
C	Maximum Fork Spacing (outside to outside)	918 (36.1)	918 (36.1)	983 (38.7)	983 (38.7)	998 (39.3)
D	Fork Length	920 (36.2)	920 (36.2)	1070 (42.1)	1070 (42.1)	1070 (42.1)
E	Tilt Angle (forward / backward)	6° / 9°		6° / 8°		
F	Overall Length	3018 (118.8)	3018 (118.8)	3433 (135.2)	3433 (135.2)	3641 (143.3)
G	Overall Width (fenders)	1160 (45.7)	1160 (45.7)	1190 (46.8)	1190 (46.8)	1230 (48.4)
H	Overall Height (to top of mast, lowered)	2128 (83.8)	2128 (83.8)	2191 (86.3)	2191 (86.3)	2200 (86.6)
I	Overall Height (to top of overhead guard)	2180 (85.8)	2180 (85.8)	2200 (86.6)	2200 (86.6)	2250 (88.6)
J	Overall Height (to top of mast, extended)	4327 (170.4)	4327 (170.4)	4327 (170.4)	4327 (170.4)	4435 (174.6)
K	Tread (front)	950 (37.4)	950 (37.4)	980 (38.6)	980 (38.6)	990 (39.0)
L	Tread (rear)	898 (35.4)	898 (35.4)	985 (38.8)	985 (38.8)	985 (38.8)
M	Wheelbase	1400 (55.1)	1400 (55.1)	1585 (62.4)	1585 (62.4)	1730 (68.1)
N	Front Overhang	392 (15.4)	392 (15.4)	417 (16.4)	417 (16.4)	480 (18.9)
O	Rear Overhang	306 (12.0)	306 (12.0)	361 (14.2)	361 (14.2)	361 (14.2)
P	Underclearance (at center of wheelbase)	105 (4.1)	105 (4.1)	122 (4.8)	122 (4.8)	123 (4.8)

Unit: mm (in.)

GENERAL INFORMATION: STANDARD MODELS

General Information (Standard Models)

			Truck Model					
			Units	EP16	EP18	EP20	EP25	EP30
Standard Controller			MicroCommand					
Standard Simplex Mast Size			meters	3.3	3.3	3.3	3.3	3.2
Service Weight (standard axle)	Without Battery	kg(lb)	2355 (5190)	2415 (5325)	2940 (6485)	3095 (6825)	3495 (7710)	
	With Max. Battery		3705 (8170)	3765 (8300)	4705 (10,375)	4860 (10,715)	5585 (12,315)	
Work Performance	Rated Capacity / Load Center		kg/mm (lb/in.)	1600/500 (3000/24)	1800/500 (3500/24)	2000/500 (4000/24)	2500/500 (5000/24)	3000/500 (6000/24)
	Maximum Fork Height		mm(in.)	3335(131)		3340(132)		3345(132)
	Lift Speed (rated load)	36V	m/sec. (fpm)	0.29(57)	0.29(57)	0.29(57)	0.27(53)	—
		48V		0.39(77)	0.38(75)	0.38(75)	0.36(71)	—
		80V		0.40(79)	0.39(77)	0.40(79)	0.38(75)	0.34(67)
	Lowering Speed (rated load)			0.58(114)			0.59(116)	0.52(102)
	Tilt Angle (forward/backward)		degrees	6°/9°		6°/8°		
Free Lift		mm (in)	115(4.5)		142(5.6)		150(5.9)	
Traveling Performance	Travel Speed (without load)	36V	km/h (mph)	12.2(7.6)	12.0(7.4)	15.0(9.3)	14.3(8.9)	—
		48V		16.3(10.1)	16.0(9.9)	20.0(12.4)	19.0(11.8)	—
		80V		16.7(10.4)	16.7(10.4)	20.0(12.4)	19.0(11.8)	19.5(12.1)
	Minimum Turning Radius		mm (in)	1885 (74.2)	1885 (74.2)	2125 (83.7)	2125 (83.7)	2260 (89.0)
Power Train	Traction Motor Output (60 min duty)	36V	KW—1 hr (hp)	5.5(7.4)		9.1(12.2)		—
		48V		7.6(10.2)		12.5(16.8)		—
		80V		9.4(12.6)		11.0(14.8)		—
	Transfer Gear	Type	Spur					
		Ratio	3.983					
	Reduction Gear	Type	Skew Bevel					
		Ratio	3.769					
	Differential	Axle Housing		Banjo				
Gear Type/ Number		Gears	Straight Bevel /2					
		Pinions	Straight Bevel / 2					

GENERAL INFORMATION: STANDARD MODELS

				Truck Model					
				Units	EP16	EP18	EP20	EP25	EP30
Power Steering System	Type			Dynamic Load Sense					
	Turning Angle	Inside	Degrees	83°					
		Outside		56.5°					
	Steering Wheel Diameter		mm (in.)	328 (13)					
Cylinder Minimum Test Pressure		kgf/cm ² (psi) [kPa]	163 (2320) [16,000]						
Brake System	Service Brake	Type		Self-Adjusting Duo Servo					
		Inside Drum Diameter	mm (in.)	254 ^{+0^{0.13}}	279.4 ^{+0^{0.13}} (11.00 ^{+0^{0.0051}})	310.0 ^{+0^{0.13}} (12.20 ^{+0^{0.0051}})			
		Lining Thickness	mm (in.)	4.87 (.19)	5.1(0.20)	5.67(0.22)			
		Master Cylinder ID	mm (in.)	19.05 ^{+0^{0.052}} (0.7500 ^{+0^{0.00205}})	19.05 ^{+0^{0.052}} (0.7500 ^{+0^{0.00205}})				
	Wheel Cylinder ID	mm (in.)	22.22 ^{+0^{0.052}} (0.8748 ^{+0^{0.0020}})	22.22 ^{+0^{0.052}} (0.8748 ^{+0^{0.00205}})	28.58 ^{+0^{0.052}} (1.1252 ^{+0^{0.0020}})				
	Park Brake	Type		Mechanical, Mounted on Front Wheels					
Lever Operating Effort		kgf (lbf) [N]	25 to 30 (55 to 66) [245 to 294]						
Traveling System	Mounting	Front Wheels		Fixed Type					
		Rear Wheels		Center Pivot Type					
	Wheel Alignment	Oscillation Angle	Degrees	3°					
Camber		1°							

GENERAL INFORMATION: STANDARD MODELS

		Truck Model					
		Units	EP16	EP18	EP20	EP25	EP30
Hydraulic System	Hydraulic Pump	Type		Gear			
		Make		Ultra Hydraulics, Inc.			
		Model		1SX230	2SR029		
		Displacement	cc (cu in.)	23.0 (1.40)/rev.	29.0 (1.77)/rev.		
	Control Valve	Make		Kayaba			
		Model		KVSF65			
		Relief Pressure	kgf /cm ² (psi) [kPa]	185*0 ⁵ (2631*0 ⁷¹) [18142*0 ⁴⁹⁰]			
	Flow Regulator Valve	Type		Variable			
	Lift Cylinders	Regulated Flow Rate	liter (cu.in.) / min	50±3 (3051± 183)	65 ± 3 (3967 ± 183)		75 ± 3 4577 ± 183
		ID	mm (in.)	45 (1.77)	50 (1.97)	55 (2.17)	
		Stroke		1650 (64.96)		1600 (62.99)	
	Tilt Cylinders	ID		63 (2.48)	70(2.75)	80 (3.15)	
Stroke			96 (3.78)	98 (38.6)	124 (4.88)		
Hydraulic Tank Capacity (Approx)		liter (US gal.)	25(6.6)	25 (6.6)	30 (7.9)		
Mast and Forks	Mast		Roller type CL				
	Mast Dimensions (Flange Inside Width x THK x WEB THK)	Outer	mm (in.)	100 x 15 x 12 (3.94 x 0.59 x 0.47)	115 x 20 x 13 (4.53 x 0.79 x 0.51)	115 x 21 x 13 (4.53 x 0.83 x 0.51)	
		Inner		100 x 17 x 12 (3.94 x 0.67 x 0.47)	115 x 21 x 13 (4.53 x 0.83 x 0.51)		
	Main Rollers	Type		# 6308 Ball Bearing	#6309 Ball Bearing		
		Diameter x Width		100 x 30 (3.94 x 1.18)	115 x 35 (4.53 x 1.58)		
	Side Rollers	Type		Lubricating type needle roller bearing			
		Diameter x Width	mm (in.)	42 x 36 (1.65 X 1.42)			
	Lift Chains			BL534	BL634	BL834	
	Forks (Lgth x wdth x Thk)		mm (in.)	920 x 100 x 35 (36 x 4 x 1.4)	920 x 100 x 35 (36 x 4 x 1.4)	1070 x 125 x 40 (42 x 5 x 1.6)	1070 x 125 x 45 (42 x 5 x 1.8)
	Fork Spacing (out to out)			200 to 918 (7.9 to 36.1)		250 to 983 (9.8 to 38.7)	250 to 998 (9.8 to 39.3)

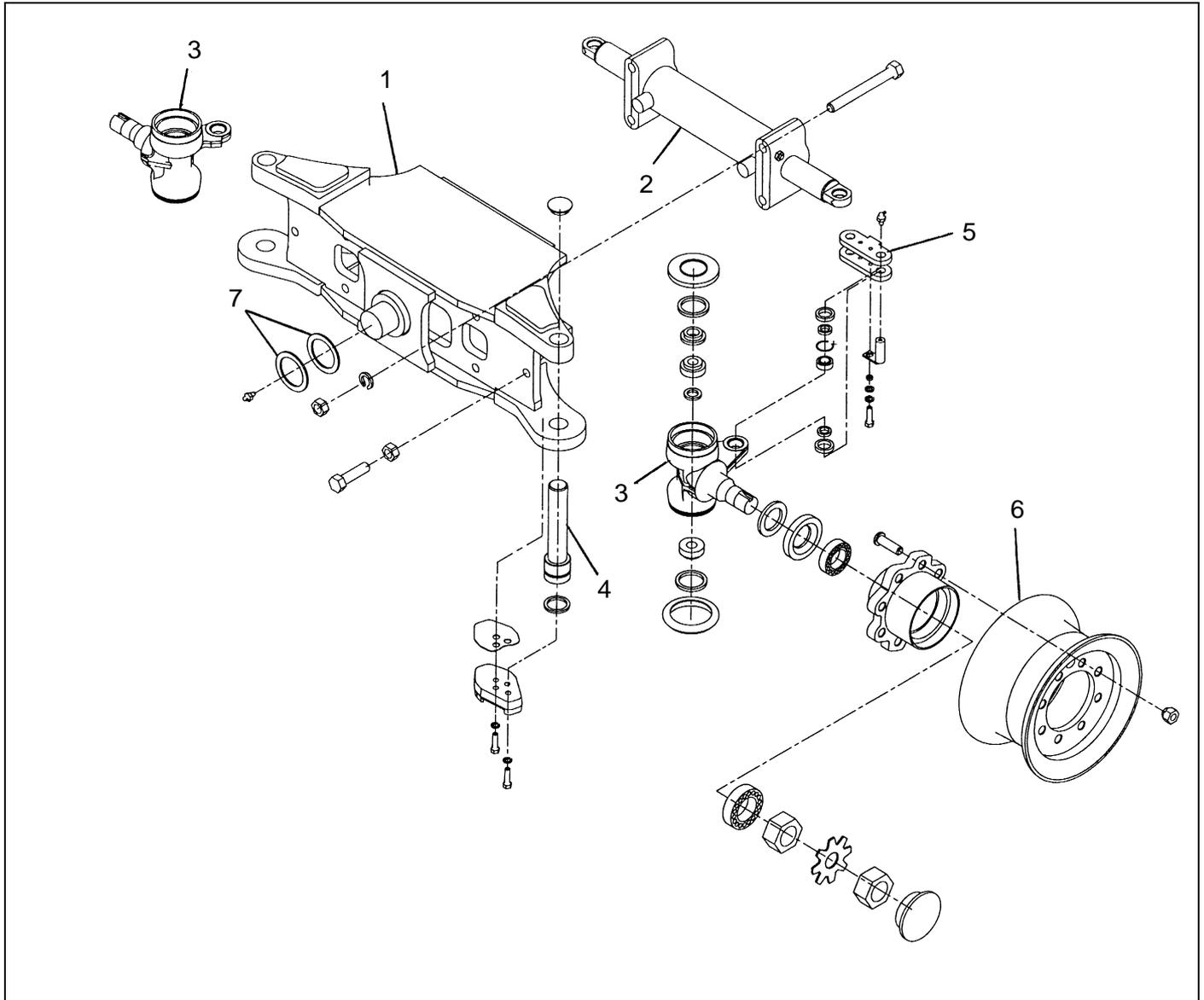
GENERAL INFORMATION

		Truck Model						
		Units	EP16	EP18	EP20	EP25	EP30	
Battery	Voltage		36/48/72/80	36/48/72/80	36/48/72/80	36/48/72/80	72/80	
	Amp Hours (5hr. rate) max.	36V	1050		1350		—	
		48V	750		1050		—	
		72V	500		600		800	
		80V	450		600		750	
	Compartment Dimensions	Height-Center	mm (in.)	794 (31.3)				
		Heights-Edges		788 (31.0)				
		Length		580		725		870
		Width		1040		1040		1040
	Weight (Min/Max)	kg (lb)	995/1350 (2194/2977)	1215/1350 (2679/2977)	930/1765 (2050/3892)	1385/1765 (3054/3892)	1710/2090 (3770/4608)	

Chapter 2: Rear Axle

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Description



1. Rear axle
2. Steering cylinder
3. Steering knuckles
4. King pins
5. Tie rods
6. Wheel rims
7. Shims

General Information

The machine is steered by the rear wheels. The rear axle is connected to the frame by its center pivot shaft. Because of the center pivoting feature, the rear axle can oscillate up to 3° in each direction.

Removal and Installation of Rear Wheels

WARNING

Servicing and changing tires and rims can be dangerous and should be done only by trained personnel using proper tools and procedures. If correct procedures are not followed while servicing tires and rims, the assemblies could burst with explosive force and cause serious physical injury or death. Carefully follow the specific information provided by your tire servicing company or dealer.

Use a tire inflation gauge and stand behind the tread when inflating a tire and checking tire pressure.

Proper inflation equipment and training in using the equipment are necessary to reduce the risk of overinflation. A tire blowout or rim failure can result from improper or misused equipment.

NOTE

When changing tires, change them in sets, even if only one of the tires is damaged. If new and used tires are on the same axle, tilting of the mast and rapid tire wear will result.

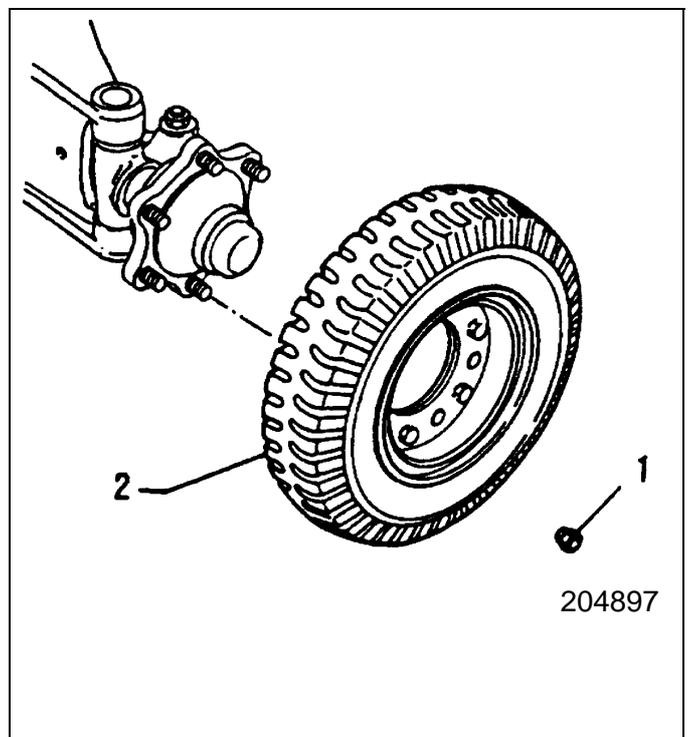
The mounting faces of the hub, wheel nuts and wheels must be free of any foreign material and lubricants of any kind. Tighten wheel nuts again after 24 hours of operation.

Removal

1. Wheel nuts
2. Rear wheel

CAUTION

- Always deflate tires before changing them to reduce the risk of a tire explosion.
- Make sure the replacement tire is of the same size, type and load range.
- Make sure the replacement tire is properly inflated.



Suggestions

1. Block the front wheels.
2. Pull the parking brake lever, and loosen the wheel nuts one to two turns.
3. Slightly deflate tires to be removed.
4. Raise the rear end of the machine with a jack.

Jack Capacities

EP16, EP18	3 ton (6700 #lb) minimum
EP20, EP25, EP30	5 tons (12000 #lb) minimum

WARNING

- **To avoid the possibility of serious injury DO NOT attempt to change the tire with the truck loaded.**
- **BE SURE to get off the truck when raising the rear tire.**
- **Stop raising the truck when the tire clears the ground. To avoid the possibility of serious injury, DO NOT raise the truck more than is necessary.**
- **DO NOT put any portion of your body under the truck. SECURELY SUPPORT with blocks after jacking.**

Method Using a Jack

Position the jack under the side of the frame or beneath the center of the steer axle beam.

After lifting, securely support by blocks.

REAR AXLE: REAR WHEELS

5. Remove the wheel nuts (loosened in step 2).



Be careful NOT to strip the bolt threads when removing the wheel.

6. Firmly grip the wheel with both hands and remove it from the truck.

NOTE

The tire pressure is indicated on the nameplate attached to the top of the battery hood.

Installation

To install, follow the reverse of the removal sequence, including the following steps.

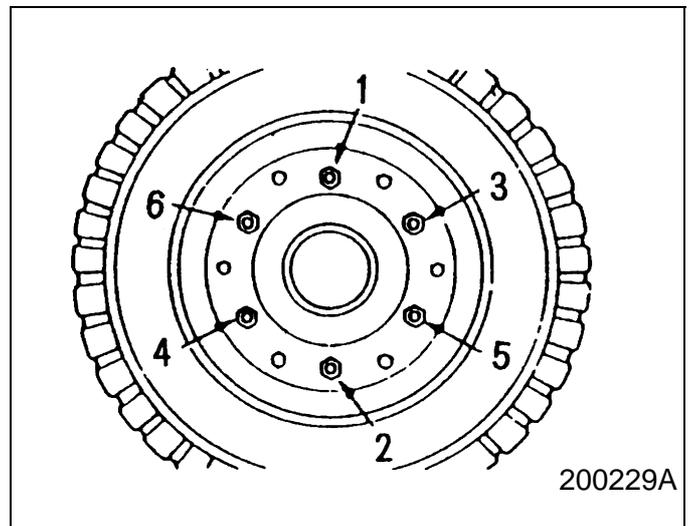


Use the same size and brand tire.

1. Install the tire and tighten the wheel nuts so the the tire will not rattle.
2. Jack the truck and remove supporting blocks. Lower the truck by operating the jack until the tire just touches the ground. Then tighten the wheel nuts in the sequence shown in two or three steps, to the specified torque.

Tighten torque for wheel nuts	16 kgf·m (116 lbf·ft) [157 N·m]
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3. Lower the truck fully, inflate tires and restore the jack.
4. Check to make sure the tire pressure is correct.

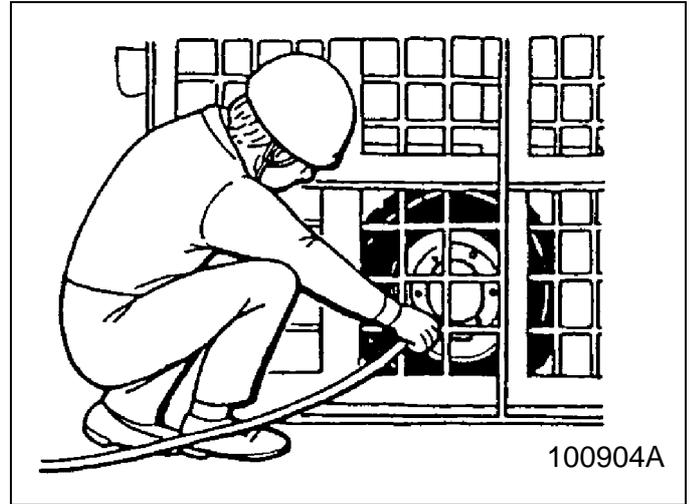


5. After tire replacement, drive the truck for a while and check the wheel nuts for tightness.

! WARNING

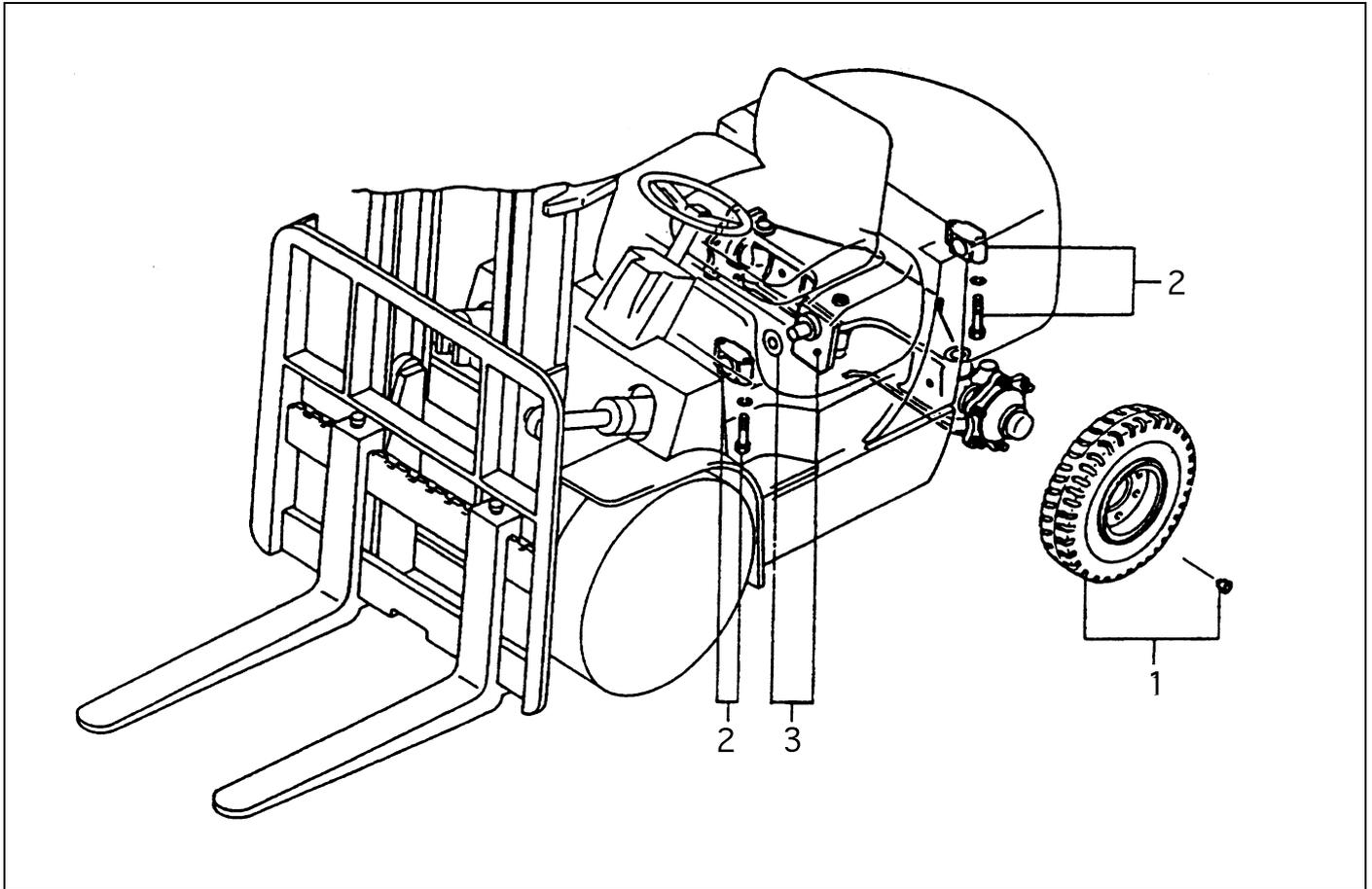
When adding air to the tire or when checking tire pressure, **BE SURE** to keep your body away from the side. The use of an inflation cage, or some other safety device helps reduce the risk of serious injury.

When adding air to the tire using an air compressor, make sure the compressor valve is correctly set. Failure to follow this precaution may cause serious injury or may damage the tire. Always maintain correct tire pressure.



REAR AXLE: REMOVAL & INSTALLATION

Removal and Installation of Rear Axle

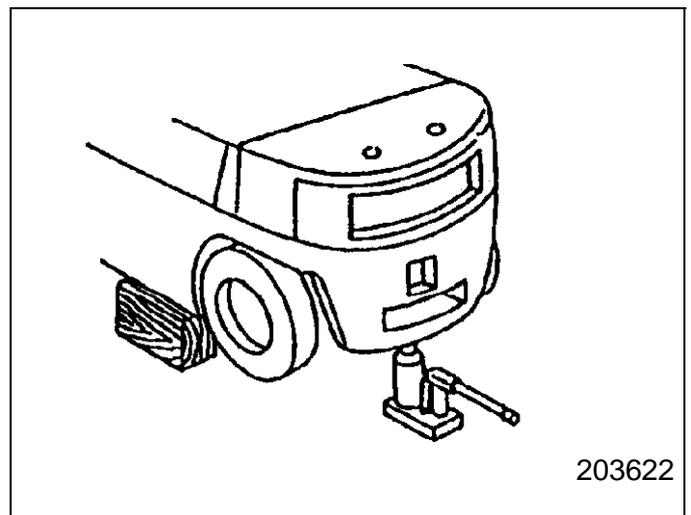


Sequence

1. Rear wheel, wheel nuts
2. Bearing support
3. Rear axle assembly [thrust washer]

To Start:

1. Apply the parking brake and block the front wheels.
2. Raise the rear end of the truck with a jack and place wood blocks under the side frames (with the left and right rear wheels slightly clearing the floor).



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REAR AXLE: REMOVAL & INSTALLATION

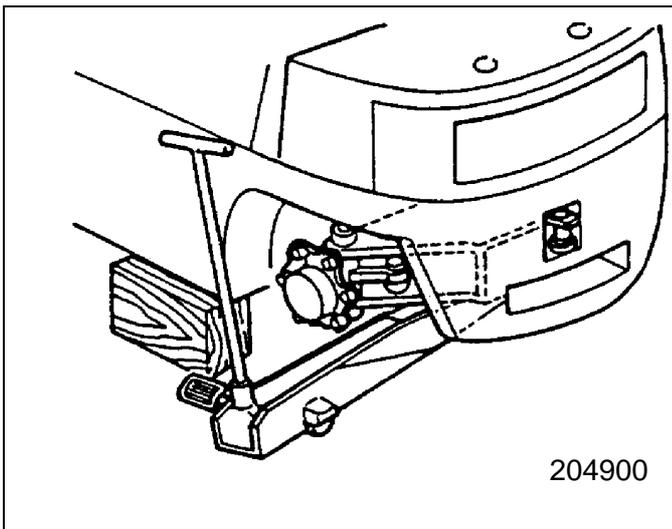
Removal

Removing Rear Axle Assembly

! WARNING

Be sure the pressure in the hydraulic system is released before any lines or hoses are disconnected.

1. Put identification marks on the hoses, then disconnect them.
2. Support the rear axle at its center with a garage jack.
3. Loosen and remove the axle mounting bolts.



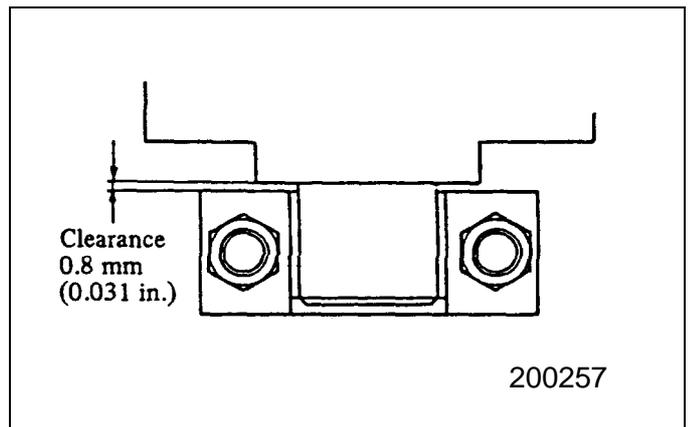
Installation

To install, reverse the removal sequence including the following.

Adjusting Bearing Support Clearance

Adjust the longitudinal clearance to 0.8mm (0.031 in.) with the thrust washer, and tighten the bolts holding the bearing support to the specific torque.

Tightening torque for bearing support bolts	14.8 kgf·m (107 lbf·t) [145 N·m]
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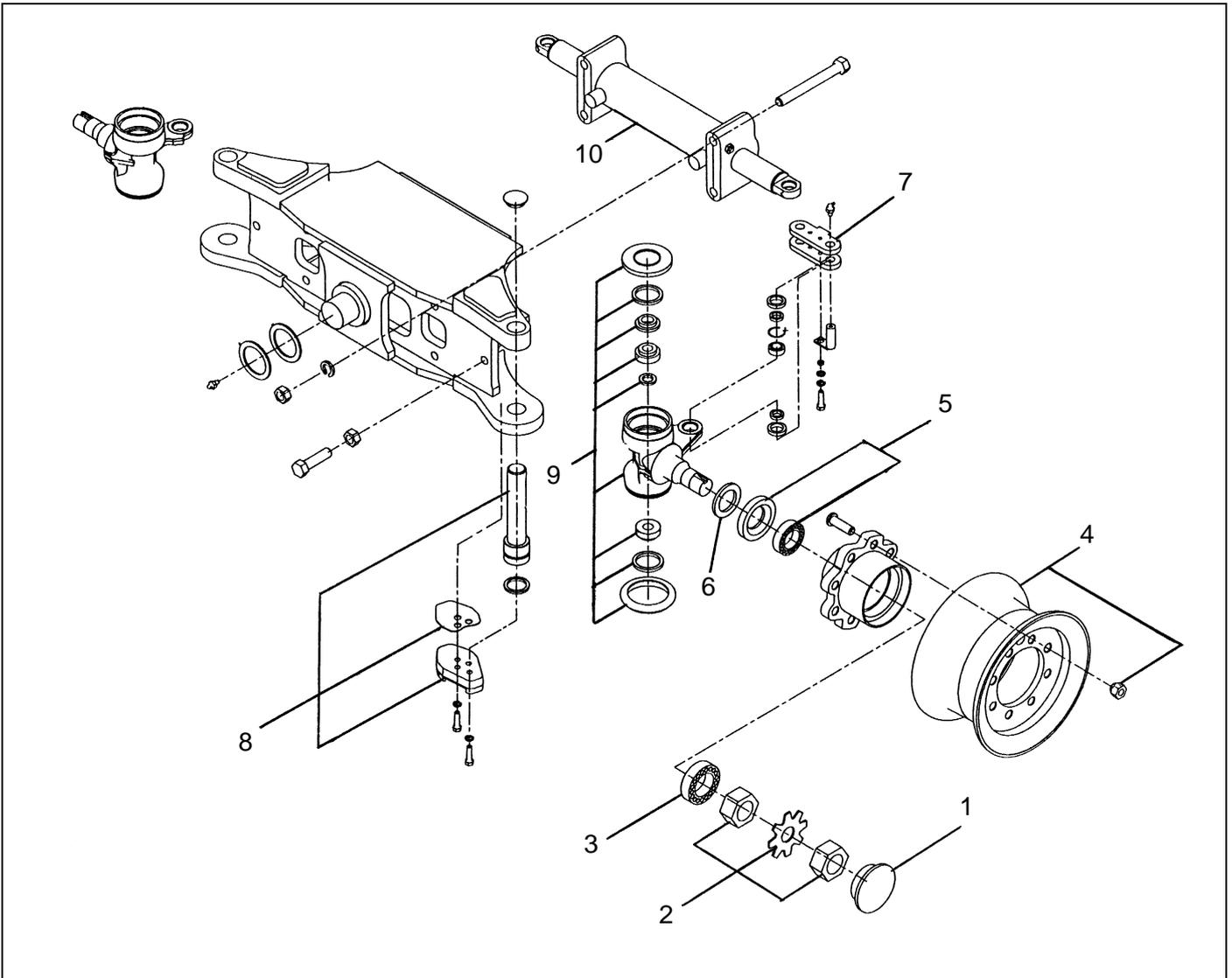
REAR AXLE: DISASSEMBLY

Product: Caterpillar EP16 EP18 EP20 EP25 EP30 Chassis with MicroCommand II? Controller Forklifts Service Repair Work

Full Download: <https://www.arepairmanual.com/downloads/caterpillar-ep16ep18-ep20ep25ep30-chassis-with-microcommand-ii-controller-forklif>

<https://www.arepairmanual.com/downloads/caterpillar-ep16ep18-ep20ep25ep30-chassis-with-microcommand-ii-controller-forklif>

Disassembly



Sequence

- | | |
|-------------------------|-----------------------|
| 1. Cap | 6. Oil seal |
| 2. Nuts and washer | 7. Tie rods |
| 3. Bearing | 8. King pins |
| 4. Wheel rim | 9. Knuckles |
| 5. Bearing and retainer | 10. Cylinder assembly |