



Service Manual

Chassis & Mast

| | |
|-------------|-------------------------|
| FD80 | F32B-00011-09999 |
| FD90 | F32B-50001-59999 |

FOREWORD

This service manual is a guide to servicing of Mitsubishi Forklift Trucks of 8-ton and 9-ton models. The instructions are grouped by systems to serve the convenience of your ready reference.

Long productive life of your forklift trucks depends to a great extent on correct servicing – the servicing consistent with what you will learn from this service manual. We hope you read the respective sections of this manual carefully and know all the components you will work on before attempting to start a test, repair or rebuild job.

The descriptions, illustrations and specifications contained in this manual were of the trucks of serial numbers in effect at the time it was approved for printing. Mitsubishi reserves the right to change specifications or design without notice and without incurring obligation.

These forklift trucks are powered by Mitsubishi 6D16 diesel engine. For the items of the engine, refer to the following service manual:

6D16 Diesel Engine Service Manual (Pub. No. 99709-58100)

Safety Related Signs

The following safety related signs are used in this service manual to emphasize important and critical instructions:



Indicates a specific potential hazard resulting in serious bodily injury or death.



Indicates a specific potential hazard resulting in bodily injury, or damage to, or destruction of, the machine.



Indicates a condition that can cause damage to, or shorten service life of, the machine.

SAFETY

 **WARNING**

The proper and safe lubrication and maintenance for this forklift truck, recommended by Mitsubishi, are outlined in the OPERATION & MAINTENANCE MANUAL for these trucks.

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 serviceman or mechanic may be unfamiliar with many of the systems on this truck. 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 truck components, the serviceman or 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 truck before operating, lubricating or repairing the product.
2. Always wear protective glasses and protective shoes when working around trucks. In particular, wear protective glasses when pounding on any part of the truck or its attachments with a hammer or sledge. Use welders 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 truck that is supported only by lift jacks or a hoist. Always use blocks or jack stands to support the truck before performing any disassembly.

4. Lower the forks or other implements to the ground before performing any work on the truck. 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 truck unless you have read and understand the instructions in the OPERATION & MAINTENANCE MANUAL. Improper truck operation is dangerous and could result in injury or death.

5. Use steps and grab handles (if applicable) when mounting or dismounting a truck. Clean any mud or debris from steps, walkways or work platforms before using. Always face truck 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 avoid back injury, use a hoist when lifting components which weigh 23 kg (50 lb.) 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 avoid burns, be alert for hot parts on trucks 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 truck. 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 truck 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 truck parked on a level, hard surface. Block truck so it does not roll while working on or under truck.
13. Disconnect battery and discharge any capacitors (electric trucks) before starting to work on truck. 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 fuel, lubricant and 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 personal injury. Use cardboard or paper to locate pin hole leaks.
19. Tighten connections to the correct torque. Make sure that 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 exhaust 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 truck 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.

HOW TO READ THIS MANUAL

1. Service data in the text

Example:

A: Standard value B: Repair or service limit

Unit: mm (in.)

| | | |
|---------------------------------------|---|--|
| Clearance between cylinder and piston | A | 0.020 to 0.105 (0.00079 to 0.00413) |
| | B | 0.15 (0.0059) |

2. Symbols or abbreviations

OP Option

R1/4 Taper pipe thread (external) 1/4 inch (formerly PT1/4)

Rc1/8 Taper pipe thread (internal) 1/8 inch (formerly PT1/8)

G1/4A Straight pipe thread (external) 1/4 inch (formerly PF1/4-A)

Rp1/8 Straight pipe thread (internal) 1/8 inch (formerly PS1/8)

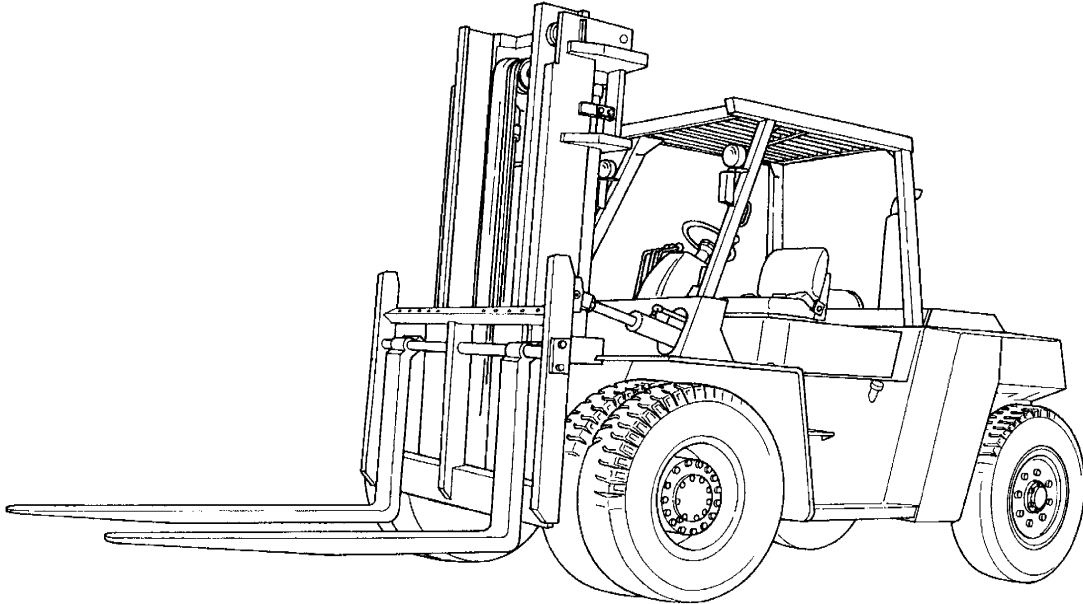
GROUP INDEX

| GROUP INDEX | Items | |
|--|---|-----------|
| GENERAL INFORMATION | Model view, Truck models covered, Serial number locations, Technical data, Dimensions | 1 |
| COOLING SYSTEM | Removal and installation, Fan belt adjustment | 2 |
| ELECTRICAL SYSTEM | Console box, Major components, Lamp bulb specifications, Batteries, Electrical system schematic | 3 |
| POWER TRAIN | 2-speed transmission, 3-speed transmission, Gear ratios, Removal and installation, Engine and transmission unit | 4 |
| 2-SPEED POWERSHIFT TRANSMISSION | Torque converter, Transmission, Power flow, Control valve, Main regulator valve, Hydraulic controls, Speed selector system, Control system | 5 |
| 3-SPEED POWERSHIFT TRANSMISSION | Torque converter, Transmission, Power flow, Control valve, Main regulator valve, Hydraulic controls, Speed selector system, Control system | 6 |
| FRONT AXLE AND REDUCTION DIFFERENTIAL | Front wheels (tires), Front axle and Reduction differential | 7 |
| REAR AXLE | Rear axle, Power cylinder, Minimum turning radius | 8 |
| BRAKE SYSTEM | Wheel brake system, Brake control valve, Air master, Air governor, Air dryer, Parking brake, Testing and Adjusting | 9 |
| STEERING SYSTEM | Steering control valve, Tilt steering assembly | 10 |
| HYDRAULIC SYSTEM | Hydraulic system, Hydraulic tank, Gear pump, Priority valve, Control valve, Flow regulator valve, Down safety valve, Lift and tilt cylinders | 11 |
| MASTS AND FORKS | Dual-stage panoramic mast (Simplex mast), Triple-stage full free panoramic mast (Triplex mast) | 12 |
| SERVICE DATA | Maintenance chart, Tightening torque for standard bolts and nuts, Periodic replacement parts, Lubrication instructions, Weight of major components, Special tools | 13 |

GENERAL INFORMATION

| | |
|--------------------------------|-------|
| Model View | 1 – 1 |
| Truck Models Covered | 1 – 1 |
| Serial Number Locations | 1 – 2 |
| Technical Data | 1 – 3 |
| Dimensions (Approximate) | 1 – 4 |

Model View



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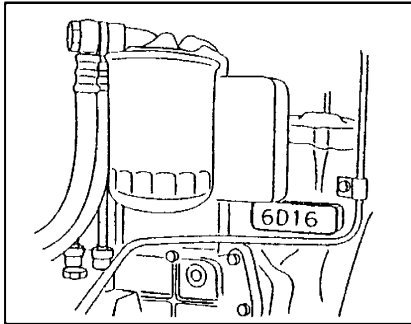
Truck Models Covered

This Service Manual furnishes servicing and maintenance information for the following trucks:

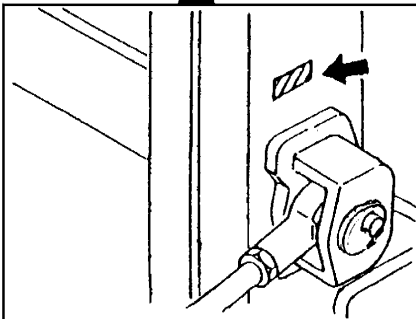
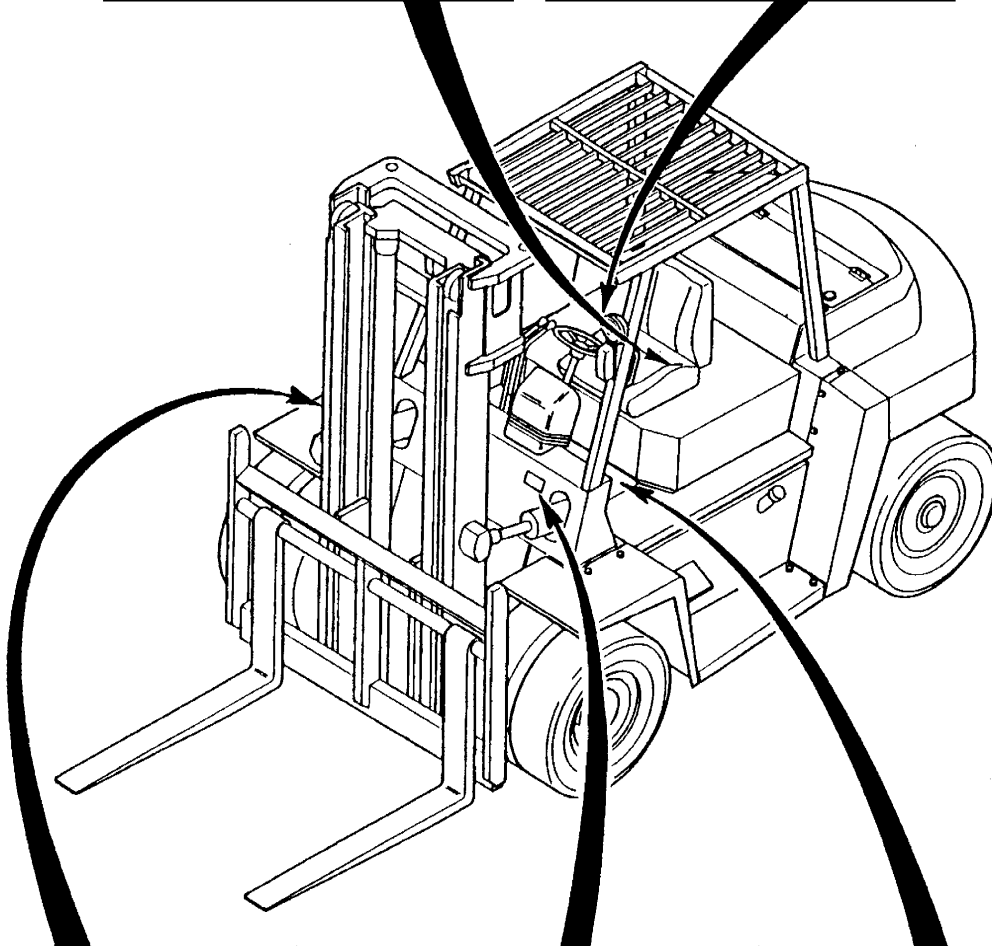
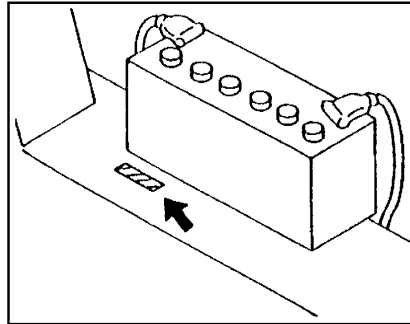
| Truck model | Transmission | Designation – Serial number | Engine mounted |
|-------------|--------------|-----------------------------|-------------------------------|
| FD80 | Powershift | F32B – 00011- 49999 | Mitsubishi 6D16 diesel engine |
| FD90 | Powershift | F32B – 50001- 99999 | Mitsubishi 6D16 diesel engine |

Serial Number Locations

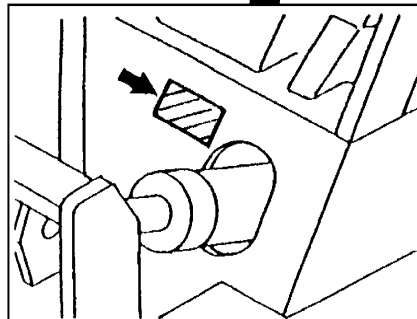
Diesel engine serial number



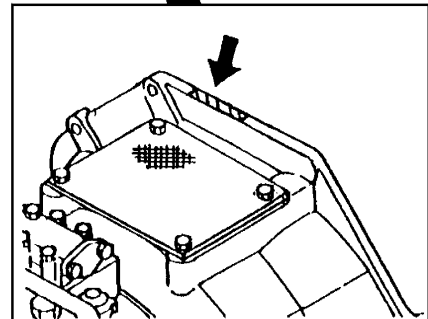
Chassis serial number



Mast serial number



Name plate

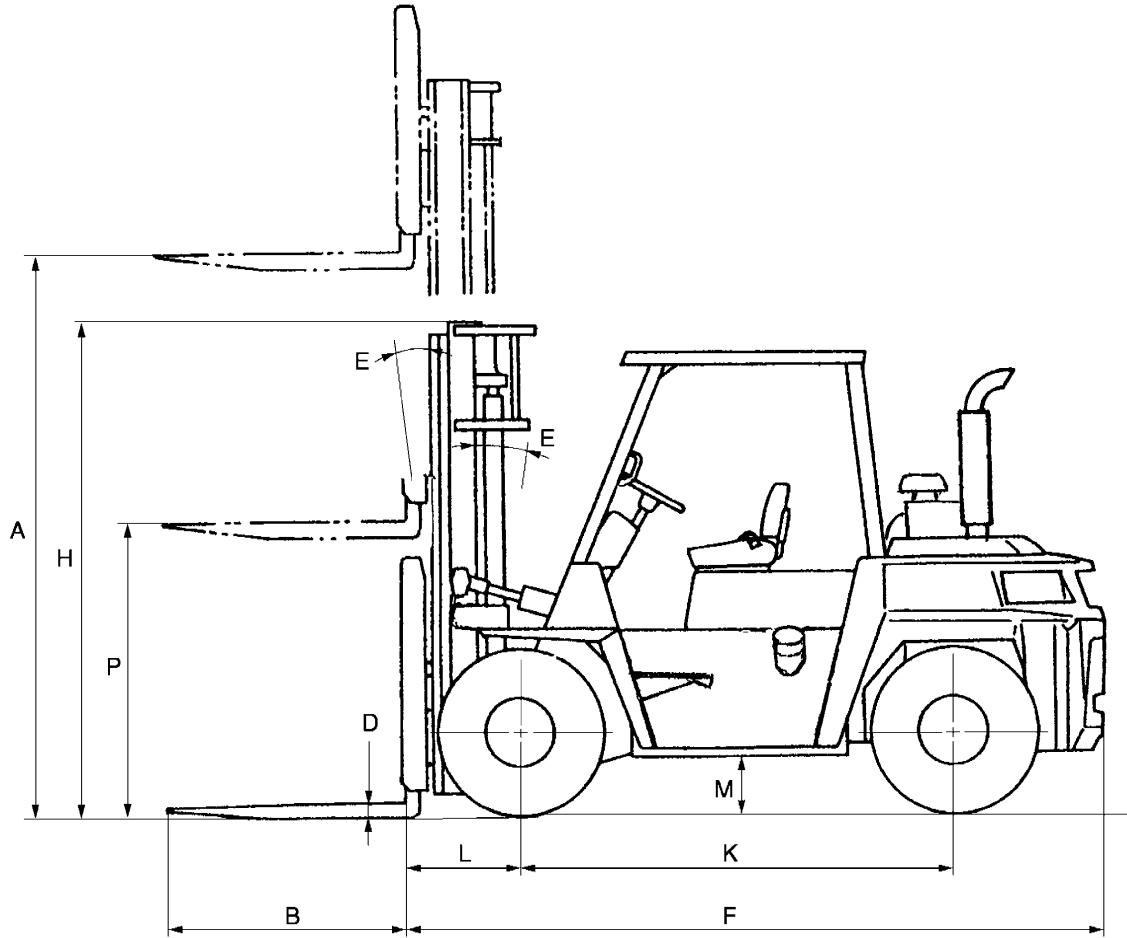
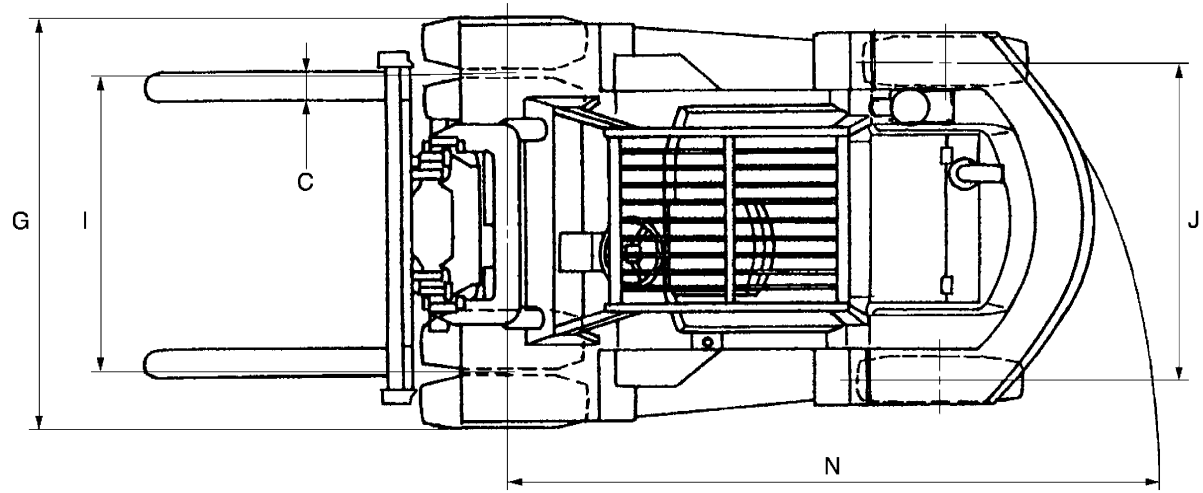


Transmission serial number

Technical Data

| Item | | Truck Model | | FD80 | FD90 |
|--|---|---|-----------------------|------|-----------------------|
| | | Mitsubishi F32B | | | |
| Designation | | Mitsubishi F32B | | | |
| Type | | Standard (with 3-speed powershift transmission) | | | |
| General | Capacity/load center kgf/mm (lbf/in.) | | 8000/600 (17500/24) | | 9000/600 (20000/24) |
| | Lift mm (in.) | | 3300 (130) | | |
| | Lift speed (unloaded/loaded) mm/sec (fpm) | | 530/500 (104/98) | | 430/410 (85/81) |
| | Lowering speed (unloaded/loaded) mm/sec (fpm) | | 500 (98) | | 400 (79) |
| | Tilt angle (forward – backward) | | 15° – 10° | | |
| | Free lift mm (in.) | | 220 (8.7) | | 0 |
| Performance | Travel speeds (unloaded/ loaded) km/h (mph) | Forward | 33.5/33.5 (20.8/20.8) | | 33.0/33.0 (20.5/20.5) |
| | | Reverse | | | |
| | Minimum turning radius mm (in.) | | 3740 (147) | | 3835 (151) |
| | Turning angle | Inside | 74° | | |
| | | Outside | 48°25' | | |
| | Minimum intersecting aisle mm (in.) | | 3300 (130) | | 3400 (134) |
| Gradeability (rated load) | At 1.6 km/h (1 mph) | 43 % | | 37 % | |
| | At 2 km/h (1.2 mph) | 38 % | | 34 % | |
| Tires | Size of tires (front and rear) | | 9.00-20-12PR (I) | | 9.00-20-14PR (I) |
| | Inflation pressure of tires (front and rear) kPa (kgf/cm ²) [psi] | | 640 (6.5) [92] | | 690 (7) [100] |
| Weight and axle loading (unloaded) | Weight kg (lb) | | 11380 (25090) | | 13190 (29080) |
| | Front axle loading kg (lb) | | 5420 (11950) | | 6200 (13670) |
| | Rear axle loading kg (lb) | | 5960 (13140) | | 6990 (15410) |

Dimensions (Approximate)



205523C

Unit: mm (in.)

| Ref. No. | Item | Truck Model | |
|----------|---|--------------|----------------------------|
| | | FD80 | FD90 |
| A | Lift | Simplex mast | 3300 (130) |
| | | Triplex mast | 4700 (185) - |
| B | Fork length | 1220 (48) | |
| C | Fork width | 180 (7.1) | |
| D | Fork thickness | 60 (2.4) | 70 (2.8) |
| E | Tilt angle (forward – backward) | Simplex mast | 15° – 10° |
| | | Triplex mast | 6° – 6° - |
| F | Overall length | 4000 (157) | 4170 (164) |
| G | Overall width (outside of tires) | 2390 (94) | |
| H | Overall height (to top of mast lowered) | Simplex mast | 2925 (115) 3120 (123) |
| | | Triplex mast | 2925 (115) - |
| I | Tread (front) | 1820 (72) | |
| J | Tread (rear) | 1750 (69) | |
| K | Wheelbase | 2580 (102) | |
| L | Front overhang | Simplex mast | 670 (26) 755 (30) |
| | | Triplex mast | 725 (28.5) - |
| M | Ground clearance (at frame) | 305 (12) | |
| N | Minimum turning radius | 3740 (147) | 3835 (151) |
| P | Free lift (floor to fork top, Triplex mast) | 1665 (65.5) | - |

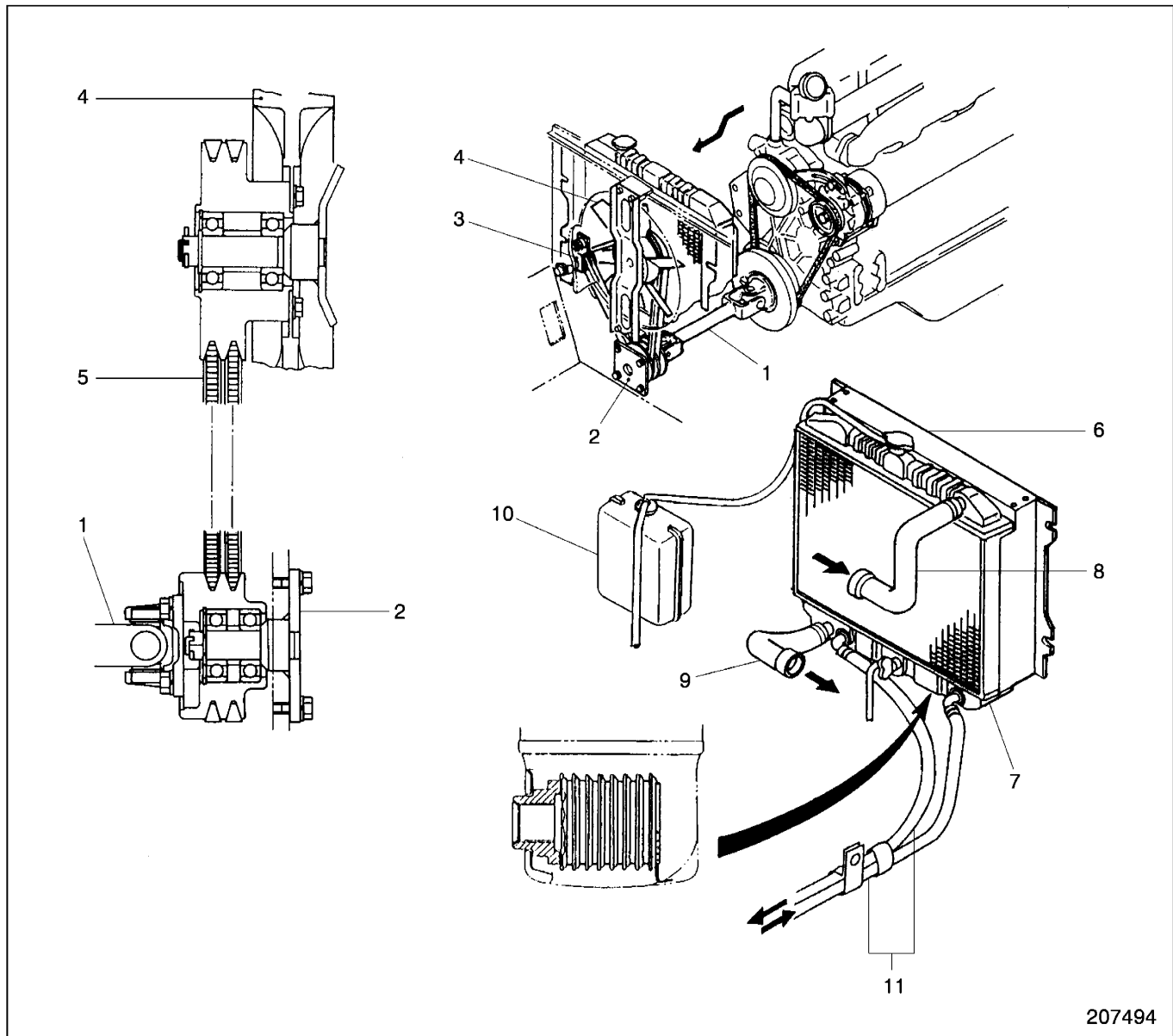
COOLING SYSTEM

| | |
|---------------------------------------|--------|
| Specifications | 2 – 1 |
| Description | 2 – 2 |
| Removal and Installation | 2 – 3 |
| Radiator | 2 – 3 |
| Fan Belt | 2 – 5 |
| Inspection | 2 – 9 |
| Fan Belt | 2 – 9 |
| Fan Belt Adjustment | 2 – 9 |
| Troubleshooting | 2 – 10 |

Specifications

| Item | Truck Model | FD80 | FD90 |
|----------------------------|---|----------|------|
| Type | Forced circulation | | |
| Radiator type | Corrugated fin with pressure cap (with built-in transmission oil cooler) | | |
| Water pump type | Centrifugal type, driven by V-belt | | |
| Capacity (complete system) | liter (U.S. gal.) | 23 (6.1) | |

Description



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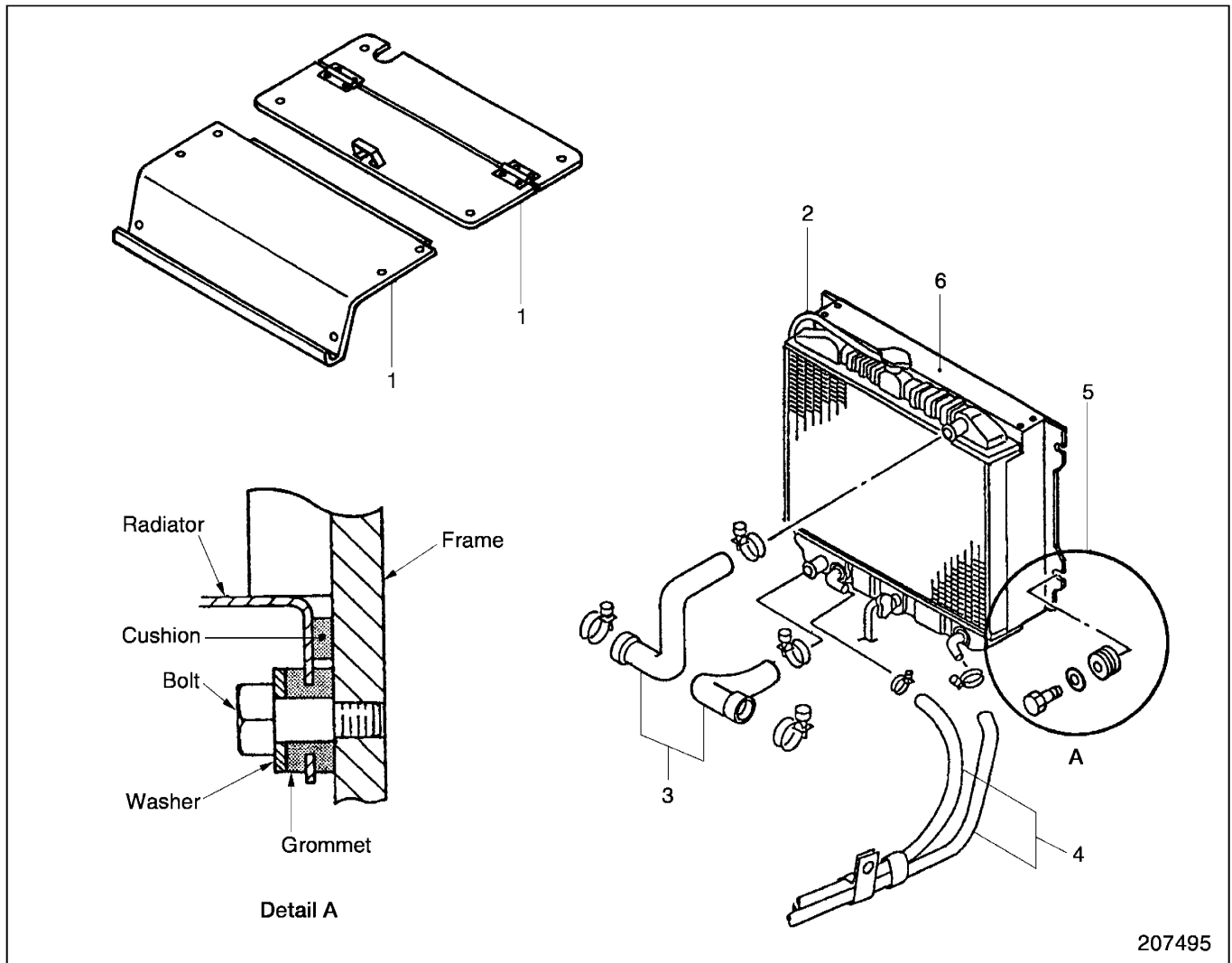
- | | |
|--------------------|-----------------------------------|
| 1. Universal joint | 7. Transmission oil cooler |
| 2. Pulley boss | 8. Hose (upper) |
| 3. Tension pulley | 9. Hose (lower) |
| 4. Fan | 10. Reserve tank |
| 5. Fan belts | 11. Transmission oil cooler hoses |
| 6. Radiator | |

A reserve tank and a transmission oil cooler come standard on this cooling system. Fan belt adjustment is easy.

Removal and Installation

Radiator

Removal



207495

Sequence

1. Radiator cover, Cover
2. Reserve tank hose
3. Radiator hoses (upper and lower)
4. Transmission oil cooler hoses
5. Radiator mount, Grommet, Washers, Cushions, Bolts
6. Radiator

Start by:

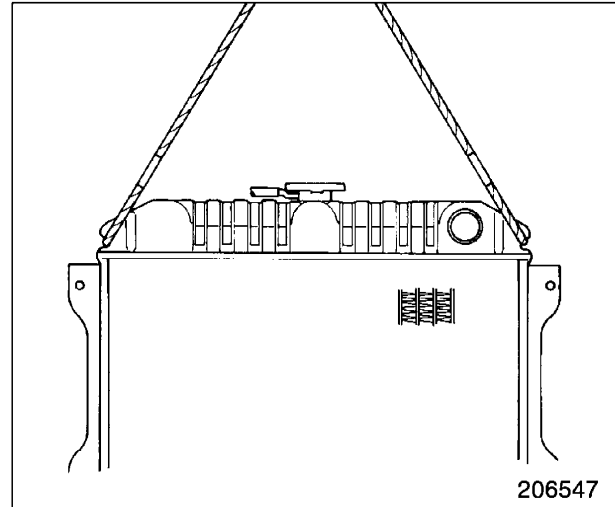
- (a) Remove the gas spring and engine hood.
- (b) Loosen the radiator drain cock to drain coolant from the radiator.

Suggestions for Removal

- (1) Fasten a hoist to the radiator and sling the radiator.

| | |
|--------------------|-----------------|
| Weight of radiator | 22.5 kg (50 lb) |
|--------------------|-----------------|

- (2) Remove the radiator mounts (at 4 places) and lift off the radiator.



Inspection

1. Radiator

- (1) Blow dirt and bugs, if any, from the radiator fins with compressed air. Be careful not to bend the fins because this will decrease cooling efficiency.
- (2) Replace the radiator if the fins are damaged beyond repair.
- (3) Check the rubber cushions of the radiator mounts for condition. Replace them if damaged or deteriorated.

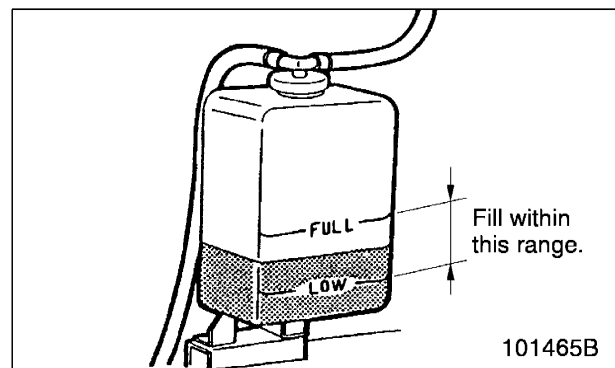
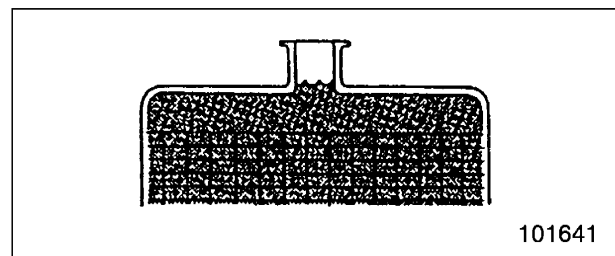
2. Upper and lower hoses

Check the radiator hoses, upper and lower, for condition. Replace them if defective.

Installation

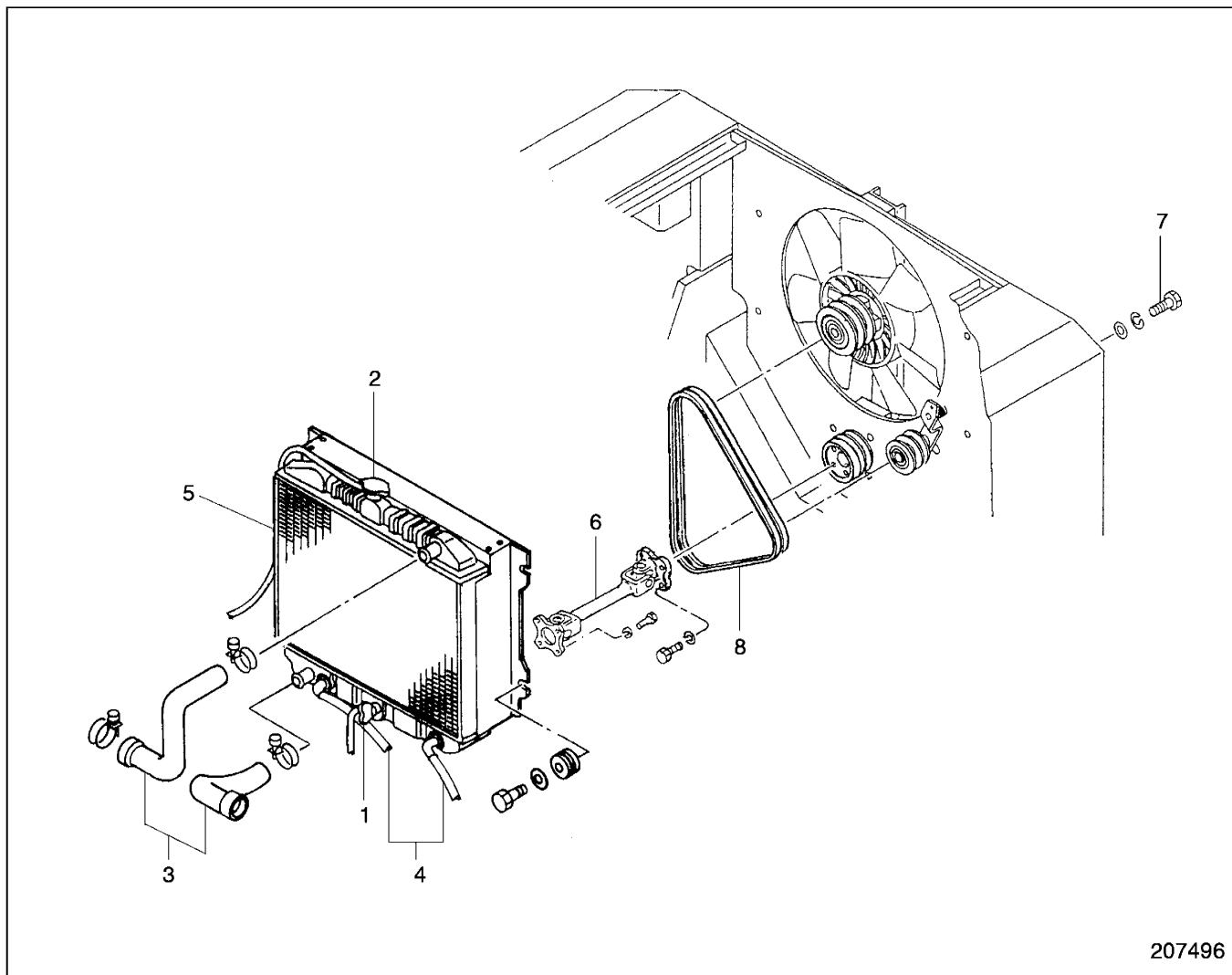
To install, follow the reverse of removal sequence and do the following steps:

- (1) Slide the hoses on to the tubes of the radiator and tighten all the clamps. Make sure the hoses are properly clamped at flared portions of the tube.
- (2) Fill the cooling system with coolant to the correct level. Start the engine and, with the engine running at low idle, listen for any abnormal noise. Check to be sure the coolant level in the reserve tank is correct.



Fan Belt

Removal after removing radiator



207496

Sequence

- | | |
|---------------------------------|------------------------|
| 1. Drain cock | 5. Radiator |
| 2. Cap | 6. Universal joint |
| 3. Hoses (for coolant) | 7. Tension pulley bolt |
| 4. Hoses (for transmission oil) | 8. Belts |

Start by:

- (a) Remove the radiator cover and cover.
- (b) Remove the engine hood and gas springs.

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