CATERPILLAR®

99709-86120

Service Manual

DP60, DP70
Chassis & Mast

For use with S6S
Engine Service Manual

FOREWORD

This service manual is a guide to servicing of Caterpillar Lift Trucks. The instructions are grouped by systems to serve the convenience of your ready reference.

Long productive life of your lift 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. Caterpillar reserves the right to change specifications or design without notice and without incurring obligation.

These lift trucks are powered by Caterpillar S6S diesel engine. For the items of the engine, refer to the following service manual:

S6S Diesel Engine Service Manual (Pub. No. 99709-56100)

Pub. No. 99709-86120

SAFETY

⚠ WARNING

The proper and safe lubrication and maintenance for this machine, recommended by Caterpillar, 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 serviceman or 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 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 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 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 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 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 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 (electric trucks) 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 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 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.

HOW TO READ THIS MANUAL

1. Service data in the text

Example

Clearance between cylinder and piston, mm [in.]	A	0.020 to 0.105 [0.000 79 to 0.004 13]
	B	0.15 [0.005 9]

A = Assembly standard
B = Repair or service limit

2. Symbols or a 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)

GENERAL INDEX

	Information contained
General information	Model view; truck models covered; serial number locations; technical data; dimensions
Cooling system	Radiator
Electrical system	Console box; fuses; light bulbs; batteries; schematic
Power train	Engine & transmission combination
Powershift transmission	Torque converter; transmission; control valve; regulator valve
Front axle and reduction differential	Front wheels; front axle; reduction differential
Rear axle	Rear wheels; rear axle; power cylinder
Brake system	Service brake; parking brake; wheel cylinders; master cylinder
Steering system	Steering control valve
Hydraulic system	Hydraulic tank; gear pump; control valve; flow regulator valve; lift cylinders; tilt cylinders
Masts and forks	Simplex masts
Service data	Maintenance chart; tightening torques; periodic replacement parts; lubrication instructions; weight of major components; special tools

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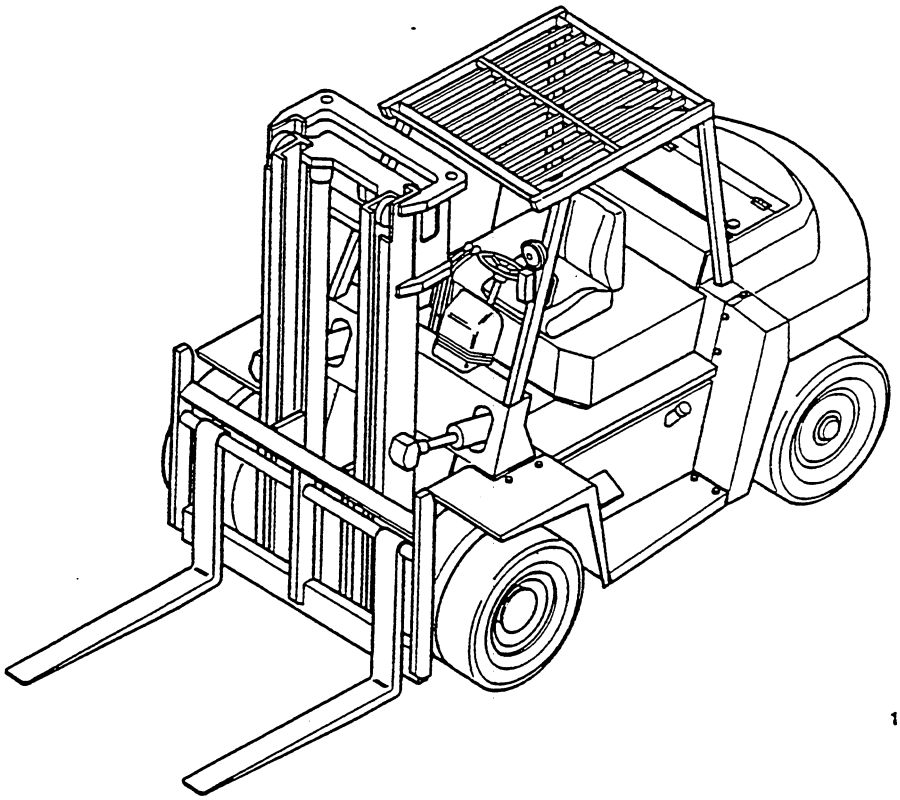
MODEL VIEW



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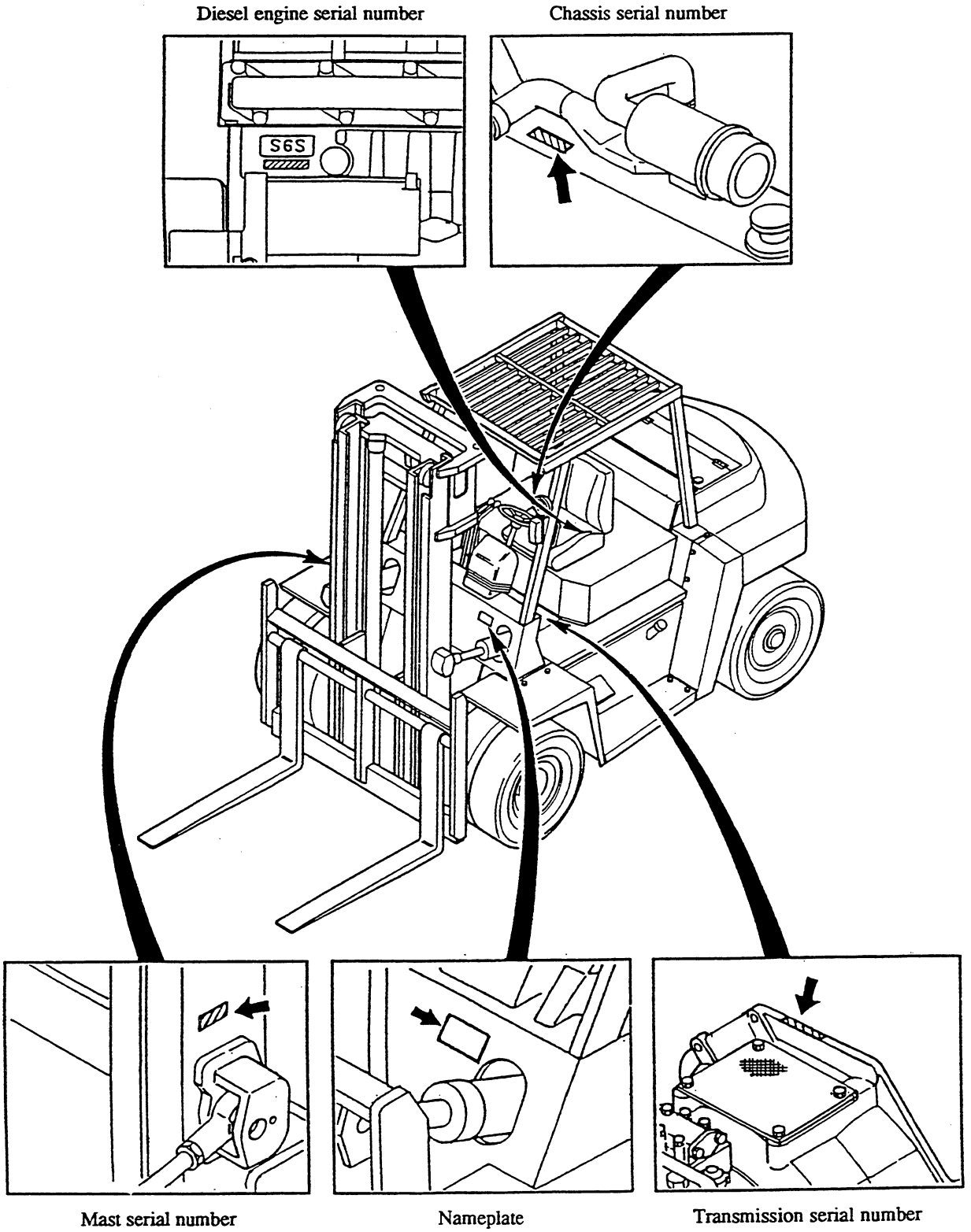
TRUCK MODELS COVERED

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

Truck model	Transmission	Engine mounted
DP60	Powershift	Caterpillar S6S diesel engine
DP70	Powershift	Caterpillar S6S diesel engine

SERIAL NUMBER LOCATIONS



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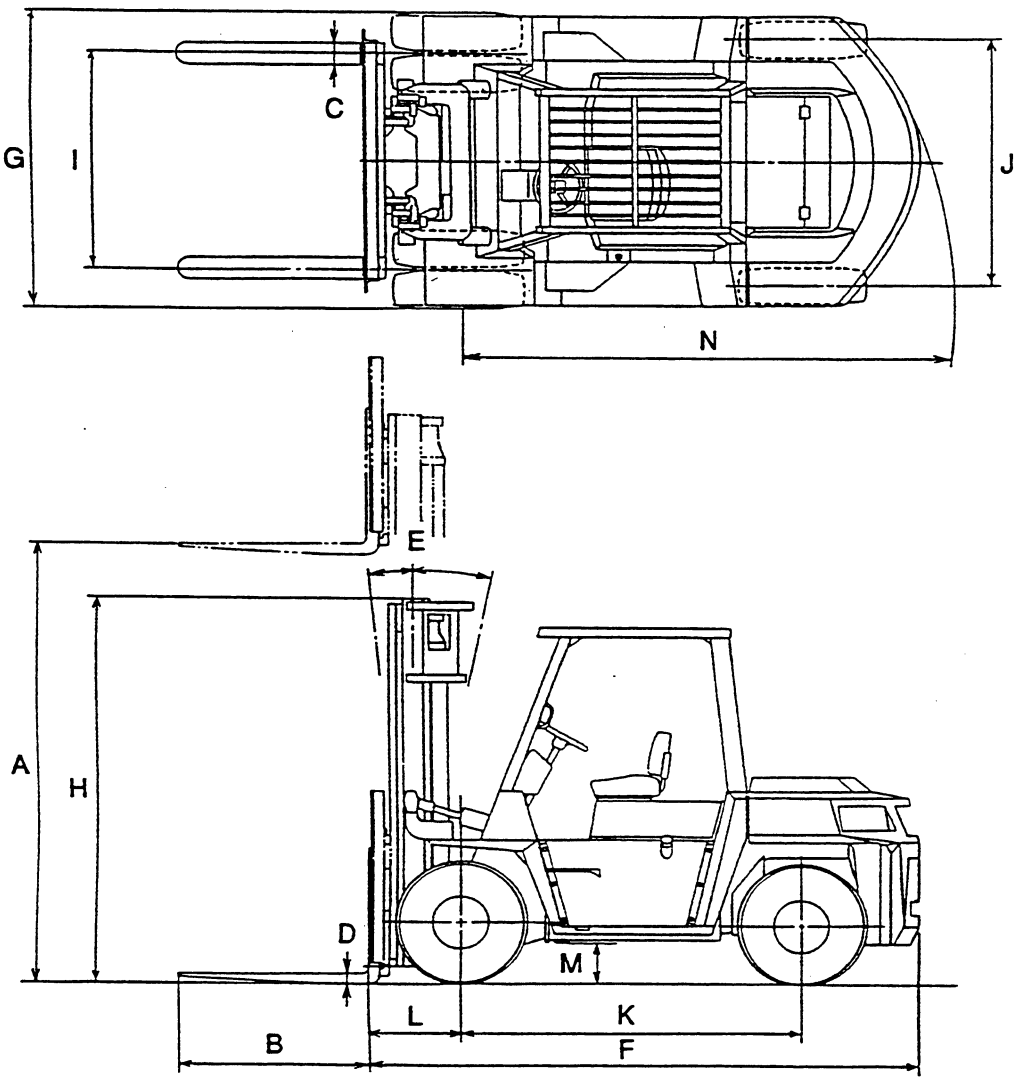
TECHNICAL DATA

Item \ Truck model			DP60	DP70
Designation			F20C	
Type			Standard	
General	Capacity/load center, kgf/mm [lbf/in.]		6 000/600 [13 500/24]	7 000/600 [15 500/24]
	Lift, mm [in.]		3 300 [130]	
	Lift speed (unloaded/loaded), mm/sec [fpm]		470/440 [93/87]	
	Lowering speed (unloaded/loaded), mm/sec [fpm]		550 [108]	
	Tilt angle (forward – backward)		6° – 12°	
	Free lift, mm [in.]		205 [8.1]	
Performance	Travel speeds (unloaded/loaded), km/h [mph]	Forward	27.5/23.0 [17.1/14.3]	27.5/22.0 [17.1/13.7]
		Reverse		
	Minimum turning radius, mm [in.]		3 310 [130.3]	3 395 [133.7]
	Turning angle	Inside	76°16'	
		Outside	49°41'	
	Minimum intersecting aisle, mm [in.]		3 000 [118.1]	3 050 [120.1]
	Gradeability (rated load), tan % at 1.6 km/h [1 mph]		27	24
Tires (size and inflation), kPa (kgf/cm²) [psi]		Front	8.25-15-12PR(I) 686 (7) [100]	
		Rear		
Weight and axle loading	Unloaded, kg [lb]	Weight	8715 [19170]	9325 [20515]
		Front axle loading	4160 [9150]	4050 [8910]
		Rear axle loading	4555 [10020]	5275 [11605]

DIMENSIONS



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Unit: mm [in.]

Ref. No.	Item \ Truck model	DP60	DP70
A	Lift	3 300 [130]	
B	Fork length	1 220 [48]	
C	Fork width	150 [5.9]	
D	Fork thickness	60 [2.4]	
E	Tilt angle (forward – backward)	6° – 12°	
F	Overall length	3 580 [141]	3 635 [143]
G	Overall width (outside of tires)	2 170 [85.4]	
H	Overall height (to top of mast lowered)	2720 [107.1]	
I	Tread (front)	1 650 [65]	
J	Tread (rear)	1 650 [65]	
K	Wheelbase	2 300 [90.6]	
L	Front overhang	585 [23]	
M	Ground clearance (at frame)	265 [10]	
N	Minimum turning radius	3 310 [130.3]	3 395 [133.7]

COOLING SYSTEM

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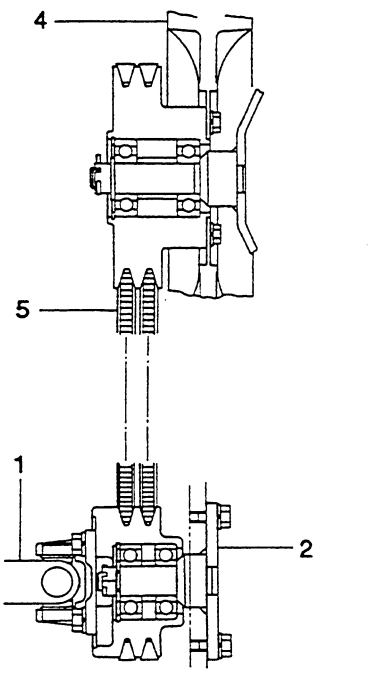
SPECIFICATIONS

Item \ Truck model	DP60	DP70
Type	Forced circulation	
Radiator, type	Corrugated fin with pressure cap	
Capacity, complete system, liter [U.S. gal.]	18 [4.8]	
Water pump, type	Centrifugal, driven by V-belt	
Thermostat, type	Wax	

DESCRIPTION



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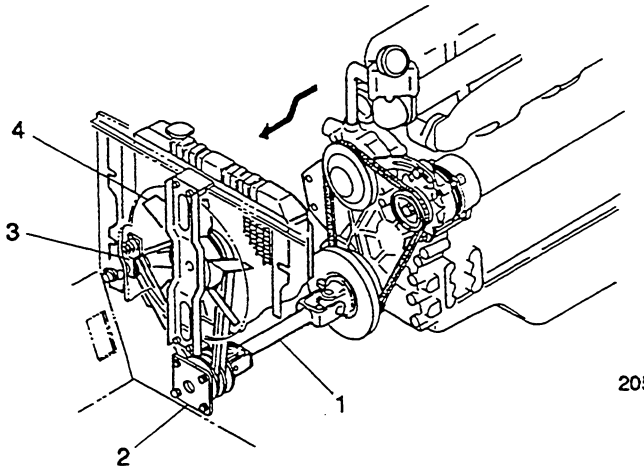

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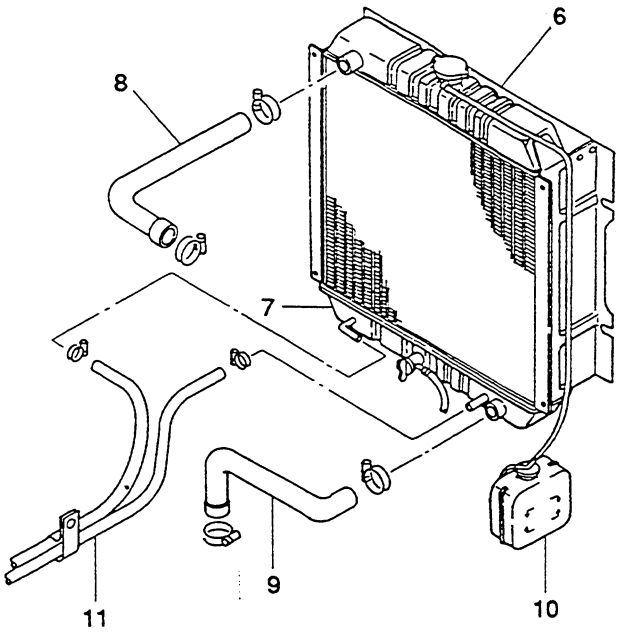

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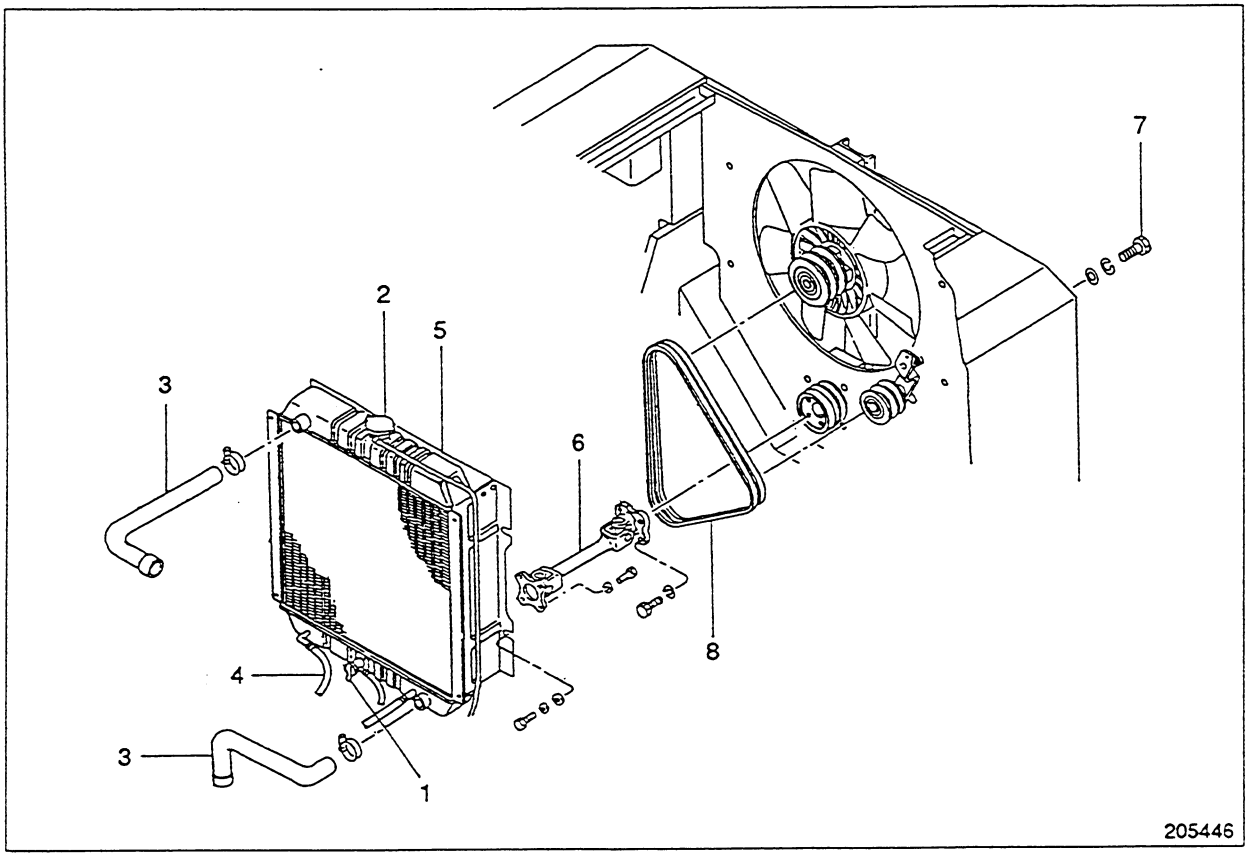
1 Universal joint
2 Pulley boss
3 Tension pulley
4 Fan
5 Fan belts
6 Radiator
7 Transmission oil cooler
8 Hose (upper)
9 Hose (lower)
10 Reserve tank
11 Transmission oil hoses

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

REMOVAL AND INSTALLATION

Fan Belt

Removal after removing radiator



Sequence

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

Start by:

a) remove the radiator cover

b) remove the engine hood and gas-filled cylinders

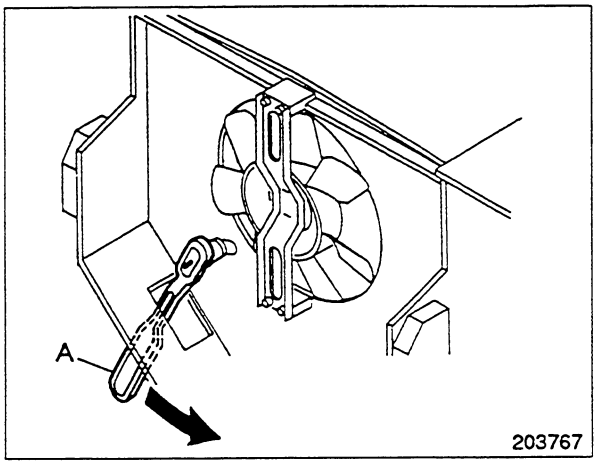
Suggestions for removal

(1) Open the drain cock and drain the coolant.

⚠ WARNING

Make sure the coolant temperature is low before opening the drain cock.

(2) Loosen the tension pulley bolt one to two turns with Ratchet Wrench A through the access hole in the frame. Using a bar, force the tension pulley toward the fan as far as it will go and tighten the pulley bolt, then remove the fan belts.



Installation

Follow the reverse of removal sequence and do the following steps:

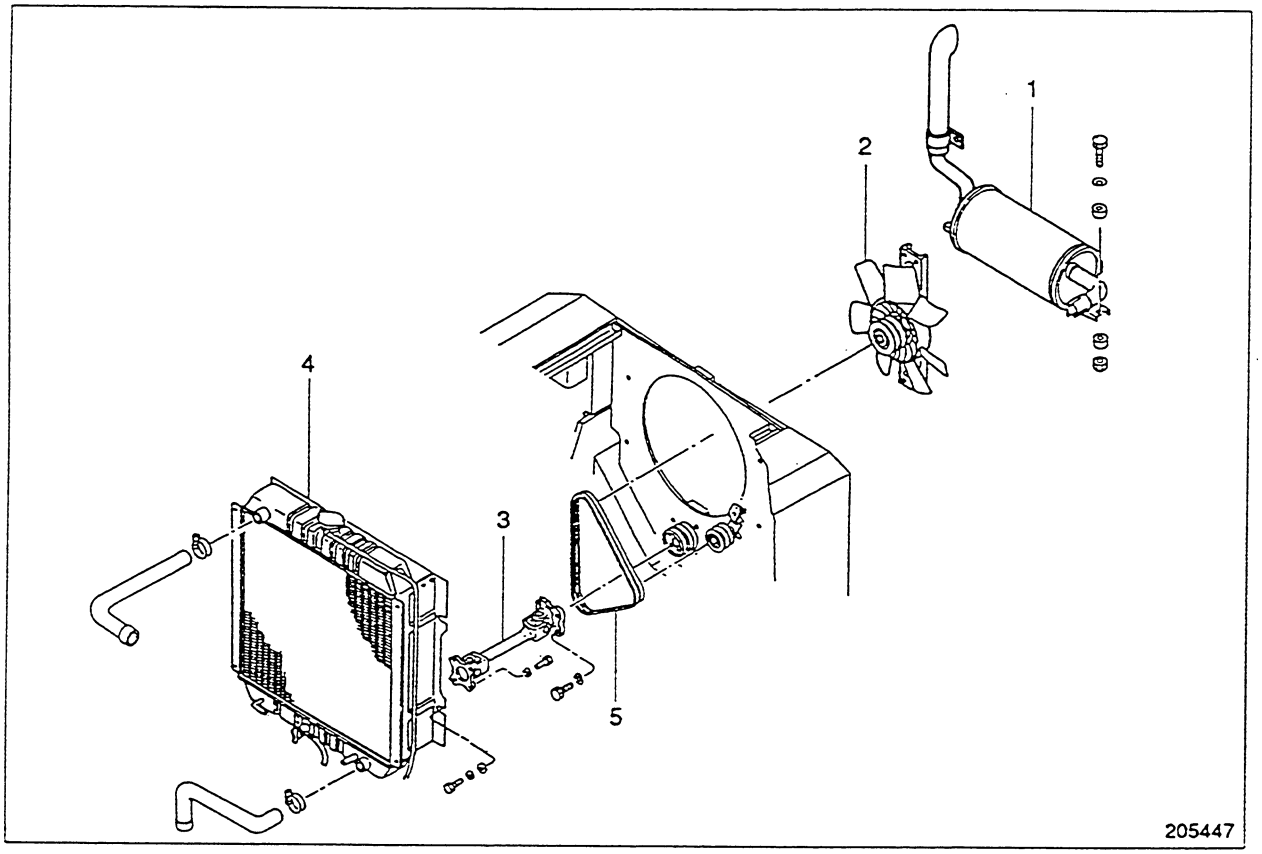
(1) Turn the fan by hand to make sure it rotates freely. If the bearings have noise, replace them.

(2) After putting the belt on the drive and driven pulleys, push it midway between the pulleys to make sure the tension pulley moves freely, then tighten the pulley bolt.

(3) When connecting the hoses to the radiator, push them over the flared ends of the hose connectors and clamp them securely.

(4) Fill the radiator with antifreeze and water and start the engine. Run the engine at low idle. Check the noise and the coolant level in the reserve tank.

Removal after removing counterweight



Sequence

1 Muffler
2 Fan assembly
3 Universal joint
4 Radiator
5 Belts

Start by:

a) remove the radiator cover

b) remove the exhaust pipe

c) remove the bolts that hold the counterweight and remove the counterweight with a hoist

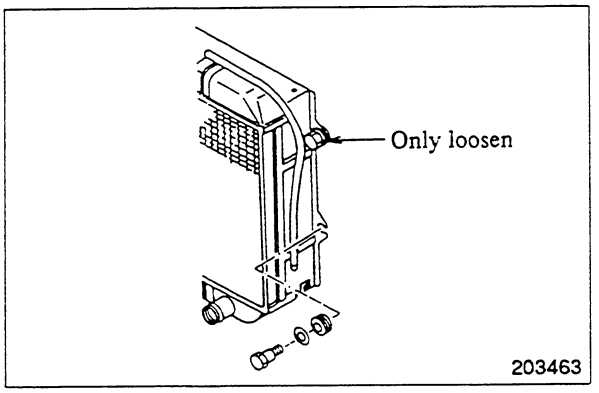
NOTE

Check the weight of the counterweight.

Suggestions for removal

(1) Remove the bolts that hold the fan support. Remove the belt from the driven pulley (fan assembly), then remove the fan assembly. Lay the fan assembly on the bench with the fan support down. Turn the fan by hand to check the bearings for condition. Replace the bearings if they have noise.

(2) Remove two bolts at the bottom of the radiator. Loosen two bolts at the top of the radiator.



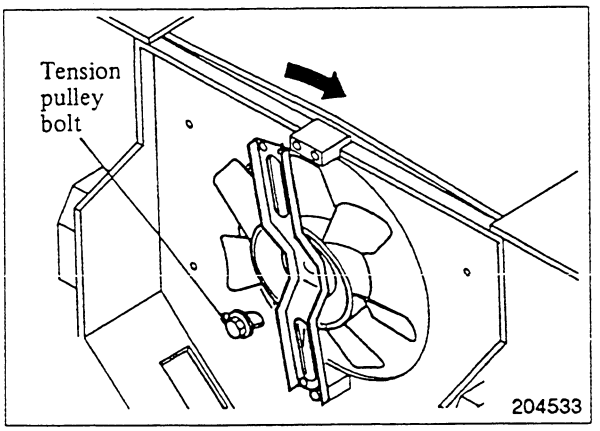
(3) Push the radiator toward the engine and remove the belt from the tension pulley, letting it fall onto the universal joint.

Installation

Follow the reverse of removal sequence and do the following steps:

(1) Fan assembly installation

Put the belt over the driven pulley (fan assembly) and tighten one bolt finger tight at the bottom of the fan support. Loosen the tension pulley bolt. Grasp the top of the fan support and move it over to the mounting boss (frame) and tighten the bolts that hold the support.



(2) Push the belt midway between the drive and driven pulleys through the space between the fan blades to make sure the tension pulley moves freely, then tighten the tension pulley bolt.

INSPECTION

Fan Belt

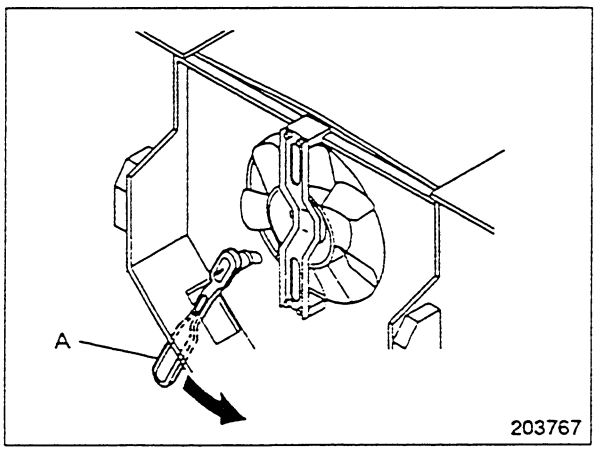
(1) Check to make sure the belt is free of oil, grease or other foreign matter. Replace the belt as necessary. A slightly dirty belt can be reused by cleaning with cloth or paper. Do not clean the belt with gasoline or the like.

(2) Check the belt and replace it as necessary each time the engine is overhauled, or the belt is adjusted.

Fan Belt Adjustment

(1) Using Ratchet Wrench A, loosen the tension pulley bolt one to two turns through the access hole in the frame.

(2) After having adjusted the belt properly, tighten the tension pulley bolt.



MITSUBISHI CATERPILLAR FORKLIFT AMERICA INC.

SCHEMATIC(S) INSERTION

Schematic(s) name/number

99709-86120 (A3)

Schematic on 8mm tape

ELECTRICAL SYSTEM

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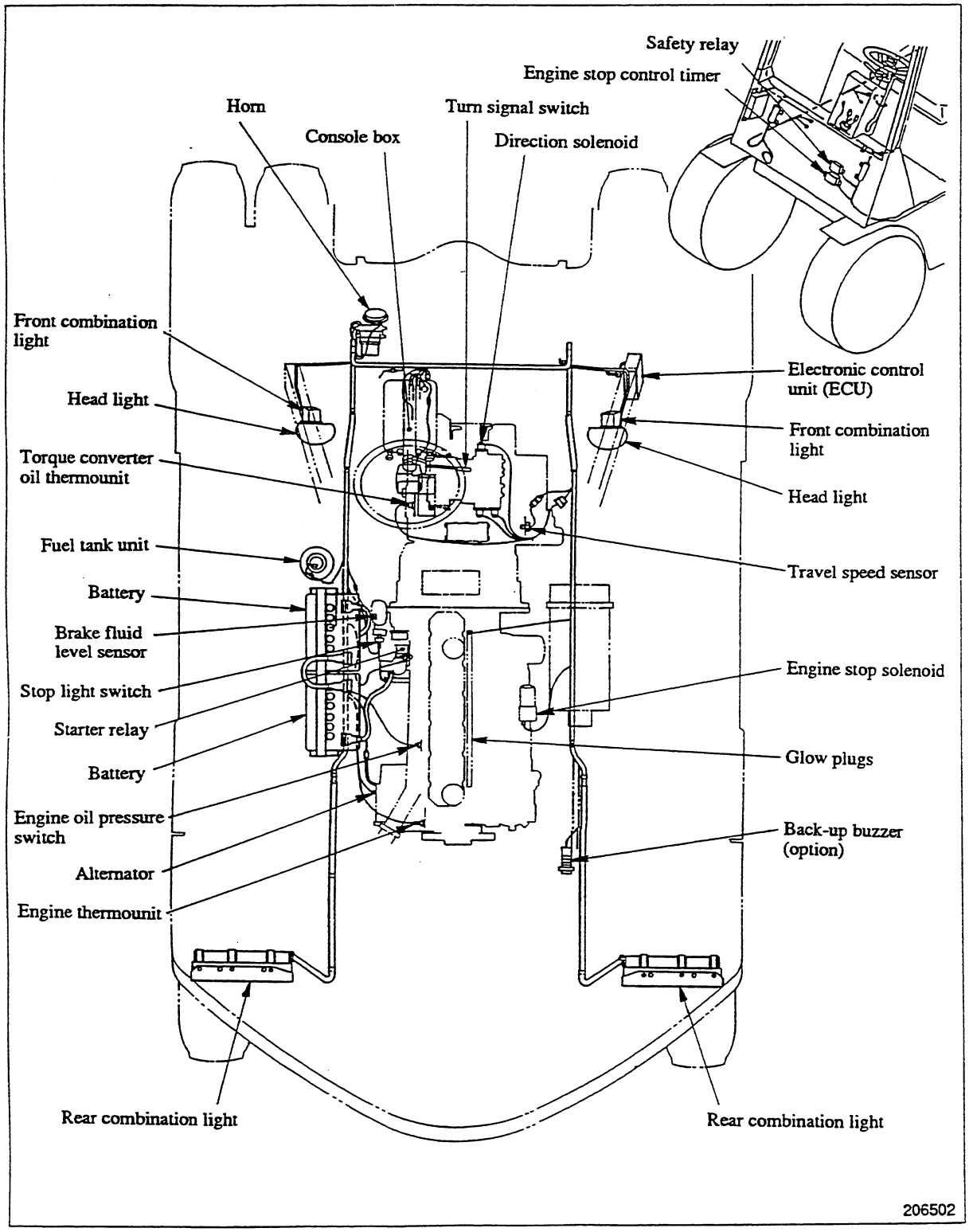
SPECIFICATIONS

Item \ Truck model		DP60	DP70
Battery	Model nomenclature — No. of batteries	65D23R — 2	
	Voltage, V	12	
	Capacity, Ah	52	
Direction lever		Electric	
Console box		With OK monitor	
2-speed automatic transmission controller		Electronic control unit (ECU)	
Starter switch		Anti-restart type	
Lights		See Light Bulb Specifications.	

LOCATION OF COMPONENTS

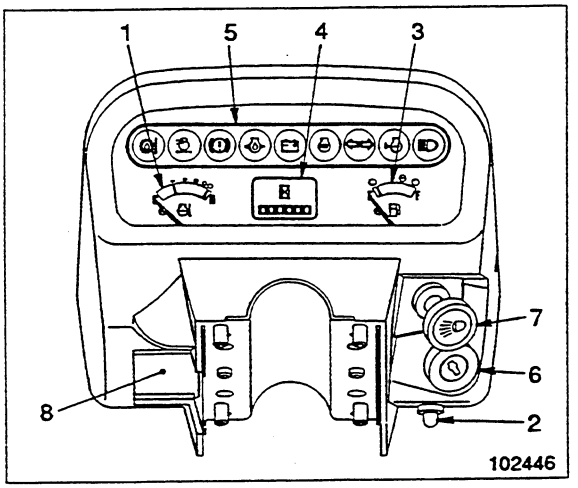


⚠CAUTION Clamp the harnesses away from moving parts or sharp edges. Repair a frayed harnesses with vinyl tape.

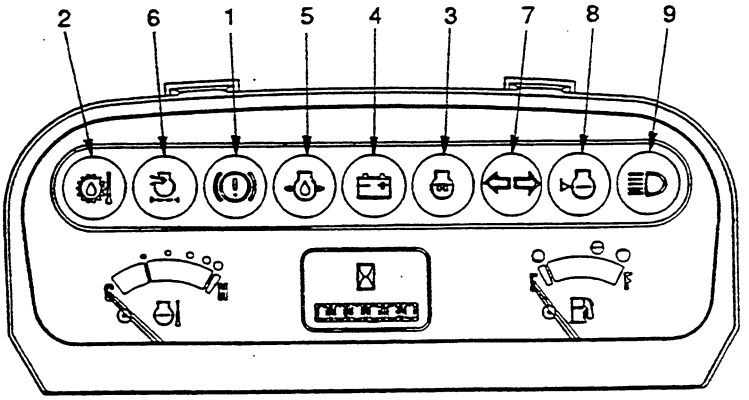
DESCRIPTION

Console Box

1 Engine coolant temperature gauge
2 Speed selector switch
3 Fuel gauge
4 Service hour meter
5 OK monitor
6 Starter switch
7 Light switch
8 Fuse box



OK monitor



Function

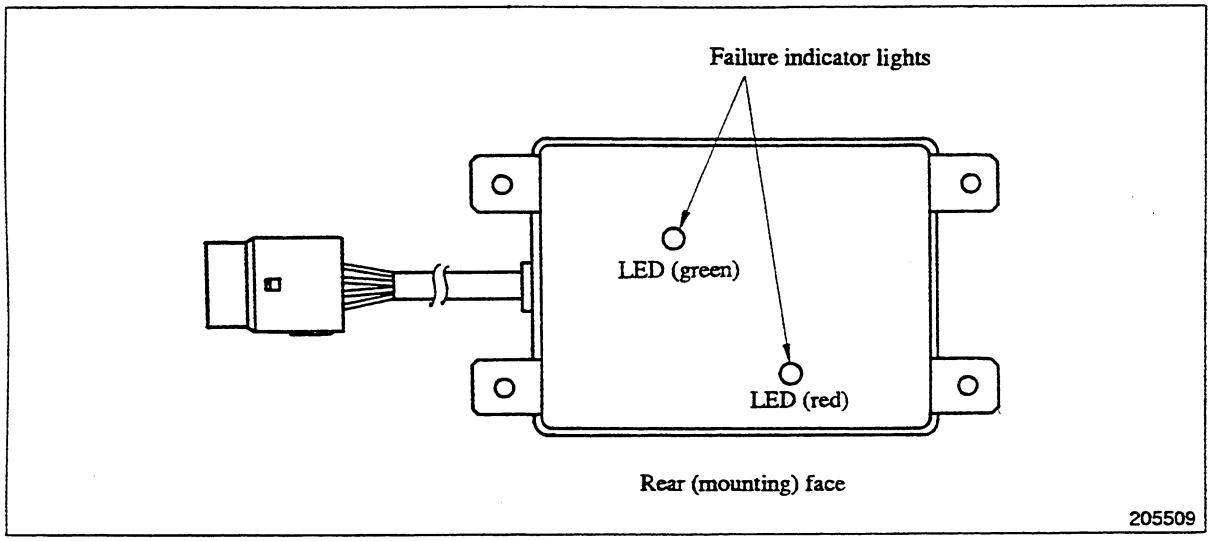
No.	Indicator light	OFF	ON or flickering	Remarks
1	Brake fluid level indicator light	Normal	Low	
2	Powershift transmission oil temp. indicator light	Normal	Overheating	
3	Glow plug indicator light	Heating completed	Heating	
4	Alternator not charging indicator light	Normal	Abnormal	
5	Engine oil pressure indicator light	Normal	Low	
6	Air cleaner element indicator light	Normal	Clogged	Option
7	Head light beam indicator light	Low	High	Option
8	Engine coolant level indicator light	Normal	Low	Option
9	Turn signal indicator light		Turn signal ON	

How to check indicator light bulbs

The bulbs are normal if the indicator lights 1, 2, 6 and 8 come ON when the starter switch key is turned to I (ON) position. (The indicator lights will go OFF when the engine starts.)

Major Components

Electronic control unit (ECU)



The electronic control unit (ECU) has a built-in 1-chip microcomputer. This computer processes signals from the travel speed sensor for actuating the 2-speed automatic transmission.

The ECU has "self-diagnostic" failure indicator lights which come on when any problem occurs in the electrical system, thereby allowing the operator to locate the problem. It has the following fail-safe systems so that failure of power, control circuit, or other components will not endanger the operator.

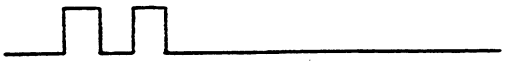
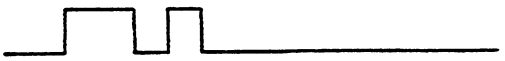
NOTE

The failure indicator lights are located on the rear (mounting) face of the ECU. This makes it necessary to remove the ECU from the machine to observe these lights.

Fail-safe Systems

Failure	Function
Solenoid output signal circuit open	Turns OFF the power line and causes an indicator light to come on when the solenoid output signal circuit is open.
Travel speed sensor circuit open	Allows the machine to run at the present travel speed but causes an indicator light to come on.

Failure Indicator Light Flashing Patterns

Failure	Flashing pattern
Travel speed sensor circuit open	
2-speed automatic transmission control circuit open	

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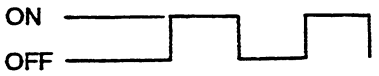
NOTE: The failure indicator lights come ON and go OFF as shown below:



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