FR 160.2

wheel loader

operation and maintenance instruction manual

Form 604.00.552

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ATTENZIONE

STUDY THE OPERATION AND MAINTENANCE INSTRUCTION MANUAL THRUOGH BEFORE STARTING, OPERATING, MAINTAINING, FUELING OR SERVICING THIS MACHINE.

This symbol is your safety alert sign. It MEANS ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED.

Read and heed all safety instructions carrying the signal words WARNING and DANGER.

Machine mounted safety signs have been color coded yellow with black borders and lettering for WARNING and red with white borders and lettering for DANGER points.

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SAFETY RULES

GENERAL

Study the Operation and Maintenance Instruction Manual before starting, operating, maintaining, fuelling or servicing machine.

Read and heed all machine-mounted safety signs before starting, operating, maintaining, fuelling or servicing machine.

Do not allow unauthorized personnel to operate service or maintain this machine.

Do not operate machinery when not in good health conditions.

Do not wear rings, wrist watches, jewellery, loose or hanging apparel, such as ties, torn clothing, scarves, unbuttoned or unzipped jackets that can catch on moving parts. Wear proper safety equipment as authorized for the job. Examples: hard hats, safety shoes, heavy gloves, ear protectors, safety glasses or goggles, reflector vests, or respirators. Consult your employer for specific safety equipment requirements.

Keep operator's compartment, stepping points, grabrails and handles clear of foreign objects, oil grease, mud or snow accumulation to minimize the danger of slipping or stumbling. Clean mud or grease from shoes before attempting to mount or operate the machine.

Do not jump on or off machine. Keep two hands and one foot, or two feet and one hand in contact with steps, grab rails and handles at all times.

Do not use controls or hoses as handholds when climbing on or off machine. Hoses and controls are movable and do not provide a solid support. Controls also may be inadvertently moved causing accidental machine or equipment movement.

Never attempt to operate the machine or its tools from any position other than seated in the operator's seat. Keep head, body, limbs, hands and feet inside operator's compartment at all times, to reduce exposure to hazards outside the operator's compartment. Be careful of slippery conditions on stepping points, hand rails and on the ground.

For your personal protection, do not attempt to climb on or off machine while machine is in motion.

Do not leave the machine until it is completely stopped.

Check the seat safety belt at least twice a year. If there are signs of wear or fraying or other signs of weakness that could lead to failure, replace it.

START

DO NOT START AN UNSAFE MACHINE. Before working the machine, be sure that any unsafe condition has been satisfactorily remedied.

Check brakes, steering and attachment controls before moving. Advise the proper maintenance authority of any malfunctioning part or system.

Be sure all protective guards or panels are in place and in good operating condition.

Be sure exposed personnel in the area of operation are clear of the machine before moving the machine or its attachments. WALK COMPLETELY AROUND machine before mounting. Sound horn.

Before starting machine, check, adjust and lock the operator's seat for maximum comfort and control of the machine.

Fasten seat belts (where needed).

Obey flag man, safety signals and signs.

Because of the presence of flammable liquid on board, never check or fuel the tanks, batteries and accumulators near fire, free flame or sparks.

STARTING FLUID IS FLAMMABLE. Follow the recommendations as outlined in the Operation and Maintenance Instruction Manual and as marked on the containers.

DO NOT PUNCTURE OR BURN CONTAINERS.

Store containers in cold, well-ventilated place secure from unauthorized personnel. Follow the Manufacturer's instructions.

Do not use these products near open flames or sparks.

OPERATION

Check the fasteners of wheels and rims before starting a working shift. If necessary, retighten to the prescribed torque.

Do not run the engine of this machine in closed areas without proper ventilation to remove deadly exhaust gases.

Roll Over Protective Structures are required on wheel loaders, dozer tractors, track type loaders, graders and scrapers by local or national requirements. DO NOT operate this machine without a Roll Over Protective Structure (ROPS).

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Wiring diagram

1. Batteries
2. Master switch
3. Starter motor
4. Starter relay switch contact
5. Fuel booster coil
6. 4-Amp fuse
7. Engine starting key switch
8. Starter relay solenoid
9. Starting inhibitor solenoid
10. Diode ref. 8
11 Cold starting electrovalve
12. Engine shutoff control solenoid
13. LINK 50-Amp fuse
14. Services relay.
15. Instrument panel right lamp
16. Resistance
17. Right marker light
18. Front left parking light (TUV version)
19. Rear right parking light
20. 4-Amp fuse
21. Front left parking light
22. Front right parking light
23. 4-Amp fuse
24 .Diode
25. Outer lighting switch
26. Rear left parking light
27. Front right parking light (TUV version)
28. License plate light
29. Left marker light
30. Instrument panel left lamp
31. Front left low beam headlamp
32. 7.5-Amp fuse
33. Front right low beam headlamp
34. Front left high beam headlamp
35. 7.5-Amp fuse
36. Front right high beam headlamp
37. High beams indicator
38. Outer lighting change-over switch
39. Front left turn signal light
40. Front left turn signal light (TUV version)
41. Rear left turn signal light
42.7.5-Amp fuse
43.7.5-Amp fuse
44. Hazard warning light switch, w/indicator
45. Front right turn signal light
46. Front right turn signal light (TUV version)
47. Rear right turn signal light
48. Turn signal lights indicator
49. Electronic flasher
50. Front wiper motor-reduction unit
51. 7.5-Amp fuse
52. Light switch (front wiper/washer section)
53. Front washer pump
54. 7.5-Amp fuse
55. Rear wiper/washer switch
56. Rear wiper motor-reduction unit
57. Rear washer pump
58. 7.5-Amp fuse
59.Cab mounted front lights on cab switch (with incorporated indicator)
60. Engine coolant max. temperature switch
61. Cab front right work light
62. Cab front left work light
63. 7.5-Amp fuse
64. Cab mount rear lights switch (with incorporated indicator)
65. Cab mounted right rear lights
66. Cab mounted left rear lights
67. Engine oil pressure gauge sensor
68. 7.5-Amp fuse
69. Stop lights pressure switch
70. Solenoid switch (stop lights)
71. Left stop light
72. Right stop light
73. Magnetic breaker (8A)
74. Emergency steering timer
75. Gearshift selector
76. Transmission neutralizer relay contact
77. Backup alarm relay switch
78. Kick-down indicator
79. Starter inhibitor relay switch
80. Backup alarm relay switch
81. 7.5-Amp fuse
82. Backup alarm
83. Transmission neutralizer switch (during brake application)
84.
86. 7.5-Amp fuse
87. Transmission/parking brake disconnect relay
88. Parking brake indicator pressure switch
89. Parking brake indicator

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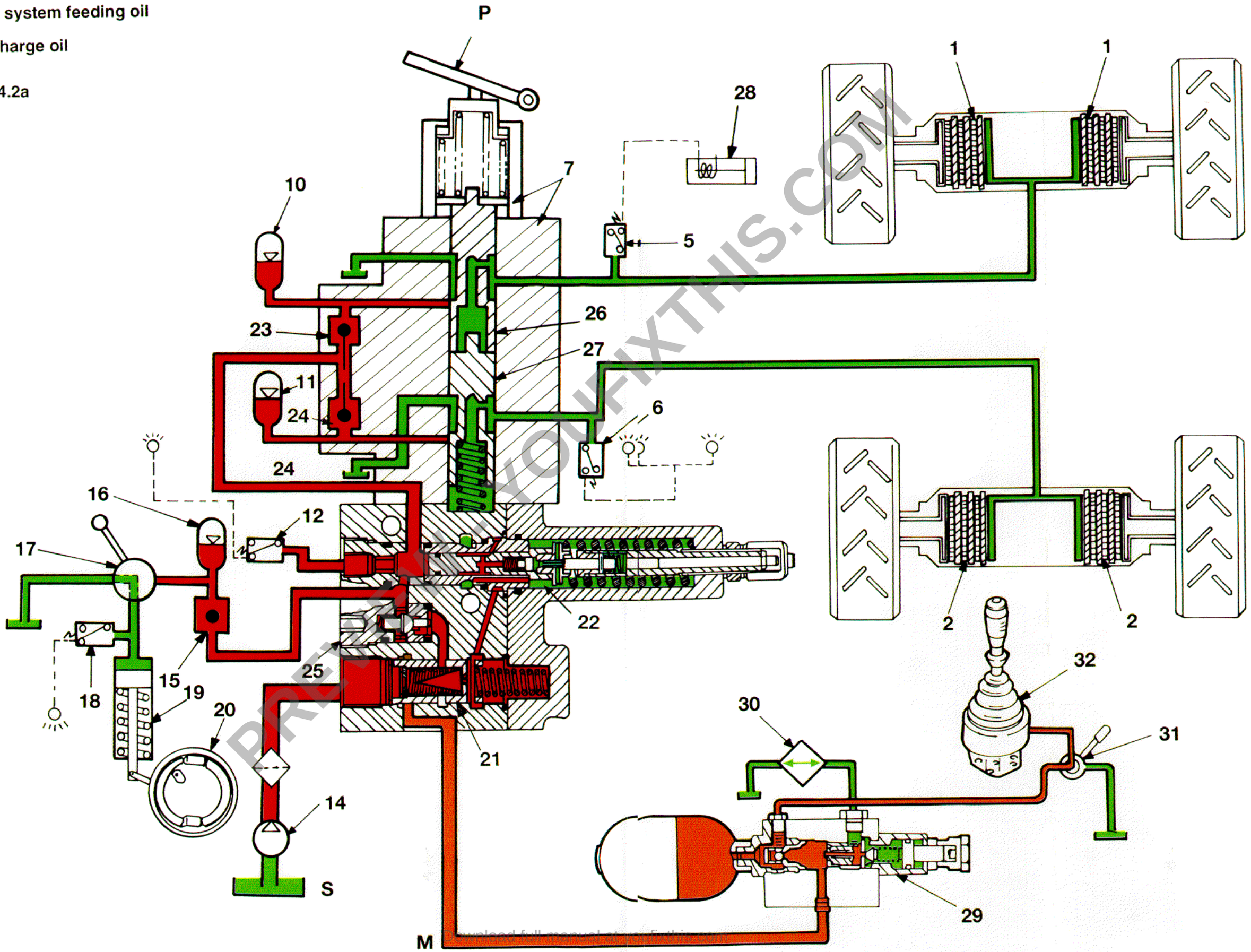
BRAKES HYDRAULIC SYSTEM DIAGRAM

Brakes system feeding oil

Pilot system feeding oil

Discharge oil

Fig. 4.2a



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1.3.3 TURBO-CHARGER
(REMOVAL/INSPECTION/INSTALLATION)

WARNING

Normally the turbo-charger is removed from the engine for one of the following three reasons: inspection, repair or overhaul. When the turbo-charger is removed from the engine, always keep all openings of the intake and exhaust manifolds totally closed. This will prevent dirt from entering the manifolds and damage the turbo-charger or the engine, when the latter is returning to operating conditions.

1.3.3.1 Removal

Before removing the turbo-charger clean externally the group to prevent entry of dirt into the engine during the removal.

Remove the turbo-charger and disassemble it considering fig. 1.17.

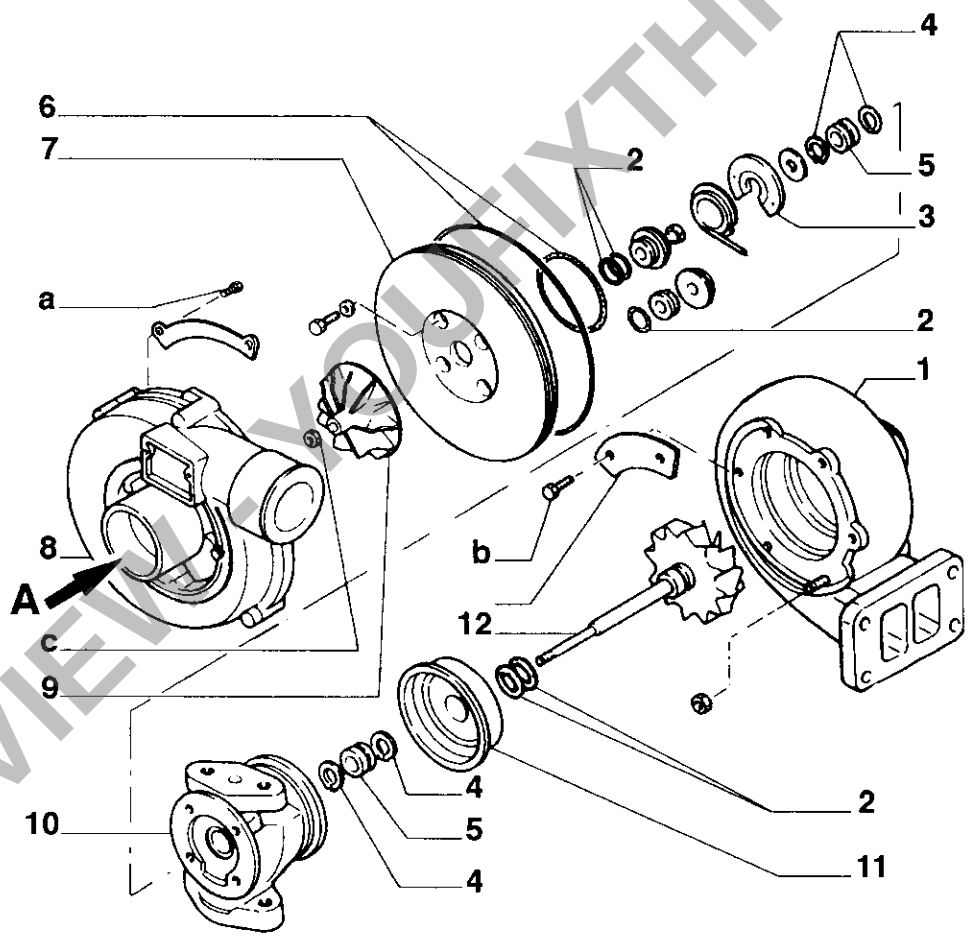


Fig.1.17 - Exploded view of turbo-charger

A. Air intake - **a.** Housing (8) securing screw - **b.** Housing (1) securing screw - **c.** Compressor wheel (9) securing nut - **1.** Housing, exhaust side - **2.** O-Rings - **3.** Thrust collar - **4.** Retaining rings - **5.** Bushes - **6.** O-Rings - **7.** Intermediate plate - **8.** Housing, inlet side - **9.** Compressor wheel - **10.** Central body - **11.** Cup - **12.** Turbine and shaft.

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NUTS (ZNT)					SCREWS (ZNT / DEIDR)		
Strength grade: 10 (R 80)					Strength grade: 10.9 (R 100)		
Diameter and pitch mm	normal daNm	low type daNm	with polyamide ring		Diameter and pitch mm	normal ZNT daNm	self-locking ZNT daNm
			normal daNm	low type daNm			
M6 x 1	1.3	1.2	-	-	M6 x 1	1.3	-
M8 x 1.25	3.2	2.6	3.9	3.2	M8 x 1.25	1.3	3.5
M10 x 1.25	7.2	5.2	8.2	6.2	M10 x 1.25	7.1	7.9
M10 x 1.5	6.5	5	7.7	6	M10 x 1.5	6.5	7
M12 x 1.25	13	8.7	14.5	10.2	M12 x 1.25	12.7	13.9
M12 x 1.75	11	8.1	12.9	9.6	M12 x 1.75	11	12
M14 x 1.5	19.5	13	21.6	15	M14 x 1.5	20	22
M14 x 2	18	12.5	20	14.6	M14 x 2	18	19
M16 x 1.5	30	17	34	20	M16 x 1.5	30	33
M16 x 2	-	-	-	-	M16 x 2	-	-
M18 x 1.5	45	25	50	29	M18 x 1.5	45	48
M18 x 2.5	-	-	-	-	M18 x 2.5	-	-
M20 x 1.5	60	30.5	64.5	35	M20 x 1.5	60	65
M20 x 2.5	-	-	-	-	M20 x 2.5	-	-
M22 x 1.5	80	41	-	-	M22 x 1.5	80	90
M22 x 2.5	-	-	-	-	M22 x 2.5	-	-
M24 x 2	100	47	108	52.5	M24 x 2	100	110
M24 x 3	-	-	-	-	M24 x 3	-	-
M27 x 2	95	40.1	-	-	M27 x 2	100	-
M30 x 2	130	49.4	-	-	M30 x 2	140	-
M33 x 2	170	-	-	-	M33 x 2	190	-
M36 x 3	220	-	-	-	M36 x 3	240	-

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Case	TROUBLE	PROBABLE CAUSE
M1	The starter motor does not work	• Battery cut-off main switch OPEN or FAULTY • Transmission speed selector NOT in NEUTRAL • Battery exhausted • LINK fuse burnt • Key switch faulty • Speed selector connection discontinued • Starter remote switch faulty • Starter motor faulty
M2	The starter motor turns, but the DIESEL engine does not start	• Fuel exhausted • Fuel filter clogged • Stop solenoid faulty • Injectors clogged • Injection pump faulty
M3	The engine smokes excessively and does not perform	• Injectors faulty • Injection pump out of calibration or faulty
M4	The engine does not stop, in spite of specific command	• Stop solenoid linkage out of alignment • Stop solenoid faulty

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1.3 REPAIR PROCEDURES

1.3.1 PHASING OF INJECTION PUMP ON ENGINE

WARNING

Keep hands and face away from the tip of nozzles when calibrating injectors. Sprayed fuel under pressure can cause injuries and damages. Always were goggles or glasses with side panels when testing injector efficiency. Keep your hands and face away from loosen piping connections when testing fuel lines. Always were goggles or glasses with side panels.

Position the engine so that the phasing marks are aligned with the flywheel housing.

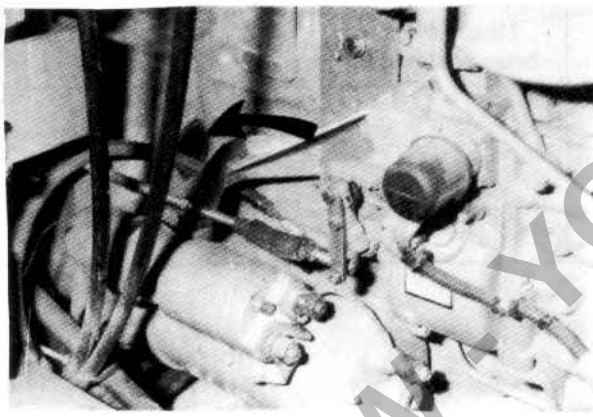


Fig. 1.5

Couple the engine and the injection pump mating the corresponding splines. Check that element **1** of the pump starts to raise, than hand-tight the securing screws.

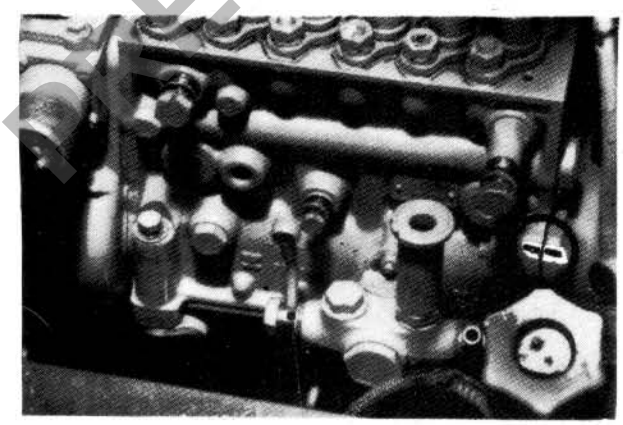


Fig. 1.6

Remove the access plug from the pump body.

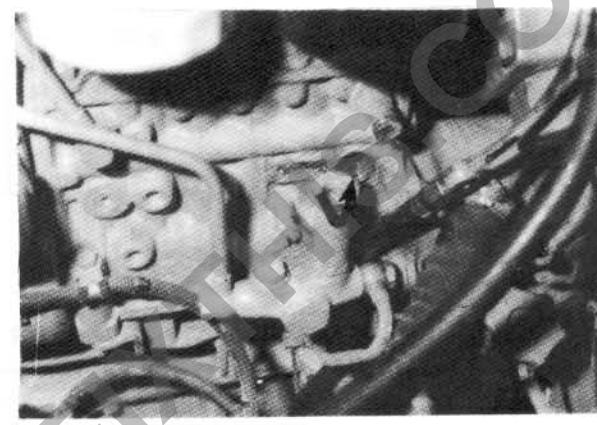


Fig. 1.7

Helped by an assistant, rotate the engine cranking with a lever on the crankshaft pulley, to rotate both engine and injection pump.

When the plunger (visable through the accesshole on the pump) starts its upward stroke, the phasing mark on the flywheel starts to appear through the hole on the flywheel housing.

Continue to rotate the engine until the phasing mark on the flywheel corresponds with the pointer on the flywheel housing itself.

Plug the delivery port of the injection pump.

Mount the bleeding pipe on the high pressure outlet port of plunger no. **1.**

Plug the remaining ports of the pump to avoid that other delivery valves of the pump open.

Move the throttle lever to half stroke.

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2.1 DESCRIPTION

The torque converter and the transmission form a single unit. The unit is driven by the engine through a flex-joint flanged to the flywheel. The converter is a single-stage type, including three co-axial elements: impeller wheel-turbine - stator. The impeller operates as a centrifugal pump, takes the oil flow from the center and discharges it through the outer part of the wheel to the turbine. The turbine drives the converter output shaft and transfers the oil to the reaction element. The converter reaction element is located between the impeller wheel and the turbine. Its function is to take the oil coming from the turbine and change its direction to allow the correct introduction in the impeller wheel. The converter multiplies the torque up to its maximum ratio obtained when the output shaft speed is zero. The transmission is a power-shift type with four forward and three reverse speeds.

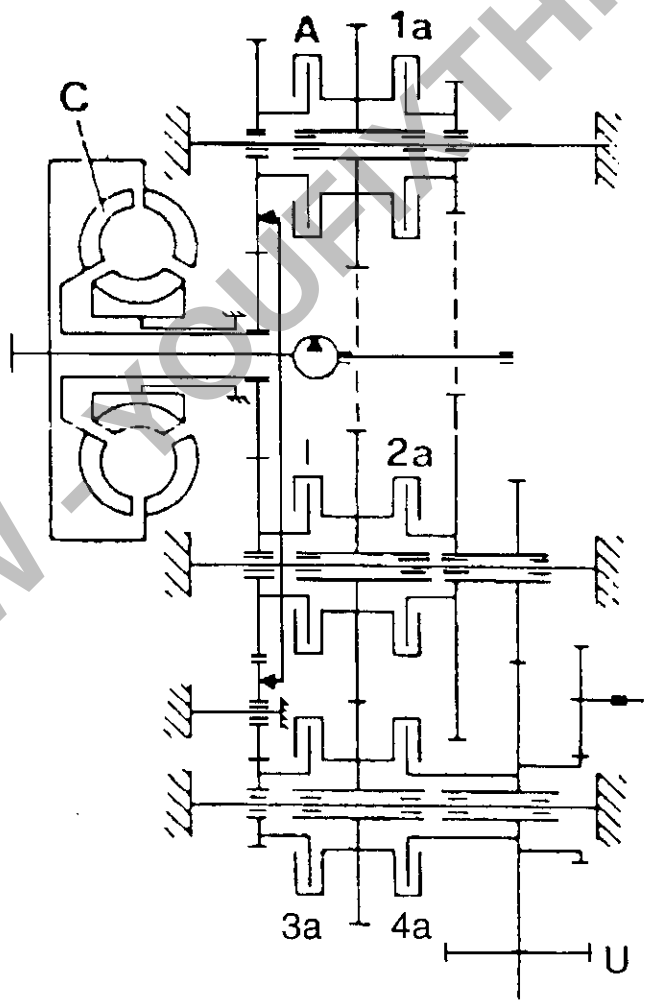


Fig. 2.1 Transmission diagram

A. Forward - **C**. Converter - **I**. Reverse - **U**. Output.

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SPECIFICATIONS

ENGINE

Model: 8065.25.093

Diesel cycle, 4-stroke, direct-injection, with exhaust gas driven turbocharger.

Number of cylinders: 6

Cylinder bore	115 mm (4.53 in)
Piston stroke	130 mm (5.11 in)
Total displacement	8102 cu cm (495 cu in)
Compression ratio	15.8:1
Max. rated power	141 KW at 2150 RPM
Max. rated torque	74 daNm at 1300 RPM

Lubrication System

Type :Force-feed by gear pump

Gauze strainer on pump intake.

Full-flow oil filters w/replaceable cartridge.

Low oil pressure warning indicator in Electronic Data Monitor Panel.

Timing

Overhead Valve, Pushrod Operation

Intake	
Opens	11° BTDC
Closes	27° ABDC
Exhaust	
Opens	55° BBDC
Closes	17° ATDC
Valve clearance:	
For normal operation:	
- Intake	0.30 mm
- Exhaust	0.30 mm

Fuel system

Plunger feed pump, in-line injection pump, integral all-speed governor and automatic advance variator.

Throwaway cartridge fuel filters.

Pump timing to engine: 24° to 26° B.T.D.C. in cylinder No. 1 in compression stroke (start of delivery).

Firing order: 1-5-3-6-2-4

Fuel injectors release pressure: 230 - 238 bar (3335 - 3450 psi)

Fuel filtration: replaceable cartridge filters.

Dry air cleaner with centrifugal separator and replaceable paper cartridges.
Air cleaner cartridge clogging indicator (light) on DATA MONITOR.

Cooling System

Water cooled, forced circulated by centrifugal pump.

Radiator: 5 tube row core

Fan: 7 blade, pusher

Water circulation between engine and radiator governed by thermostat.

Engine coolant low level/high temperature warning indicator in Electronic Data Monitor.

Starting

By electric motor.

DRIVE TRAIN

Transmission-to-Axles

Two drive shafts between transmission and front axle with central support. The first shaft, between transmission and transfer gear, is sliding with double U-joint. The second, between transfer gear and front axle, is rigid with single U-joint.
The drive shaft between transmission and rear axle consist of a shaft with sliding double U-joint.

Converter/Transmission

Hydraulic torque converter

Stall torque ratio 2.57 to 1.

Transmission: "automatic powershift", 4 speeds forward and 3 reverses electrically operated by a single lever on steering column.

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1.2.4 INJECTION PUMP CALIBRATION DATA

Injection pump: PES6P110A720RS530 (BOSCH)

Governor: RQV450 - 1075 PA1016 - 3

Fuel pump: FP/K22P9

Pressure piping (ENGINE): diam. 6 x diam. 1.5 length for no. 1 cylinder = 320 mm, no. 2 - 3 = 340 mm, no. 4 = 420 mm, no. 5 = 490 mm, no. 6 = 565 mm.

Injector setting (ENGINE): 200 ÷ 208 bar.

Min. engine speed, no-load: 880 ÷ 960 rpm.

Static timing mounting 23° ± 1° BTDC, plunger 1 of injection pump in beginning of fuel injection and piston no. 1 on compression stroke.

Test bench with static and dynamic specifications according to ISO 4008/1 and 4008/2 standards.

Piping diam. 6 x diam. 1.5 x 600 mm length (according to ISO 4093.3 standard).
(Outside diameter x wall thickness x length).
Injectors ISO standard (calibrated orifice).
Injector setting 172 ÷ 175 bar.
Test fluid according to ISO 4113 standard, temperature: 38 ÷ 42 °C (100 ÷ 108 °F).
Feeding pressure 1.5 bar.
Burette emptying time: 30 sec.
Relief valve set at 1.3 ÷ 1.8 bar.

INJECTION PUMP PHASING

(Spill point test - Stop block removed)

Plunger lift (corresponding to covering of port)	2.00 ÷ 2.10 mm (from BTDC)
Firing order	1 - 5 - 3 - 6 - 2 - 4
Rotation	clockwise

PUMP BASIC CALIBRATION (Stop block removed)

Type of operation	Pump rpm	Position of rake (mm)	cucm/1000 strokes	Max. discrepancy between cylinders (cucm)	Press. on LDA (bar)
Calibration	1075	10.80 ÷ 10.90	122 ÷ 124	4	0.7
Test	700		126 ÷ 130		0.7
Test	500		93 ÷ 95		0
Test	450	6.0 ÷ 6.4	17 ÷ 22	4	0

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PRELIMINARY INSTRUCTIONS AND BREAK-IN PERIOD

PRELIMINARY INSTRUCTIONS

On delivery of the machine, the Sales Organization Staff will instruct the Buyer on the main operation and maintenance rules.

Here below is a check list of such instructions intended to show the Operator how to:
- Store fuel properly
- Check fluid levels: coolant, fuel, oils.
- Bleed the fuel system
- Drain deposits accumulated in fuel tank
- Start and stop engine and machine
- Work safely during working and service operations
- Run-in the machine
- Properly use the machine and the control levers
- Tire pressure
- Lubricate properly and products needed.
- Service the air cleaner
- Service the fuel, engine and hydraulic filters.
- Service the cooling system (the cooling system is filled at factory with a mixture of water and permanent type (glycol base) antifreeze.
- Service the hydraulic systems of converter/transmission, steering and attachment (s)

Check tools and equipment.

Start the engine. Observe all instruments and indicators for proper pressure, etc.
Operate controls and check for proper operation.
Stop engine and check hoses, lines and fittings for leakages. Tighten as necessary.

BREAK-IN PERIOD

A minimum break-in period of 60 hours is required.
Proceed as follows:

- Before driving away after starting from cold, warm up engine at idle speed for a few minutes.
- Avoid prolonged full power operation
- Inspect the machine frequently, making sure there are no oil or coolant leaks.

During the initial period of machine operation, in addition to the routine maintenance described in the relevant section, you are advised to carry out the following supplementary servicing operations that later may be omitted or protracted to longer intervals.

Within the first 100 hours:
Change engine oil and associated filter.
Change fuel filter.
Change converter/transmission oil and associated filter.
Change hydraulic oil return filter.

Within the first 200 hours:
Change axles oil

Within the first 300 hours:
Check fuel system.

All the above recommendations apply also to newly overhauled machines.

WARNING

Study the Operating and Maintenance Instruction Manual before starting, operating, maintaining, fueling, or servicing this machine.

Never lubricate, service or adjust a machine with the engine running, except as called for in the Operation and Maintenance Instruction Manual.

WARNING

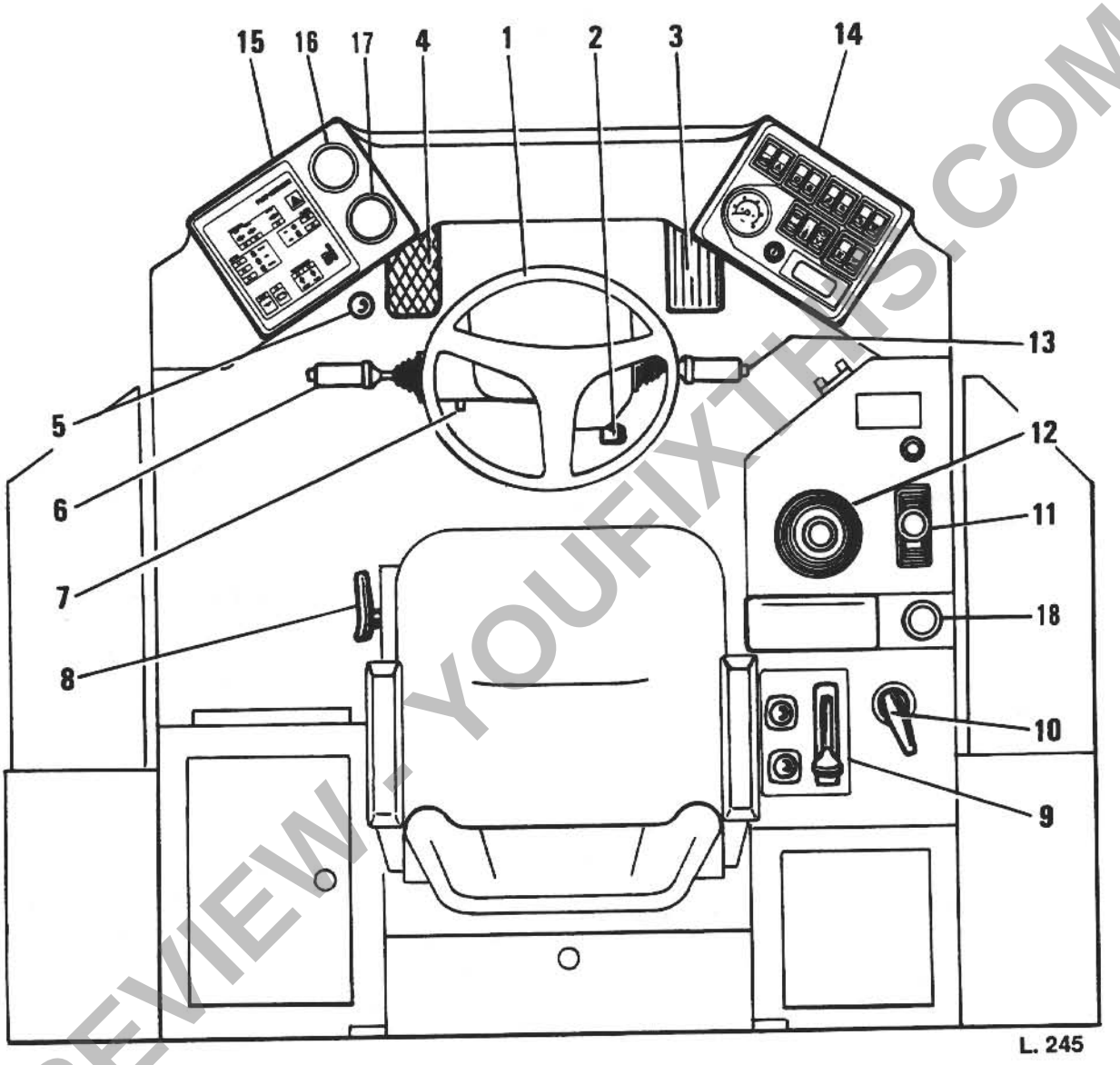
Warn all people who may be servicing or working around machine before starting engine.

Do not run engine of this machine in closed areas without proper ventilation to remove deadly exhaust gases.

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CONTROLS AND INSTRUMENTS



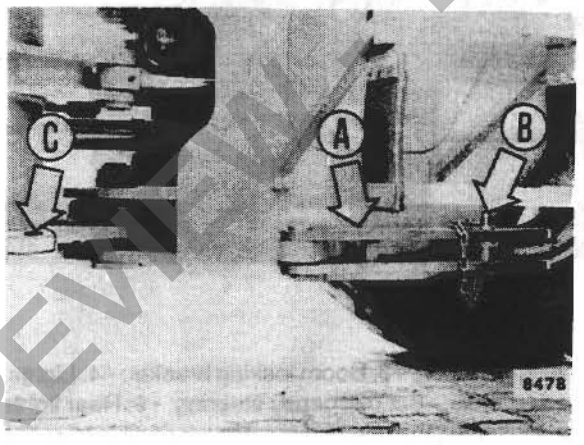
Note - The terms LEFT and RIGHT as referred to in this Manual, are determined by sitting on the Operator's seat and facing the front (bucket) end of the loader.

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TRANSPORTING

Use suitable vehicle of appropriate capacity.
Load and unload on a level area that gives full support under the wheels of the transporting vehicle. Use ramps of adequate strength, low angle and proper height. Use chock blocks on transport vehicle wheels, so it cannot move.
Keep bed of transporting vehicle clean of clay, oil and all materials that become slippery.
Use a signal person stationed in a place thal provides full view of ramp, vehicle bed, machine and operator.
Raise implements just high enough for clearance.
Keep engine speed low so machine will creep up the ramps and onto transporting vehicle load bed.
Make the least possible use of accelerator and steering conlrols. When loaded, lower all implements. Set parking brake. Heed all shutdown procedures.
Tie machine securely to bed of transporting vehicle and block wheels as required by the carrier.
Verify that the cab door, compartment doors or other mobile components are securely locked.
Install the signals prescribed by Road Regulations, should the dimensions of the machine exceed the approved limits.
Lock the steering frame modules with the appropriate safety lock bar **A** and pin **B**, as illustrated.



ROADING

⚠ WARNING

Avoid transporting the machine on the road with a loaded bucket. Make sure that the bucket controls are in neutral position and lock them with the appropriate device. This is to avoid that unwanted or accidental movements of the bucket controls cause dangerous situations.

Check all fluid levels and tire pressure. Position implements within wheel width, raised high enough for clearance. Bucket must be empty. Make sure all lights work properly. Check with tire manufacturer for advice. Some tires and tread designs are not suitable for highway travel.

Know your stopping distance at any given speed. Regulale travel speed accordingly.

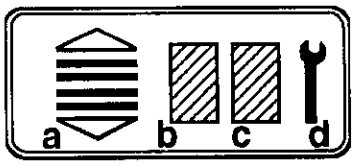
Obey all traffic regulations. If traffic backs up, pull to the side of the road and allow traffic to pass. Stop for 30 minutes after two hours of travel to allow tires to cool. Tire pressure will rise during operation; this is normal and must not be reduced.

Monitor system indicators frequently to insure that all systems are functioning properly. Travel with a signal vehicle equipped with flashing lights and signs to adequately warn oncoming traffic. If a rhythmic bounce develops, slow down to stop it, then continue at a slower speed.
During transfers on roads open to normal traffic obey all highway code regulations.

Caution: When travelling on roads open to traffic, obey all laws and regulations. Keep all lights in good working conditions. Replace immediately any bulb out of order.

NOTE: The rules quoted in this manual are subject to slight changes if so dictated by local traffic regulations in different Countries.

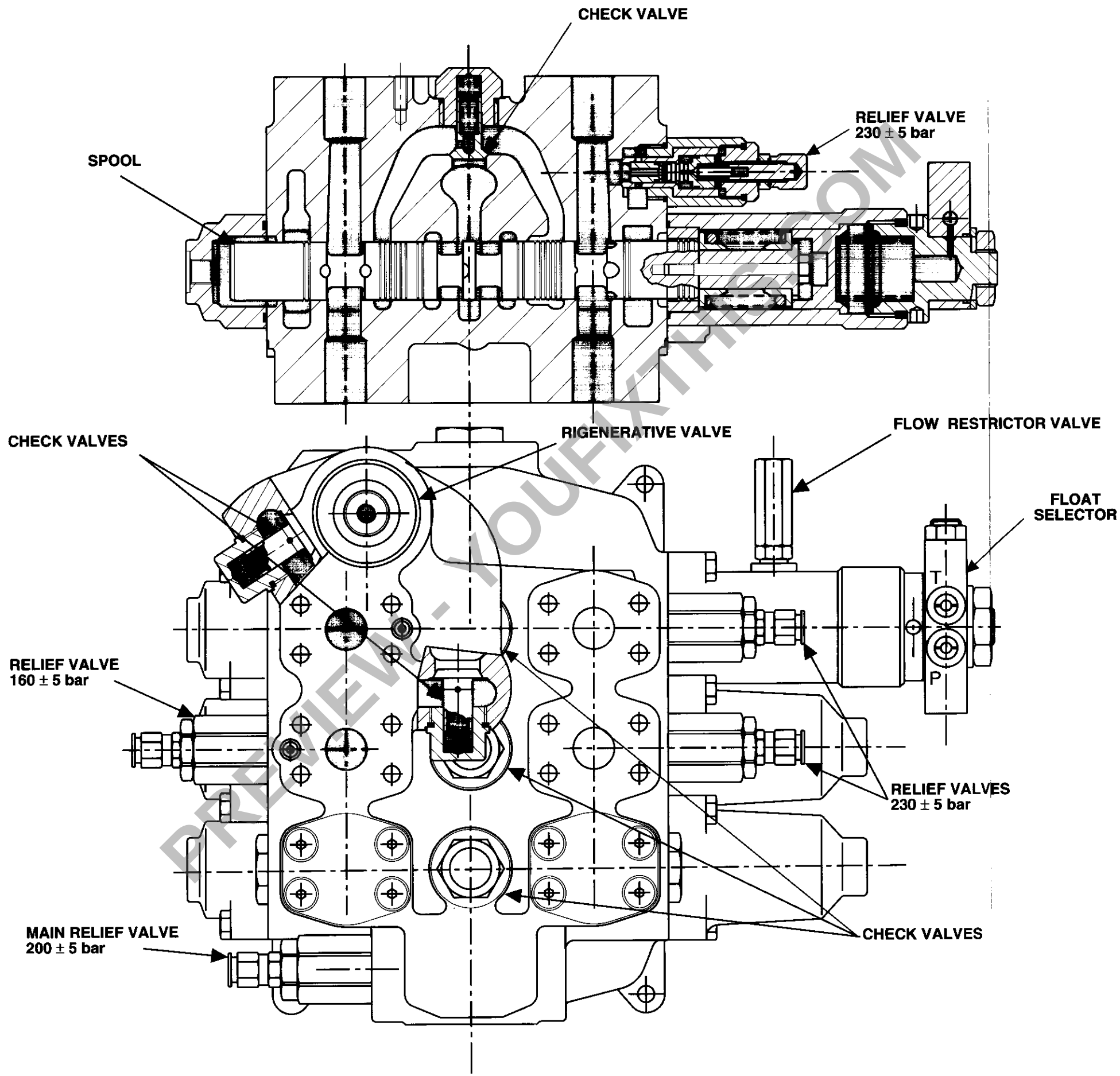
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TROUBLE	PROBLABLE CAUSE	REMEDY
4. With engine running the LEDs (**b** and **c**) signal **E E** flashing.  	One or more of the 5 transmission control valve solenoids is defective or one of the wires is cut.	Check individually the 5 solenoid continuity (the resistance measured with ohmmeter is 90 ÷ 95 ohm).
- The transmission remains in neutral, the machine does not move.	Logic box defective.	Replace the logic box with one working appropriately.
5. Display OK, or LEDs (**b** and **c**) signal **E E** flashing in at least one condition. - The selector does not select correctly all speeds.	Transmission selector defective.	- Check the selector with ohmmeter according to switch actuation diagram. - Replace selector. - Use "**ZF**" tester to check selector.
6. Display OK. - Pushing the button of "**kick-down**" with second speed ON, the horizontal bars on the display do not flash and the speed engaged digit does not shift-down.	Button switch of "**kick-down**" on equipment lever hand-grip defective.	Check the "**kick-down**" button switch and relevant feeding.
7. Display OK - The "**shift-down**" does not occur. Pushing the "**kick-down**" button with transmission in automatic, the horizontal bars on the display do not flash and the speed engaged digit does not shift-down.	The "**kick-down**" button switch on the equipment control lever is defective. Electrical connections or switch under throttle pedal defective.	Check "**kick-down**" button switch and relevant feeding. Check switch under the throttle pedal, that must be closed when the pedal is released and must be adjusted as prescribed. Check the electrical connections.

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HYDRAULIC SYSTEM FR 160.2 BOOM SECTION



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