1650K - Table of fluids used

ITEM	QUANTITY (litres)	Fluids and lubrificants Ambra	VISCOSITY GRADE	Outdoor temperatures of reference	International Classification
Cooling system	28	CASE Coolant MS1710	Ethylene Glycol mixed with 50% water protects down to - 35 °C (- 31°F)	Down to - 35 °C (- 31 °F)	ASTM D-5345 Mixture of water and antifreeze at 50%. The mixture provides oxidation, foaming, corrosion, scaling and freezing protection properties down to - 35 °C (- 31 °F).
Fuel reservoir	270	No.2 Diesel fuel	–	–	DIESEL FUEL ASTM No. 2D Grade TT of reputable quality and make
Engine	14	CASE NO. 1 Engine Oil	SAE 15W - 40	- 25 / 45 °C (-10 / 115 °F)	API CH-4
			SAE 10W - 30	- 30 / 10 °C (- 22 / 50 °F)	API CG-4
Torque converter / Transmission (Front Transmission Housing)	32	CNH Hy-Tran Ultra Fluid	SAE 10W	- 30 /50 °C (- 20 / 120 °F)	ATF Type A Suffix A
Rear Transmission housing - Planetary steering / brakes	94	CASE NO. 1 Engine Oil	SAE 10W - 30	- 25 / 45 °C (- 10 / 115 °F)	API CG-4
Equipment Hydraulic Reservoir	63	CASE Hydraulic Excavator Fluid - MS 1230	SAE 10W - 30	- 30 / 50 °C (- 20 / 120 °F)	ISO VG 46
Final drives (each)	38	CASE 135 HEP Gear Oil	SAE 80W - 90	All season	API GL5 or MIL-L-2105
Idlers Rollers and track chains	7	CASE NO. 1 Engine Oil	SAE 10W - 30	- 30 / 50 °C (- 20 / 120 °F)	API CG-4
Grease fittings		CASE Molydisulfide Grease	Grade 251 H - EP, Spec B-27	All season	–
Cab tilting pump	0.5	CNH Hy-Tran Ultra Fluid	SAE 10W	- 30 / 50 °C (- 20 / 120 °F)	ATF Type A Suffix A

Note: Oil quantities indicated are those required for periodical changes.

If the content of sulphur of the fuel exceeds 0.5 %, change the engine oil as follows:

as 0.5% sulphur	Normal service interval
0.5 to 1 %	Half normal interval
up to 1%	One quarter normal interval

Carefully read personal and machine SAFETY PRECAUTIONS (at the beginning of this manual)

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2.2 TROUBLESHOOTING

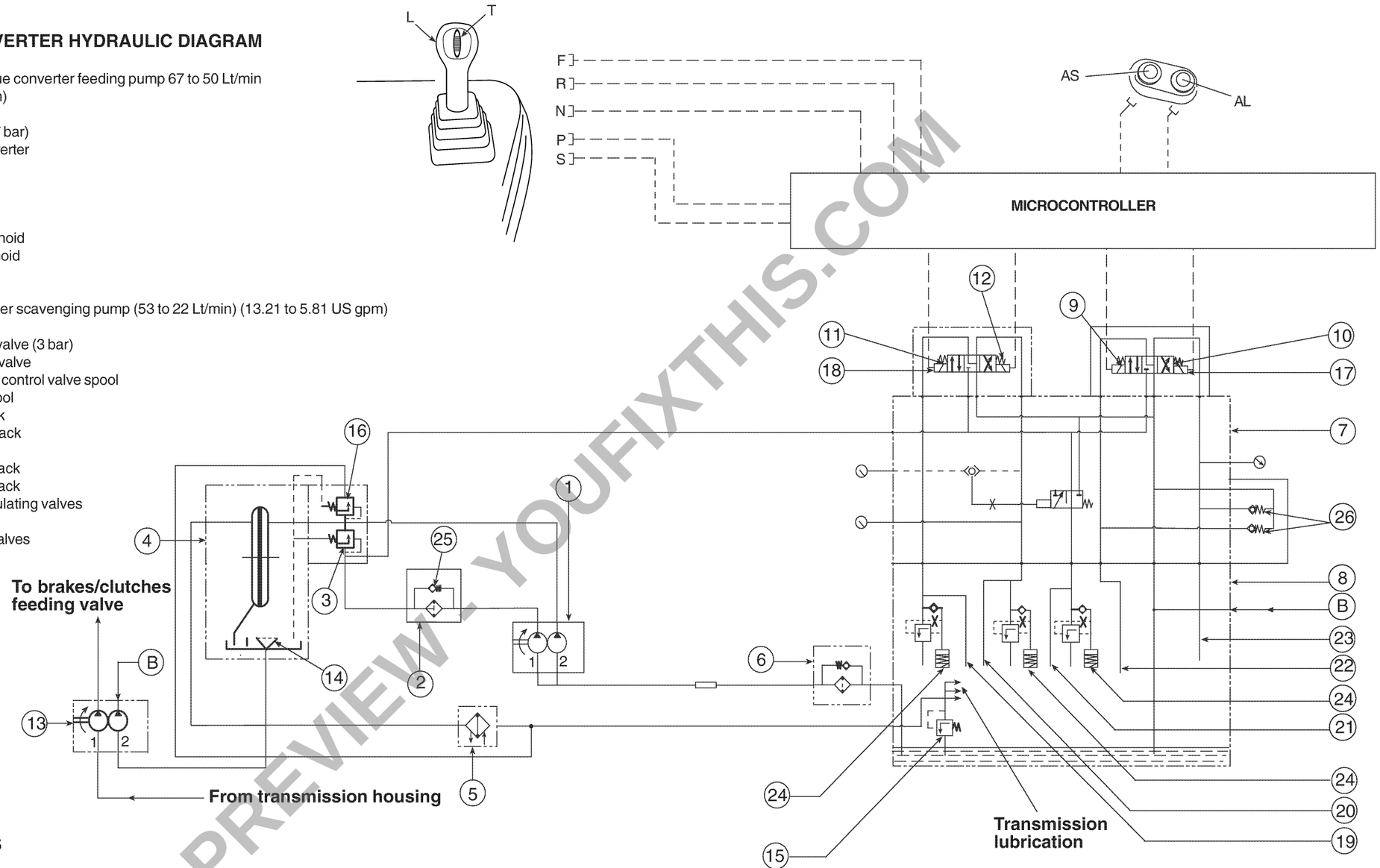
TROUBLE	PROBABLE CAUSE	TOOLS REQUIRED	TEST	SOLUTION
Low lube oil pressure. The indicator light is ON with engine running.	Transmission oil level low.	Instruction Manual	Pull-out the dipstick and check the level	Top-up oil up to prescribed level.
	Torque converter pump suction filter clogged			Clean the filter
	Outer crack allowing the seeping of air into the pump		If the oil is foaming, check if a crack is present	Eliminate the crack
	Hose defective		Suction pipe clogged	Change or clean the pipe
	Oil of a wrong type	Instruction Manual	Check oil specifications with data provided by Manufacturer	Drain the oil and change it with oil of the prescribed type

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Fig. 1 TORQUE CONVERTER HYDRAULIC DIAGRAM

1. Dual transmission/torque converter feeding pump 67 to 50 Lt/min (17.70 to 13.21 US gpm)
2. Oil filter (delivery)
3. Pressure relief valve (17 bar)
4. TWIN-DISC torque converter
5. Heat exchanger
6. Oil filter (suction)
7. Control valve
8. Transmission housing
9. FORWARD speed solenoid
10. REVERSE speed solenoid
11. 1st speed solenoid
12. 3rd speed solenoid
13. Steering torque converter scavenging pump (53 to 22 Lt/min) (13.21 to 5.81 US gpm)
14. Mesh filter
15. Lube oil pressure relief valve (3 bar)
16. Torque converter safety valve
17. FORWARD/REVERSE control valve spool
18. 1st - 3rd control valve spool
19. To 1st speed clutch pack
20. To 3rd speed clutches pack
21. 2nd speed clutch pack
22. To FOR speed clutch pack
23. To REV speed clutch pack
24. 1st - 2nd - 3rd speed modulating valves
25. Filter clogging valve
26. FOR/REV modulating valves



TRANSMISSION CONTROL BUTTONS

B. To transmission housing
F. Forward speed
R. Reverse speed
P. Upshifting
S. Downshifting
N. Neutral
AS. Auto-shift function
AL. Auto kick-down function
L. Transmission control manipulator
T. Up-Down Shifting Button

KSM0003

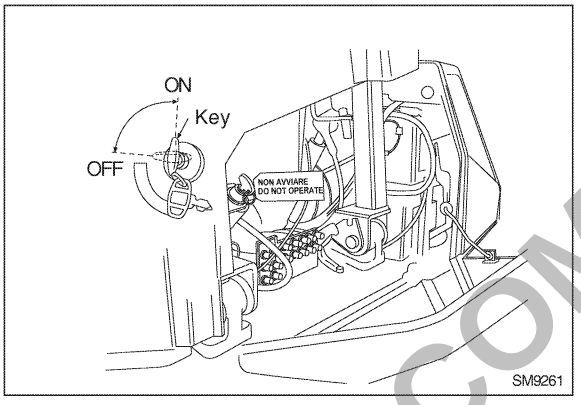
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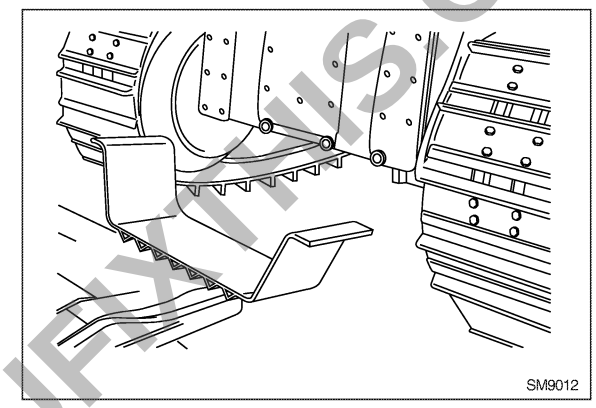
2.4 PROCEDURES FOR THE REPAIR OF THE TORQUE CONVERTER

2.4.1 REMOVAL

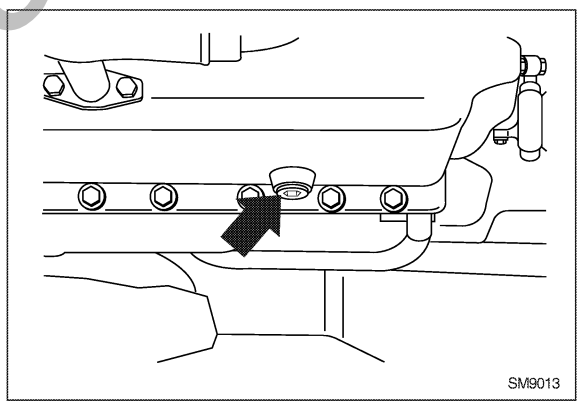
Turn the main switch into position "OFF". Place a "*DO NOT OPERATE*" warning signal on the machine. please refer to the Section "CAB" of this Manual to tilt the cab.



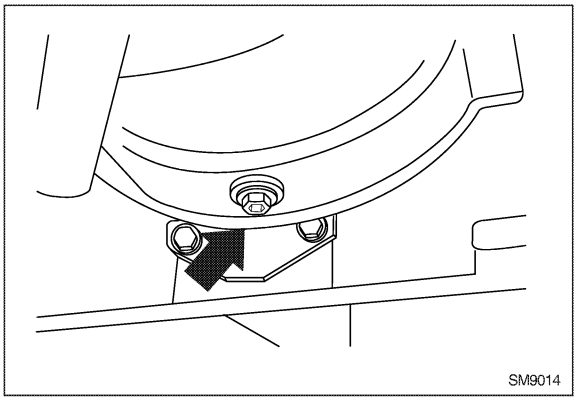
Remove the central lower guard.



Drain the transmission oil through the draining plug.



Drain the oil from the torque converter housing through the draining plug.



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3.1.1 Final drive

157. Housing
158. Cover
159. Bearing housing
160. Sprocket shaft
161. Driven or idle gear
162. Bearing
163. Housing
164. Spacer
165. Spacer
166. Spacer
167. Sprocket gear
168. Plate
169. Driving gear
170. Bearing housing
171. O-Ring 3.53 x 171
172. O-Ring 3.53 x 142.50
173. O-Ring 3.53 x 183.7
174. O-Ring 3.53 x 190.1
175. Screw TE M16x1.5x65
176. Washer 16x30x3
178. Roller bearing 40x90x33
179. Roller bearing 70x150x35
180. Roller bearing 70x150x51
181. Roller bearing 55x120x43
182. Bearing
183. Plug M27x2x16
184. O-Ring 3x24
185. Seal
186. Screw TE M12x50
187. Washer 12x24
188. O-Ring 3.53 x 215.5
189. Front seal
190. Beaded ringnut
194. Circlip 170

C. Final drive cover
G. Dowel
R. Final drive upper guard
V. Sprocket hub securing screw (M20x1.5)
V_1. Final drive securing screw to PIVOT SHAFT (M24x2x260) (M24x2x130)
V_2. Final drive securing screw to transm. housing (M16x1.5)
C_1. Segment securing screws (M22x1.5)
S. Sprocket segments
M. Sprocket hub

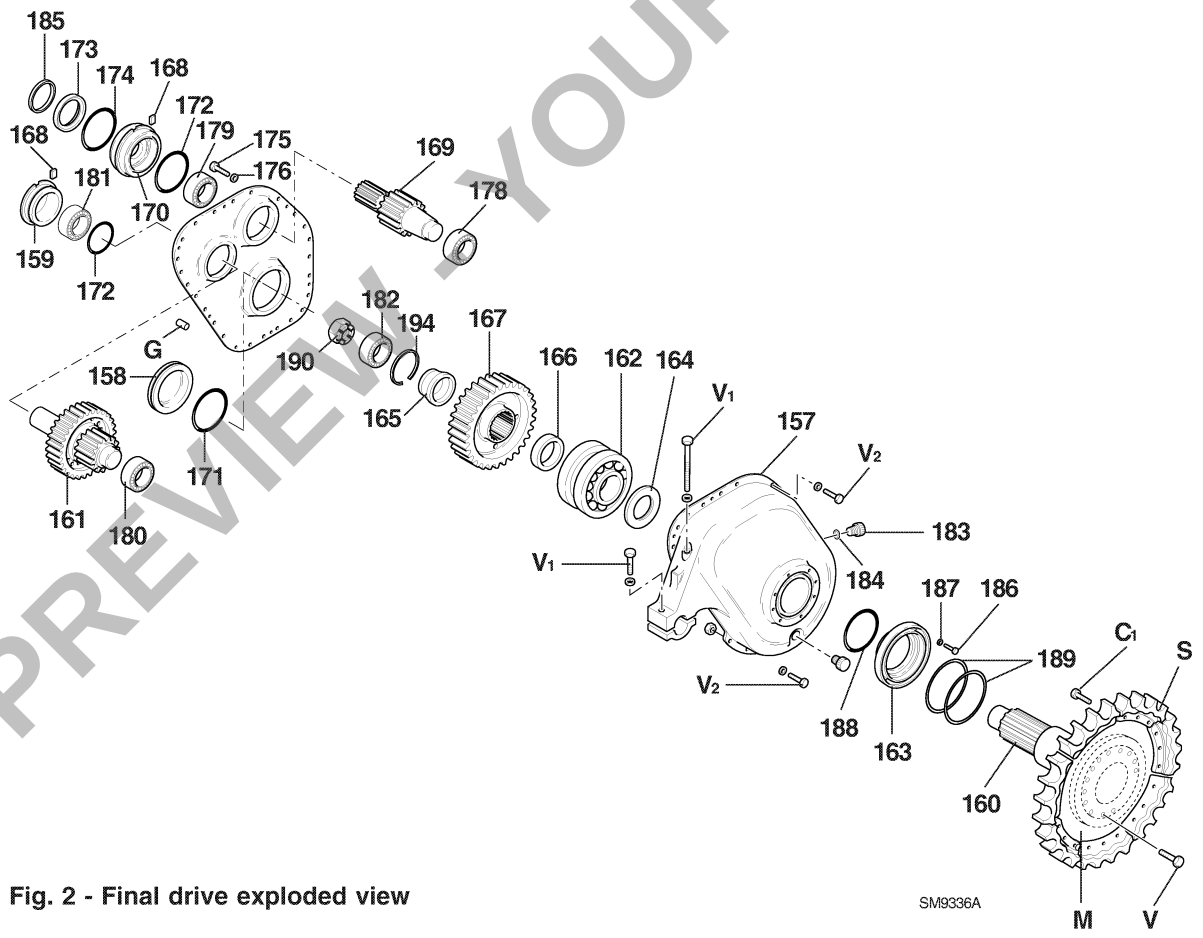


Fig. 2 - Final drive exploded view

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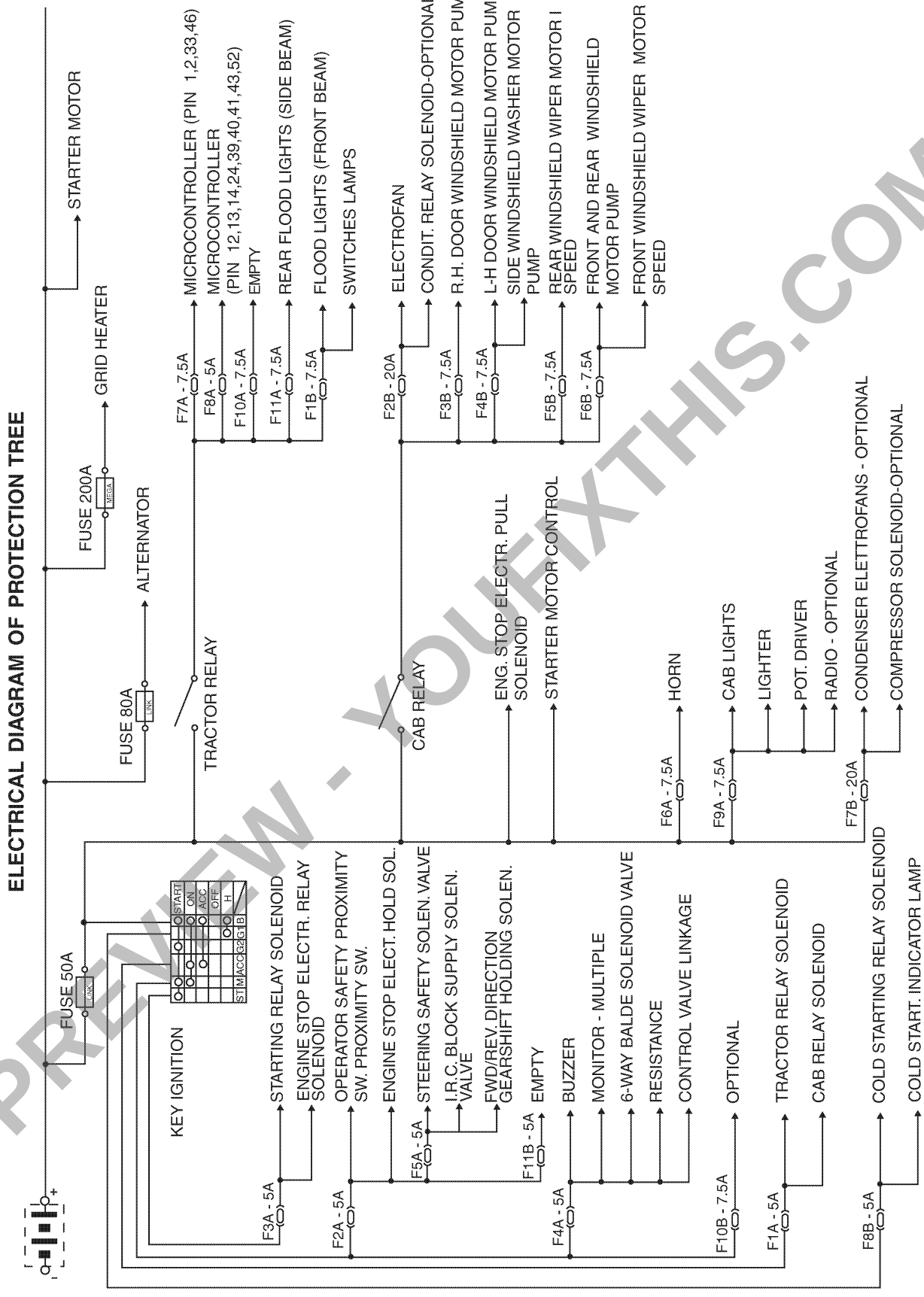
TABLE OF TIGHTENING TORQUES

When the tightening torque of bolts and nuts is not indicated in the single sections, this can be obtained from the table here below:

NUTS (ZNT)					SCREW (ZNT / DEIDR)		
Strength class: 10 (R 80)					Strength class: 10.9 (R 100)		
Diameter and pitch	normal	low type	w/polyamide ring		Diameter and pitch	normal ZNT	self-locking ZNT
			normale	tipo basso			
mm	daNm	daNm	daNm	daNm	mm	daNm	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	49.9	-	-	M30 x 2	140	-
M33 x 2	170	-	-	-	M33 x 2	190	-
M36 x 3	220	-	-	-	M36 x 3	240	-

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4.2 TROUBLESHOOTING

4.2.1 DIAGNOSIS ON THE DISPLAY

The display has 5 text field digits signalling the following messages:

A. Work hourmeter signal

The engine hours are signalled by coming ON for about 1 second when the general test of the instrument panel is performed. To repeat the reading of the engine hours, it is necessary to cut-off and to energise again the system with the starter switch key. The hours stay ON until the engine is started.

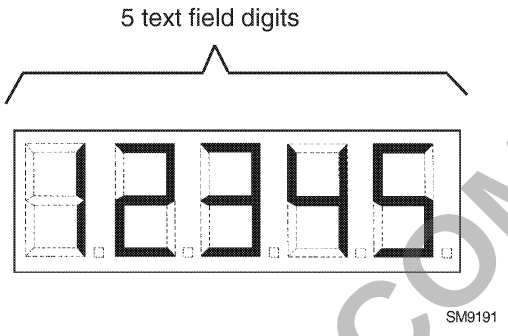
or

B. Speed engaged + failure code signal

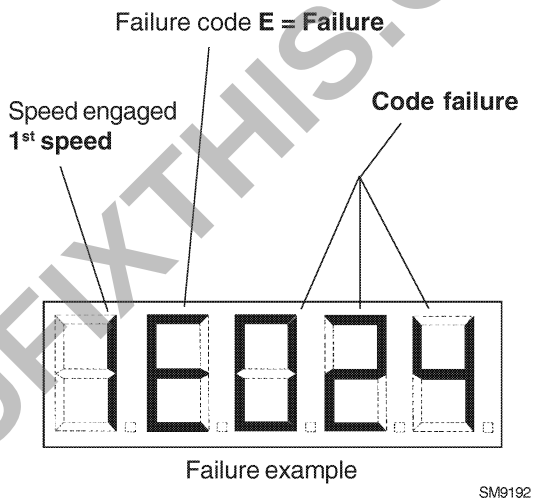
- The first digit indicates the speed engaged
- The second digit indicates E in the event of a failure.
- The 3 rd - 4 th and 5 th digits indicate the code of the type of failure and they are distinguished by two types.

Failure codes of a single component of the brakes and transmission control system (see table 1).

Failure codes for more than one component (see table 2).



SM9191



Failure example

SM9192

When the display shows one of the failure codes here below, identify the corresponding failed component, as per table 1.

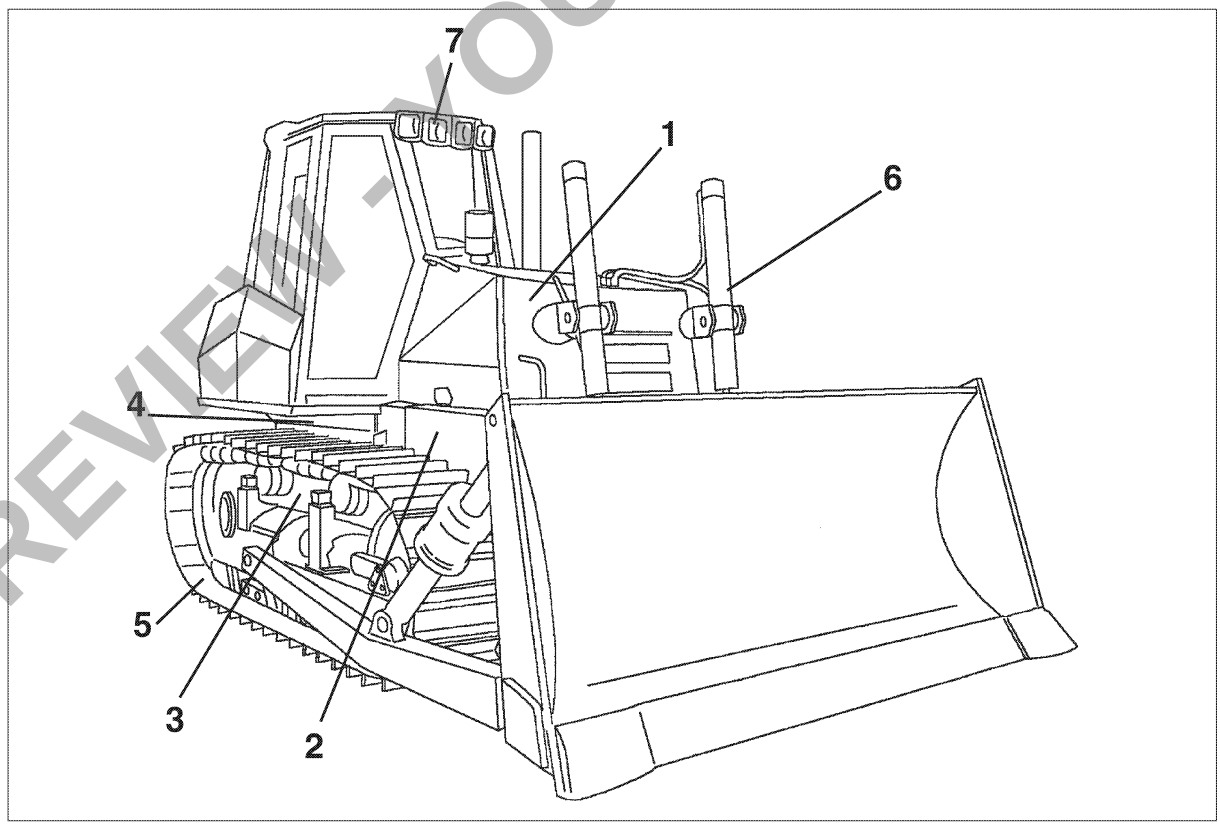
TABLE 1

Failed component	Failure code
Forward speed "F" solenoid	004
Reverse speed "R" solenoid	008
1st speed solenoid	016
3nd speed solenoid	032

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SUMMARY

GENERALITIES	SECT. 0
ENGINE	SECT. 1
TRANSMISSION	SECT. 2
FINAL DRIVES	SECT. 3
STEERING - BRAKES	SECT. 4
UNDERCARRIAGE	SECT. 5
DOZER EQUIPMENT HYDRAULIC SYSTEM	SECT. 6
ELECTRICAL SYSTEM	SECT. 7



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⚠ WARNING

Study carefully this Manual before starting, operating, maintaining, fuelling or servicing the machine.

Read and heed all safety rules before any intervention.

SAFETY RULES

- Do not allow unauthorised personnel to operate service or maintain this machine.
- Do not wear rings, wrist watches, jewellery, loose or hanging apparels, such as ties, torn clothing, scarves, unbuttoned or unzipped jackets that can catch on moving parts. Wear proper safety equipment as recommended for the job. Examples: hard hat, heavy gloves, ear protection, safety glasses or goggles, reflector vests, respirator. 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 minimise 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 the machine. Keep two hands and one foot, or two feet and one hand in contact with step grab rails and handles at all times.
- Do not use controls or hoses as hand holds when climbing on or off machine. Hoses and controls are movable and do not provide a solid support. Also, controls 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. Wear safety boots or shoes that have a high slip resistant sole material.
- 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.

STARTING

- NEVER START NOR OPERATE AN UNSAFE MACHINE. Before operating a machine, always ensure 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 all safety devices provided are in place and in good operating conditions.
- Be sure exposed personnel in the area of operation are clear of the machine before moving it or its attachments. WALK COMPLETELY AROUND the 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 your seat belt (when provided).
- Obey all flag signals and signs.
- Due to the presence on the machine of flammable fluids, never check or fill fuel reservoirs or batteries near open flames, smoking materials or sparks.
- REMEMBER THAT STARTING FLUID IS FLAMMABLE. Follow strictly the recommendations printed on containers and in the Operation and Maintenance Manual.
- DO NOT PUNCTURE OR BURN CONTAINERS.
- Containers must be stored in fresh, well ventilated places, out of reach of unauthorised persons. Follow strictly the instructions provided by the Manufacturer.
- Never use these products near open flames, smoking materials or sparks.

OPERATION

- 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 loaders, dozers, graders, excavators. NEVER OPERATE machines without ROPS.
- Make sure the Operator's compartment is free of foreign objects, especially if not firmly secured. Never use the machine to transport objects, unless proper securing points are provided.

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UNITS OF MEASURE

The units of measure in this Manual are those implemented by the International System (S.I.) replacing those previously used by the M.K.S. system.

Force: decanewton (daN) supersedes kilogram (kg)

Pressure: bar, supersedes kg/sq cm

Torque: dacanewton x meter (daNm) supersedes kg m

For the conversion of units of measure, the following table applies:

	multiply	by	to obtain
Force	kg	0.9807	daN
Pressure	kg/sq cm	0.9807	bar
Torque	kg m	0.9807	daN m

NOTE - For current repair needs, the following equivalences are considered valid:
kg = daN; kg/sq cm = bar; kg m = daNm.

For the conversion of units of measure from the International System to British System please refer to the following table:

	multiply	by	to obtain
Mass	kg	2.205	lb
Length	mm	0.03937	in.
Pressure	bar	14.5	p.s.i.
Torque	daNm	7.373	lb.ft
Flow	lt/min	0.2199 0.2641	gal/min (UK) gal/min (US)

CLASSIFICATION OF STANDARDISED PARTS FOR THE DETERMINATION OF TIGHTENING TORQUES

NOTE - In the event, in the different sections, no tightening torque is prescribed, please refer to the table "TIGHTENING TOQUES" only after identifying exactly the item.

The latter is identified by an eight-digit coded number fully designating the part.

Example:

l	/	a	b	c	d	e	/	f	g

l - Index number of standard

It is always indicated by digit 1. This digit indicates that the part can be made in several versions differing for the material and coating.

a - b - c - d - e - Bas number of the standard

It is a number always composed of five digits identifying the part and its dimensional specifications.

f - Index number for the material

This digit indicates the material prescribed for a specific item. Its meaning is indicated in the table to follow.

g - Index number for the coating

It is a digit indicating the coating prescribed for a specific item.

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2.4.4 REASSEMBLY

To reassemble, reverse the disassembly procedures, with the following modifications:

In case the dowels, the sleeve or the sealing ring have been removed, install new parts.

Always install new O-Rings and seals.

In the event the heating of a bearing is required, use an appropriate heater and warm-up at 121 °C (250 °F).

In the event the freezing of a bearing of its components is required, place the part in dry ice 4 hours prior to the installation.

Pay attention to the correct installation of the oil deflector.

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FORWARD REVERSE MODULATING VALVES

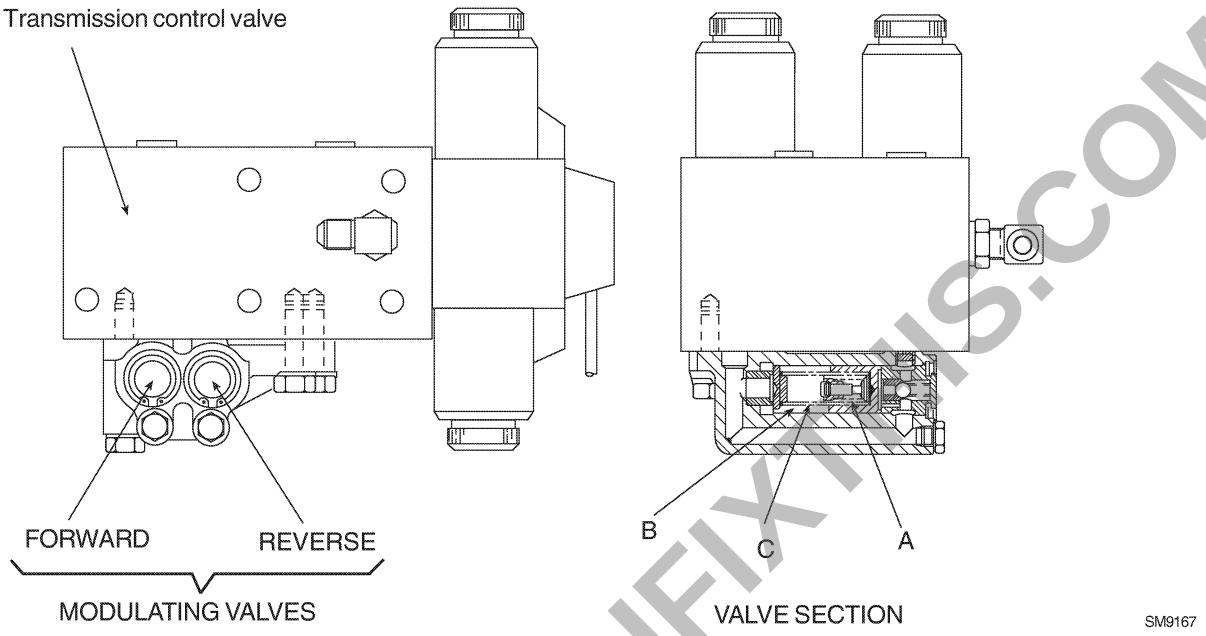
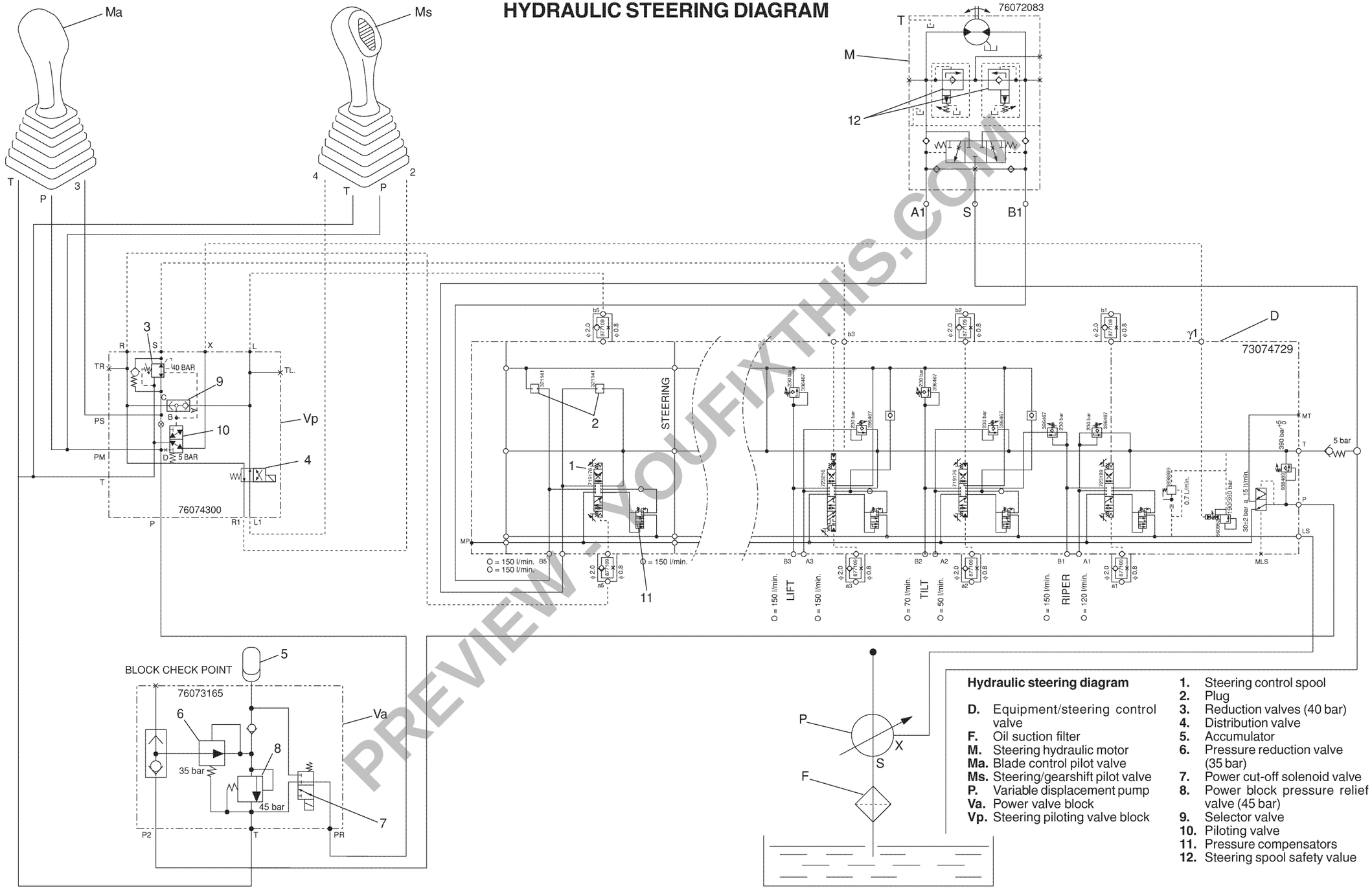


Fig. 14 Transmission control valve and modulating valves

		mm	in
A	Specifications of modulating valve inner spring:		
	Free length	48	1.89
	Load for spring compressed at 22 mm (0.866 in)	4.44 to 4.90 daNm	32.745 to 36.14 ft lbs
B	Ø Outside diameter of plunger	23.987 to 24.000	0.944 to 0.945
	Ø Inner diameter of modulating valve body	24.020 to 24.041	0.946 to 0.946
	Clearance between plunger and seat	0.020 to 0.054	0.001 to 0.002
C	Specifications of modulating valve outer spring:		
	Free length	64	2.52
	Load for spring compressed at 46 mm (1.811 in)	2.05 to 2.25 daNm	15.12 to 16.59 ft lbs

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HYDRAULIC STEERING DIAGRAM



Hydraulic steering diagram

- **D.** Equipment/steering control valve
- **F.** Oil suction filter
- **M.** Steering hydraulic motor
- **Ma.** Blade control pilot valve
- **Ms.** Steering/gearshift pilot valve
- **P.** Variable displacement pump
- **Va.** Power valve block
- **Vp.** Steering piloting valve block

1. Steering control spool
2. Plug
3. Reduction valves (40 bar)
4. Distribution valve
5. Accumulator
6. Pressure reduction valve (35 bar)
7. Power cut-off solenoid valve
8. Power block pressure relief valve (45 bar)
9. Selector valve
10. Piloting valve
11. Pressure compensators
12. Steering spool safety value

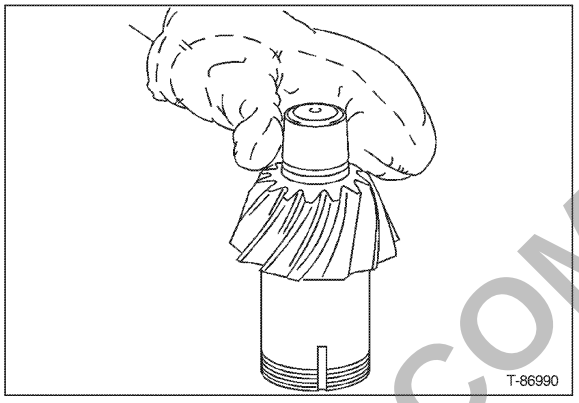
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Assembly of bevel pinion

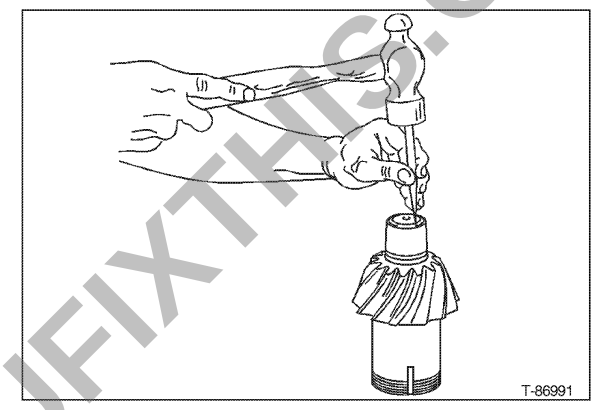
Warm-up the small bearing and install it in the seat on the smaller end of the pinion shaft.



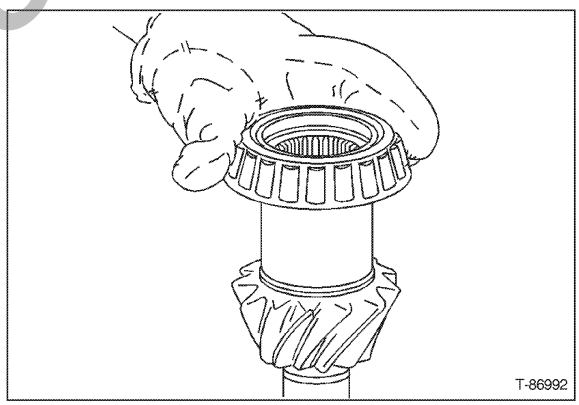
Stake the smaller end of the shaft.

WARNING

It is dangerous to strike hardened steel parts with tools different from mild steel or non-ferrous metals. When removing or installing these components, always wear safety glasses with side shields, gloves etc, to reduce the possibility of personal injuries.



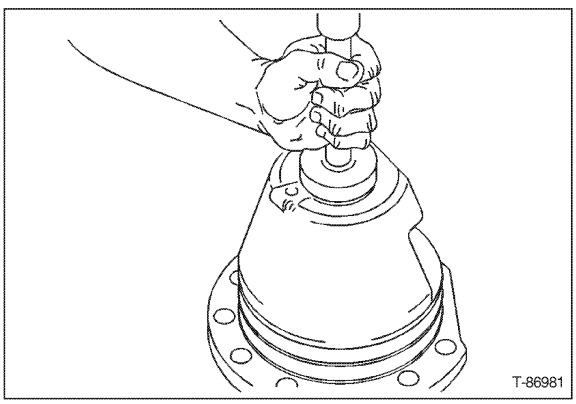
Warm-up the lower bearing race and install it on the shaft.



Using a punch, insert the roller bearing in the housing.

WARNING

It is dangerous to strike hardened steel parts with tools different from mild steel or non-ferrous metals. When removing or installing these components, always wear safety glasses with side shields, gloves etc, to reduce the possibility of personal injuries.



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– disconnect the terminal from oil filter clogging signal sender (**5**, fig. 5) for equipment hydraulic circuit;
– remove the two upper screws (**C**) securing the oil tank to the fuel tank;
– remove the four lower screws (**C1**) securing the tank to the frame;
– remove the tank with an adequate lifting device.

DANGER

Make sure that lifting cables are secured to points strong enough to handle the load. Keep all bystanders away from the securing point, cables or chains.

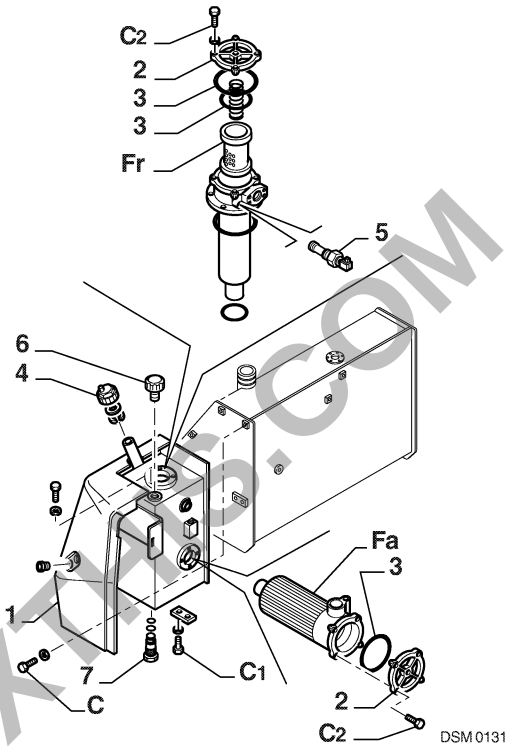


Fig. 5. Hydraulic oil tank and filters.

1. Hydraulic oil tank - **2.** Filter covers - **3.** O-Ring - **4.** Oil filler cap - **5.** Oil return filter clogging sensor - **C.** Tank upper securing screws (M14x2x30) - **C1.** Tank lower securing screws (M14x2x35) - **C2.** Cover securing screws - **Fa** - Suction filter - **Fr** - **6.** Breather - **7.** Draining plug.

FILTERS

The cleaning of the oil of the equipment hydraulic system is ensured by two separate full-flow filters located inside the hydraulic oil tank and precisely:
– filter (**Fa**, fig. 5) located on the pump suction and metal element filter;
– filter (**Fr**) located on the pump return, equipped with a paper-filtering element, with a filter by-pass valve cutting-off the filter in case of clogging and sender (**5**) for the indicator located on the dashboard.

Both filters are accessible by removing covers (**2**) located on the tank, removing the relevant securing screws (**C2**).
Filter (**Fa**) is cleaned using an appropriate solvent at each hydraulic oil change (every 2000 hours) and is replaced when needed only.

Return filter (**Fr**) must be replaced periodically every 500 hours, to prevent that a clogged filter prevents the filtration of the oil.

DANGER

Never use gasoline, solvent or other flammable fluid to clean parts. Use exclusively qualified, non-flammable, non-toxic approved commercial solvents.

Re-installation of filters and tank

To re-install the filters and hydraulic oil tank reverse the removal procedures.

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