

ENGINE DATA**88 kW (120 CV)****Turbo Aftercooler**

Model		Diesel
Number of cylinders		4 in-line
Bore	mm	102
Stroke	mm	120
Displacement	cm ³	3900
Total displacement		17 : 1
Firing order		1.3.4.2
Low idle	rpm	800-900
Max. idle	rpm	2350-2450
Nominal speed	rpm	2200
Maximum torque		450 Nm

COOLING SYSTEM

Type	Pressurised, full-flow, w/ by-pass con camera di espansione
Fan	7 blades
Fan belt deflection	10 - 16 mm
Drive belt deflection	
Air conditioner compressor	16 mm
Thermostat:	
Starts opening at	81 °C
Radiator cap	1 bar

INTAKE SYSTEM

Injection pump	
Type	Rotary
Cold start device	Thermostart
Excess fuel device	Automatic governor
Fuel shut off	Solenoid
Lift pump	Mechanical

ENGINE OVERHAUL ON BENCH

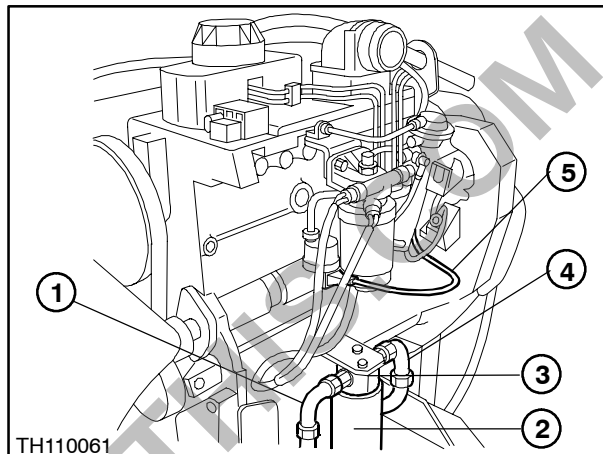
Engine disassembly

Drain the engine oil by removing the sump plug and the filler cap on the cylinder head cover.

Remove the fan group from the fan pulley.

To install bracket 380000661 to the engine to secure it on the engine overhaul stand proceed on the left side of the engine:

- remove oil filter (2) from support (3) using tool 380000670;
- remove oil pipes (1) and (4) of filter support (3);
- remove support (3);
- remove electric harness (5).



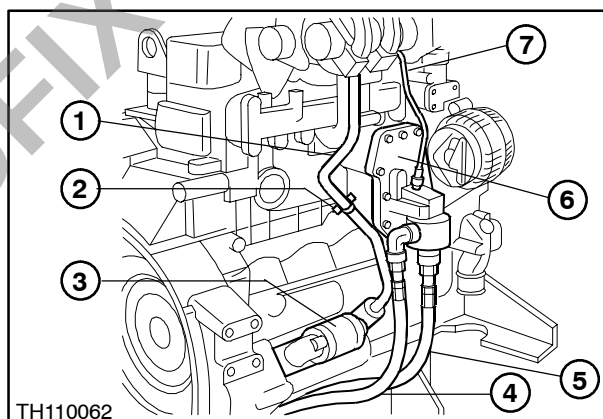
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To install bracket 380000661 on the right side of the engine, remove:

- starter motor (3);
- oil return (1) securing bracket (2);
- oil return pipe (1) relative to the turbine;
- remove oil pipes (4) and (5) from heat exchanger group (6).

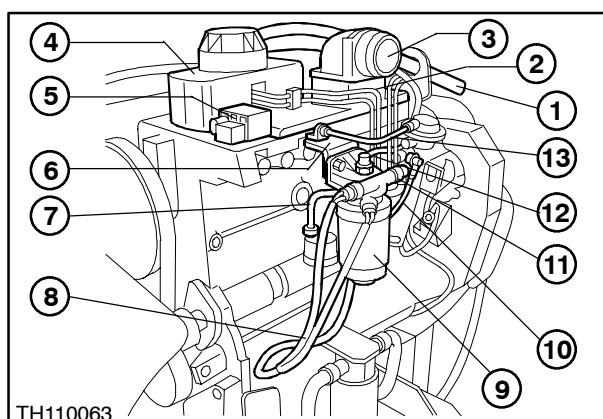
Secure the engine to rotary stand 380000301

- disconnect turbine lubrication delivery pipe (7)



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- disconnect the engine oil fumes recovery pipe from blow-by (1);
- remove rocker arm cover (4);
- remove electric harness (8);
- remove fuel filter (9);
- remove intake manifold (3);
- remove heater (2);
- remove heater (5) controller;
- remove LDA system pipe (13);
- remove quick release pipes (7), (10), (11) and (12) following the notices provided in figure 51;
- remove fuel filter support (6).



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TROUBLESHOOTING

The engine fails to start

Cause

1. Batteries partially exhausted.
2. Battery terminal connections corroded or loosen.
3. Wrong timing of injection pump on the engine.
4. Accumulation of dirt or water in fuel lines.
5. Empty fuel tank.
6. Presence of air in fuel lines.
7. No fuel supply to injection pump.
8. Starter motor damaged.
9. Cold starting system inefficient.

Remedy

1. Check; recharge batteries and replace, if required.
2. Clean; check, tighten nuts and, if required, replace excessively corroded terminals and nuts.
3. Set correct timing of injection pump on engine.
4. Disconnect lines and injection pump and clean accurately. If necessary, clean and dry fuel tank.
5. Refuel.
6. Check fuel pump and replace if required.
7. Check lines, connections, fuel pump, filters and injection pump to ascertain presence of air, the bleed the system.
8. Repair or replace starter motor.
9. Check or replace cold starter.

The engine stalls

Cause

1. Low idle too low.
2. Irregular deliveries by injection pump.
3. Accumulation of dirt and water in fuel lines.
4. Clogged fuel filters.
5. Abnormal valve clearance.
6. Burnt or cracked valves.
7. Presence of air in fuel lines.
8. Injection pump drive damaged.

Rimedio

1. Adjust low idle.
2. Check calibration of deliveries on bench.
3. Disconnect lines and injection pump and clean accurately. If necessary, clean and dry fuel tank.
4. Replace filter integral cartridges.
5. Adjust valve clearance.
6. Replace valves.
7. Check lines, connections, fuel pump, filters and injection pump to ascertain presence of air, the bleed the system.
8. Replace damaged parts.

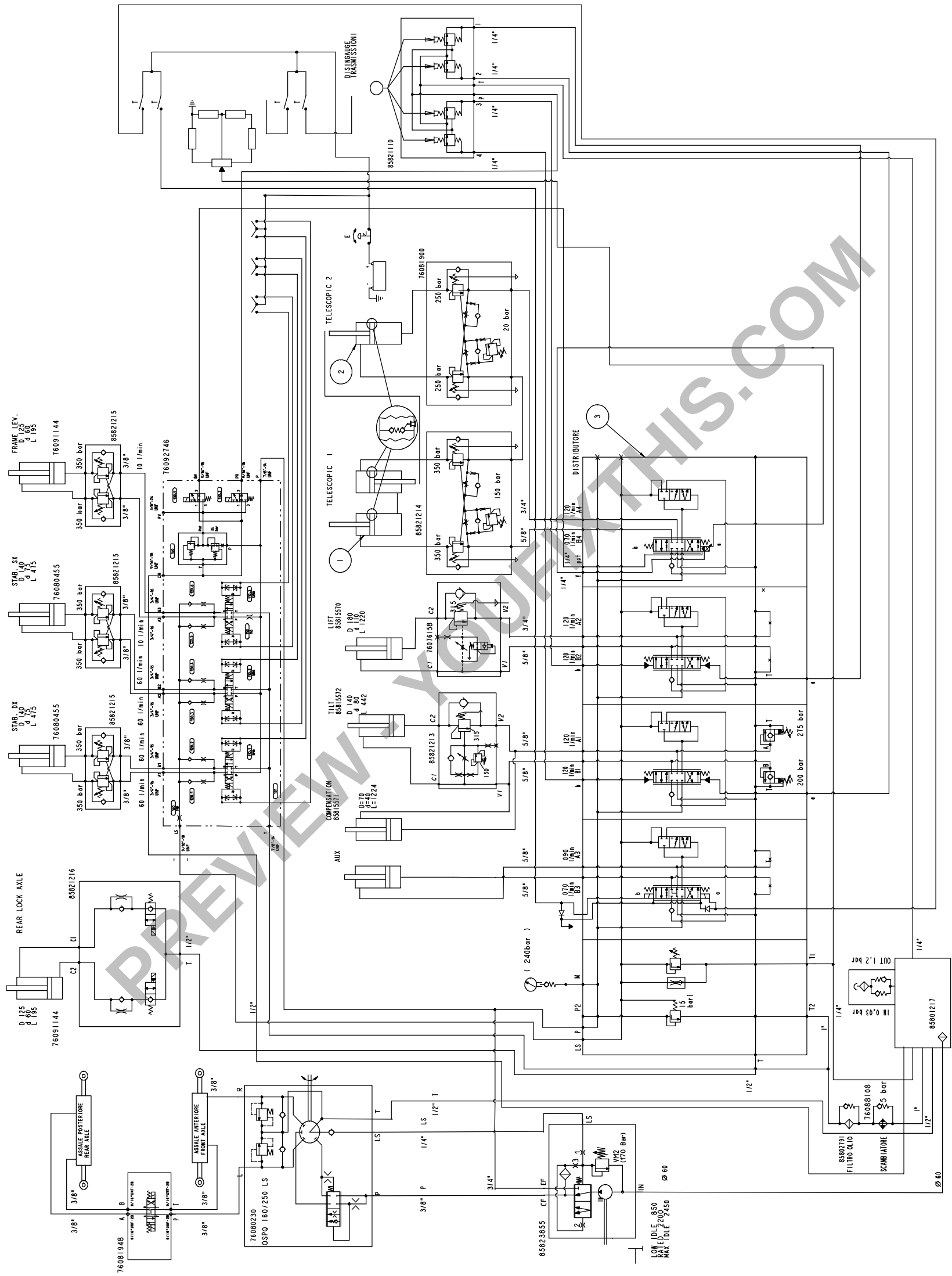
The engine is overheating

Cause

1. Inefficient cooling system pump.
2. Inefficient thermostat
3. Radiator partially inefficient.
4. Scaling in the coolant passages in cylinder head and cylinder block.

Remedy

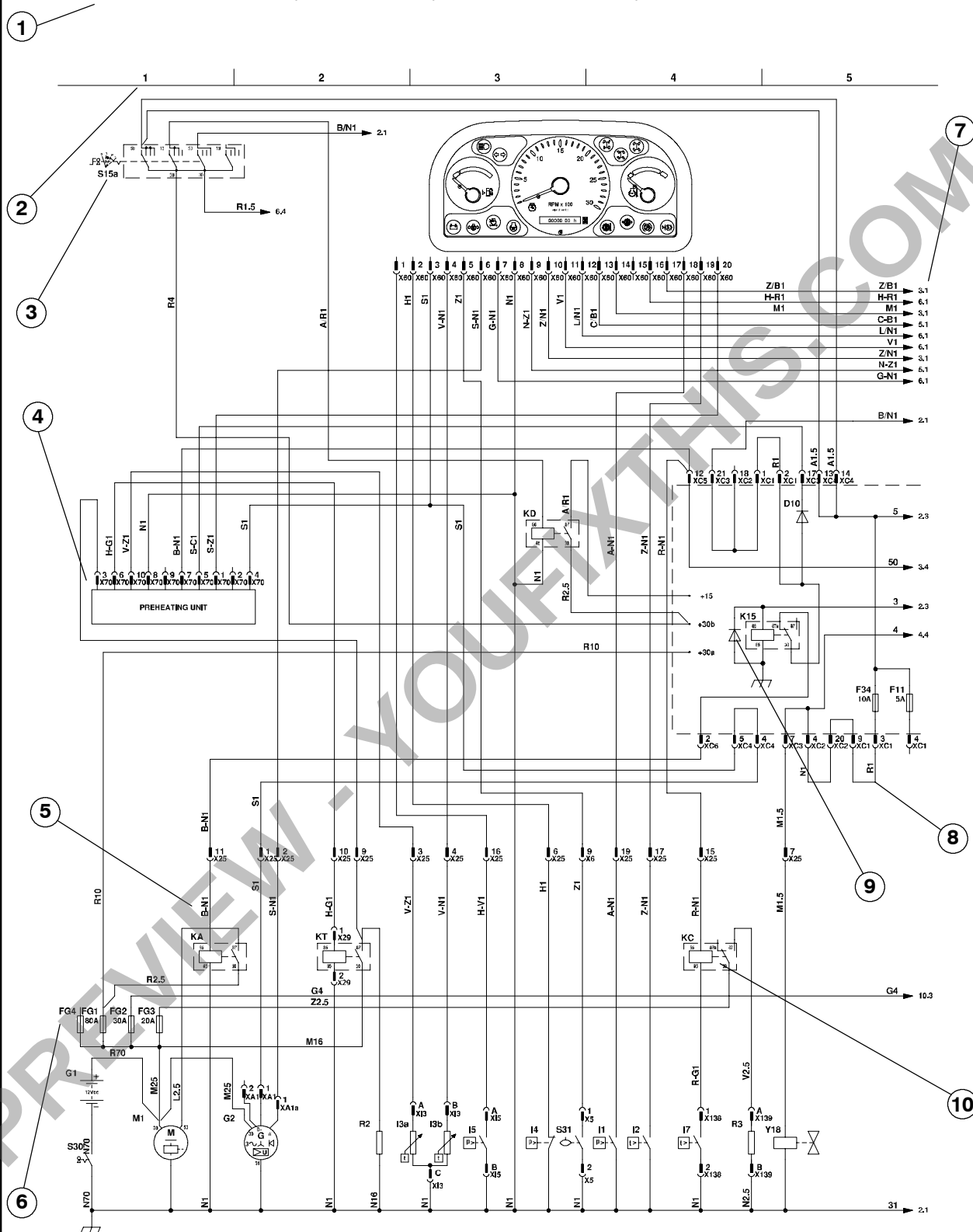
1. Overhaul pump and replace, if necessary.
2. Replace thermostat.
3. Eliminate possible scaling by flushing, check and repair possible leakages from pipes.
4. Flush accurately



TH135008

Telescopic boom circuit

DIAGRAM 1 – STARTING/RECHARGE/WARNING LAMPS/INDICATORS



TH155084

MINIMUM TIGHTENING TORQUES FOR FASTENERS

IN NEWTON-METRES (Nm)
FOR NORMAL INSTALLATION APPLICATIONS

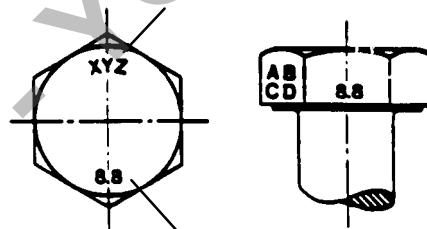
METRIC BOLTS AND LOCK NUTS

NOMINAL DIMENSION	CLASS 5.8		CLASS 8.8		CLASS 10.9		LOCK NUT CL 8 with BOLT CL 8.8
	NOT PLATED	PLATED Zn/Cr	NOT PLATED	PLATED Zn/Cr	NOT PLATED	PLATED Zn/Cr	
M4	1.7	2.2	2.6	3.4	3.7	4.8	1.8
M6	5.8	7.6	8.9	12	13	17	6.3
M8	14	18	22	28	31	40	15
M10	28	36	43	56	61	79	30
M12	49	63	75	97	107	138	53
M16	121	158	186	240	266	344	131
M20	237	307	375	485	519	671	265
M24	411	531	648	839	897	1160	458

IDENTIFICATION

HEX SCREWS (WITHOUT NUT) AND ROUND HEAD BOLTS
CLASS 5.6 AND HIGHER

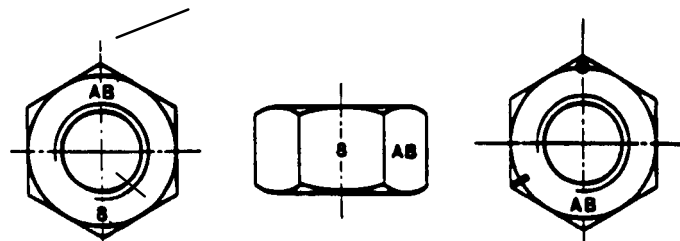
IDENTIFICATION OF THE MANUFACTURER



COMMERCIAL CLASS

HEX NUTS AND TIGHTENING NUTS
CLASS 05 AND HIGHER

IDENTIFICATION OF THE MANUFACTURER



COMMERCIAL CLASS

MARKING

Service manual

T13 - T14 - T17

TELESCOPIC HANDLERS

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SAFETY RULES

PAY ATTENTION TO THIS SYMBOL



This alert symbol announces important messages involving your safety. Read carefully the safety instructions listed and follow the precautions recommended to avoid potential risks and to safeguard your health and your safety. You will find this symbol in the text of this Manual with the following key words:



WARNING - Cautions intended to avoid improper repair interventions involving potential consequences for the safety of the personnel performing the repairs.

DANGER - These warnings qualify specifically potential dangers for the safety of the operator or other persons directly or indirectly involved.

AVOID ACCIDENTS

Most accidents, whether they occur in workshop, on the farm, at home or on the road, are caused by the failure of some individuals to follow simple and fundamental safety rules and precautions. For this reason **MOST ACCIDENTS CAN BE PREVENTED** by recognising the real cause and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of any type of equipment, there are many conditions that cannot be completely safeguarded against without hindering reasonable accessibility and efficient operation.

A careful operator is the best insurance against an accident.

The complete observance of one simple rule would prevent many serious accidents.

DANGER. Never attempt to clean, lubricate or maintain a machine while it is in motion.

SAFETY RULES

SAFETY RULES

- ◇ Read and heed all safety rules before any intervention.
- ◇ Do not wear rings, wristwatches, jewellery, and 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.
- ◇ Do not perform any service operation on the machine with a person seated in the operator's compartment, unless he is an authorised oper-

ator co-operating in the operation to be performed.

- ◇ Never attempt to operate the machine or its tools from any position other than seated in the operator's seat.
- ◇ Never perform any intervention on the machine with engine running unless this is prescribed.
- ◇ Cut-off the engine and make sure that all pressures in the hydraulic systems are released before removing caps, covers, valves etc.
- ◇ All service interventions must be performed with the utmost care and attention.
- ◇ Shop and/or field service platforms or ladders must be constructed and maintained in accordance with local and national regulations.
- ◇ Disconnect the batteries and tag all controls to signal that an intervention is in progress. Block the machine and all equipment that must be lifted.
- ◇ Do not check nor refill fuel tanks, as well as batteries, nor use starting fluid while smoking or near open flames since these fluids are flammable.
- ◇ Brakes are inactive when manually released for service interventions. Under such circumstances it is necessary to maintain the control of the machine using appropriate blocks or similar devices.
- ◇ The fuel-filling nozzle must be kept constantly inside the filling neck. Keep this contact from the beginning to the end of the fuelling operation to avoid the possibility that sparks due to static electricity are generated.
- ◇ Use only designated towing or attaching points. Use care in making attachments. Make sure pins and/or locks are secure before pulling. Stay clear of drawbars, cables or chains under load.
- ◇ To move a disabled machine, use a trailer or a low-boy, if available.

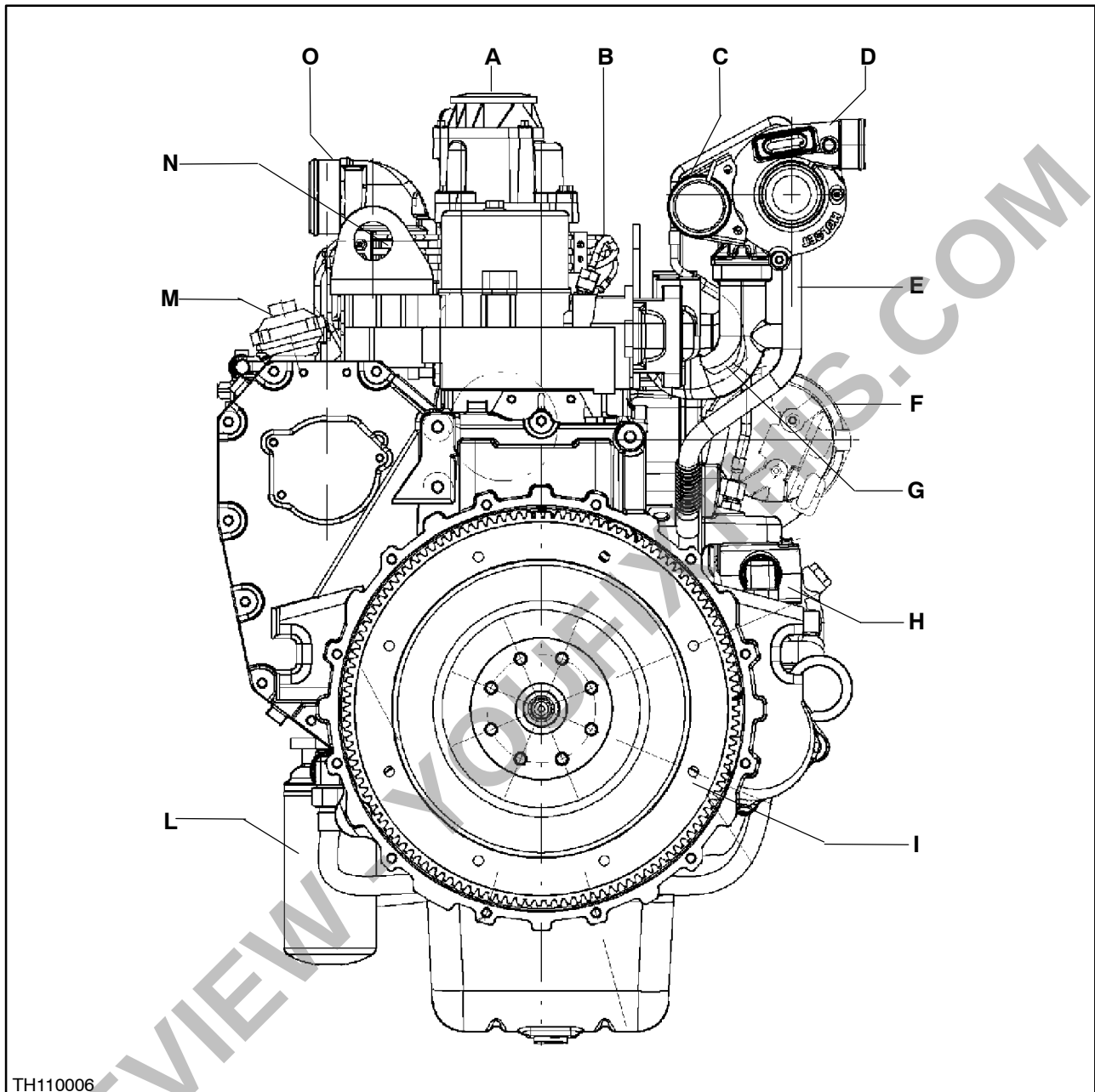
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Rear view



- A. Blow-by
- B. Injector fuel lines
- C. WASTGATE valve
- D. Turbocharger
- E. Oil unloading pipe from turbocharger
- F. Alternator
- G. Exhaust manifold

- H. Starter motor
- I. Engine flywheel
- L. Oil filter
- M. Injection pump
- N. Air heater
- O. Intake manifold

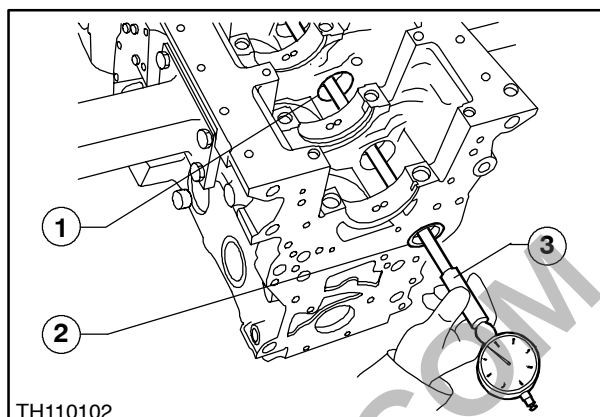
BUSHES

Bushes (2) of the camshaft must be forced into the relevant seats.

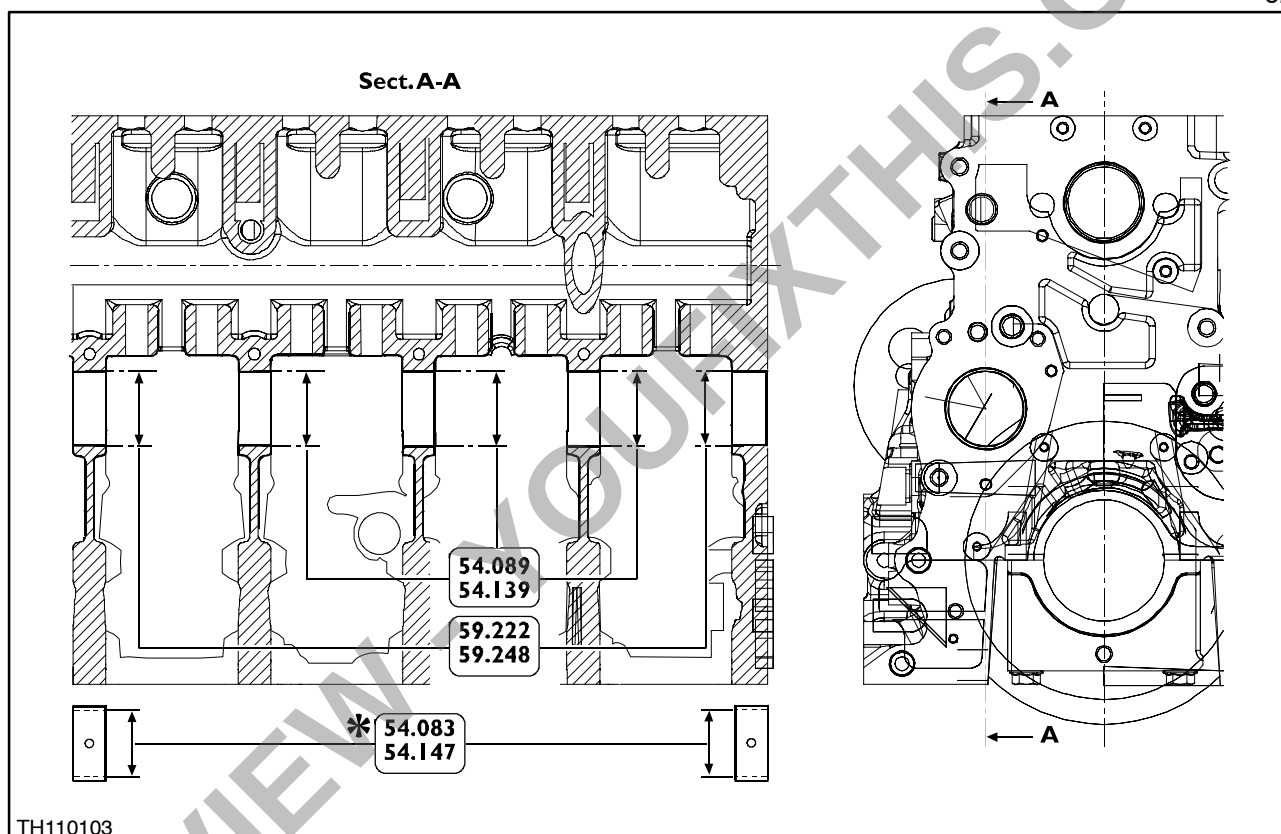
The inner surfaces must be free from any sign of seizing or wear.

Measure with bore gauge (3) the diameter of front and rear bushes (2) and intermediate seats (1) of the camshaft.

The measurements must be done on two axis perpendicular between them.



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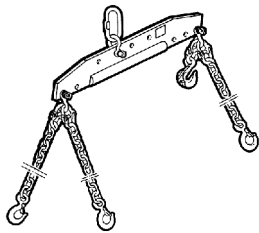
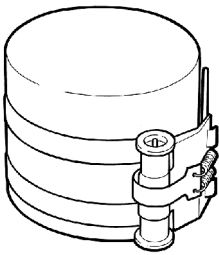
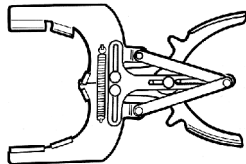
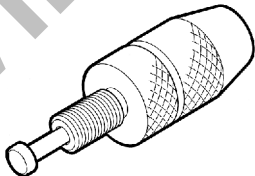
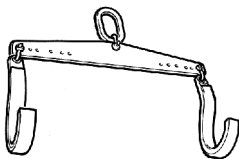


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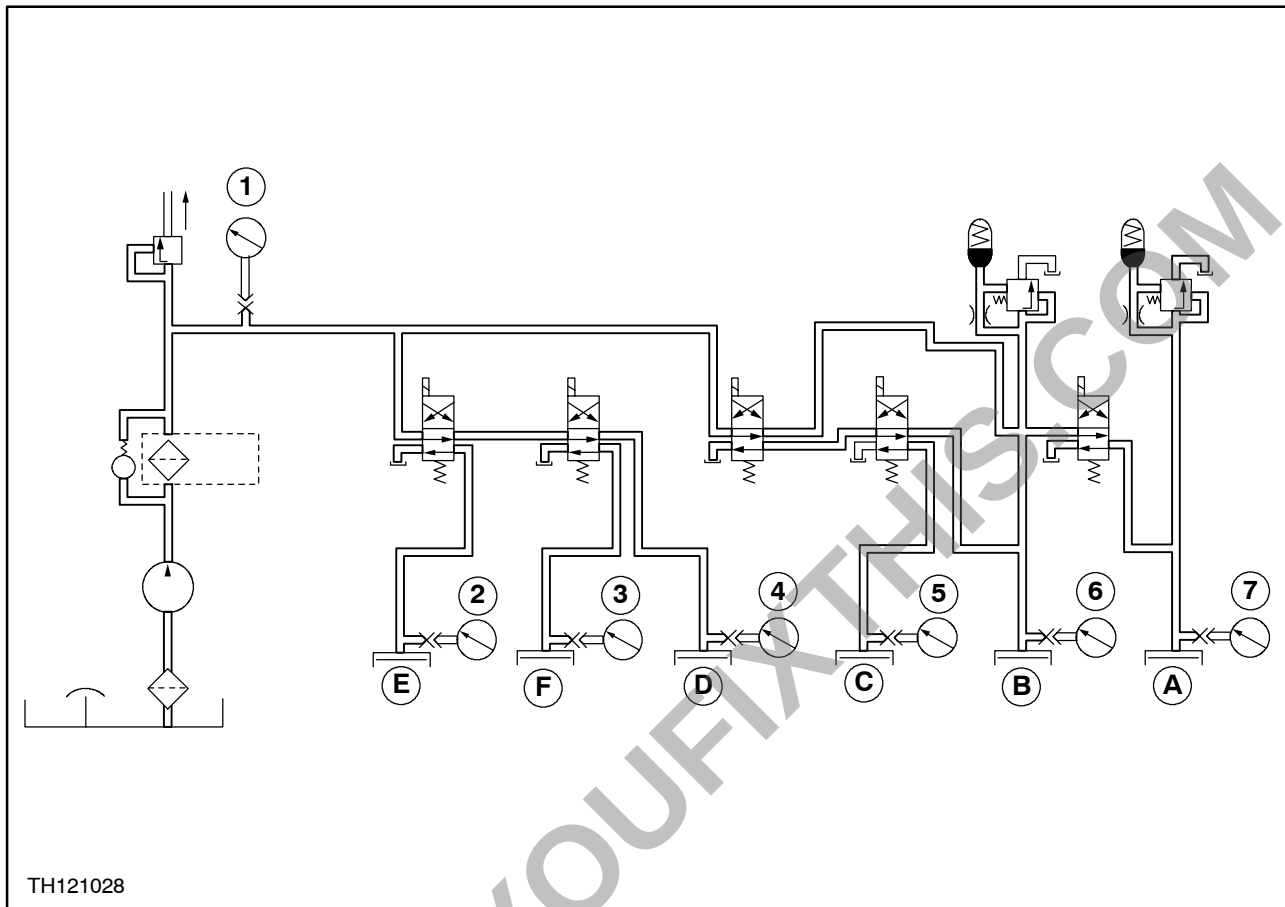
MAIN DATA OF CAMSHAFT BUSHES AND RELEVANT SEATS

* dimension to be obtained after press fitting the bushes

TOOLING

TOOL no.	DESIGNATION
380000216	Balanced rig for engine removal and installation
	
380000220	Band for piston insertion into cylinder sleeves (60-125 mm)
	
380000221	Pliers for piston rings removal and installation (65-110 mm)
	
380000228	Dial gauge (0-5 mm)
	
380000229	Dial gauge holder tool for rotary injection pump timing (use w/ 380000228)
	
380000362	Engine crankshaft lifting tool
	

PRESSURE TESTING CLUTCH AND HIGH PRESSURE CIRCUIT



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Port 1 System pressure

Engine set to idle.

Minimum pressure 13 bar.

Desired oil pressure 16 – 19 bar.

Port 2 E Clutch

Engine set to idle.

Pressure range clutch activated 16 – 19 bar.

Clutch released 0 – 0.2 bar (0 – 3 lb/in²).

Port 3 F Clutch

Engine set to idle.

Pressure range clutch activated 16 – 19 bar.

Clutch released 0 – 0.2 bar (0 – 3 lb/in²).

Port 4 D Clutch

Engine set to idle.

Pressure range clutch activated 16 – 19 bar.

Clutch released 0 – 0.2 bar (0 – 3 lb/in²).

Port 5 C Clutch

Engine set to idle

Pressure range clutch activated 16 – 19 bar.

Clutch released 0 – 0.2 bar (0 – 3 lb/in²).

Port 6 B Clutch

Engine set to idle.

Pressure range clutch activated 16 – 19 bar.

Clutch released 0 – 0.2 bar (0 – 3 lb/in²).

Port 7 A Clutch

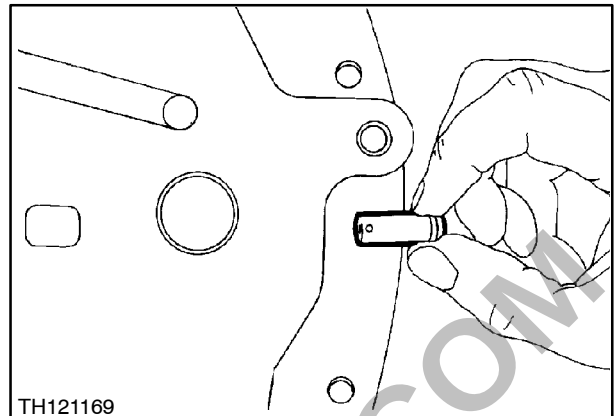
Engine set to idle.

Pressure range clutch activated 16 – 19 bar.

Clutch released 0 – 0.2 bar (0 – 3 lb/in²).

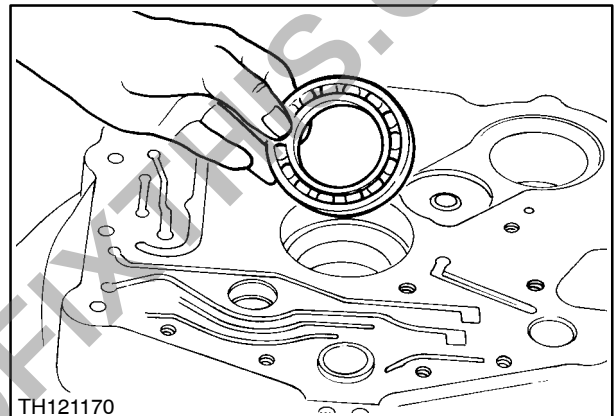
Disassembly of the converter housing

From the top of the housing remove the hexagonal head plug. Then using a small screwdriver, lever out the check valve ball assembly and remove it from the top of the housing.



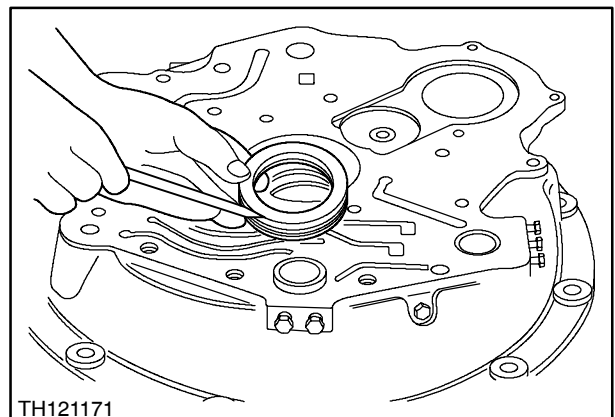
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Remove the torque converter bearing.



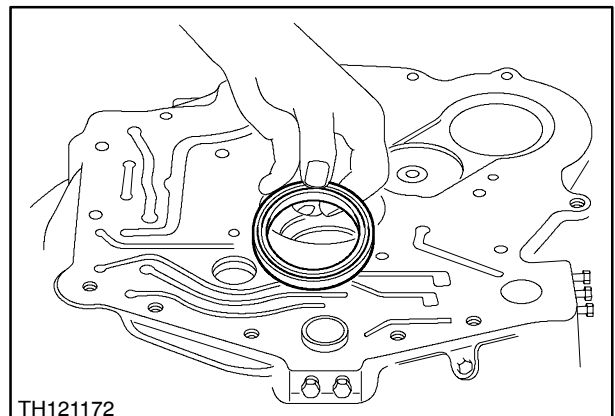
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Remove the oil distributor.



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Remove the converter oil seal.

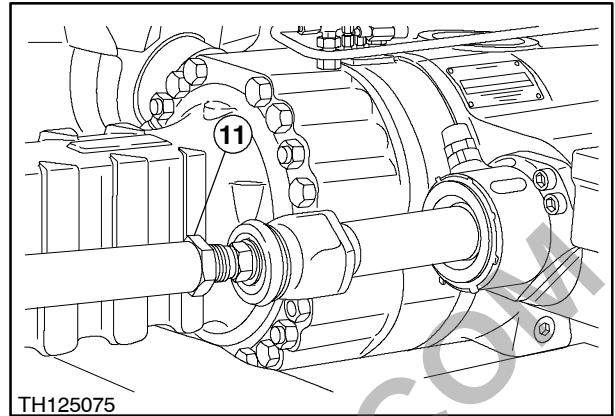


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Loosen the nuts (11) and screw them onto the ball-and-socket joints.

Hold the steering knuckles still and rotate the ball-and-socket joints. Once the convergency has been adjusted, lock the nuts (11).

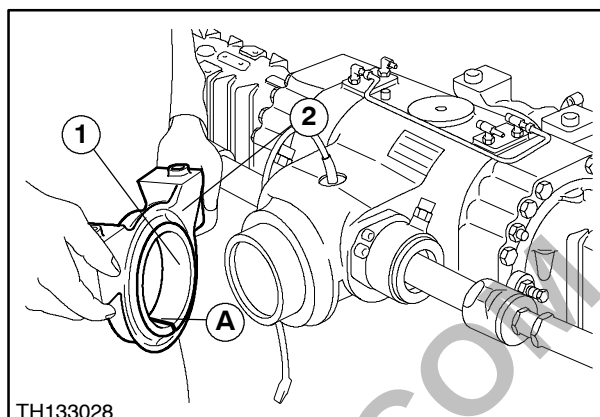
Torque wrench setting for nuts: $298 \div 328$ Nm



Brakes disassembly

Remove the swivel support (2).

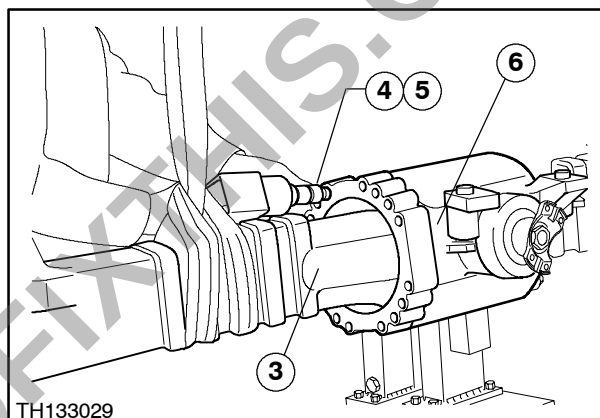
NOTE: If the bush (1) is worn and needs to be replaced, take note of the fitting "A" notch assembly side.



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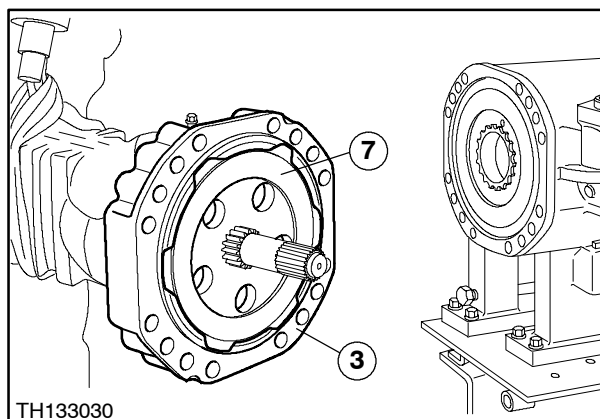
Remove the steering tie rod pins from the steering knuckle (see "STEERING CYLINDER REMOVAL"). Sling the axle shaft to be removed (3) with a hoist and tension the hoist a little.

Slacken and remove the screws (4) and the washers (5) fastening the axle shaft (3) to the central unit (6).



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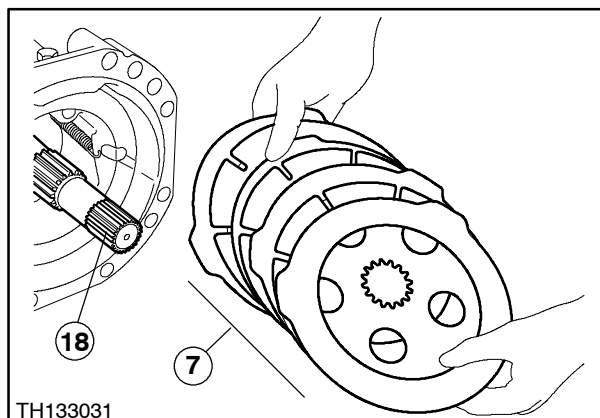
Remove the axle shaft (3) and the brake disc unit (7). Set the axle shaft on a bench.



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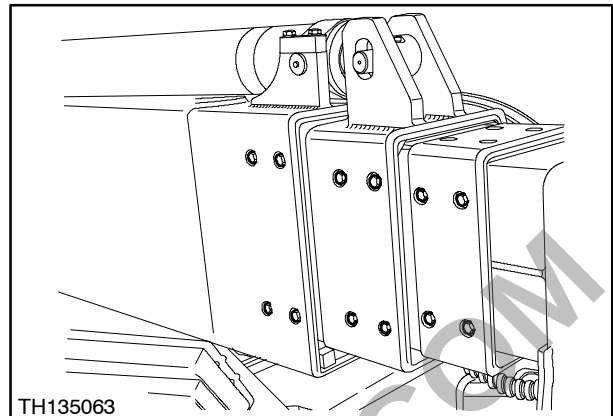
Remove the brake discs (7) and write down the assembly order.

NOTE: 1 – If the discs do not have to be replaced, ensure their original position is maintained.
2 – Remove the double universal joint (18).



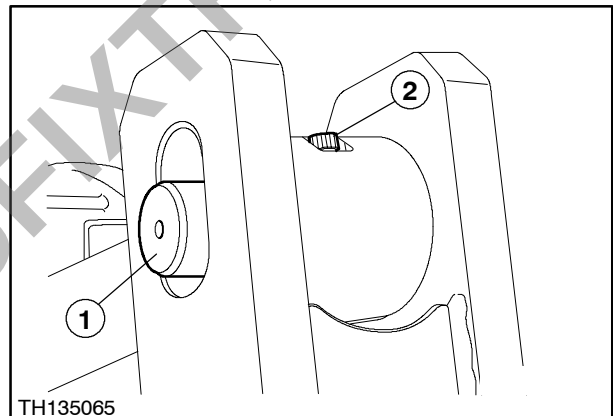
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- Unscrew and remove all the mounting hardware fastening the shoes so as to release them (you can unscrew this on all the sections).



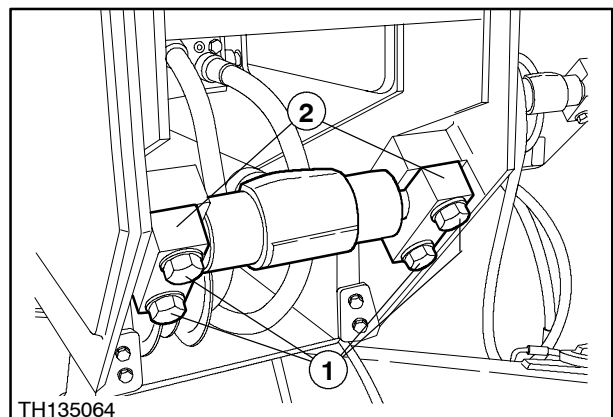
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- Disconnect the hydraulic pipes of the "tilt" cylinder and the hydraulic pipes of the auxiliary system tool.
- Pull out the fourth section; together with this the accompanying shoes are also removed.
- To take out the pin (1) of the outer telescopic cylinder, remove the central screw (2) and then pull out the pin (1).



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- Disconnect the inner telescopic cylinder pipes.
- Remove the third and second sections (still connected together) and pull out simultaneously the shoes of the second section.
- Remove the screws (1) of the supports (2) of the inner telescopic cylinder pin on the back of the second section and pull out the pin.
- Pull out the inner telescopic cylinder from the back of the second section.
- Remove the third section (by pulling it out from the front end) from the second section (and the accompanying shoes).



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BOOM ASSEMBLY PROCEDURE

Fit back the boom sections by repeating the same steps in reverse order.

Change of frequency

In case of interferences or conflict with other radio systems, it is possible to change the radio frequency in operation. With transmitter unit switched on and started up, it is necessary to keep START push button actuated for 5-6 seconds: a long beep joined by the lighting up of both signalling LEDs will indicate that the change of frequency has occurred. During this operation the receiver unit will switch off: the operation can be resumed pressing the START push button again as the usual start-up operation.

LED signalling

Some operating conditions of the transmitter unit are pointed out by two signalling LEDs (one green and one red).

Signalling pattern	Led	
	green	red
Slow flashing	Normal operation	
Quick flashing	Warning: battery almost exhausted	Warning: battery exhausted
Light on at start-up*		Control connected during start-up
Light of both LEDs is on at the same time*	Change of frequency accomplished	
* joined by a sound signal		

When the battery has delivered approximately 90% of its charge, the green LED increases the flashing speed giving a pre-alarm that battery needs charging. If the operator continues to use the radio control, approximately 3 minutes before the battery will be fully exhausted, the red LED starts flashing and at the same time a sound alarm is activated. When this situation occurs, the machine must be put immediately in safety condition, the transmitter unit must be switched off and the battery must be charged (or replaced with other full-charged battery).

Automatic switch-off

The switch-off of the transmitter unit can occur automatically when:

- the battery is not sufficiently charged and/or;
- the radio control has not been operated during approximately 3.5 minutes (the automatic switch-off can be disabled).

For all instructions, warnings and technical data regarding the batteries and battery-chargers, refer to the supplied booklet.

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