

Shop Manual

PC4000-6

HYDRAULIC MINING SHOVEL SERIAL NUMBERS PC4000-6 8170

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SAFETY

SAFETY NOTICE

- **IMPORTANT SAFETY NOTICE**

Proper service and repair is extremely important for safe machine operation. The service and repair techniques recommended by Komatsu and described in this manual are both effective and safe. Some of these techniques require the use of tools specially designed by Komatsu for the specific purpose.

The following Symbols are used in this Manual to designate Instructions of particular Importance.



WARNING - Serious personal injury or extensive property damage can result if the warning instructions are **not** followed.

To prevent injury to workers, this symbol is used to mark safety precautions in this manual. The cautions accompanying these symbols should always be followed carefully. If any dangerous situation arises or may possibly arise, first consider safety, and take the necessary actions to deal with the situation.



CAUTION - Minor personal injury can result or a part, an assembly, or the shovel can be damaged if the caution instructions are **not** followed.



NOTE - Refers to special information

GENERAL PRECAUTIONS

Mistakes in operation are extremely dangerous. Read the OPERATION & MAINTENANCE MANUAL carefully BEFORE operating the machine.

1. Before carrying out any greasing or repairs, read all the precautions given on the decals which are fixed to the machine.
2. When carrying out any operation, always wear safety shoes and helmet. Do not wear loose work clothes, or clothes with buttons missing.
 - Always wear safety glasses when hitting parts with a hammer.
 - Always wear safety glasses when grinding parts with a grinder, etc.

continued

Cont'd:

GENERAL PRECAUTIONS

3. If welding repairs are needed, always have a trained, experienced welder carry out the work. When carrying out welding work, always wear welding gloves, apron, glasses, cap and other clothes suited for welding work.
4. When carrying out any operation with two or more workers, always agree on the operating procedure before starting. Always inform your fellow workers before starting any step of the operation. Before starting work, hang UNDER REPAIR signs on the controls in the operator's compartment.
5. Keep all tools in good condition and learn the correct way to use them.
6. Decide a place in the repair workshop to keep tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt or oil on the floor. Smoke only in the areas provided for smoking. Never smoke while working.

PREPARATIONS FOR WORK

7. Before adding oil or making repairs, park the machine on hard, level ground, and block the wheels or tracks to prevent the machine from moving.
8. Before starting work, lower bucket, hammer or any other work equipment to the ground. If this is not possible, insert the safety pin or use blocks to prevent the work equipment from falling. In addition, be sure to lock all the control levers and hang warning signs on them.
9. When disassembling or assembling, support the machine with blocks, jacks or stands before starting work.
10. Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine. Never jump on or off the machine. If it is impossible to use the handrails, ladders or steps, use a stand to provide safe footing.

PRECAUTIONS DURING WORK

11. When removing the oil filler cap, drain plug or hydraulic pressure measuring plugs, loosen them slowly to prevent the oil from spurting out. Before disconnecting or removing components of the oil, water or air circuits, first remove the pressure completely from the circuit.
12. The water and oil in the circuits are hot when the engine is stopped, so be careful not to get burned.
Wait for the oil and water to cool before carrying out work on the oil or water circuits.

continued

Cont'd:

PRECAUTIONS DURING WORK

13. Before starting work, remove the leads from the battery. ALWAYS remove the lead from the negative (-) terminal first.
14. When raising heavy components, use a hoist or crane.
Check that the wire rope, chains and hooks are free from damage.
Always use lifting equipment which has ample capacity.
Install the lifting equipment at the correct places. Use a hoist or crane and operate slowly to prevent the component from hitting any other part. Do not work with any part still raised by the hoist or crane.
15. When removing covers which are under internal pressure or under pressure from a spring, always leave two bolts in position on opposite sides. Slowly release the pressure, then slowly loosen the bolts to remove.
16. When removing components, be careful not to break or damage the wiring, Damaged wiring may cause electrical fires.
17. When removing piping, stop the fuel or oil from spilling out. If any fuel or oil drips on to the floor, wipe it up immediately. Fuel or oil on the floor can cause you to slip, or can even start fires.
18. As a general rule, do not use gasoline to wash parts. In particular, use only the minimum of gasoline when washing electrical parts.
19. Be sure to assemble all parts again in their original places. Replace any damaged part with new parts.
 - When installing hoses and wires, be sure that they will not be damaged by contact with other parts when the machine is being operated.
20. When installing high pressure hoses, make sure that they are not twisted. Damaged tubes are dangerous, so be extremely careful when installing tubes for high pressure circuits. Also check that connecting parts are correctly installed.
21. When assembling or installing parts, always use the specified tightening torques. When installing protective parts such as guards, or parts which vibrate violently or rotate at high speed, be particularly careful to check that they are installed correctly.
22. When aligning two holes, never insert your fingers or hand. Be careful not to get your fingers caught in a hole.
23. When measuring hydraulic pressure, check that the measuring tool is correctly assembled before taking any measurements.
24. Take care when removing or installing the tracks of track-type machines. When removing the track, the track separates suddenly, so never let anyone stand at either end of the track.

FOREWORD

GENERAL

With this **SERVICE MANUAL** KOMATSU provides you with the description of the construction and the function of the major systems of the Hydraulic Excavator **PC4000**.

We describe for you all functions and how to carry out the inspections and adjustments.

How do you find "your" desired information?

In the table of CONTENT all the functions and components are shown in their sequence of the description.

If after reading this **SERVICE MANUAL** you can give us suggestions and comments for improvements - please do not hesitate to contact us.

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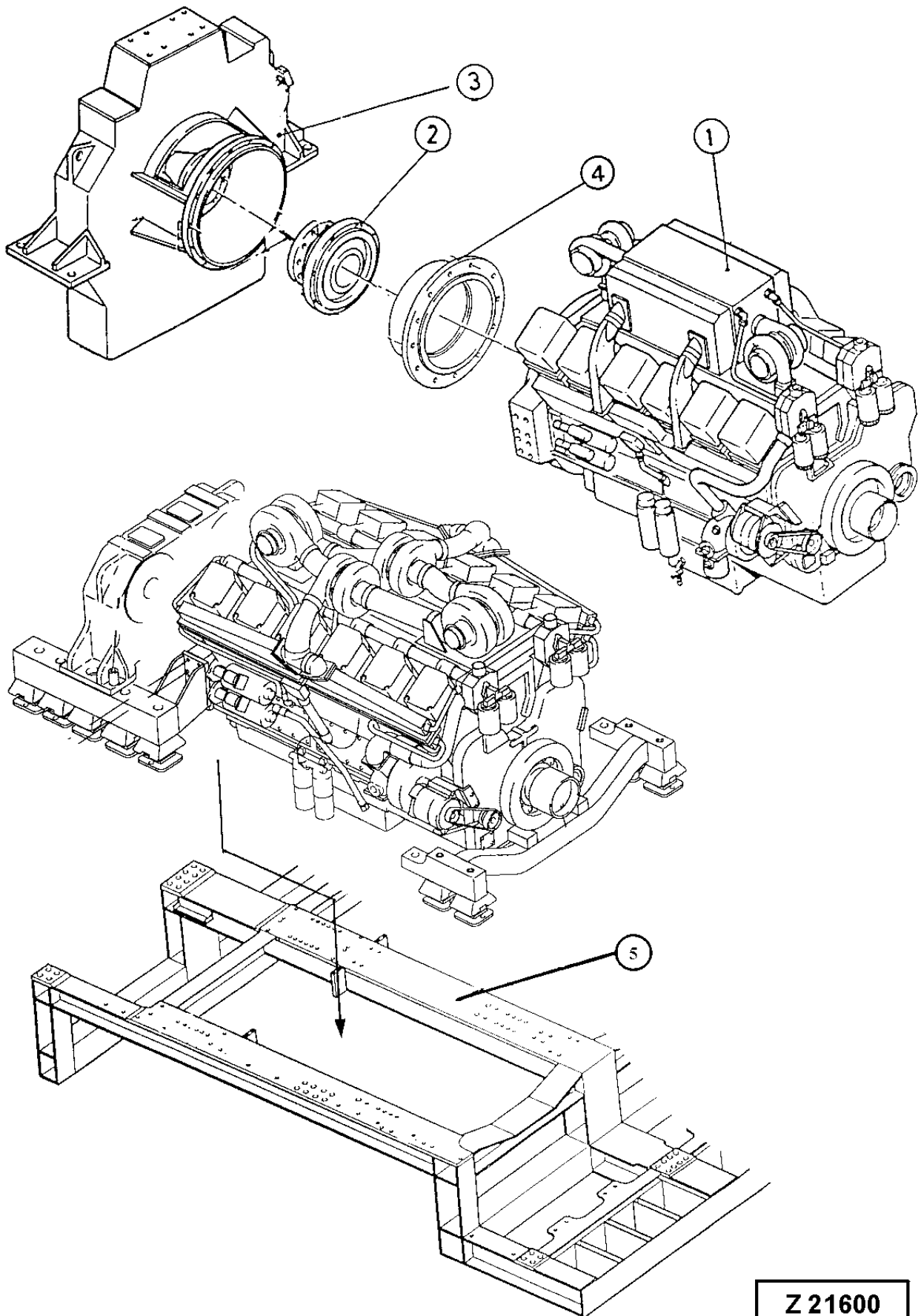
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The editorial staff will be pleased about your co-operation.

- FROM THE PRACTICE - FOR THE PRACTICE -



- **This service manual corresponds to the state of development of the machine at the time the manual was produced.**
Variations based on special customers request and special equipment are not included in this manual



Z 21600

2.0 Prime drive assembly

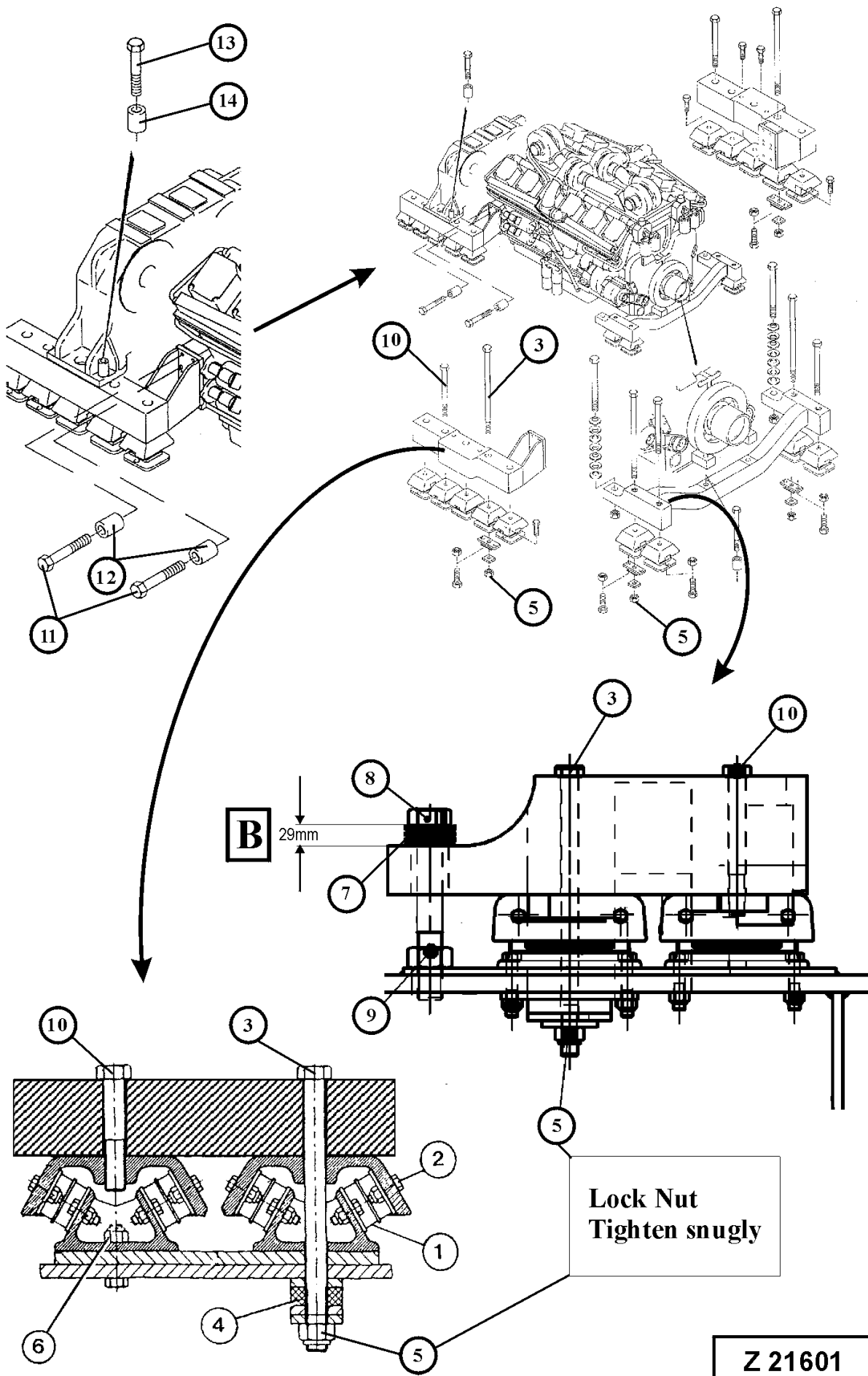
Legend for illustration (Z 21600):

- (1) Engine
- (2) Torsion type coupling
- (3) Pump distributor gear (PTO)
- (4) Adapter flange
- (5) Power frame

General

The drive unit, consists of the PTO gear and the engine, is bolted to the power frame.

The connection between engine and PTO gear is a flexible coupling.



2.1 Engine and PTO mounts

Legend for illustration (Z 21601):

(1) Flexible bearing

(2) Bolt with self locking nut

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
4 per mount	M 10 x35	8.8	17	43

(3) Tie bolt

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
4	M 24 x400	10.9	36	snugly

(4) Rubber-bounded metal bar

(5) Self locking nut

(6) Bolt M16 with self locking nut

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
2	M 16x 80	10.9	24	265

(7) Cup springs, seven per bolt

(8) Stop bolt

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
2	M 36 x250	10.9	55	Not specified

(9) Nut

(10) Bolt

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
10	M 24 x 200	10.9	36	880

(11) Bolt

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
16	M 20 x 120	10.9	30	510

(12) Resilient sleeve

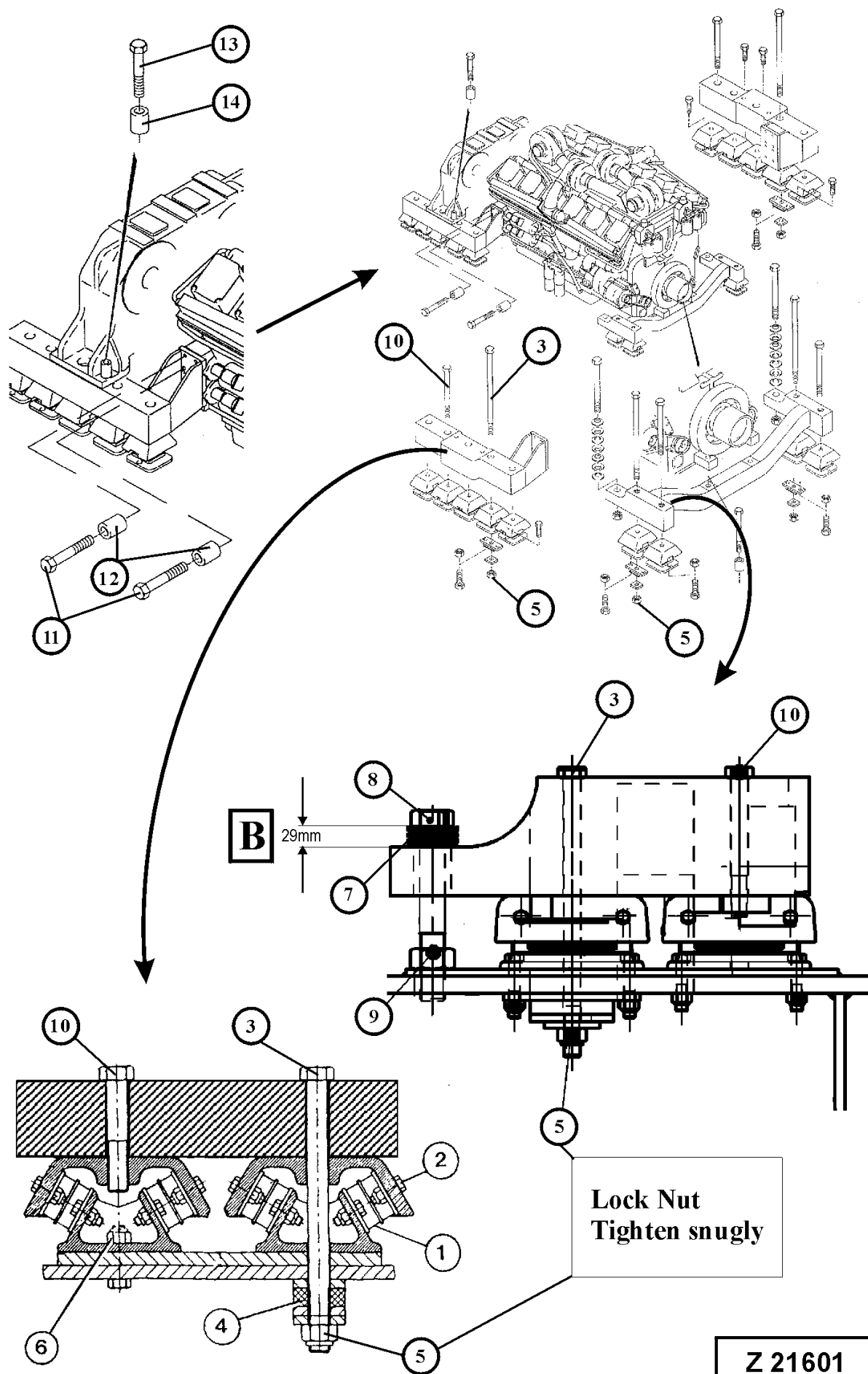
(13) Bolt

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
4	M 30 x 200	10.9	46	1770

(14) Resilient sleeve

* SW = Wrench size

continued



2.1 Engine and PTO mounts

Cont'd

General

The flexible bearings are installed to take the vibrations and the torsion forces and they carry the total weight of the engine, the pump distributor gear with all hydraulic pumps.

Check mounting and security of Diesel engine and pump distributor gear, illustration (Z 21601)

- **Check all flexible bearings (1) for engine and pump distributor gear.**

Check the flexible bearings for damage and signs of fatigue. Make sure that there is no contact between the upper and lower metal brackets of the flexible bearings (1). Replace the bearings if necessary. Use new bolts and self locking nuts (2).

After new flexible bearings have been installed, check distance (B) on both torque supports.



- **All flexible bearings (1) and all rubber-bounded metal bars (4) should be replaced during engine overhaul.**

- **Check distance (B) between torque support and stop bolt (8).**

With setting of the flexible engine bearings (1) the distance (B) increases and must be readjusted. To do this, loosen lock nut (9) and tighten stop bolt (8) until the correct distance (B) is obtained. Tighten lock nut (9) and recheck distance (B). If new flexible engine bearings (1) have been installed, replace also cup springs (7) and adjust distance (B) to 29 mm.

- **Check tie bolts (3) on front and rear carrier units for looseness.**

(four tie bolts)

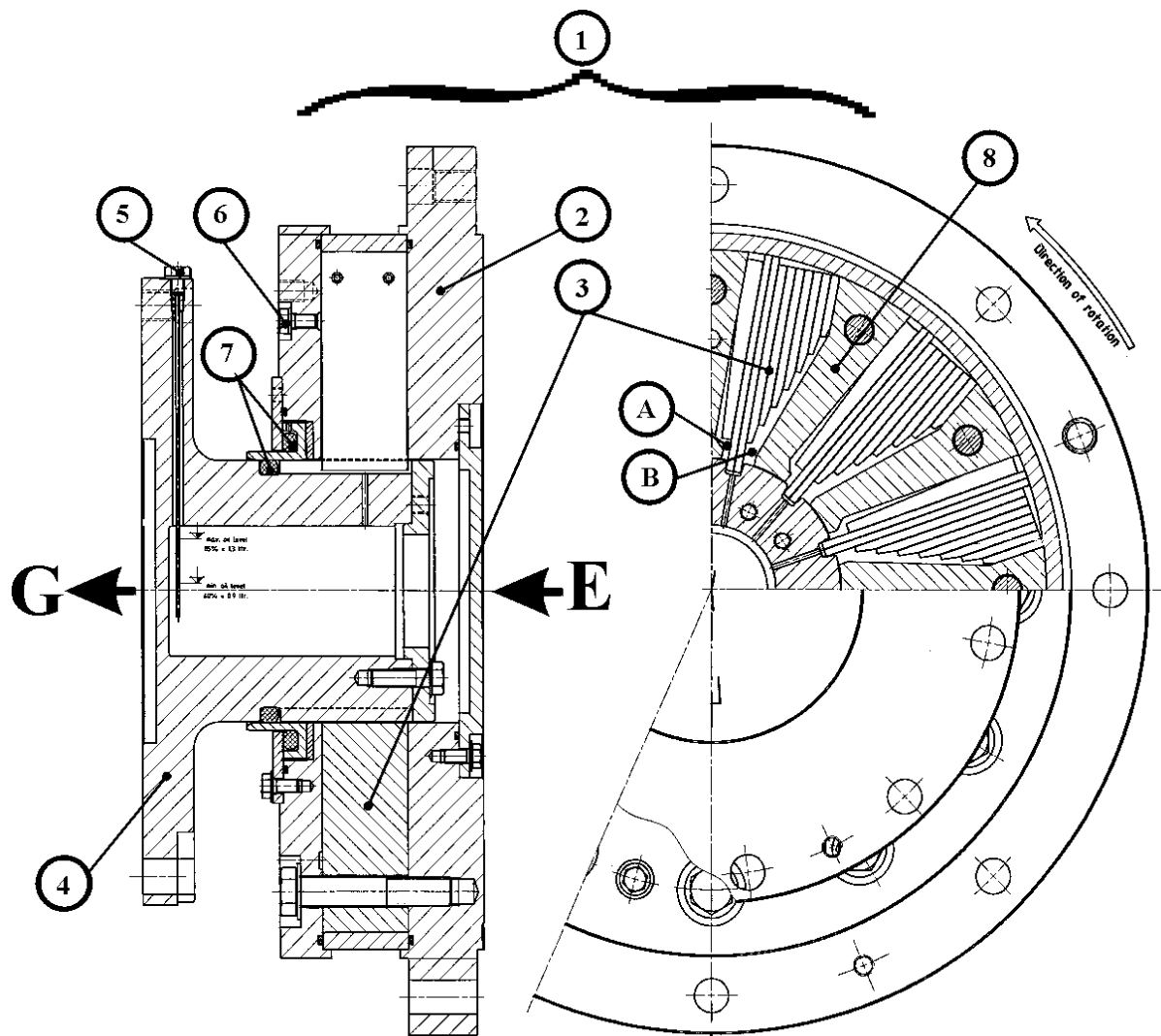
Check to make sure that the self locking retainer nuts (5) are tight and that there is no gap between nut and rubber-bounded metal bar (4). If necessary retighten retainer nuts (5) snugly.

Check rubber-bounded metal bars (4) for signs of fatigue and damage.

Replace as necessary.



- **Check all bolt connections for correct tightening torque.**
- **Check condition of engine carrier and brackets. If any damages, failures or wrong condition are found, corrective action must be taken.**
- **For more information, refer to Parts & Service News REF NO AH01521.**



Z 21602

2.2 Coupling

Legend for illustration (Z 21602):

- (1) Coupling Assy.
- (2) Input drive flange
- (3) Leave spring assy.
- (4) Output drive flange
- (5) Dip stick
- (6) Bleeder plug
- (7) O-Rings
- (8) Spacers
- E** Engine side
- G** Gearbox side (PTO-side)

Task:

The coupling is the connecting link between the engine and the PTO

Function: "GEISLINGER COUPLING"

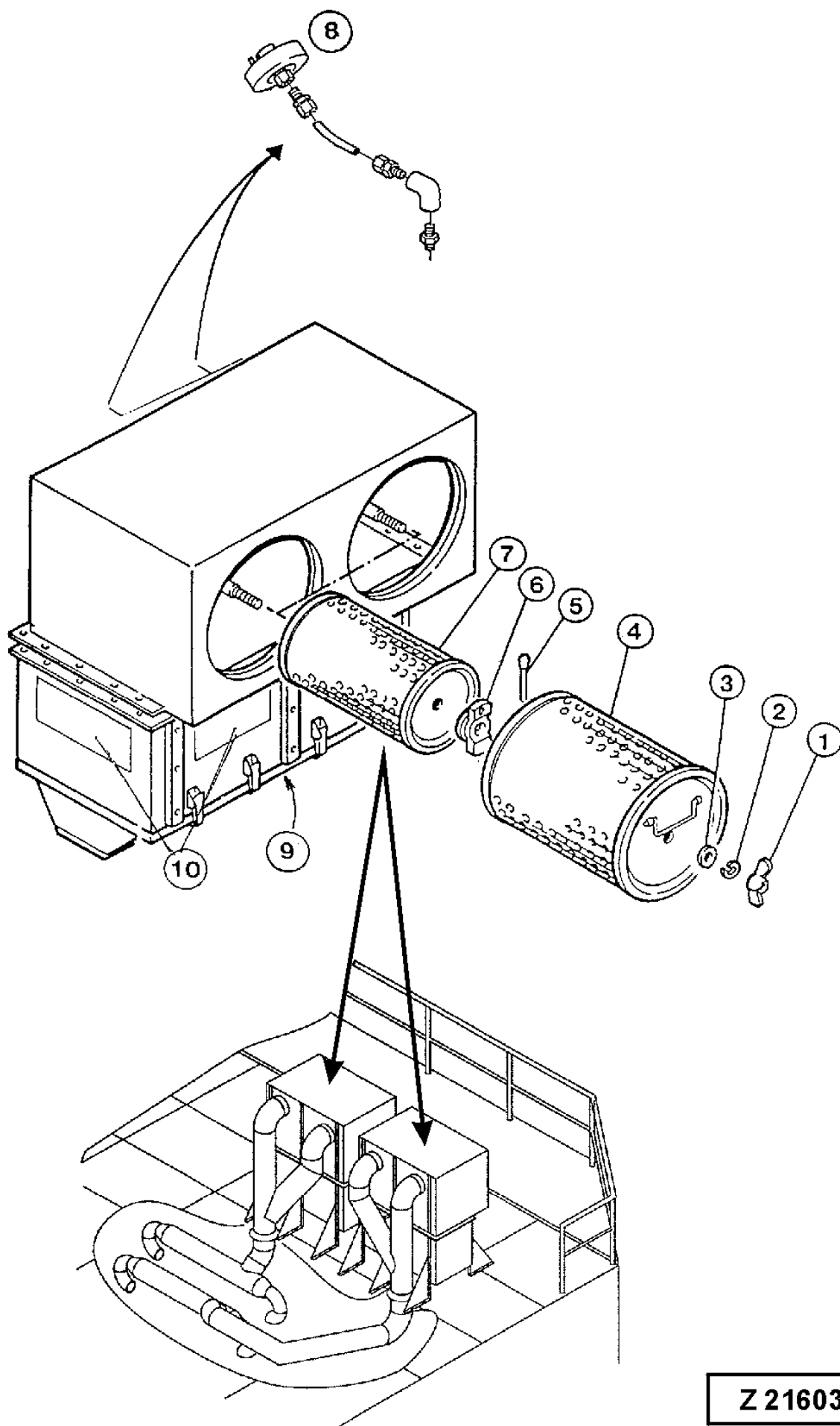
The combination of the high elasticity of its leaf springs with complimentary viscous damping by oil displacement, ensures that the coupling reduces the intensity of torsional vibrations effectively.

The widest engine speed range free of vibration periods and dangerous resonance's is thus obtained.

The springs (3) together with the inner driving and outer driven member form chambers A and B which are filled with oil.

If the outer member is displaced in relation to the inner member, the deflection of the leaf springs displaces oil from one chamber to the next, by this action the relative movements of the two members of the coupling are braked and the vibrations are dampened.

The spacers (8) limits the movement of the leaf springs.



2.3 Air Filter

Legend for illustration (Z 21603):

- (1) Wing nut
- (2) Washer
- (3) Seal ring
- (4) Main filter element
- (5) Cotter pin
- (6) Wing nut with service indicator
- (7) Safety element
- (8) Maintenance switch
- (9) Flap for pre-separator
- (10) Air intake with pre-separation

The air is filtered by a dry-air-filter with pre-separator for coarse impurities. One filter housing includes 2 filter sets. Each one consists of a main filter element (4) and a safety element (7).

The filter condition is monitored by the maintenance switch (8). A fault message like „**Engine air filter restricted**“ is displayed at the operator's dash board as soon as the restriction is too high.

The wing nut (6) incorporates a service indicator.

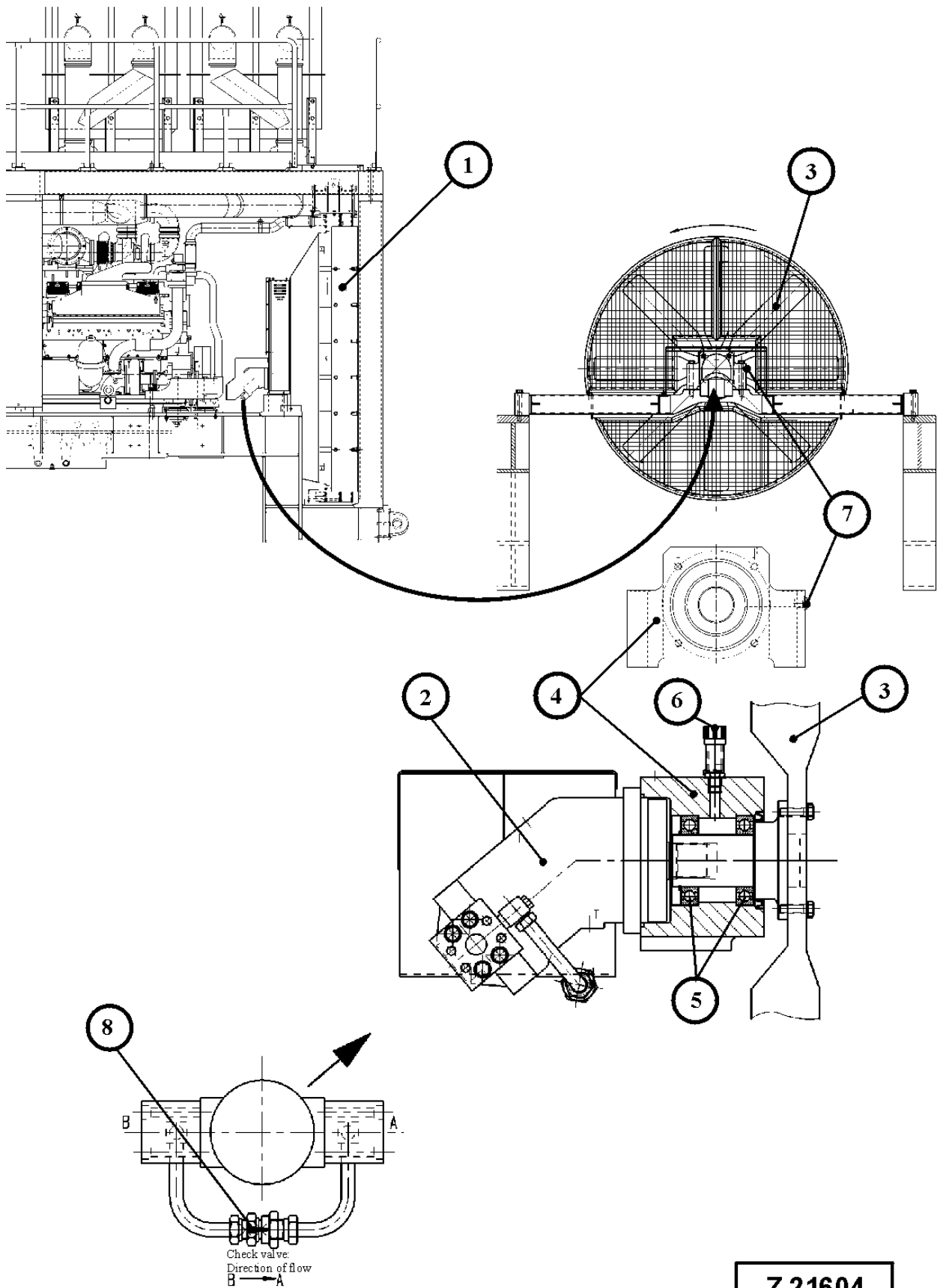
Green indication = O.K.

Red indication = safety element (7) needs maintenance.

The indication mark must be re-set by blowing through the nut opposite to the normal air flow or by sucking at the other end, this can be done with the mouth.



- **For service intervals and procedure refer to the OPERATION AND MAINTENANCE MANUAL of the corresponding machine.**



Z 21604

2.4 Fan drive and radiator assembly

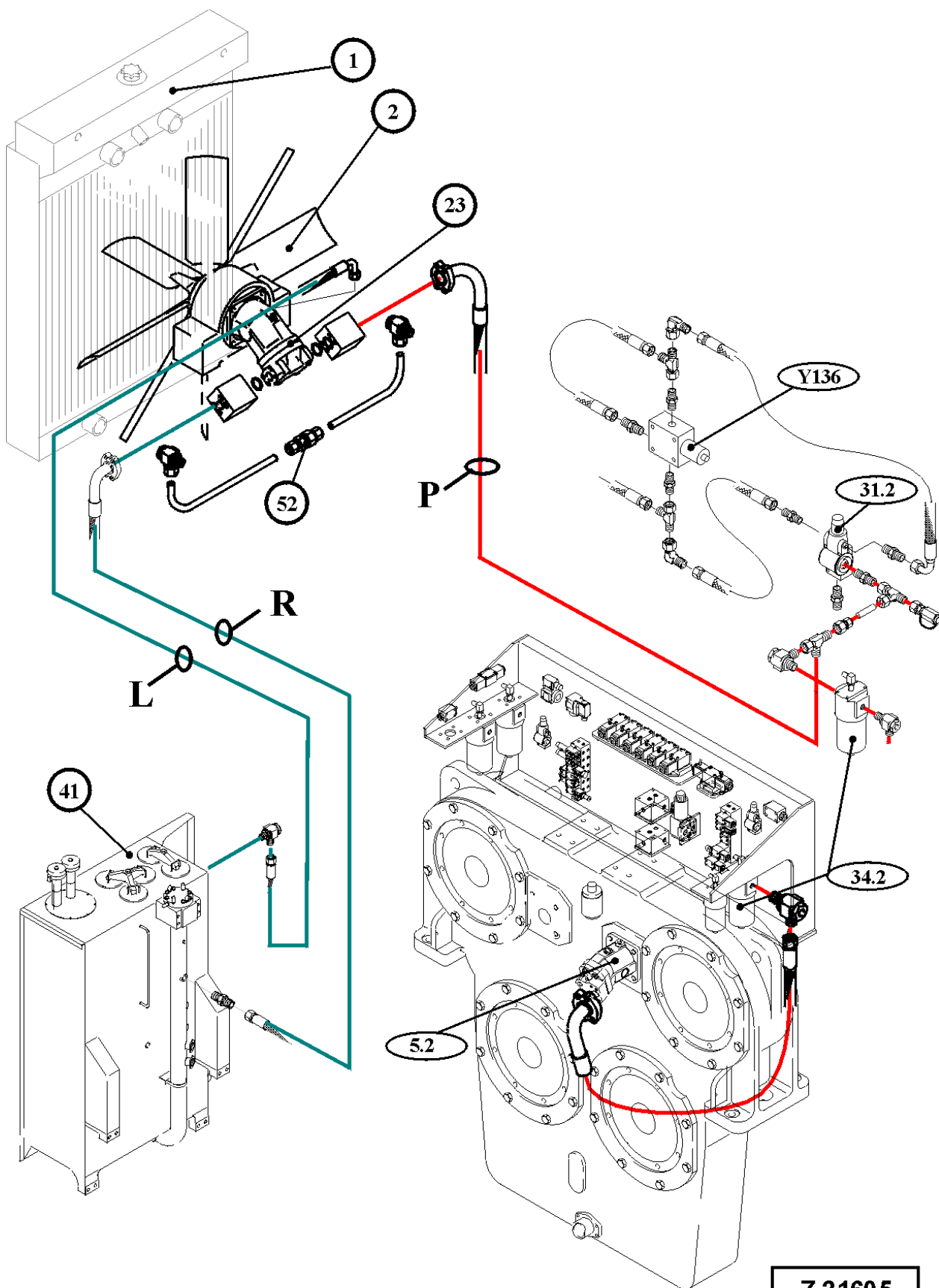
Legend for illustration (Z 21604):

- (1) Radiator
- (2) Fan motor (Axial piston motor)
- (3) Intake air fan
- (4) Bearing group carrier
- (5) Ball bearings
- (6) Breather filter
- (7) Oil level plug
- (8) Check valve (Anti-cavitation valve)



- **For service intervals and procedure refer to the OPERATION AND MAINTENANCE MANUAL of the corresponding machine.**

continued



Z 21605

2.4 Fan drive and radiator assembly

Cont'd

Legend for illustration (Z 21605):

- (1) Radiator
- (2) Intake air fan
- (5.2) Axial piston pump (fixed displacement pump, with variable setting)
- (23) Fan motor (Axial piston motor)
- (31.2) Pressure relief valve - Engine radiator fan drive
- (34.2) Pressure filter with pressure differential switch B21
- (41) Main oil reservoir
- (52) Check valve – (Anti cavitation valve for fan drive motor)
- (Y136) Proportional solenoid valve - Engine radiator fan speed (infinitely variable)
- (L) Leak oil (case drain) to tank
- (P) Pressure to motor
- (R) Return oil to tank

Function:

From pump (5.2) flows the oil through the filter (34.2) to the fan motor (23) and then back to the tank.

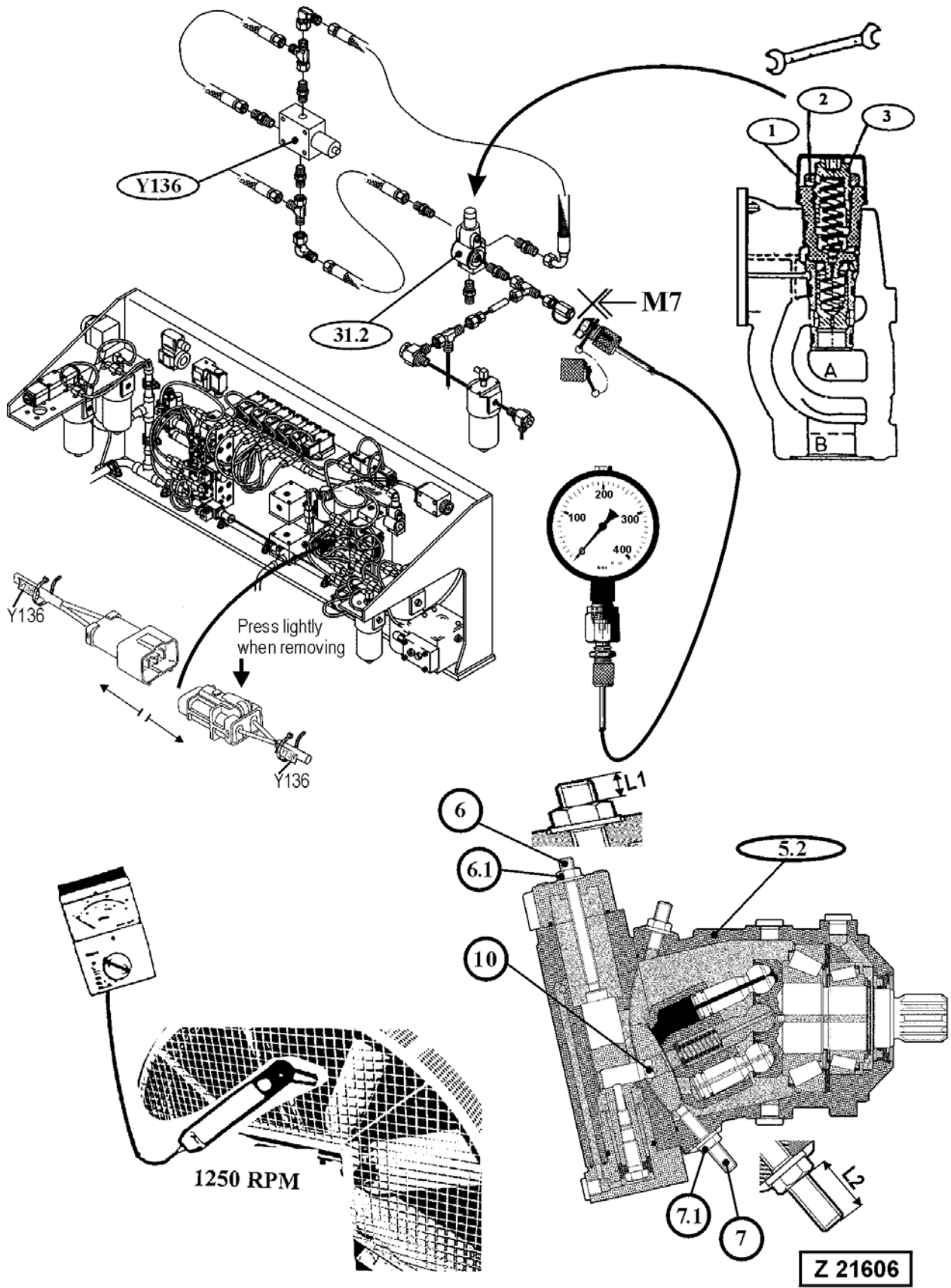
The check valve (52) act as an anti cavitation valve and is installed, because the fan motor -driven by inertial force- is running for a short period after the engine has been switched off.

The hydraulic circuit "Fan drive" is secured by the pilot controlled pressure relief valve (31.2). This valve works together with the proportional solenoid valve (Y136). The proportional solenoid valve(Y136) operates depending on engine coolant temperature.

The ECM (Electronic Control Module) of the engine controls the proportional solenoid valve (Y136) by sending variable current signals, depending on the engine coolant temperature.

Which in turn changes the fan speed.

With a low current signal to the proportional solenoid the relief valve is functioning and the fans are running with the max. set- speed. With a high current signal to the proportional solenoid the relief valve is not functioning and the fans are running with a very low speed, caused by the flow resistance only.



2.5 Radiator fan drive speed adjustment

Basic Adjustment

Legend for illustration (Z 21606):

- (1) Dust cap
- (2) Lock nut
- (3) Set screw
- (5.2) Axial piston pump (fixed displacement pump, with variable setting)
- (6) Q_{\min} stop bolt
- (6.1) Lock nut
- (7) Q_{\max} stop bolt
- (7.1) Lock nut
- (10) Positioning pin (mover)
- (31.2) Pressure relief valve - Engine radiator fan drive
- (Y136) Proportional solenoid valve - Engine radiator fan speed (infinitely variable)
- (L1) Measurement of Q_{\min} stop bolt
- (L2) Measurement of Q_{\max} stop bolt
- (M7) Pressure check points - Engine radiator fan drive operating pressure



- **Basic adjustment has to be carried out whenever one of the following components has been replaced:**

- **pump**
- **relief valve**
- **hydraulic motor**

1. Reduce the output flow of pump (5.2), by adjusting the minimum possible swivel angle, to avoid over speeding the fan:

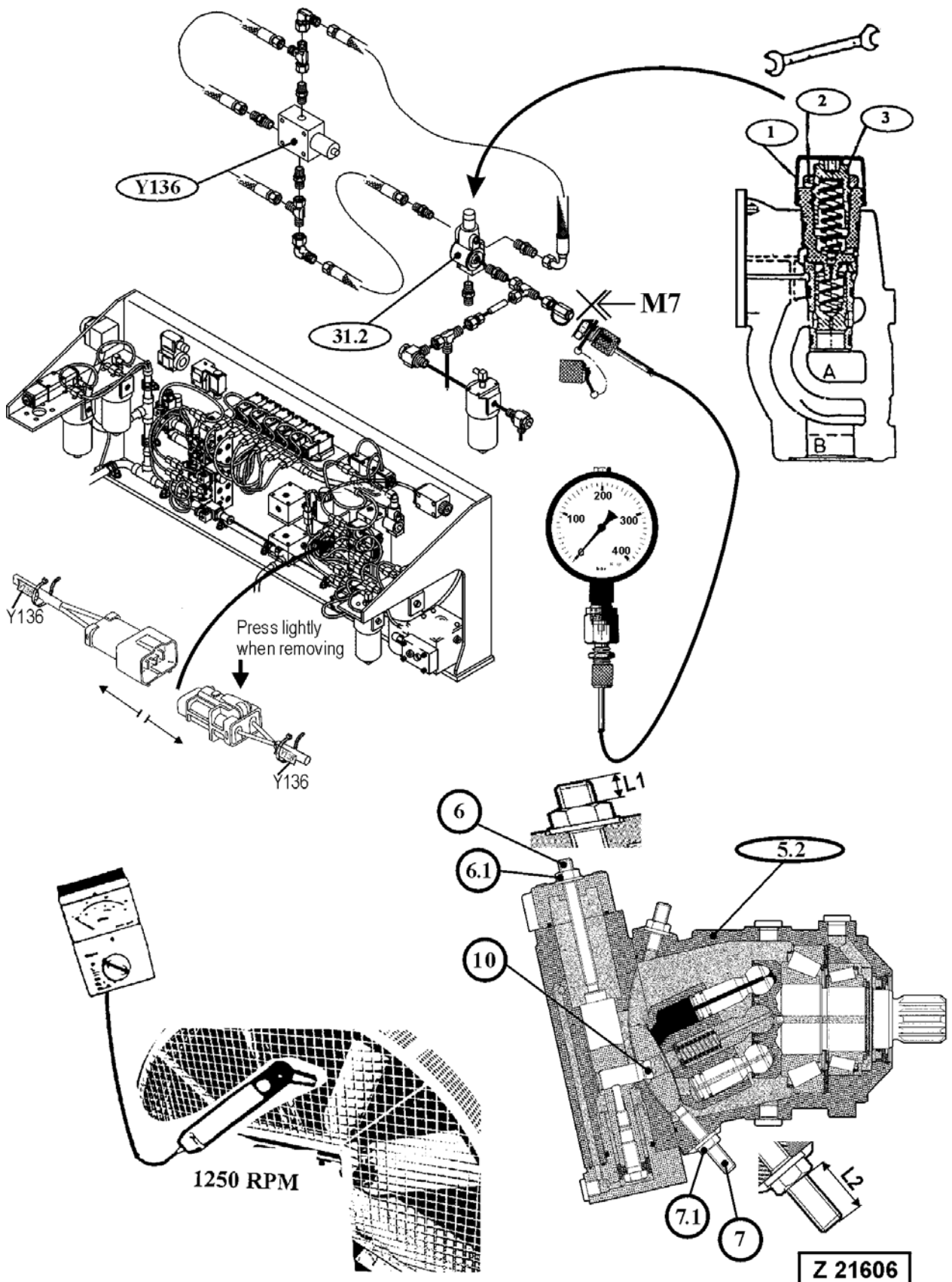
To do this, loosen both lock nuts (6.1 + 7.1) and turn **out** bolt (6) and turn **in** bolt (7) the **same length**.

This is necessary to avoid a loose positioning pin (10), resulting in oscillating of the cylinder barrel.

Tighten the lock nuts.

2. Remove protection cap (1) from relief valve (31.2), loosen lock nut (2) and turn set screw (3) fully clockwise and then a half turn counter clockwise.
3. Isolate the function of proportional solenoid valve (Y136), by disconnecting the plug connector, to ensure that the full flow of pump 5.2 will be delivered to the fan motor.
4. Connect a pressure gauge to check point (M7).
5. Start the engine and let it run with max. speed.

continued



2.5 Radiator fan drive speed adjustment

Cont'd

Basic Adjustment

6. Check the fan speed with a non-contact rev counter

Required fan speed: **1250 min⁻¹**



- **Be careful not to get caught in the fan or other rotating parts**

7. Increase the output flow of pump (5.2), by adjusting the swivel angle, until the fan speed will be 20 min⁻¹ higher than required:

To do this, loosen both lock nuts (6.1 + 7.1) and turn **in** bolt (6) and turn **out** bolt (7) the **same length**.

This is necessary to avoid a loose positioning pin (10), resulting in oscillating of the cylinder barrel.

Tighten the lock nuts (6.1 + 7.1).



- **Do not exceed the maximum permissible operating pressure of 230bar.**



- **Note down the lengths "L1" and "L2" as reference measurements.**

8. Loosen lock nut (2) of the relief valve (31.2), and decrease the pressure with set screw (3) until the correct fan speed is obtained.
9. Tighten lock nut (2) and fix protection cap (3).
10. Activate the function of proportional solenoid valve (Y136), by connecting the plug connector. (Fan speed controlled in relation to the engine temperature)
11. Disconnect the pressure gauge from check point (M7).

Fan speed check

If the fan speed is out of adjustment, increase or decrease first the pressure at relief valve (31.2), to change the speed.



- **Do not exceed the maximum permissible operating pressure of 230bar.**

If the speed can not be raised by increasing the pressure then increase the output flow of pump (5.2).



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