

Operation & Maintenance Manual

PC5500-6

HYDRAULIC MINING SHOVEL

SERIAL NUMBER 15066 & 15071

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KOMATSU
MINING GERMANY

1. INTRODUCTION

1.1 CONTENTS OF THE BINDER

Assembled in this file are the Operation-, Lubrication- and Maintenance Manuals for your KOMATSU Hydraulic Mining Shovel.

1.2 DIVISION OF THE BINDER

Part 1:

Operation Manual

Part 2:

Lubrication- and Maintenance Manual

Part 3:

Depending on the volume of Part 3 a second Binder "Volume 2" is being delivered with the Shovel. This Binder contains the General Assembly Procedure Manual for the Shovel, Specification Booklet, Service Literature for the Power Unit (Diesel Engine or Electric Motor) and for Special Equipment. The Electrical- and Hydraulic Diagrams are attached in the pocket of the front cover.

Refer to the "TABLE OF CONTENTS VOLUME 2 BINDER" for details.

Read the Manuals before You Start the Engines.

Before operating the machine, familiarize yourself with its instruments and controls.

Observe the instructions in these manuals for:

- 1 your Personal SAFETY
- 1 Operating SAFETY, and
- 1 READY and EFFICIENT PERFORMANCE of your KOMATSU Hydraulic Mining Shovel.

Periodic preventive inspections and maintenance are the surest means of keeping the machine in proper working order. Prompt detection and correction of minor irregularities, and immediate replacement of worn out or broken parts will prevent failures and avoid expenses.

Replace damaged graphics and symbols.

Observe safety precautions to prevent injury and damage.

If you have any questions concerning this literature please contact

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1.3 DESIGNATED USE OF THE SHOVEL

This machine has been manufactured in accordance with advanced and up-to-date technology standards including recognized safety rules. Nevertheless, its use may constitute a risk to life and limb of the user or of third parties, or cause damage to the machine and to other material property.

The machine must only be used in technically perfect condition in accordance with its designated use and the instructions set out in the operation manual. Only trained safety-conscious operators who are fully aware of the risks involved should operate the machine. Any functional disorders, especially those affecting the safety of the machine, should, therefore, be rectified immediately.

The hydraulic Shovel is designed exclusively for excavating, i.e. excavation of bulk material and natural soil structure (e.g. earth, clay, sand and stones ashore and off-shore). Observe local and national safety regulations. Special conditions at the worksite require additional safe working precautions, follow your company's safety instructions. Short traveling distances for changing the working site are considered as part of the designated use of the Shovel.

Using the Shovel for purposes other than those mentioned above (such as object handling and use as a transport vehicle) is considered contrary to its designated use. The manufacturer/supplier cannot be held liable for any damage resulting from such use. The risk of such misuse lies entirely with the user.

 **WARNING**

Special use of the Shovel beyond its designated use, e.g. object handling operations, require written agreement from the manufacturer and retrofitment of the Shovel with respective safety related equipment before such special applications are permitted.

1.4 DELIVERY OF THE SHOVEL

The Shovel is being delivered disassembled into its main components.

For assembling the Shovel refer to the separate Manual "Assembly Procedure" in Volume 2 Binder.

⚠ WARNING

Personnel entrusted with work on the machine must have read the Assembly Manual, the Operation,- Lubrication- and Maintenance Manual and in particular the section on safety before beginning work. Reading the instructions after work has begun is too late.

If there are any questions concerning the assembling procedure, contact your local Service Center.

Prior to first operation, inspect the Shovel thoroughly with the Service Engineer responsible for the erection of the machine. Check all fluid levels according to the Lubrication and Maintenance Schedule.

Damages and defects caused by incorrect operation and maintenance are not covered by the manufacturers guarantee.

NOTICE

If the Shovel is equipped with a fire suppression system, make sure that the system is ready for operation.

SPARE PARTS

For your spare part orders refer to the Parts Catalogue.

In order to keep your Shovel in first-class operating condition use only genuine spare and wear parts.

The use of any part other than the genuine part releases the KOMATSU MINING GERMANY GmbH from any guarantee.

SERVICE

For all questions related to your Shovel please contact your local Service Center.

In all your written or phoned inquiries please indicate the model and serial number of your Shovel.

1.5 EXPLANATION OF ABBREVIATIONS

| ABB. | Definition |
|-------------|--|
| A | Ampere |
| AC | Alternating Current |
| API | American Petroleum Institute |
| cSt | Centistoke |
| °C | Degree Celsius |
| CENSE | Engine Monitoring System |
| CLS | Central Lubrication System |
| DC | Direct Current |
| DIN | German Institute for Standardization |
| EBL | Electronic Bucket Levelling System |
| ECM | Electronic Control Module (Engine) |
| FGPS | Front Guard Protective Structure |
| FOPS | Falling-Object Protective Structure |
| GL | Gear Lubricant |
| h | hours of operation |
| HPF | High Pressure Filter (Hydraulic Oil) |
| HT | High Tension |
| LED | Light Emitting Diode |
| LT | Low Tension |
| LTA | Low Temperature Aftercooling |
| MPG | Multi-Purpose Grease |
| N | Newton |
| Nm | Newton meter |
| PLC | Programmable Logic Controller |
| PM | Planned Maintenance |
| ppm | parts per million |
| PTO | Power Take-Off (Pump Distributor Gear) |
| QSK | Electronically controlled fuel system |
| SLS | Swing circle pinion Lubrication System |
| V | Volt |
| VHMS | Vehicle Health Monitoring System |
| 1/min | Revolutions Per Minute (RPM) |

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2. SAFETY

2.1 SAFETY INSTRUCTIONS

2.1.1 WARNINGS AND SYMBOLS

The following signs and designations are used in the manual to designate in-structions of particular importance.

 **WARNING**

Refers to orders and prohibitions designed to prevent injury or extensive damage.

 **CAUTION**

Refers to special information and/or orders and prohibitions directed towards preventing damage.

NOTICE

Refers to special information on how to use the machine most efficiently.

2.1.2 BASIC OPERATION AND DESIGNATED USE OF THE HYDRAULIC SHOVEL

Refer to "DESIGNATED USE OF THE SHOVEL" on page 6 for details.

 **WARNING**

The use of the Shovel for object handling operations without the respective safety related equipment is not allowed.

2.1.3 ORGANIZATIONAL MEASURES

- 1 The Operation,- Lubrication and Maintenance Manual must always be at hand at the place of use of the machine, e. g. by stowing them in the box provided for such purpose.
- 1 In addition to the Operation,- Lubrication and Maintenance Manual, observe and instruct the user in all other generally applicable legal and other mandatory regulations relevant to accident prevention and environmental protection.
These compulsory regulations may also deal with the handling of hazardous substances, issuing and/or wearing of personal protective equipment, or traffic regulations.
- 1 The Operation,- Lubrication and Maintenance Manual must be supplemented by instructions covering the duties involved in supervising and notifying special organizational features, such as job organization, working sequences or the personnel entrusted with the work.
- 1 Personnel entrusted with work on the machine must have read the Operation,- Lubrication and Maintenance Manual and in particular the chapter on safety before beginning work. Reading the instructions after work has begun is too late. This applies especially to persons working only occasionally on the machine, e. g. during setting up or maintenance.
- 1 Check - at least from time to time - whether the personnel is carrying out the work in compliance with the Operation,- Lubrication and Maintenance Manual and paying attention to risks and safety factors.
- 1 For reasons of security, long hair must be tied back or otherwise secured, garments must be close-fitting and no jewellery - such as rings - may be worn. Injury may result from being caught up in the machinery or from rings catching on moving parts.
- 1 Use protective equipment wherever required by the circumstances or by law.
- 1 Observe all safety instructions and warnings attached to the machine.
- 1 See to it that safety instructions and warnings attached to the machine are always complete and perfectly legible.
- 1 In the event of safety-relevant modifications or changes in the behaviour of the machine during operation, stop the machine immediately and report the malfunction to the competent authority/person.
- 1 Never make any modifications, additions or conversions which might affect safety without the supplier's approval. This also applies to the installation and adjustment of safety devices and valves as well as to welding work on load-bearing elements.
- 1 Spare parts must comply with the technical requirements specified by the manufacturer. Spare parts from original equipment manufacturers can be relied to do so.

- 1 Replace hydraulic hoses within stipulated and appropriate intervals even if no safety-relevant defects have been detected.
- 1 Adhere to prescribed intervals or those specified in the Operation,- Lubrication and Maintenance Manual for routine checks and inspections.
- 1 For the execution of maintenance work, tools and workshop equipment adapted to the task on hand are absolutely indispensable.
- 1 The personnel must be familiar with the location and operation of fire extinguishers.
- 1 Observe all fire-warning and fire-fighting procedures.

2.1.4 SELECTION AND QUALIFICATION OF PERSONNEL - BASIC RESPONSIBILITIES

- 1 Any work on and with the machine must be executed by reliable personnel only. Statutory minimum age limits must be observed.
- 1 Employ only trained or instructed staff and set out clearly the individual responsibilities of the personnel for operation, set-up, maintenance and repair.
- 1 Make sure that only authorized personnel works on or with the machine.
- 1 Define the machine operator's responsibilities - also with regard to observing traffic regulations - giving the operator the authority to refuse instructions by third parties that are contrary to safety.
- 1 Do not allow persons to be trained or instructed or persons taking part in a general training course to work on or with the machine without being permanently supervised by an experienced person.
- 1 Work on the electrical system and equipment of the machine must be carried out only by a skilled electrician or by instructed persons under the supervision and guidance of a skilled electrician and in accordance with electrical engineering rules and regulations.
- 1 Work on chassis, brake and steering systems must be performed by skilled personnel only which has been specially trained for such work.
- 1 Work on the hydraulic system must be carried out only by personnel with special knowledge and experience of hydraulic equipment.

2.1.5 SAFETY INSTRUCTIONS GOVERNING SPECIFIC OPERATIONAL PHASES

STANDARD OPERATION

- 1 Avoid any operational mode that might be prejudicial to safety.
- 1 Before beginning work, familiarize yourself with the surroundings and circumstances of the site, such as obstacles in the working and travelling area, the soil bearing capacity and any barriers separating the construction site from public roads.
- 1 Take the necessary precautions to ensure that the machine is used only when in a safe and reliable state.
Operate the machine only if all protective and safety-oriented devices, such as re- movable safety devices, emergency shut-off equipment, sound-proofing elements and exhausters, are in place and fully functional.
- 1 Check the machine at least once per working shift for obvious damage and defects. Report any changes (incl. changes in the machine's working behaviour) to the competent organization/person immediately. If necessary, stop the machine immediately and lock it.
- 1 In the event of malfunctions, stop the machine immediately and lock it. Have any defects rectified immediately.
- 1 Start the machine from the driver's seat only.
- 1 During start-up and shut-down procedures always watch the indicators in accordance with the Operation,- Lubrication and Maintenance Manual.
- 1 Before starting up or setting the machine in motion, make sure that nobody is at risk.
- 1 Before starting work or travelling with the machine, check that the braking, steering, signalling and lighting systems are fully functional.
- 1 Before setting the machine in motion always check that the accessories have been safely stowed away.
- 1 When travelling on public roads, ways and places always observe the valid traffic regulations and, if necessary, make sure beforehand that the machine is in a condition compatible with these regulations.
- 1 In conditions of poor visibility and after dark always switch on the lighting system.
- 1 Persons accompanying the driver must be seated on the passenger seat provided for this purpose.
- 1 When crossing underpasses, bridges and tunnels or when passing under overhead lines always make sure that there is sufficient clearance.

- 1 Always keep at a distance from the edges of building pits and slopes.
- 1 Avoid any operation that might be a risk to machine stability.
- 1 Never travel across slopes; always keep the working equipment and the load close to the ground, especially when travelling downhill.
- 1 On sloping terrain always adapt your travelling speed to the prevailing ground conditions. Never change to a lower gear on a slope but always before reaching it.
- 1 Before leaving the driver's seat always secure the machine against inadvertent movement and unauthorized use.

SPECIAL WORK IN CONJUNCTION WITH UTILIZATION OF THE MACHINE AND MAINTENANCE AND REPAIRS DURING OPERATION; DISPOSAL OF PARTS AND CONSUMABLES

- 1 Observe the adjusting, maintenance and inspection activities and intervals set out in the Operation,- Lubrication and Maintenance Manual, including information on the replacement of parts and equipment. These activities may be executed by skilled personnel only.
- 1 Brief operating personnel before beginning special operations and maintenance work, and appoint a person to supervise the activities.
- 1 In any work concerning the operation, conversion or adjustment of the machine and its safety-oriented devices or any work related to maintenance, inspection and repair, always observe the start-up and shut-down procedures set out in the Operation,- Lubrication and Maintenance Manual and the information on maintenance work.
- 1 Ensure that the maintenance area is adequately secured.
- 1 If the machine is completely shut down for maintenance and repair work, it must be secured against inadvertent starting by:
 - m locking the principal control elements and removing the ignition key and/or
 - m attaching a warning sign to the main switch
- 1 Carry out maintenance and repair work only if the machine is positioned on stable and level ground and has been secured against inadvertent movement and buckling.
- 1 To avoid the risk of accidents, individual parts and large assemblies being moved for replacement purposes should be carefully attached to lifting tackle and secured. Use only suitable and technically perfect lifting gear and suspension systems with adequate lifting capacity. Never work or stand under suspended loads.

-
- 1 The fastening of loads and the instructing of crane operators should be entrusted to experienced persons only. The marshaller giving the instructions must be within sight or sound of the operator.
 - 1 For carrying out overhead assembly work always use specially designed or otherwise safety-oriented ladders and working platforms. Never use machine parts as a climbing aid. Wear a safety harness when carrying out maintenance work at greater heights.
Keep all handles, steps, handrails, platforms, landings and ladders free from dirt, snow and ice.
 - 1 Clean the machine, especially connections and threaded unions, of any traces of oil, fuel or preservatives before carrying out maintenance/repair. Never use aggressive detergents. Use lint-free cleaning rags.
 - 1 Before cleaning the machine with water, steam jet (high-pressure cleaning) or detergents, cover or tape up all openings which - for safety and functional reasons - must be protected against water, steam or detergent penetration. Special care must be taken with electric motors and switchgear cabinets.
 - 1 Ensure during cleaning of the machine that the temperature sensors of the fire-warning and fire-fighting systems do not come into contact with hot cleaning agents as this might activate the fire-fighting system.
 - 1 After cleaning, remove all covers and tapes applied for that purpose.
 - 1 After cleaning, examine all fuel, lubricant, and hydraulic fluid lines for leaks, loose connections, chafe marks and damage. Any defects found must be rectified without delay.
 - 1 Always tighten any screwed connections that have been loosened during maintenance and repair.
 - 1 Any safety devices removed for set-up, maintenance or repair purposes must be refitted and checked immediately upon completion of the maintenance and repair work.
 - 1 Ensure that all consumables and replaced parts are disposed of safely and with minimum environmental impact.

2.1.6 WARNING OF SPECIAL DANGERS

ELECTRIC ENERGY

- 1 Use only original fuses and circuit breakers with the specified current rating. Switch off the machine immediately if trouble occurs in the electrical system.
- 1 When working with the machine, maintain a safe distance from overhead electric lines. If work is to be carried out close to overhead lines, the working equipment must be kept well away from them. Caution, danger! Check out the prescribed safety distances.
- 1 If your machine comes into contact with a live wire
 - m do not leave the machine
 - m drive the machine out of the hazard zone
 - m warn others against approaching and touching the machine
 - m have the live wire de-energized
 - m do not leave the machine until the damaged line has been safely de-energized.
- 1 Work on the electrical system or equipment may only be carried out by a skilled electrician himself or by specially instructed personnel under the control and supervision of such electrician and in accordance with the applicable electrical engineering rules.
- 1 If provided for in the regulations, the power supply to parts of machine, on which inspection, maintenance and repair work is to be carried out must be cut off.
Before starting any work, check the de-energized parts for the presence of power and ground or short-circuit them in addition to insulating adjacent live parts and elements.
- 1 The electrical equipment of the machine is to be inspected and checked at regular intervals. Defects such as loose connections or scorched cables must be rectified immediately.
- 1 Necessary work on live parts and elements must be carried out only in the presence of a second person who can cut off the power supply in case of danger by actuating the emergency shut-off or main power switch. Secure the working area with a red-and-white safety chain and a warning sign. Use insulated tools only.
- 1 Before starting work on high-voltage assemblies and after cutting out the power supply, the feeder cable must be grounded and components such as capacitors short-circuited with a grounding rod.

GAS, DUST, STEAM AND SMOKE

- 1 Operate internal combustion engines and fuel operated heating systems only on adequately ventilated premises. Before starting the machine on enclosed premises, make sure that there is sufficient ventilation.
Observe the regulations in force at the respective site.
- 1 Carry out welding, flame-cutting and grinding work on the machine only if this has been expressly authorized, as there may be a risk of explosion and fire.
- 1 Special care must be taken before welding, flame-cutting and grinding operations are carried out on the counterweight. The filling of the counterweight chambers can create explosive gases which will accumulate in the chambers of the counterweight. These gases must be expelled before welding, flame-cutting and grinding operations are carried out on the counterweight. Danger of explosion.
Follow the instructions given in PARTS & SERVICE NEWS No. AH04518 for expelling the gases from the counterweight chambers.
- 1 Before carrying out welding, flame-cutting and grinding operations, clean the machine and its surroundings from dust and other inflammable substances and make sure that the premises are adequately ventilated (risk of explosion).

HYDRAULIC AND PNEUMATIC EQUIPMENT

- 1 Work on hydraulic equipment may be carried out only by persons having special knowledge and experience in hydraulic systems.
- 1 Check all lines, hoses and screwed connections regularly for leaks and obvious damage. Repair damage immediately. Splashed oil may cause injury and fire.
- 1 Depressurize all system sections and pressure pipes (hydraulic system, compressed-air system) to be removed in accordance with the specific instructions for the unit concerned before carrying out any repair work.
- 1 Hydraulic and compressed-air lines must be laid and fitted properly. Ensure that no connections are interchanged. The fittings, lengths and quality of the hoses must comply with the technical requirements.

NOISE

- 1 During operation, all sound baffles must be closed.
- 1 Always wear the prescribed ear protectors.

OIL, GREASE AND OTHER CHEMICAL SUBSTANCES

- 1 When handling oil, grease and other chemical substances, observe the product-related safety regulations.
- 1 Be careful when handling hot consumables (risk of burning or scalding).

2.1.7 TRANSPORTING AND TOWING -RECOMMISSIONING

- 1 The machine must be towed, loaded and transported only in accordance with the Operation,- Lubrication and Maintenance Manual.
- 1 For towing the machine observe the prescribed transport position, admissible speed and itinerary.
- 1 Use only appropriate means of transport and lifting gear of adequate capacity.
- 1 The recommissioning procedure must be strictly in accordance with the Operation,- Lubrication and Maintenance Manual.

2.1.8 SPECIAL SAFETY EQUIPMENT

SAFETY HARNESS IN CONFORMITY WITH EN 361 (EUROPEAN STANDARD)

The safety harness should only be used together with connectors according to EN 354, and fall arrest according to EN 355, or fall protection devices according to EN 360.

Refer to page page 29 in this section for more information.

FALLING-OBJECT PROTECTIVE STRUCTURE "FOPS" FOR OPERATOR'S CAB.

The Shovel must be equipped with a falling object protective structure "FOPS" if it is used for applications where there is a risk of falling material.

The "FOPS" structure shall comply with EN 474.

FRONT GUARD PROTECTIVE STRUCTURE "FGPS" FOR OPERATOR'S CAB

The Shovel must be equipped with a front guard protective structure "FGPS" if it is used for applications where there is a risk of hitting objects from the front.

OBJECT HANDLING

Object handling operations are not allowed. If the Shovel is used for object handling applications it must be equipped with the respective safety devices.

LIGHTING

The Shovel must only be operated when the operator has sufficient visibility in relation to the work area. Disturbing shady areas or dazzling effects must be avoided.

If necessary, the Shovel must be retrofitted with lighting equipment (working lights) in order to ensure sufficient visibility conditions.

WARNING BEACON

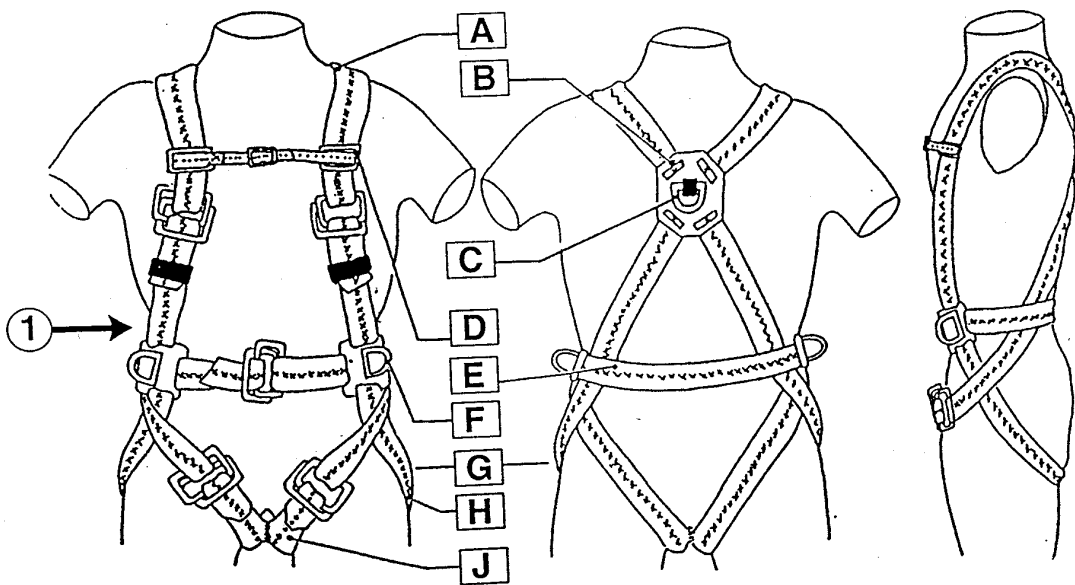
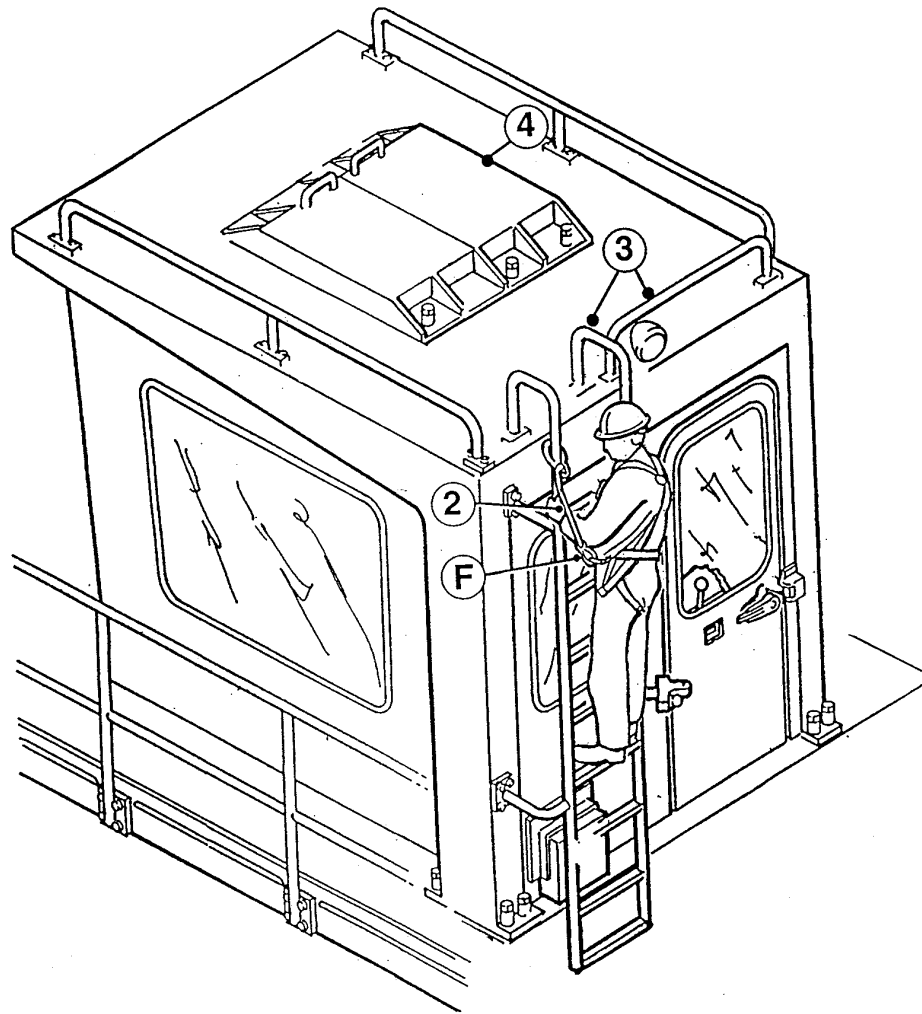
The Shovel can be retrofitted with a warning beacon which is fitted on the cab roof by means of a magnetic bracket.

NOTICE

The above-mentioned special safety devices can be ordered as accessories together with the Shovel.

They are also available as a field package for installation through our service organization.

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Z 20885

2.1.9 SAFETY HARNESS IN CONFORMITY WITH EN 361 (EUROPEAN STANDARD)

⚠ WARNING

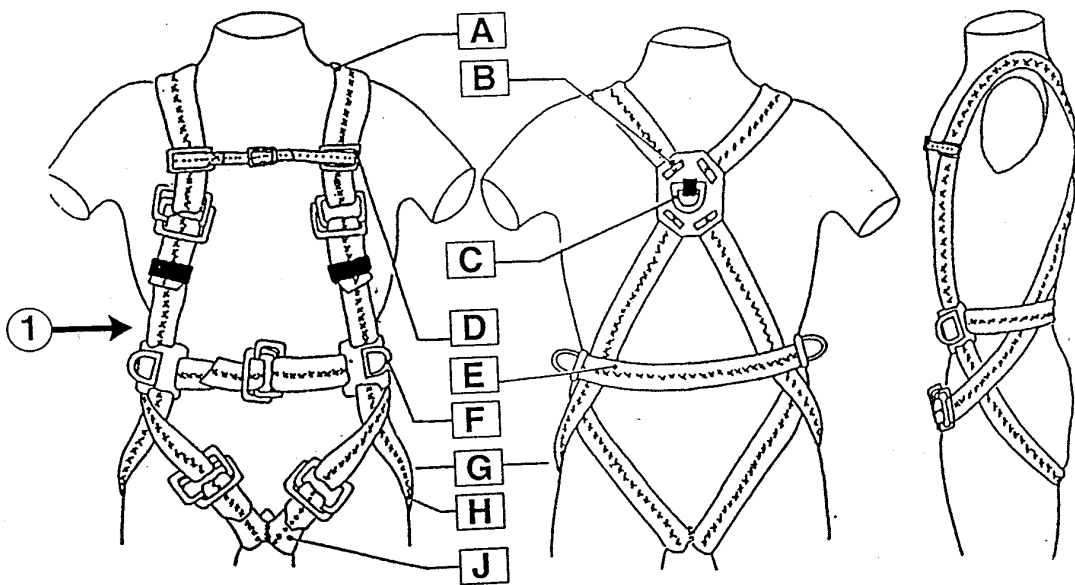
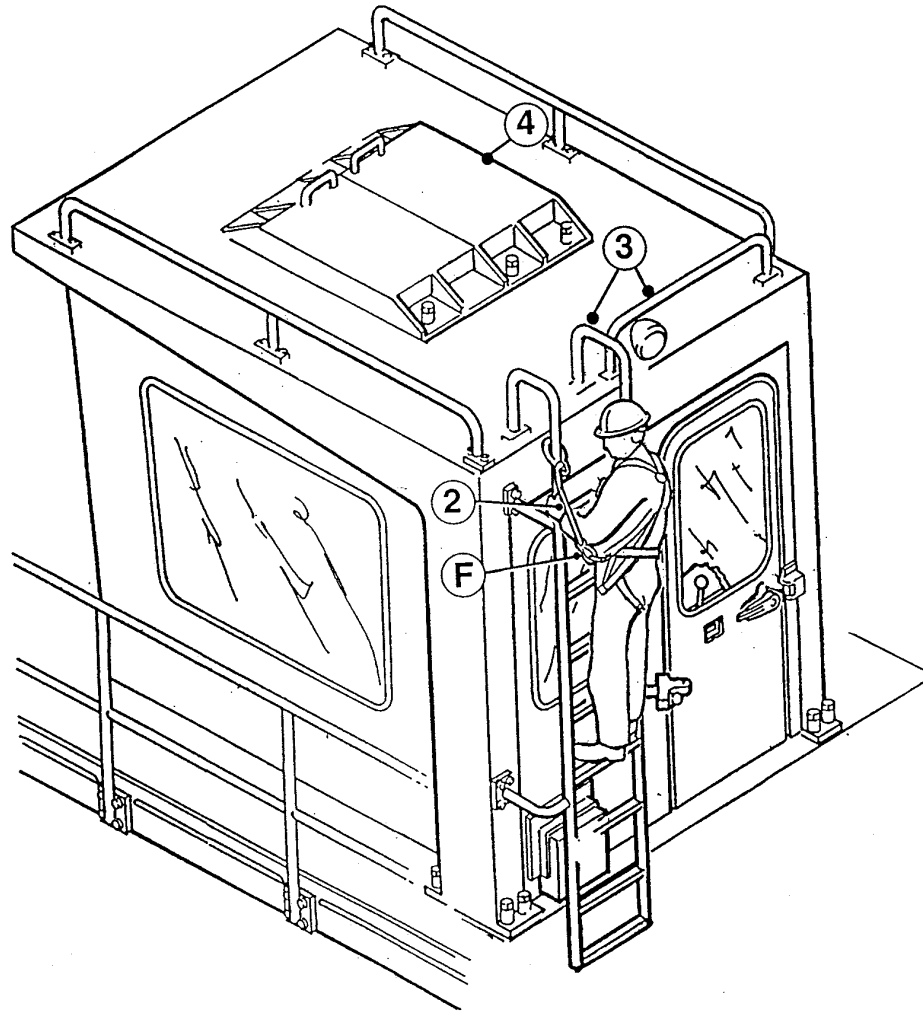
Always use the Safety Harness (1) in conjunction with strap type Fall Absorber (2), illust. (Z 20885) before mounting onto the loader attachment or other unsecured places of the Shovel.

NOTICE

- 1 The Safety Harness is located in the Cabinet of the Operator's Cab.
- 1 The illustration (Z 20885) shows a typical use of the safety harness in connection with the strap type fall absorber.

Legend for illustration Z 20885

- (1) Safety Harness according to EN 361
- (2) Strap-Type Fall Absorber according to DIN EN 355
- (3) Ladder to cab roof and railings (attachment points)
- (4) Protection hoods for roof mounted air conditioning, if so equipped
- (A) Shoulder Strap
- (B) Back Plate
- (C) Catching Hook
- (D) Shoulder-Strap Fixing
- (E) Belly Strap
- (F) Holding Hook
- (G) Hold-Back Hook
- (H) Pelvis Strap
- (J) Leg Strap



Z 20885

INSTRUCTIONS FOR USE

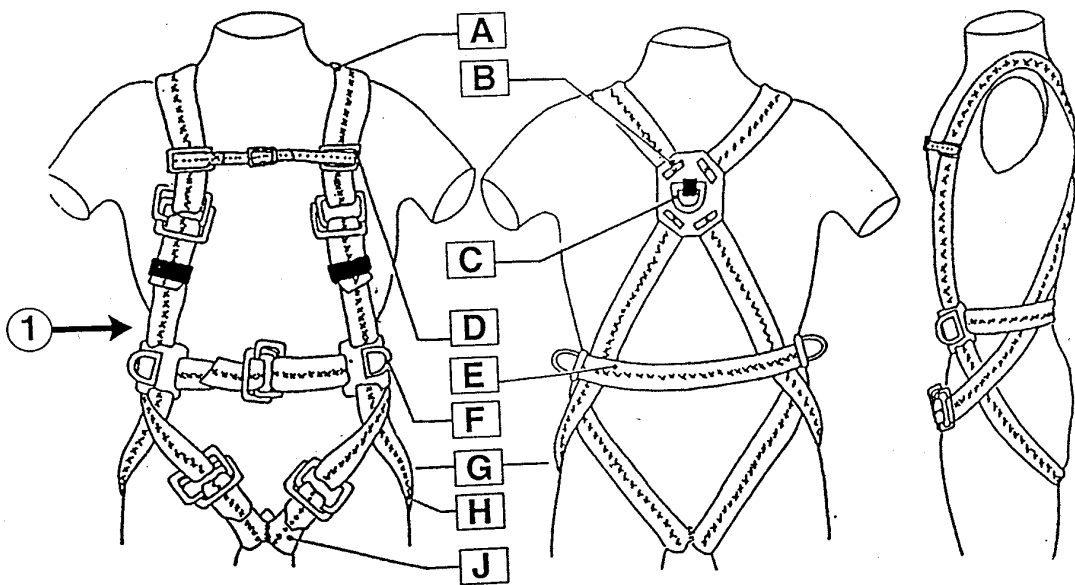
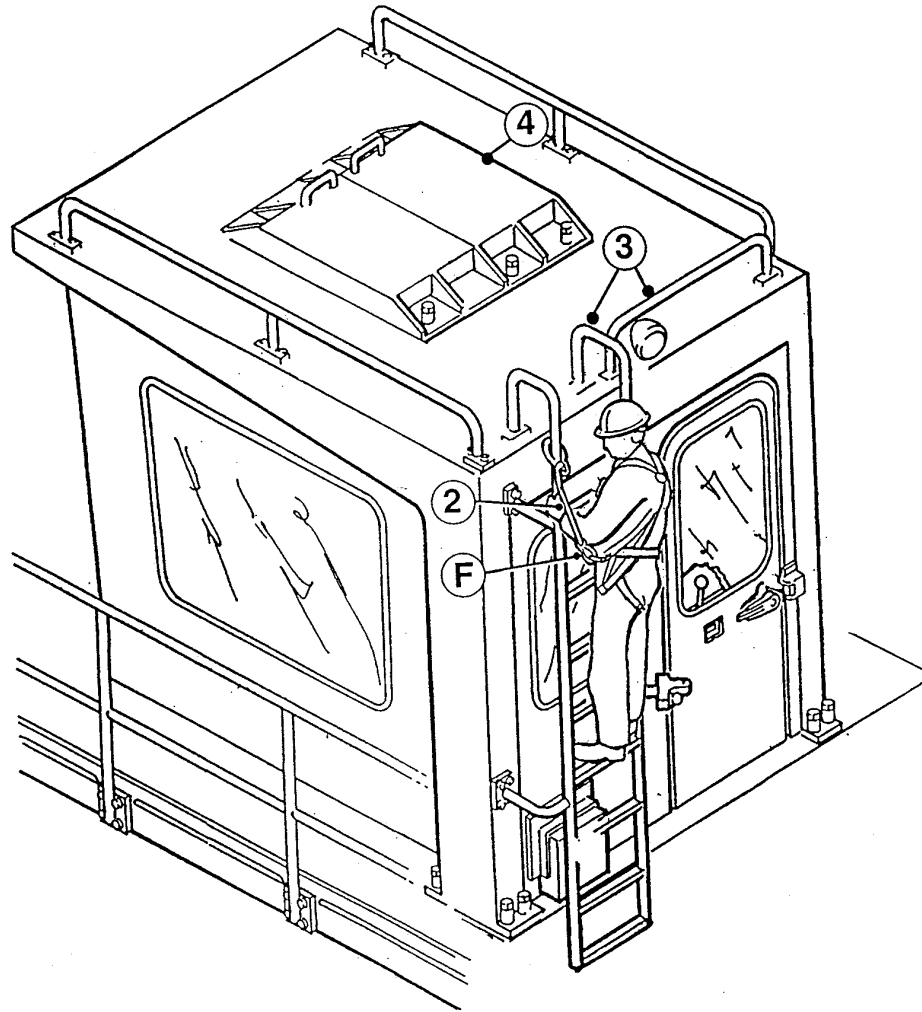
Open the lock, lift the harness by the catch hook (C), the blue straps (leg straps J) are below. The harness is being put on just like a jacket. Pull the belly strap (E) through the lock, as shown on the illustration, and secure it.

By closing the breast strap, you avoid the shoulder straps to side-slip. Bring the leg straps (J) around the legs to the front, pull them in, as shown in the illustration, and tighten them. Adapt the harness to body form, seeing to perfect fit, in particular that the catching hook (C) be in the center of the back.

The safety harness should belong to its wearer personally.

The safety harness should only be used together with connectors acc. to EN 354, and fall arrest acc. to EN 355, or fall protection devices acc. to EN 360.

The attachment point for the safety harness should be above the wearer, and the carrying capacity of the attachment point should be sufficient to correspond with the minimum carrying capacity acc. to EN 795.



Z 20885

PRIOR TO USING THE HARNESS (1), THE WEARER SHALL

- 1 Carry out a visual check of the system or component; correct functioning and perfect working order have to be assured.
- 1 Make sure that the recommendations for use with other components of the system be observed in conformity with the instructions for use.

The system or component must no longer be used, if there are any doubts in respect

of its safe condition. The equipment has to be inspected by the manufacturer or by a qualified person.

It is essential for safety reasons that a fall protection system or system component which has already been subjected to fall be removed from service and sent back to the manufacturer or an authorized qualified repair shop for maintenance and renewed testing.

Fall protection systems have to be treated with care and to be kept clean and ready for use. It has to be warned against bringing the systems into contact with acids or other caustic liquids and gases, oils, detergents, or sharp-edged objects.

Should the harness have become wet during use or cleaning, do not dry near a fire or other sources of heat, but rather in a natural way in not too warm rooms. Keep the harness freely suspended or loosely rolled up.

When using the fall protection systems, the pertaining safety regulations in force and the "Rules for Use of Personal Fall Arrest Systems" have to be observed for protection against danger.

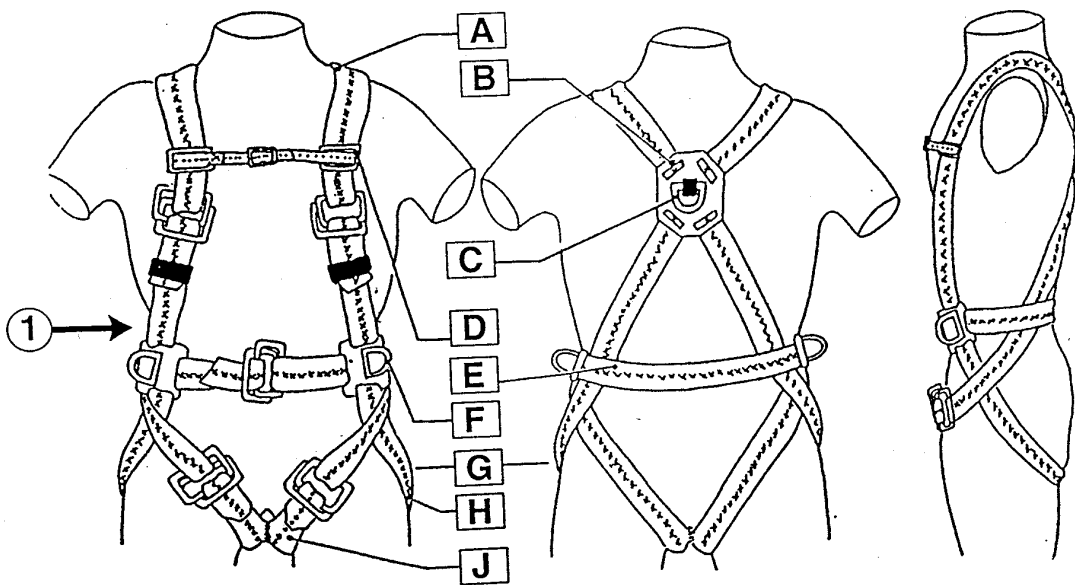
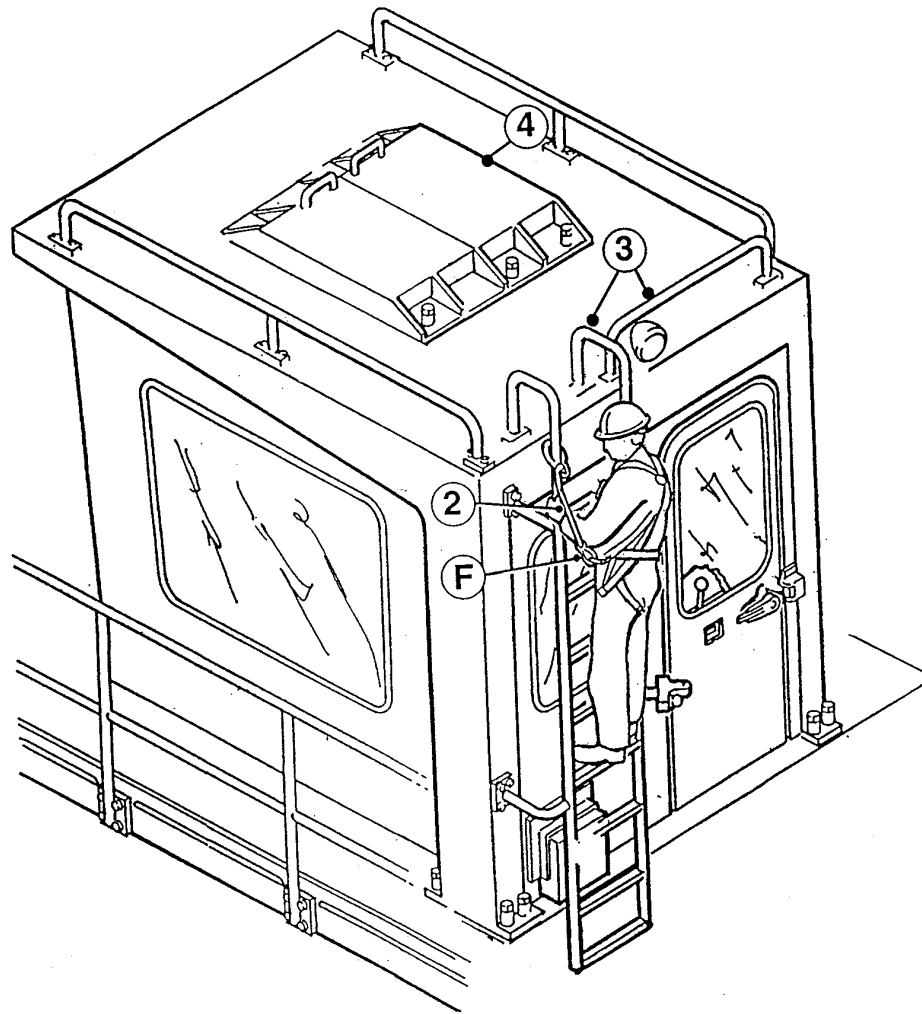
At least every 12 months, the safety harness and its components have to be inspected by a competent person authorized by the manufacturer and maintained, if the manufacturer considers it necessary.

RECOMMENDATIONS FOR USE OF THE HOLDING HOOKS AND HOLD-BACK HOOKS OF THE SAFETY HARNESS (1),

During the holding function, the connectors may only be placed around a mast or other construction between the two holding hooks, so that free fall is limited to max.0.5 m.

It should be strictly seen to it that the connector be not slung around constructions with too small diameter or sharp edges.

With the lateral holding hooks, work may only be carried out on horizontal or almost horizontal surfaces (roofs). The connectors have to be adjusted in such a way that the area, where danger of falling down prevails, cannot be reached.



Z 20885

INSTRUCTIONS FOR USE

Strap-Type Fall Absorber acc. to DIN EN 355 (Type E.K.N.-BFD)

Use

Within a fall-arrest system, the strap-type fall absorber (2) has to be used in conjunction with a safety harness (1) acc. to DIN EN 361. The maximum length including the safety rope must not exceed 2.0 m. For longer ropes, a rope-shortening device has to be applied in addition.

Fix the rope to the attachment point and attach the strap-type fall absorber to the catching hook in the back of the safety harness. The attachment point should be above the wearer and its minimum carrying capacity should be 10 KN, acc. to DIN EN 795.

The strap-type fall absorber and the safety rope must not be damaged, e.g. never pull them over sharp edges nor get them burnt by welding sparks.

Storing and maintenance

The strap-type fall absorber has to be kept dry in an airy and shady room. It must not be exposed to acids, caustic chemicals, nor to an aggressive atmosphere, and contact with oils has to be avoided. If the strap-type fall absorber is dirty, it may be cleaned with a little water and a light-duty detergent. Dry it in a shady place (nowhere near fire or other sources of heat). Protect it from sharp-edged objects.

Inspection

Prior to use, all parts have to be inspected for safe condition and damages. At least once a year, the strap-type fall absorber has to be tested by a competent person. A damaged or used strap-type fall absorber has to be removed from service immediately. The strap-type fall absorber must not be changed in any way. Repair work has to be done by the manufacturer only.

3. OPERATION

3.1 FOREWORD

This Operation Manual contains the instructions for correct operation of your KOMATSU Mining Shovel. It should always be ready for use in the Operator's cab.

▲ WARNING

The information in this manual does not replace any safety rules or laws used in your area.

Special safety regulations are given in the rules for the prevention of accidents. It is your responsibility to observe these rules.

Carefully read the Safety Instructions → See "SAFETY" on page 15.

Before operating the machine, familiarize yourself with its instruments and controls.

Observe the instructions in this manual for:

- your Personal SAFETY
- Operating SAFETY, and
- READY and EFFICIENT PERFORMANCE of your KOMATSU Mining Shovel.

▲ WARNING

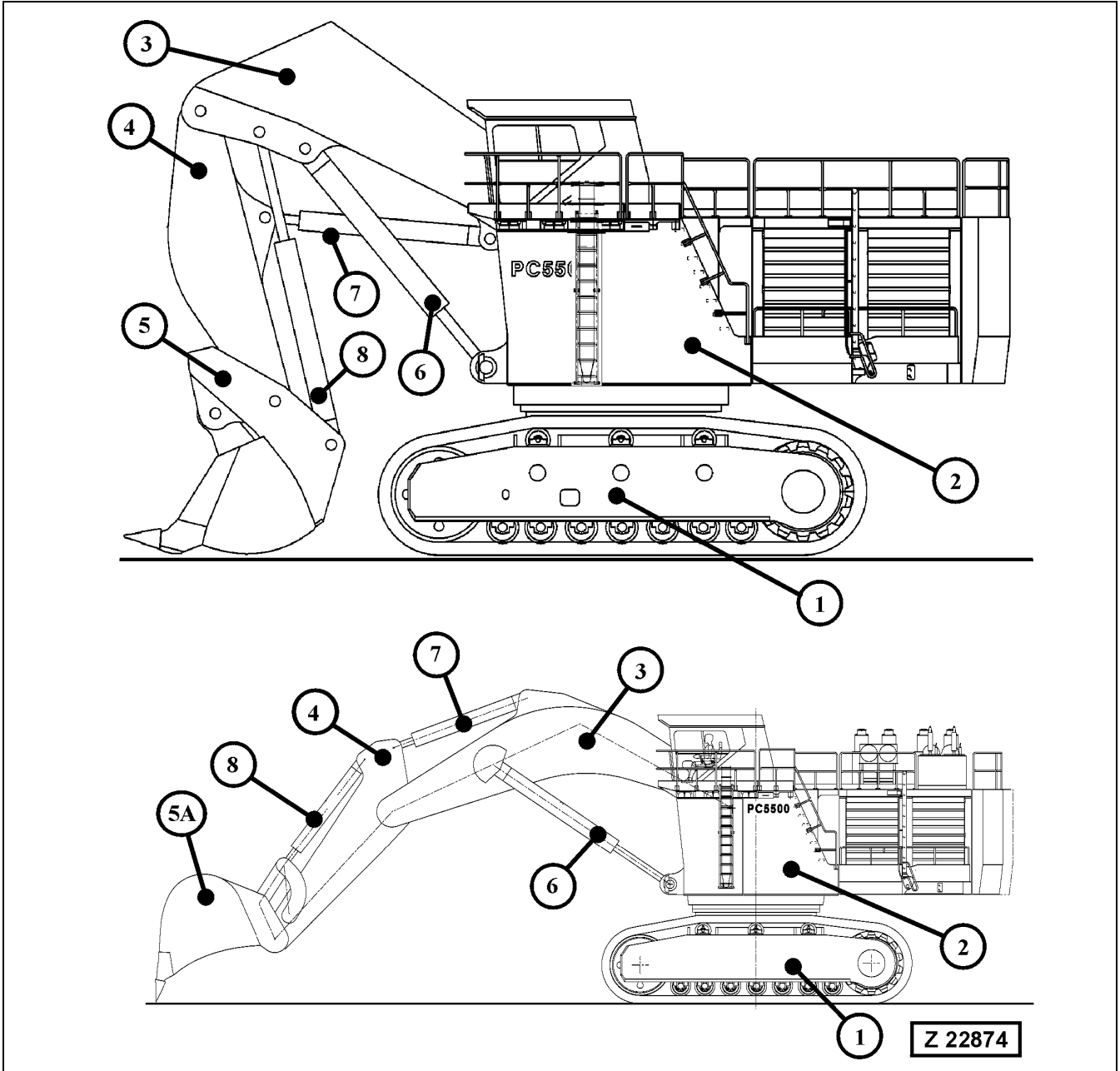
Improper operation of this machine can cause injury or death.

NOTICE

Optional equipment and accessories are available. Disregard the instructions for equipment not on your Shovel.

3.2 CONSTRUCTION OF THE SHOVEL

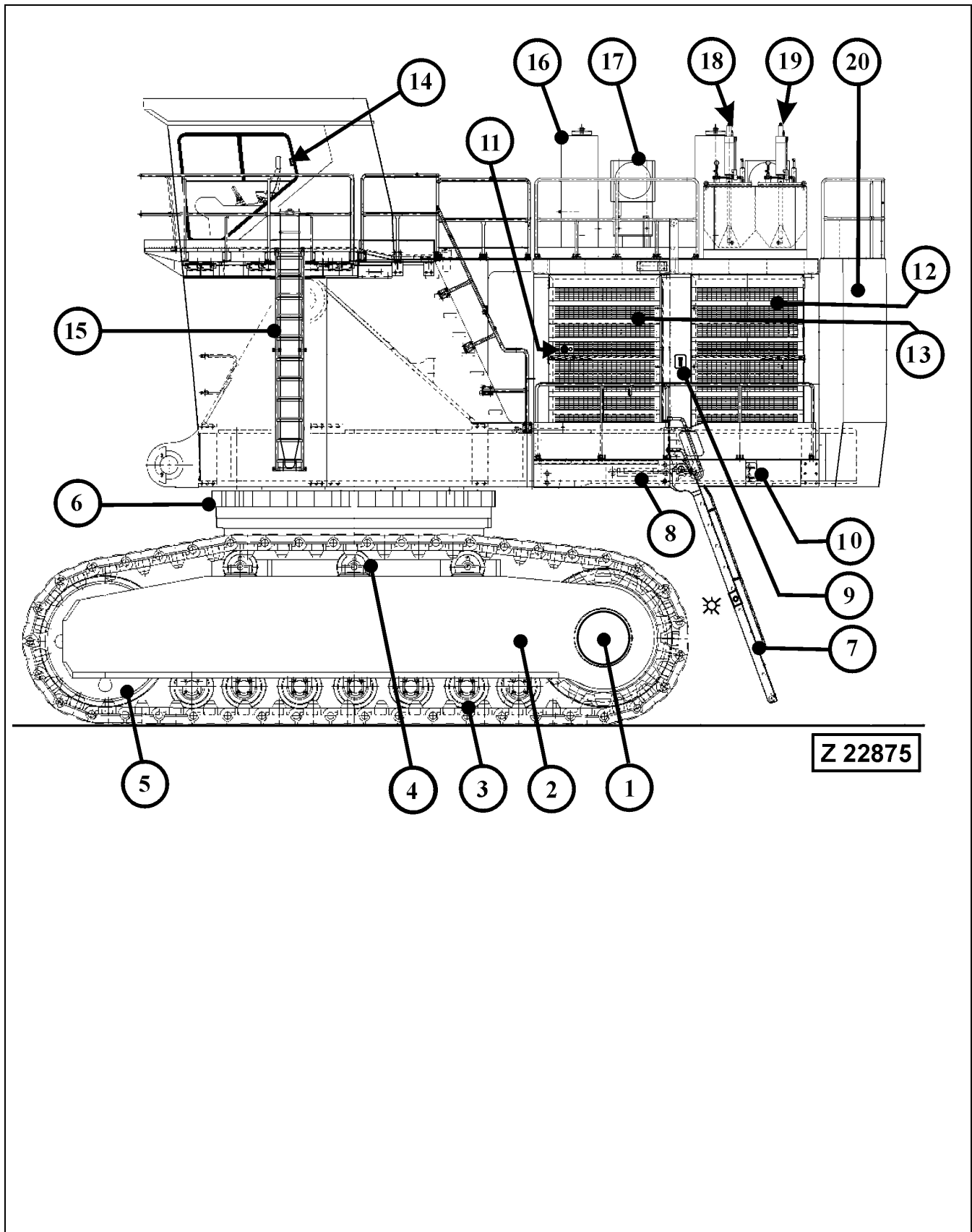
3.2.1 OVERALL VIEW



Legend for illustration Z22874

- | | |
|------------------------|----------------------|
| (1) Undercarriage | (5A) Backhoe bucket |
| (2) Superstructure | (6) Boom cylinders |
| (3) Boom | (7) Stick cylinders |
| (4) Stick | (8) Bucket cylinders |
| (5) Bottom dump bucket | |

3.2.2 UNDERCARRIAGE AND SUPERSTRUCTURE



Legend for illustration Z22875

- (1) Final drive, hub type travel gear
- (2) Crawler carrier
- (3) Track roller
- (4) Carrier roller
- (5) Guide wheel
- (6) Swing circle guard
- (7) Hydraulically operated access ladder, see page 46 for more information
- (8) Hydraulic cylinder for access ladder
- (9) Control switch for access ladder
- (10) Battery main switches
- (11) Emergency engine shut down switch and manual actuator switch for the fire suppression system, if so equipped.

⚠ CAUTION

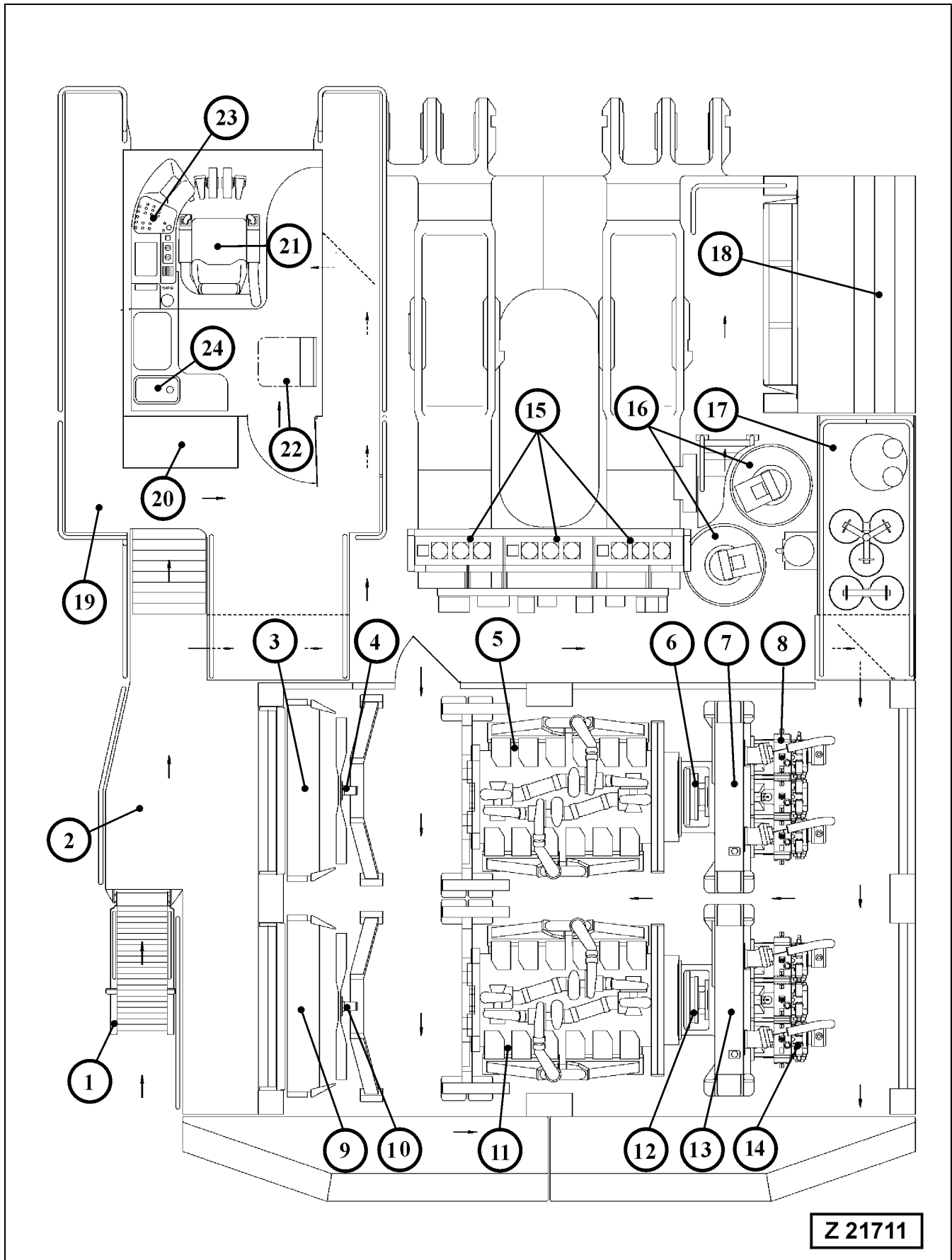
Never stop the engines from a full load except in case of emergency. If a hot engine is shut down without previous idling period of three to five minutes, the temperature in certain engine parts rising sharply after the cooling system ceases to function. The resulting thermal stress, especially in the turbochargers, may cause serious damage.

- (12) Radiator of rear engine, designation number 1
- (13) Radiator of front engine, designation number 2
- (14) Sliding window of operator's cab, see page 56 for more information
- (15) Emergency escape ladder
- (16) Exhaust muffler
- (17) Engine air cleaners
- (18) Hydraulically driven grease pump of the Swing circle pinion Lubrication System (SLS)
- (19) Hydraulically driven grease pump of the Central Lubrication System (CLS)
- (20) Counterweight

⚠ WARNING

The chambers of the counterweight are filled with a mixture of concrete, granulated ore and steel pellets. This mixture can create explosive gases which will accumulate in the chambers of the counterweight. Before any welding, flame-cutting, grinding or drilling procedures are carried out on the counterweight it is vital to expel these gases from the counterweight chambers. Failure to properly expel the gases from the counterweight chambers can result in an explosion with serious personal injury or death. Follow the instructions given in PARTS & SERVICE NEWS No. AH04518 for expelling the gases from the counterweight chambers.

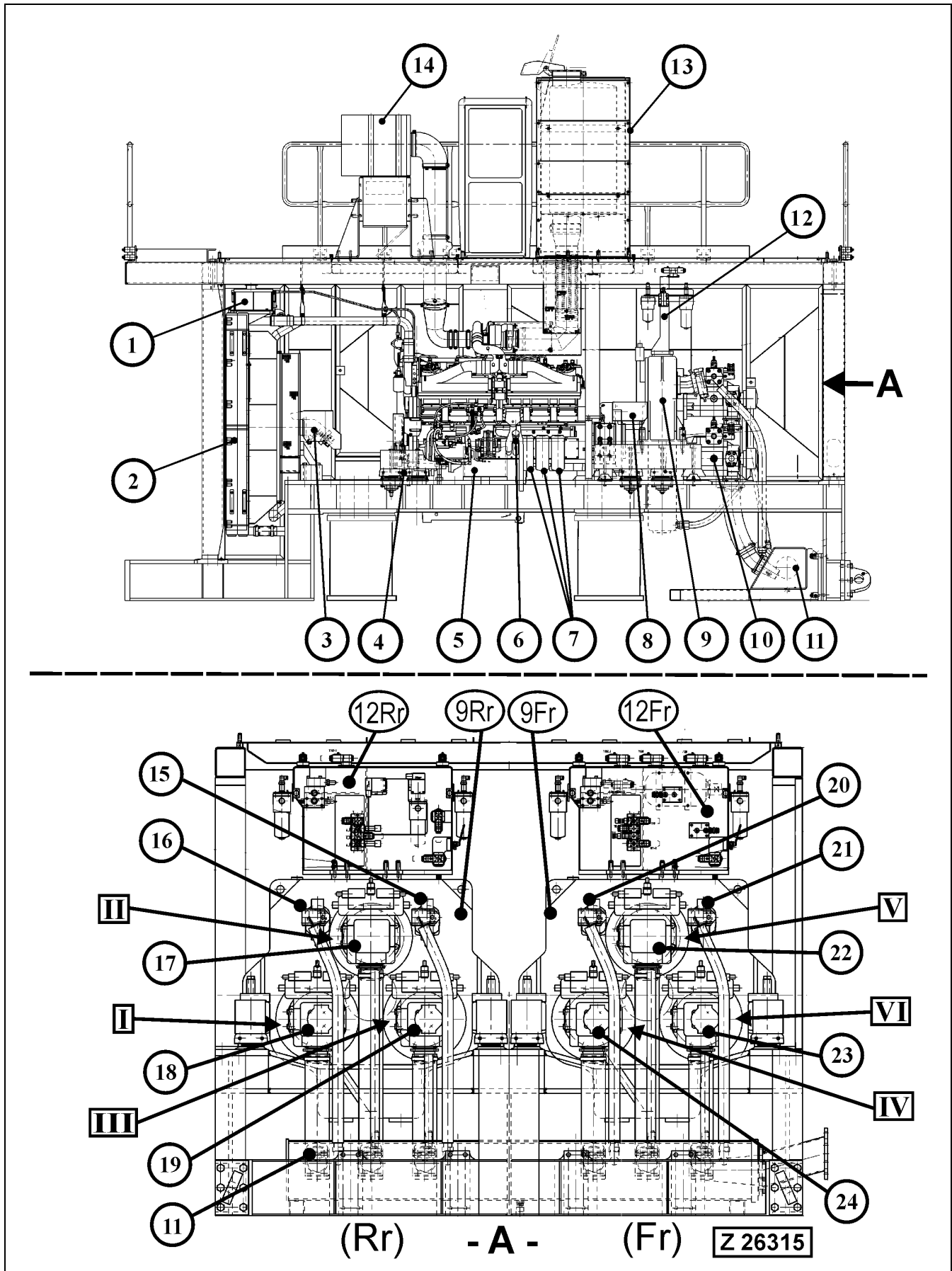
SUPERSTRUCTURE - TOP VIEW



Legend for illustration Z21711

- (1) Hydraulically operated access ladder, see page 46 for more information
- (2) Lower deck
- (3) Coolant radiator for front engine number 2
- (4) Hydraulic motor for radiator fan drive
- (5) Front Diesel engine, designated as engine number 2
- (6) Flexible coupling
- (7) Front PTO (pump distributor gear)
- (8) Main hydraulic pumps
- (9) Coolant radiator for rear engine number 1
- (10) Hydraulic motor for radiator fan drive
- (11) Rear Diesel engine, designated as engine number 1
- (12) Flexible coupling
- (13) Rear PTO (pump distributor gear)
- (14) Main hydraulic pumps
- (15) Control valves with high pressure in-line filters
- (16) Swing gear
- (17) Main hydraulic oil tank
- (18) Hydraulic oil coolers
- (19) Upper deck
- (20) Air conditioner unit for Operator's cab
- (21) Operator's seat, see page 63 for more information
- (22) Co-driver's seat, see page 64 for more information
- (23) Instrument panel, see page 79 for more information
- (24) Hand wash sink, see page 61 for more information

MACHINERY HOUSE



Legend for illustration Z26315**REMARK**

The upper part of the illustration shows the rear power unit, viewed from counterweight side.

The lower part, view -A- shows the pump compartment of the Rear power unit (Rr), engine number 1, and the pump compartment of the Front power unit (Fr), engine number 2.

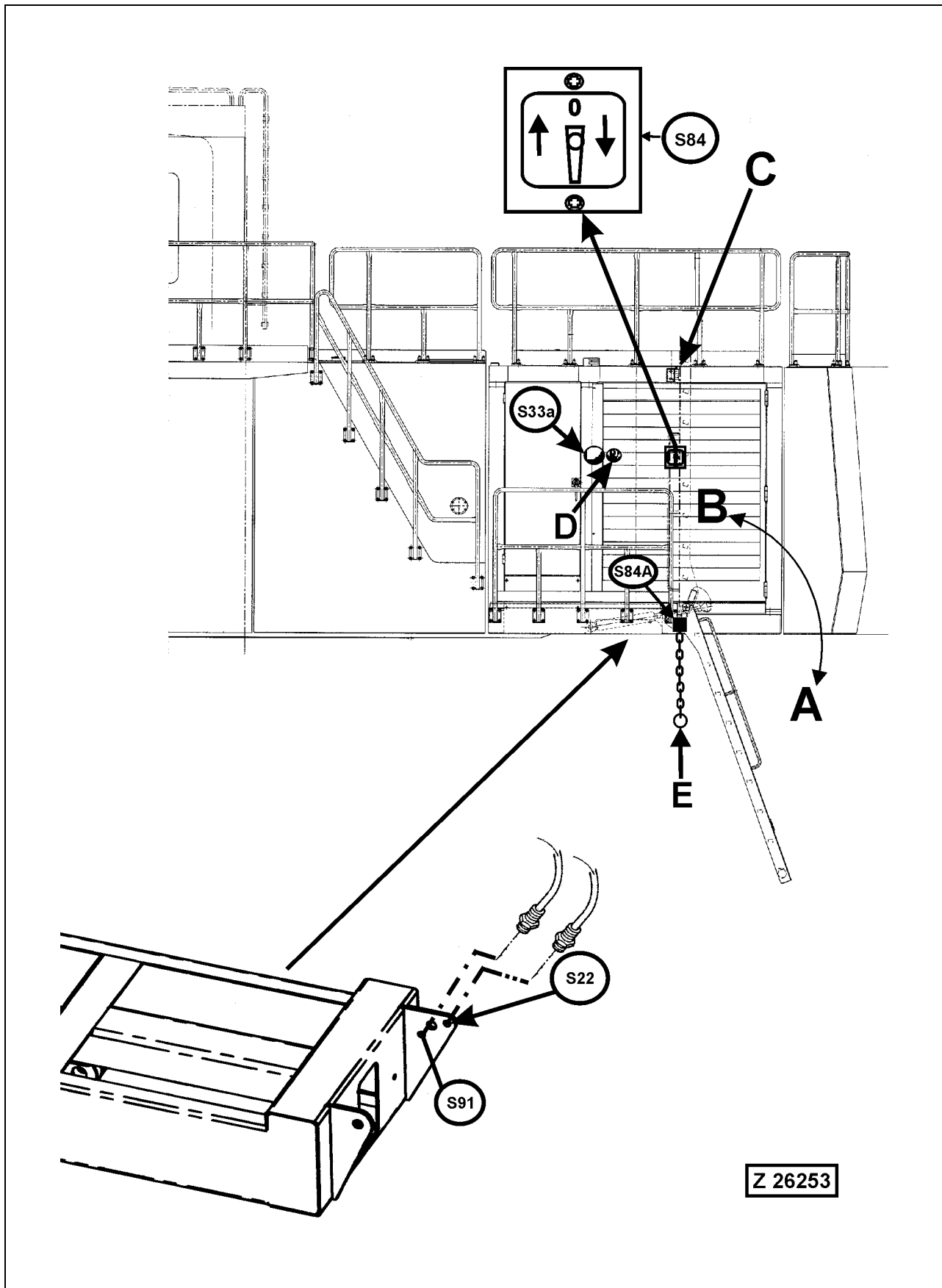
- (1) Expansion tank for radiator
- (2) Coolant radiator
- (3) Hydraulic motor for radiator fan drive
- (4) Engine mounts
- (5) Diesel engine, refer to the separate Operation and Maintenance Manual, filed in volume 2 binder, for all operation and maintenance instructions.
- (6) Engine oil filler tube with oil level gauge
- (7) Second stage fuel filters.

REMARK

The second stage fuel filters of engine 1 and engine 2 are relocated for better accessibility. They are placed in a box mounted at the counterweight. The first stage fuel filters with water separators are also mounted at the counterweight, see section 4 for more information.

- (8) Cover for flexible coupling
- (9) PTO, pump distributor gear
 - (Rr) Rear PTO
 - (Fr) Front PTO
- (10) Main hydraulic pumps (I - VI)
- (11) Suction oil reservoir
- (12) Control and filter panel
 - (Rr) Rear Control and filter panel
 - (Fr) Front Control and filter panel
- (13) Exhaust muffler covering
- (14) Engine air cleaner
- (15) Hydraulic pump for hydraulic oil cooler fan drive
- (16) Hydraulic pump for radiator fan drive of engine 1
- (17) Circulating pump for hydraulic oil cooling circuit
- (18) Pump for PTO gear 1 lubrication
- (19) Pump for pilot pressure circuit
- (20) Hydraulic pump for radiator fan drive of engine 2
- (21) Hydraulic pump for hydraulic oil cooler fan drive
- (22) Circulating pump for hydraulic oil cooling circuit
- (23) Pump for pilot pressure circuit
- (24) Pump for PTO gear 2 lubrication

3.2.3 HYDRAULICALLY OPERATED ACCESS LADDER



Legend for illustration Z26253

- (A) Access ladder in lowered position
- (B) Access ladder in upper position (Working position)
- (C) Stop bar
- (D) Manual actuator for fire suppression system (if so equipped)
- (E) Pull chain for emergency lowering of the access ladder

⚠ CAUTION

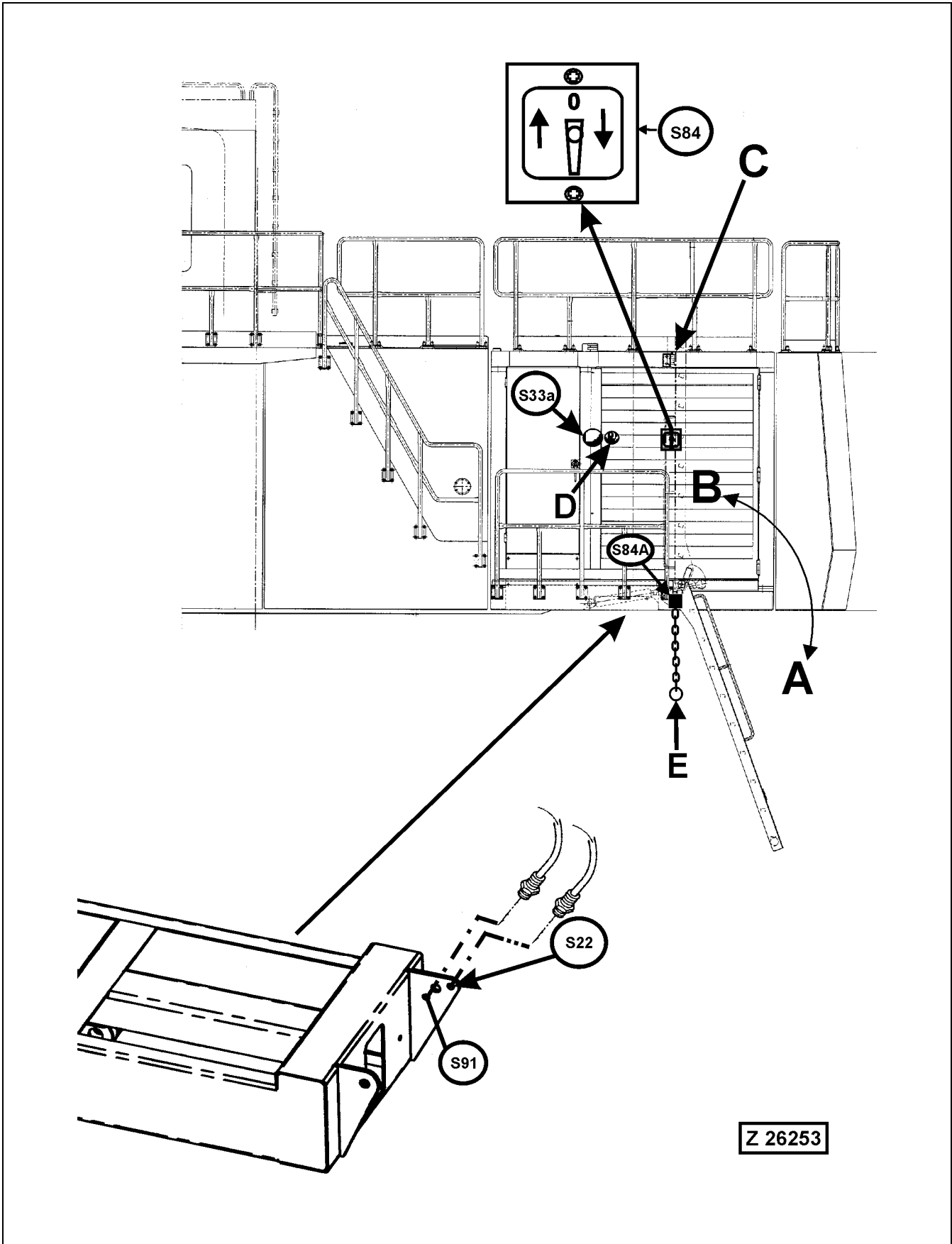
Use this chain only in emergency cases, when the Operator does not respond to other communication signals.

- (S84) Ladder control switch for lifting and lowering the ladder
- (S84A) Safety switch for emergency lowering of the access ladder. When the chain (E) is being pulled down with the engine running, the pilot control system is made inoperative, preventing further movements of the Shovel.
- (S22) Safety sensor, located on ladder pivot bracket
Function of sensor (S22): Cut out of the pilot control system and actuation of the hydraulic swing brake with the ladder in lowered position.
- (S91) Monitor and control sensor
Function of sensor (S91):
This sensor monitors the ladder position and controls the moving speed of the ladder. In case the sensor (S22) fails to function properly, the sensor (S91) prevents unintended movement of the ladder.
- (S33A) Emergency shutdown switch for both engines

Operating the hydraulic Access Ladder

⚠ WARNING

- **Make sure the moving range of the ladder is clear of all persons before raising the ladder. If there are any obstacles within the moving range of the ladder, stop raising the ladder by setting the control switch (S84) to 0 position.**
 - **Mount the ladder only in completely lowered position. Entering the ladder in any other position can result in serious injury or death.**
 - **DO NOT lift persons with the hydraulic access ladder. Death or serious injury can result.**
 - **DO NOT lift objects (tools) with the hydraulic access ladder.**
-



Operating the hydraulic Access Ladder, illust. (Z26253)**Raise the ladder**

Enter the Shovel with ladder in fully lowered position (A).

Start the engine.

For starting procedure → See "STARTING THE ENGINES" on page 174.

Go back to the ladder control switch (S84) at the machinery house.

Raise the ladder by turning switch (S84) to the left (arrow up) and hold until the ladder contacts the stop bar (C) in position (B).

Lowering the ladder

Stop the engine.

For stopping procedure → See "STOPPING THE ENGINES" on page 206.

Lower the ladder by turning switch (S84) to the right (arrow down) and hold until the ladder is completely lowered. If necessary, slightly push the ladder until it starts moving down by its own weight.

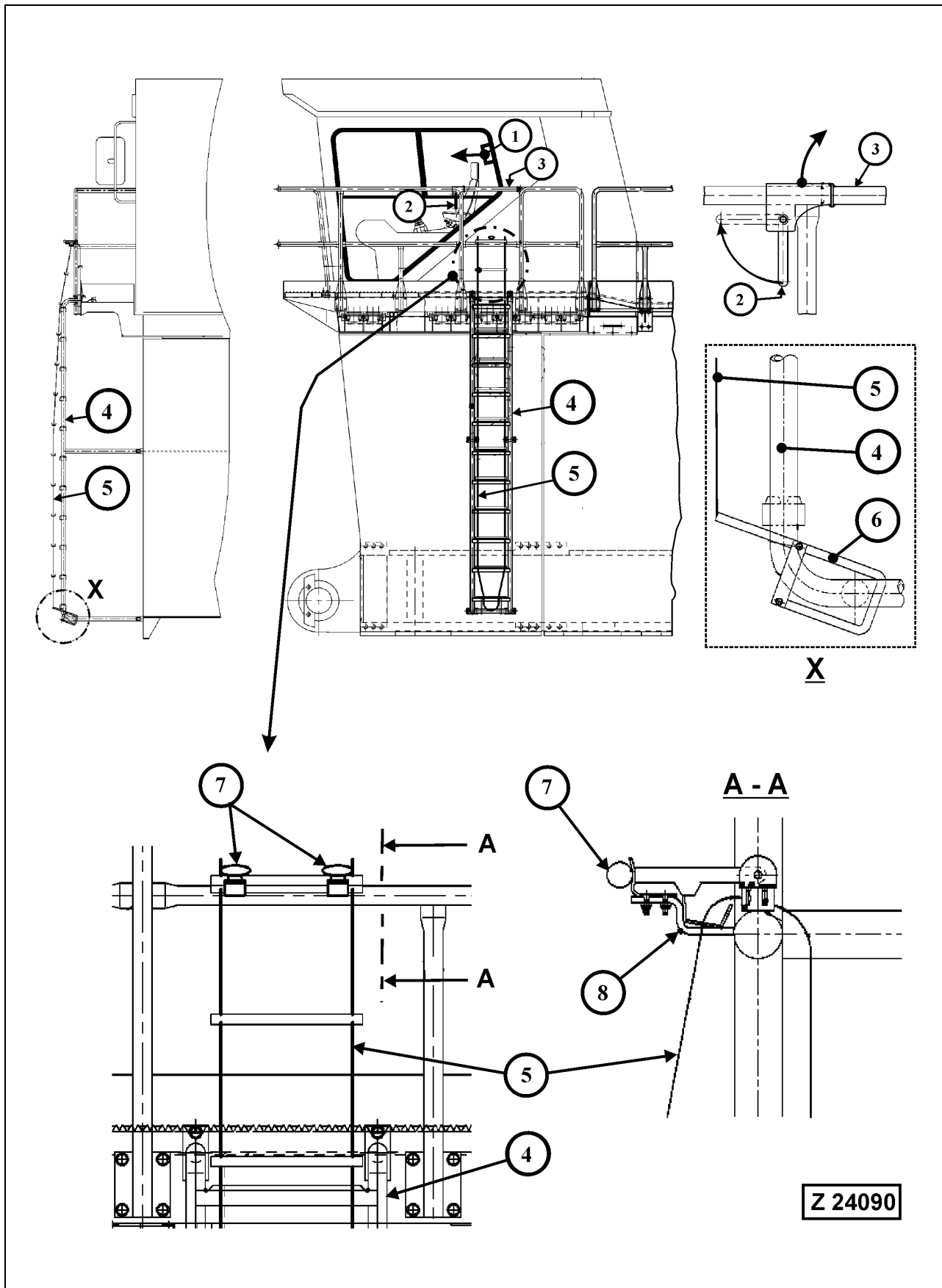
▲ WARNING

- **Make sure the moving range of the ladder is clear of all persons before lowering the ladder.**
 - **Enter the ladder only after the ladder is in fully lowered position (A).**
-
-

NOTICE

Check safety sensor of access ladder for correct function after every 50 operating hours or once a week. Refer to Maintenance Section 4, for checking procedure.

3.2.4 EMERGENCY ESCAPE LADDER



Legend for illust. Z24090

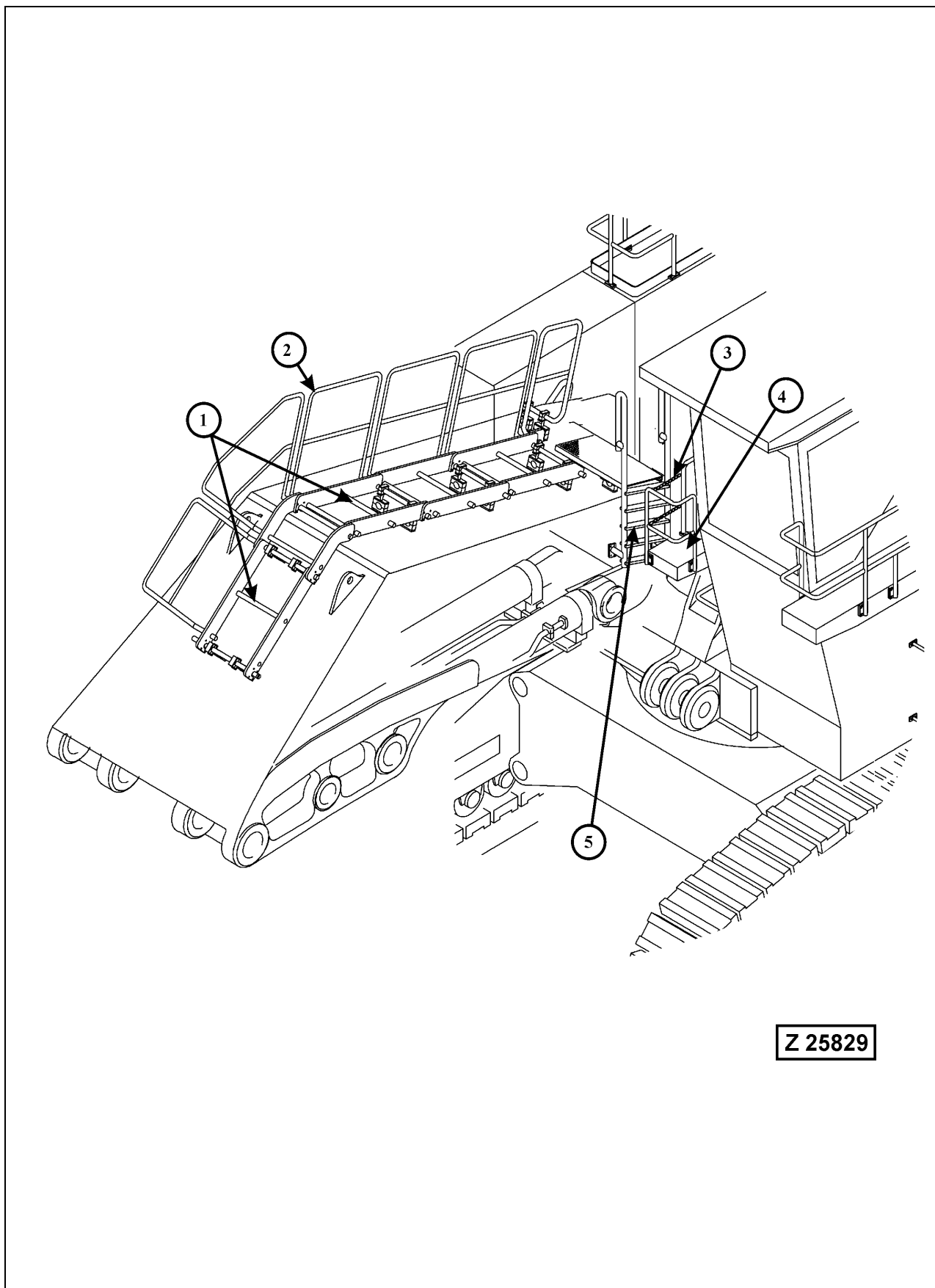
- (1) Sliding window, serves also for emergency exit
- REMARK**
- If the operator's cab is equipped with external metal sun visors, disengage the four catches and push out the sun visor panel.
- (2) Release lever for hinged railing bar (3)
 - (3) Hinged railing bar
 - (4) Rigidly mounted emergency escape ladder. The rigidly mounted emergency escape ladder with rope ladder extension provides the means to go down to the ground.
 - (5) Rope ladder. The upper end of the rope ladder is fixed onto the lower rung of the rigid escape ladder (4) by means of the fasteners (6), see detail (X). The lower end of the rope ladder is fixed on brackets (8) and secured with rubber fasteners (7), see section (A-A).
 - (6) Hooks for fastening the rope ladder onto the rigid ladder (4)
 - (7) Rubber fasteners for rope ladder in lifted position
 - (8) Bracket for rope ladder in lifted position. The lower rung of the rope ladder is hooked up into the brackets (8)

Using the emergency escape ladder

In case of emergency with normal walkways obstructed use escape ladder (4) and (5) for leaving the machine. Proceed as follows:

1. Move up lever (2) and pull out.
2. Open the hinged railing bar (3).
3. Unhook fasteners (7) and take out rope ladder rung from brackets (8).
4. Let the rope ladder fall down to the ground. The upper end of the rope ladder is fixed onto the lower rung of the rigid ladder (4).
5. Use the rigid ladder (4) and then the rope ladder (5) for leaving the shovel.

3.2.5 BOOM ACCESS LADDER AND WALKWAY



Legend for illust. Z25829

- (1) Ladder rungs on boom
- (2) Handrails on boom
- (3) Safety chains on handrail of cabin walkway
- (4) Walkway around operator's cabin
- (5) Boom access ladder

Accessing the boom

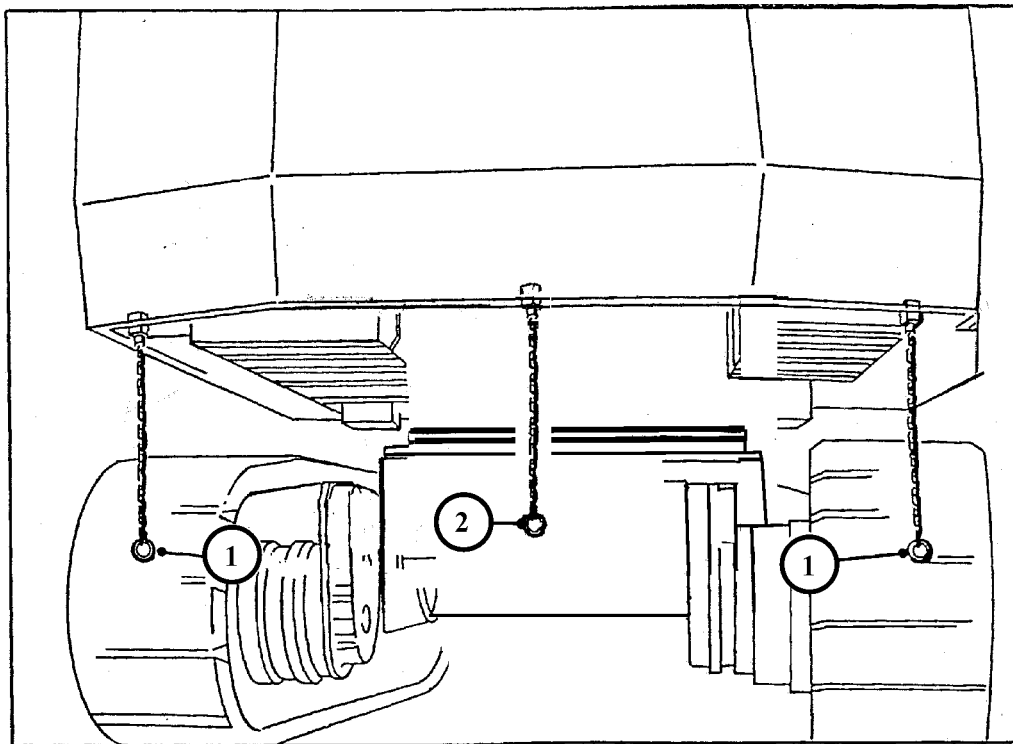
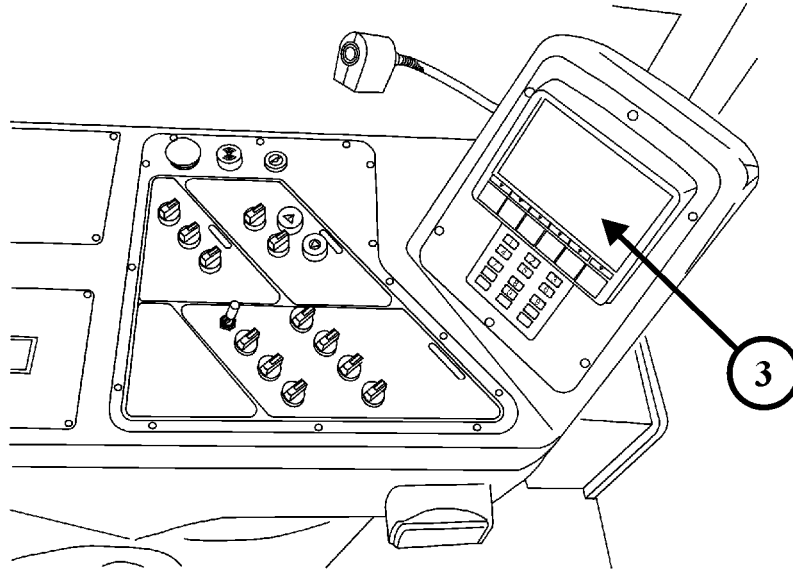
The walkway (4) on the inner side of the cabin leads to the access ladder (5). The safety chains (3) on the handrail of the walkway are to be unhooked in order to gain access to the boom.

 WARNING

When working on the boom, a safety harness and fall absorber are to be worn at all times. See page 15 for further details.

Be sure to attach safety chains (3) after leaving the boom.

3.2.6 EMERGENCY ENGINE SHUTDOWN FROM GROUND MAN OR OPERATOR WARNING SYSTEM



Z 26316

Emergency Engine Shutdown System actuated from Ground Man (Special Equipment)

Legend for illust. Z26316

- (1) Actuating chains for emergency shut down of both engines. To stop the engines, pull down one of the chains (1).
- (2) Actuating chain for hydraulically operated service arm.
- (3) VHMS display on the instrument panel in the Operator's cab. When one of the chains (1) is being pulled down from ground man, both engines will be stopped and the following message will be displayed on the VHMS monitor (3):
Engine shut down has been actuated from ground man.

CAUTION

Never stop the engines from a full load except in case of emergency.

If a hot engine is shut down without previous idling period of three to five minutes, the temperature in certain engine parts rising sharply after the cooling system ceases to function. The resulting thermal stress, especially in the turbochargers, may cause serious damage.

Operator Warning System (Special Equipment)

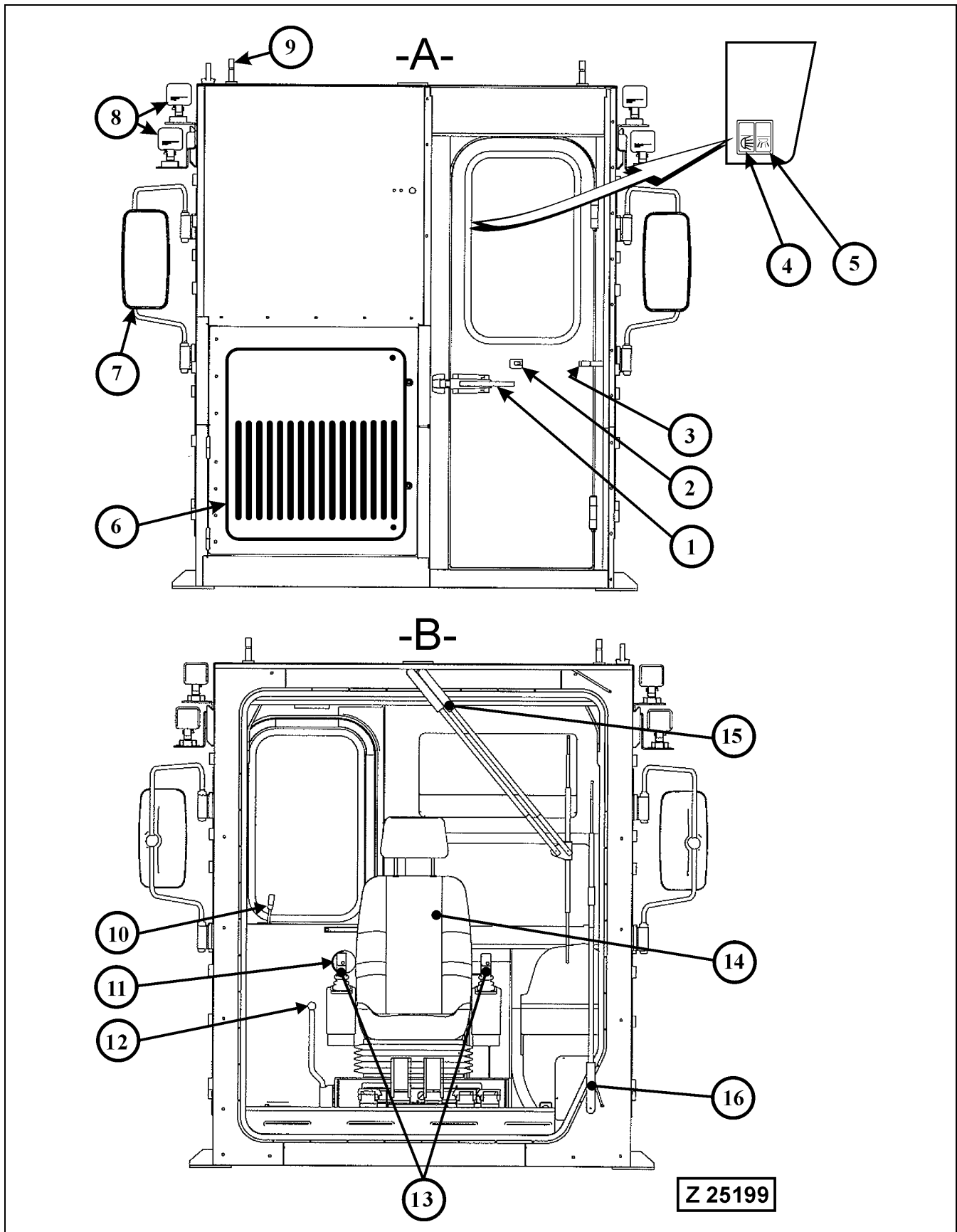
This system is used to inform the Operator that someone wants to enter the Shovel or to draw the Operator's attention to special circumstances requiring his action.

Legend for illust. (Z26316):

- (1) Actuating chains for pull switches of the Operator warning system
- (2) Actuating chain for hydraulically operated service arm.
- (3) VHMS display on the instrument panel in the Operator's cab. When one of the chains (1) is being pulled down the following message will be displayed on the VHMS monitor (3):
Warning: Pull switch from ground man actuated.

As soon as a chain (1) is being pulled down, the above message will be displayed informing the Operator that someone wants his attention. In such a case, the Operator should stop work until he has received the ground man's request.

3.2.7 OPERATOR'S CAB WITH INTEGRATED FALLING OBJECT PROTECTIVE STRUCTURE (FOPS)



Legend for illust. Z 25199**NOTICE**

The Operator's cab is equipped with an integrated Falling Object Protective Structure (FOPS) that meets the requirements of ISO 3449. Any modifications on the steel structure of the cab are inadmissible. Repairs on the FOPS must only be carried out by specialists having the authorization for repair work on Falling Object Protective Structures and in accordance with the manufacturer's repair instructions.

A Rear View of Operator's Cab

- (1) Door handle
- (2) Door latch (with door fully opened)
- (3) Door locking pin, engages into latch (2) when the cab door is fully opened.
- (4) Light switch for access area lighting
- (5) Light switch for interior cab lighting
- (6) Air conditioner door
- (7) Outside Mirrors with integrated heaters, both mirrors are adjusted electrically via a control switch on the instrument panel. Refer to page 79 for more information.
- (8) Main Working Lights
- (9) Adapter for Warning Beacon

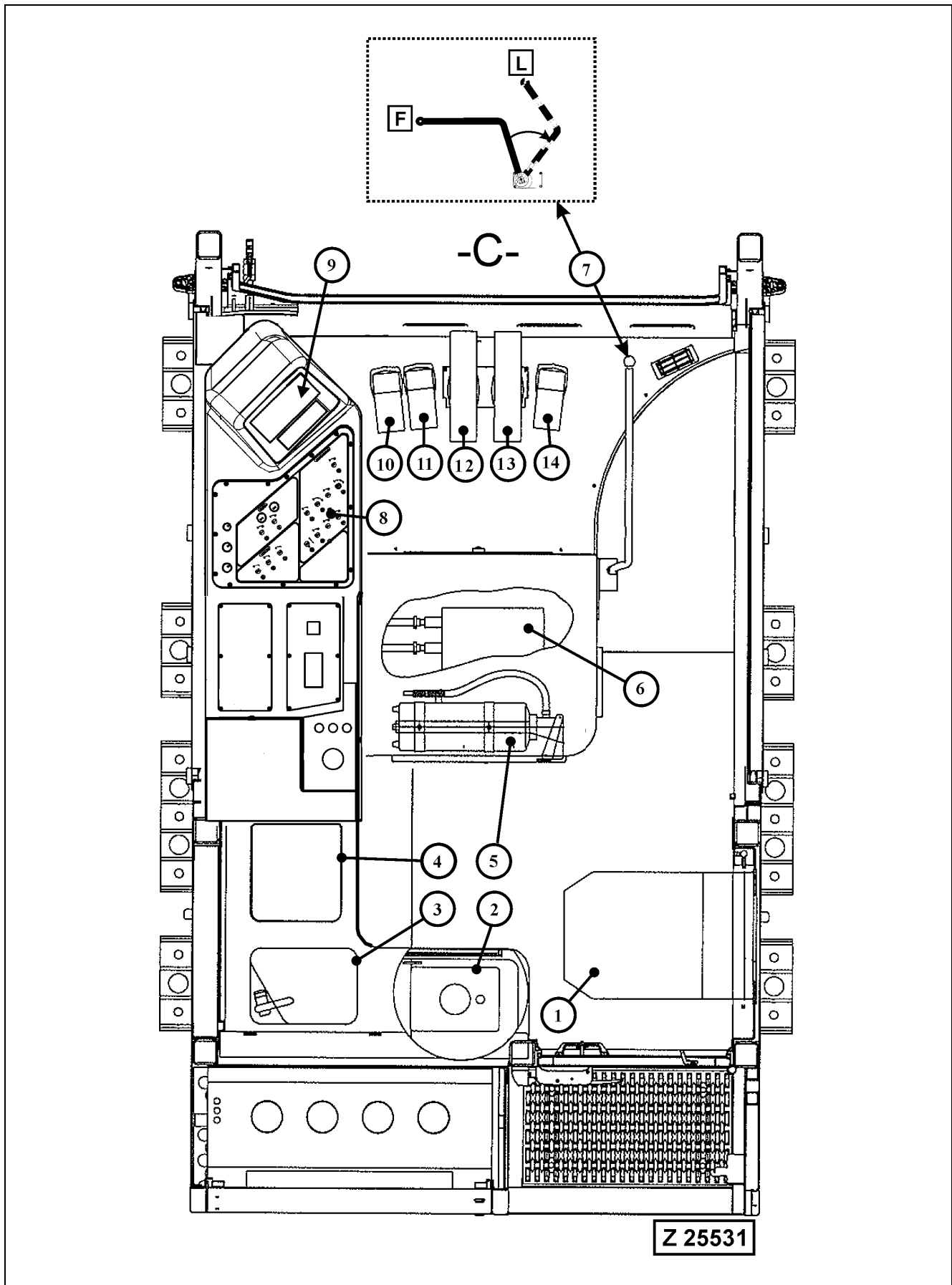
B Front View of Operator's Cab

- (10) Release lever for door lock (2 - 3)
- (11) Door opener push button
- (12) Lock lever, see page 59 for more information
- (13) Control levers for working attachment, see page 70 for more information.
- (14) Operator's Seat, refer to page page 63 for more information.
- (15) Upper windshield wiper
- (16) Lower windshield wiper

CAUTION

Make sure the cab door is always closed when working with the Shovel.

Lock the door in open position by engaging latch (2) into locking pin (3).



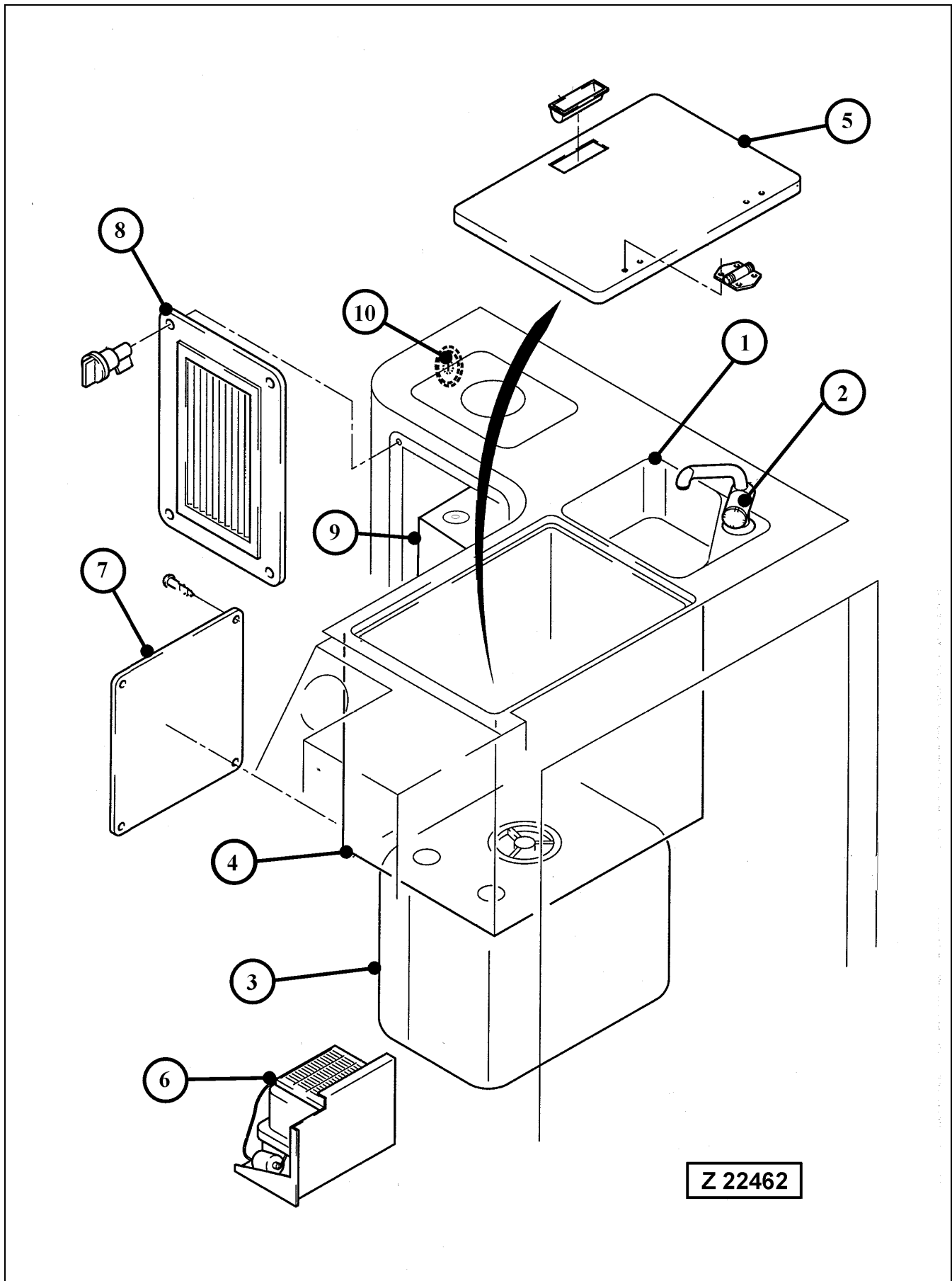
Legend for illustration Z25531**C Top View of Operator's Cab**

- (1) Co-driver's seat, refer to page 64 for more information
- (2) Windshield washer reservoir, refer to page 61 for more information.
- (3) Washbasin with water tap
- (4) Refrigerator box
- (5) Portable fire extinguisher located behind the Operator's seat. Make sure the fire extinguisher is always charged and ready for use.
- (6) Heater unit located in the seat base
- (7) Lock lever.
 - This lever locks the controls for working equipment, swing and travel drive when placed in the fully rear position (L).
 - Start the engine with lock lever in LOCKED position (L). Thereafter set the lock lever to free position (F) in order to enable operation of the hydraulic control system.

▲ WARNING

Before leaving the operator's cab set the lock lever to LOCK position (L). If the controls are not locked, and they are touched inadvertently, this may lead to a serious accident.

- (8) Instrument panel, see page 81 for more information.
- (9) Monitor of the **Vehicle Health Monitoring System -VHMS-**, see page 90 for more information.
- (10) Pedal for closing the bottom dump bucket (Face shovel only)
- (11) Pedal for opening the bottom dump bucket (Face shovel only)
- (12) Travel control pedal, left track forward - reverse
- (13) Travel control pedal, right track forward - reverse
- (14) Swing brake pedal



Operator's Cab - Hand Wash Sink and Refrigerator Box

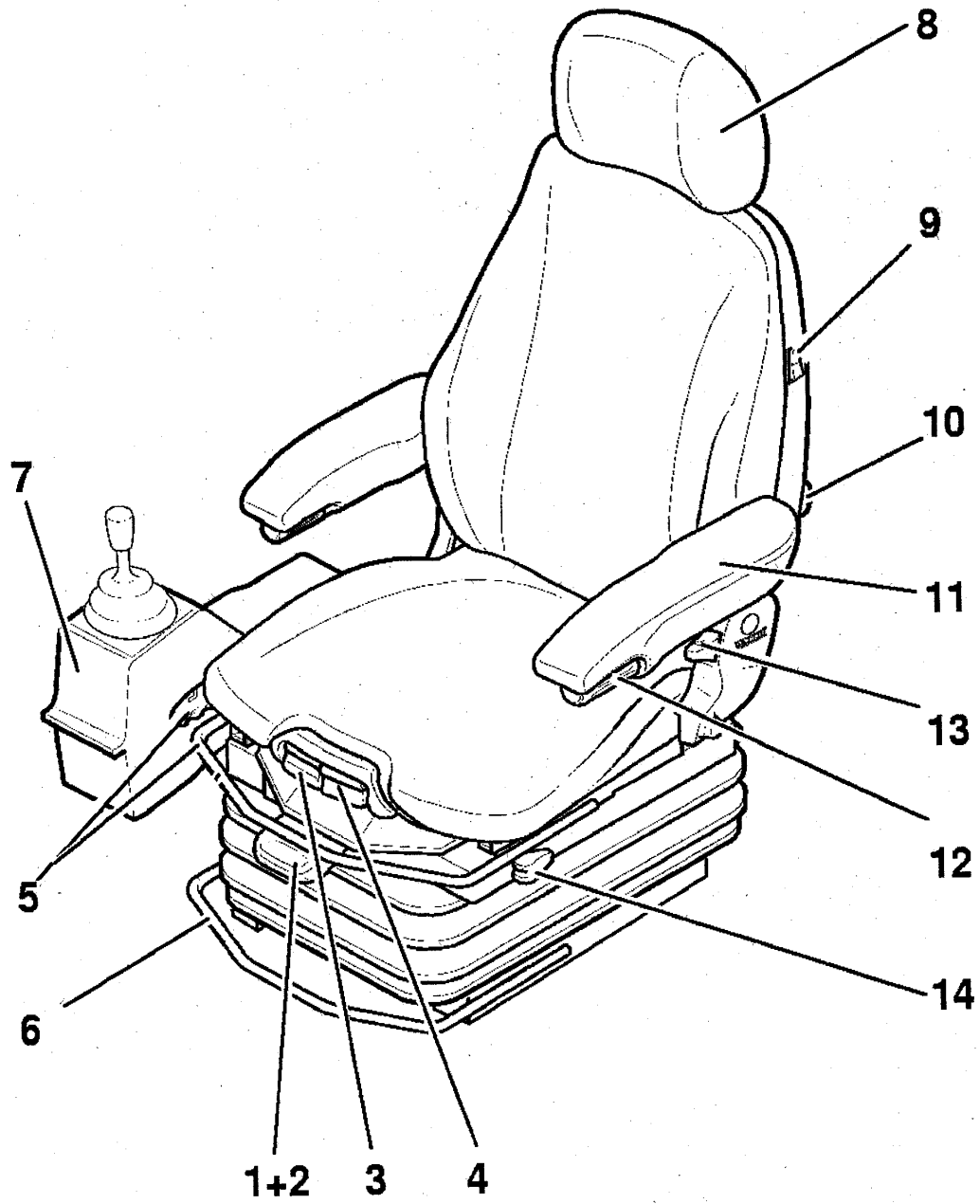
Legend for illust. Z 21589

- (1) Hand wash sink
- (2) Water-tap

 **WARNING**

**No drinking water.
Use for hand washing only**

- (3) Water tank for hand wash sink. The capacity of the water tank is 50 liters. The tank can be filled through the filler opening (10) or via the adapter on the service arm. Refer to page 230 for more information.
- (4) Refrigerator box
- (5) Refrigerator box cover
- (6) Refrigerator unit
- (7) Access cover for water tank (3) and refrigerator unit (6)
- (8) Access cover for windshield washer reservoir
- (9) Windshield washer reservoir. The water reservoir is accessible after removing the cover (8). The reservoir has a capacity of 7 liters.
- (10) Filler cap lockable. To fill the water tank (3) unlock cap (10) using the key provided and remove. Be sure to lock the cap after filling the water tank.



Z 21420

Operator's Seat Adjustment

Before operating the Shovel adjust the seat and mirrors for Operators maximum comfort, visibility, and complete control of the Shovel.

Legend for illust. (Z 21420):

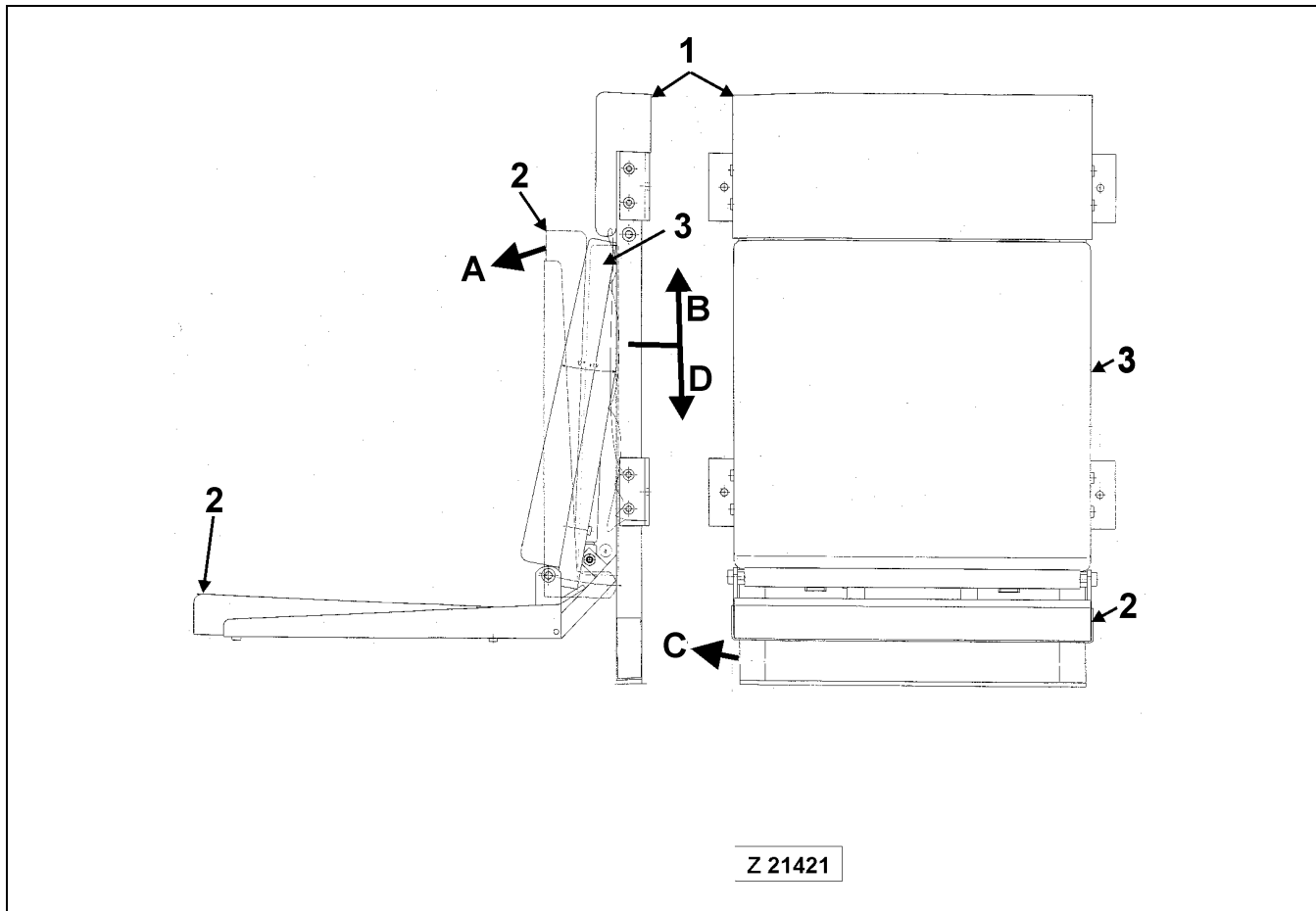
- (1) Seat suspension adjustment (firm to soft ride)
 - (2) Height adjustment
 - (3) Seat depth adjustment
 - (4) Seat cushion tilt adjustment
 - (5) Fore/aft adjustment
 - (6) Not used on this model
 - (7) Control lever carrier
 - (8) Headrest (optional)
 - (9) Seat heater switch (optional)
 - (10) Lumbar support adjustment
 - (11) Armrest, foldable
 - (12) Armrest adjustment
 - (13) Backrest adjustment
 - (14) Fore/aft isolator
- Seat belt (not shown)

⚠ WARNING

- **Use seat belt in accordance with the local safety regulations and laws.**
 - **Check condition and fastening of the seat belt. Replace any worn or damaged part of the seat belt system.**
 - **To ensure proper functioning of the seat belt replace the seat belt and securing parts after every three years.**
-
-

For more Information, refer to the separate Operating Instruction Manual "AIR SUSPENSION SEAT" in volume 2 binder.

Co-driver's Seat



Legend for illust. Z 21421

- (1) Seat suspension frame (3) Back rest
 (2) Folding seat

Adjust Seat Position

A - Fold down seat to sitting position. The seat will automatically move up when released.

B - To swing the seat out, towards the front, first lift seat suspension frame (1) and then swing seat to the front; facing the wind-shield.

C - Swing seat to stop position.

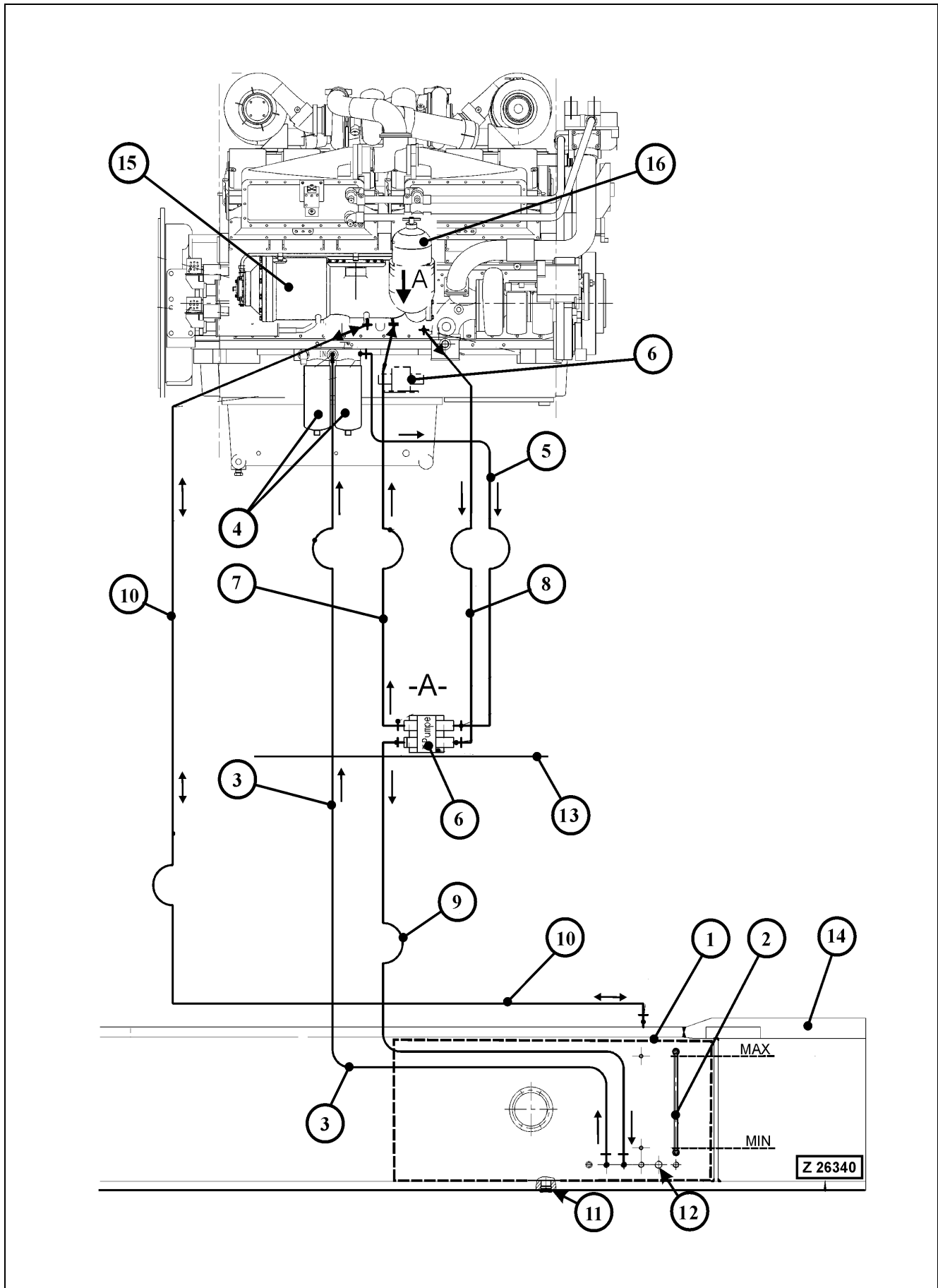
D - With the seat in its final stop position lower seat suspension frame (1). The seat suspension frame (1) must engage into stop blocks mounted in the seat carrier.

REMARK

Be sure to secure the seat in its home position and swung out position by lowering suspension frame (1) into the stop blocks of the seat carrier.

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3.2.8 ENGINE OIL MANAGEMENT SYSTEM



Engine Oil Management System

The engine oil management system of each engine combines the automatic engine oil supply system **Reserve** and the oil burning system **Centinel** in connection with the **Eliminator** oil filtration system.

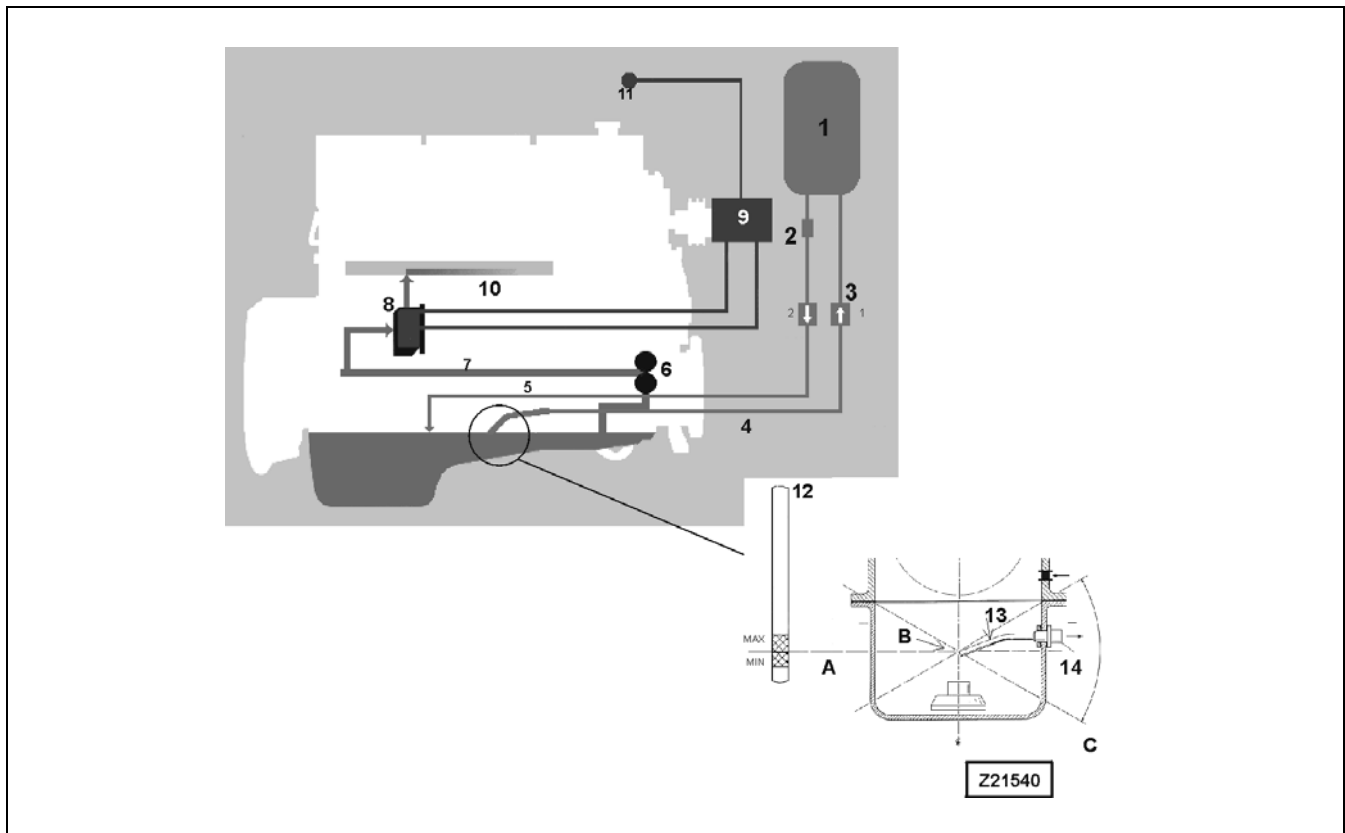
REMARK

On machines destined for Australia, the **Centinel** system is made inoperative for legal reasons. The oil change intervals are reduced accordingly, see maintenance section for more information.

Reserve System Oil Flow Schematic, illust. Z26340. Front engine -2- shown. Rear engine -1- is connected to the reserve tank in the LH side member of the main frame

- (1) Reserve oil tank. The reserve oil tank for the rear engine -1- is an integrated part of the LH main frame side member. The reserve oil tank for the front engine -2- is an integrated part of the RH main frame side member.
- (2) Oil level sight gauge
- (3) Suction line from reserve tank
- (4) Oil filters for the engine oil reserve system
- (5) Suction line to pumping unit
- (6) Pumping unit, located at the power frame just below the eliminator filter (15). The pump unit works automatically as soon as the engine speed is above 300 RPM. The pump unit consists of a pumping element for feeding oil from tank (1) into the engine oil pan. The second pumping element withdraws oil from the engine oil pan and feeds it back into the reserve tank when the oil level in the oil pan exceeds the maximum running oil level. This function maintains a favorable engine oil level. The combined operation of the pumping elements provides constant circulation of oil between the engine sump and reserve tank (1) increasing the total volume of working oil. This maintains the oil quality over longer periods. Oil drawn off by the Centinel burn system is also replaced through the supply system Reserve.
- (7) Supply line from pumping unit to crankcase
- (8) Withdrawal oil line from engine oil pan to pump
- (9) Oil feed-back line to reserve tank
- (10) Ventilation line for reserve tank
- (11) Drain plug
- (12) Connector for refilling line from swing down service arm
- (13) Power frame
- (14) RH side member of main frame
- (15) Eliminator filter
- (16) Centrifuge

Oil Burning System "Centinel" combined with Oil Supply System "Reserve"



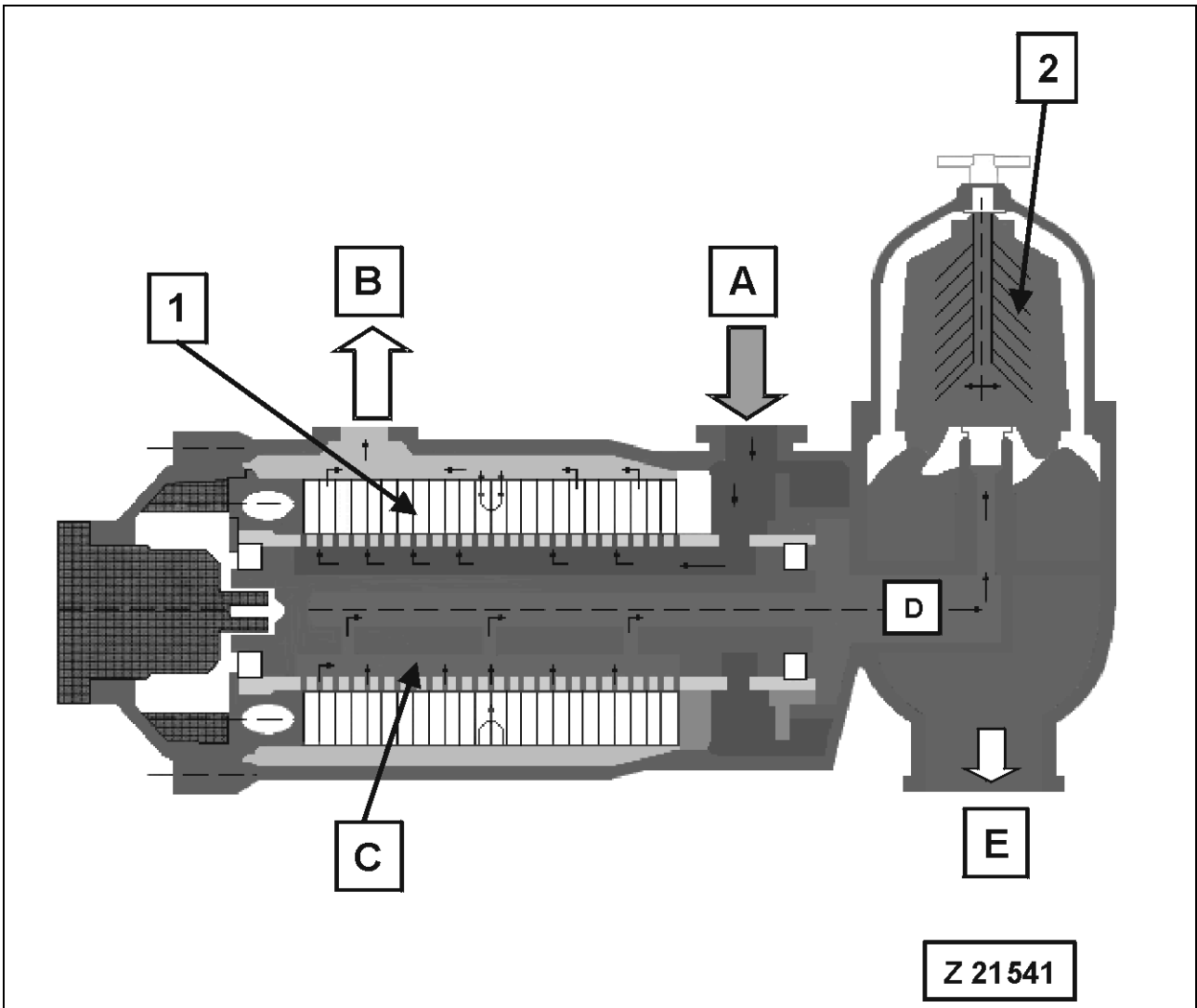
Legend for illust. Z 21473 (schematic illustration)

- | | |
|-------------------------------------|--|
| (1) Engine oil reserve tank | (10) Fuel/lube oil blend return to fuel tank |
| (2) Oil filters | (11) System function indicator LED's |
| (3) Pump unit | (12) Oil level gauge |
| (4) Suction oil to reserve tank | (13) Oil withdrawal tube |
| (5) Supply oil from tank to oil pan | (14) Withdrawal adapter plate |
| (6) Engine oil pump | (A) Oil level with engine running |
| (7) Main oil rifle | (B) Control point for filling / withdrawal |
| (8) Oil control valve | (C) Roll or tilt oil level |
| (9) Centinel Control Module (CCM) | |

Brief description of system function

The combined "Centinel - Reserve" system is a continuous oil replacement system of electromechanical design and can extend oil change intervals through continuous oil exchange. This is accomplished by injecting engine oil at a controlled rate, proportional to fuel consumed, into the fuel system for consumption. Make-up oil is introduced into the engine by the oil supply system "Reserve", maintaining an optimal engine oil level.

Eliminator Engine Oil Filtration System

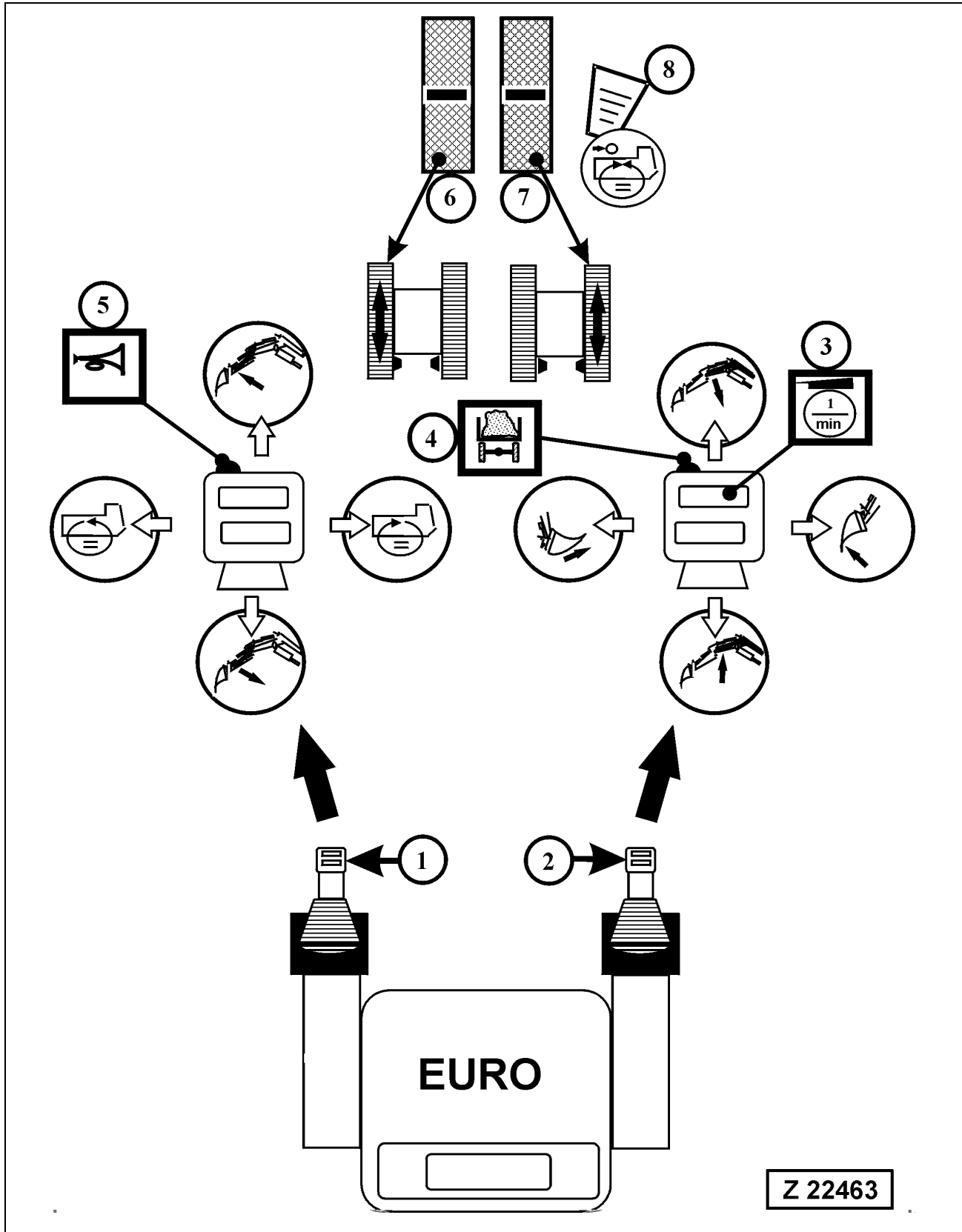


Legend for illust. Z 21541 (schematic illustration)

- | | | | |
|-----|--|-----|---|
| (A) | Oil inlet from engine (100%) | (E) | Oil flow to engine oil pan (5%) |
| (B) | Oil outlet to engine (95%) | (1) | Stainless steel filter removes particles as small as 20 μm |
| (C) | Backflush oil (5%) for cleaning the filter | (2) | Centrifugal separator removes particles up to a size of 2 μm |
| (D) | Oil flow to centrifuge (5%) | | |

3.3 OPERATOR'S CAB - CONTROLS

3.3.1 CONTROLS WITH BACKHOE ATTACHMENT



Z 22463

Hydraulic Control System

There are two control patterns of levers (1 and 2) available:

- "EURO" control pattern and
- "KMG" (Komatsu Mining Germany) control pattern

Your Shovel is equipped with the **EURO** control pattern for levers (1 and 2).

For more information → See "WORKING WITH THE ATTACHMENT" on page 194.

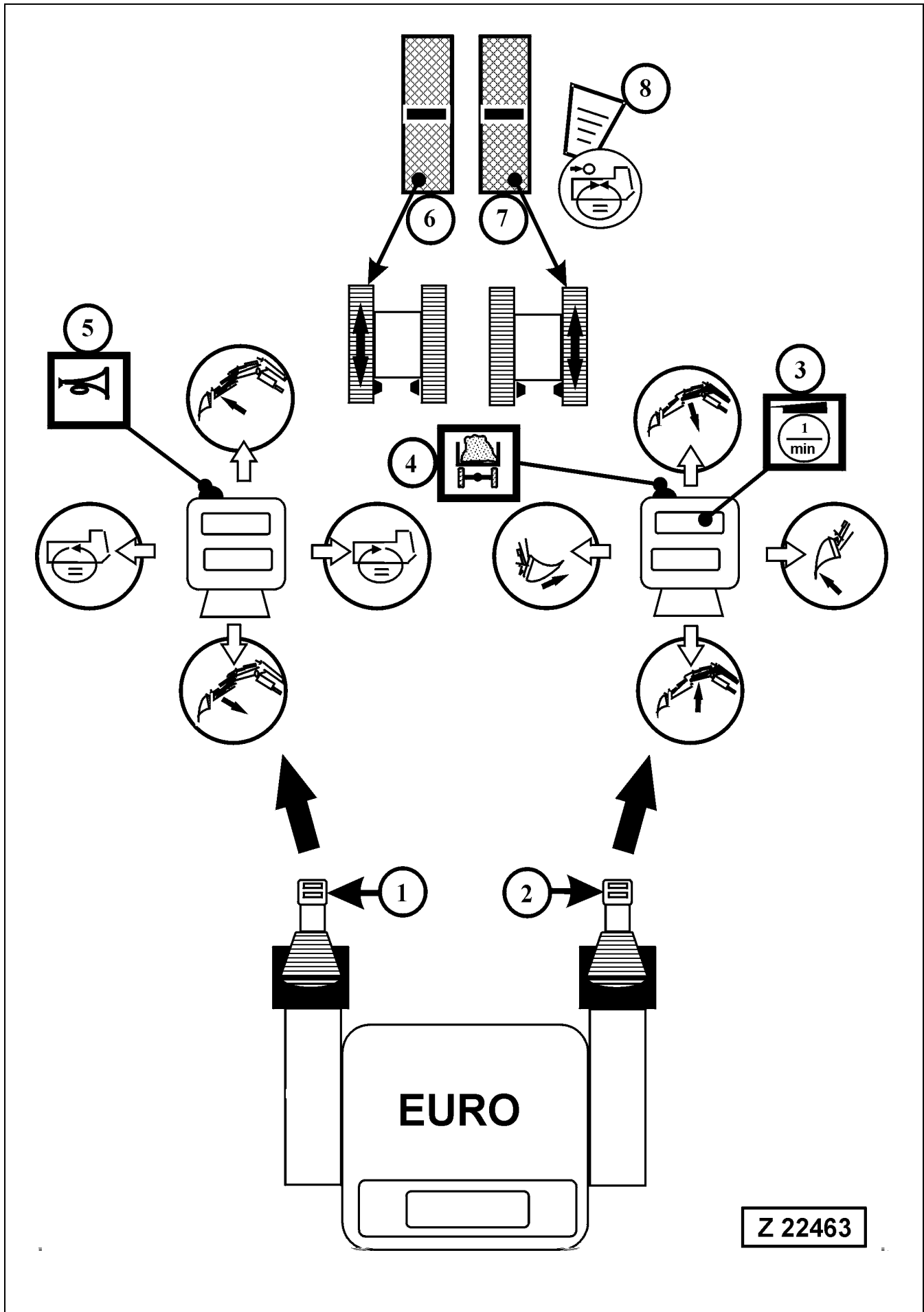
WARNING

- Wrong operation of the controls can cause mechanical break-down, property damage, injury or death.
 - Observe the Safety Instructions → "SAFETY" on page 15.
 - Before starting the engine / motor, make sure you know the location and function of each control.
 - Always sit in the Operator's seat when operating this machine.
-
-

Safety Circuit for Controls

(Pilot control system cut-out and actuation of hydraulic swing parking brake)

This system is controlled through the lock lever at the operator's seat, the retractable access ladder and the service arm of the refilling system. It prevents movements of the Shovel and its attachment as long as the lock lever is in the upper locked position and/or the retractable ladder is in the lowered position or when the service arm of the central refilling system is in its lowered position.



EURO Control Pattern

Legend for illustration (Z 22463)

- (1) Control lever for stick and swing machinery
- (2) Control lever for boom and bucket
- (3) Toggle switch for engine speed selection
Low idle – High idle
- (4) Push button for Truck counter number 1 (TR1)
For counting loaded trucks press this button. The total number of trucks loaded is shown on the VHMS monitor field TR1, refer to page 91 for more information. A second truck counter switch is located on the control panel, refer to page 81 for more information.

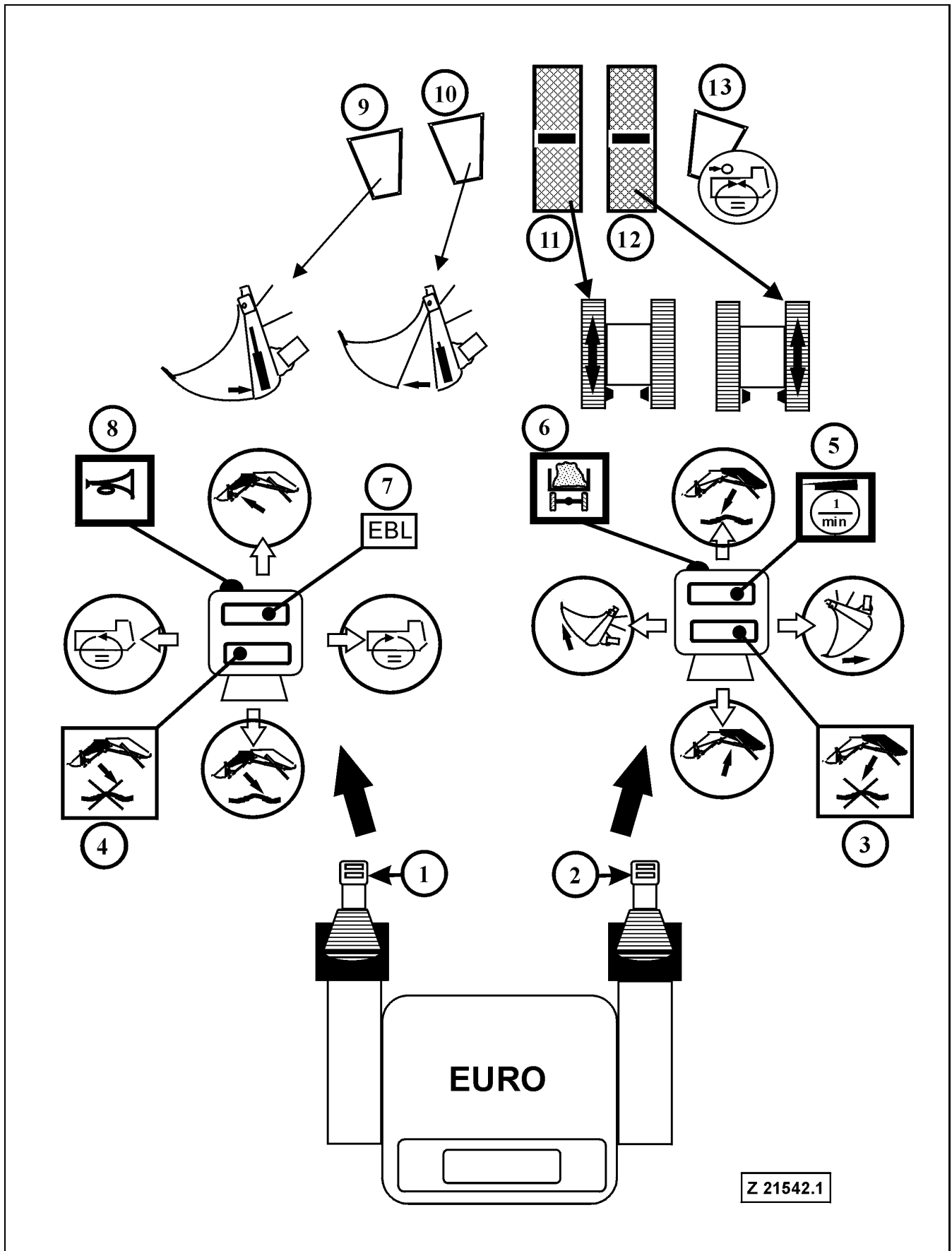
NOTICE

The push button (4) has a second function. When the Vehicle Health Monitoring System is switched to the PM CLINIC group within the SERVICE MENU, selected PM CLINIC data can be frozen by pushing button (4). Frozen data can then be stored in the PM CLINIC MEMORY. For more information refer to the SERVICE MANUAL VHMS-System.

- (5) Signal horn button
- (6) Travel control pedal, left track forward - reverse
- (7) Travel control pedal, right track forward - reverse
- (8) Swing brake pedal

For more information → See "WORKING WITH THE ATTACHMENT" on page 194.

3.3.2 CONTROLS WITH BOTTOM DUMP BUCKET ATTACHMENT



Hydraulic Control System

There are two control patterns of levers (1 and 2) available:

- "EURO" control pattern and
- "KMG" (Komatsu Mining Germany) control pattern

Your Shovel is equipped with the **EURO** control pattern for levers (1 and 2).

For more information → See "WORKING WITH THE ATTACHMENT" on page 194.

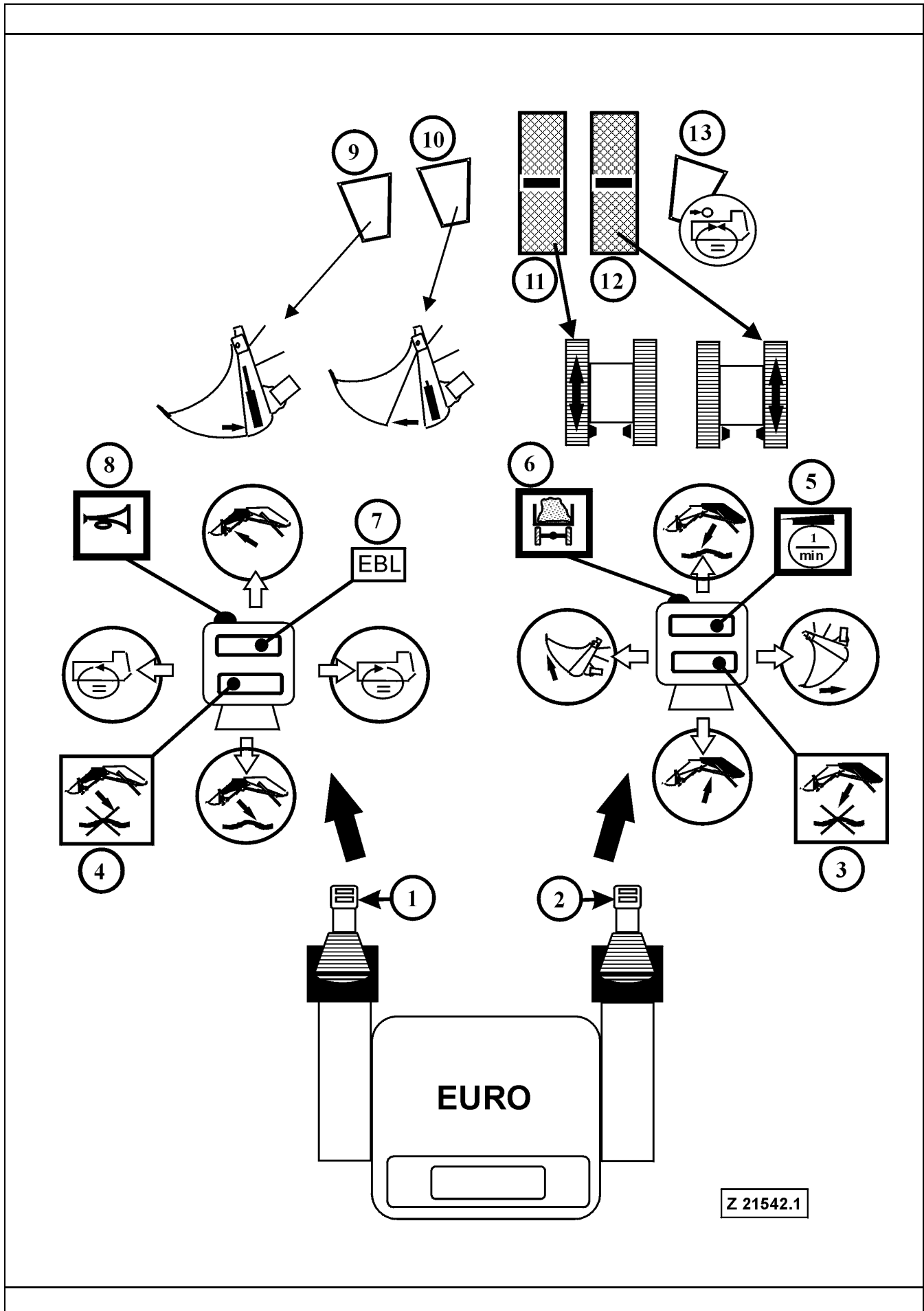
WARNING

- **Wrong operation of the controls can cause mechanical break-down, property damage, injury or death.**
 - **Observe the Safety Instructions → "SAFETY" on page 15.**
 - **Before starting the engine / motor, make sure you know the location and function of each control.**
 - **Always sit in the Operator's seat when operating this machine.**
-
-

Safety Circuit for Controls

(Pilot control system cut-out and actuation of hydraulic swing parking brake)

This system is controlled through the lock lever at the operator's seat, the retractable access ladder and the service arm of the refilling system. It prevents movements of the Shovel and its attachment as long as the lock lever is in the upper locked position and/or the retractable ladder is in the lowered position or when the service arm of the central refilling system is in its lowered position.



EURO Control Pattern

Legend for illustration (Z 21542.1)

- (1) Control lever for stick and swing machinery
- (2) Control lever for boom and bucket
- (3) Push button for deactivation of boom float position
- (4) Push button for deactivation of stick float position
- (5) Toggle switch for engine speed selection
Low idle – High idle
- (6) Push button for Truck counter number 1 (TR1)
For counting loaded trucks press this button. The total number of trucks loaded is shown on the VHMS monitor field TR1, refer to page 93 for more information. A second truck counter switch is located on the control panel, refer to page 81 for more information.

NOTICE

The push button (6) has a second function. When the Vehicle Health Monitoring System is switched to the PM CLINIC group within the SERVICE MENU, selected PM CLINIC data can be frozen by pushing button (6). Frozen data can then be stored in the PM CLINIC MEMORY. For more information refer to the SERVICE MANUAL VHMS-System.

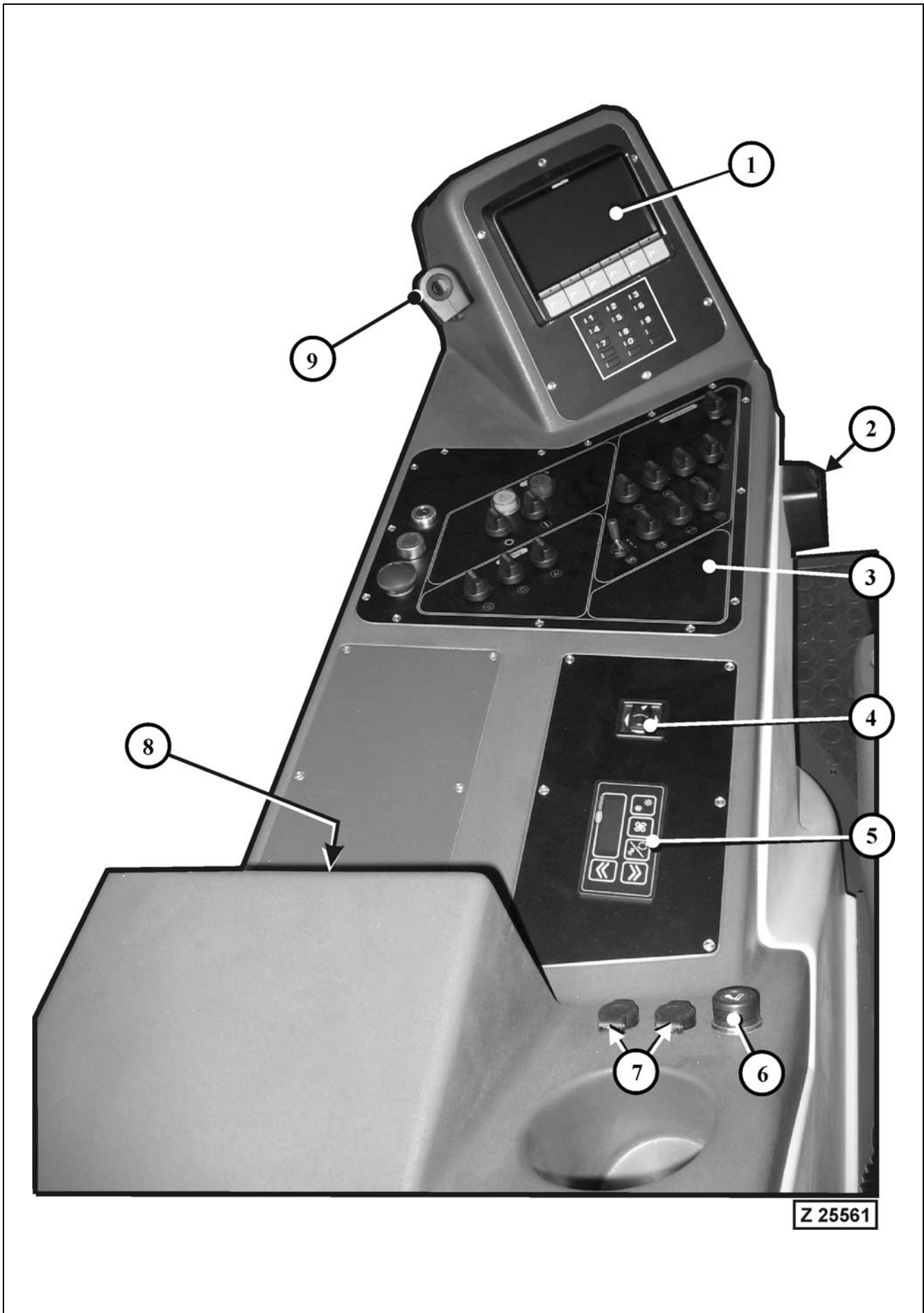
- (7) Toggle switch for the Electronic Bucket Levelling system "EBL" (If so equipped). This system prevents material from spilling over at the rear bucket wall by stopping the Roll Back motion of the bucket automatically in a predetermined position. The "EBL" system is switched ON and OFF with the toggle switch (7). The VHMS text display informs the Operator about the operating condition of the "EBL" system.
- (8) Signal horn button
- (9) Pedal for closing the bottom dump bucket
- (10) Pedal for opening the bottom dump bucket
- (11) Travel control pedal, left track forward - reverse
- (12) Travel control pedal, right track forward - reverse
- (13) Swing brake pedal

Automatic Float Position for Boom and Stick

The Shovel operates automatically with the float position for boom and stick activated.

That means the lowering movement of boom and stick is always done in the float position. To deactivate the float position, press button (3) for boom and/or (4) for stick, and keep depressed as long as the float position shall be deactivated. When releasing the buttons the float position is activated again.

For more information → See "WORKING WITH THE ATTACHMENT" on page 194.



3.3.3 OPERATOR'S CONSOLE

Legend for illustration Z25561

- (1) Monitor of the **Vehicle Health Monitoring System**
>VHMS<

The monitor (1) displays the condition of the machine, the maintenance status, and messages for the operator and service man, and is also used to input the necessary data.

The key pads below the monitor are used to switch the screen and for input of data.

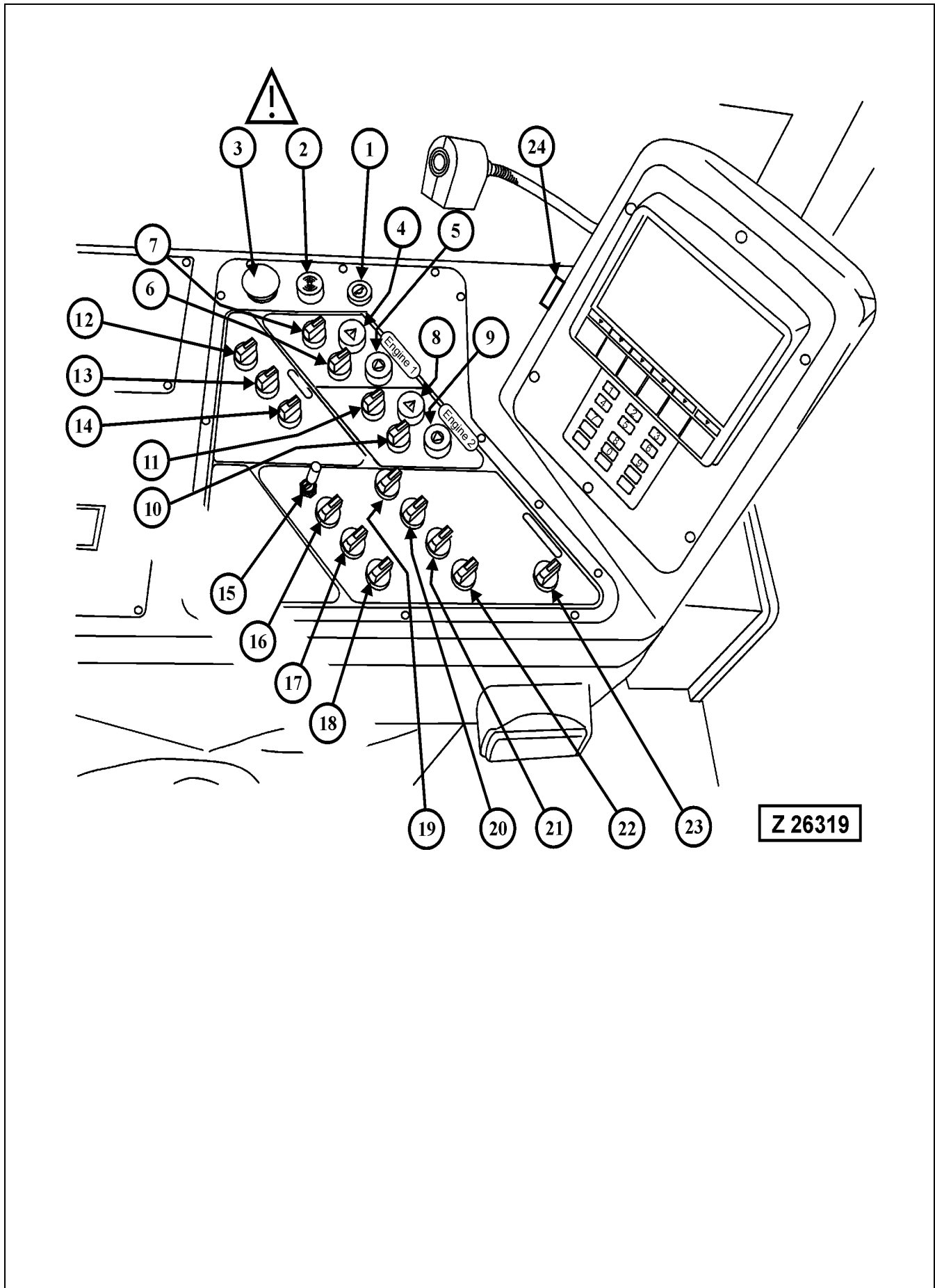
See page 90 for more information

- (2) Ashtray
- (3) Switch board, refer to next page for description of components
- (4) Switch for left and right mirror adjustment
- (5) Control unit for air conditioning and heating, see page 134 for more information
- (6) Cigarette lighter
- (7) Plug sockets, 24V DC
- (8) Radio location
- (9) Switch board lighting with flexible arm

 **CAUTION**

Make sure the cab door is always closed when working with the Shovel.

Secure the door in open position with the locking device provided.



Switch Board

Legend for illustration Z26319

- (1) Key operated main switch

CAUTION

After switching OFF main switch (1), wait at least 3 minutes before switching OFF the battery main switches. VHMS needs this period for saving data. If batteries are switched OFF before this time period is over, data will be lost.

- (2) High level alarm: **Automatic engine shutdown.**
The high level alarm (2) will sound approximately 10 seconds before an automatic engine shutdown occurs and will continue to sound during the 10 second period. At the same time a blinking message *SHUTDOWN* will be displayed on the VHMS monitor.

WARNING

Use the time period to move the machine to a safe place and lower the attachment to the ground. Inform service about the shutdown condition.

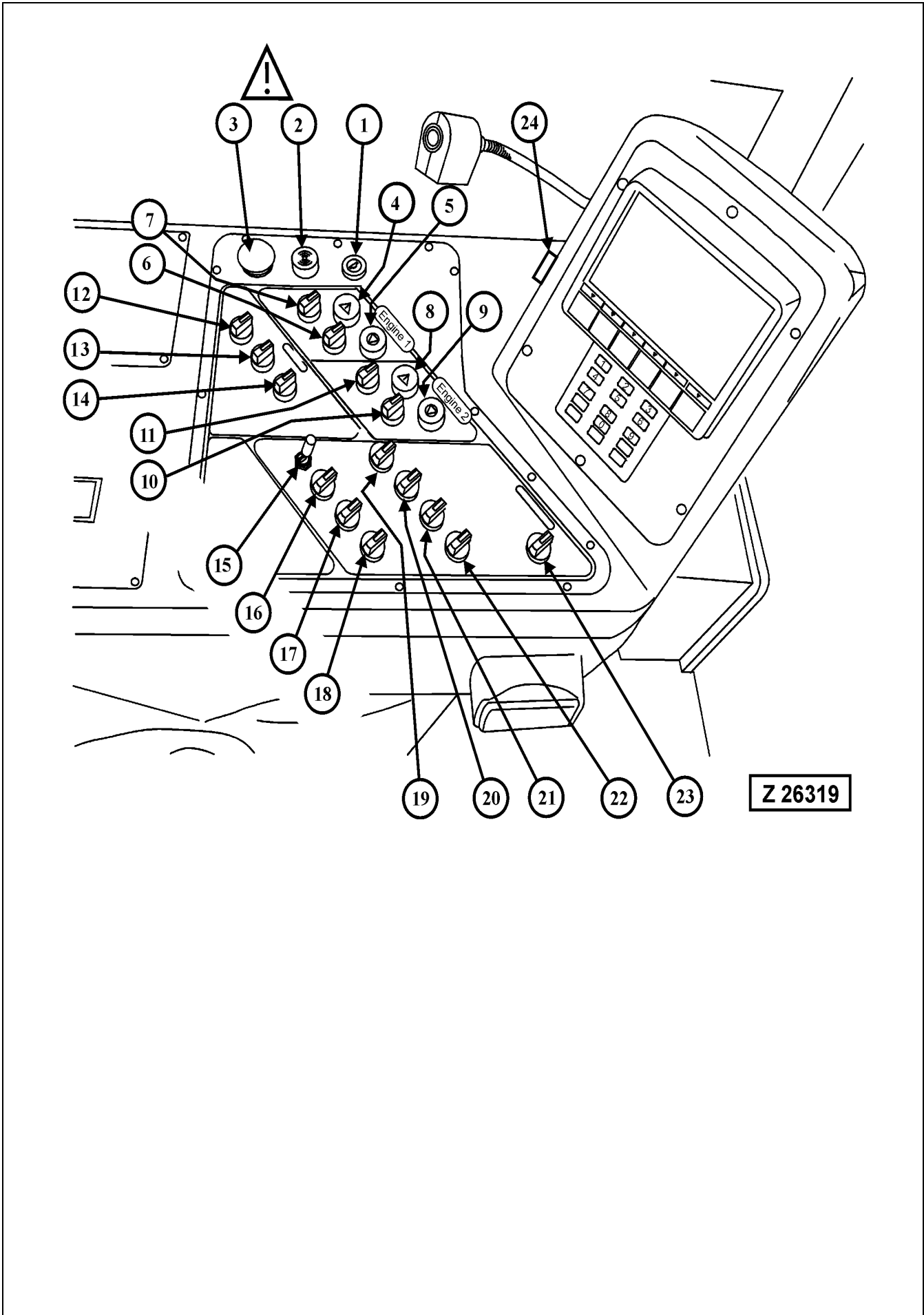
- (3) Strike button, emergency shut down of both engines and pilot control system cut out.

WARNING

In case of emergency push in this button to stop both engines and to cut out the pilot control circuit.
DO NOT use for normal stopping procedure.

For releasing the switch, turn and pull-up the strike button.

- (4) WARNING lamp (Yellow) of rear engine 1. This lamp is used to monitor engine out-of-range condition, in case the VHMS Monitor fails to function. When this lamp illuminates, the engine can still be operated until end of shift, but it can lose some system features which sometimes results in power loss (derate condition). Inform Service about the engine problem.
- (5) STOP lamp (Red) of rear engine 1. This lamp is used to monitor engine out-of-range condition, in case the VHMS Monitor fails to function. When this lamp illuminates, stop the engine operation in a safe manner immediately. The engine monitoring system CENSE or the electronic control module ECM will initiate automatic engine shutdown due to serious engine problem. Inform Service about the engine failure.
- (6) Rotary switch REAR Engine 1 START
- (7) Rotary switch REAR Engine 1 STOP



Switch Board (continued)

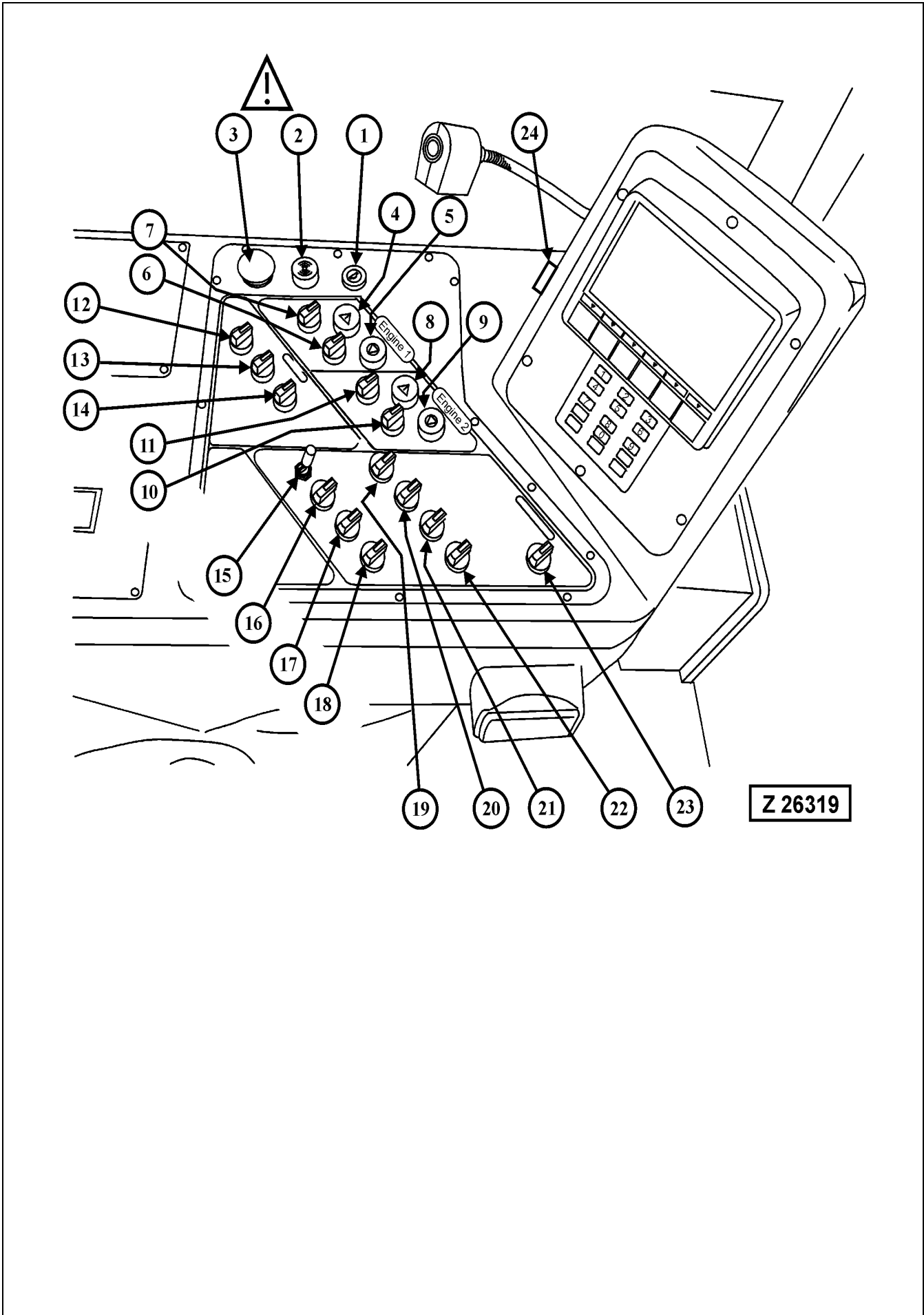
Legend for illustration Z26319

- (8) WARNING lamp (Yellow) of front engine 2. This lamp is used to monitor engine out-of-range condition, in case the VHMS Monitor fails to function. When this lamp illuminates, the engine can still be operated until end of shift, but it can lose some system features which sometimes results in power loss (derate condition). Inform Service about the engine problem.
- (9) STOP lamp (Red) of front engine 2. This lamp is used to monitor engine out-of-range condition, in case the VHMS Monitor fails to function. When this lamp illuminates, stop the engine operation in a safe manner immediately. The engine monitoring system CENSE or the electronic control module ECM will initiate automatic engine shutdown due to serious engine problem. Inform Service about the engine failure.
- (10) Rotary switch FRONT Engine 2 START
- (11) Rotary switch FRONT Engine 2 STOP
- (12) Switch for warning beacon on cab roof
- (13) Switch for interior illumination
- (14) Switch for main working lights
- (15) Toggle switch, swing parking brake
 - 0 - Parking brake released - UP
 - 1 - Parking brake applied - DOWN.

CAUTION

The parking brake should only be applied with superstructure at complete standstill, except in case of emergency. Refer to page 191 for more information.

- (16) Enable switch for hydraulic service arm operation. Set this switch to ON position -1- before lowering the service arm. With this switch in ON position, the pilot control system is made inoperative and the hydraulic swing brake is applied. After completion of replenishment procedure, swing back the service arm to its home position and set switch (16) to OFF position -0-.
- (17) Switch, manual actuation of central lubrication system



Switch Board (continued)

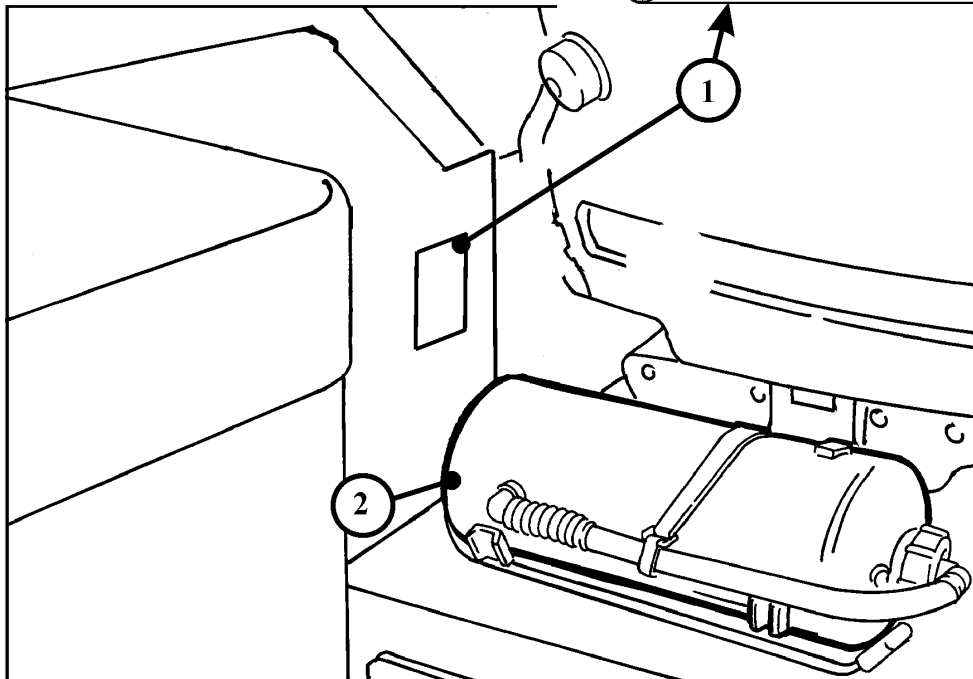
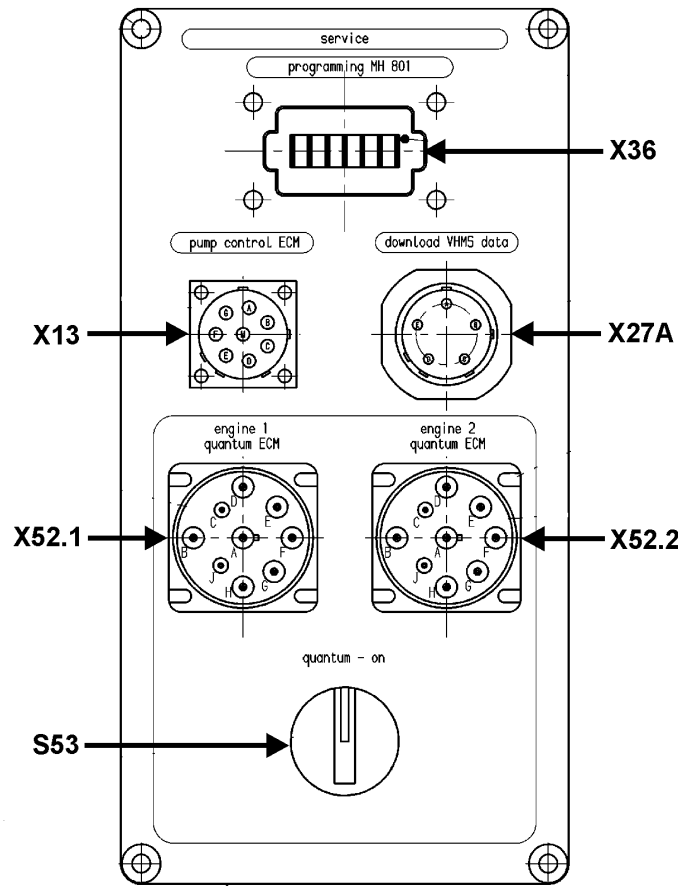
Legend for illustration Z26319

- (18) Switch, windshield washer
- (19) Switch, mirror heating
- (20) Switch, cab ventilation blower. Blower runs with low speed, even with switch in -0- position. (Cab pressurizing prevents ingress of dust).
- (21) Switch, manual actuation of swing ring gear pinion lubrication system
- (22) Switch for upper and lower windshield wiper
 - 0 - Off
 - 1 - Interval stage
 - 2 - Slow stage
 - 3 - Fast stage
- (23) Switch for Truck counter number 2 (TR2). For counting loaded trucks rotate this switch. The total number of trucks loaded is shown on the VHMS monitor field TR2, refer to page 90 for more information. The push button for Truck counter number 1 (TR1) is located on the RH control lever.
- (24) Acoustic warning signal

This signal sounds for approximately 1 second when a fault message appears on the VHMS monitor.

CAUTION

In case of too low hydraulic oil level this signal sounds continuously. Shut down the Shovel, locate and correct the cause immediately. Fill up hydraulic oil to the correct level. For the correct checking procedure → "CHECKS BEFORE STARTING THE ENGINES" on page 168.

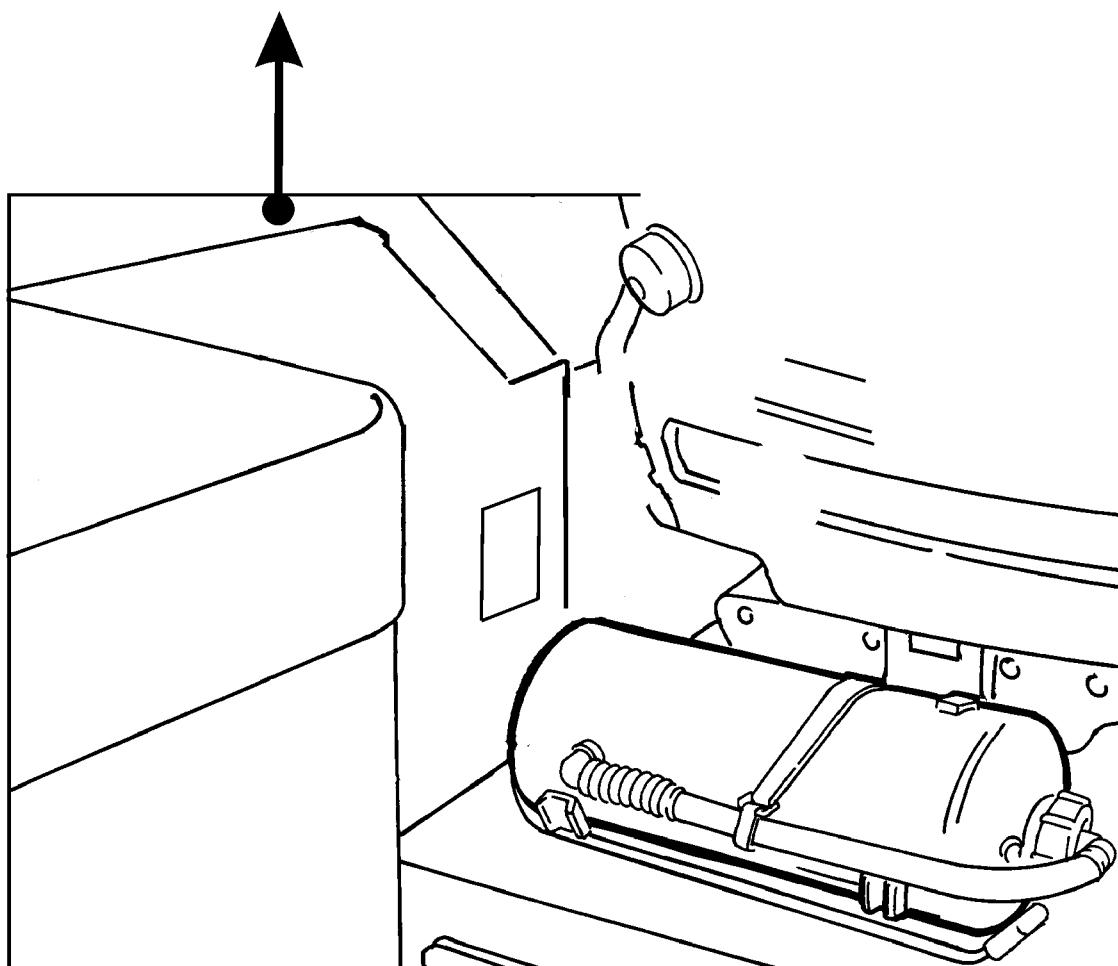
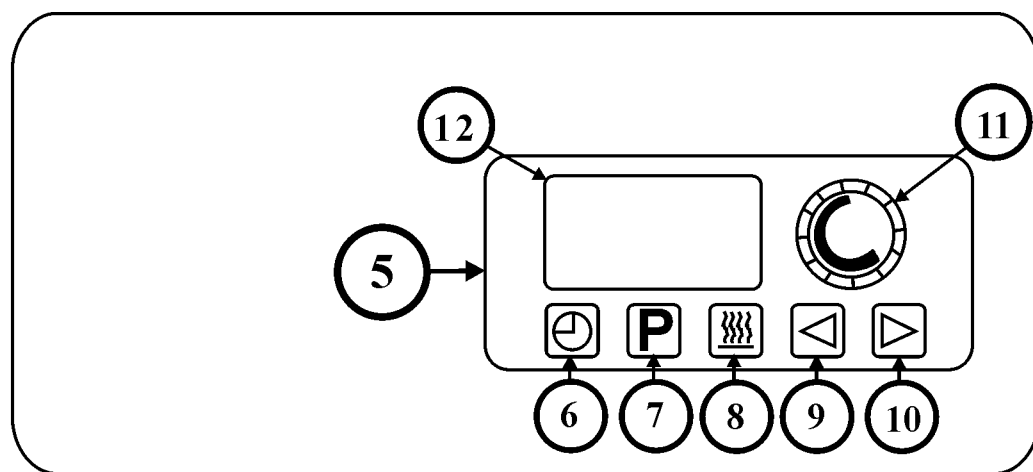


Z 26320

3.3.4 INTERFACE PANEL FOR DIAGNOSTICS

Legend for illustration Z26320

- (1) Interface panel on rear operator's console
- (X36) Data link connector for programming the VHMS monitor
- (X27A) Data link connector for download of VHMS memory data
- (X13) Data link connector for Electronic Tool connection to the electronic pump control system RC4
- (X52.1) Data link connector for Electronic Tool connection to the ECM of engine number 1 monitoring system and the electronic controlled fuel system QUANTUM.
- (X52.2) Data link connector for Electronic Tool connection to the ECM of engine number 2 monitoring system and the electronic controlled fuel system QUANTUM.
- (S53) Enable switch for engine diagnostics. For download of engine data and for programming the engine Electronic Control Modules (ECM's) stop the engine and set main key switch to off position, then turn on switch (S53). Use same procedure for checking active fault codes of the engine via service lamps located on switch board (X2) in the cab base. Refer to page 149 for more information.
- (2) Portable fire extinguisher. Observe the local Fire Prevention Regulations in regard to number, size and location of portable fire extinguishers. Make sure the fire extinguisher is always charged and ready for use.



Z 26081

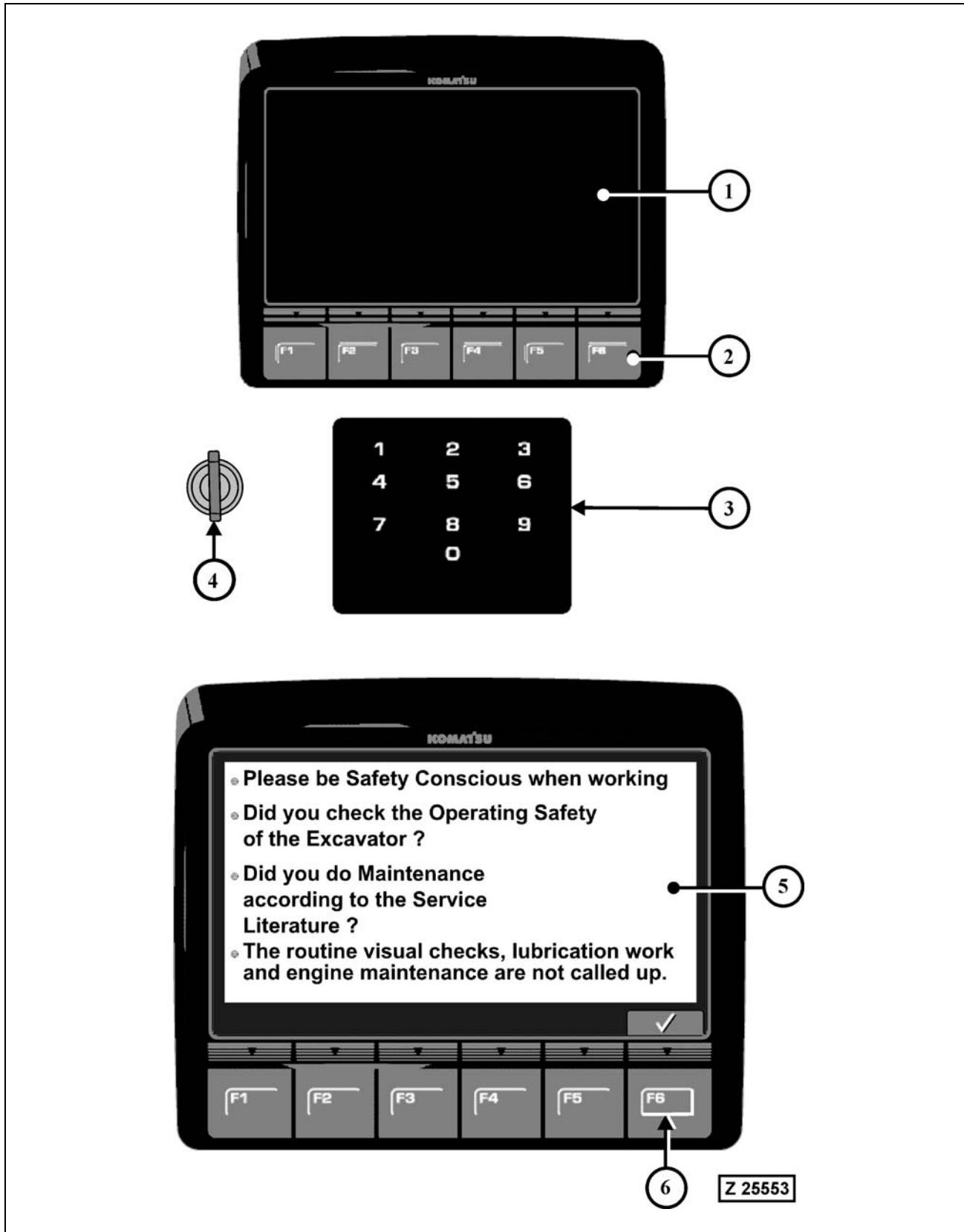
3.3.5 CONTROL MODULE FOR AUXILIARY CAB HEATER

Special Equipment

Legend for illust. Z26081

- (5) Control module for the engine independent auxiliary cab heater.
This module is used for switching ON and OFF the auxiliary cab heater during operation of the shovel with the Diesel engines running, and for pre-selection of heater start times and duration of heating periods. For detailed setting instructions of the control module refer to the separate operating instruction sheet in volume 2 binder.
- (6) Button for actual time indication
- (7) Button for preselection of heating time
- (8) Button for heating indication
- (9) Button for settings backwards
- (10) Button for settings forward
- (11) Not used
- (12) Display shows the operating condition of the auxiliary cab heater

3.4 VEHICLE HEALTH MONITORING SYSTEM VHMS – HEALTH MONITOR



Legend for illustration Z25553

- (1) Monitor screen displays the condition of the machine, the maintenance status, and messages for the operator and maintenance man.
- (2) Function key group for changing the screen and for settings in the user menu,
- (3) Key pad for entering data and Personal Identification Number (PIN)
- (4) Main key switch on dashboard
- (5) Opening message
- (6) Acknowledgement button for opening message

3.4.1 SEQUENCE OF DISPLAYS

When the main key switch (4), illustration Z25553 is turned ON, the initialization screen (KOMATSU logo) illustration Z25555 is displayed for approx. 3 seconds.

REMARK

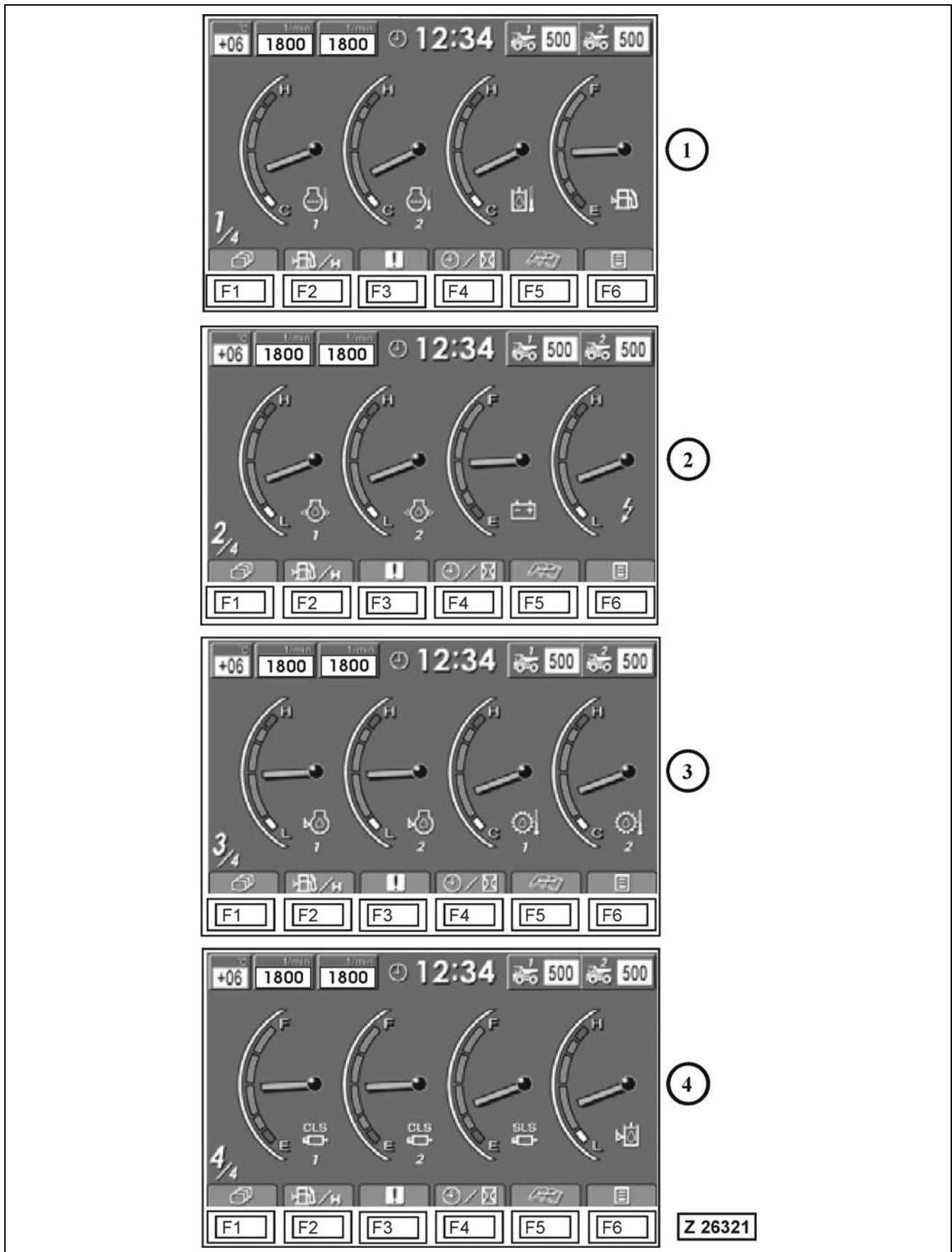
The system offers three languages, for example ENGLISH - GERMAN - SPANISH, according to Customer request. Changing of the present language can be carried out in the main menu Settings, see illustration Z25541 on page 102.

**3.4.2 OPENING SCREEN**

The second display, see no. (5) in the illustration Z25553, is of general information for the operator.








Press function key (6) to acknowledge this message, the display will change to the Main Gauge Screen 1, see illustration Z26321 on page 92.

3.4.3 MAIN GAUGE SCREENS 1 TO 4



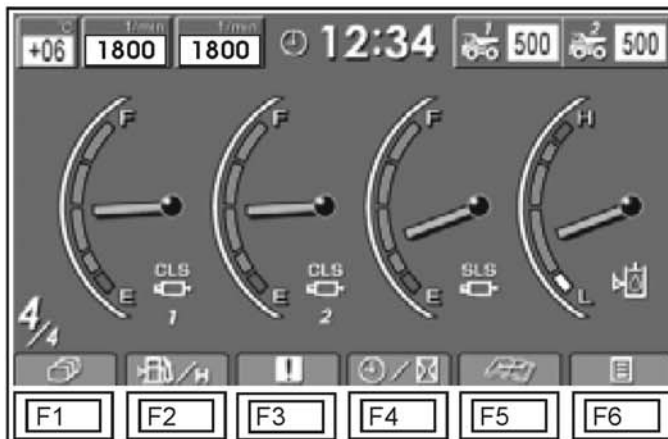
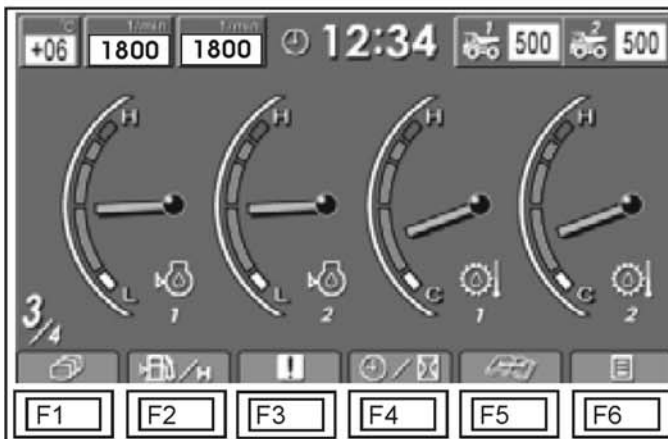
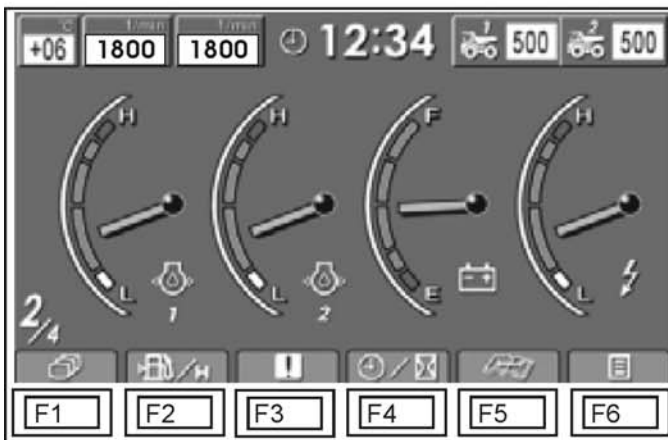
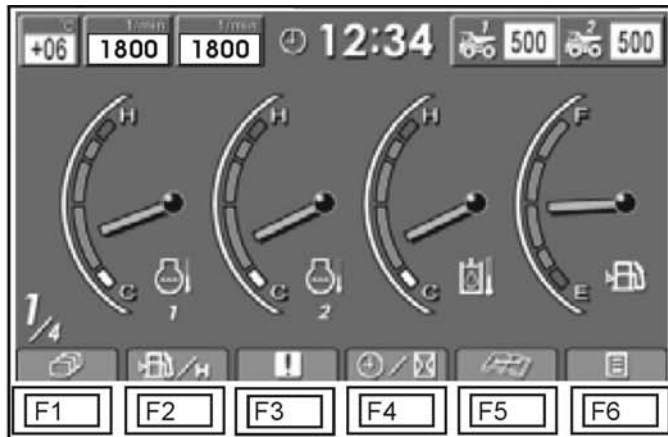
Main Gauge Screen 1

Symbol explanation, illustration Z26321

| | |
|---|--|
| °C | Celsius, ambient temperature |
| 1/min | Revolutions Per Minute (RPM), engine speed |
|  | Time |
|  | Truck Counter 1 |
|  | Truck Counter 2 |
|  | Engine 1 Coolant Temperature |
|  | Engine 2 Coolant Temperature |
|  | Hydraulic Oil Temperature |
|  | Fuel Level |

Function of Keys F1 to F6






| | |
|-----------|---|
| F1 | This button is used to scroll through the four Main Gauge Screens (1, 2, 3 and 4). With other screens selected the function of this key changes accordingly, see examples on the following pages. |
| F2 | This button switches to Fuel Consumption screen, for details see page 99. |
| F3 | This button switches to Failure Message history screen for the operator. The color of the icon above this switch changes to yellow when a current message is available in the Failure Message history. The button remains yellow as long as the cause for the message exists, even if the message was canceled. For details see Failure Message screen on page 100. |
| F4 | This button switches to the Main Screen for changing the display from Time to Service Meter Reading or to Date and vice versa, for details see page 100. |
| F5 | This button switches to the Maintenance Monitor. The color of the icon above this switch changes to yellow or red when Maintenance is due, for details see Maintenance Monitor on page 101. |
| F6 | This button switches to the User Menu Settings for Operator, for details see page 102. |



Z 26321





Main Gauge Screen 2

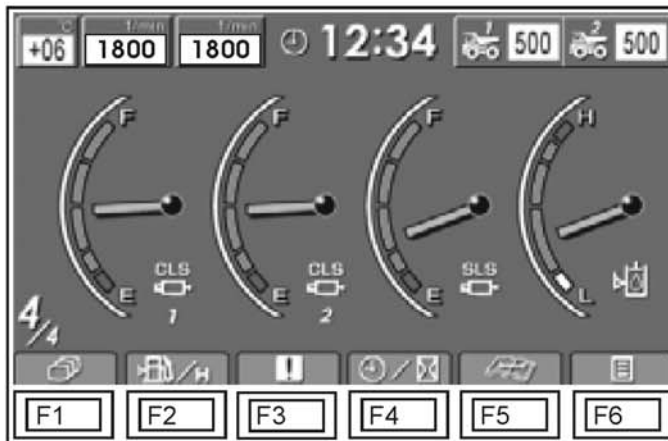
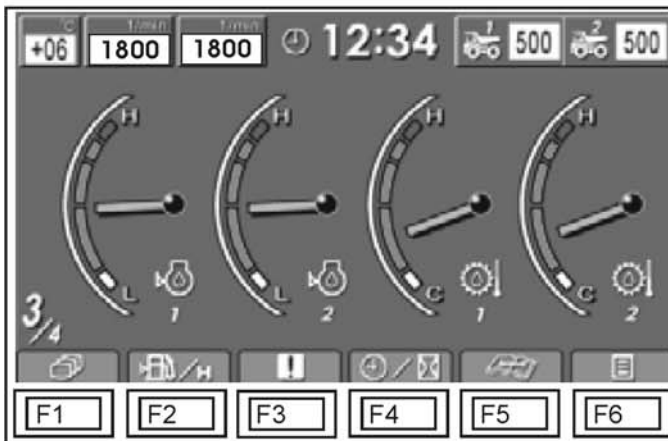
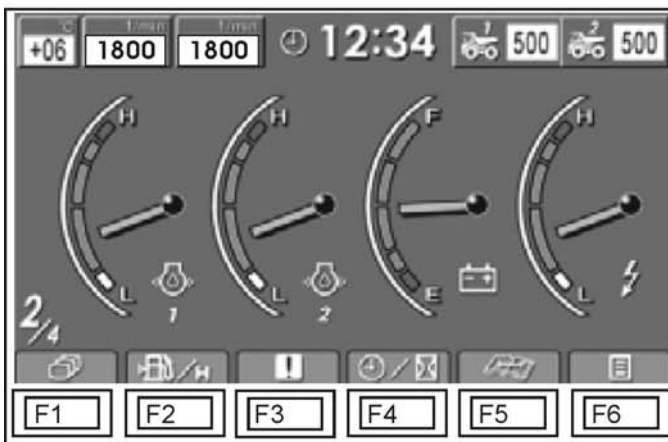
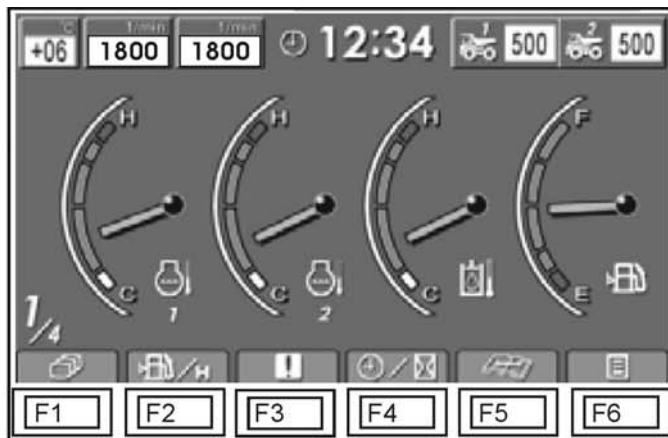
Symbol explanation, illustration Z26321

| | |
|--|------------------------------|
|  | Service Meter Reading (SMR) |
| 1  | Engine 1 Oil Pressure |
| 2  | Engine 2 Oil Pressure |
|  | Battery Charging Current AMP |
|  | Boardnet Voltage |

Main Gauge Screen 3

Symbol explanation

| | |
|--|----------------------------|
| 1  | Engine 1 Oil Level |
| 2  | Engine 2 Oil Level |
| 1  | PTO 1 Gear Oil Temperature |
| 2  | PTO 2 Gear Oil Temperature |



1

2





3

4

Z 26321

Main Gauge Screen 4

Symbol explanation


| | |
|--|---|
| CLS 1  | Central Lubrication System (CLS) Superstructure |
| CLS 2  | Central Lubrication System (CLS) Attachment |
| SLS  | Slew Ring Gear Lubrication System (SLS) |
|  | Hydraulic Oil Level |

Color Definition


| | |
|-------|---|
| Green | Normal operating range |
| Red | Serious trouble, act immediately. Engine derate or shutdown may happen. |

REMARK

When the pointer of a gauge moves into a red range the corresponding symbol will also change to red, and there will be in most cases an automatic message display informing the operator in plain text about the failure and the necessary action to be taken. For a typical display see Error Message on page 108.


 Fuel Consumption


| | |
|---------------------------|-----------|
| Start Time | Stop Time |
| Split Consumption 0.0 l/h | |
| Hours 0.0 h | |


START 

1


F1 F2 F3 F4 F5 F6

 Fuel Consumption


| | |
|---|-----------|
| Start Time 17/May/2008 15:00  | Stop Time |
| Split Consumption 0.0 l/h | |
| Hours 0.0 h | |

STOP 

2

 Fuel Consumption

| | |
|---------------------------------|--------------------------------|
| Start Time 17/May/2008 15:00 | Stop Time 18/May/2008 15:00 |
| Split Consumption XXX l/h | |
| Hours 24:00 h | |

START 

3

Z 26325

3.4.4 FUEL CONSUMPTION SCREEN

Measuring fuel consumption

Starting from one of the four Main Gauge screens press button F2, the screen changes to Fuel Consumption screen (1), illustration Z26325. The fields in screen (1) can be either blank or filled with the data of the last measurement. If you want to start fuel consumption measurement, push the START button F1. The Date and local Time will be inserted into the Start Time field and the START button changes to STOP button, see screen (2).

Push return button F5 to go back to the Main Gauge Screen 1.

When the time period for fuel consumption measurement is over, for example after 24 hours, select the CONSUMPTION Screen from any of the four Main Gauge Screens by pushing the fuel consumption button F2. The displayed consumption screen shows the starting date and time of fuel consumption measurement. Push the STOP button. The current date and time is inserted into the Stop Time field and the split fuel consumption calculated during the time period is inserted into the Split Consumption field. The STOP button changes to START button, see screen (3).

Push return button F5 to go back to the Main Gauge Screen 1.

3.4.5 FAILURE MESSAGE HISTORY SCREEN FOR OPERATOR

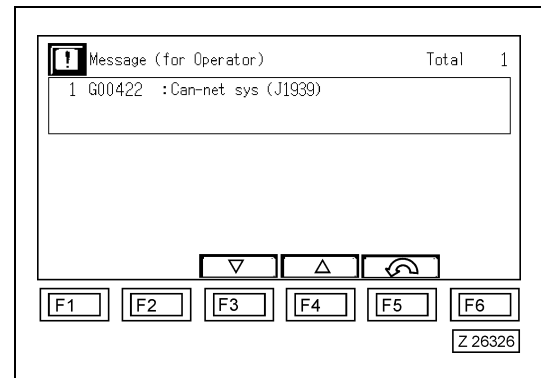
Failure history for Operator

The Failure Message history screen illustration Z26326 can be selected from the Main Gauge Screens 1, 2, 3 or 4 by pressing the Message button F3. The color of the icon above this button changes to yellow when a current message is available in the failure message history for the operator.

Legend for illustration Z26326

| | |
|----|--|
| F3 | Scroll down button, shifts single messages |
| F4 | Scroll up button, shifts single messages |
| F5 | Standard monitor display button, switches back to the Main Gauge Screen 1. |

When the cause for a message listed in the failure history has gone, the message will be removed from the failure history for operator and the time and date is added to the already stored message in the memory of the Failure History for Service.

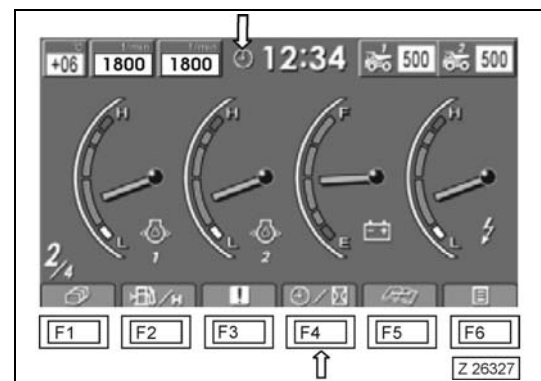


3.4.6 MAIN SCREEN - CHANGE >TIME >SMR >DATE

The button F4 switches to the Main Screen for changing the display from Time to Service Meter Reading (SMR) or to Date and vice versa.

Push button F4 again to change the display from Time to Service Meter Reading. For display of the Date push the button F4 again.

The selected display Time, SMR or Date will be shown on all four Main Gauge Screens.



3.4.7 MAINTENANCE MONITOR

The Maintenance Monitor can be selected from the Main Gauge Screens 1, 2,3 or 4 by pressing the Maintenance button F5. The color of the icon above the button changes to yellow when maintenance is due. The color will change to red when maintenance is overdue.

The illustration Z25539 shows a Maintenance Monitor of a new machine which has been operated for 10 operating hours. There are 240 hours left before the 250 hour maintenance is due and 2990 hours before the 3000 hours maintenance is due. For returning to the Main Gauge Screen press button F5.

| MAINTENANCE MONITOR | | Remain |
|---------------------|--|--------|
| 250h Maintenance | | 240 h |
| 500h Maintenance | | 490 h |
| 1000h Maintenance | | 990 h |
| 2000h Maintenance | | 1990 h |
| 3000h Maintenance | | 2990 h |

Z 25539

Peculiarities to be observed:

Higher maintenance also include lower maintenance. (Lower maintenance must also be carried out!) Exception: On performance of the 3000 h maintenance it is not necessary to also carry out the 2000 h maintenance. The maintenance cycles are rigidly linked to the running time meter. Only running time hours are taken into consideration (No minutes or seconds).

NOTICE

The routine visual checks and inspections after every 10 and 50 operating hours are not called up on the Maintenance Monitor. Carry out these checks and inspections according to the MAINTENANCE section 4 in this manual. The engine maintenance has to be carried out according to the separate Engine Operation and Maintenance Manual filed in volume 2 binder.

REMARK

On new machines an INITIAL SERVICING after the first 250 and 1000 operating hours is required, in addition to the periodic maintenance intervals displayed on the monitor. Carry out all maintenance items according to the MAINTENANCE section 4 in this Manual.

Maintenance confirmation through Service Personnel

Maintenance indicated with yellow or red color of the icon above the maintenance key F5 should be confirmed through Service Personnel in the Service Menu subsequent to the execution of the maintenance. With the confirmation the actual value maintenance number is increased by 1. Thus, the length of the maintenance cycle is added to the display value and the gray color will appear on the maintenance icon.

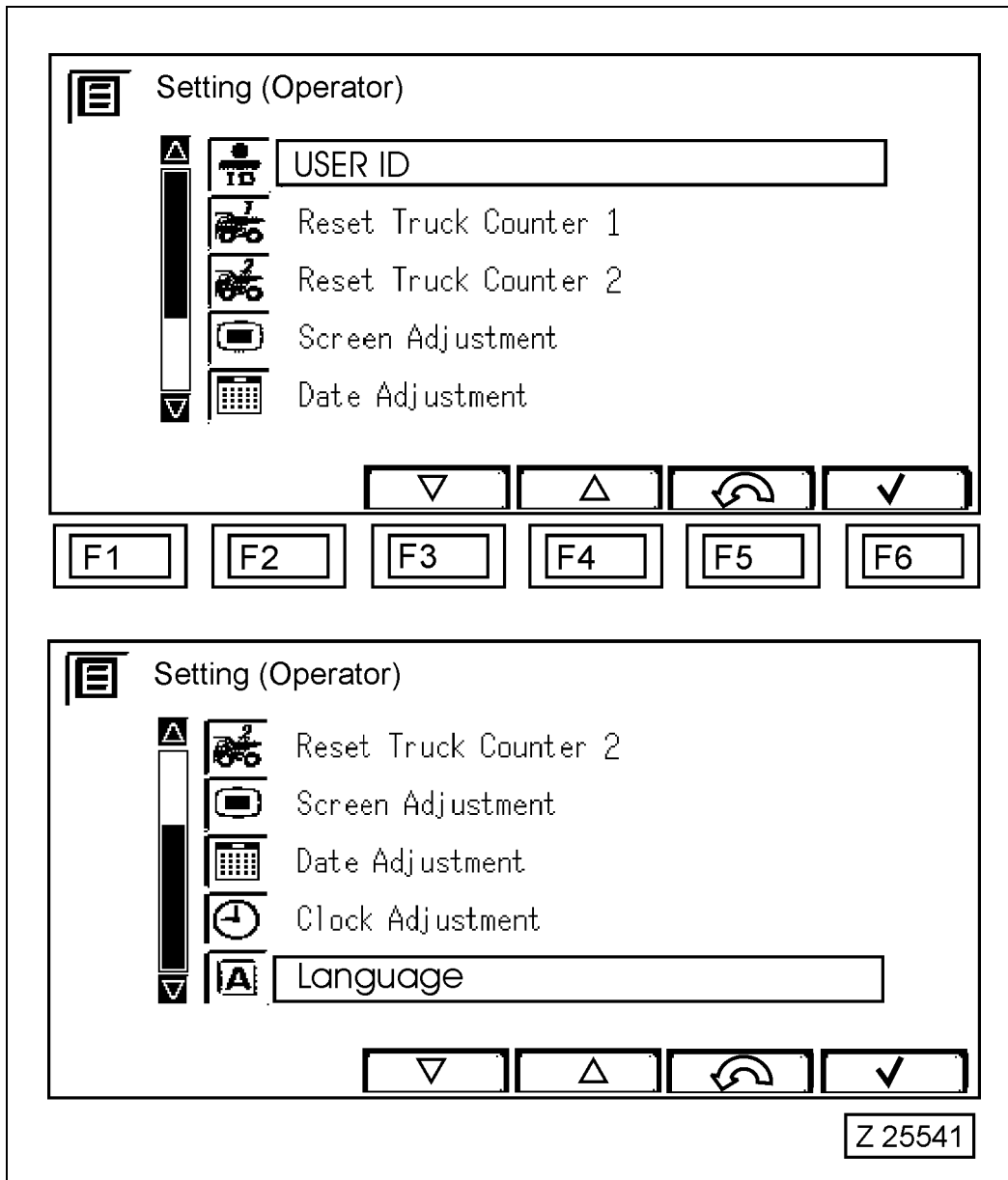
The message in the Service Menu for maintenance confirmation then turns white instead of yellow.

For more information of maintenance confirmation refer to the Service Manual of the machine.

3.4.8 SETTINGS FOR OPERATOR

The User Menu Settings for Operator can be selected from the Main Gauge Screens 1, 2, 3 or 4 by pressing the button F6.

Main Screen Settings for Operator, illustration Z25541



Selection of Setting Screens

The selection menu for settings offers seven possibilities of setting screens. Starting with USER ID and ending with Language selection. Use scroll button F3 or F4 for selection of the desired screen. Push acknowledge button F6 for switching over the selected setting screen. Button F5 switches back to Main Gauge Screen 1.

The setting screens on the following pages appear in the same sequence as shown in the Main Setting Screen.

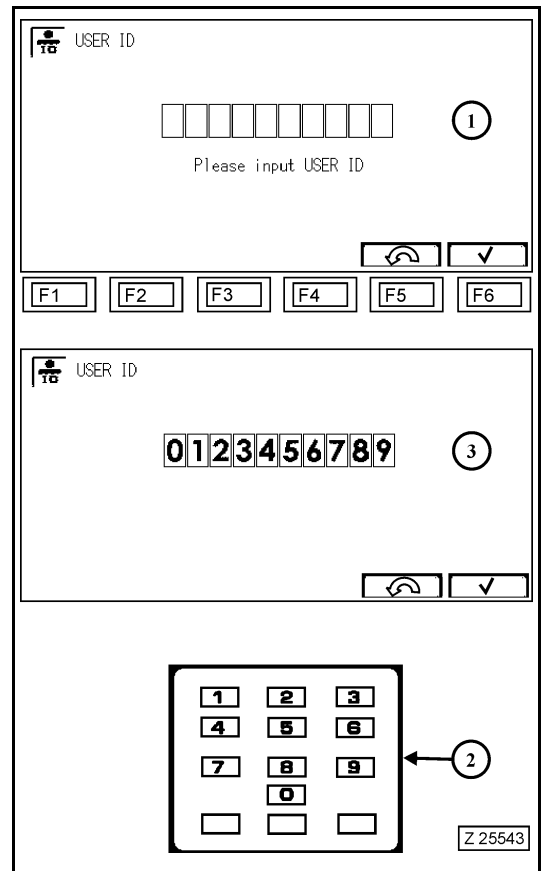
Settings for Operator

User ID Screen

Entry of the Operator identification number (USER ID), illustration Z25543

To distinguish Operators, it is possible to enter a ten-digit Operator identification number by using key group (2). The screen changes from (1) to (3). Acknowledge ID number by pressing button F6, the display changes to Main Screen Settings.

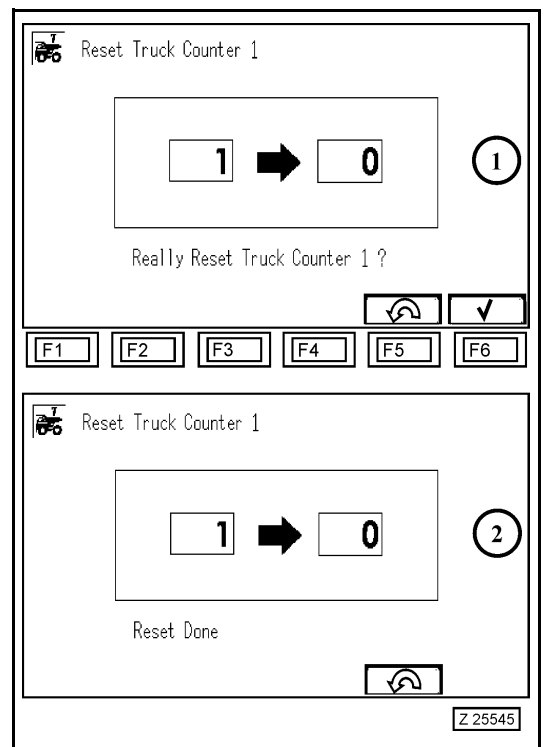
If ten numbers were entered each further entry will be ignored.



Reset Truck Counter 1

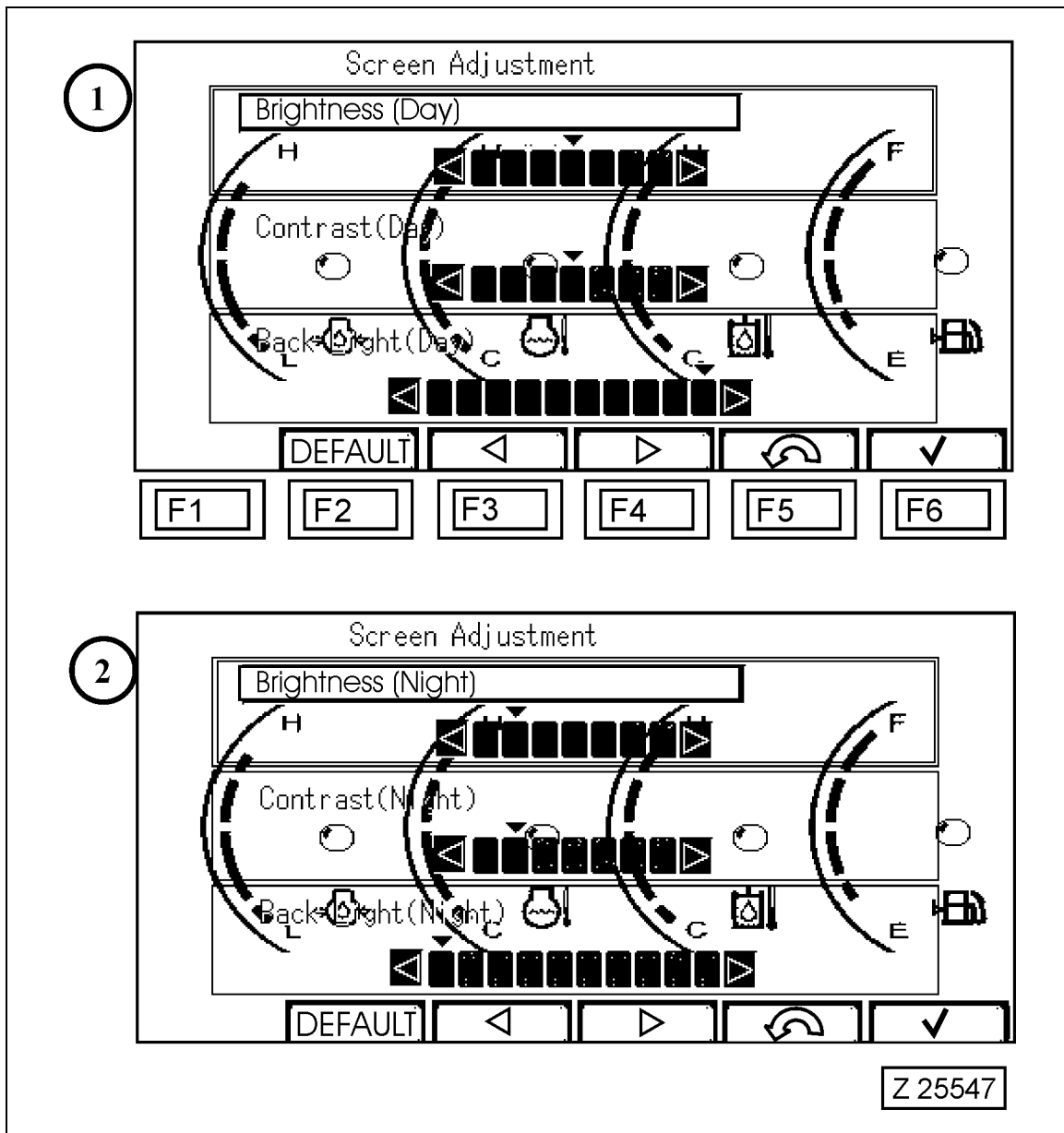
With screen (1), illustration Z25545 displayed press button F6 to reset truck counter 1 to zero. The screen switches back to the Main Screen Setting. If you don't want to reset the truck counter press button F5 for going back to the Main Screen Setting.

Truck counter 2 is reset in the same way.



Screen Adjustment

Screen adjustment Day and Night, illustration Z25547



Screen adjustment Day and Night

The Day Screen (1) will be displayed during the day with the main working lights off.

The screen changes automatically to Night when the main working lights are on, see screen (2).

Adjustment of both screens is done in the same way.

Explanation of key functions for screen adjustment illustration Z25547

| | |
|----|---|
| F2 | Button for automatic adjustment of Brightness, Contrast and Backlight |
| F3 | Button for decreasing Brightness, Contrast and Backlight |
| F4 | Button for increasing Brightness, Contrast and Backlight |
| F5 | Button for switching back to Main Screen Settings |
| F6 | Button for selection of Brightness, Contrast and Backlight |

Screen adjustment

- Brightness shall be changed.

The first display of the screen shows the Brightness field highlighted. For increasing the Brightness push button F4 until the desired stage is obtained. For decreasing the Brightness push button F3 until the desired stage is obtained.

- Backlight shall be changed.

Push button F6 until the Backlight field in the third line is highlighted. For increasing the backlight push button F4 until the desired stage is obtained. For decreasing the backlight push button F3 until the desired stage is obtained.

- Contrast shall be changed.

Push button F6 until the Contrast field in the second line is highlighted. For increasing the Contrast push button F4 until the desired stage is obtained. For decreasing the Contrast push button F3 until the desired stage is obtained.

After adjustment is done press button F5 for returning to the Main Screen Settings.

Date Adjustment Screen

REMARK

The Date Adjustment Screen, illustration Z26333 offers also the possibility to adjust the Time and the Daylight Saving Time.

- Date shall be changed.

The first display of the screen shows the Date and Year field highlighted. If, for example, the Month date shall be changed push button F1 once the Month field becomes highlighted, see screen (1). Use button F3 (down) or F4 (up) for changing the Month date. For changing the Day date push button F1 again the Day field will be highlighted. Use button F3 (down) or F4 (up) for changing the Day date. For returning to the Main Screen Settings push button F5.

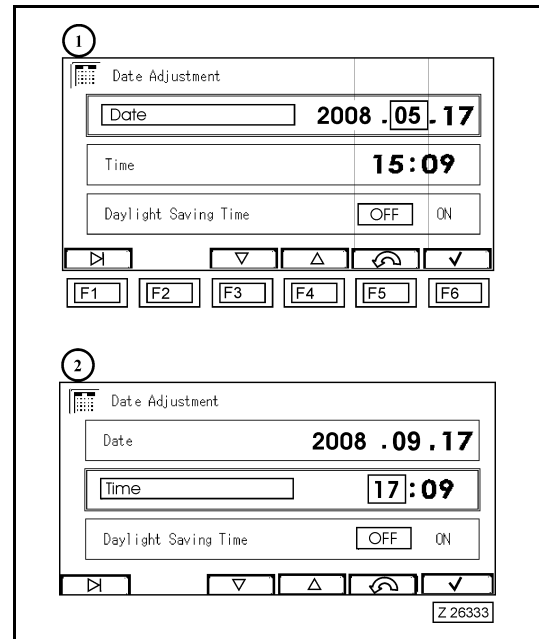
- Time shall be changed.

Starting from screen (1) push button F1 three times the Time and Hours field will be highlighted, see screen (2). Use button F3 (down) or F4 (up) for changing the Hours. For changing the Minutes push button F1 again the Minute field will be highlighted. Use button F3 (down) or F4 (up) for changing the Minutes. For returning to the Main Screen Settings push button F5.

- Daylight Saving Time shall be changed.

Starting from screen (1) push button F1 five times the Daylight Saving Time field will be highlighted. Use button F3 or F4 for changing the Daylight Saving Time field from OFF to ON and vice versa.

After adjustment is done press button F5 for returning to the Main Screen Settings.

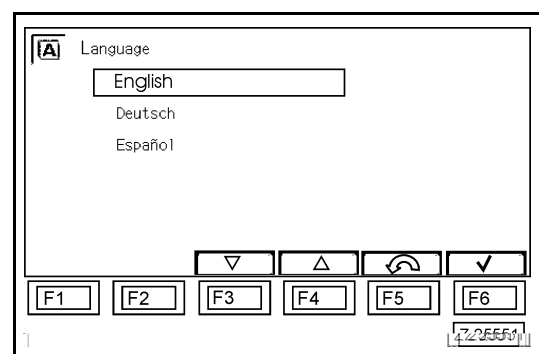


Clock Adjustment Screen

The Clock Adjustment Screen offers basically the same settings as the Date Adjustment Screen. However, the display will start with the Time field highlighted. Settings are carried out in the same way as in the Date Screen.

Language Selection Screen

Select the desired language with button F3 or F4 and acknowledge the selection with button F6. The screen changes back to the Main Screen Settings.



3.4.9 AUTOMATIC MESSAGES

If a failure or an information condition occurs during operation, the present display is automatically replaced by a message in text. If there are several messages at the same time, the system starts rolling up of all present messages and the present display. Each message is being displayed a few seconds. The message text informs the operator about the type of failure and the action to be taken. Carry out the action given on the screen.

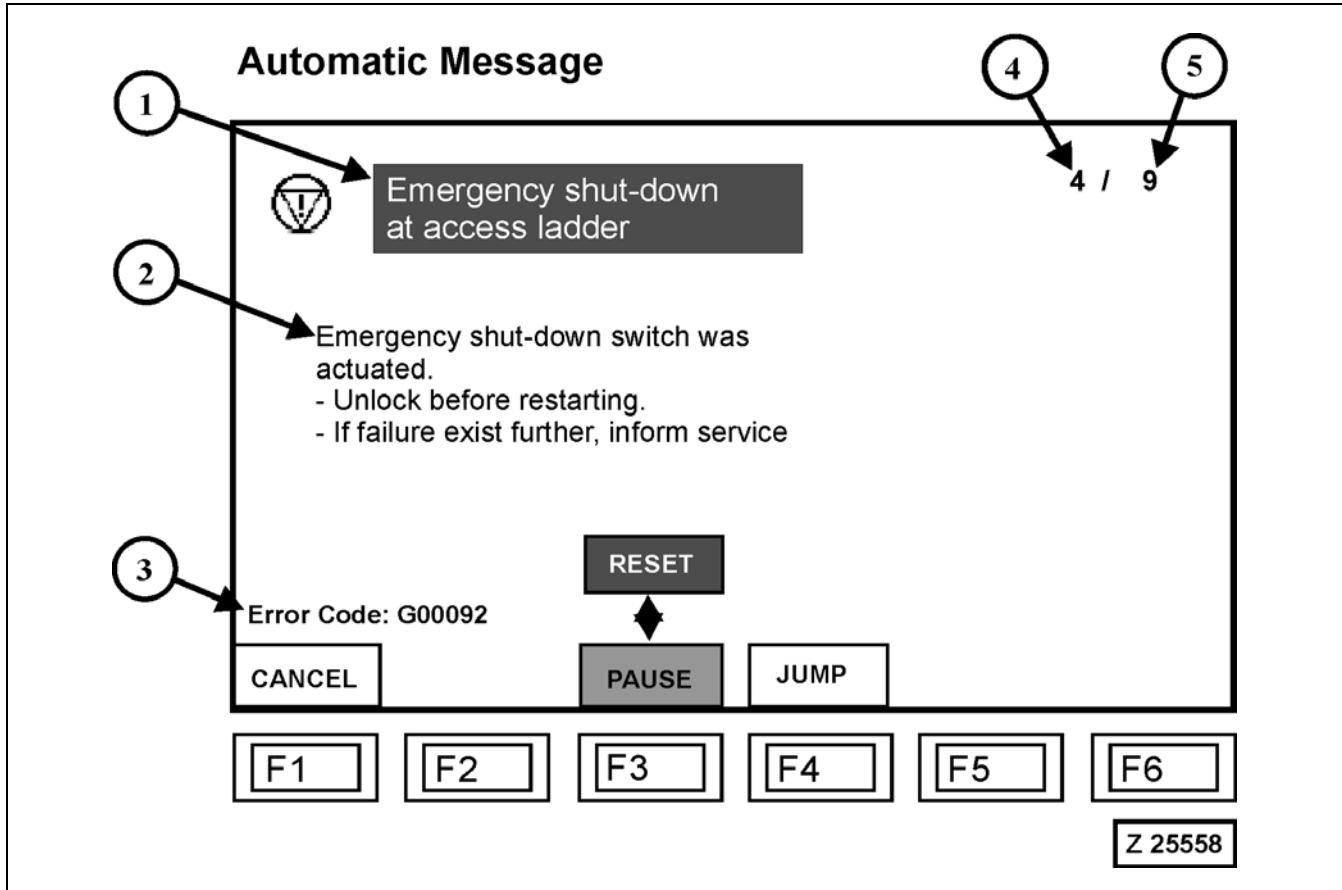
REMARK

The headings of automatic messages have a background color indicating the severity of the condition as follows:

| | |
|---------------|---|
| RED | Severe - act immediately. See page 108 for a typical message with red background. |
| YELLOW | Caution - inform service, work can be continued. See page 109 for a typical message with yellow background. |
| GREEN | Information. See page 110 for a typical message with green background. |

Automatic Messages

Example of a message with red background color of the top message, see illustration Z25558.



Legend for illustration Z25558 and Z25557

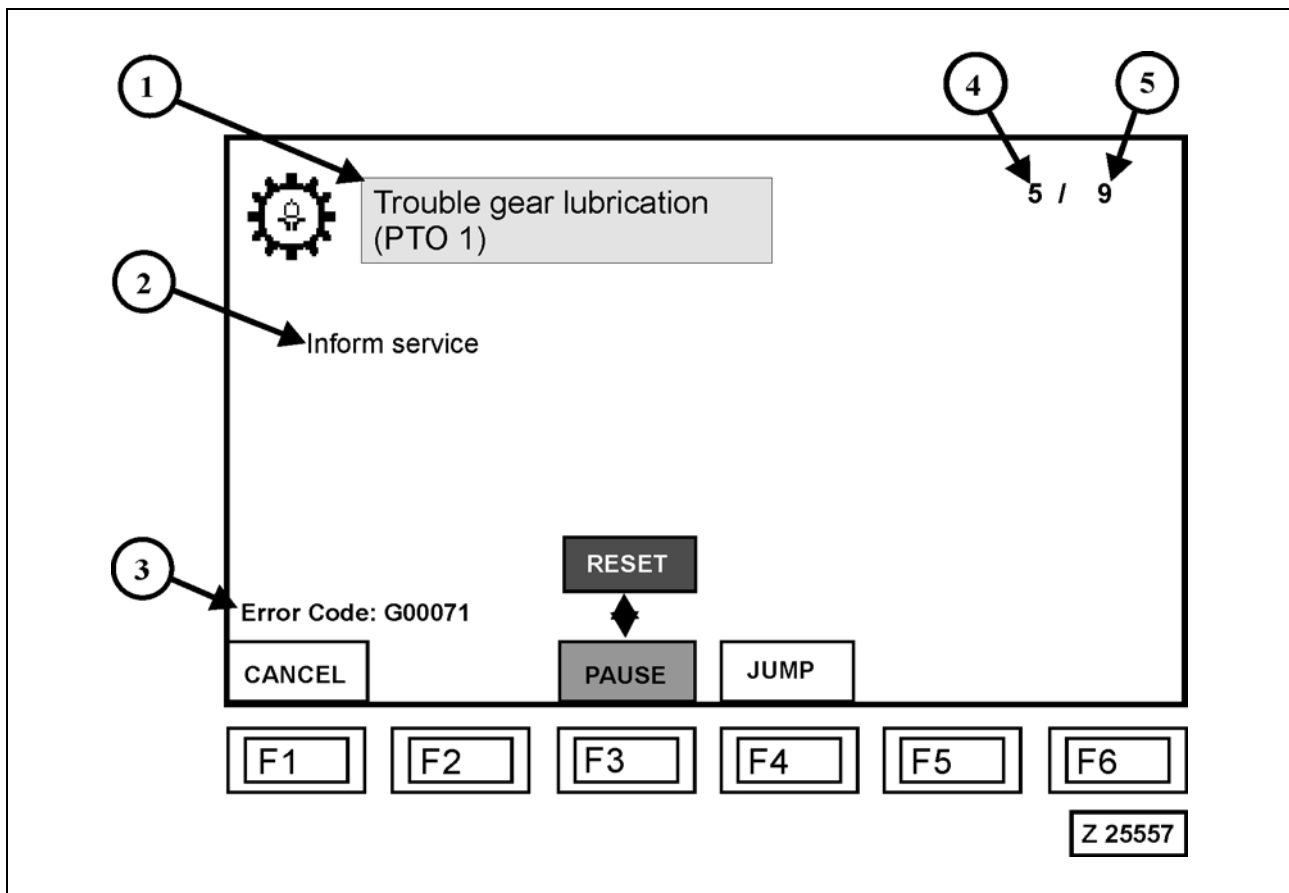
| | |
|---|--|
| 1 | Top message: Type of failure |
| 2 | Instruction message: Follow the displayed instructions |
| 3 | Message number (Error code): G = Shovel generated message C = engine 1 or engine 2 generated message |
| 4 | Order of occurrence of message now being displayed |
| 5 | Total number of existing messages |

Automatic Messages

Legend for illustration Z25558 and Z25557 continued

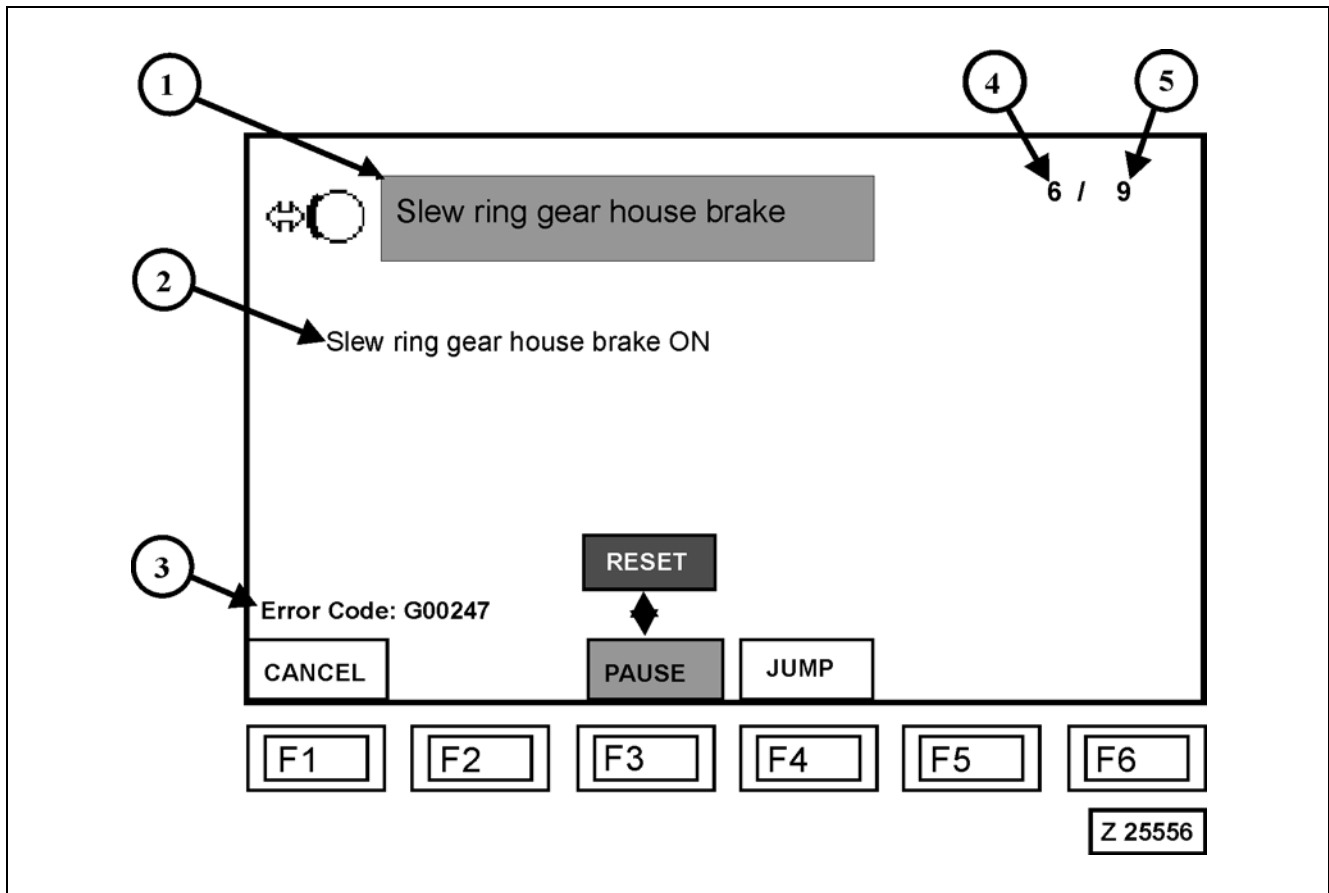
| | |
|------------------|---|
| <p>F1</p> | <p>Cancel button: When this button is pressed, the displayed current message disappears and is listed in the failure history for operator. The message will be displayed again when a different Operator Identification number (ID) is entered.</p> |
| <p>F3</p> | <p>Pause button (green): When this button is pressed, automatic rolling up of messages is stopped and the displayed message will be frozen on the screen for two minutes. Then the button changes to Reset (red) and automatic roll up of current messages starts again. New message will overwrite a frozen message.</p> |
| <p>F4</p> | <p>Jump button: This button switches to the last displayed menu, normally the Main Gauge Screen 1. After two minutes the display jumps automatically back to the last displayed Automatic Message and rolling up of messages starts again. If a menu select button was activated during the two minutes standard Monitor display period, the display will also jump back to Automatic Message when the two minutes are over. New message will overwrite any menu display and rolling up of messages starts again.</p> |

Example of a message with yellow background color of the top message, see illustration Z25557.



Automatic Messages

Example of an information message with green background color of the top message, see illustration Z25556.



Legend for illustration Z25556

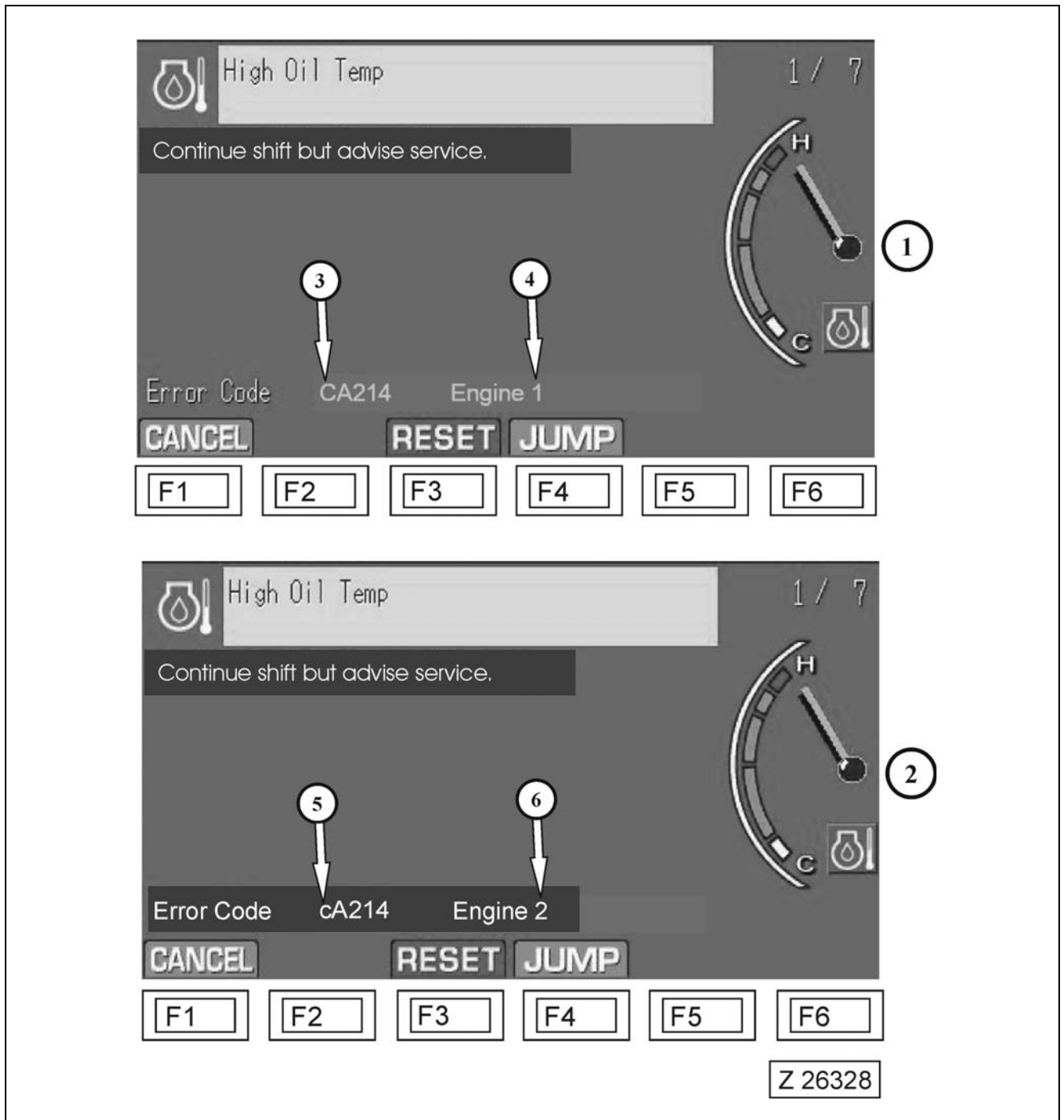
| | |
|---|---|
| 1 | Top message: Type of information |
| 2 | Explanation of condition |
| 3 | Message number (Error code): G = Shovel generated message C = engine 1 generated message |
| 4 | Order of occurrence of message now being displayed |
| 5 | Total number of existing messages |

REMARK

All messages available in the system are listed up on the following pages.

Automatic Engine Messages

Example of failure message no. 214 of engine 1 and engine 2, see illustration Z26328.



Legend for illust. Z 26328

- | | | | |
|-----|--|-----|---|
| (1) | Failure message of engine 1 | (4) | Engine 1 identification in plain text |
| (2) | Failure message of engine 2 | (5) | Lower case letter c indicates engine 2 |
| (3) | Capital letter C indicates engine 1 | (6) | Engine 2 identification in plain text |

3.4.10 TABLE OF ALL TOP MESSAGES PROVIDED BY THE SYSTEM

NOTICE

The Instruction Messages belonging to the TOP Messages are listed in a separate Table, see page 123. The number shown in the Instruction Message column indicates the applying Instruction Message for the TOP Message.

| Error Code (Message number) G = Shovel C = Engine 1 or engine 2 | Color code of TOP Message: 0 = RED 1 = YELLOW 2 = GREEN | Instruction Message Number. Refer to separate Table | TOP Message with colored background REMARK Messages w/o color code are not displayed. These messages are stored in the history memory only. |
|--|--|--|---|
| G00001 | 0 | 1 | Trouble Shut-Off (gate) valve |
| G00002 | 2 | 37 | Test speed 1800 rpm, engine 1 |
| G00003 | 1 | 38 | Trouble pump controller |
| G00005 | 1 | 39 | Low hydraulic oil level |
| G00006 | 1 | 37 | Test speed 1800 rpm, engine 2 |
| G00007 | 0 | 2 | Trouble hydraulic oil level |
| G00008 | 0 | 3 | Trouble HPF 1 |
| G00009 | 0 | 3 | Trouble HPF 2 |
| G00010 | 0 | 3 | Trouble HPF 3 |
| G00011 | 0 | 3 | Trouble HPF 4 |
| G00012 | 1 | 17 | CLS grease level too low |
| G00013 | 1 | 17 | SLS grease level too low |
| G00014 | 0 | 3 | Trouble HPF 5 |
| G00015 | 0 | 3 | Trouble HPF 6 |
| G00020 | 0 | 4 | Trouble Shut-Off (gate) valve (Start blocked) |
| G00021 | 0 | 5 | Trouble monitoring HPF 1 |
| G00022 | 0 | 5 | Trouble monitoring HPF 2 |
| G00023 | 0 | 5 | Trouble monitoring HPF 3 |
| G00024 | 0 | 5 | Trouble monitoring HPF 4 |
| G00025 | 0 | 5 | Trouble monitoring HPF 5 |
| G00026 | 0 | 5 | Trouble monitoring HPF 6 |
| G00031 | 2 | | Set engine to low idle |
| G00033 | 1 | 2 | Trouble VHMS-Controller |
| G00034 | 1 | 2 | Trouble VHMS-Display |
| G00035 | 0 | 34 | Trouble total loss of gear oil (PTO 1) |
| G00036 | 0 | 34 | Trouble total loss of gear oil (PTO 2) |

| Error Code (Message number) G = Shovel C = Engine 1 or engine 2 | Color code of TOP Message: 0 = RED 1 = YELLOW 2 = GREEN | Instruction Message Number. Refer to separate Table | TOP Message with colored background REMARK Messages w/o color code are not displayed. These messages are stored in the history memory only. |
|--|--|--|---|
| G00037 | 0 | 2 | Trouble monitoring, engine 2 speed too low |
| G00038 | 0 | 2 | Trouble monitoring, engine 2 speed too high |
| G00039 | 2 | | Actuate engine speed selector switch |
| G00060 | 0 | 6 | Fire in the power house |
| G00061 | 0 | 2 | Trouble monitoring, engine 1 speed too low |
| G00062 | 0 | 2 | Trouble monitoring, engine 1 speed too high |
| G00063 | 0 | 2 | Trouble monitoring hydraulic oil temp |
| G00064 | 0 | 2 | Trouble monitoring hydraulic oil level |
| G00065 | 1 | 2 | Very low hydraulic oil level |
| G00066 | 0 | 7 | Trouble hydraulic oil temperature |
| G00067 | 1 | 2 | Trouble battery voltage too high |
| G00068 | 1 | 2 | Trouble gear lubrication (PTO 2) |
| G00069 | 1 | 2 | Trouble monitoring oil temp gear (PTO 1) |
| G00070 | 1 | 2 | Trouble oil temperature gear (PTO 1) |
| G00071 | 1 | 2 | Trouble gear lubrication (PTO 1) |
| G00072 | | | Trouble monitoring hydraulic oil level |
| G00073 | | | Trouble monitoring remote engine oil level 1 |
| G00074 | | | Trouble monitoring grease pressure (central 1) |
| G00075 | | | Trouble monitoring grease pressure (swing) |
| G00076 | | | Trouble monitoring pressure suction tank |
| G00077 | | | Trouble monitoring grease level (central 1) |
| G00078 | | | Trouble monitoring grease level (swing) |
| G00079 | | | Trouble monitoring pressure oil cooler 1 |
| G00080 | | | Trouble monitoring pressure preload valve |
| G00081 | 0 | 7 | Trouble lubrication system |
| G00082 | | | Trouble monitoring remote engine oil level 2 |
| G00083 | 1 | 2 | Trouble monitoring oil temp gear (PTO 2) |
| G00084 | 1 | 2 | Trouble oil temperature gear (PTO 2) |
| G00085 | | | Trouble monitoring pressure oil cooler 2 |
| G00086 | 0 | 12 | SHUTDOWN |
| G00089 | 1 | 2 | EBL bypassed |

| Error Code (Message number) G = Shovel C = Engine 1 or engine 2 | Color code of TOP Message: 0 = RED 1 = YELLOW 2 = GREEN | Instruction Message Number. Refer to separate Table | TOP Message with colored background REMARK Messages w/o color code are not displayed. These messages are stored in the history memory only. |
|--|--|--|---|
| G00090 | 0 | 8 | Trouble power supply |
| G00091 | 0 | 9 | Pilot control cut out |
| G00092 | 0 | 10 | Emergency shut-down at access ladder |
| G00093 | 0 | 10 | Emergency shut-down at valve block |
| G00094 | 0 | 10 | Emergency shut-down at hydraulic control panel |
| G00095 | 0 | 10 | Emergency shut-down in cab |
| G00096 | 0 | 14 | Pilot control cut out |
| G00097 | 0 | 10 | Emergency shut-down at counterweight |
| G00098 | 0 | 10 | Emergency shut-down at radiator |
| G00099 | 1 | 48 | No 24V at circuit breaker F13a |
| G00100 | 0 | 11 | Maintenance safety switch |
| G00101 | 1 | 0 | Faulty switch M7_LD |
| G00102 | 1 | 0 | Switch off wiper |
| G00103 | 1 | 0 | Faulty switch M4_UR |
| G00104 | 1 | 15 | Trouble battery current |
| G00105 | 1 | 16 | Trouble battery charging current too low |
| G00133 | | | Trouble monitoring pump 5 |
| G00134 | | | Trouble monitoring pump 6 |
| G00139 | 1 | 17 | Trouble monitoring X1-2 Pressure |
| G00140 | 1 | 17 | Trouble monitoring X1-1 Pressure |
| G00141 | 1 | 17 | Trouble monitoring X2-Pressure |
| G00142 | 1 | 17 | Trouble monitoring pump support pressure X4-1 |
| G00143 | | | Trouble monitoring pump 1 |
| G00144 | | | Trouble monitoring pump 2 |
| G00145 | | | Trouble monitoring pump 3 |
| G00146 | | | Trouble monitoring pump 4 |
| G00147 | 1 | 17 | Trouble monitoring gear lubrication (PTO 1) |
| G00148 | 1 | 17 | Trouble monitoring fuel level |
| G00149 | | | Trouble monitoring ambient temperature |
| G00150 | 1 | 17 | Trouble monitoring gear lubrication (PTO 2) |
| G00151 | 1 | 17 | Trouble monitoring gear oil filter (PTO 1) |

| Error Code (Message number) G = Shovel C = Engine 1 or engine 2 | Color code of TOP Message: 0 = RED 1 = YELLOW 2 = GREEN | Instruction Message Number. Refer to separate Table | TOP Message with colored background REMARK Messages w/o color code are not displayed. These messages are stored in the history memory only. |
|--|--|--|---|
| G00152 | 1 | 17 | Trouble monitoring oil filter pump lubrication |
| G00153 | 1 | 17 | Trouble monitoring oil filter pump control |
| G00154 | 1 | 17 | Trouble monitoring return oil filter |
| G00155 | 1 | 17 | Trouble monitoring leak oil filter |
| G00156 | 1 | 17 | Trouble monitoring oil filter radiator 2 |
| G00157 | 1 | 17 | Trouble monitoring oil filter radiator 1 |
| G00158 | 1 | 17 | Trouble monitoring oil filter fan drive oil cooler 1 |
| G00159 | 1 | 17 | Trouble monitoring breather filter |
| G00160 | 1 | 17 | Trouble monitoring engine air cleaner 1 |
| G00161 | 1 | 17 | Trouble monitoring battery voltage |
| G00162 | 1 | 17 | Trouble monitoring charging-/discharging current |
| G00163 | 1 | 17 | Trouble monitoring pilot control |
| G00164 | 1 | 17 | Trouble air cleaner 1 |
| G00165 | 1 | 17 | Trouble breather filter hydraulic oil tank |
| G00166 | 1 | 17 | Trouble oil filter gear (PTO 1) |
| G00167 | 1 | 17 | Trouble oil filter pump lubrication |
| G00168 | 1 | 17 | Trouble oil filter pump control |
| G00169 | 1 | 17 | Trouble return oil filter hydraulic oil tank |
| G00170 | 1 | 17 | Trouble leak oil filter hydraulic oil tank |
| G00171 | 1 | 17 | Trouble oil filter fan drive oil cooler 1 |
| G00172 | 1 | 17 | Trouble oil filter fan drive radiator 1 |
| G00173 | 1 | 18 | Trouble monitoring swing gear house brake |
| G00174 | 1 | 19 | Trouble monitoring travel gear house brake |
| G00175 | 1 | 19 | Trouble travel gear house brake |
| G00176 | 1 | 17 | Trouble battery voltage |
| G00177 | 1 | 17 | Trouble battery charging circuit |
| G00178 | 1 | 17 | Trouble battery charging current too high |
| G00179 | 1 | 17 | Trouble control pressure X1-1 |
| G00180 | 1 | 17 | Trouble pilot pressure X2 too low |
| G00181 | 1 | 17 | Trouble pilot pressure X2 too high |
| G00182 | 1 | 17 | Trouble control pressure X1-2 |

| Error Code (Message number) G = Shovel C = Engine 1 or engine 2 | Color code of TOP Message: 0 = RED 1 = YELLOW 2 = GREEN | Instruction Message Number. Refer to separate Table | TOP Message with colored background REMARK Messages w/o color code are not displayed. These messages are stored in the history memory only. |
|--|--|--|---|
| G00183 | 1 | 17 | Trouble pump support pressure X4-1 |
| G00184 | 1 | 20 | Central lubrication system empty |
| G00185 | 1 | 20 | Trouble central lubrication system |
| G00186 | 1 | 20 | Trouble central lubrication system |
| G00187 | 1 | 20 | Swing gear lubrication system empty |
| G00188 | 1 | 20 | Trouble swing gear lubrication system |
| G00189 | 1 | 20 | Trouble swing gear lubrication system |
| G00190 | 1 | 17 | Trouble oil filter fan drive radiator 2 |
| G00191 | 1 | 17 | Trouble oil filter gear (PTO 2) |
| G00192 | 1 | 17 | Trouble oil filter fan drive oil cooler 2 |
| G00193 | 1 | 17 | Trouble monitoring gear oil filter (PTO 2) |
| G00194 | 1 | 17 | Trouble monitoring oil filter fan drive oil cooler 2 |
| G00195 | 1 | 17 | Trouble pump support pressure X4-2 |
| G00196 | 1 | 17 | Trouble monitoring pump support pressure X4-2 |
| G00197 | 1 | 17 | Trouble monitoring engine air cleaner 2 |
| G00198 | 1 | 17 | Trouble air cleaner 2 |
| G00201 | 1 | 20 | Attachment lubrication system empty |
| G00202 | 1 | 17 | Attachment lubrication system grease level too low |
| G00203 | 1 | 20 | Trouble attachment lubrication system |
| G00204 | 1 | 20 | Trouble attachment lubrication system |
| G00205 | 1 | | Trouble monitoring grease level attachment |
| G00206 | 1 | | Trouble monitoring grease pressure attachment |
| G00207 | 1 | 2 | Engine 1 remote oil tank empty |
| G00208 | 1 | 2 | Engine 2 remote oil tank empty |
| G00240 | 2 | 21 | Trouble hydraulic oil temperature |
| G00242 | 2 | 22 | Engine 1 already running |
| G00243 | 2 | 23 | Fill up fuel tank |
| G00245 | 0 | 24 | Engine shutdown from ground |
| G00246 | 2 | 25 | Hydraulic oil temperature |
| G00247 | 2 | 26 | Swing gear house brake |

| Error Code (Message number) G = Shovel C = Engine 1 or engine 2 | Color code of TOP Message: 0 = RED 1 = YELLOW 2 = GREEN | Instruction Message Number. Refer to separate Table | TOP Message with colored background REMARK Messages w/o color code are not displayed. These messages are stored in the history memory only. |
|--|--|--|---|
| G00248 | 2 | 22 | Engine 2 already running |
| G00249 | 1 | 27 | Hydraulic oil temperature |
| G00251 | 2 | 28 | VHMS is by-passed |
| G00252 | 0 | 10 | Emergency shut-down at access ladder |
| G00253 | 0 | 10 | Emergency shut-down at valve block |
| G00254 | 0 | 10 | Emergency shut-down at hydraulic control panel |
| G00255 | 0 | 10 | Emergency shut-down in cab |
| G00256 | 1 | | Operator warning system |
| G00257 | 2 | 30 | Hydraulic oil temperature |
| G00258 | 0 | 10 | Emergency shut-down at counterweight |
| G00259 | 0 | 10 | Emergency shut-down at radiator |
| G00261 | 1 | 11 | Maintenance Safety Switch |
| G00262 | 1 | 20 | Trouble screen at hydraulic cooler entry clogged |
| G00417 | 1 | 2 | Communication failure PLC <=> VHMS controller |
| G00419 | 1 | 2 | Source voltage error |
| G00420 | 1 | 2 | Connector sel error |
| G00421 | 1 | 2 | Farm sys error |
| G00422 | 1 | 2 | Can-net sys (J1939) |
| G00423 | 1 | 2 | Application sys error |
| G00424 | 1 | 2 | Hot short ckt in buzzer |
| G00425 | 1 | 2 | Settings impossible to take over into the PLC |
| G00491 | 1 | 2 | Communication failure MH801 - VHMS Controller |
| MFAO | | | Manual Trigger |
| | | | |
| C00112 | 1 | 35 | Timing Fueling Mismatch |
| C00113 | | | Timing Act Shorted High |
| C00115 | 0 | 34 | Speed Signal Lost |
| C00116 | 1 | 35 | Timing Rail Press Ckt Failed High |
| C00117 | 1 | 35 | Timing Rail Press Ckt Failed Low |
| C00118 | | | Fuel Pump Press Ckt Failed High |
| C00119 | | | Fuel Pump Press Ckt Failed Low |

| Error Code (Message number) G = Shovel C = Engine 1 or engine 2 | Color code of TOP Message: 0 = RED 1 = YELLOW 2 = GREEN | Instruction Message Number. Refer to separate Table | TOP Message with colored background REMARK Messages w/o color code are not displayed. These messages are stored in the history memory only. |
|--|--|--|---|
| C00121 | | | 1 Eng Speed Signal Lost |
| C00122 | | | LB Boost Ckt Failed High |
| C00123 | | | LB Boost Ckt Failed Low |
| C00124 | 1 | 31 | High Boost LB |
| C00125 | | | Low Boost LB |
| C00126 | | | High Boost RB |
| C00127 | | | Low Boost RB |
| C00128 | | | RB Boost Ckt Failed High |
| C00129 | | | RB Boost Ckt Failed Low |
| C00135 | | | Oil Press Ckt Failed High |
| C00136 | | | Pre Filter Oil Press Ckt Failed High |
| C00137 | | | Pre Filter Oil Press Ckt Failed Low |
| C00141 | | | Oil Press Ckt Failed Low |
| C00143 | 0 | 33 | Low Oil Press |
| C00144 | | | Coolant Temp Ckt Failed High |
| C00145 | | | Coolant Temp Ckt Failed Low |
| C00151 | 0 | 33 | High Coolant Temp |
| C00153 | | | LBF IMT Ckt Failed High |
| C00154 | | | LBF IMT Ckt Failed Low |
| C00155 | 0 | 33 | High IMT LBF |
| C00156 | | | LBR IMT Ckt Failed High |
| C00157 | | | LBR IMT Ckt Failed Low |
| C00158 | 1 | 32 | High IMT LBR |
| C00159 | | | RBF IMT Ckt Failed High |
| C00161 | | | RBF IMT Ckt Failed Low |
| C00162 | 0 | 32 | High IMT RBF |
| C00163 | | | RBR IMT Ckt Failed High |
| C00164 | | | RBR IMT Ckt Failed Low |
| C00165 | 0 | 32 | High IMT RBR |
| C00212 | | | Oil Temp Ckt Failed High |
| C00213 | | | Oil Temp Ckt Failed Low |

| Error Code (Message number) G = Shovel C = Engine 1 or engine 2 | Color code of TOP Message: 0 = RED 1 = YELLOW 2 = GREEN | Instruction Message Number. Refer to separate Table | TOP Message with colored background REMARK Messages w/o color code are not displayed. These messages are stored in the history memory only. |
|--|--|--|---|
| C00214 | 1 | 31 | High Oil Temp |
| C00221 | | | Ambient Air Press Failed High |
| C00222 | | | Ambient Air Press Failed Low |
| C00223 | | | CORS Burn Valve Open Circuit |
| C00231 | | | Coolant Press Ckt Failed High |
| C00232 | | | Coolant Press Ckt Failed Low |
| C00233 | 0 | 33 | Low Coolant Press |
| C00234 | 0 | 32 | Engine Overspeed |
| C00235 | 1 | 31 | Low Coolant Level |
| C00252 | | | Oil Level Signal Invalid |
| C00253 | 0 | 33 | Oil Level Low |
| C00254 | 0 | 34 | FSOV Open Circuit |
| C00259 | 1 | 31 | FSOV Mech Stuck Open |
| C00261 | 0 | 33 | High Fuel Temp |
| C00263 | | | Fuel Temp Ckt Failed High |
| C00265 | | | Fuel Temp Ckt Failed Low |
| C00299 | | | Hot Shutdown |
| C00316 | | | Fuel Pump Open Circuit |
| C00318 | | | Fuel Pump Mech Stuck |
| C00343 | | | ECM Hardware Issue Non Mission Disabling |
| C00346 | | | ECM Software / Hardware Failure |
| C00423 | 1 | 35 | Timing Press Incorrect |
| C00426 | | | J1939 Broadcast Data Missing |
| C00427 | | | J1939 Datalink Can Not Transmit |
| C00441 | 1 | 31 | Low Battery Voltage |
| C00442 | 1 | 31 | High Battery Voltage |
| C00451 | | | Rail Press Ckt Failed High |
| C00452 | | | Rail Press Ckt Failed Low |
| C00455 | 1 | 31 | Rail Actuator Open Ckt |
| C00467 | 1 | 35 | Desired Timing Not Achieved |
| C00468 | 1 | 40 | Desired Rail Press not Achieved |

| Error Code (Message number) G = Shovel C = Engine 1 or engine 2 | Color code of TOP Message: 0 = RED 1 = YELLOW 2 = GREEN | Instruction Message Number. Refer to separate Table | TOP Message with colored background REMARK Messages w/o color code are not displayed. These messages are stored in the history memory only. |
|--|--|--|---|
| C00514 | 1 | 40 | Rail Actuator Mech Stuck |
| C00527 | | | Dual Output A Shorted High or Open Ckt |
| C00529 | | | Dual Output B Shorted High or Open Ckt |
| C00551 | 0 | 32 | Throttle Validation Switch High Error |
| C00553 | 1 | 31 | Rail Press OOR High |
| C00554 | 1 | 40 | Rail Press Incorrect |
| C00555 | 0 | 33 | High Blowby Press |
| C00611 | | | Hot Shutdown Key Switch Error |
| C00612 | 1 | 31 | High Oil Filter Rest |
| C00616 | | | High Turbo Comp Inlet Temp LBR |
| C00621 | | | Low Power #1 LB |
| C00622 | | | Low Power #2 LB |
| C00623 | | | Low Power #3 LB |
| C00624 | | | Low Power #4 LB |
| C00625 | | | Low Power #5 LB |
| C00626 | | | Low Power #6 LB |
| C00627 | | | Low Power #7 LB |
| C00628 | | | Low Power #8 LB |
| C00631 | | | Low Power #1 RB |
| C00632 | | | Low Power #2 RB |
| C00633 | | | Low Power #3 RB |
| C00634 | | | Low Power #4 RB |
| C00635 | | | Low Power #5 RB |
| C00636 | | | Low Power #6 RB |
| C00637 | | | Low Power #7 RB |
| C00638 | | | Low Power #8 RB |
| C00641 | 0 | 32 | High Exh Temp #1 LB |
| C00642 | 0 | 32 | High Exh Temp #2 LB |
| C00643 | 0 | 32 | High Exh Temp #3 LB |
| C00644 | 0 | 32 | High Exh Temp #4 LB |
| C00645 | 0 | 32 | High Exh Temp #5 LB |

| Error Code (Message number) G = Shovel C = Engine 1 or engine 2 | Color code of TOP Message: 0 = RED 1 = YELLOW 2 = GREEN | Instruction Message Number. Refer to separate Table | TOP Message with colored background REMARK Messages w/o color code are not displayed. These messages are stored in the history memory only. |
|--|--|--|---|
| C00646 | 0 | 32 | High Exh Temp #6 LB |
| C00647 | 0 | 32 | High Exh Temp #7 LB |
| C00648 | 0 | 32 | High Exh Temp #8 LB |
| C00651 | 0 | 32 | High Exh Temp #1 RB |
| C00652 | 0 | 32 | High Exh Temp #2 RB |
| C00653 | 0 | 32 | High Exh Temp #3 RB |
| C00654 | 0 | 32 | High Exh Temp #4 RB |
| C00655 | 0 | 32 | High Exh Temp #5 RB |
| C00656 | 0 | 32 | High Exh Temp #6 RB |
| C00657 | 0 | 32 | High Exh Temp #7 RB |
| C00658 | 0 | 32 | High Exh Temp #8 RB |
| C00661 | | | High Power #1 LB |
| C00662 | | | High Power #2 LB |
| C00663 | | | High Power #3 LB |
| C00664 | | | High Power #4 LB |
| C00665 | | | High Power #5 LB |
| C00666 | | | High Power #6 LB |
| C00667 | | | High Power #7 LB |
| C00668 | | | High Power #8 LB |
| C00671 | | | Exh Temp Ckt Failed Low #1 LB |
| C00672 | | | Exh Temp Ckt Failed Low #2 LB |
| C00673 | | | Exh Temp Ckt Failed Low #3 LB |
| C00674 | | | Exh Temp Ckt Failed Low #4 LB |
| C00675 | | | Exh Temp Ckt Failed Low #5 LB |
| C00676 | | | Exh Temp Ckt Failed Low #6 LB |
| C00677 | | | Exh Temp Ckt Failed Low #7 LB |
| C00678 | | | Exh Temp Ckt Failed Low #8 LB |
| C00694 | | | LBR Turbo Comp Inlet Temp Sesnor Ckt Failed High |
| C00695 | | | LBR Turbo Comp Inlet Temp Sesnor Ckt Failed Low |
| C00711 | | | High Power #1 RB |

| Error Code (Message number) G = Shovel C = Engine 1 or engine 2 | Color code of TOP Message: 0 = RED 1 = YELLOW 2 = GREEN | Instruction Message Number. Refer to separate Table | TOP Message with colored background REMARK Messages w/o color code are not displayed. These messages are stored in the history memory only. |
|--|--|--|---|
| C00712 | | | High Power #2 RB |
| C00713 | | | High Power #3 RB |
| C00714 | | | High Power #4 RB |
| C00715 | | | High Power #5 RB |
| C00716 | | | High Power #6 RB |
| C00717 | | | High Power #7 RB |
| C00718 | | | High Power #8 RB |
| C00719 | | | Blowby Press Ckt Failed High |
| C00721 | | | Exh Temp Ckt Failed Low #1 RB |
| C00722 | | | Exh Temp Ckt Failed Low #2 RB |
| C00723 | | | Exh Temp Ckt Failed Low #3 RB |
| C00724 | | | Exh Temp Ckt Failed Low #4 RB |
| C00725 | | | Exh Temp Ckt Failed Low #5 RB |
| C00726 | | | Exh Temp Ckt Failed Low #6 RB |
| C00727 | | | Exh Temp Ckt Failed Low #7 RB |
| C00728 | | | Exh Temp Ckt Failed Low #8 RB |
| C00729 | | | Blowby Press Ckt Failed Low |
| C00753 | | | Cam Sync Error |
| C00777 | | | Ambient Derate Error |
| C00783 | 0 | 32 | Rapid Rise in LBF IMT |
| C02154 | | | Post Oil Filter Press Ckt Failed High |
| C02155 | | | Post Oil Filter Press Ckt Failed Low |
| C02157 | 0 | 32 | Rapid Rise in LBR IMT |
| C02158 | 0 | 32 | Rapid Rise in RBF IMT |
| C02159 | 0 | 32 | Rapid Rise in RBR IMT |

3.4.11 TABLE OF AVAILABLE INSTRUCTION MESSAGES

NOTICE

TOP Messages and applying Instruction Messages are always displayed together.

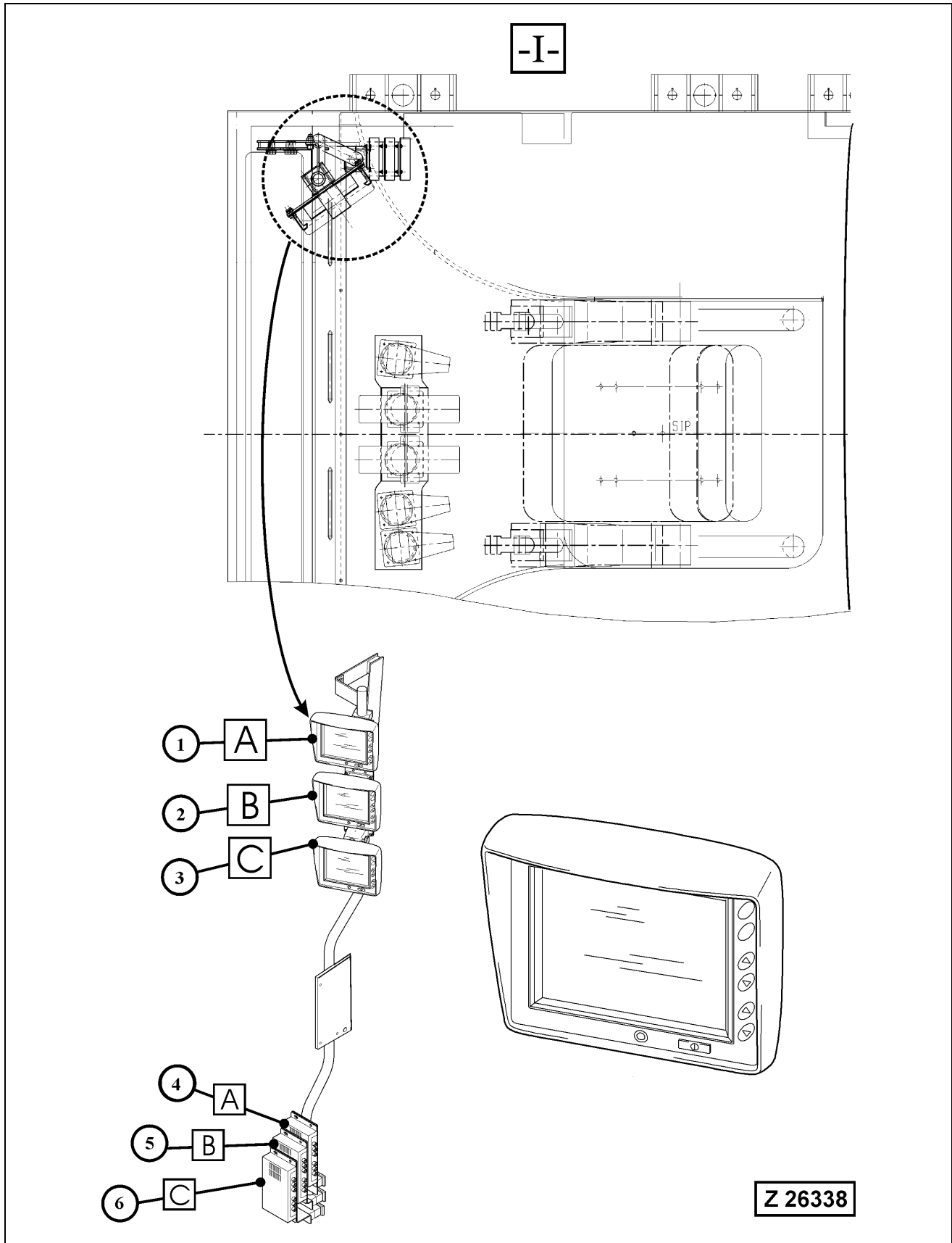
| Message No. | Instruction Message |
|-------------|--|
| 0 | |
| 1 | Engine stopped because of main Shut-Off (gate) valve. - Open the Shut-Off (gate) valve. - If failure exist further, inform service. |
| 2 | Inform service. |
| 3 | Stop the engine. - Inform service. |
| 4 | Start blocked because of main Shut-Off (gate) valve. - Open the Shut-Off (gate) valve. - If failure exist further, inform service. |
| 5 | Start blocked. - Inform service. |
| 6 | The fire suppression system has been actuated. - Inform the fire brigade. - Evacuate endangered persons. - Fight the fire. - Inform service. |
| 7 | Bucket motion switched off. - Inform service. |
| 8 | Circuit breaker F13 switch on. - If failure exist further, inform service. |
| 9 | Ladder end switch or lock lever contact open or service arm down or unlocked. - If failure exist further, inform service. |
| 10 | Emergency shut-down switch was actuated. - Unlock before restarting. - If failure exist further, inform service. |
| 11 | Engine switched off by Maintenance safety switch in the engine room. - Unlock before restarting. - If failure exist further, inform service. |
| 12 | Operate the machine into the parking position |
| 13 | |
| 14 | Enable switch for refilling arm active. - If failure exist further, inform service. |
| 15 | Load of the batteries too high. - Inform service. |
| 16 | Batteries are not being charged. - Inform service. |
| 17 | Inform service till end of shift and then press cancel button. |
| 18 | Swing gear house brake OFF - Inform service till end of shift and then press cancel button. |
| 19 | Travel gear house brake OFF - Inform service till end of shift and then press cancel button. |
| 20 | Inform service and then press cancel button. |
| 21 | Hydraulic oil far below operating temperature! - Pre-heat hydraulic oil or warm up at low idle speed and reduced power. |

| Message No. | Instruction Message |
|-------------|--|
| 22 | Engine runs (starter motor inactive). |
| 23 | A fuel reserve only is still in the tank. - Order tanker. |
| 24 | Engine shutdown has been actuated from ground man. |
| 25 | Hydraulic oil below operating temperature. - Operate with reduced power! |
| 26 | Swing gear house brake ON |
| 27 | Hydraulic oil overheat - engine power derated |
| 28 | The VHMS is by-passed. - Reset by-pass switch. |
| 29 | Engine shutdown by key switch before proper engine cool down. - Before you switch off the engine, cool down the engine at low idle speed for 2 - 3 minutes. |
| 30 | Hydraulic oil far below operating temperature! Pre-heat hydraulic oil or warm up at low idle speed and reduced power. |
| 31 | Continue shift but advise service. |
| 32 | Stop engine call service. |
| 33 | Derate active continue to work. Later shutdown possible. Inform service. |
| 34 | Call service because of shutdown. |
| 35 | Interrupt work and inform service about Speed Derate. |
| 36 | Continue work until next PM (Schedule work for next PM) |
| 37 | Switch Test speed in cab base forces the engine to run constantly 1800 rpm. |
| 38 | If failure exist further, inform service. |
| 39 | Inform service if attachment in defined position. |
| 40 | Continue to work and inform service about Power Derate |
| 46 | Switch off windscreen wiper and inform service |
| 47 | Only upper windscreen wiper. Inform service |
| 48 | Circuit breaker F13a switch on. -If failure exist further, inform service. |
| D0001 | System test running! |

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3.5 CAMERA SYSTEM WITH MONITORS

(Special Equipment)



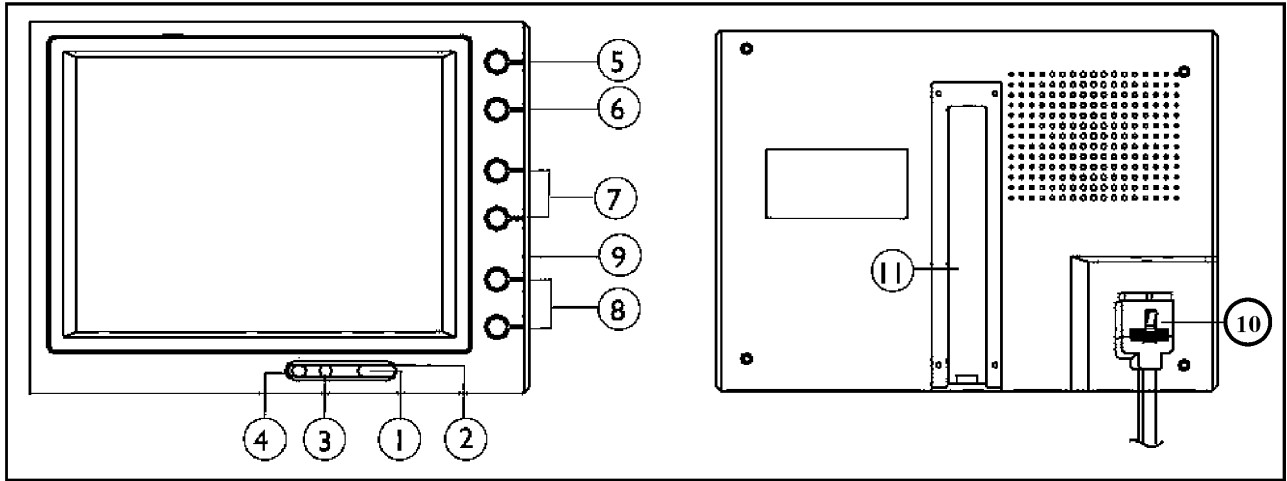
3.5.1 LOCATION OF MONITORS AND CONTROL UNITS

Legend for illustration Z26338

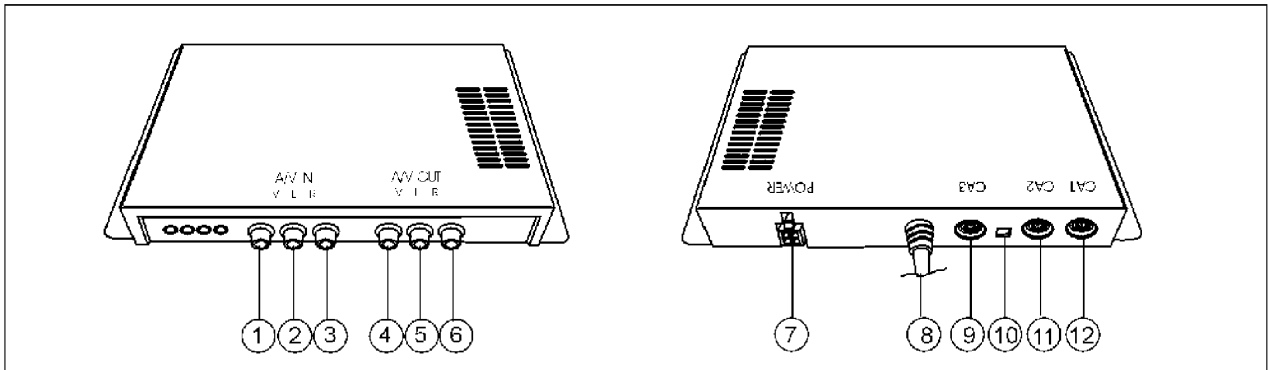
- I - Top view of Operator's cab
- (A) Components of the camera system mounted on the access ladder stop bar, see page 133 for details.
- (B) Components of the camera system mounted on the counterweight railing
- (C) Components of the camera system mounted on the right machinery house railing
- (1) Monitor for viewing the left area of the excavator
- (2) Monitor for viewing the rear area of the excavator
- (3) Monitor for viewing the right area of the excavator
- (4) Control unit for monitor (1)
- (5) Control unit for monitor (2)
- (6) Control unit for monitor (3)

Refer to page 129 for operating instructions of the monitors.

-D-



-E-



Z 25088

Operating the Monitors

Legend for illustration Z25088

LCD Monitor -D-

- (1) **Power LED.** With ignition key in ON position the LED lights up to indicate the stand-by modus
- (2) **Power ON - OFF switch.** This switch is used for switching the display on and off
- (3) **Remote control sensor.** The monitor can also be operated with a remote controller. To operate the monitor point the remote controller towards the sensor.
- (4) **Brightness sensor.** (Day/Night automatic brightness control) The brightness of the display is automatically adjusted according to the light conditions. This function is only available with Day/Night switch (9) in ON position
- (5) **Camera selection button.** This function is not used
- (6) **Menu button.** By pressing this button the selectable menu functions appear on the monitor. The menu will disappear after 5 seconds if no further button is actuated. Select the desired function with buttons (8) CH:
 - SCALE -Evaluation scale- (Not used)
 - CA1 -Mirror-
 - AUTO TIME (Not used)
 - COLOR
 - BRIGHTNESS
 - CONTRAST
- (7) **Volume button.** This function is not used
- (8) **CH-Menu selection buttons.** Displayed menu functions can be selected with these arrow buttons
- (9) **Day/Night switch ON - OFF.** Switch for automatic brightness control
- (10) **Input terminal.** Connector for control unit cable
- (11) **Rail for monitor bracket.** Adjustable

Ajustments of the Monitor

1. SCALE CONTROL (Not used)

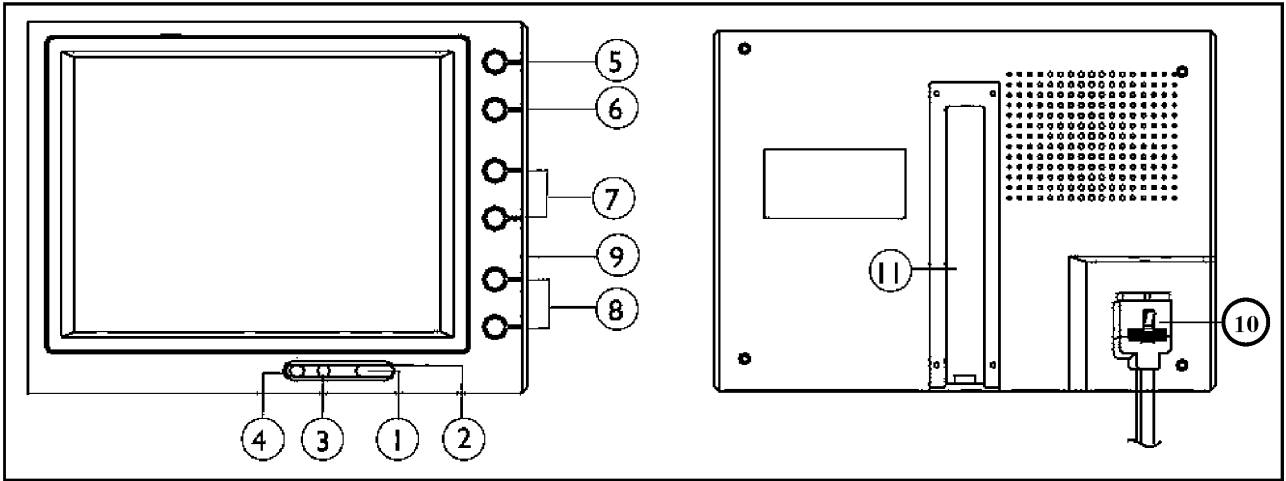
2. CAMERA MIRROR CONTROL

Selection of mirror or normal image.

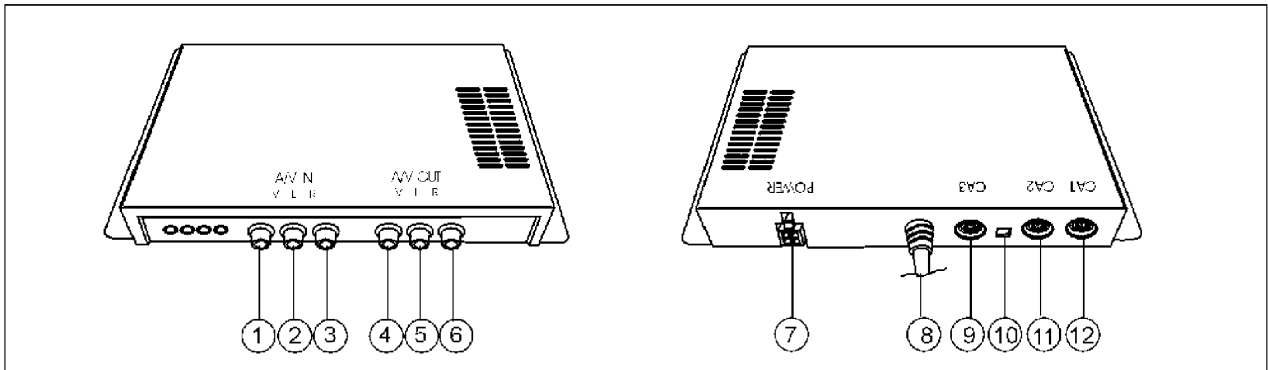
1. Press the MENU button (6).
2. Select CA1 (MIRROR) or CA1 (NORMAL) with buttons CH.
3. Choose the desired function with button CA. SEL.
4. Press the MENU button.

3. AUTO TIME CONTROL (Not used)

-D-



-E-



Z 25088

Adjustments of the Monitor (continued)

4. Color setting

1. Press the MENU button.
2. Select menu item COLOR with the buttons CH and acknowledge the selection with button CA.SEL.
3. Adjust the desired color by using the buttons CH.
4. Press button MENU to finish the set-up.

5. Brightness setting

1. Press the MENU button.
2. Select menu item BRIGHT with the buttons CH and acknowledge the selection with button CA.SEL.
3. Adjust the desired brightness by using the buttons CH.
4. Press button MENU to finish the set-up.

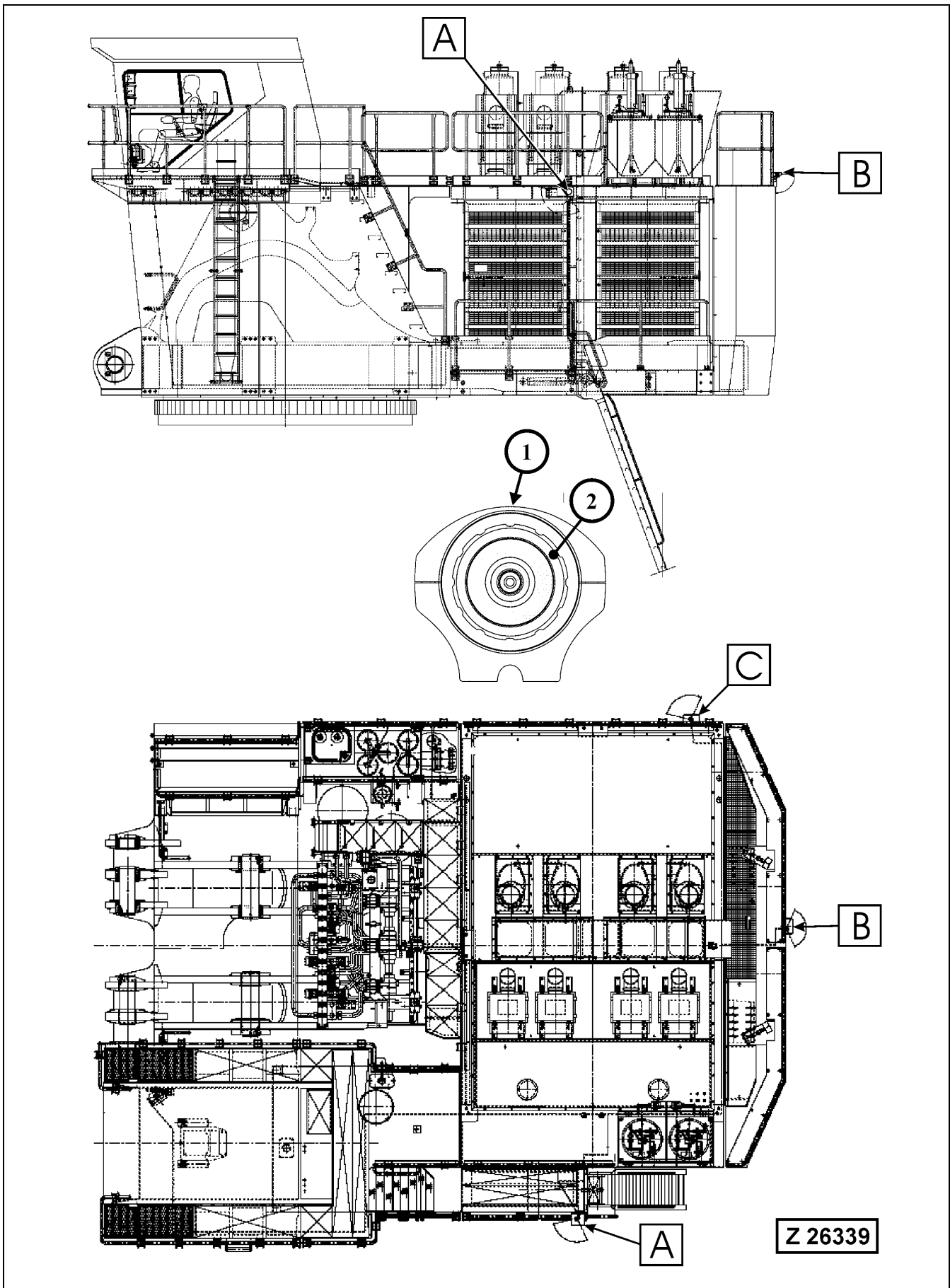
6. Contrast setting

1. Press the MENU button.
2. Select menu item CONTRAST with the buttons CH and acknowledge the selection with button CA.SEL.
3. Adjust the desired contrast by using the buttons CH.
4. Press button MENU to finish the set-up.

Legend for illustration Z25088

Control Unit -E-

- (1) Video input, e.g. for DVD player or Video recorder (if utilized)
- (2) Audio input -L- (if utilized)
- (3) Audio input -R- (if utilized)
- (4) Video output -L- (if utilized)
- (5) Audio output -R- (if utilized)
- (6) Audio output -R- (if utilized)
- (7) Power input plug
- (8) Connector cable to monitor
- (9) Plug socket for additional camera 3 (not applicable)
- (10) Control switch for camera 2 and 3 (not applicable)
- (11) Plug socket for additional camera 2 (not applicable)
- (12) Plug socket for the utilized camera



Arrangement of the Cameras

Legend for illustration Z26339

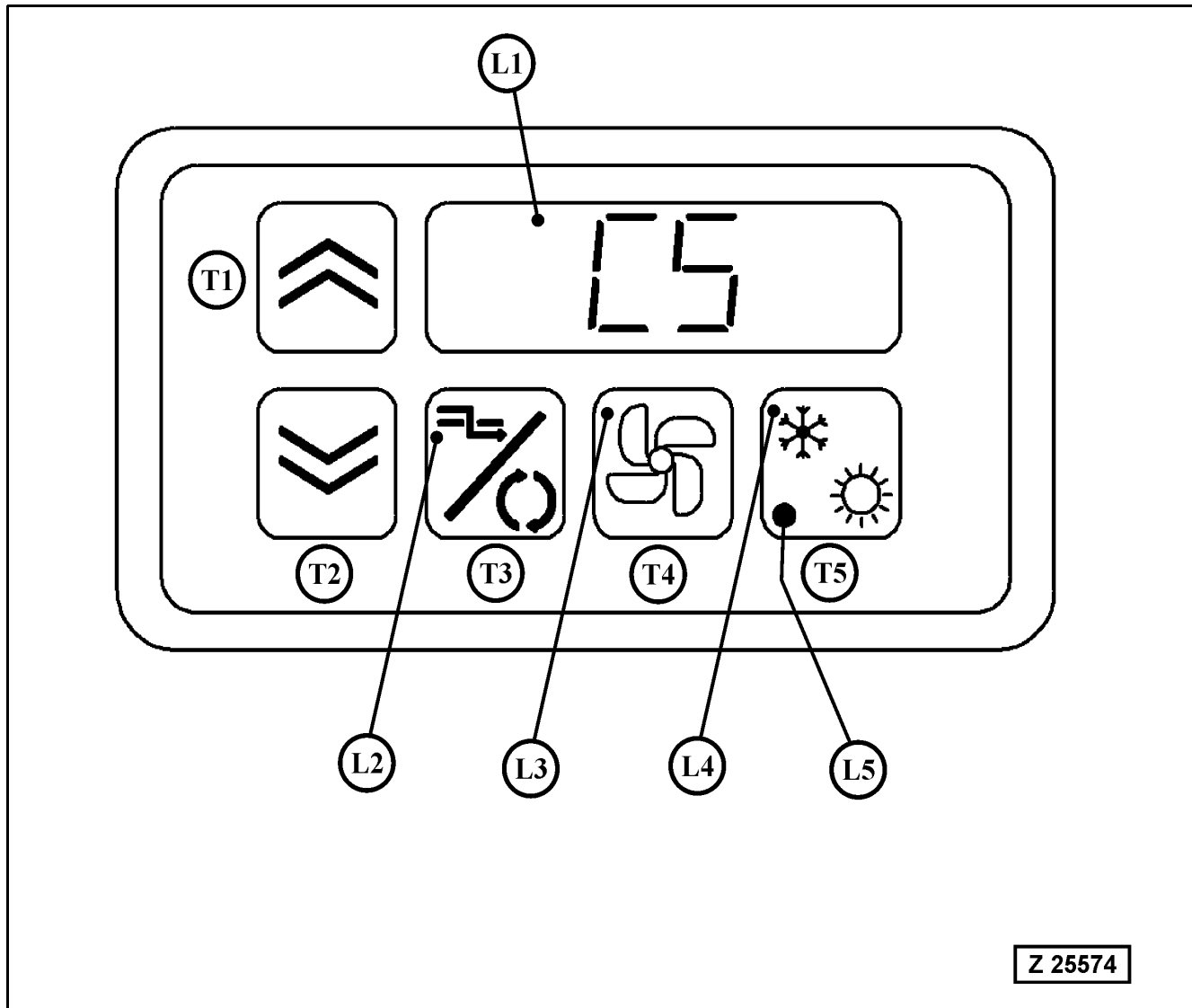
- (A) Camera mounted on the access ladder stop bar.
 - View angle horizontal: 102°
 - View angle vertical: 130°
- (B) Camera mounted on the counterweight railing
 - View angle horizontal: 130°
 - View angle vertical: 102°
- (C) Camera system mounted on the right machinery house railing
 - View angle horizontal: 102°
 - View angle vertical: 130°
- (1) Camera bracket
- (2) Camera

NOTICE

Never remove the lens glass from the camera. The housing is filled with nitrogen which prevents moisture from getting into the camera. The nitrogen would escape if the lens glass is being removed.

3.6 OPERATING THE HEATER, VENTILATION AND AIR CONDITIONING

Digital Display



Function of Keys when "Engine On" and controller active.
See Illustration Z 25574

Key T1: Plus Key

Increases interior temperature setpoint by one degree per stroke or increases manual blower speed, depending on displayed mode.

Key 2: Minus Key

Decreases interior temperature setpoint by one degree per stroke or decreases manual blower speed, depending on displayed mode.

Key T3: Recirculating Air/Fresh Air

Switches from recirculated air to fresh air and vice versa.

Key T4: Blower Control

Switches on the manual blower control. Press plus/minus key to select the following speeds: 1*) -2-3-4-5.

1*) to 5: adjusts the blowers to speeds 20%, 40%, 60%, 80%, 100%.

Off*): Switches off the blowers or switches to automatic.

Automatic: The blowers are controlled automatically based on the interior temperature.

Key T5: Automatic climate control

Switches on the automatic temperature control.

Key T2+T3: Temperature indication.

Shows the inside temperature for 10 seconds. If pressed a second time, it shows the outside temperature for 10 seconds (optional)

Key T3+T5: Reheat (optional)

Starts reheat mode for 3 minutes. (Duration adjustable)

Key T3+T4: Controller OffSwitches of all control functions and the display.

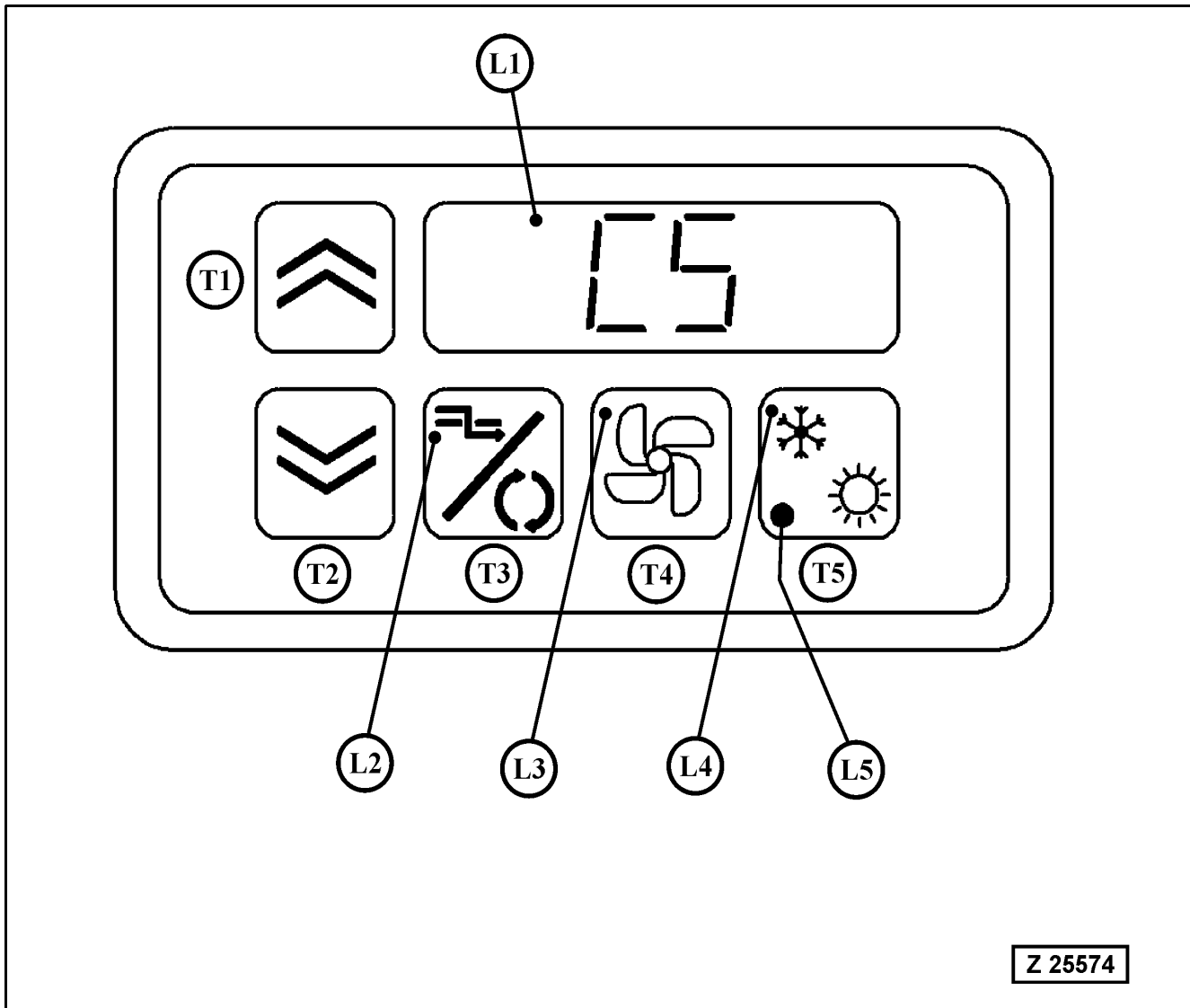
*) The following blower steps are disabled when the automatic climate control is on.

2-,3-Step: off

continuously adjustable blower: Off, 1

Air Flow Control

- For defrosting the windshield close the slide in the seat base. The whole air flow is now directed to the windshield.
- To direct the air flow to your feet, open the slide in the seat base.

Luminous Indication.**Function of Indication when "Engine On" and Controller active. See Illustration Z 25574**

LED Field L1: Standard indication is the setpoint temperature.

LED Field L2: Fresh air operation (green)

LED Field L3: Manual blower control "ON" (green)

LED Field L4: Cooling/Heating mode (green)

LED Field L5: Malfunction cooling unit (red).

Operating Instructions.

When the engine is running, press any key to activate the air conditioning control unit.

All previous settings are reactivated.

Display

When the unit is ON, the display shows the interior setpoint temperature. When selecting individual functions, the display shows the corresponding information for a short period of time. The display is dark when engine or control unit are OFF.

Interior Temperature Control.

When the unit is ON, select Automatic Climate Control (T5) to start interior temperature control.

Press the plus (T2) or minus (T3) to set the required interior temperature.

The temperature can be adjusted between 18° and 28°C.

When outside temperatures are below 2°C (adjustable parameter), the cooling function remains disabled.

Ventilation

When the unit is operating in Automatic Climate Control mode, the blower speed is controlled based on the room temperature.

However, the blowers may be switched to manual mode by pressing the blower key.

Press the plus (T1) or minus (T2) keys to define one of five different blower settings. The blowers can not be switched OFF when Automatic Climate Control (T5) is ON.

When Automatic Climate Control is OFF, the blowers stop when the manual blower control is turned to zero.

Reheat (optional)

The reheat mode is used to remove air humidity and to help defog the windshields. Press T3 and T5 (Illustration Z 25574) at the same time to activate reheat. Heating and cooling will be active for 3 minutes (adjustable parameter) during which time the blowers must be switched to maximum speed and the fresh air flap is to be closed. When the windshields are defogged at the end of the preselected duration time, all functions are to be set to the previously selected settings.

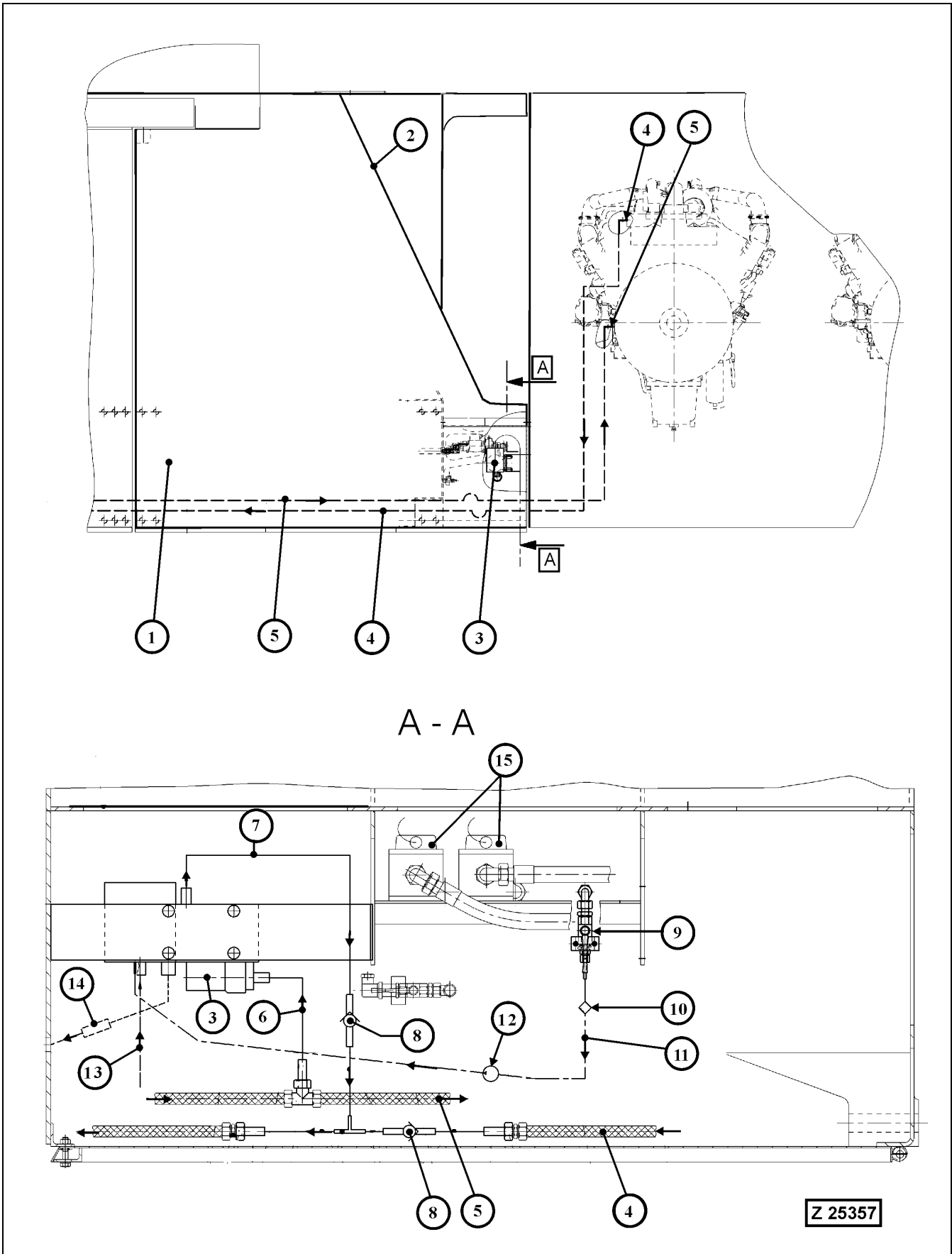
Reheat mode is disabled when outside temperatures are below 2°C (adjustable parameter) or when the sensor is not installed or is defective.

Temperature indication

Press T2 and T3 (Illustration Z 25574) at the same time to display the inside temperature, eg. "i 22" for 10 seconds.

Additionally, when pressing the keys a second time, the outside temperature can be displayed, eg. "o 19".

A sensor malfunction is shown as "i--" or "o--".



3.6.1 AUXILIARY HEATER FOR OPERATOR'S CAB

Special Equipment

REMARK

The auxiliary cab heater is located in the compartment below the stair to the operator's cab. View A-A shows the arrangement of components and the flow of water, fuel and air.

Legend for illustration Z25357

- (1) Fuel tank
- (2) Stair to operator's cab
- (3) Heater unit HYDRONIC 10, refer to the separate operation manual HYDRONIC 10 for all operating and maintenance instructions. The manual is filed in volume 2 binder.
- (4) Water supply line from engine to cab heater
- (5) Water return line
- (6) Water line to auxiliary heater
- (7) Hot water line from auxiliary heater to cab heater
- (8) Check valve
- (9) Fuel shut off-cock for fuel supply to heater (3)
- (10) Fuel strainer
- (11) Fuel supply line
- (12) Fuel dosing pump
- (13) Combustion air intake line
- (14) Exhaust muffler
- (15) Fuel shut-off solenoid valves

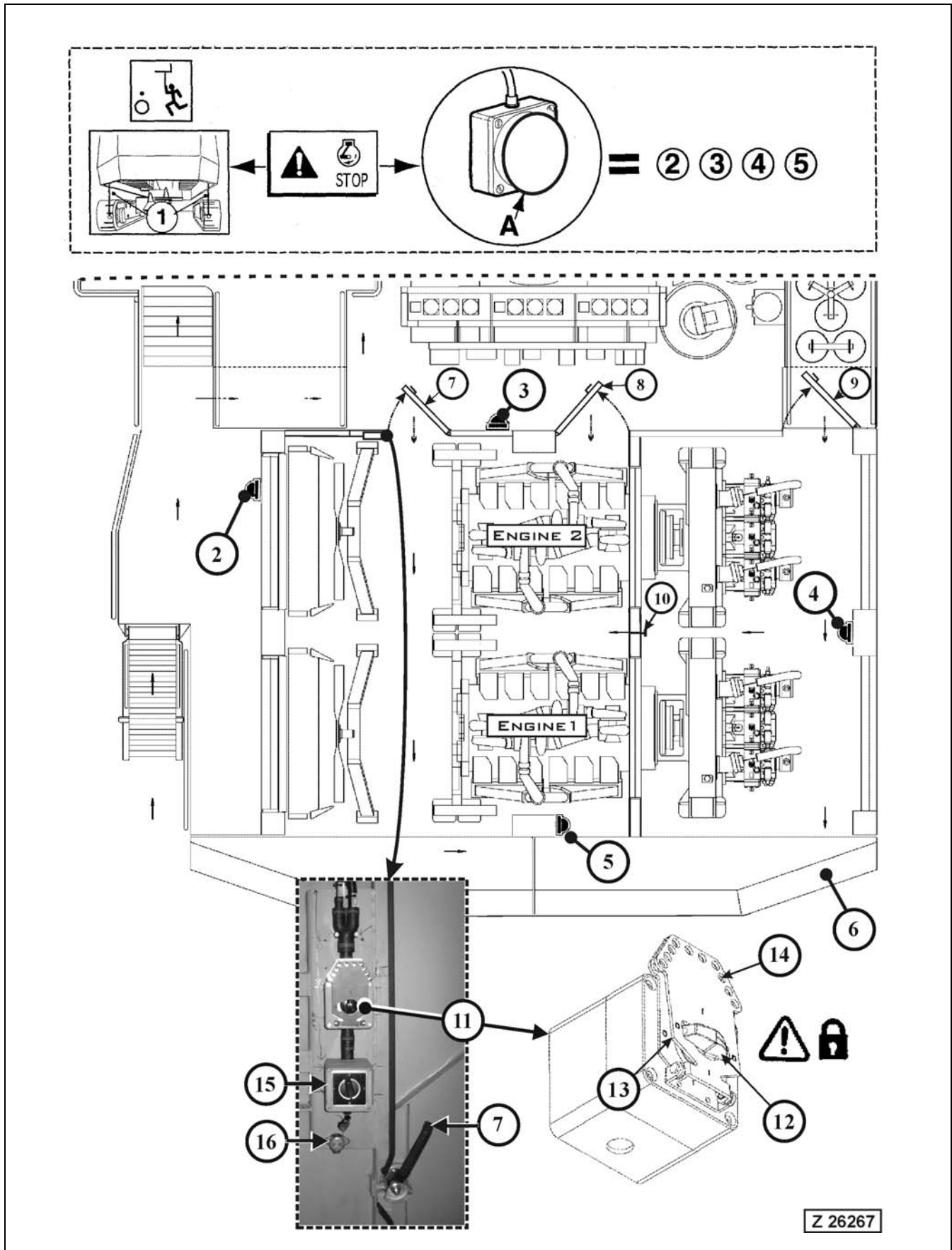
Operation

To activate the heater (3), open fuel shut off-cock (9). Select the desired heating stage with the control module (5) shown on page 89.

REMARK

During the warm season the fuel shut-off cock (9) should be closed.

3.7 MACHINERY HOUSE



Z 26267

3.7.1 EMERGENCY ENGINE SHUTDOWN SWITCHES

Legend for illustration Z26267

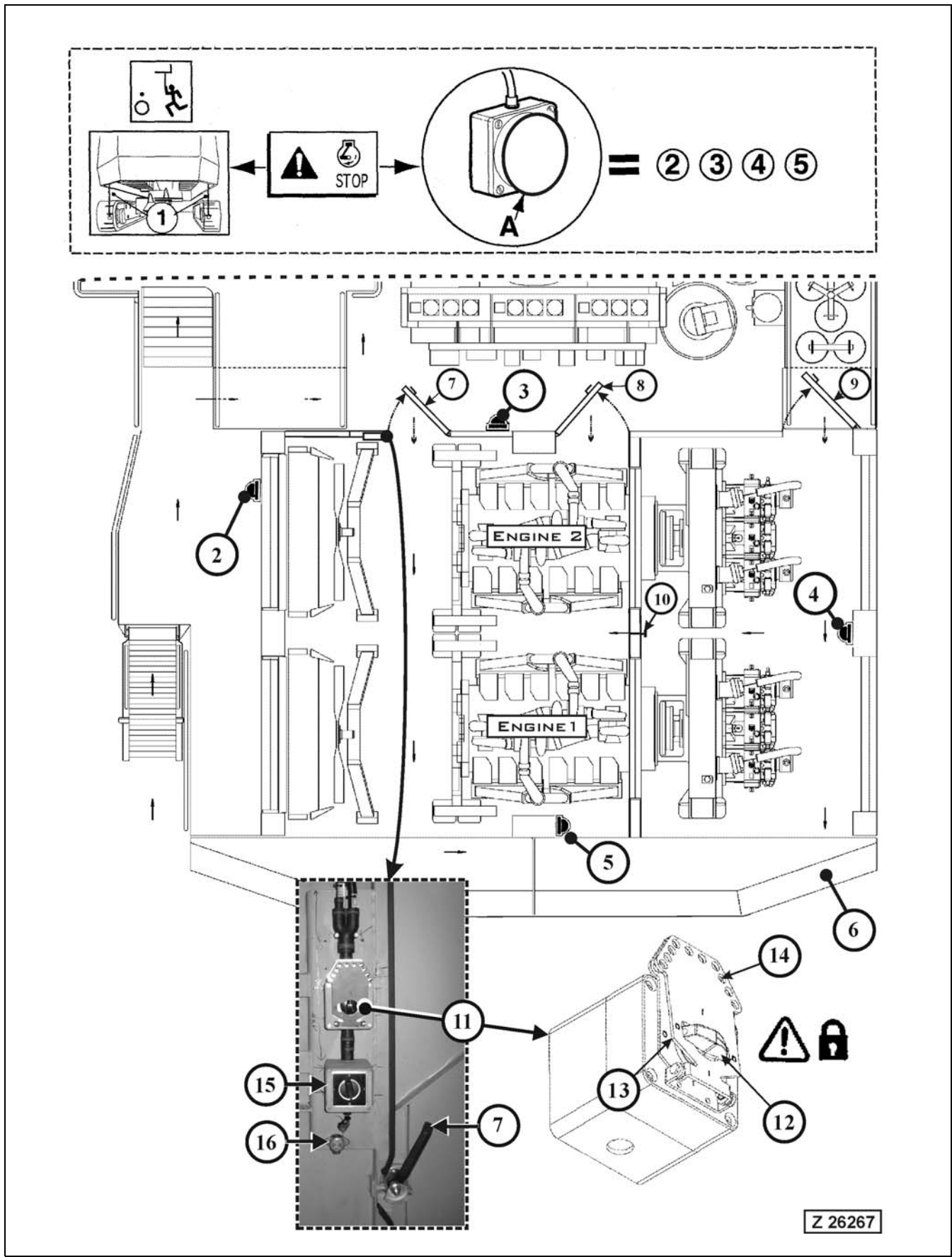
- (1) Pulling chains for emergency shut down from ground man (special equipment). When one of the chains (1) is being pulled down for emergency shut down of both engines, the Operator will be informed by the following message, displayed on the VHMS monitor:
" # Engine shut down has been actuated from ground man"
- (2) Emergency engine shutdown switch (S33A) on radiator door
- (3) Emergency engine shutdown switch (S33B) at the main control valves
- (4) Emergency engine shutdown switch (S33C) in pump compartment on center post
- (5) Emergency engine shutdown switch (S33D) at the counterweight
- (A) Push button of emergency shutdown switches (2, 3, 4 and 5) for stopping both engines
- (6) Counterweight

▲ WARNING

- In case of emergency push in the button (A) to stop both engines.
 - Never stop the engines from a full load except in case of emergency. If a hot engine is shut down without previous idling period of three to five minutes, the temperature in certain engine parts rising sharply after the cooling system ceases to function. The resulting thermal stress, especially in the turbochargers, may cause serious damage.
-
-

NOTICE

- For releasing button (A) turn it to the right, the button returns to normal position.
- In order to reset the emergency shutdown circuit, set the main key switch at the control panel in the operator's cab to -OFF- position and then to -ON- position. The engines can then be started in the normal way.
- The engines can not be started with button (A) in depressed position.
- When one of the shutdown switches (2 - 5) is activated, the VHMS monitor informs the Operator by a corresponding message.



Z 26267

3.7.2 SAFETY SWITCH FOR MAINTENANCE

Legend for illustration Z26267

- (7) Front door
- (8) Access door to the oil level gauge of the front engine
- (9) Access door to the pump compartment
- (10) Center floor door
- (11) Maintenance safety switch for start prevention of the engines
- (12) Rotary switch
Switch positions:
 - 0- Engine start blocked
 - 1- Normal operation
- (13) Securing flap for rotary switch in -0- position
- (14) Holes for attaching padlocks

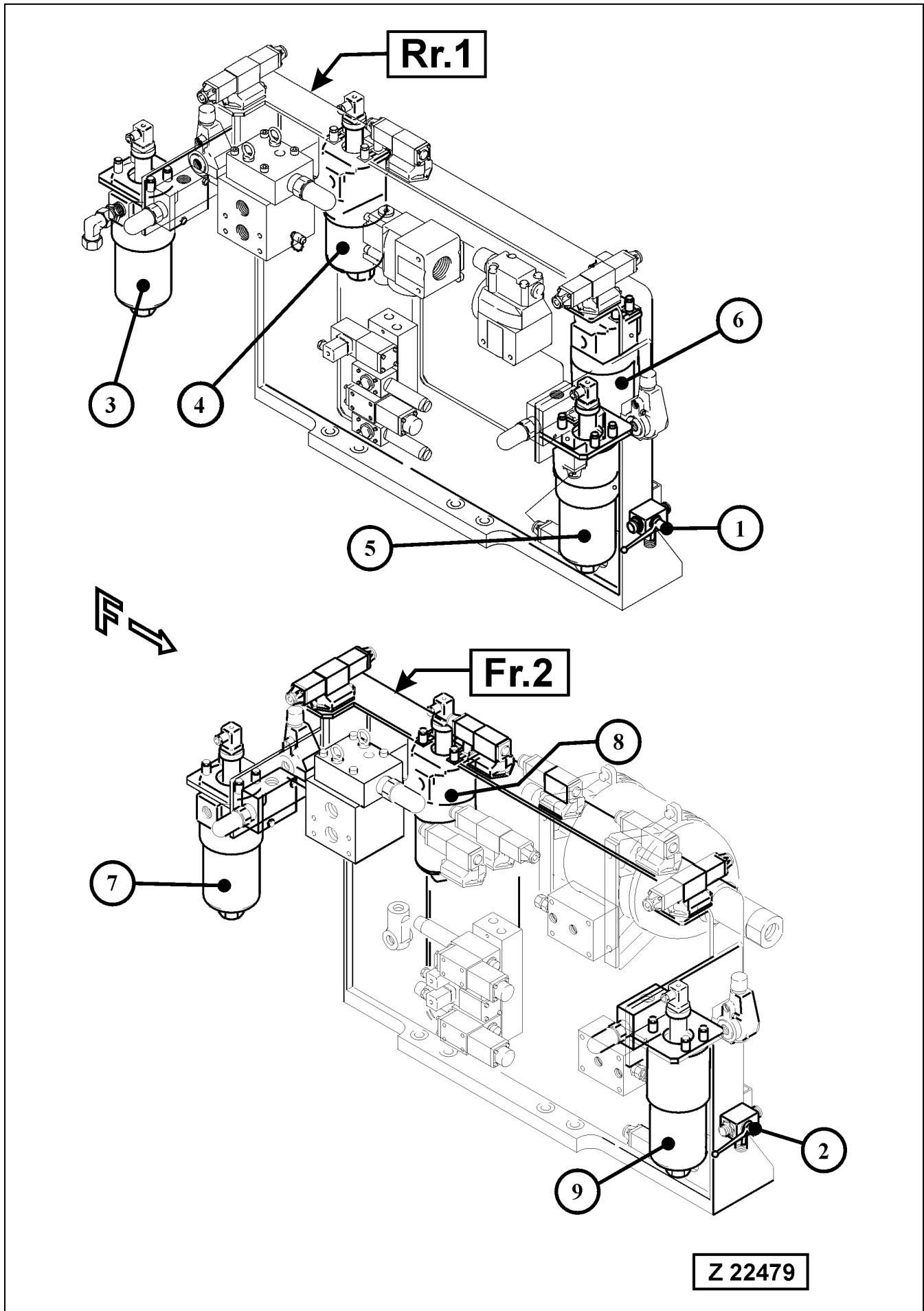
⚠ WARNING

Before beginning any maintenance operation set the rotary switch (12) to -0- position to prevent starting of the engines during maintenance. Fold up flap (13) and secure this position by inserting a padlock into the holes (14) of flap (13) and safety switch (11). Up to ten padlocks can be attached.

- (15) Light switch
- (16) Plug socket 24V DC

⚠ CAUTION

Make sure that all machinery house doors are securely closed before starting the engines.



3.7.3 CONTROL AND FILTER PANEL OF REAR- AND FRONT POWER UNIT

Legend for illustration Z22479

- (Rr.1) Control and filter panel of rear power unit, engine 1
- (Fr.2) Control and filter panel of front power unit, engine 2
- (1) Change over valve for operation mode of pump control system for rear power unit, engine 1.
- (2) Change over valve for operation mode of pump control system for front power unit, engine 2.
- (3) Pressure oil filter for fan drive hydraulic motor of coolant radiator for rear engine "1". Filter restriction monitored by differential pressure switch B21-1.
- (4) Pressure oil filter for pump distributor gear PTO "1" lubricating oil. Filter restriction monitored by differential pressure switch B27-1.
- (5) Pressure oil filter for fan drive motor of hydraulic oil cooler "1". Filter restriction monitored by differential pressure switch B28-1.
- (6) Pressure oil filter for pilot- and pump control oil circuit. Filter restriction monitored by differential pressure switch B22.
- (7) Pressure oil filter for fan drive hydraulic motor of coolant radiator for front engine "2". Filter restriction monitored by differential pressure switch B21-2.
- (8) Pressure oil filter for pump distributor gear PTO "2" lubricating oil. Filter restriction monitored by differential pressure switch B27-2.
- (9) Pressure oil filter for fan drive motor of hydraulic oil cooler "2". Filter restriction monitored by differential pressure switch B28-2.

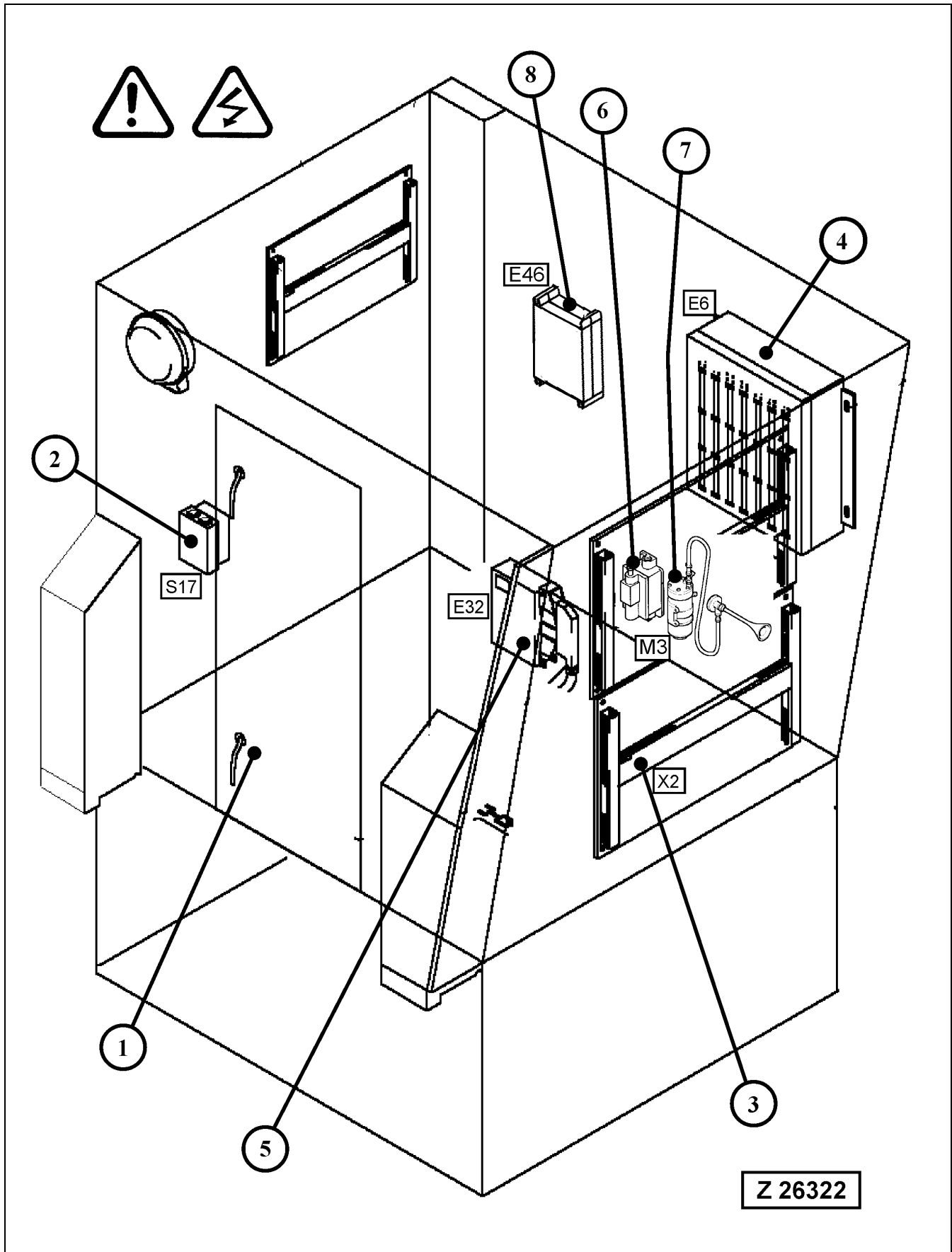
Operation Modes of Pump Regulation System

The standard operation mode of the pump control system is the Electronic Operation Mode.

For testing purposes the pump control system can be changed to the hydraulic operation mode. In case of a failure in the electronic control system the hydraulic operation mode can be used to continue operation.

The lever positions for electronic and hydraulic operation mode are marked with corresponding symbols at levers (1) and (2).

3.8 ELECTRICAL EQUIPMENT IN CAB BASE



3.8.1 STANDARD COMPONENTS IN CAB BASE

REMARK

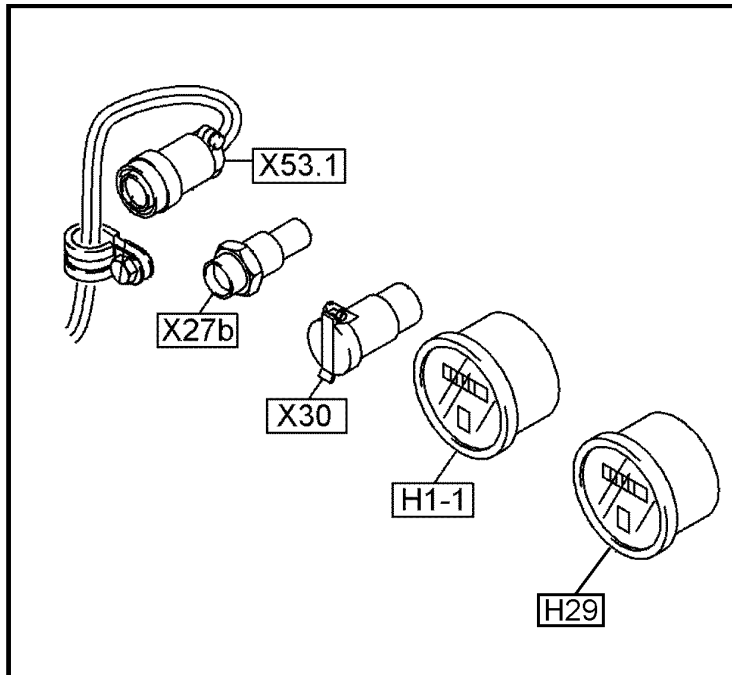
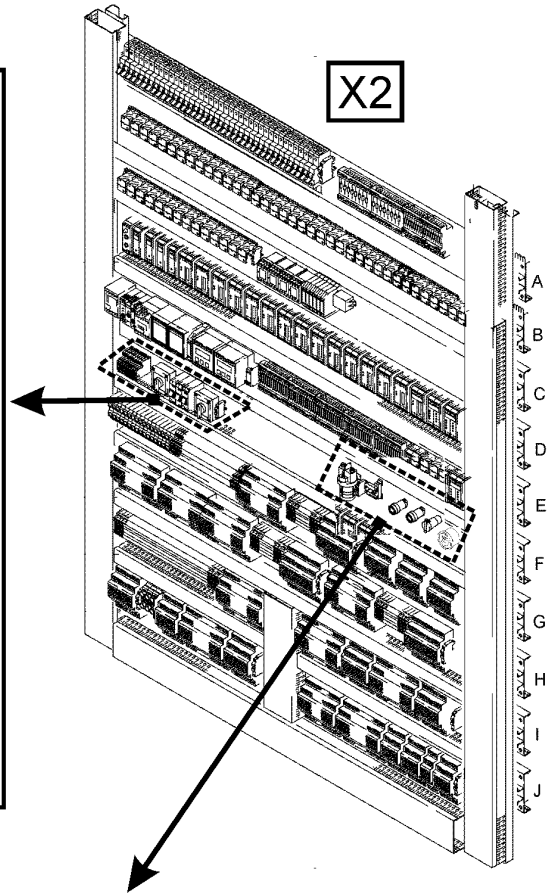
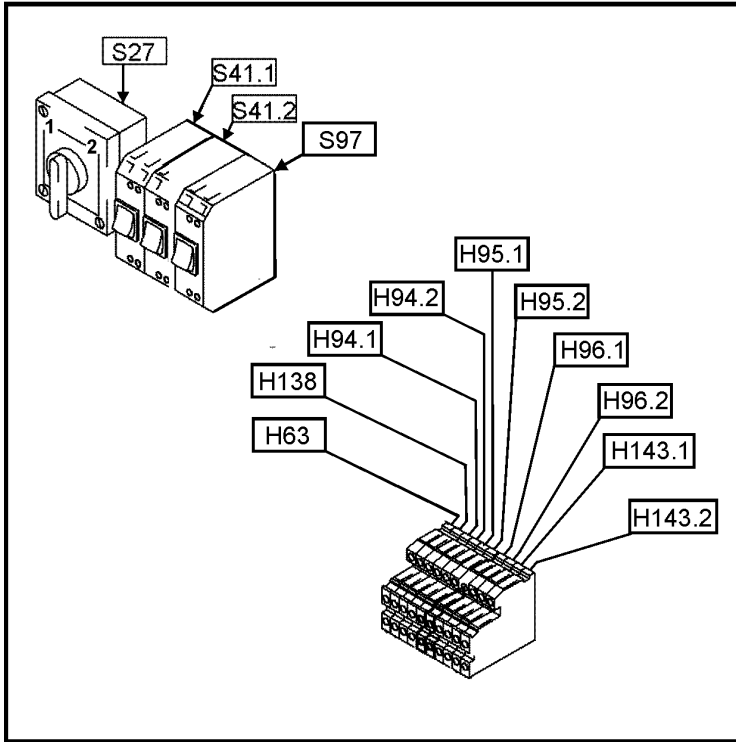
On shovels with electrical pre-heating systems there are additional components in the cab base. Refer to page 159 for more information.

⚠ WARNING

- **The cab base may contain high tension electrical appliances. Access to the cab base for authorized service staff only.**
 - **DO NOT touch cables and their terminals and connected components. Always contact authorized Electricians having the permission to work on medium and high voltage systems.**
-
-

Legend for illustration Z26322

- (1) Cab base door. Keep the door always locked, access to the cab base for authorized personnel only.
- (2) Light switch
- (3) Main switch board (X2), refer to page 149 for switch board components.
- (4) Programmable logic controller (PLC)
- (5) Electronic pump control module (RC4)
- (6) Pressure switch DPST of the FIRE DETECTION; ACTUATION AND SUPPRESSION SYSTEM (special equipment).
Refer to page 214 for more information.
- (7) Signal horn compressor
- (8) Controller of the VHMS system



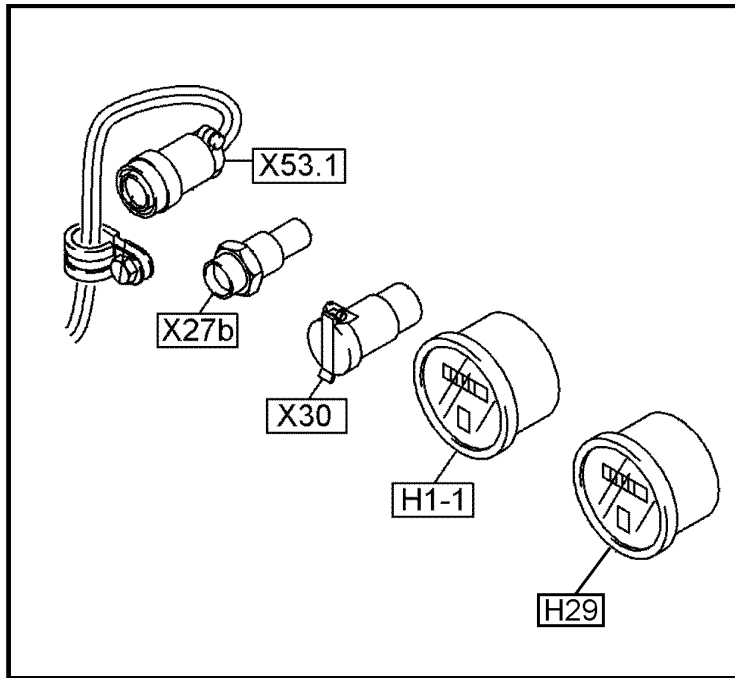
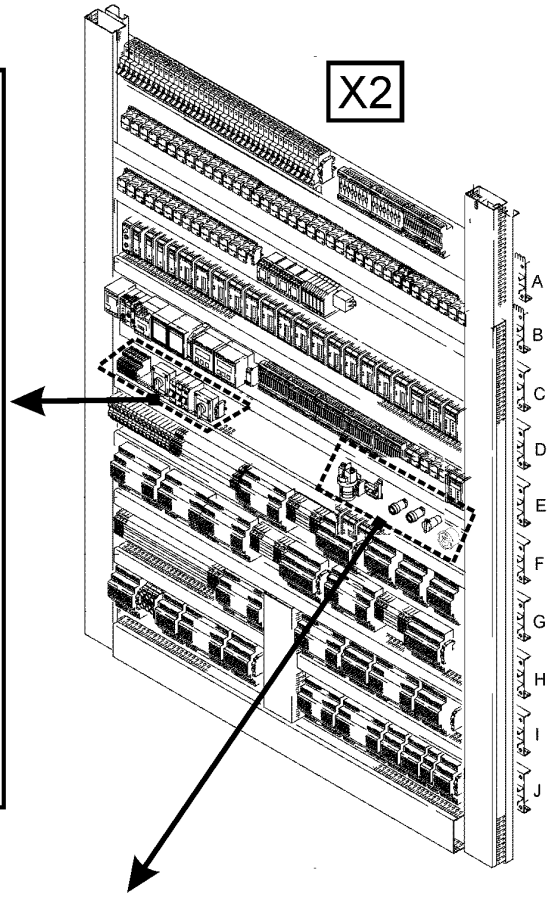
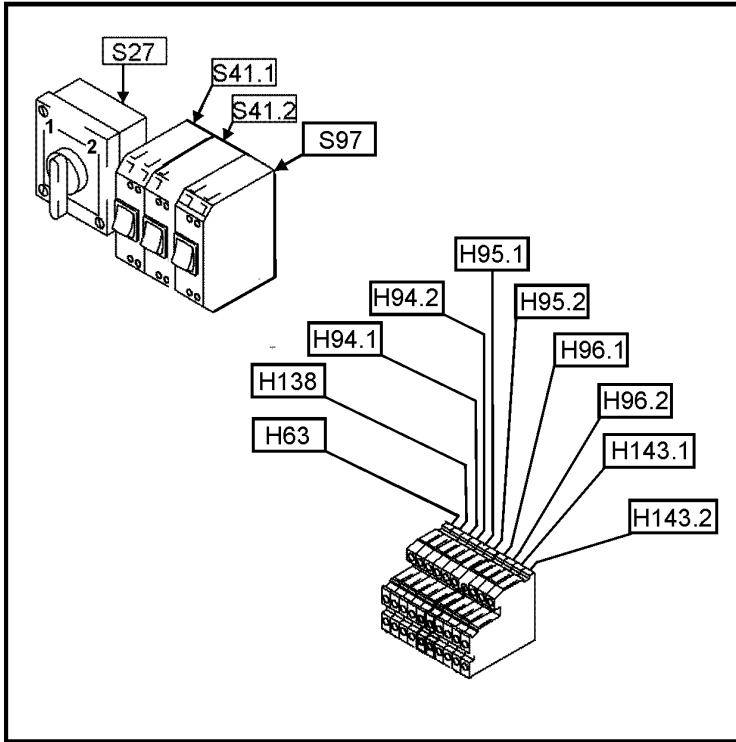
Z 26323

3.8.2 SWITCH BOARD (X2) IN CAB BASE

Legend for illustration Z26323

Switches

- (S27) Emergency By-pass switch for the shutdown function of the PLC (E6).
Switch positions:
1 - Normal operating position
2 - By-pass position
If an automatic shutdown is initiated by Shovel systems, with a dangerous situation for man or machine, which needs the Shovel to be operable to over-come the dangerous situation, actuate this switch to override the shutdown function of the system and to enable a restart of the Diesel engine.
- NOTICE**
- **This switch can not override engine initiated shutdowns.**
 - **As soon as the immediate situation of danger is over, shutdown the unit. Correct the fault that caused the shut down and re-set the Emergency By-pass switch (S27).**
- (S41.1) Switch for constant speed adjustment of engine 1 to 1800 RPM (rated speed) for testing purposes
- (S41.2) Switch for constant speed adjustment of engine 2 to 1800 RPM (rated speed) for testing purposes
- (S97) Switch for upload of new program to VHMS controller (E46), refer to VHMS Service Manual for more information.



Z 26323

Legend for illustration Z26323

Service Indicator Lights

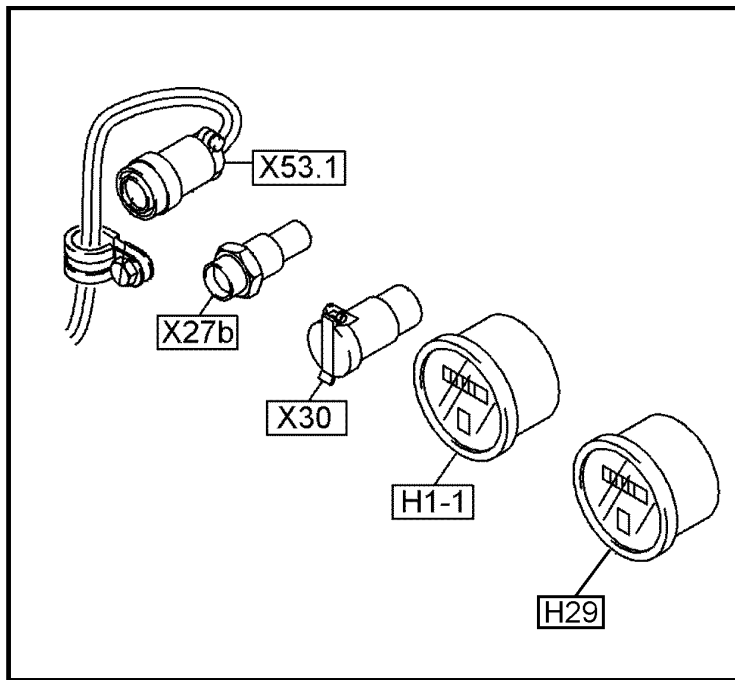
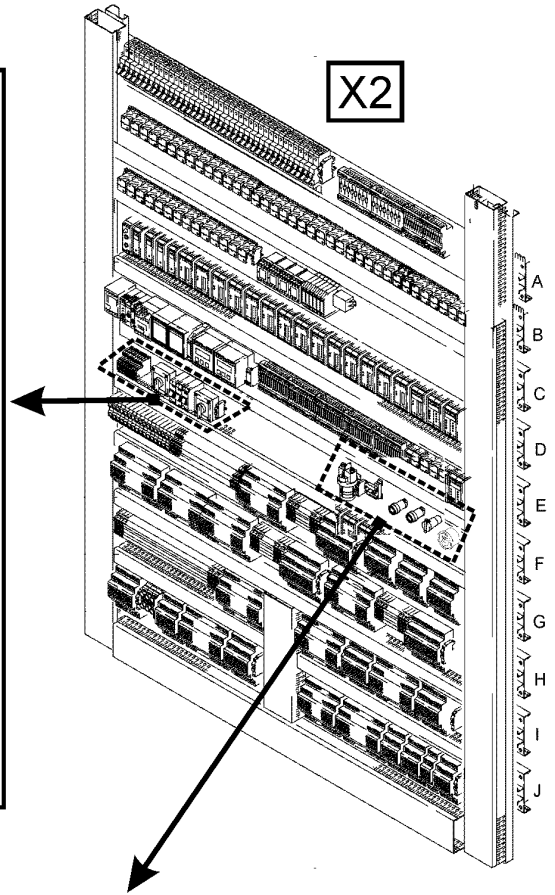
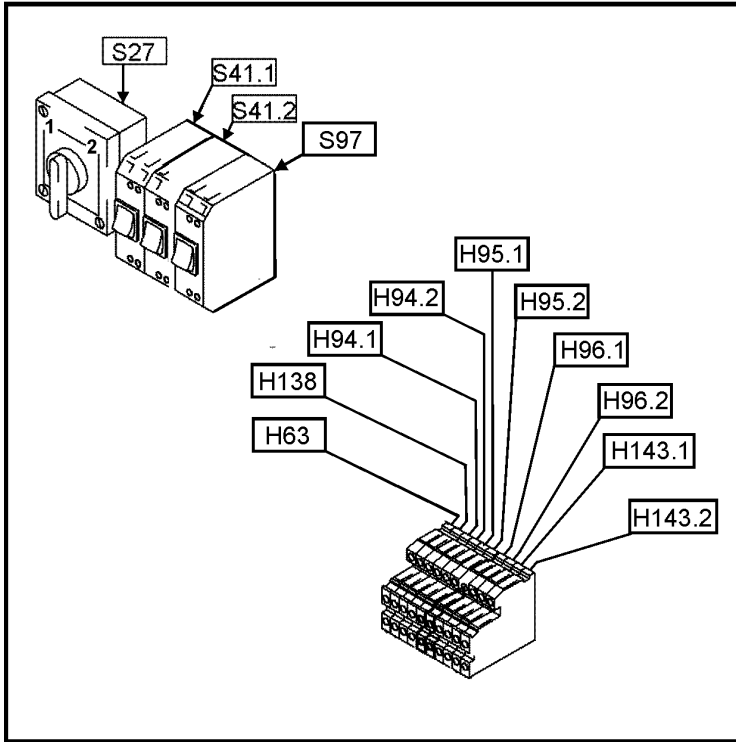
- (H63) Electronic pump control module (RC4) active and program information
- (H138) This light pulses if there is a failure in the electronic pump control module (RC4)
- (H94.1) Engine 1 STOP lamp red. This lamp flashes out fault codes of the QUANTUM electronic engine control system. See heading **-Checking active diagnostic fault codes-** for more information.
- (H94.2) Engine 2 STOP lamp red. This lamp flashes out fault codes of the QUANTUM electronic engine control system. See heading **-Checking active diagnostic fault codes-** for more information.
- (H95.1) Engine 1 WARNING lamp yellow. This lamp flashes out fault codes of the CENSE electronic engine monitoring system.
- (H95.2) Engine 2 WARNING lamp yellow. This lamp flashes out fault codes of the CENSE electronic engine monitoring system.
- (H96.1) Engine 1 FLUID lamp white. The engine PROTECTION system will illuminate the FLUID lamp when an abnormal condition occurs
- (H96.2) Engine 2 FLUID lamp white. The engine PROTECTION system will illuminate the FLUID lamp when an abnormal condition occurs
- (H143.1) Monitoring light of the automatic engine oil supply system -Reserve- for engine 1
- Steady light: oil is pumped from engine oil pan to reserve oil tank.
 - Regular blinking: oil is pumped from reserve oil tank to engine oil pan.
 - Irregular blinking: oil is pumped in both directions, oil level in engine oil pan is correct.
- (H143.2) Monitoring light of the automatic engine oil supply system -Reserve- for engine 2

NOTICE

If the indicator lights (H143.1/H143.2) are off with the engines running, there is a failure in the reserve system. Have the reserve systems checked and repaired through authorized service personnel.

Other Components

- (X53.1) Connector for Modular Mining System (MMS) service processor (Option)
- (X27B) Connector for program upload to the VHMS controller
- (X30) Plug socket 24 Volt
- (H1-1) Hour meter engine running
- (H29) Hour meter traveling operation



Z 26323

Checking diagnostic fault codes of the engine electronic controlled fuel system QUANTUM and of the engine protection system

REMARK

The indicator lamps (H94.1) STOP, (H95.1) WARNING, and (H96.1) FLUID indicate trouble conditions of engine 1.

The indicator lamps (H94.2) STOP, (H95.2) WARNING, and (H96.2) FLUID indicate trouble conditions of engine 2.

With the engine diagnostic enable switch (S53) in ON position, the indicator lamps

(H94) STOP, (H95) WARNING, and (H96) FLUID will illuminate and stay illuminated if no faults are present.

If active faults are present, then fault code flashout will start if the engine diagnostic switch is ON and the engine is off.

The fault code will flash in the following sequence:

1. The WARNING lamp (H95) will flash.
2. A one second pause with both WARNING (H95) and STOP (H94) lamps off.
3. The STOP (H94) lamp will flash the recorded fault code with a one second pause between digits.
4. When the number has stopped flashing, the WARNING (H95) lamp will illuminate.
5. The fault code number will repeat in the same sequence.

The FLUID lamp (H96) will remain on as long as a fault condition is present.

To check for active fault codes proceed as follows:

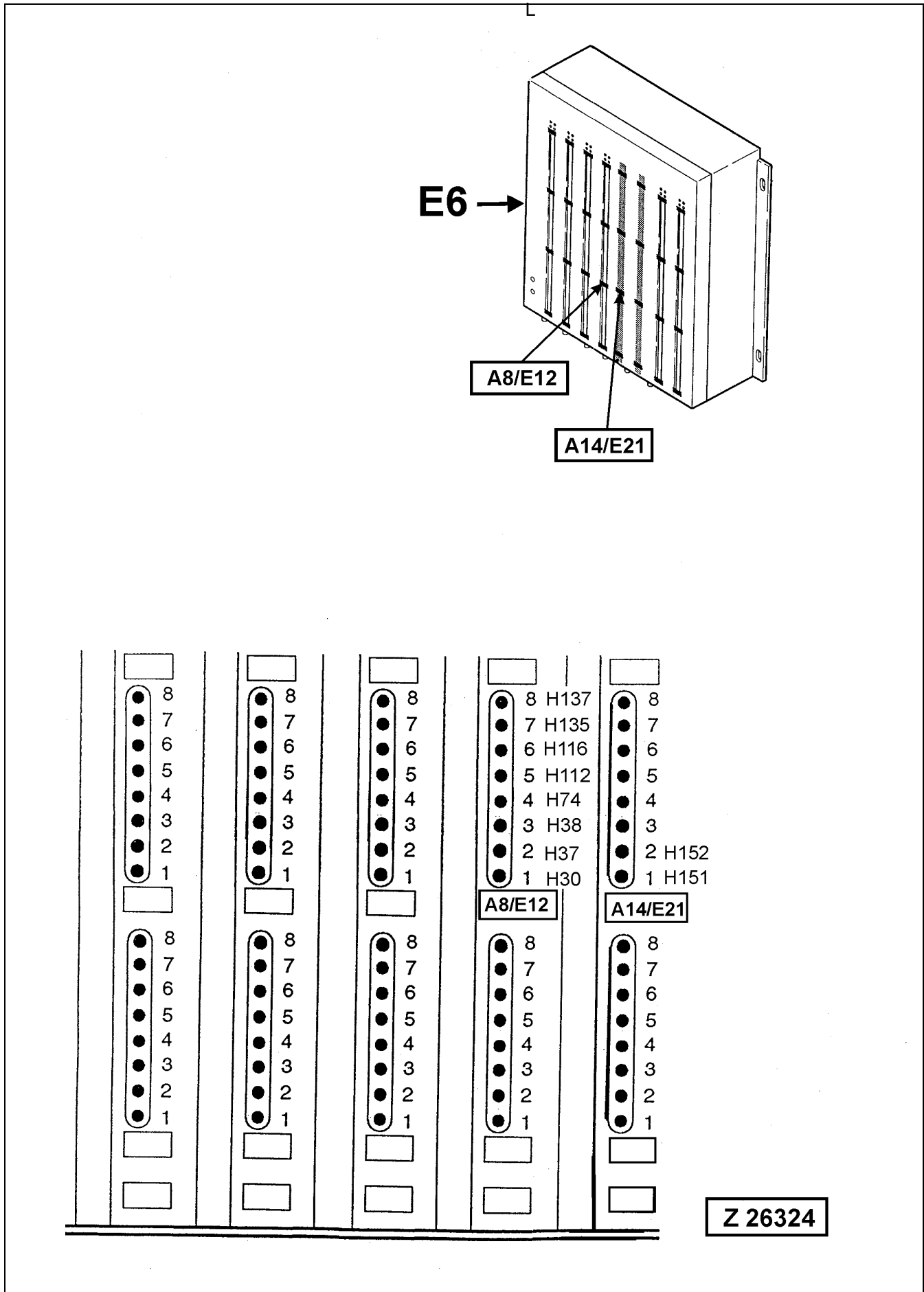
1. Stop the engines and turn the Excavator main key switch to OFF position.
2. Turn the engine diagnostic enable switch to ON position. The diagnostic switch is located on the operator console, see page 87 for more information.
3. All active QUANTUM faults are flashed out first on the red STOP indicator lamp (H94). After all QUANTUM fault codes are flashed out, the active engine protection system fault codes will be flashed out on the WARNING lamp (H95).

CAUTION

**Active faults must be corrected as soon as possible.
Contact your Komatsu dealer for repair.**

REMARK

For more information, refer to the separate Engine Operation and Maintenance Manual filed in volume 2 binder.



Emergency Indication of Operating Conditions

The VHMS system is equipped with an emergency indication via LED's on the Programmable Logic Controller PLC (E6), illust. Z26324.

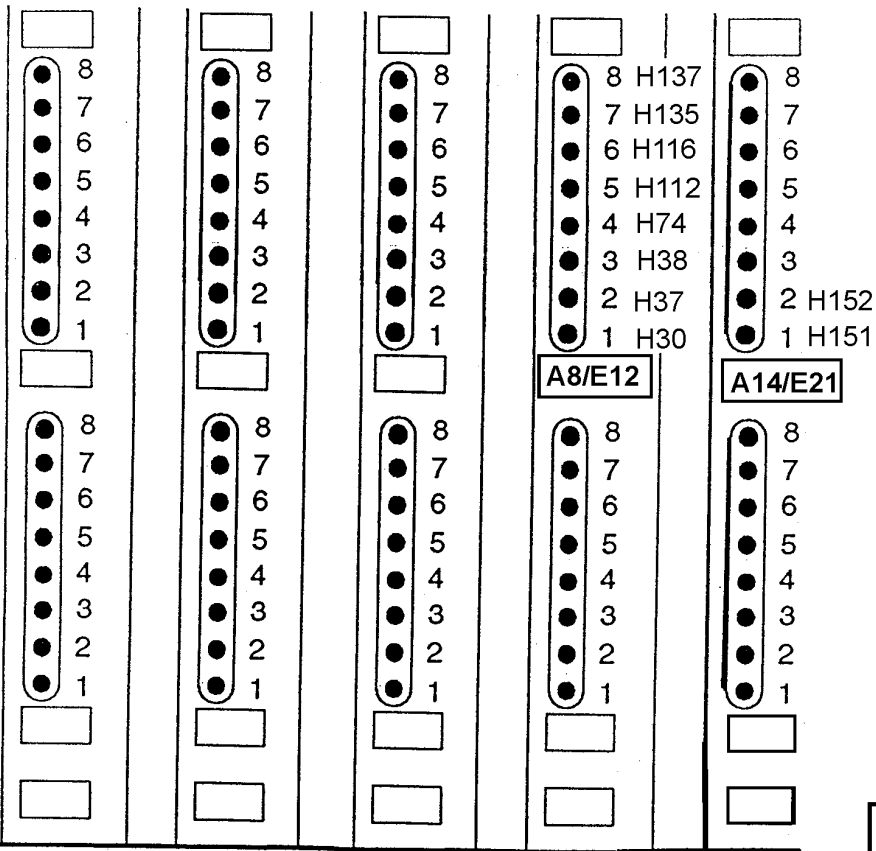
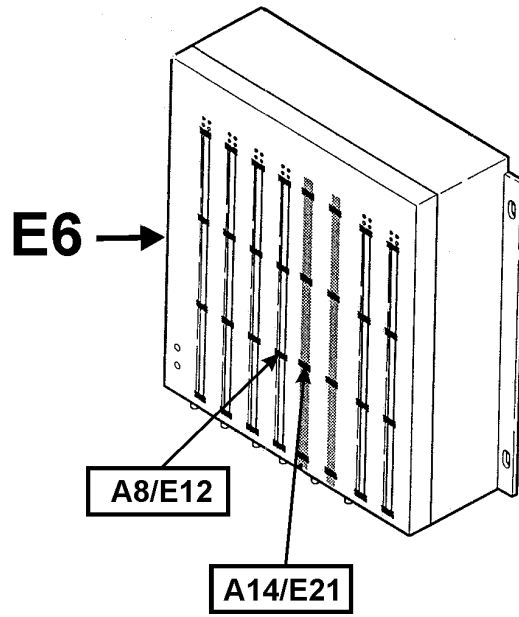
In case of a malfunction of the monitor in the operator's cab, the LED's in the columns (A8/A14) of the PLC indicating failures in vital operating systems of the Shovel.

The following faults are indicated:

| Fault: | LED No.: |
|--|----------|
| The VHMS system is by-passed (By-pass switch S27 actuated) | H30 |
| Start of both engines blocked, resp. engine shut down, due to closed main shut-off (gate) valve hydraulic tank | H37 |
| Faulty monitor channel for hydraulic oil temperature | H38 |
| Strainer oil cooler clogged | H74 |
| Faulty monitor channel engine speed | H112 |
| Emergency shut down switch actuated | H116 |
| Engine shutdown from ground man (if so equipped) | H135 |
| Operator warning system actuated from ground man (if so equipped) | H137 |
| VHMS Controller trouble | H151 |
| VHMS Display trouble | H152 |

REMARK

The location of the numbered LED's on the PLC may differ from that shown in the illustration.



Z 26324

High Pressure Filter "HPF" Identification Codes of LED H31

The LED "H31", illust. Z26324, monitors all six high pressure filters. If a failure condition of a high pressure filter occurs, the LED "H31" will begin flashing out a diagnostic code for identification of the concerned filter. If more than one filter send a failure signal at the same time, the LED will always show the diagnostic code of that filter with the lowest number.

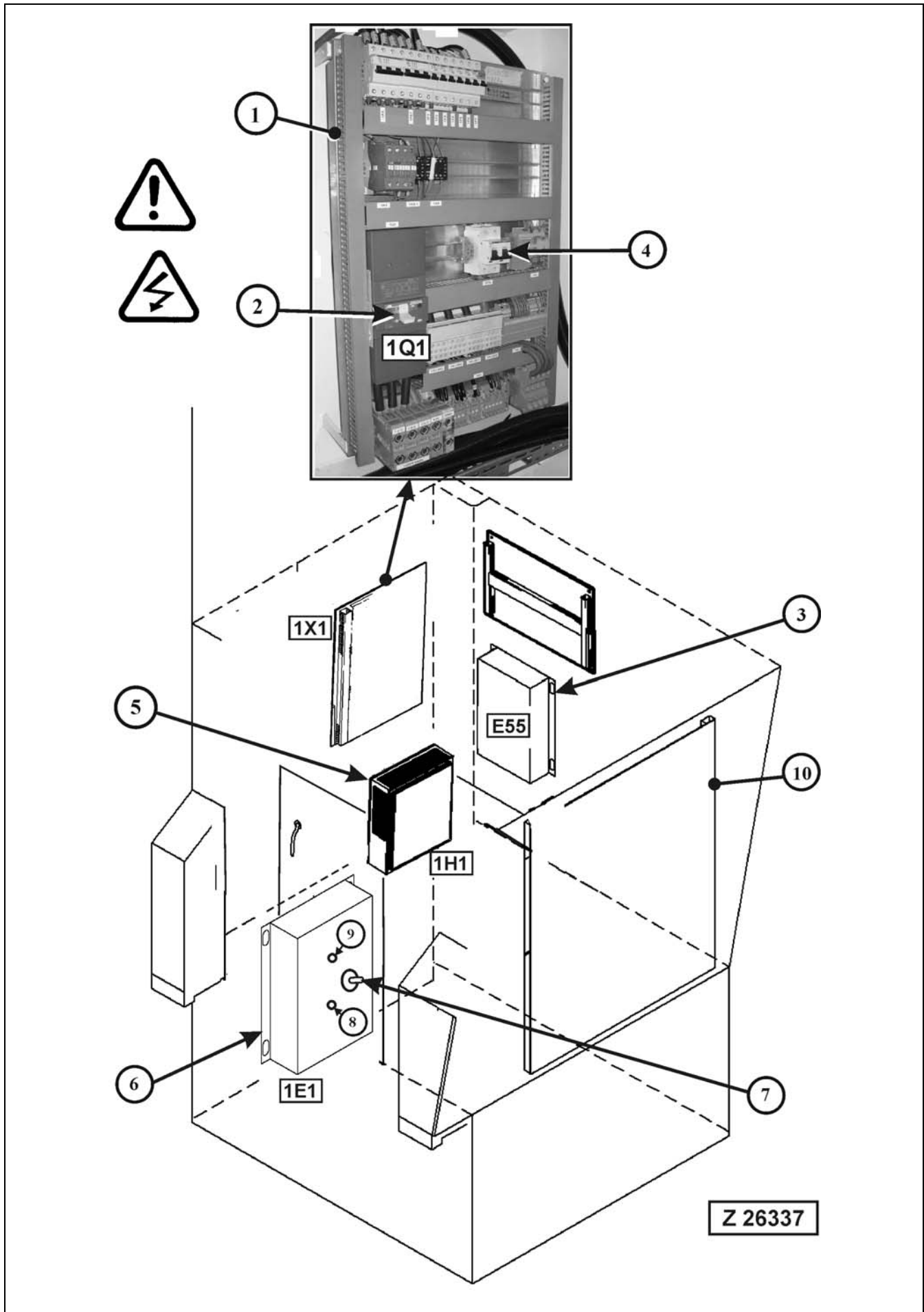
High Pressure Filter "HPF" number:

| | | | | | | | | | | | |
|-------------|------|------|------|------|------|------|------|------|------|------|----|
| Code HPF #1 | 1 | 1 | 1 | 1 | | | | | | | |
| Code HPF #2 | 1 | 2 | 1 | 2 | 1 | 2 | | | | | |
| Code HPF #3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | | | | |
| Code HPF #4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | | | |
| Code HPF #5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | | |
| Code HPF #6 | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | | |
| | 0.5s | 0.5s | 0.5s | 0.5s | 0.5s | 0.5s | 0.5s | 0.5s | 0.5s | 0.5s | 2s |

Example:
Identification Code for High Pressure Filter #4 :

When the differential pressure switch of high pressure filter #4 sends the signal "Filter restricted", the LED H31 will flash four times at regular intervals of 0.5 seconds and then after two seconds pause time will start again flashing four times at regular intervals of 0.5 seconds and so on.

The number of the four 0.5 seconds interval flashing groups corresponds to the number of the high pressure filters.



3.8.3 COMPONENTS OF ELECTRICAL PREHEATING SYSTEM IN CAB BASE

⚠ WARNING

**The cab base contains high voltage electrical appliances.
Access to the cab base for authorized service staff only.**

General

The preheating system is a special equipment and can be installed in the factory or locally at site. Power supply to the preheating system is provided by an external power source.

The following systems are equipped with heaters:

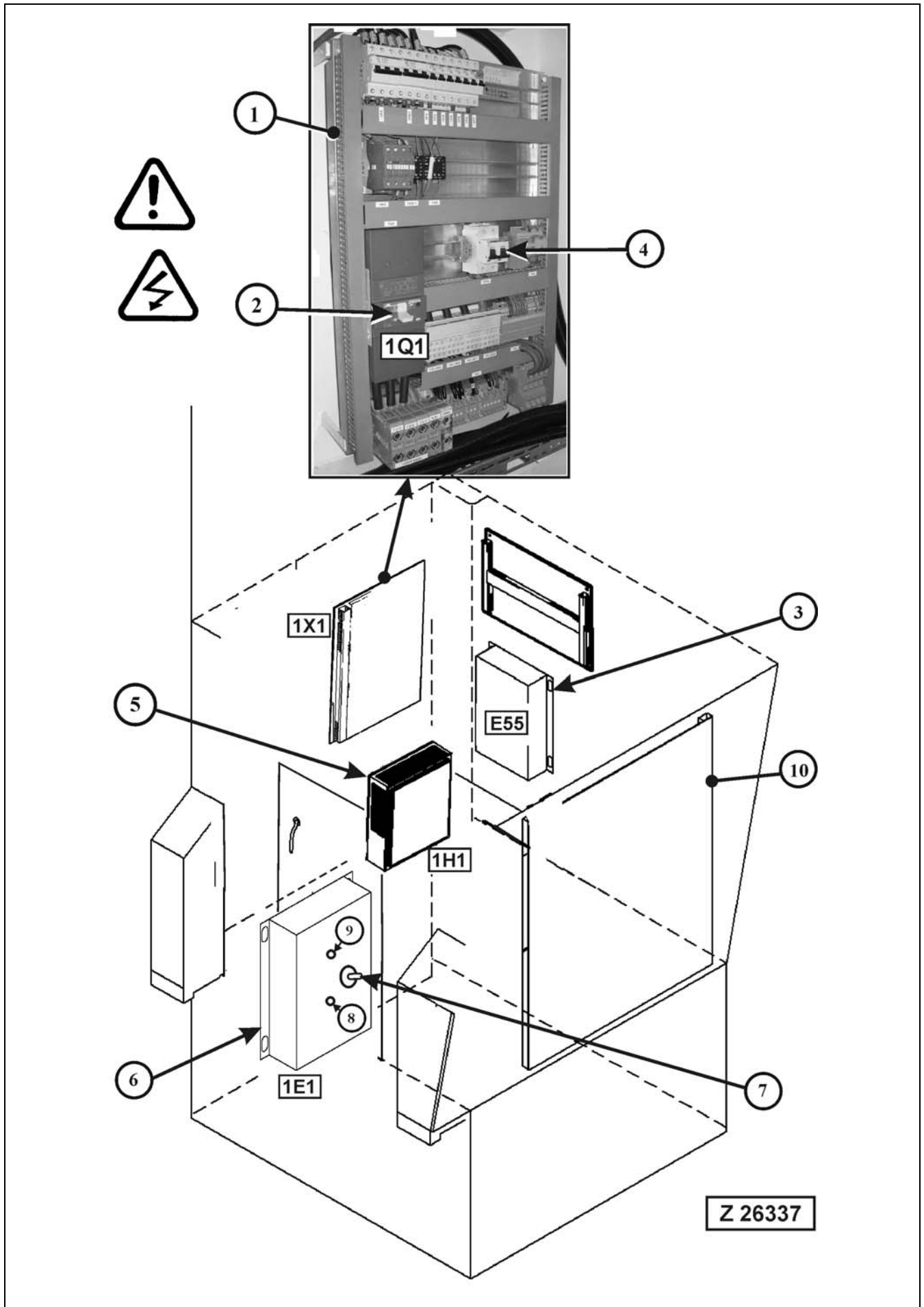
- Engine cooling system
- Engine lubricating system
- Hydraulic system (main and suction oil reservoir)
- PTO (pump distributor gears)
- Storage batteries

REMARK

The auxiliary heater unit in the cab base (5), illust. Z26337 and the battery charger (3) are also connected to the external power supply.

Legend for illustration Z26337

- (1) Main switch board (1X1) for the preheating systems, located in the cab base
- (2) Main switch (1Q1) for all system heaters
- (3) Battery charger (E55)
- (4) Circuit breaker 1F76 - 125A for battery charger
- (5) Heater unit (1H1) for cab base
- (6) Control box for hydraulic oil heating
- (7) Switch, hydraulic oil heating ON / OFF
- (8) Indicator light green, hydraulic oil heating ON.
- (9) Warning light red, heating system failure.
- (10) Main switch board (X2)



Components of Electrical Preheating System in Cab Base (continued)

⚠ WARNING

Be sure to switch off main switch (2), illust. Z26337 and to shut down the generator set or to disconnect the power supply cable from external power source before working on any part of the heating system.

Operating the Preheating System

Use the preheating system during stand-still periods e.g. over night and low ambient temperatures.

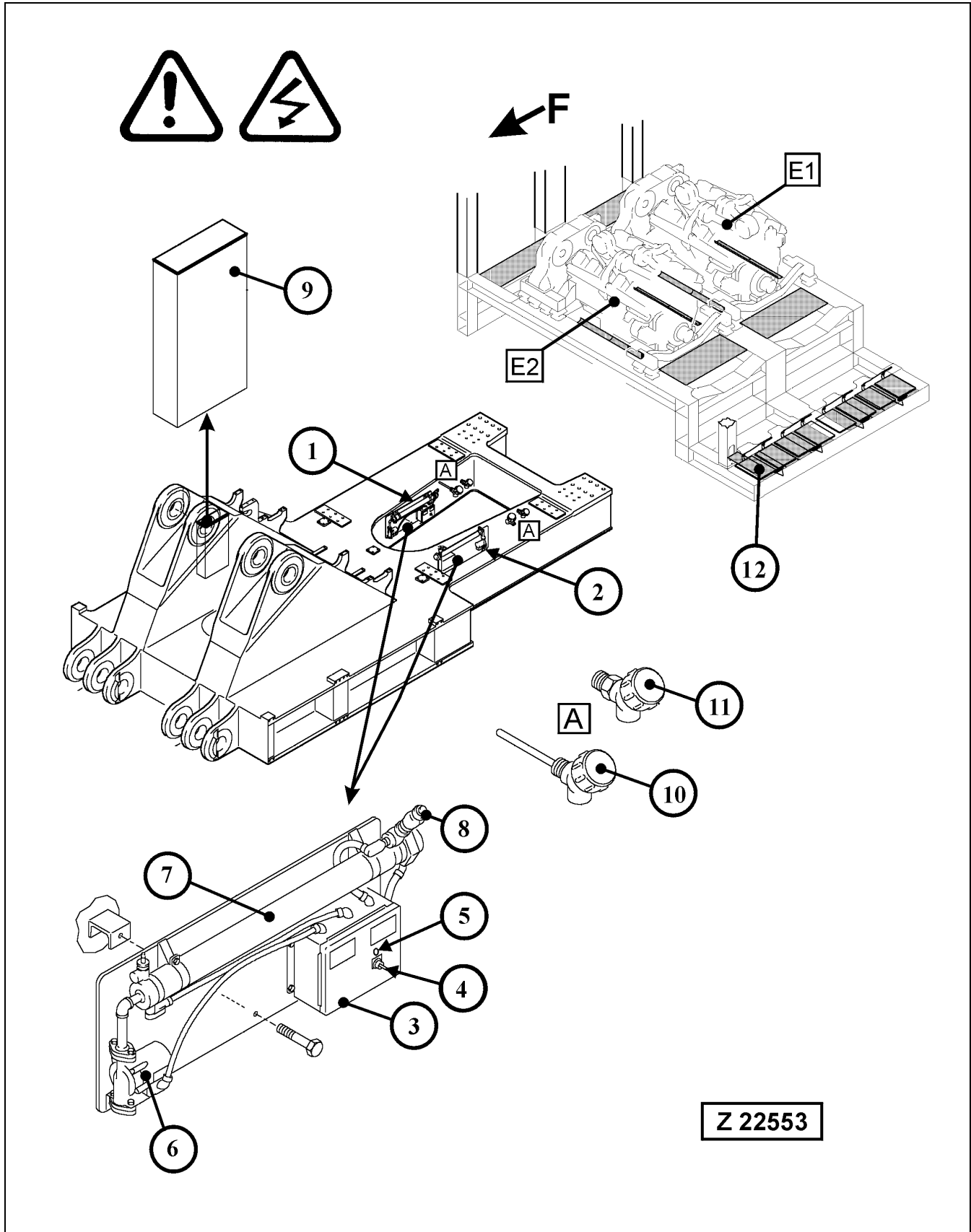
The heating system should be energized as soon as the engines are stopped. This allows the heating system to maintain the desired temperature with the use of minimum power.

The preheating system for engine coolant is equipped with an additional control box with separate ON/OFF switch. See following pages for more information.

Battery Charger (3)

Power supply to the battery charger is provided by the generator set or an external power source connected to the 1X2 plug socket at the cab stairway. The batteries of the shovel are charged by the battery charger (3). The battery charger is switched ON and OFF with the switch on the front panel of the battery charger. For operating instructions refer to the separate Users Manual *MASTERVOLT* battery charger filed in volume 2 binder.

3.9 PREHEATING SYSTEMS FOR OIL, COOLANT AND BATTERIES



Engine Coolant and Engine Oil Reserve Tank Heating

Legend for illustration Z 22553

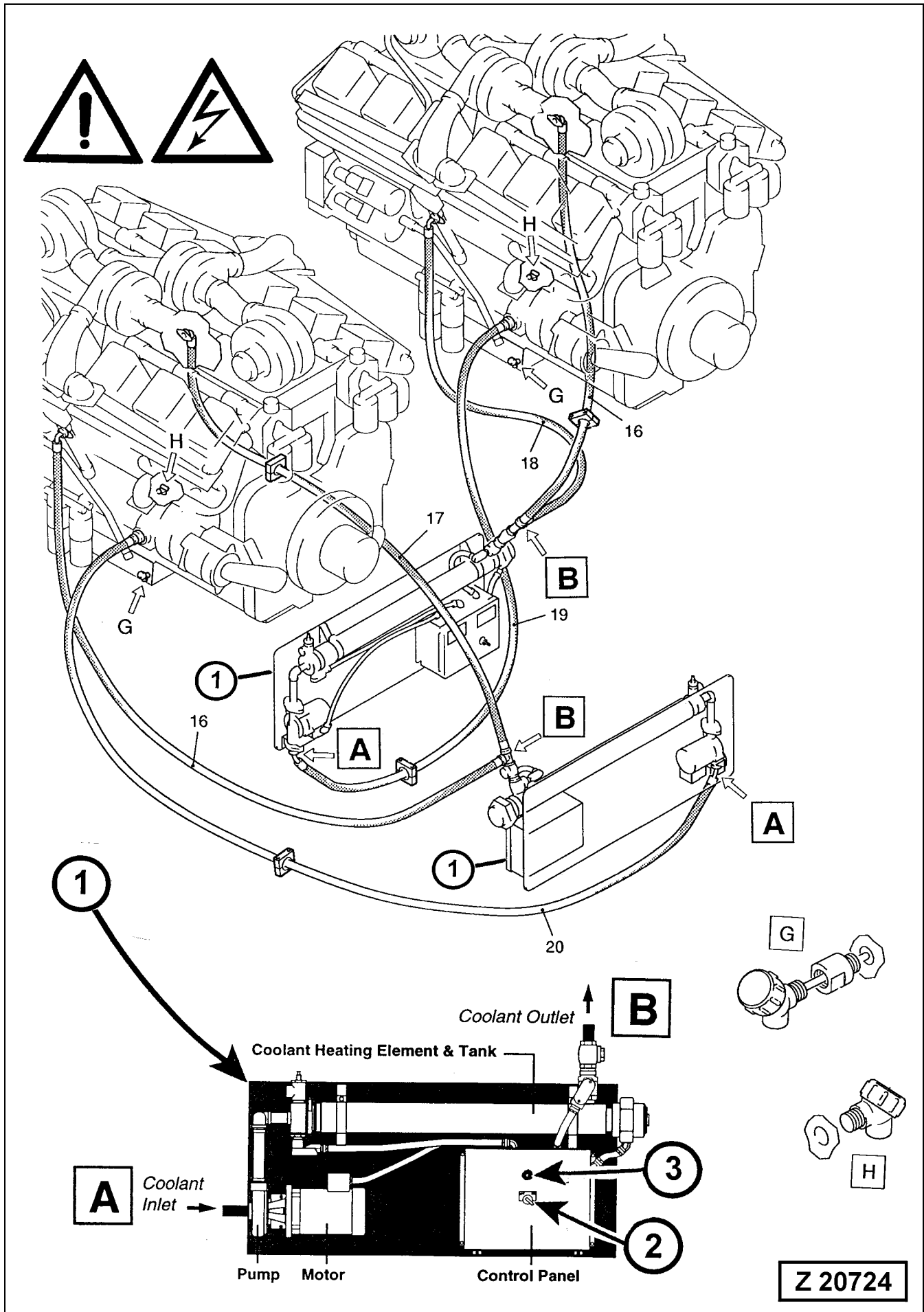
- (1) Coolant heating for rear engine 1 (E1), installed on RH side member of the main frame
- (2) Coolant heating for front engine 2 (E2), installed on LH side member of the main frame
- (3) Control box for coolant heating
- (4) Switch, coolant heater ON/OFF
- (5) Indicator light, coolant heating ON,
- (6) Water pump with motor
- (7) Coolant heating element and tank
- (8) Coolant flow switch
- (9) Not used
- (10) Engine oil heaters installed in the engine oil reserve tank
- (11) Thermostats for engine oil heaters installed in the engine oil reserve tank
- (12) Battery heater plates

To activate the coolant heating, set main switch (1Q1) on the switch board in cab base to ON position. The coolant heating can then be switched on with switch (4) on the control panel. The lamp (5) illuminates with coolant heating ON.

Before starting the shovel engines, switch OFF the coolant heaters.

REMARK

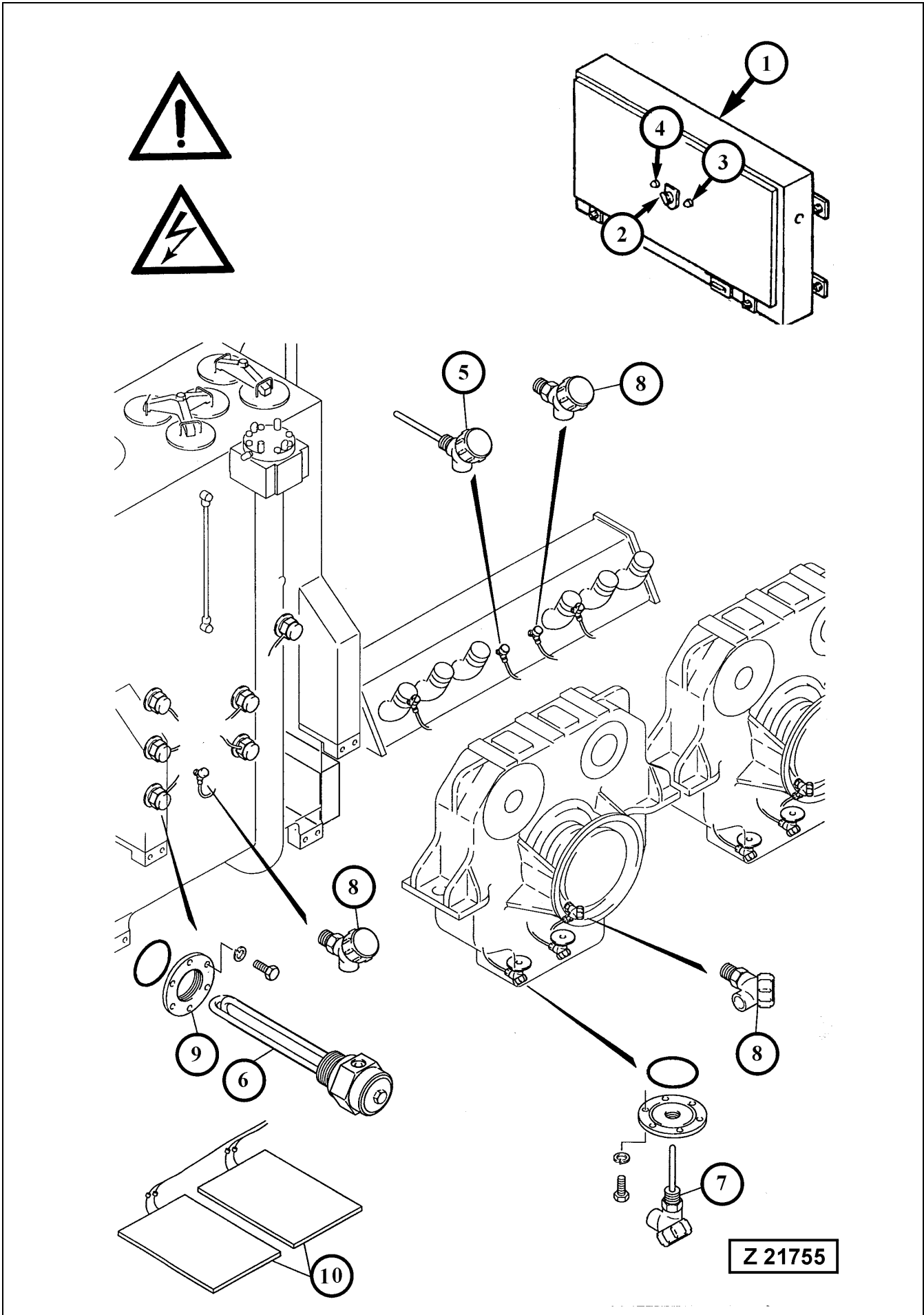
For more information about the coolant heating system, refer to the operation manual *Coolant Heating System* filed in volume 2 binder.



Engine Coolant and Engine Oil Heating

Legend for illustration Z 20724

- (1) Coolant heating systems, installed on RH and LH side member of the main frame.
- (2) Switch, coolant heater ON/OFF.
- (3) Indicator light, coolant heating ON,
- (16) Coolant hoses, preheated coolant to the engine.
- (17) Coolant hose, preheated coolant to the engine.
- (18) Coolant hose, preheated coolant to the engine.
- (19) Coolant hose from engine to coolant heater
- (20) Coolant hose from engine to coolant heater
- (A) Coolant inlet
- (B) Coolant outlet
- (G) Engine oil heaters installed in the engine oil pan
- (H) Thermostats for engine oil heaters installed in the engine oil pan

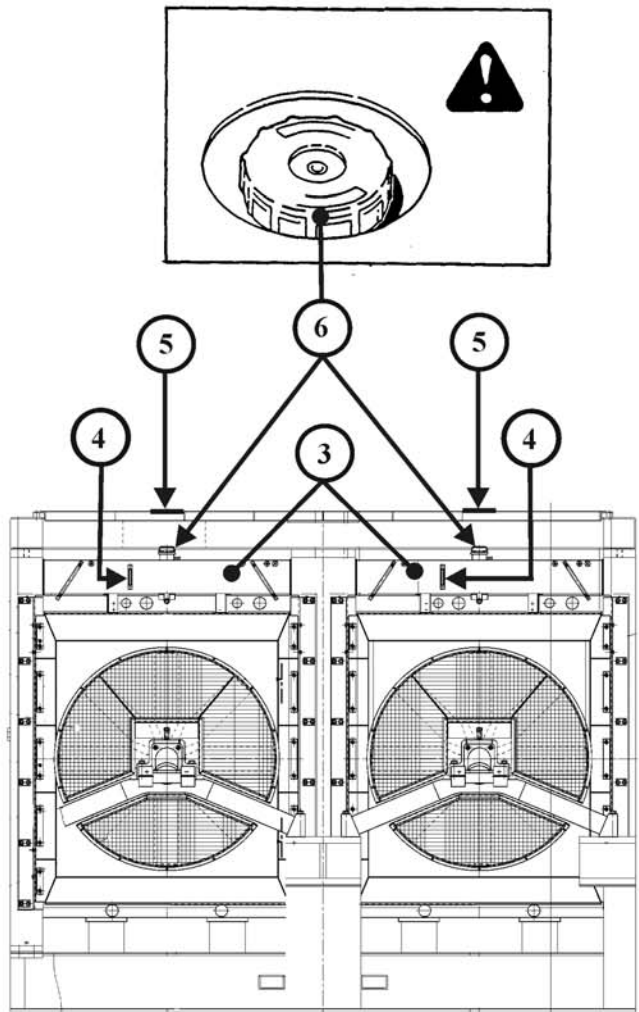
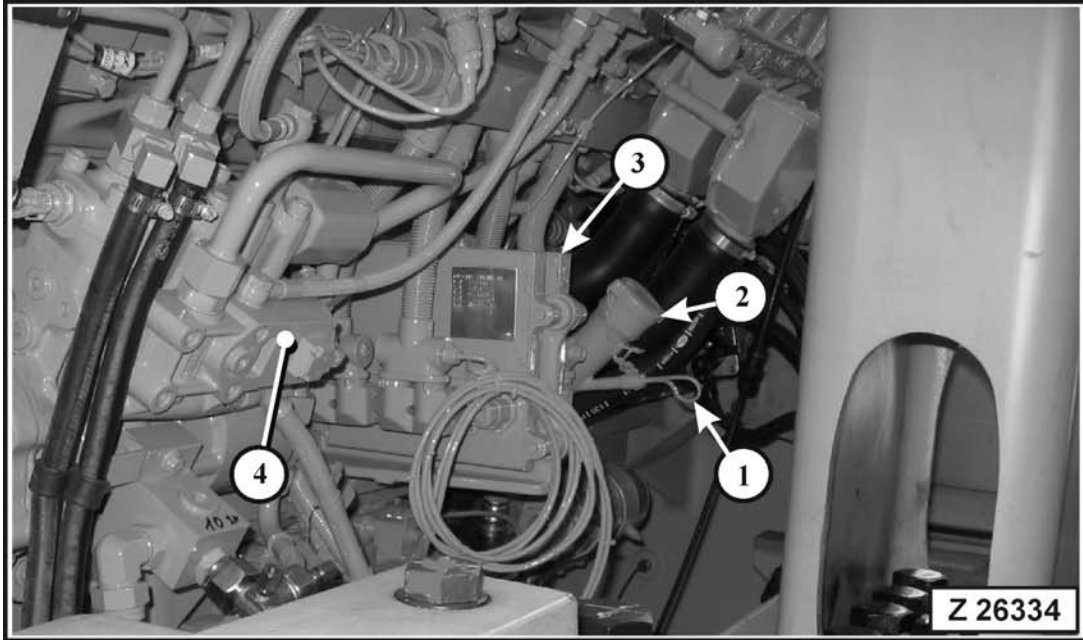


Hydraulic Oil and PTO Gear Oil Heating

Junction Box for Hydraulic Oil Heating and Location of Heaters and Thermostats, illustration Z 21755

- (1) Junction box for hydraulic oil heating, this box is located in the cab base
- (2) Switch, hydraulic oil heating ON/OFF.
- (3) Warning light red, heating system failure,
- (4) Indicator light green, hydraulic oil heating ON.
- (5) Immersion heaters installed in the suction oil reservoir
- (6) Immersion heaters installed in the main oil reservoir
- (7) Immersion heaters installed in the PTO's (pump distributor gears)
- (8) Thermostats installed in the main oil reservoir, suction oil reservoir and in the PTO's (pump distributor gears)
- (9) Adapter flange for heater element
- (10) Heater plates for batteries

3.10 CHECKS BEFORE STARTING THE ENGINES



CAUTION

Before starting the Engines, make sure that no one will be endangered when starting the Engines.

CHECK THE FOLLOWING ITEMS

Legend for illustration Z26334

- (1) Engine oil pan dipstick oil level gauge
- (2) Oil filler tube for engine oil pan
- (3) Engine Electronic Fuel System Control Module
- (4) Fuel pump

Walk-around Inspection

Make a "Walk-around" inspection of the Shovel. Refer to page 295 in the Maintenance Section for the daily inspection items.

Engine oil level of Front and Rear Engine

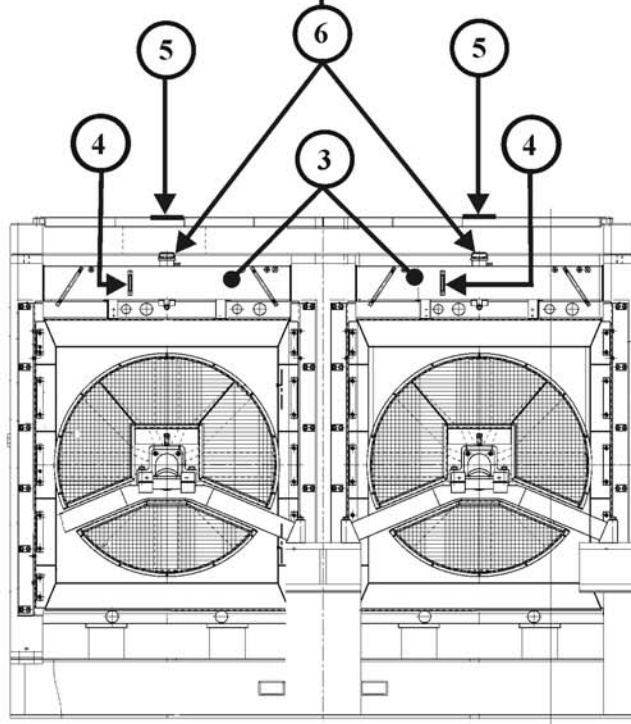
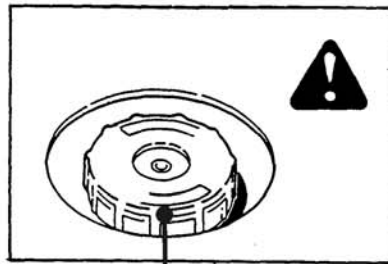
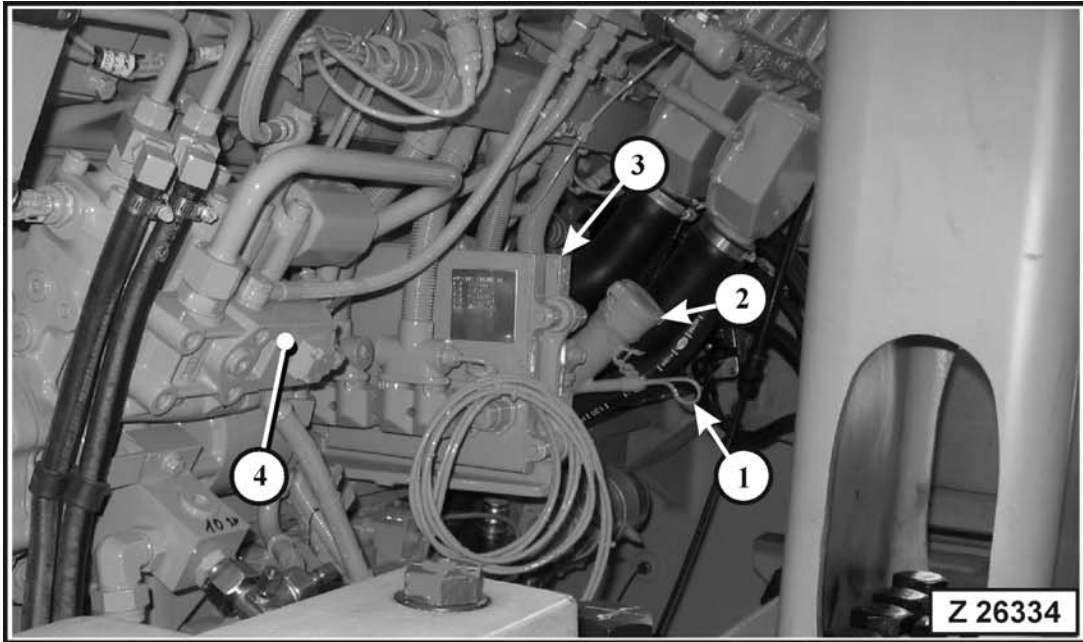
Check oil level with Shovel standing on level ground. Check oil level in engine oil pan with the dipstick oil gauge (1). For accurate readings, the oil level should not be checked until the oil has settled into the oil pan after the engine has been shut down (about 5 minutes).

REMARK

The oil level in the engine oil pan can vary between the MIN and MAX marking on gauge (1) depending on the operating condition of the reserve system when the engine was stopped. With sufficient oil in the reserve tank and with the reserve system in proper working order, there is no need to fill the engine oil pan even with the oil level at the MIN mark on gauge (1). If the oil level is below the MIN marking on the gauge, corrective action must be taken. Fill the reserve tank and check the reserve system. The function of each reserve system is monitored by an indicator light located on the "X2" switch board in the cab base. See section "SWITCH BOARD (X2) IN CAB BASE" for more information.

Check the oil level in both engine oil reserve tanks, see page 271 for more information.

Be sure to fill the corresponding reserve tank of rear engine -1- or the reserve tank of front engine -2- when the information message "**Engine oil reserve tank 1 (or 2) empty**" is being displayed on the VHMS monitor in the operator's cab.



Coolant Level

Legend for illustration Z26335

- (3) Coolant expansion tank of front and rear engine radiators
- (4) Coolant level sight gauge on front and rear coolant expansion tanks
- (5) Cover plates on power house roof above front and rear radiator pressure caps
- (6) Radiator pressure caps

⚠ WARNING

DO NOT remove the radiator pressure cap (6), illust. Z26335 from a hot engine. Wait until the temperature is below 50°C before removing the pressure cap (6). Failure to do so can result in personal injury from heated coolant spray or steam. Press the red button on the radiator pressure cap to allow the pressure to escape. Turn the radiator cap slowly counter-clockwise to the safety stop, then continue to turn until cap is free to be removed.

The coolant level should be in the upper field of the sight gauges (4). If necessary add coolant via the swing down service arm to the MAX marking on the sight gauge. Refer to section "CENTRAL REFILLING SYSTEM" on page 230 for more information.

REMARK

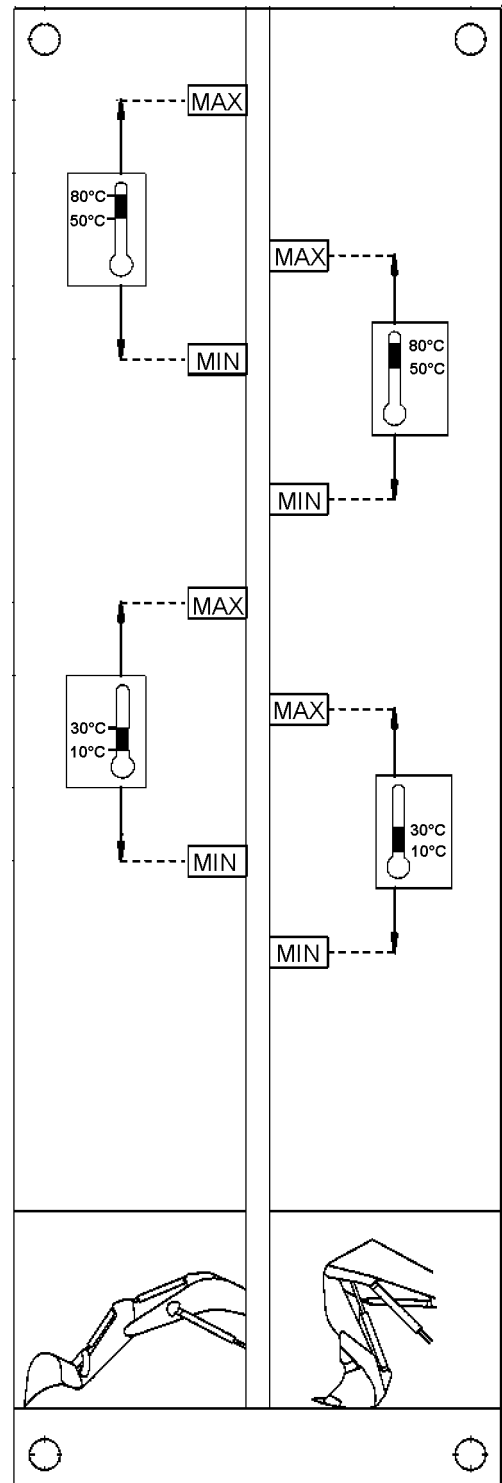
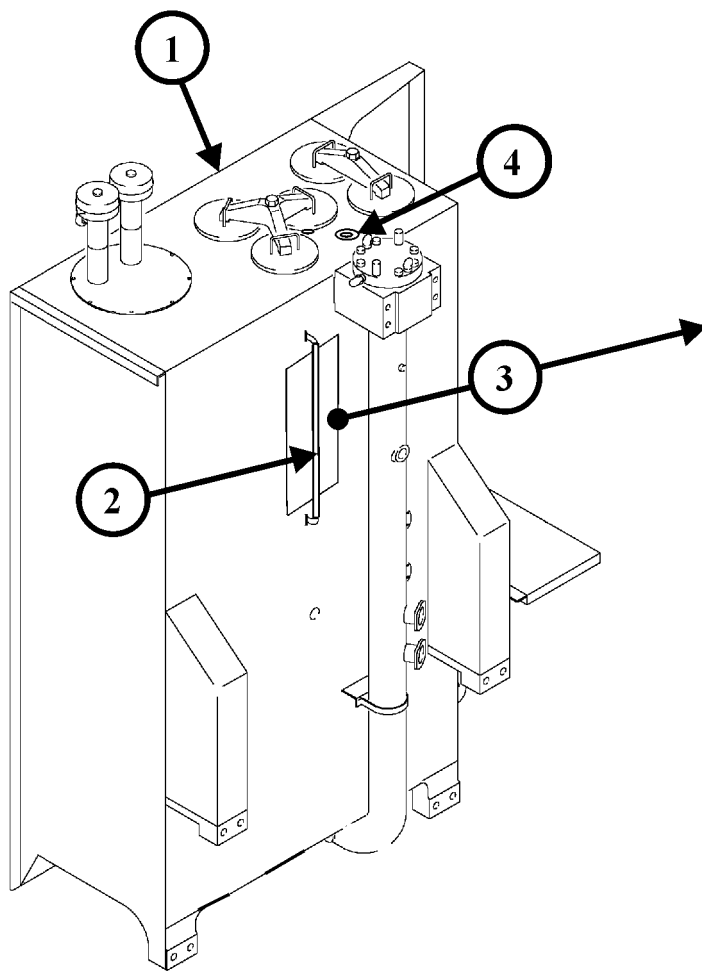
Refer to the Engine Manual for the correct coolant composition and filling procedure.

Fill Engine Fuel Tank

⚠ WARNING

Engine fuel is flammable and can cause a fire or an explosion. Do not fill the fuel tank or service the fuel system near an open flame, welding, burning cigar or cigarettes, etc.

Fill the fuel tank at the end of the of the shift to prevent condensation from forming. Fill the fuel tank via the swing down service arm. Refer to section "CENTRAL REFILLING SYSTEM" on page 230 for more information. Observe the fuel specifications in the engine operation and maintenance manual.



Z 22878

HYDRAULIC SYSTEM - CHECK OIL LEVEL

General Information

The hydraulic oil level in the main oil reservoir fluctuates depending on the oil temperature and the position of the loader attachment (hydraulic cylinders retracted / extended).

Legend for illustration Z22878

- (1) Main hydraulic oil reservoir
- (2) Hydraulic oil level sight gauge
- (3) Oil level plate
- (4) Oil filler plug

For checking the oil level lower the attachment (backhoe or bottom dump bucket) onto the ground in a position as shown in the illustration Z22878.

Depending on type of attachment and the present oil temperature, select the applying oil level range on plate (3). Be sure to use the correct marking on oil level plate (3).

Add hydraulic oil as necessary.

Machinery House Doors

Make sure that all machinery house doors are securely closed before starting the engines.

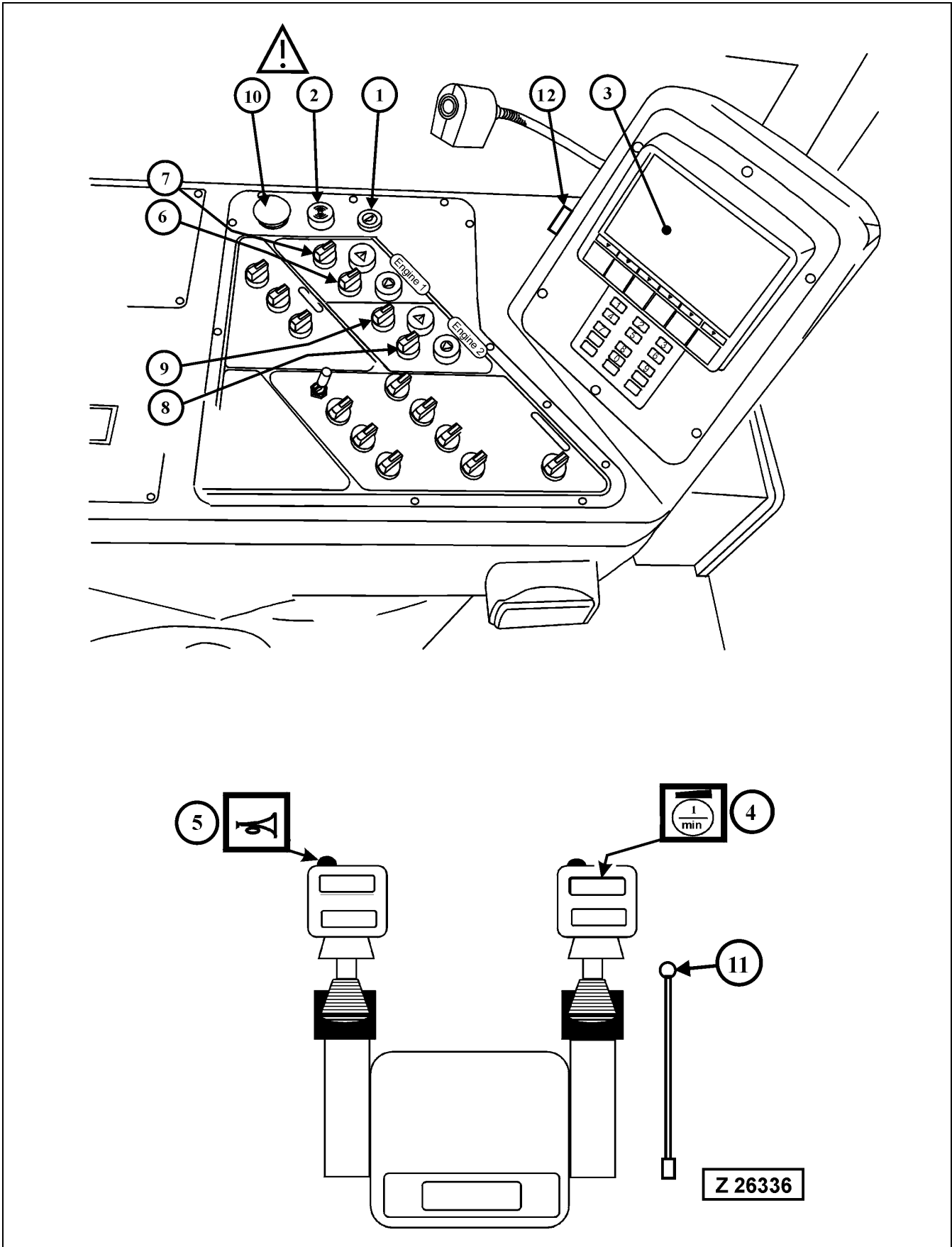
OPERATOR'S SEAT ADJUSTMENT

Before operating the Shovel adjust the seat and mirrors for Operators maximum comfort, visibility, and complete control of the Shovel.

 **CAUTION**

Use seat belt in accordance with the local safety regulations and laws.

3.11 STARTING THE ENGINES



NOTICE

- Before starting read the Engine Operation Manual. Observe the instructions for starting the Engine.

⚠ WARNING

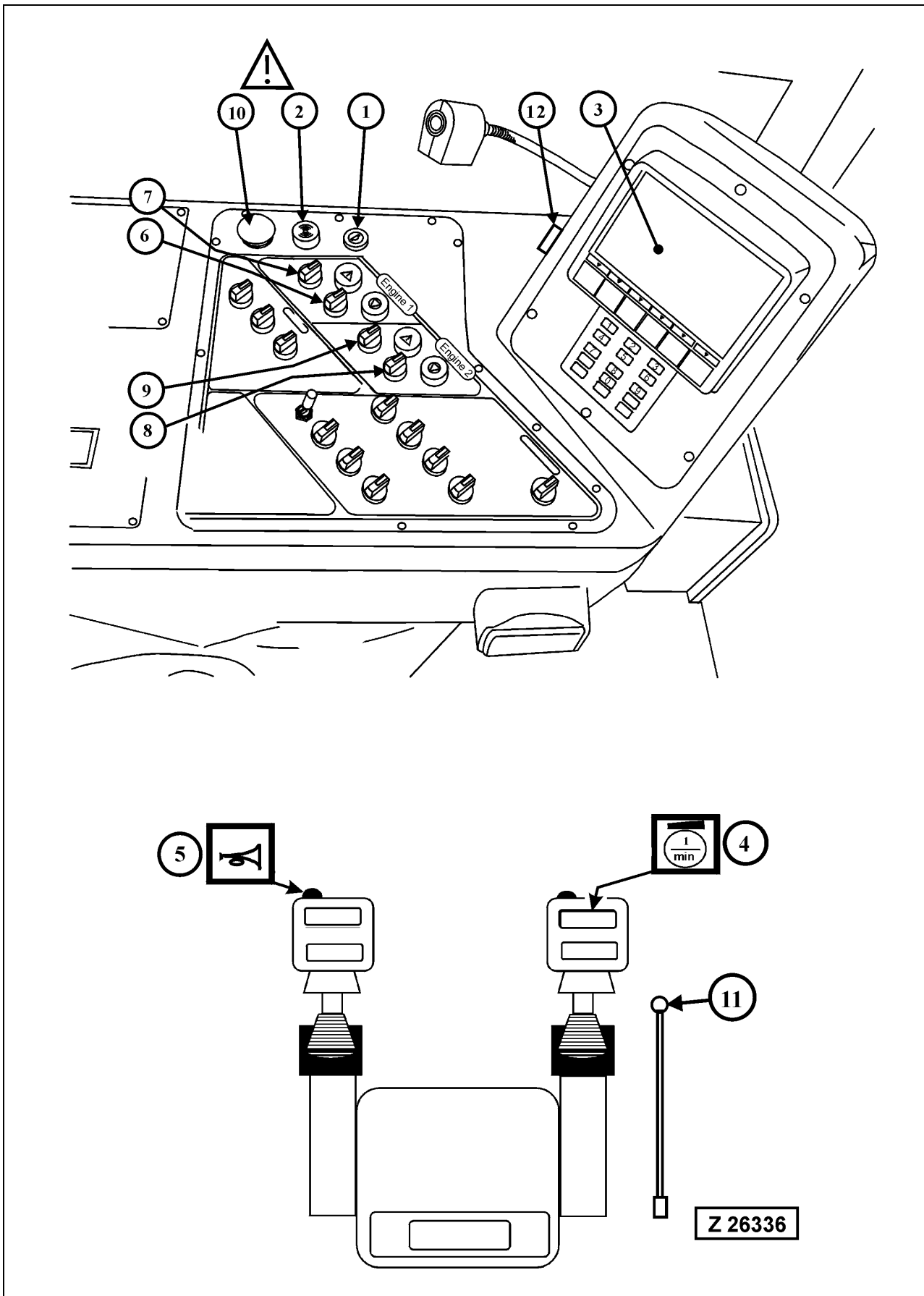
- After repairs on the Diesel engines or starter motors, make sure that the ground cables are correctly connected before starting the engines. Loose or missing ground cables can cause fire, serious injury or death.
 - Start the engines from the operator's seat only. Never attempt to start the engine by shorting across starter terminals. This can cause fire, serious injury or death.
 - Before each starting make sure that all controls are in neutral position.
 - Be sure to sound the signal horn before starting to make your intention clear.
-
-

⚠ CAUTION

Before starting the engines and again before starting work, pay attention to the hydraulic oil temperature. Refer to paragraph "Hydraulic Oil Warm-up" in this section.

Legend for illustration Z26336

- (1) Key operated main switch
- (2) High level alarm: **Automatic engine shutdown.**
The high level alarm (2) will sound approximately 10 seconds before an automatic engine shutdown occurs and will continue to sound during the 10 second period. At the same time a blinking message *SHUTDOWN* will be displayed on the health monitor. Use the time period to move the machine to a safe place and lower the attachment to the ground. Inform service about the shutdown condition.
- (3) Health monitor
- (4) Engine speed selector switch
 - Low idle - High idle
- (5) Signal horn button
- (6) Rotary switch - rear engine 1 start
- (7) Rotary switch - rear engine 1 stop
- (8) Rotary switch - front engine 2 start
- (9) Rotary switch - front engine 2 stop
- (10) Strike button - emergency engine shutdown and cut out of pilot control system
- (11) Lock lever
- (12) Acoustic warning signal



3.11.1 STARTING PROCEDURE

CAUTION

If the ambient temperature is below -25°C proceed according to step 7 on next page.

REMARK

Start the engines one after another, e.g. first rear engine 1 and then front engine 2. Both engines are started in the same way.

1. Insert battery main switch keys and turn to operating position.

REMARK

Start the engines with the lock lever (11) illust. Z26336 in the fully rear LOCKED position. When the engines are running move the lock lever fully to the front in FREE position.

2. Insert key into main switch (1) and turn to operating position. The high level alarm (2) must give an acoustic test signal. If the alarm fails to function, corrective action must be taken.
3. Observe health monitor (3). Normally the initialization screen is displayed on the monitor, see page 91 for more information.
4. Set toggle switch (4) to low idle speed position.
5. Sound the signal horn (5).
6. Start the engines by turning starter switches (6 and 8).

REMARK

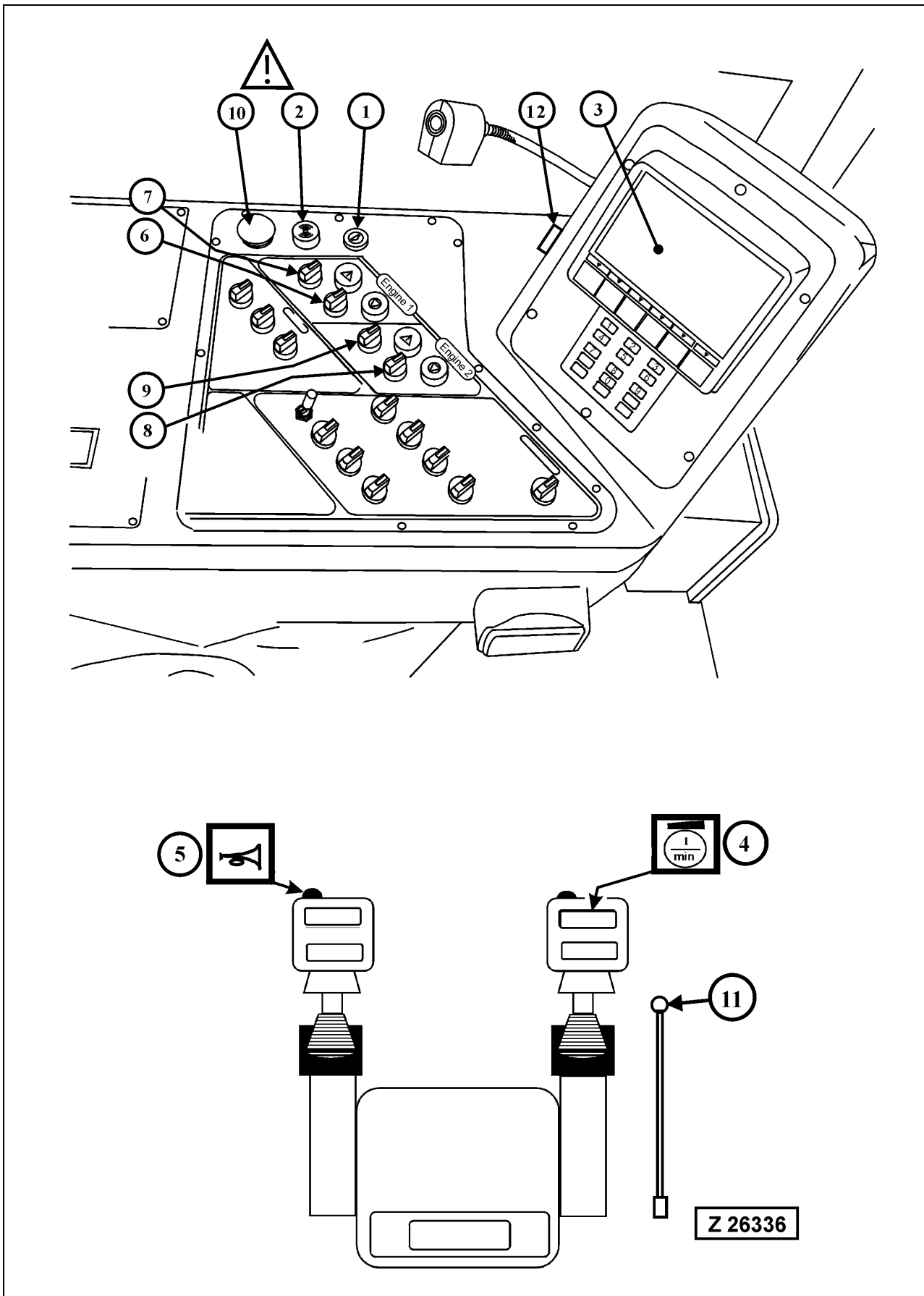
Each engine is equipped with a prelubrication system which is activated by the starter switches (6 and 8). Turning and holding the switch in the start position sends current to the prelubrication starter solenoid which then pre lubricates the engine. This solenoid timer prevents current from flowing to the conventional starting motor until adequate oil pressure has been achieved in the cam oil rifle. After a subsequent 3 second delay, current is then directed to the conventional starting motors for cranking the engine.

Cold Weather Starting Aid

Controlled Ether Injection

The electronic control module (ECM) of the engine controls ether injection into the intake manifold while cranking if the engine is below a calibrated minimum coolant temperature or intake manifold temperature value. It will continue to inject ether until a calibrated maximum engine speed has been reached. For more information refer to Engine Manual.

Never operate the starter longer than 30 seconds at a time in order to avoid damage. If the engine does not start within the first 30 seconds, wait 2 minutes before cranking again. As soon as the engines are running, check health monitor (3), for information.



7. Cold Weather Starting at ambient Temperatures below -25°C and to -40°C

⚠ CAUTION

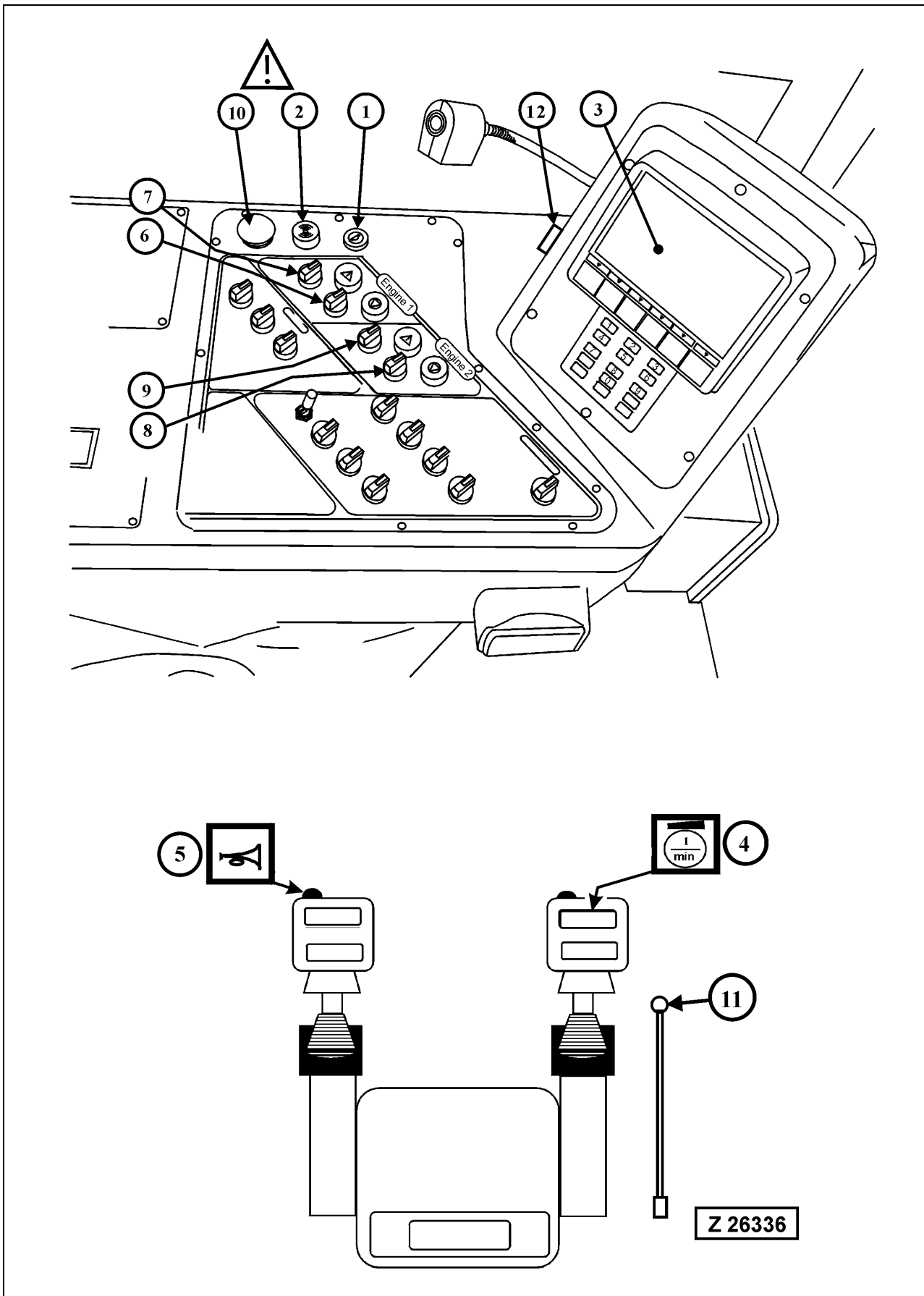
When starting the engines at such extremely low temperatures, it is vital to proceed according to the following start-up procedure. The reliability of the machine and equipment will be seriously impaired if the following procedure is not properly carried out.

1. Record the Outside Ambient Temperature. If it is colder than -40°C , then
DO NOT start the Machine and keep the electrical preheating systems activated.
2. If the Outside Ambient Temperature is between -40°C and -25°C , then check that the preheating systems are duly energized and that all the Heaters are functioning properly.
3. Let the preheating systems warm the hydraulic oil and the engine coolant up to a temperature of -25°C or warmer. These temperatures are indicated on the health monitor (3) . (With Heaters properly functioning, these temperatures should never fall below -25°C).

3.1. If the preheating systems were not energized during the Standstill Period, the warm-up phase may last several hours, depending on the actual ambient temperature the shovel was exposed to, and the length of time the shovel stood still, until the minimum starting temperature of -25°C for the hydraulic oil and engine coolant is reached.

3.2. If the outside ambient temperature is below -40°C , warm up the entire machine, using any safe means of heat generation such as hot air blower in connection with air-borne parachute, and/or any other appropriate means, before start-up, especially when the machine has been shutdown for a long period, moreover when the preheating systems were not energized during the standstill period.

4. When the hydraulic oil and the engine coolant have been warmed-up to the minimum starting temperature of -25°C , switch off the engine coolant pre-heating system. All other heating systems remain active.
5. Start cranking the Engine, up to three times.
6. Once the Engine is started, keep it at low idle speed for five minutes, then shift Engine to high idle speed in order to warm-up the Engine.



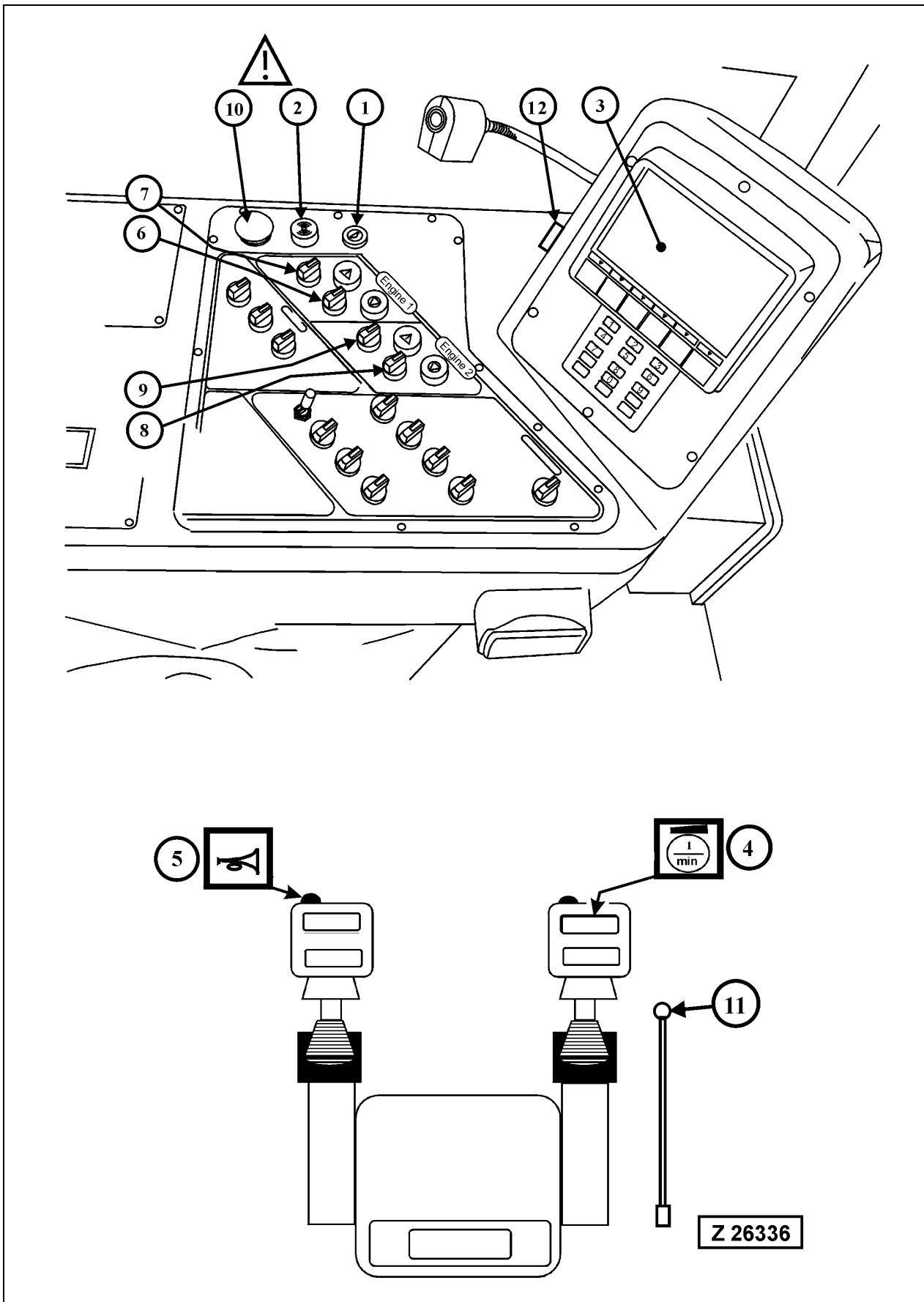
7. Cold Weather Starting at ambient Temperatures below -25°C and to -40°C (continued)

7. Once the Engines are up to working temperature, switch OFF the remaining electrical preheating systems and, if an external power source is used, disconnect the power supply cable. Carefully start moving the attachment by operating controls very slowly. Follow the steps below:
 - 7.1 Raise the attachment slightly off the ground and start by holding the clam closed function over relief. Keeping in mind not to hold over relief for long periods of time as it may damage the relief valve due to overheating.
 - 7.2 After holding clam closed function over relief, slowly open clam and hold open function over relief. Continue working clam and holding over relief until the hydraulic oil temperature begins to rise and then proceed on to the bucket functions.
 - 7.3 While holding the bucket functions over relief, continue to work the clam to keep the oil flowing through the circuit.
 - 7.4 As the temperature of the hydraulic oil rises, move on to the stick and then to the boom functions, keeping other functions in motion as well. Once the hydraulic oil temperature is approximately $+30^{\circ}\text{C}$, start adding swing functions into motion.
 - 7.5 Once the hydraulic oil is close to working temperature swing over one track, raise the track off of the ground with the attachment, and slowly rotate the raised track to remove cold oil from the circuit. The running surfaces of track pads must not be obstructed with dirt, mud, or other debris. Once the track has been rotated in both directions for a few minutes, lower the track and repeat the same procedure with the opposite track.
8. Operate the Shovel normally but smoothly, avoiding shocks and jerky movements, as hydraulic hoses may burst when the outside ambient temperature is extremely low. Operators must be more careful as temperature goes down to the limit of -40°C .
9. If during operation, the ambient temperature drops below -40°C , stop work, move the loader attachment in the correct parking position, shut down the engines and switch on the electrical preheating systems.

REMARK

Never operate the starter longer than 30 seconds at a time in order to avoid damage. If the engine does not start within the first 30 seconds, wait 2 minutes before cranking again.

10. As soon as the engines are running, check display (3) for messages.



After starting observe the following

The VHMS System monitors the Shovel's functions and provides information about the appropriate operational data.

If a FAULT message is displayed on screen (3), the acoustic warning signal (12) will sound simultaneously for approximately 1 second. In such a case proceed according to the instructions of the displayed message.

Warning buzzer (12) will sound continuously when the hydraulic oil level is too low. In this case, stop the engine, locate and correct the cause immediately. Fill up hydraulic oil to the correct level.

11. After warming up of the engines, the speed can be increased by setting switch (4) to high idle speed position.

NOTICE

DO NOT idle the engines for excessively long periods. Long periods of idling, more than 10 minutes, can damage the engine because combustion chamber temperature drop so low the fuel will not burn completely. This will cause carbon to clog the injector spray holes and piston rings and can cause the valves to stick.

CAUTION

Never let the engines run with disconnected batteries. This may cause alternator damage.

Emergency By-pass Switch for the Shut-down Function of the Programmable Logic Controller

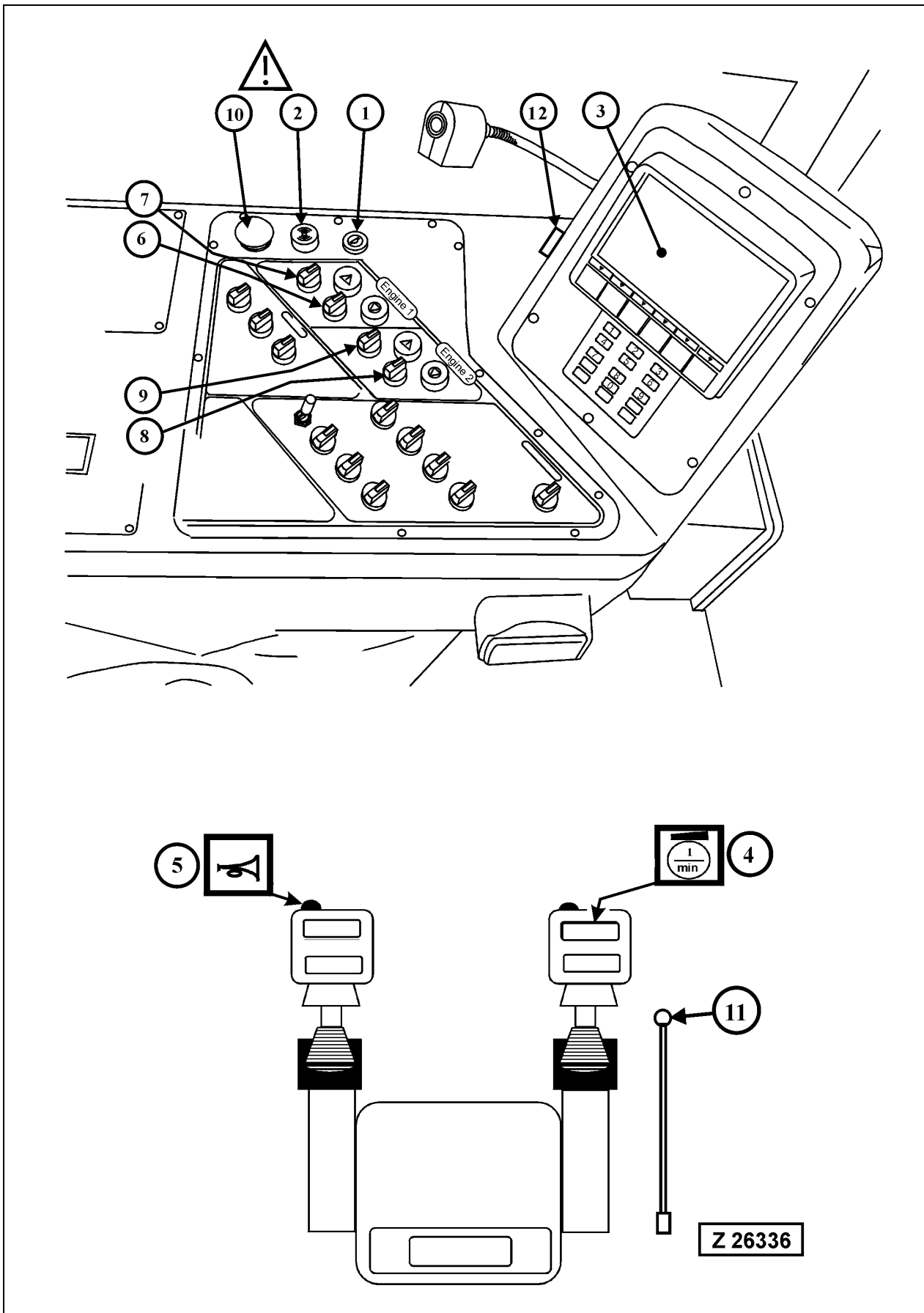
The emergency by-pass switch is located on the -X2- switch board in the cab base compartment and marked with (S27). If an automatic shutdown is initiated by Shovel systems, with a dangerous situation for man or machine, which needs the Shovel to be operable to over-come the dangerous situation, actuate this switch to override the shutdown function of the system and to enable a restart of the Diesel engines.

NOTICE

This switch can not override engine initiated shutdowns.

CAUTION

As soon as the immediate situation of danger is over, shut down the unit. Correct the fault that caused the shut down and re-set the Emergency By-pass switch.



3.11.2 ENGINE WARM-UP

After starting let the engines run for a warm-up period before increasing the engine speed. This is necessary to avoid piston and bearing seizure.

Refer to the engine operation and maintenance manual for more information.

3.11.3 HYDRAULIC OIL WARM-UP

CAUTION

**On machines WITHOUT hydraulic oil pre-heating system:
DO NOT start the engine if the ambient temperature (oil temperature) is below the starting temperature shown in column "1" of the hydraulic oil viscosity chart in this section.**

**On machines WITH hydraulic oil pre-heating system:
Before starting the engine, warm-up the hydraulic oil to the starting temperature shown in column "1" of the hydraulic oil viscosity chart.**

REMARK

With hydraulic oil too cold, corresponding messages will be displayed on the health monitor (3). Follow the instructions given by message text.

The Shovel is equipped with a "½ Qmax control circuit for cold oil" which limits the main pumps oil delivery to approximately 50% of the total capacity as long as the oil temperature has not reached the minimum operating temperature shown in column -2- of the Viscosity and Temperature Chart on next page.

The pumps will move to maximum delivery position as soon as the minimum operating temperature of the hydraulic oil is obtained.

During the warm-up period, complete several operating cycles of all hydraulic movements without load. Avoid operation against limit stops. (high pressure build up).

Work can be started when the minimum operating temperature shown in column -2- of the viscosity chart is obtained.

Hydraulic Oil Viscosity and Temperature Chart

| Rated viscosity at 40° C of hydraulic oil grade: | Starting temperature (max. 1000 cSt) -1- | Operating range (100 - 10 cSt) -2- |
|--|---|---------------------------------------|
| ISO VG | °C | °C |
| Shell Tellus Arctic 32 *1) | - 32 | 10 - 85 |
| Shell Tellus Arctic 32 *2) | - 34 | 5 - 81 |
| HLP 22 | -20 | 8 - 55 |
| HLP 32 | -14 | 16 - 70 |
| HLP 46 | -6 | 25 - 80 |
| HLP 68 | 0 | 32 - 85 |
| HLP 100 | +5 | 39 - 85 |

*1) Temperature values for new oil (freshly filled in).

*2) Temperature values for used oil. This temperature value has to be adjusted when the viscosity of the hydraulic oil has decreased by 10 to 12 percent compared with new oil. The determination of the hydraulic oil viscosity should be carried out in the course of the regular oil analysis procedure.

REMARK

The starting and operating temperatures in the above chart depend on the hydraulic oil viscosity grade used in the system. See decal in the operator's cab for viscosity grade of the factory oil filling.

For example:

Hydraulic system filled with **VG 22** viscosity grade oil.

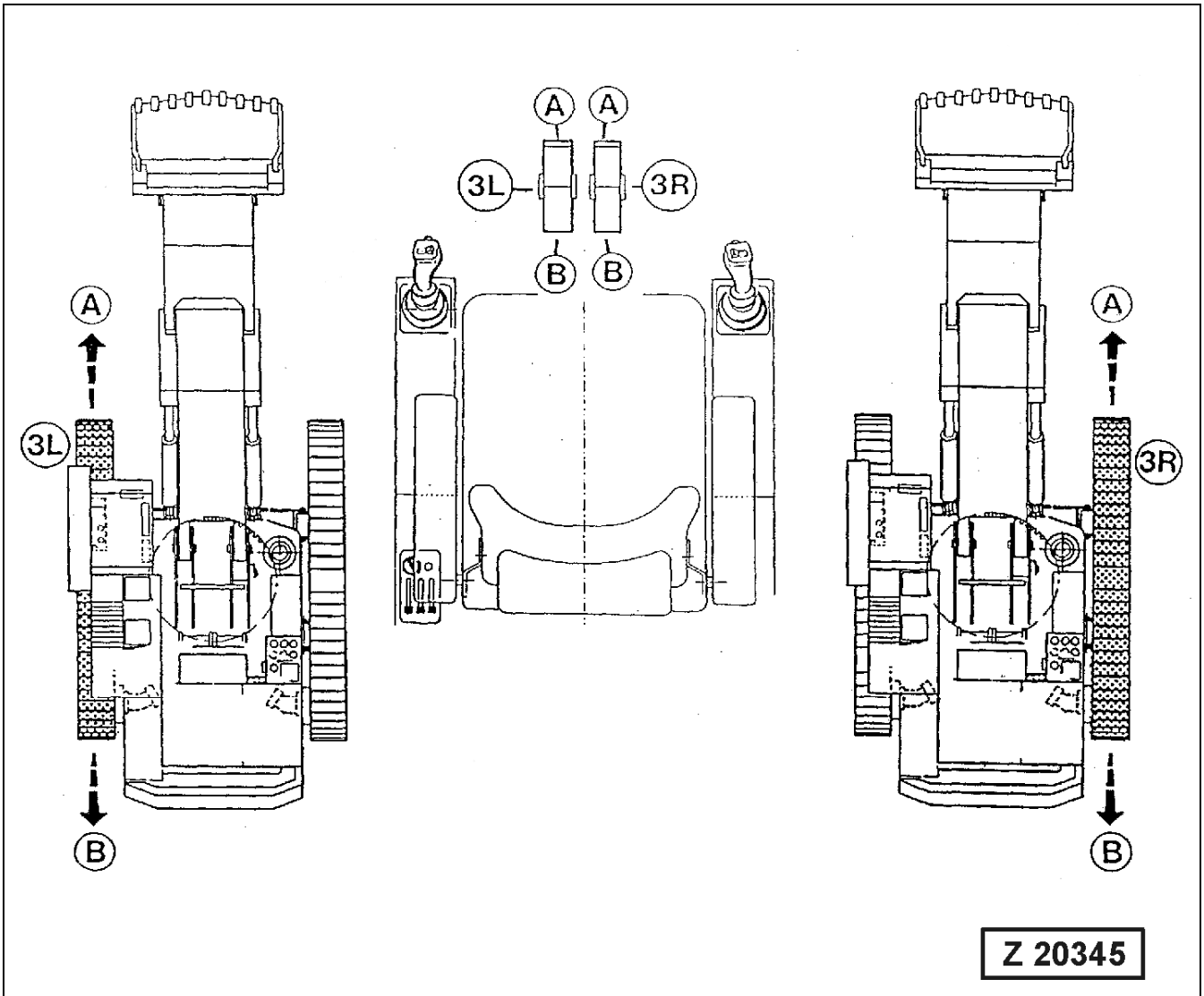
1. Lowest permissible starting temperature (ambient temperature):
-20° C, see column "1"
2. Operating temperature:
min. + 8° C
max. + 55° C, see column "2"

3.12 MOVING THE SHOVEL

3.12.1 TRAVEL CONTROL WITH FOOT PEDALS

NOTICE

Travelling directions with cab in normal working and travel position i.e. cab above idler wheel. Counter weight above drive sprockets.



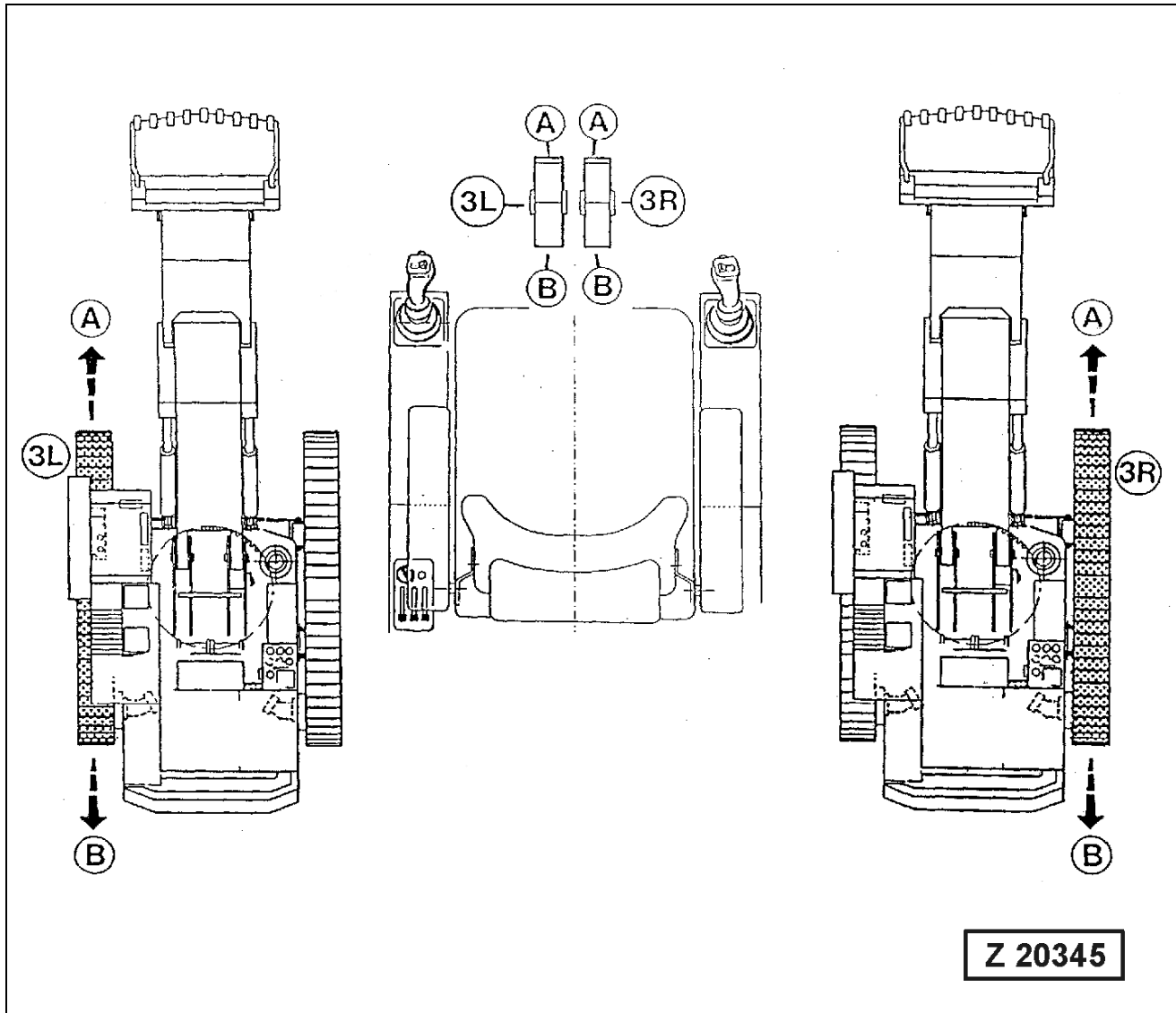
Legend for illustration Z 20345

- (3L) Left pedal, inside
- A Left track forward
- B Left track reverse

- (3R) Right pedal, inside
- A Right track forward
- B Right track reverse

WARNING

Be sure to sound the signal horn before starting to drive to make your intention clear.



Regulate travel speed by depressing the pedals more or less.
Apply swing circle brake as necessary.

On machines with two-speed range travel drive, select normal or fast speed range according to ground conditions.

For braking the machine release pedals (3L and 3R)

DO NOT reduce engine speed for braking, otherwise travel motors and gears could be damaged.

⚠ WARNING

- Travelling on a grade requires special care. Plan your work so that the Shovel travels up- and downhill parallel to the grade. The superstructure must be parallel with the undercarriage and the working attachment must face to the front in travel direction. The travel gears must be at the rear in the direction of travel.
 - **DO NOT** use the **FAST TRAVEL SPEED RANGE** when travelling on a grade.
 - For maximum stability carry the bucket as close to ground level as possible. Operate the travel control pedals sensitively. Avoid jerky acceleration and deceleration of travel motions. Travel speed must be conform to the ground conditions.
-

NOTICE**Two Speed Range Travel Drive**

If the Shovel is equipped with a Two Speed Range travel drive, always use the low speed range when travelling on a slope.

Never go downhill with fast speed range engaged.

The low travel speed range must also be used during cornering.

PARKING BRAKE

The Shovel is equipped with spring loaded disk type parking brakes. These brakes engaging and releasing automatically. They are arranged between the hydraulic motors and travel gears. When the motor/engine is running the parking brakes are automatically released by pilot oil pressure. With the motor/engine at standstill the parking brakes are engaged.

TRAVEL ALARM / BACK-UP ALARM

(Special equipment)

The Shovel can be equipped with one of the above alarm systems. The back-up alarm will sound at reverse travel. The travel alarm will sound at forward and reverse travel.

3.12.2 TRAVELLING INSTRUCTIONS

- Never travel the Shovel without first making certain that no one will be endangered.
- Be sure to sound the signal horn before starting to drive to make your intention clear.
- Before travelling long distances swing the superstructure parallel to the undercarriage and apply the swing brake.
- When travelling over inclines and gradients raise the working attachment only to such a height, that the bucket has sufficient ground clearance.
- Do not travel crossways to slope.
- Whenever possible operate the Shovel with the sprockets to the rear in the direction of travel.
- On steep terrain make sure that the final drives are at the rear in relation to travel direction.
- Before travelling over a bridge find out whether its bearing capacity is sufficient for the operating weight of the Shovel.
- Check for sufficient clearance and use a spotter.
- Pay attention to high voltage lines. On rough terrain observe movement of the boom.
- Travel speed must conform to local conditions so that the Shovel can be stopped at any time.
- Change travelling direction only after the machine is stopped.
- In order to avoid damage to track rollers and links, never turn the undercarriage over ditches and troughs.
- When working attachment is removed, the reduced stability of the Shovel has to be considered during travelling or slewing and when basic boom is operated. The stability can be improved, when the final drives are positioned opposite to counterweight.
- Observe permissible tilt angle of the Diesel engine when travelling uphill or downhill (superstructure must be in line with the undercarriage). Refer to Engine Operation Manual for the respective data.

3.13 SLEWING AND BRAKING THE SUPERSTRUCTURE

3.13.1 SLEWING THE SUPERSTRUCTURE

MACHINES WITH "EURO" CONTROL

Legend for illustration Z25222

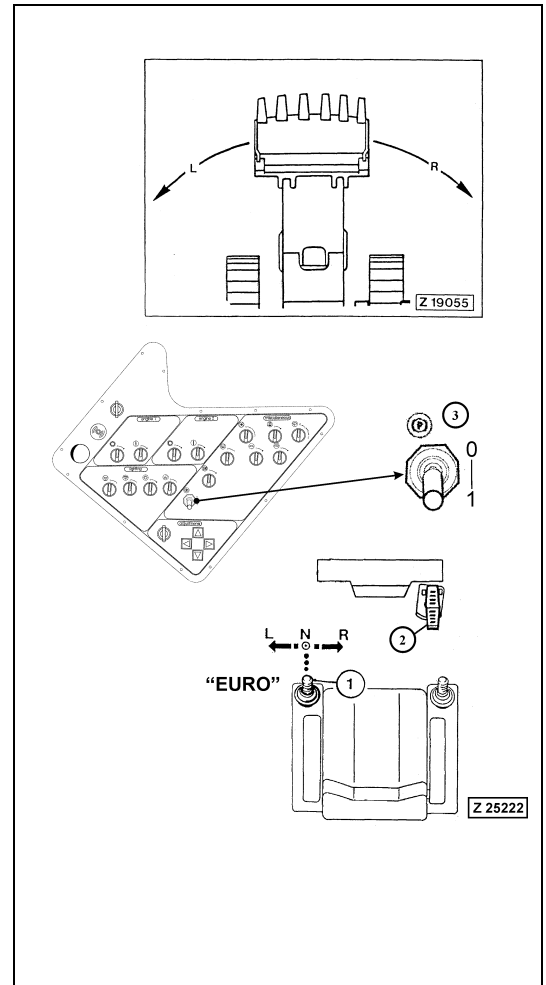
"L" CCW- Lever (1) to the left "L"

"N" Neutral position

"R" CW- Lever (1) to the right "R"

WARNING

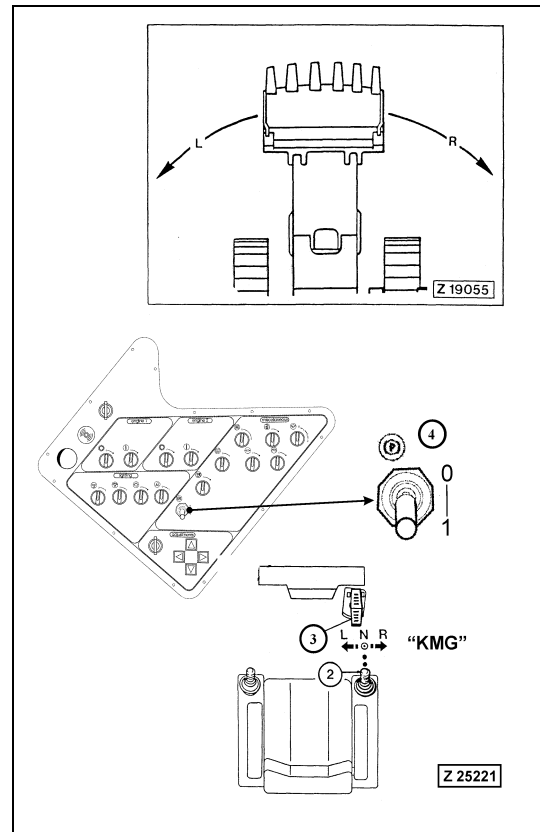
- Be sure everyone is in the clear before slewing the superstructure.
- Never swing or position the attachment or load over persons or vehicle cabs.
- Never allow anyone to walk or work under the Shovel or load while the Shovel is operating.



MACHINES WITH "KMG" CONTROL

Legend for illustration Z25221

- "L" CCW- Lever (2) to the left "L"
- "N" Neutral position
- "R" CW- Lever (2) to the right "R"



WARNING

- Be sure everyone is in the clear before slewing the superstructure.
- Never swing or position the attachment or load over persons or vehicle cabs.
- Never allow anyone to walk or work under the Shovel or load while the Shovel is operating.

BRAKING THE SUPERSTRUCTURE

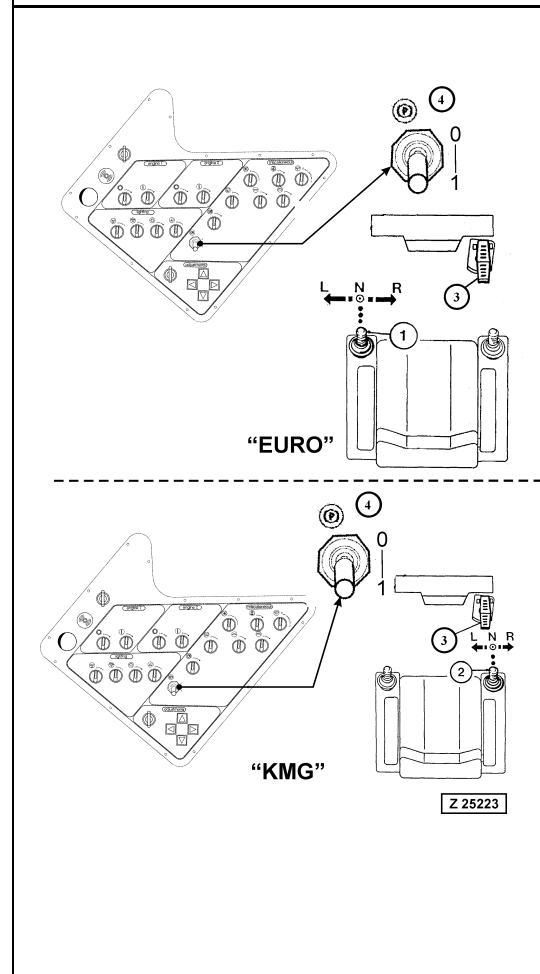
Braking of the superstructure from a slewing movement is carried out first by returning the control lever (1) or (2), illustration Z25223 to the neutral position (N). This procedure can be shortened by depressing the swing brake pedal (3).

Swing Parking Brake

The parking brake for the swing gears is a spring loaded disk type brake. This brake is switched ON and OFF with toggle switch (4).

NOTICE

The swing parking brake must only be applied with the Superstructure at complete standstill. Applying the parking brake with superstructure still slewing may result in severe damage to the brake.



WARNING

- Use the swing parking brake only in an emergency situation for stopping the rotating superstructure.
- If the parking brake has been used for emergency stopping, it is necessary to shut down the Excavator and to have the parking brake of each swing gear inspected and repaired if necessary. Contact your Komatsu dealer for support.

Switch Positions, illustration Z25223

- "0" Parking brake OFF
- "1" Parking brake ON

Applying the Parking Brake

Pull out toggle switch (4) against spring force and move down to position "1".

Releasing the Parking Brake

Move up toggle switch (4) to position "0". In this position the switch is automatically pulled down by spring force.

NOTICE

Be sure to release the parking brake before slewing the superstructure.

Hydraulic Swing Brake actuated by hydraulic access Ladder and Service Arm of Central Refilling System

The hydraulic swing brake will be applied automatically when the access ladder and/or the service arm of the central refilling system is not in its completely lifted position.

Important Instructions for Slewing the Superstructure

 WARNING

- **DO NOT** swing over persons or over the unprotected cab of a truck.
 - **DO NOT** level the ground in front of the Shovel by turning superstructure back and forth.
 - **Never** swing against the wall of a pit. First raise the attachment out of the pit and then start rotating the superstructure.
 - **Start digging** only after finishing the slewing operation.
-

3.14 WORKING WITH THE ATTACHMENT

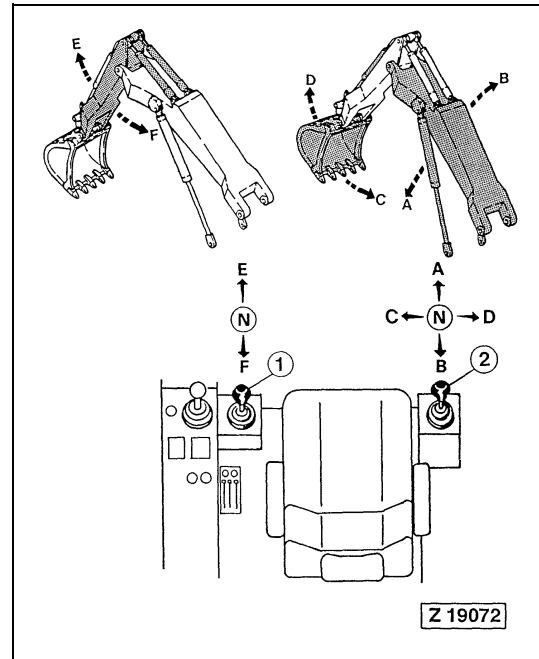
3.14.1 MACHINES EQUIPPED WITH "EURO" CONTROL SYSTEM

NOTICE

The illustrations show a typical construction of control stand and working attachment. However, the shown operation - and working movements apply to this machine.

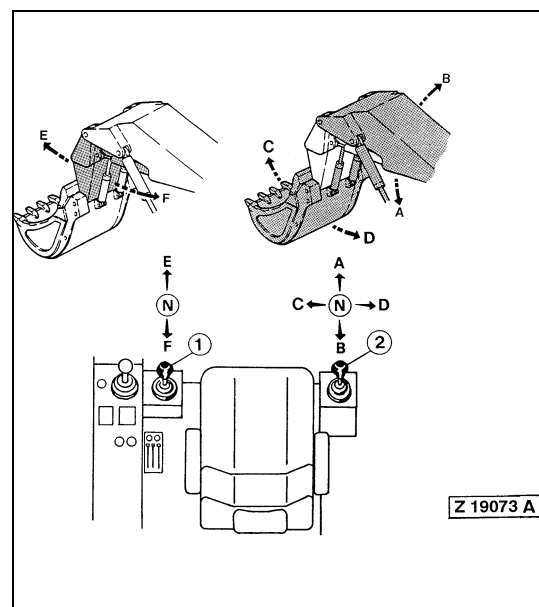
BACKHOE

- | | |
|---------------------|----------------------------------|
| LH control lever(1) | RH control lever (2) |
| E Extending stick | A Lowering boom |
| F Retracting stick | B Lifting boom |
| | C Filling bucket (roll back) |
| | D Emptying bucket (roll forward) |



FACE SHOVEL

- | | |
|----------------------|---------------------------------|
| LH control lever (1) | RH control lever (2) |
| E Extending stick | A Lowering boom |
| F Retracting stick | B Lifting boom |
| | C Filling bucket (roll forward) |
| | D Emptying bucket (roll back) |



NOTICE

The raised working attachment can also be lowered with the ENGINE at standstill. If, for example, the engine stalls with the working attachment in a raised position, lowering of the working attachment is possible by moving control lever (2) to position (A). The necessary oil pressure for shifting the spools of the main control valves is provided by a pressure accumulator in the pilot oil circuit. After stopping the engine, relieve the pressure in the hydraulic system.

For more information → See "STOPPING THE ENGINES" on page 206.

3.14.2 MACHINES EQUIPPED WITH "KMG" CONTROL SYSTEM

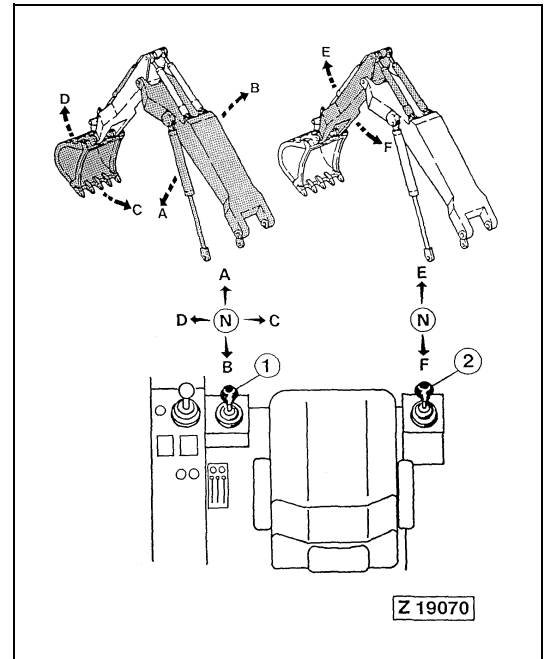
NOTICE

The illustrations show a typical construction of control stand and working attachment.

However, the shown operation - and working movements apply to this machine.

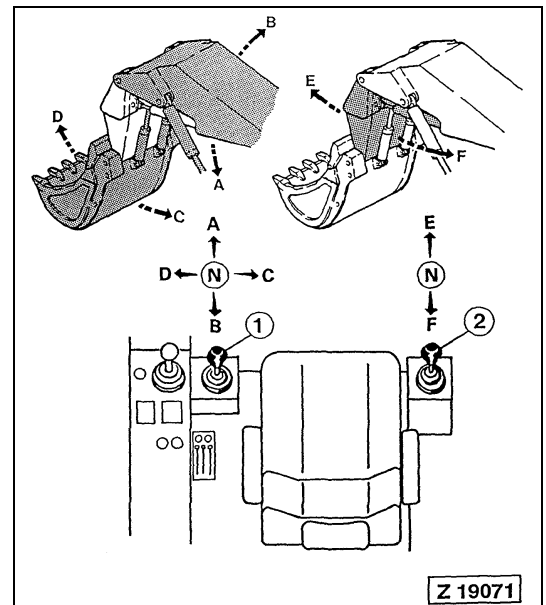
BACKHOE

- | | |
|-------------------------------------|------------------------|
| L.H. control lever (1) | R.H. control lever (2) |
| A Lowering boom | E Extending stick |
| B Lifting boom | F Retracting stick |
| C Filling bucket (roll back) | |
| D Emptying bucket (roll forward) | |



FACE SHOVEL

- | | |
|------------------------------------|------------------------|
| L.H. control lever (1) | R.H. control lever (2) |
| A Lowering boom | E Extending stick |
| B Lifting boom | F Retracting stick |
| C Emptying bucket (roll back) | |
| D Filling bucket (roll forward) | |



NOTICE

The raised working attachment can also be lowered with the engine at standstill. If, for example, the engine stalls with the working attachment in a raised position, lowering of the working attachment is possible by moving control lever (1) to position (A). The necessary oil pressure for shifting the spools of the main control valves is provided by a pressure accumulator in the pilot oil circuit. After stopping the engine, relieve the pressure in the hydraulic system.

For more information → See "STOPPING THE ENGINES" on page 206.

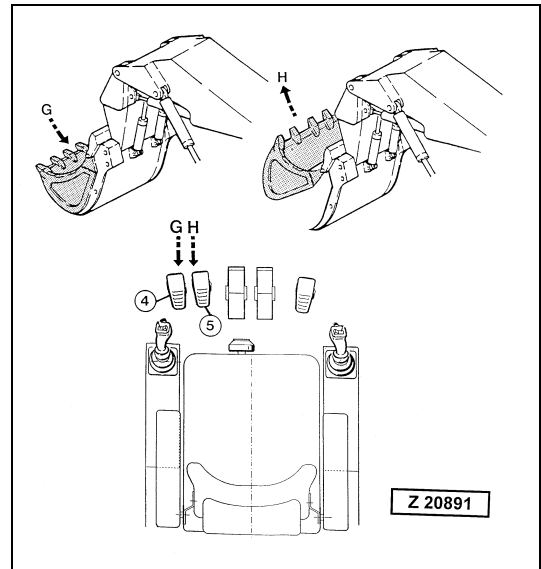
3.14.3 BOTTOM DUMP BUCKET

NOTICE

The illustration shows a typical construction of control stand and working attachment. However, the shown operation- and working movements apply to this machine.

OPERATING THE BUCKET CLAM

- G Closing the bottom dump bucket:
Depress LH pedal (4)
- H Opening the bottom dump bucket:
Depress RH pedal (5)

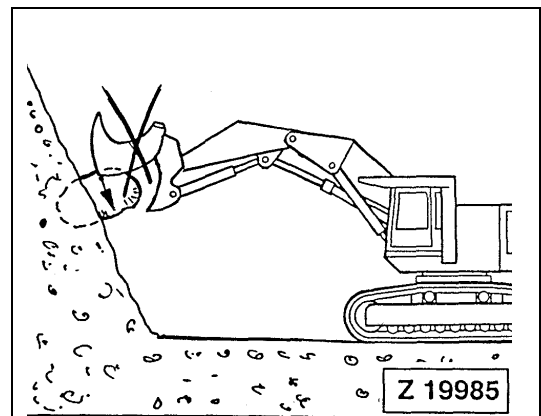
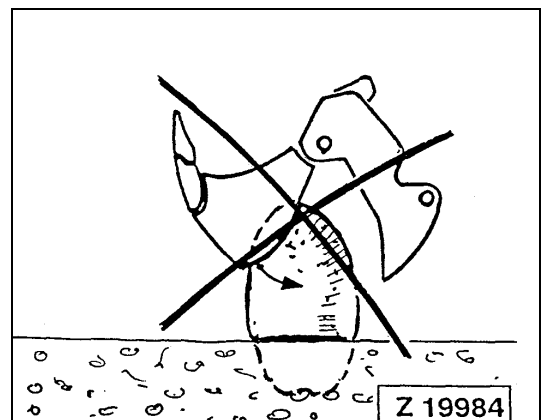


CAUTION

As soon as the bucket is completely closed, release pedal (4). Otherwise the pressure relief valve of the bucket closing circuit will open resulting in unnecessary loading of the hydraulic system.

CAUTION

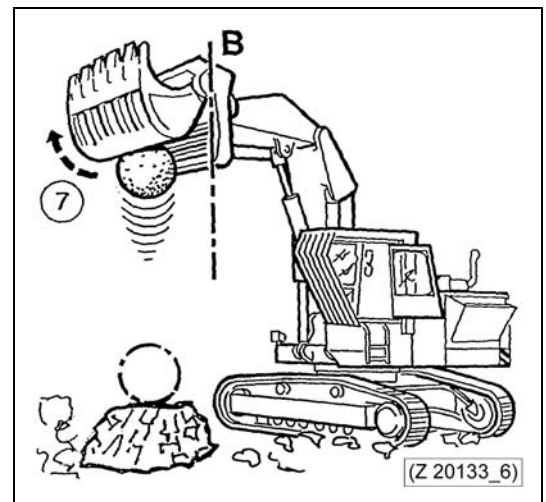
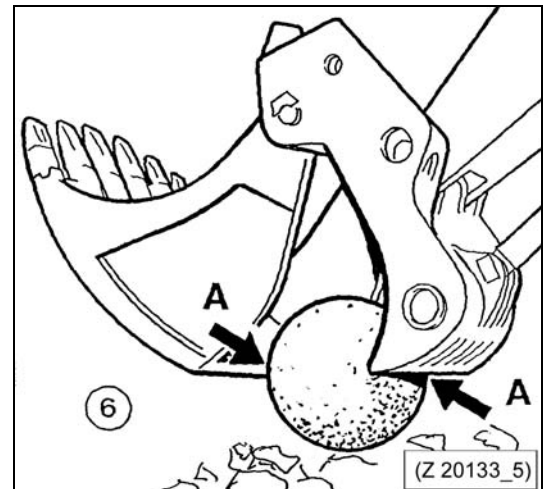
DO NOT use the bucket clam for loosening or removing anchored rocks or other solid objects (illust. Z 19984 and Z 19985), since such operations may result in severe damage to the clam pivot bearings.



3.14.4 DROP BALL OPERATION

⚠ WARNING

- Make sure all safety devices are correctly installed on your machine.
- Always walk-around and look for hazards before you operate your machine in the work area.
- Consult the supervisor of the job site for instructions concerning safe operation in the work area.
- Know the rules for movement of people and machines on the job site. Follow the instructions of the supervisor.
- Before starting drop ball operation, clear area of other persons and sound the signal horn. Stop drop ball operation when other persons approaching to the work area.
- The drop ball must never be placed loosely in the bucket. Always pick-up the drop ball at its greatest circumference, see detail (A) in the illustration number (6).
- When lifting the drop ball, make sure the back wall of the bucket remains in a vertical position, see detail (B) in illustration no. (7). The ball drop height is reached, when the bucket is on a level with the cab roof.
- With the drop ball lifted, never tilt back the bucket beyond the vertical position (B), otherwise the drop ball could roll over and fall on the Shovel.
- Before leaving the Shovel locate the drop ball on a safe place. DO NOT leave the drop ball in the bucket.



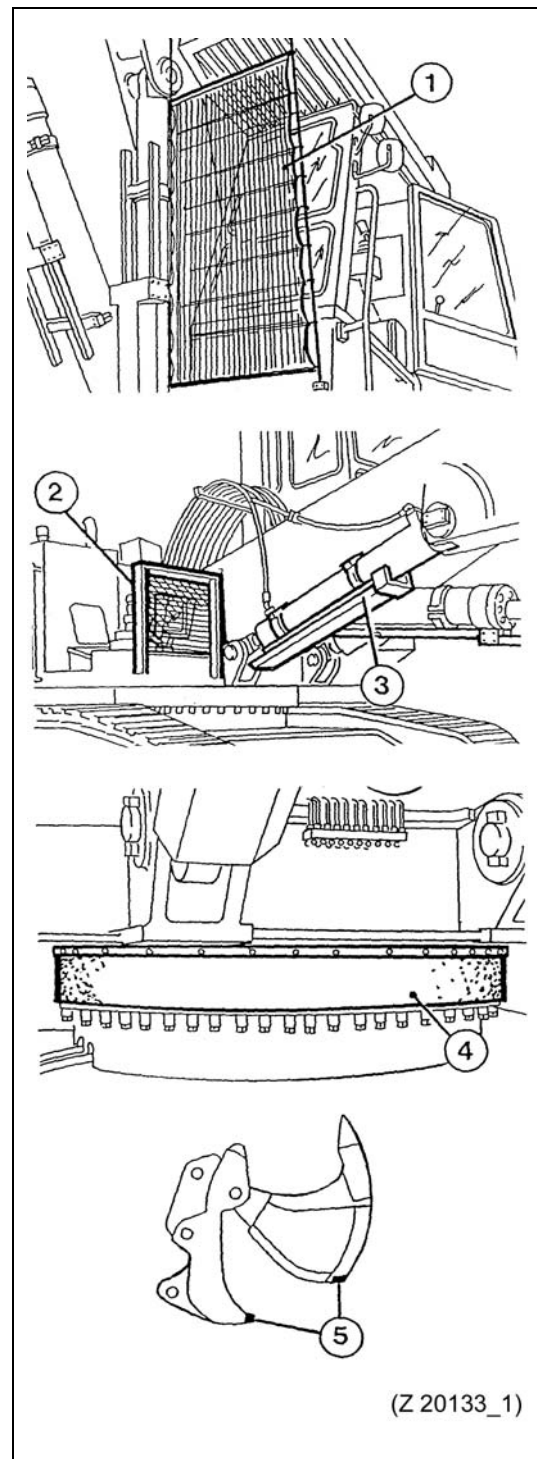
SAFETY DEVICES (SPECIAL EQUIPMENT)

Legend for illustration Z 20133_1

- (1) Front splinter guard for operator's cab
- (2) Protection screen for lubrication system, swing gear and working lights (if so equipped)
- (3) Cylinder piston rod guard
- (4) Swing ring guard
- (5) Reinforcement ledges on bucket wall and clam edges

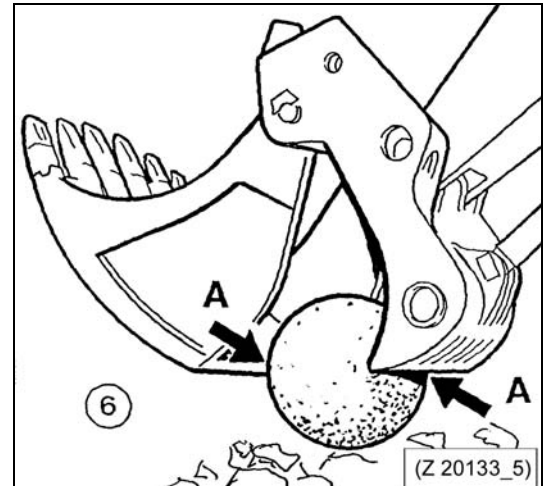
NOTICE

More information regarding safety devices for drop ball operation on request.

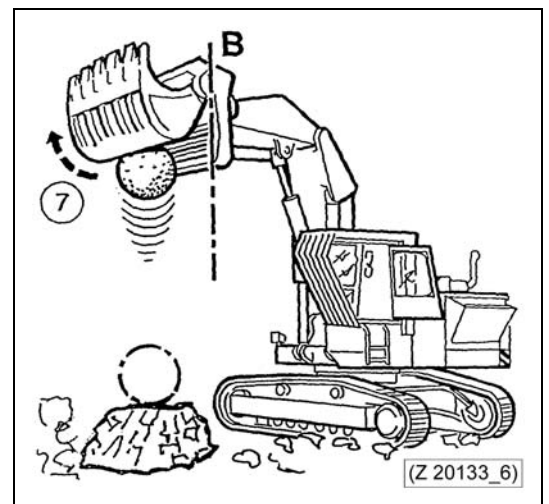


Legend for illustration Z 20133_5

- (6) Pick-up position of the drop ball
 A - Greatest circumference of the drop ball

**Legend for illustration Z 20133_6**

- (7) Drop height, level with cab roof
 B - Back wall of the bucket in vertical position

**WORKING HINTS**

Place the rock to be crushed on a solid and level ground with the impact surface in a horizontal position.

If so equipped lift up the cab front guard (1). The roof mounted beacon will then automatically switch on for warning other persons.

Change the impact surface of the rock by 90°, if after two to three drops the rock is not being crushed.

3.14.5 COMBINED OPERATION CYCLES

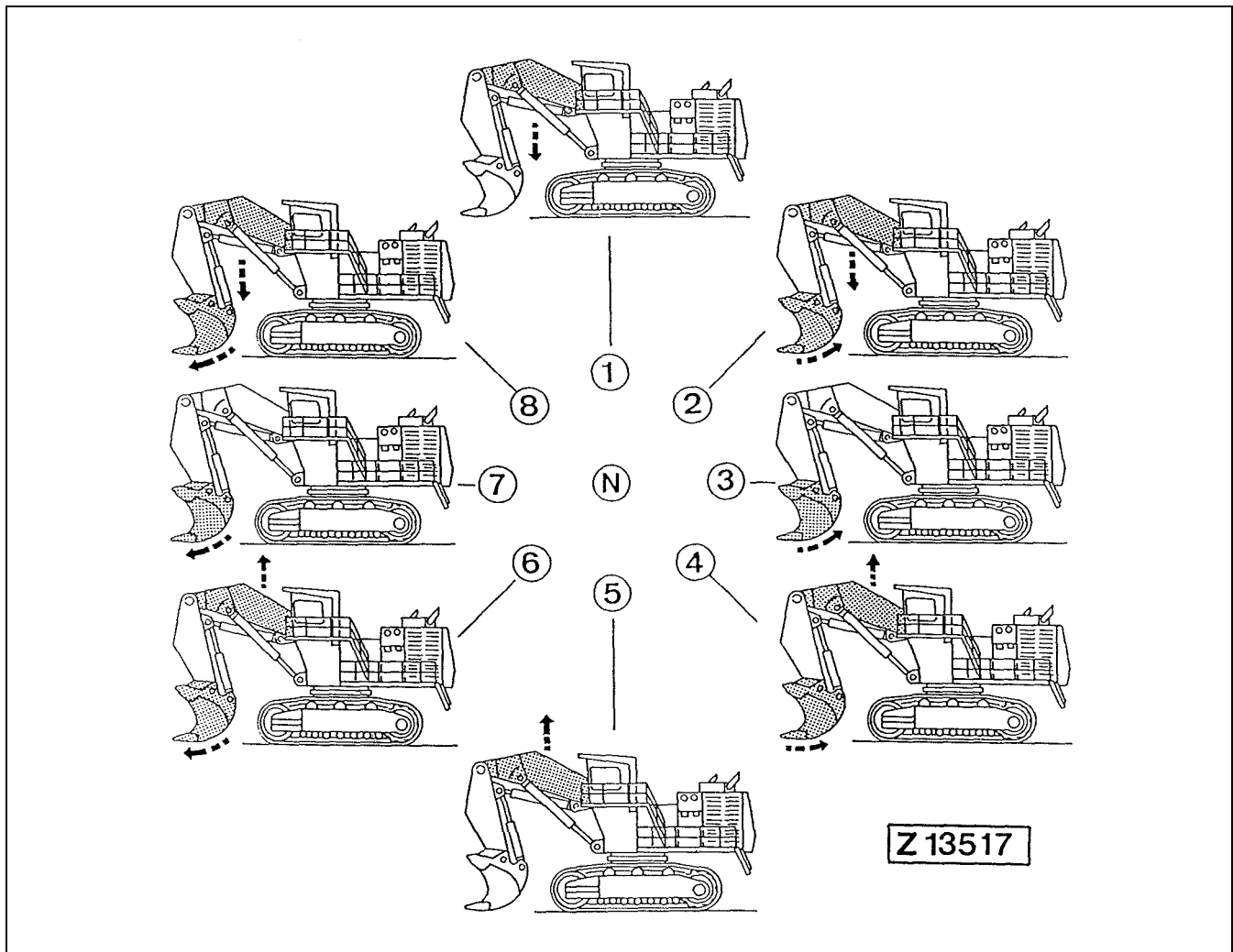
With each of the control levers, two operation cycles can be initiated simultaneously. In order to obtain efficient operation, always select intermediate control lever positions in relation to work load.

NOTICE

The illustration shows a typical Shovel.

The movements shown in the illustration are controlled:

- at KMG control system with L.H. lever
- at EURO control system with R.H. lever



Legend for illustration Z 13517

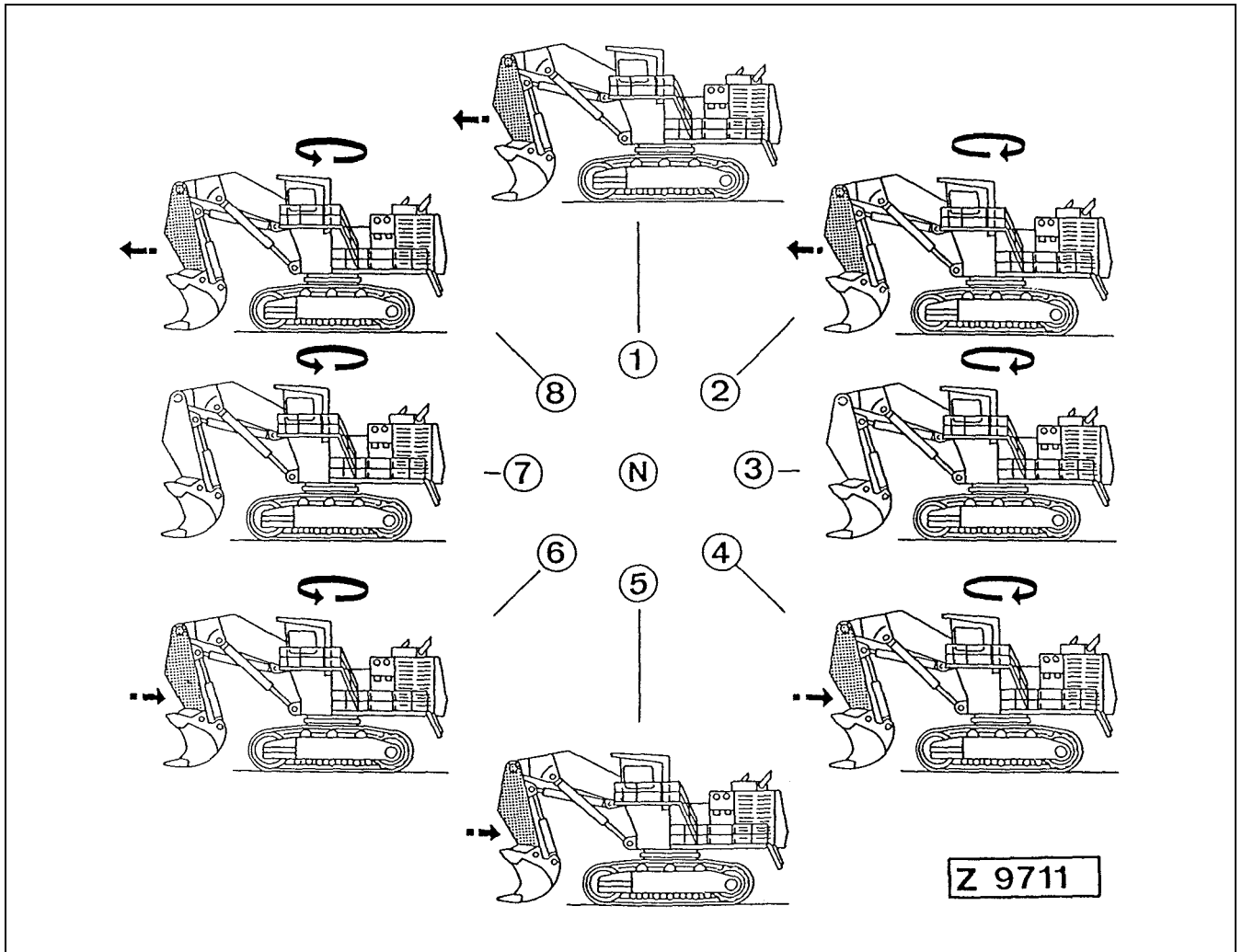
- | | |
|---------------------------------------|--------------------------------------|
| (N) Neutral position | (5) Raising boom |
| (1) Lowering boom | (6) Raising boom and filling bucket |
| (2) Lowering boom and emptying bucket | (7) Filling bucket |
| (3) Emptying bucket | (8) Lowering boom and filling bucket |
| (4) Raising boom and emptying bucket | |

NOTICE

The illustration shows a typical Shovel.

The movements shown in the illustration are controlled:

- at KMG control system with R.H. lever
- at EURO control system with L.H. lever

**Legend for illustration Z 9711)**

- | | | | |
|-----|---|-----|--|
| (N) | Neutral position | (5) | Retracting stick |
| (1) | Extending stick (away from machine) | (6) | Retracting stick and slewing to the left |
| (2) | Extending stick and slewing to the right | (7) | Slewing to the left |
| (3) | Slewing to the right | (8) | Extending stick and slewing to the left |
| (4) | Retracting stick (towards machine) and slewing to the right | | |

3.15 WORKING INSTRUCTIONS

3.15.1 STABILITY OF THE SHOVEL



WARNING

Before beginning work prepare a suitable Shovel base, to ensure adequate stability for safe working of the Shovel.

The stability of the Shovel is determined according to DIN 24087, and is based on a level ground.

The Shovel must therefore be operated in such away, that its stability is always ensured and the danger of tipping over is avoided.

When slewing the superstructure take in account, that the stability of the Shovel is being reduced when the superstructure (bucket) is turning in a transverse direction to the undercarriage.

Avoid working with the crawler tracks across the slope, as this reduces stability and increases the tendency for the Shovel to slide or to tip over.

In the following a few Examples of Operating and Working Conditions which can reduce the Stability of the Shovel:

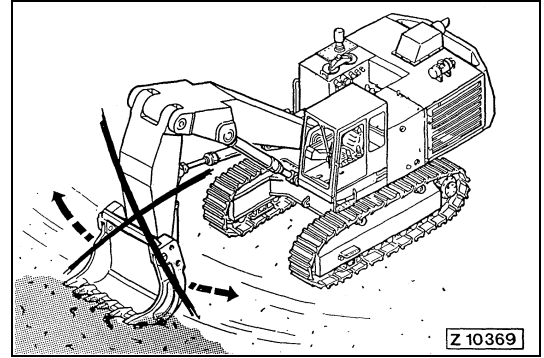
- Overloading of the Shovel (Bucket overfilled).
- Ground conditions such as loose sand or wet soil (possibility of a cave-in).
- Jerky acceleration or deceleration of working- and travel motions.
- Operating on a slope.

3.15.2 SHOVEL OPERATION

- When working with the loader attachment, switch-off the fast speed range (if equipped).
- Do not operate control levers jerkily.
- Do not work below overhanging rocks or earth masses.
- Always keep a safe distance to the edge of an excavation where bank cave-ins are possible.
- Operation on a grade requires special care. Plan your work so that the Shovel travels uphill and downhill parallel to the grade. Bear in mind, that the Shovel's stability is reduced when operating on a slope.
- Always keep the Shovel under control.
- Know the Shovel's limits - and do not exceed them.

CAUTION

DO NOT "Sweep" with the loader attachment, illust. (Z 10369), as this may result in severe damage on swing gear components.



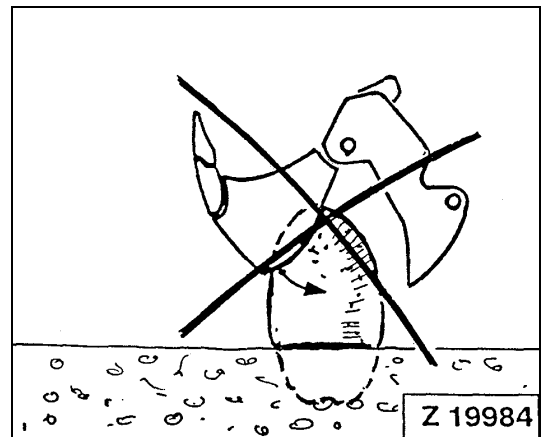
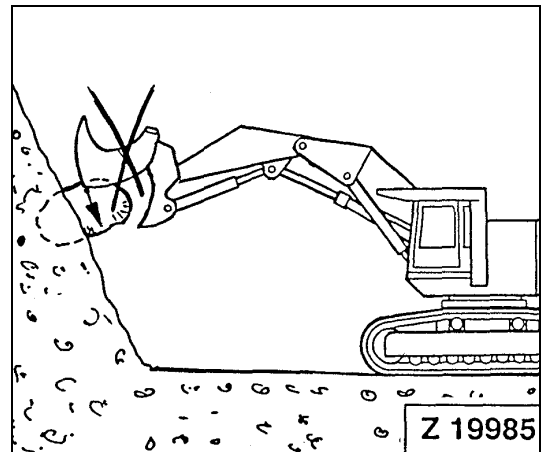
CAUTION

DO NOT use the bucket clam for loosening or removing anchored rocks or other solid objects (illust. Z 19984 and Z 19985), since such operations may result in severe damage to the clam pivot bearings.

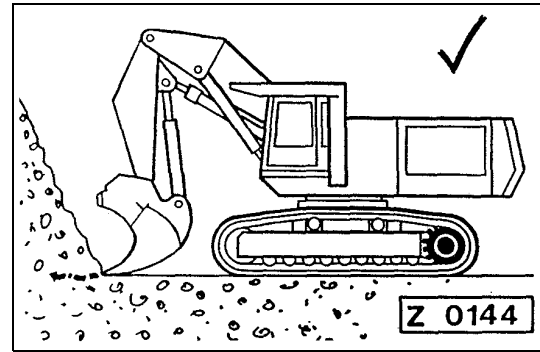
Precautions when operating hydraulic cylinders to end of stroke

Do not operate the hydraulic cylinders of the working attachment to the end of their strokes. This will bring excessive force onto the inner stoppers of the cylinders and will reduce the lifetime of the cylinders.

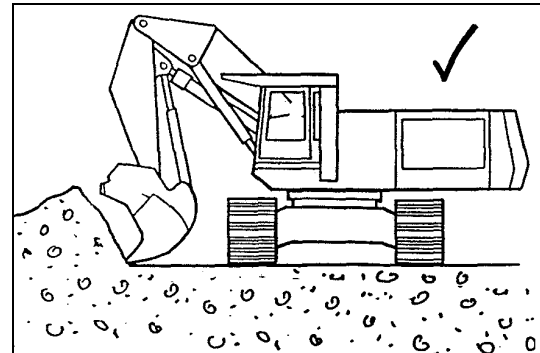
To prevent this, move the control levers to neutral position before the cylinders reach their end of stroke.



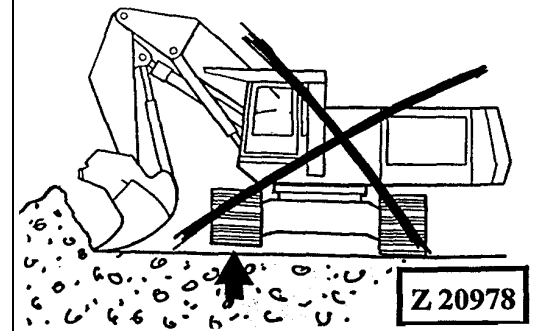
- When working with the bucket in the longitudinal direction, the final drives should be in the rear position illust. (Z 0144), for the following reasons:
 - The travel motors and travel gears are protected from falling rocks etc.
 - When the Shovel is operated on muddy ground and the tracks are covered with mud, the sprocket runs on a clean track when backing up.



- When working with the loader in a cross direction to the track group, be sure that the track is not raised off the ground, illust. (Z 20978). This can cause the track to set-off from the rollers when it is lowered down on the ground. Also the flanges of the track rollers and the track shoes can be bent by the excessive load.



- **Loading Trucks:**
 Position the truck as closely as possible to the Shovel.
 Do not swing the attachment over unprotected driver cabs.
 Swing the attachment at a sufficient height over the loading platform
 Distribute material evenly on loading platform.
 Do not overload the truck.



- Remove sticky material from the bucket.
- Always keep the Shovel as close as possible to the work area. Short boom trips - high efficiency.
- When turning into a pit, the rotating motion must not be stopped by the walls of the pit.
- Only a bucket with a complete set of teeth and cutting edges in good condition ensures efficient performance.
- Loosen hard material and rocks with the bucket, not with the stick crowding thrust.
- Correct bucket size and properly adjusted equipment prevents overloading and ensures maximum operating efficiency of the Shovel.

3.16 PARKING THE SHOVEL

Park the machine at a safe place on level and solid ground.

- Lower the working attachment onto the ground in a position as shown on the oil level plate at the hydraulic oil reservoir.
- Stop the engines and relieve the pressure in the hydraulic system, see page 209 for more information.
- Move the lock lever fully to the rear in locked position.

WARNING

DO NOT leave the Operator's Cab when the engines are running.

- Be sure to lock the operator's cab door before leaving the Shovel.
- If the Shovel has to be parked on steep terrain, the track groups must be secured with wedges.
- Before leaving the Shovel make sure that the parked machine does not impair local requirements, have consideration for other mining traffic.

CLEANING THE TRACK GROUPS

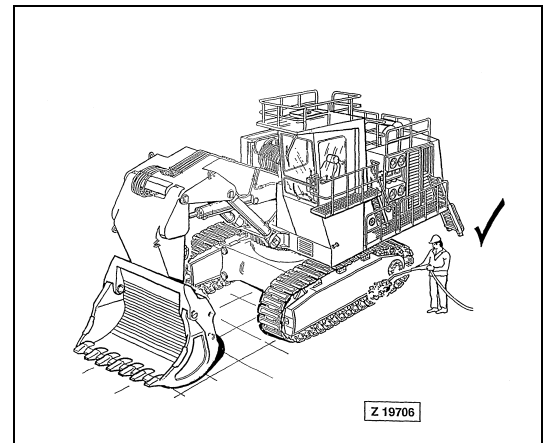
Under working conditions with excessive material build up on the crawler components, cleaning of the crawlers is very important to prevent damage.

Material build up on guide wheels, drive sprockets and tracks can lead to over tensioning of the tracks, resulting in severe damage to these components.

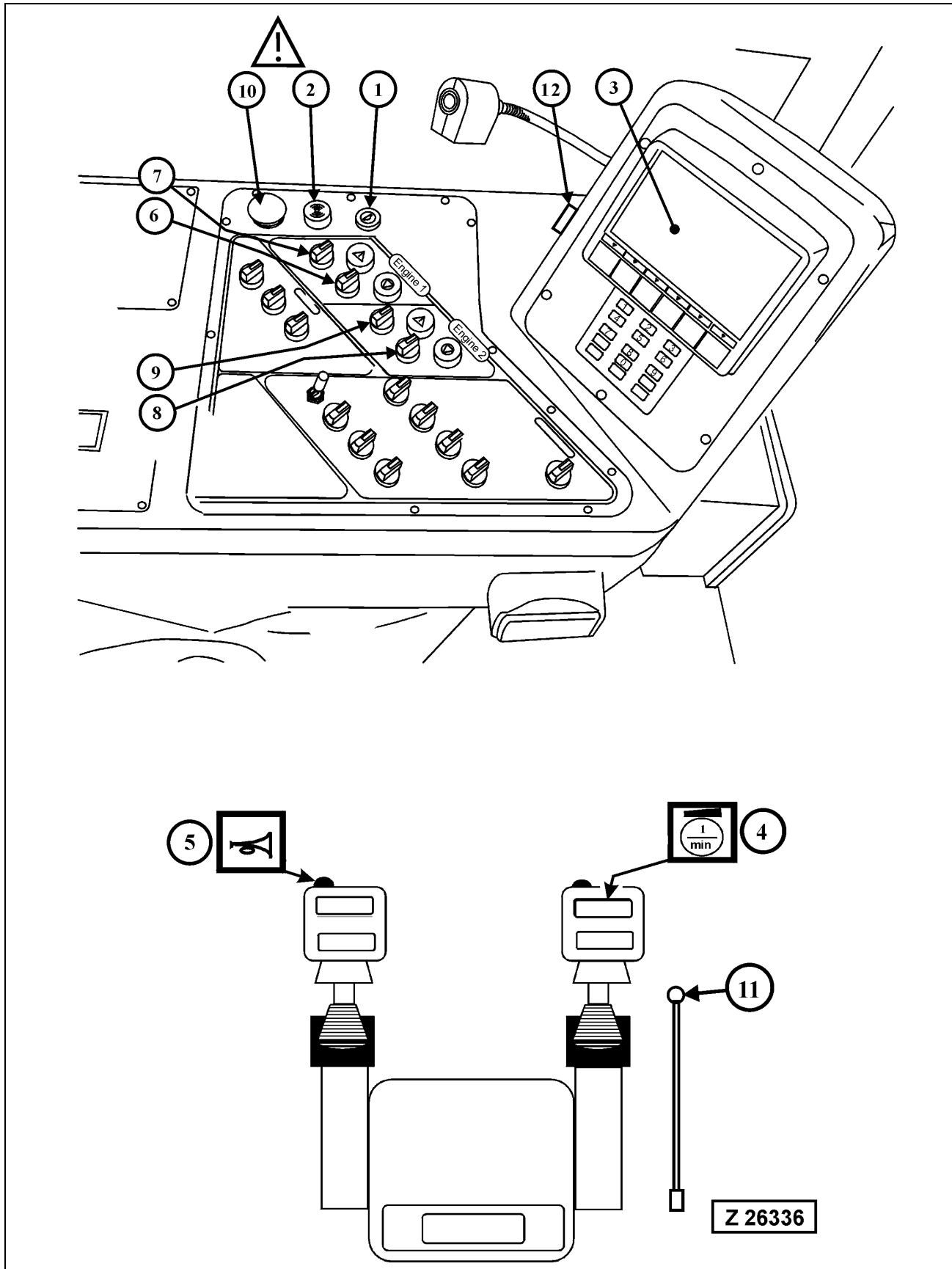
If there is danger of frost, the tracks must also be cleaned.

NOTICE

Use a suitable cleaning device for removing dirt, mud and debris from the tracks, rollers, guide wheels and sprockets.



3.17 STOPPING THE ENGINES



CAUTION

Never stop the engines from full load except in case of emergency.

Before shutting down run the engines at idling speed for approximately 5 minutes. This cooling down period prevents heat accumulation and thermal stress, especially in the turbochargers.

CAUTION

For EMERGENCY SHUTDOWN of the Engines, use STRIKE BUTTON (10).

Additional emergency shut-down switches are located on the power house. For more information → See "MACHINERY HOUSE" on page 140.

Stopping procedure, see illustration Z26336.

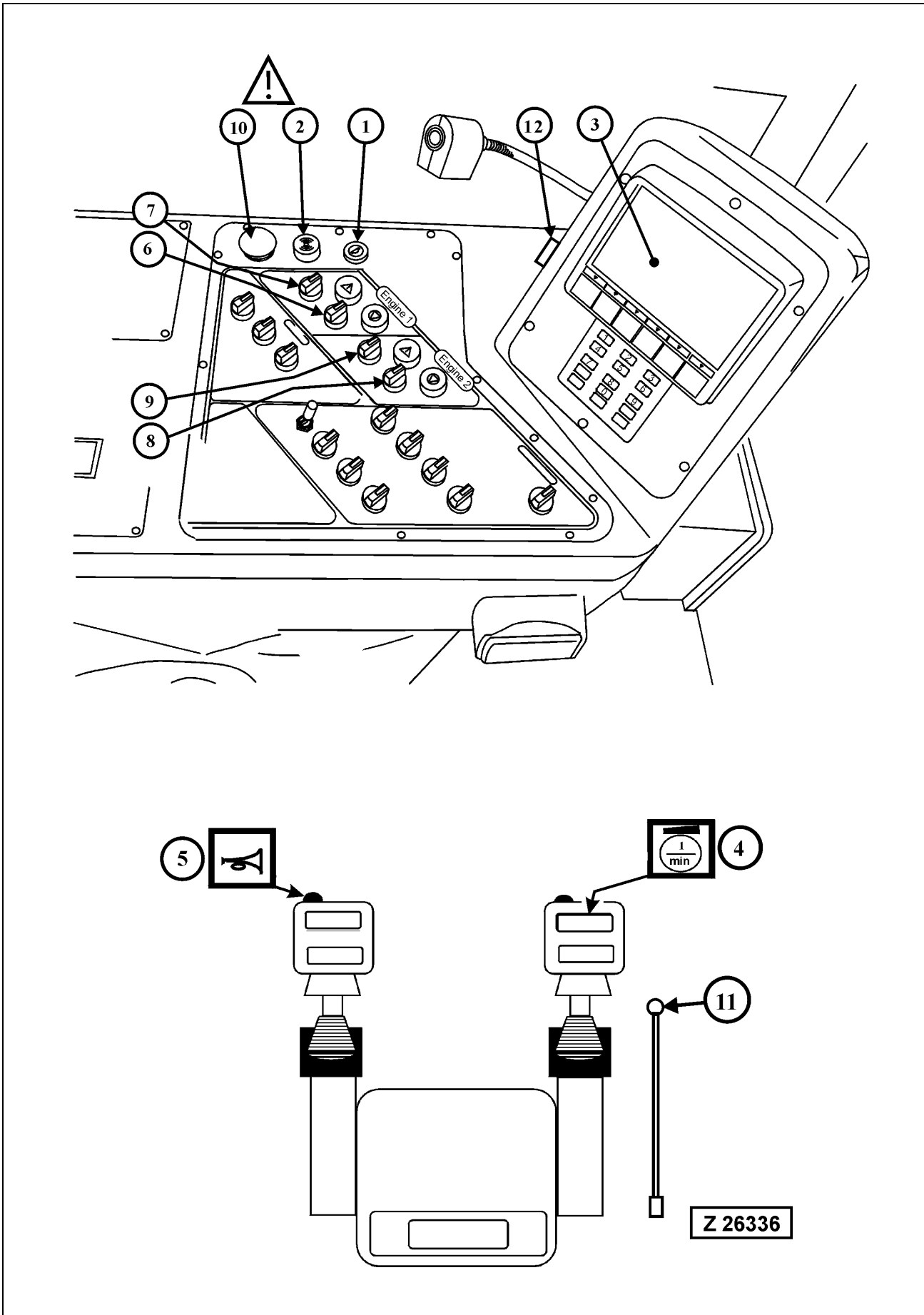
1. Park the Shovel at a safe place on level and solid ground.

For more information → See "PARKING THE SHOVEL" on page 205.

2. Deposit the working attachment onto the ground, proceed as follows:
 - **A - Backhoe Attachment**
Lower the backhoe attachment fully extended onto the ground in a position as shown on the oil level plate.
 - **B - Bottom Dump Bucket Attachment**
Lower the bottom dump bucket attachment onto the ground in a position as shown on the oil level plate.

The positions A or B are necessary to prevent unintentional movement of the working attachment when the pressure in the hydraulic system is relieved and for correct checking of the hydraulic oil level.

3. Move all controls into neutral position.
4. Set toggle switch (4) to low idle speed position. Let the engines idle for about five minutes without load.
5. Turn switches (7 and 9) clockwise to stop position. After the engines have come to standstill, relieve the pressure in the hydraulic system.



3.17.1 RELIEVE PRESSURE IN THE HYDRAULIC SYSTEM

⚠ WARNING

With the engines at standstill and main switch (1) in ON position, move all controls for working attachment and crawlers several times through all shift positions to relieve the pressure in the hydraulic system. The necessary oil pressure for shifting the spools of the main control valves is provided by a pressure accumulator in the pilot oil circuit.

NOTICE

The pressure accumulator in the pilot oil circuit serves also for lowering a raised working attachment to the ground with the engines at standstill. If, for example, the engines stall with the working attachment in a raised position, lowering of the working attachment is possible by operating the respective control lever.

6. Set main switch key (1) to "0" position and remove.

NOTICE

After switching OFF the main key switch in the Operator's cab, wait at least 3 minutes before switching OFF the battery main switches. The Vehicle Health Monitoring System (VHMS) needs this period for saving data. If batteries are switched OFF before this time period is over, data will be lost.

7. Set lock lever (11) fully to the rear in LOCKED position.

8. Switch off the battery main switches and remove keys.

3.18 OPERATION OF THE LUBRICATION SYSTEM

3.18.1 CENTRAL LUBRICATION SYSTEM -CLS- FOR SUPERSTRUCTURE AND ATTACHMENT

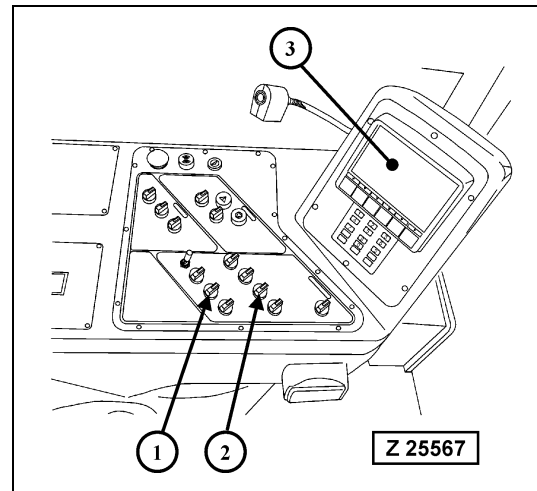
The central lubrication system works automatically as soon as the engine is running at high idle speed.

The VHMS System monitors the function of the central lubrication system.

Trouble conditions of the lubrication system are indicated through fault messages on health monitor (3).

Legend for illustration Z25567

- (1) Switch, manual actuation of central lubrication system
- (2) Switch, manual actuation of slew ring gear lubrication system
- (3) Health monitor



Manual actuation of the central lubrication system

Manual actuation of the lubrication system overrides the adjusted pause time (factory setting 15 minutes). The lubrication cycle starts after a pressure build up time of 1 to 2 minutes. Thereafter the monitoring time of 10 minutes starts. The complete lubrication cycle takes approximately 12 minutes. After this period the lubrication cycle counter adds one lubrication cycle to the memory. For display of the cycle counter reading use the service menu of the VHMS system.

REMARK

The start of a manually actuated lubrication cycle can be delayed by up to 10 minutes if the system is in the monitoring time period of a previous automatic lubrication cycle.

CAUTION

If the central lubrication system fails to work for a period longer than four hours an automatic bucket motion cut off can happen depending on the installed VHMS soft ware. Repair the system as soon as possible.

ADJUSTMENTS OF THE CENTRAL LUBRICATION SYSTEM

The following adjustments can be made in the service menu of the VHMS system, under menu point 4.8.1:

Level 4: Service Menu / Settings 4.8.1

- *PAUSE TIME
- *MONITORING TIME
- *PRESSURE RELIEF TIME
- *LUBE CYCLE COUNTER

Refer to Service Manual VHMS system for description of adjustment procedure.

Repairs on the Central Lubrication System with the Engine running or with the Engine OFF and Main Switch Key in ON position

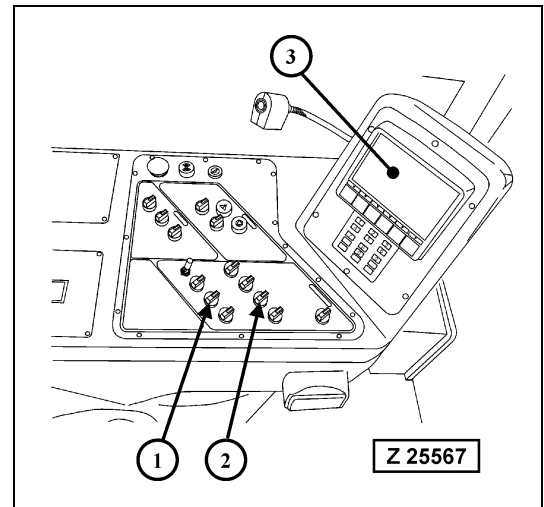
If repairs under the above conditions have been carried out it is necessary to reset the control circuit of the lubrication system by actuating the rotary switch (1), illust. (Z25567) for a full lube cycle.

If this manually actuated lube cycle is not being carried out, the fault message -LUBE SYSTEM FAILURE- will remain on the health monitor (3).

Resetting of the lube system control circuit can also be done by shutting down the engine and switching OFF the main switch key.

NOTICE

For more information regarding inspection, trouble shooting and maintenance of the lubrication system, refer to the separate manual LUBRICATION SYSTEMS in volume 2 binder.



3.18.2 SWING CIRCLE PINION LUBRICATION SYSTEM -SLS-

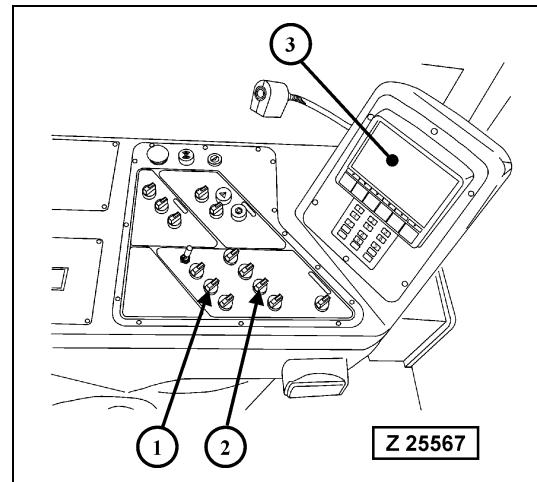
This system works automatically as soon as the engine is running at high idle speed.

The VHMS System monitors the function of the swing circle lubrication system.

Trouble conditions of the lubrication system are indicated through fault messages on health monitor (3).

Legend for illustration Z25567

- (1) Switch, manual actuation of central lubrication system
- (2) Switch, manual actuation of swing circle lubrication system
- (3) Health monitor



Manual actuation of the swing circle lubrication system

Manual actuation of the lubrication system overrides the adjusted pause time (factory setting 15 minutes). The lubrication cycle starts after a pressure build up time of 1 to 2 minutes. Thereafter the monitoring time of 10 minutes starts. The complete lubrication cycle takes approximately 12 minutes. However, since the swing circle lubrication system works only during slewing of the superstructure also the monitoring time elapses only during the slewing movement. This is the reason why the total monitoring time usually lasts longer than the adjusted 10 minutes. After elapsing of the monitoring time the lubrication cycle counter adds one lubrication cycle to the memory. For display of the cycle counter reading use the service menu of the VHMS system.

REMARK

The start of a manually actuated lubrication cycle can be delayed by up to 10 minutes if the system is in the monitoring time period of a previous automatic lubrication cycle.

CAUTION

If the swing circle lubrication system fails to work for a period longer than four hours an automatic bucket motion cut off can happen depending on the installed VHMS software. Repair the system as soon as possible.

SWING CIRCLE LUBRICATION SYSTEM "SLS"

Repairs on the swing circle lubrication system with the Engine running or with the Engine OFF and Main Switch Key in ON position

If repairs under the above conditions have been carried out it is necessary to reset the control circuit of the lubrication system by actuating the rotary switch (2), illust. (Z25567) for a full lube cycle.

If this manually actuated lube cycle is not being carried out, the fault message -LUBE SYSTEM FAILURE- will remain on the health monitor (3).

Resetting of the lube system control circuit can also be done by shutting down the engine and switching OFF the main switch key.

NOTICE

For more information regarding inspection, trouble shooting and maintenance of the lubrication system, refer to the separate manual LUBRICATION SYSTEMS in volume 2 binder.

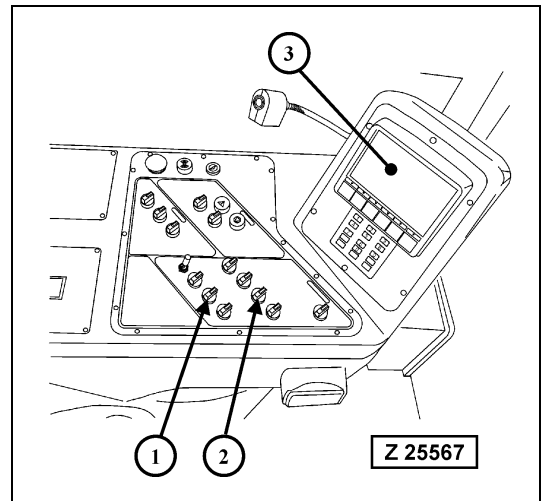
ADJUSTMENTS OF THE SWING CIRCLE-LUBRICATION SYSTEM

The following adjustments can be made in the service menu of the VHMS system, under menu point 4.8.1:

Level 4: Service Menu / Settings 4.8.1

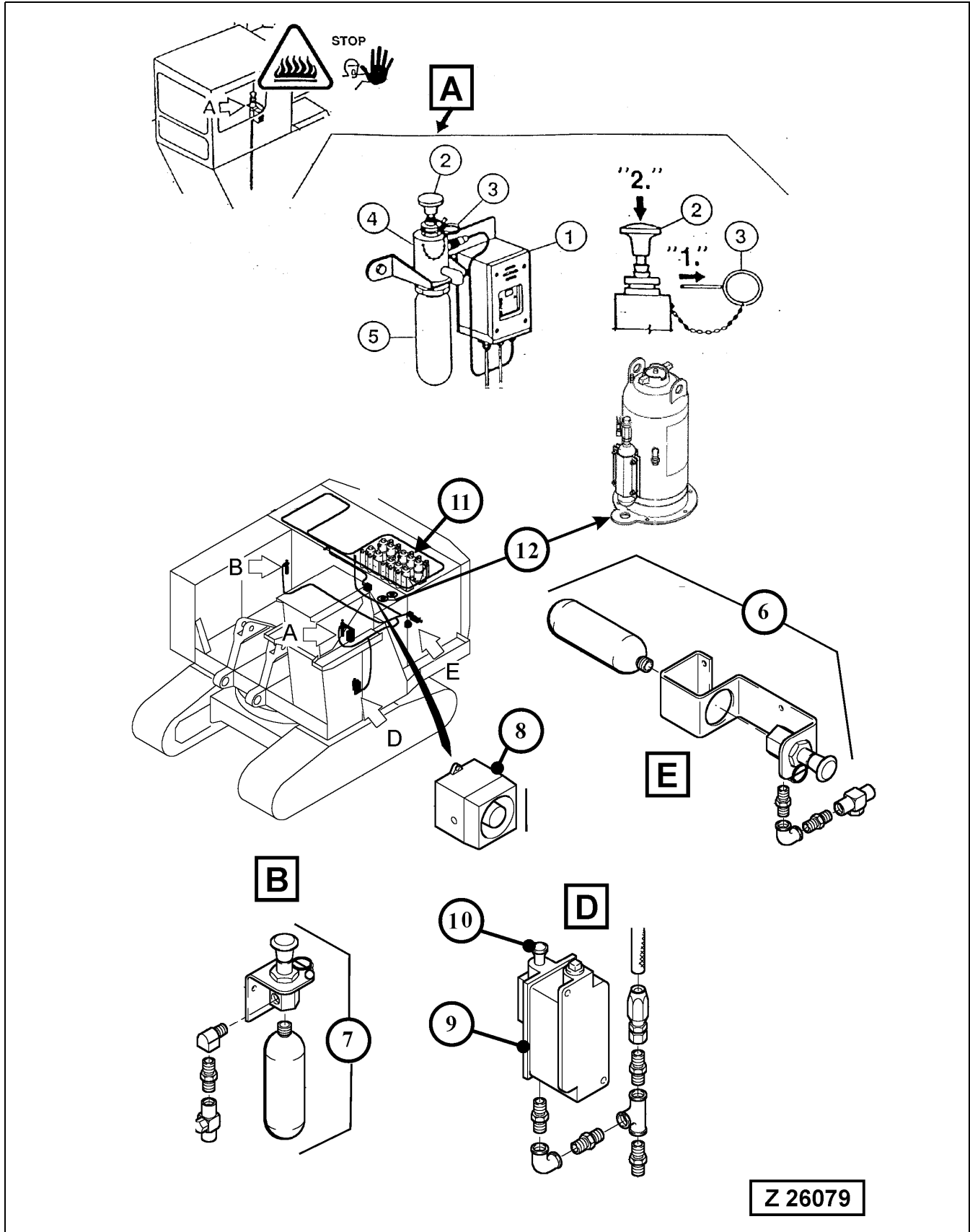
- *PAUSE TIME
- *MONITORING TIME
- *PRESSURE RELIEF TIME
- *LUBE CYCLE COUNTER

Refer to Service Manual VHMS system for description of adjustment procedure.



3.19 FIRE DETECTION AND SUPPRESSION SYSTEM

(Special Equipment)



FIRE DETECTION AND SUPPRESSION SYSTEMS

The mining shovel is equipped with the following systems:

- CHECKFIRE SC-N ELECTRIC DETECTION AND ACTUATION SYSTEM
- DRY CHEMICAL FIRE SUPPRESSION SYSTEM LT-A-101
- LIQUID AGENT FIRE SUPPRESSION SYSTEM LVS

The CHECKFIRE SC-N system provides automatic fire detection and automatic or manual actuation of the fire suppression systems. If the CHECKFIRE SC-N system detects a fire it will automatically actuate the suppression systems in two steps. First the DRY CHEMICAL FIRE SUPPRESSION SYSTEM LT-A-101 will be actuated and after a 20 second delay the LIQUID AGENT FIRE SUPPRESSION SYSTEM LVS will be actuated.

The dry chemical portion of the twin agent system is primarily responsible for the suppression. Although the LVS wet chemical solution is primarily intended for cooling, it can also aid in suppression by two means:

- The water content of the solution cools the fuel and the surroundings surface areas. Cooling the surrounding surface areas minimizes the change for reflash.
- Forming a film over the fuel, which aids in securing against reflash.

For detailed description of the above systems refer to the separate Inspection and Maintenance Manuals filed in volume 2 binder.

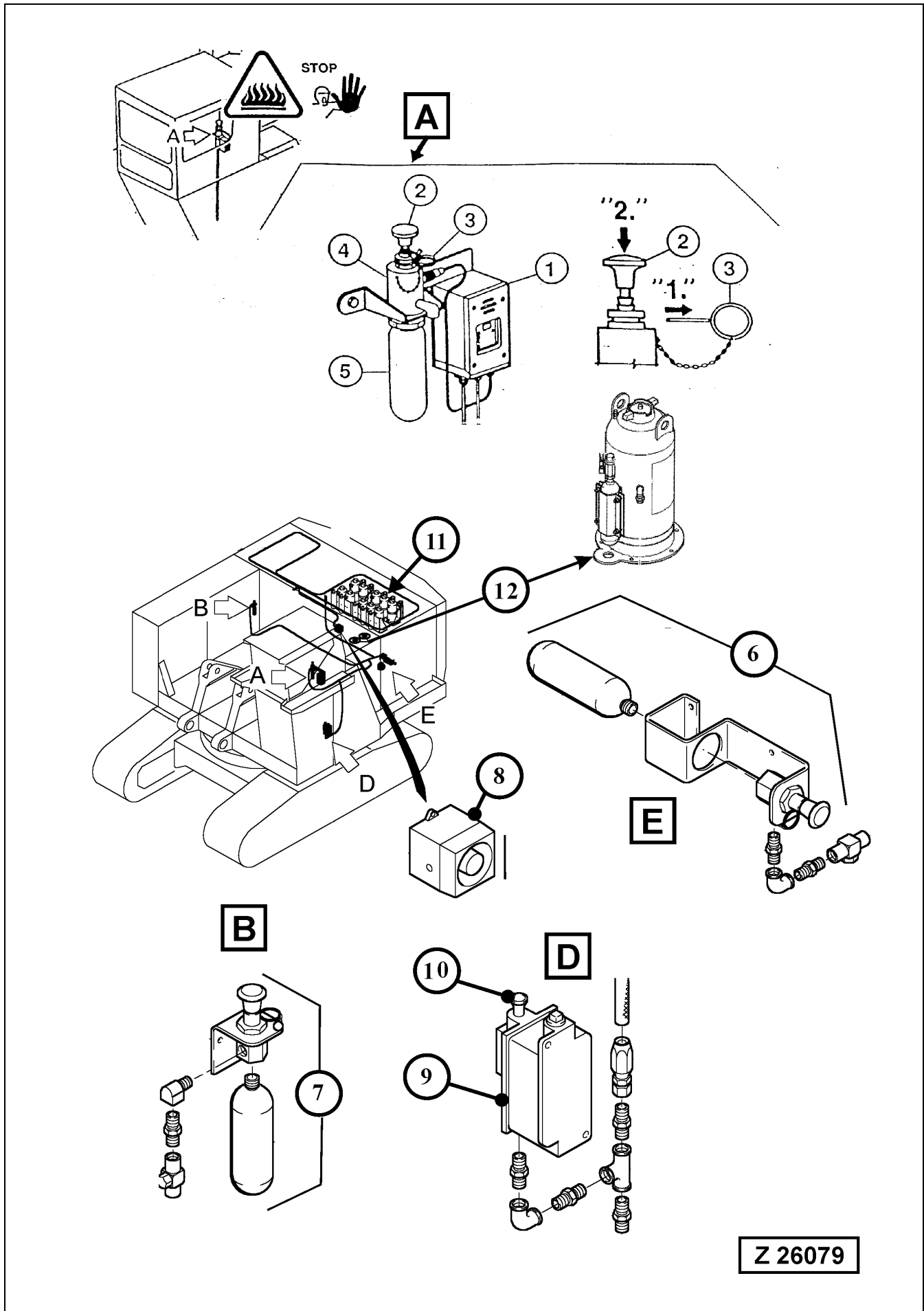
WARNING

Before operating the Shovel make sure the Fire Detection, Actuation and Suppression systems are operative. Carry out inspection and maintenance according to the separate manuals CHECKFIRE SC-N ELECTRIC DETECTION AND ACTUATION SYSTEM and FIRE SUPPRESSION SYSTEMS in volume 2 Binder.

CAUTION

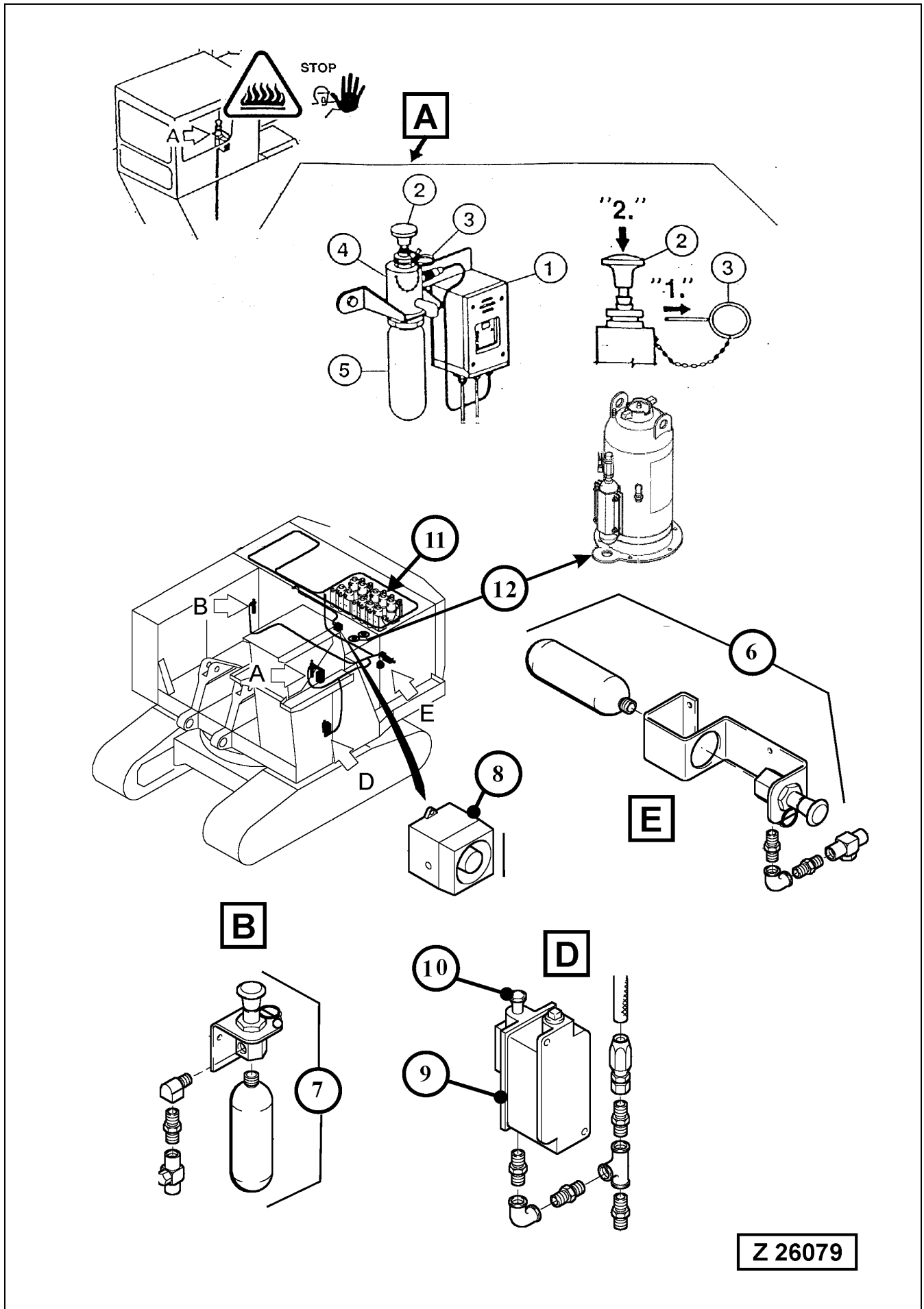
This section covers only such information necessary for the operator to understand operation of the fire detection and actuation system.

All other information i.e. placing the system in service, daily inspection, functional tests, maintenance and trouble shooting are contained in the separate manuals.



Legend for illustration Z26079

- (A) Control module with manual/automatic actuator in the Operator's cab
- (1) Control module, refer to the separate Manual "CHECKFIRE SC ELECTRIC DETECTION AND ACTUATION SYSTEM" for all information concerning - Operational Modes, Daily Inspection, Maintenance and System Conditions -.
- (2) Strike button, manual actuation
- (3) Ring pin
- (4) Manual / automatic actuator
- (5) LT-5-R cartridge
- (6) Manual actuator switch at the radiator door
- (7) Manual actuator switch at the rear power house door
- (8) High level alarm on operator's cab
- (9) Pressure switch - DPST located in the cab base. This switch shuts off the engine immediately when the fire detection system has a fire detected. The reset plunger (10) moves out into its upper position. When the fire suppression system has been recharged, push in the reset plunger.
- (10) Reset plunger, be sure to push in this plunger as soon as the fire suppression system has been recharged after actuation of the system.
- (11) Fire extinguishing tanks on power house roof
- (12) Extinguishing agent tank assembly of the liquid agent fire suppression system LVS



3.19.1 HIGH LEVEL ALARM "FIRE"

The high level alarm (8), illust. Z26079 will sound approximately 15 seconds before discharge of the fire suppression system in case of automatic actuation of the system. Act according to the circumstances and the applying safety regulations. Evacuate area to lessen risk of injury from flames.

3.19.2 ENGINE SHUT-DOWN THROUGH FUEL SHUT-OFF SOLENOID VALVE

The fuel shut-off solenoid valve for the engine is actuated through pressure switch (9), illust. Z26079.

When the fire detection system detects a fire, the valve will be closed shutting-off fuel supply to the engine (Shut-down of the engine).

3.19.3 ACTUATION MODES OF THE FIRE SUPPRESSION SYSTEMS

MANUAL ACTUATION

Via strike button (2) in operator's cab or strike button of switches (6) on radiator door and (7) at the rear power house door.

▲ WARNING

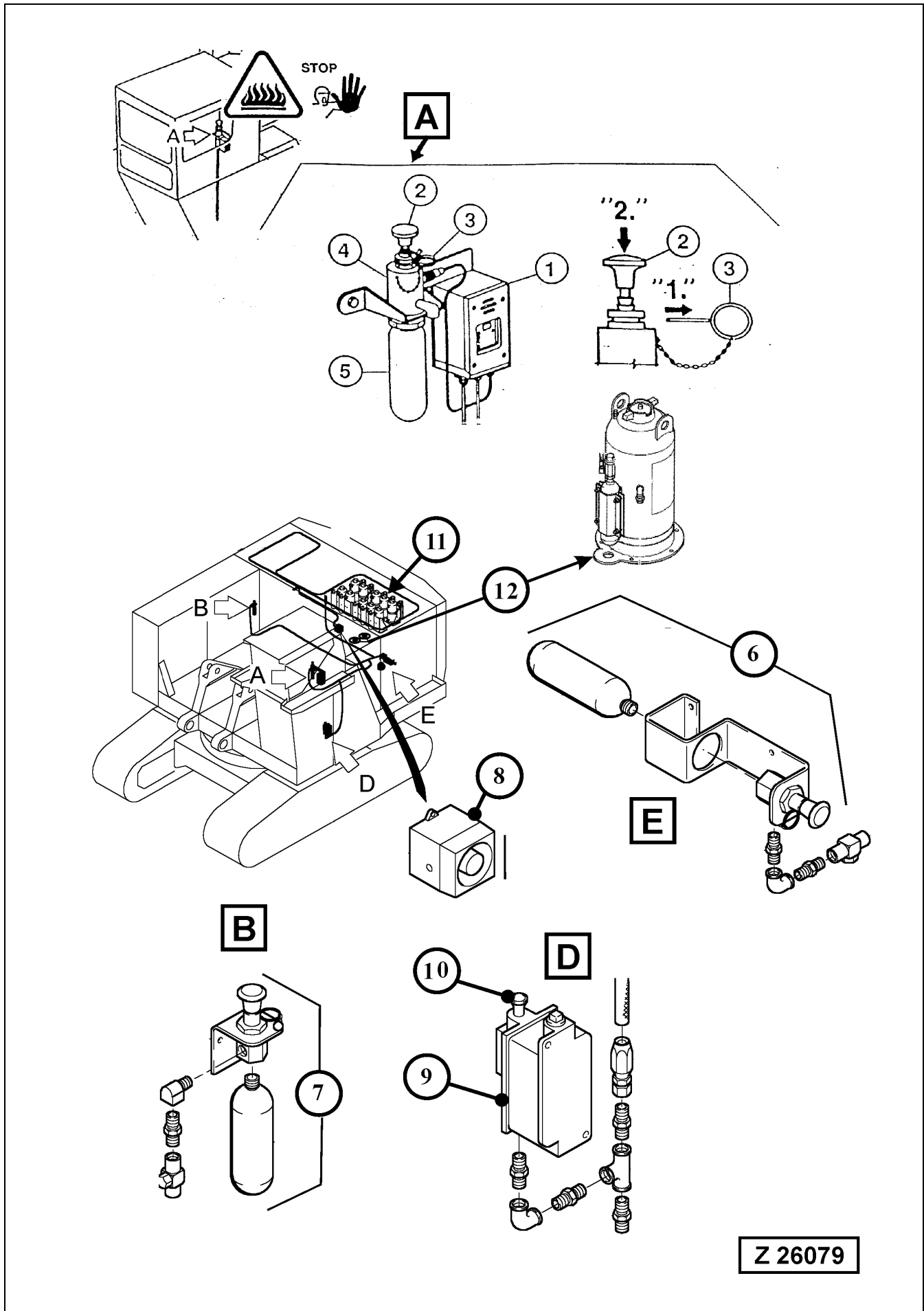
Manual actuation will result in immediate system discharge which may obscure vision. Make certain the Shovel is stopped safely before manually actuating the system. Manual actuation will bypass all auxiliary shutdown and alarm functions.

NOTICE

For manual actuation via switches (4, 6 or 7), pull ring (3) and strike button (2).

AUTOMATIC ACTUATION

Via detection wires routed through the engine - and hydraulic pump compartments.



3.19.4 INDICATION OF OPERATIONAL MODES AT CONTROL MODULE, AFTER AUTOMATIC ACTUATION OF THE FIRE SUPPRESSION SYSTEMS

Alarm to Shutdown Period - The RED alarm LED and the audio alarm will pulse at a rate of 2 times per second.

Shutdown to Discharge Period - The RED alarm LED and the audio alarm pulses "on" four times per second.

Timer Setting (factory adjustment)

- Alarm to Shutdown: 5 seconds
- Shutdown to Discharge: 10 seconds

 **WARNING**

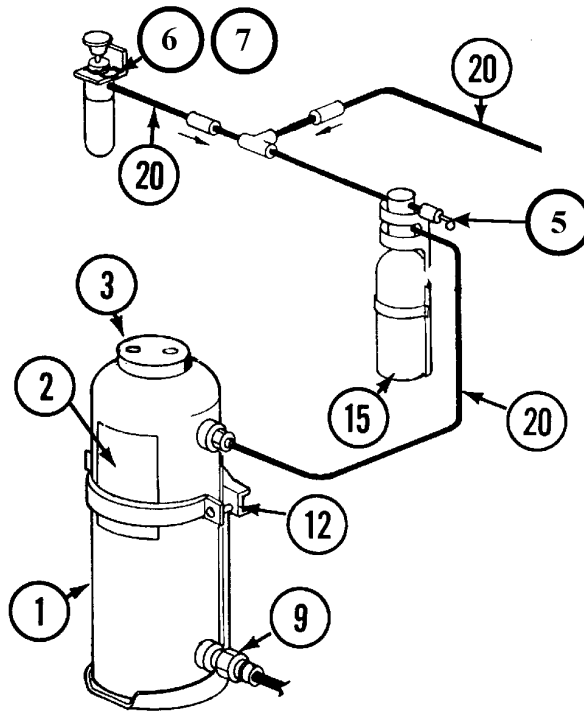
In Case of Fire

- Act according to the circumstances and the applying safety regulations.
 - Evacuate area to lessen risk of injury from flames, heat, hazardous vapours, explosions, or other hazards that may be created.
 - Evacuate endangered Persons.
 - Inform the fire brigade.
 - Fight the fire.
-
-

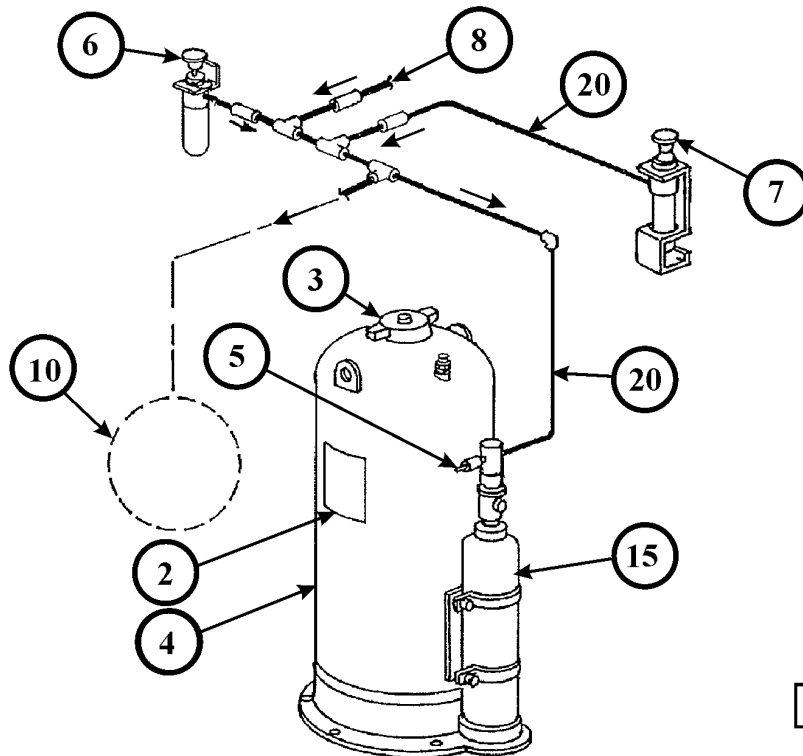
 **CAUTION**

For continued protection, the Detection and Actuation System and the Fire Suppression Systems must be recharged through authorized Service Personnel immediately after operation.

- A -



- B -



Z 25570

3.19.5 LOCATION OF THE EXTINGUISHING AGENT TANK ASSEMBLIES AND EXPELLANT GAS CARTRIDGES ON POWER HOUSE ROOF

Legend for illustration Z25570

- A - Components of the dry chemical fire suppression system LT-A-101
- B - Components of the liquid agent fire suppression system LVS
- (1) Extinguishing agent tank assembly of the dry chemical suppression system LT-A-101
- (2) Name plate
- (3) Fill cap
- (4) Extinguishing agent tank assembly of the liquid agent fire suppression system LVS
- (5) Relief valve
- (6) Manual actuator switch at the radiator door
- (7) Manual actuator switch at the rear power house entrance
- (8) From automatic detection system
- (9) Extinguishing agent outlet to nozzle
- (10) Pressure switch for engine shutdown
- (12) Mounting clamp
- (15) Expellant gas Nitrogen cartridge
- (20) Pneumatic actuation line

REMARK

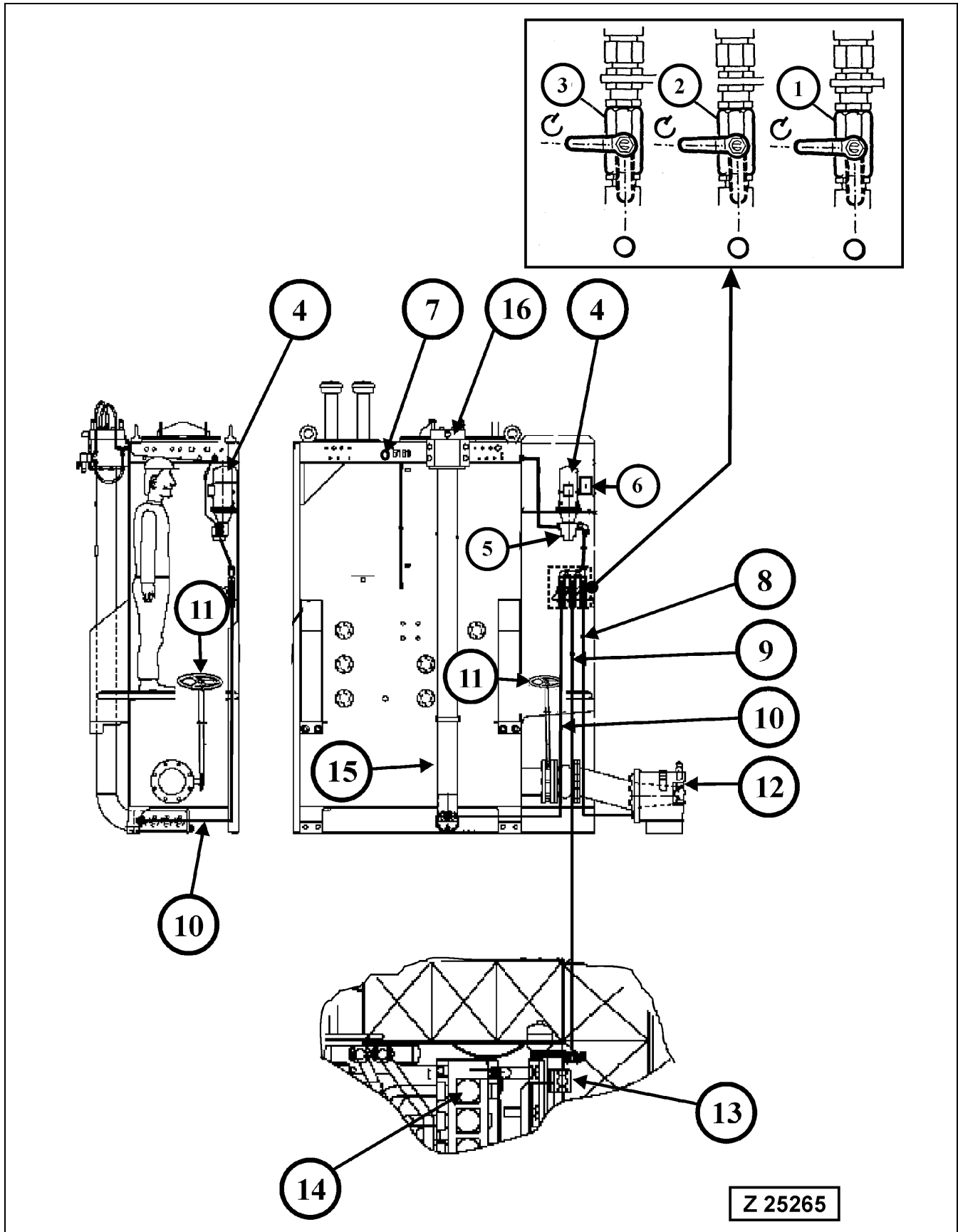
Check Extinguishing agent tank assemblies (1 and 4) and Expellant gas cartridges (15) for good condition and proper mounting.

Check filling level of Extinguishing agent tank assembly (1) of the dry chemical suppression system LT-A-101 according to the instructions in the separate Inspection and Maintenance manual LT-A-101 VEHICLE FIRE SUPPRESSION SYSTEM.

When checking the filling level, make sure the extinguishing powder is not compacted. Stir up the extinguishing powder with a suitable stick until it is in a free flowing condition.

3.20 TRANSFER PUMP FOR HYDRAULIC OIL

(SPECIAL EQUIPMENT)



3.20.1 OPERATING THE TRANSFER PUMP

Legend for illust. Z25265

REMARK

The illustration shows the transfer pump arrangement viewed from center of the platform.

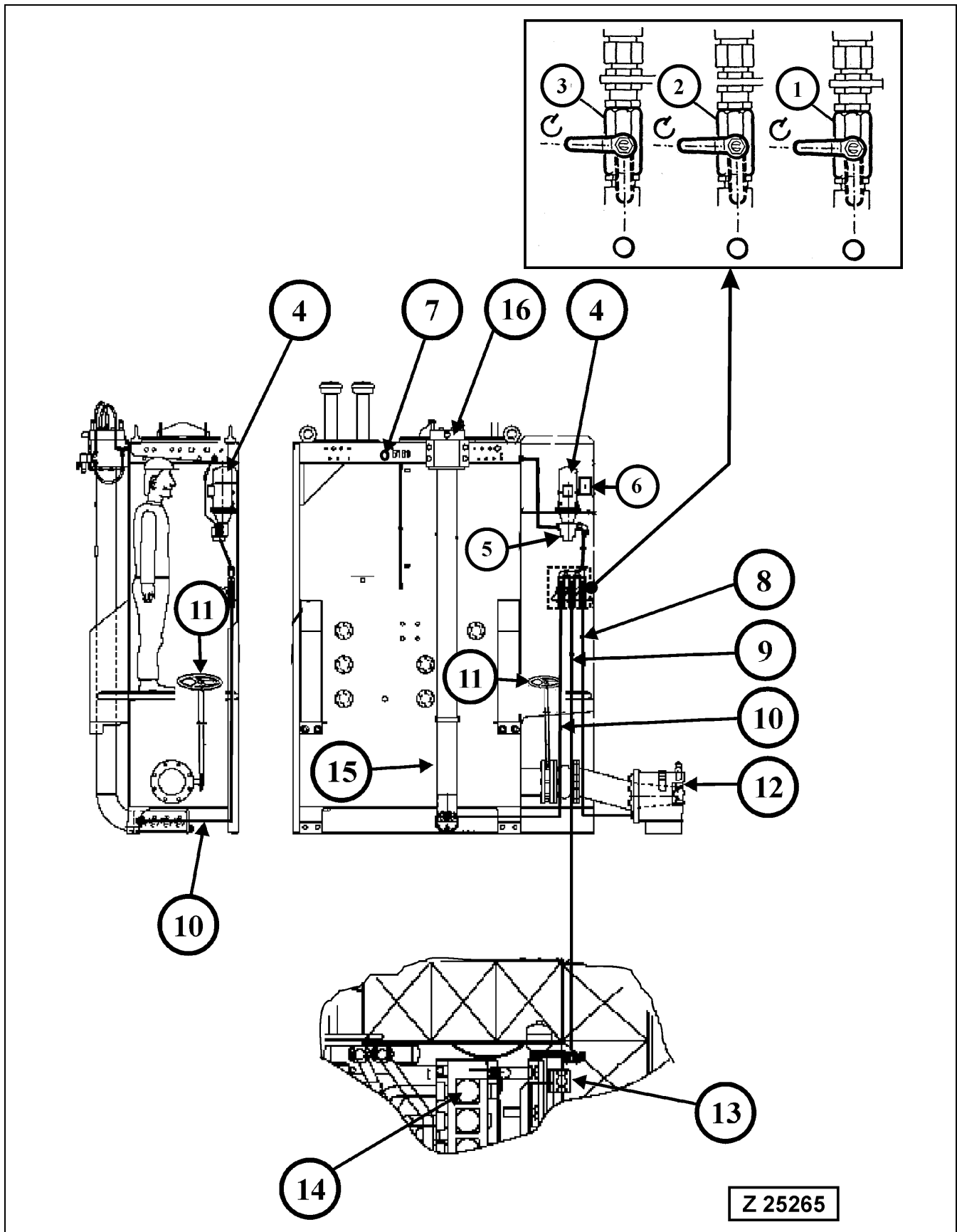
- (1) Cock for suction oil reservoir (12)
- (2) Cock for return oil collector pipe (13)
- (3) Cock for back-pressure valve pipe (15)
 - C - Closed
 - O - Open
- (4) Electric motor of the transfer pump
- (5) Transfer pump
- (6) Operating switch (S35) for transfer pump (4)
- (8) Suction line to suction oil reservoir (12)
- (9) Suction line to return oil collector pipe (13)
- (10) Suction line to back-pressure valve pipe (15)
- (11) Hand wheel of main shut-off valve between suction oil reservoir and main oil reservoir
 - To OPEN the valve turn hand wheel (11) CCW to the stop.
 - To CLOSE the valve turn hand wheel (11) CW to the stop.

A proximity switch located on the gearbox of the shut-off valve monitors the valve position. With the valve not fully open a corresponding message will be displayed on the VHMS monitor in the Operator's cab.

CAUTION

Before starting the engines make sure the shut-off valve is completely open by turning hand wheel (11) fully to the left (CCW).

- (12) Suction oil reservoir
- (13) Return oil collector pipe in front of main control valves
- (14) Main control valves
- (15) Back-pressure valve pipe
- (16) Back-pressure valve



3.20.2 FUNCTIONS OF THE TRANSFER PUMP

A - Transfusing oil from the suction oil reservoir (12), illustration Z25265 into the main oil reservoir. Necessary for evacuation of the suction oil reservoir, when changing the hydraulic oil (main oil reservoir will be evacuated via service arm connector, see page 230 for details). Before servicing the main hydraulic pumps it is advisable to empty the suction oil reservoir partially.

B - Transfusing oil from return oil collector pipe (13) and back-pressure valve pipe (15) into main oil reservoir. Necessary when changing the hydraulic oil and prior to servicing the high pressure filters or the main control valves (oil return system).

CAUTION

Before operating the transfer pump, lower the attachment to the ground with the stick fully retracted and the bucket fully rolled back. Shut down the engines.

NOTICE

During normal operation the valves (1, 2 and 3) must be in closed position -C-.

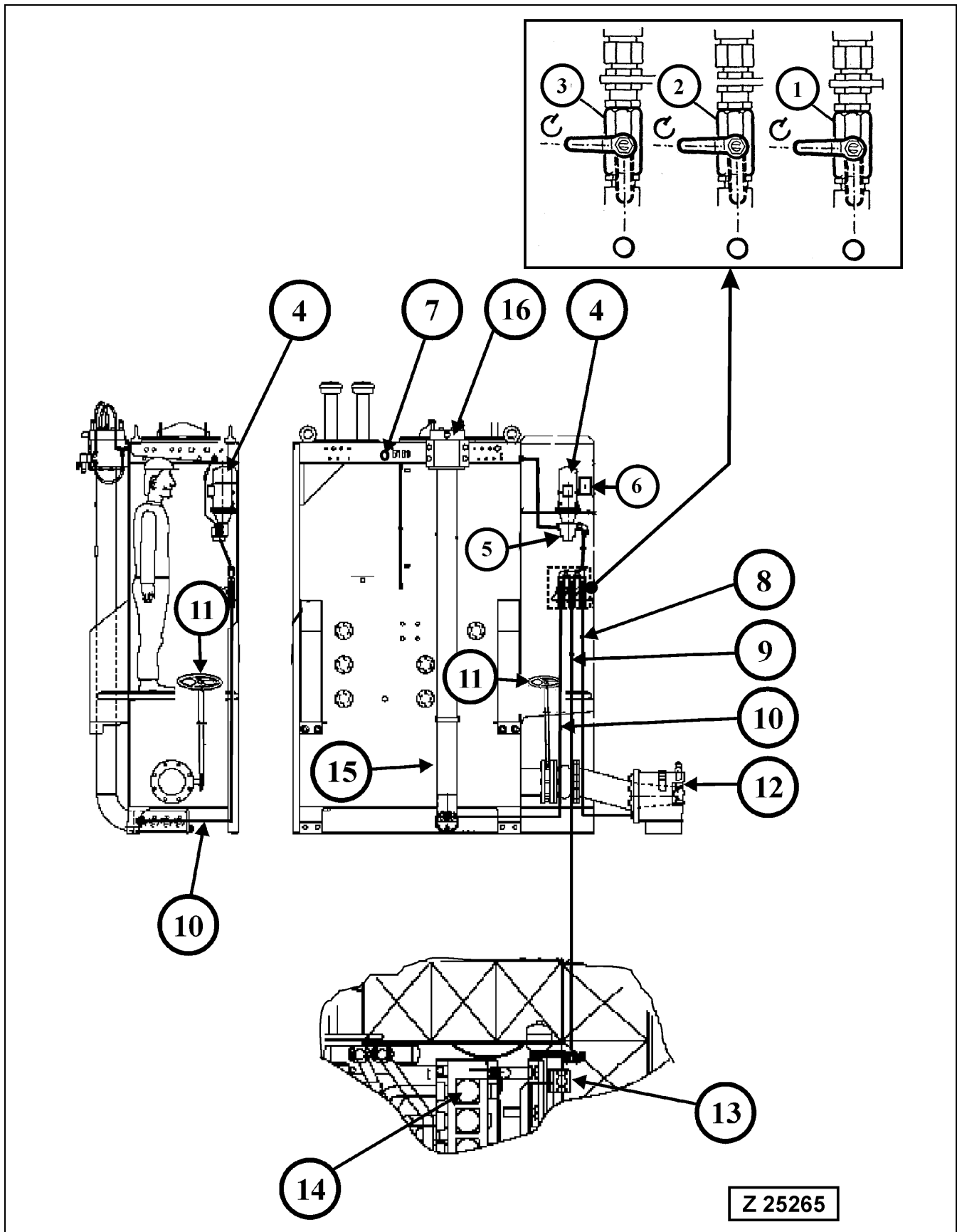
A - Pumping the oil from the Suction Oil Reservoir (12) into the Main Oil Reservoir

1. Close main valve (11).
2. Aerate the return oil filter chamber by opening the filler plug on top of the main reservoir.
3. Open cock (1), position -O-.

REMARK

In order to prevent build-up of a vacuum in the suction system, open the vent plugs on the suction port of each main hydraulic pump.

4. Switch on pump (4) with switch (6).
When changing the hydraulic oil, be sure to evacuate the main oil reservoir via the service arm connector simultaneously with the transfusion procedure. Otherwise overfilling of the main oil reservoir. Observe oil level at sight gauge.
5. When the suction oil reservoir is empty or after completion of the maintenance job switch off transfer pump (4) with switch (6). Close cock (1), position -C- and open main valve (11).
6. With the main shut-off valve (11) open, the suction oil reservoir will be filled with oil from the main oil reservoir. Let the vent plugs on the main pump suction ports open to allow the air to escape from the suction oil reservoir and hoses.



A - Pumping the oil from the Suction Oil Reservoir (12) into the Main Oil Reservoir (continued)

7. The suction oil reservoir and the suction hoses are filled, when bubble free oil flows out at the vent plug openings on each main pump. Install vent plugs and tighten securely.
8. Check oil level in all main pump housings and vent the hydraulic pumps according to page 441 in the Maintenance Section 4.
9. Check oil level in the main reservoir. Fill up with new hydraulic oil as necessary and install filler plug.
10. Start the engines and run without load to allow trapped air to be removed from the hydraulic system.

⚠ CAUTION

DO NOT start the engines when the suction oil reservoir is empty.

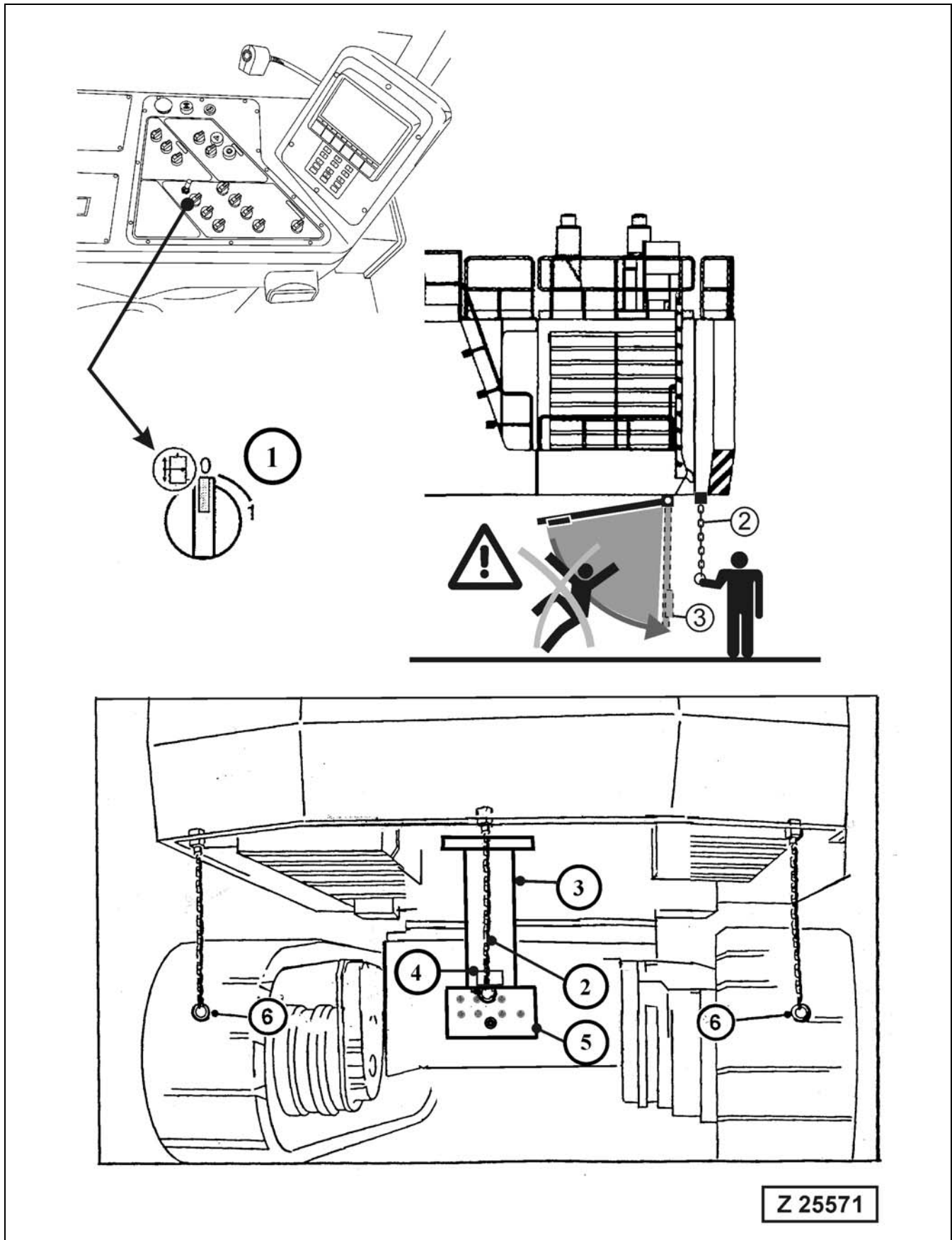
B - Pumping the Oil from the Return Oil Collector Pipe (13) and back-pressure valve pipe (15) into the Main Reservoir

1. To empty the collector pipe (13), open cock (2).
2. Aerate the return oil filter chamber by opening the filler plug on top of the main reservoir.
3. To prevent build-up of a vacuum in the return oil collector pipe or back-pressure valve pipe, open a vent plug on each pipe.
4. Switch on pump with switch (6).
5. Observe oil level sight gauge at the main oil reservoir. As soon as the oil level remains constant the return oil collector pipe is empty. Now switch off the transfer pump (4) and close cock (2).
6. To empty the back-pressure valve pipe (15), open cock (3).
7. Switch on pump with switch (6).
8. Observe oil level sight gauge at the main oil reservoir. As soon as the oil level remains constant the back-pressure valve pipe is empty. Now switch off the transfer pump (4) and close cock (3).
9. Install filler plug on top of the main oil reservoir and close vent plugs on collector pipe and back-pressure valve pipe.

⚠ CAUTION

DO NOT start the engines during servicing.

3.21 CENTRAL REFILLING SYSTEM



3.21.1 SYSTEMS CONNECTED TO THE REFILLING SYSTEM

The following systems are connected to the receiver panel (5) of service arm (3), illust. (Z25571):

- Fuel Tank
- Water Tank for Hand Wash Sink in the Operator's Cab
- Front and Rear Engine Oil Pan
- Front and Rear Engine Oil Reserve Tank
- Front and Rear Engine Coolant Radiator
- Main Hydraulic Oil Reservoir
- Central Lubrication System (CLS)
- Swing circle pinion Lubrication System (SLS)

Legend for illustration Z25571

- (1) Enabling switch for hydraulic service arm operation
- (2) Actuating chain for lowering and lifting of hydraulic service arm (3)
- (3) Service arm, hydraulically operated
- (4) Monitoring and control box
- (5) Receiver panel
- (6) Actuating chains for Operator Warning System or Emergency Shutdown of the Engines (if so equipped).

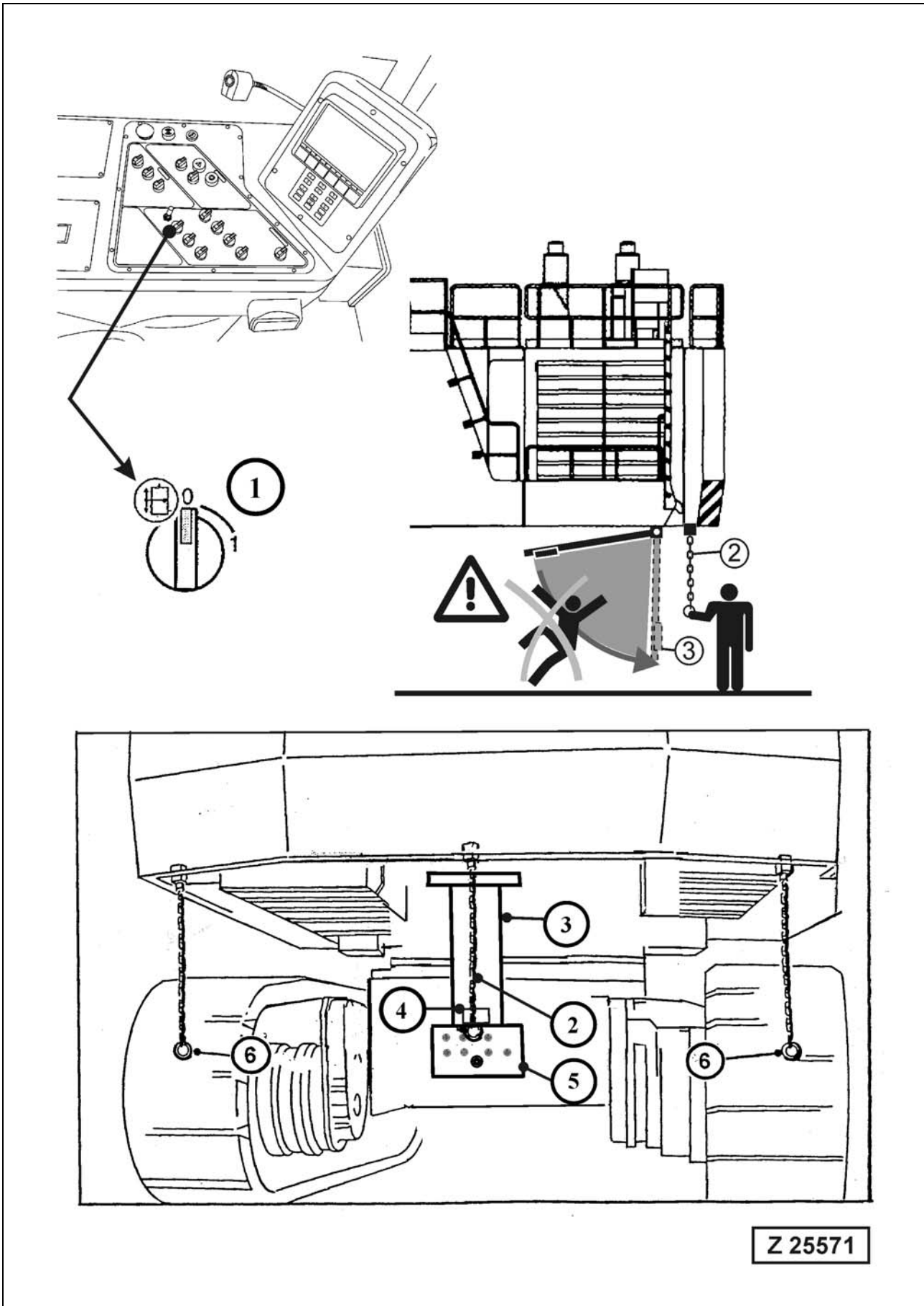
Operation of the hydraulic Service Arm

⚠ WARNING

- **Never enter, or allow anyone else to enter the moving range of the service arm (3). Death or serious injury can result.**
 - **DO NOT loosen any connections on the hydraulic circuit of the service arm. The circuit is under pressure. Lower the service arm completely before carry out any work on the hydraulic circuit.**
-
-

REMARK

With Enabling switch (1) in ON position "1" and/or Service Arm (3) not in fully lifted home position, the pilot control system is inoperative i.e. no Shovel movement possible.



3.21.2 OPERATING THE HYDRAULIC SERVICE ARM

A - Diesel Engines OFF

The Service Arm can only be lowered.

Proceed as follows:

1. Turn main key switch to ON position.
2. Turn enabling switch (1), illust. (Z25571) to ON position "1".
3. For lowering the Service Arm (3) pull down chain (2).
4. Release chain (2) when arm (3) is in fully lowered position.

REMARK

To stop lowering movement of the Service Arm in any position release chain (2).

5. Before leaving the Shovel turn enabling switch (1) to OFF position "0" and remove the main switch key.

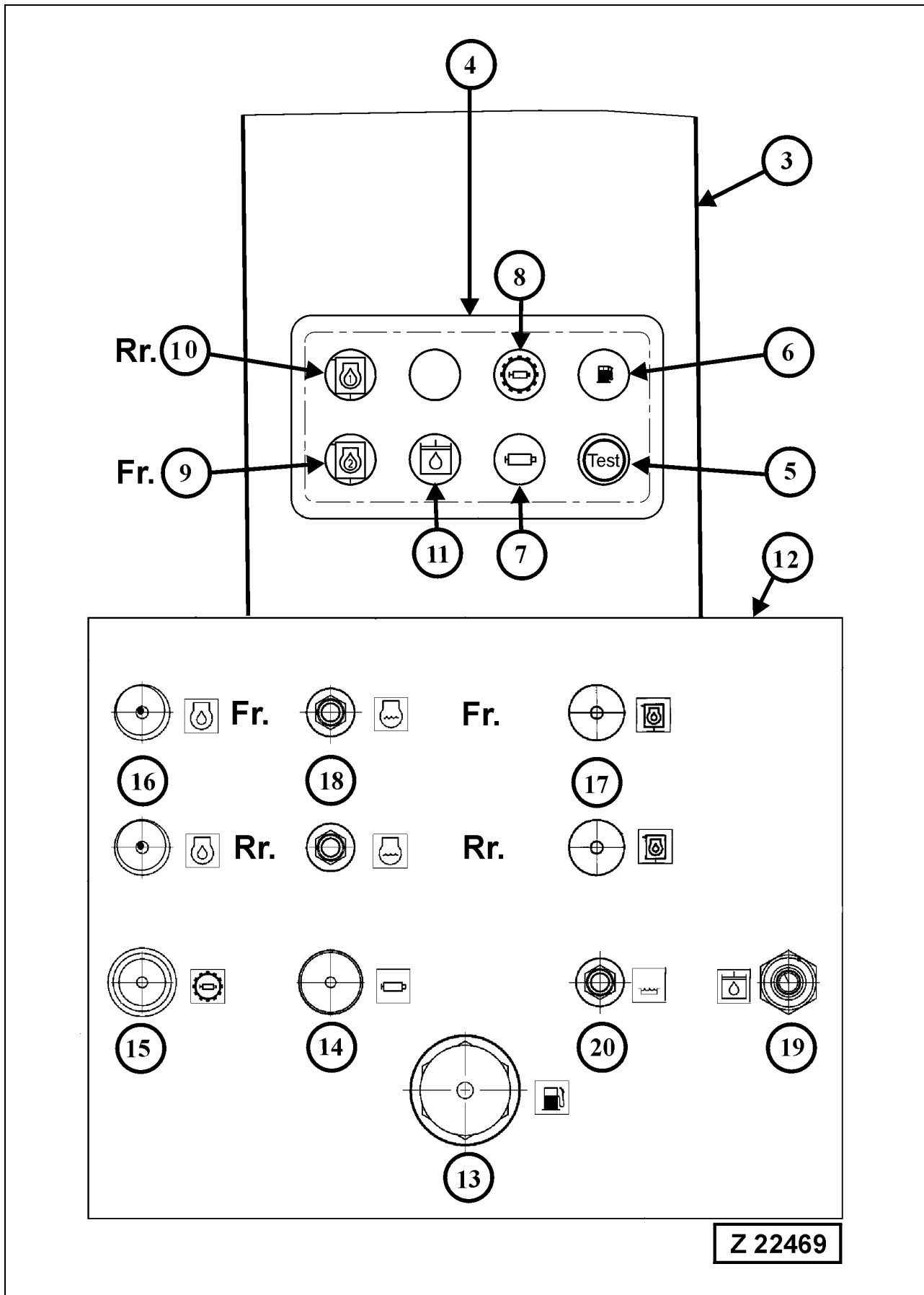
B - Diesel Engines running

Control the Service Arm as follows:

1. Turn enabling switch (1), illust. (Z25571) to ON position "1".
2. To lower the service arm (3) pull chain (2) and hold until the service arm is in fully lowered position. For reversing moving direction of service arm release the chain (2) to stop service arm movement and then pull chain (2) again.
3. To lift the service arm pull chain (2) and hold until the service arm is completely lifted into its home position.

NOTICE

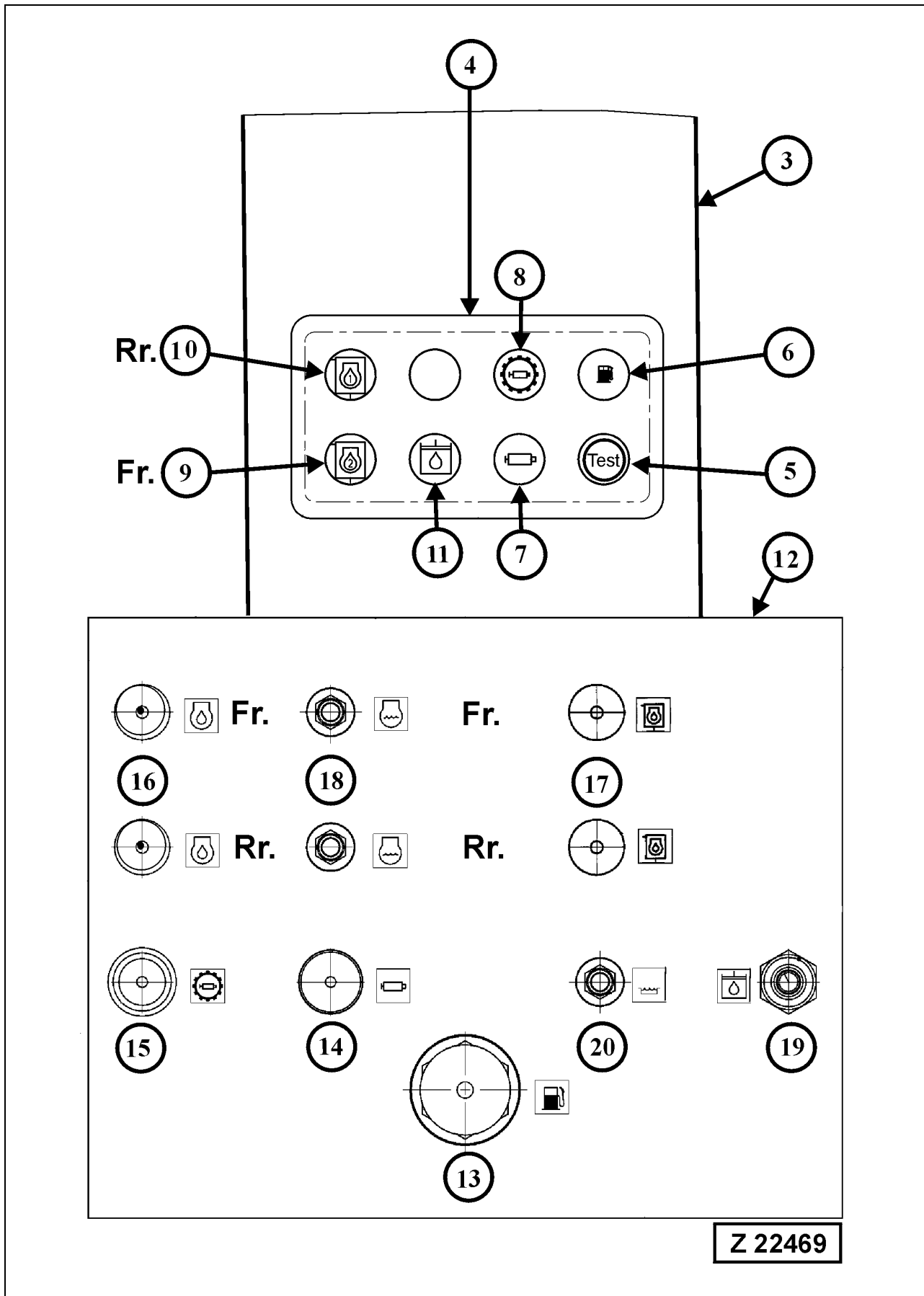
Be sure the Service Arm is completely lifted to its home position otherwise the proximity sensor in the guide frame of the service arm will not release the pilot control system.



3.21.3 RECEIVER PANEL WITH MONITOR BOX

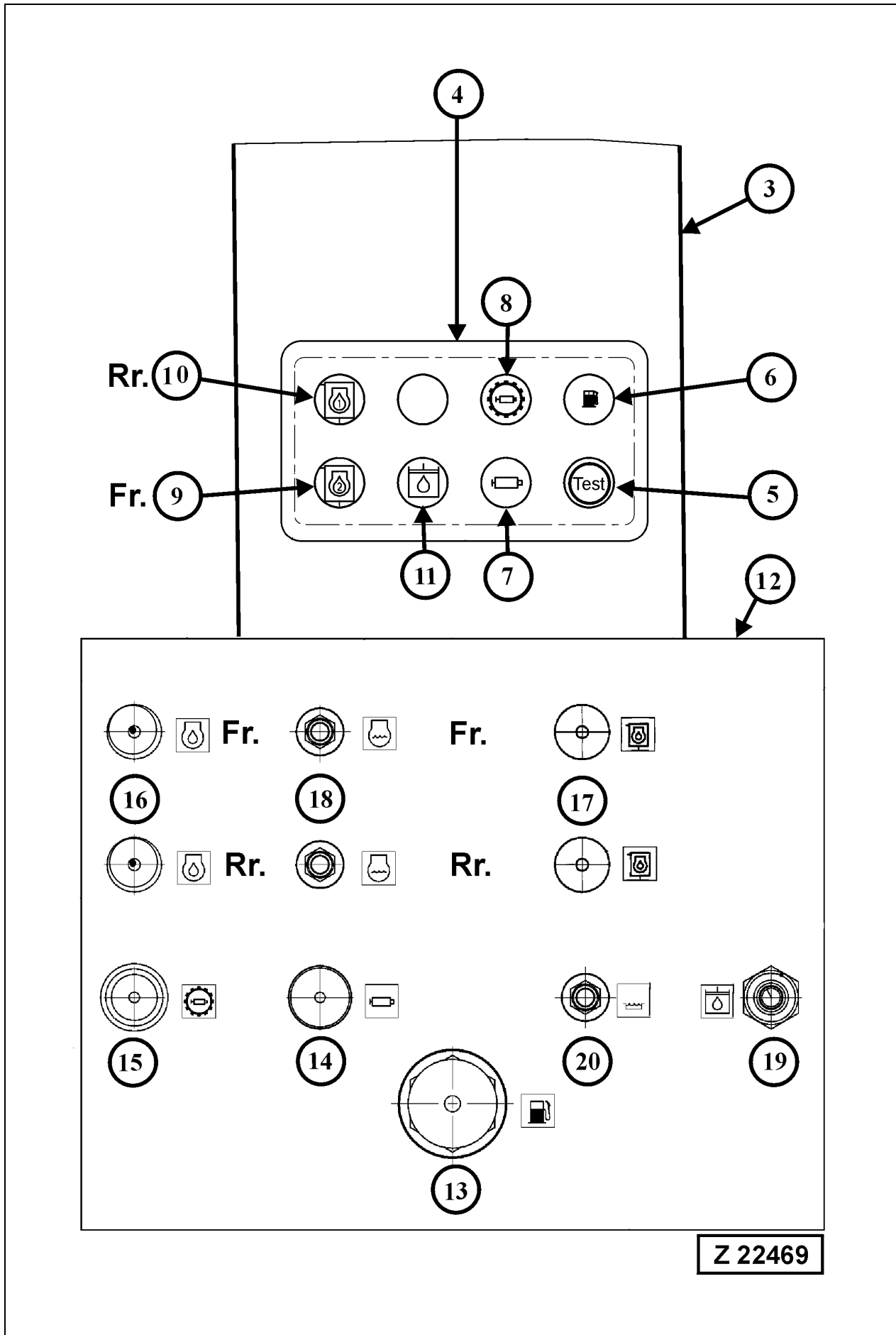
Legend for illustration Z 22469:

| | |
|----|---|
| 3 | Service arm, hydraulically operated |
| 4 | Monitoring and control box |
| 5 | Push button for testing lamps (6, 7, 8, 9, 10 and 11). Push the button, all lamps must light up. If a lamp does not light up, corrective action must be taken. |
| 6 | Indicator lamp, fuel tank full. (H139). When this lamp lights up, shut off the fuel filling pump. |
| 7 | Indicator lamp, grease container of Central lubrication System FULL. (H76) |
| 8 | Indicator lamp, grease container of Swing circle pinion Lubrication System FULL. (H78) |
| 9 | Indicator lamp, engine oil reserve tank for Front engine 2 FULL. (H142-2) |
| 10 | Indicator lamp, engine oil reserve tank for Rear engine 1 FULL. (H142-1) |
| 11 | Indicator lamp, main hydraulic oil reservoir FULL. Recheck hydraulic oil level at the sight gauge before operating the machine. (H52) |
| 12 | Receiver panel |
| 13 | Fuel filling adapter, observe lamp (6). REMARK The fuel nozzle cut-out pressure should be adjusted to 0,38 bar. If this pressure is too low for filling the fuel tank up to the correct level, gradually increase the cut-out pressure until the pressure is sufficient for filling up to the correct level The maximum flow rate should not exceed 680 liter per minute. |
| 14 | Adapter for filling the grease container of the Central Lubrication System (CLS). Before filling the grease container make sure the grease filter in the filling line is not obstructed. Observe lamp (7). |
| 15 | Adapter for filling the grease container of the Swing circle pinion Lubrication System (SLS). Before filling the grease container make sure the grease filter in the filling line is not obstructed. Observe lamp (8). |
| 16 | (Fr.) Front engine, (Rr.) Rear engine. Oil evacuation and filling adapter connected to the engine oil pan. Monitor oil level at level gauge. |



Legend for illustration Z 22469

| | |
|---|--|
| 17 | Engine oil evacuation and filling adapters of the reserve tanks for Front engine (Fr.) and Rear engine (Rr.). Observe the corresponding indicator lamp (9) and (10). |
| 18 | (Fr.) Front engine, (Rr.) Rear engine. Radiator coolant draining and filling adapter. Monitor coolant level at radiator filler neck. |
| <p>NOTICE</p> <p>The two-loop type cooling system of each engine is equipped with two radiators. One radiator for the engine crankcase and cylinder heads and one radiator for the low temperature aftercooler (LTA) system. The radiators are connected with a pipe on the bottom side. This pipe contains a check valve which allows coolant flow from rear radiator to the front LTA radiator only. For draining the coolant from the front mounted LTA radiator, it is necessary to open the shut-off cock in the draining/filling hose line just below the radiators. Refer to the engine Operation and Maintenance Manual in volume 2 binder for the maintenance instructions of the cooling system.</p> <p style="text-align: center;">CAUTION</p> <p>Be sure to close the shut-off cock on the bottom side of the radiators as soon as the maintenance of the cooling system is finished.</p> | |
| 19 | Adapter for evacuation and filling of the main hydraulic oil reservoir. After the oil is completely evacuated, drain the oil from suction oil reservoir, collector pipe and back-pressure valve pipe. Refer to maintenance section, item hydraulic oil change for draining procedure. Open the shut-off valve between main oil reservoir and suction oil reservoir. Fill the hydraulic reservoir and observe indicator lamp (11). |



RECEIVER PANEL WITH MONITOR BOX

Legend for illust. Z 22469

| | |
|----|---|
| 20 | Adapter for filling the water tank in the Operator's cab. The water tank has a capacity of 50 liters. The filling line of the water tank is equipped with a drain cock. Before filling the water tank, drain the old water by opening this drain cock. Close the drain cock and fill in 50 liters of clear water. The tank can also be filled through a filler opening in the Operator's cab. |
|----|---|

NOTICE

If freezing temperatures are expected, drain the water from the filling line by opening the drain cock. Switch on the engine-independent auxiliary cab heater during standstill periods to prevent freezing of the water in the cab water tank.

⚠ WARNING

- **DO NOT drink the water from the water-tap in the Operator's cab.**
- **Use for hand washing only.**

REMARK

The overflow line of the hand wash sink and water tank must not be obstructed. The overflow line is routed inside the cab base through a hole in the base floor to the outside. Excess water will flow through this line to the outside just below the cab base.

Refilling Procedure:

REMARK

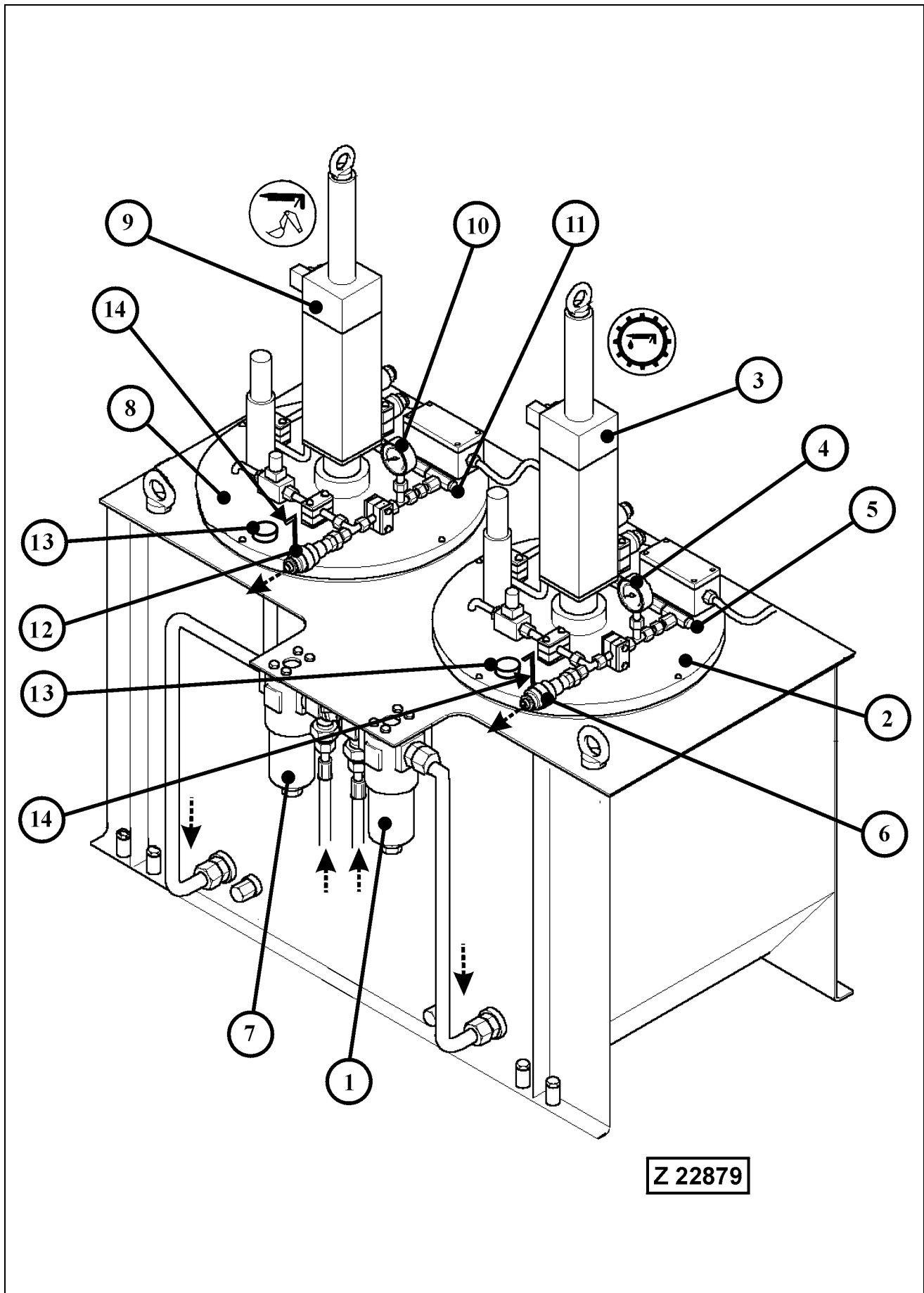
Refer to Maintenance section 4, for the correct lubricant specifications and filling capacities.

For Engine Lubricants and Coolants refer to the separate Engine Operation & Maintenance Manual in volume 2 Binder.

1. Connect supply lines to the respective adapters.
2. Monitor the respective fluid/lubricant level at the indicator lights (6, 7, 8, 9, 10 and 11).
3. After finishing the refilling operation, cover the adapters with the protection caps provided and swing back hydraulic service arm (3) to its home position.

⚠ CAUTION

Recheck fluid levels before operating the machine.



3.21.4 REFILLABLE GREASE CONTAINERS OF THE AUTOMATIC LUBRICATION SYSTEMS

Legend for illustration Z22879

- (1) Grease filter for swing circle pinion lubrication system. Before filling the grease container make sure the filter is not obstructed. Service the filter element according to the instructions in the maintenance section 4, item no. 4.8.
- (2) Grease container of the swing circle pinion lubrication system
- (3) Hydraulically driven grease pump
- (4) Grease pressure gauge
- (5) In-line grease filter
- (6) Quick disconnect coupling
- (7) Grease filter for central lubrication system. Before filling the grease container make sure the filter is not obstructed. Service the filter element according to the instructions in the maintenance section 4, item no. 4.8.
- (8) Grease container of the central lubrication system
- (9) Hydraulically driven grease pump
- (10) Grease pressure gauge
- (11) In-line grease filter
- (12) Quick disconnect coupling
- (13) Breather filters
- (14) Grease level gauge for manual checking of the grease level

Refill the respective grease container, when the Fault message
-Central lube system grease container on reserve- or
-Swing circle lube system grease container on reserve-
is being displayed on the VHMS monitor.

CAUTION

The central lubrication system and the swing circle pinion lubrication system have to be filled with different types of grease. Select the correct greases according to the Lubricant Charts in volume 2 binder.

As soon as a grease container is filled up to the correct level the corresponding indicator lamp (7 or 8), illust. (Z 22469) lights up and the signal horn sounds. In order to ensure proper operation of the lubrication systems carry out the periodic maintenance of the grease filters (1 and 7), illust. (Z22879). Refer to maintenance section 4, item no. 4.8. Periodic inspection of the grease pumps (3 and 9) at least once a year is advisable. After finishing the refilling operation, cover the adapters with the protection caps provided. Carry out a test-run of the lubrication systems by actuating the switches on the instrument panel.

3.22 WORK ON THE LOADER ATTACHMENT

WARNING

- **Work on the loader attachment must be carried out only by personnel with special knowledge of the Shovel. Improper working on the attachment can cause severe accidents with personal injury.**
 - **If you are not sure how to carry out the work on the attachment contact your local Komatsu Service Station for support.**
-

OBSERVE THE FOLLOWING INSTRUCTIONS

- Wear safety clothing, goggles, respirator and other safety devices, whenever working conditions make this necessary.
- Provide hoists of sufficient capacity to lift heavy units. Refer to the separate "Assembly Procedure Manual" filed in volume 2 binder for more information.
- Before working on the loader attachment lower it to the ground, stop the engine and cycle all hydraulic control levers to relieve all pressure before disconnecting hydraulic lines.

For more information → See "STOPPING THE ENGINES" on page 206

- Lifting gear, tools and other suspension systems must be in good condition and of sufficient lifting capacity.
- Be sure hydraulic cylinders and attachment components are properly supported from hoist and securely fastened before removing supporting pins.
- Floors must be clean and dry. After draining operations be sure all spillage is cleaned up.

3.23 TRANSPORTATION AND LIFTING OF THE SHOVEL

⚠ WARNING

Before Disassembling, Lifting or Transporting this Shovel contact your local Komatsu Service Station for all the necessary instructions for safe and economic disassembling, lifting and transportation procedures of your Shovel.

3.23.1 DISASSEMBLING OF THE SHOVEL

The Shovel is being transported disassembled into its main components.

⚠ WARNING

Disassembling of the Shovel must be carried out only by personnel with special knowledge of the Shovel. Improper disassembling procedures can cause severe accidents with personal injury.

The sequence of disassembly can be derived from the Assembly Procedure Manual in volume 2 Binder. Disassembling is basically the reverse order of the assembling procedure.

3.23.2 TRANSPORTATION AND LIFTING

The transport dimensions and weights of the Shovel's components are listed in the separate Assembly Procedure Manual filed in volume 2 binder.

Observe the operating permits of the low loader used for transportation. They contain the permissible load, loading width and height.

⚠ WARNING

- **Observe the federal, state and local laws and regulations for transportation of heavy units. Know the safety rules and laws before you transport this Shovel.**
 - **Make sure the low loader and the components of the Shovel are equipped with the correct safety devices.**
 - **Secure the Shovel and all components transported on the low loader against movement.**
-

3.24 RETRIEVAL PROCEDURE

⚠ WARNING

- Before starting retrieval measures, inform the responsible safety department.
 - Check whether fuel or oil has flown out.
 - Observe the local fire prevention- and safety regulations.
-

⚠ CAUTION

Contact your local Komatsu service station for all the necessary instructions for safe and economic retrieval procedures of your Shovel

NOTICE

Select the sequence of retrieval steps with regard to the stability of the Shovel. It must be prevented that the removal of main components impairs the stability of the Shovel

GENERAL

The "Assembly Procedure Manual" in volume 2 binder contains information for lifting the main components of the Shovel.

Provide adequate crane and lifting gear with sufficient lifting capacity.

3.25 SHOVEL STORAGE

GENERAL

Storage periods up to 30 days require no special preservation when the unit is stored in a protected place. When the Shovel is placed in storage for 30 days or more follow the procedure below.

NOTICE

The description below includes special equipment which may not be installed in your machine.

3.25.1 PREPARING FOR STORAGE

1. Clean the Shovel thoroughly, lubricate all points according to the lubrication chart. Move the machine to a protected place or cover the Shovel with a tarpaulin. Retract all hydraulic cylinders as far as possible. Cover the protruding piston rods with grease.
2. Refer to Engine Operation and Maintenance Manual for Engine storage procedure.
3. Fill up cooling system with anti-freeze and coolant. Observe instructions in the Engine Manual.
4. Service the engine air cleaner.
5. Drain condensation from fuel tank and fill the fuel tank with a mixture of 90% Diesel fuel and 10% protection oil, e.g. Shell Ensis 20.
6. Seal the engine air intake, exhaust outlet, electrical components, fuel tank ventilation and breather on the hydraulic oil reservoir to prevent dirt and moisture from entering.
7. Remove the batteries and store them in a cool, dry place (0 to 10° C) to minimize self discharge. Be sure the batteries are fully charged. Never allow batteries to run down below $\frac{3}{4}$ full charge.
8. Loosen all drive belts.
9. Repaint areas that have paint damage with a good quality paint. Grease all machined unpainted surfaces with good quality grease to prevent rust.
10. Drain condensation from hydraulic oil reservoir. If necessary, add hydraulic oil.
11. Attach a tag to the instrument panel to indicate what work has been done.

3.25.2 ONE MONTH REPETITIVE SERVICE PERIOD

1. Service the engine according to the engine manual.
2. Check coolant level and cooling systems for leakage.
3. Check all oil levels according to the lubrication chart.
4. Drain condensation from fuel tank and hydraulic oil reservoir.
5. Operate air conditioning for approx. ½ hour.

3.25.3 SIX MONTH REPETITIVE SERVICE PERIOD

1. Perform steps 1 through 4 of the one month repetitive service period.
2. Lubricate the Shovel according to lubrication chart (manual lubrication only).
3. Completely fill the fuel tank.
4. Check hydraulic system and all gear boxes for leakage. If necessary - fill up the units with the specified lubricant. Repaint surfaces that have paint damage.
5. Prepare the engine for operation according to the engine manual. Tighten all drive belts. Install fully charged batteries. Make sure the alternator is correctly connected.
6. Remove coverings from engine air intake, exhaust outlet, electrical components, fuel tank ventilation and breathers on the hydraulic reservoir.
7. Start the engine and run at low idle a few minutes to allow distribution of lubricating oil. DO NOT increase engine speed until normal oil pressure and temperature are reached.
8. Operate heater unit and air conditioning.
9. Operate the central lubricating system and swing ring gear lubrication system. Check the lubrication results at the respective lubrication points.
10. Carry out several complete working cycles with the loader attachment.
11. Stop the engine, observe the cooling down period. Install all coverings which have been removed according to step 6. Service the engine according to the engine manual. Lubricate all machined surfaces. Remove Batteries and store as described under "Preparing for Storage". Loosen all drive belts. Fill up the fuel tank.

3.25.4 PREPARING FOR OPERATION

1. Remove grease from all machined unpainted surfaces (piston rods).
2. Install fully charged batteries.
3. Remove all coverings.
4. Fill up fuel tank with an approved Diesel fuel.
5. Check cooling system for leaks, loose connections and coolant level. Check mixture ratio of antifreeze, refer to the engine manual for details.
6. Service the engine according to the engine manual. Tighten all drive belts. Make sure the alternator is correctly connected.
7. Carry out the maintenance according to the lubrication and maintenance manual of the Shovel.
8. Start the engine and run at low idle speed until the normal oil pressure and temperature are reached. DO NOT place the Shovel under load before the normal values are indicated.
9. If the engine is misfiring or loss of power is evident, check the fuel system for restriction or loose parts.
10. Carry out several complete working cycles. Check the function of special equipments (central lubricating system, swing circle pinion lubricating system, fire detection and suppression system etc.).

3.26 TROUBLE SHOOTING

GENERAL

The following charts list a number of the most common problems encountered in operation. Some of the faults may be due to careless handling or operation, improper maintenance or the use of lubricating oils other than specified. The "Probable Cause" column is formulated in such a way as to imply the answer to particular failure. For repairs requiring expert knowledge and tools, consult authorized service personnel.

3.26.1 ENGINE

| Problem | Probable cause |
|------------------------------------|--|
| Engine will not start | <ul style="list-style-type: none"> ● Fuel tank empty or filter clogged ● Fuel supply system air-bound or clogged ● Fuel filters not sealed properly ● Engine speed control system defective ● Cold starting aid, fluid container empty |
| Uneven engine operation | <ul style="list-style-type: none"> ● Fuel filters clogged ● Air in fuel system ● Engine speed governor defective |
| Engine overheats | <ul style="list-style-type: none"> ● Coolant supply insufficient ● Fan belt slipping ● Coolant passages in cooling system clogged with dirt or scale ● Radiator air passages clogged with dirt ● Exhaust pipe or muffler restricted ● Thermostat defective |
| Engine does not develop full power | <ul style="list-style-type: none"> ● Air cleaner clogged ● Fuel filters clogged ● Exhaust pipe or muffler restricted ● Engine speed control system incorrectly adjusted ● Valve (s) faulty ● Fuel lines restricted ● Turbocharger faulty, or inoperative |
| Loss of oil pressure | <ul style="list-style-type: none"> ● Oil filter (s) clogged ● Low oil level ● Poor quality oil ● Oil pressure switch defective ● Oil pump filter screen clogged ● Dirt in regulating valve ● Crankshaft, connecting rod or camshaft bearing (s) worn excessively. |

NOTICE

Refer to the engine manual for more detailed information.

3.26.2 HYDRAULIC SYSTEM

| Problem | Probable cause |
|-----------------------------------|--|
| Poor hydraulic system performance | <ul style="list-style-type: none"> ● Hydraulic oil not at operating temperature. ● Engine speed too low. ● Reservoir low on oil ● Restrictions in lines ● Cooling circuit, pump control system and/or pilot control circuit defective. ● Internal leakage (control blocks, valves or power units.) ● Pressure lines twisted or kinked ● Spool not in full stroke. ● Relief valve defective, or out of adjustment. ● Worn cylinders. ● Defective hydraulic pump. |
| Excessive oil temperature | <ul style="list-style-type: none"> ● Low oil level ● Incorrect viscosity or type of oil ● Hydr. oil cooler clogged with dirt. ● Oil cooler fan defective or wrong speed. ● Cooling circuit defective ● Pump control system defective ● Spool not in full stroke. ● Internal leakage (control blocks, valves or power units) ● Worn pump components ● Job conditions (high temperature of materials being handled) |
| Jerky motion of power cylinders | <ul style="list-style-type: none"> ● Piston rod bent ● Piston sticking ● Inside diameter of cylinder tube partially increased or scored ● Air in control circuit ● Oil too cold ● Valve spool sticking, centering springs defective ● Pump and/or engine control system defective ● Valve of power circuit defective |
| Noise when slewing | <ul style="list-style-type: none"> ● Inssufficient lubrication of swing ring gear and/or slewing connection. ● Slewing connection mounting bolts loose ● Drive pinion worn ● Swing gear bearings worn ● Sun gear or planetary pinions worn ● High pressure circuit valves defective ● Anti-cavitation valves sticking |
| Excessive oil foaming | <ul style="list-style-type: none"> ● Air in hydraulic system ● Poor quality oil ● Excessive by-passing of oil over relief valves ● Pressure hoses badly twisted or kinked ● Restricted oil flow due to foreign matter ● Breather on the reservoir clogged. ● Relief valve improperly adjusted |

3.26.3 FINAL DRIVES AND SWING GEAR

| | |
|-----------------|---|
| Noisy operation | <ul style="list-style-type: none"> ● Incorrect lubricant or oil level too low ● Bearings scored or damaged. ● Sun gear teeth excessively worn or damaged ● Bearings of planetary pinions worn |
|-----------------|---|

3.26.4 CRAWLER TRACKS

| | |
|----------------------------------|--|
| Excessive track wear | <ul style="list-style-type: none"> ● Wrong track tension ● Track roller loose or out of alignment ● Track shoes loose ● Track links stuck ● Worn drive sprocket |
| Excessive wear on drive sprocket | <ul style="list-style-type: none"> ● Wrong track tension ● Track links (pins/bores) Excessively worn ● Sprocket, rollers and guide wheel out of alignment |

4. MAINTENANCE

4.1 FOREWORD

This section contains instructions for the correct care and maintenance of your machine.

NOTICE

Since this section covers also special equipment and accessories, you may find illustrations and descriptions which do not apply to your machine.

DEFINITIONS

Service point

Unit or system where the prescribed maintenance work has to be performed (e.g. engine, hydraulic, PTO etc.).

Service intervals

Number of operating hours after which the maintenance work has to be performed (e.g. "Every 10 Operating Hours", at 10, 20, 30 etc.; "Every 250 Operating Hours", at 250, 500, 750 etc.).

GENERAL RECOMMENDATIONS

Thoroughly clean all grease fittings, caps and plugs before lubricating.

Seals must be replaced when oil drain plugs and oil level plugs have been opened.

Fill-up fuel tank at the end of the shift to prevent condensation of moisture.

It is recommended to carry-out oil change in assemblies when they are still at operating temperature to speed up draining.



WARNING

Avoid direct contact of hot oil with your skin. Hot oil can cause personal injury.

4.2 SAFETY PRECAUTIONS FOR MAINTENANCE

- Before starting any lubrication or maintenance work read the Fundamental Safety Instructions on page 15.
- Park the Excavator at a safe place on level ground. Proceed according to the instructions on page 205 "Parking the Excavator". Lower the attachment flat onto the ground. Move all control levers to neutral position.
- Stop the engine and move all control levers through their shift positions to relieve the pressure in the hydraulic system. Refer to page 206 "Stopping the Engine" for detailed description of the stopping procedure.
- Before any maintenance work is started, set the maintenance safety switch to 0 position. Refer to page 143 for location of the maintenance safety switch. In the 0 position the engines can not be started. Secure this position by inserting a padlock into the holes of the switch. Up to ten padlocks can be attached to the holes provided.
- A warning plate "CAUTION MACHINE MAINTENANCE" must be fixed in the Operator's cab before any lubrication or maintenance work is started.

NOTICE

Some checks and adjustments can only be done with the engine running. For such jobs two men are necessary. Thereby, the controls must not be left unattended, while the other man carries out checks and adjustments.

The man in the operator's seat must keep constant visual contact with the other one and they must agree on suitable communication signals before they start their work.

- Block the machine to prevent machine movement
- Always use safety devices to block hydraulic cylinders. Never rely on the machine hydraulic system to hold when working on the loader attachment. A hydraulic line or cylinder could fail or someone could accidentally strike the control levers causing the loader to fall.
- Relieve all pressure in the hydraulic system before servicing the hydraulic system.
- Oily cloth and inflammable material must be removed from the machine. Clean the excavator before starting maintenance work.
- Switch-off battery main switches and remove keys, before working on the electrical system.
- Work on the electrical system or equipment may only be carried out by a skilled electricians and in accordance with the applicable electrical engineering rules.

Safety Precautions for Maintenance (continued)

- Wear safety clothing, goggles, respirator and other safety devices, whenever working conditions make this necessary. Observe the local safety rules.
- Never allow unauthorized persons access to the machine during lubrication and maintenance work.
- After servicing, remove oily cloth, inflammable material and all tools from the machine.
- Clean the Excavator with a steam jet, especially after servicing fuel system, engine and hydraulic system.

⚠ WARNING

When using a steam cleaner, wear safety glasses and protective clothing. Hot steam can cause serious personal injury.

NOTICE

- For cleaning the Excavator and its components use only fresh water with a salt content of less than 0.05%.
- For cleaning the headlights, **DO NOT** use steam jet, high pressure cleaning device or strong water jet.
- Be sure to reinstall safety devices, guards or shields after adjusting and/or servicing the machine.

4.3 FLUIDS AND LUBRICANTS

4.3.1 LUBRICANTS FOR OPERATION IN COLD AND ARCTIC CLIMATES

| Lubrication Point | Lubricant | Ambient Temperature °C |
|---|---|--|
| Hydraulic System (pre-heated) | Shell Tellus Arctic 32 ESSOTRANS EXTRA | - 50 to + 35 - 50 to + 28 |
| Travel Gears | Shell Omala HD 220 | All seasons |
| Final Drives | Shell Omala HD 220 | All seasons |
| Swing Gears | Shell Omala HD 220 | All seasons |
| Track Rollers and Idler Wheels | Shell Omala HD 220 | All seasons |
| Pump Distributor Gears (pre-heated) | Shell Transaxle Oil 75W-90 Tranself Synthese FE 75W-90 | All seasons - 45 to + 35 |
| Pump drive shaft housings on the Pump Distributor Gears | Shell Tellus Arctic 32 | All seasons |
| Brake housings and Motor adapter housings of Gears | Shell Tellus Arctic 32 | All seasons |
| Fan Bearing Housings of Radiators and Hydraulic Oil Coolers | Shell Omala HD 220 | All seasons |
| Central Lubrication System | Fuchs Stabyl L-TS MO Shell Darina XL 102 Moly Fuchs Urethyn HGO | - 10 to + 35 - 30 to + 35 - 50 to - 10 |
| Swing Circle Lubrication System | Shell Malleus GL 400 Shell Malleus GL 25 Fuchs Urethyn HGO | - 10 to + 35 - 30 to 0 - 50 to - 10 |
| Refrigerant Lubricant | Shell Clavus Oil R 68 | - 50 to + 35 |
| Refrigerant | Shell R 134 a | - 50 to + 35 |
| Engine Oil | SAE15W-40 API Category CG-4SH | All seasons |
| Engine Coolant and Fuel | Refer to ENGINE OPERATION AND MAINTENANCE MANUAL for Specifications. | |

4.3.2 FLUIDS AND LUBRICANTS FOR MODERATE AND HOT CLIMATES

| Point of Lubrication | Lubricant | Ambient Temperature °C | Viscosity Grades | Quality Grades DIN/API |
|---|--|------------------------|------------------|---------------------------|
| Engines | Refer to ENGINE OPERATION AND MAINTENANCE MANUAL for Specifications of Engine Oil, Coolant and Fuel. | | | |
| Hydraulic System | Hydraulic oil HLP or HLPD with ZINC anti-wear additives *1) | - 20 to + 11 | 22 | DIN 51524 T.2 and T.3-HLP |
| | | -14 to + 21 | 32 | |
| | | - 6 to + 31 | 46 | |
| | | 0 to + 40 | 68 | |
| | | + 5 to + 48 | 100 | |
| Travel gears, Final drives and Swing gears | Gear oil CLP *2) | -15 to + 50 | CLP 220 | DIN 51517 3 - CLP |
| | | | | |
| Brake housings and Motor adapter housings of Travel Gears and Swing Gears *3) | Engine oil | all | SAE 10 | DIN 51524T.2 and T.3- HLP |
| | or Hydraulic oil | | HLP 32 | |
| PTO's (Pump distributor gears) | Gear oil CLP *2) | -15 to + 50 | CLP 150 | DIN 51517 3 - CLP |
| | | | | |
| Pump drive shaft housings on PTO | Hydraulic oil | all | HLP 32 | DIN 51524T.2 and T.3- HLP |
| Fan bearing housings of Radiators and Hydraulic oil coolers | Gear oil CLP | all | CLP 220 | DIN 51517 3 - CLP |

NOTICE

- *1) DO NOT mix ZINC-FREE Hydraulic oils with Hydraulic oils containing Zinc. DO NOT mix Mineral Hydraulic oils with Synthetic Hydraulic oils. Mixing of the above oils, will reduce anti wear properties and oxidation stability of the oil. Quick plugging of the oil filters in the hydraulic system will occur.
- *2) Refer to the chart GEAR OILS filed in volume 2 binder for the released gear oil qualities and viscosity grades.
- *3) Brake housings of swing gears manufactured by L&S have no separate oil compartment, as brake disks are lubricated by splash oil from gear box.
- The lubricating instructions in this book refer to the recommended grade specifications. Damages caused by using lubricants other than specified are not covered by the manufacturer's warranty.

| Point of Lubrication | Lubricant | Ambient Temperature °C | Viscosity Grades | Quality Grades |
|---|--------------------------------|---|--|--------------------|
| | | | | DIN/API |
| Grease Fittings (manual lubrication) Central Lubrication System | Multi-Purpose Grease "MPG" | Refer to the Lubricant Chart in volume 2 binder for the recommended Multi-Purpose Greases. The part numbers of recommended Multi-Purpose Greases are listed in the Parts Catalog. | | |
| Swing Circle Teeth (manual lubrication) Swing Circle Pinion Lubrication System | | | | |
| Track rollers, Carrier rollers and Idler wheels | Adhesive Lubricant | all | CLP 220 | DIN 51517 3 CLP |
| Air conditioning system | | | | |
| Refrigerant compressor | Special oil See Note below. | | R 134a REMARK The Air Conditioning is prepared for Refrigerant "R134a" only. Observe Notice below. | |

NOTICE

The Air Conditioning must be filled with refrigerant "R134a" through authorized Service Specialists only. DO NOT use refrigerant "R12", otherwise serious damage on system components could occur. The lubrication oil for the refrigerant compressor must be compatible with "R134a" refrigerant.

4.4 FILLING CAPACITIES

| Unit or System | Liter (approx.) | Unit or System | Liter (approx.) |
|--|-------------------|--|-----------------|
| Cooling System | | Swing Gears made by L&S , each: | 42.0 |
| Front Engine | 360.0 | Motor Adapter Housings | 0.6 |
| Rear Engine | 360.0 | Swing Gears made by Siebenhaar , each: | 60.0 |
| Engine Oil | | Motor Adapter Housings | *2) |
| Front Engine Oil Pan | 190.0 | Brake Housings | 0.2 |
| Front Engine Reserve Tank (Refill) | 580.0 (425.0) | Travel Gears made by L&S , each: Travel Gears made by ZOLLERN , each: | 155.0 180 |
| Rear Engine Oil Pan | 190.0 | Motor Adapter Housings, made by L&S , each: Motor Adapter Housings, made by ZOLLERN , each: | 2.0 0.5 |
| Rear Engine Reserve Tank (Refill) | 580.0 (425.0) | REMARK The travel gear brakes are dry type multiple disk brakes. DO NOT fill the housings with oil. | |
| Fuel Tank | 10800.0 | Final drive housings, each | 165.0 |
| Hydraulic Oil Reservoir | 3600.0 *1) | Guide Wheels, each | 3.2 |
| Total Hydraulic System | 6600.0 | Support Rollers, each | 7.0 |
| Pump Distributor Gears, each | 95.0 | Track Rollers, each | 2,7 |
| Oil Collector Reservoir, Auxiliary Hydraulic Pumps | 1.0 | Water tank for hand wash sink in Operator's cab | 50.0 |
| Main Hydraulic Pumps, Drive Shaft Housing | 1.5 | Water reservoir for windshield washer | 7.0 |

***1)** Oil change quantity including suction oil tank and return oil collector pipes approximately 4450 liter with loader attachment in oil level checking position, see oil level plate on the main hydraulic oil reservoir.

***2)** Fill up to level gauge marking.

Capacities listed above are approximate values. For proper checking use level plugs, dipsticks, and inspection openings provided for this purpose. Prior to commissioning check the fluid levels in all units and systems listed above.

4.5 STANDARD TORQUE LIST

| Bolt dia. | Wrench size [mm] | Tightening torque | | |
|-----------|------------------|-------------------|------|------|
| | | Nm | | |
| | | lbs.ft. | | |
| | | Quality grades | | |
| | | 8.8 | 10.9 | 12.9 |
| M 10 | 17 | 43 | 63 | 73 |
| | | 32 | 47 | 54 |
| M 12 | 19 | 74 | 108 | 127 |
| | | 54.6 | 80 | 94 |
| M 14 | 22 | 118 | 173 | 202 |
| | | 87 | 128 | 149 |
| M 16 | 24 | 179 | 265 | 310 |
| | | 132 | 196 | 229 |
| M 18 | 27 | 255 | 360 | 425 |
| | | 188 | 265 | 313 |
| M20 | 30 | 360 | 510 | 600 |
| | | 265 | 376 | 443 |
| M 22 | 32 | 485 | 690 | 810 |
| | | 358 | 509 | 597 |
| M 24 | 36 | 620 | 880 | 1030 |
| | | 457 | 649 | 760 |
| M 27 | 41 | 920 | 1310 | 1530 |
| | | 679 | 966 | 1128 |
| M 30 | 46 | 1250 | 1770 | 2080 |
| | | 922 | 1305 | 1534 |
| M 33 | 50 | 1690 | 2400 | 2800 |
| | | 1246 | 1770 | 2065 |
| M 36 | 55 | 2170 | 3100 | 3600 |
| | | 1600 | 2286 | 2655 |
| M 39 | 60 | 2800 | 4000 | 4700 |
| | | 2065 | 2950 | 3466 |

Insert all bolts lubricated with MPG, KP2K

4.6 LUBRICATION AND MAINTENANCE SCHEDULE

4.6.1 INITIAL SERVICING

AFTER THE FIRST 250 OPERATING HOURS

Change oil in Swing gears, Travel gears and PTO's (pump distributor gears). Thereafter every 3000 hours, but at least once a year. An oil sample analysis should be made every 1000 operating hours.

Hydraulic system: Replace return oil filter elements and leakage oil filter element. Inspect return oil strainers. Thereafter every 1000 hours.

AFTER THE FIRST 250 AND 1000 OPERATING HOURS

Check tightening torque of high strength bolt connections. Thereafter every 1000 hours.

NOTICE

- **The mounting bolts of the left and right crawler carrier to the undercarriage carbody have to be retightened only after the first 1000 operating hours, see page 399 for retightening procedure.**
- **The swing circle connection bolts need only to be checked after the first 1000 operating hours in accordance with PARTS&SERVICE NEWS No. AH00511 filed in volume 2 binder.**

NOTICE

The above initial service is of vital importance for proper operation and long service life of the machine.

4.6.2 PERIODIC SERVICING INTERVALS

All following intervals of time between services are based on average operating conditions. Under unusually severe conditions of operation, reduce the interval of time between services.

NOTICE

**The periodic servicing intervals are also displayed on the maintenance monitor of the VHMS system.
Carry out the maintenance work of indicated service intervals according to this maintenance section.**

4.6.3 PERIODIC SERVICING SCHEDULE

| Service Intervals | Service Point | Service | See |
|---|---|---|----------|
| When necessary | Engine Air Cleaners | Maintenance | page 281 |
| | Swing circle toothing | Immediately apply grease if bare spots are visible | page 285 |
| | Automatic lubrication systems | Fill grease containers Clean or replace filter elements | page 287 |
| | Track rollers | If leakage occurs replace | page 291 |
| | Carrier rollers | floating seals and fill with GL | |
| | Guide wheels | ISO VG CLP 220 | |
| | Cold starting aid | Replace fluid cartridges | page 293 |
| Every 10 operating hours or daily | Excavator | Walk-around inspection | page 295 |
| | Working attachment | Check grease injectors of automatic lubrication system. Check for proper lubrication. | page 299 |
| | Swing circle | Check grease injectors of automatic lubrication system. Check for proper lubrication. | page 303 |
| | Air cleaners | Clean pre-cleaner | page 305 |
| | Radiators | Check coolant level | page 307 |
| | Track groups | Clean, esp. in winter | page 307 |
| | Engines | Check oil level | (1) |
| | Fire detection and actuation system | Inspection | (2) |
| Every 50 operating hours or weekly | Swing gears and Motor adapter housings | Check oil levels | page 309 |
| | Travel gears, Motor adapter housings and Final drives | Check oil levels | page 315 |
| | PTO's (Pump distributor gears) | Check oil level | page 321 |
| | Hydraulic access ladder | Check safety sensor | page 325 |
| | Hydraulic oil cooler and radiator | Check and clean as necessary | page 327 |

- (1) Perform maintenance according to separate Engine Operation and Maintenance Manual filed in volume 2 binder.
- (2) Perform inspections according to the separate Manual "FIRE DETECTION AND ACTUATION SYSTEM" filed in volume 2 binder.

| Service Intervals | Service Point | Service | See |
|--|--|---|----------|
| Every 250 operating hours or monthly | Refrigerant compressor | Check drive belt tension | page 329 |
| | Signal horn compressor | Lubricate | page 331 |
| | Oil cooler fan bearings and Radiator fan bearing | Check for leakages and clean breather filters | page 331 |
| | Automatic lube systems | Clean in-line grease screens and breather filters | page 333 |
| | Cab air cleaner | Clean or replace filter element | page 335 |
| | Air conditioning for Operator's cab | Inspection | page 339 |
| | Windshield washer reservoir | Check fluid level | page 341 |
| | Engine | Maintenance | (1) |
| | Fire suppression system | Inspection | (2) |
| | Eliminator filter | Maintenance check | (4) |
| Every 500 operating hours or quarterly | Batteries | Check fluid level | page 343 |
| | | | |
| | Fuel tank | Drain condensation | page 345 |
| | Crawler tracks | Inspection | page 347 |
| | Engine and alternator ground cables | Check for correct connection | page 353 |
| | Cab ground cable | Check for correct connection | page 355 |
| | Fire detection and actuation system | Maintenance | (2) |

- (1) Perform maintenance according to separate Engine Operation an Maintenance Manual filed in volume 2 binder.
- (2) Perform inspections according to the separate Manuals "FIRE DETECTION AND ACTUATION SYSTEM" and "FIRE SUPPRESSION SYSTEM" filed in volume 2 binder.
- (3) Perform inspections according to the separate Manual "OPERATING INSTRUCTIONS AC" filed in volume 2 binder.
- (4) Perform maintenance according to separate Service Bulletin "Eliminator Filter" filed in volume 2 binder.

CAUTION

Carry out initial service according to item 4.6.1.

| Service Intervals | Service Point | Service | See |
|---|---|--|----------|
| Every 1000 operating hours or every 6 months | High strength bolt connections | Check for correct tightening torque and security | page 357 |
| | Hydraulic system | - Replace return and leakage oil filter elements - Clean or replace pressure filter elements - Clean or replace high pressure filter elements - Replace breather filter elements - Drain sediments | page 415 |
| | PTO's (Pump distributor gears) Swing gears and Travel gears | Oil sample analysis | page 429 |
| | Signal horn compressor | Clean and lubricate | page 431 |
| | Hydraulic track tensioning system | Check pressure accumulators | page 433 |
| | Water filter for hand wash sink in Operator's cab | Replace carbon filter cartridge | page 435 |
| | Hydraulic oil cooler doors and machinery house doors | Inspect and lubricate door hinges | page 437 |
| | Engine | Maintenance | (1) |
| | Fire suppression system | Maintenance | (2) |
| | Air conditioning | Inspect the complete system | (3) |

- (1) Perform maintenance according to separate Engine Operation an Maintenance Manual filed in volume 2 binder.
- (2) Perform inspections according to the separate Manual "FIRE SUPPRESSION SYSTEM" filed in volume 2 binder.
- (3) Perform inspections according to the separate Manual "OPERATING INSTRUCTIONS AC" filed in volume 2 binder.

CAUTION

Carry out initial service according to item 4.6.1.

| Service Intervals | Service Point | Service | See |
|--|---|---|----------|
| Every 2000 operating hours or yearly. | Hydraulic system | - Change oil (*) - Replace suction strainers (*) - Replace pulsation damper | page 441 |
| | Emergency escape ladder | Inspect | page 453 |
| | Fire detection and actuation system | Maintenance | (3) |
| Every 3000 operating hours however at least once a year. | Swing gears and Motor adapter housings | Change oil | page 455 |
| | Travel gears, Motor adapter housings and Final drives | Change oil | page 463 |
| | PTO's (Pump distributor gears) | Change oil | page 467 |
| | Engine | Maintenance | (1) |

(*) The hydraulic oil change intervals can be extended for a further time period, when an oil sample analysis shows a positive result. When extending the oil change interval, it is necessary to carry out an oil sample analysis after every 1000 operating hours. However, it is recommended to change the hydraulic oil and the suction strainers after 6000 operating hours at the latest.

REMARK

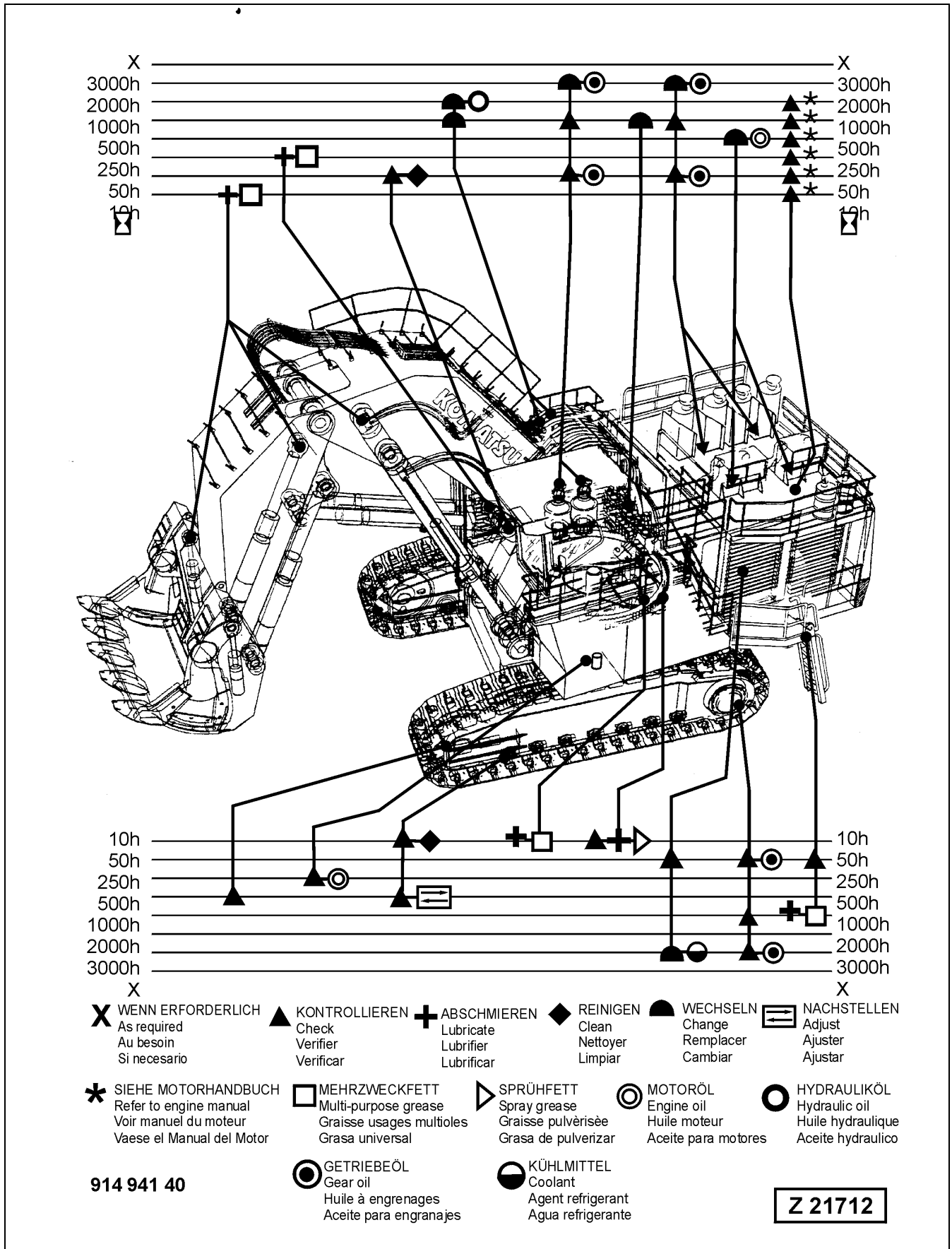
The pulsation damper of the hydraulic oil cooler circuit must be replaced after every 2000 operating hours.

- (1) Perform maintenance according to separate Engine Operation and Maintenance Manual filed in volume 2 binder.
- (3) Perform inspections according to the separate Manual FIRE SUPPRESSION SYSTEM filed in volume 2 binder.

NOTICE

The Lubrication oil Pumps for Pump Distributor Gear Lubrication should be replaced with new pumps after every 5000 OPERATING HOURS.

Lubrication Chart



4.6.4 REPLACEMENT OF HYDRAULIC HOSE LINES AND FUEL HOSE LINES

Hydraulic hoses and fuel hoses are subjected to natural aging. Hence, their usable lifetime is limited to maximum 6 years.

NOTICE

Hose lines considered as Safety Critical Parts have to be replaced earlier, see page 267 for more information.

CAUTION

The maximum permissible storage time of hydraulic hoses and fuel hoses is 2 years. This storage period is part of the usable lifetime and must be considered when a new hose line is being installed. If, for example, a hose line with a one year storage time is to be installed, the remaining service life of the hose line is 5 years. All hose lines are marked with the date of production.

All hydraulic hoses and fuel hoses of the Shovel have to be replaced after every 6 years at the latest, even if there is no visible damage.

WARNING

Repairs on hydraulic hoses and fuel hoses are not allowed. Use ONLY GENUINE KMG replacement hose lines.

INSPECTION OF HOSE LINES

Inspect all hoses, hose lines and fittings during the course of the daily walk-around inspection. Check for leaks and damages. Replace damaged parts without delay. Hydraulic fluid escaping under pressure can cause serious injuries. Fuel and oil leaks can cause fires.

Some examples of faults on hydraulic hoses and fuel hoses requiring replacement of the concerned part:

- Damage to the outer layer (e.g. chafed spots, cuts or scratches).
- Brittle top layers. Flaws on the hose material
- Distortion of the hose line (strong deviation from the original shape) under pressurized and pressureless conditions or when kinked or crushed, e.g. disintegration of hose layers or blistering.
- Leaks
- Detachment of hose and fitting. Damaged hose fitting.

4.6.5 PERIODIC REPLACEMENT OF SAFETY CRITICAL PARTS

To ensure safety at all times when operating the machine, the user of the machine must always carry out periodic maintenance. In addition, to further improve safety, the user should also carry out periodic replacement of the parts given in the table. These parts are particularly closely connected to safety and fire prevention.

With these parts, the material changes as time passes, or they easily wear or deteriorate. However, it is difficult to judge the condition of the parts simply by periodic maintenance, so they should always be replaced after a fixed time has passed, regardless of their condition. This is necessary to ensure that they always maintain their function completely.

However, if these parts show any abnormality before the replacement interval has passed, they should be repaired or replaced immediately.

If the hose clamps show any deterioration, such as deformation or cracking, replace the clamps at the same time as the hoses.

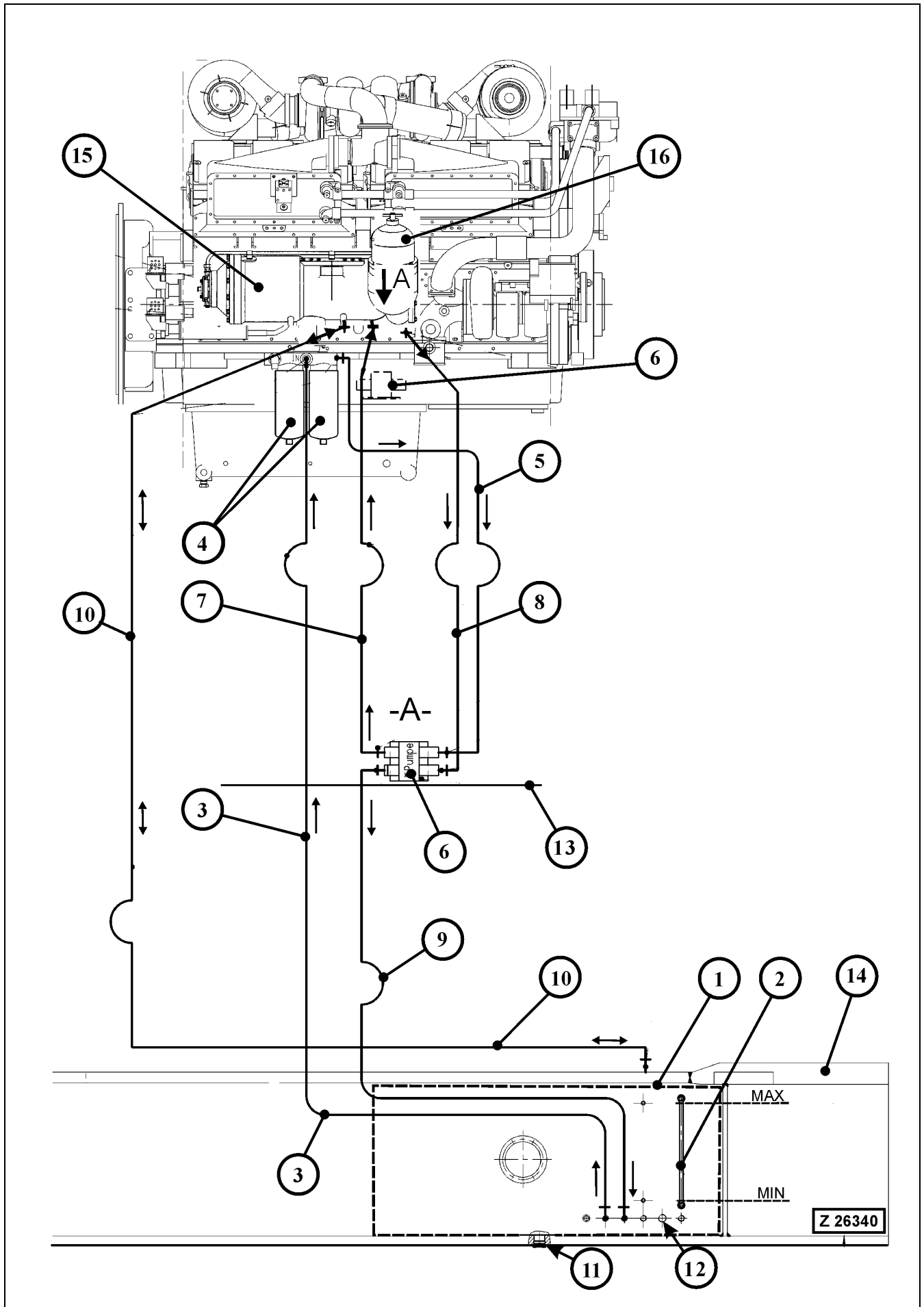
When replacing the hoses, always replace the O-rings, gaskets, and other such parts at the same time.

Ask your Komatsu distributor to replace safety critical parts.

Safety critical parts

| No. | Safety critical parts for periodic replacement | Replacement intervals |
|-----------|---|---|
| 1. | Hydraulic system | Every 6000 operating hours or every 2 years, whichever comes first |
| 1.1 | High pressure hoses | |
| 1.1.1 | Hoses between main pumps, pressure filters and main control blocks | |
| 1.1.2 | Hoses between manifold and return oil collector pipe (secondary relief valve lines) | |
| 1.1.3 | Hoses between manifold and all attachment cylinders | |
| 1.1.4 | Slew circuit hoses | |
| 1.1.5 | Travel circuit hoses | |
| 1.2 | Accumulator for pilot control circuit | |
| | | |
| 2. | Fuel system | |
| 2.1 | Fuel supply hoses | |
| 2.2 | Fuel return hoses | |
| 2.3 | Fuel drain hoses | |
| 2.4 | Fuel refilling hoses | |
| 2.5 | Fuel cooler hoses (if so equipped) | |
| | | |
| 3. | Turbocharger lubrication system | |
| 3.1 | Oil supply hose | |
| 3.2 | Oil drain hose | |
| | | Every 3 years |
| 4. | Seat belts | |
| | | Observe the instructions on the maintenance sticker affixed to the fire extinguisher container. |
| 5. | Portable fire extinguishers | |
| 6. | Automatic fire detection and suppression system | Follow the instructions given in the manufacturer's maintenance manual. |

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4.6.6 EXTENDED SERVICE INTERVALS FOR ENGINES EQUIPPED WITH ENGINE OIL MANAGEMENT SYSTEM

Legend for illustration Z 26340

- (1) Reserve oil tank. The reserve oil tank for the rear engine -1- is an integrated part of the LH main frame side member. The reserve oil tank for the front engine -2- is an integrated part of the RH main frame side member.
- (2) Oil level sight gauge
- (3) Suction line from reserve tank
- (4) Oil filters for the engine oil reserve system
- (5) Suction line to pumping unit
- (6) Pumping unit, located at the power frame just below the eliminator filter (15).
- (7) Supply line from pumping unit to crankcase
- (8) Withdrawal oil line from engine oil pan to pump
- (9) Oil feed-back line to reserve tank
- (10) Ventilation line for reserve tank
- (11) Drain plug
- (12) Connector for refilling line from swing down service arm
- (13) Power frame
- (14) RH side member of main frame
- (15) Eliminator filter
- (16) Centrifuge

Servicing Intervals

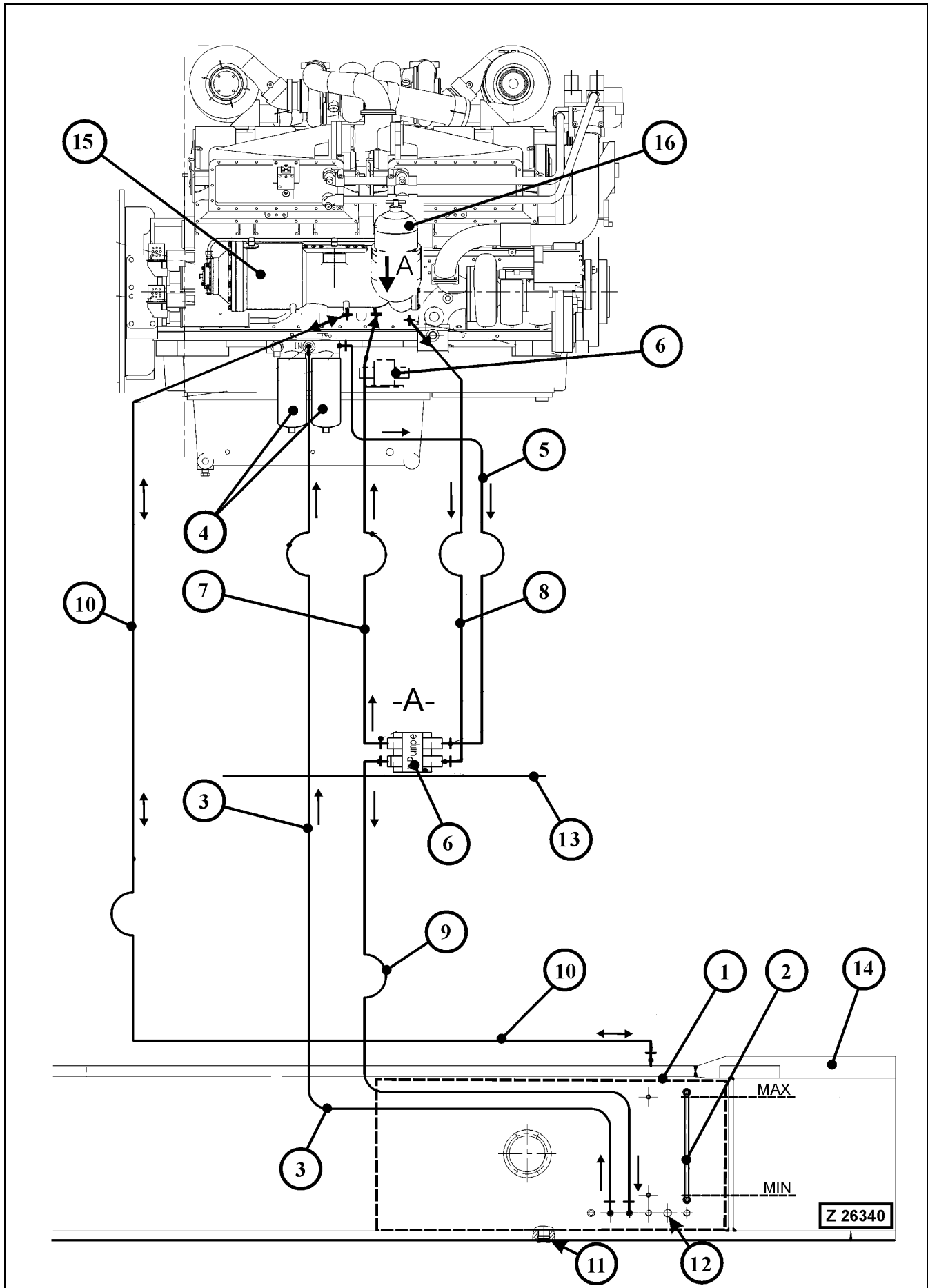
- **Every 10 operating hours**

Check oil level in both engine oil pans with Excavator standing on level ground. Check also oil level in both reserve tanks at sight gauge (2), illust. Z26340.

REMARK

The oil level in the engine oil pan can vary between the MIN and MAX marking on the oil level gauge depending on the operating condition of the reserve system when the engine was stopped.

With sufficient oil in the reserve tank and with the reserve system in proper working order, there is no need to fill the engine oil pan even with the oil level at the MIN mark on the level gauge. If the oil level is below the MIN marking on the gauge, corrective action must be taken. Fill the reserve tank and check the reserve system. The function of pumping unit (6) is monitored by an indicator light located on the -X2- switch board in the cab base. See section "SWITCH BOARD (X2) IN CAB BASE" for more information.



Extended Service Intervals for Engines equipped with Engine Oil Management System

- **Every 10 operating hours (continued)**

Be sure to fill the corresponding reserve tank of rear engine -1- or the reserve tank of front engine -2- when the information message

Engine oil reserve tank 1 (or 2) empty is being displayed on the VHMS monitor in the operator's cab.

- **Every 250 operating hours**

Carry out lubricating oil analysis.

- **Every 500 operating hours (except for machines destined for Australia)**

The contents of each engine oil reserve tank is sufficient for approximately 500 hours of operation. Fill the reserve tanks via the swing down service arm. Use engine oil according to the specifications in the Engine Operation and Maintenance Manual.

Change both oil filter cartridges (4) of the reserve system.

- **Every 4000 operating hours (except for machines destined for Australia)**

Change engine oil. Drain the oil from both engine oil pans and from both engine oil reserve tanks. See illustration Z26340 for location of the drain plugs (11) on the reserve tanks. It is recommended to change the oil when the oil level in the reserve tanks is near the minimum level.

- **Every 500 operating hours (for machines destined for Australia only)**

Change both oil filter cartridges (4) of the reserve system.

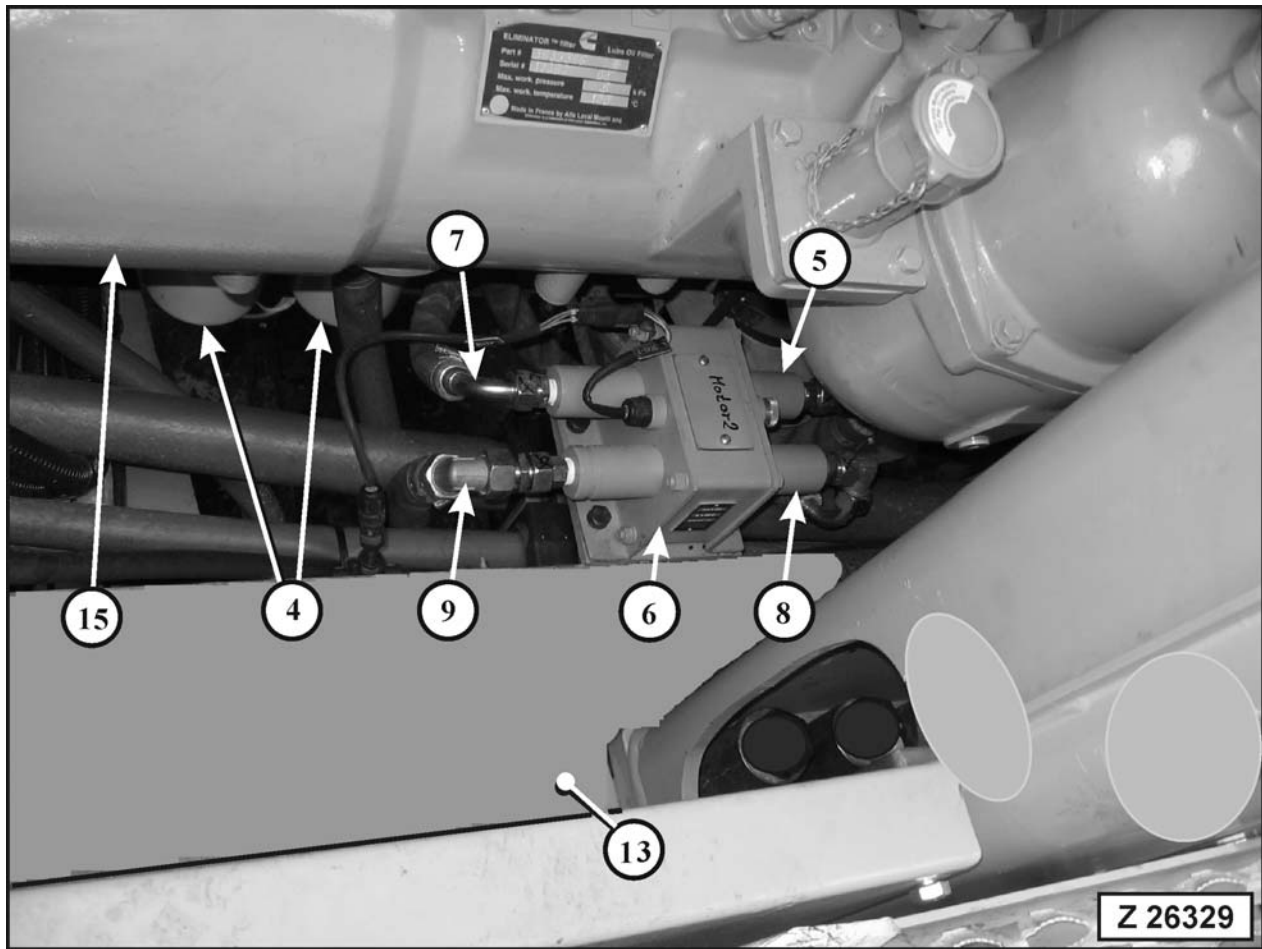
- **Every 1000 operating hours (for machines destined for Australia only)**

Change engine oil. Drain the oil from both engine oil pans and from both engine oil reserve tanks. See illustration Z26340 for location of the drain plugs (11) on the reserve tanks. It is recommended to change the oil when the oil level in the reserve tanks is near the minimum level.

REMARK

After the engine oil has been drained from both engine oil pans and from both reserve tanks, fill both engine oil pans and both reserve tanks via the swing down service arm. See section Central Refilling System on page 230 for more information. DO NOT use the oil in the reserve tanks to fill the engine oil pans after an oil change.

Refer also to the Engine Operation and Maintenance Manual for oil change procedure and oil specifications.



Extended Service Intervals for Engines equipped with Engine Oil Management System

The illustration Z26329 shows the arrangement of the reserve system components of front engine 2. The reference numbers are the same as in illustration Z26340 on the previous pages.

Legend for illust. Z26329

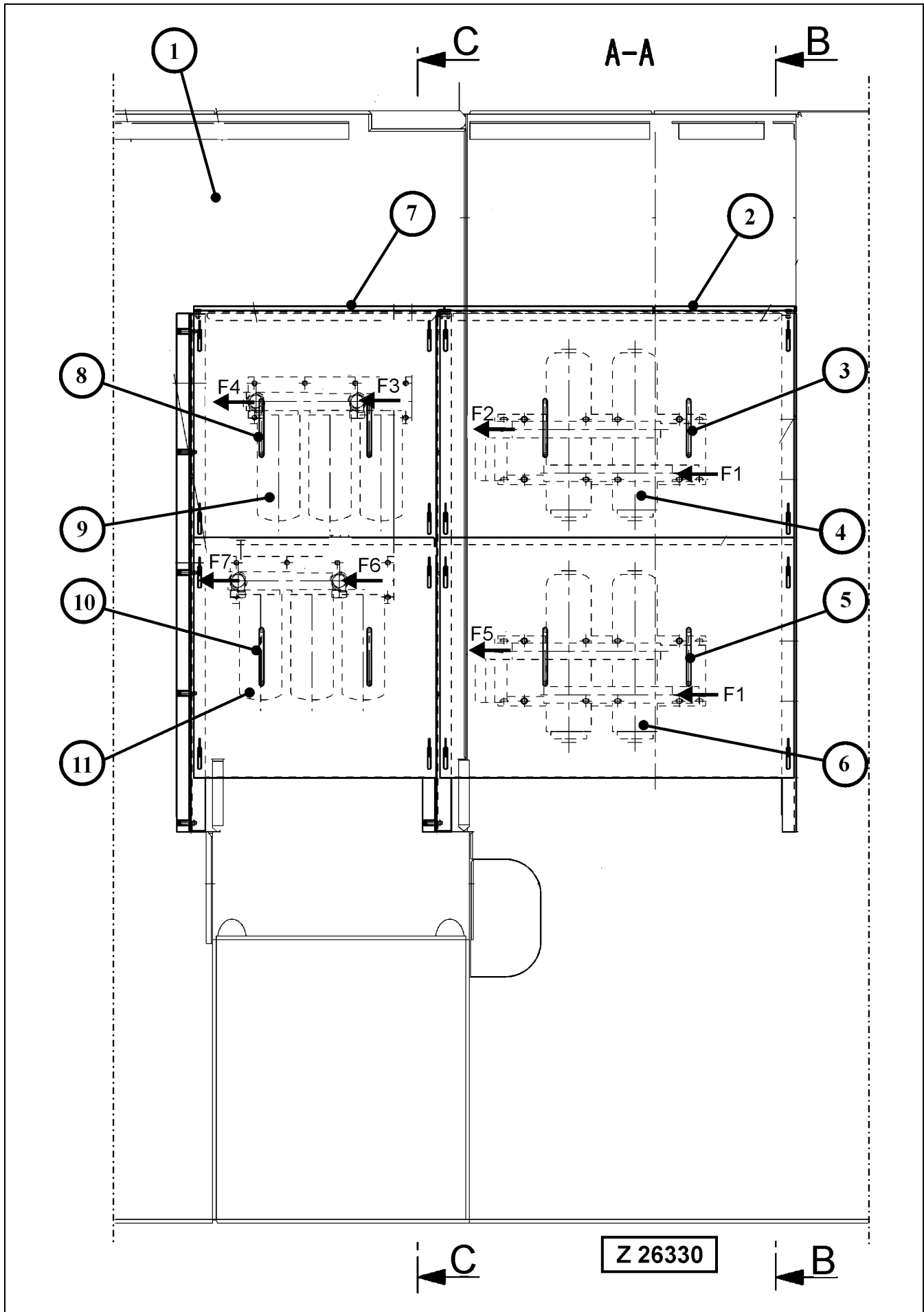
- (4) Oil filters for the engine oil reserve system
- (5) Connector for suction line to pumping unit
- (6) Pumping unit, located at the power frame (13).
- (7) Supply line from pumping unit to crankcase
- (8) Connector for withdrawal oil line from engine oil pan to pump
- (9) Oil feed-back line to reserve tank
- (13) Power frame
- (15) Eliminator filter

4.6.7 MAINTENANCE OF THE ENGINES

All maintenance has to be carried out in accordance with the separate Engine Operation and Maintenance Manual.

REMARK

Service the Eliminator Oil Filter according to the separate Service Bulletin "**Eliminator Filter**" filed in volume 2 Binder.



4.6.8 ENGINE FUEL FILTER LOCATION

REMARK

For safety reasons and better accessibility, the fuel filtration systems for engine 1 and 2 are relocated as shown in illustration Z26330.

⚠ WARNING

Fuel is flammable. When inspecting or performing service or repair on the fuel system, to reduce the possibility of fire and resulting severe personal injury, death or property damage, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area.

Legend for illustration Z26330

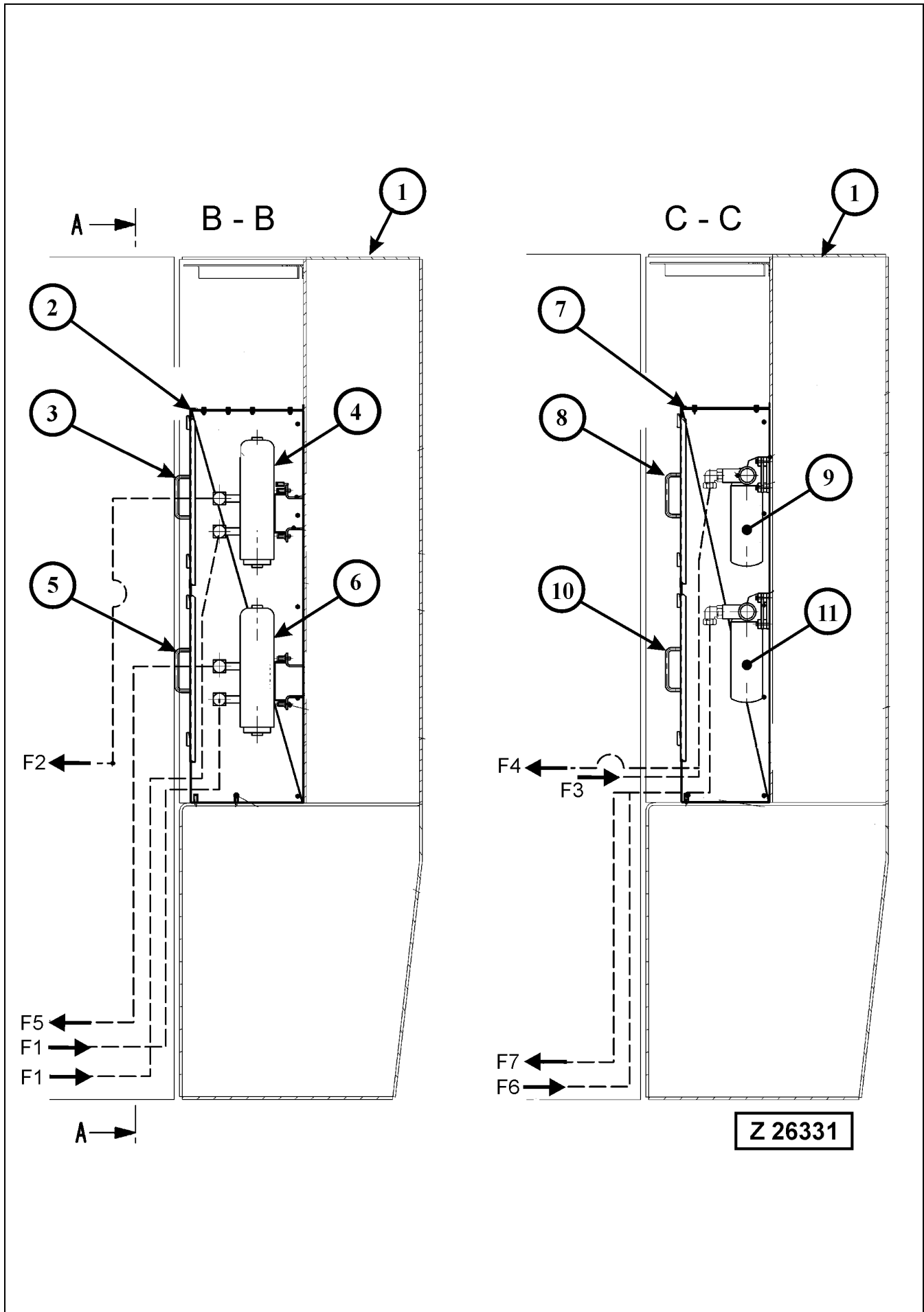
- (1) RH section of counterweight viewed from rear engine 1
- (2) Filter box of the first stage fuel filters with water separators
- (3) Upper cover for first stage filters of rear engine 1
- (4) First stage fuel filters with water separators for rear engine 1
- (5) Lower cover for first stage filters of front engine 2
- (6) First stage fuel filters with water separators for front engine 2
- (7) Filter box of the second stage fuel filters
- (8) Upper cover for second stage filters of rear engine 1
- (9) Second stage fuel filters for rear engine 1
- (10) Lower cover for second stage filters of front engine 2
- (11) Second stage fuel filters for front engine 2

Fuel Flow

- F1 From fuel tank
- F2 To fuel lift pump of rear engine 1
- F3 From fuel lift pump of rear engine 1
- F4 To rear engine 1 fuel pump
- F5 To fuel lift pump of front engine 2
- F6 From fuel lift pump of front engine 2
- F7 To front engine 2 fuel pump

REMARK

The sectional views (B - B) and (C - C) are shown in illustration Z26331 on next page.



Engine Fuel Filter Location (continued)

Legend for illustration Z26331

- (1) Counterweight
- (2) Filter box of the first stage fuel filters with water separators
- (3) Upper cover for first stage filters of rear engine 1
- (4) First stage fuel filters with water separators for rear engine 1
- (5) Lower cover for first stage filters of front engine 2
- (6) First stage fuel filters with water separators for front engine 2
- (7) Filter box of the second stage fuel filters
- (8) Upper cover for second stage filters of rear engine 1
- (9) Second stage fuel filters for rear engine 1
- (10) Lower cover for second stage filters of front engine 2
- (11) Second stage fuel filters for front engine 2

Fuel Flow

- F1 From fuel tank
- F2 To fuel lift pump of rear engine 1
- F3 From fuel lift pump of rear engine 1
- F4 To rear engine 1 fuel pump
- F5 To fuel lift pump of front engine 2
- F6 From fuel lift pump of front engine 2
- F7 To front engine 2 fuel pump

NOTICE

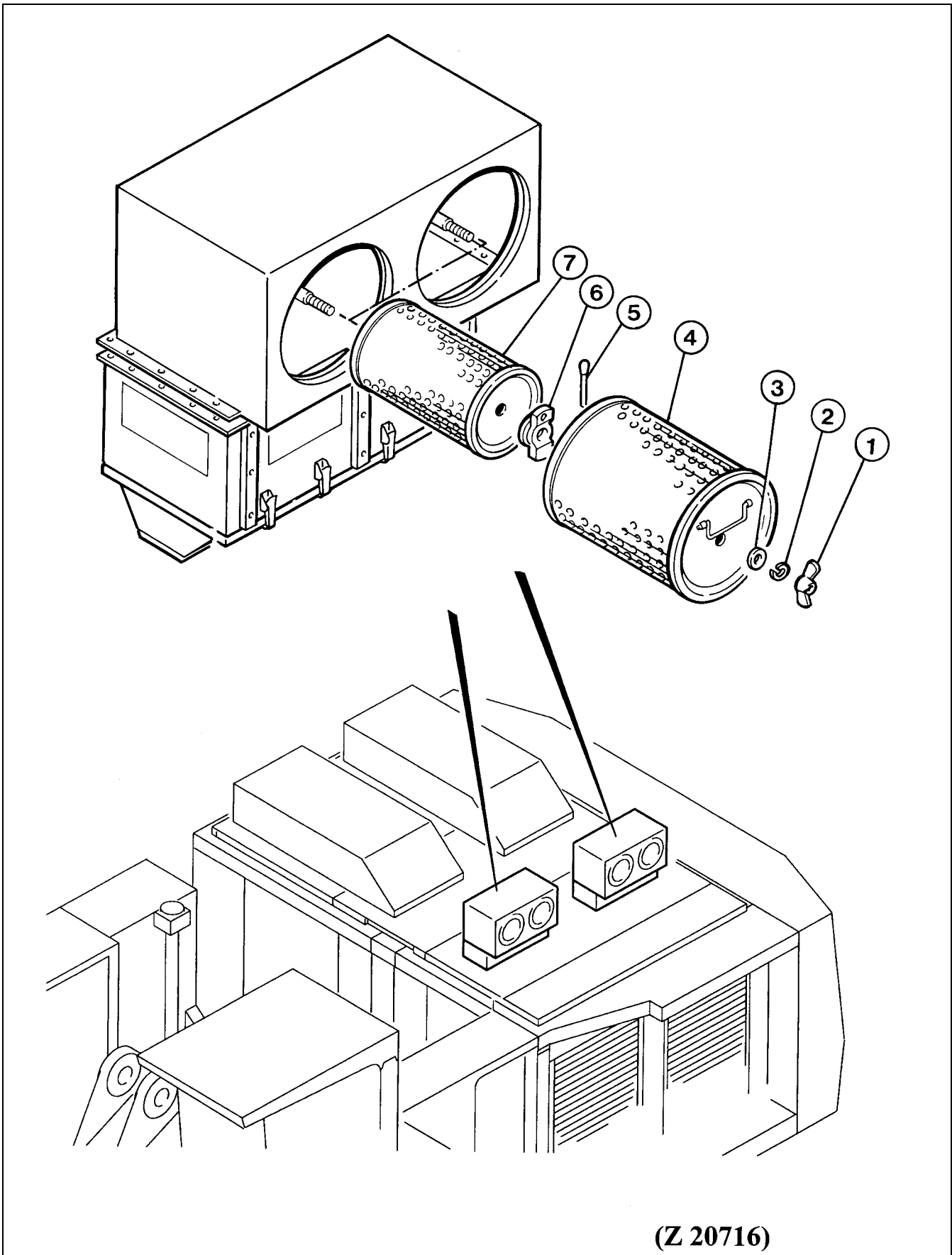
- **Shut down both engines and switch off battery main switches, before draining water from the separators and before performing service on the fuel system.**
- **Carry out fuel system maintenance according to the instructions in the separate Engine Operation and Maintenance Manual filed in volume 2 binder.**

For access to the filter units lift off the respective box cover.

CAUTION

Be sure to attach all the removed covers when the maintenance work on the fuel filtration system is finished.

4.7 WHEN NECESSARY



(Z 20716)

4.7.1 ENGINE AIR CLEANER MAINTENANCE

NOTICE

Before servicing the filter elements clean dust cups of the pre-cleaners.

Servicing the main filter elements, illust. Z 20716:

 CAUTION

Never service air cleaner while engine is running.
Clean main filter elements as soon as the fault message "Air cleaner element restricted" is displayed on the VHMS screen.
Replace elements after 6 cleanings or annually, whichever occurs first.

1. Remove elements in sequence of reference numbers (1 to 4).
2. Clean and check respectively. replace main filter element.
Wipe out filter housing with a clean cloth.
3. Element cleaning methods:
Clean main element by one of the following methods.
Compressed air or washing:
Compressed air is recommended when element will be re-used immediately because a washed element must be dried before re-use.

Compressed air:

Direct air through element in the direction opposite to normal air flow through the element. Move nozzle up and down while rotating element. Keep nozzle at least one inch from pleated paper. Maximum air pressure to prevent damage of element is 100 P.S.I. (6 bar).

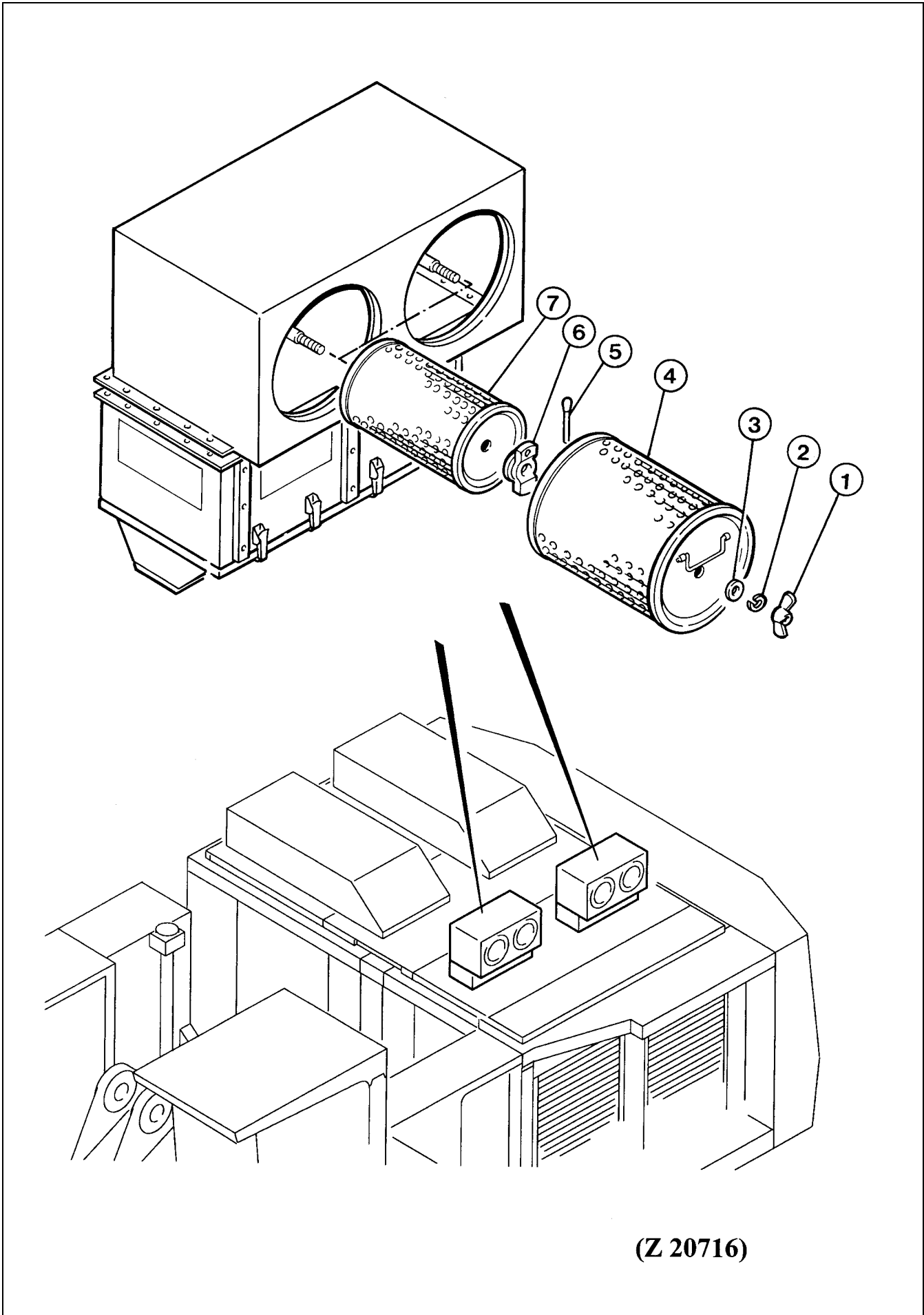
Washing:

1. Soak element 15 minutes or more in cleaning solution. See package for full instructions.
2. Rinse until water is clear maximum water pressure 40 P.S.I. (2.5 bar).
3. Air-dry or use warm flowing air, max. 160° F (+70° C). Do not use compressed air or light bulbs.

REMARK

Before installing main elements (4) check service indicator (6) of safety element (7). If a red signal is shown, replace safety element (7). Clean indicator (6) then suck on the outer side of the indicator to reset signal to green indication.

4. Install main filter elements (4).



(Z 20716)

Air Cleaner Maintenance, illustration Z 20716

NOTICE

- If the fault message "Air cleaner element restricted" is again displayed on the VHMS screen after installation of a new main filter element the safety-filter element has also to be replaced.
- If faulty service or a defect has been detected while servicing the main filter element also the safety filter element has to be replaced.
- After having the main filter element cleaned three-times or replaced also the safety filter element has to be replaced.

Replacing the safety filter element (7):

1. Remove element in sequence of ref. no. (1 to 7).
2. Cover air intake opening.
3. Install new safety filter element (7).

WARNING

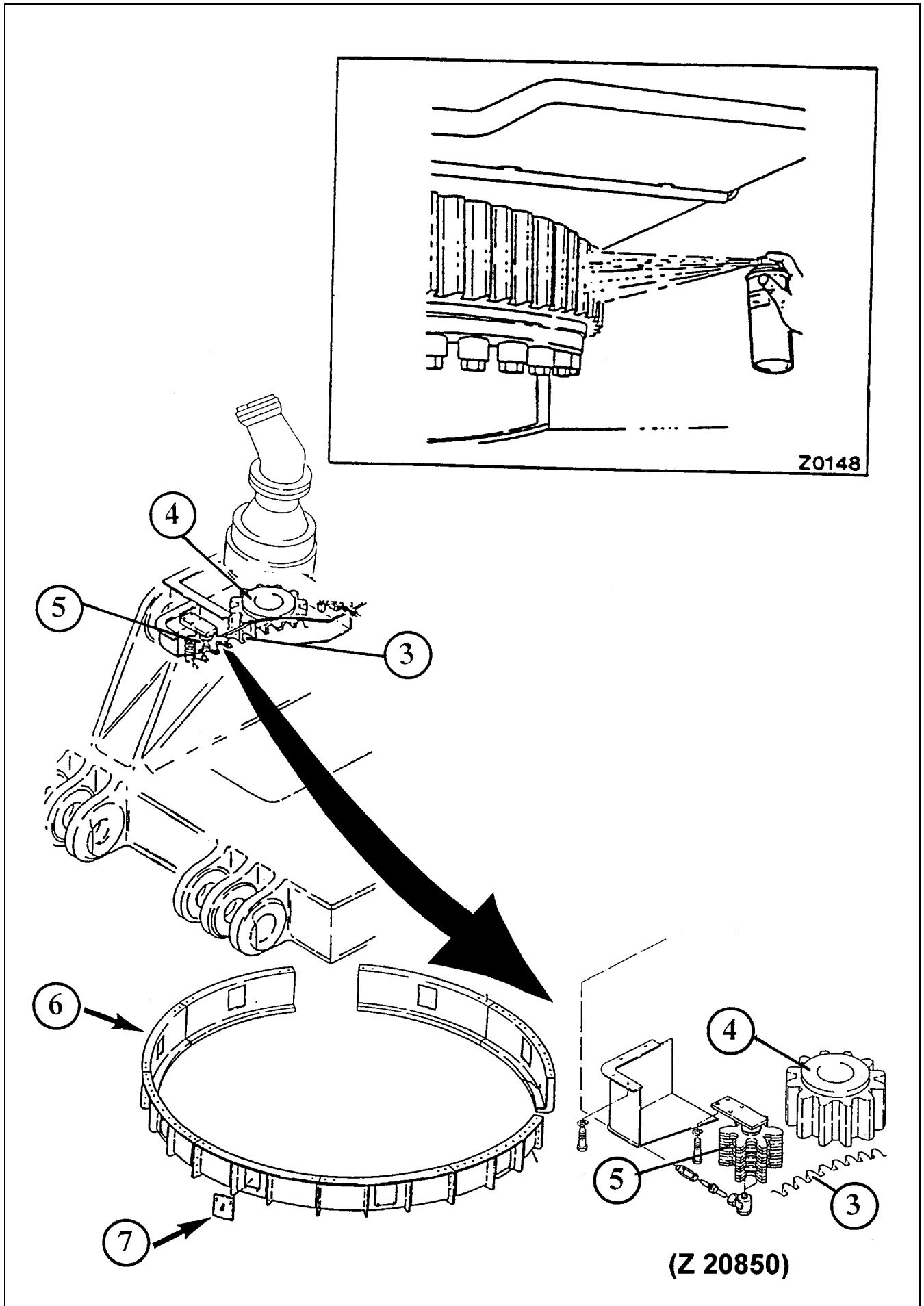
The safety filter element may not be cleaned and re-used

4. Remove cover from air intake opening.
5. Install safety and main filter element, take care service indicator (6) is correctly secured by cotter pin (5).

General Service Tips

The air cleaners should be inspected periodically to maintain maximum engine protection and maximum service life. These inspections should include the following points.

1. Inspect the air transfer duct between the air cleaner and the engine to be sure all clamps are tight, all flange joints are tight, and there are no cracks in the ducting.
2. Air cleaner mounting bolts and clamps must be tight to hold the air cleaner securely.
3. Check the dust cup to make sure it is sealing 360° around the air cleaner body.
4. Automatic dust unloader valve (if so equipped) must be in place, not inverted or damaged, and free from obstruction.



4.7.2 SWING CIRCLE TOOTHING LUBRICATION

See illustration Z 20850

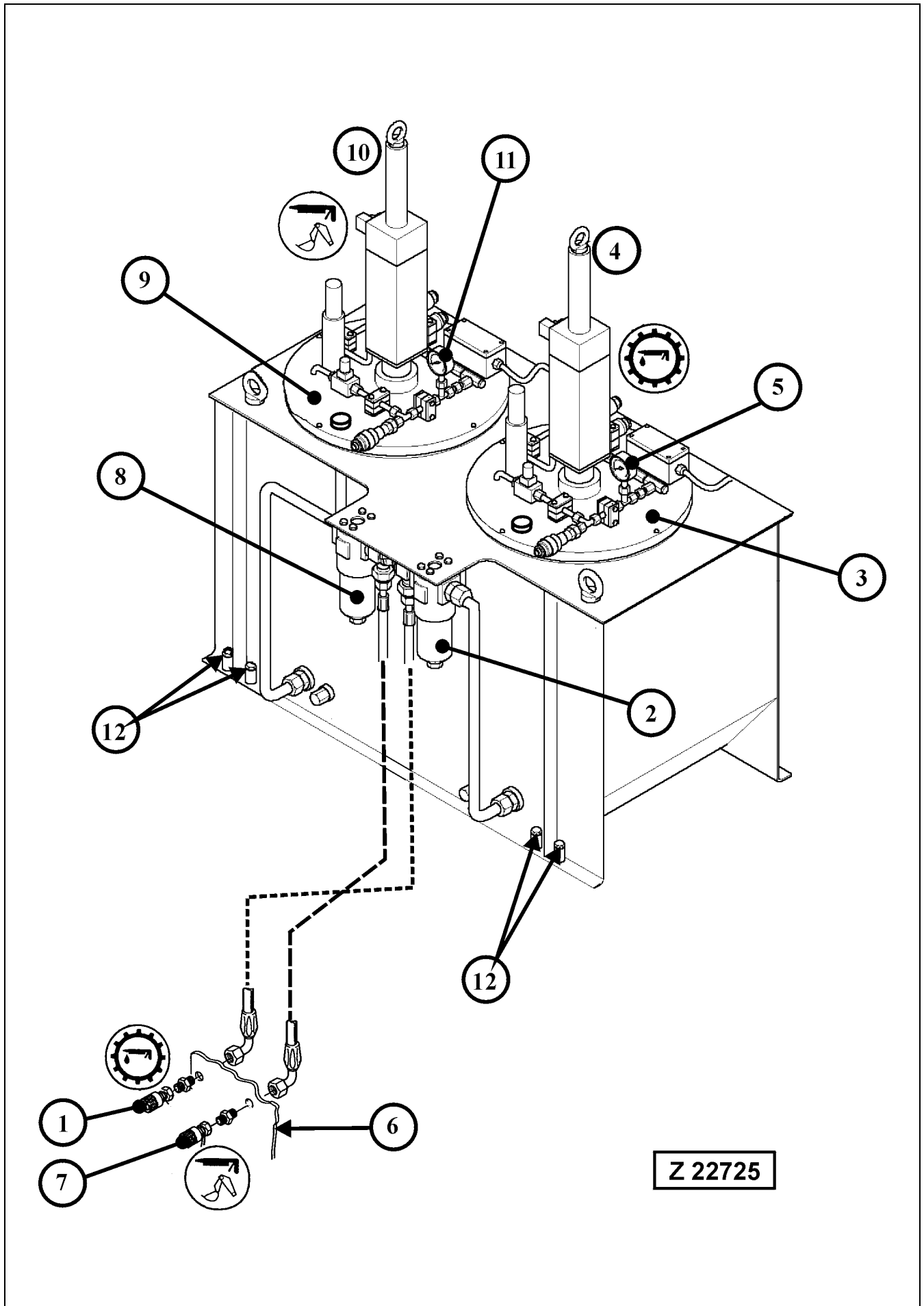
All teeth of the ring gear (3) must be completely covered with grease.

If teeth are not completely covered with grease, they have to be lubricated immediately with special adhesive spray grease, illust. (Z 0148) or spread type adhesive grease as specified in the Parts Catalog. The spread type grease can be applied, for example, with a brush.

Observe the instructions on the grease container for correct use of the lubricant.

NOTICE

- **If the machine is equipped with gear ring guard (6), remove covers (7) for swing circle teeth inspection.**
- **If the automatic lubrication system of the swing circle-teeth, is out of function for more than one shift, lubricate manually (using spray grease) and remove the lube pinion (5), to prevent serious damages.**
- **In order to ensure proper adherence of the lubricant, clean and dry the ring gear prior lubrication. In most cases it is sufficient to rotate the superstructure several times for removing moisture from the gear teeth.**
- **Make sure that the multi-purpose grease of the swing circle bearing does not come in contact with the teeth of the swing circle because this will diminish lubrication capability of the swing circle teeth lubricant. If necessary remove excessive multi-purpose grease from the swing circle above the dust seal ring.**



4.7.3 AUTOMATIC LUBRICATION SYSTEMS FILL GREASE CONTAINERS

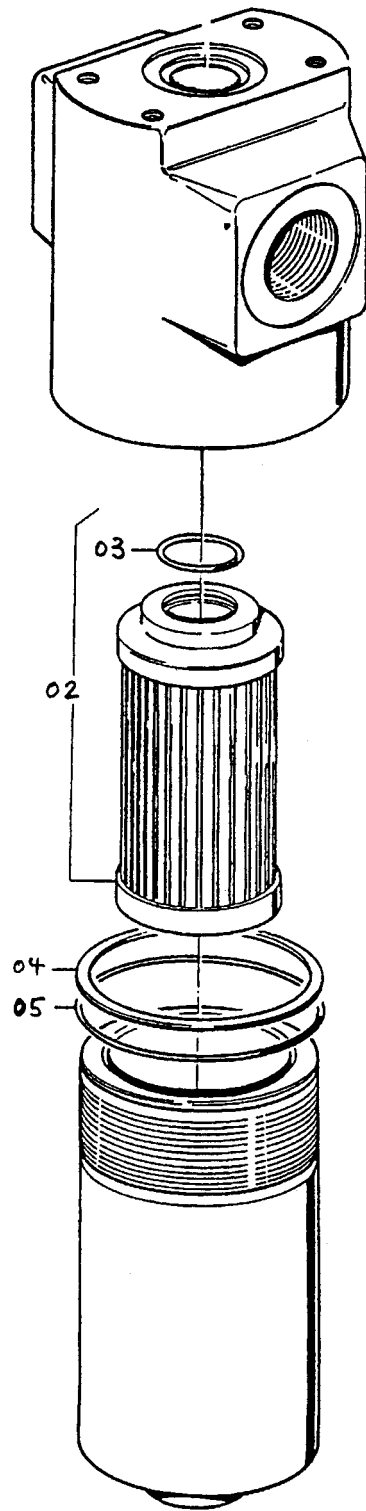
Fill the grease containers of the Central Lubrication System and Swing circle pinion Lubrication System when the corresponding message "grease container on reserve" is displayed on the VHMS monitor. Make sure the grease filters in the filling lines are not obstructed. If necessary service the Grease Filters.

Legend for illustration Z22725

- (1) Coupling on swing down service arm for filling the grease container (3) of the Swing circle gear Lubrication System -SLS-
 - (2) Grease filter for Swing circle gear Lubrication System -SLS- grease container.
Before filling the grease container make sure the filter is not obstructed.
Service the filter element according to instructions on page 289.
 - (3) Grease container of the swing circle pinion lubrication system
 - (4) Hydraulically driven grease pump
 - (5) Grease pressure gauge for -SLS-
 - (6) Receiver panel on swing down service arm
 - (7) Coupling on swing down service arm for filling the grease container (9) of the Central Lubrication System -CLS-
 - (8) Grease filter for Central Lubrication System -CLS- grease container.
Before filling the grease container make sure the filter is not obstructed.
Service the filter element according to instructions on page 289.
 - (9) Grease container of the Central Lubrication System -CLS-
 - (10) Hydraulically driven grease pump
 - (11) Grease pressure gauge for -CLS-
 - (12) Mounting bolts of the grease container housing
- Fill the grease containers according to the instructions on page 230.

REMARK

Check mounting bolts (12) on front and rear side of the grease container housing for correct tightening torque.



(Z 20718)

Service the Grease Filters for Refillable Grease Containers of the Central Lubrication System and Swing circle pinion Lubrication System, illustration Z 20718

1. Screw off filter case.
2. Remove element assy. (02) and clean. Take care not to contaminate the "Clean" inside of the element when flushing.

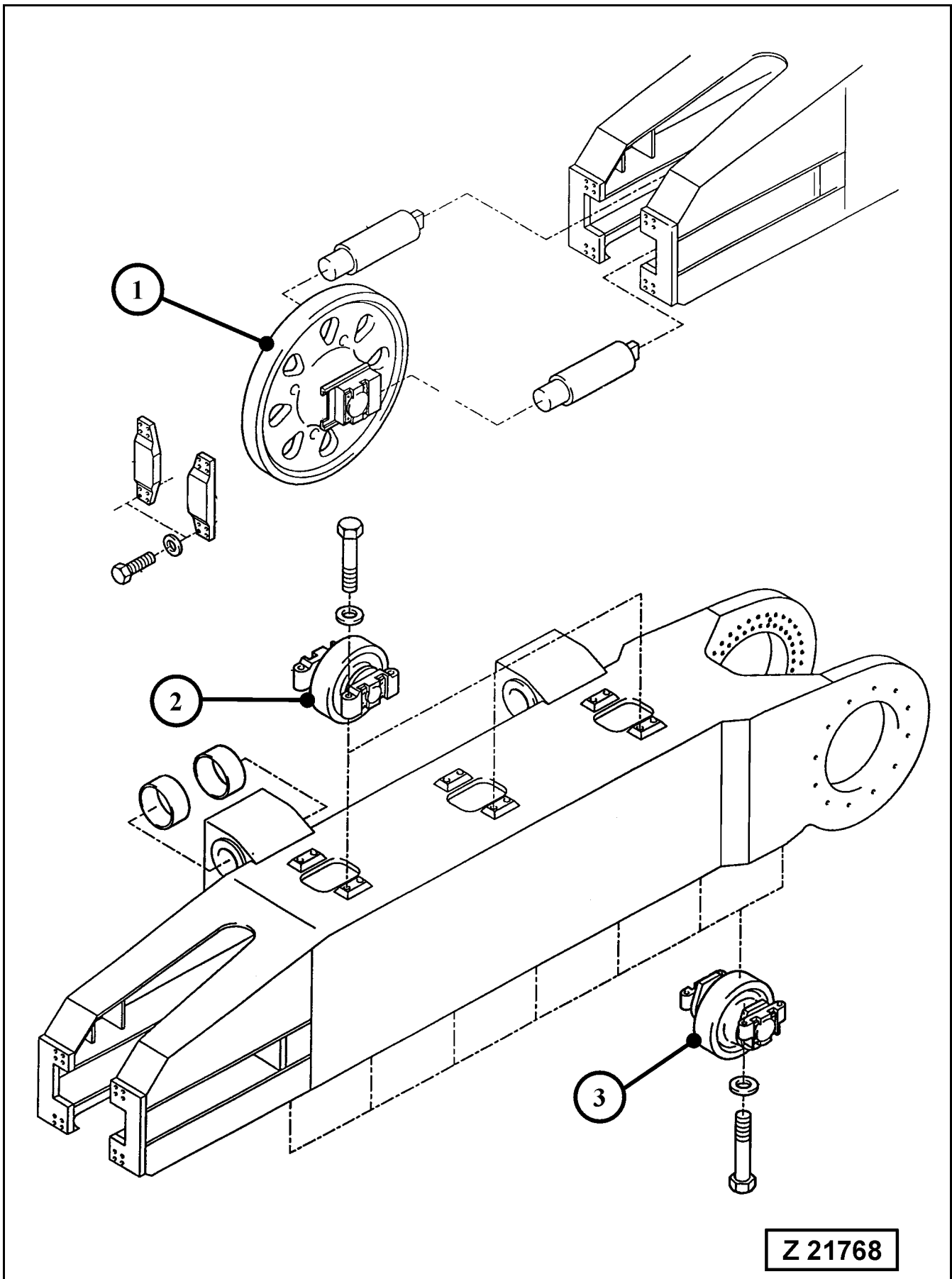
NOTICE

Carefully inspect elements for damage. Always install new elements if ruptures or other damages are found.

3. Inspect O-rings (03 and 05) and back-up ring (04). Replace if necessary.
4. Fill filter case half way up with the specified grease.
5. Installation sequence vice versa. Take care for proper position of filter element (02).

NOTICE

Replace element (02) after three cleanings or after every 5000 operating hours, whichever occurs first.

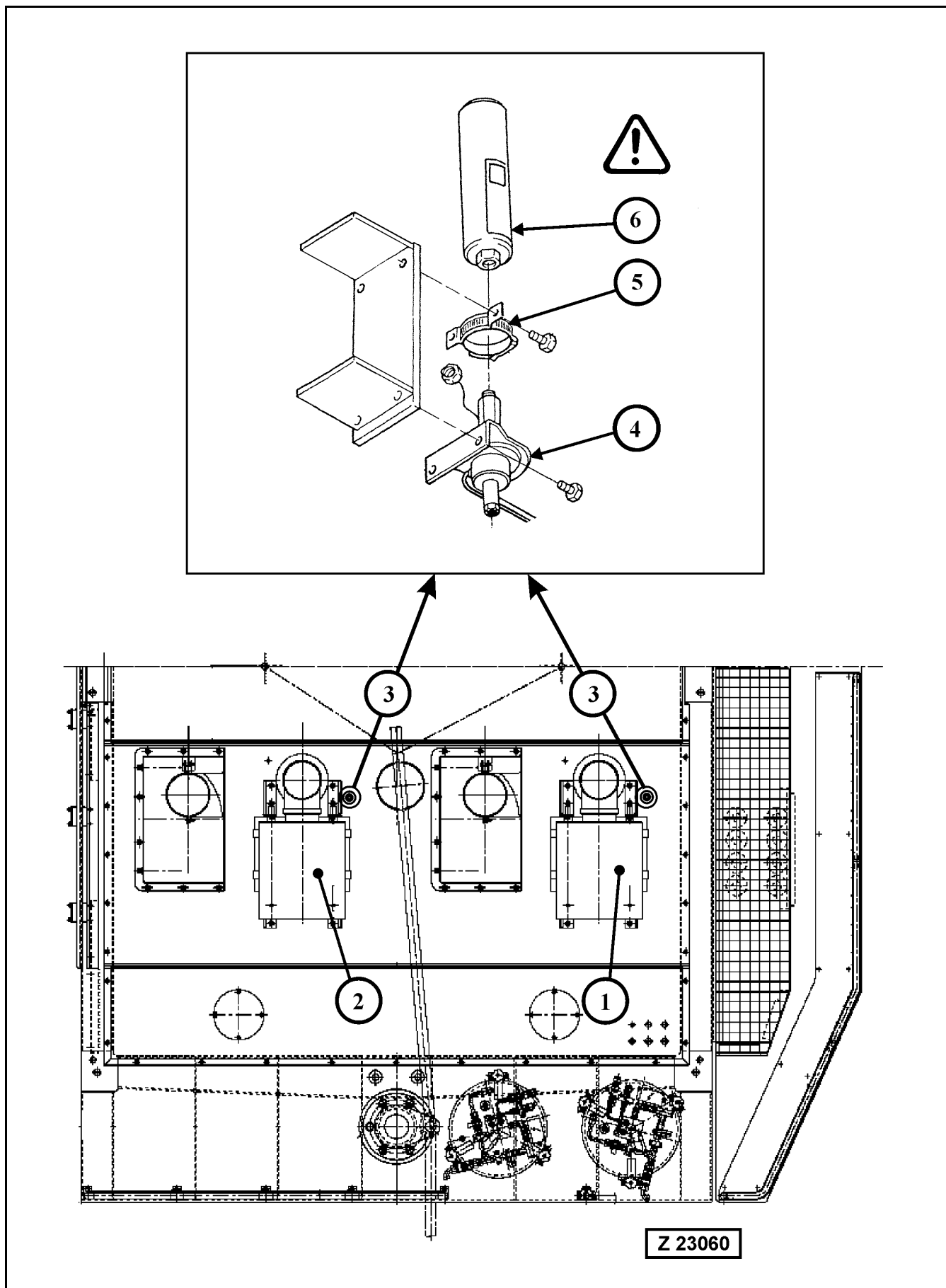


Z 21768

4.7.4 TRACK ROLLERS AND GUIDE WHEELS - REPLACE FLOATING SEALS

Legend for illustration Z 21768

- (1) Guide wheel, if leakage occurs. replace floating seal.
Refer to repair manual for replacement procedure.
- (2) Carrier roller, if leakage occurs. replace floating seal.
Refer to repair manual for replacement procedure.
- (3) Track roller, if leakage occurs. replace floating seal.
Refer to repair manual for replacement procedure.



4.7.5 COLD STARTING AID, REPLACE FLUID CYLINDER

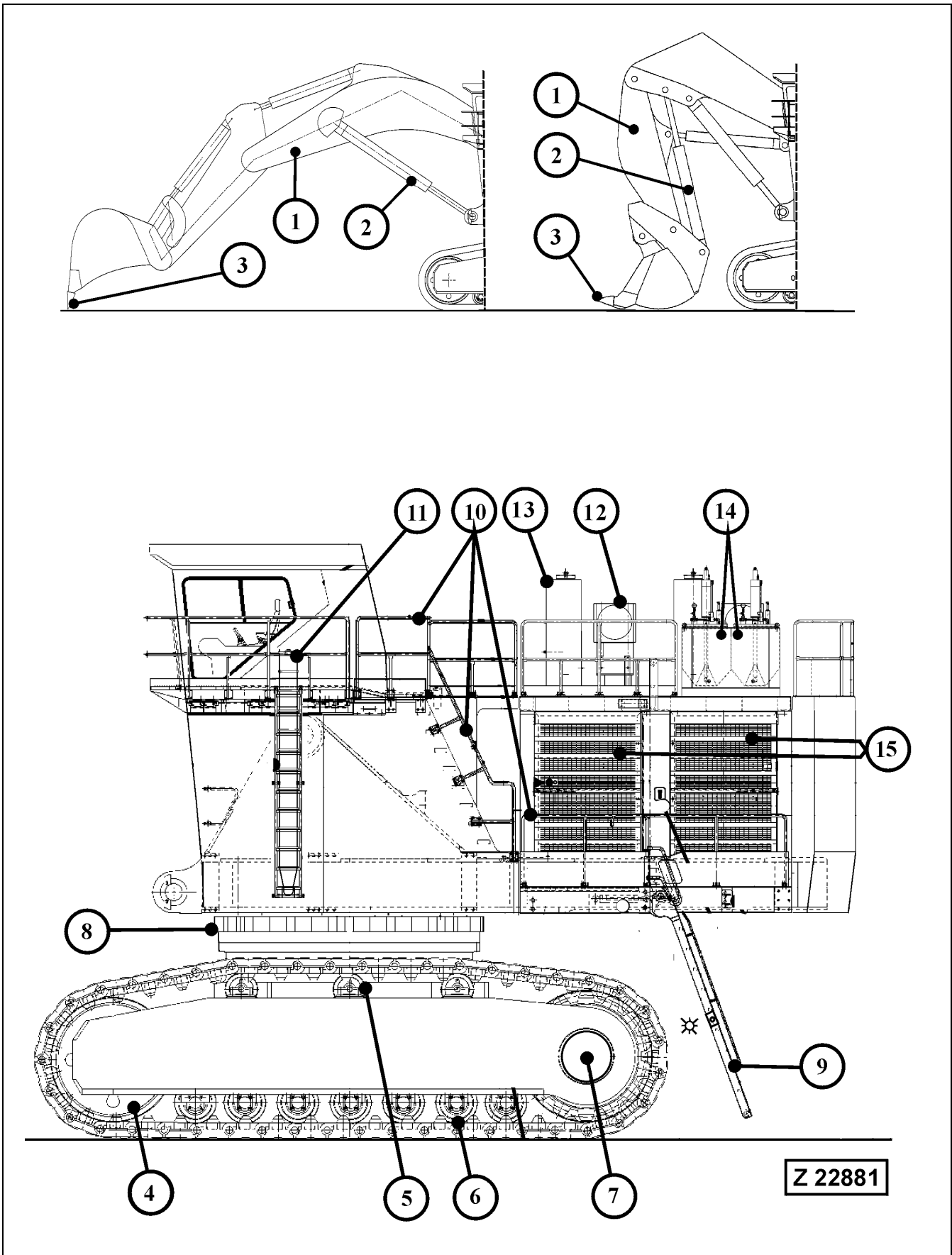
Legend for illustration Z 23060

- (1) Air cleaner for rear engine 1
- (2) Air cleaner for front engine 2
- (3) Cold starting aid mounted on the air cleaner carrier
- (4) Electrically operated valve
- (5) Mounting clamp
- (6) Cold start fluid cylinder

▲ WARNING

- Starting fluid is poisonous and flammable
 - Do not store replacement cylinders in living areas
 - Do not smoke while changing cylinders
 - Use only in well ventilated areas
 - Use with care to avoid fires
 - Avoid breathing of vapors or repeated contact with skin
 - Do not puncture or burn cylinders
 - Discard cylinders in a safe place
 - Keep fluid container away from heat, sparks, open flame, or open sunlight. It may explode
 - Observe instructions on the container
 - Do not store or use at temperatures above 93° C (200° F)
-
-

4.8 EVERY 10 OPERATING HOURS OR DAILY



4.8.1 WALK - AROUND INSPECTION

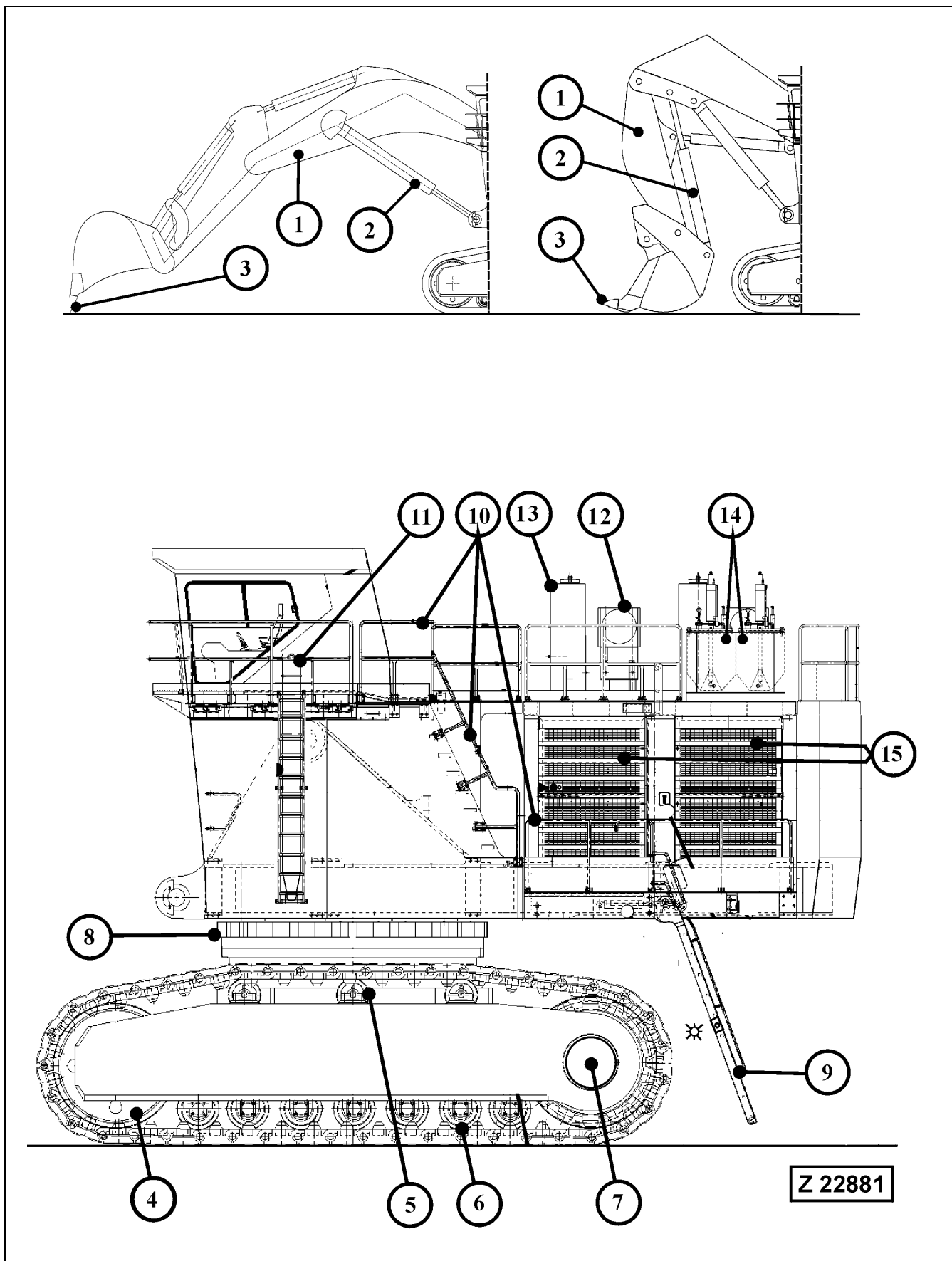
WARNING

Before carry out any maintenance on this machine, make sure the mounting ladder, handrails and walkways are properly installed and in good condition. Keep the ladder, steps, handrails and walkways free of mud, oil and grease.

Always use the ladder, handrails and steps to get on or off the machine. Jumping on or off the machine can cause an injury.

Legend for illustration Z22881

- (1) Working attachment. Check overall condition. Inspect for loose or missing securing parts.
- (2) Hydraulic cylinders. Check cylinders, hydraulic lines and connections for leakage and damage.
- (3) Check bucket teeth for proper mounting. Inspect for loose or missing securing parts.
Check condition of the loader bucket. Both loader bucket versions, bottom dump bucket and backhoe bucket are equipped with wear protection packages as specified in the contract. These wear packages protect the base body of the bucket from premature wear and tear. Therefore it is important to check the condition of the wear protection elements regularly. Worn or damaged protection elements should be replaced at an early stage in order to prevent damage to the base body of the bucket.
In case the bucket base is already weakened, reconditioning measures will be necessary. Contact your Komatsu dealer for support.
- (4) Check guide wheels for leakage.
- (5) Check carrier rollers for leakage.
- (6) Check track rollers for leakage.
- (7) Check final drives and hydraulic motors for leakage. Check hydraulic hoses, hose lines and fittings for leakage and damage.
- (8) Check swing circle tothing for adequate lubrication.
- (9) Check condition, fastening and security of access ladders.
- (10) Check condition, fastening and security of all walkways, steps, railings and hand rails.
- (11) Check condition, fastening and security of emergency escape ladder
- (12) Check condition and fastening of engine air cleaners
- (13) Check condition and fastening of exhaust mufflers



Walk - around Inspection (continued)

Legend for illustration Z22881

(14) Check condition, fastening and security of the automatic lubrication system grease container.

(15) Make a visual inspection of the engine room. Check engine oil level and coolant level.

Check engine for good condition and security. Check for oil and fuel leakages. Check fuel hoses, hose lines and fittings for leakage and damage.

Engine mounts, check for good condition and correct fastening.

Check radiator coolant level. Check cooling system for leakage, damaged hoses and connections.

Check housing of radiator fan bearing for leakage. Check fan guards and coverings for correct installation, good condition and security.

Check flexible coupling between engine and PTO for leakage.

Check condition and mounting of PTO and hydraulic pumps. Check hydraulic hoses, hose lines and fittings for leakage and damage.

Check housing of oil cooler fan bearing for leakage. Check fan guards and coverings for correct installation, good condition and security. Check hydraulic hoses, hose lines and fittings for leakage and damage.

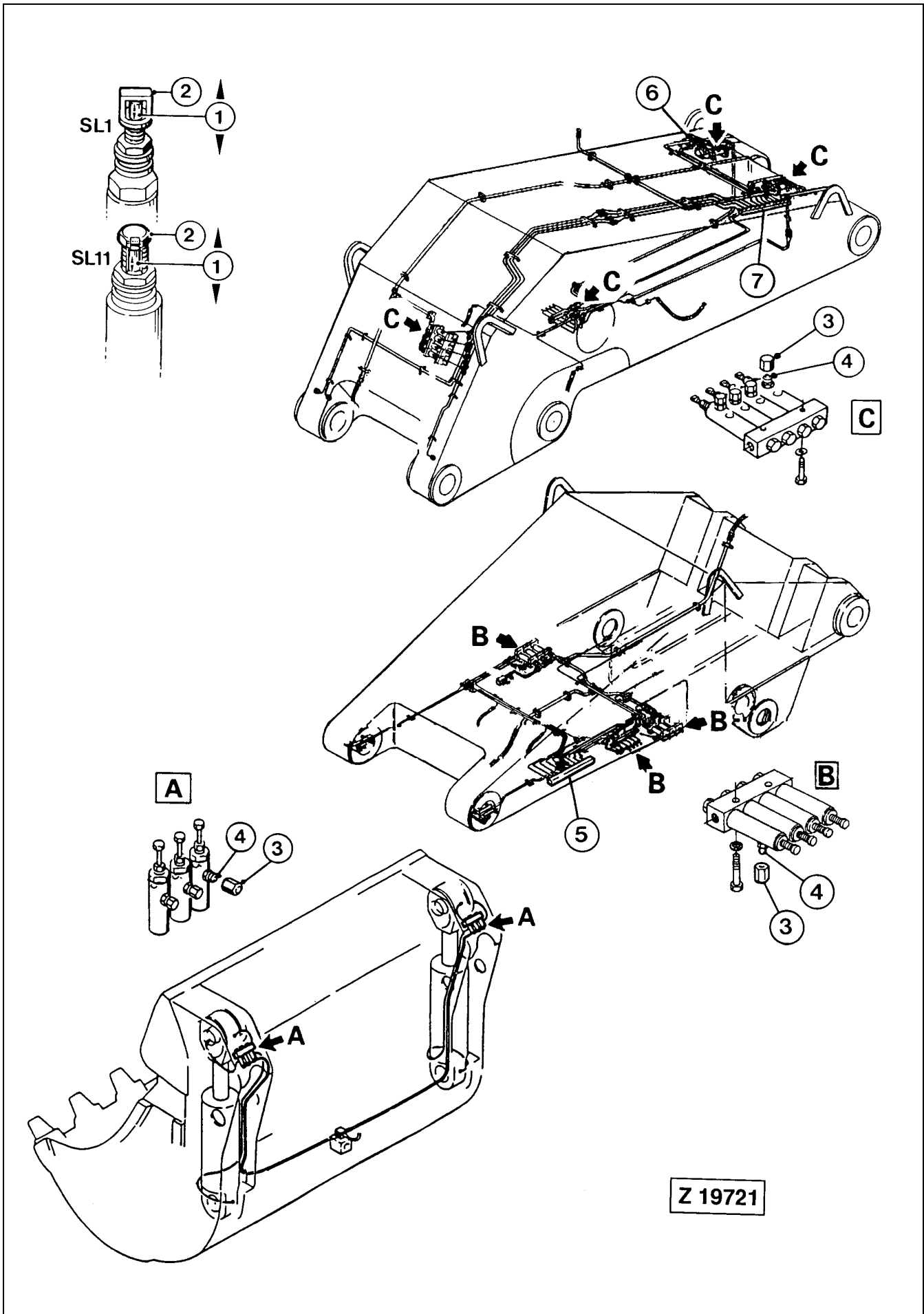
Check hydraulic oil cooler for plugged cores.

Check hydraulic oil level. Check hydraulic oil reservoir for leakage, damaged hoses and connections.

Check condition and fastening of control valves. Check hydraulic hoses, hose lines and fittings for leakage and damage.

NOTICE

If any damages, failures or wrong condition, have been found during the inspection, corrective action must be taken.



WORKING ATTACHMENT - CHECK GREASE INJECTORS FOR PROPER OPERATION

NOTICE

There are two types of grease injectors installed "SL1" and "SL11" injectors, see illust. (Z 19721).

Legend for illustration Z 19721

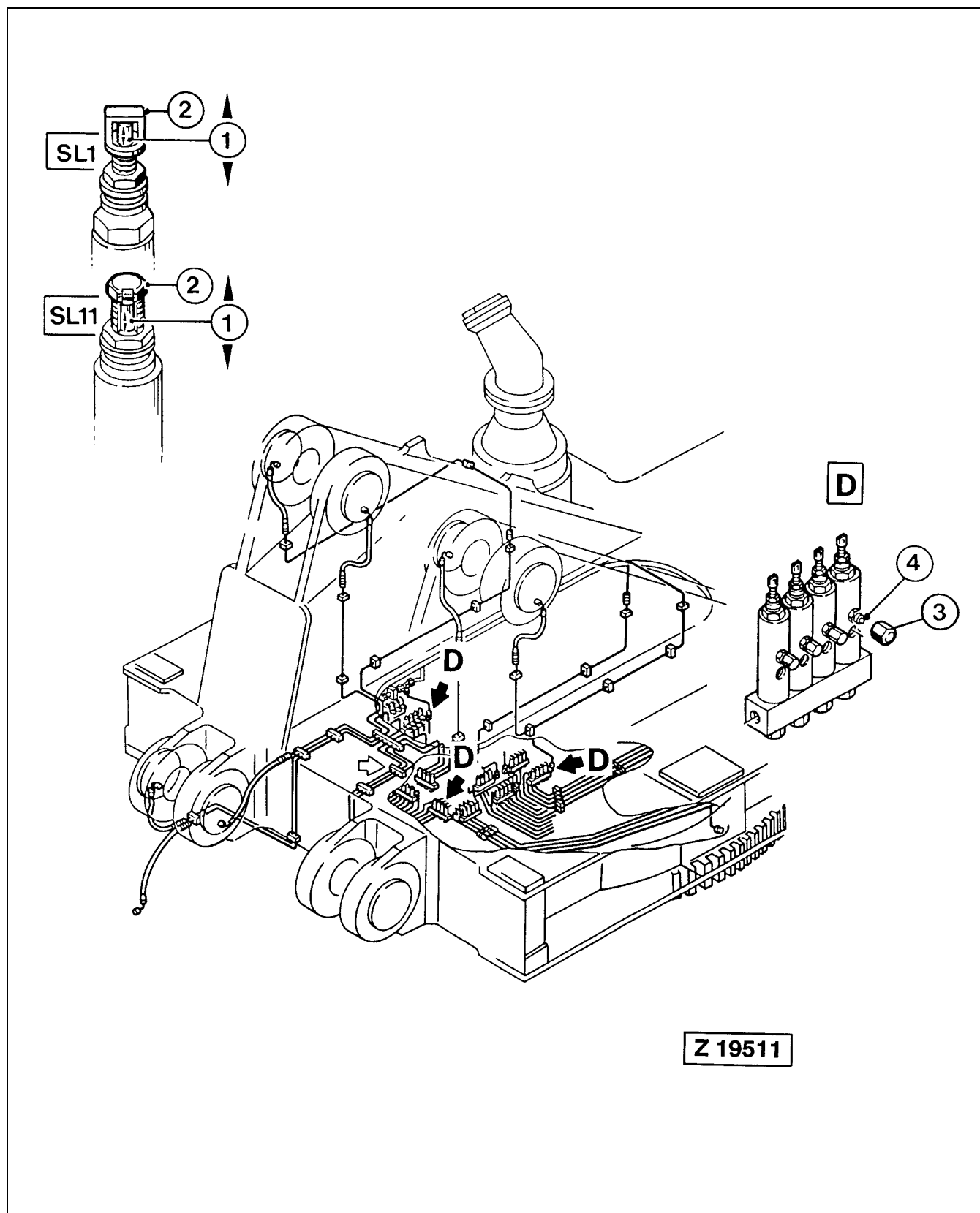
- A Injectors on bucket
- B Injectors on stick
- C Injectors on boom
- (1) Indicator stem for visual indication of injector operation
- (2) Output adjusting screw
- (3) Protection cap
- (4) Grease fitting
- (5) Distributor ledge, stick
- (6) Boom
- (7) Distributor ledge, boom

Check operation of all grease injectors (A, B and C) by visually watching the cycle indicator stem (1) while operating the central lubrication system manually. Stem (1) must move in and out once a complete lubrication cycle.

If a cycle indicator (1) does not move during a lubrication cycle, grease supply to the lubrication point of the concerned injector is interrupted.

Refer to paragraph "CORRECTIVE ACTIONS" in this section and to the separate manual "Lubrication Systems" in volume 2 binder for corrective action.

Carry out same checks on the injectors for slewing connection.



CHECK GREASE INJECTORS

Legend for illustration Z 19511

- (D) Injectors on slewing connection
- (1) Indicator stem for visual indication of injector operation
- (2) Output adjusting screw
- (3) Protection cap
- (4) Grease fitting

Check operation of all grease injectors (D) by visually watching the cycle indicator stem (1) while operating the central lubrication system manually. Stem (1) must move in and out once a complete lubrication cycle.

If a cycle indicator (1) does not move during a lubrication cycle, grease supply to the lubrication point of the concerned injector is interrupted, proceed according to paragraph CORRECTIVE ACTIONS.

NOTICE

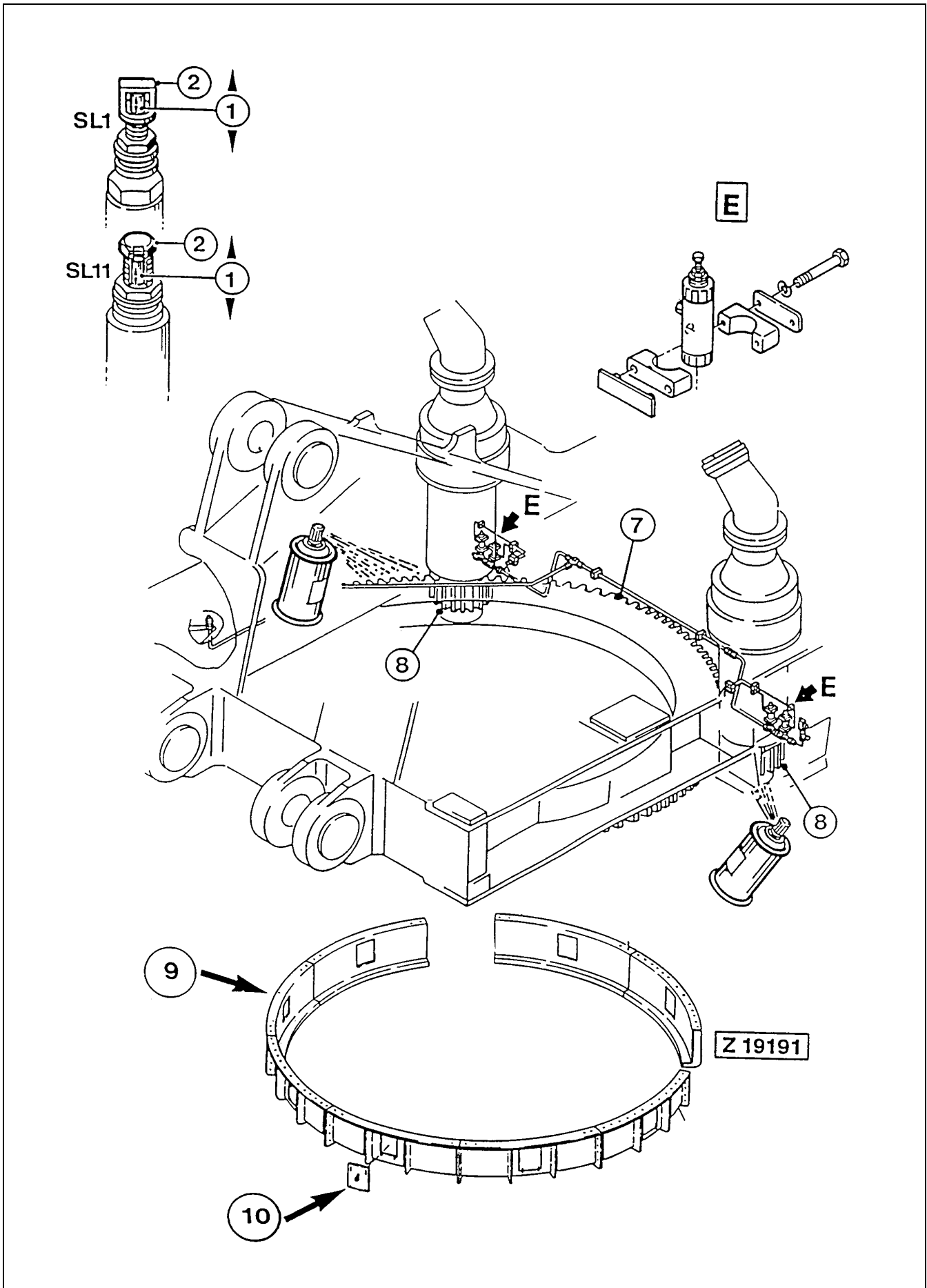
If the failure is caused through a defective central lubrication system, manually lubricate at grease fittings (4) after removal of caps (3).

CORRECTIVE ACTIONS

1. Check to make sure grease supply through inlet line is provided.
2. Disconnect the outlet line of the respective injector.
3. Operate the central lubrication system manually.
 - A -
If now the injector works, i.e. cycle indicator stem (1) moves in and out the disconnected line or the grease passage at the lubrication point is damaged or blocked by foreign matter. Repair as necessary.
 - B -
If the injector does not work, i.e. cycle indicator stem (1) stationary, replace the respective injector.
4. Operate the central lubrication system and re-check operation of the grease injectors.

REMARK

If the failure is caused through a defective central lubrication system, manually lubricate at grease fittings (4) after removal of caps (3).



SWING CIRCLE - CHECK GREASE INJECTORS

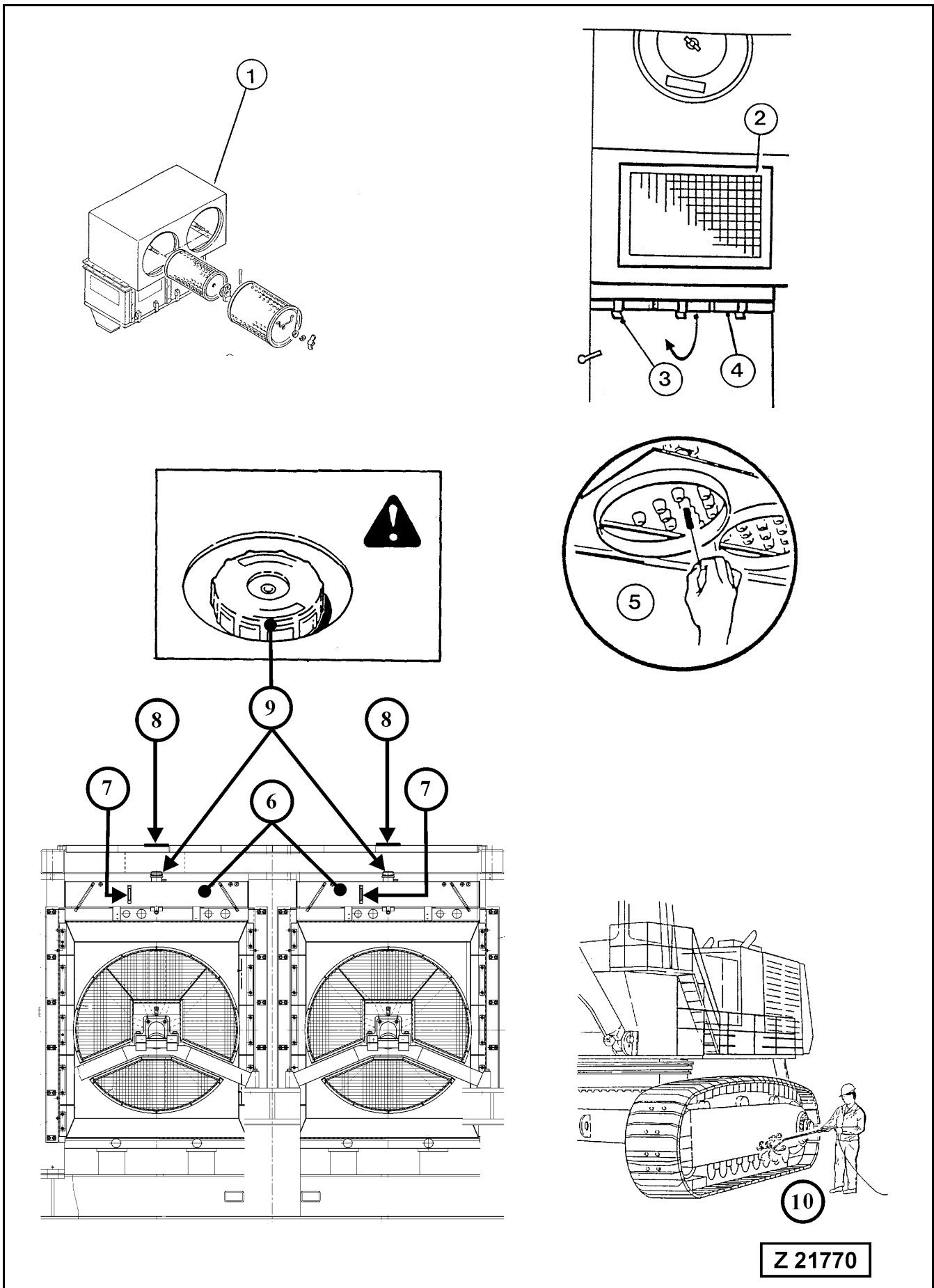
Legend for illustration Z 19191

- E - Injectors for swing circle teeth lubrication
- (1) Indicator stem for visual indication of injector operation
- (2) Output adjusting screw
- (7) Slew gear ring
- (8) Slew gear ring
- (9) Slew gear ring guard (if so equipped)
- (10) Inspection covers for slew gear ring

Check operation of injectors "E".
If necessary lubricate manually, using spray grease.

REMARK

If the machine is equipped with gear ring guard (9), remove covers (10) for gear ring inspection.



4.8.2 AIR CLEANER - CLEAN PRE-CLEANER

Clean dust cups of pre-cleaners

Legend for illust. Z 21770:

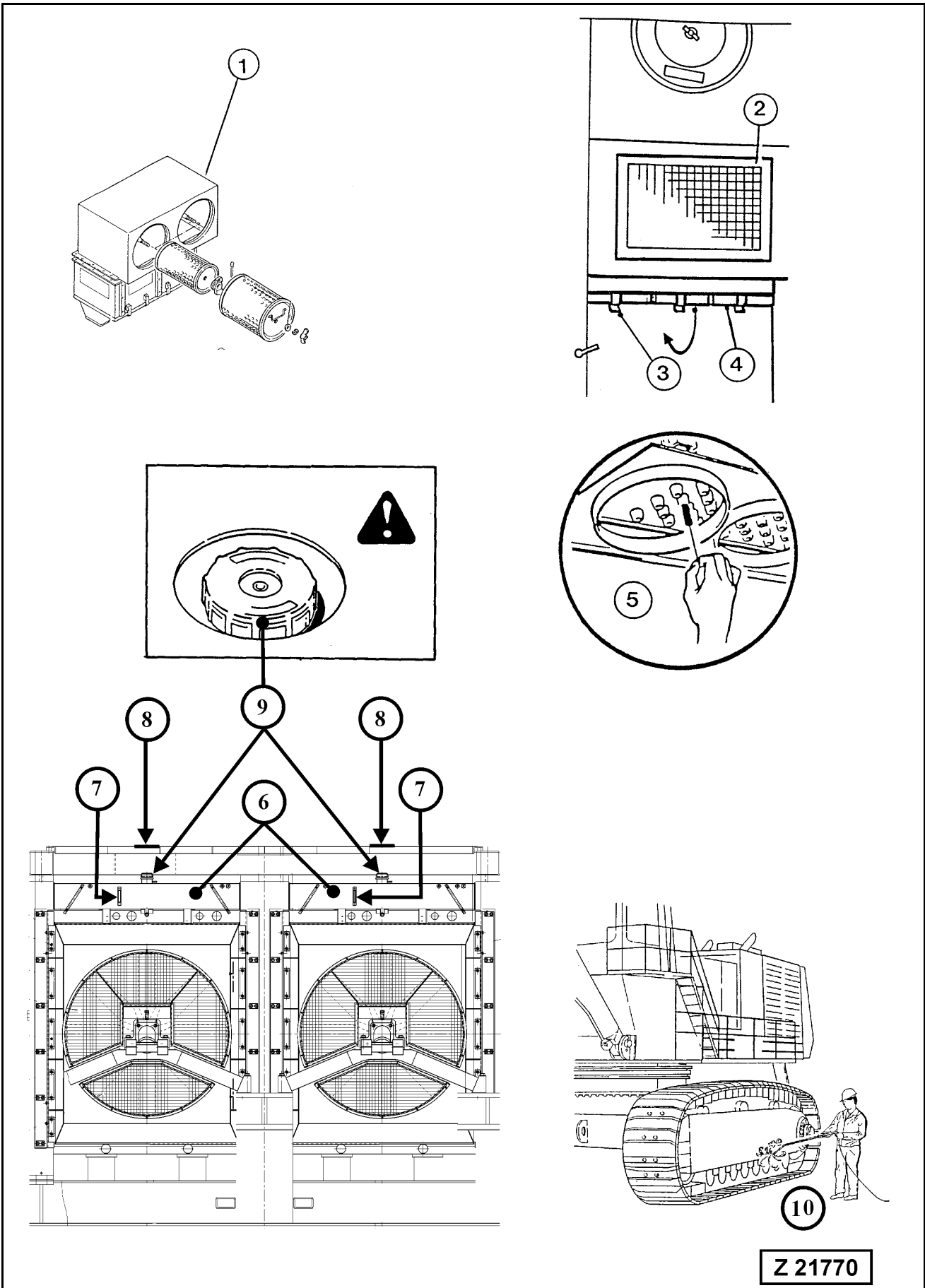
- (1) Roof mounted air cleaner units
- (2) Air intake screen
- (3) Clamps
- (4) Dust cups
- (5) Jet tubes

1. Provide suitable container for collecting the dust before opening the dust cups (4).
2. Loosen the clamps and swing down dust cups (4).
3. Remove dust from pre-cleaner dust cups.
4. Check condition of the dust cup gaskets and replace if necessary.
5. Swing back dust cups (4) to closed position and secure with the clamps provided.
6. Check air cleaner mounting parts for tight fit and security.

NOTICE

When operating the machine under very dusty conditions, check pre-cleaner jet tubes (5) for plugging. Dust plugging of tubes can be removed with a stiff fiber brush.

Never clean tubes with compressed air unless both the primary and safety elements are installed in the air cleaner. Do not steam-clean tubes.



4.8.3 RADIATORS - CHECK COOLANT LEVEL

Legend for illustration Z 21770

- (6) Coolant expansion tank of front and rear engine radiators
- (7) Coolant level sight gauge on front and rear coolant expansion tanks
- (8) Cover plates on power house roof above front and rear radiator pressure caps
- (9) Radiator pressure caps

▲ WARNING

DO NOT remove the radiator pressure cap (9), illust. Z21770 from a hot engine. Wait until the temperature is below 50°C before removing the pressure cap (9). Failure to do so can result in personal injury from heated coolant spray or steam. Press the red button on the radiator pressure cap to allow the pressure to escape. Turn the radiator cap slowly counter-clockwise to the safety stop, then continue to turn until cap is free to be removed.

The coolant level should be in the upper field of the sight gauges (7). If necessary add coolant.

REMARK

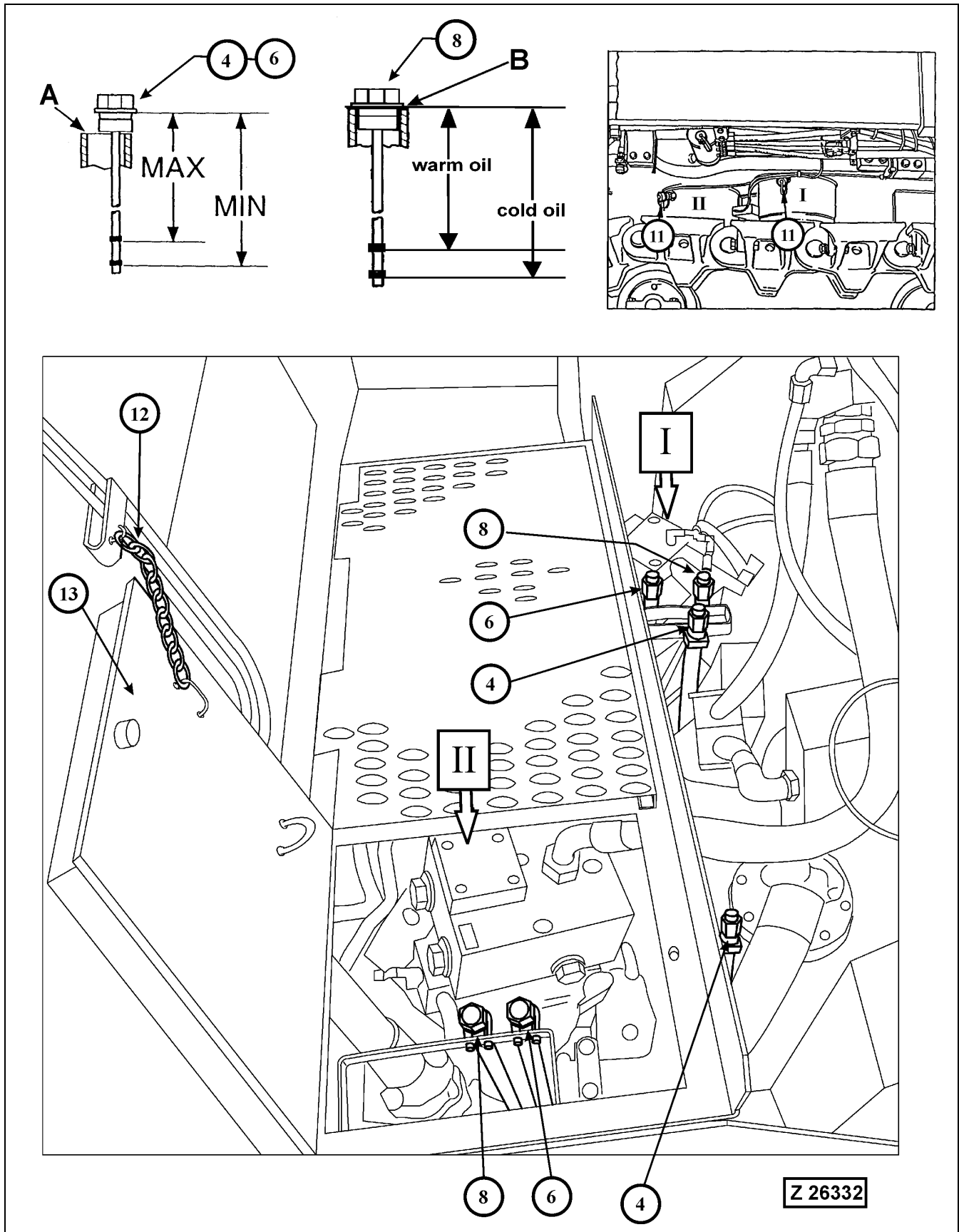
Refer to the Engine Operation and Maintenance Manual for the correct coolant composition.

4.8.4 TRACK GROUPS - CLEAN

See (10), illustration Z 21770.

Clean track groups especially during the cold season.

4.9 EVERY 50 OPERATING HOURS OR WEEKLY



4.9.1 SWING GEARS, BRAKE HOUSINGS AND MOTOR ADAPTER HOUSINGS - CHECK OIL LEVELS

REMARK

The machine can be equipped either with swing gears of manufacturer SIEBENHAAR or of manufacturer L&S. Refer to the data plate on each swing gear housing to find out the manufacturer of the swing gear.

Swing Gears manufactured by SIEBENHAAR

Legend for illustration Z26332

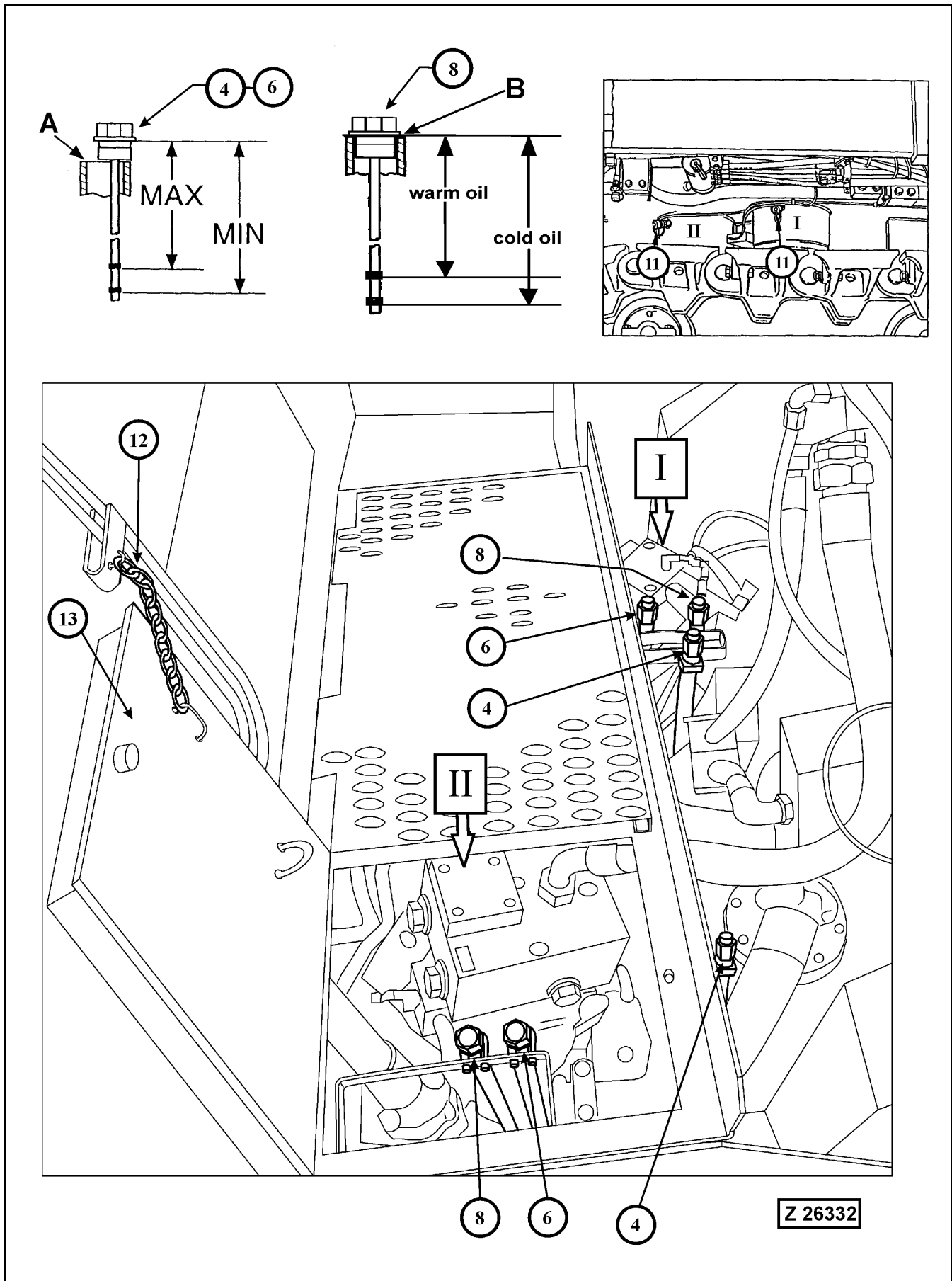
- I Front swing gear
- II Rear swing gear
- (A) Position of oil level gauge for checking the oil level in swing gears and motor adapter housings
- (B) Position of oil level gauge for checking the oil level in brake housings
- (4) Oil level gauges for swing gears
- (6) Oil level gauges for motor adapter housings
- (8) Oil level gauges for brake housings
- (11) Drain coupling or evacuation nozzle for Wiggins system
- (12) Chain to secure rear gear access hatch
- (13) Rear gear access hatch

CHECK SWING GEAR OIL LEVEL

REMARK

To access the rear swing gear (II), illust. Z26332, raise the access hatch (13) in the walkway and secure against accidental falling using chain (12).

1. Remove oil level gauge (4) of both swing gears and wipe it clean.
2. Insert the gauge but DO NOT screw in, see detail -A-.
3. Remove the gauge. The oil level should be at the upper mark of gauge (4).
4. If necessary add the specified gear oil through the filler opening.
5. Insert both gauges (4) and tighten securely
6. Remove breather filter (10) from both swing gears. Blow out with compressed air from inside to outside and reinstall.
7. Close hatch (13) and tighten the fastening bolt.



Swing Gears, Brake Housings and Motor Adapter Housings - Check Oil Levels (continued)

CHECK BRAKE HOUSING OIL LEVEL

1. Remove oil level gauge (8) of both brake housings and wipe it clean.
2. Screw in the oil level gauge, see detail -B-.
3. Remove the gauge.

REMARK

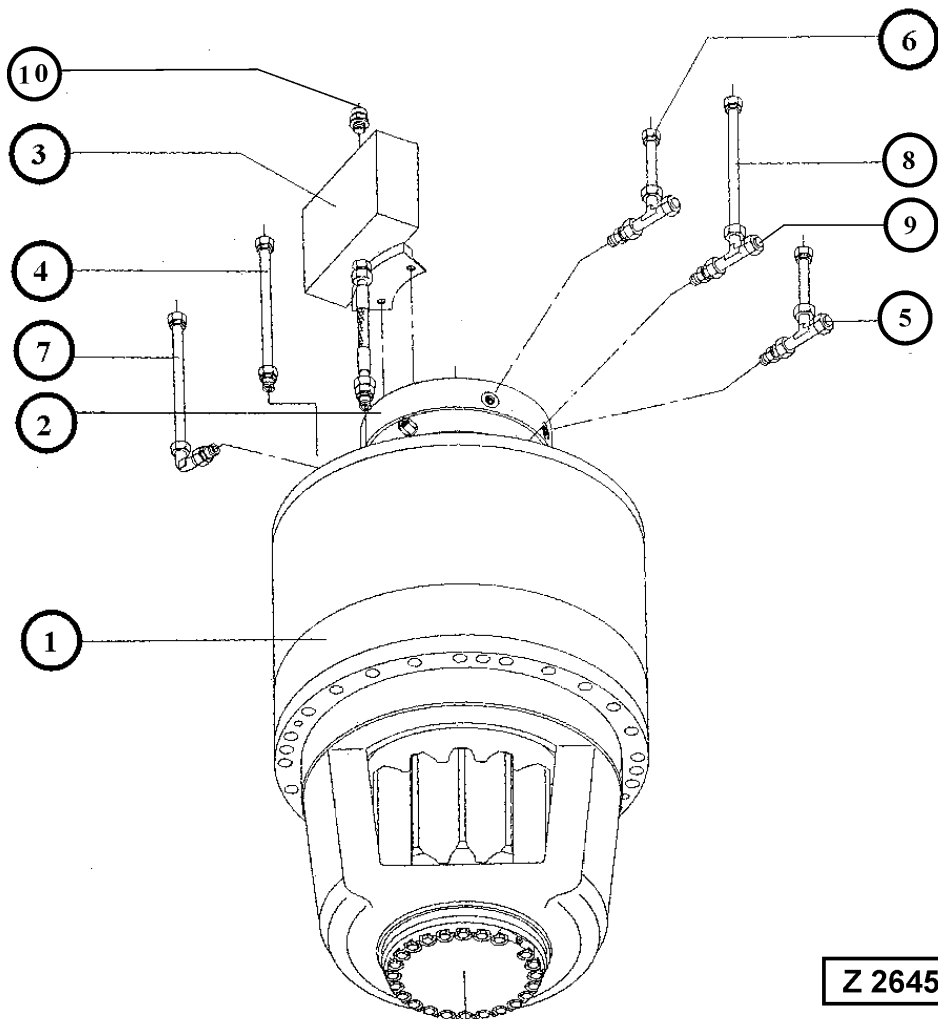
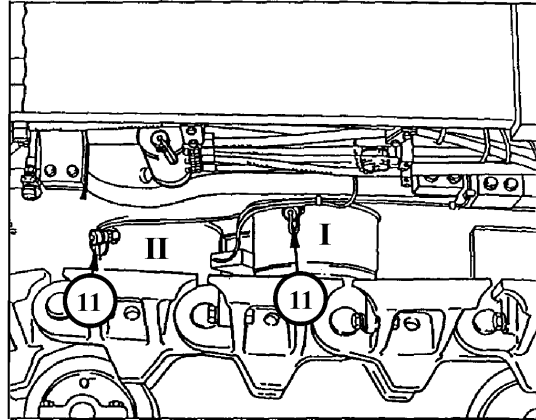
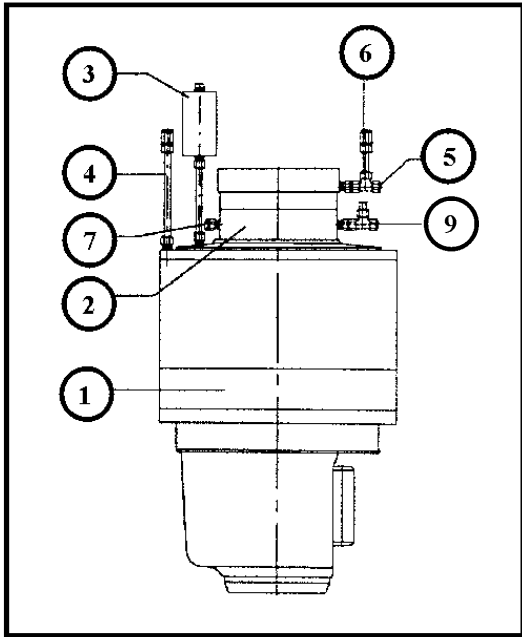
The upper mark on gauge (8) indicates the correct oil level with the oil hot.

The lower mark indicates the correct oil level with the oil cold. With cold oil, the oil level should be at the lower mark of gauge (8). With hot oil, the oil level should be just below the upper mark of gauge (8).

4. If necessary add engine oil SAE 10 or hydraulic oil HLP 22 or HLP 32 through filler opening. DO NOT overfill the brake housing, otherwise the brake could be damaged due to overheating.
5. Insert both gauges (8) and tighten securely.
6. Remove breather filter from pipe (7), see illustration Z26450 on next page, from both brake housings.
7. Blow out with compressed air from inside to outside and reinstall.

CHECK MOTOR ADAPTER HOUSING OIL LEVEL

1. Remove oil level gauge (6) of both housings and wipe it clean.
2. Insert the gauge but DO NOT screw in, see detail -A-.
3. Remove the gauge. The oil level should be at the upper mark of gauge (6).
4. If necessary add engine oil SAE 10 or hydraulic oil HLP 22 or HLP 32 through filler opening.
5. Reinstall both oil level gauges and tighten securely.

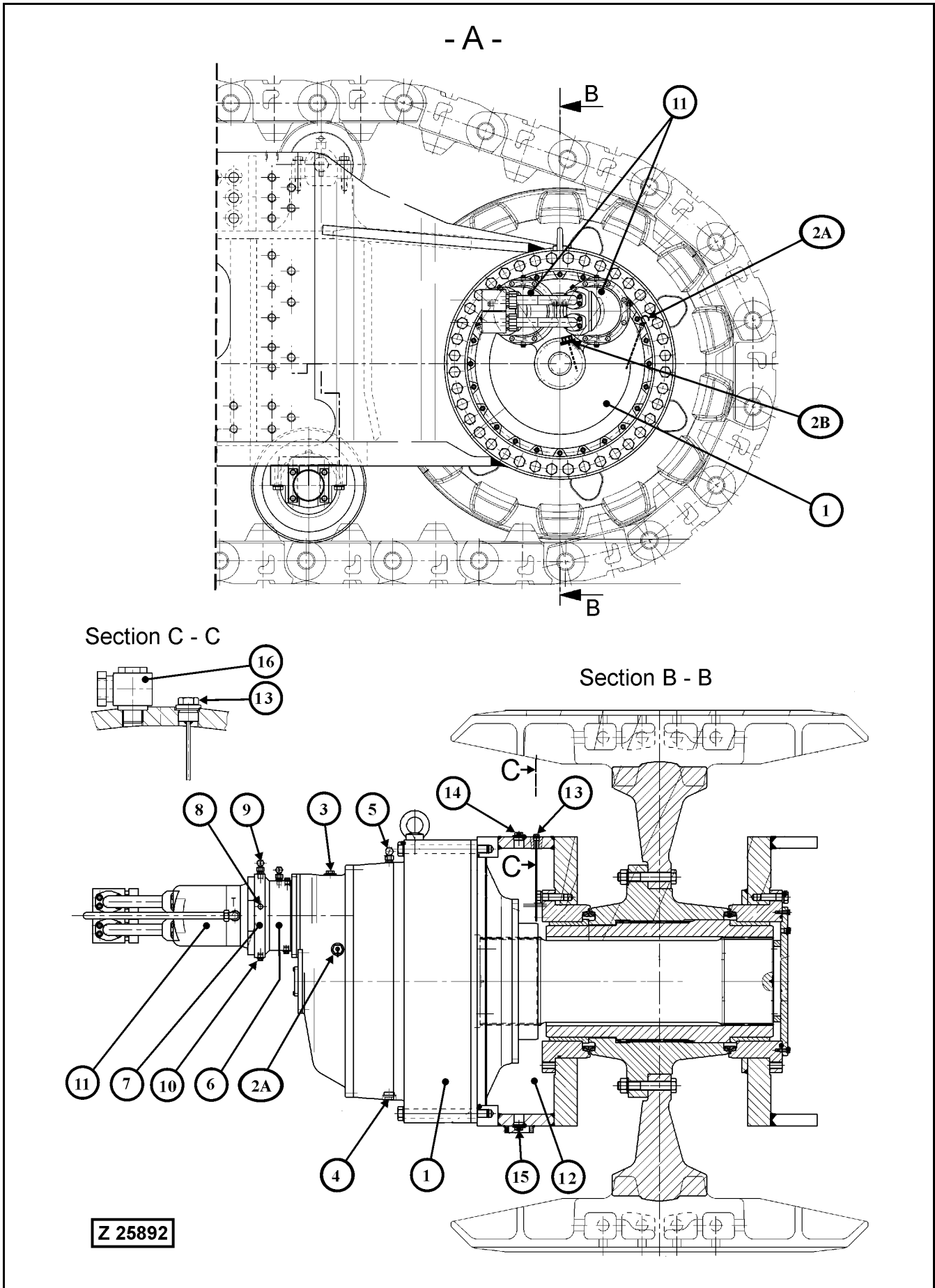


Z 26450

Swing Gears, Brake Housings and Motor Adapter Housings - Check Oil Levels (continued)

Legend for illustration Z26450

- (1) Swing gear
- (2) Brake housing
- (3) Compensator oil tank for swing gear
- (4) Oil level gauge for swing gear
- (5) Oil drain plug for motor adapter housing
- (6) Oil level gauge for motor adapter housing
- (7) Breather filter for brake housing
- (8) Oil level gauge for brake housing
- (9) Oil drain plug for brake housing
- (10) Breather filter for swing gear
- (11) Drain coupling or evacuation nozzle for Wiggins system



4.9.2 TRAVEL GEARS, MOTOR ADAPTER HOUSINGS AND FINAL DRIVES CHECK OIL LEVELS

Legend for illustration Z25892

- A - View of the RH Final drive. The configuration of the LH Final drive is the same.

(1) Travel gear

(2A) Oil level gauge on gears made by **L&S**

(2B) Oil level gauge on gears made by **ZOLLERN**

(3) Oil filler plug

(4) Oil drain plug

(5) Connector for breather filter line. The breather filter is located inside the center frame, see illustration Z25243 on page 319.

(6) Travel brake housing

REMARK

The travel gear brakes are dry type multiple disk brakes. DO NOT fill the housings with oil.

(7) Motor adapter housing

(8) Oil level plug

(9) Connector for breather filter line, the breather filter is located inside the center frame, see illustration Z25243 on page 319. The port of connector (9) is also used as oil filler opening.

(10) Oil drain plug

(11) Hydraulic motors

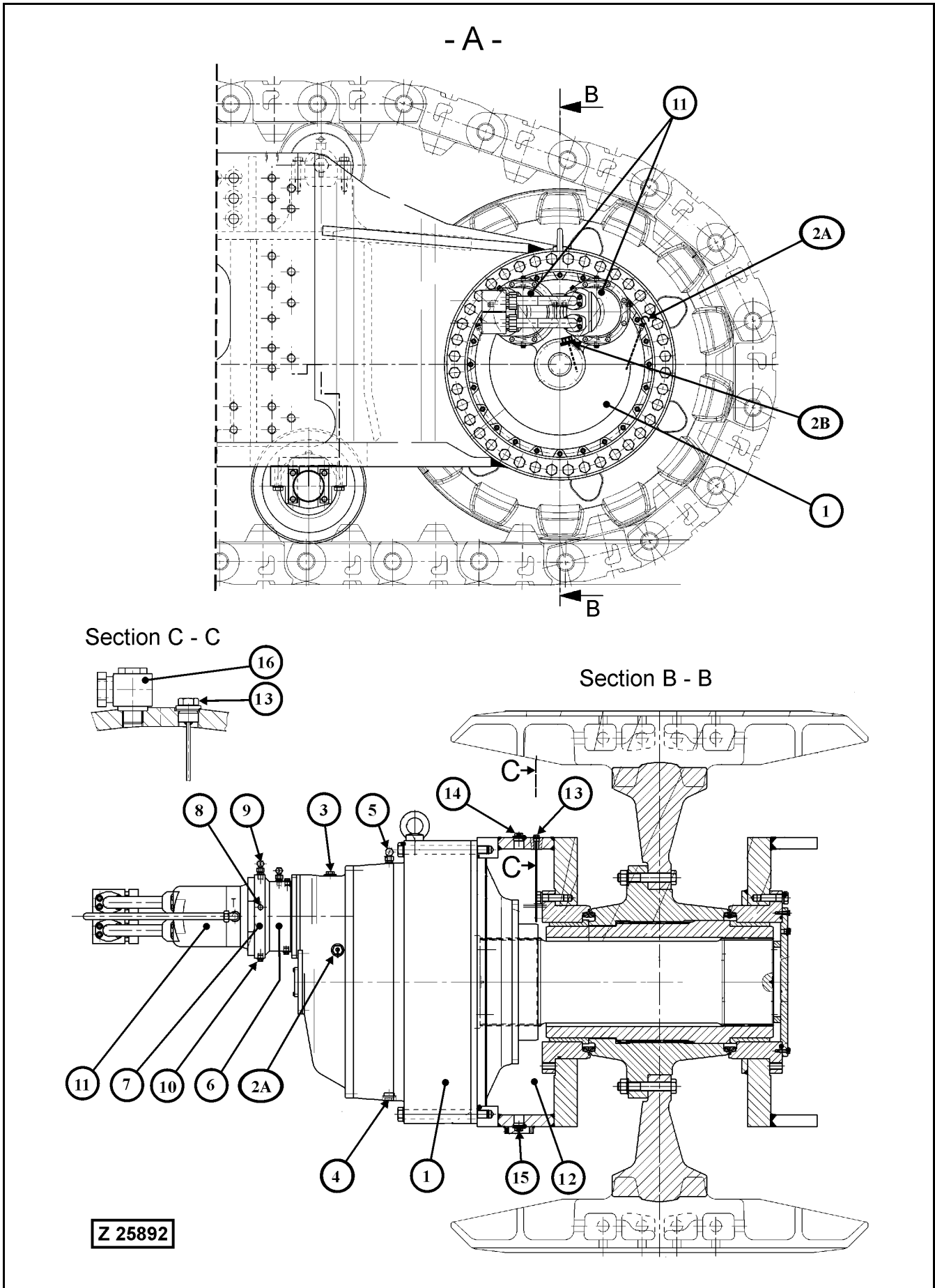
(12) Final drive housing contains the lubricating oil for sprocket bearing lubrication.

(13) Oil level gauge

(14) Oil filler plug

(15) Oil drain plug

(16) Connector for breather filter line, the breather filter is located inside the center frame, see illustration Z25243 on page 319.



TRAVEL GEAR BOX - CHECK OIL LEVEL

Illustration Z25892:

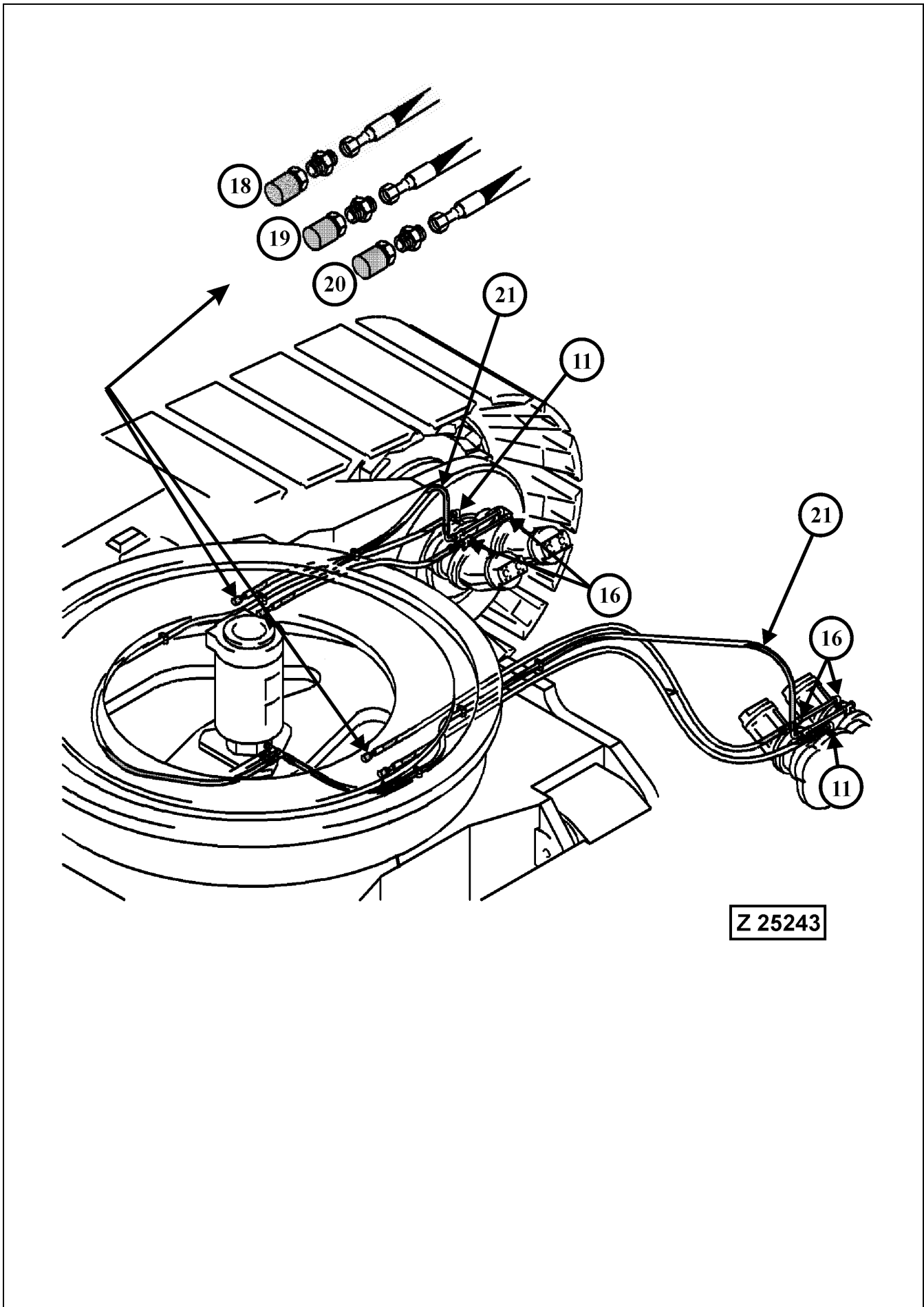
Remove oil level gauge (2A) or (2B) and wipe it clean. Insert the gauge and remove again. Oil level should be at the upper mark of gauge (2A) or (2B). If necessary add oil through filler opening (3). Insert gauge (2A) or (2B) and filler plug (3) and tighten securely. Check breather filter (18), illustration Z25243 on page 319 for restriction. If necessary, remove breather filters, blow out with compressed air from inside to outside and reinstall.

MOTOR ADAPTER HOUSINGS - CHECK OIL LEVEL

Check oil level by removing oil level plugs (8). Oil level should be at lower edge of openings (8). If necessary, remove connector (9) for breather filter line and add oil through filler opening. Install level plugs (8) and screw in breather filter line connectors (9). Check breather filter (19), illustration Z25243 on page 319 for restriction. If necessary, remove breather filters, blow out with compressed air from inside to outside and reinstall.

FINAL DRIVE HOUSING - CHECK OIL LEVEL

Remove oil level gauge (13) and wipe it clean. Screw in the gauge and remove again. Oil level should be at the upper mark of gauge (13). If necessary add oil through filler opening (14). Insert gauge (13) and filler plug (14) and tighten securely. Check breather filter (20), illustration Z25243 on page 319 for restriction. If necessary, remove breather filters, blow out with compressed air from inside to outside and reinstall.

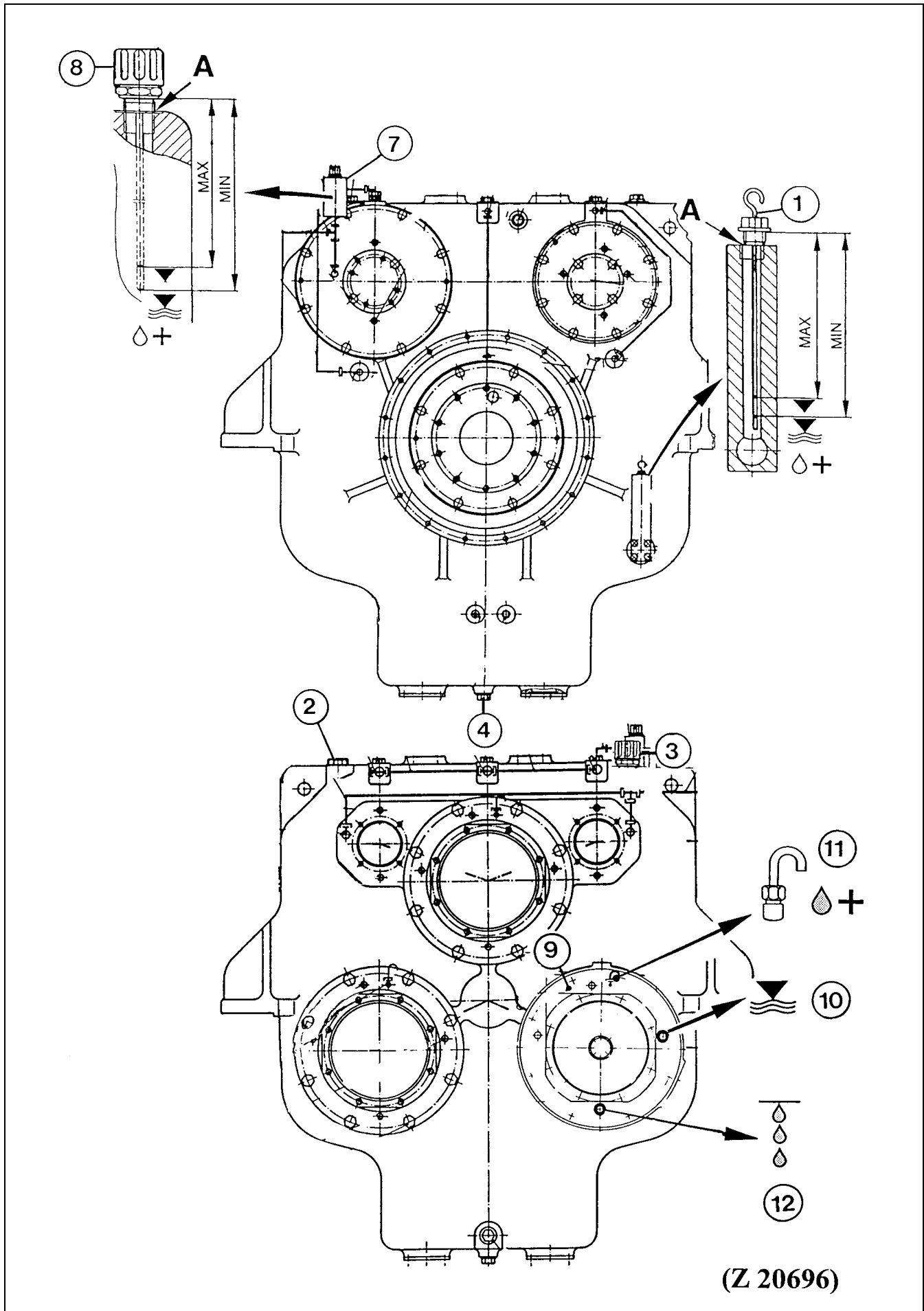


TRAVEL GEARS, MOTOR ADAPTER HOUSINGS AND FINAL DRIVES - CHECK BREATHER FILTERS

Legend for illustration Z25243

- (11) Connector on travel gear box for breather filter (18)
- (16) Connectors on motor adapter housing for breather filter (19)
- (18) Breather filters for travel gears
- (19) Breather filters for motor adapter housings
- (20) Breather filters for final drives
- (21) Pilot oil pressure hydraulic lines for releasing the parking brakes

Check the six breather filters(18, 19 and 20), located inside the center frame, for restriction. If necessary, remove breather filters, blow out with compressed air from inside to outside and reinstall.



4.9.3 PTO's (PUMP DISTRIBUTOR GEARS) AND OIL RESERVOIR - CHECK OIL LEVEL

Legend for illustration Z 20696

- (1) Oil level gauge
- (2) Oil filler plug
- (3) Breather filter
- (4) Oil drain plug
- (7) Oil collector reservoir for adapter housings of hydraulic pumps for fan drives
- (8) Breather filter with oil level gauge
- (9) Adapter housings for main hydraulic pumps
- (10) Oil level plugs
- (11) Oil filler plug with breather pipe
- (12) Oil drain plug

PUMP DISTRIBUTOR GEARS, CHECK OIL LEVEL:

NOTICE

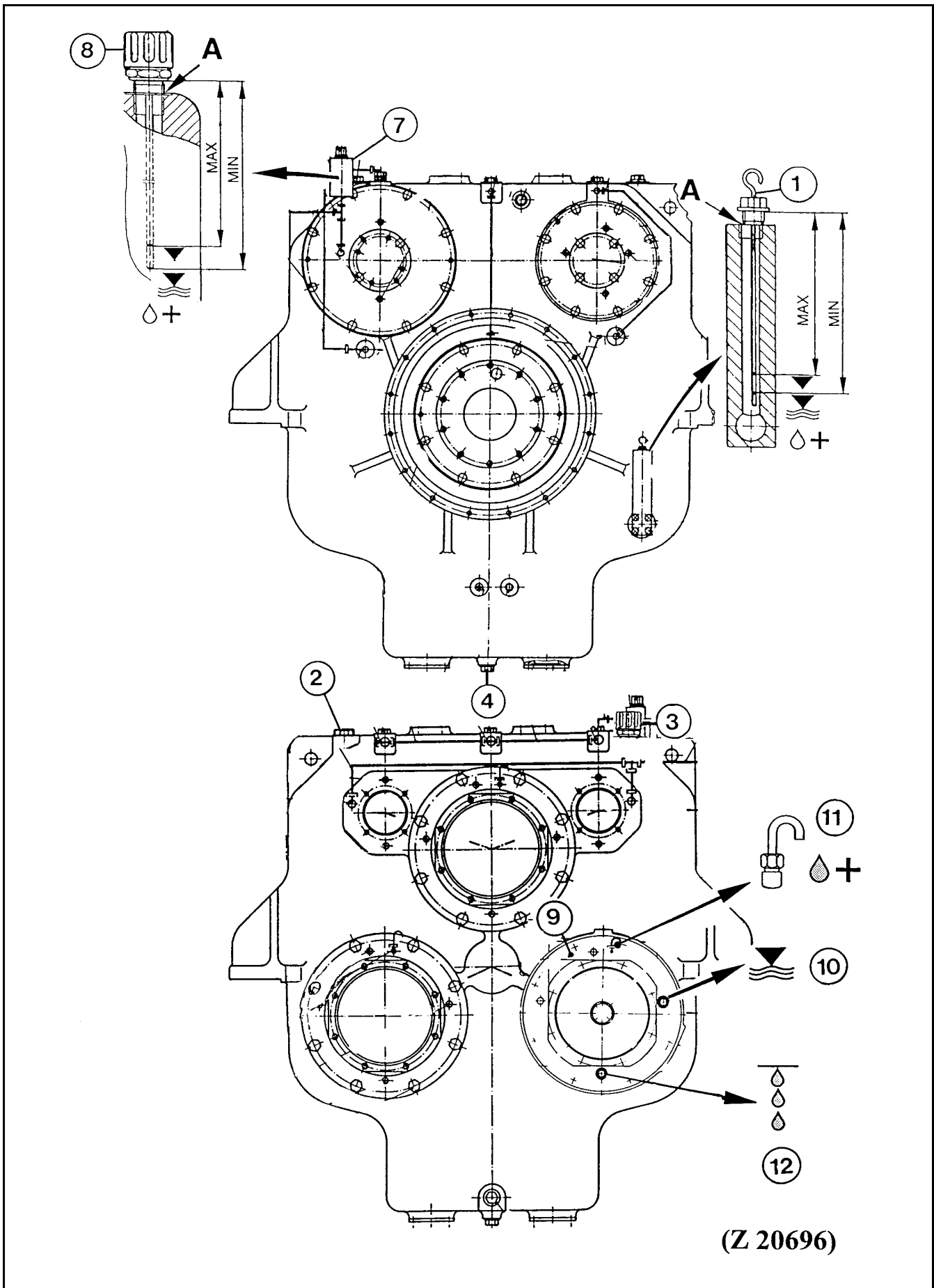
Checking of the oil level in both PTO gears must be carried out at the scheduled intervals, also on excavators equipped with an oil loss sensor. This sensor does not monitor the oil level but shuts down the excavator in case of a massive oil loss.

1. Unscrew level gauge (1) and wipe it clean.
2. Insert gauge (1), but DO NOT screw in, see detail (A).
3. Remove level gauge and read the oil level. The oil level should be between the "MIN" and "MAX" mark. If necessary, add oil through filler opening (2) up to the "MAX" mark on gauge (1).

REMARK

If the oil level is above the "MAX" mark, drain the oil down until the oil level is at the "MAX" mark. Too much oil in the pump distributor gear will cause aeration of the oil.

4. Insert gauge (1) and tighten securely. Remove breather filter (3). Blow out with compressed air from inside to outside and reinstall.



OIL COLLECTOR RESERVOIR - CHECK OIL LEVEL.

1. Unscrew level gauge (8), illustration Z 20696 and wipe it clean.
2. Insert gauge (8), but DO NOT screw in, see detail (A).
3. Remove level gauge and read the oil level.
The oil level should be between the "MIN" and "MAX" mark.
If necessary, add oil through filler opening (A) up to the "MAX" mark on gauge (8).
4. Blow out breather filter with compressed air from inside to outside. Insert gauge (8) and tighten securely.

NOTICE

If oil starts dropping out at breather (8), check oil seal of pump drive shaft for damage.

Main Hydraulic Pumps - Check Oil Level in Drive Shaft Housings

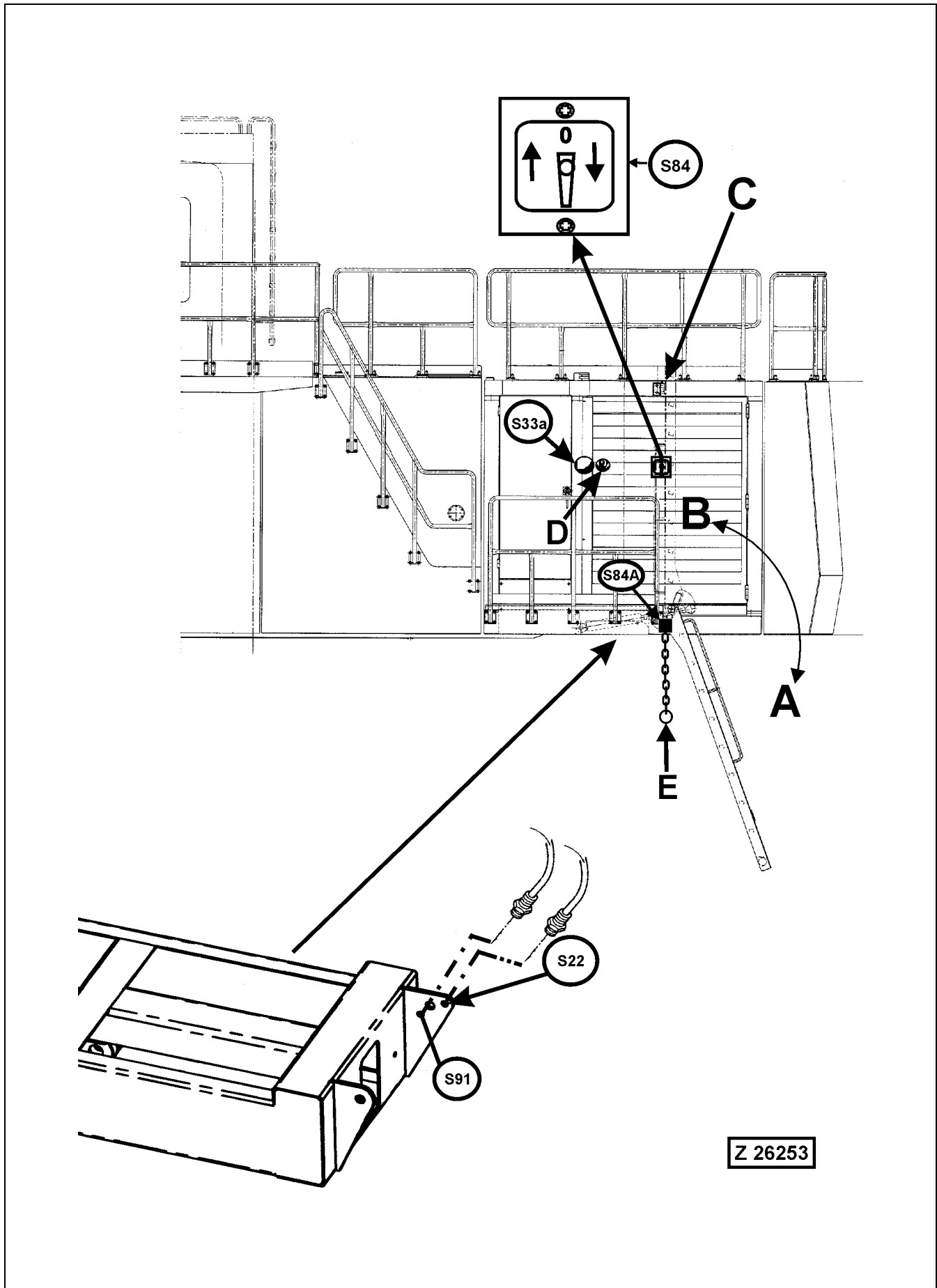
The Oil level should be at the lower edge of level plug opening (10). If necessary remove filler plug with breather pipe (11) and add Gear Oil through the filler opening up to the level opening (10).

Re-install plugs (10 and 11) and tighten securely.

If pump removal becomes necessary, drain the drive shaft housing oil by removing drain plug (12). Be sure to fill the drive shaft housing up to the filler opening (10) after mounting of the pump.

NOTICE

If oil starts dropping out at one of the breather pipes (11), the oil seal ring of the respective pump drive shaft must be checked and replaced if necessary.



Z 26253

4.9.4 HYDRAULIC ACCESS LADDER - CHECK SAFETY SENSOR

Legend for illustration Z26253

- (A) Access ladder in lowered position
- (B) Access ladder in upper position (Working position)
- (C) Stop bar
- (D) Manual actuator for fire suppression system (if so equipped)
- (E) Pull chain for emergency lowering of the access ladder

⚠ CAUTION

Use this chain only in emergency cases, when the Operator does not respond to other communication signals.

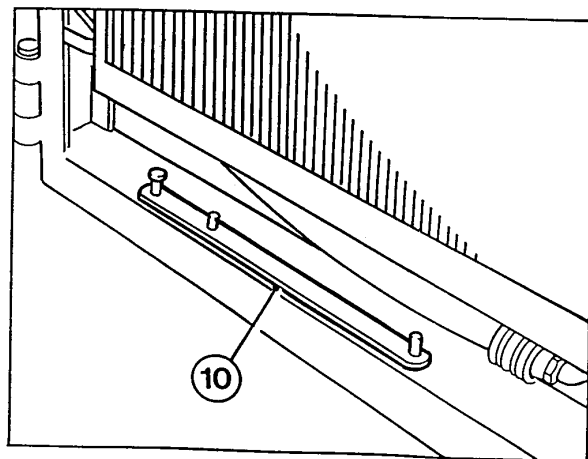
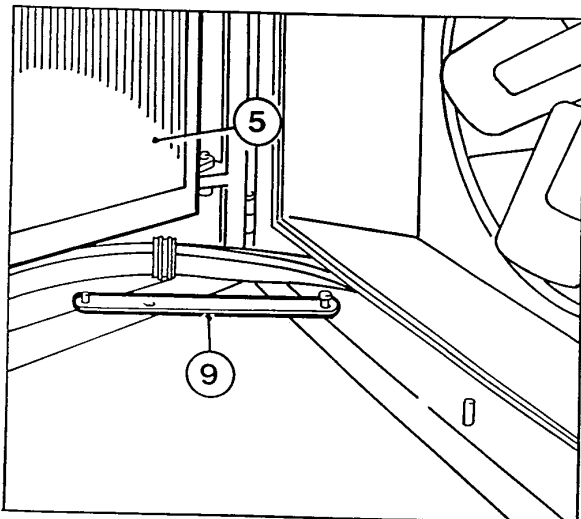
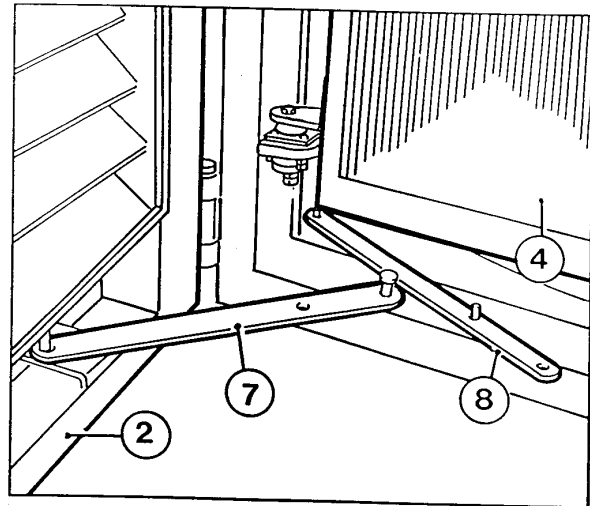
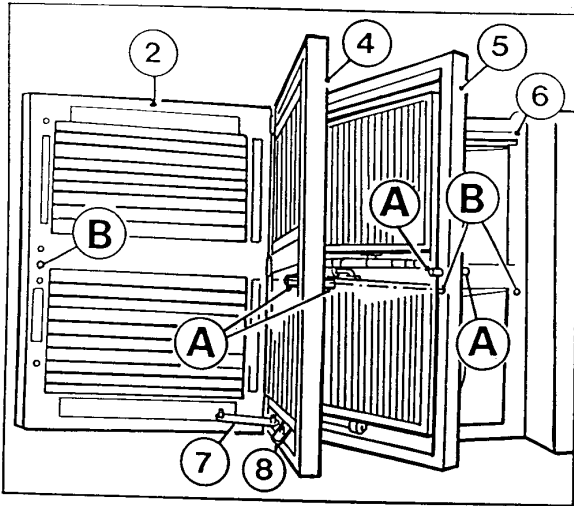
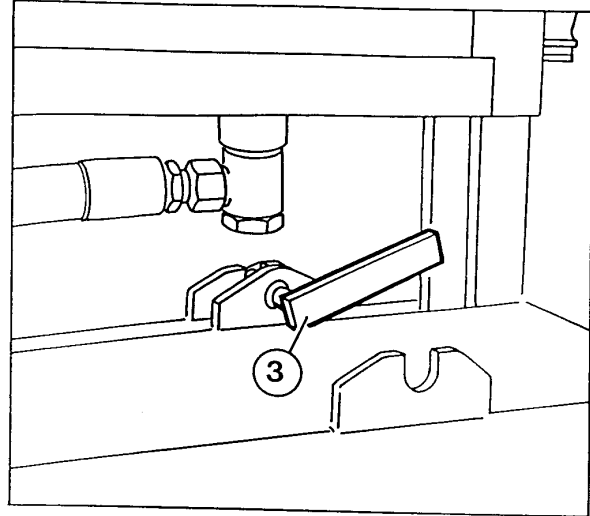
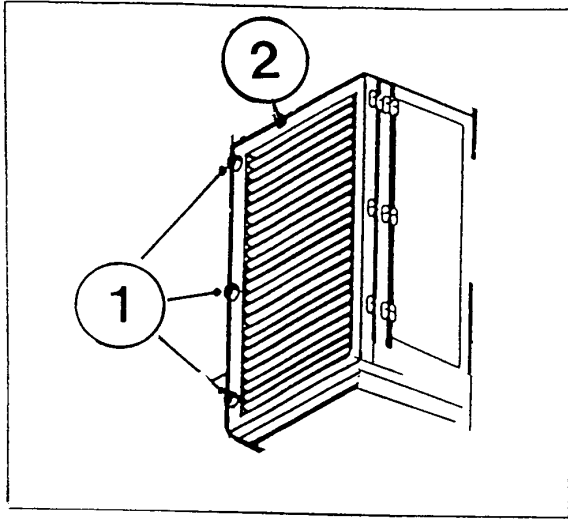
- (S84) Ladder control switch for lifting and lowering the ladder
- (S84A) Safety switch for emergency lowering of the access ladder. When the chain (E) is being pulled down with the engine running, the pilot control system is made inoperative, preventing further movements of the Shovel.
- (S22) Safety sensor, located on ladder pivot bracket
Function of sensor (S22): Cut out of the pilot control system and actuation of the hydraulic swing brake with the ladder in lowered position.
- (S91) Monitor and control sensor
Function of sensor (S91):
This sensor monitors the ladder position and controls the moving speed of the ladder. In case the sensor (S22) fails to function properly, the sensor (S91) prevents unintended movement of the ladder.
- (S33A) Emergency shutdown switch for both engines

Check Safety Sensor (S22) as follows:

With the ladder completely lowered (position A) start the engine.
Hold an iron part (screw driver) in front of sensor (S22).
The ladder must not start to move.
If the ladder starts to move, immediately remove the iron part from the sensor.

⚠ WARNING

- Inform the Service Staff about the malfunction of the ladder sensor.
- DO NOT operate the Excavator before the failure has been eliminated and the sensors function properly.



(Z 20369)

4.9.5 HYDRAULIC OIL COOLERS - INSPECT AND CLEAN IF NECESSARY

See illustration Z 20369

WARNING

- Provide adequate working platform for safe access to the hydraulic oil coolers.
- Before removing mounting bolts (1) of the hydraulic oil cooler door (2) check to make sure that all door hinges are in good condition and properly fastened on their carrier frames. If cracks are found at the welded joints of the hinges, DO NOT remove mounting bolts (1) otherwise the cooler door may become detached and fall off. Danger of accidents. Have the damage repaired as soon as possible.

CAUTION

Never clean the oil coolers with the engine running or with the cooler fans still rotating.

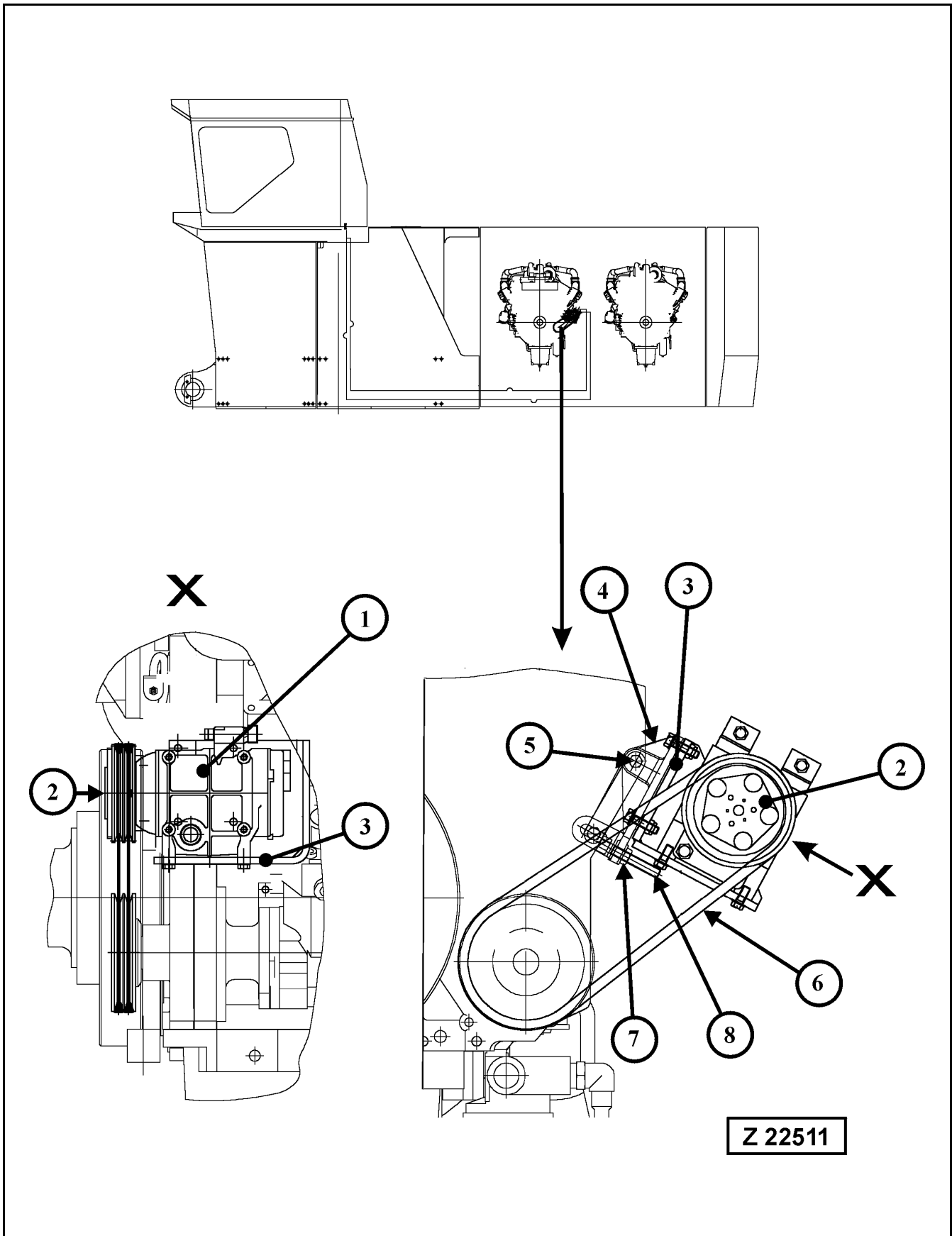
1. Loosen mounting bolts (1) and open door (2).
Details (A and B) in the illustration show LH hinged oil coolers. The description below applies also to RH hinged oil coolers.
2. Loosen fasteners (3) and swing out oil coolers (4 and 5).
3. Secure door (2) and oil coolers (4 and 5) with locking bars (7, 8 and 9).
4. Clean the oil coolers with compressed air, hot pressure water or steam cleaner. Use only clear water for cleaning the coolers. Direct the flow from inside to outside.

WARNING

When using a steam cleaner, wear safety glasses and protective clothing. Hot steam can cause serious personal injury.

5. After cleaning, swing back the oil coolers to their home position.
6. Disengage locking bars (7, 8 and 9) and fix them in storage position (10). Swing back inner cooler (5). Take care guide pin (A) fits into hole (B) of main frame (6). Secure cooler (5) with fastener (3). Swing back outer cooler (4); observe (A - B) and secure with fastener (3). Close door (2); observe (B - A). Install mounting bolts (1) and tighten securely.
7. After cleaning the oil coolers, inspect the hydraulic hose lines.

4.10 EVERY 250 OPERATING HOURS OR MONTHLY



4.10.1 AIR CONDITIONING COMPRESSOR - CHECK DRIVE BELT TENSION

WARNING

Be sure to set the maintenance safety switch to 0 position before to start the checking procedure. Refer to page 143 for the location of the maintenance safety switch. In the 0 position the engines can not be started. Secure this position by inserting a padlock into the holes of the switch. Up to three padlocks can be attached to the holes provided.

Legend for illustration Z 22511

- (1) Refrigerant compressor
- (2) Electromagnetic clutch
- (3) Compressor carrier
- (4) Swivel bracket
- (5) Pivot bolt, loosen for adjusting belt tension
- (6) Drive belts
- (7) Lock nut
- (8) Adjusting bolt for belt tension

Check tension of each belt

The tension is correct if the belt can be depressed with 110 N (25 lb.) force approximately 15 to 20 mm midway between the belt pulleys.

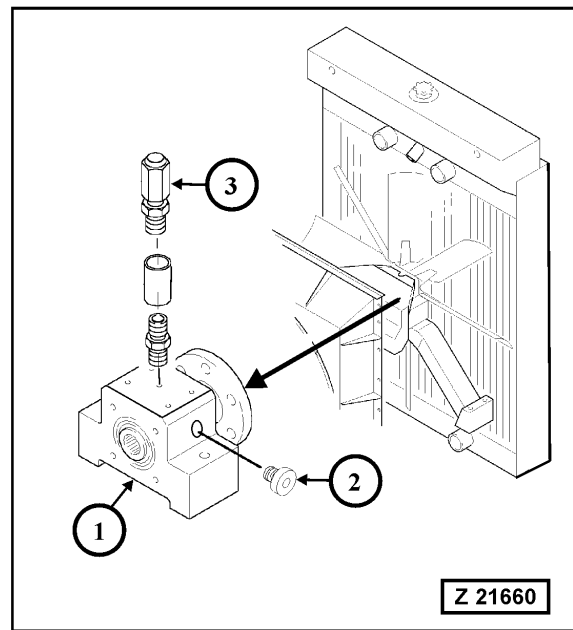
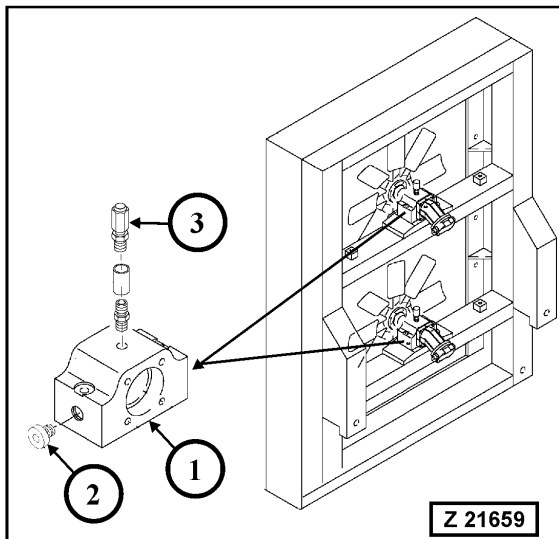
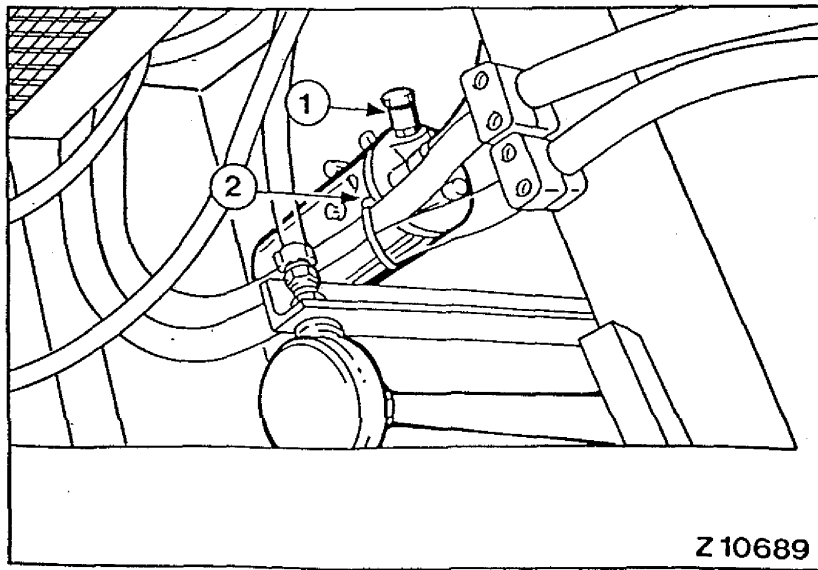
Excessive belt tension causes undue wear on the bearings. After a new belt has been in use for approximately 20 minutes, check the tension and adjust again if necessary.

NOTICE

Always replace the belts in complete sets.

Adjust belt tension

1. Loosen pivot bolt (5)
2. Loosen lock nut (7)
3. Turn adjusting bolt (8) until correct belt deflection is obtained.
Tighten lock nut (7)
4. Tighten pivot bolt (5) and check the belt adjustment.



4.10.2 SIGNAL HORN COMPRESSOR - LUBRICATE

See illustration Z 10689

The compressor (2) is located in the cab base.

Fill several drops of thin oil into the lubricator (1).

The oil must be free from resin and acid and must have the lowest solidifying-point possible (below - 40° C).

REMARK

If the Excavator is equipped with a second signal horn there is also a second compressor which has to be lubricated in the same way as the first one.

4.10.3 HYDRAULIC OIL COOLER FAN BEARINGS - CHECK FOR LEAKAGE AND CLEAN BREATHER FILTER

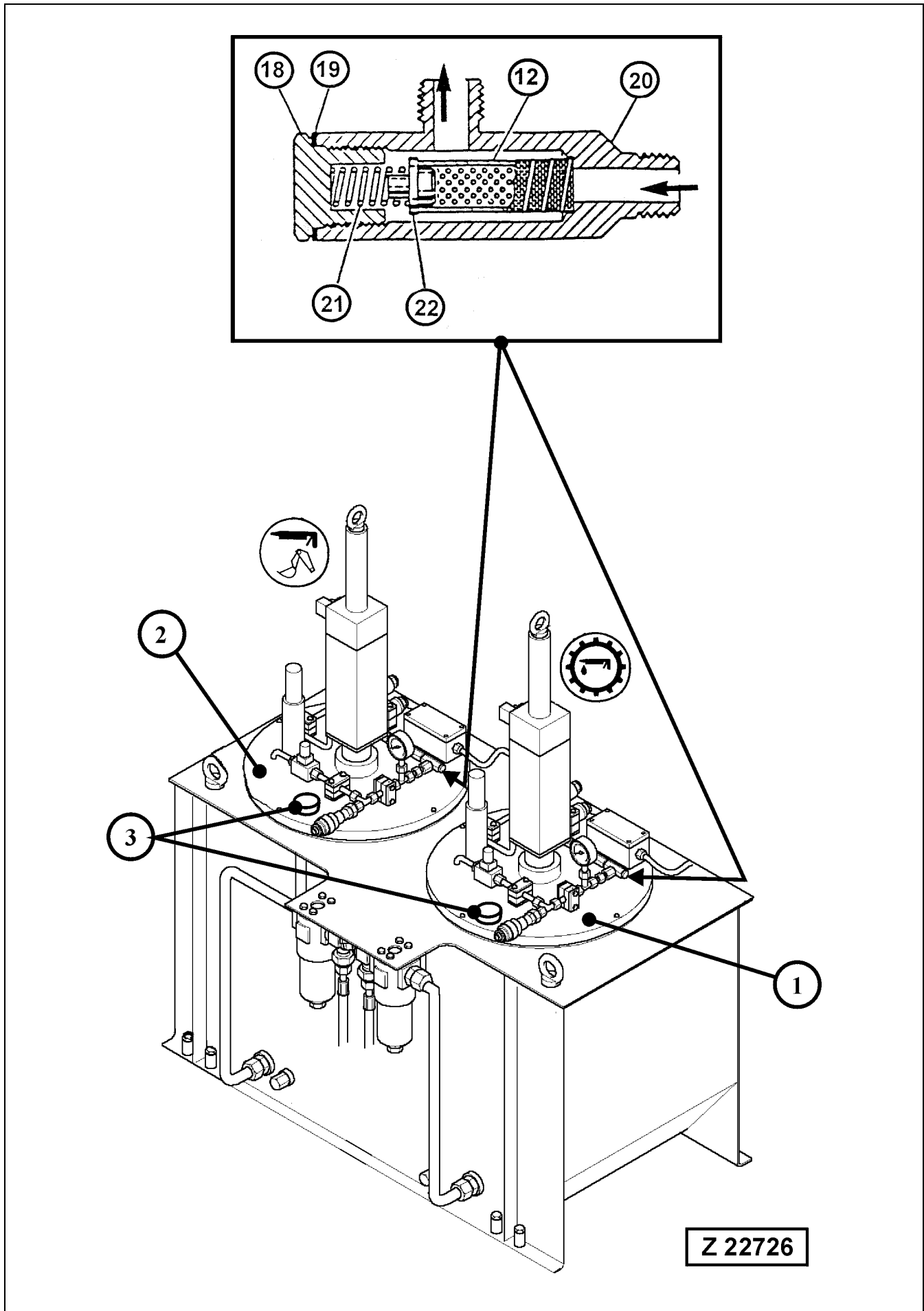
See illustration Z 21659

Check housing (1) for leakage. If leakage is found, check the oil level in the bearing housing. Remove oil level plug (2). The oil level should be at lower edge of the opening. If necessary add oil through the breather filter adapter pipe. Clean breather filter (3) with compressed air from inside to outside and install plug (2) and breather filter (3). Oil loss of the bearing housing indicates worn or damaged seal rings. To prevent damage to the fan bearings, install new seal rings.

4.10.4 RADIATOR FAN BEARINGS - CHECK FOR LEAKAGE AND CLEAN BREATHER FILTER

See illustration Z 21660

Check housing (1) for leakage. If leakage is found, check the oil level in the bearing housing. Remove oil level plug (2). The oil level should be at lower edge of the opening. If necessary add oil through the breather filter adapter pipe. Clean breather filter (3) with compressed air from inside to outside and install plug (2) and breather filter (3). Oil loss of the bearing housing indicates worn or damaged seal rings. To prevent damage to the fan bearings, install new seal rings.



4.10.5 AUTOMATIC LUBRICATION SYSTEMS - CLEAN IN-LINE GREASE FILTER AND CHECK BREATHER FILTER

Legend for illustration Z 22726

- (1) Grease container of swing circle pinion lubrication system
- (2) Grease container of central lubrication system
- (3) Breather filters

Components of In-Line-Grease-Filter:

- (12) Filter element
- (18) Plug screw
- (19) Packing ring
- (20) Filter housing
- (21) Spring
- (22) Spring guide

WARNING

Before servicing stop the engine/motor and remove ignition key in order to prevent operation of the system. Be sure to vent system pressure before removing plug (18).

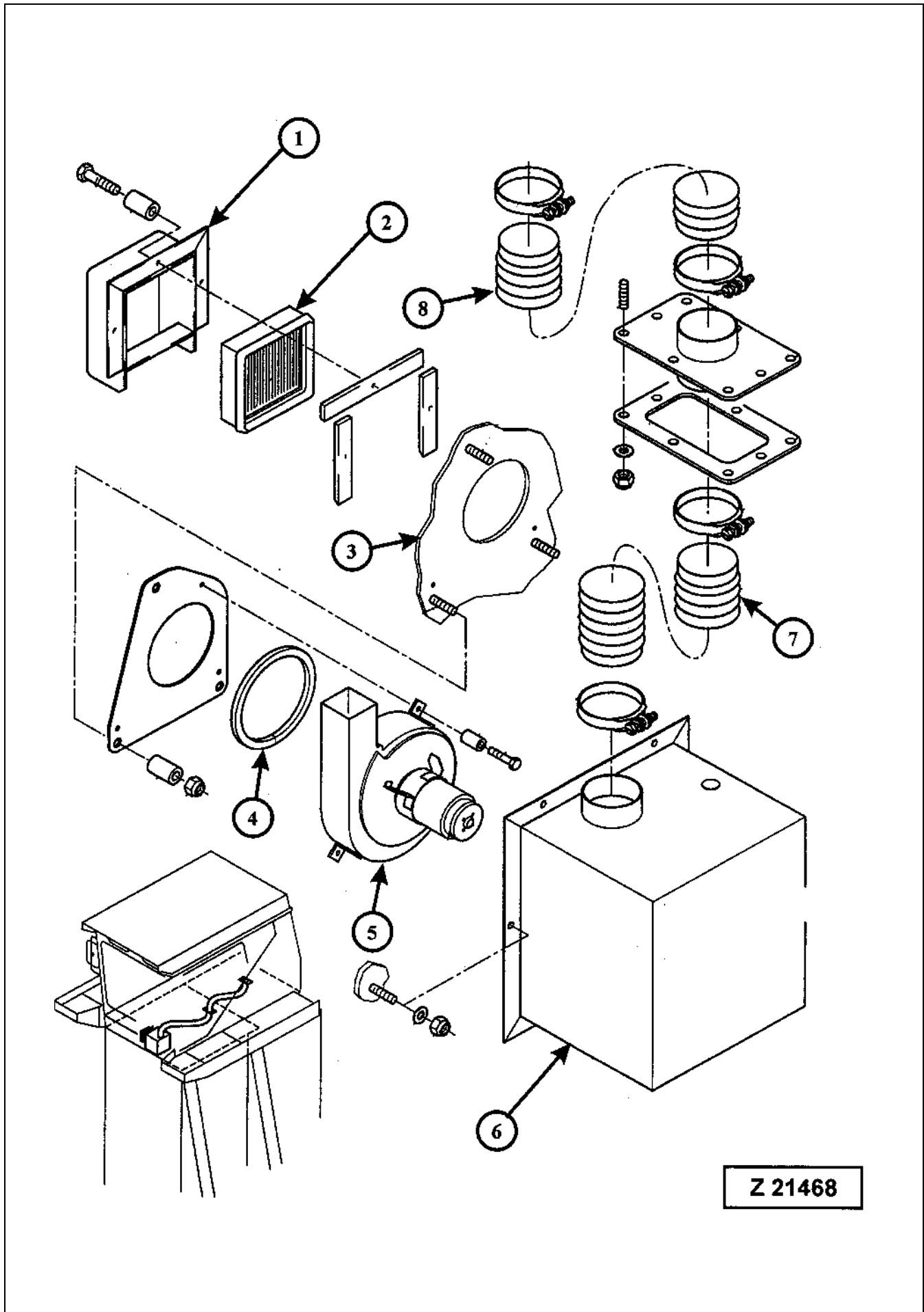
A blocked filter can disintegrate under pressure and damage the automatic lube system.

Service the in-line grease filter

1. Unscrew plug (18), illustration Z 22726, using 36 mm width wrench and remove packing ring (19).
2. Take out spring (21), spring guide (22) and element (12). Clean all parts and inspect for damage. Replace as necessary.
3. Assemble all parts according to the illustration. Make sure all sealing surfaces are clean. Take care for proper position of spring guide (22). Install plug screw (18) with new packing ring (19) and tighten with a wrench.

Check breather filter

Check condition and fastening of breather filters (3). If necessary clean the breather filter with compressed air. For removal of the breather filter it is necessary to lift off the container cover. Make sure the breather filter mounting nut inside the cover is securely tightend before lowering the cover onto the container.



4.10.6 CAB AIR CLEANER - CLEAN OR REPLACE FILTER ELEMENT

REMARK

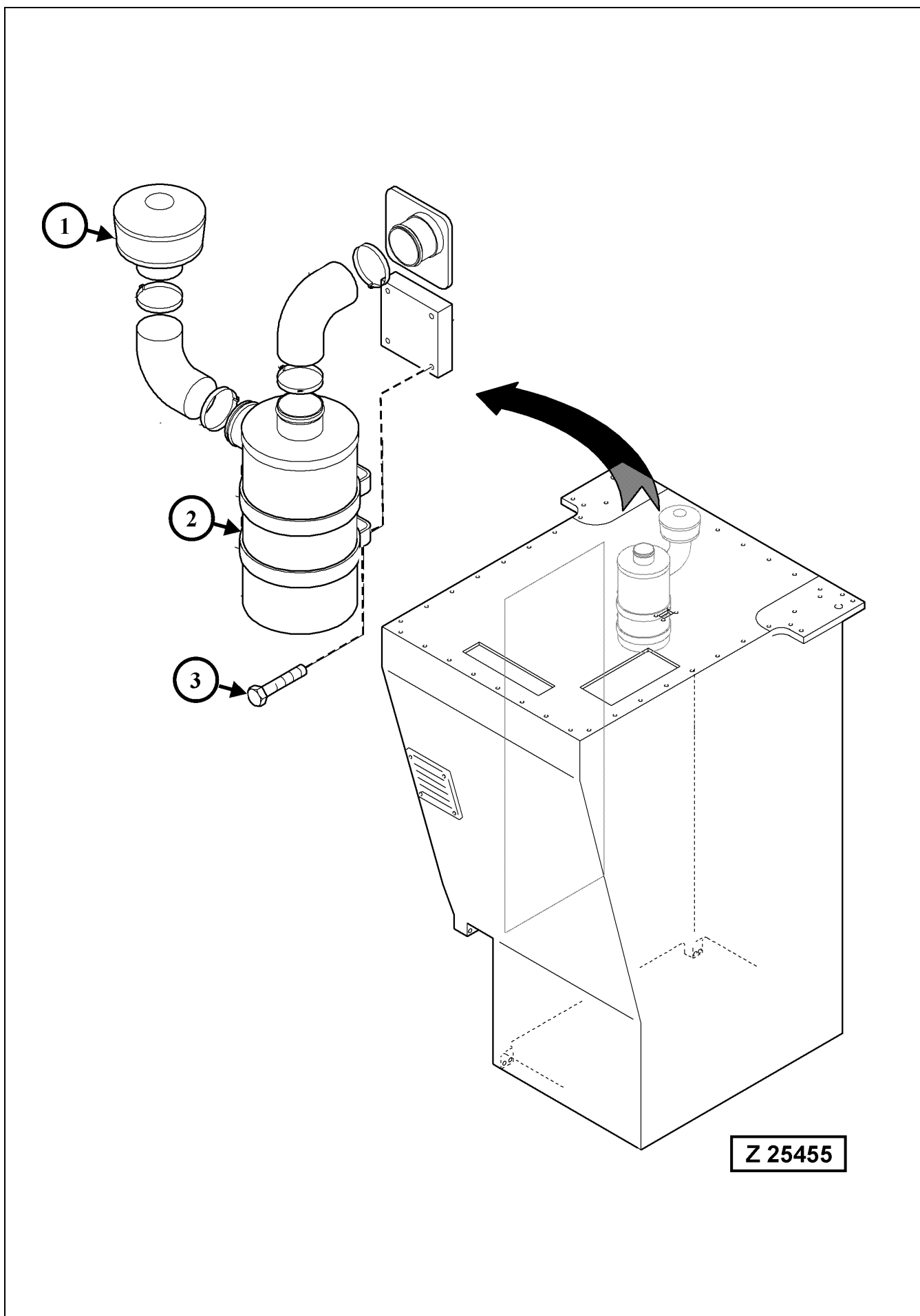
As a special equipment a heavy duty version of the cab air cleaner can be installed, see page 337 for more information.

Legend for illustration Z 21468(

- (1) Air cleaner housing located on cab base
- (2) Filter element
- (3) Cab base wall
- (4) Seal ring
- (5) Cab blower
- (6) Blower housing
- (7) Air hose to base roof
- (8) Air hose to cab bottom

Clean and inspect filter element (2) as follows:

1. Remove air cleaner housing (1).
2. Remove and inspect element (2). If any rupture, holes or damaged gaskets are discovered replace the element.
3. If the element is usable clean with compressed air from inside to outside and re-install.
4. Inspect seal ring (4), housing (6) and air hoses (7-8) for correct fastening and tightness.



CAB AIR CLEANER - CLEAN OR REPLACE FILTER ELEMENT (Heavy duty version, special equipment)

Legend for illustration Z25455

- (1) Pre-cleaner
- (2) Air cleaner housing located on cab base
- (3) Air cleaner mounting bolts

Clean pre-cleaner dust bowl

1. Check the dust level in bowl (1), if the level is near the Max. marking remove and clean the dust bowl.
2. Install dust bowl and cover.
3. Check condition of the hose and hose clamps and replace if necessary.

REMARK

When operating the machine under very dusty conditions, check pre-cleaner in shorter intervals.

Clean and inspect main filter element

1. Remove element from housing (2).
2. Clean and check resp. replace filter element. Wipe out filter housing with a clean cloth.
3. Element cleaning methods:
Clean main element by one of the following methods. Compressed air or washing. Compressed air is recommended when element will be re-used immediately because a washed element must be dried before re-use.

Compressed air:

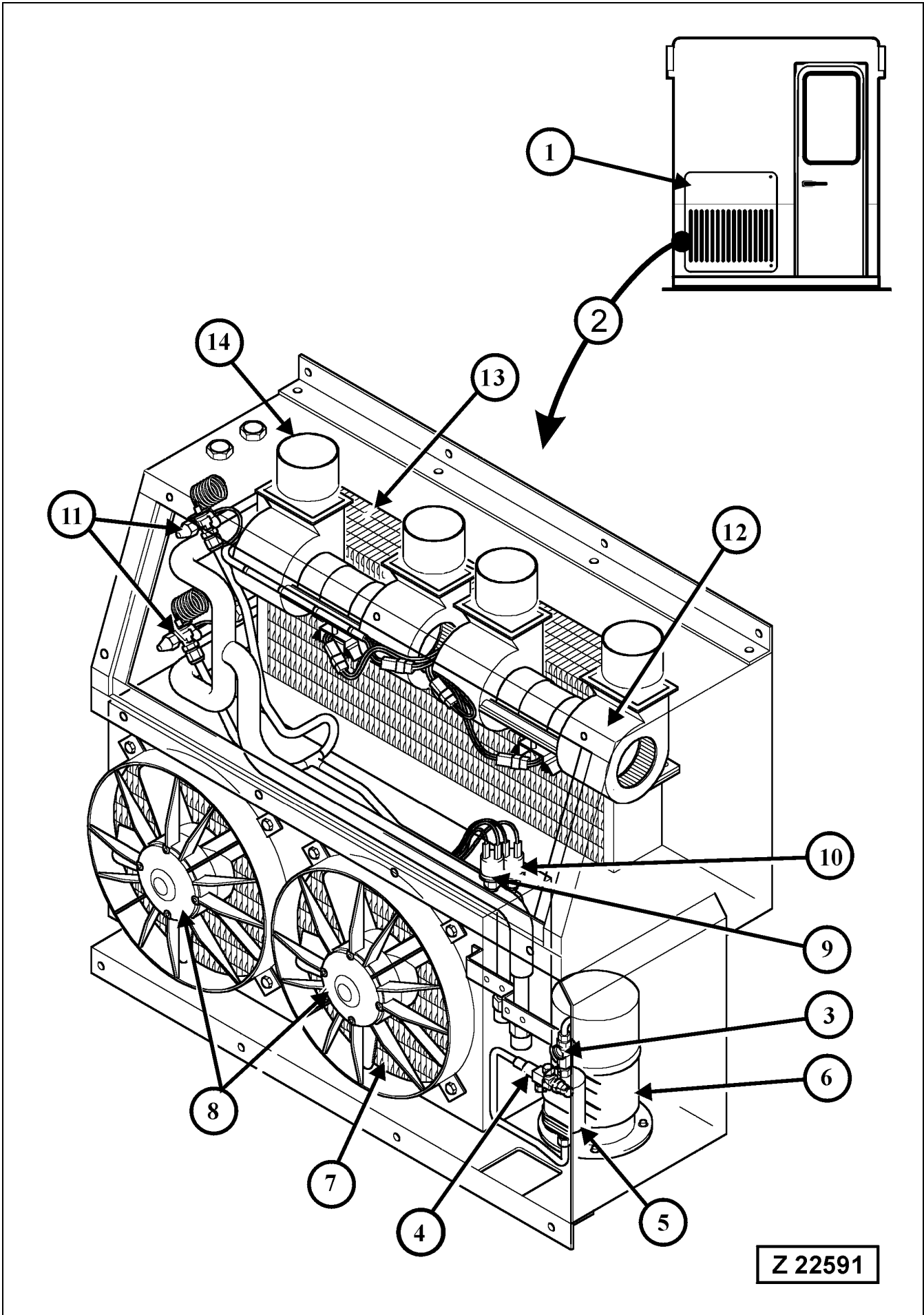
Direct air through element in the direction opposite to normal air flow through the element. Move nozzle up and down while rotating element. Keep nozzle at least one inch from pleated paper. Maximum air pressure to prevent damage of element is 100 P.S.I. (6 bar).

Washing:

Soak element 15 minutes or more in cleaning solution. See package for full instructions. Rinse until water is clear maximum water pressure 40 P.S.I. (2,5 bar). Air-dry or use warm flowing air, max. 160° F (+70° C). Do not use compressed air or light bulbs.

Replace element after 6 cleaning or annually, whichever occurs first.

4. Install filter element and bottom cover. Make sure all connections are correctly fitted and tight.



4.10.7 AIR CONDITIONING FOR OPERATOR'S CAB - CHECK REFRIGERANT LEVEL

Legend for illustration Z 22591

- (1) Air conditioner door with filter mat
- (2) Air conditioner unit
- (3) Sight glass for checking refrigerant filling
- (4) Shut-off valve on dryer cartridge
- (5) Dryer cartridge
- (6) Refrigerant collector reservoir
- (7) Condenser
- (8) Condenser blower
- (9) Low pressure switch
- (10) High pressure switch
- (11) Expansion valves
- (12) Evaporator blower
- (13) Evaporator
- (14) Cool air outlets

Checking the refrigerant level:

Switch on air conditioning equipment and run at maximum capacity for approx. 5 minutes.

Observe inspection glass (3). A refrigerant flow loaded with bubbles or foam indicates a lack of refrigerant. In this case well equipped refrigeration specialists must check the circuit for tightness and must add the missing quantity or refrigerant. If more than 200 grams per year are lost, the oil level of the refrigerant compressor must also be checked. This is a special procedure and must be carried out by refrigeration specialists only. Isolated small bubbles in the inspection glass may be neglected.

Even with an absolutely tight equipment a certain amount of refrigerant is lost through the walls of the hoses.

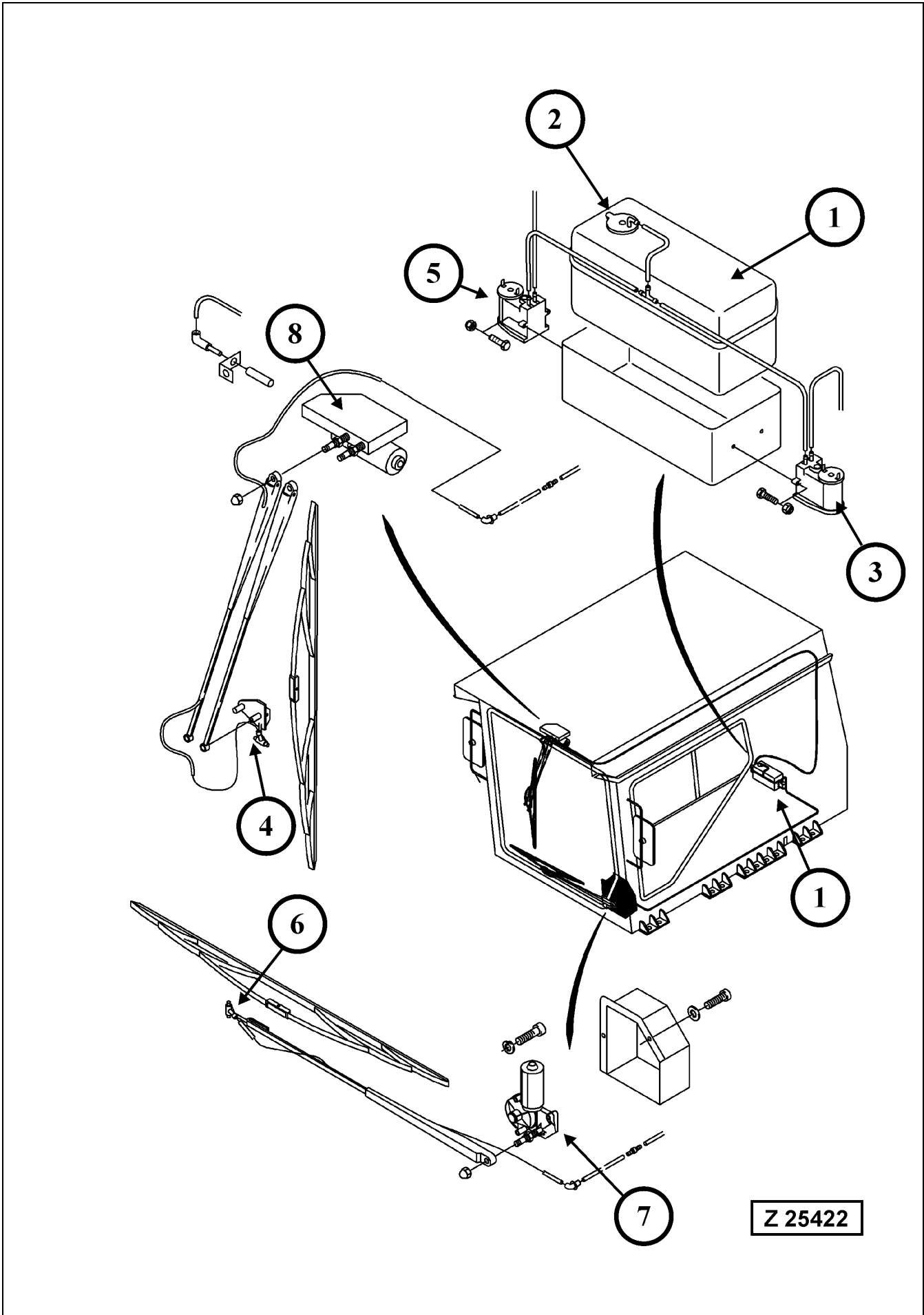
Therefore a small annual replenishment of the refrigerant quantity is normal.

The dryer cartridge (5) must be replaced after every 1000 operating hours or once a year by refrigeration specialists.

Clean the filter mats of condenser (7) and evaporator (13).

REMARK

Servicing of the air conditioning systems is restricted to workshops especially equipped for this purpose. Refer to the separate booklet "AIR CONDITIONING" in Service Literature Binder – Volume 2 for more information.



4.10.8 WINDSHIELD WASHER SYSTEM - CHECK FLUID LEVEL

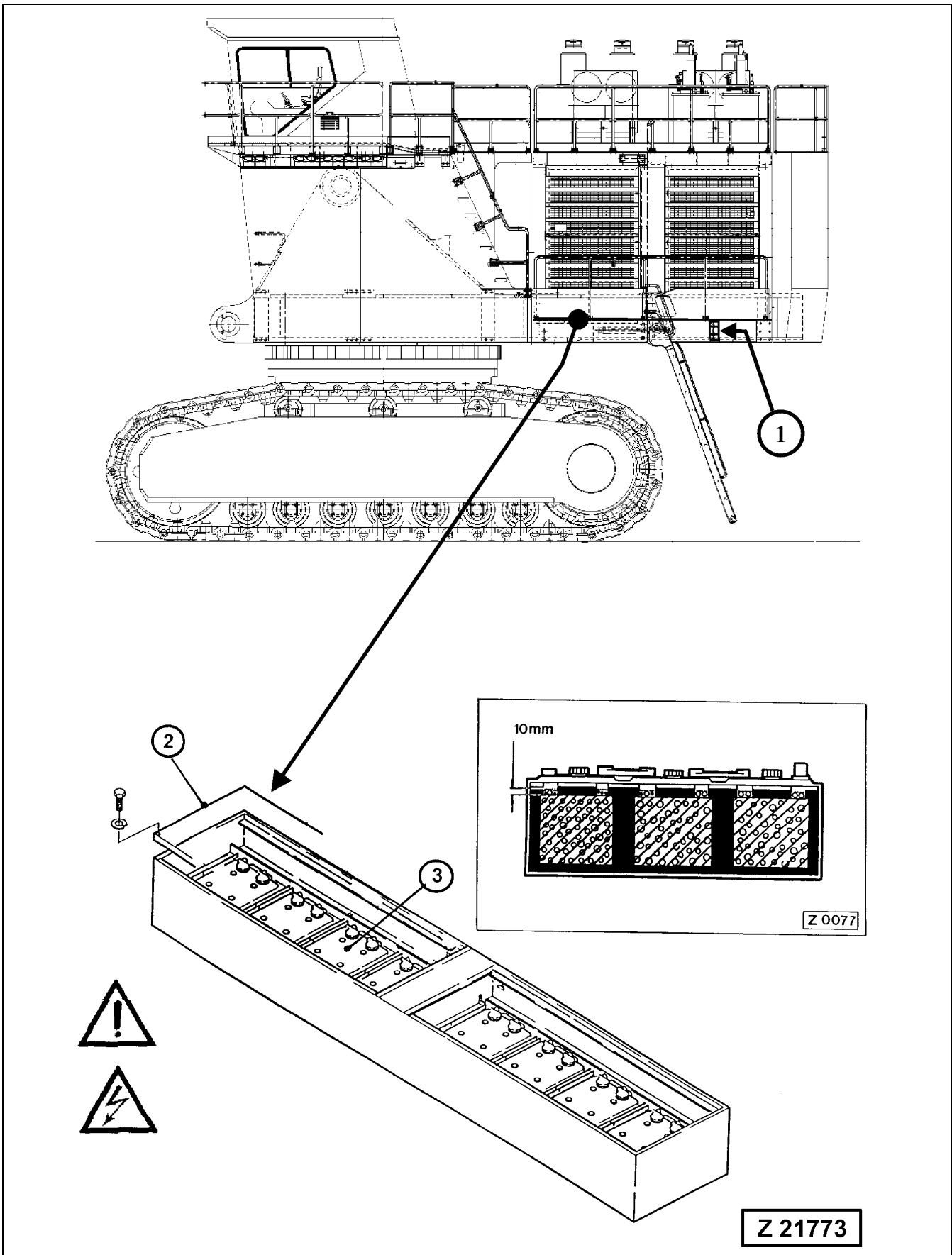
Legend for illustration Z 25422

- (1) Water reservoir for windshield washer
- (2) Filler cap with suction line
- (3) Water pump for windshield washer
- (4) Upper washer nozzle for windshield
- (5) Water pump for windshield washer
- (6) Lower washer nozzle for windshield
- (7) Wiper motor for lower windshield wiper
- (8) Wiper motor for upper windshield wiper

Fill the water reservoir (1) with clear water, add anti-freeze and cleaning agent as necessary. Filling capacity of the water reservoir is 7 liters.

Check washer and wiper system for tightness and carry out a functional test of both systems.

4.11 EVERY 500 OPERATING HOURS OR QUARTERLY



4.11.1 BATTERIES - CHECK FLUID LEVEL

See illustration Z 21773

⚠ WARNING

- **Batteries give off highly inflammable gas! Never allow sparks or open flame near the batteries!**
 - **Avoid spilling any electrolyte on hands or clothing. Repair or replace all broken wires immediately. All terminals must be clean and securely fastened; never paint connections.**
 - **DO NOT short across or ground any terminals of the batteries.**
-
-

Check electrolyte level:

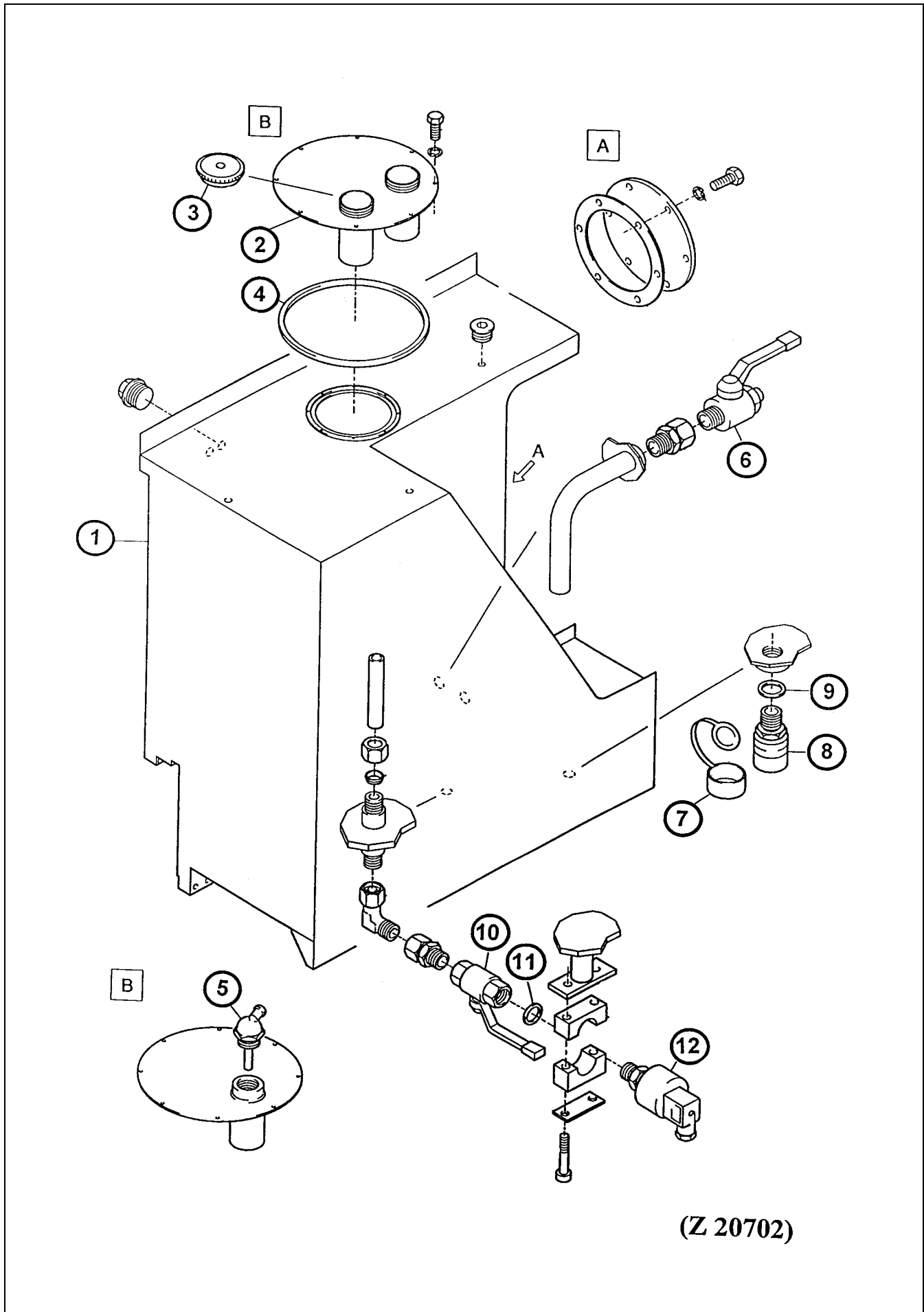
NOTICE

The batteries are located below the walkway floor in two separate boxes. To get access to the batteries remove floor plate fastening bolts and open the hinged floor plates. Secure the open floor plates against falling down with the safety chains provided.

1. Remove the two battery main switch keys (1).
2. Open floor plates (2).
3. Check electrolyte level of batteries (3) see illustr. (Z 0077).
4. If necessary remove filler and breather caps and top up with clean distilled water.
5. See that contact surfaces of battery terminals are bright. Clean if necessary and apply some vaseline to the terminal posts.

⚠ WARNING

- **Care must be taken that the batteries are not overfilled as the electrolyte will expand and overflow when the temperature rises.**
 - **On removal always disconnect the ground (-) cables first. When re-installing the batteries connect the positive (+) cables first.**
-
-



(Z 20702)

4.11.2 FUEL TANK - DRAIN CONDENSATION

Legend for illustration Z 20702

- (1) Fuel tank
- (2) Cover
- (3) Filler cap
- (4) Seal ring
- (5) Fuel tank breather valve on machines with refilling system
- (6) Main fuel shut-off cock
- (7) Protection cap for drain coupling (8)
- (8) Drain coupling
- (9) Seal ring
- (10) Shut-off cock for pressure transducer (12). Close this cock when replacing the pressure transducer (12).
- (11) Seal ring
- (12) Pressure transducer for level indication

⚠ WARNING

DO NOT smoke or use an open flame when working around inflammable fuels.

Drain Water and Sediments from Fuel Tank.

Open the hinged cover below the fuel tank.
Attach drain hose and open drain coupling (8). Collect outflowing sediments in a suitable container.

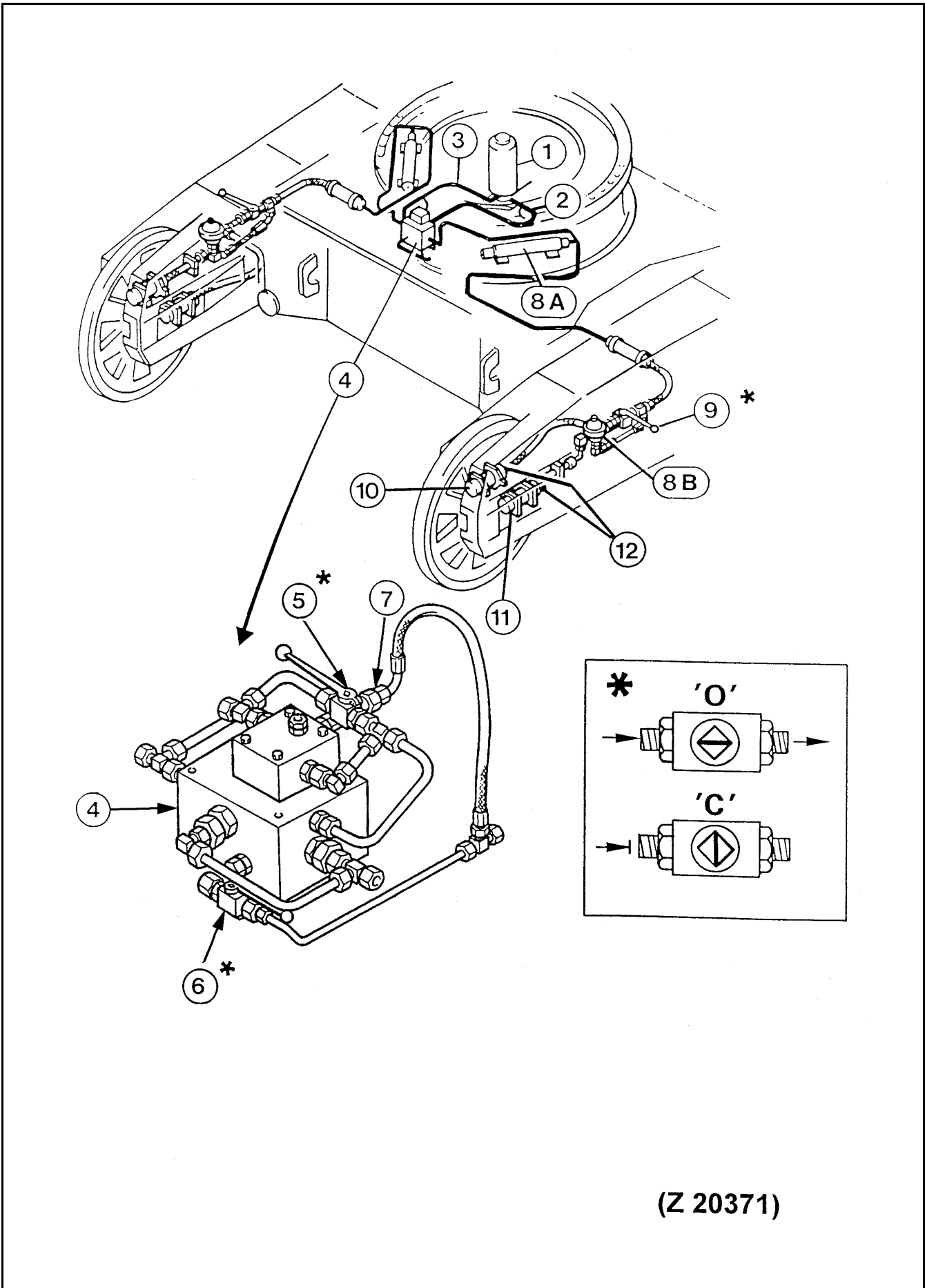
Servicing the Fuel System.

When servicing the fuel system close fuel shut-off cock (6).

NOTICE

On machines equipped with a Fire Detection and Suppression System, a solenoid valve is installed in place of the shut-off cock (6).

After finishing the service, open cock (6) and vent the fuel system according to the engine maintenance manual. Check to make sure all fuel lines and connections are in good condition. Check the complete fuel system for leaks.



4.11.3 CRAWLER TRACK - INSPECTION

CHECK ADJUSTING RANGE OF GUIDE WHEELS

(Track retensioning range)

GENERAL

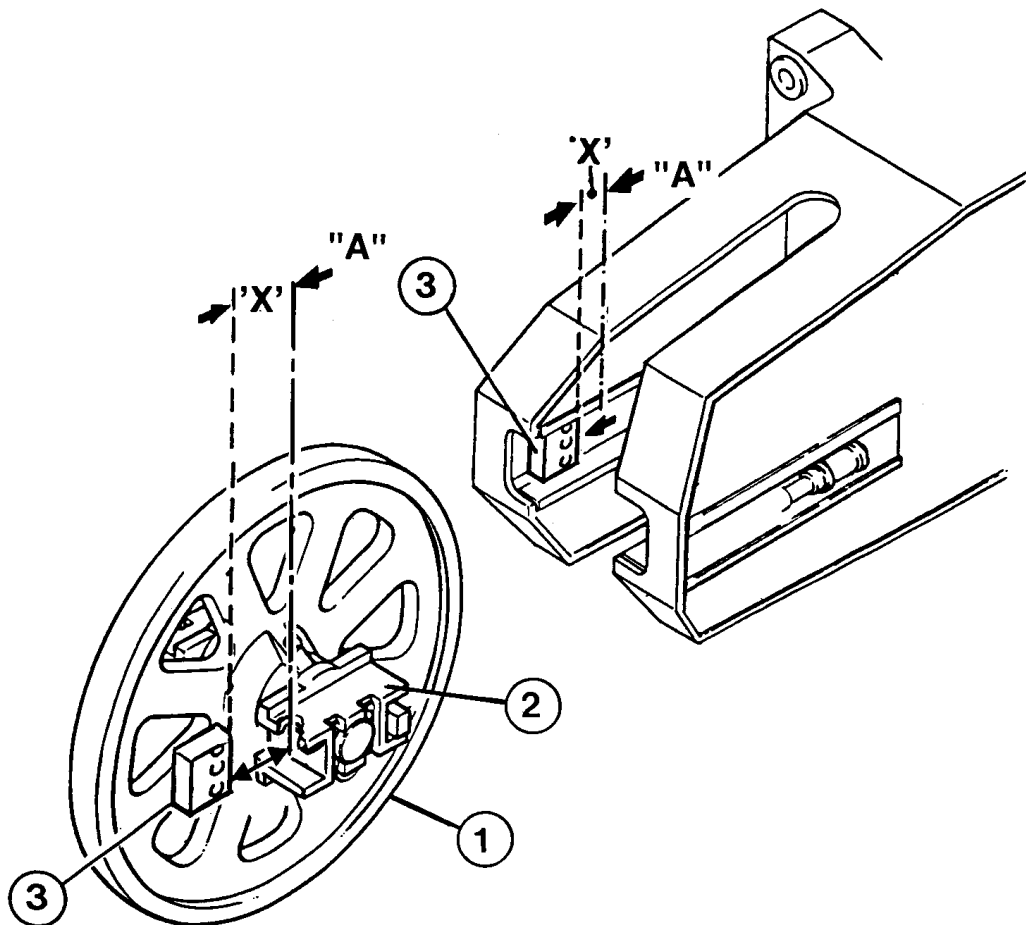
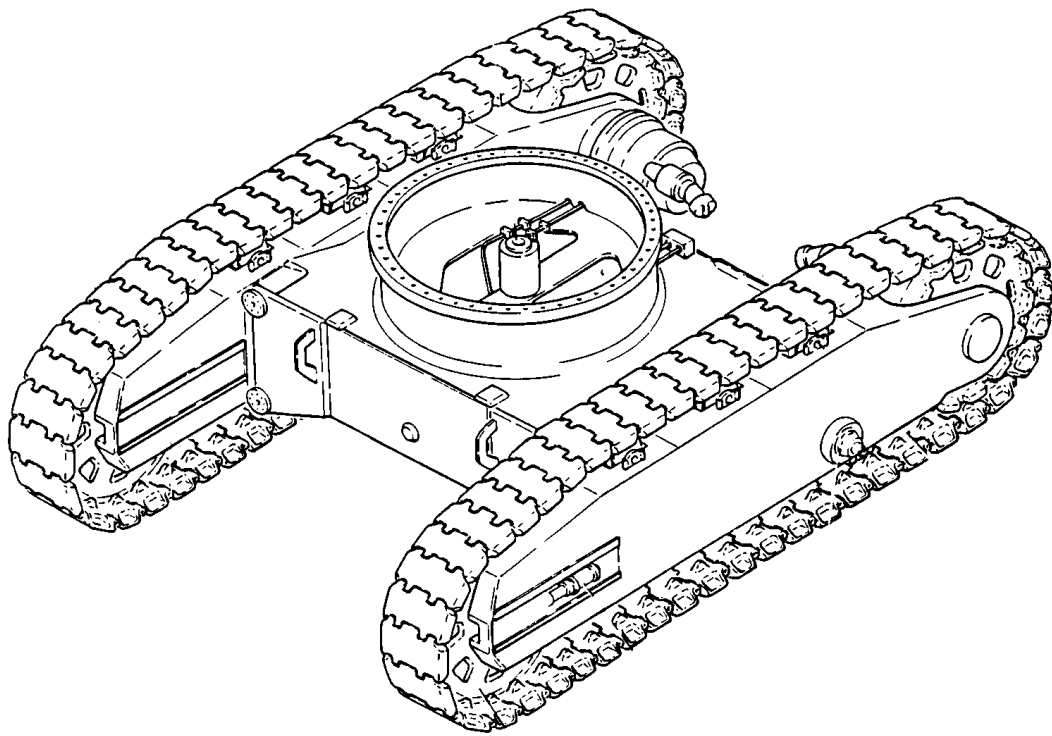
The hydraulic track tensioning system, illust. Z 20371 maintains automatically the correct track tension. The pilot pressure oil of the travel brake release circuit is used, to pressurize the four adjusting cylinders (10) and (11). The resulting force moves the guide wheels toward the front, until the correct track tension is obtained. External forces acting upon the guide wheels are absorbed through the pressure accumulators (8A) and (8B).

Legend for illust. Z 20371:

- (1) Rotary distributor
- (2) Supply line, pilot pressure from travel brake release circuit
- (3) Return oil line (leakage oil)
- (4) Valve block
- (5) Pressure relief cock for hydraulic track tensioning system.
"C" - Closed (Normal working position)
"O" - Open
- (6) Shut-off cock in supply line (if so equipped)
"O" - Open (Normal working position)
"C" - Closed
- (7) Two stage pilot pressure operated relief valve
- (8A) Pressure accumulator, high pressure (150 bar)
- (8B) Pressure accumulator, low pressure (31 bar)
- (9) Shutoff cocks, RH & LH
"O" - Open (Normal working position)
"C" - Closed
- (10) Track adjusting cylinders, inner
- (11) Track adjusting cylinders, outer
- (12) Test connectors and vent valves

WARNING

Before working on the hydraulic track tensioning system, relieve all pressure in the system by opening cock (5), position 'O'. After finishing the service work close the pressure relief cock (5), position 'C'.



Z 20015

CHECK ADJUSTING RANGE FOR GUIDE WHEELS

Legend for illustration Z 20015

- (1) Guide wheel
- (2) Slide block
- (3) Stop plate

“X” Adjusting range for track tension

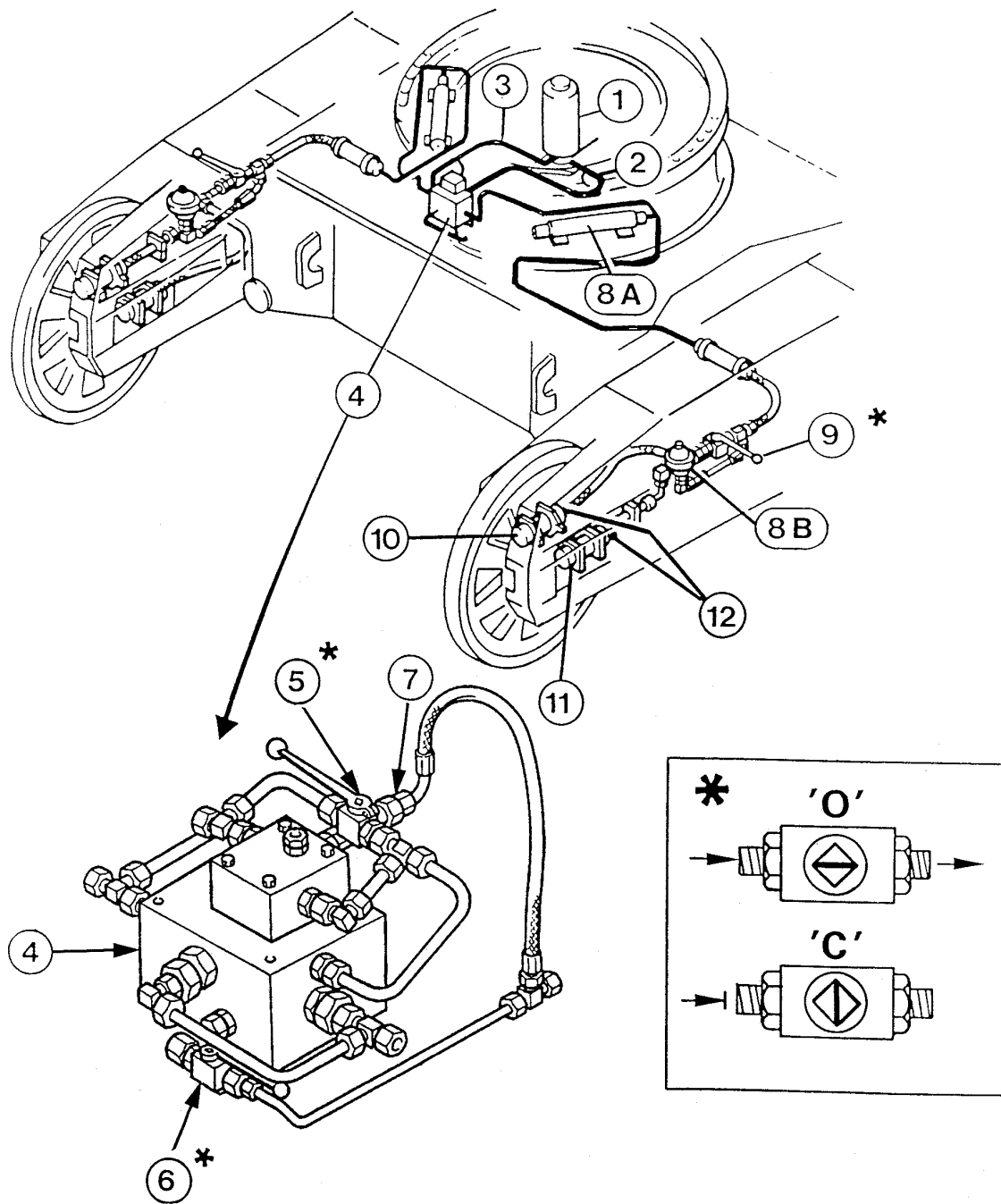
The adjusting range for track tension is the distance “X” between guide wheel slide block (2) and stop plate (3). Depending on lengthening of the track the slide block (2) may come in contact with stop plate (3). In such a case, it must be ensured that the track does not become too loose, Depending on track condition, the removal of one track pad will restore the adjusting range “X”. If necessary contact our Service Department for more information.

⚠ WARNING

Before working on the track adjusting system, relieve all pressure in the system by opening the pressure relief cock (5), see illust. Z 20371 on previous page.

NOTICE

- If removal of a track pad becomes necessary, it must be done on both tracks in order to maintain the same length of both tracks.
- During operation, the pressure relief cock (5) must always be in CLOSED position. Open cock (5) for pressure relieve prior servicing any part of the system, e.g. removal of a track pad.



(Z 20371)

CHECK ADJUSTING RANGE FOR GUIDE WHEELS

NOTICE

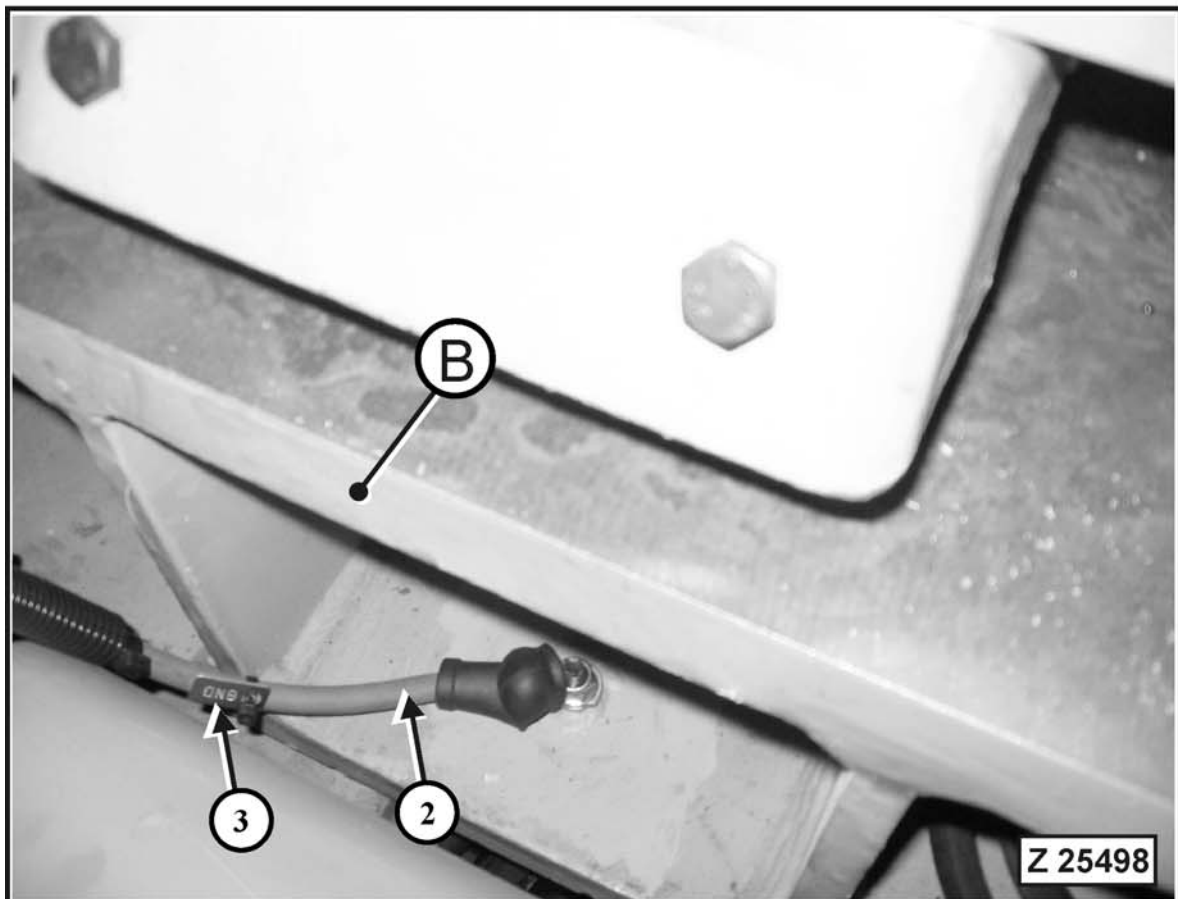
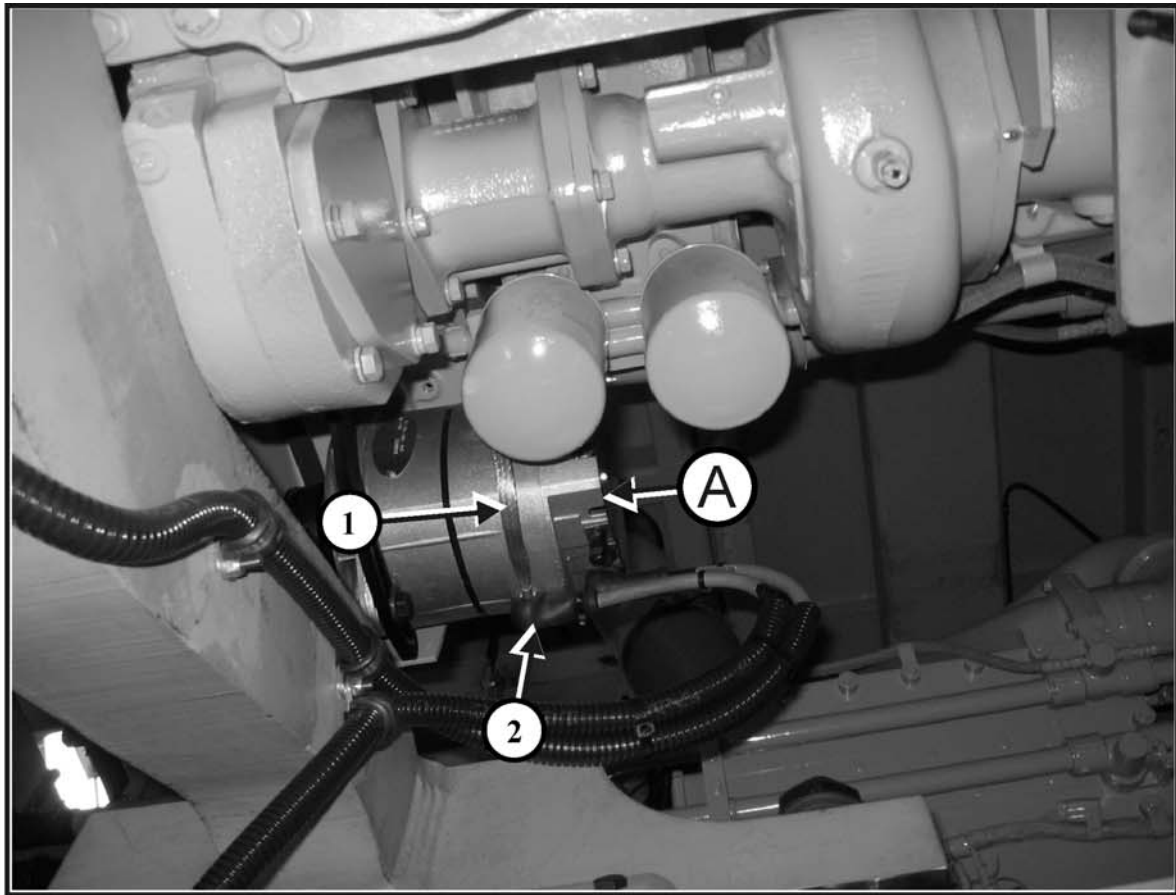
The cocks (9), illust. Z 20371 must always be in OPEN position. Close only in such cases, when the adjusting cylinders (10 and 11) must remain under pressure while servicing other components of the system.

Bleeding the System

1. Make sure pressure relief cock (5) illust. Z 20371 is in closed position "C"; and shutoff cocks (6 and 9) are in open position "O".
2. Start the engine/motor.
3. Slowly open vent valves (12) on all four adjusting cylinders until bubble free oil flows out. Close the vent valves (12).
4. Move the machine forward and reverse to distribute tension.
5. Check adjusting range "X" according to Illust. (Z 20015) on previous page.
6. Check the complete system for leakages.

NOTICE

Further track group inspection and wear measurement procedures should be carried out according to Parts and Service News Bulletin No. AH02521 filed in volume 2 binder.



4.11.4 GROUND CABLES OF ENGINE AND ALTERNATOR - CHECK FOR CORRECT CONNECTION

Legend for illustration Z25498

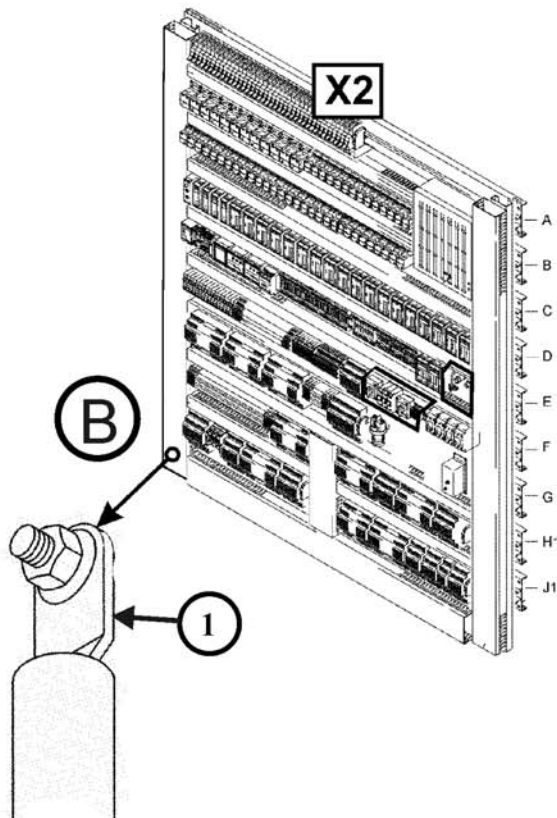
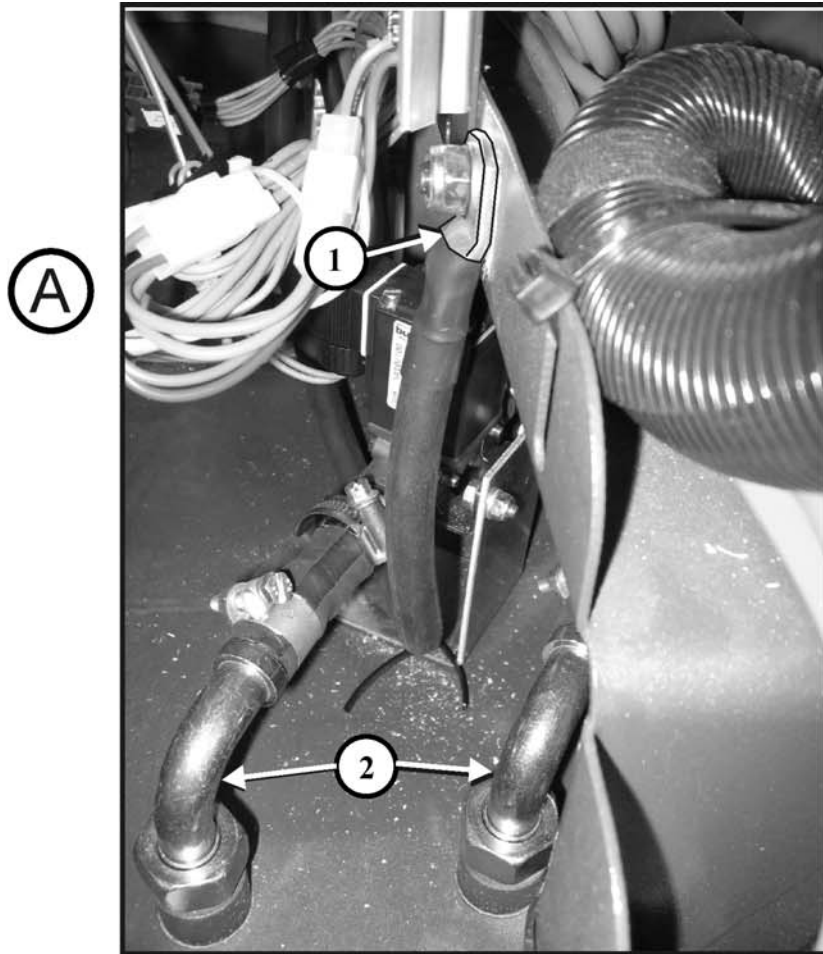
- (A) Alternator seen from below
- (B) RH member of engine carrier frame
- (1) Ground strap from engine to the ground terminal of alternator (A)
- (2) Ground cable from alternator (A) to RH member of engine carrier frame (B)
- (3) Identification plate (GND) for ground cables

Check ground cables

1. Remove both battery main switch keys.
2. Check ground strap (1) and ground cable (2) on both engines for good condition and secure fastening.

▲ WARNING

- **Be sure to replace a worn or damaged cable or fastening part without delay.**
 - **Loose or missing ground cables can cause fire, serious injury or death.**
-
-



Z 25520

4.11.5 GROUND CABLE OF OPERATOR'S CAB - CHECK FOR CORRECT CONNECTION

Legend for illustration Z25520

- (A) Ground cable fixing point inside the operator's console
- (B) Ground cable fixing point in the cab base on the lower left mounting bolt of the (X2) switch board
- (1) Ground cable from operator's console to the lower left mounting bolt of the (X2) switch board
- (2) Cab heater water lines

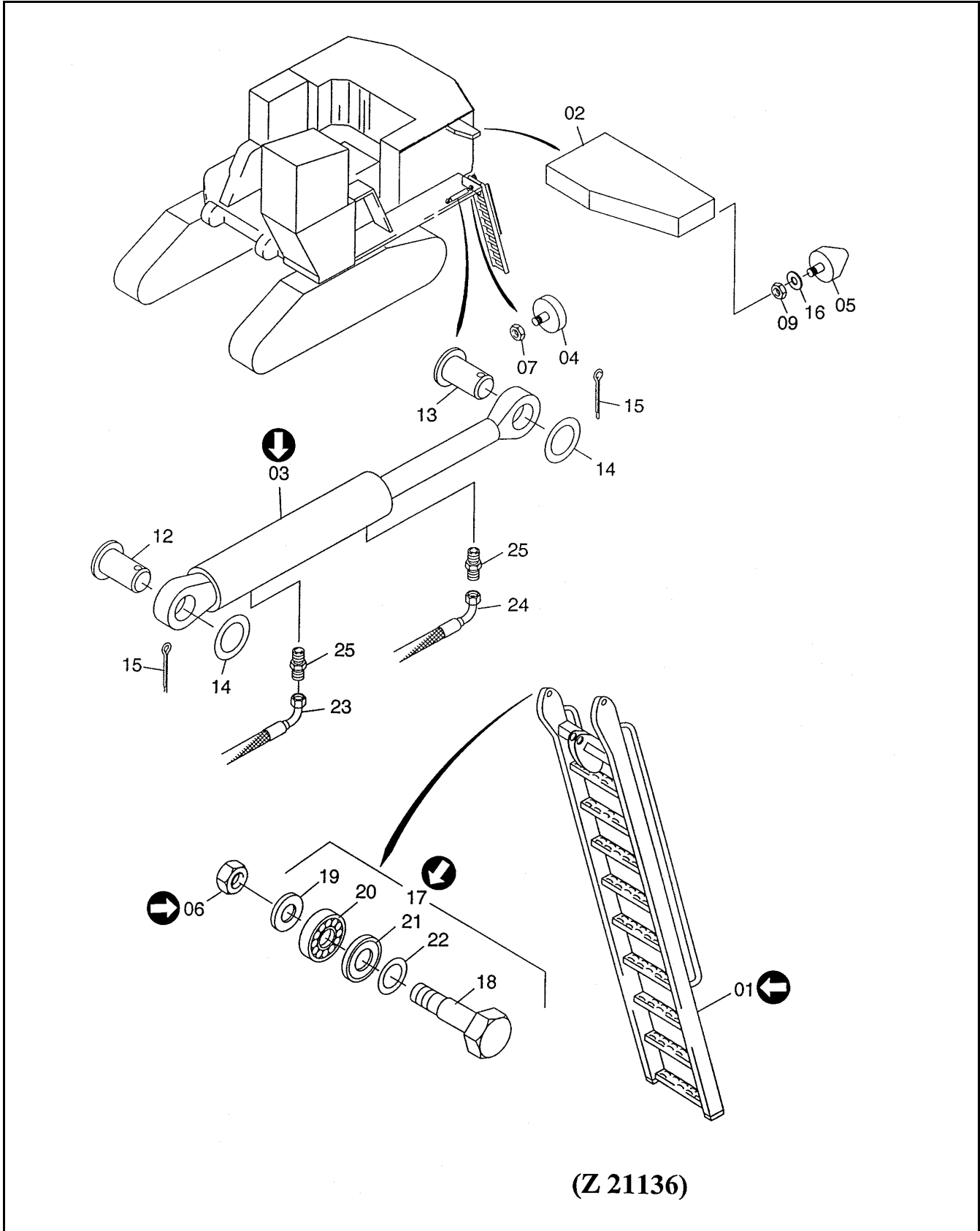
Check ground cable

1. Remove both battery main switch keys.
2. Open the dashboard of the operator's console and secure with the prop rod provided.
3. Check cable (1), view (A) for good condition and secure fastening.
4. Close the dashboard and secure with the clamps provided.
5. Check cable (1) in the cab base, view (B) for good condition and secure fastening on the lower left mounting bolt of the (X2) switch board.

⚠ WARNING

- **Be sure to replace a worn or damaged cable or fastening part without delay.**
 - **Loose or missing ground cables can cause fire, serious injury or death.**
-

4.12 EVERY 1000 OPERATING HOURS OR EVERY 6 MONTH



4.12.1 HIGH STRENGTH BOLT CONNECTIONS - CHECK TORQUE LOAD

Check high-strength bolt connections and securing elements for damage and looseness. If any damages, failures or wrong condition are found, corrective action must be taken.

NOTICE

- **If the torque load is not stated otherwise refer to standard torque chart for torque data.**
- **Bolts inserted with Multi-Purpose Grease MPG, KP2K on thread and head.**

REMARK

When selecting the tightening torque observe quality grade and bolt size

Hydraulic Access Ladder, illust. Z 21136

- (01) Hinged ladder
- (03) Ladder lifting cylinder
- (06) Self locking nut
- (17) Ladder bearing assembly

Check condition and fastening of hinged ladder (01), bearing assembly (17) and hydraulic cylinder (03).

Make sure the self locking nuts (06) are correctly tightened and have not lost their clamping torque.

Tightening Torque of Self Locking Nuts (06):

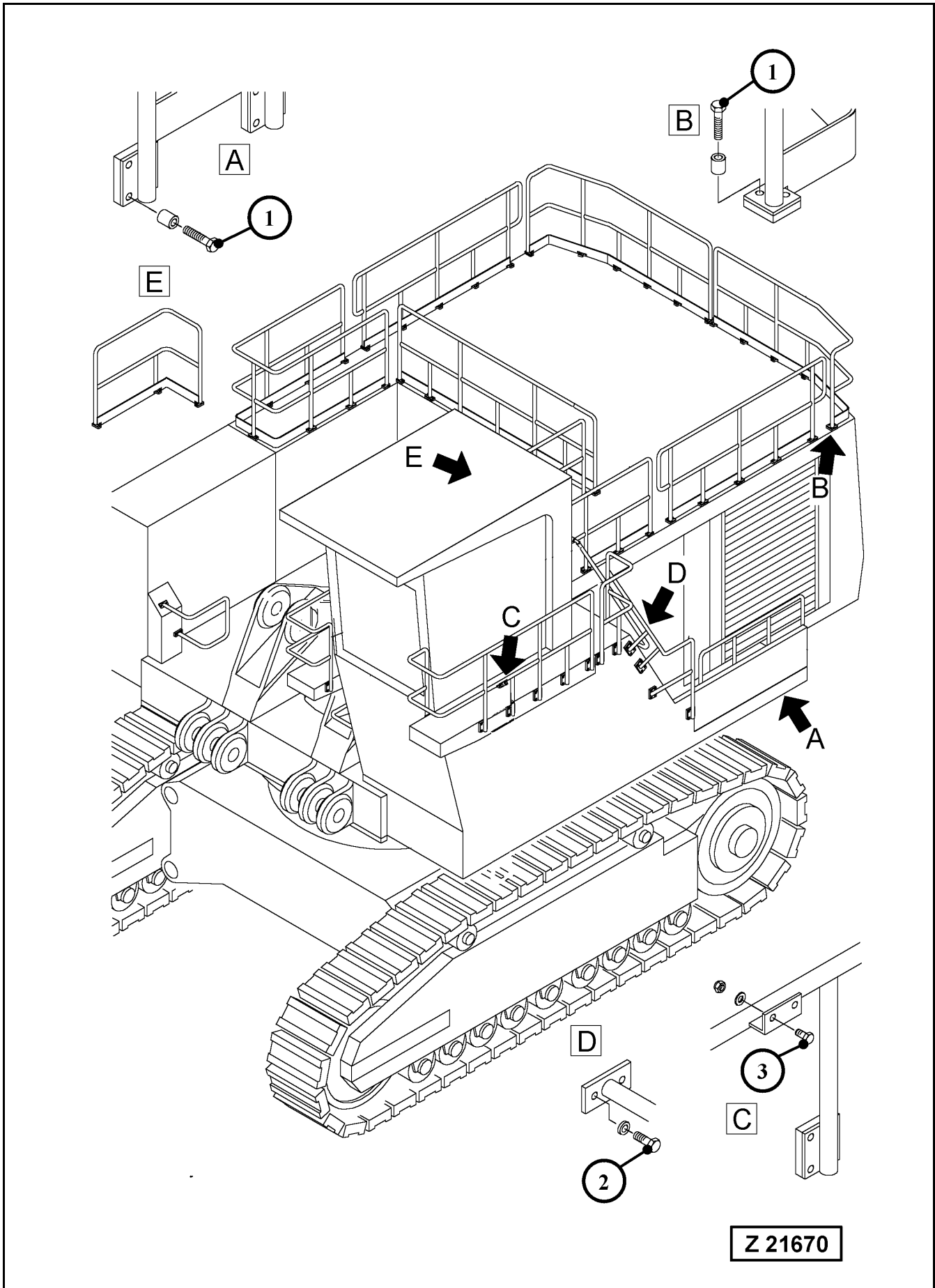
- New nut: 1000 Nm
- Used nut: 800 Nm

Clamping Torque of Self Locking Nuts (06):

- New nut: 200 Nm
- Used nut: 20 Nm minimum

If the clamping torque is less than 20 Nm, use a new self locking nut.

Lubricate both eyes of hydraulic cylinder (03). Make sure both pivot pins (12 and 13) are properly secured with cotter pins (15). Check hydraulic lines (23 and 24) for leakage and damage. Replace as necessary.



High-Strength Bolt Connections (continued)

Check fastening and condition of railings (A, B, C, D and E),
illust. Z 21670

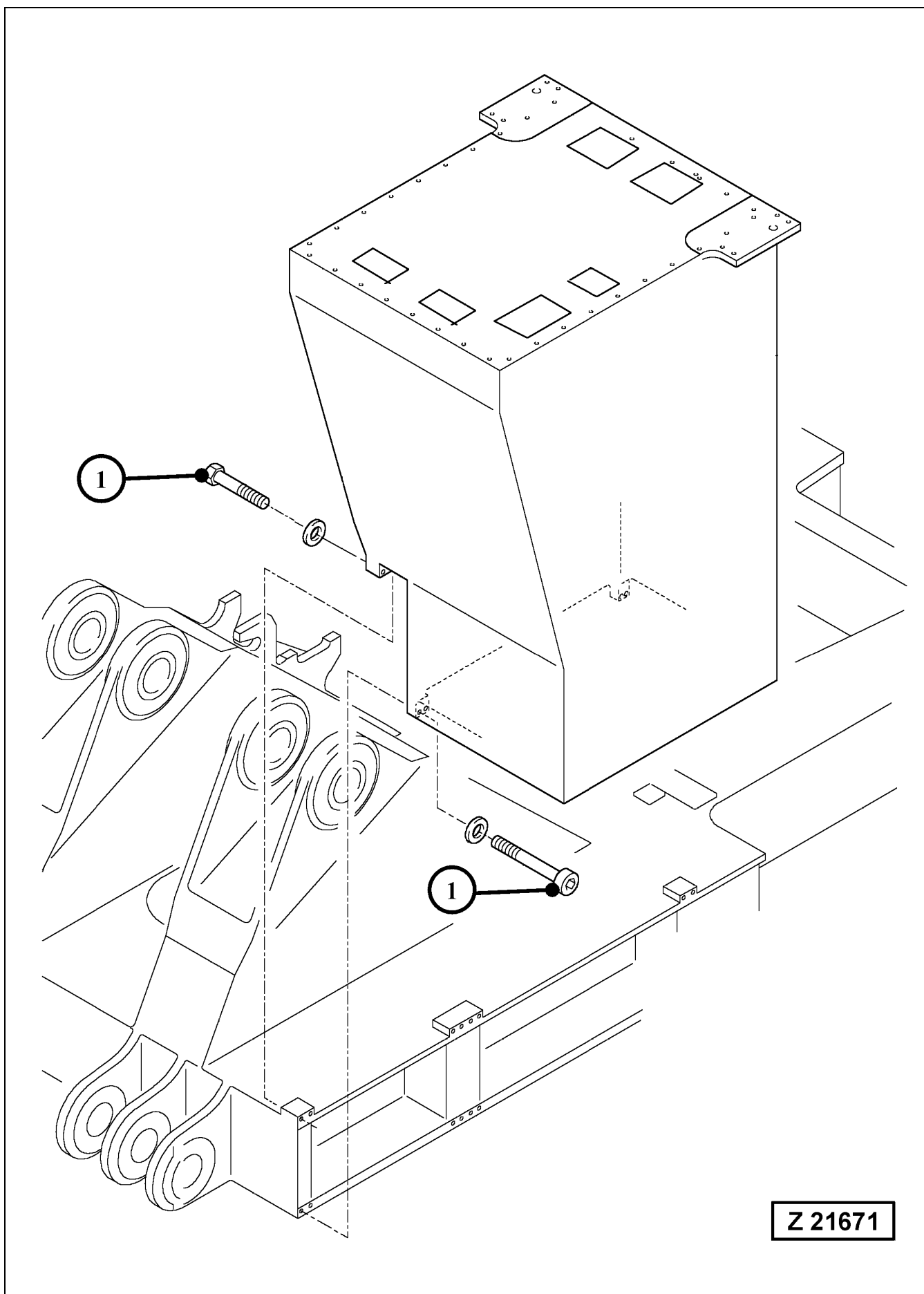
* SW = Wrench size

| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm |
|----------------|-----------------|-------|------------|-------------------------|
| (1) | M12 | 8.8 | 19 | 74 |
| (2) | M12 | 8.8 | 19 | 74 |
| (3) | M10 | 8.8 | 17 | 43 |

NOTICE

Detail (C) shows the bracket for attaching the emergency escape ladder (storage position).

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.

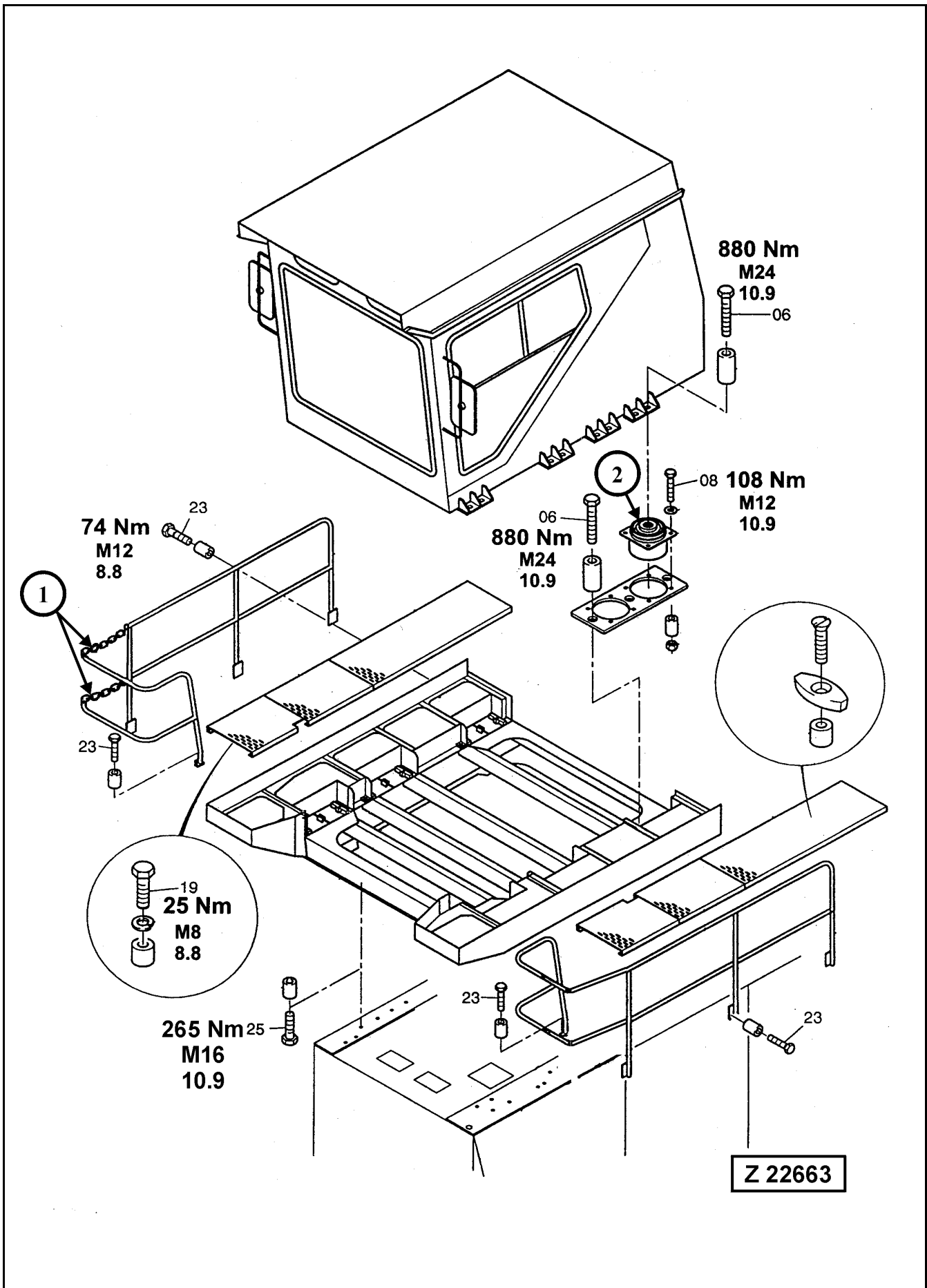


High-Strength Bolt Connections (continued)**Check fastening and condition of cab base, illust. Z 21671**

| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. |
|-----------------------|-------------------------|--------------|--------------------|---------------------------------|-------------|
| (1) | M36 | 10.9 | 55 | 3100 | 8 |

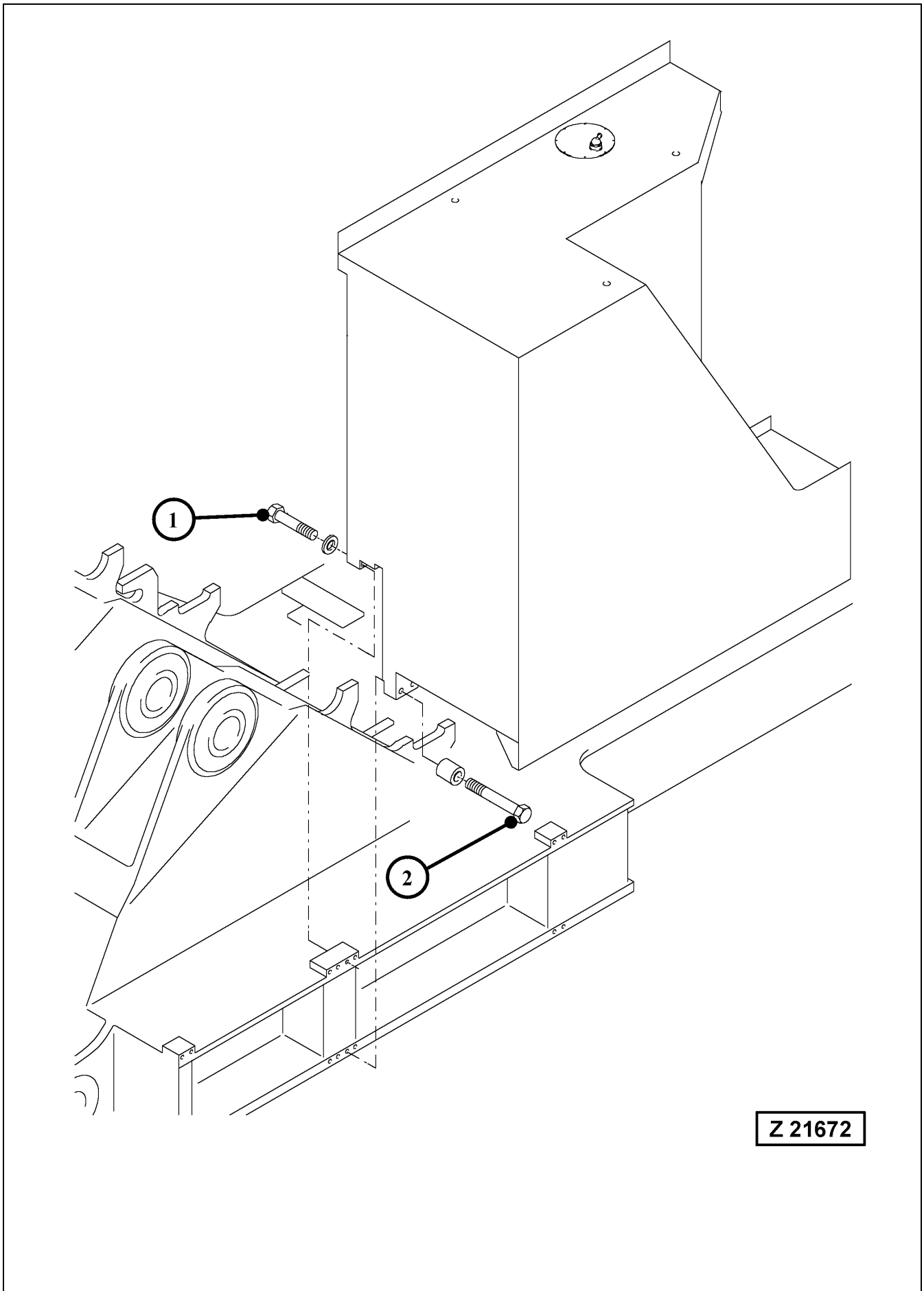
* SW = Wrench size*

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.



High-Strength Bolt Connections (continued)**Check mounting of Operator's cab, illust. Z 22663**

- Check tightening torque of mounting bolts as indicated in the illustration.
- Check condition and fastening of chains (1).
- Check the silicone oil filled viscous mounts (2) for leakage and signs of fatigue.

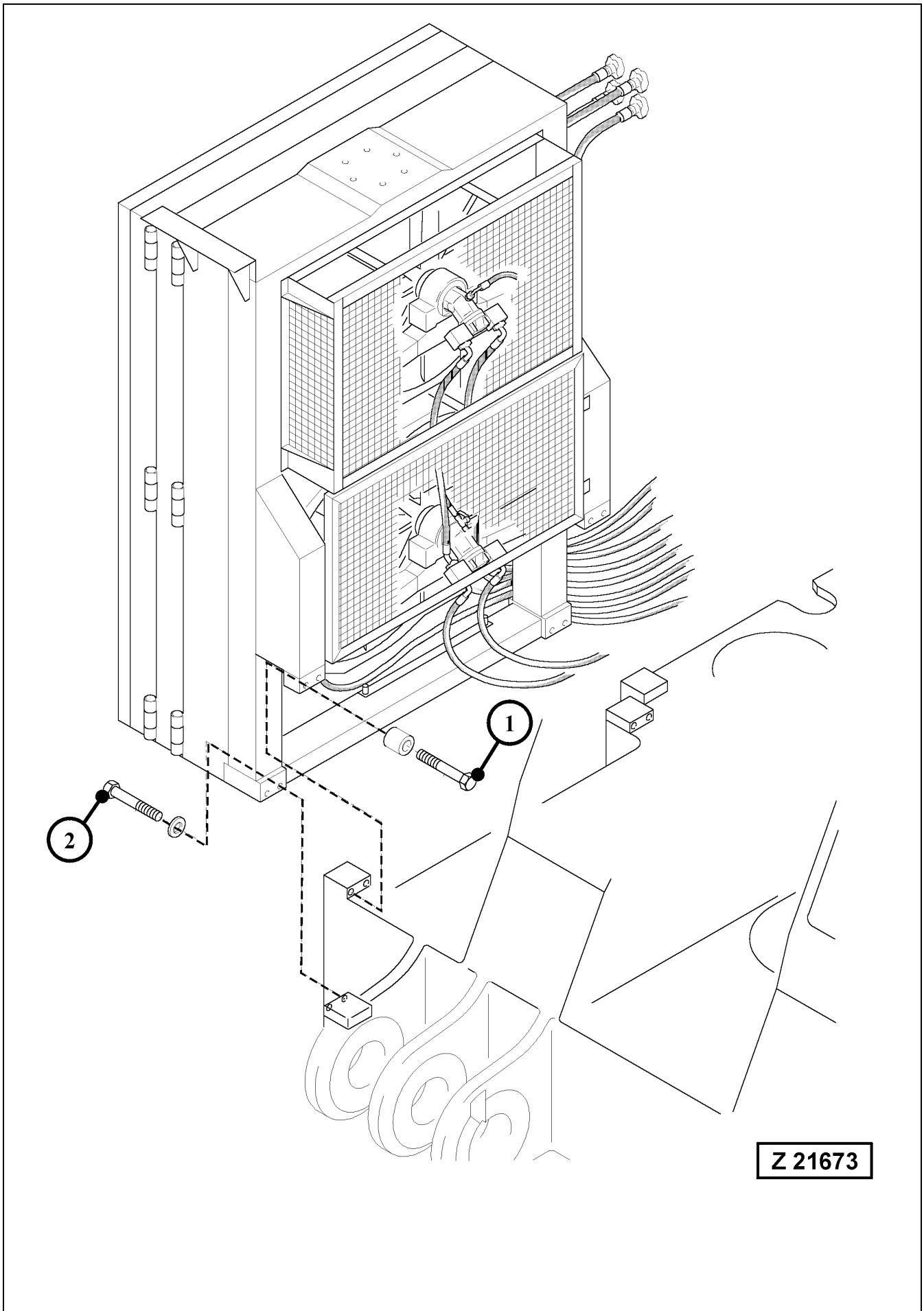


High-Strength Bolt Connections (continued)**Check fastening and condition of fuel tank, illust. Z 21672**

| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. |
|-----------------------|-------------------------|--------------|--------------------|---------------------------------|-------------|
| (1) | M36 | 10.9 | 55 | 3100 | 4 |
| (2) | M36 | 10.9 | 55 | 3100 | 4 |

* SW = Wrench size

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.



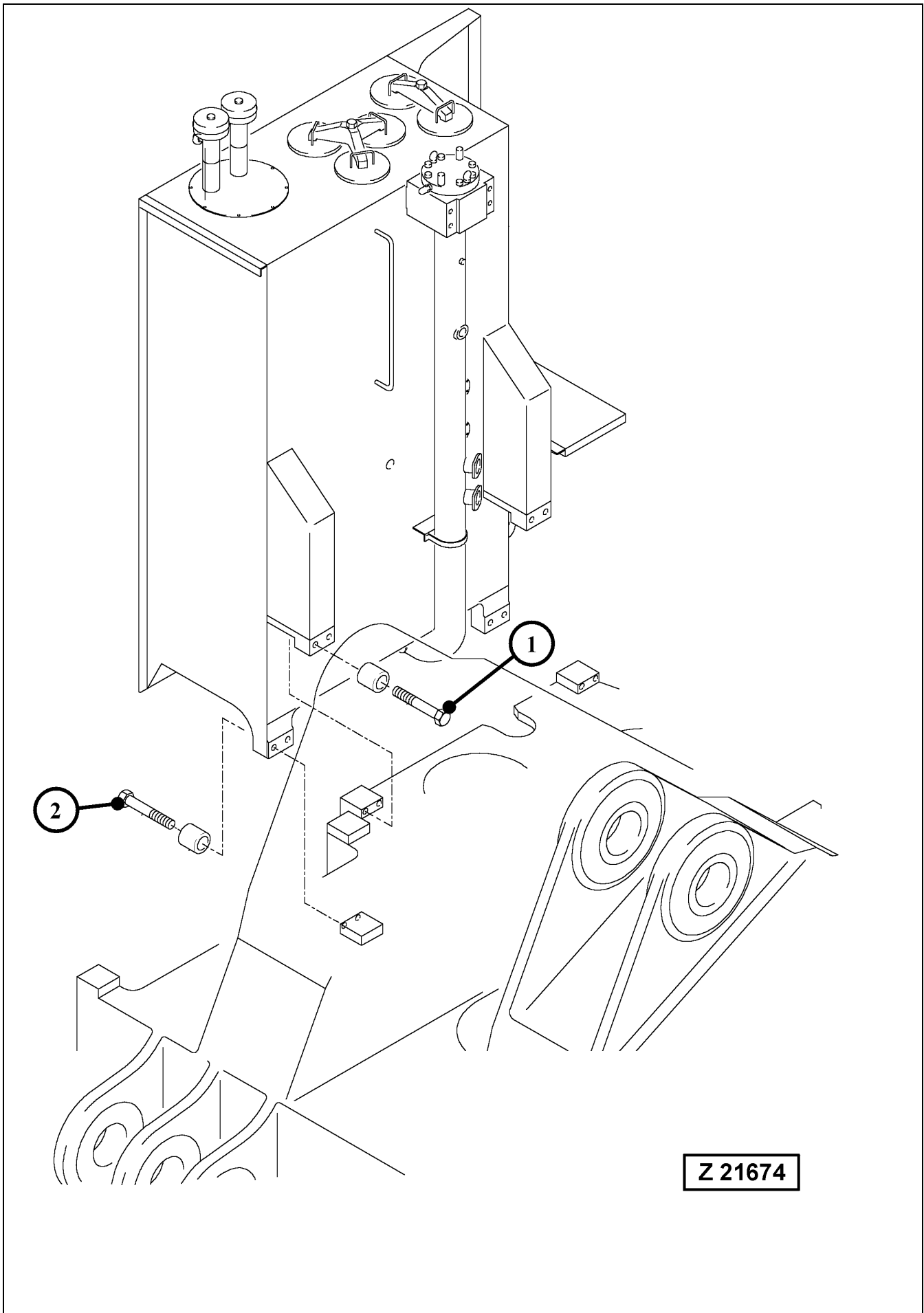
High-Strength Bolt Connections (continued)

Check fastening and condition of hydraulic oil cooler,
illust. Z 21673

| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. |
|----------------|-----------------|-------|------------|-------------------------|------|
| (1) | M30 | 10.9 | 46 | 1770 | 4 |
| (2) | M30 | 10.9 | 46 | 1770 | 4 |

* SW = Wrench size

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.



Z 21674

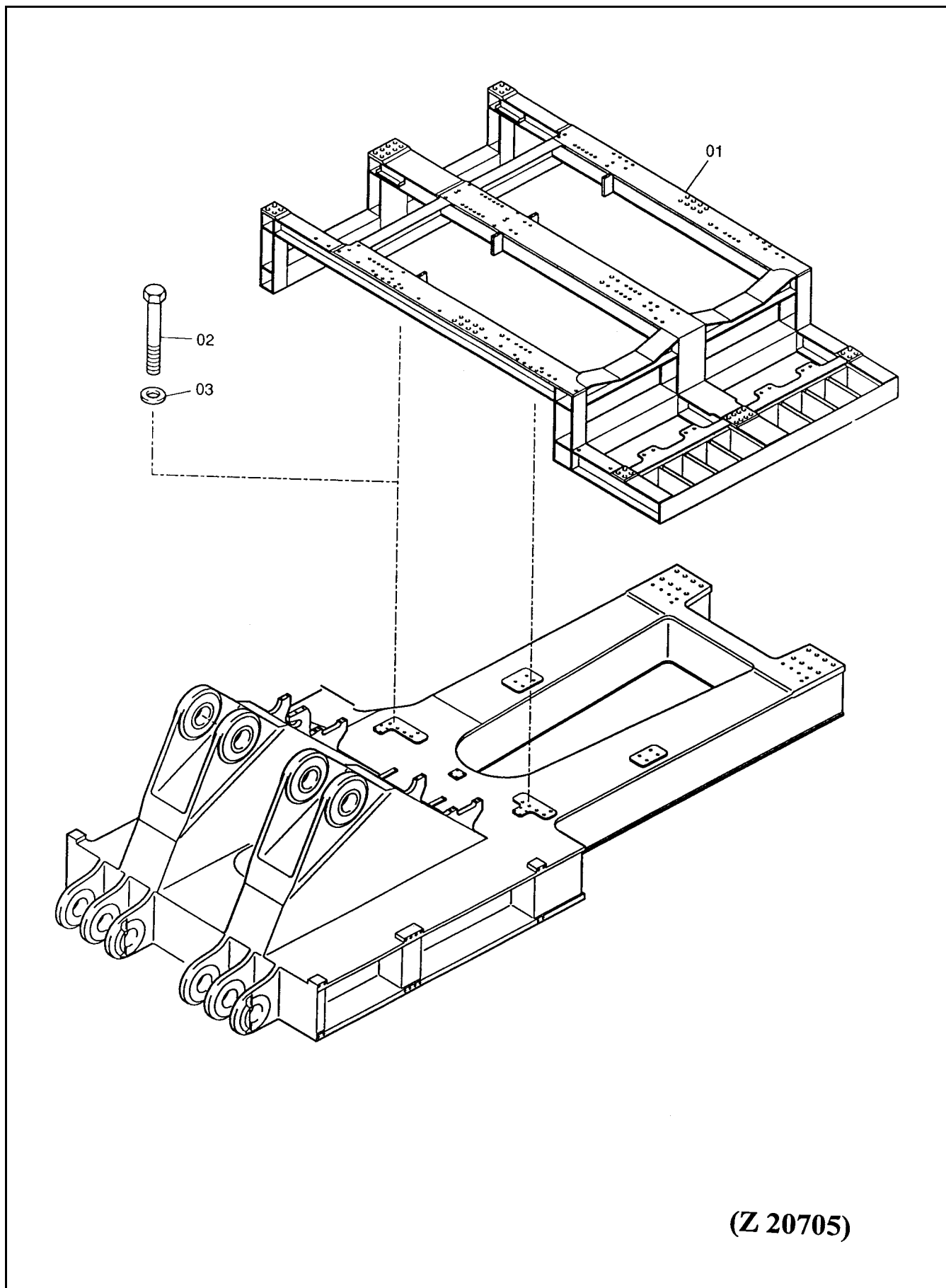
High-Strength Bolt Connections (continued)

Check fastening and condition of hydraulic oil tank,
illust. Z 21674

| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. |
|----------------|-----------------|-------|------------|-------------------------|------|
| (1) | M30 | 10.9 | 46 | 1770 | 4 |
| (2) | M30 | 10.9 | 46 | 1770 | 4 |

* SW = Wrench size

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.



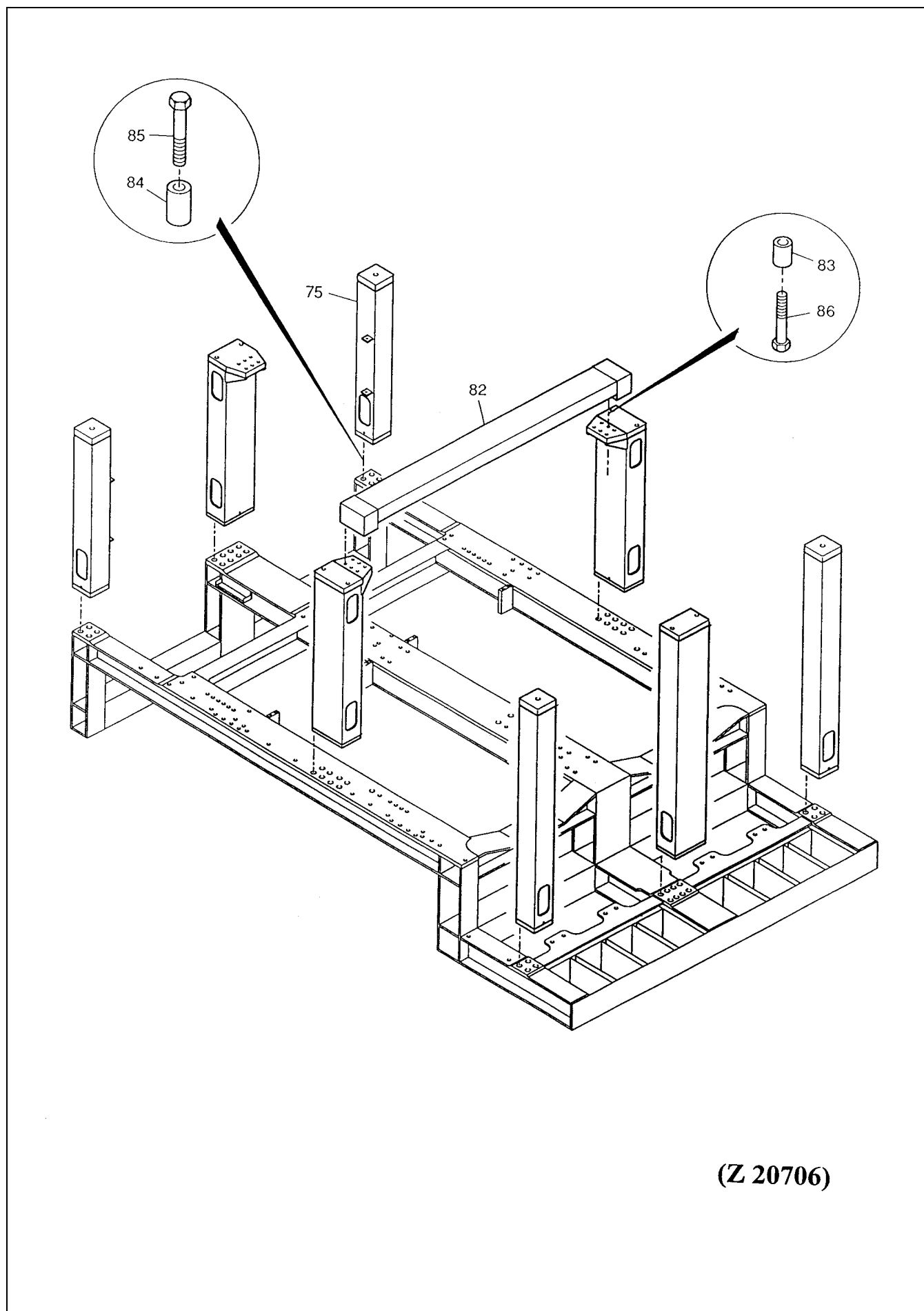
High-Strength Bolt Connections (continued)

Check fastening of power house frame (01) to superstructure main frame, illust. Z 20705

| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. |
|----------------|-----------------|-------|------------|-------------------------|------|
| (02) | M30 | 10.9 | 46 | 1770 | 28 |
| (03) | | | | Washer | 28 |

* SW = Wrench size

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.



(Z 20706)

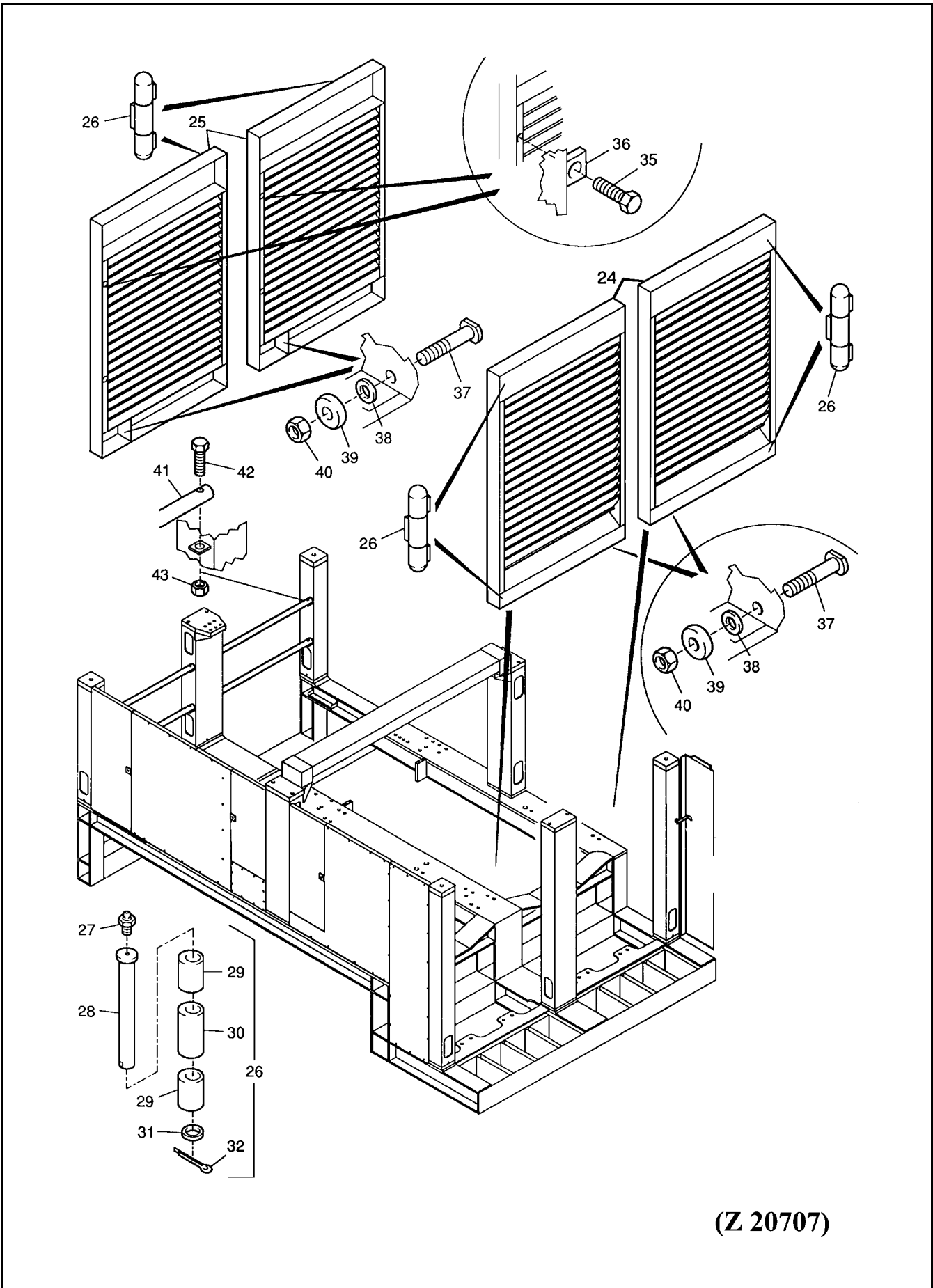
High-Strength Bolt Connections (continued)

Check fastening and condition of the eight power house posts (75) and transverse carrier (82), illust. Z 20706

| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. |
|-----------------------|-------------------------|--------------|--------------------|---------------------------------|-------------|
| (85) | M30 | 10.9 | 46 | 1770 | 48 |
| (86) | M24 | 10.9 | 36 | 880 | 12 |

* SW = Wrench size

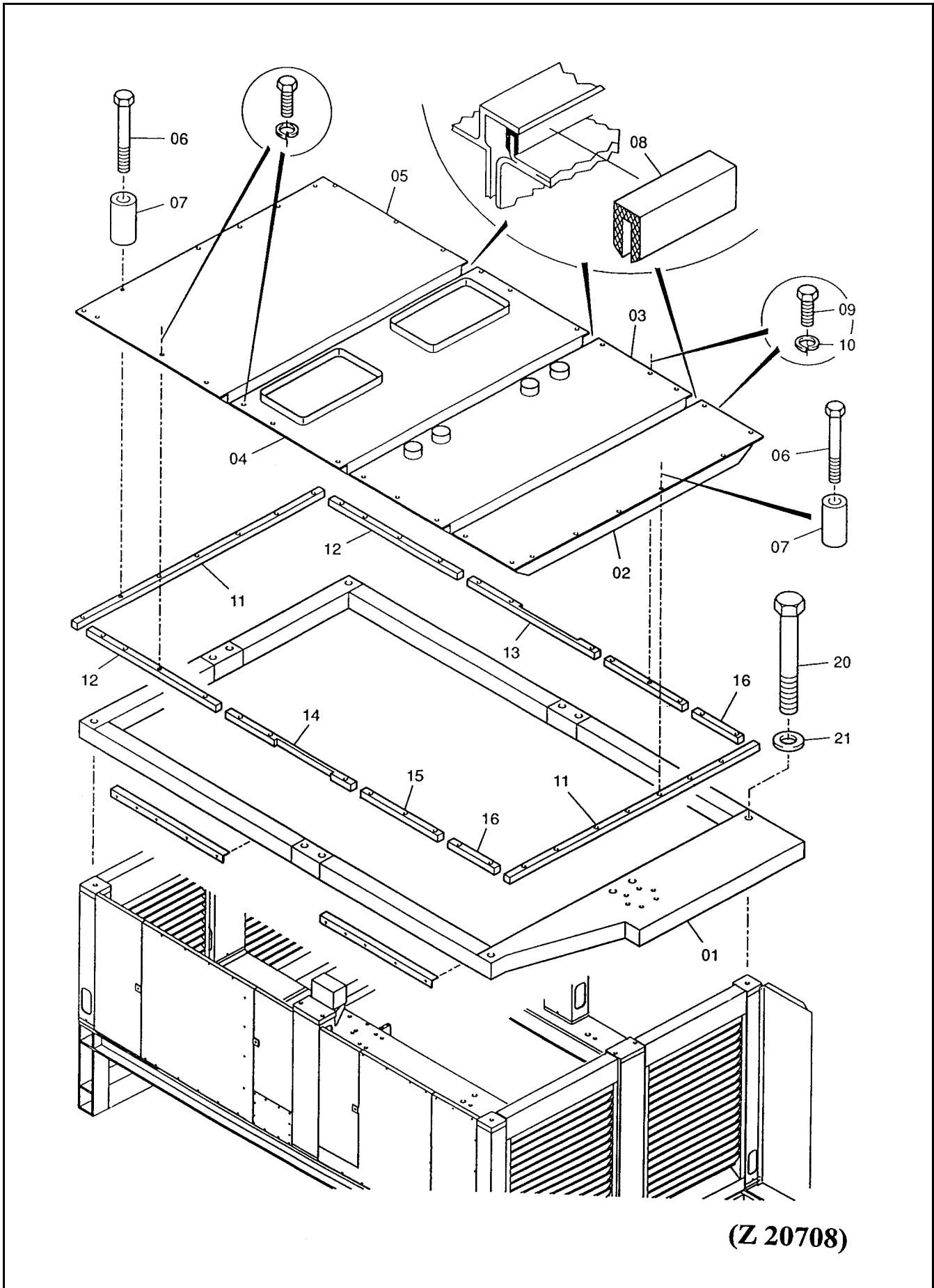
- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.



High-Strength Bolt Connections (continued)

Power House Doors, illust. Z 20707

- Check fastening and condition of power house doors (24 - 25) and door hinges (26).
- Check fastening and condition of safety rods (41).
- Check upper pump compartment door locks (35 - 36) for correct mounting.
- Check lower pump compartment door locks and radiator door locks (37 - 40) for correct mounting.
- Lubricate door hinges (26) at grease fittings (27).



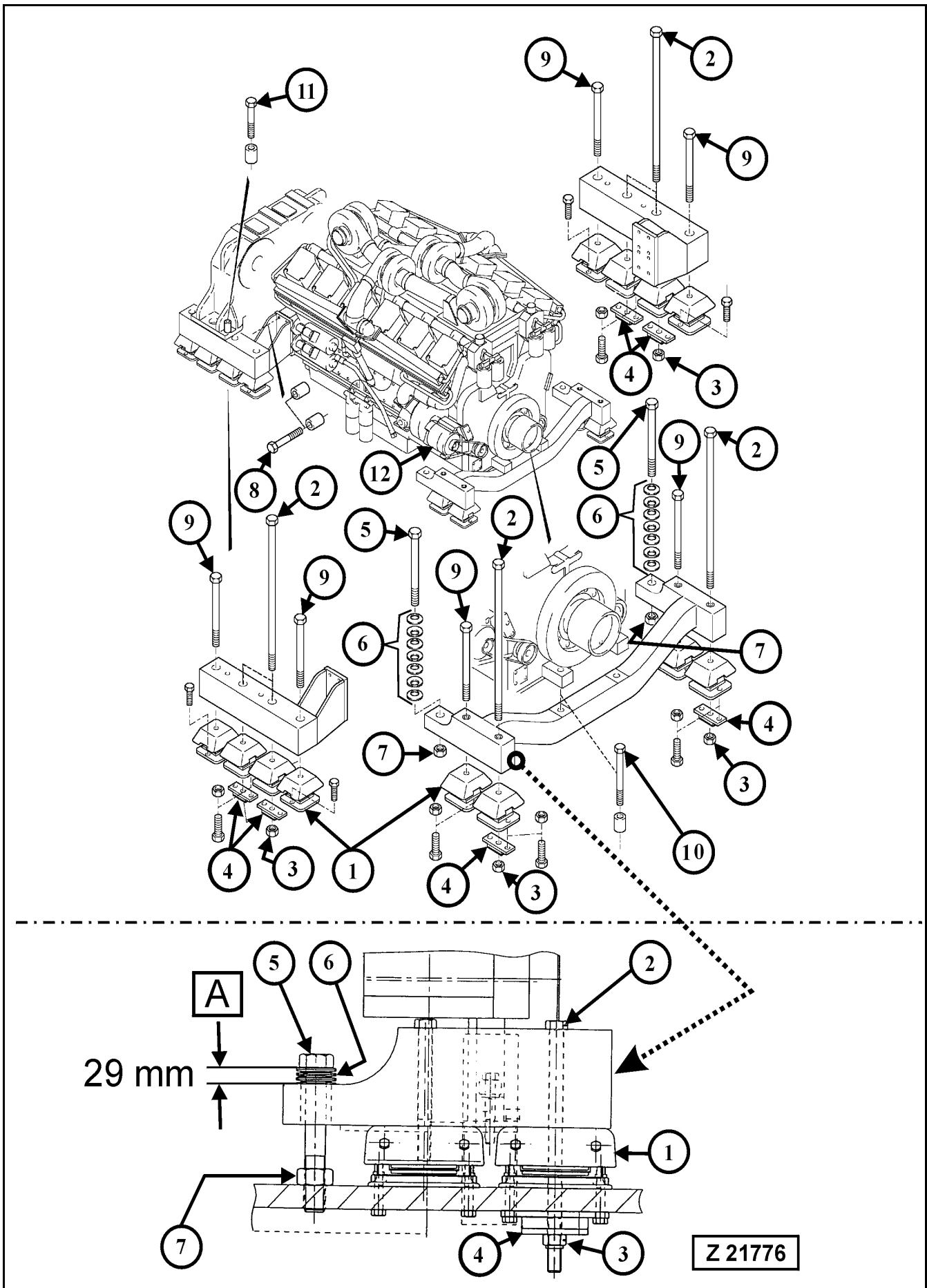
Power house Roof, illust. Z 20708

- Check fastening and condition of power house roof segments (02 - 05).
- Check sealing elements (08) between roof segments for correct seat and good condition.
- Check sealing elements (11 - 16) between roof segments and roof frame (01) for correct seat and good condition.

| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. |
|----------------|--------------|-------|---------|----------------------|------|
| (06) | M12 | 10.9 | 19 | 108 | 50 |
| (20) | M36 | 10.9 | 55 | 3100 | 12 |

* SW = Wrench size

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.



High-Strength Bolt Connections (continued)

Check mounting and security of Diesel engines and pump distributor gears, illust. Z 21776

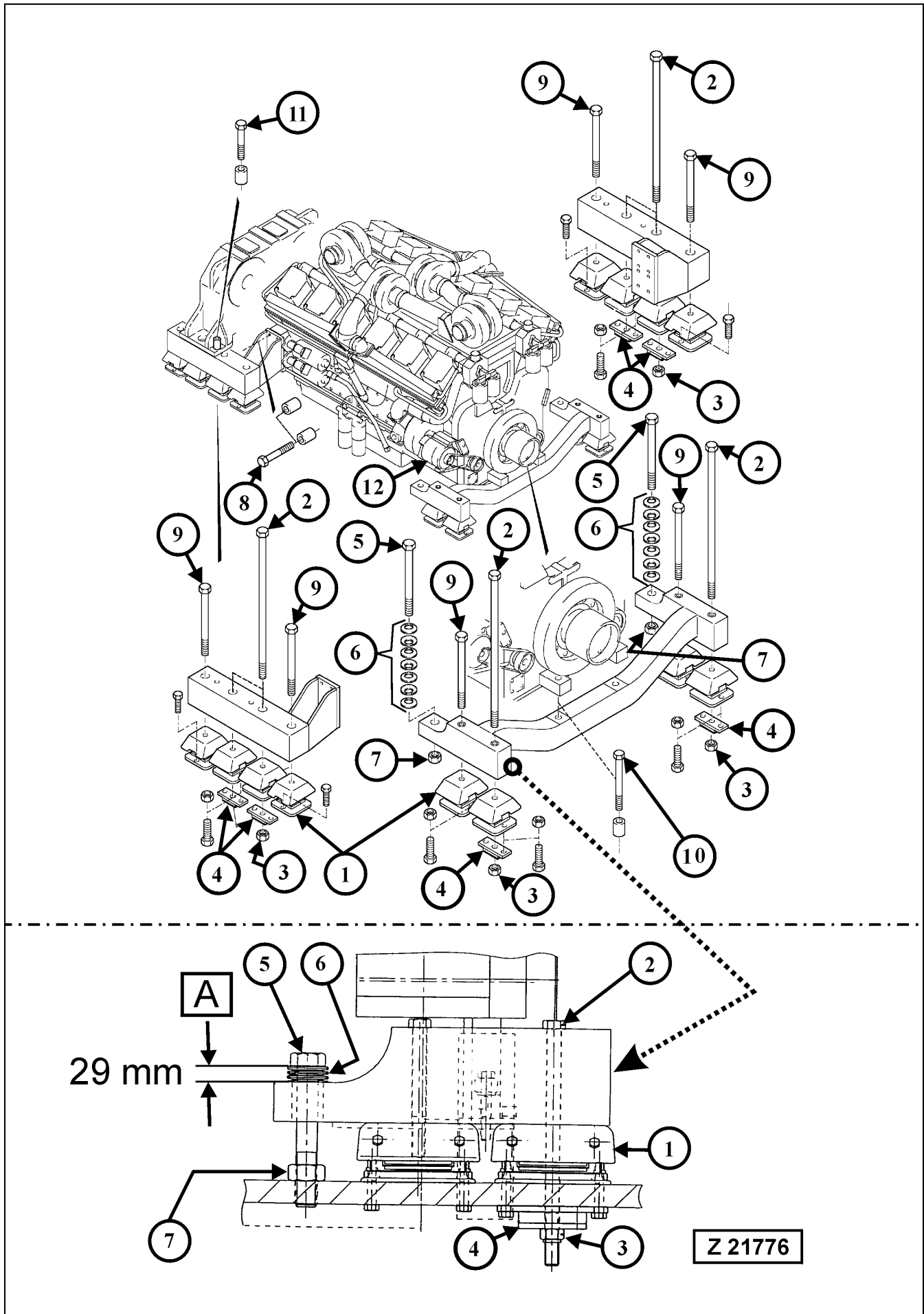
Legend for illustration Z 21776:

| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. both power units |
|-----------------------------------|--------------|-------|---------|-------------------------------|-----------------------|
| (1) Flexible bearings | | | | | 24 |
| (2) Tie bolts | M24 | 10.9 | 36 | snugly | 12 |
| (3) Self locking nuts | M24 | 8.0 | 36 | snugly | 12 |
| (4) Rubber bounded metal bars | | | | | 12 |
| (5) Stop bolts | M36 | 10.9 | 55 | to distance "A" | 4 |
| (6) Cup springs | | | | | 28 |
| (7) Lock nuts | M36 | 10.0 | 55 | | 4 |
| (8) Engine mounting bolts, rear | 3/4 - 10 | UNC | | 400 | 32 |
| (9) Bolts | M24 | 10.9 | 36 | 880 | 12 |
| (10) Engine mounting bolts, front | M18 | 10.9 | 27 | 360 | 4 |
| (11) PTO mounting bolts | M30 | 10.9 | 46 | 1770 | 8 |
| (12) Generator | | | | Check condition and fastening | 2 |

- * SW = Wrench size

REMARK

Refer to page 381 for checking procedure of engine mounting.



High-Strength Bolt Connections (continued)

Check mounting and security of each Diesel engine and pump distributor gear, illust. Z 21776

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

NOTICE

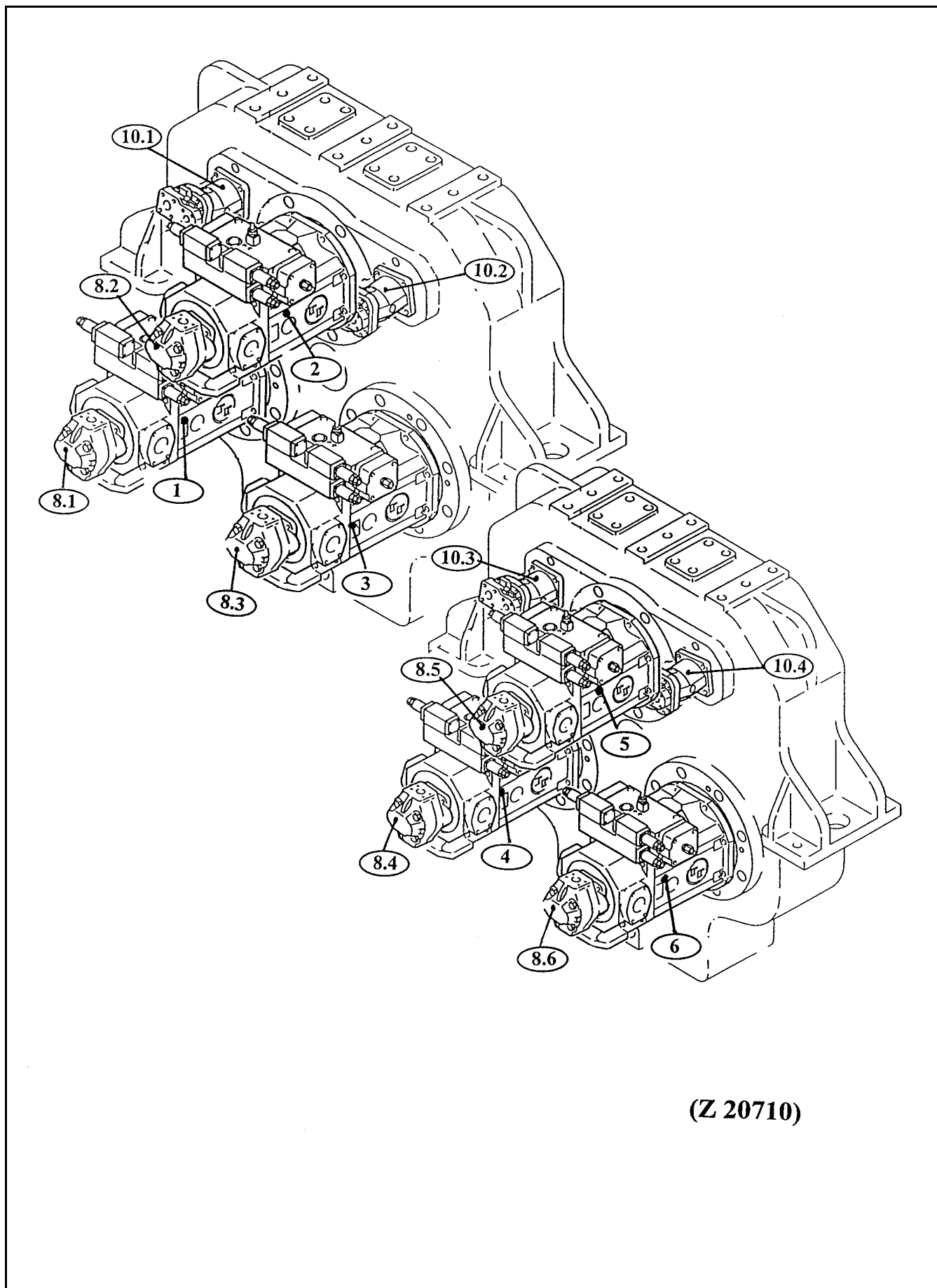
All flexible bearings (1) and all rubber-bounded metal bars (4) should be replaced during engine overhaul.

- Check distance (A) between torque support and stop bolt (5).
 - With setting of the flexible engine bearings (1) the distance (A) increases and must be adjusted. To do this, loosen lock nut (7) and tighten stop bolt (5) until the correct distance (A) is obtained. Tighten lock nut (7) and recheck distance (A).
If new flexible engine bearings (1) have been installed, replace also cup springs (6) and adjust distance (A) to 29 mm.
- Check tie bolts (2) on front and rear carrier units for looseness.
 - Check to make sure that the self locking retainer nuts (3) are tight and that there is no gap between nut and rubber-bounded metal bar (4).
If necessary retighten retainer nuts (3) snugly.
Check rubber-bounded metal bars (4) for signs of fatigue and damage.
Replace as necessary.

NOTICE

- **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.



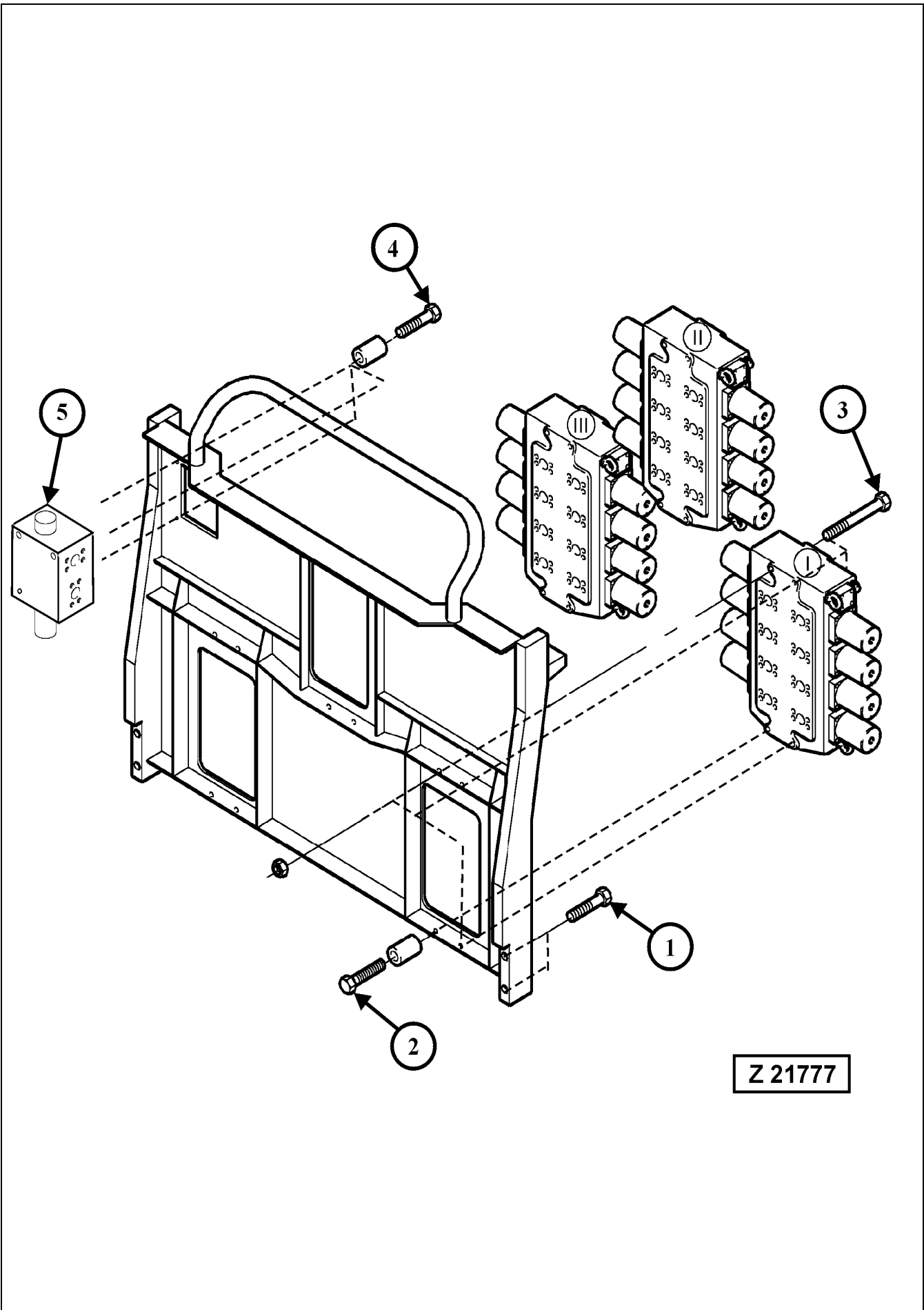
(Z 20710)

High-Strength Bolt Connections (continued)

- Check fastening and condition of main hydraulic pumps (1-6), illust. Z 20710.
Mounting bolt size: M20, Grade 8.8, tightening torque 360 Nm.
- Check fastening and condition of auxiliary pumps (8.1 - 8.6) and secondary hydraulic pumps (10.1 - 10.4).
Mounting bolt size: M12, Grade 8.8, tightening torque 74 Nm.

Pump Description:

- (1-6) Main hydraulic pumps, swash plate type for all working and travelling motions.
- (8.1-8.6) Gear type pumps.
- (10.1-10.4) Axial piston pumps.



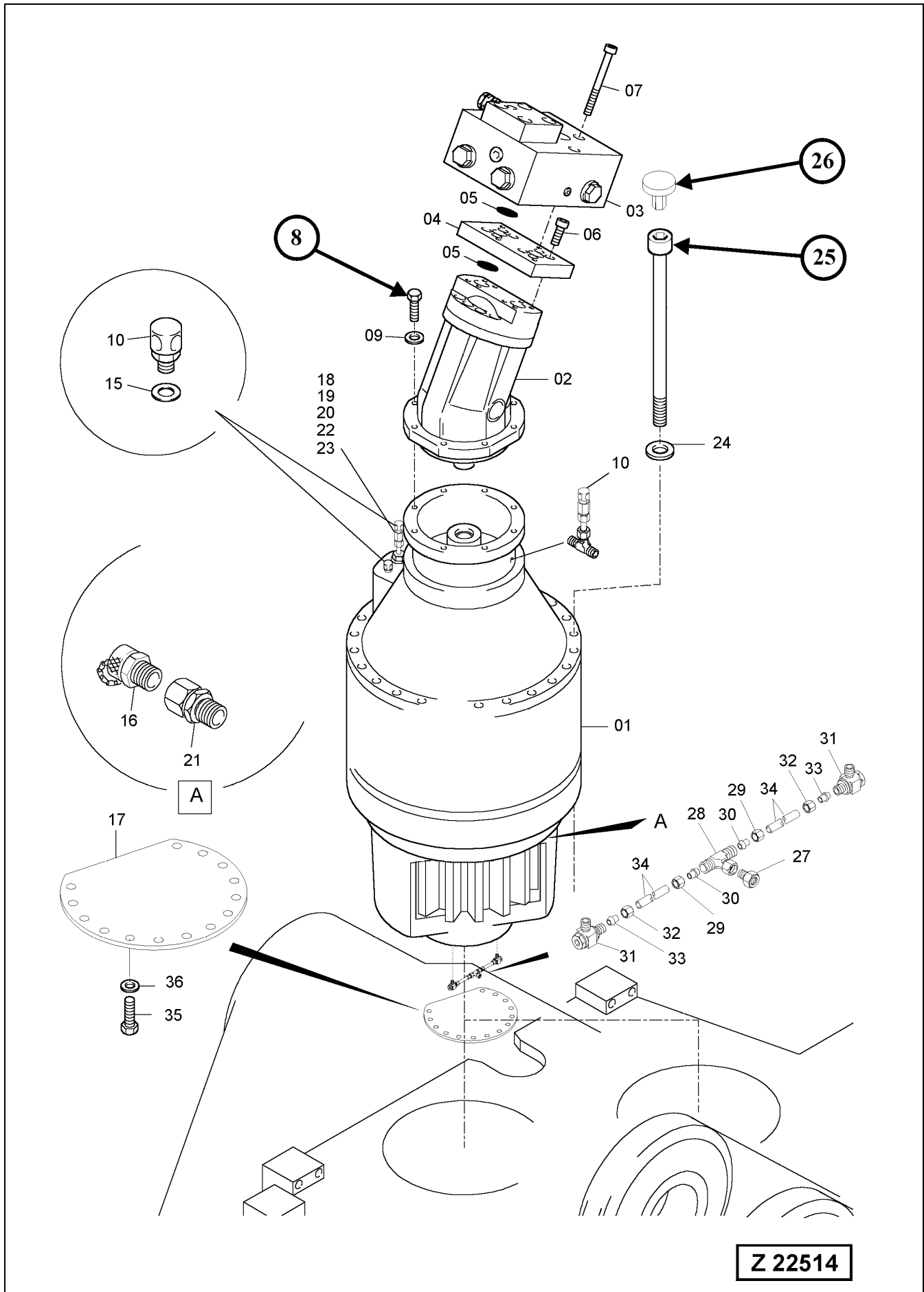
High-Strength Bolt Connections (continued)

Check fastening and condition of control valve carrier, main control valves (I, II and III) and swing control valve (5), illust. Z 21777

| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. |
|-------------------------|--------------|-------|---------|----------------------|------|
| (1) | M24 | 10.9 | 36 | 880 | 4 |
| (2) | M20 | 10.9 | 30 | 510 | 3 |
| (3) | M20 | 10.9 | 30 | 510 | 9 |
| (4) | M16 | 10.9 | 24 | 265 | 3 |
| (5) Swing control valve | | | | | |

* SW = Wrench size

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.



High-Strength Bolt Connections (continued)

Check condition and fastening of both swing gears (01) and swing motors (02), illust. Z 22514

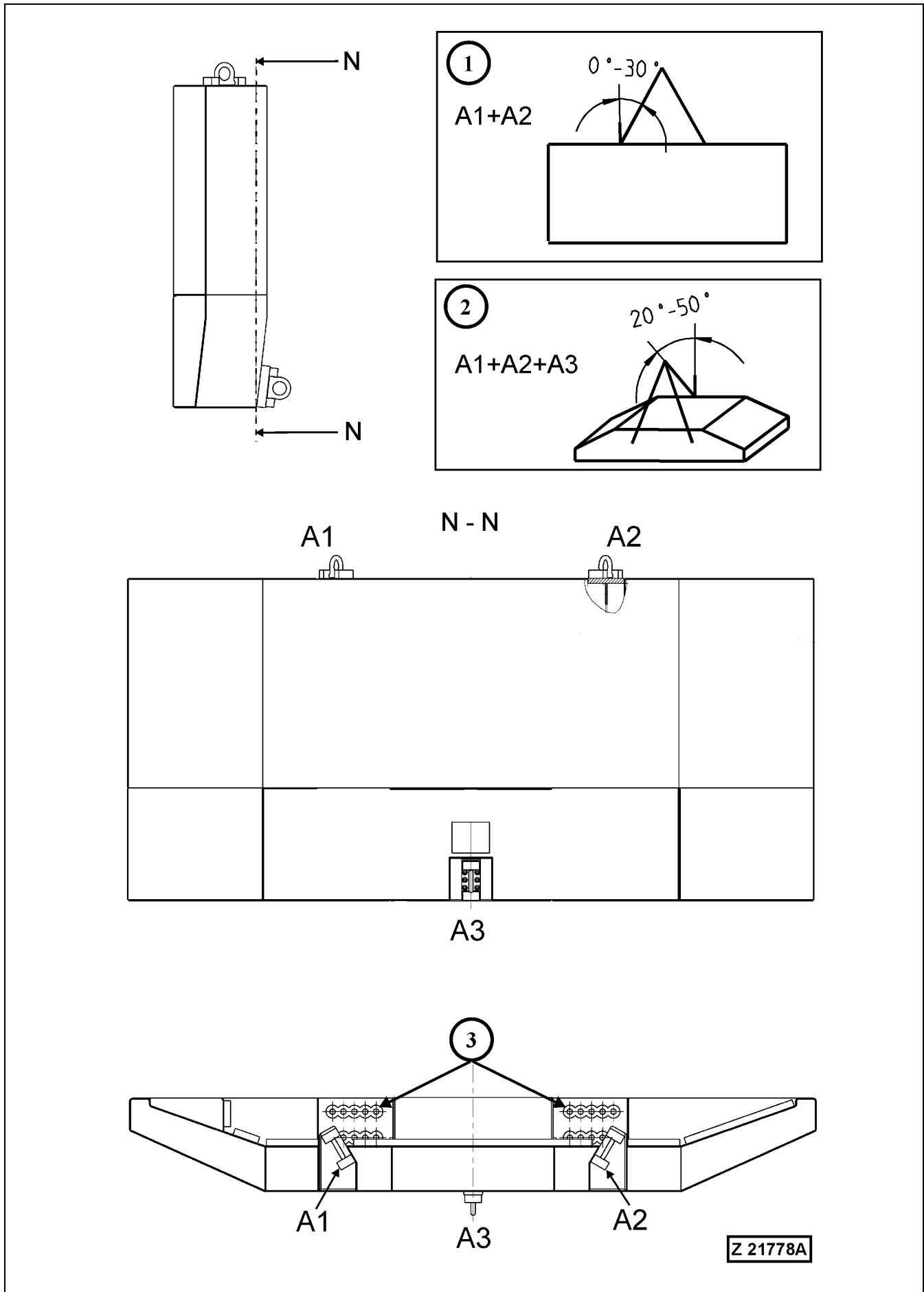
| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. |
|----------------|-----------------|-------|------------|-------------------------|------|
| (8) | M 16 | 10.9 | 24 | 265 | 16 |
| (25) | M 24 | 12.9 | 19 | 1030 | 34 |

* SW = Wrench size

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.

REMARK

After checking and retightening of swing gear mounting bolts (25), attach protection caps (26) onto the bolt heads.



High-Strength Bolt Connections (continued)

Check tightening torque of the counterweight mounting bolts, illustration Z 21778A

| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. |
|--------------------|--------------|-------|---------|----------------------|------|
| (3) Mounting bolts | M48 | 10.9 | 75 | 7500 | 20 |

* SW = Wrench size

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.

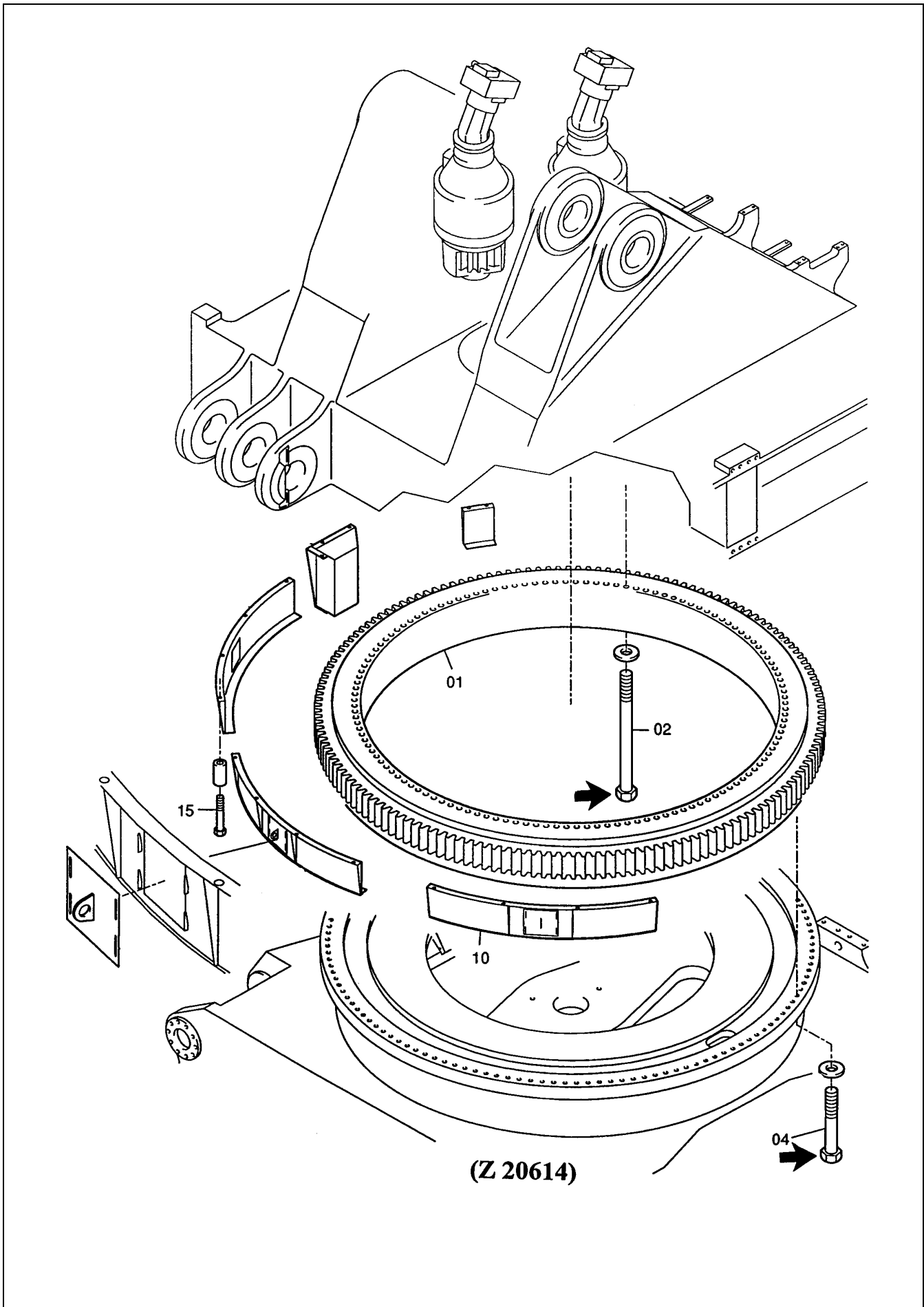
Guideline for transportation and lifting of the counterweight illustration Z 21778A

- (1) A1 and A2 fastening points for vertical transport and for raising up of the counterweight with two symmetrical ropes
- (2) A1, A2 and A3 fastening points for horizontal transport and for loading of the counterweight with three symmetrical ropes

⚠ WARNING

The chambers of the counterweight are filled with a mixture of concrete, granulated ore and steel pellets. This mixture can create explosive gases which will accumulate in the chambers of the counterweight. Before any welding, flame-cutting, grinding or drilling procedures are carried out on the counterweight it is vital to expel these gases from the counterweight chambers. Failure to properly expel the gases from the counterweight chambers can result in an explosion with serious personal injury or death.

Follow the instructions given in PARTS & SERVICE NEWS No. AH04518 for expelling the gases from the counterweight chambers.



High-Strength Bolt Connections (continued)

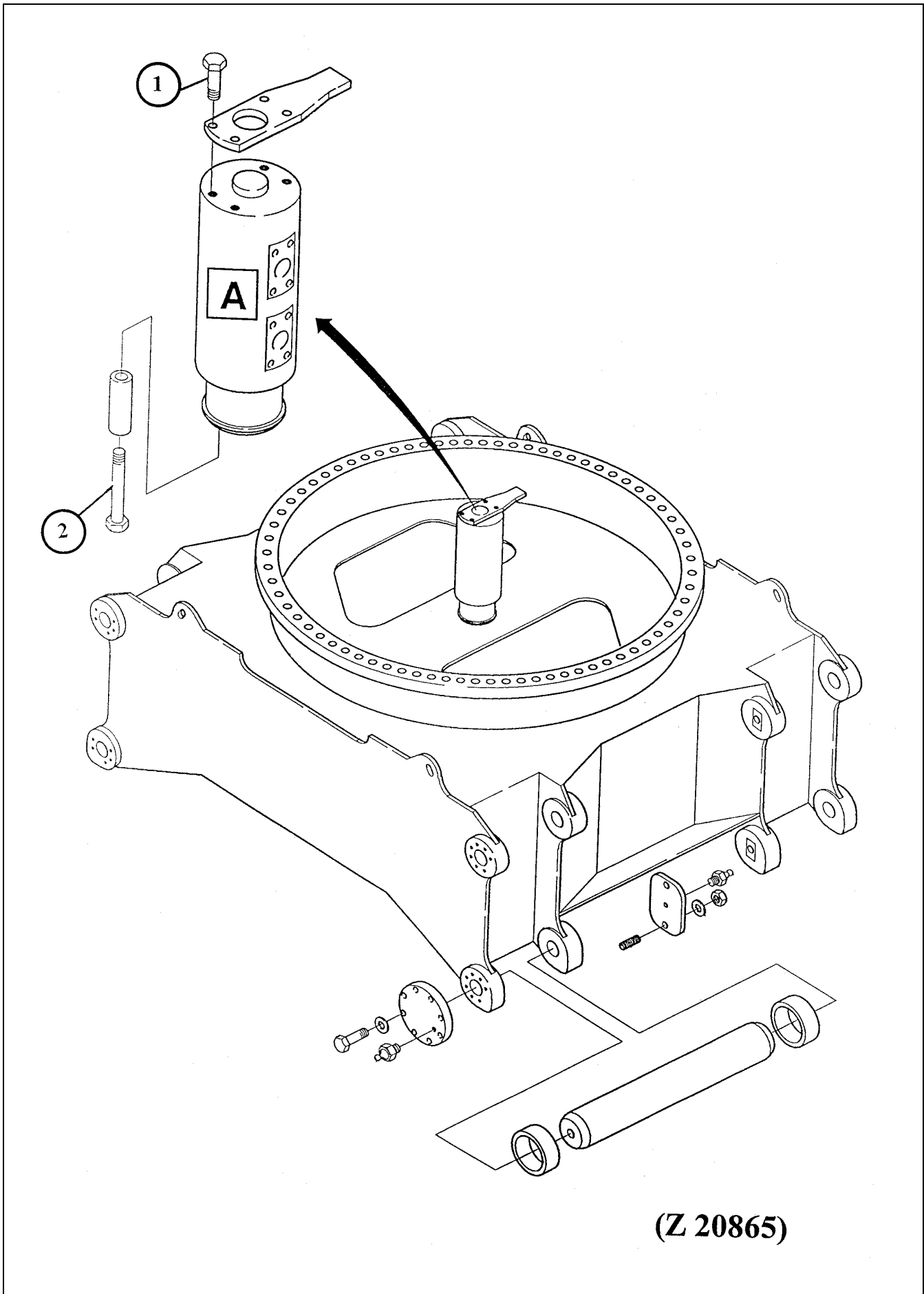
Swing circle, illust. Z 20614

Check tightening torque of inner and outer mounting bolts (02 and 04) according to PARTS & SERVICE NEWS, No. AH00511.

NOTICE

Checking/retightening of swing circle mounting bolts is only necessary after the first 1000 operating hours.

Check condition and fastening of swing circle guard (10) and bolts (15).



(Z 20865)

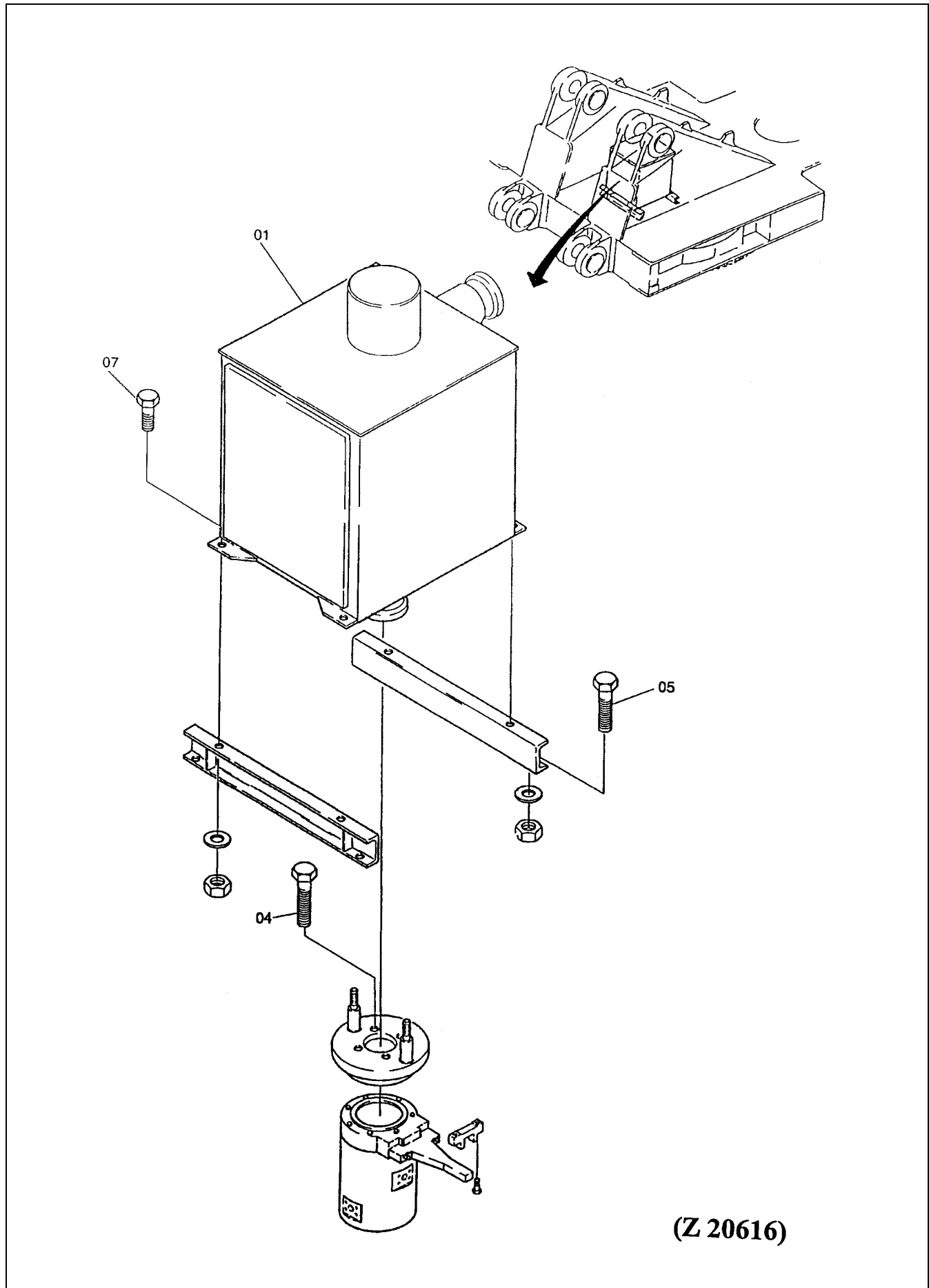
High-Strength Bolt Connections (continued)

Check condition and fastening of swivel joint (A),
illust. Z 20865

| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. |
|----------------|-----------------|-------|------------|-------------------------|------|
| (1) | M 16 | 10.9 | 24 | 265 | 4 |
| (2) | M 16 | 10.9 | 24 | 265 | 8 |

* SW = Wrench size

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.



High-Strength Bolt Connections (continued)

Excavators with Electric Prime Mover

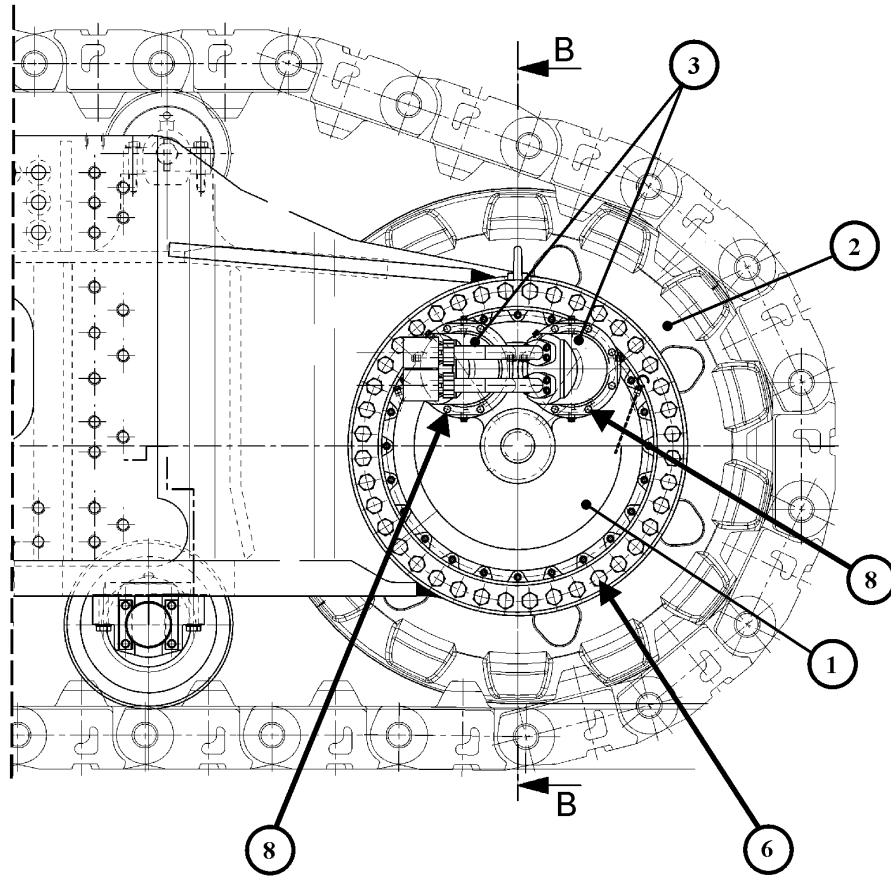
Check condition and fastening of slip ring unit (01),
illust. Z 20616

| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. |
|----------------|-----------------|-------|------------|-------------------------|------|
| ((04) | M16 | 10.9 | 24 | 265 | 4 |
| (05) | M16 | 8.8 | 24 | 180 | 4 |
| (07) | M16 | 8.8 | 24 | 180 | 4 |

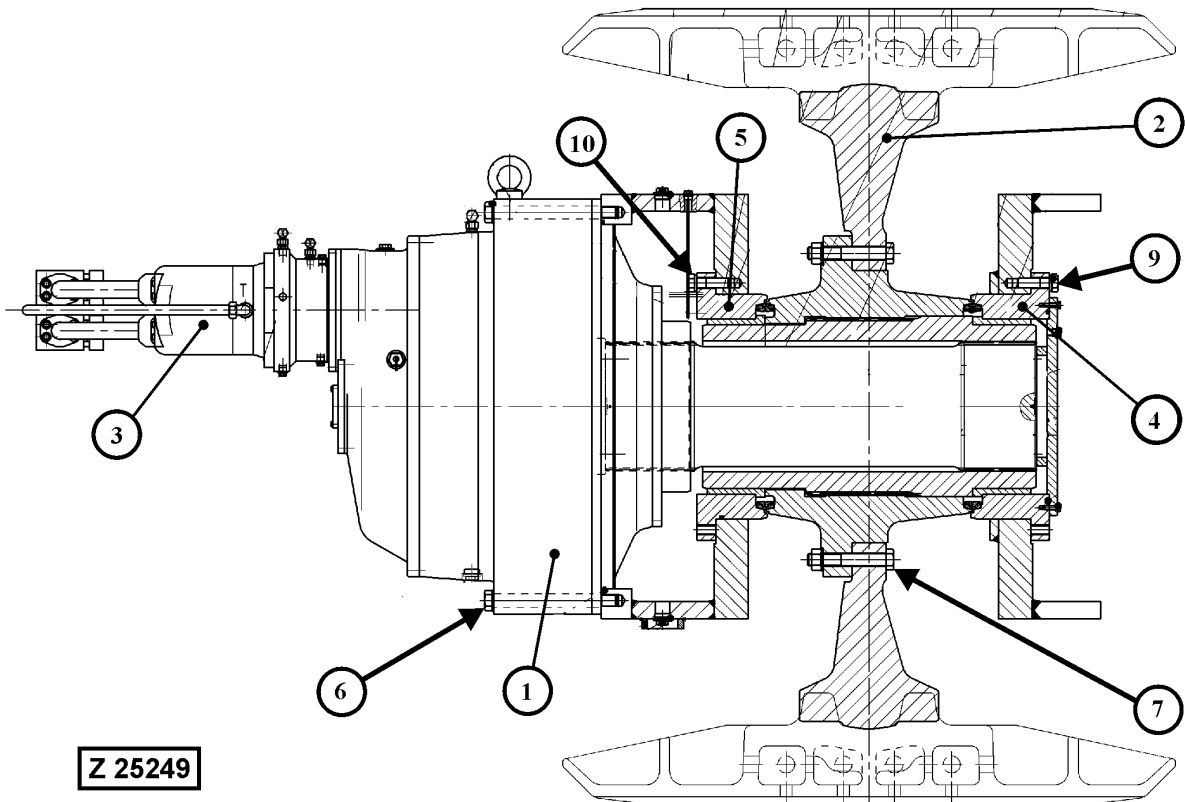
* = Wrench size

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.

- A -



Section B - B



Z 25249

High-Strength Bolt Connections (continued)

Check condition and fastening of travel gears, sprockets and travel motors

Legend for illustration Z 25249

- A - View of the RH Final drive. The configuration of the LH Final drive is the same.
- (1) Travel gear
- (2) Sprocket
- (3) Travel motors
- (4) Outer sprocket bearing
- (5) Inner sprocket bearing
- (6) Mounting bolts for travel gear to crawler carrier
- (7) Mounting bolts for sprocket to hub
- (8) Mounting bolts for travel motors
- (9) Mounting bolts for outer bearing to crawler carrier
- (10) Mounting bolts for inner bearing to crawler carrier

| Reference No.: | Bolt size mm | Grade | SW *1) mm | Tightening torque Nm | Qty. *2) |
|----------------|-----------------|-------|--------------|-------------------------|-------------|
| (6) | M36 | 10.9 | 55 | 3100 | 80 |
| (7) | M36 | 10.9 | 55 | 3100 | 72 |
| (8) | M16 | 10.9 | 24 | 265 | 32 |
| (9) | M30 | 10.9 | 46 | 1770 | 24 |
| (10) | M30 | 10.9 | 46 | 1770 | 24 |

*1) SW = Wrench size

*2) Quantity for both final drives

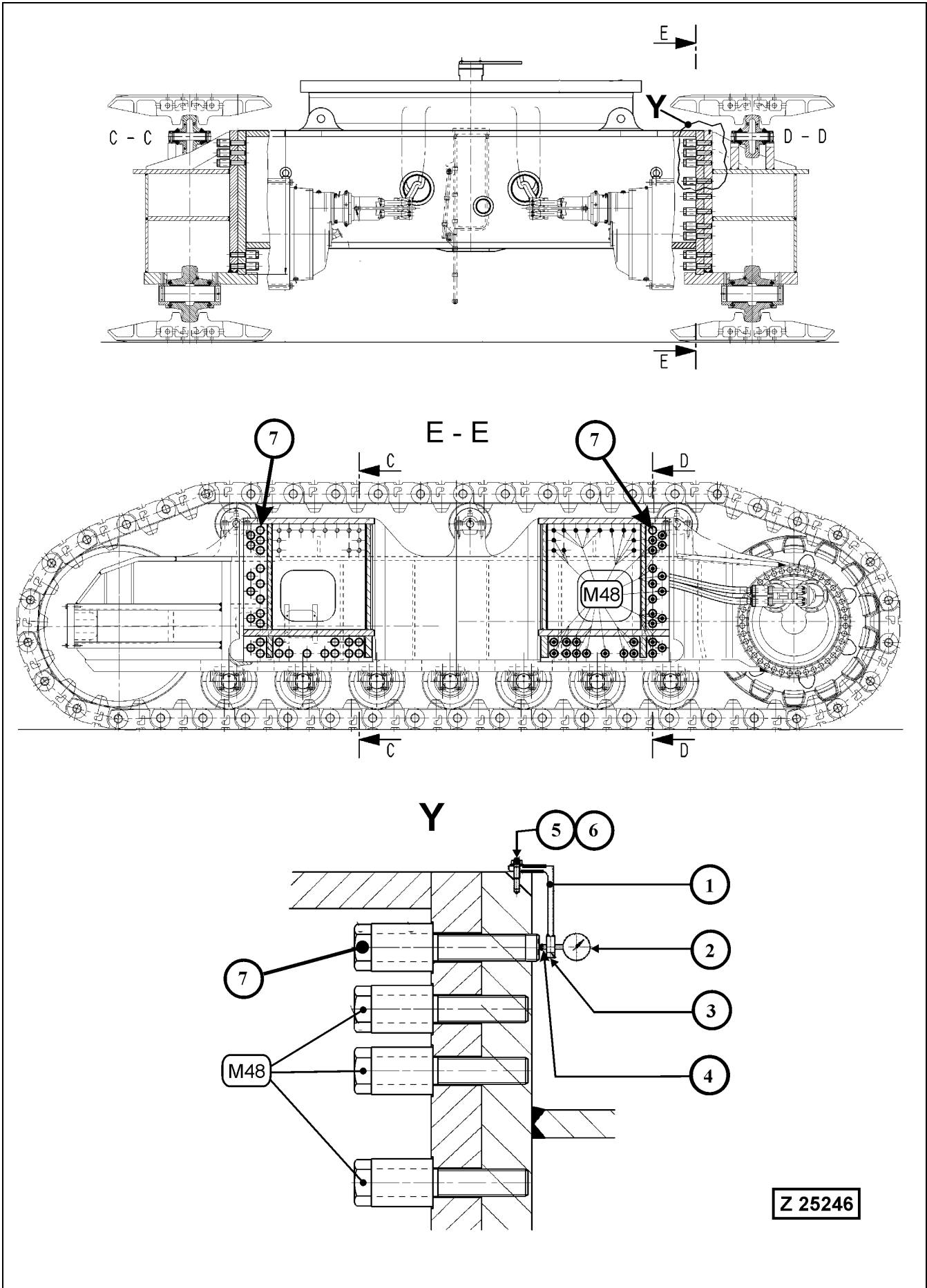
- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.

NOTICE

If the outer bolts (9) have been found loose, it is necessary to check also the inner bolts (10) for looseness.

For this purpose the travel gear assy has to be removed.

Contact your Komatsu Dealer for support.



High-Strength Bolt Connections (continued)

Retightening procedure of the crawler carrier mounting bolts

REMARK

The required tightening torque for the mounting bolts of the crawler carriers has been determined and applied during the assembling procedure of the excavator at the mine site. This procedure has to be repeated one time after the first 1000 operating hours through your Komatsu dealer.

General

The required tightening torque for all mounting bolts (M48), illustration Z25246 has to be determined with the four measuring bolts (7), which dimension is analogous to the mounting bolts.

The required axial tensioning force of the bolts (M48) is determined by means of the elongation of the bolts.

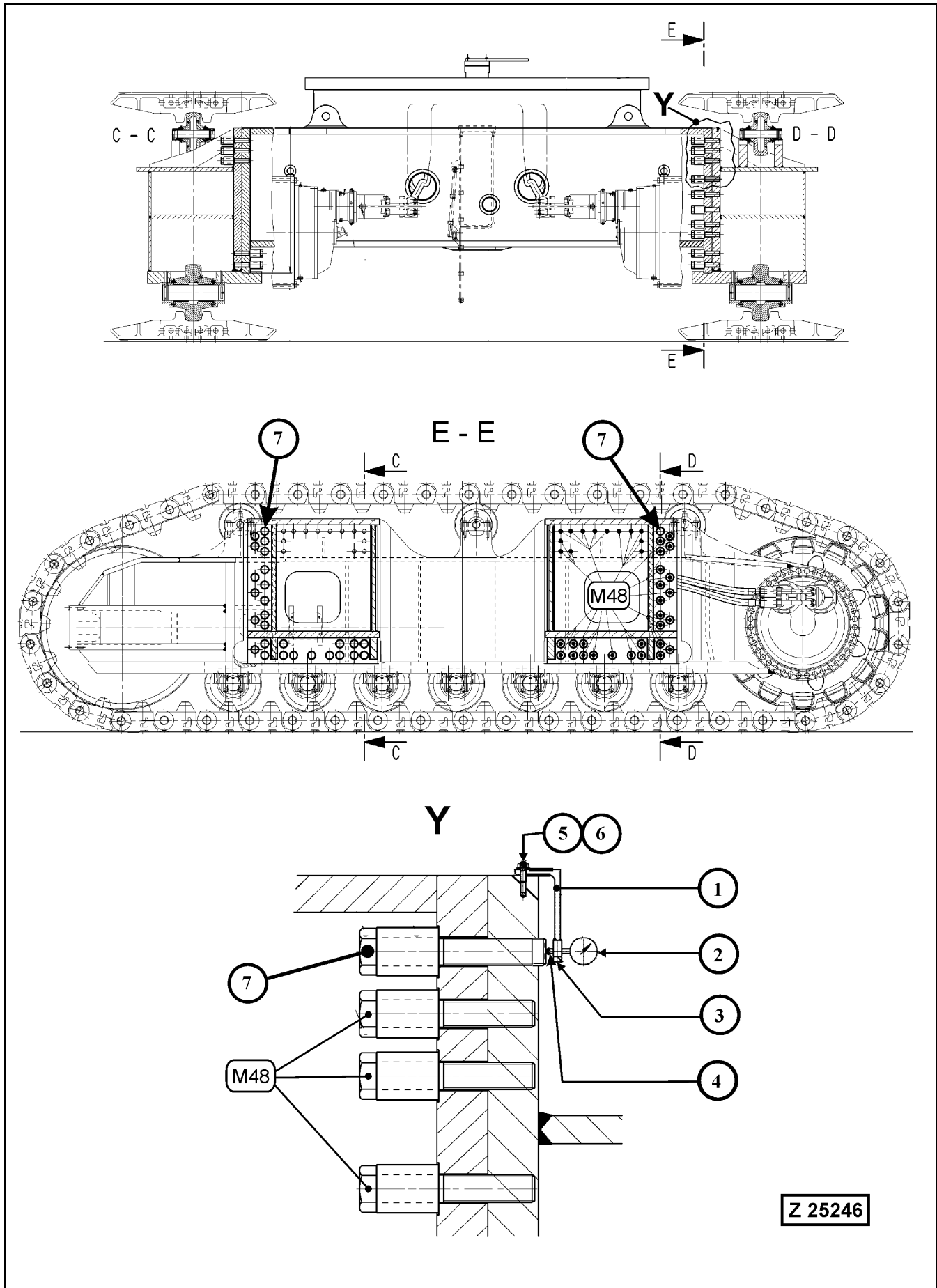
For determination of the tightening torque, two especially prepared measuring bolts (7) are installed on each crawler carrier. The measuring bolts can be identified by the centering dot at the bolt head and the milled area at the shaft end.

Necessary equipment for the retightening procedure:

- Measuring device (1 - 6) delivered with the new machine, see table below.
- Special hydraulic torque wrench, see illustration Z24072 on page 403. This tool will be provided by your Komatsu dealer.

Measuring Device PN 92847640

| Position | Part name | Part No. | Qty. |
|----------|-----------------------------|------------|------|
| 1 | Angle bar | 928 475 40 | 1 |
| 2 | Dial gauge | 092 706 40 | 1 |
| 3 | Screw M5x16 | 502 515 98 | 1 |
| 4 | Feeler | 477 172 40 | 1 |
| 5 | Bolt M10x25 | 307 777 99 | 2 |
| 6 | Washer | 517 122 98 | 2 |
| 7 | Measuring bolts (installed) | 913 613 40 | 4 |



High-Strength Bolt Connections (continued)

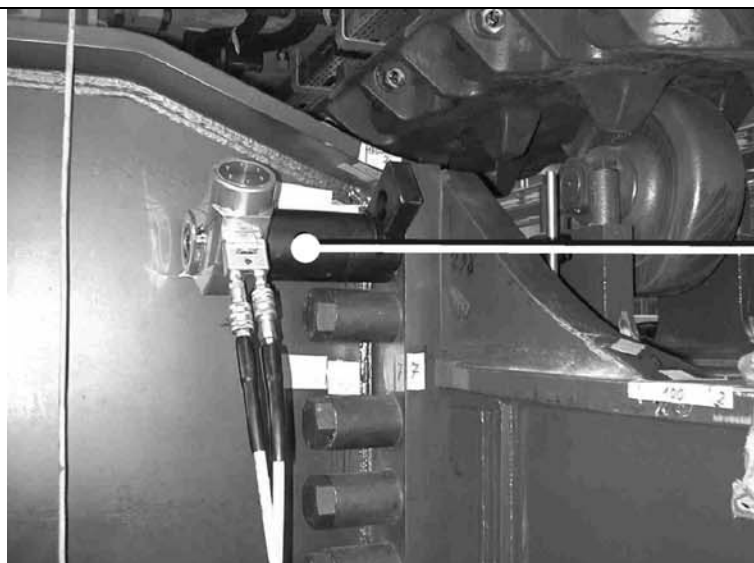
Procedure for determination of the tightening torque for the crawler carrier mounting bolts after the first 1000 operating hours, see illustration Z25246

1. Loosen the two measuring bolts (7) at the left crawler carrier and the two measuring bolts at the right crawler carrier. Do not lubricate the measuring bolts.
2. Tighten the four measuring bolts (7) with 150 Nm.
3. Attach the measuring device (1 - 6).
4. Set the dial gauge (2) to the zero position.
5. Attach the special hydraulic torque wrench (1), see illustration Z24072 on next page to the measuring bolt (7).
6. Increase the pressure at the hydraulic torque wrench until a torque of 2100 Nm is reached and tighten the measuring bolt.
7. Record the pressure and the change of the bolt length in a table.
8. Increase the pressure further by steps of 10 bar until the required elongation of 0.93 mm of the measuring bolts (7) is reached.
9. Record the corresponding hydraulic pressures in a table.
10. Repeat this procedure on all four measuring bolts (7).
11. Add the 4 determined hydraulic pressures and then divide by 4 to obtain an average value.
12. Now loosen only one of the mounting bolts (M48) and tighten up to the determined average pressure.

CAUTION

DO NOT loosen more than one bolt at the same time.
DO NOT lubricate the bolts (M48).

13. Repeat this procedure step by step at all of the 156 mounting bolts (M48) .



1



2

3



4

Z 24072

High-Strength Bolt Connections (continued)

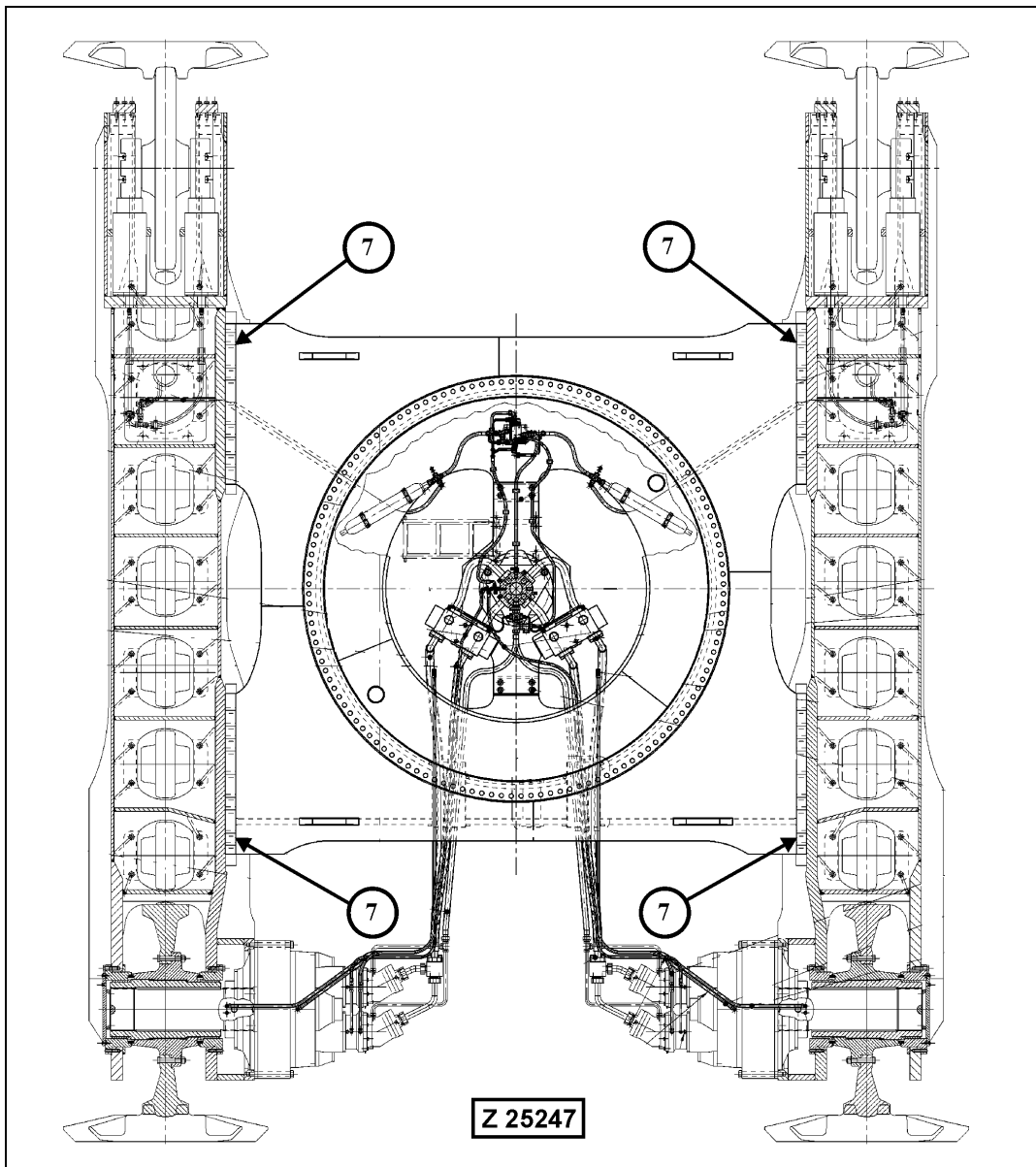
Special hydraulic torque wrench

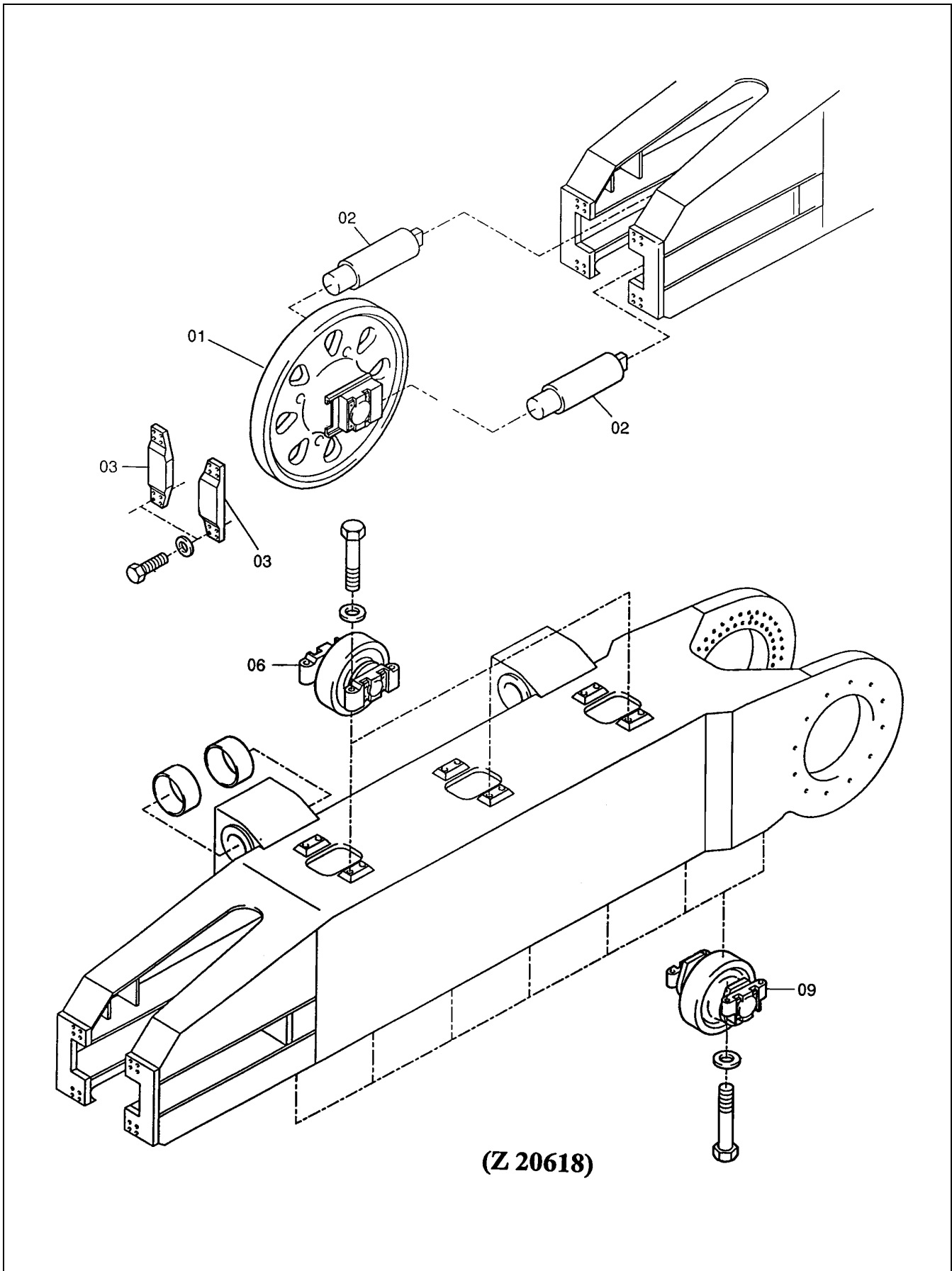
Legend for illustration Z24072:

- (1) Application of the hydraulic torque wrench
- (2) Special wrench socket with supporting bar (P/N 793 376 73)
- (3) Hydraulic wrench (P/N 793 374 73)
- (4) Electro-hydraulic pump set (P/N 793 375 73)

The equipment shown in illustration Z24072 will be provided by your Komatsu dealer.

Location of the four measuring bolts (7), illustration Z25247





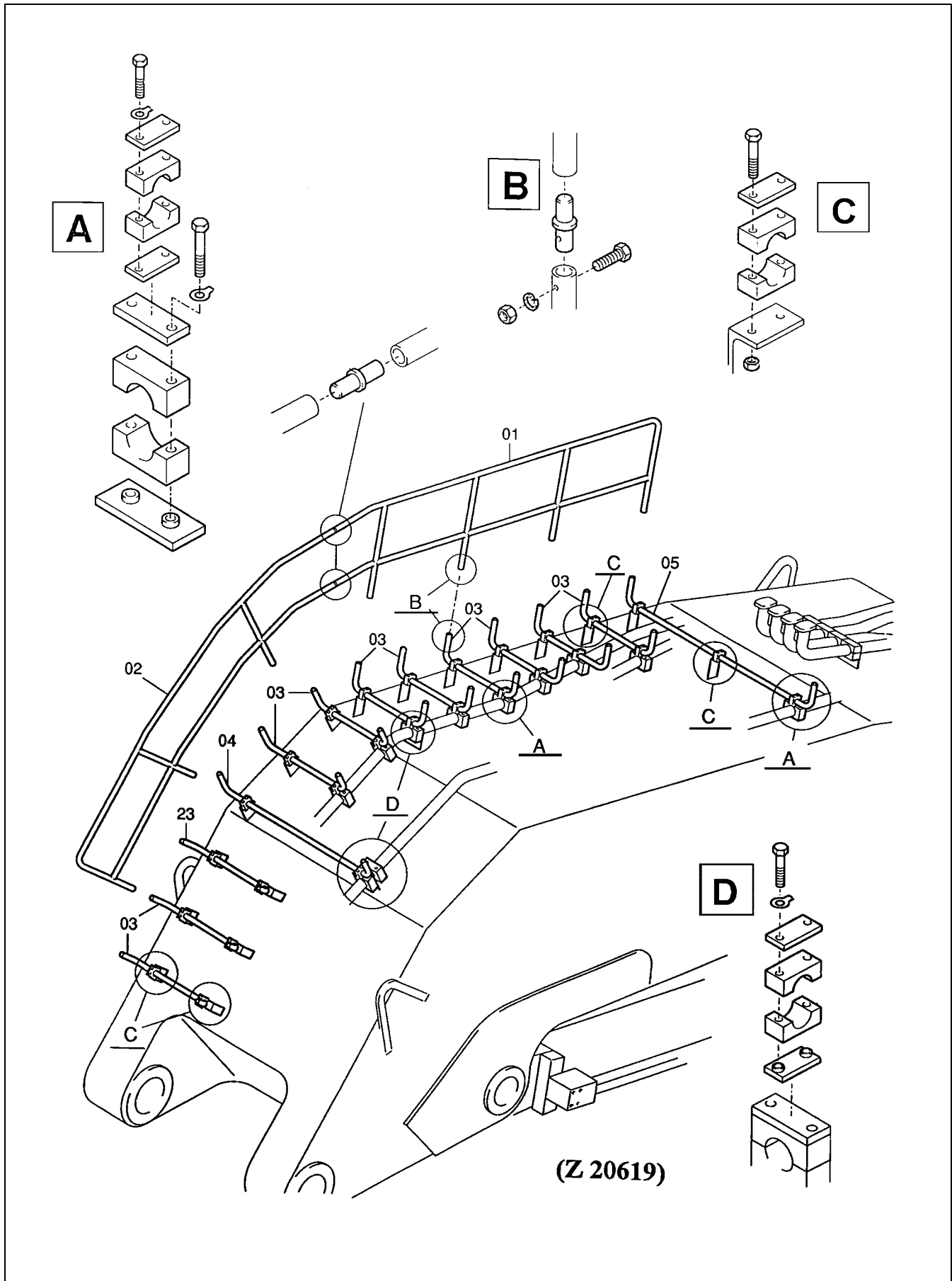
High-Strength Bolt Connections (continued)

Crawler Carrier

Check condition and fastening of guide wheels (01), stop plates (03) and rollers (06 and 09), illust. Z 20618.

Legend for illust. Z 20618:

- (01) Guide wheel
- (02) hydraulic track tensioning cylinders
- (03) Stop plates for guide wheel sliding blocks
- (06) Support rollers
- (09) Bottom rollers



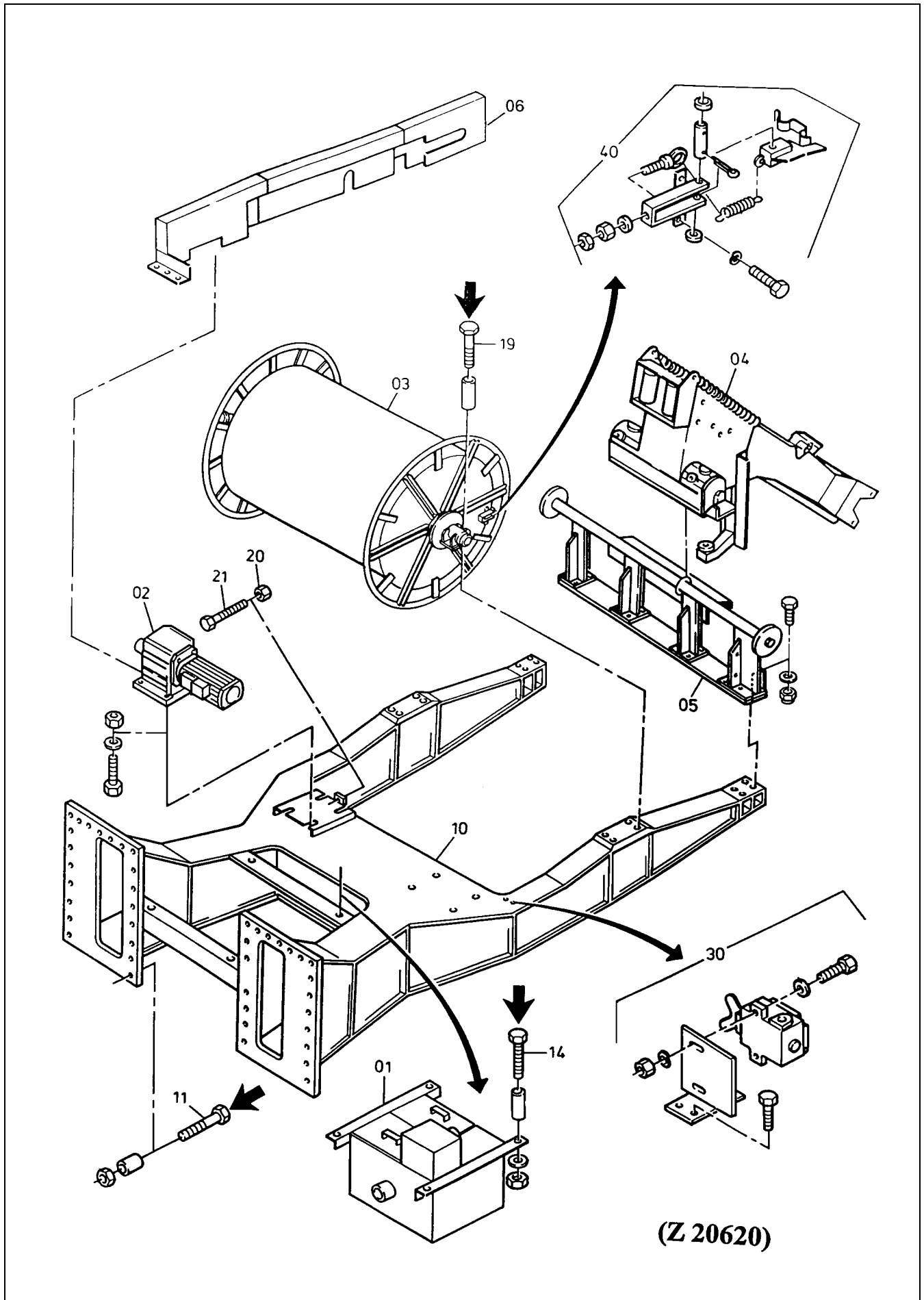
High-Strength Bolt Connections (continued)

Check condition and fastening of railings (01/02) and of steps (03, 04, 05 and 23).

See details (A - D) for mounting parts arrangement.

Legend for illust. Z 20619

- (A) Mounting assembly for steps (03) to steel pipe, version I
- (B) Mounting assembly for railing posts to steps (03)
- (C) Mounting assembly for steps (03) to boom welded brackets
- (D) Mounting assembly for steps (03) to steel pipe, version II



High-Strength Bolt Connections (continued)

Cable Drum for Excavators with Electric Prime Mover

- Check condition and fastening of parts (01 - 06) and (10, 30 and 40), illust. Z 20620

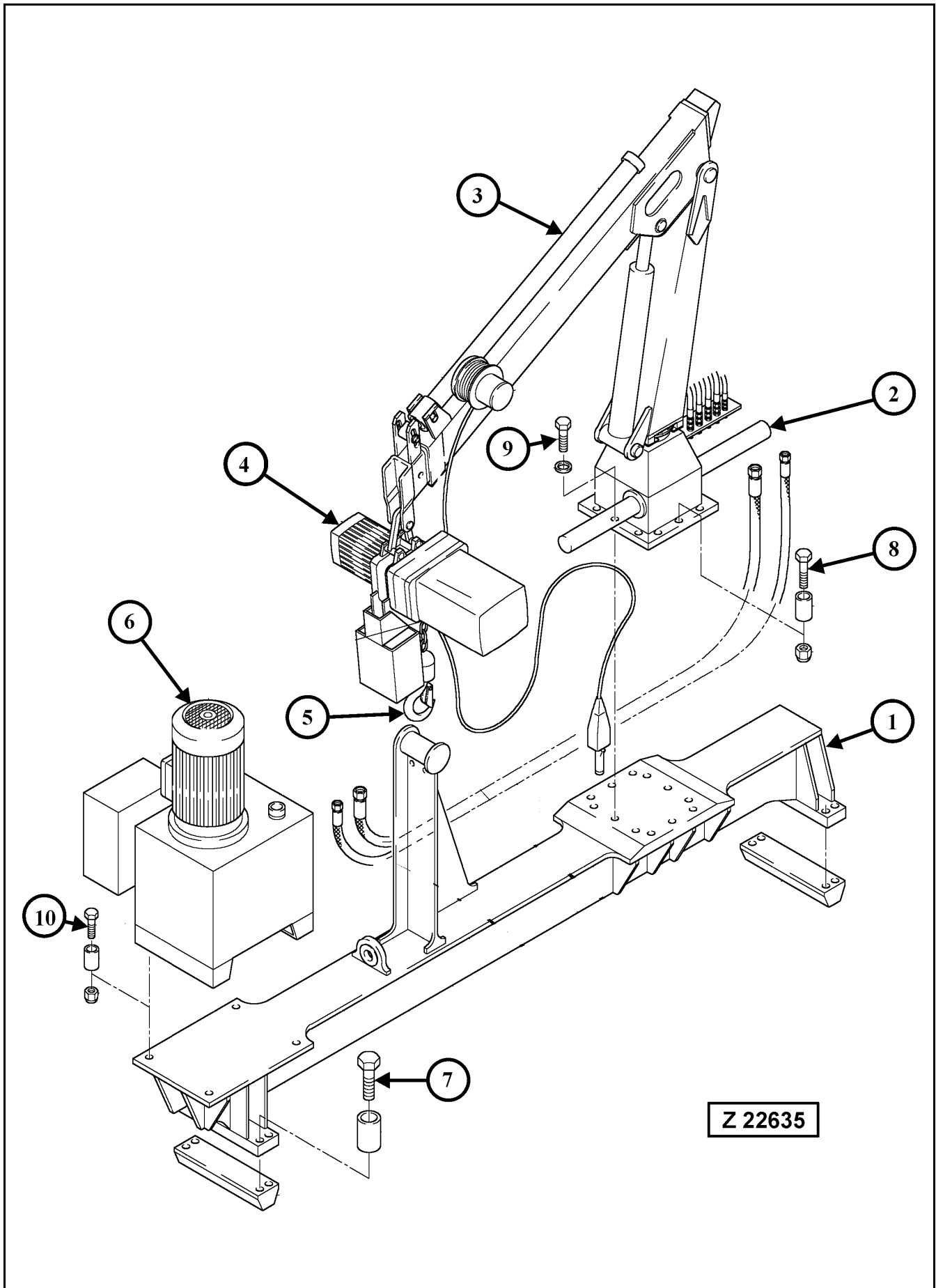
Legend for illust. Z 20620

- (01) Junction box
- (02) Brake motor
- (03) Drum body
- (04) Cable guide rocker arm
- (05) Sliding frame
- (06) Drive chain guard
- (10) Cable drum carrier frame
- (11) Mounting bolts frame (10) to undercarriage center section
- (14) Mounting bolts junction box (01) to frame (10)
- (19) Mounting bolts drum (03) to frame (10)
- (20) Lock nut
- (21) Adjusting screw for drive chain tension
- (30) Limit switch, cable end
- (40) Actuator lever for limit switch (30)

| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. |
|----------------|-----------------|-------|------------|-------------------------|------|
| (11) | M20 | 10.9 | 30 | 510 | 40 |
| (14) | M20 | 10.9 | 30 | 510 | 4 |
| (19) | M16 | 10.9 | 24 | 265 | 4 |

* SW Wrench size

For more information concerning cable drum maintenance refer to the separate booklet CABLE DRUM in volume 2 binder.



High-Strength Bolt Connections (continued)

Roof-mounted service crane available for shovels with electric prime mover only (special equipment).

Check condition and fastening of crane base and crane

Legend for illust. Z 22635

- (1) Crane base
- (2) Slew crane
- (3) Outrigger
- (4) Electric chain hoist or hydraulic rope winch
- (5) Safety hook
- (6) Electric -hydraulic power unit

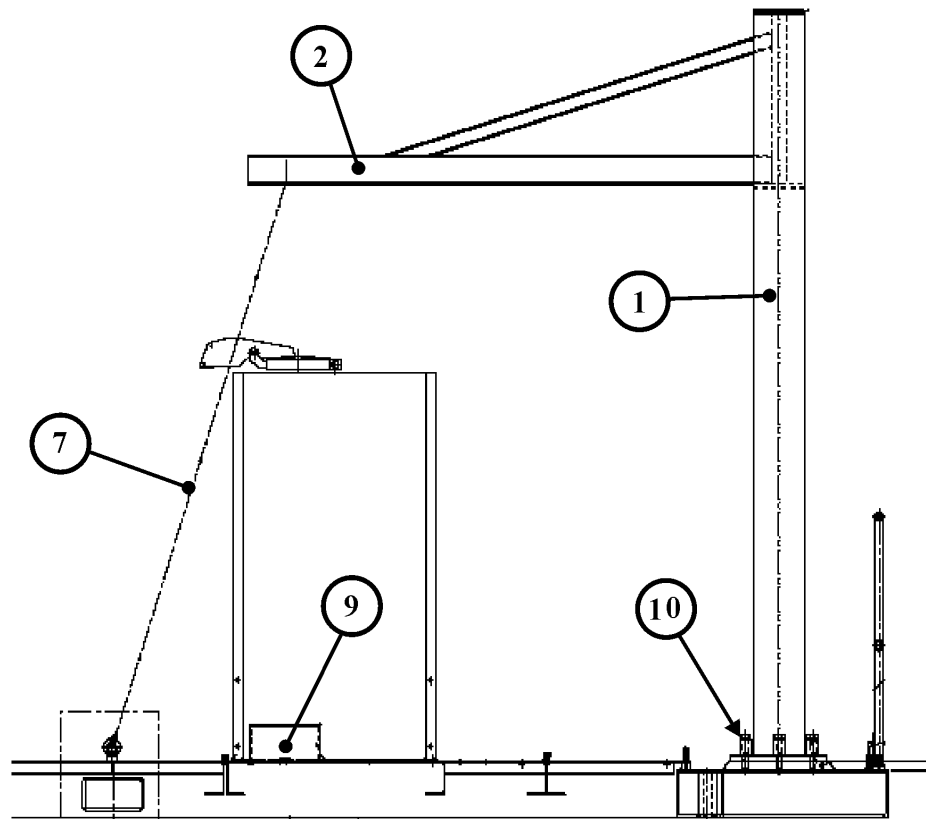
| Reference No.: | Bolt size mm | Grade | SW * mm | Tightening torque Nm | Qty. |
|----------------|-----------------|-------|------------|-------------------------|------|
| (7) | M24 | 10.9 | 36 | 880 | 8 |
| (8) | M20 | 10.9 | 30 | 510 | 10 |
| (9) | M20 | 10.9 | 30 | 510 | 2 |
| (10) | M12 | 8.8 | 19 | 74 | 16 |

* SW Wrench size

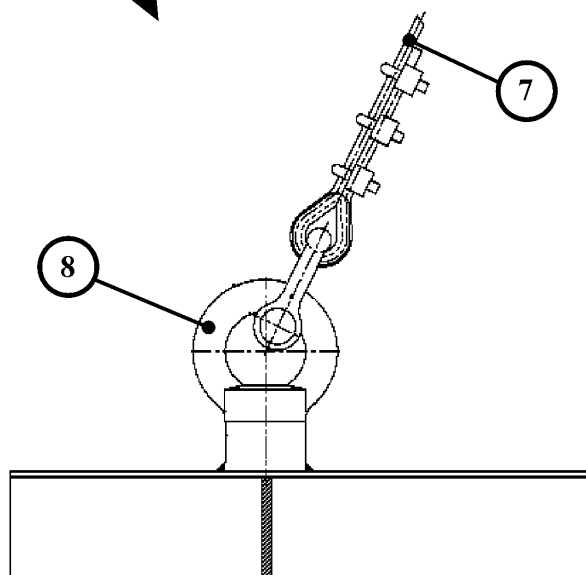
- Re-tighten loose mounting bolts and replace missing bolts.
- Replace self locking nuts which have lost their clamping torque.

REMARK

For more information concerning crane maintenance refer to the separate Instruction Manual MKG CRANE HMK 60 Ta1 filed in volume 2 binder.



View X



Z 23054

High-Strength Bolt Connections (continued)

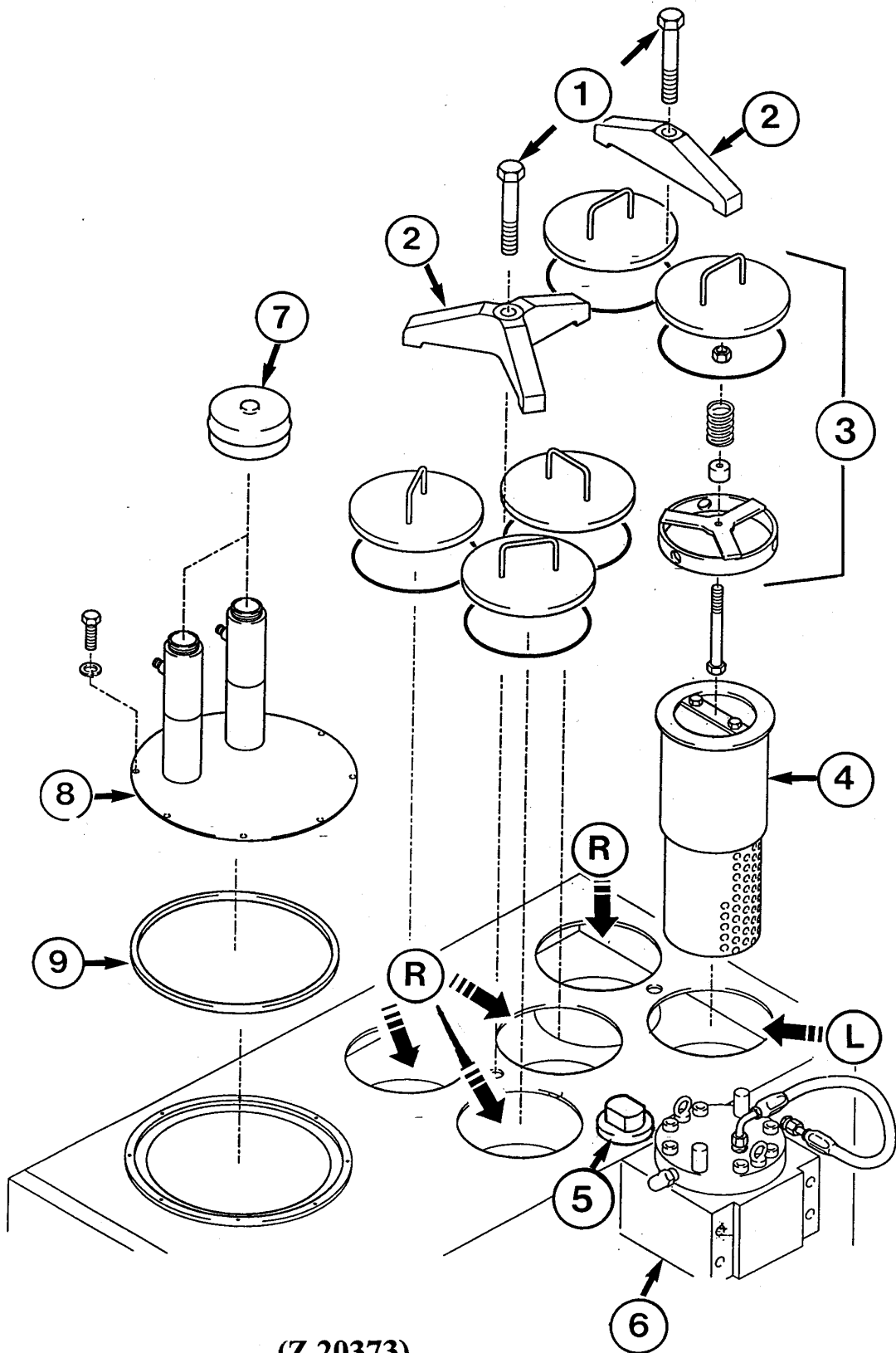
Roof-mounted crane for grease barrel replacement (special equipment)

Check condition and fastening of the crane

Legend for illustration Z 23054

- | | |
|----|--|
| 1 | Crane post |
| 2 | Outrigger |
| 7 | Ropes for securing the outrigger (2) in home position |
| 8 | Ring for fastening the wire ropes (7). |
| 9 | Storage box for hoist chain |
| 10 | Crane mounting bolts, M27 quality grade 8.8. Tightening torque 920 Nm. |

Be sure to check security and tightening torque of the crane mounting bolts (10) after the first 100 operating hours and thereafter every 1000 operating hours. Check condition of fastening ropes (7) and ring (8).



(Z 20373)

4.12.2 HYDRAULIC SYSTEM - FILTER SERVICE

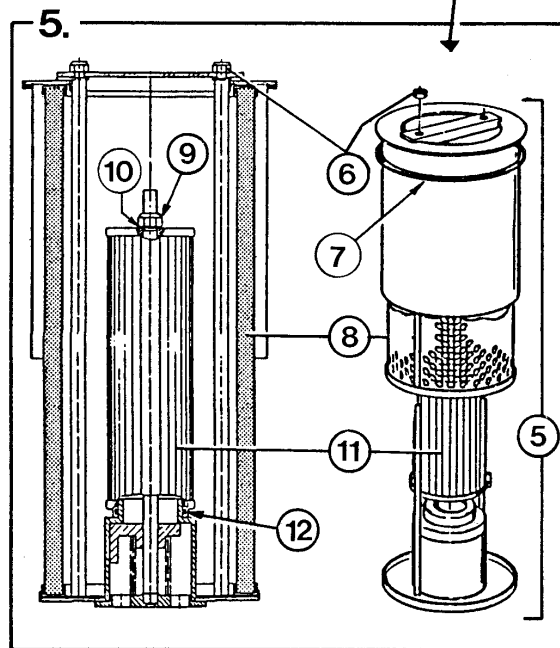
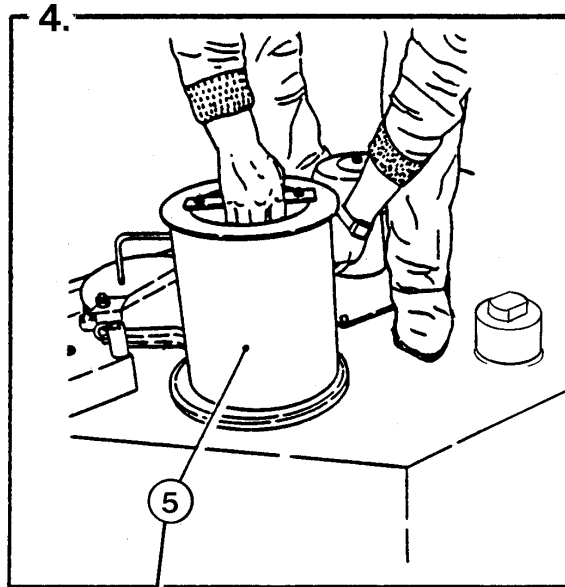
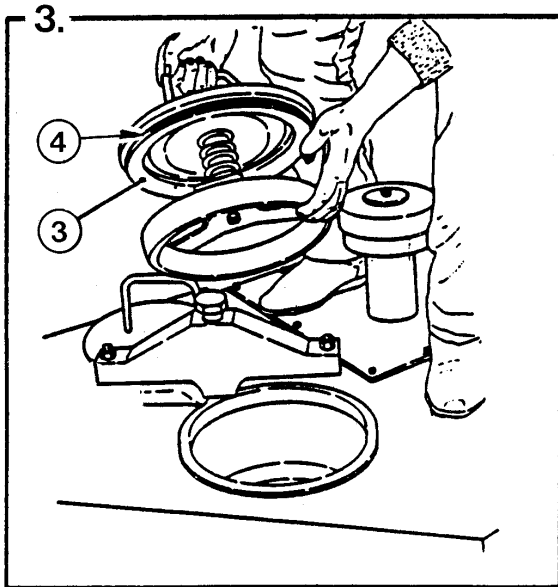
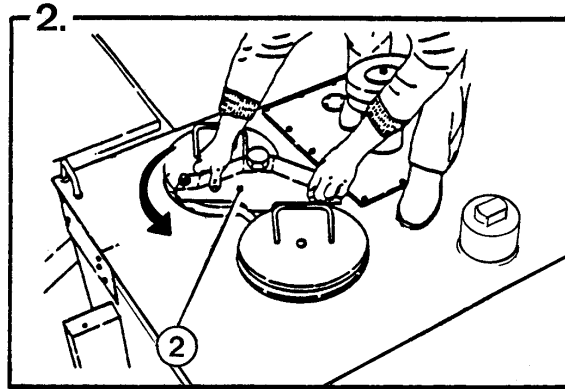
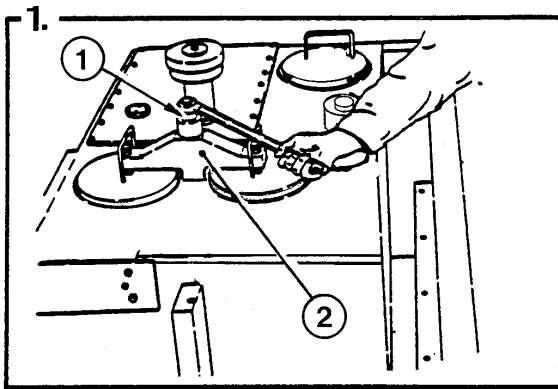
Legend for illust. Z 20373

| | |
|-----|---------------------------------|
| R | Return of filter location |
| L | Leakage oil filter location |
| (1) | Mounting bolt |
| (2) | Filter cover retainer |
| (3) | Filter cover assy |
| (4) | Return- and leakage filter unit |
| (5) | Oil filler plug |
| (6) | Back-pressure valve |
| (7) | Breather filter |
| (8) | Cover |
| (9) | Gasket |

NOTICE

The description of the hydraulic filters appears in the following sequence:

- Return- and Leakage oil filters, see page 417
- Breather filter, see page 419
- High pressure filters, see page 421
- Pressure filters on central control and filter frame, see page 425



Z 19336

FILTER SERVICE

- Replace return oil filter elements
- Replace leakage oil filter element
- Check filter screens

Follow the steps shown in illust. Z 19336:

1. Loosen bolt (1).
2. Turn retainer (2).
3. Remove cover assy (3). Inspect O-ring (4) and replace if necessary.
4. Lift out element assy (5).
5. Disassemble filter assy (5) in sequence of ref. nos. (6 to 12)
6. Discard element (8)
7. Inspect screen (11) and clean if necessary.

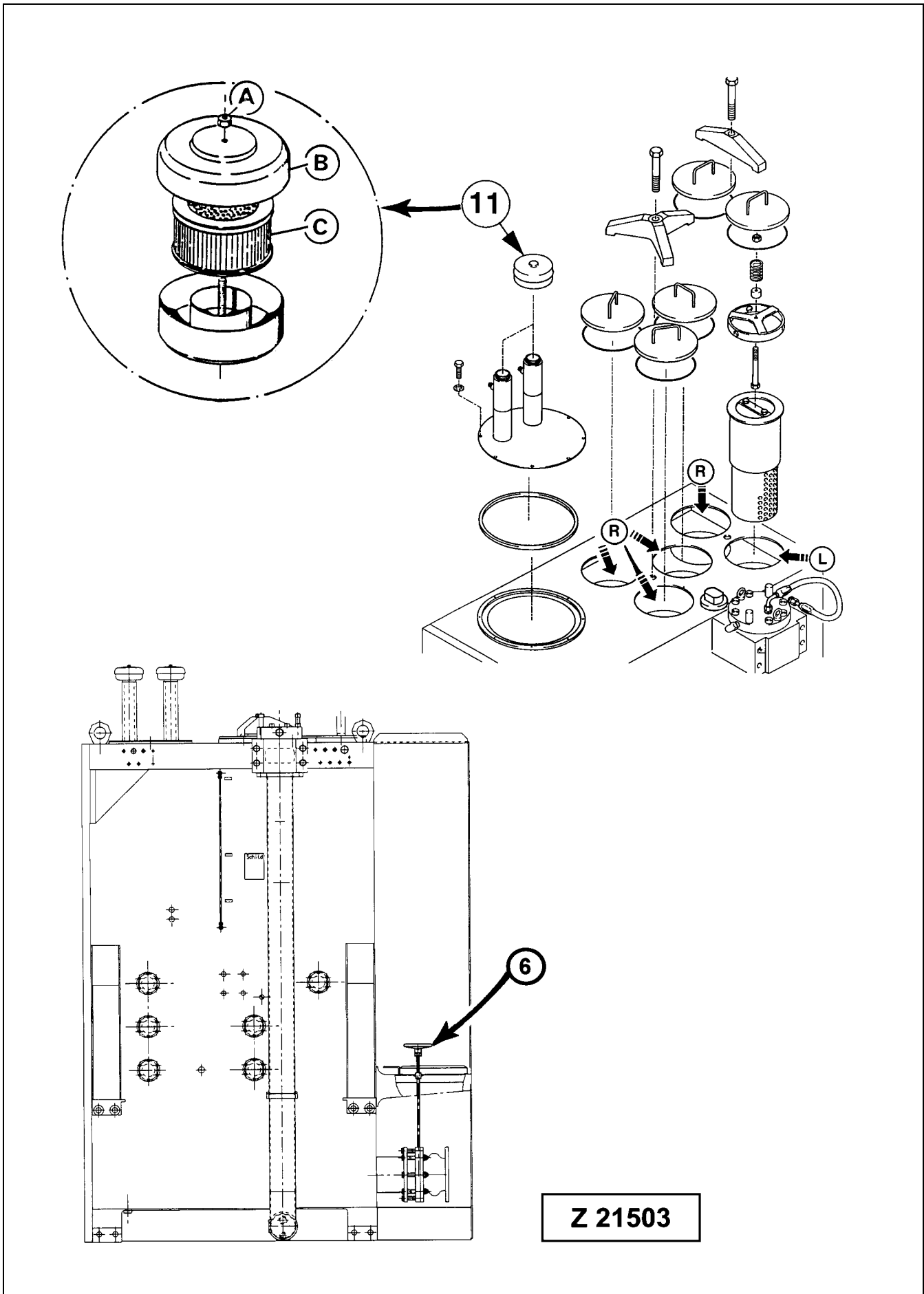
NOTICE

Take care not to contaminate the clean inside of the screen when flushing.

8. Inspect screen (11) and O-ring (12) for damage replace if necessary.
Install screen (11) use new sealing washer (10) and self locking nut (9).
9. Reassemble filter assy (5) with new element (8) according to step 5.
Use new self locking nuts (6).
10. Install filter assy use new gasket (7).
Torque bolt (1) to 850 Nm.

NOTICE

- **After each repair of the hydraulic system the elements (8) should be replaced after about 50 operating hours.**
- **The filter elements must also be replaced when the fault message "Filter restriction" is displayd on the VHMS screen.**
- **Replace screens (11) every 5000 operating hours at the latest.**



FILTER SERVICE

- Replace breather filter element
- Drain water and sediments from hydraulic oil tank

Legend for illust. Z 21503

- (6) Hand wheel of main shut-off valve located between suction oil reservoir and main oil reservoir
- To OPEN the valve, turn hand wheel (6) CCW to the stop
 - To CLOSE the valve, turn hand wheel CW to the stop

A proximity switch located on the gearbox of the shut-off valve monitors the valve position. With the valve not fully open, a corresponding message will be displayed on the VHMS screen in the Operator's cab.

REMARK

Before starting the engine, make sure the shut-off valve is completely open by turning hand wheel (6) fully to the left (CCW).

- (11) Breather filter

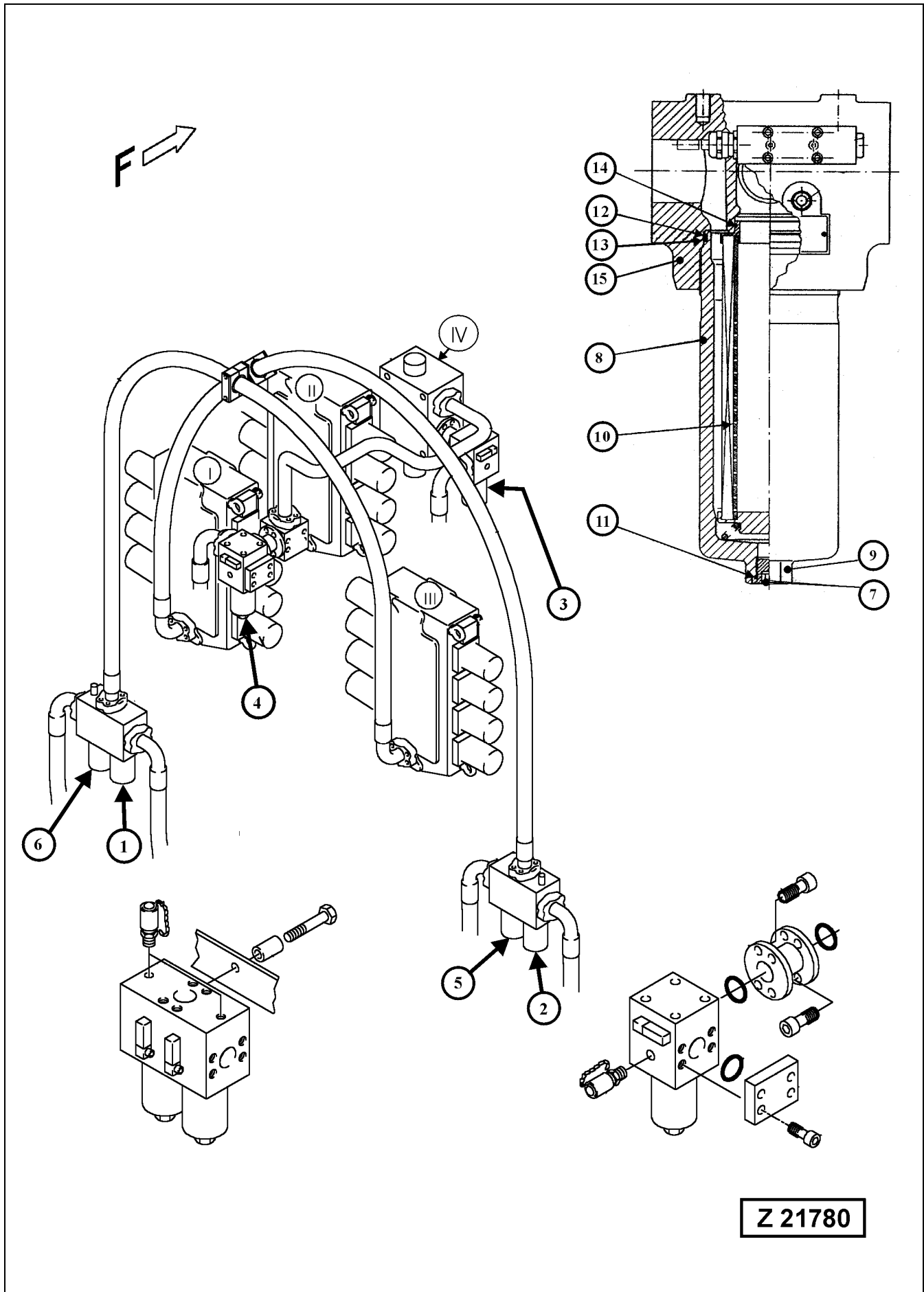
Replace Element (C) of Breather Filter (11).

1. Remove nut (A).
2. Remove cover (B).
3. Remove filter element (C).
4. Insert new filter element and reassemble the breather filter (11).

Drain Water and Sediments

Drain water and sediments with machine standing on level ground and when machine was out of operation for some time.

Refer to Operation section page 230 for evacuation procedure.



FILTER SERVICE

High Pressure Filters "HPF", illustration Z 21780

NOTICE

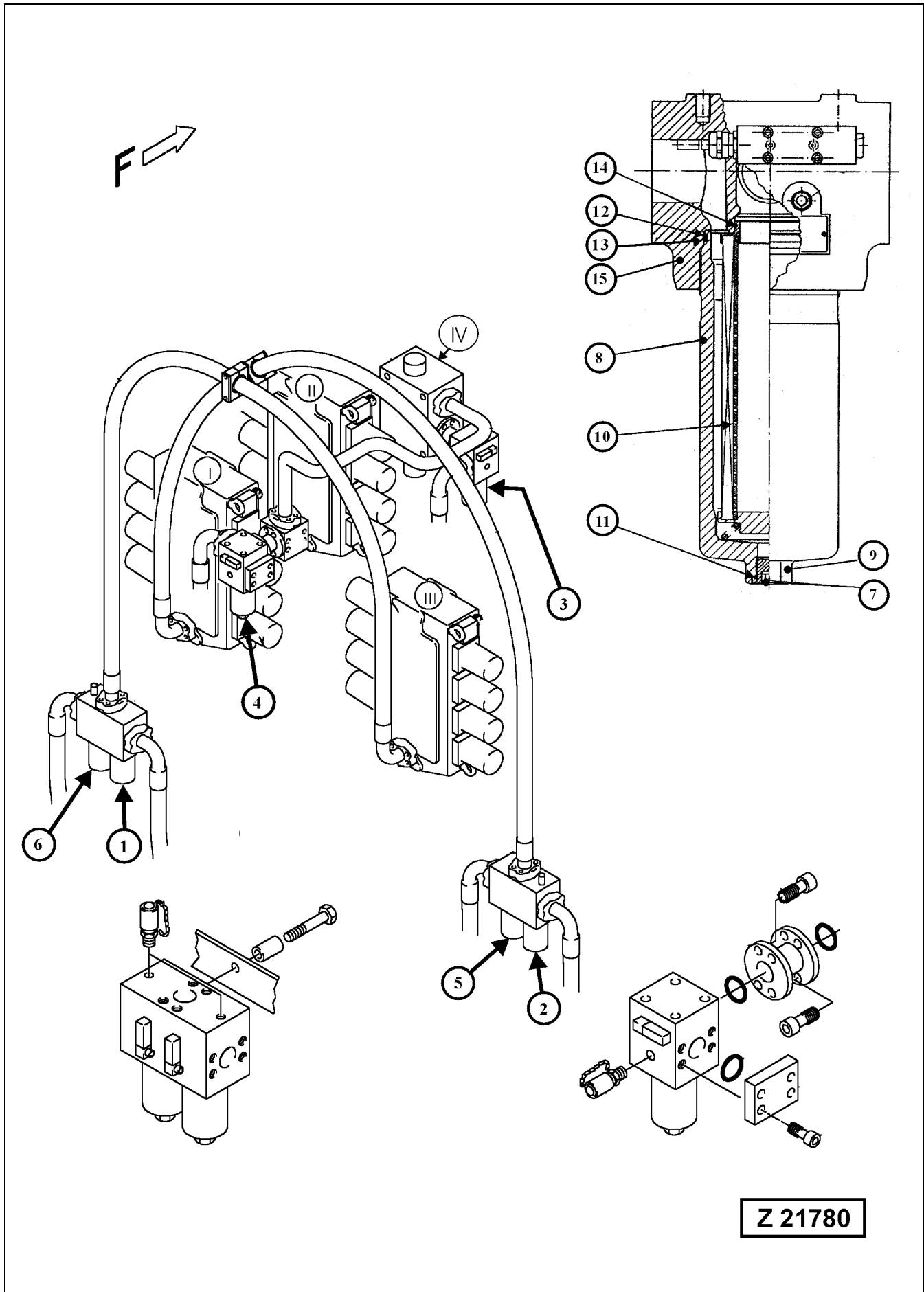
- The filter reference numbers (1 - 6) correspond to the numbering of the main pumps.
- If, for example, the fault message "High pressure filter #5 restricted" is being displayed on the VHMS screen, the filter number (5) in the illustration has to be serviced. The engine will be shifted automatically to low idle speed. Stop work and inform Service staff about the fault message.

Legend for illustration Z 21780

- (1) HPF for pump 1
- (2) HPF for pump 2
- (3) HPF for pump 3
- (4) HPF for pump 4
- (5) HPF for pump 5
- (6) HPF for pump 6
- (7) Drain plug
- (8) Filter case
- (9) Hexagon
- (10) Filter element
- (11) Packing ring
- (12) O-ring
- (13) Back-up ring
- (14) O-ring
- (15) Filter header

Clean or replace high pressure filter elements:

1. Place working attachment on the ground and shut-off the engines.
Relieve pressure in the hydraulic system with several movements of the control levers.
2. Place a suitable container below the filter in order to collect outflowing oil.
3. Remove plug (7) and drain the oil.
4. Screw off filter case (8).



Z 21780

FILTER SERVICE

High Pressure Filters "HPF", illustration Z 21780

NOTICE

Carefully inspect elements for damage. Always install new elements if ruptures or other damages are found.

5. Remove element (10) and clean. Take care not to contaminate the "Clean" inside of the element when flushing.
6. Inspect O-rings (12 and 14) and back-up ring (13). Replace if necessary.
7. Install drain plug (7) with new packing ring (11). Fill filter case (8) half way up with clean hydraulic oil and re-assemble the filter. Make sure element (10) is properly seated in the filter head.
8. After short operating period check filter units for leakage.

⚠ CAUTION

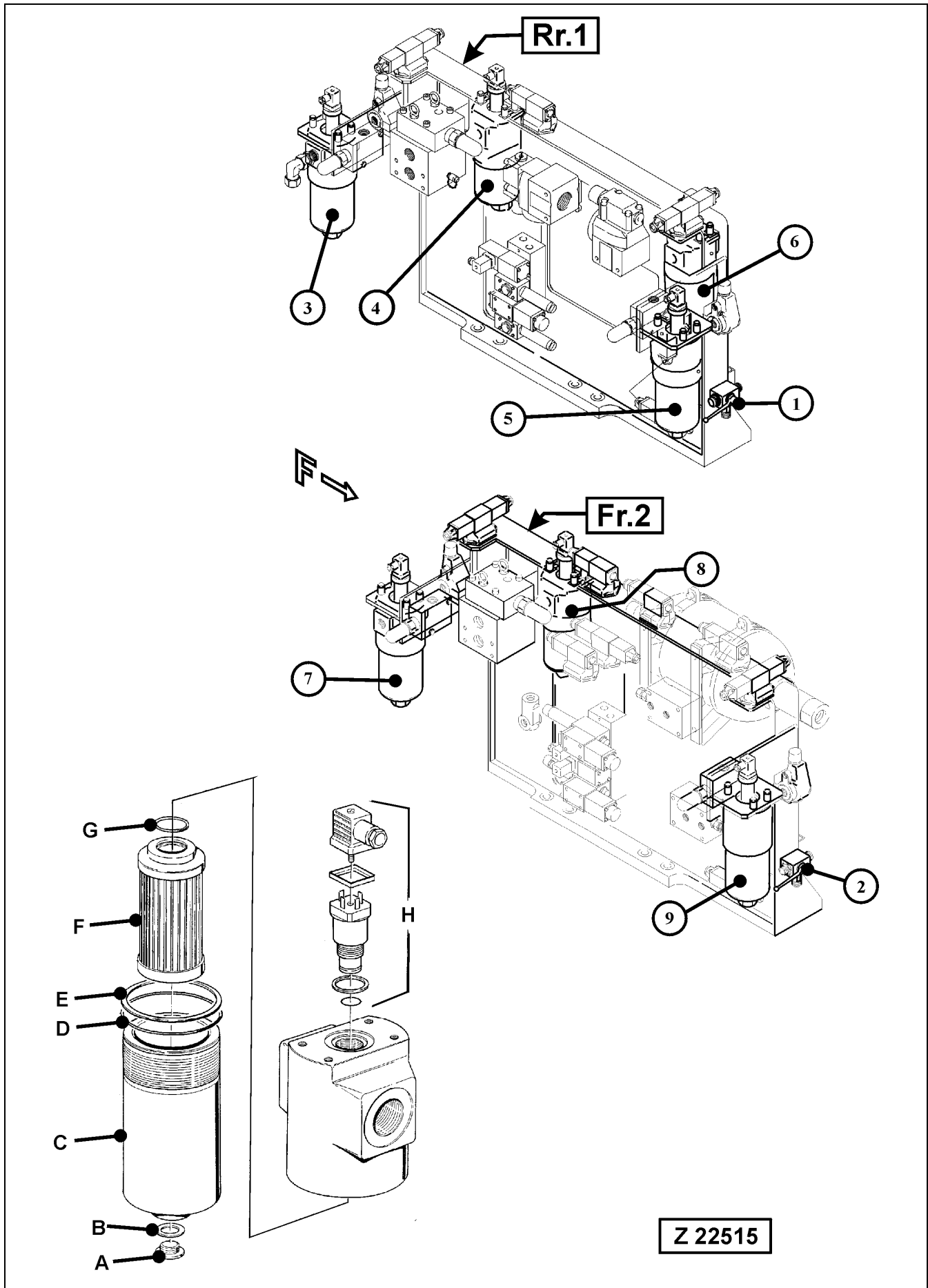
In case filter element (10) is soiled by metal chips, examine hydraulic pump for damages. Install new element (10).

NOTICE

If after cleaning of the filter element, the message "High pressure filter restricted" is displayed again, replace the filter element.

Replace elements (10) after three cleanings or after every 5000 operating hours, whichever occurs first.

After pump repairs all high pressure filter elements must be replaced.



FILTER SERVICE

Clean or replace filter elements of the hydraulic oil pressure filters

NOTICE

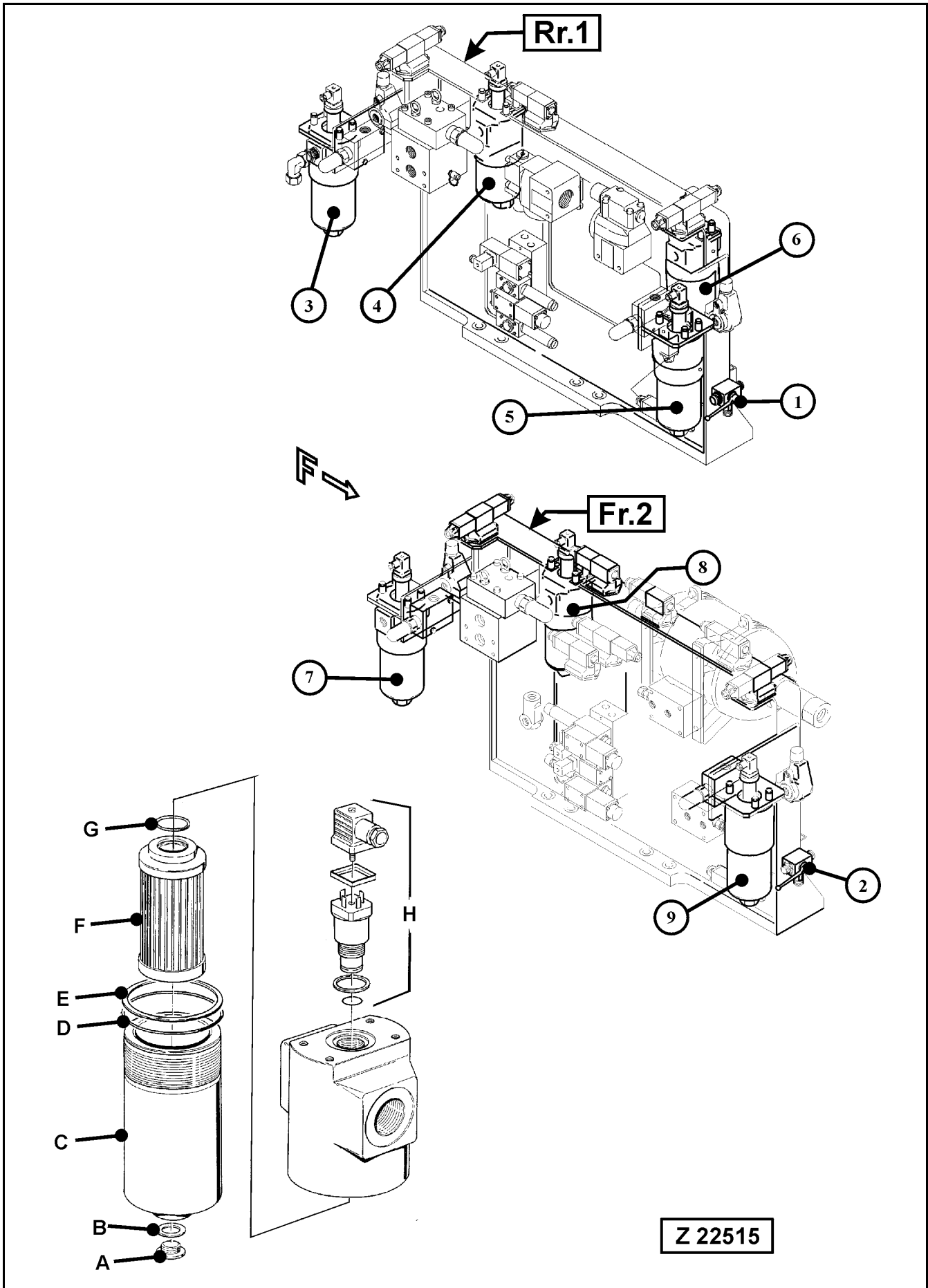
When a fault message "Pressure Filter restricted" is displayed, stop work and clean or replace element of the corresponding pressure filter.

Legend for illust. Z 22515

- (Rr.1) Control and filter panel of rear power unit, engine 1
- (Fr.2) Control and filter panel of front power unit, engine 2
- (1) Change over valve for operation mode of pump control system for rear power unit, engine 1.
- (2) Change over valve for operation mode of pump control system for front power unit, engine 2.
- (3) Pressure oil filter for fan drive hydraulic motor of coolant radiator for rear engine "1". Filter restriction monitored by differential pressure switch B21-1.
- (4) Pressure oil filter for pump distributor gear PTO "1" lubricating oil. Filter restriction monitored by differential pressure switch B27-1.
- (5) Pressure oil filter for fan drive motor of hydraulic oil cooler "1". Filter restriction monitored by differential pressure switch B28-1.
- (6) Pressure oil filter for pilot- and pump control oil circuit. Filter restriction monitored by differential pressure switch B22.
- (7) Pressure oil filter for fan drive hydraulic motor of coolant radiator for front engine "2". Filter restriction monitored by differential pressure switch B21-2.
- (8) Pressure oil filter for pump distributor gear PTO "2" lubricating oil. Filter restriction monitored by differential pressure switch B27-2.
- (9) Pressure oil filter for fan drive motor of hydraulic oil cooler "2". Filter restriction monitored by differential pressure switch B28-2.

REMARK

The pressure filters (4 and 8) for PTO gear lubrication can not be cleaned. These elements must be replaced.



FILTER SERVICE

Clean or replace pressure filter elements, illust. Z 22515, as follows:

1. Place working equipment on the ground and shut-off the engines.
Relieve pressure in the hydraulic system according to page 209 in the operation section.
2. Place a suitable container below the filter in order to collect outflowing oil.
3. Remove plug (A) and drain the oil.
4. Unscrew case (C) of the respective filter and clean the filter case.

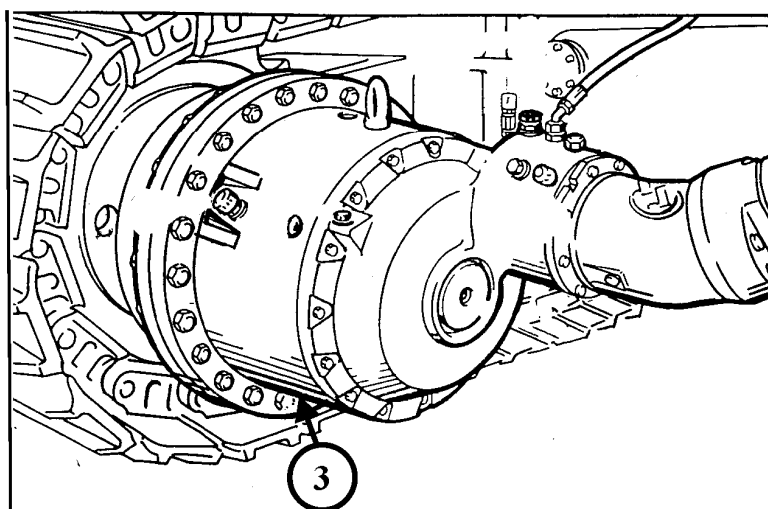
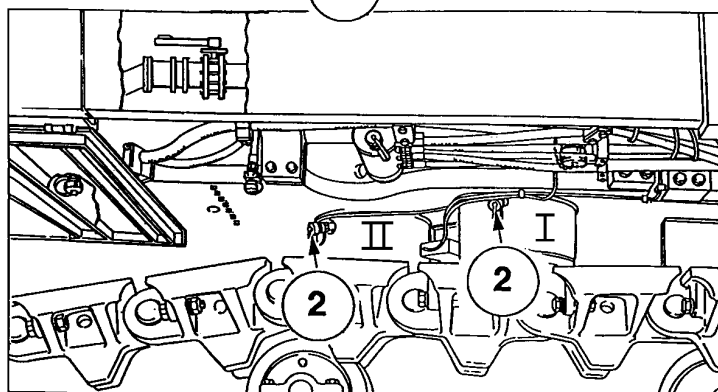
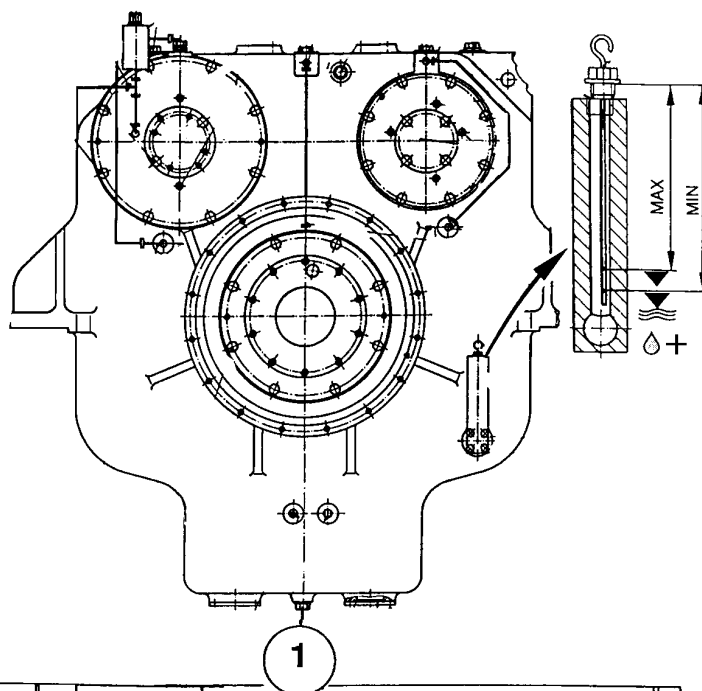
NOTICE

Carefully inspect elements for damage. Always install new elements if ruptures or other damages are found.

5. Remove element (F) and clean. Take care not to contaminate the "Clean" inside of the element when flushing.
6. Inspect O-rings and back-up ring. Replace if necessary.
7. Install drain plug (A) with new packing ring (B).
8. Lubricate the thread at the filter head and at filter case (C) with multi-purpose grease K2K.
9. Insert the cleaned element or a new element (F) with new O-ring (G).
10. Fill the case (C) half way up with clean hydraulic oil.
11. Screw the case (C) into the head and tighten.
12. After short operating period check filter for leakage.
13. Check restriction indicator (H) for proper mounting and good condition.

NOTICE

Replace elements (F) after three cleanings or after every 5000 operating hours, whichever occurs first.



Z 25250

4.12.3 PTO'S (PUMP DISTRIBUTOR GEARS), SWING GEARS AND TRAVEL GEARS - OIL SAMPLE ANALYSIS

The oil sample analysis gives information about the grade of contamination and aging of the gear oils. Refer to the tables below for limits of contamination.

Oil drain plugs, illustration Z25250

- (1) PTO (Pump distributor gears)
- (2) Swing gears (I and II)
- (3) Travel gears

PTO (PUMP DISTRIBUTOR GEAR)

(Oil contamination)

| Element | | Normal | Increased | | Critical |
|----------|---|---------|---------------|---|----------|
| Iron | < | 100 ppm | 100 - 300 ppm | > | 300 ppm |
| Copper | < | 10 ppm | 10 - 20 ppm | > | 20 ppm |
| Chromium | < | 5 ppm | 5 - 15 ppm | > | 15 ppm |
| Silicon | < | 40 ppm | 40 - 60 ppm | > | 60 ppm |

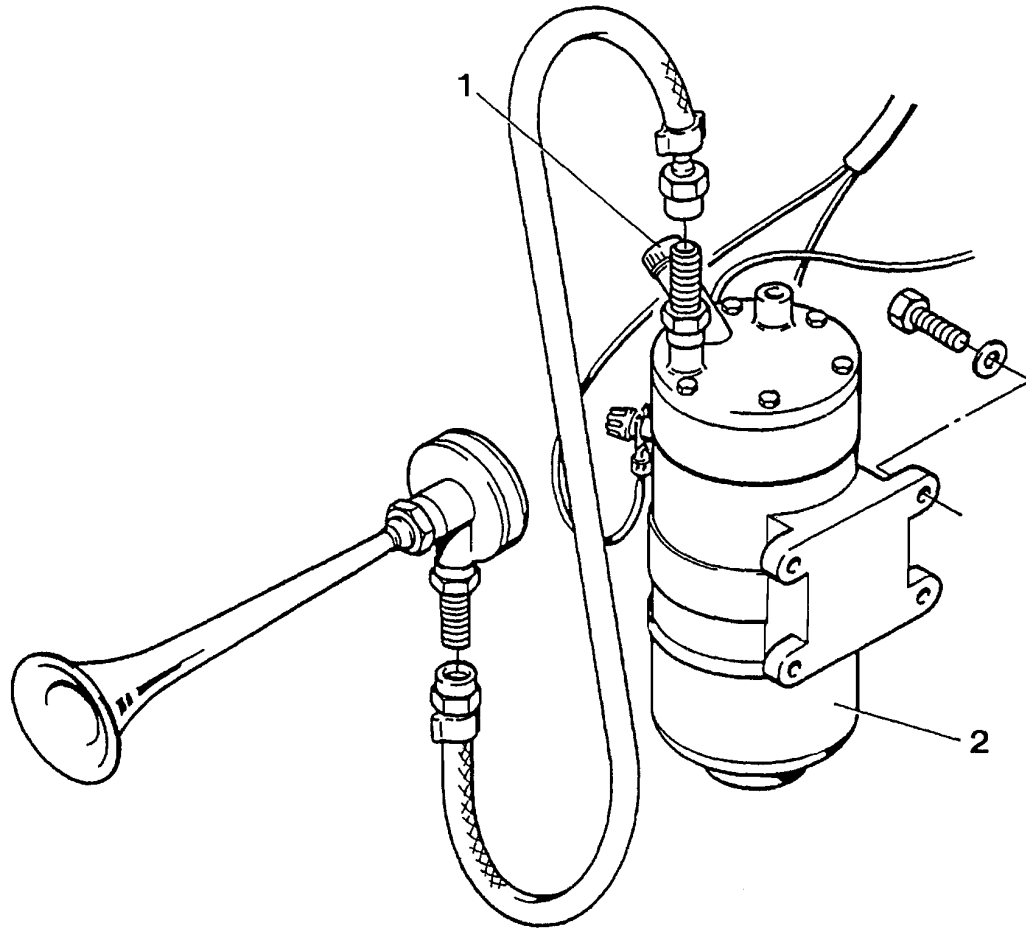
SWING GEARS AND TRAVEL GEARS

(Oil contamination)

| Element | | Normal | Increased | | Critical |
|----------|---|---------|---------------|---|----------|
| Iron | < | 400 ppm | 400 - 700 ppm | > | 700 ppm |
| Copper | < | 25 ppm | 25 - 60 ppm | > | 60 ppm |
| Chromium | < | 5 ppm | 5 - 15 ppm | > | 15 ppm |
| Silicon | < | 40 ppm | 40 - 60 ppm | > | 60 ppm |

NOTICE

If the grade of contamination approaches to the “critical” values in the above tables, change the gear oil. However, the regular oil changes must be carried out every 3000 operating hours or once a year, whichever occurs first.



Z9543

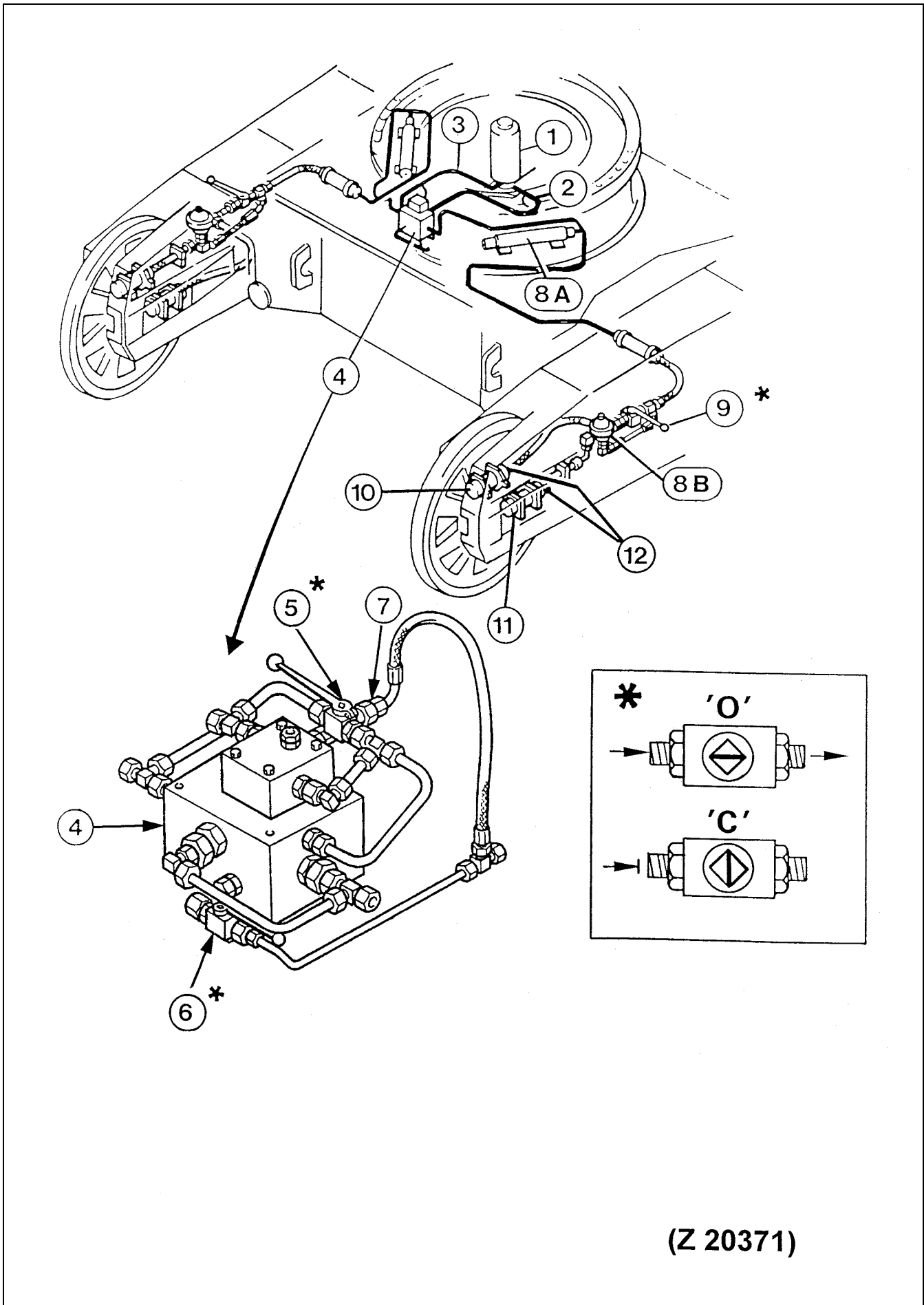
4.12.4 SIGNAL HORN COMPRESSOR - CLEAN AND LUBRICATE

See illustration Z 9543

Unscrew collector protection cap (2).

Unscrew ball bearing cover and fill it half way up with grease.

If the fins of the collector are very strongly blackened or coated with verdigris, clean them with emery cloth.



4.12.5 HYDRAULIC TRACK TENSIONING SYSTEM - CHECK PRESSURE ACCUMULATORS

WARNING

Before working on any part of the hydraulic track tensioning system relieve all pressure in the system by opening pressure relief cock (5), illustration Z 20371.

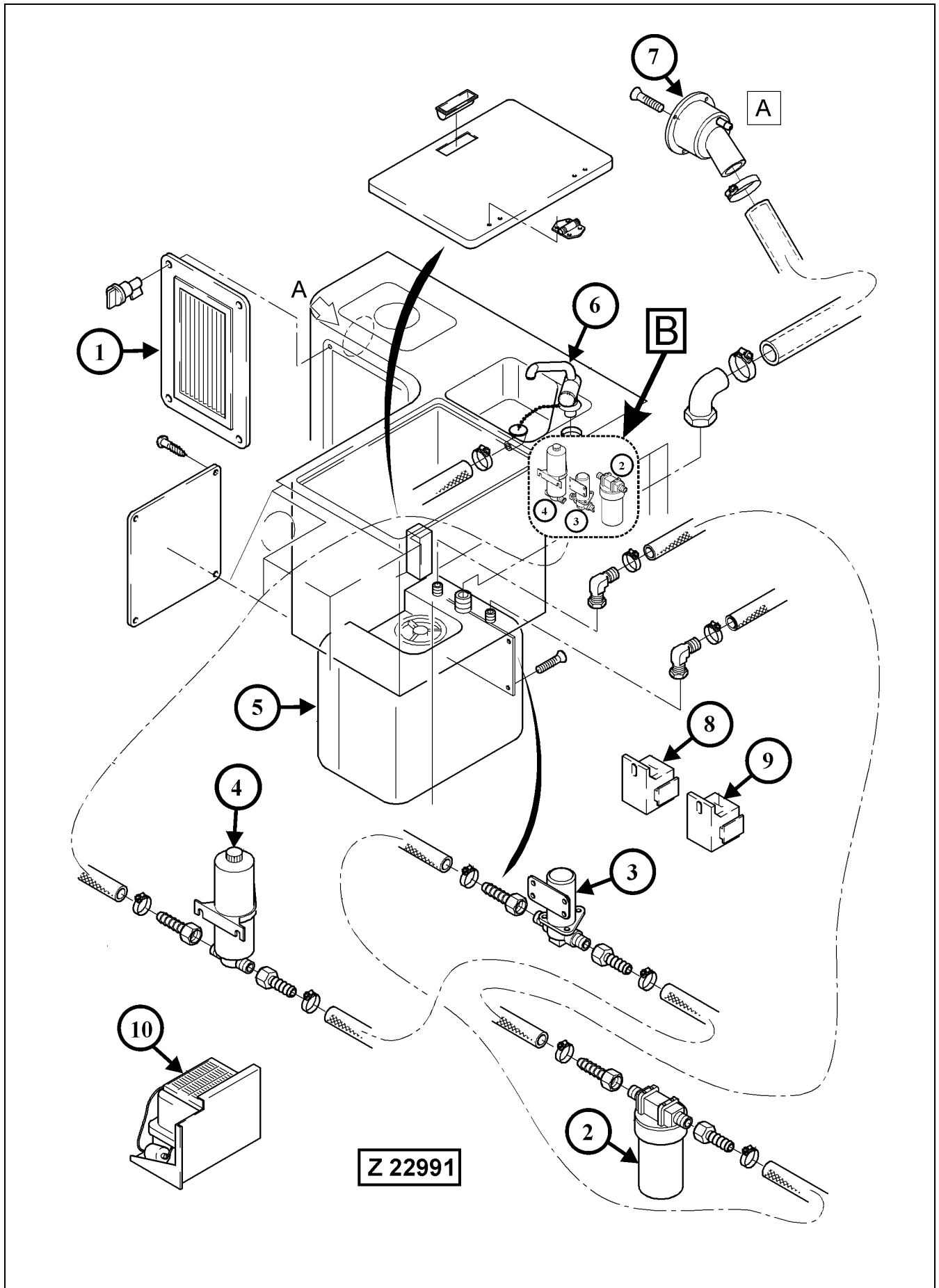
NOTICE

For checking the charging pressure a special testing and filling device must be used. This device can be ordered from your Komatsu Dealer.

The testing and filling procedure of the pressure accumulators has to be carried out in accordance with Service Bulletin No. AH01531.

Legend for illust. Z 20371:

- (1) Rotary distributor
- (2) Supply line, pilot pressure from travel brake release circuit
- (3) Return oil line (leakage oil)
- (4) Valve block
- (5) Pressure relief cock for hydraulic track tensioning system.
 "C" - Closed (Normal working position)
 "O" - Open
- (6) Shut-off cock in supply line (if so equipped)
 "O" - Open (Normal working position)
 "C" - Closed
- (7) Two stage pilot pressure operated relief valve
- (8A) Pressure accumulator, high pressure (150 bar)
- (8B) Pressure accumulator, low pressure (31 bar)
- (9) Shutoff cocks, RH & LH
 "O" - Open (Normal working position)
 "C" - Closed
- (10) Track adjusting cylinders, inner
- (11) Track adjusting cylinders, outer
- (12) Test connectors and vent valves



4.12.6 WATER FILTER - REPLACE FILTER CARTRIDGE

Legend for illust. Z22991

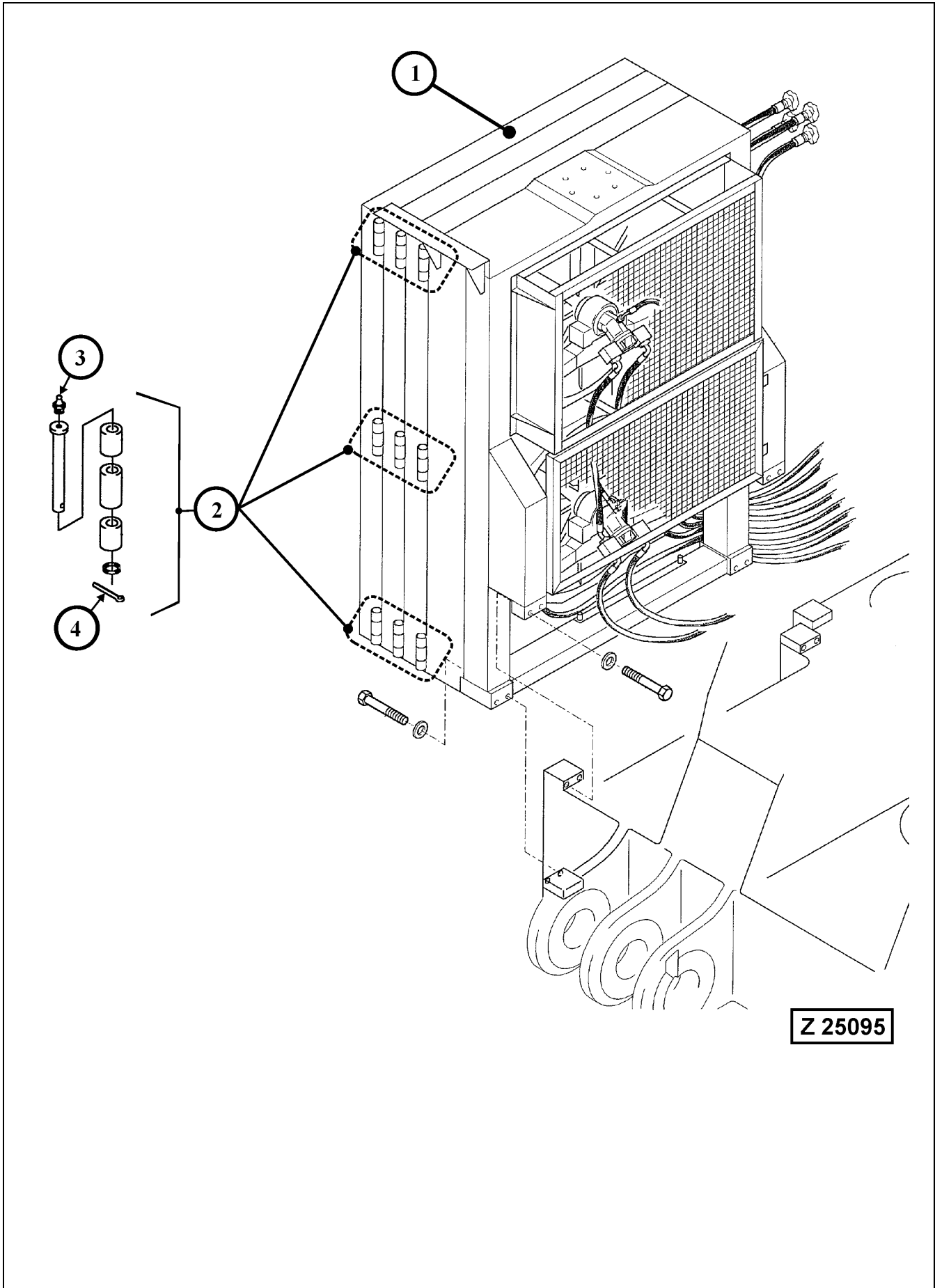
- (A) Location of filler neck for water tank (5)
- (B) Location of water filter (2), pump (3) and pressure compensation tank (4).
- (1) Access cover for water filter compartment
- (2) Water filter
- (3) Water pump
- (4) Pressure compensation tank
- (5) Water tank
- (6) Water tap
- (7) Filler neck for water tank
- (8) Relay
- (9) Circuit breaker 7,5 A
- (10) Refrigerator

Replace filter cartridge of water filter (2) as follows:

1. Open water tap (6) and drain all water from tank (5). Remove access cover (1). Depress red pressure relief button on filter header (if so equipped) to relieve pressure.
2. Unscrew bottom of housing. Remove large O-ring, wipe clean of lubricant and set aside. Remove used cartridge and discard. Rinse out bottom of housing and fill about 1/3 full with water. Add 2 tablespoons of bleach and scrub cap and bottom of housing with nonabrasive cloth. Rinse thoroughly.
3. Lubricate O-ring with clean petroleum jelly (Vaseline). Place O-ring back into groove and smooth into place with finger. Insert new cartridge over stand pipe in bottom of housing. Cartridges with tapered ends need to be specifically installed with the tapered end toward the threads of the housing.
4. Screw bottom of housing onto cap and hand tighten. DO NOT over-tighten. Make sure cap standpipe slips into cartridge. Fill water tank (5) with 50 liters of clear water. Depress pressure relief button (if so equipped) to release trapped air.
5. Open water tap (6) and flush the new filter cartridge for a minimum of 5 minutes. The water must be completely clear before closing the tap.

⚠ WARNING

DO NOT drink the water of the cab water system. The cab water system is not constructed as a drinking water system.



Z 25095

4.12.7 HYDRAULIC OIL COOLER - INSPECT AND LUBRICATE DOOR HINGES

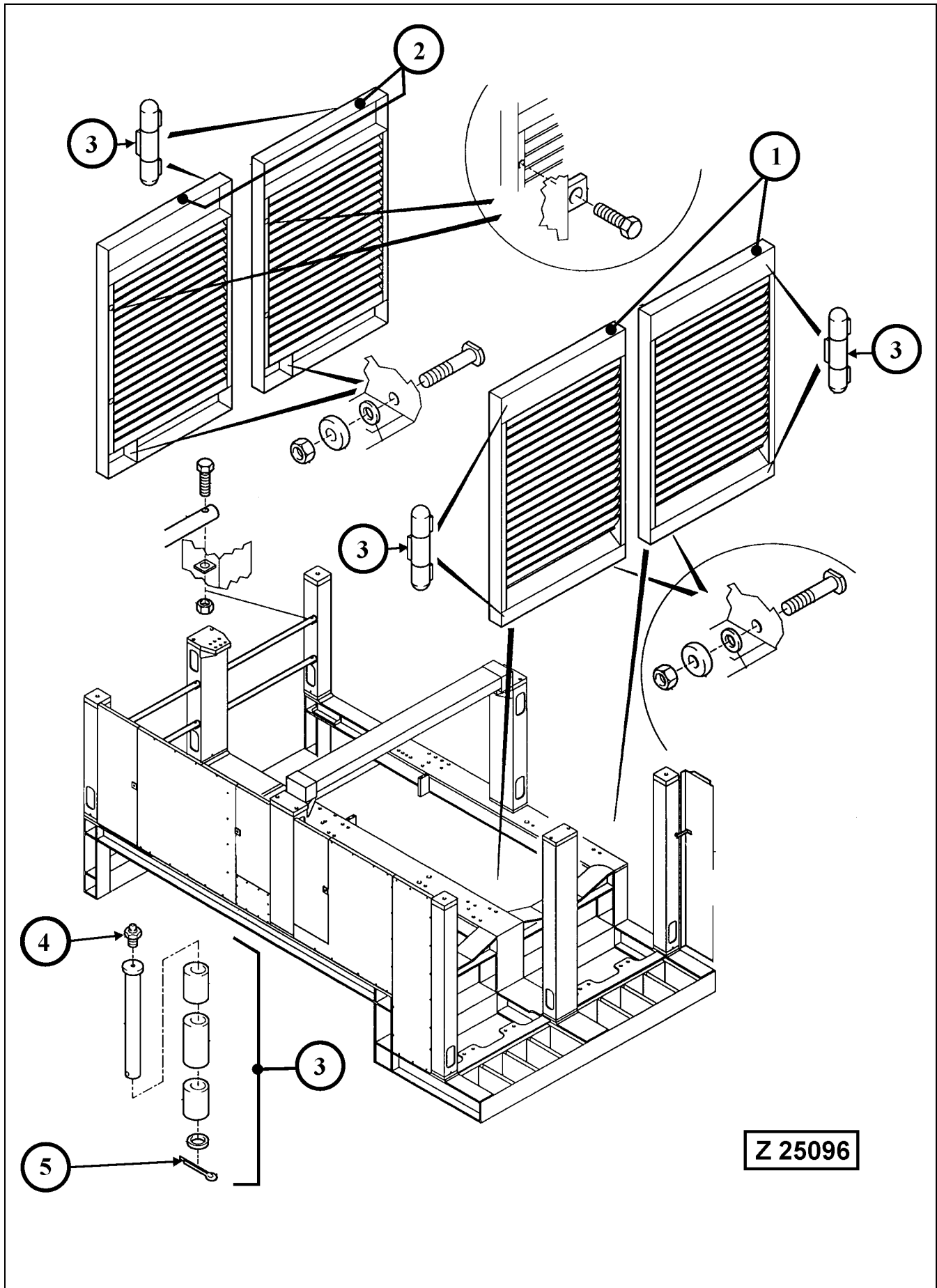
 **WARNING**

- Provide adequate working platform for safe access to the hydraulic oil cooler.
 - Check all door hinges (2) for good condition and proper fastening to their carrier frames. If cracks or distortion at the weld area of the hinges are found corrective action must be taken. **DO NOT** try to open the cooler doors before the damage has been repaired otherwise the cooler door may become detached and fall off. Danger of accidents.
-
-

Legend for illust. Z25095

- (1) Hydraulic oil cooler
- (2) Cooler hinges
- (3) Grease fitting
- (4) Cotter pin

- Lubricate all cooler hinges (2) at grease fittings (3).
- Check to make sure that the hinge pins are properly secured with cotter pins (4).



4.12.8 MACHINERY HOUSE DOORS - INSPECT AND LUBRICATE DOOR HINGES

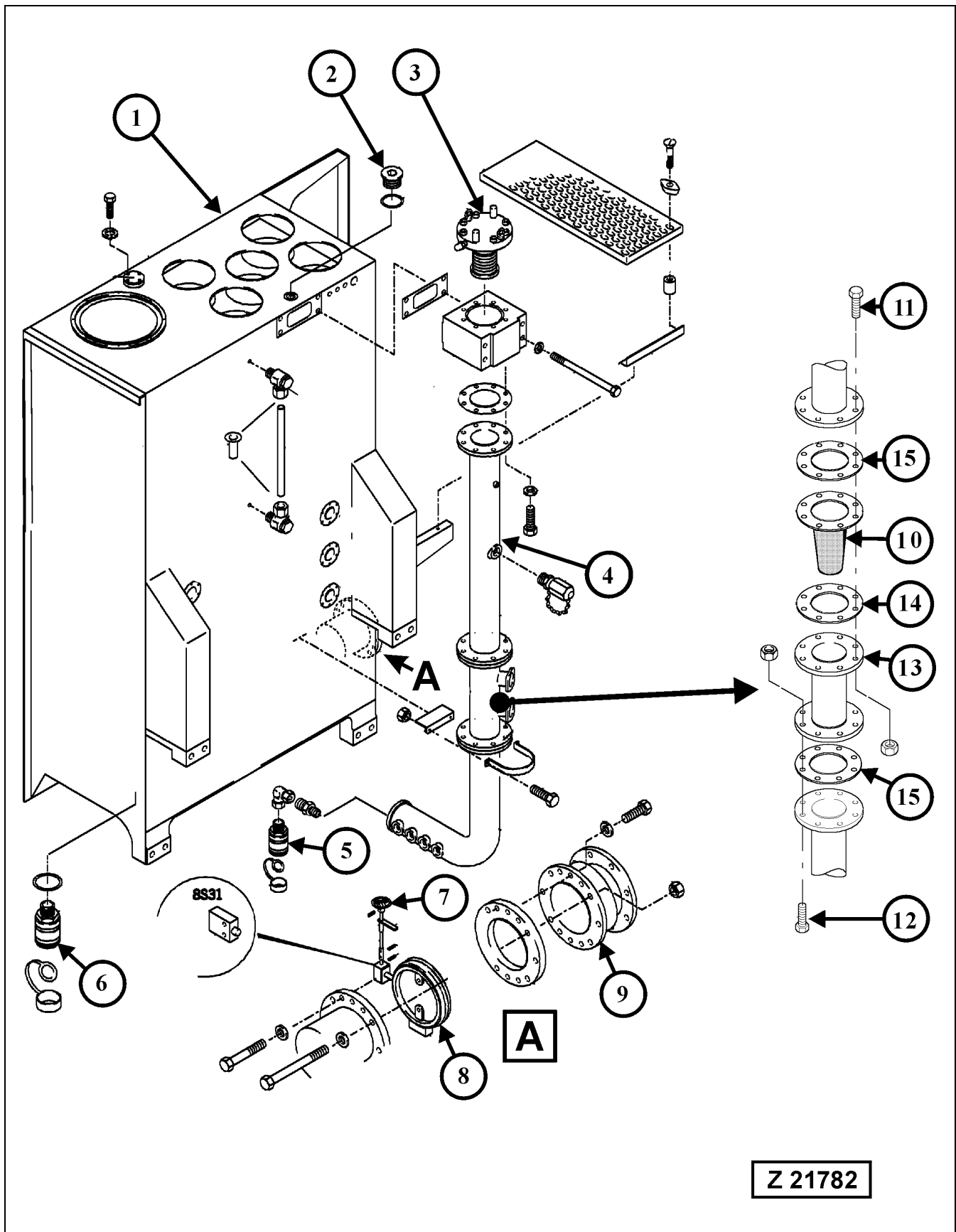
 **WARNING**

- Provide adequate working platform for safe access to the rear machinery house doors (2).
 - Check all door hinges (3) for good condition and proper fastening to their carrier frames. If cracks or distortion at the weld area of the hinges are found corrective action must be taken.
-
-

Legend for illust. Z25096

- (1) Radiator doors (on Diesel engine powered shovels only)
 - (2) Rear doors of machinery house
 - (3) Door hinges
 - (4) Grease fitting
 - (5) Cotter pin
- Lubricate all door hinges (3) at grease fittings (4).
 - Check to make sure that the hinge pins are properly secured with cotter pins (5).

4.13 EVERY 2000 OPERATING HOURS OR YEARLY



4.13.1 HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER

NOTICE

The hydraulic oil change intervals can be extended for a further time period, when an oil sample analysis shows a positive result. When extending the oil change interval, it is necessary to carry out an oil sample analysis after every 1000 operating hours.

However, it is recommended to change the hydraulic oil and the suction strainers after 6000 operating hours at the latest. The pulsation damper must be replaced after every 2000 operating hours.

Legend for illust. Z 21782

- (1) Main oil reservoir
- (2) Oil filler plug
- (3) Back-pressure valve
- (4) Return oil collector pipe
- (5) Drain coupling for collector pipe
- (6) Drain coupling for main oil reservoir
- (7) Hand wheel of main shut-off valve
- (8) Main shut-off valve
- (9) Compensator between main oil reservoir and suction oil reservoir. Check condition and tightness of compensator and connected parts.
- (10) Return oil strainer
- (11) Bolt
- (12) Bolt
- (13) Intermediate pipe
- (14) Gasket
- (15) Gaskets

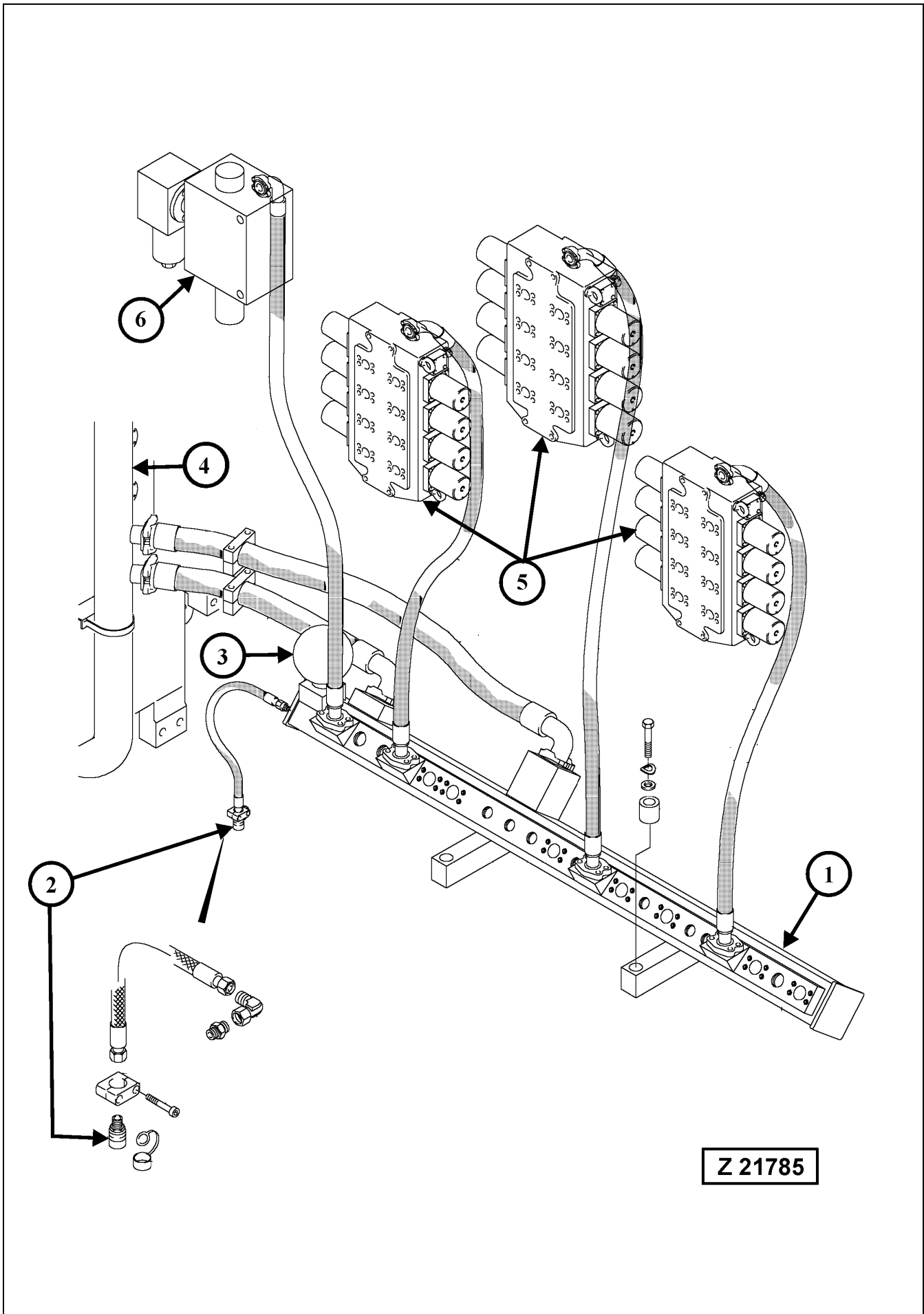
Evacuate main hydraulic oil reservoir according to section Central Refilling System on page 230.

Attach drain hose (part of tool set) to coupling (5) and drain oil from return oil collector pipe (4). Drain also the oil from return oil manifold, see illustration Z 21785 and from suction oil reservoir, see illustration Z 21787.

REMARK

Replace return oil strainer (10), illustration Z 21782 after major repairs on the hydraulic system and after every 6000 operating hours. Use new gaskets (14 and 15).

With hydraulic oil reservoir empty, service the return oil filters and inspect the reservoir for sediments. Clean the reservoir if necessary.



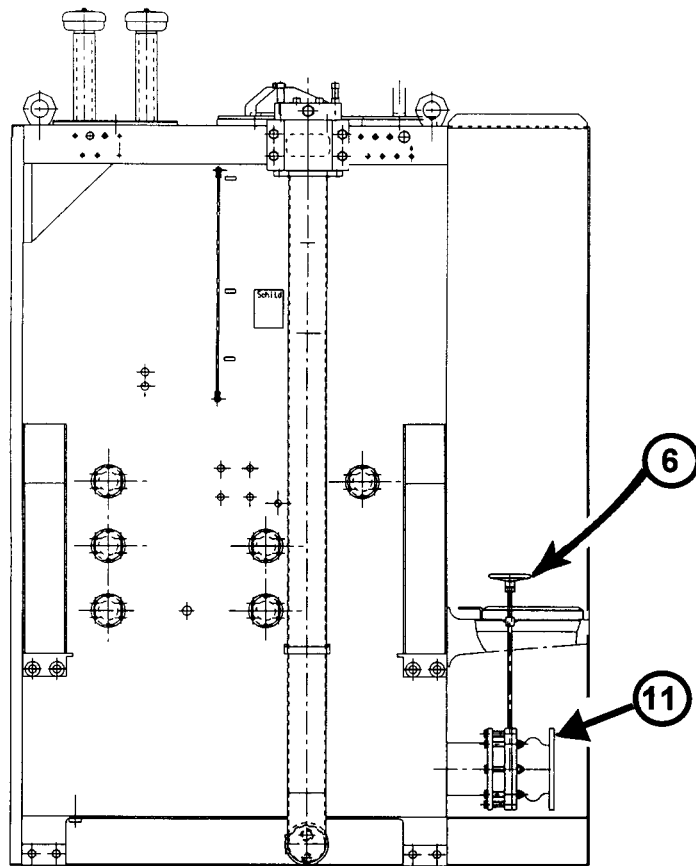
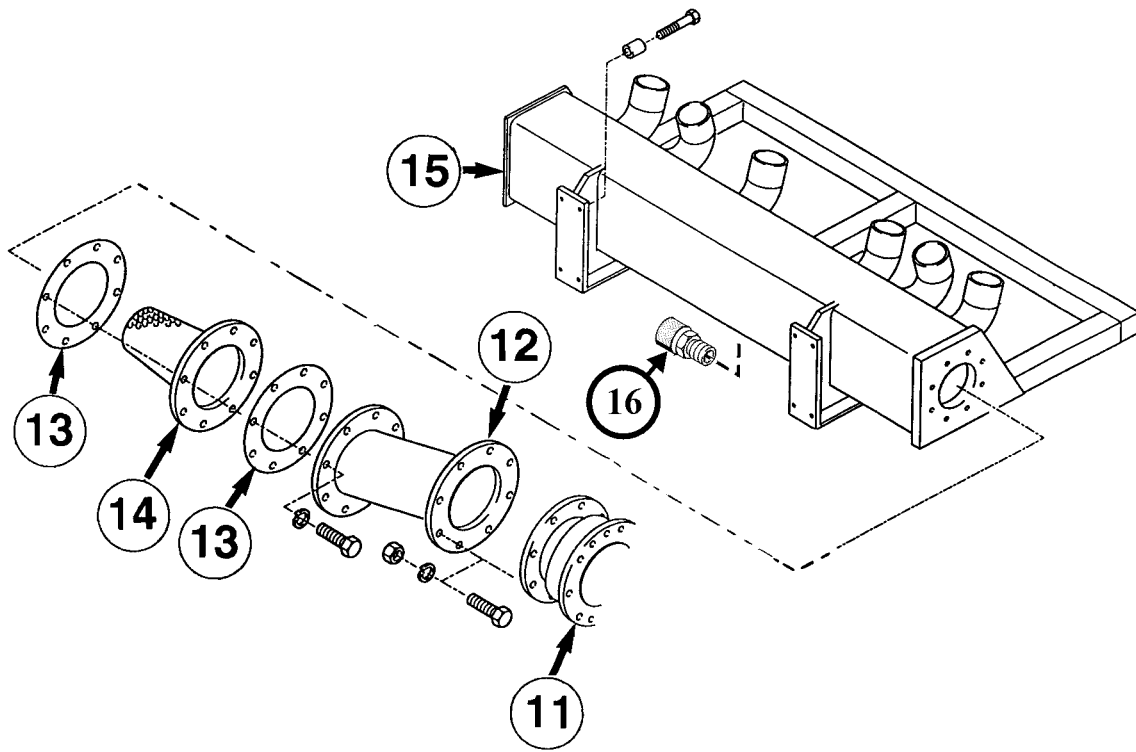
HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER

Legend for illust. Z 21785

- (1) Return oil collector manifold
- (2) Drain coupling
- (3) Pulsation damper
- (4) Return oil collector pipe
- (5) Main control valves
- (6) Swing control valve

NOTICE

Attach drain hose (part of tool set) to coupling (2) and drain oil from return oil collector manifold (1). Remove pulsation damper (3) and install new pulsation damper with new O-ring.



Z 21787

HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER

Legend for illust. Z 21787

- (6) Hand wheel of main shut off valve between main oil reservoir and suction oil reservoir
- To open the valve, turn hand wheel (6) CCW to the stop
 - To close the valve, turn hand wheel (6) CW to the stop

NOTICE

Before starting the engines, make sure the shut off valve is completely open by turning the hand wheel (6) fully to the left (CCW).

- (11) Compensator
- (12) Intermediate pipe

REMARK

On the bottom of the intermediate pipe there is a cover for inspection of strainer (14).

- (13) Gaskets
- (14) Suction oil strainer
- (15) Suction oil reservoir
- (16) Drain coupling

Replace suction strainer (14)

Attach drain hose (part of tool set) to coupling (16) and drain oil from suction oil reservoir. Remove intermediate pipe (12) and strainer (14). Install new strainer (14) with new gaskets (13).

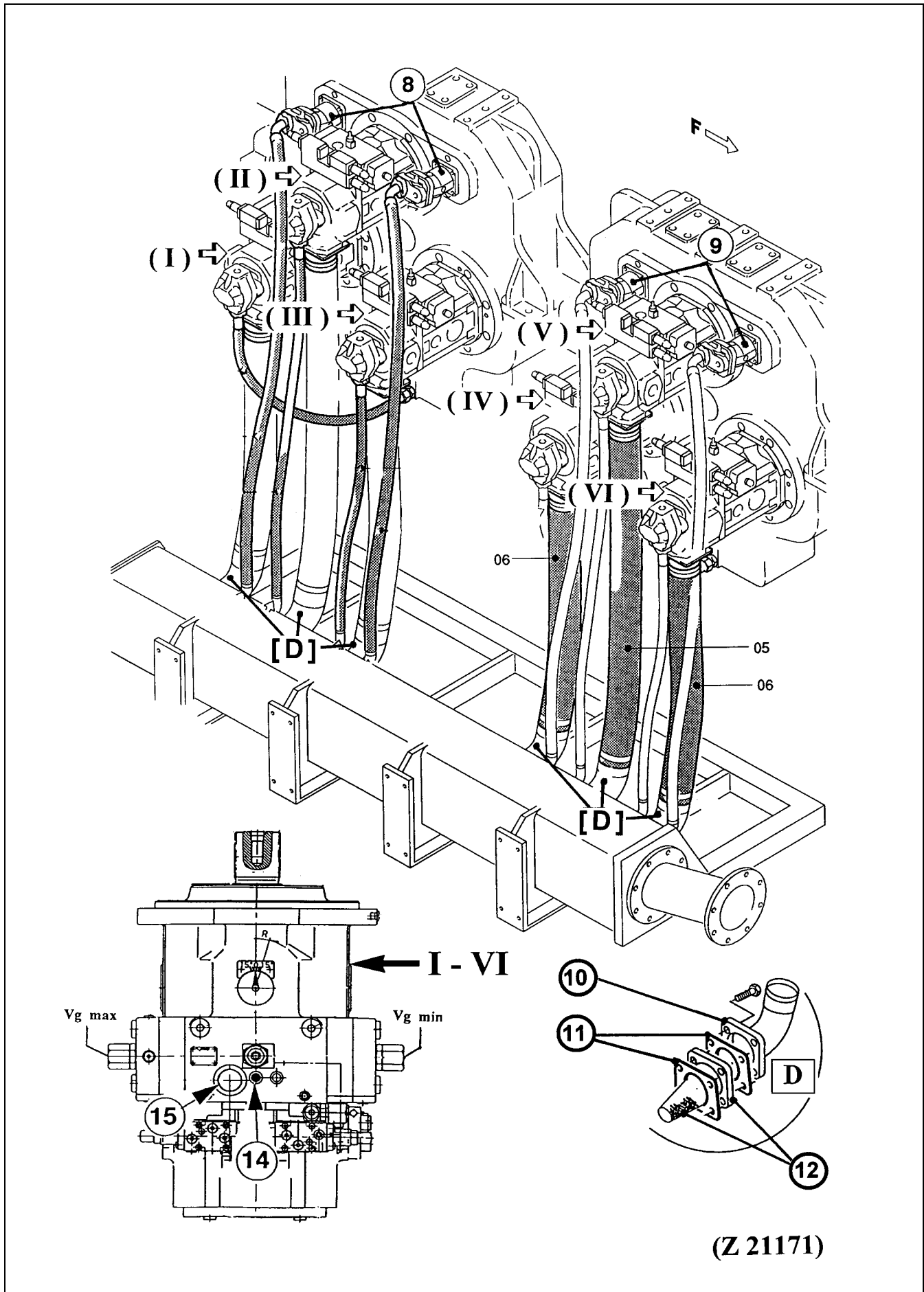
REMARK

For inspection of strainer (14) between oil changes proceed as follows:

1. Close main shut-off valve (6).
2. Remove drain plug from bottom cover and drain the oil from intermediate pipe (12).
3. Remove bottom cover. Inspect strainer (14) and replace if necessary.
4. Install bottom cover using a new O-ring.
5. Open main shut-off valve (6) and bleed the air from suction oil reservoir. Check hydraulic oil level and add oil as necessary.

REMARK

There are six further strainers installed in the suction oil reservoir (15). Refer to page 447 for replacement instructions.



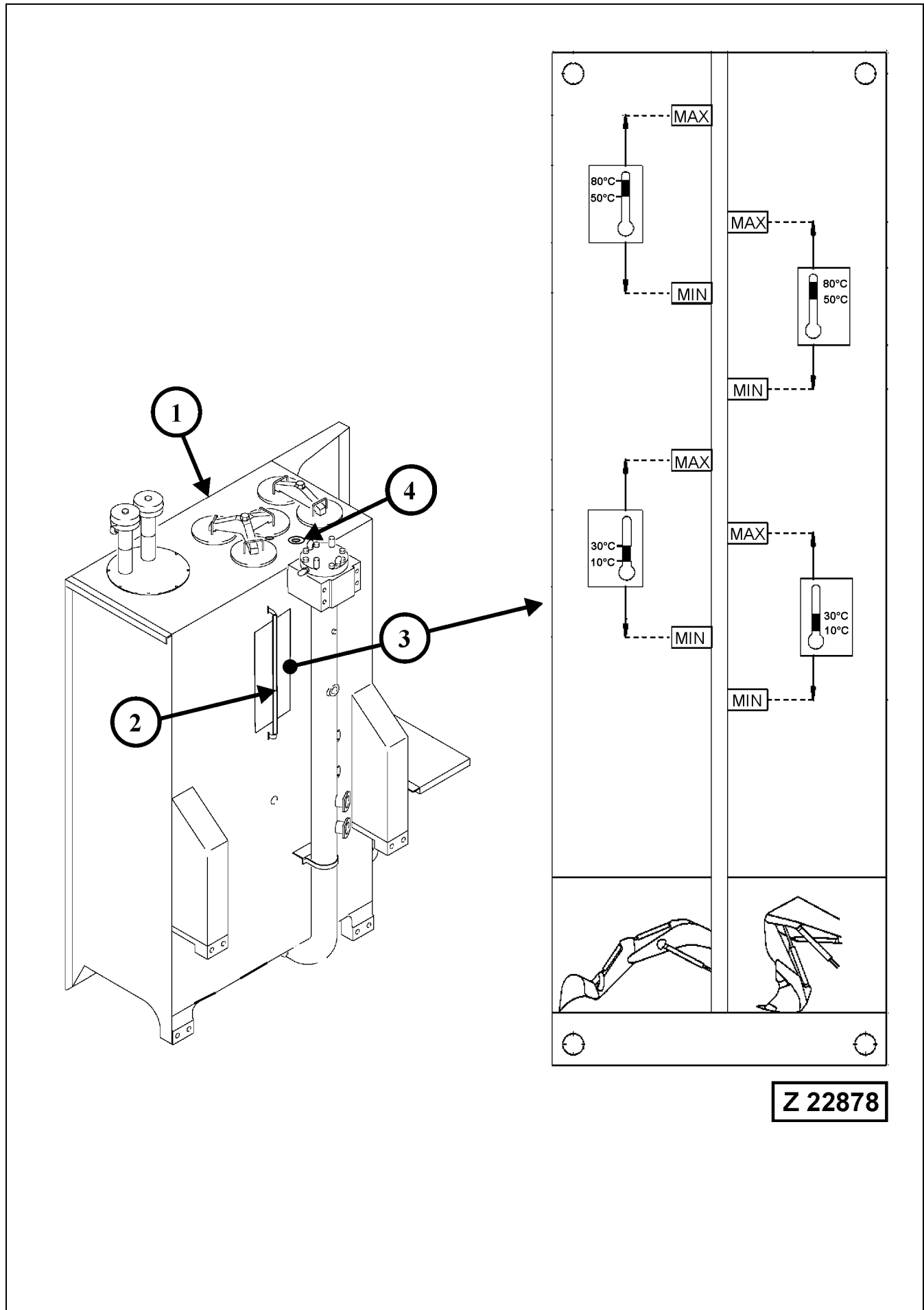
HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER

Legend for illust. Z 21171

| (I-VI) | Main Hydraulic pumps |
|---------|--|
| (D) | Location of the suction strainers for the six main pumps |
| (05-06) | Main pump suction lines |
| (8) | Secondary hydraulic pumps on PTO gear 1 |
| (9) | Secondary hydraulic pumps on PTO gear 2 |
| (10) | Suction hose elbow |
| (11) | Gaskets |
| (12) | Suction strainer for the six main pumps |
| (14) | Plug |
| (15) | Port of leakage oil return line, use this port as Oil level and filler opening for the main pump housing |

Replace Suction Strainer of Main Pumps

1. Remove elbows (10), of all six main pump suction hoses (D), from suction oil reservoir.
2. Remove gaskets (11) and strainer (12) and discard.
3. Insert new strainer (12) with new gaskets (11) and mount suction hose elbow (10) onto the suction oil reservoir.
4. Check to make sure that the hose clamps of suction hoses (D) are in good condition and properly fitted.



HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER

FILLING THE HYDRAULIC SYSTEM

1. Make sure main shut-off valve is in open position and all connections are securely tightened.

REMARK

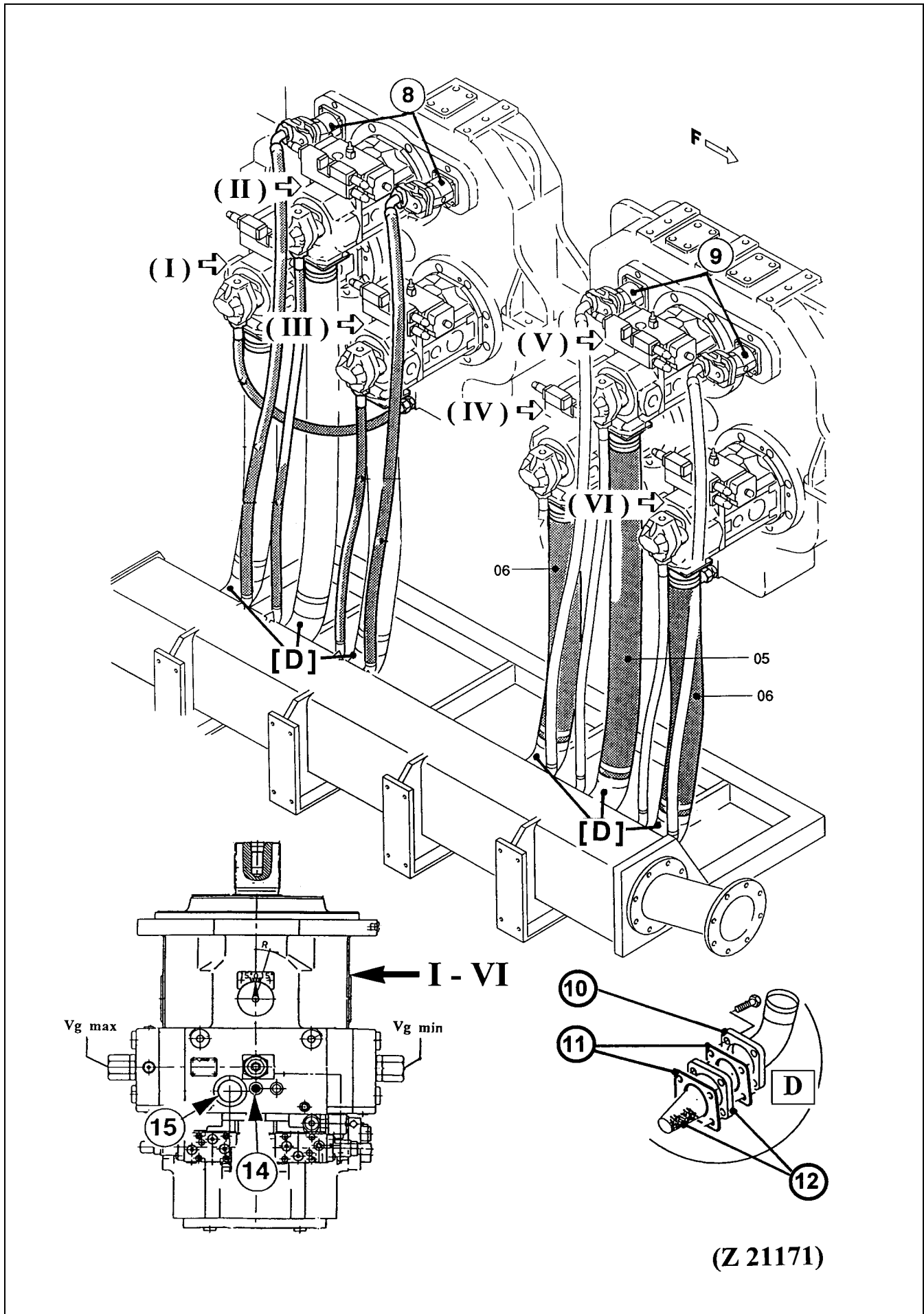
Select hydraulic oil viscosity grade according to ambient temperatures.

If the new hydraulic oil has a different viscosity grade compared with the drained oil it is necessary to enter the new viscosity grade into the appropriate "**Service SETTINGS**" group of the VHMS Menu Control.

2. On machines equipped with Central Refilling System fill main hydraulic oil reservoir according to section "Central Refilling System" on page 230.
On machine without central refilling system fill main oil reservoir through opening (4), illustration Z22878. Depending on type of attachment and the present oil temperature, select the applying oil level range on plate (3). Be sure to use the correct marking on oil level plate (3).

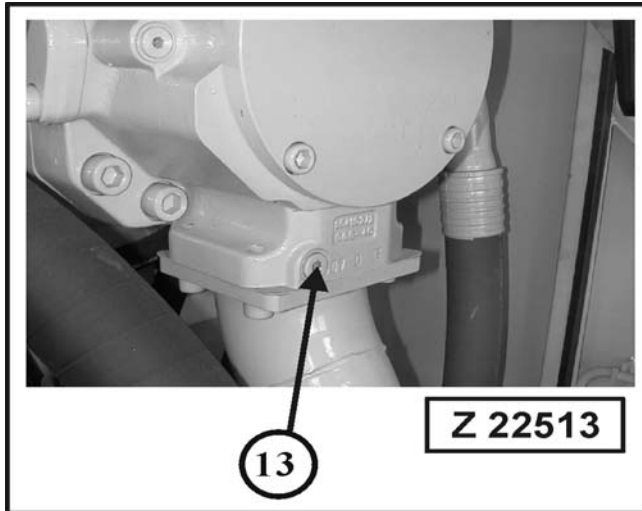
Legend for illustration Z22878

- | | |
|-----|---------------------------------|
| (1) | Main hydraulic oil reservoir |
| (2) | Hydraulic oil level sight gauge |
| (3) | Oil level plate |
| (4) | Oil filler plug |



HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER

Vent Hydraulic pumps



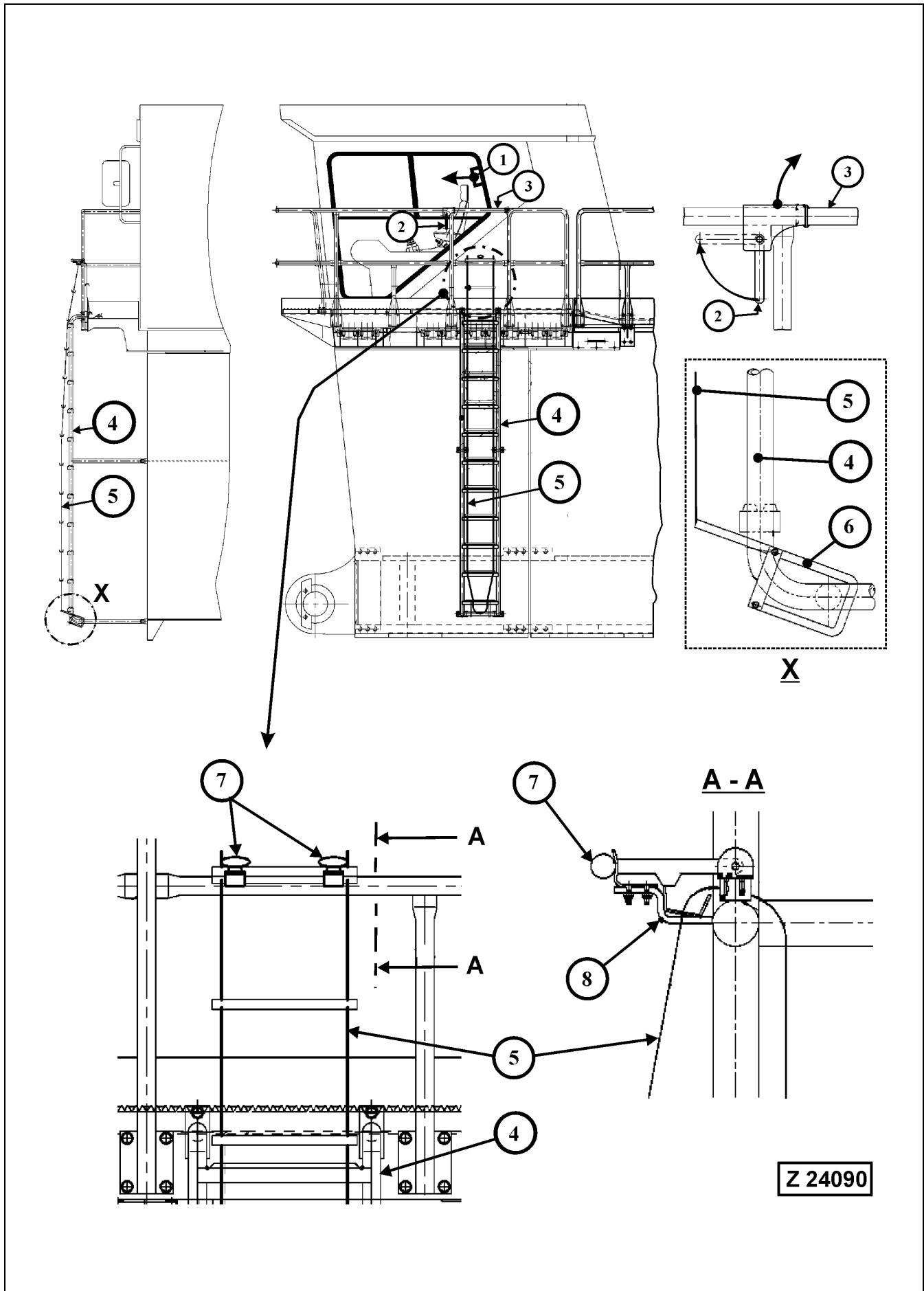
1. Open vent plug (13), illust. Z 22513 on the pump suction port of all six main pumps.
2. As soon as bubble free oil flows out, tighten the vent plug (13).
3. Open vent screw on secondary pumps (8 and 9), illustration Z 21171. Close vent screw as soon as bubble free oil flows out.
4. Open vent plug (13) on the pump suction port of the piggy-back gear pumps and wait until bubble free oil flows out then tighten the vent plugs (13).
5. Check hydraulic oil level and the whole hydraulic system for leakage.

Check the Oil level in all six Main Pump Housings (I - VI), illust. 21171:

1. Remove leakage oil return line from port (15). The oil level in the pump housing should reach the lower edge of port (15).
2. If necessary add hydraulic oil up to the lower edge of the filler opening.
3. Connect leakage oil return line to port (15).

NOTICE

Make sure the main pump housings are correctly filled, otherwise the pump drive shaft bearings could be damaged due to lack of lubrication.



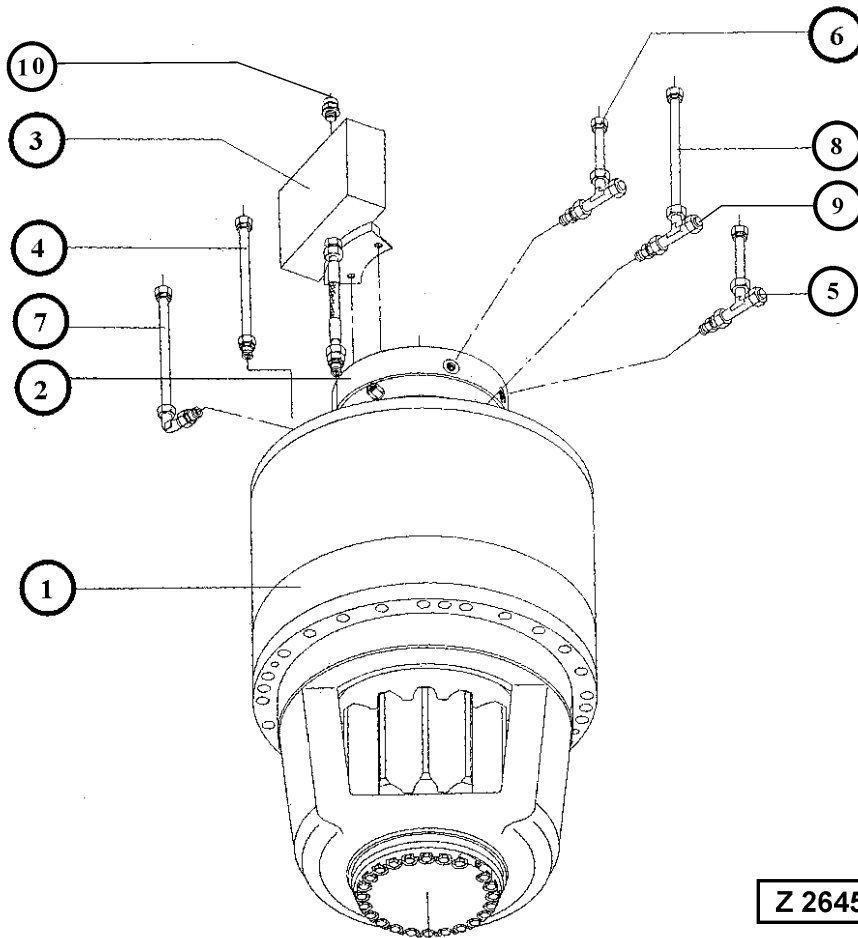
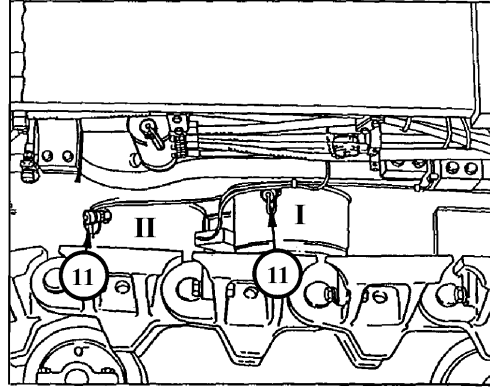
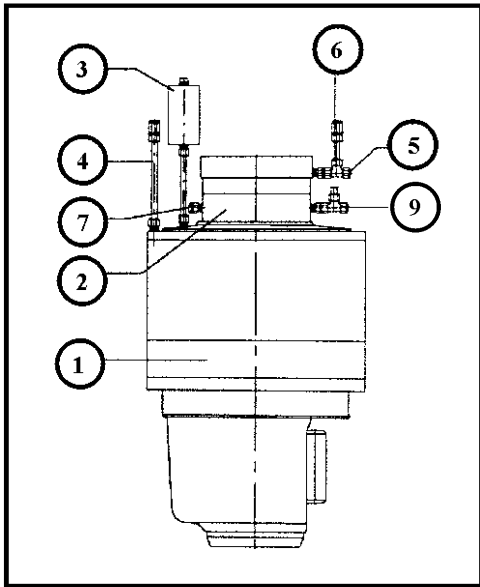
4.13.2 EMERGENCY ESCAPE LADDER - INSPECTION

Legend for illust. Z24090

- (1) Sliding window, serves also for emergency exit
 - (2) Release lever for hinged railing bar (3)
 - (3) Hinged railing bar
 - (4) Rigidly mounted emergency escape ladder
 - (5) Rope ladder. The upper end of the rope ladder is fixed onto the lower rung of the rigid escape ladder (4) by means of the fasteners (6), see detail (X). The lower end of the rope ladder is fixed on brackets (8) and secured with rubber fasteners (7), see section (A-A).
 - (6) Hooks for fastening the rope ladder onto the rigid ladder (4)
 - (7) Rubber fasteners for rope ladder in lifted position
 - (8) Bracket for rope ladder in lifted position. The lower rung of the rope ladder is hooked up into the brackets (8)
- Check rigidly mounted emergency escape ladder (4) for good condition and proper fastening.
 - Check rope ladder (5) for good condition and proper fastening.

If any damage or bad condition is found replace the concerned parts without delay.

4.14 EVERY 3000 OPERATING HOURS HOWEVER AT LEAST ONCE A YEAR



Z 26450

4.14.1 SWING GEARS, BRAKE HOUSINGS AND MOTOR ADAPTER HOUSINGS - CHANGE OIL

REMARK

The machine can be equipped either with swing gears of manufacturer SIEBENHAAR or of manufacturer L&S. Refer to the data plate on each swing gear housing to find out the manufacturer of the swing gear.

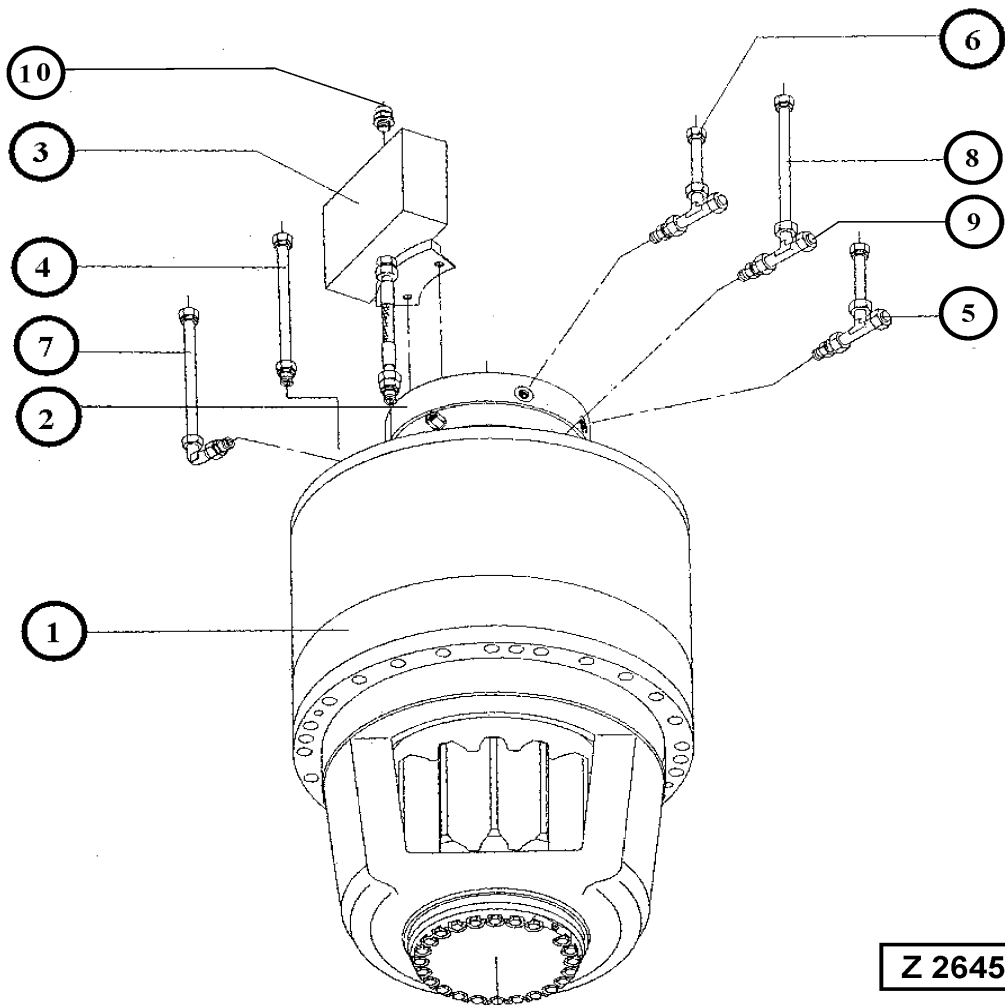
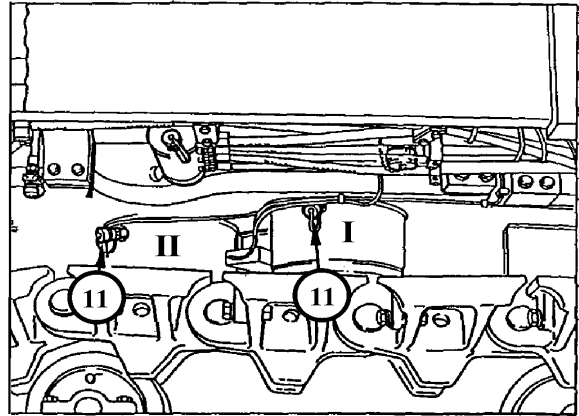
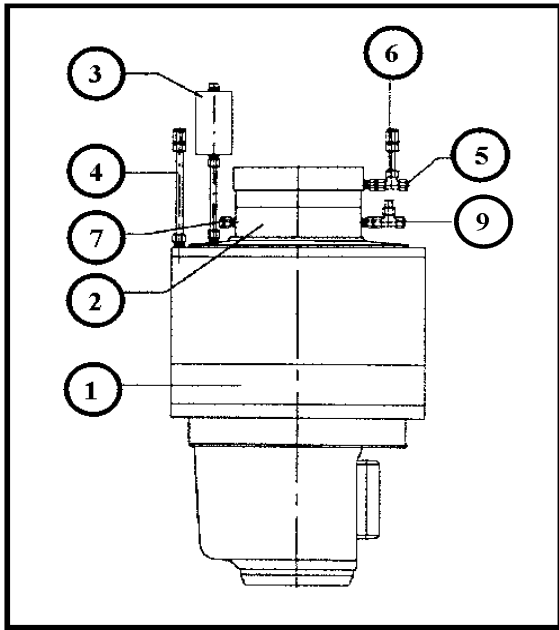
Swing gears manufactured by SIEBENHAAR

Legend for illustration Z26450

- (I) Front swing gear
- (II) Rear swing gear
- (1) Swing gear (Front and Rear)
- (2) Brake housing
- (3) Compensator oil tank for swing gear
- (4) Oil level gauge for swing gear
- (5) Oil drain plug for motor adapter housing
- (6) Oil level gauge for motor adapter housing
- (7) Breather filter for brake housing
- (8) Oil level gauge for brake housing
- (9) Oil drain plug for brake housing
- (10) Breather filter
- (11) Drain coupling or evacuation nozzle for Wiggins system

Swing Gears, change oil:

1. Use adequate working platform for draining the oil. Place receptacles of sufficient capacity (approx. 100 liter) below each drain coupling (11). Attach drain hose (part of tool set) to drain coupling (11). Remove parts (4 and 10) to speed up draining.
2. Clean breather filter (10) with compressed air from inside to outside and re-install.
3. After the oil is completely drained, flush the gear with the regular gear oil.
4. Remove drain hose from coupling (11) and attach the protection cap onto the drain coupling.
5. Fill gear housing through filler pipe with fresh oil up to the MAX mark on oil level gauge (4), see page 459 for details.



Z 26450

Swing Gears - Change Oil (continued)

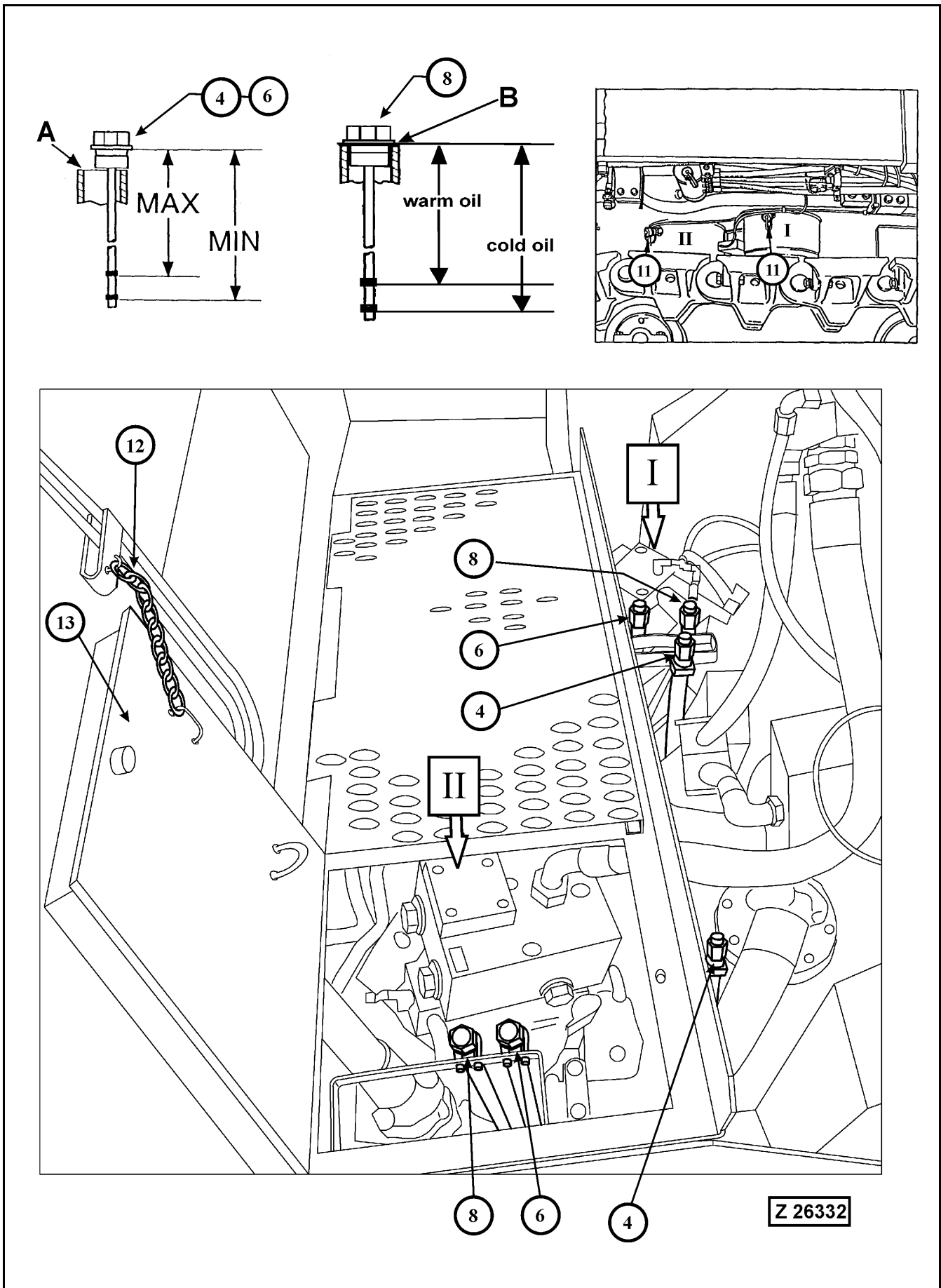
6. After short operating period check oil level and housings for leaks.

Brake Housing - Change Oil

1. Remove level gauge (8), illustration Z26450, drain plug (9) and breather filter (7). Drain the oil into a receptacle of approx. 5 liter capacity.
2. Clean breather filter (7) with compressed air from inside to outside and re-install.
3. Install drain plug (9) and fill-up engine oil SAE 10 or hydraulic oil HLP 22 or HLP 32 through filler opening up to the lower mark on level gauge (8), see illustration Z26332 on next page for correct oil level indication. DO NOT overfill the brake housing, otherwise the brake could be damaged due to overheating.
4. After short operating period check oil level and housing for leaks.

Motor Adapter Housing - Change Oil

1. Remove level gauge (6) and drain plug (5). Drain the oil into a receptacle of approx. 5 liter capacity.
2. Install drain plug (5) and fill-up engine oil SAE 10 or hydraulic oil HLP 22 or HLP 32 through filler opening up to the MAX mark on level gauge (6) see illustration Z26332 on next page for correct oil level indication.
3. After short operating period check oil level and housing for leaks.



Establish the correct Oil Level in Swing Gears, Brake Housings and Motor Adapter Housings

Legend for illustration Z26332

- I Front swing gear
- II Rear swing gear
- (A) Position of oil level gauge for checking the oil level in swing gears and motor adapter housings
- (B) Position of oil level gauge for checking the oil level in brake housings
- (4) Oil level gauges for swing gears
- (6) Oil level gauges for motor adapter housings
- (8) Oil level gauges for brake housings
- (11) Drain coupling or evacuation nozzle for Wiggins system
- (12) Chain to secure rear gear access hatch
- (13) Rear gear access hatch

Swing Gear Oil Level

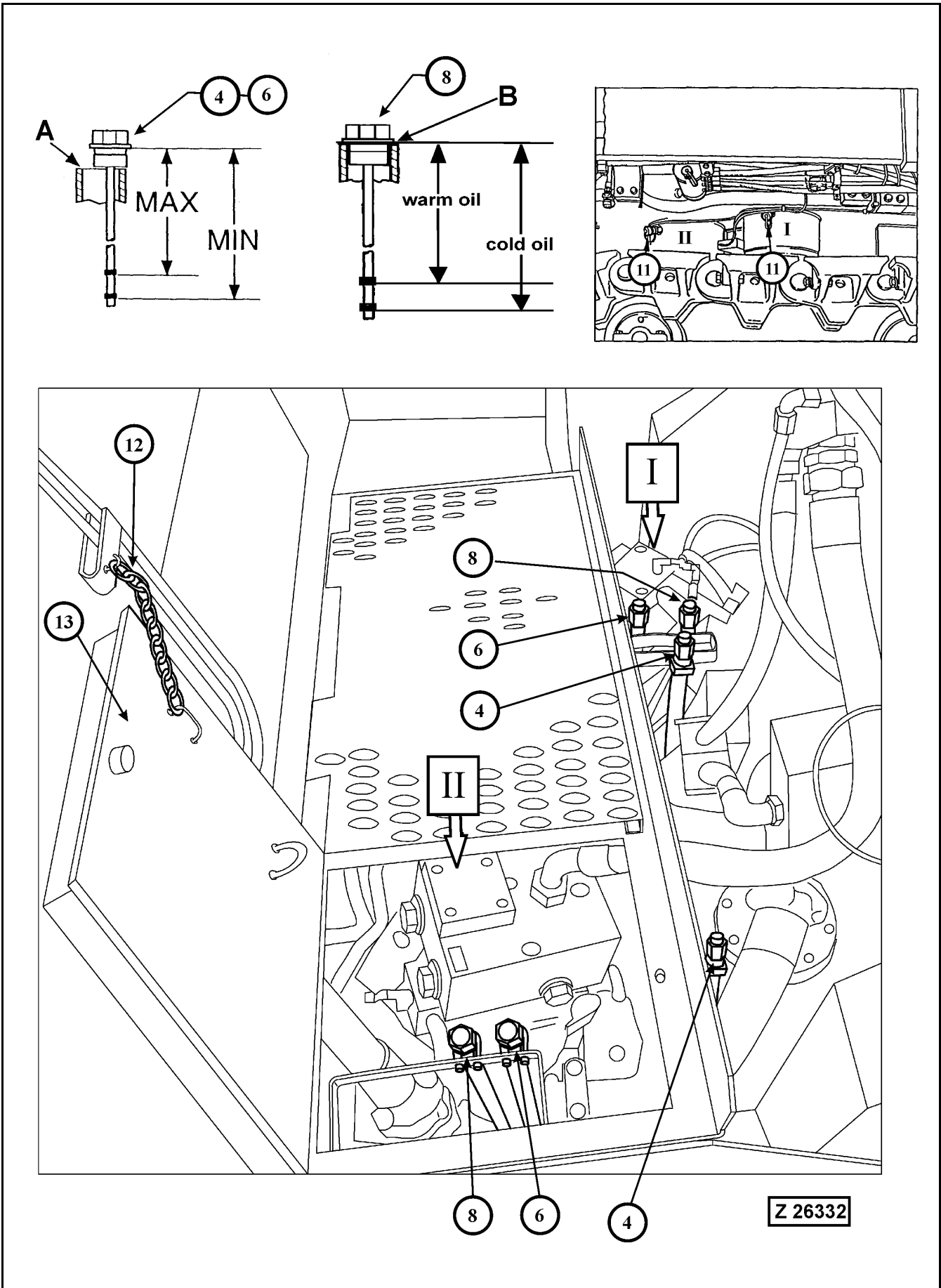
REMARK

To access the rear swing gear (II), illust. Z26332, raise the access hatch (13) in the walkway and secure against accidental falling using chain (12).

1. Remove oil level gauge (4) of both swing gears and wipe it clean.
2. Insert the gauge but DO NOT screw in, see detail -A-.
3. Remove the gauge. The oil level should be at the upper mark of gauge (4).
4. If necessary add the specified gear oil through the filler pipe.
5. Insert both gauges (4) and tighten securely
6. Close hatch (13) and tighten the fastening bolt.

Brake Housing Oil Level

1. Remove oil level gauge (8) of both brake housings and wipe it clean.
2. Screw in the oil level gauge, see detail -B-.
3. Remove the gauge.



Establish the correct Oil Level in Swing Gears, Brake Housings and Motor Adapter Housings (continued)

Brake Housing Oil Level

REMARK

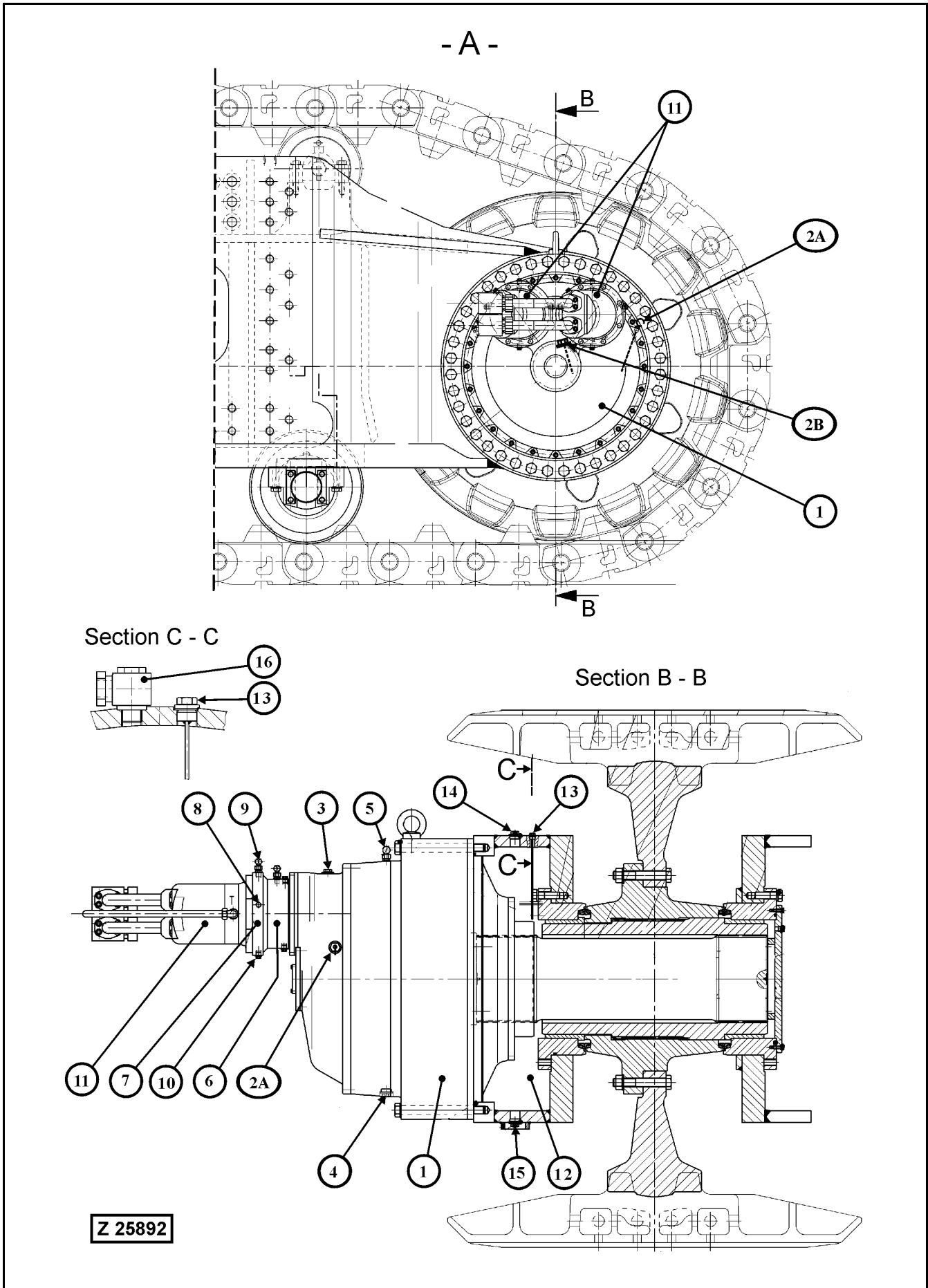
The upper mark on gauge (8) indicates the correct oil level with the oil hot.

The lower mark indicates the correct oil level with the oil cold. With cold oil, the oil level should be at the lower mark of gauge (8). With hot oil, the oil level should be just below the upper mark of gauge (8).

4. Add engine oil SAE 10 or hydraulic oil HLP 22 or HLP 32 through filler opening. DO NOT overfill the brake housing, otherwise the brake could be damaged due to overheating.
5. Insert both gauges (8) and tighten securely.

Motor Adapter Housing Oil Level

1. Remove oil level gauge (6) of both housings and wipe it clean.
2. Insert the gauge but DO NOT screw in, see detail -A-.
3. Remove the gauge. The oil level should be at the upper mark of gauge (6).
4. If necessary add engine oil SAE 10 or hydraulic oil HLP 22 or HLP 32 through filler opening.
5. Reinstall both oil level gauges and tighten securely.



4.14.2 TRAVEL GEARS, MOTOR ADAPTER HOUSINGS AND FINAL DRIVES CHANGE OIL

Legend for illustration Z25892

- A - View of the RH Final drive. The configuration of the LH Final drive is the same.

(1) Travel gear

(2A) Oil level gauge on gears made by **L&S**

(2B) Oil level gauge on gears made by **ZOLLERN**

(3) Oil filler plug

(4) Oil drain plug

(5) Connector for breather filter line. The breather filter is located inside the center frame, see illustration Z25243 on page 319.

(6) Travel brake housing

REMARK

The travel gear brakes are dry type multiple disk brakes. DO NOT fill the housings with oil.

(7) Motor adapter housing

(8) Oil level plug

(9) Connector for breather filter line, the breather filter is located inside the center frame, see illustration Z25243 on page 319. The port of connector (9) is also used as oil filler opening.

(10) Oil drain plug

(11) Hydraulic motors

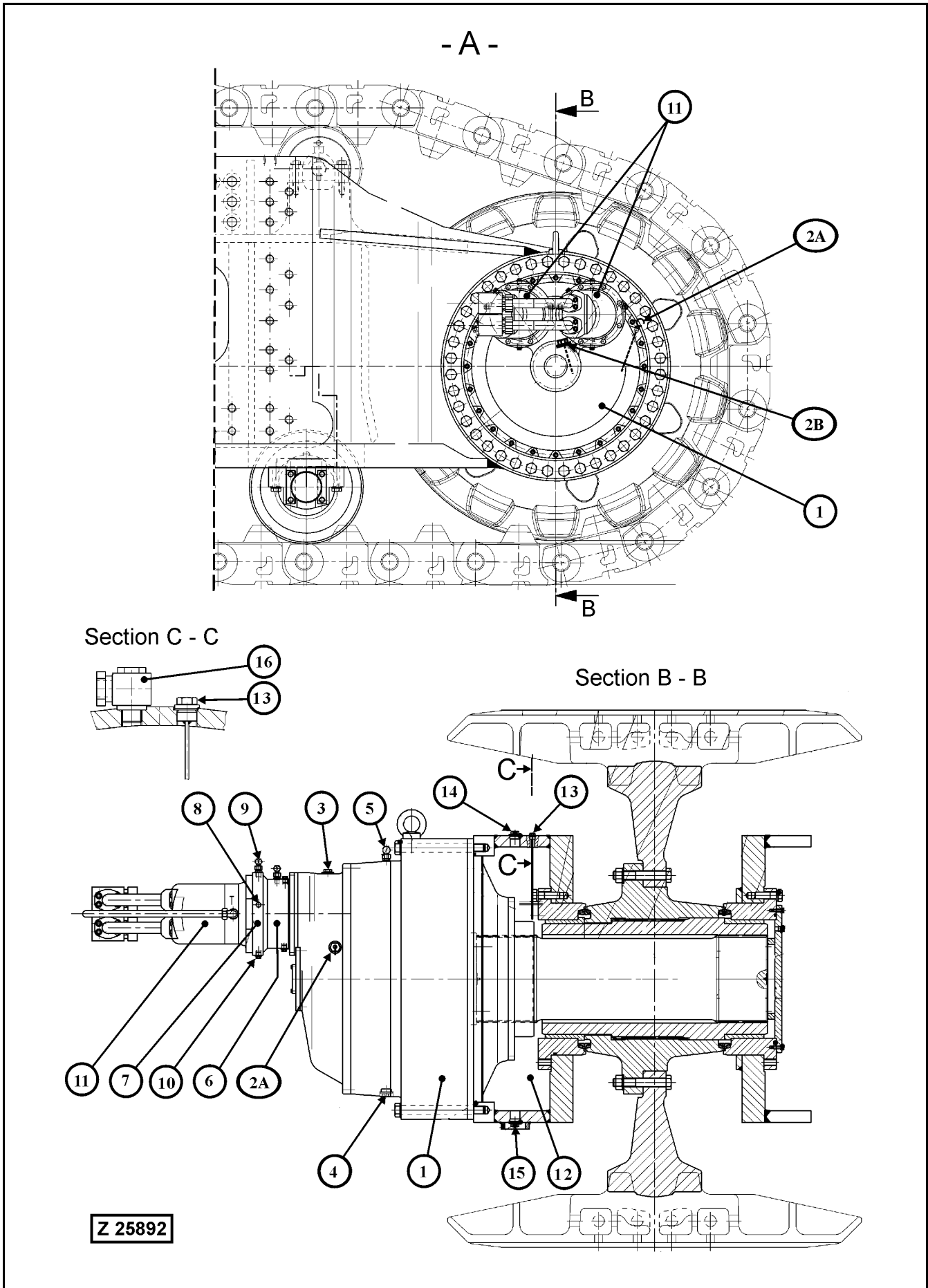
(12) Final drive housing contains the lubricating oil for sprocket bearing lubrication.

(13) Oil level gauge

(14) Oil filler plug

(15) Oil drain plug

(16) Connector for breather filter line, the breather filter is located inside the center frame, see illustration Z25243 on page 319.



TRAVEL GEARS - CHANGE OIL

Illustration Z25892:

REMARK

The breather filters for the travel gears are mounted inside the center frame and connected with extension hoses.

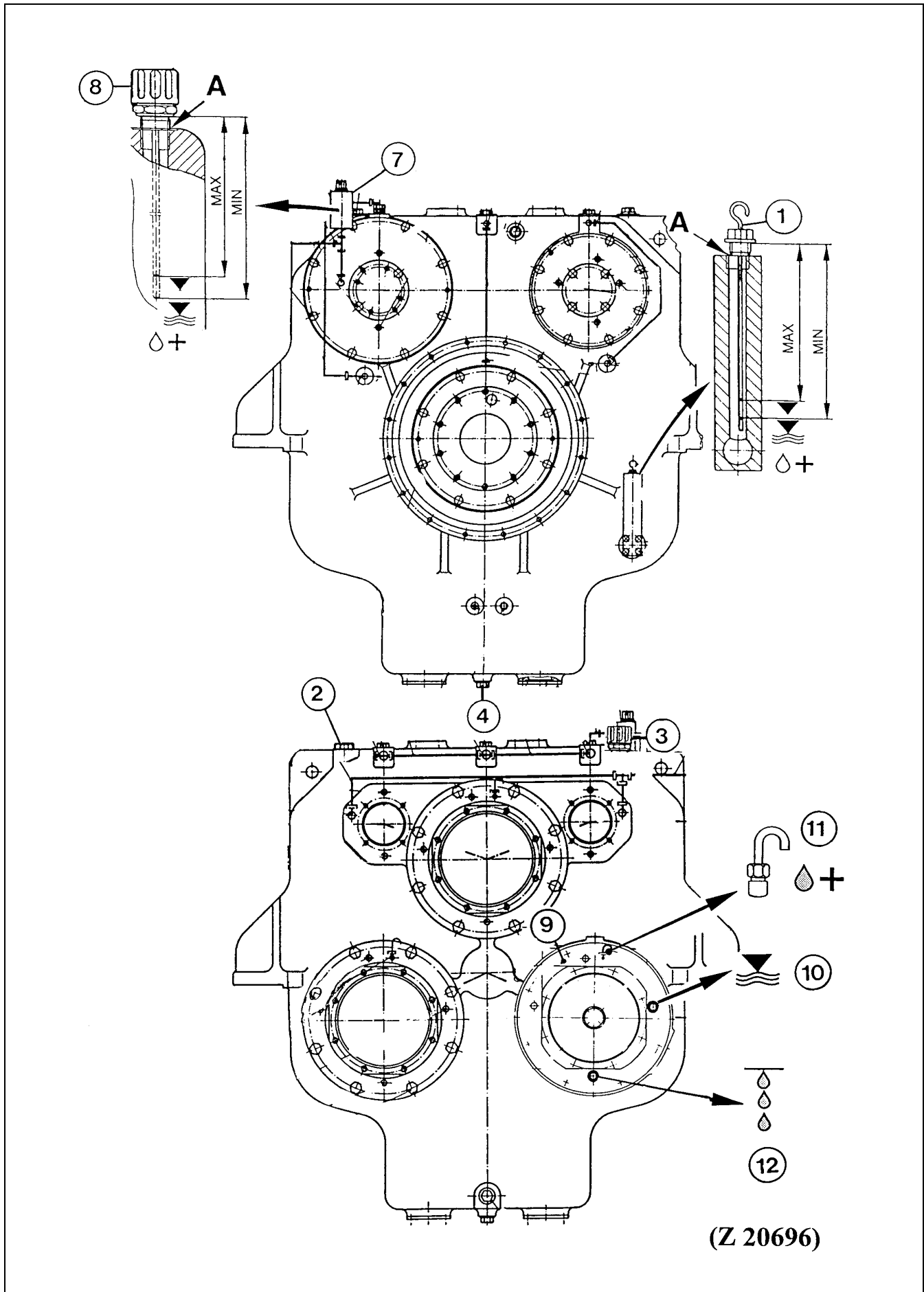
1. Remove drain plugs (4), filler plug (3) and oil level gauge (2A) or (2B). Check breather filter, mounted inside center frame, and clean as necessary.
2. After the oil is completely drained, flush the gear with the regular gear oil and reinstall drain plugs (4).
3. Fill the gear with fresh oil through filler opening (3) up to the Max mark on oil level gauge (2A) or (2B).
4. Install filler plug (3) and gauge (2A) or (2B) and tighten securely.
5. After short operating period check gears for leakage.

MOTOR ADAPTER HOUSINGS - CHANGE OIL

1. Remove parts (8, 9 and 10) and drain the oil completely.
2. Check breather filter, mounted inside center frame, and clean as necessary.
3. Install drain plug (10) and fill-up oil to level opening (8). Reconnect breather filter hose line to filler opening (9).

FINAL DRIVE HOUSINGS - CHANGE OIL

1. Remove drain plug (15), filler plug (14) and oil level gauge (13) and drain the lubricating oil.
2. Check breather filter mounted inside center frame, and clean as necessary.
3. After the oil is completely drained, install the cleaned drain plug (15) and tighten securely.
4. Fill in new oil up to the "MAX" marking on oil level gauge (13).
5. Clean filler plug (14) and reinstall.
6. Insert oil level gauge (13) and tighten securely.
7. After short operating period check oil level and gear for leakage.



4.14.3 PTO (PUMP DISTRIBUTOR GEAR) - CHANGE OIL

Legend for illustration Z 20696

- (1) Oil level gauge
- (2) Oil filler plug
- (3) Breather filter
- (4) Oil drain plug
- (7) Oil collector reservoir for adapter housings of hydraulic pumps for fan drives of radiator and hydraulic oil coolers
- (8) Breather filter with oil level gauge
- (9) Adapter housings for main hydraulic pumps
- (10) Oil level plug
- (11) Oil filler plug with breather pipe
- (12) Oil drain plug

Gear Oil Viscosity

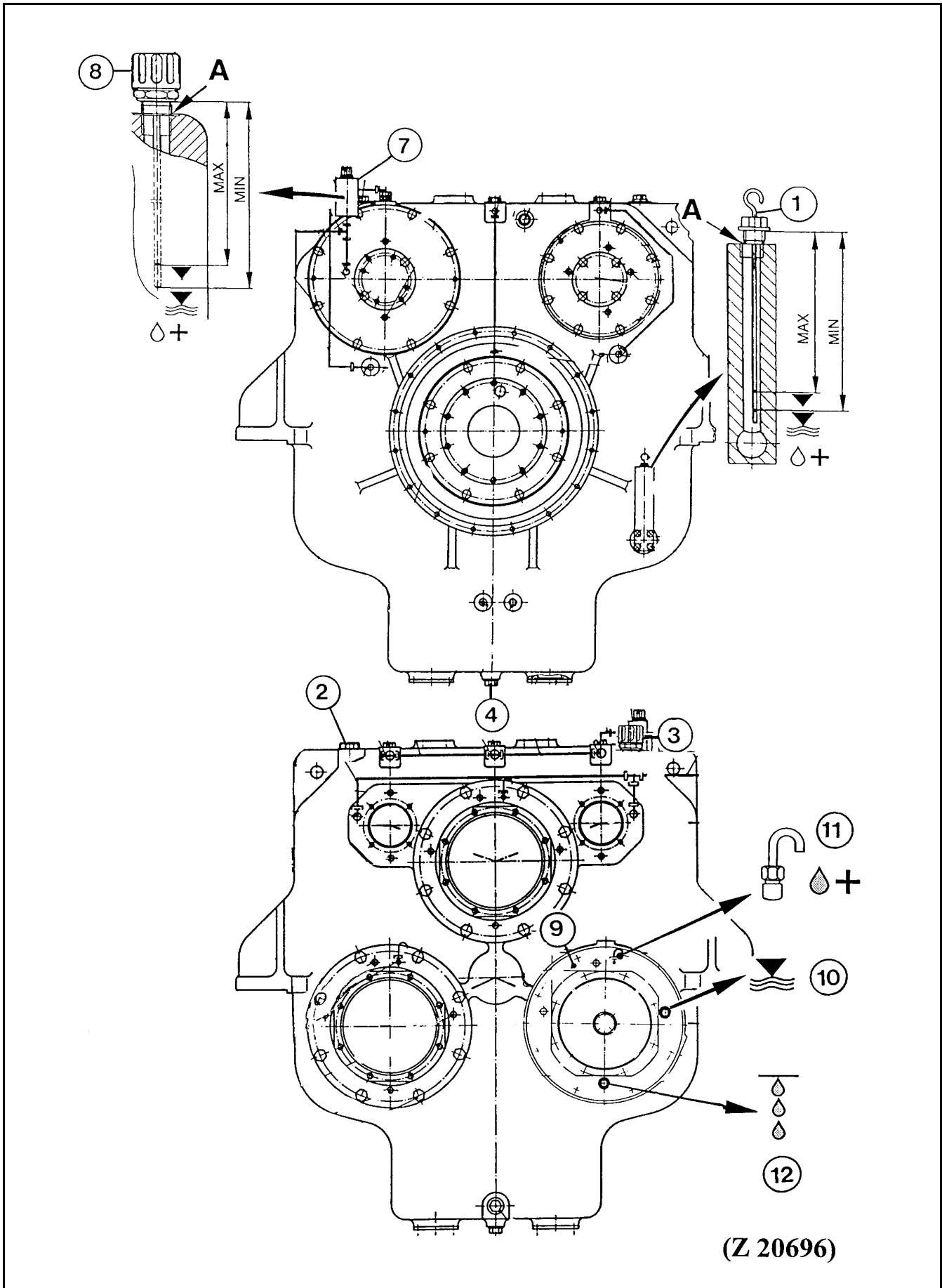
Select gear oil viscosity grade according to ambient temperatures.

If the new gear oil has a different viscosity grade compared with the drained oil it is necessary to enter the new viscosity grade into the appropriate "**Excavator Components**" group.

Refer to page 90 for the INPUT procedure of the oil viscosity.

NOTICE

Before opening the access covers from below the pump distributor gears provide an adequate working platform with sufficient space for the oil collecting container (approx. 200 liters for both gears).



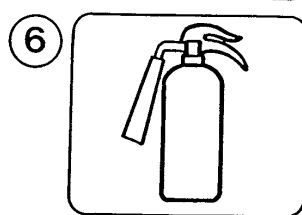
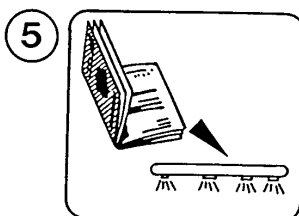
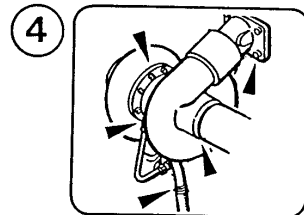
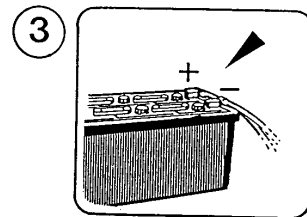
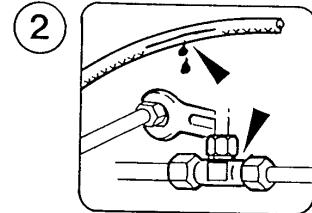
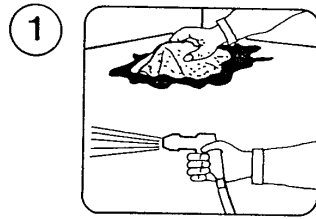
Change the Oil

1. Remove drain plug (4).
2. Remove gauge (1) and filler plug (2).
3. Remove breather filter (3), blow out with compressed air from inside to outside and re-install.
4. After the oil is completely drained, flush the gear with the regular gear oil and reinstall drain plug (4).
5. Fill in new oil through opening (2) up to the "MAX" mark on gauge (1). If the machine is equipped with a central refilling system, proceed according to page 230.
6. Re-install parts (1 and 2).
7. After short operating period, check oil level and housing for leakage.

NOTICE

If the oil level is above the "MAX" mark, drain the oil down until the oil level is at the "MAX" mark. Too much oil in the pump distributor gear will cause aeration of the oil.

4.15 FIRE PREVENTION



Z 19360

PRECAUTIONS

See illustration Z 19360

In order to prevent risks of possible fire break out observe the following items:

1. Keep the excavator clean, especially from inflammable materials.
Clean the excavator after servicing the hydraulic system, engine and fuel system by means of a steam jet.
2. Clean engine compartment, hydraulic pump compartment and service platform of the superstructure.
Thereafter check fuel lines, engine oil lines and hydraulic oil lines for leakage, loose fastenings and damage.
If any leakage, damage or loose fastening is found, corrective action must be taken immediately.
3. Check all electrical cables, terminals and connections for loose fastenings, damage and wear.
Replace or repair defective or worn parts without delay.
4. Check the turbocharger for correct mounting and tight exhaust, intake and lube oil connections.
Carry out all necessary repairs without delay.
5. **On machines equipped with a fire detection, actuation and suppression system:**
Refer to the manufacturers service manuals filed in Service Literature Binder Volume 2 for correct maintenance and inspection of the systems.
When checking the filling level of the dry chemical tanks, make sure that the extinguishing powder (Ansul FORAY dry chemical agent) is not compacted.
Stir up the extinguishing powder with a suitable stick until it is in a free flowing condition.

NOTICE

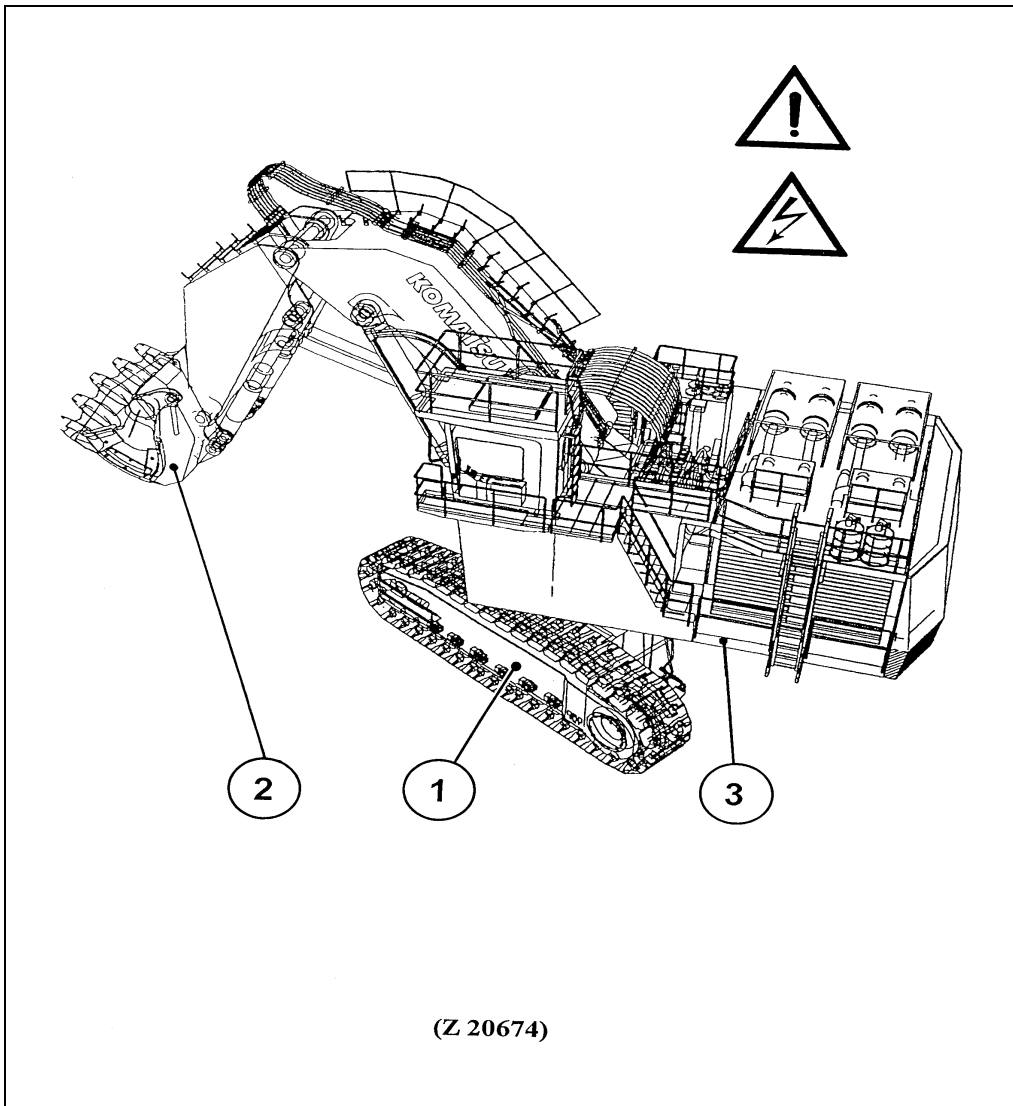
When cleaning the power house take care the heat detection sensors do not come in contact with hot steam or other hot agent. Otherwise the fire suppression system may be triggered.

6. Make sure fire extinguishers are charged and ready for use.

NOTICE

**After cleaning lubricate all lubrication points by means of central lube system or manually.
Lubricate swing circle gear after drying by means of the automatic lube system or manually.**

4.16 WELD REPAIRS



CAUTION

Before carry out weld repairs, contact our Service Department EXCAVATORS in order to avoid improper welding procedures. Weld repairs can cause severe damage to an entire structure if performed incorrectly. If cracks are found in the steel construction of your excavator, please inform our Service Department as soon as possible. Attach suitable information material (photos, catalog drawings etc.) showing the location and nature of the crack.

GENERAL INFORMATION

Welding operations can cause damage to electronic components. (Computers, Control Units, Sensors etc.), in case the welding current goes through these units. Therefore protective measures are necessary before any weld repair is started.

GENERAL PROTECTIVE MEASURES

- A. Observe the prevailing safety and fire prevention regulations.

Before any weld repair is started, a survey should be made of the area and all safety considerations satisfied such as fuel tanks, oil lines, electrical cables and synthetic materials.

- B. Attach the welding ground directly to the part that is being repaired. Do not allow welding current to go through bearings. Welding current could arc the bearings, resulting in severe damage to the bearing.

WELD REPAIRS ON MAJOR COMPONENTS OF THE EXCAVATOR

COUNTERWEIGHT

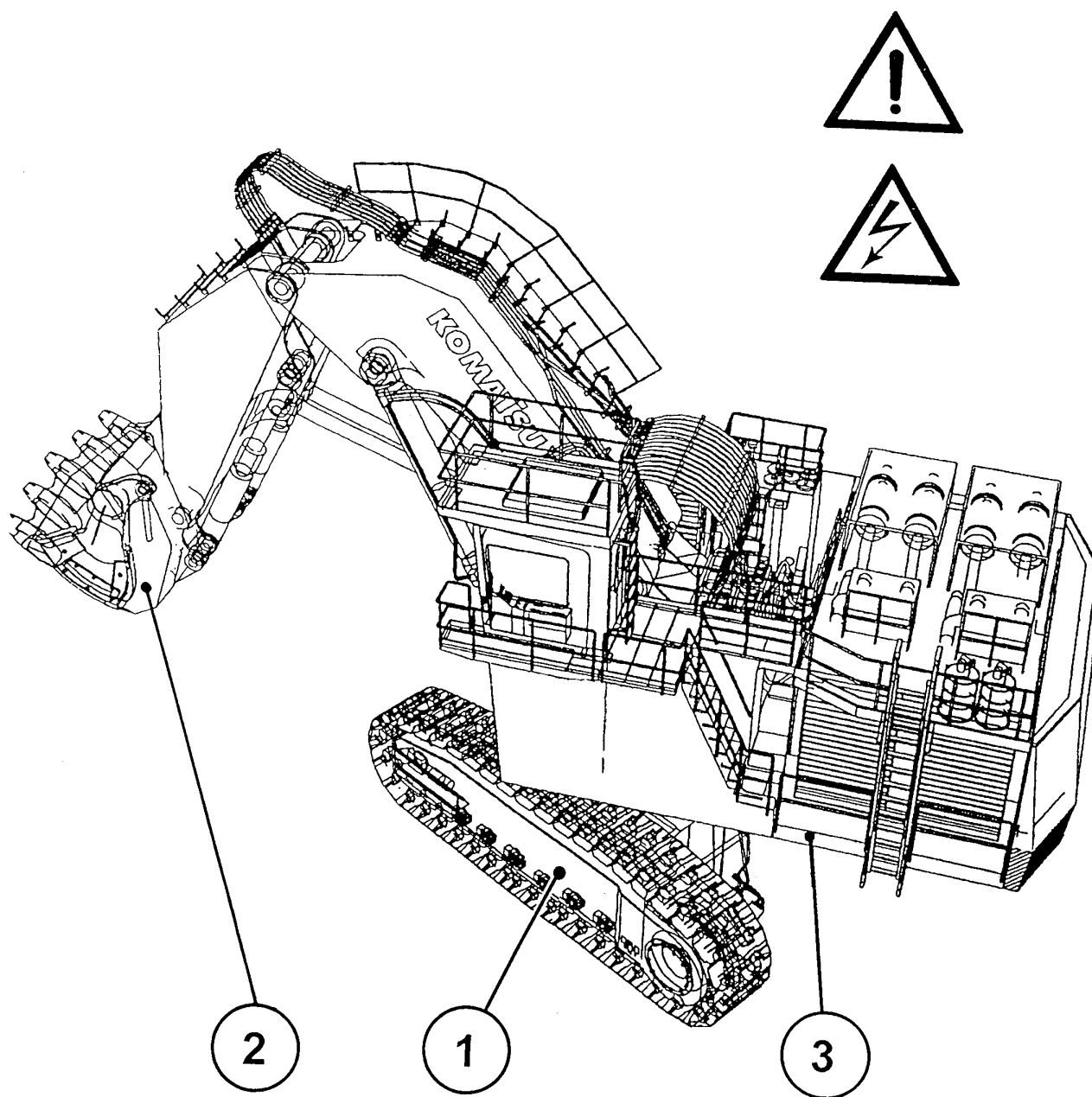
⚠ WARNING

The chambers of the counterweight are filled with a mixture of concrete, granulated ore and steel pellets. This mixture can create explosive gases which will accumulate in the chambers of the counterweight. Before any welding, flame-cutting, grinding or drilling procedures are carried out on the counterweight it is vital to expel these gases from the counterweight chambers. Failure to properly expel the gases from the counterweight chambers can result in an explosion with serious personal injury or death.

Follow the instructions given in **PARTS & SERVICE NEWS No. AH04518** for expelling the gases from the counterweight chambers.

Legend for illustration Z 20674

- (1) Undercarriage, refer to page 475 for protective measures.
- (2) Loader attachment, refer to page 477 for protective measures.
- (3) Superstructure, refer to page 479 for protective measures.



(Z 20674)

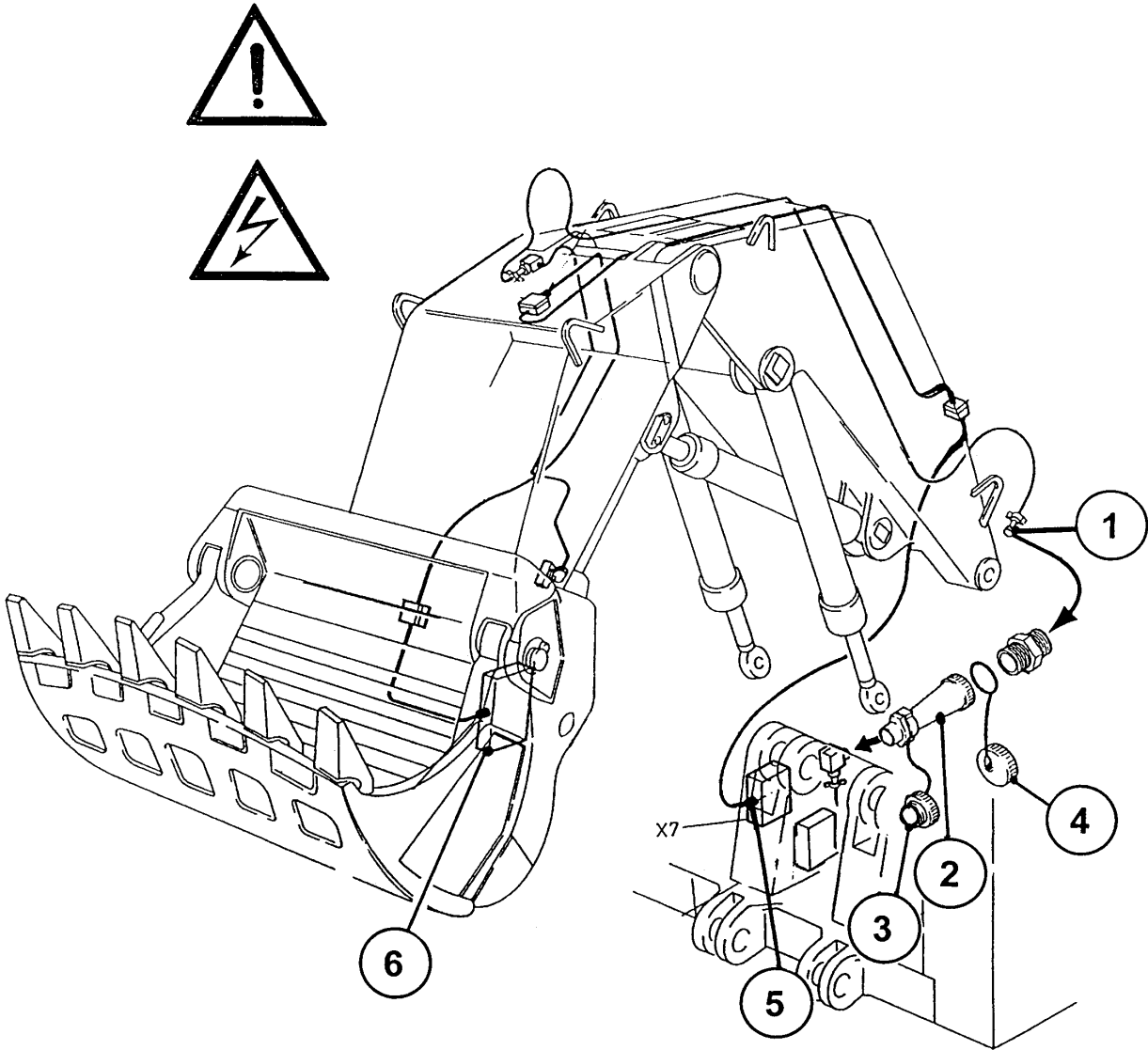
4.16.1 PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE UNDERCARRIAGE

See illustration Z 20674

On standard Excavators there are no special protective measures necessary.

However, the general protective measures (A and B) must be observed.

On Excavators with a power unit (generator set) mounted to the undercarriage, all electrical connections between the Excavator and the power unit have to be disconnected.



(Z 20675)

4.16.2 PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE LOADER ATTACHMENT

Legend for illustration Z 20675

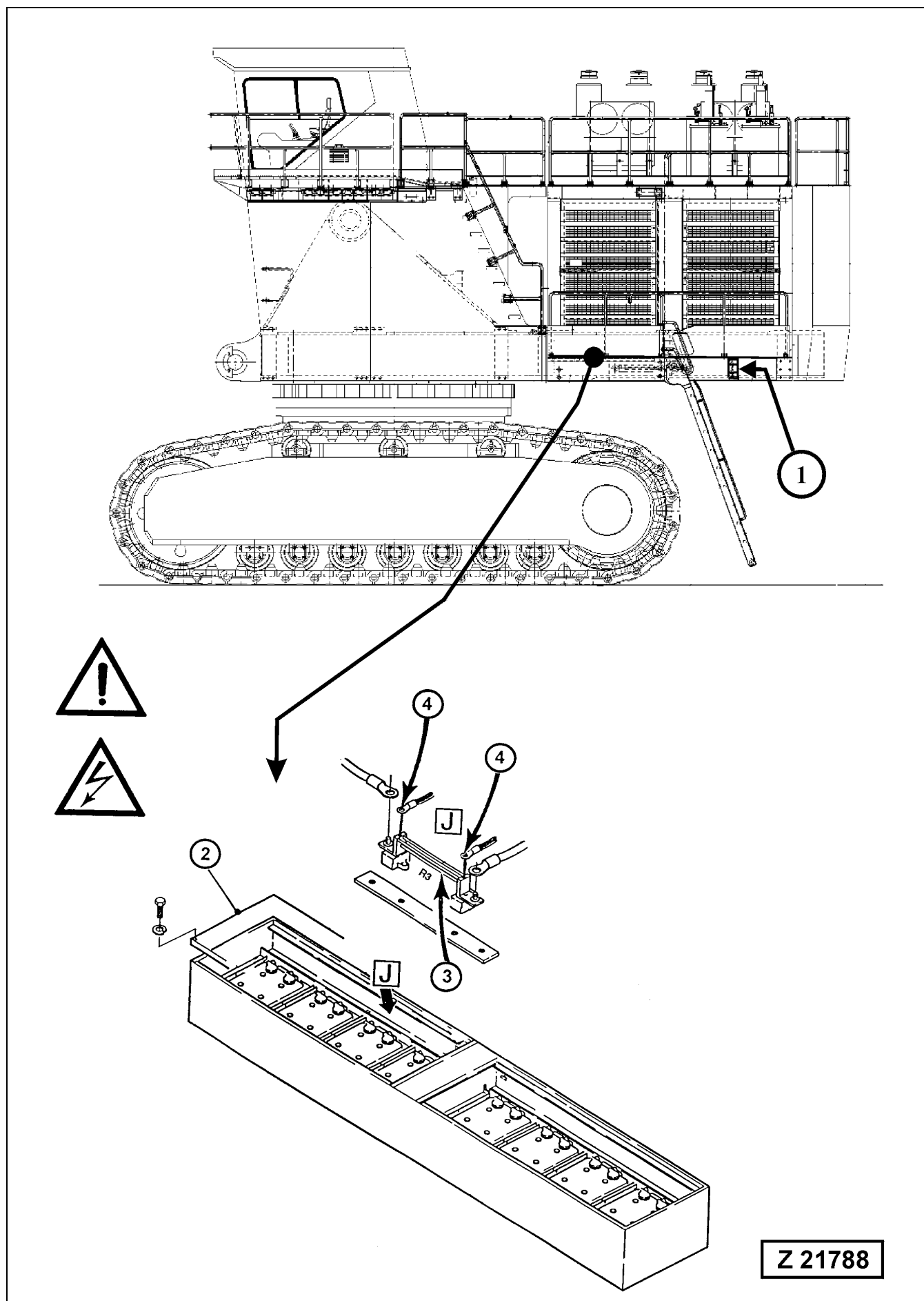
- (1) Electrical cable connector of the end-line pressure switch for the central lubrication system
- (2) Plug socket
- (3) Protection cap for (2)
- (4) Protection cap for (1)
- (5) Switch box of the electronic bucket levelling system "EBL", (Special Equipment)
- (6) Bucket position detector box for the "EBL" system (Special Equipment)

NOTICE

If weld repairs have to be carried out on the Loader Attachment (Bucket, Stick and/or Boom) disconnect the end line pressure switch cable connector (1) from socket (2) and close the openings with caps (3 and 4).

If the Excavator is equipped with an electronic Bucket Levelling System, disconnect also the cable connector on switch box (5).

Be sure to disconnect electrical connections of working lights and other electrical equipment mounted on the loader attachment.



4.16.3 PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE SUPERSTRUCTURE

Legend for illustration Z 21788

- (1) Battery main switch keys
- (2) Battery box cover underneath the cat walk
- (3) Battery current sensor (auxiliary resistor)
- (4) Cables for transmitting the battery charging current to the DC converter (E7)
- (J) Location of battery current sensor (auxiliary resistor) (3)

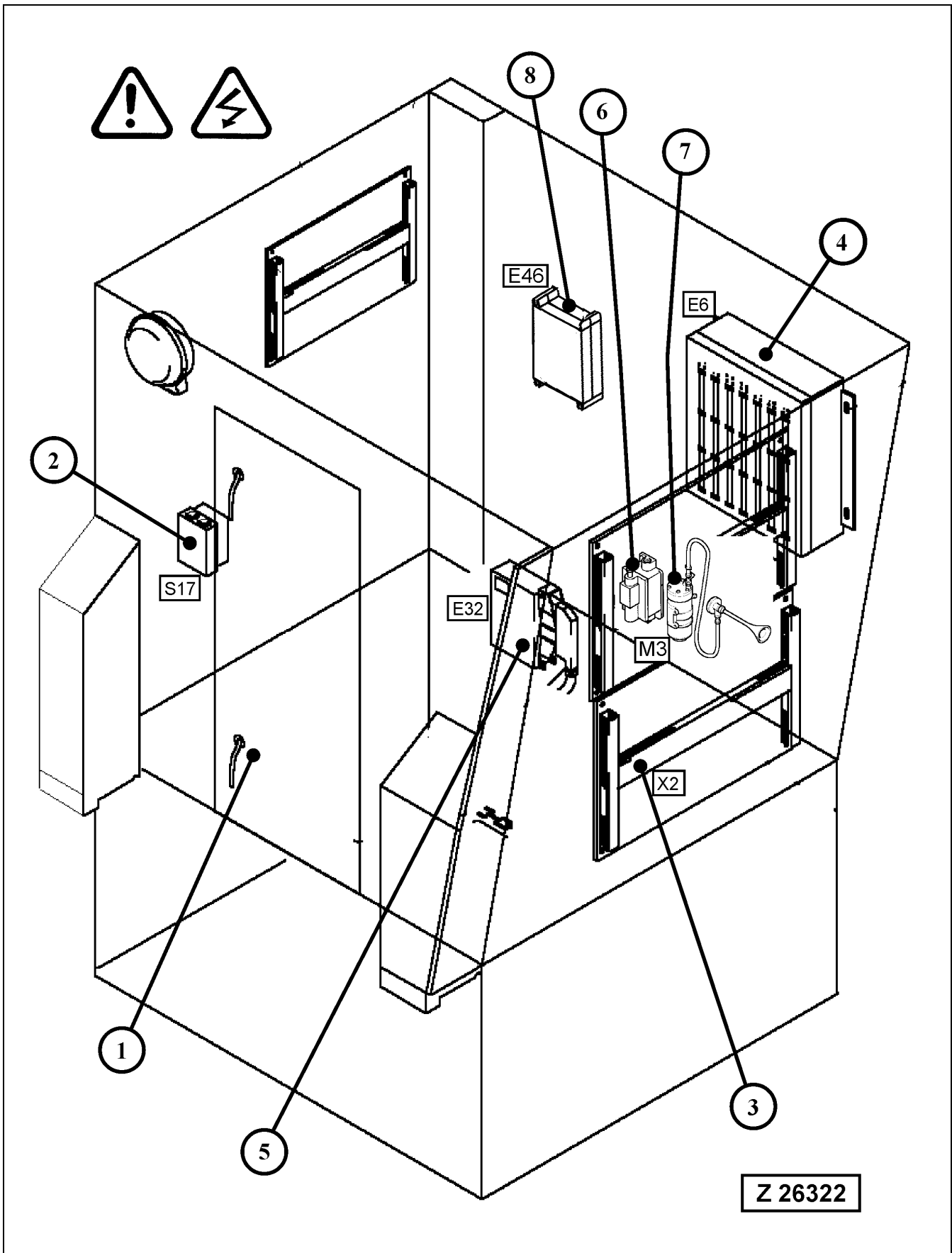
Observe sequence of steps:

1. Remove keys (1) of the two battery main switches.
2. Open the battery box cover (2) and secure in open position with the safety chains provided.
3. Disconnect both cables (4) from auxiliary resistor (3).

⚠ WARNING

Batteries give off highly inflammable gas! Never allow sparks or open flame near the batteries! Avoid spilling any electrolyte on hands or clothing. repair or replace all broken wires immediately. All terminals must be clean and securely fastened; never paint connections.

DO NOT short across or ground any terminals of the batteries.



Electrical Units in Cab Base, illustration Z26322

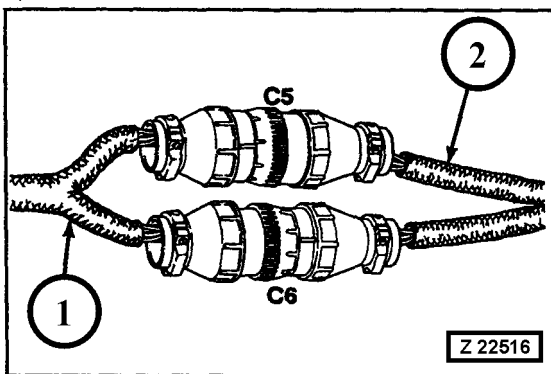
1. Switch off all circuit breakers on switch board -X2-.
2. Disconnect all plugs on the programmable logic controller (4).
3. Remove the wiring harness connector from electronic pump control module (5).
4. Switch off all circuit breakers on the switch board for preheating systems (if so equipped).

REMARK

Be sure to isolate Electronic Components of Special Equipment.

Engine Electronics

Disconnect the Deutsch connectors illustration Z22516 at the interface box on the LH engine side near the flywheel housing. For more information refer to the Engine Operation and Maintenance Manual filed in Volume 2 Binder.



- (1) - Engine harness
 (2) - Shovel harness

4.16.4 AFTER FINISHING THE WELD REPAIRS ON THE SUPERSTRUCTURE

After finishing the weld repairs connect all cable connectors which have been disconnected. When connecting the Deutsch connectors at the interface box, make sure you hear a click.

When all electrical connections are established insert the battery main switch keys.

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