

# Operation & Maintenance Manual

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# PC5500-6

## HYDRAULIC MINING SHOVEL

### SERIAL NUMBER 15044

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Sept 2006

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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:**

- your Personal SAFETY
- Operating SAFETY, and
- 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.

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 **WARNING**

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**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.**

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## 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.**

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**⚠ WARNING**

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**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.**

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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

<b>ABB.</b>	<b>Definition</b>
A	Ampere
AC	Alternating Current
API	American Petroleum Institute
cSt	Centistoke
°C	Degree Celsius
CLS	Central Lubrication System
DC	Direct Current
DIN	German Institute for Standardization
EBL	Electronic Bucket Levelling System
ECM	Electronic Control Module
ECS	Electronic Control and Monitoring System
EF	Earth Fault Protection Switch
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
M1	Rear motor on counterweight side designated as motor 1
M2	Front motor on operator's cab side designated as motor 2
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)
SLS	Swing circle pinion Lubrication System
V	Volt
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

- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- Use protective equipment wherever required by the circumstances or by law.
- Observe all safety instructions and warnings attached to the machine.
- See to it that safety instructions and warnings attached to the machine are always complete and perfectly legible.
- 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.
- 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.
- Spare parts must comply with the technical requirements specified by the manufacturer. Spare parts from original equipment manufacturers can be relied to do so.

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

## **2.1.4 SELECTION AND QUALIFICATION OF PERSONNEL - BASIC RESPONSIBILITIES**

- Any work on and with the machine must be executed by reliable personnel only. Statutory minimum age limits must be observed.
- Employ only trained or instructed staff and set out clearly the individual responsibilities of the personnel for operation, set-up, maintenance and repair.
- Make sure that only authorized personnel works on or with the machine.
- 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.
- 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.
- 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.
- Work on chassis, brake and steering systems must be performed by skilled personnel only which has been specially trained for such work.
- 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

- Avoid any operational mode that might be prejudicial to safety.
- 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.
- 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.
- 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.
- In the event of malfunctions, stop the machine immediately and lock it. Have any defects rectified immediately.
- Start the machine from the driver's seat only.
- During start-up and shut-down procedures always watch the indicators in accordance with the Operation,- Lubrication and Maintenance Manual.
- Before starting up or setting the machine in motion, make sure that nobody is at risk.
- Before starting work or travelling with the machine, check that the braking, steering, signalling and lighting systems are fully functional.
- Before setting the machine in motion always check that the accessories have been safely stowed away.
- 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.
- In conditions of poor visibility and after dark always switch on the lighting system.
- Persons accompanying the driver must be seated on the passenger seat provided for this purpose.
- When crossing underpasses, bridges and tunnels or when passing under overhead lines always make sure that there is sufficient clearance.



- Always keep at a distance from the edges of building pits and slopes.
- Avoid any operation that might be a risk to machine stability.
- Never travel across slopes; always keep the working equipment and the load close to the ground, especially when travelling downhill.
- 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.
- 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**

- 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.
- Brief operating personnel before beginning special operations and maintenance work, and appoint a person to supervise the activities.
- 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.
- Ensure that the maintenance area is adequately secured.
- If the machine is completely shut down for maintenance and repair work, it must be secured against inadvertent starting by:
  - locking the principal control elements and removing the ignition key and/or
  - attaching a warning sign to the main switch
- 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.
- 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.

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- 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.
  - 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.
  - 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.
  - 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.
  - 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.
  - After cleaning, remove all covers and tapes applied for that purpose.
  - 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.
  - Always tighten any screwed connections that have been loosened during maintenance and repair.
  - 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.
  - 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

- Use only original fuses and circuit breakers with the specified current rating. Switch off the machine immediately if trouble occurs in the electrical system.
- 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.
- If your machine comes into contact with a live wire
  - do not leave the machine
  - drive the machine out of the hazard zone
  - warn others against approaching and touching the machine
  - have the live wire de-energized
  - do not leave the machine until the damaged line has been safely de-energized.
- 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.
- 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.
- 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.
- 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.
- 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**

- 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.
- 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.
- 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.
- 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**

- Work on hydraulic equipment may be carried out only by persons having special knowledge and experience in hydraulic systems.
- Check all lines, hoses and screwed connections regularly for leaks and obvious damage. Repair damage immediately. Splashed oil may cause injury and fire.
- 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.
- 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**

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

## **OIL, GREASE AND OTHER CHEMICAL SUBSTANCES**

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

### **2.1.7 TRANSPORTING AND TOWING -RECOMMISSIONING**

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

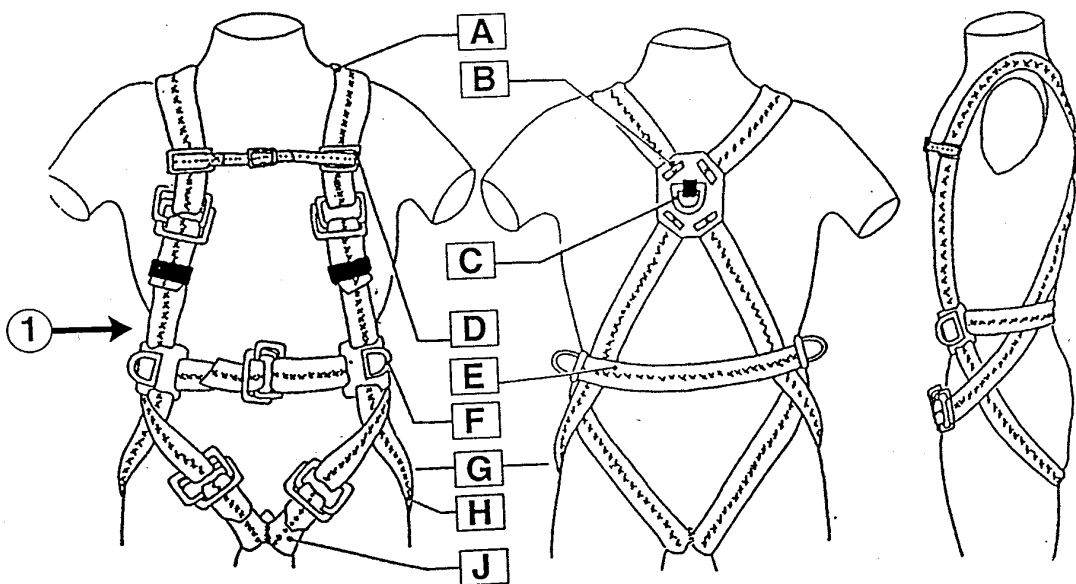
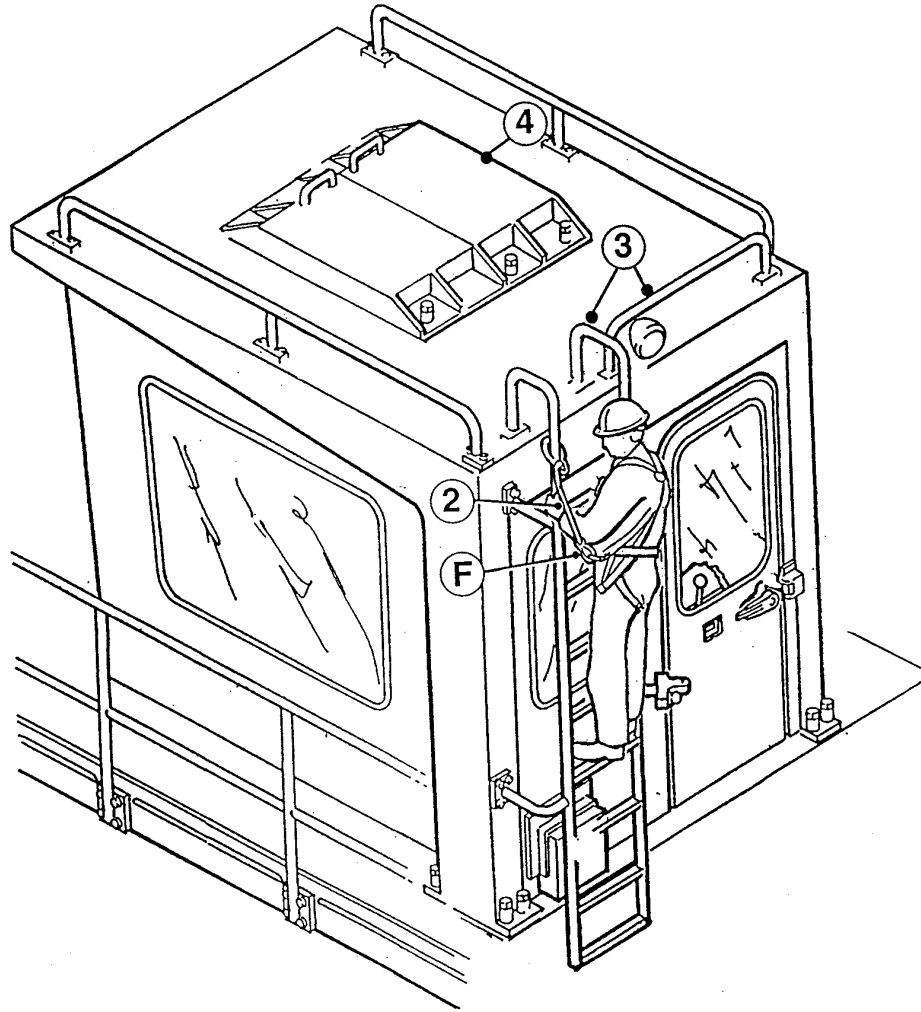
The Shovel can be retrofitted with a warning beacon which is fitted on the cab roof by means of a magnetic bracket.

## **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

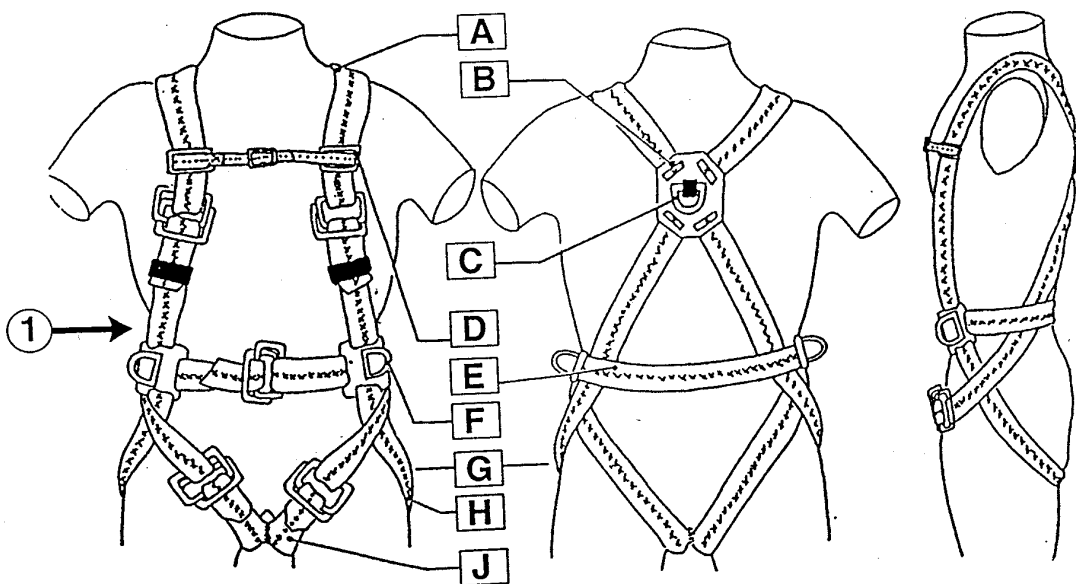
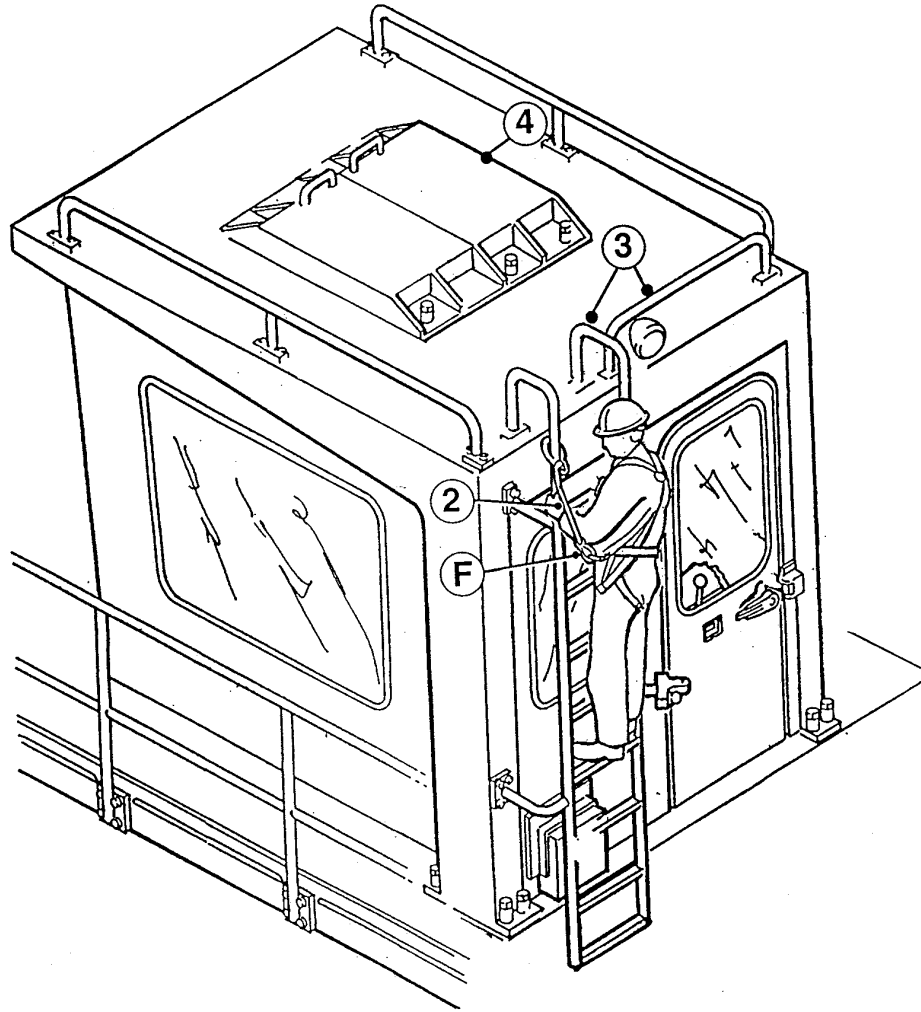
Always use the Safety Harness (1) in conjunction with strap type Fall Absorber (2), illust. (Z 20885) before mounting onto the loader attachment or other unsecured places of the Shovel.

### NOTICE

- The Safety Harness is located in the Cabinet of the Operator's Cab.
- 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

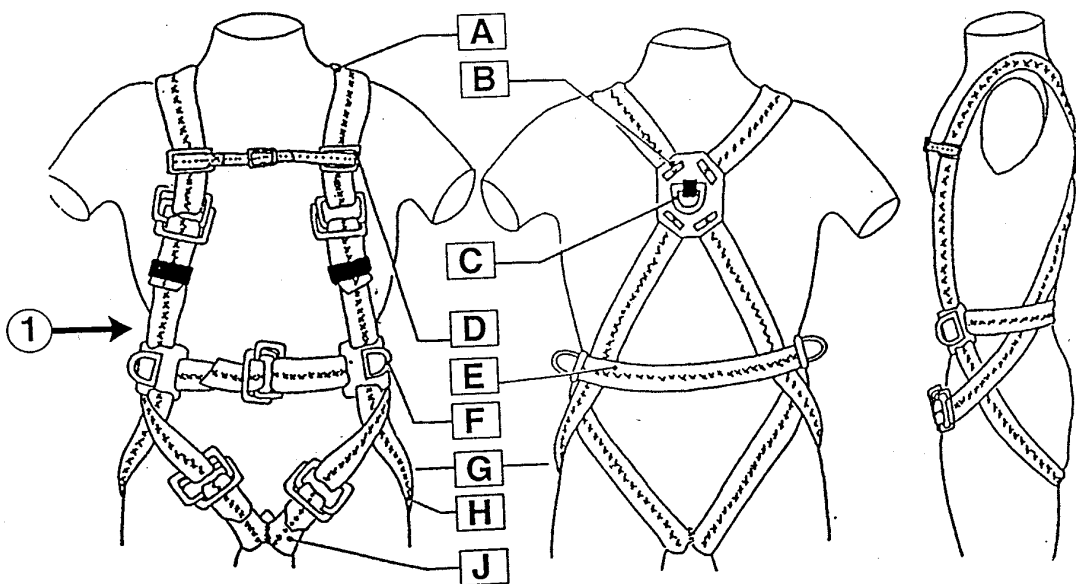
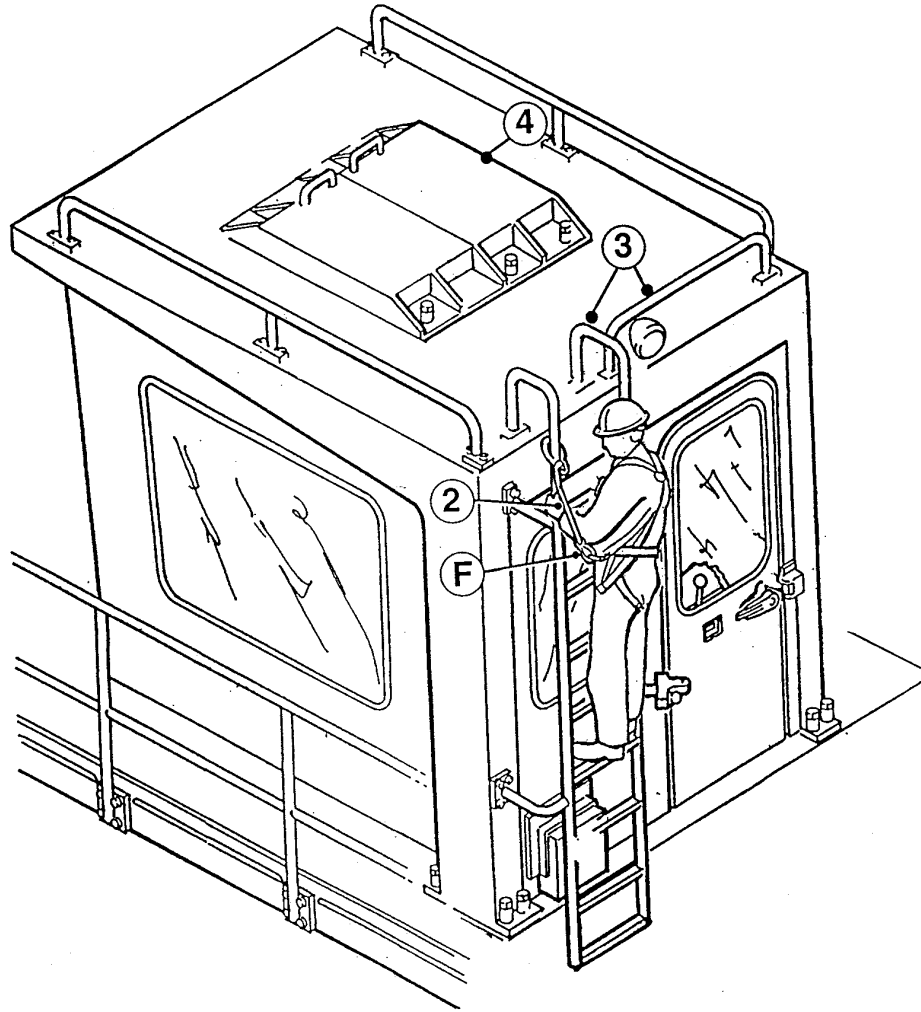
Open the lock, lift the harness by the catch hook (C), the blue straps (leg straps J) are below. The harness is being put on just like a jacket. Pull the belly strap (E) through the lock, as shown on the illustration, and secure it.

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**

- Carry out a visual check of the system or component; correct functioning and perfect working order have to be assured.
- 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.

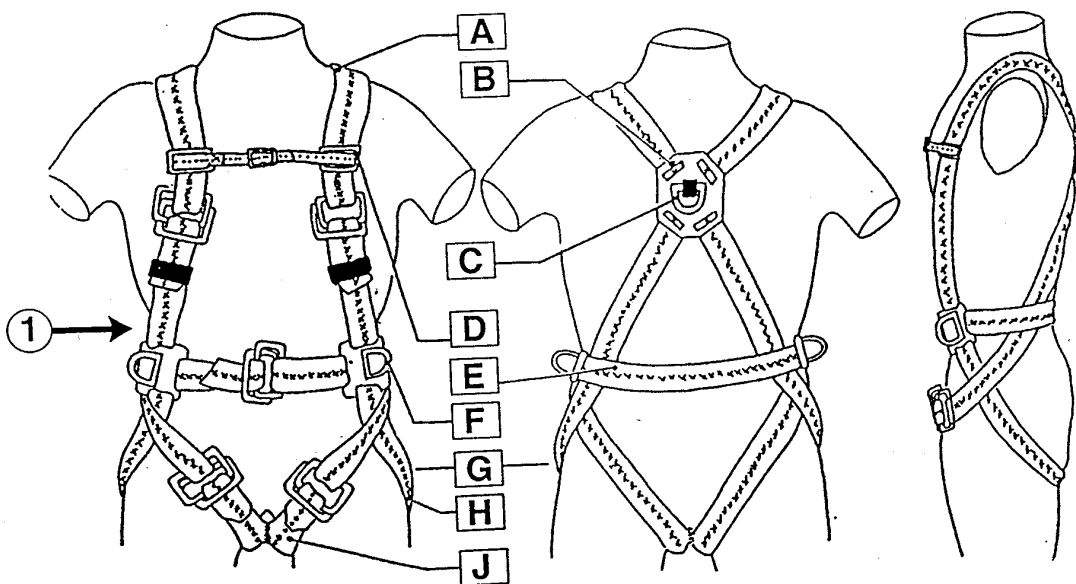
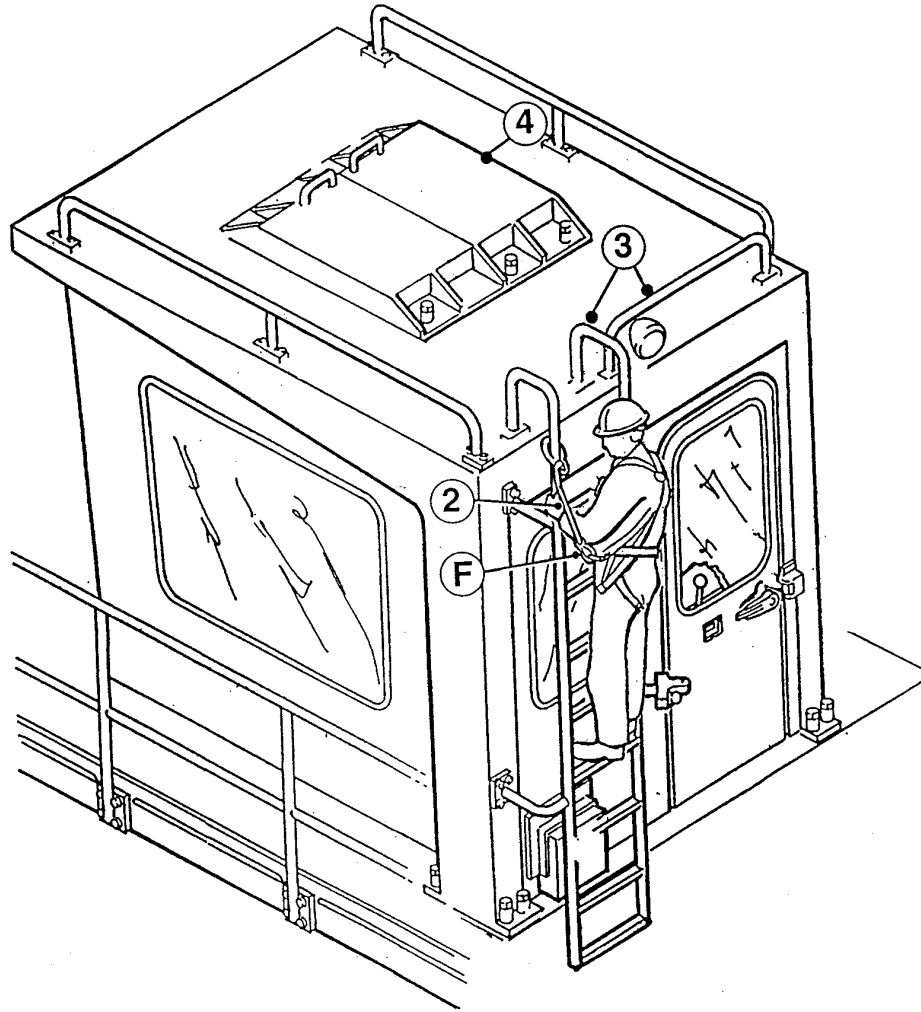
At least every 12 months, the safety harness and its components have to be inspected by a competent person authorized by the manufacturer and maintained, if the manufacturer considers it necessary.

## **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





# **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.

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**⚠ WARNING**

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

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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.

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**⚠ WARNING**

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**Improper operation of this machine can cause injury or death.**

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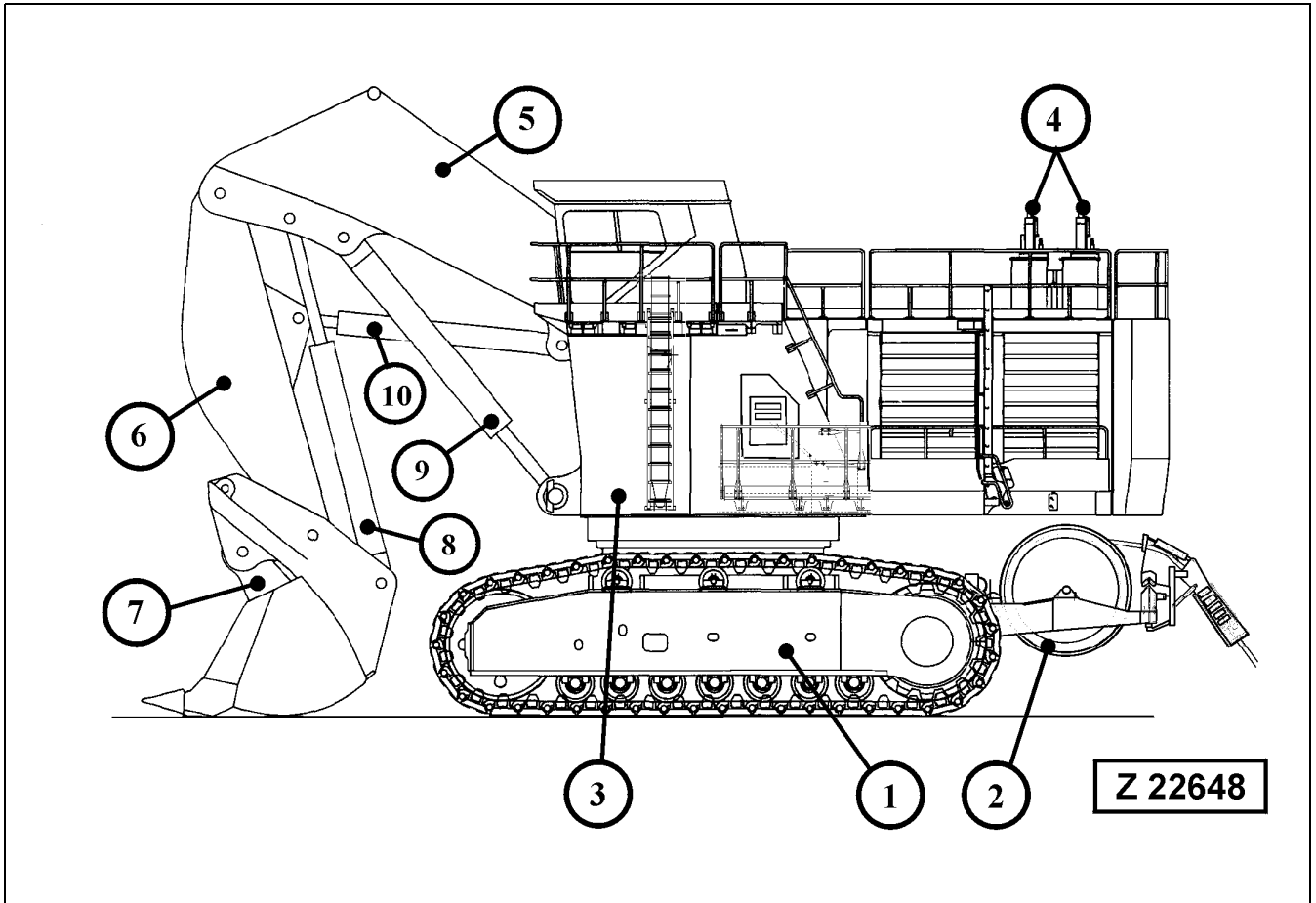
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### NOTICE

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

## 3.2 CONSTRUCTION OF THE SHOVEL

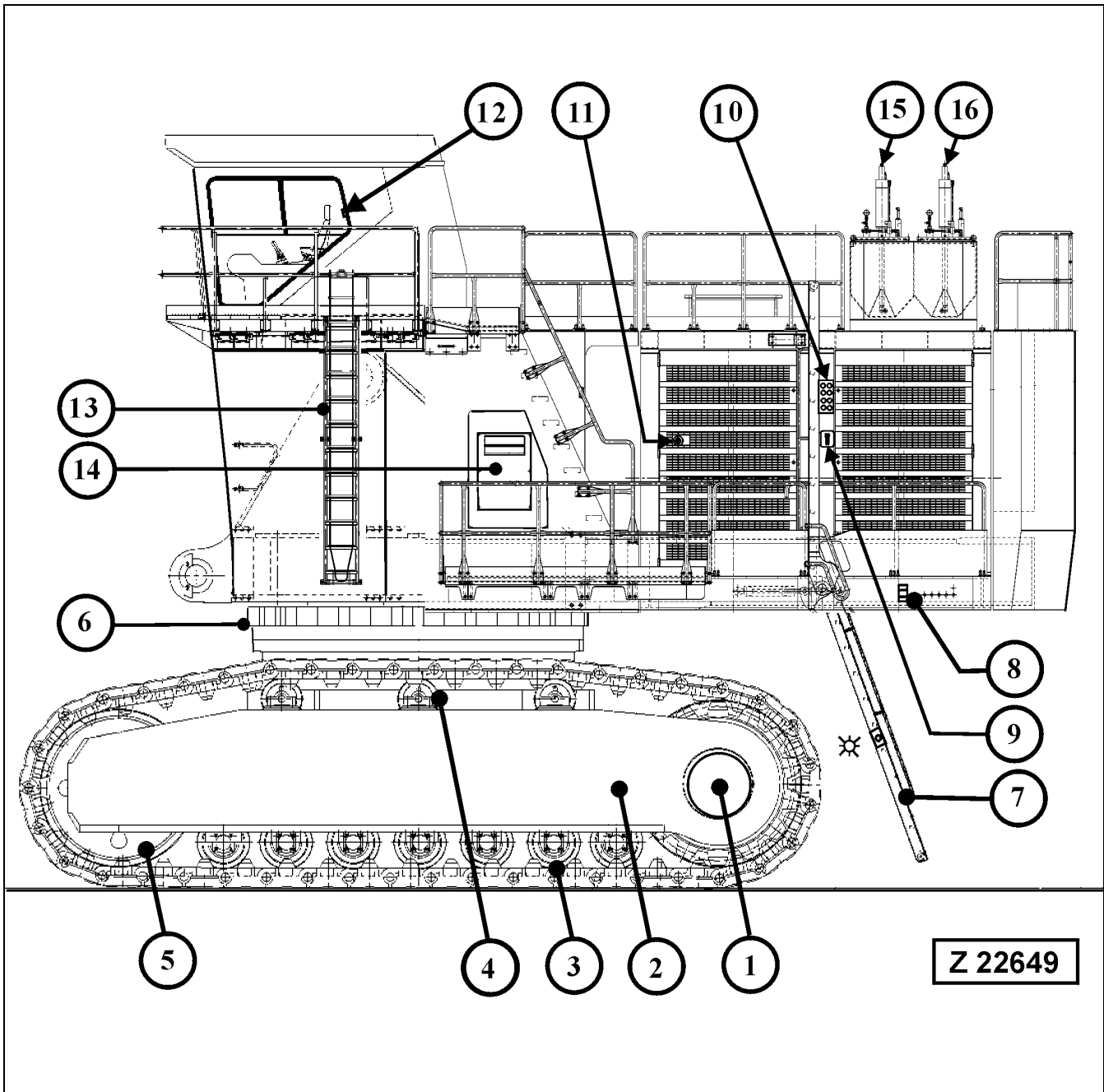
### 3.2.1 OVERALL VIEW



#### Legend for illustration Z 22648

- |     |                               |      |                    |
|-----|-------------------------------|------|--------------------|
| (1) | Undercarriage                 | (6)  | Stick              |
| (2) | Cable drum                    | (7)  | Bottom dump bucket |
| (3) | Superstructure                | (8)  | Bucket cylinders   |
| (4) | Automatic lubrication systems | (9)  | Boom cylinders     |
| (5) | Boom                          | (10) | Stick cylinders    |

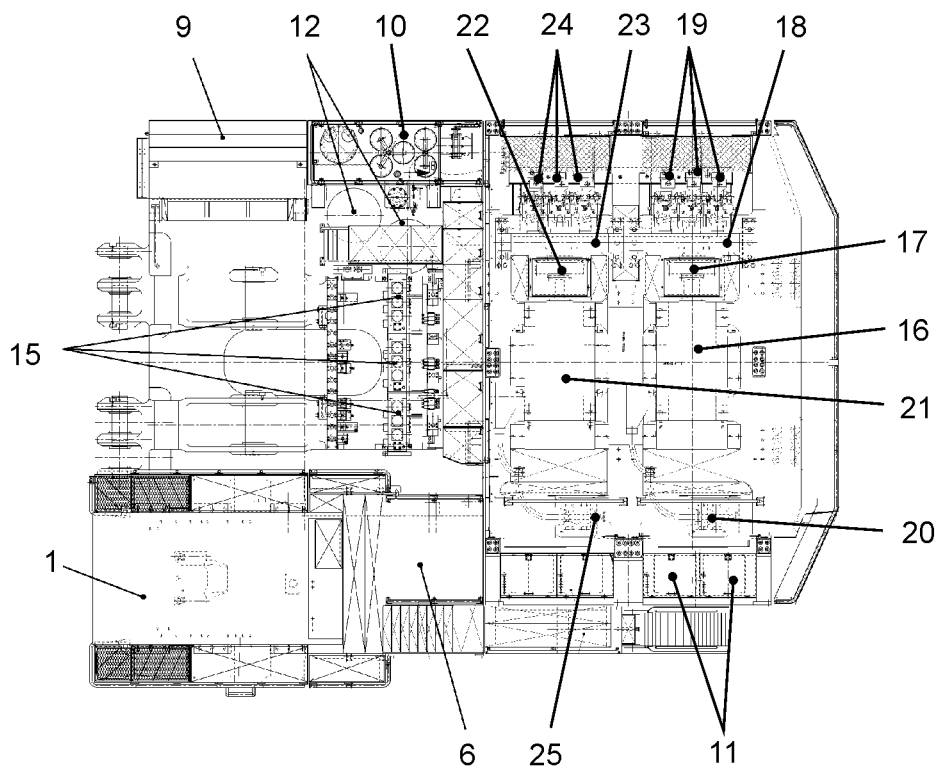
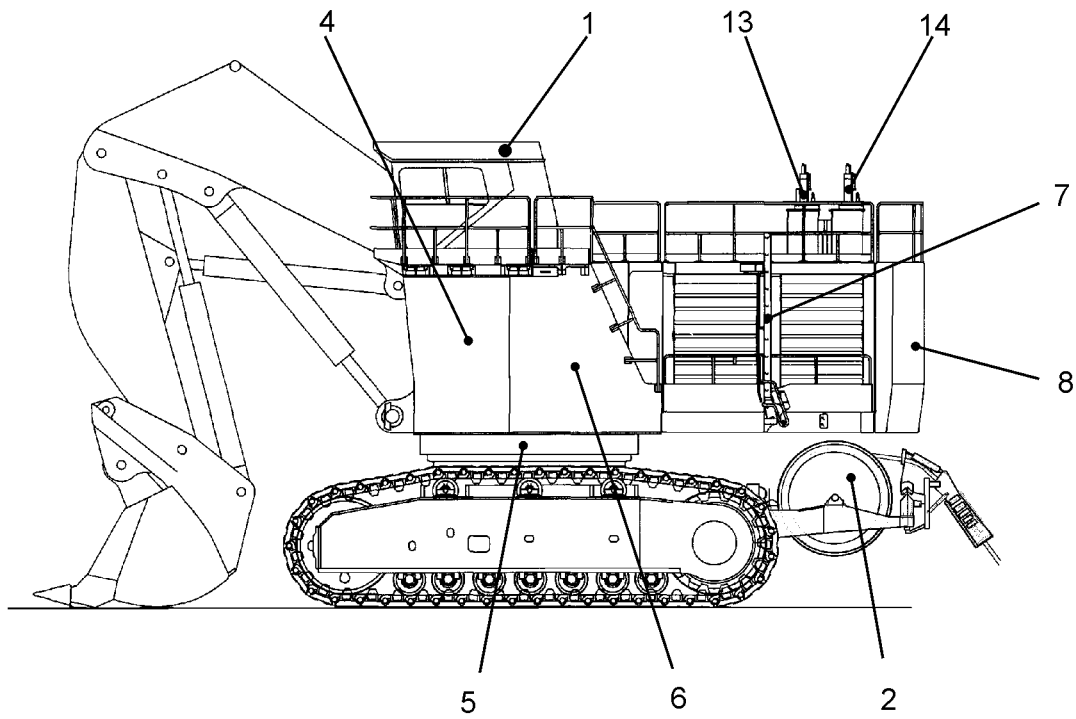
### 3.2.2 UNDERCARRIAGE AND SUPERSTRUCTURE



**Legend for illustration Z 22649**

- (1) Final drive
- (2) Crawler carrier
- (3) Track roller
- (4) Carrier roller
- (5) Guide wheel
- (6) Swing circle guard
- (7) Hydraulically operated access ladder, see page 48 for more information
- (8) Battery main switches
- (9) Control switch for access ladder
- (10) Monitor box for central refilling system, see page 278 for more information
- (11) Push button for emergency shut down of both main drive motors.  
DO NOT use the emergency shut down button for normal stopping procedure.
- (12) Sliding window of operator's cab, see page 56 for more information
- (13) Emergency escape ladder, see page 48 for more information
- (14) Air conditioner unit for high voltage switch cabinet
- (15) Hydraulically driven grease pump of the Swing circle pinion Lubrication System (SLS)
- (16) Hydraulically driven grease pump of the Central Lubrication System (CLS)

**SUPERSTRUCTURE - TOP VIEW**



**Z 22386a**

**Legend for illustration Z22386a**

- (1) Operator's cab with integrated FOPS, see page 56 for more information
- (2) Cable drum
- (3) Not used
- (4) Cab base, contains the middle and low voltage electrical equipment
- (5) Swing circle
- (6) High voltage switch cabinet
- (7) Hydraulically operated access ladder, see page 48 for more information
- (8) Counterweight

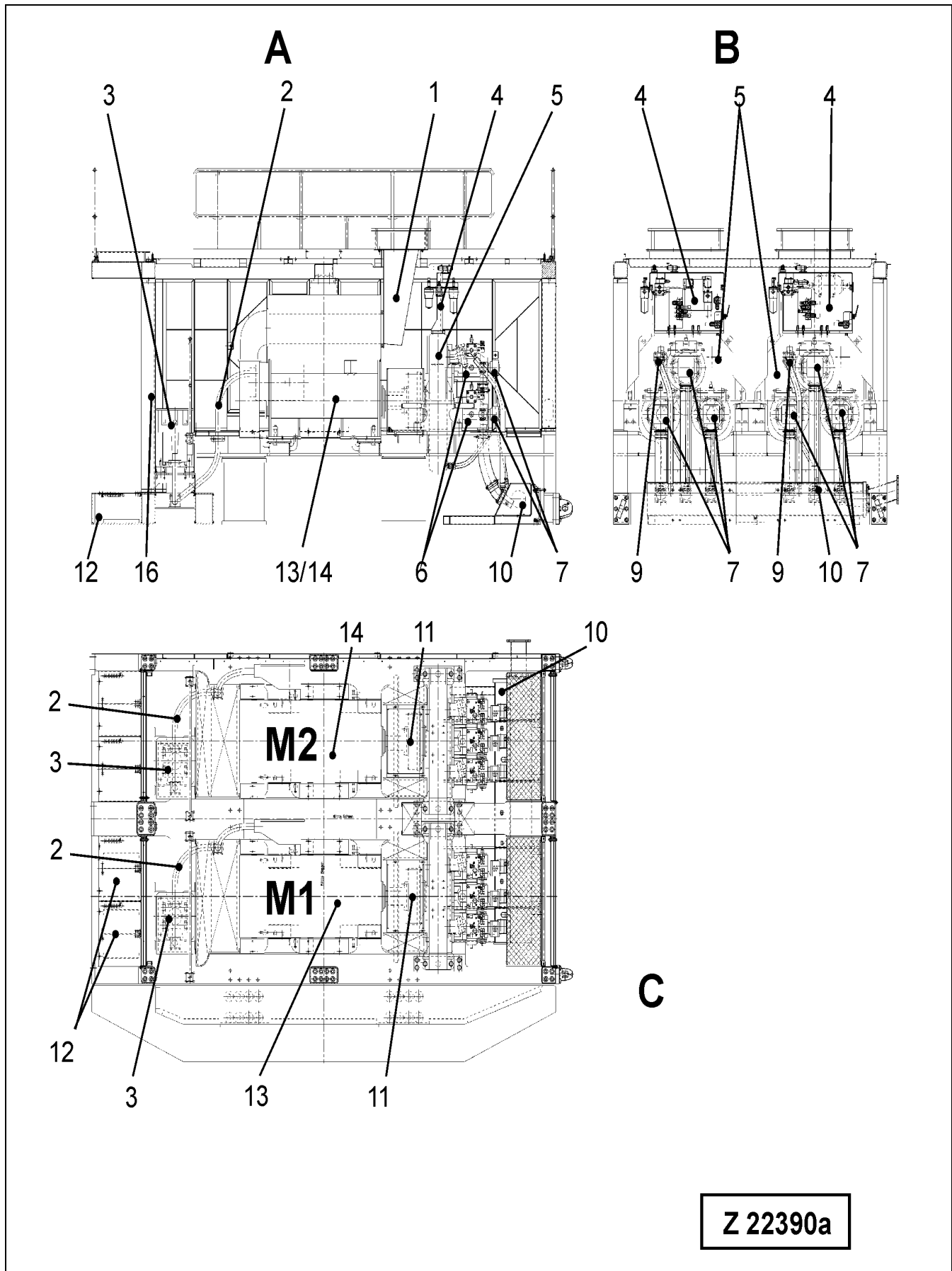
**⚠ WARNING**

**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.**

- (9) Hydraulic oil cooler with hydraulically driven fans
- (10) Main hydraulic oil reservoir
- (11) Batteries
- (12) Swing gears
- (13) Hydraulically driven grease pump of the Swing circle pinion Lubrication System (SLS)
- (14) Hydraulically driven grease pump of the Central Lubrication System (CLS))
- (15) Main control valves with high pressure in-line filters
- (16) Main drive electric motor 1. Refer to the separate User's Manual >DRIVE INDUCTION MOTORS AND GENERATORS< filed in Service Literature binder volume 2 for all operation and maintenance instructions.
- (17) Flexible coupling, rear
- (18) Rear PTO 1
- (19) Main hydraulic pumps 1, 2 and 3
- (20) Capacitor motor 1
- (21) Main drive electric motor 2
- (22) Flexible coupling, front
- (23) Front PTO 2
- (24) Main hydraulic pumps 4, 5 and 6
- (25) Capacitor motor 2

**MACHINERY HOUSE**

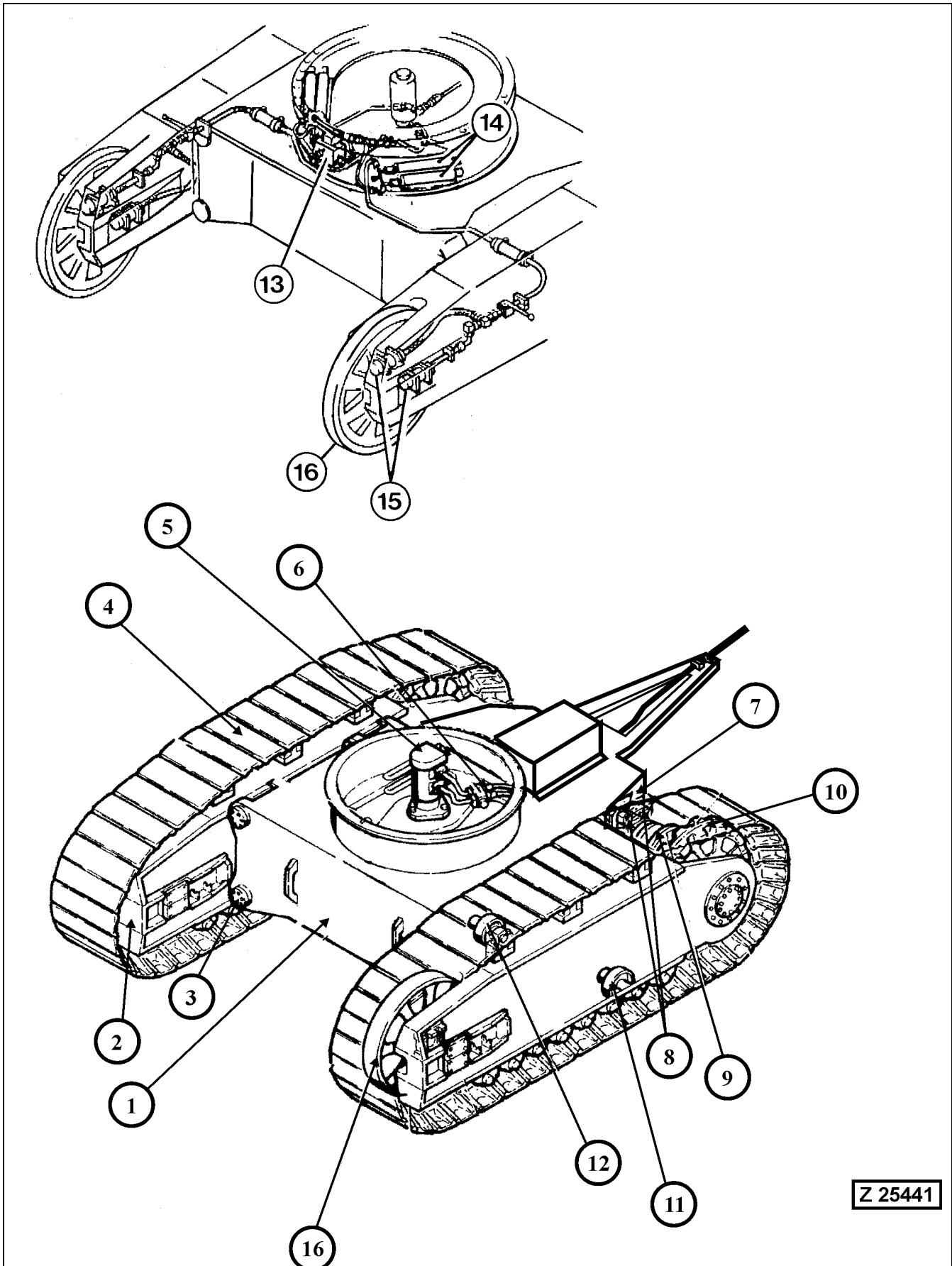




**Legend for illustration Z22390a****Machinery house**

- A View from rear side without counterweight
- B View from right side
- C Top view
- (1) Motor cooling air outlet duct
- (2) Power supply cable
- (3) Capacitor
- (4) Hydraulic control and filter panels
- (5) PTO gear boxes
- (6) Main hydraulic pumps
- (7) Auxiliary hydraulic pumps
- (8) Not used
- (9) Hydraulic pump for hydraulic oil cooler fan drive
- (10) Suction oil reservoir
- (11) Flexible couplings
- (12) Batteries
- (13) Motor 1
- (14) Motor 2
- (15) Not used
- (16) Air intake doors

### 3.2.3 UNDERCARRIAGE

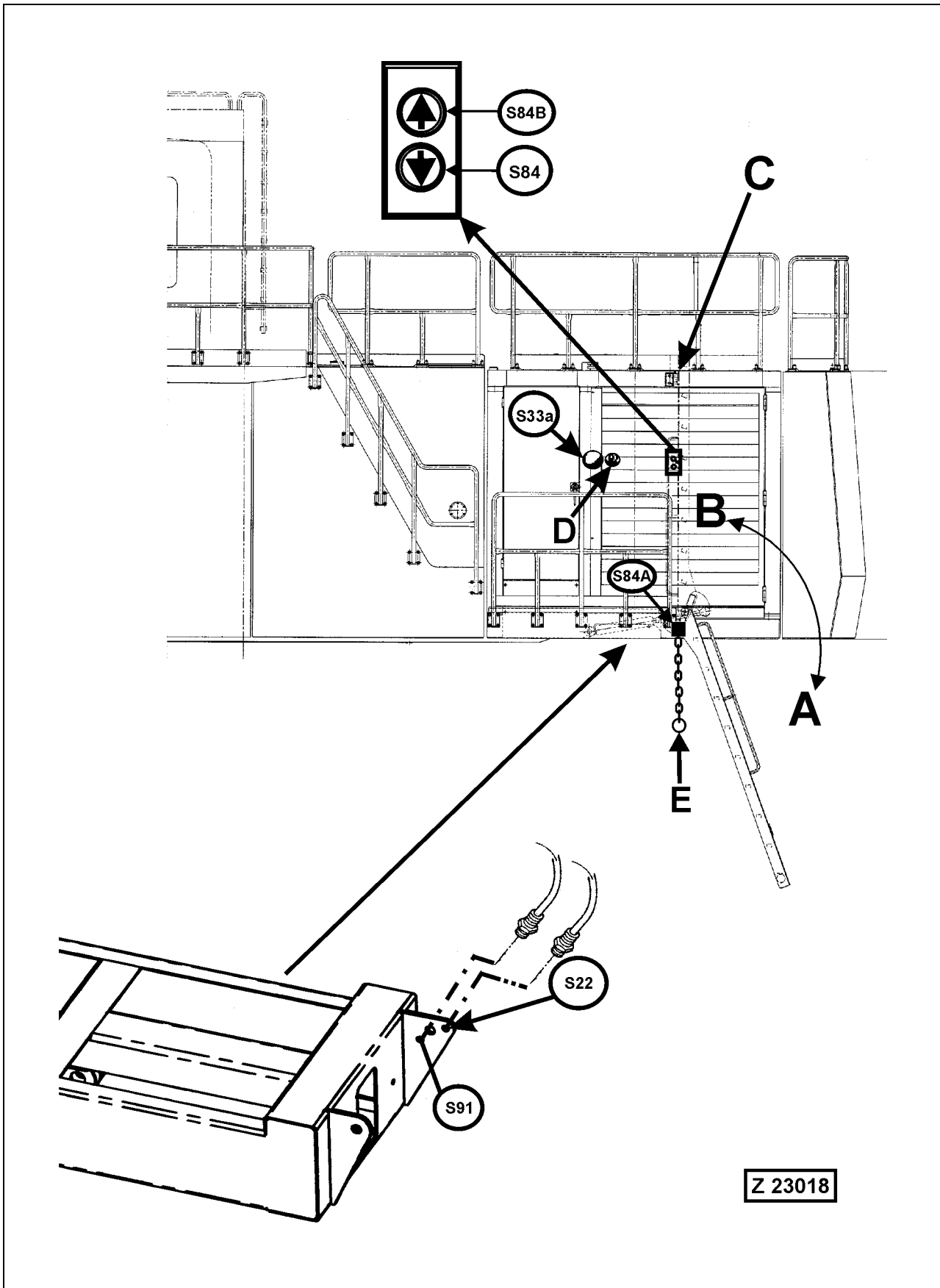


Z 25441

**Legend for illustration Z 25441**

- (1) Undercarriage center body
- (2) Crawler carrier
- (3) Connection pins center body to crawler carrier
- (4) Crawler tracks
- (5) Rotary distributor
- (6) Brake valves
- (7) Travel motors
- (8) Parking brakes (spring loaded multiple disk type brakes)
- (9) Travel gears
- (10) Sprocket
- (11) Track rollers
- (12) Carrier rollers
- (13) Valve block of the hydraulic track tensioning system
- (14) Hydraulic track tensioning cylinders
- (15) Track adjusting cylinders
- (16) Guide wheels

### 3.2.4 HYDRAULICALLY OPERATED ACCESS LADDER



**Legend for illustration Z 23018**

- (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**

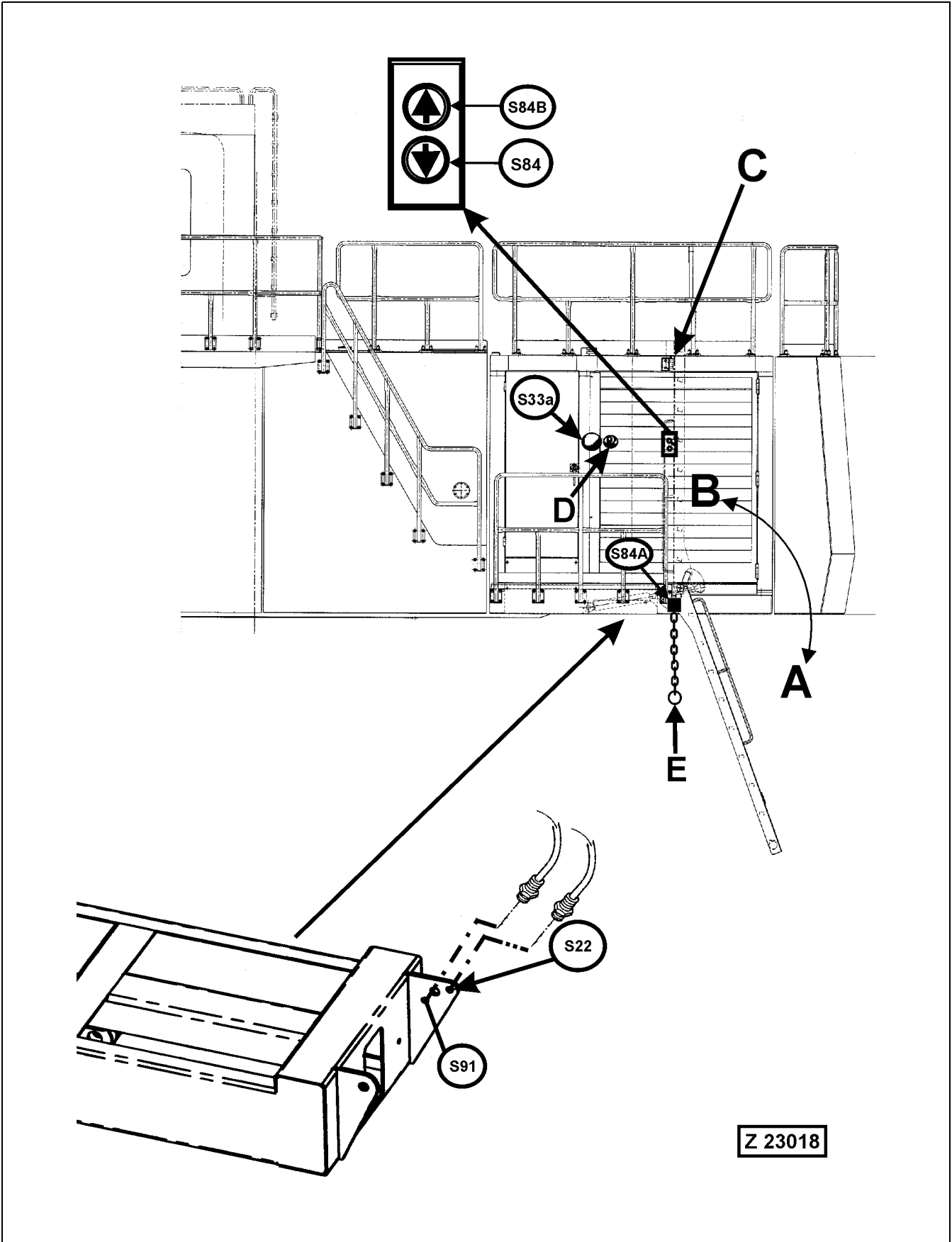
**Use this chain only in emergency cases, when the Operator does not respond to other communication signals.**

- (S84) Ladder control switch for lowering the ladder
- (S84B) Ladder control switch for lifting the ladder
- (S84A) Safety switch for emergency lowering of the access ladder. When the chain (E) is being pulled down with the motor 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 main drive motors

**Operating the hydraulic Access Ladder**

**WARNING**

- **Make sure the moving range of the ladder is clear of all persons before raising the ladder. Stop raising the ladder by releasing the control switch (S84B) if there are any obstacles within the moving range of the ladder.**
- **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. (Z 23018)****Raise the ladder**

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

Start the motor.

**For starting procedure → See "STARTING THE MAIN DRIVE MOTORS" on page 230.**

Go back to the ladder control switch (S84B).

Raise the ladder by pressing button (84B) until the ladder contacts the stop bar (C) in position (B).

**Lowering the ladder**

Stop the main drive motors.

**For stopping procedure → See "STOPPING THE MAIN DRIVE MOTORS" on page 256.**

Lower the ladder by pressing push button (S84). If necessary, slightly push the ladder until it starts moving down by its own weight.

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**⚠ WARNING**

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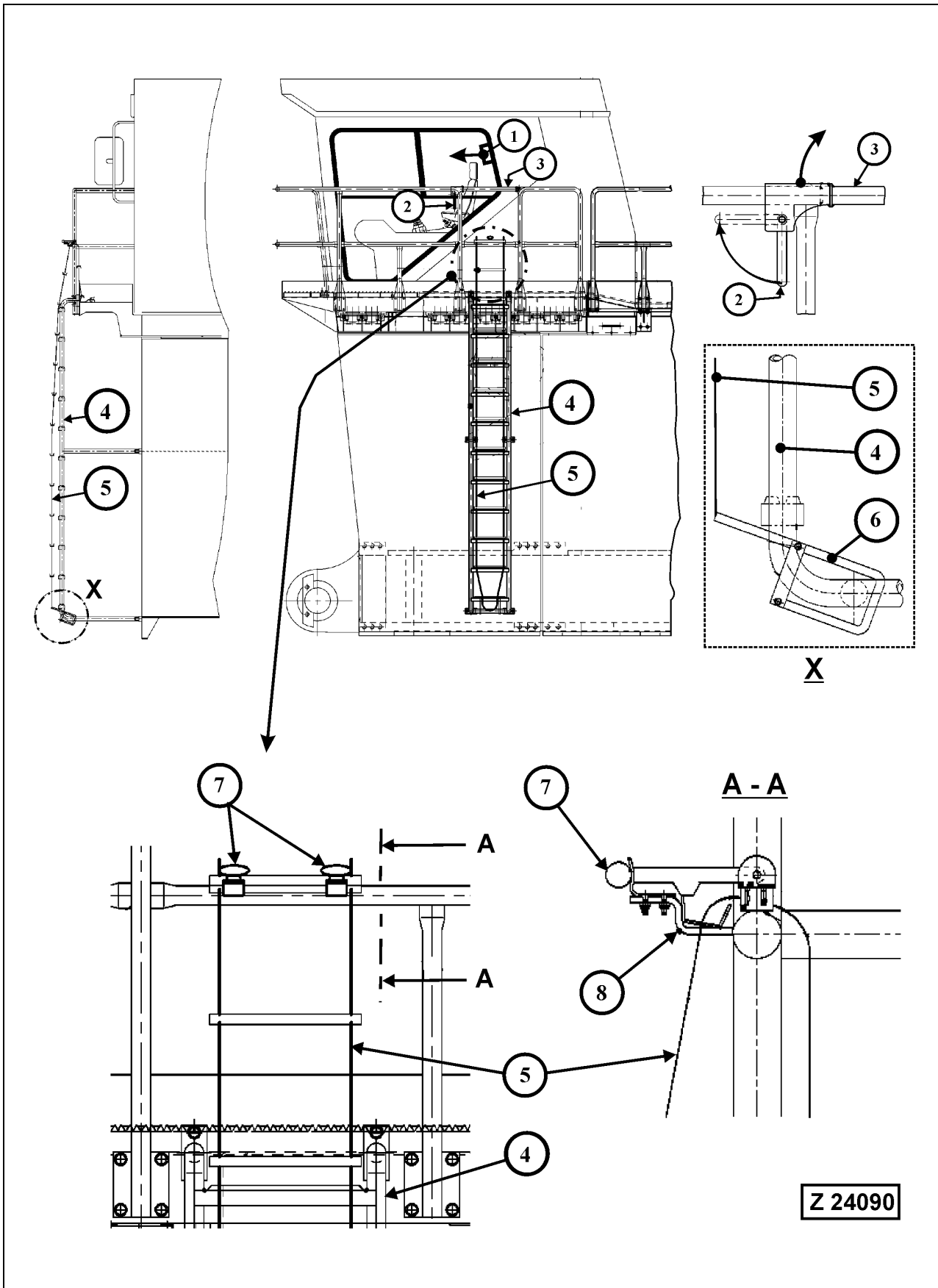
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- **Make sure the moving range of the ladder is clear of all persons before lowering the ladder.**
  - **Enter the ladder only after the ladder is in fully lowered position (A).**
- 
- 

**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.**

### 3.2.5 EMERGENCY ESCAPE LADDER





**Legend for illust. Z24090**

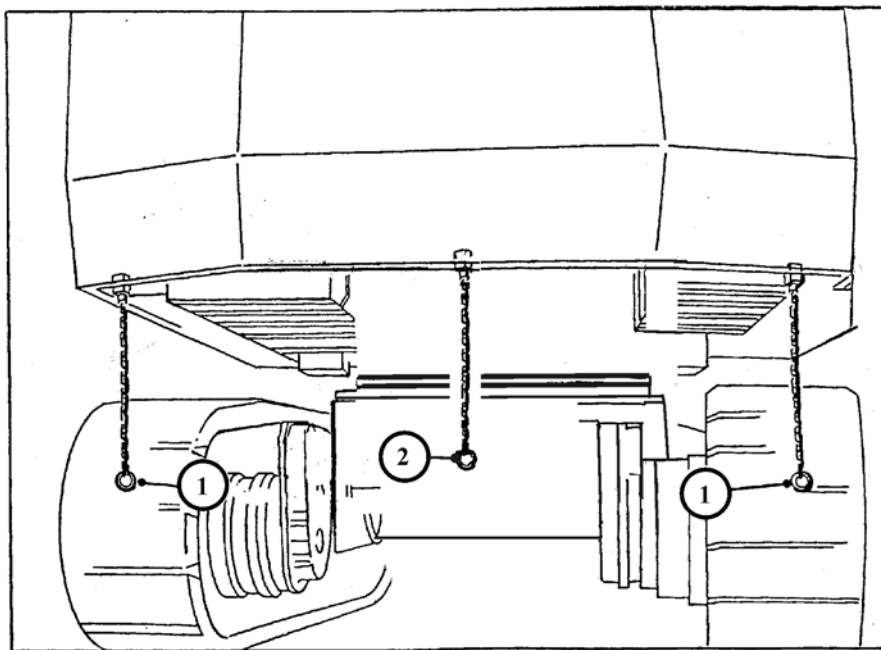
- (1) Sliding window, serves also for emergency exit
- (2) Release lever for hinged railing bar (3)
- (3) Hinged railing bar
- (4) Rigidly mounted emergency escape ladder
- (5) Rope ladder. The upper end of the rope ladder is fixed onto the lower rung of the rigid escape ladder (4) by means of the fasteners (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)

**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.

### 3.2.6 EMERGENCY MOTOR SHUTDOWN FROM GROUND MAN OR OPERATOR WARNING SYSTEM



Z 25252

## Emergency Motor Shutdown System actuated from Ground Man (Special Equipment)

### Legend for illust. Z25252

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

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 **CAUTION**

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**Never stop the main drive motors with the actuating chains (1) except in case of emergency.**

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## Operator Warning System (Special Equipment)

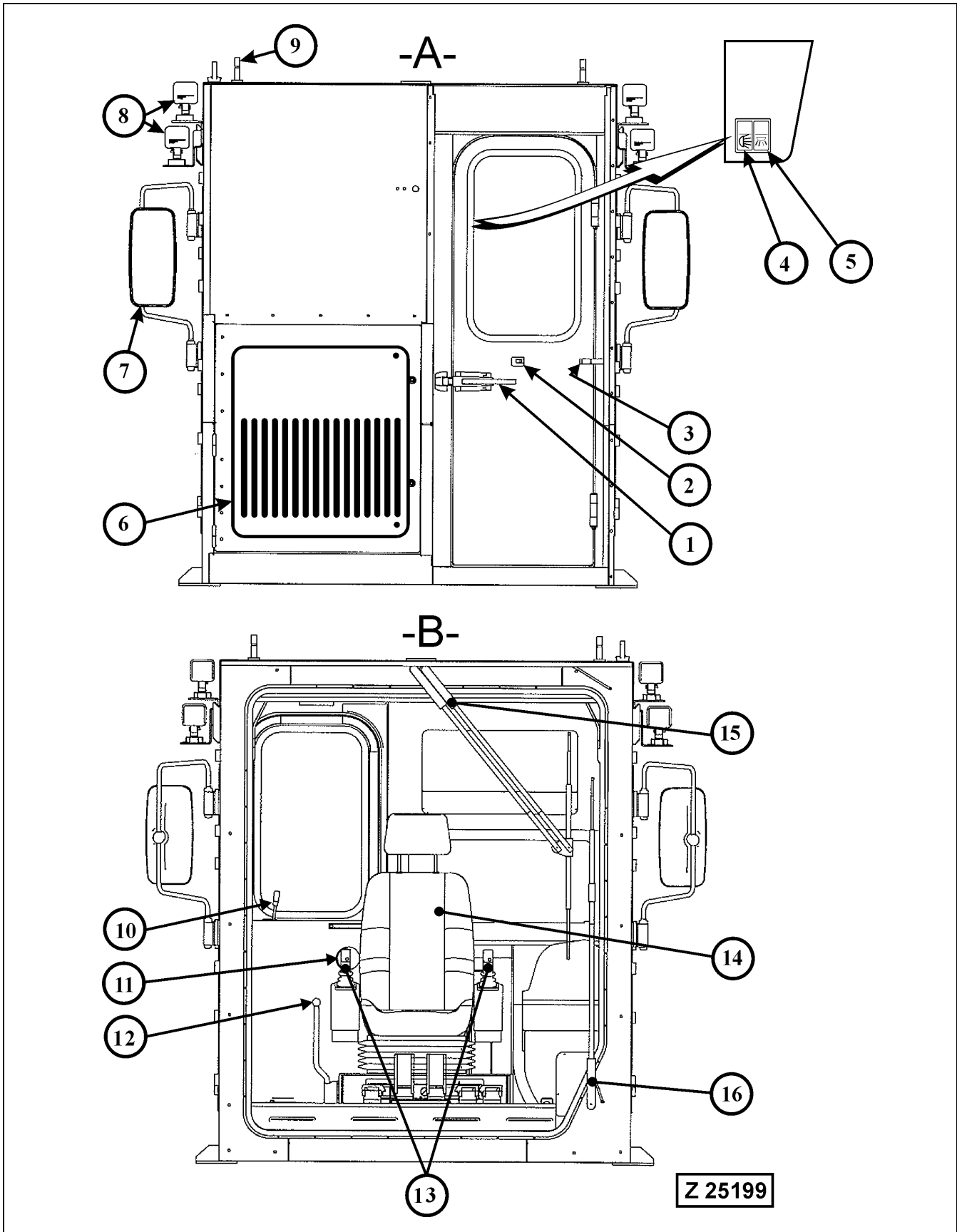
This system is used to inform the Operator that someone wants to enter the Shovel or to draw the Operator's attention to special circumstances requiring his action.

### Legend for illust. Z25252

- (1) Actuating chains for pull switches of the Operator warning system
- (2) Actuating chain for hydraulically operated service arm.
- (3) ECS 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 ECS screen (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) Safety lock lever, see page 59 for more information
- (13) Control levers for working attachment, see page 68 for more information.
- (14) Operator's Seat, refer to page page 65 for more information.
- (15) Upper windshield wiper
- (16) Lower windshield wiper

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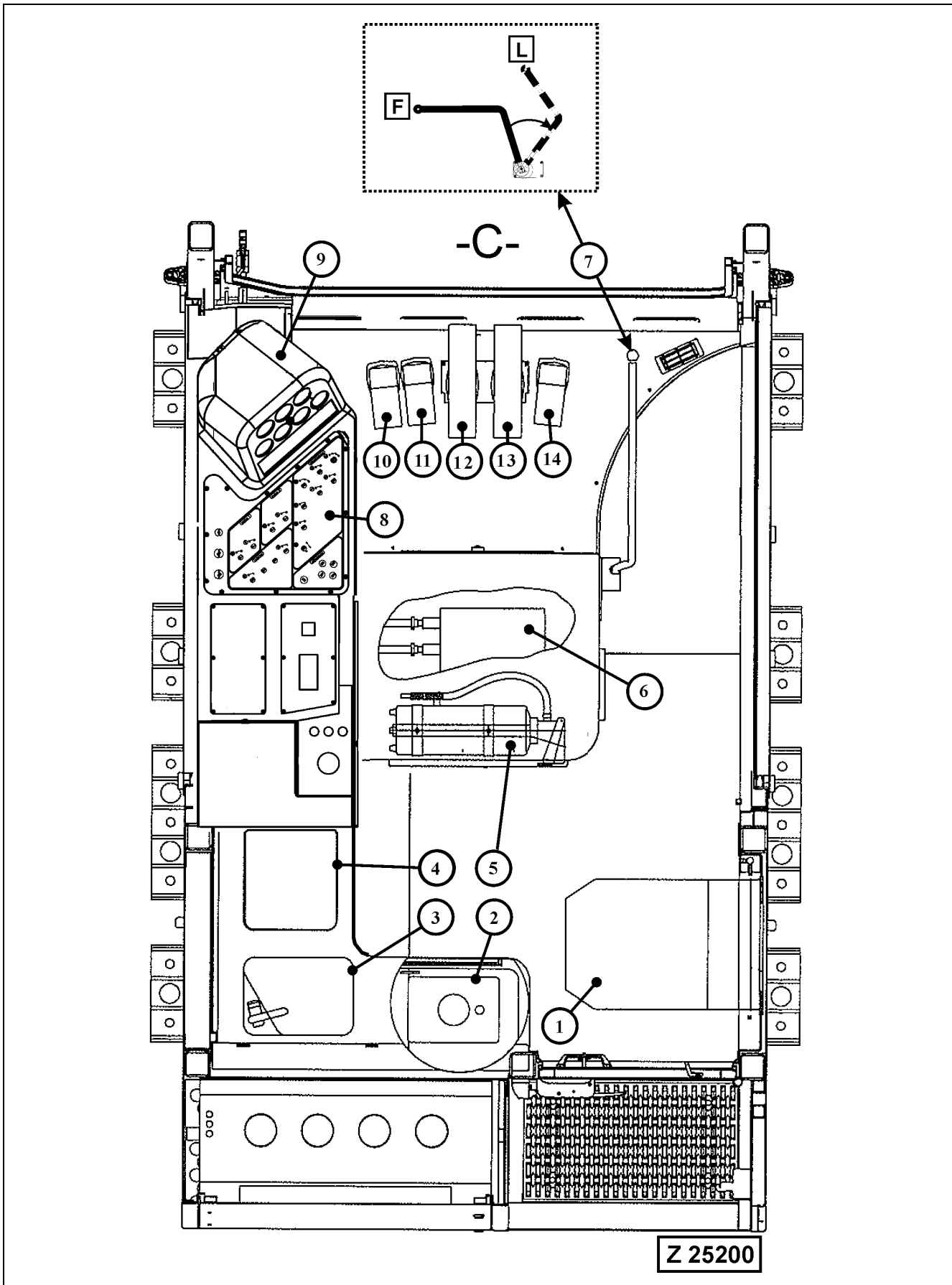
**⚠ CAUTION**


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**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 Z25200****C Top View of Operator's Cab**

- (1) Co-driver's seat, refer to page 66 for more information
- (2) Windshield washer reservoir, refer to page 63 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) Safety lock lever.
  - This lever locks the controls for working equipment, swing and travel drive when placed in the fully rear position (L).
  - Start the motor 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.

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** WARNING**

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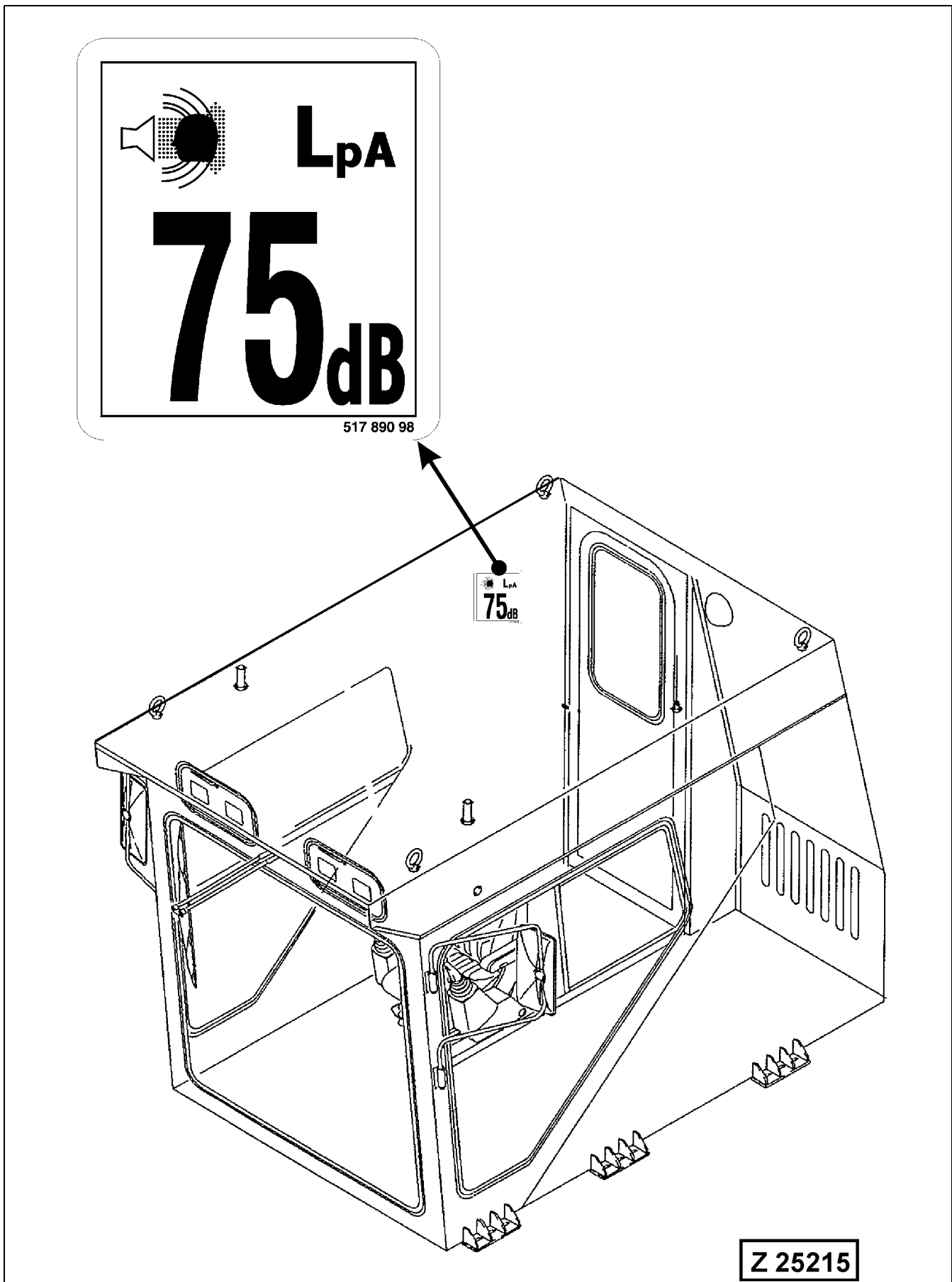
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**Before leaving the operator's cab set the safety lock lever to LOCK position (L). If the controls are not locked, and they are touched inadvertently, this may lead to a serious accident.**

---

---

- (8) Instrument panel, see page 79 for more information.
- (9) Analog gauges and ECS display, see page 79 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

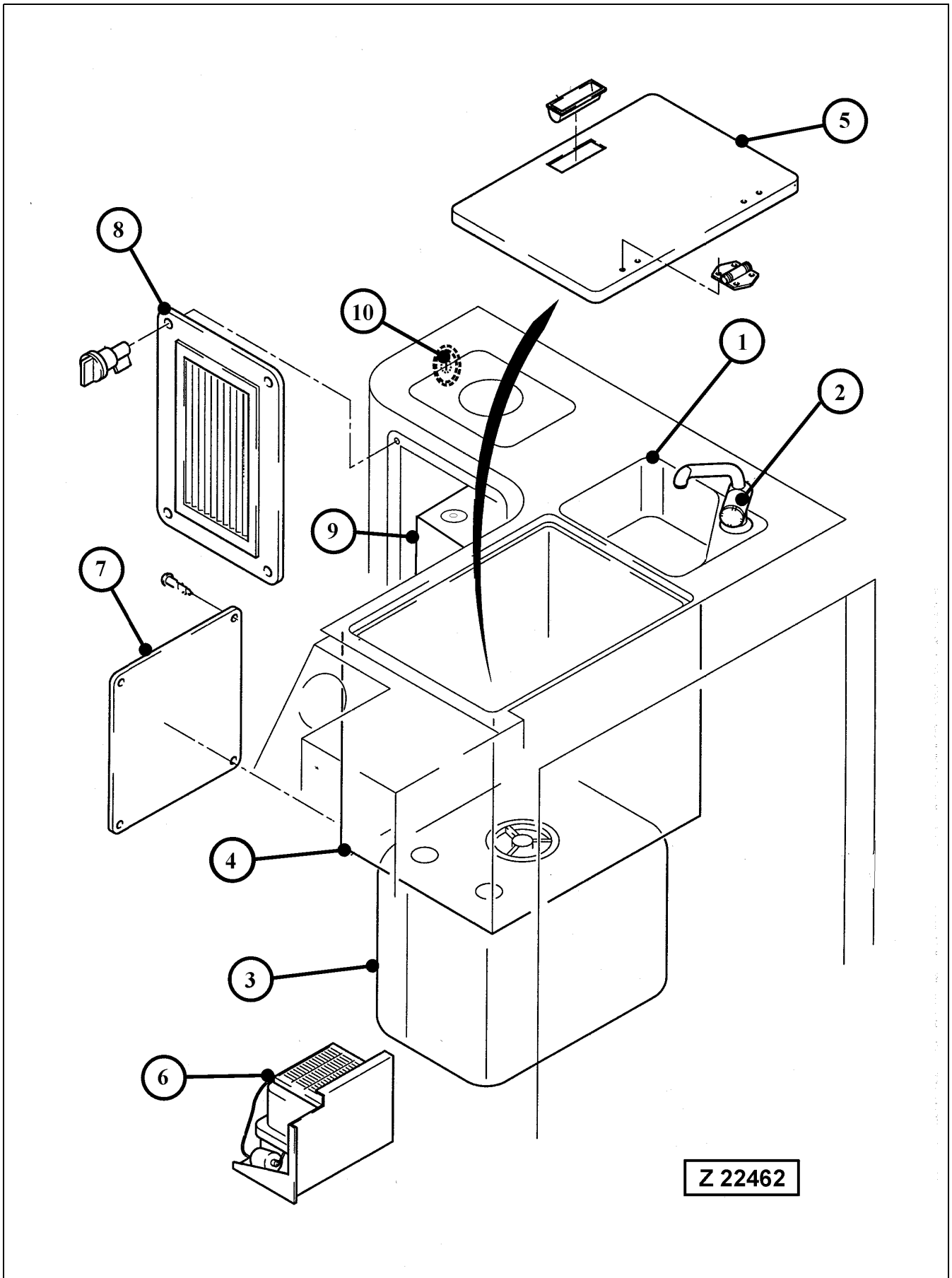




**Sound Pressure Level in the Operator's Cab**

The sound pressure level in the operators cab is 75 dB (A) measured according to ISO 6396 (Dynamic test method).

The sound pressure value is also shown on the decal attached to the wall inside the operator's cab. See Illustration Z25215



## Operator's Cab - Hand Wash Sink and Refrigerator Box

### Legend for illust. Z 22462

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

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 **WARNING**

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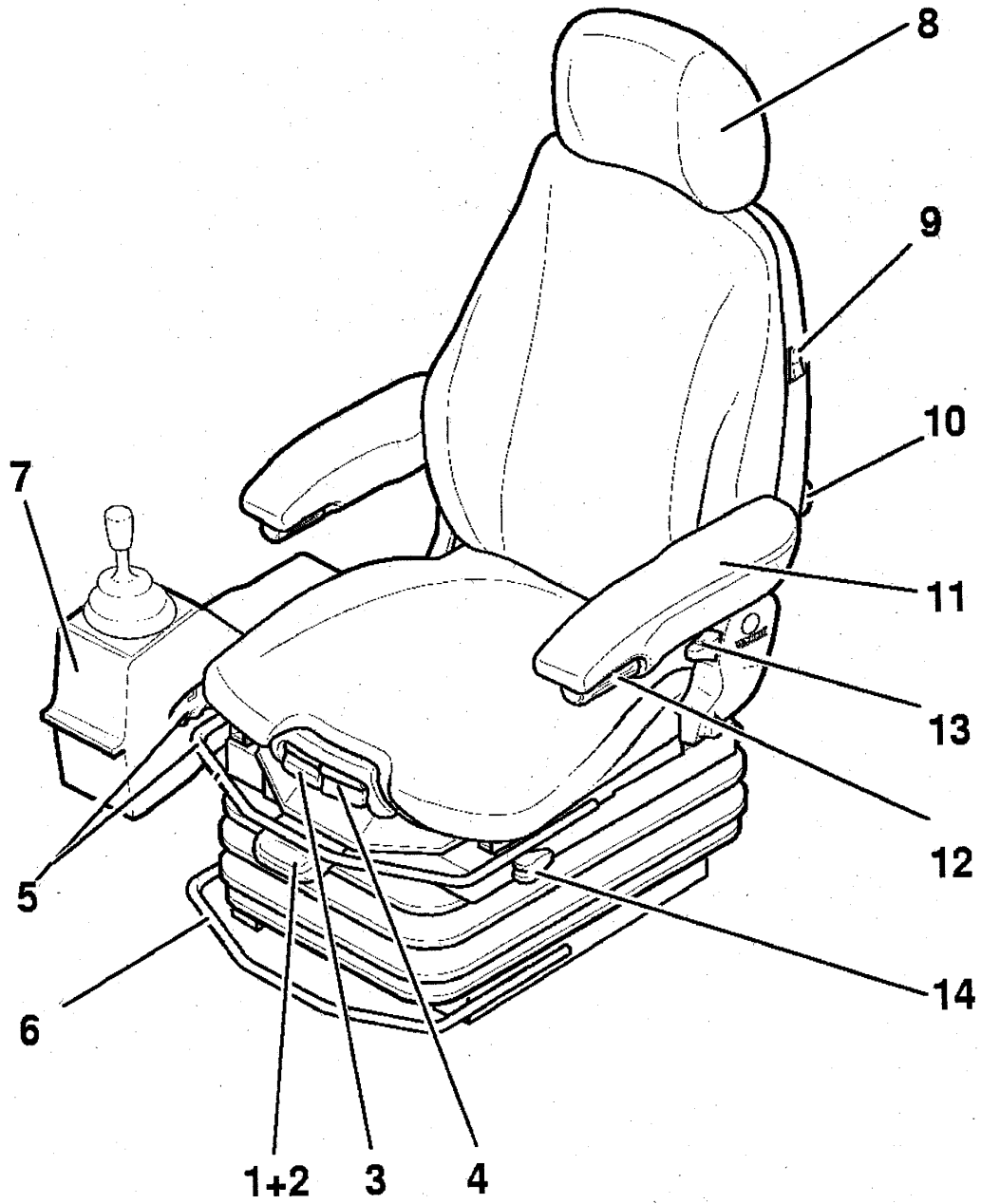
---

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

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---

- (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 receiver panel. Refer to page 278 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)

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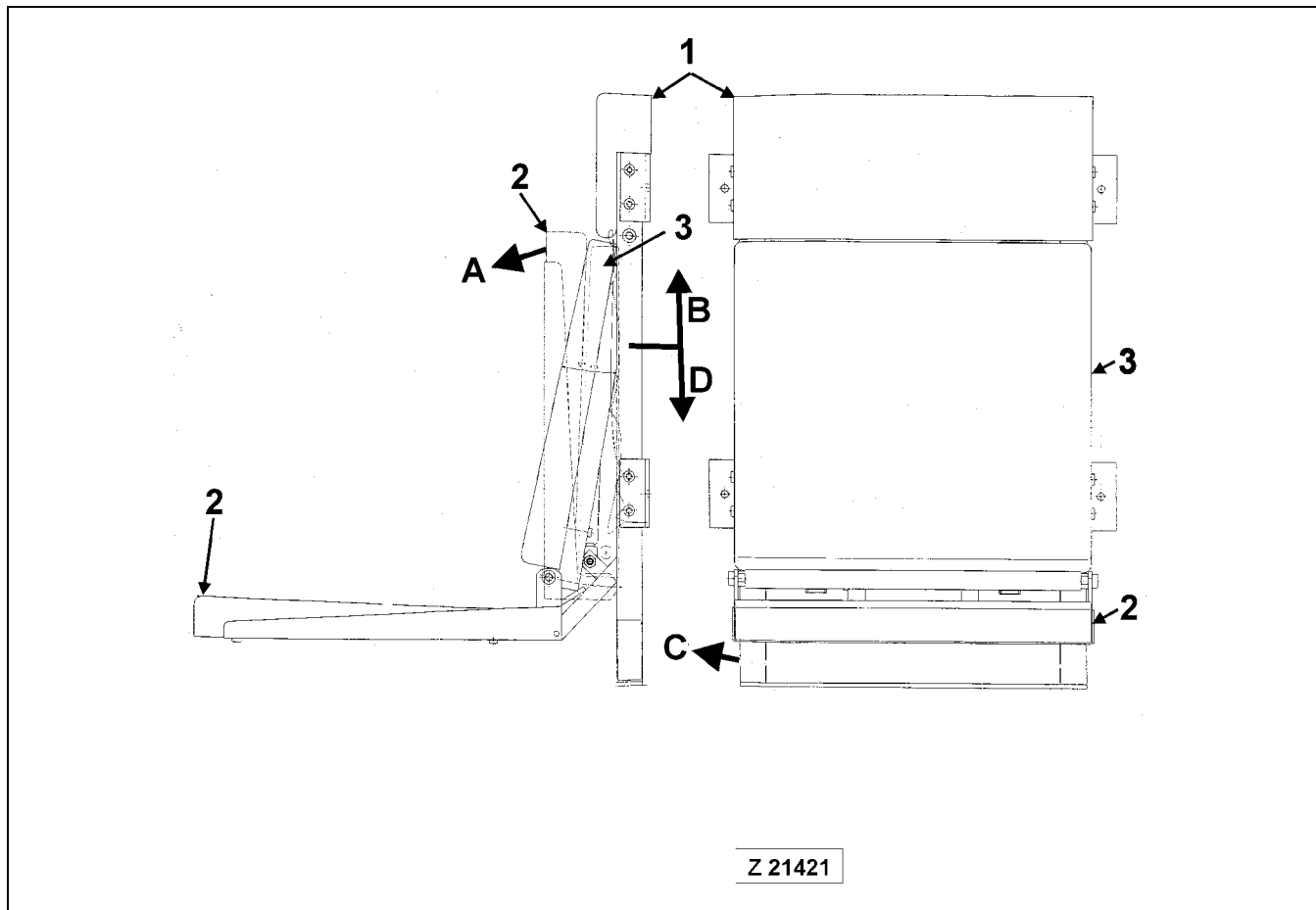
**⚠ WARNING**

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- **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.

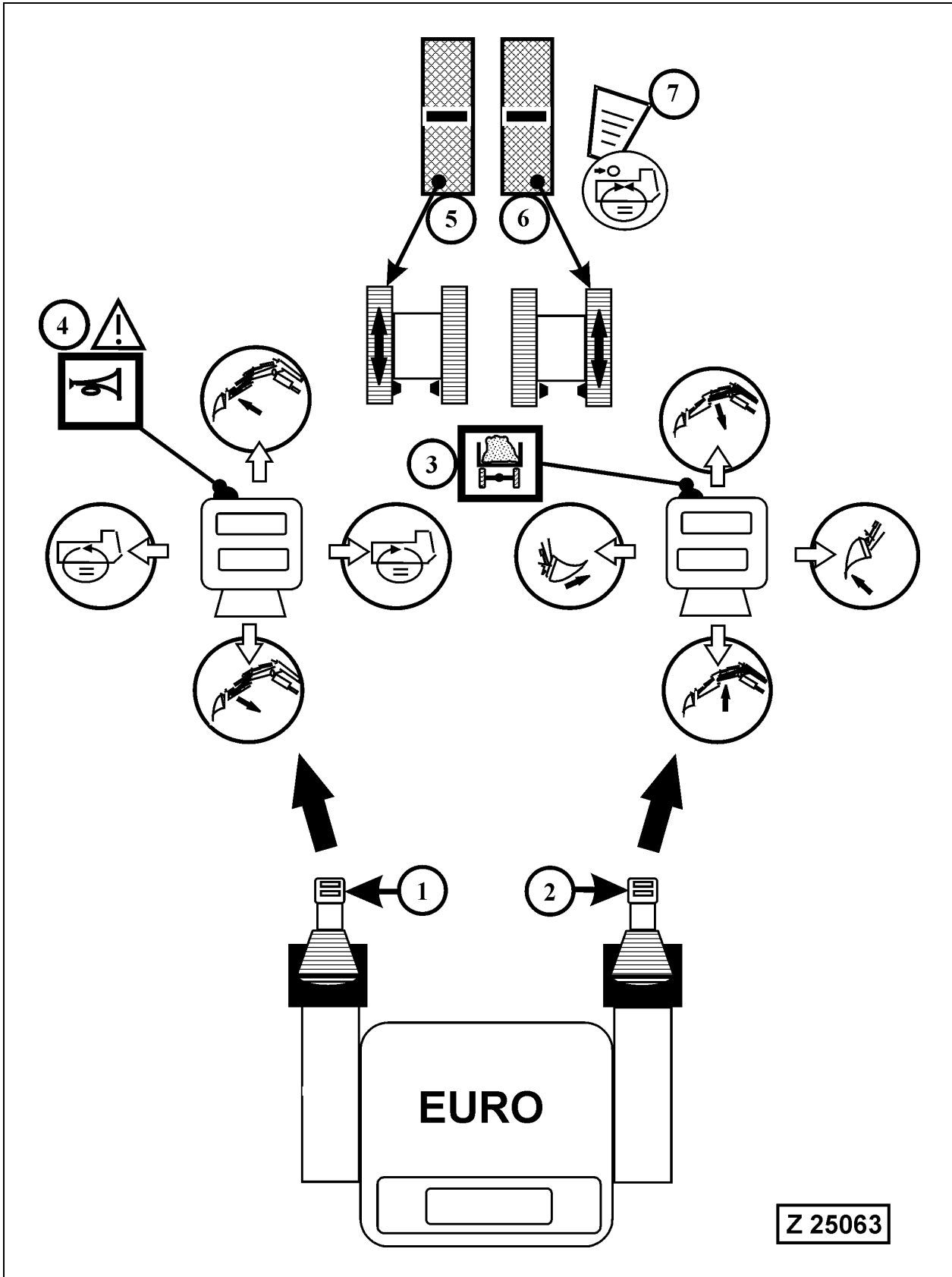
### REMARK

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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### 3.3 OPERATOR'S CAB - CONTROLS

#### 3.3.1 CONTROLS WITH BACKHOE ATTACHMENT



Z 25063



## 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 244.**

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### WARNING

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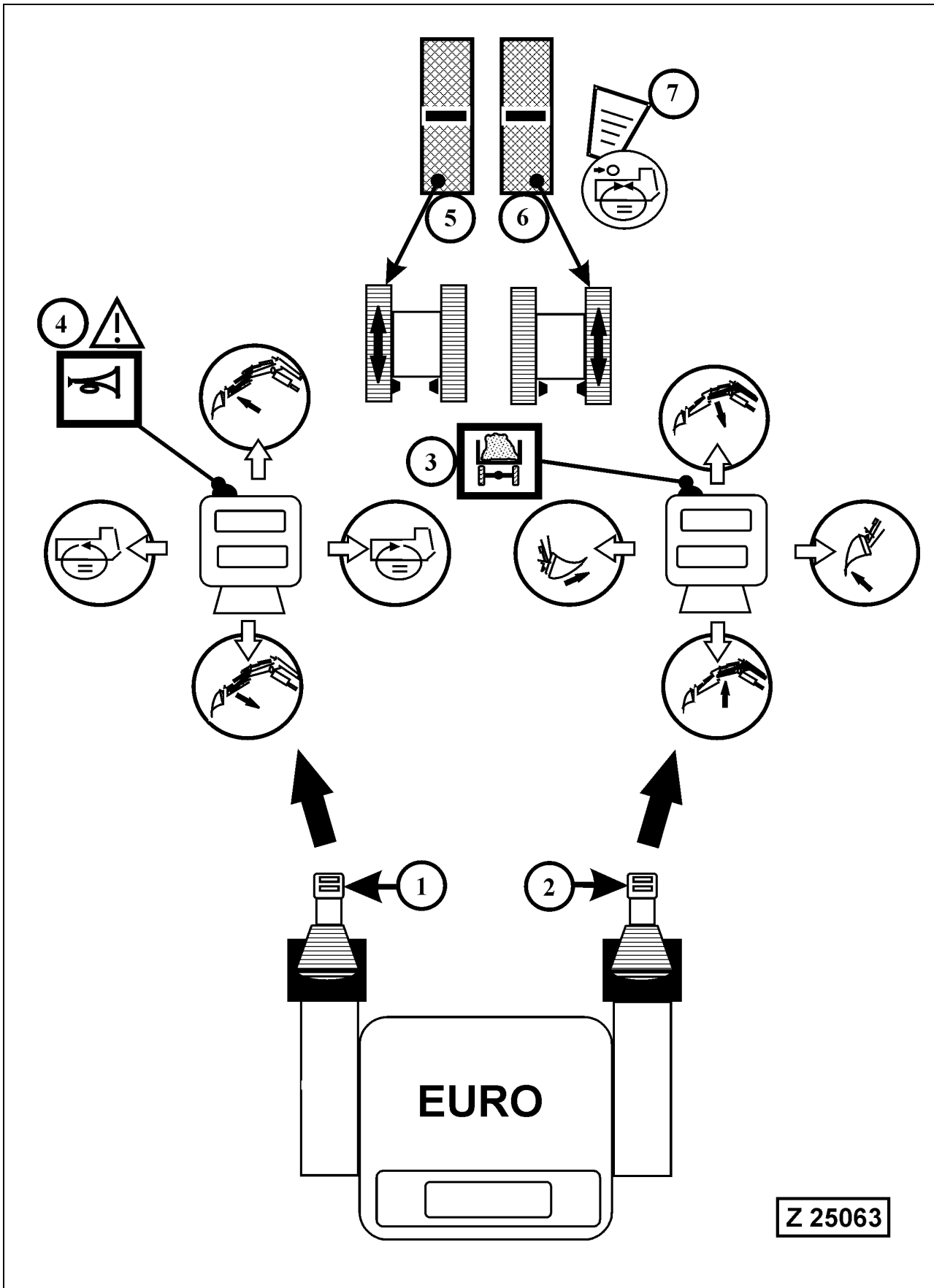
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- **Wrong operation of the controls can cause mechanical break-down, property damage, injury or death.**
  - **Observe the Safety Instructions.**
  - **Before starting the motor, make sure you know the location and function of each control.**
  - **Always 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 safety lock lever, the hydraulic access ladder and the service arm of the refilling system, if so equipped. It prevents movements of the Shovel and its attachment as long as the safety lock lever is in locked position and/or the access ladder is in the lowered position or when the service arm of the central refilling system is in its lowered position.



Z 25063

## Controls with Backhoe Attachment

### Legend for illustration (Z 25063)

- (1) Control lever for stick and slew gear
- (2) Control lever for boom and bucket
- (3) Push button for Truck counter. For counting loaded trucks press this button. The total number of trucks loaded is shown on the ECS display for five seconds, refer to page 88 for more information.
- (4) Signal horn button and emergency override switch for cable drum initiated reverse travel cut off.

### **CAUTION**

**If reverse travel cut off occurs the warning buzzer on the instrument panel sounds and the message "Reverse travel cut off by cable drum" appears on the ECS display. There are three possible causes for reverse travel cut off:**

- Power cable too slack or
- The ground contact sensing bar of the cable drum hits an obstruction or
- Temperature of cable drum drive motor too high

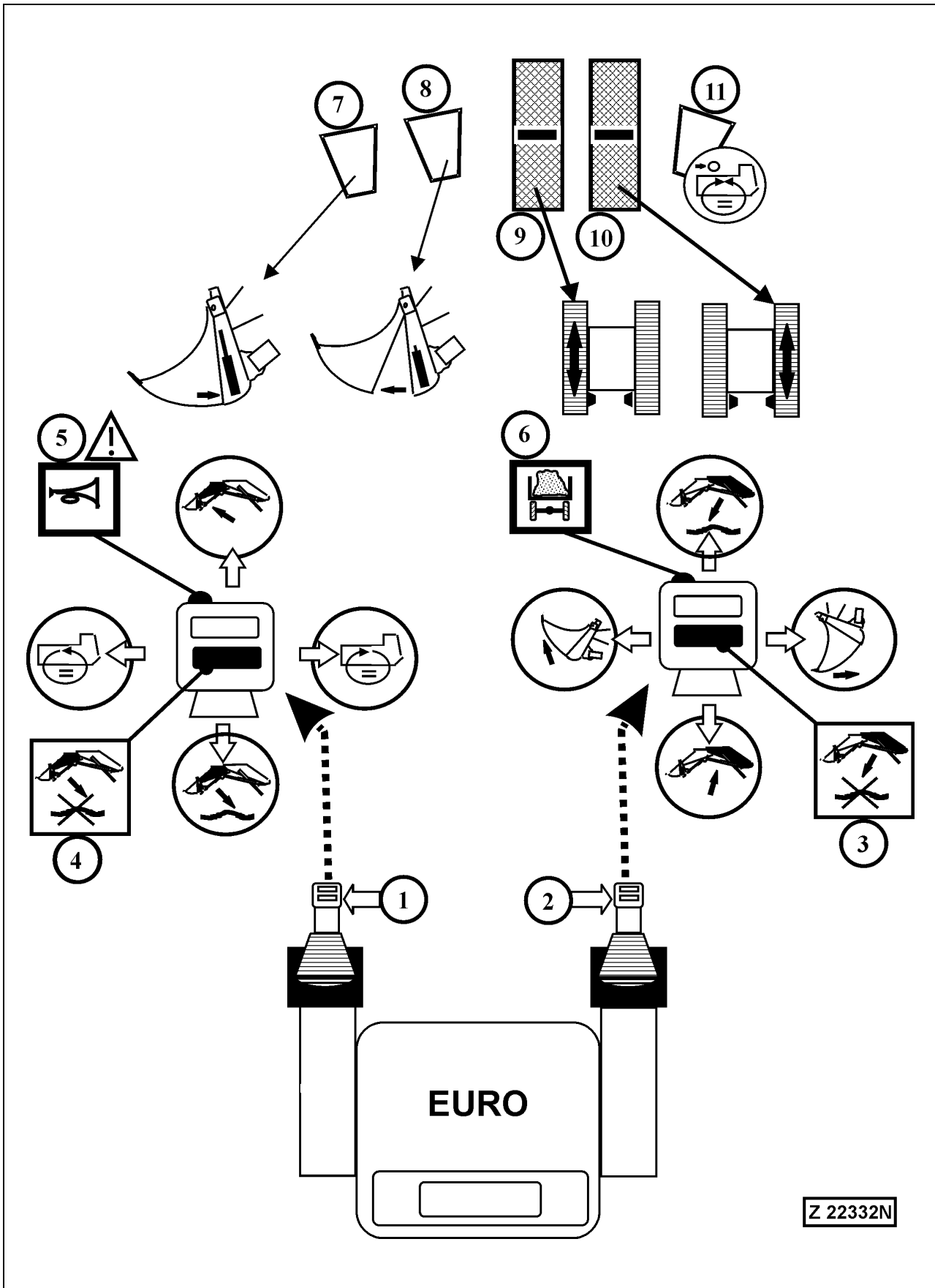
Call service personnel for solving the problem.

### **WARNING**

**If such a travel cut off happens with a dangerous situation for man or machine which requires reverse travelling for moving away from a collapsing face or bench, press button (4) and move the Excavator out of the endangered area. Then stop moving backwards and call your supervisor for advice. The power cable and/or cable drum may be damaged through the reverse movement.**

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

### 3.3.2 CONTROLS WITH BOTTOM DUMP BUCKET ATTACHMENT



Z 22332N

## 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 244.**

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### WARNING

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- **Wrong operation of the controls can cause mechanical break-down, property damage, injury or death.**
  - **Observe the Safety Instructions.**
  - **Before starting the 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

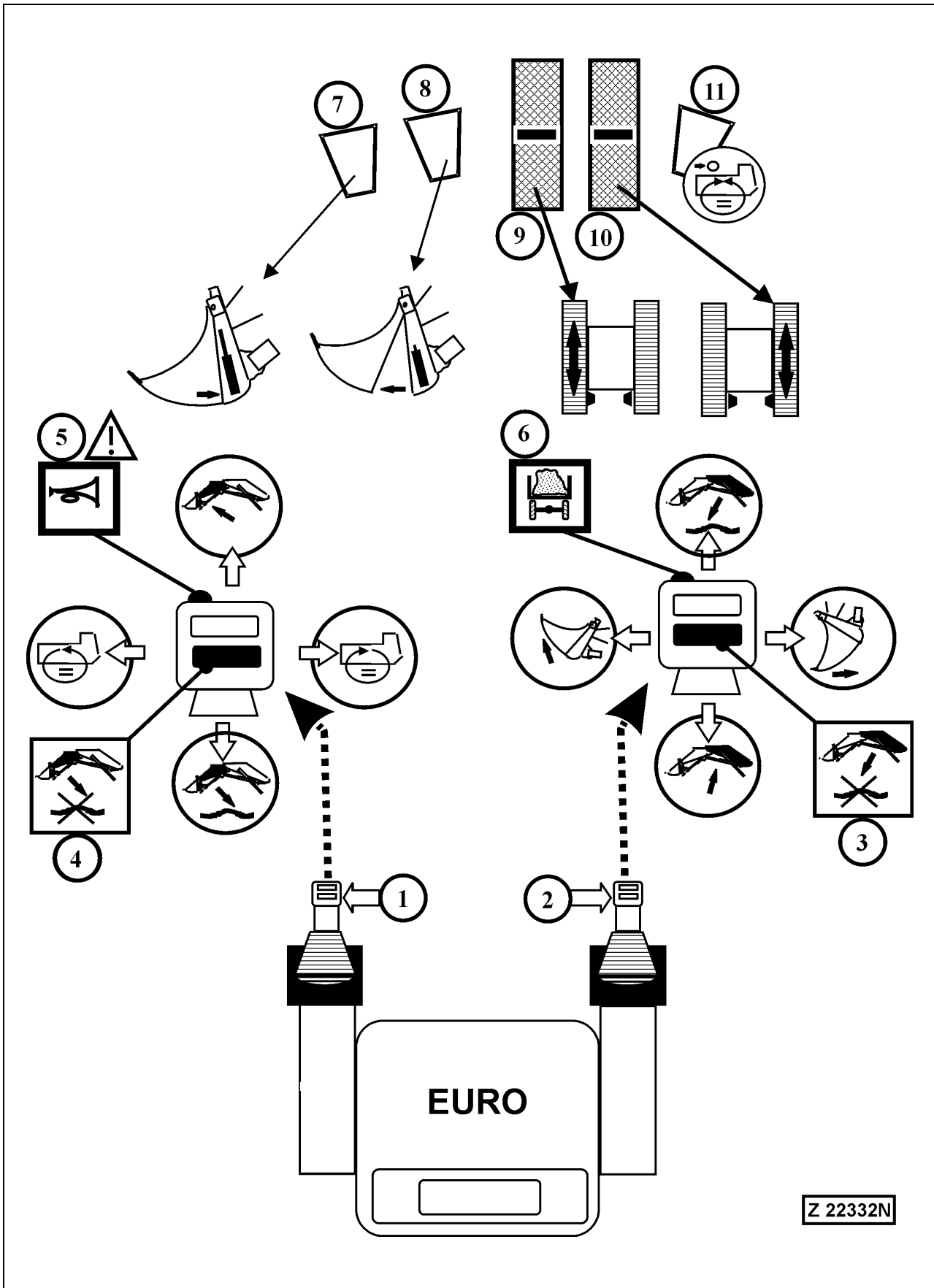
(Pilot control system cut-out and actuation of hydraulic swing parking brake)

This system is controlled through the safety lock lever, the hydraulic access ladder and the service arm of the refilling system, if so equipped. It prevents movements of the Shovel and its attachment as long as the safety lock lever is in locked position and/or the access ladder is in the lowered position or when the service arm of the central refilling system is in its lowered position.

## 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.



## Controls with Bottom Dump Bucket Attachment

### Legend for illustration (Z 22332N)

- (1) Control lever for stick and slew gear
- (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) Signal horn button and emergency override switch for cable drum initiated reverse travel cut off.

### CAUTION

**If reverse travel cut off occurs the warning buzzer on the instrument panel sounds and the message "Reverse travel cut off by cable drum" appears on the ECS display. There are three possible causes for reverse travel cut off:**

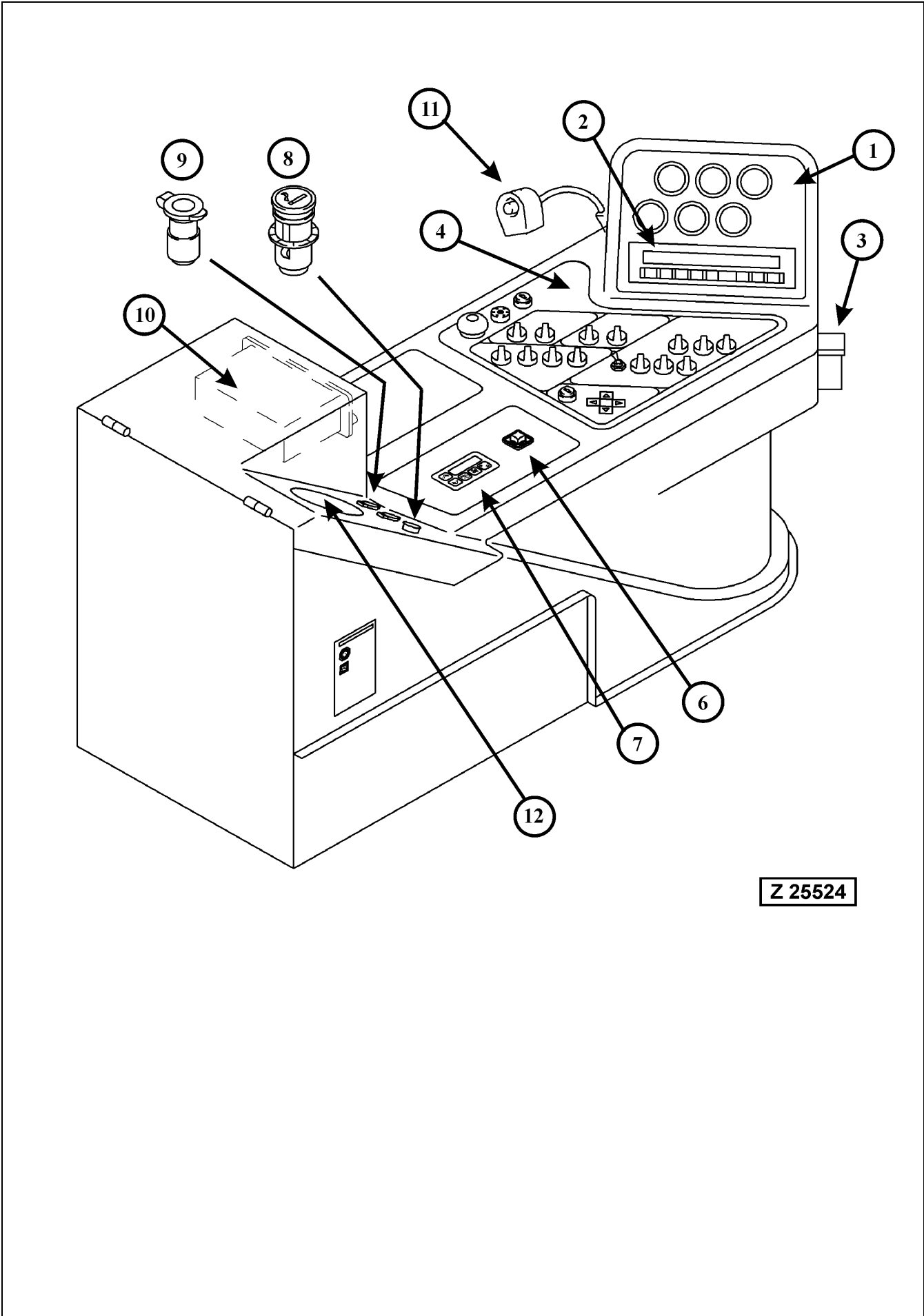
- Power cable too slack or
- The ground contact sensing bar of the cable drum hits an obstruction or
- Temperature of cable drum drive motor too high

Call service personnel for solving the problem.

### WARNING

**If such a travel cut off happens with a dangerous situation for man or machine which requires reverse travelling for moving away from a collapsing face or bench, press button (5) and move the Excavator out of the endangered area. Then stop moving backwards and call your supervisor for advice. The power cable and/or cable drum may be damaged through the reverse movement.**

- (6) Push button for Truck counter.  
For counting loaded trucks press this button. The total number of trucks loaded is shown on the ECS display, refer to page 88 for more information.
- (7) Pedal for closing the bottom dump bucket
- (8) Pedal for opening the bottom dump bucket
- (9) Travel control pedal, left track forward - reverse
- (10) Travel control pedal, right track forward - reverse
- (11) Swing brake pedal



Z 25524



### 3.3.3 OPERATOR'S CONSOLE

#### Legend for illustration Z25524

- (1) Analog gauges, see page 79 for more information
- (2) Text display with key board of the Electronic Control and Monitoring System (ECS). Refer to page 88 for more information.
- (3) Ashtray
- (4) Switch board, see page 79 for more information
- (6) Air conditioning control panel, see page 200 for more information
- (7) Switch for adjustment of left and right cab mirror
- (8) Cigarette lighter
- (9) Plug sockets 24V DC
- (10) Radio location

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 **CAUTION**

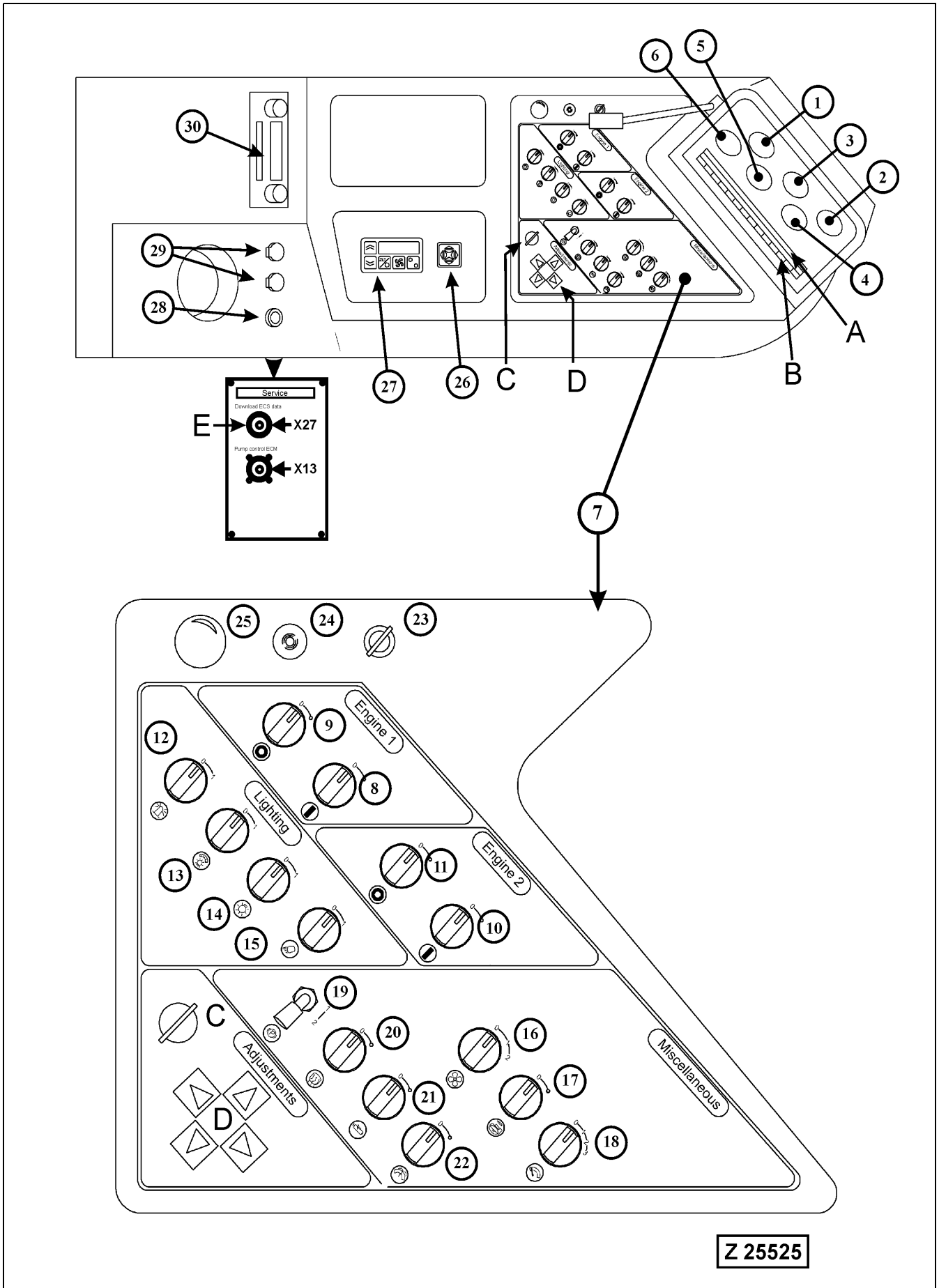
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**Make sure the cab door is always closed when working with the Shovel.**  
**Secure the door in open position with the locking device provided.**

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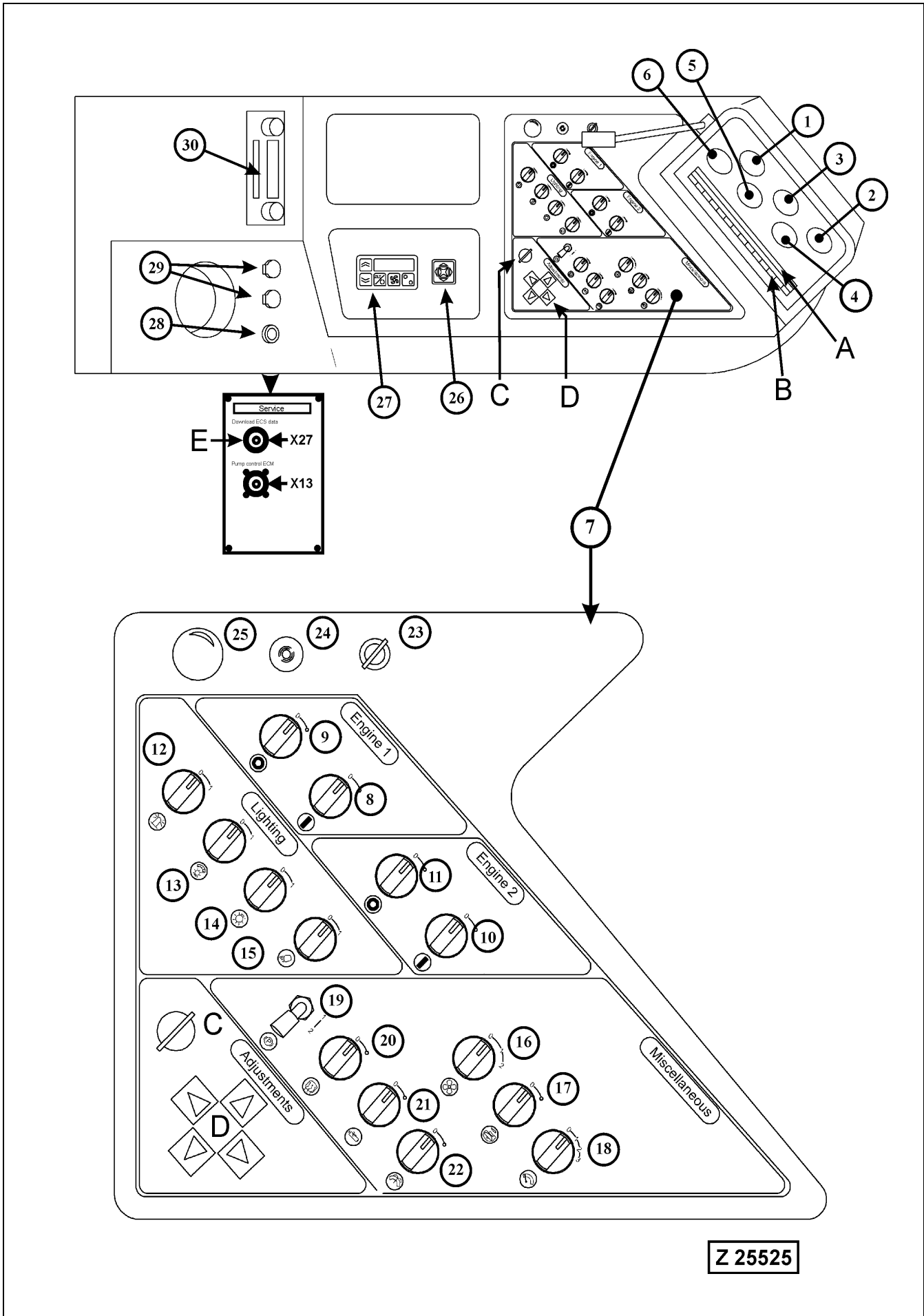
## Control Panel

### Legend for illust. Z25525

#### NOTICE

The items (A, B, C, D and E) are part of the Electronic Monitoring and Control System, refer to page 88 for more information.

- (A) The screen (A) displays the condition of the machine, the maintenance status, and messages for the operator and service man.
  - (B) Keyboard with 8 keys, used to switch the screen and for input of data
  - (C) Key operated switch for enabling access to the Shovel Component levels and for input of operational data.
  - (D) Switch group with four switches for menu control of the Service functions and for the Shovel Components (On screen display).
  - (E) Serial interface (X27) for download of ECS memory data
- (1) Ammeter for rear motor 1
  - (2) Ammeter for front motor 2
  - (3) Voltmeter, power supply system
  - (4) Hydraulic oil temperature gauge
  - (5) Voltmeter, 24V board net system
  - (6) Operating hour meter, main drive motors running
  - (7) Switch board
  - (8) Rotary switch "Rear Motor 1 START"
  - (9) Rotary switch "Rear Motor 1 STOP"
  - (10) Rotary switch "Front Motor 2 START"
  - (11) Rotary switch "Front Motor 2 STOP"
  - (12) Switch, warning beacon on cab roof
  - (13) Switch, dashboard illumination
  - (14) Switch, interior illumination
  - (15) Switch, main working lights



## Switch Board

### Legend for illust. Z25525

- (16) Switch, cab ventilation blower. Blower runs with low speed, even with switch in -0- position. (Cab pressurizing prevents ingress of dust).
- (17) Switch, manual actuation of swing ring gear pinion lubrication system
- (18) Switch for upper and lower windshield wiper
  - 0 - Off
  - 1 - Interval stage
  - 2 - Slow stage
  - 3 - Fast stage
- (19) Toggle switch, swing parking brake
  - 0 - Parking brake released - UP
  - 1 - Parking brake applied - DOWN.

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**▲ CAUTION**

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**The parking brake should only be applied with superstructure at complete standstill, except in case of emergency. Refer to page 242 for more information.**

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- (20) Mirror Heating
- (21) Switch, manual actuation of central lubrication system
- (22) Switch, windshield washer
- (23) Key operated main switch
- (24) Acoustic warning signal
 

This signal sounds for approximately 1 second when a fault message appears on the ECS screen.

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**▲ CAUTION**

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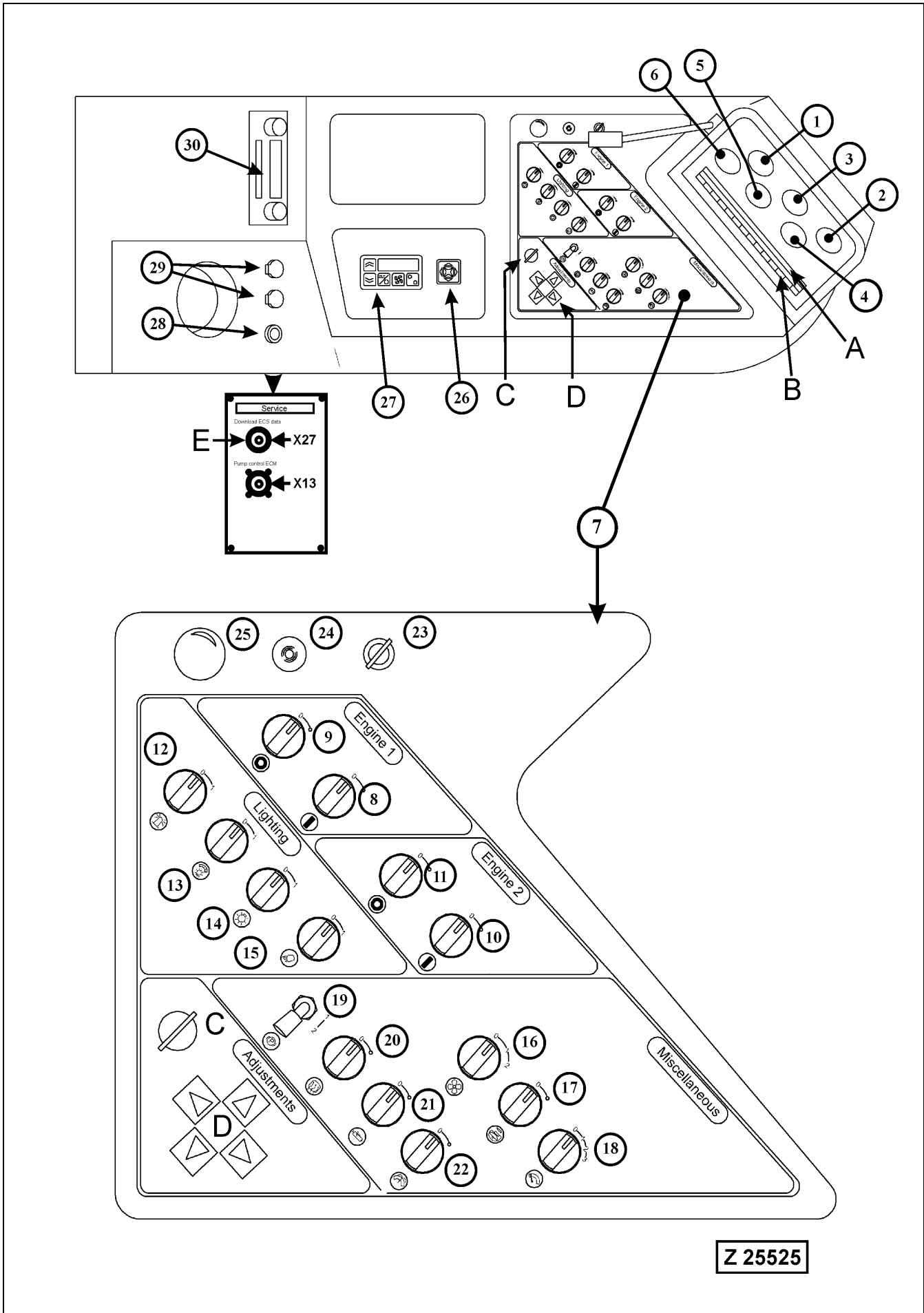
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**In case of too low hydraulic oil level this signal sounds continuously. Shut down the Shovel, locate and correct the cause immediately. Fill up hydraulic oil to the correct level. For the correct checking procedure → See "CHECKS BEFORE STARTING THE MAIN DRIVE MOTORS" on page 226.**

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## Switch Board (continued)

### Legend for illust. Z25254

- (25) Strike button, emergency shut down of both main drive motors and pilot control system cut out.

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**▲ WARNING**

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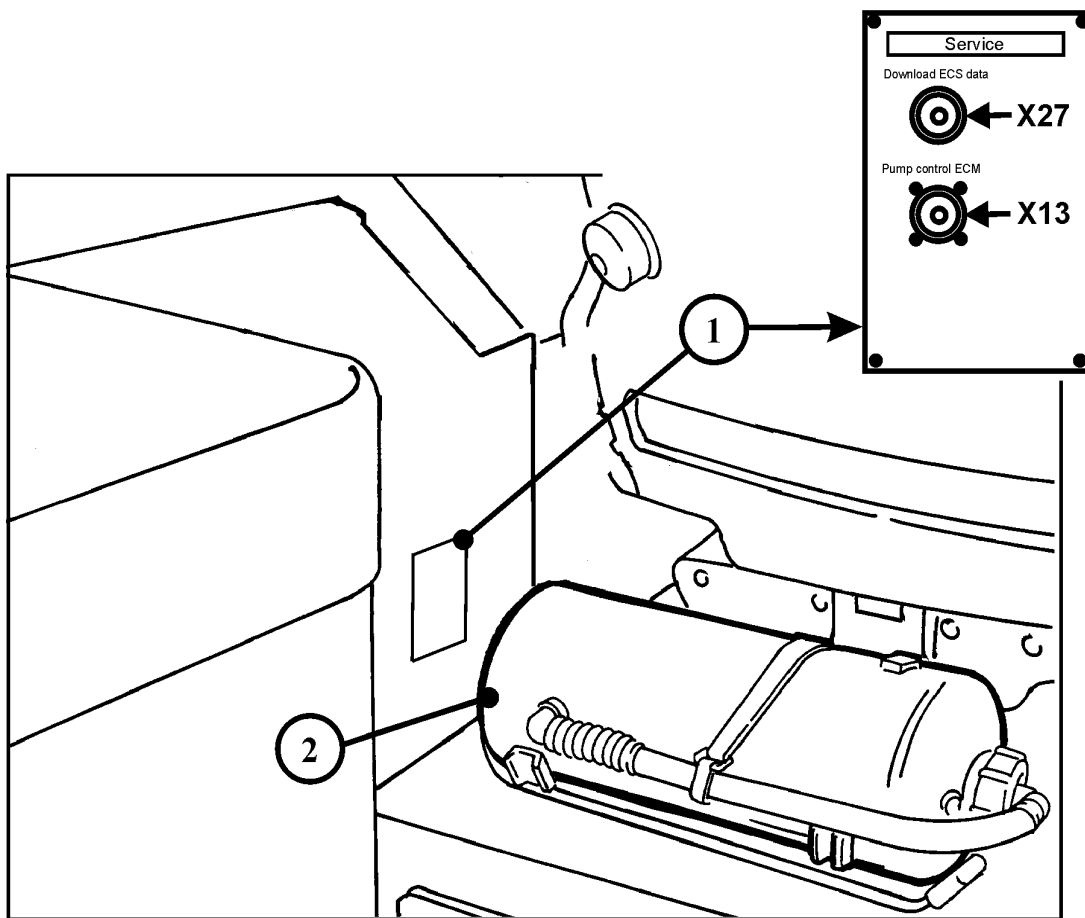
**In case of emergency push in this button to stop both main drive motors and to cut out the pilot control circuit. DO NOT use for normal stopping procedure.**

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

- (26) Switch, RH and LH mirror adjustment
- (27) Air conditioning controls, see page 200 for more information.
- (28) Cigarette lighter
- (29) Plug sockets 24V DC
- (30) Radio



Z 25430



## INTERFACE PANEL FOR DIAGNOSTICS

### Legend for illust. Z25430

1. Interface panel
- X27 Adapter for download of ECS data
- X13 Adapter for connecting an electronic tool to the ECM of the pump control system MC7
2. Portable fire extinguisher. Observe the local fire prevention regulations in regard to number, size and location of the portable fire extinguishers.  
Ensure the fire extinguisher is always charged and ready to use.



Z 25258

### 3.3.4 CONTROL UNITS FOR FIRE DETECTION, ACTUATION AND SUPPRESSION SYSTEM

There are two different systems installed:

**A** – CHECKFIRE **SC-N** electric detection and actuation system which controls the Carbon Dioxide fire suppression system for the following areas:

- Slip ring unit.
- High voltage switch cabinet.
- Medium voltage and low voltage switch cabinet in the cab base.

The CHECKFIRE SC-N electric detection and actuation system consists of control module (1), manual actuator (2), automatic actuator (3) and thermal spot detectors located in the protected areas.

The Carbon Dioxide fire suppression system consists of a steel cylinder filled with extinguishing gas Carbon Dioxide, piping and discharge nozzles located in the protected areas.

**B** – CHECKFIRE **SC-N** electric detection and warning system which monitors the machinery house via a linear detection wire routed in the machinery house.

The CHECKFIRE SC-N electric detection and warning system consists of control module (4) and the linear detection wire routed in the machinery house.

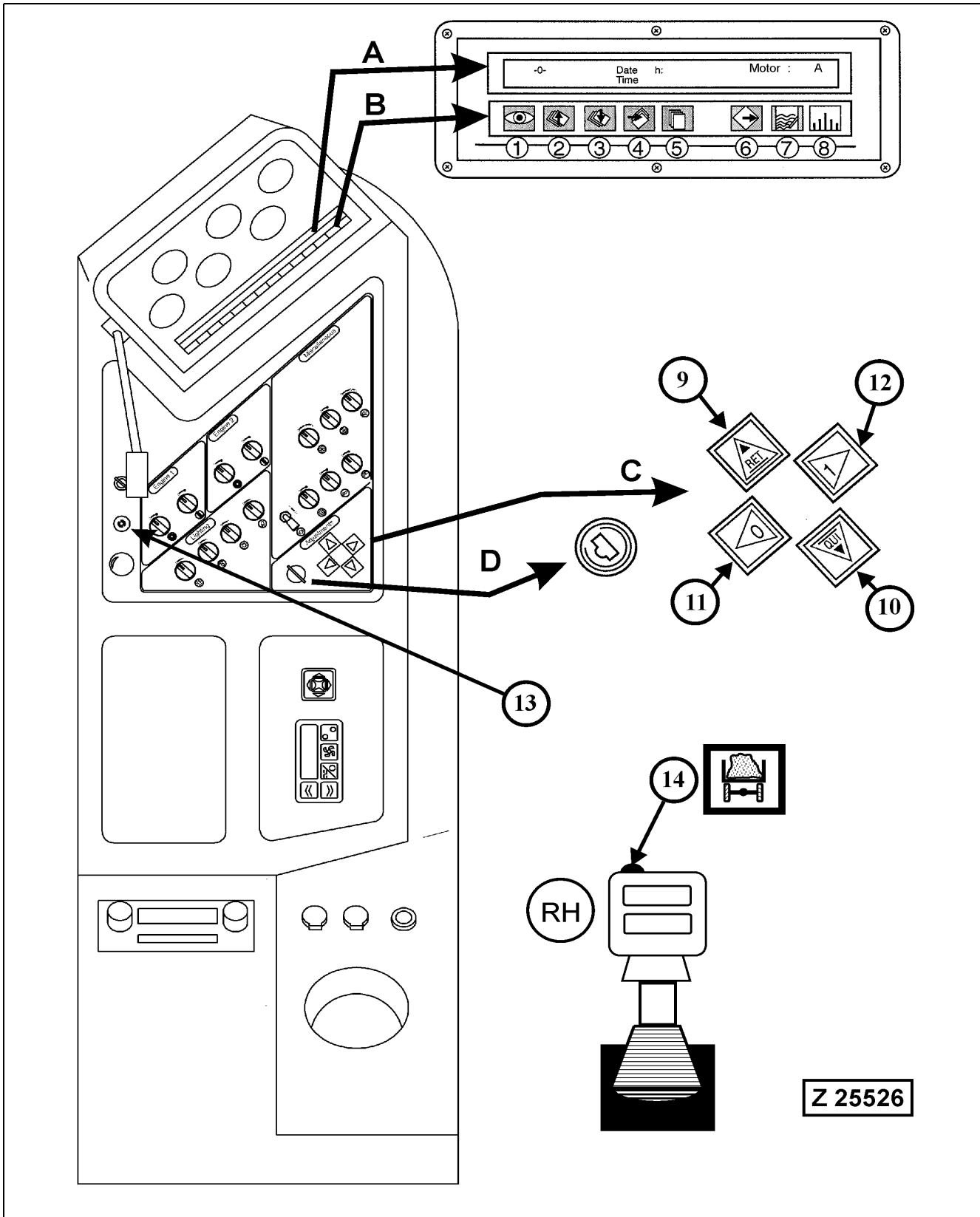
#### REMARK

The machinery house is not equipped with a fire suppression system.

#### Legend for illustration Z25258

- (1) Control module of the CHECKFIRE **SC-N** electric detection and actuation system. For more information see page 264.  
Refer also to the separate Manual "CHECKFIRE **SC-N** ELECTRIC DETECTION AND ACTUATION SYSTEM" for all information concerning - Operational Modes, Daily Inspection, Maintenance and System Conditions. This manual is filed in volume 2 binder.
- (2) Strike button, manual actuation of the Carbon Dioxide fire suppression system -A-.
- (3) Automatic actuator of the Carbon Dioxide fire suppression system -A-.
- (4) Control module of the CHECKFIRE **SC-N** electric detection and warning system -B-. For more information see page 264.  
Refer also to the separate Manual "CHECKFIRE **SC-N** ELECTRIC DETECTION AND ACTUATION SYSTEM" for all information concerning - Operational Modes, Daily Inspection, Maintenance and System Conditions. This manual is filed in volume 2 binder.

# 3.4 ELECTRONIC MONITORING AND CONTROL SYSTEM ECS



### 3.4.1 INTRODUCTION

The Electronic Monitoring and Control System ECS incorporates the following two main functional groups:

1. TEXT DISPLAY (A) with INTEGRATED KEY BOARD (B), illustration Z25255
2. SERVICE FUNCTIONS operated with KEY GROUP (D) and KEY SWITCH (C)

#### 1. TEXT DISPLAY and KEY BOARD

##### 1.1 Text Display (A)

Plain text display for continuous monitoring of all Shovel functions and operating conditions.

Also included are the periodic servicing intervals which will be displayed according to the operating hours of the Shovel.

##### 1.2 Integrated Key Board (B) of the Text Display for the following functions:

Call up messages

Change of value settings

Call up contents of Protocol and Statistics memory

Print out of Protocol and Statistics contents

Refer to page 95 for detailed description of the key functions.

#### 2. SERVICE FUNCTIONS operated with KEY GROUP (D) and KEY SWITCH (C), illustration Z25526

Display/Deletion of Truck Counter Reading.

Display of Central Lubrication System cycle counter reading

Display of Swing ring gear Lubrication System cycle counter reading

Display of Service section

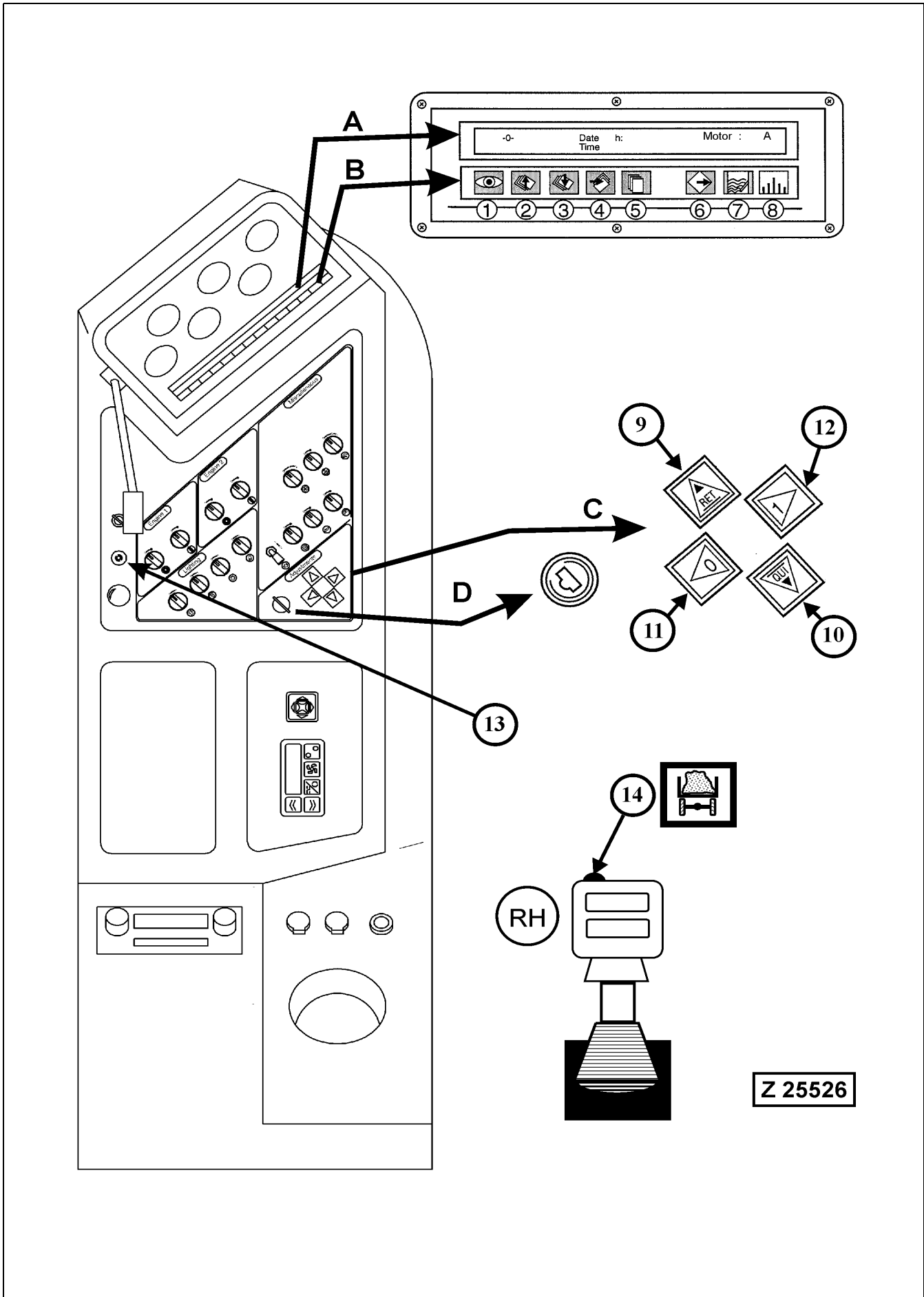
Selection of displayed language.

Power Checks.

Display of Maintenance Intervals.

Acknowledgement of carried out Maintenance

Settings of ECS operational data.



**SERVICE FUNCTIONS operated with KEY GROUP (D) and KEY SWITCH (C), illustration Z25526, continued****Display of "INPUTS-OUTPUTS".**

This section is basically used for Testing procedures through authorized service staff and therefore locked during normal operation by the software program. Access to this section can be obtained in the Service section "INPUTS-OUTPUTS ON/OFF" through actuation of key switch (C).

**Messages ON/OFF**

The creation of Messages can be switched off, when for example, tests in the INPUT / OUTPUT levels are carried out with the ECS control functions operative (motors running) and test conditioned messages shall not be displayed (stored), i.e. Protocol and Statistics memory will not be filled with messages caused by testing operations.

**Evaluation ON/OFF.**

When commissioning or servicing the Shovel the data evaluation in the respective service function can be switched off with key switch (C). This prevents an overwriting of the selected function (Standard display, Inputs-Outputs or Service) by occurring messages, caused by repairs on the ECS system.

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**⚠ CAUTION**

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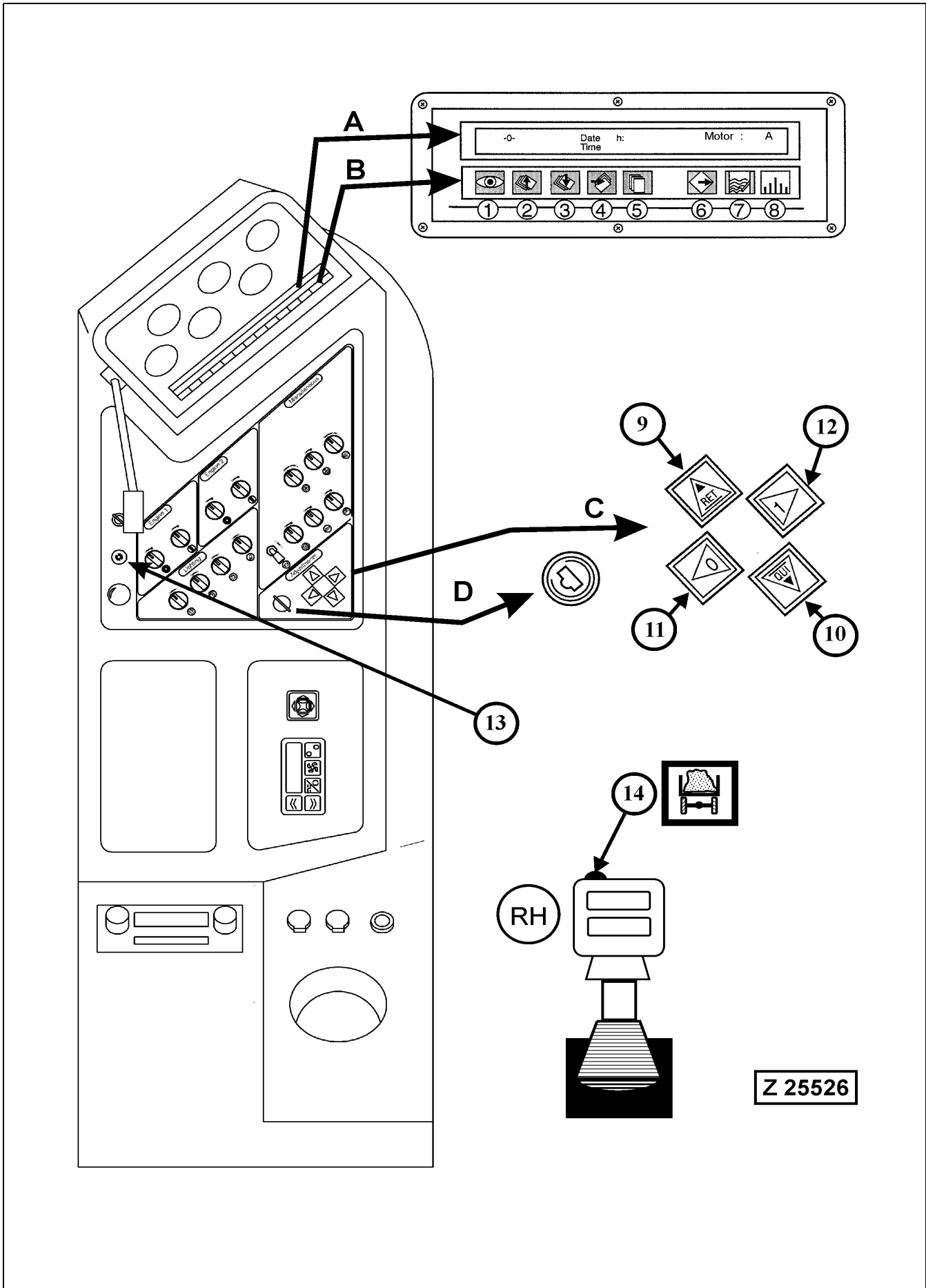
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**The function EVALUATION must only be switched OFF through authorized Service Staff. The instructions in the ECS Service Manual have to be observed. With the Evaluation switched OFF all monitoring and control functions of the ECS are inoperative.**

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Refer to Section "SERVICE FUNCTIONS" and "MENU CONTROL" on page 125 for more information.





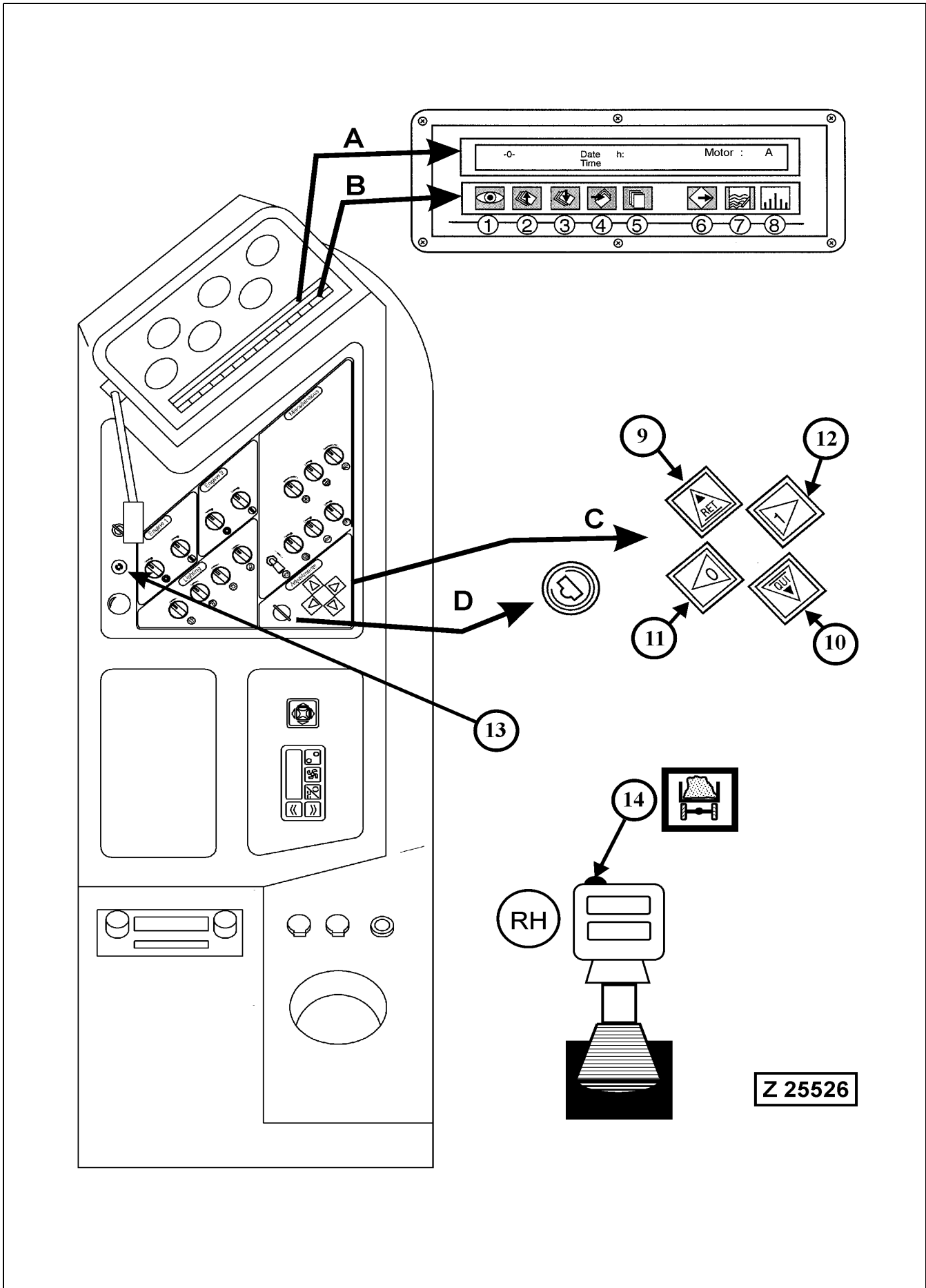
**Legend for illust. Z25526**

- (A) Display with basic information
- (B) Key board with 8 keys. For the function of the keys refer to page 95.
- (C) Key operated switch for enabling access to the INPUT-OUTPUT levels and input of operational data.
- (D) Key section with 4 keys for menu control of Service Functions and for INPUT-OUTPUT functions (On Screen Display).
- (9) RETURN Key, this key is used for returning to previous level of INPUT-OUTPUT or Service Functions.
- (10) QUI Key, this key is used for access to the next lower level of INPUT-OUTPUT or Service Functions and going back to the Standard Display from a displayed current message.
- (11) "0" Key, this key is used for selection of horizontal menu items within a main section of the inputs-outputs or service levels (LH direction).
- (12) "1" Key, same function as key (11) but in RH direction. Refer to page 127 Menu Control, for more information about the key section (D).
- (13) Acoustic warning signal (Buzzer)
  - This signal is heard for approximately 1 second when a fault message appears on screen (B).
  - Continuous sound when the hydraulic oil level is too low.

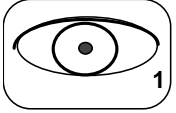



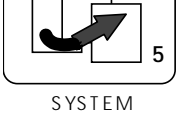



**▲ CAUTION**

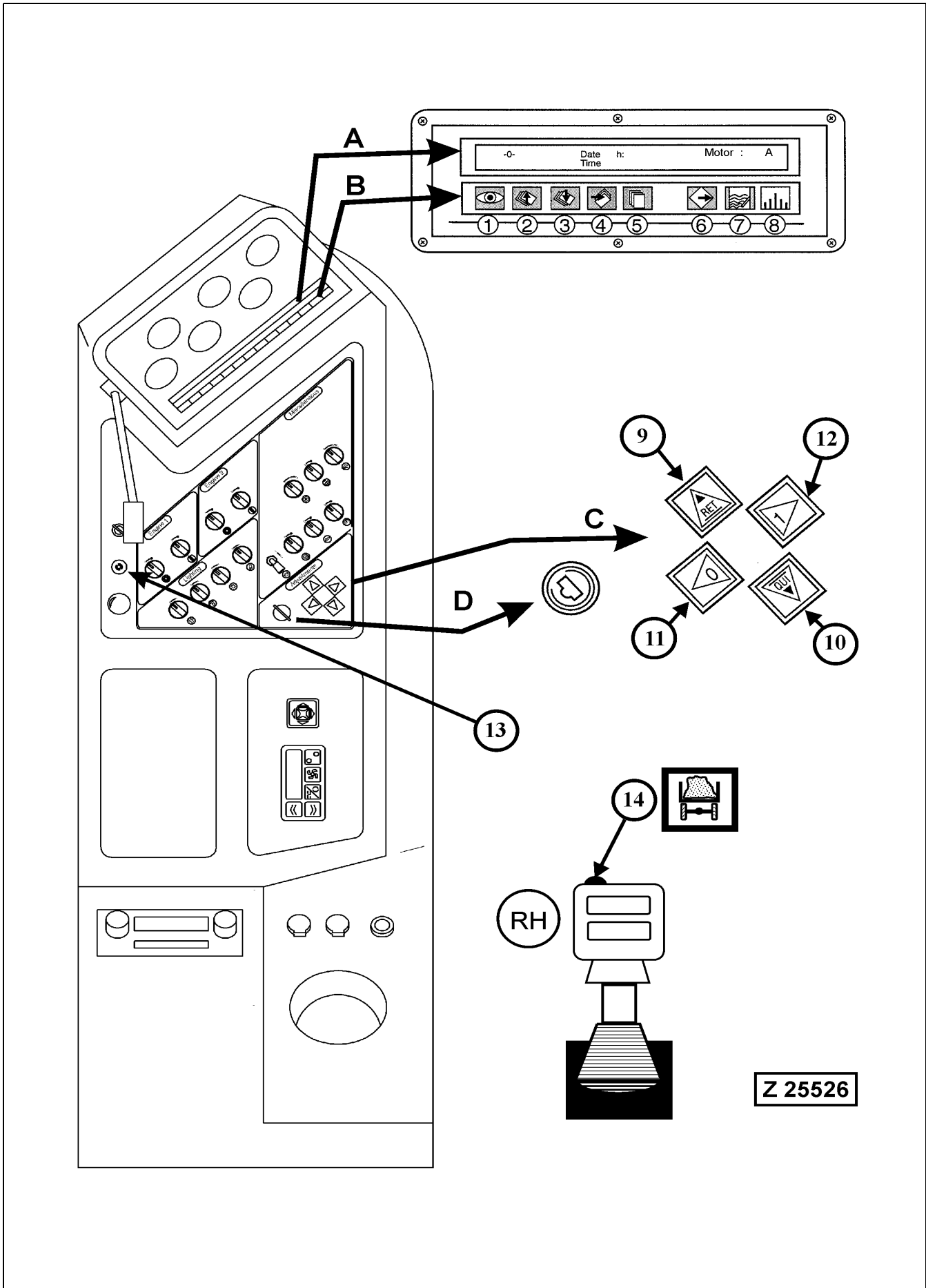
**In case of too low hydraulic oil level this signal sounds continuously. Shut down the Shovel, locate and correct the cause immediately. Fill up hydraulic oil to the correct level.**

- (14) Switch for truck counter on RH control lever. The loaded trucks can be counted by actuating this switch. The total number of trucks loaded will then be displayed on screen (A) for five seconds.
- (E) Plug socket for connecting remote printer or other data downloading equipment.  
For printing out the contents of the **Statistics** memory, press key (8) and key (6). For printing out the contents of the **Protocol** memory, press keys (7, 6 and 3). Keep key (3) depressed until all messages are selected and then press key (6) two times. Refer also to page 117 for more detailed information.



**Function of the keys (1 to 8) of Keyboard (B):**

 MESSAGE	<ul style="list-style-type: none"> <li>● Text display of that page, which was selected from the Text store, Record memory or Statistics memory.</li> <li>● Shifting to the mode "leaf through" of current messages.</li> <li>● Acknowledgement of changed settings.</li> </ul>
 UP	<ul style="list-style-type: none"> <li>● Calls up the next text lines or the next pages (in the text mode).</li> <li>● Change of settings (figures)</li> </ul>
 DOWN	<ul style="list-style-type: none"> <li>● Calls up the preceding text lines or preceding pages (in the text mode).</li> <li>● Change of settings (figures)</li> </ul>
 PAGE NO	<ul style="list-style-type: none"> <li>● Display of a desired message</li> <li>● Moves the cursor</li> <li>● Change-over to the text mode</li> </ul>
 SYSTEM	<ul style="list-style-type: none"> <li>● Return to the basic display (basic information or last indicated message) from record memory, statistics memory or text store.</li> </ul>
 DATA OUT	Print out of: <ul style="list-style-type: none"> <li>● Contents of record memory</li> <li>● Contents of statistics memory</li> <li>● Acknowledgement of changed settings</li> </ul>
 PRO	<ul style="list-style-type: none"> <li>● Display of the record memory</li> </ul>
 STA	<ul style="list-style-type: none"> <li>● Display of the statistics memory</li> </ul>



## 3.4.2 OPERATING THE ELECTRONIC MONITORING SYSTEM

### 1.0 TEXT DISPLAY (A) with integrated KEY BOARD (B) illust. Z25526

After switching on the Shovel's key operated main switch, the following introductory messages will be displayed on screen (A):

1<sup>st</sup>. # Please be Safety Conscious when working!

This message will be displayed for approximately 10 seconds.

2<sup>nd</sup>. |QUI| Did you check the Operating Safety of the Shovel?

Press the "QUI" key (10) to acknowledge this message.

3<sup>rd</sup>. |QUI| Did you do Maintenance according to the Service Literature?

Press the "QUI" key (10) to acknowledge this message. Thereafter the basic ECS display normally automatically appears on the screen (A) if no information - or fault messages are present. Present information - or fault messages overwrite the introductory messages no. 2 and 3.

-0- Date	h:	M1 *1) A:
Time		M2 *2) A:

\*1) **M1** = Short form for rear motor on counterweight side designated as motor 1.

\*2) **M2** = Short form for front motor on Operator's cab side designated as motor 2.

All messages related to one of the two motors, their motor protection relays and pump distributor gears are identified by the figure 1 or 2.

Example of a motor related message:

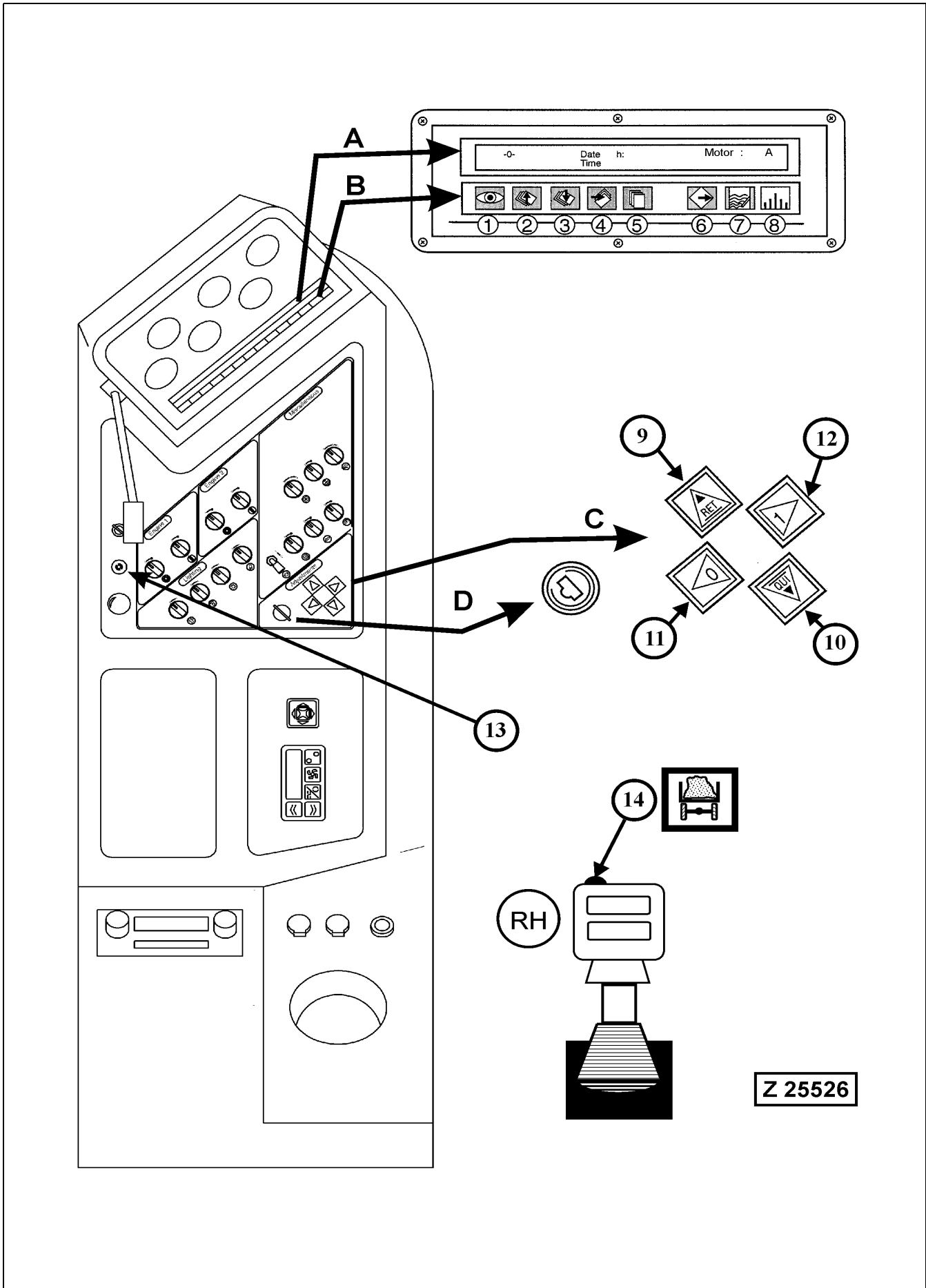
Fault No. 512:  
(515)

\$h:	Shutdown of motor 1 by motor protection relay 0F4-1
------	--

Help:

- Watch main motor temperature and let motor cool down.
- Check motor protection relay 0F4.

This message applies to the **rear motor** on counterweight side  
**-motor 1-**.



### Basic Display

The basic display in system level -0- is for general information during operation and shows the Date, the Time of Day, the Operating Hours (h) and the motor current (A) of motor 1 (M1) and motor 2 (M2). Within Level -0- further operating data can be called up by pressing key (12).

Call up further Operating Data in System Level -0-:  
The following data can be called up by pressing key (12), illust.  
Z22334

-0- PTO Gear oil temperature M1	Nominal< °C)	Actual: °C
-0- PTO Gear oil temperature M2	Nominal< °C)	Actual: °C
-0- Hydraulic oil temperature	Nominal< °C)	Actual: °C
-0- Ambient temperature		: °C

### REMARK

The maximum permissible temperature of the PTO gear oil and of the hydraulic oil depends on the viscosity of the oil used. The following table shows the maximum permissible temperature of the respective oil viscosity.

#### PTO Gear Oil

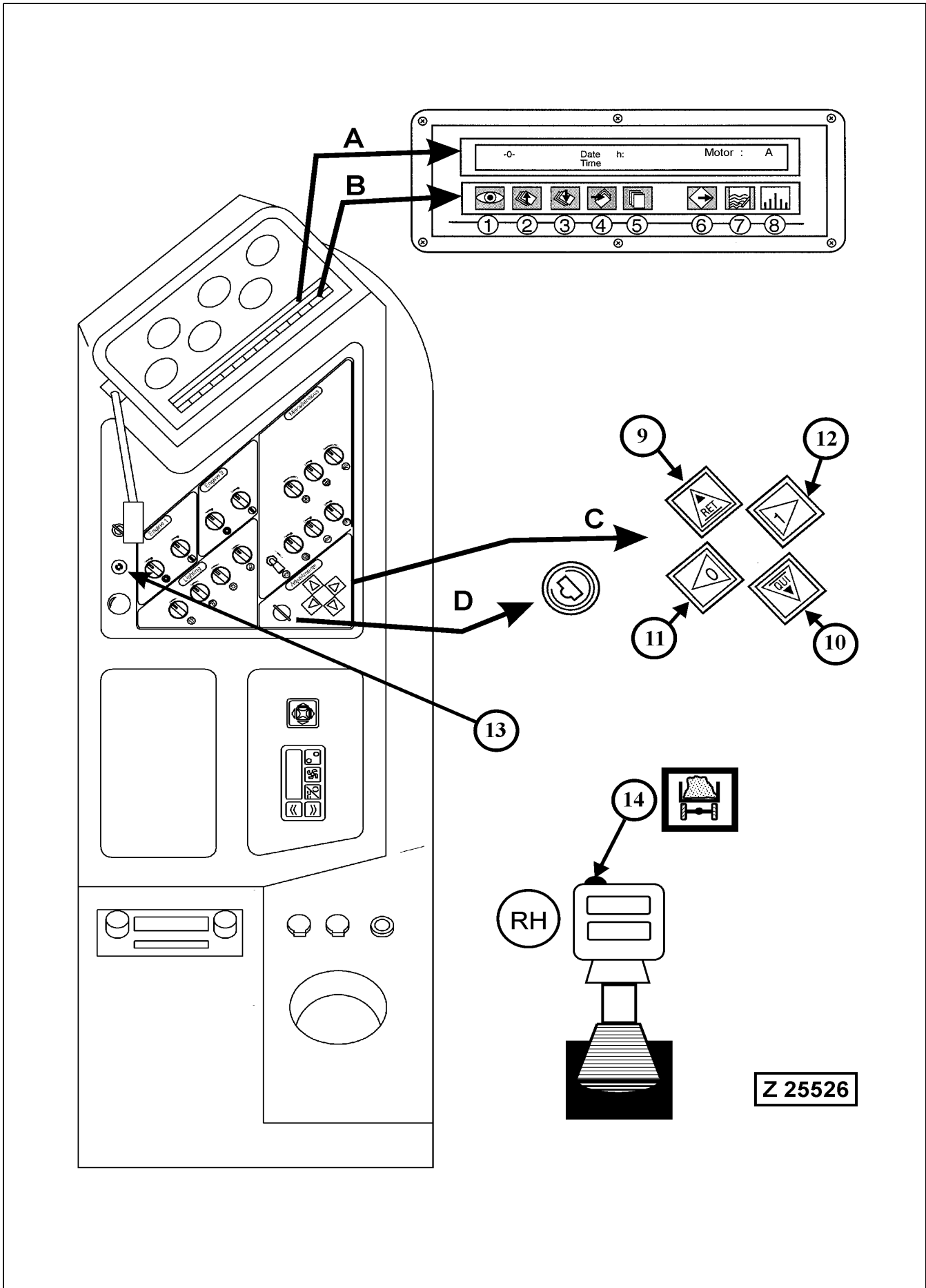
Viscosity class according to ISO	T 32	CLP 150	SAE 75W-140
maximum permissible temperature °C:	< 60	< 95	< 95

#### Hydraulic Oil

Viscosity class according to ISO	VG 22	VG 32	VG 46	VG 68	VG 100	ATF 3
maximum permissible temperature °C:	< 58	< 69	< 79	< 85	< 85	< 82

The input (setting) of the viscosity class has to be done in main group Service \*SETTINGS\*.

For more information refer to page 131.





### 3.4.3 AUTOMATIC DISPLAY OF MESSAGES

The messages of the ECS system are divided into three main categories as follows:

#### Category I:

Information messages indicating an operating condition, e.g. "# swing Parking Brake Applied" or a present maintenance interval message.

#### How to act:

- These information messages are self-explanatory.
- Press the "RET" key (9) twice for returning to basic display.

#### Category II:

Fault messages without automatic shut-down of the unit. These messages indicating a deviation from normal operating condition.

#### How to act:

- Immediate shut-down of the unit is not necessary.
- Inform the responsible Service Staff about the fault message.
- Press the "RET" key (9) twice for returning to basic display.

#### Category III:

Fault messages resulting in an automatic shut-down of the unit. These messages indicating a serious failure.

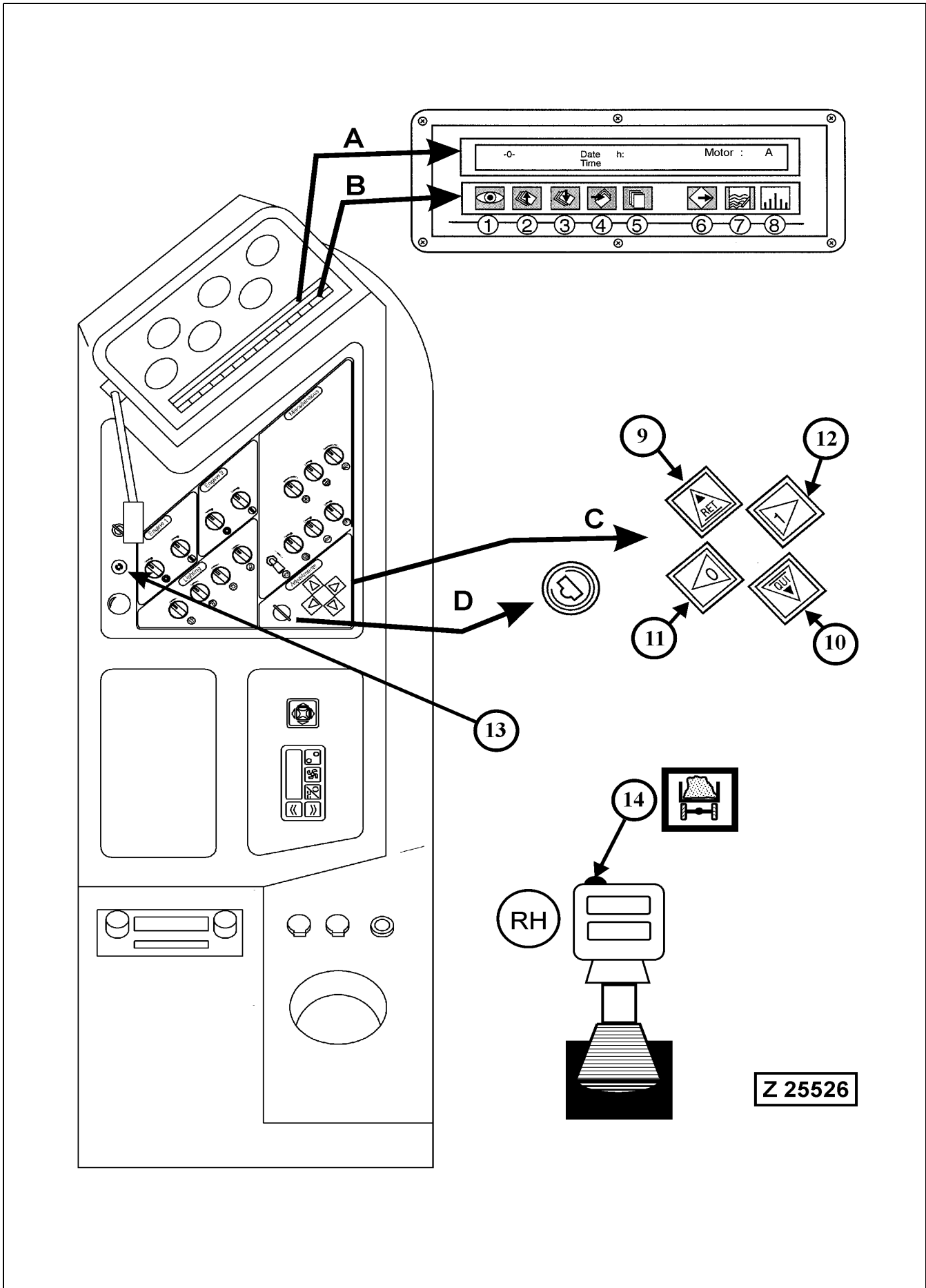
#### How to act:

- Press the "RET" key (9) twice for returning to basic display.
- Re-start of the unit can be tried. If the fault still exists, the unit will not start or automatic shut-down will happen again.

#### Emergency By-pass switch for the ECS- Shut-down Function.

The unit is equipped with an Emergency By-pass Switch for the ECS-system. This switch is located on the "X2" switch board in the cab base compartment and marked with "S27". The location of the switch is shown on page 211. If an automatic shut-down of the Shovel happens, with a dangerous situation for man or machine, which needs the Shovel to be operable to overcome the dangerous situation, actuate this switch to override the shut-down function of the system and to enable a restart of the motors.

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.



### **Automatic Display of Messages**

If a fault or an information condition occurs during operation, the basic display is automatically replaced by a message in text. If a further condition occurs, another message is displayed so that the operator is always shown the latest message.

The message text provides the operator with an explanation of the condition in standard texts.

When a fault message is displayed, further "HELP" information relating to the fault message can be obtained by pressing the "DOWN" key (3), illust. Z25526. All fault and information messages are listed in section "Message Texts". Each message is related to a page. These MESSAGE PAGES are numbered and can be called up individually. When a fault message is displayed the number of operating hours is displayed and stored at the same time. Fault and information messages are held as long as their cause is existent

### **Maintenance Schedule**

In accordance with the operating hours of the Shovel, the initial and periodic maintenance intervals are automatically displayed.

Example:

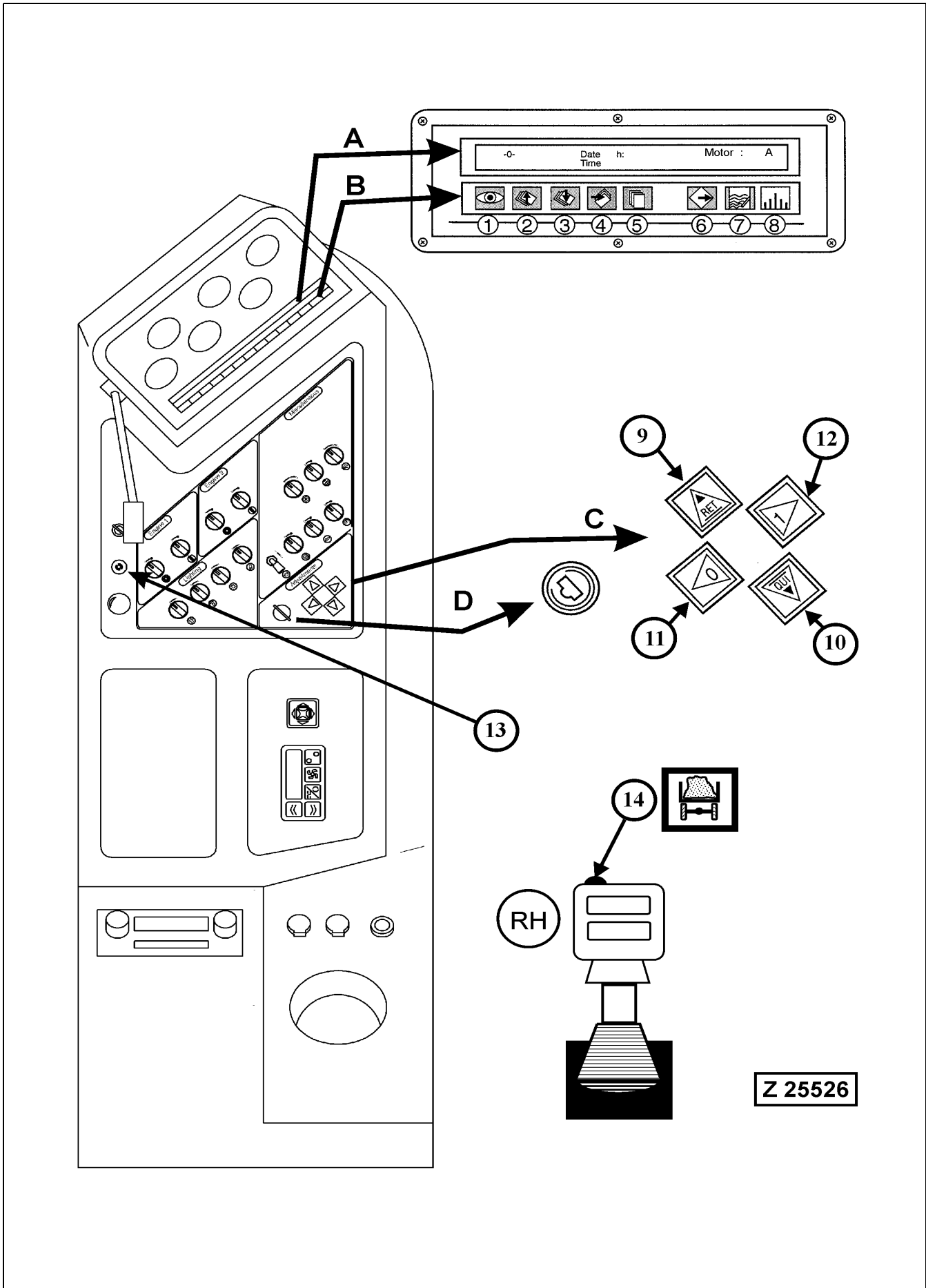
After the first 250 operating hours of the Shovel the following message will be displayed:

# Initial 250 h Maintenance  
Perform initial 250 h Maintenance.

Perform maintenance according to the Maintenance section.

### **Acknowledgement of performed maintenance.**

The acknowledgement of performed maintenance is obtained in the main group "Service" under menu item "Maintenance" refer to Menu Control Chart -VI- on page 145.



## Message Classification

All messages filed in the text store of the text display are listed in Section "Table of messages" on page 167 in sequence of their page numbers and are divided into the following 4 groups:

### Group 1

Fault Messages of message text pages number 500 - 731.  
When a fault message of this group is displayed, the warning buzzer (13), illust. Z25526 will sound for 1 second, depending on the severity of the fault an automatic shut-down of the Shovel can happen. These messages are recorded in the protocol memory and in the statistics memory for later evaluation.

### Group 2

Fault Messages of message text pages number 734 - 1309.  
When a fault message of this group is displayed, the warning buzzer (13) will sound for 1 second, no shut down of the Shovel. These messages are recorded in the protocol memory and in the statistics memory for later evaluation.

### Group 3

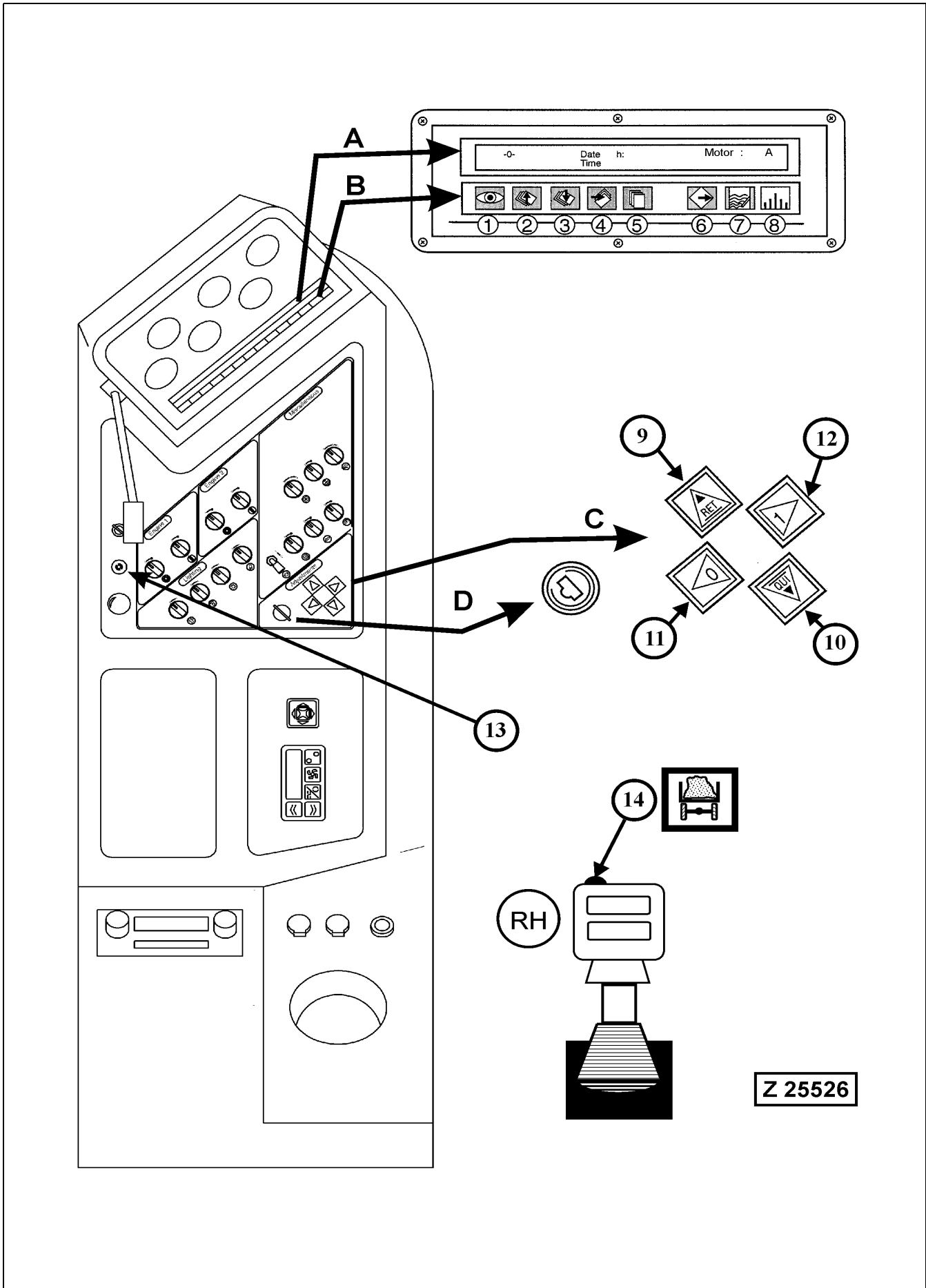
Acknowledgement messages of performed maintenance of message text pages number 1310 - 1319.  
The acknowledgement messages serve only for protocollation of the acknowledgement of performed maintenance. They are recorded in the protocol memory and in the statistics memory for later evaluation.

### Group 4

Information Messages of message text pages number 1320 - 1535.  
Information messages are identified by the sign (#) in the upper LH corner of the screen (A). These messages are for information only and are not recorded.

### REMARK

The message pages no. 1 - 499 contain the text of the MENU CONTROL (Service function) of the ECS-system.

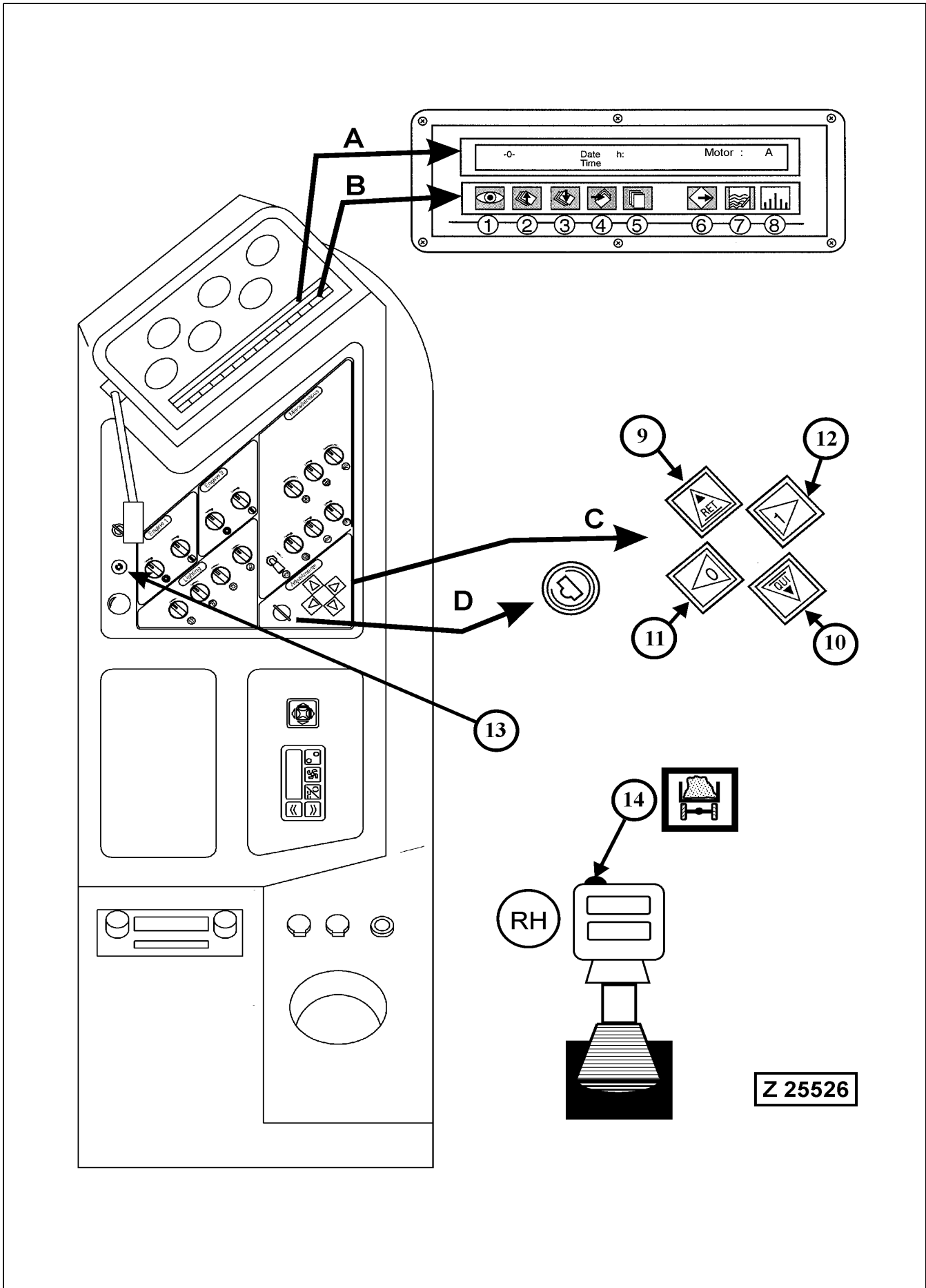


## Emergency Indication of Operating Conditions.

The ECS system is equipped with an emergency indication. In case the text display (A) fails to work, it indicates faults in important operating systems of the Shovel. The indication is effected by means of LED's at the Programmable Logic Controller "PLC" installed in the cab base. Refer to page 208 for the location of the "PLC".

The following faults are indicated:

Fault:	LED No.:
The ECS system is by-passed (By-pass switch S27 actuated)	H30
Start of motor 1 and/or motor 2 blocked by one or more of the six high pressure filters.	H31
<b>NOTICE</b> The LED "H31" monitors all six high pressure filters. Refer to page 215 for description of the diagnostic codes flashed out by LED "H31".	
Start of both motors blocked due to closed main shut-off (gate) valve hydraulic tank	H37
Faulty monitor channel for hydraulic oil temperature	H38
Too low hydraulic oil level! Stop the motors	H39
Emergency shut down switch actuated	H116
Motor shutdown from ground man (if so equipped)	H135

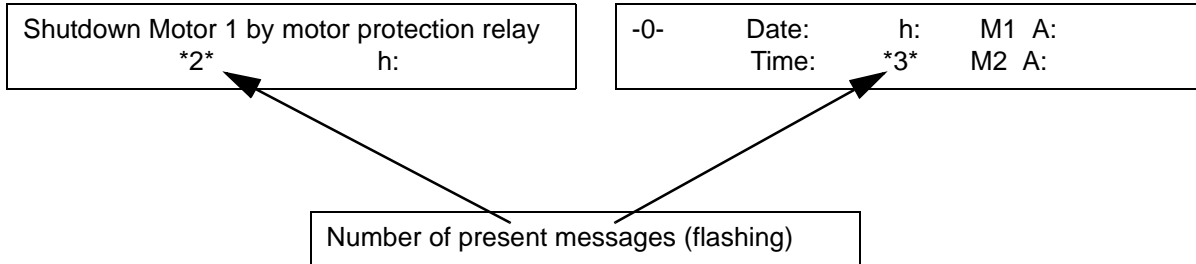




**TEXT DISPLAY (A), illust. Z25255**

Several messages are present at the same time:  
 The last input message is displayed. The number of all current messages is indicated by a flashing number in the second text line.

Example: Fault message No. 512:



These present messages can be called up with key (1) (MESSAGE). Press key 2 (UP) or 3 (DOWN) for the display of the present messages.

**Call up of "HELP" Information (HELP Texts) to a displayed message.**

If additional "HELP" information (HELP Texts) to a displayed fault message are desired, press key (4) to enter the Text mode. Then press key (3), to display the "HELP" text.

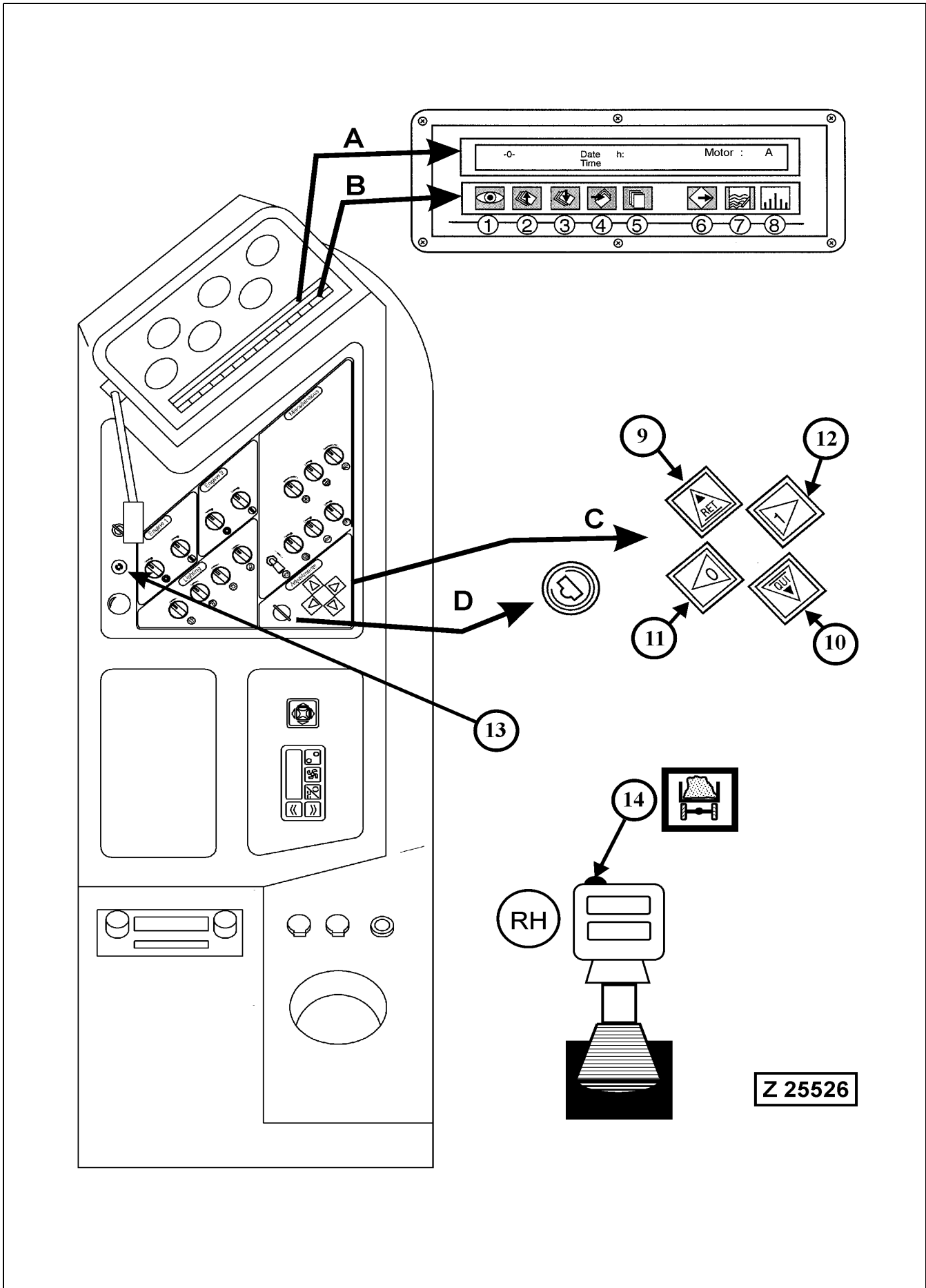
Example fault message 512:

Fault No. 512: (515)	\$h: Shutdown of motor 1 by motor protection relay 0F4-1
Help:	- Watch main motor temperature and let motor cool down. - Check motor protection relay 0F4.

Messages and Help texts are displayed each time in two text lines. The two next text lines can be called up by pressing key (3) "DOWN".

The fault messages including the Help text consist of maximum 8 text lines. For return to the fault message press key (2) "UP" until the message is displayed again.

Resetting Fault Messages of the Lubrication Systems after Repairs which have been carried out with the motor(s) running or with the motor(s) OFF and Main Switch Key in ON position. After repairs under the above conditions it is necessary to reset the control circuit of the concerned lubrication system by actuating the rotary switch on the instrument panel 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 ECS display. Resetting of the lube system control circuit can also be done by shutting down the motor(s) and switching OFF the main switch key.



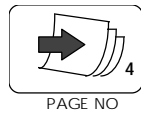
**Display of message pages without present message.**

If there is a statistics print out and the individual Nos. of the message pages cannot be adjoined to the message text, the message text can be called up as follows.

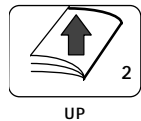
Starting from basic display (Message 2)

-0-	Date	h:	M1 A:
	Time		M2 A:

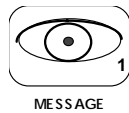
**Message 500 shall be displayed.**



Press, a page no appears.



Press, until page 500 appears

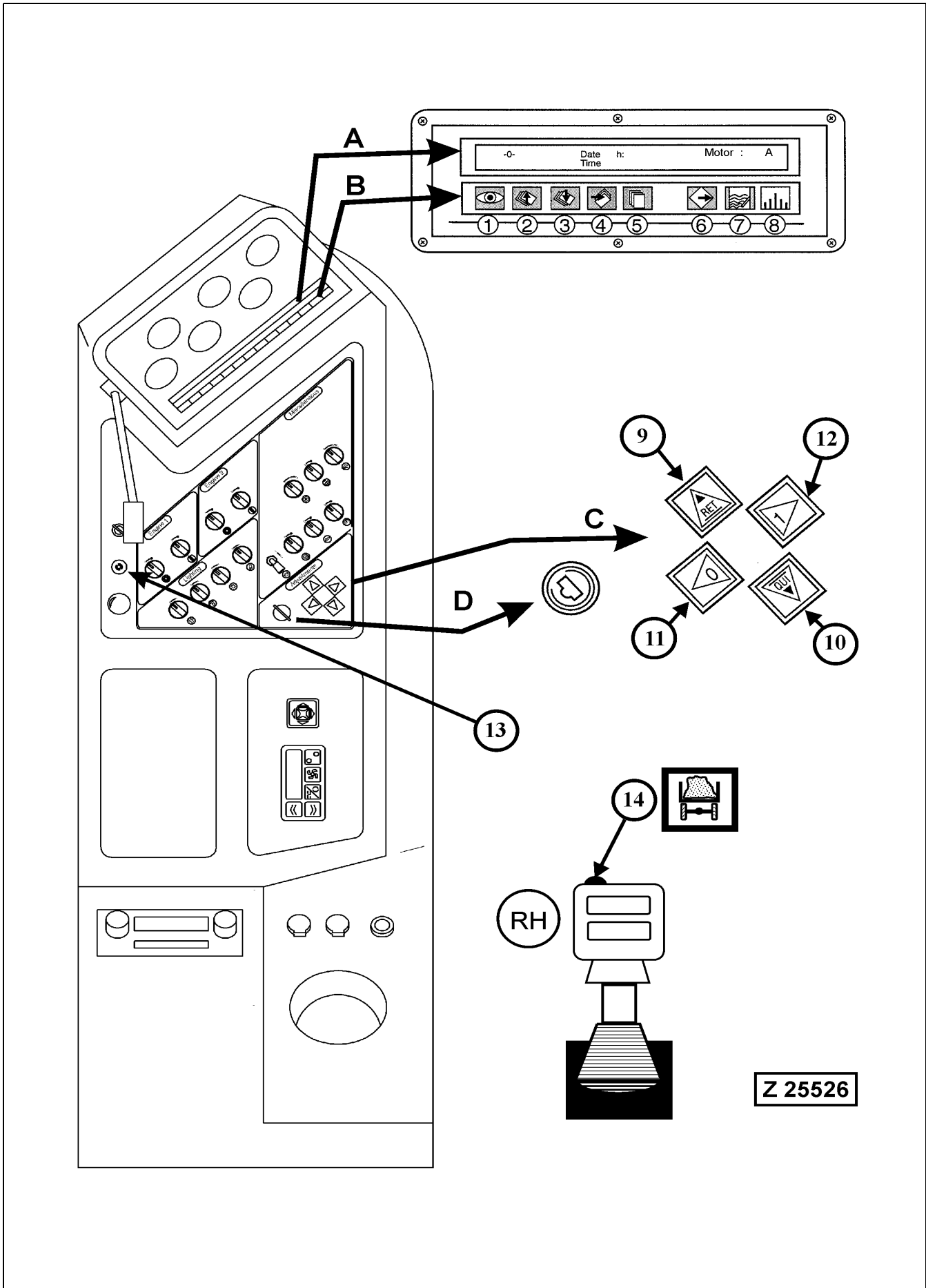


Press, to display text of message 500

Display:

Fault No. 500:  
(503)

\$h:	Start blocked because of main shut off (gate) valve
------	---



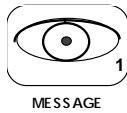
### Display the Contents of Record (PROTOCOL) Memory, illust. Z25526



Press to display Protocol memory.

Display:

PROTOCOL entry no: 1 status : going
message : 626 date 15.07.05 at 15:27:32

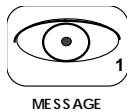


Press to display message 626.

### Example for other entries (e.g. Message No. 980)



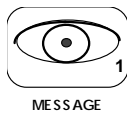
Press until the desired message **no. 980** appears.



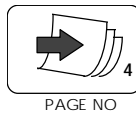
Press to display message 980.

Display: Fault Message No. 980:

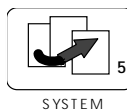
\$h	Swing gear house brake off
-----	----------------------------



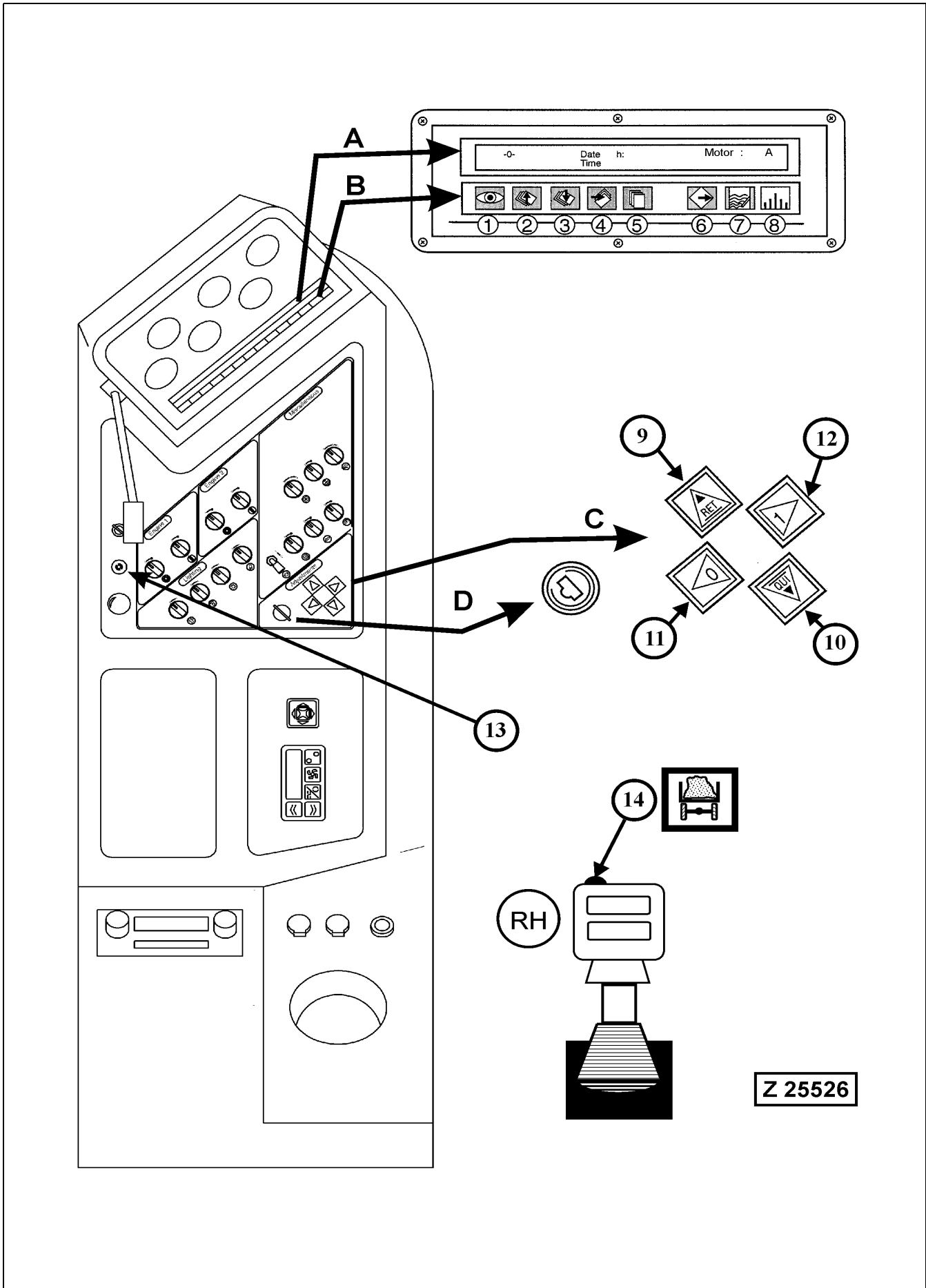
or



Press to return to the last message text.



Press to return to the basic display (Standard display) or to the last current message



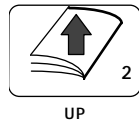
### Display the Contents of Statistics Memory, illust. Z25526



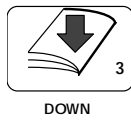
Press to display statistics memory.

Display:

STATISTICS	Appeared:	4 = 80.0 %
Error :	644 Elapsed :	00:02:40 = 100.0 %



or



Press to leaf through all recorded messages.

Example

Indication in percent how often the fault has occurred in relation to the total number of faults = 100%

STATISTICS	Appeared:	1 = 20.0 %
Error :	500 Elapsed :	00:03:40 = 74.5 %

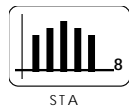
Message page 500

Duration of the fault

Fault portion in percent of the total error time

### Print out Contents of Statistics Memory:

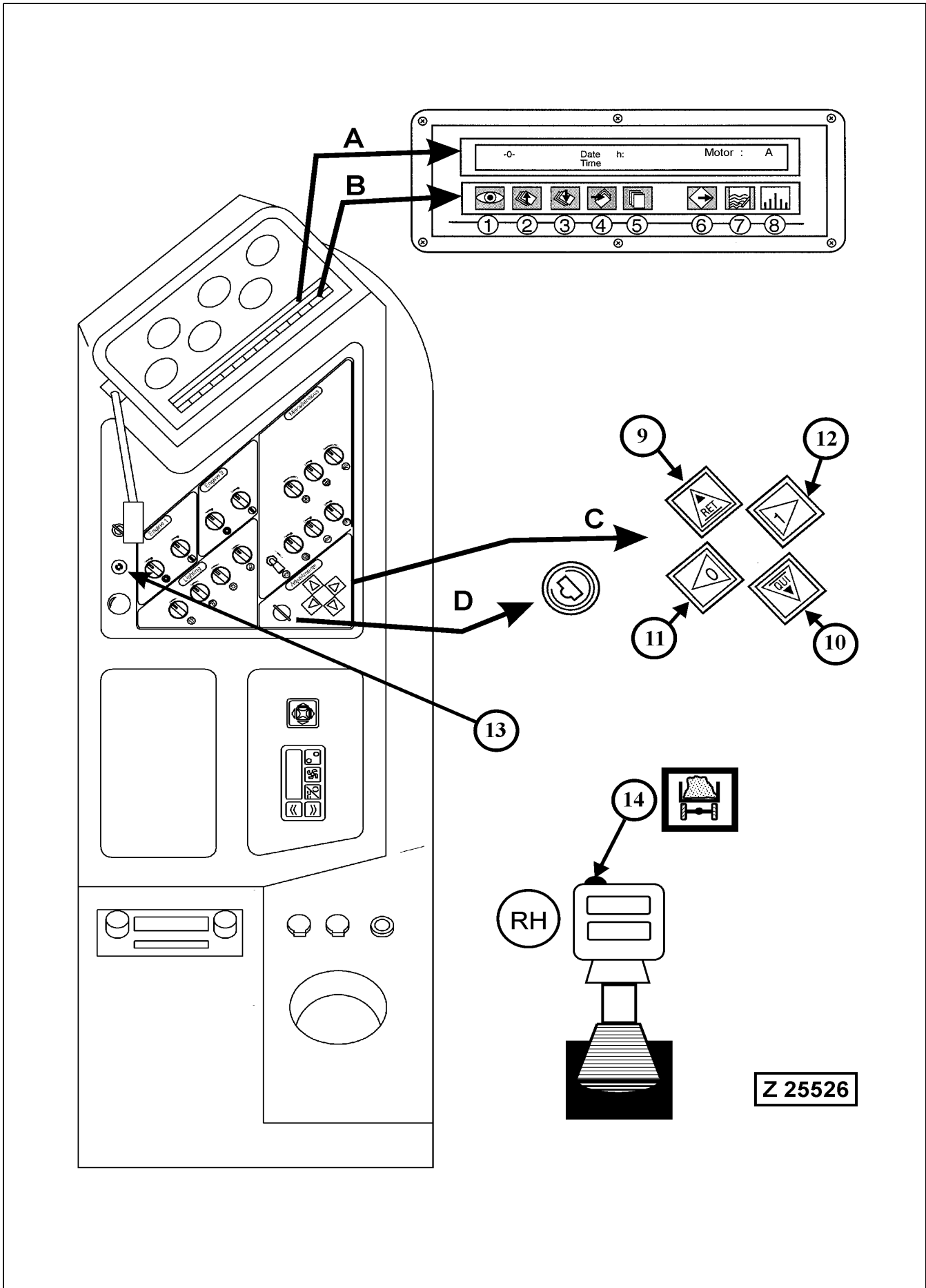
-0-	Date	h:	M1 A:
	Time		M2 A:



The complete statistics are now being printed out.

Display:

***** STATISTICS PRINTOUT *****
Printing statistics table, please wait....





**How to print out Contents of Record (PROTOCOL) Memory:**

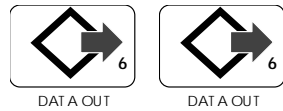
Print out the *complete* Contents of Record (PROTOCOL) Memory

Display:



Press until the maximum amount of entries (**39**) is reached

Print from the last	>	1< PRO entries
page no all * PRO has		39 entries *P*



The complete PROTOCOL is now being printed out.

Distinctive marks for "OLD" and "NEW" entries:

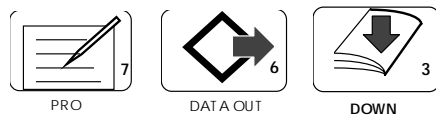
New entries, not yet displayed / called up / printed or downloaded are marked with \*P\*.

After being displayed / called up / printed or downloaded the marking will change to -P-.

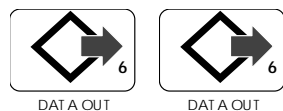
**Print out the *last* Entries of the Record (PROTOCOL) Memory**

1<sup>st</sup>. Possibility - The last (X) Entries under consideration of all Messages

(X) = desired number of the last entries e.g. **10** (the last 10 entries of 39 total entries)

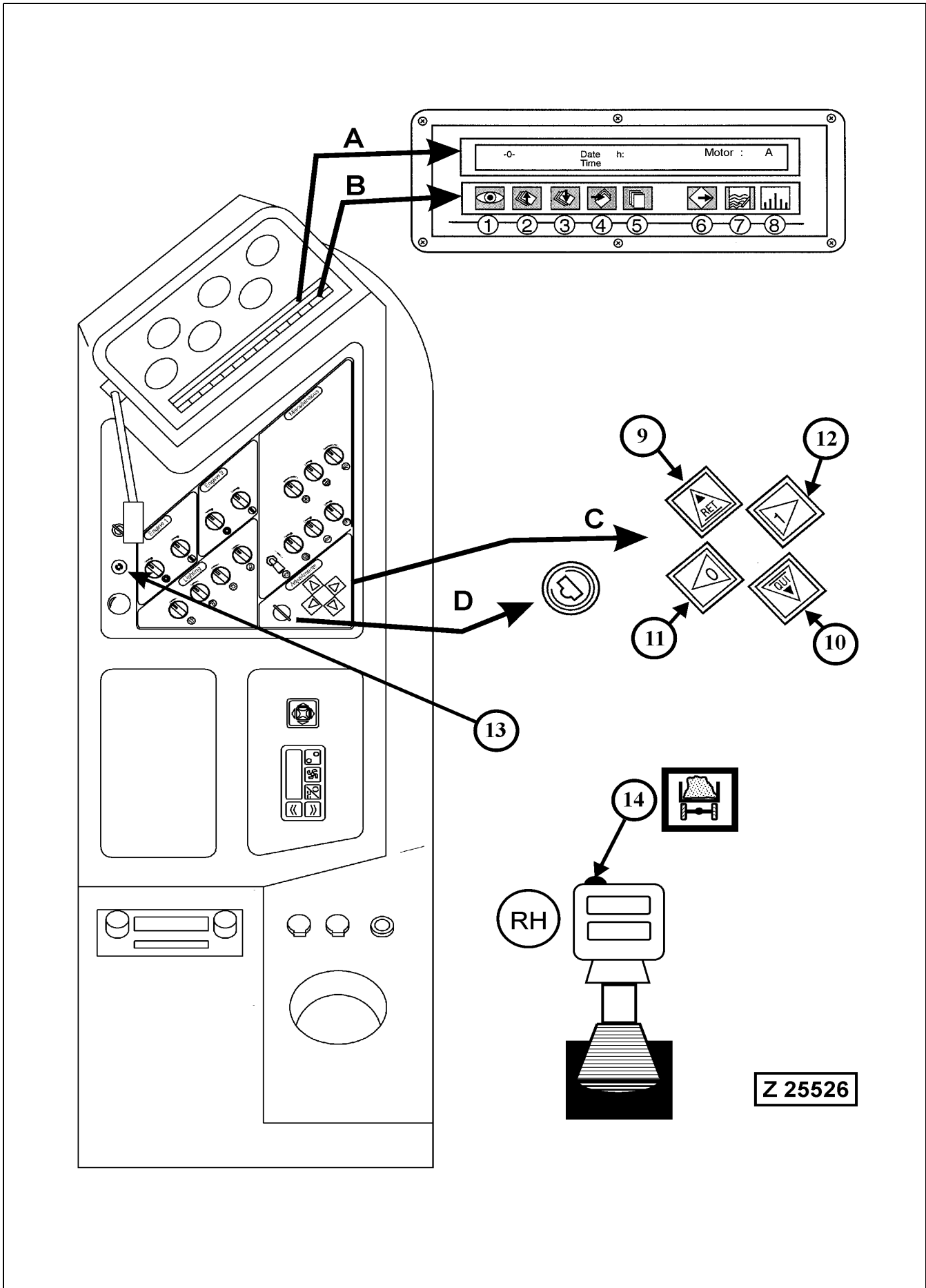


Press until the desired nos. of entries are reached, e.g. 10.



The record memory with the last 10 entries is now being printed out.

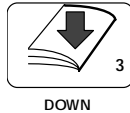
Print from the last	>	10<PRO entries
page no all * PRO has		39 entries *P*



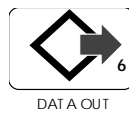
**2<sup>nd</sup>. Possibility - The last (X) Entries of a certain Message**

**(X)** = desired number of the last entries e.g. **10**.

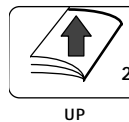
This print shows, whether the desired message appeared within the last 10 entries.



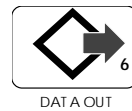
Press until the desired nos. of entries are reached, e.g. 10.



The position of the brackets > < is now being changed from the entries to the message texts.



Select message (page) e.g. 524.



The records of message 524 of the last 10 entries are printed out..

Print from the last	10 PRO entries
page no > 524<PRO has	39 entries *P*

### Explanation of the statistics print-out

You receive for example the following print-out:

Column	1	2	3	4	5
Good	0	=	0.0 %	02:00:00	= 33.3%
524:	1	=	14.3 %	01:00:00	= 25.0%
560:	1	=	14.3 %	01:00:00	= 25.0%
590:	3	=	42.6 %	02:30:00	= 62.5%
626	2	=	28.6 %	01:00:00	= 25.0%
Err.:	7	=	100 %	04:00:00	= 66.6%

#### Column 1:

Good: Time with no faults, number of faults = 0

Err : Time, where faults have occurred, number of faults = 7

The numbers 524, 560, etc. indicate the message page number in the text store.

#### Column 2:

The number indicates, how often the fault has occurred, for example the fault of page no. 590 has occurred 3 times. In line "Err" (Error) the number of faults is summed up, the result is 7.

#### Column 3:

Here is indicated in percent, how often the fault has occurred applying to the total number of faults (7 = 100 %).

#### Column 4:

The time indicates, how long the fault has been present. If a fault has occurred more than one time, the sum of time will be indicated here.

#### Column 5:

The duration of the fault applying to the total time with faults (Err), = 4:00:00 (4 hours). This number results in the temporal overlapping of the faults. If you sum up the times, you receive 5:30:00. Good and Err apply to the sum of Good and Err, respectively. Refer to the diagram on next page for more information.

**Time Diagram of Statistics Print**

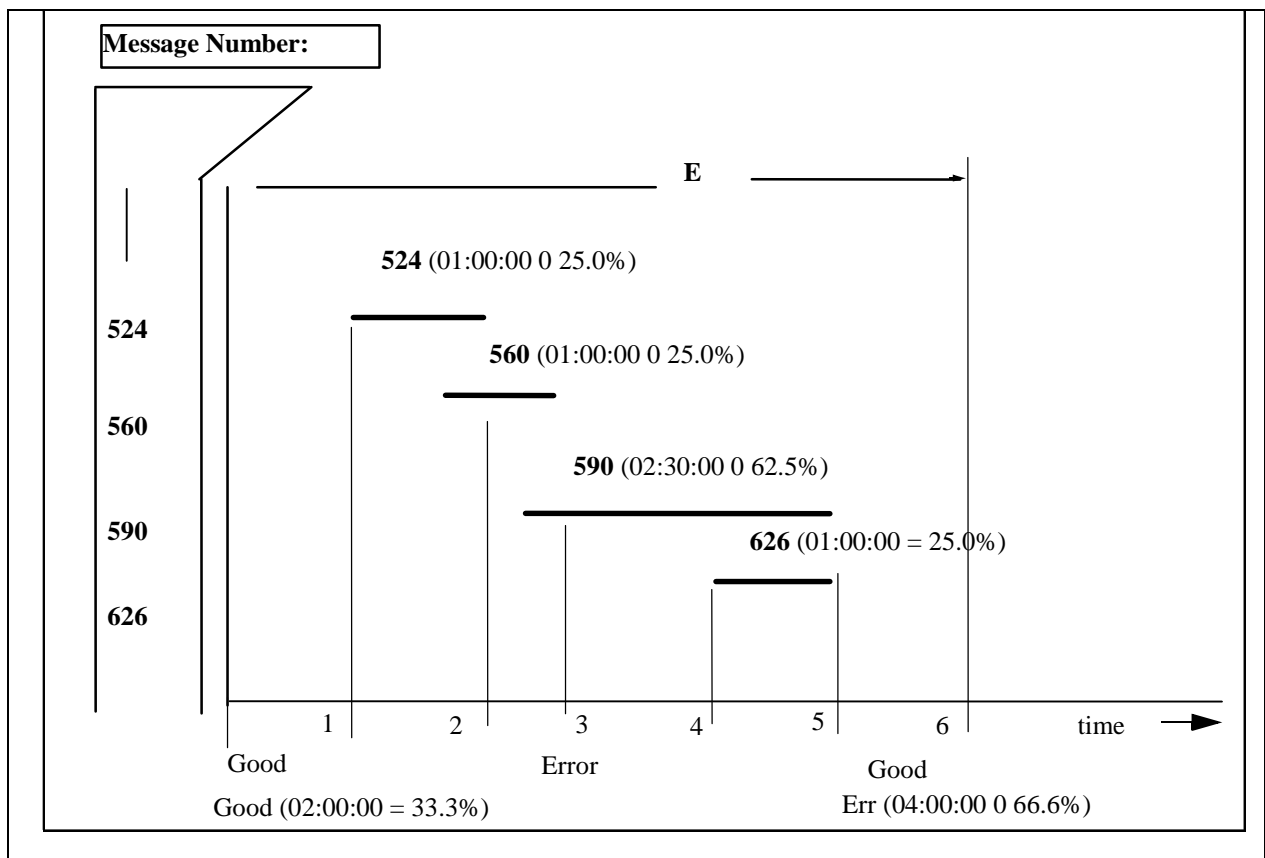
The diagram below shows an example, how the time without faults (Good) and the time with faults (Err) could be distributed within the total operating time of the ECS.

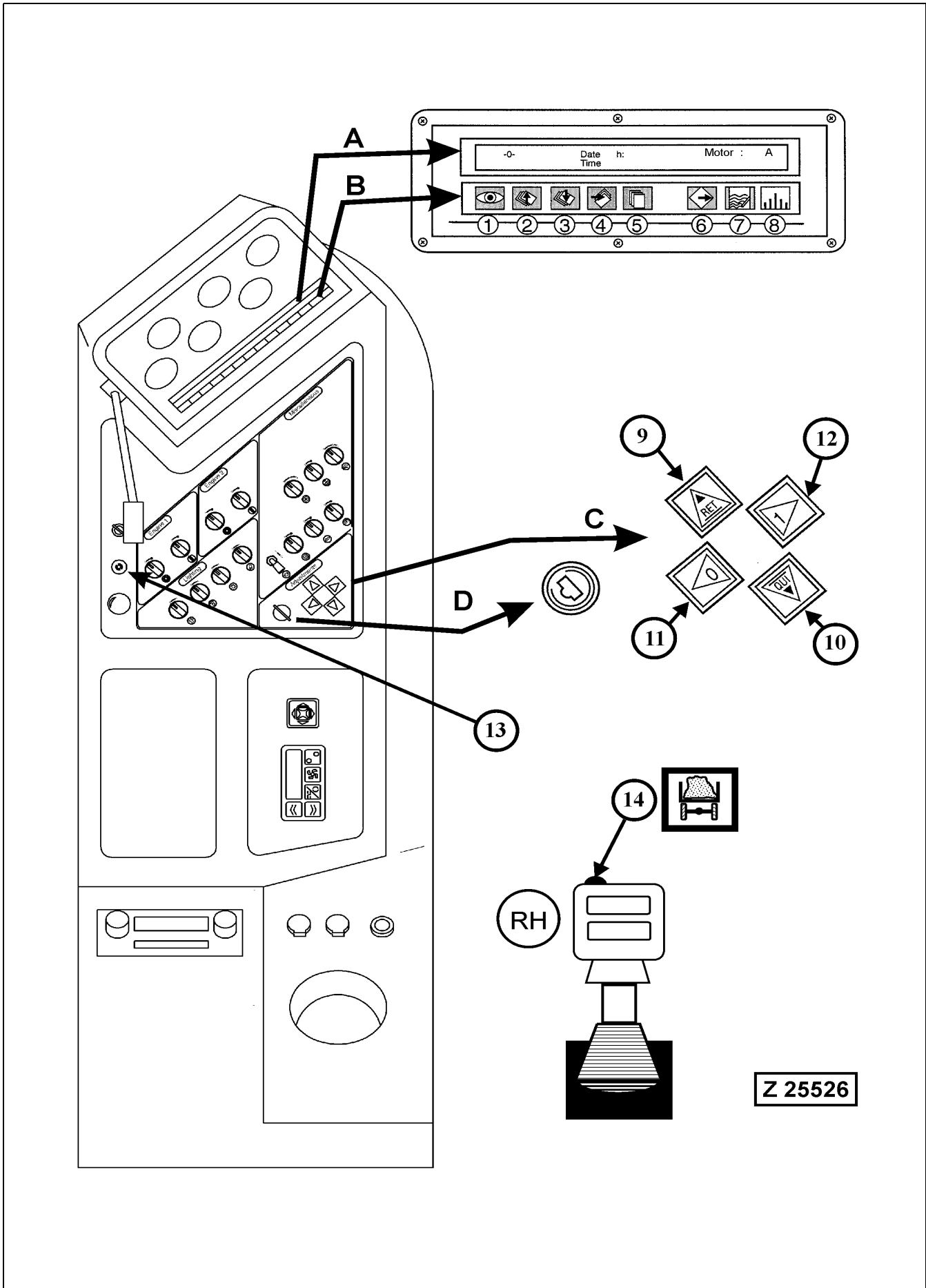
**E:** Total operating time of the ECS

**524/560/590/626:** Total time of a message

**Err:** Total time of all messages

**Good:** Total time without messages





**Return to SYSTEM level:**

Display of the Last Message Received or Menu  
(Standard Display)

Operation of the keyboard (B) has no influence to the recording of input messages. For example, if the record memory is called up via keyboard (B), the ECS switches back to SYSTEM level after a period of 20 seconds when no further key is actuated within this period. For immediate return to SYSTEM level (message display or menu) press key 5 (SYSTEM).

**Setting of Screen Brightness**

Increase brightness: Press keys (5 and 2) simultaneously.

Decrease brightness: Press keys (5 and 3) simultaneously.

Ex works the display is adjusted to maximum brightness (basic setting). Any change of the screen brightness via keyboard (B) will be kept until the system is switched off. When the system is switched on again, the maximum brightness of screen (A) will be restored automatically (basic setting).

**System Languages**

The text of the messages and of the menu control of the ECS-System is available in 2 languages and can be selected in the main group SERVICE with the menu control.

Refer to the section "SERVICE FUNCTIONS AND MENU CONTROL" for further information.

**Message Numbers and Message PAGE Numbers**

Each message of the two available system languages is related to a message page. The **message number** and the **message PAGE number** are identical for the **first language**, e.g. English. The **message PAGE numbers** of the second language have always a higher number (offset), although the **message number** itself remains the same.

If, for example, the **message number. 500**

(\$h: Start blocked because of main Shut-Off (gate) valve)

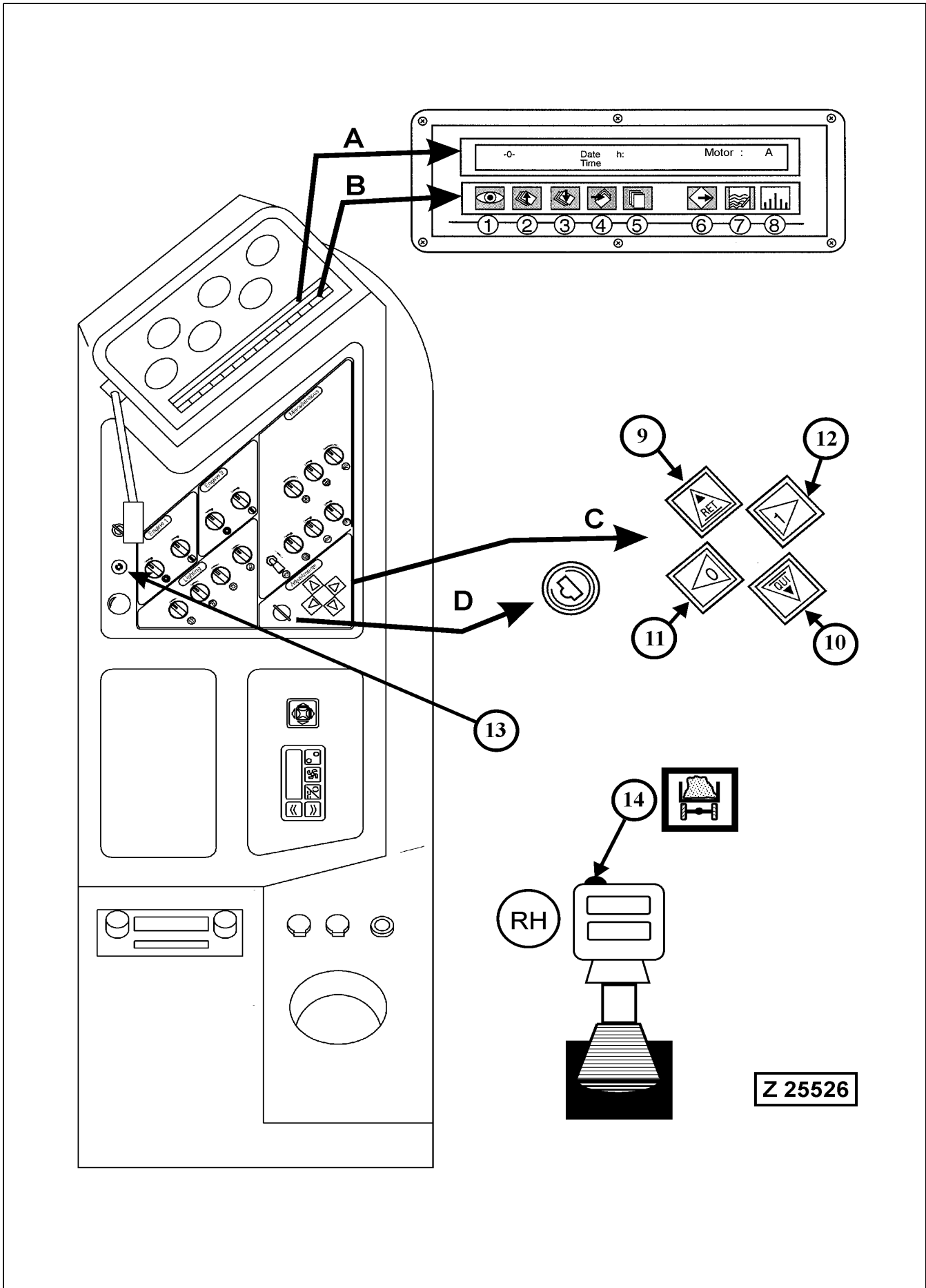
is displayed in the English (first) language, the applying **message PAGE number is also 500**. In the second language e.g. German the message page number is 503. The message number displayed on the screen never changes, only the related message page number in the second language changes. If the contents of the protocol memory are printed out in the second language, only the message page numbers of the second language are shown on the print. Depending on the type of the message, the **message PAGE number** of the second language will be **higher** than the **message number** by the following numbers (offsets):

Message number range **500-1309**: message pages with **3** numbers offset

Message number range **1310-1349**: message pages with **1** number offset

Message number range **1350-1439**: message pages with **2** numbers offset

Message number range **1440-1515**: message pages with **5** numbers offset





### 3.4.4 MENU CONTROL AND SERVICE FUNCTIONS

Menu Control operated with Key Switch (C) and Key Group (D),  
illust. Z25526

The menu controls are structured hierarchically. The highest-level menu is designated "LEVEL 0" and is accessed by depressing the "RET" key (9). All lower-level menus have consecutively higher numbers up to "LEVEL 5", see Menu Control Charts I - VI on the following pages and are accessed by depressing the "QUI" key (10). In menu levels (1 and 2), the menu options (main groups) can be selected horizontally, without having to return to the higher menu level. In menu levels (3 and 4), the menu options (sub groups) are horizontally only accessible within their main groups.

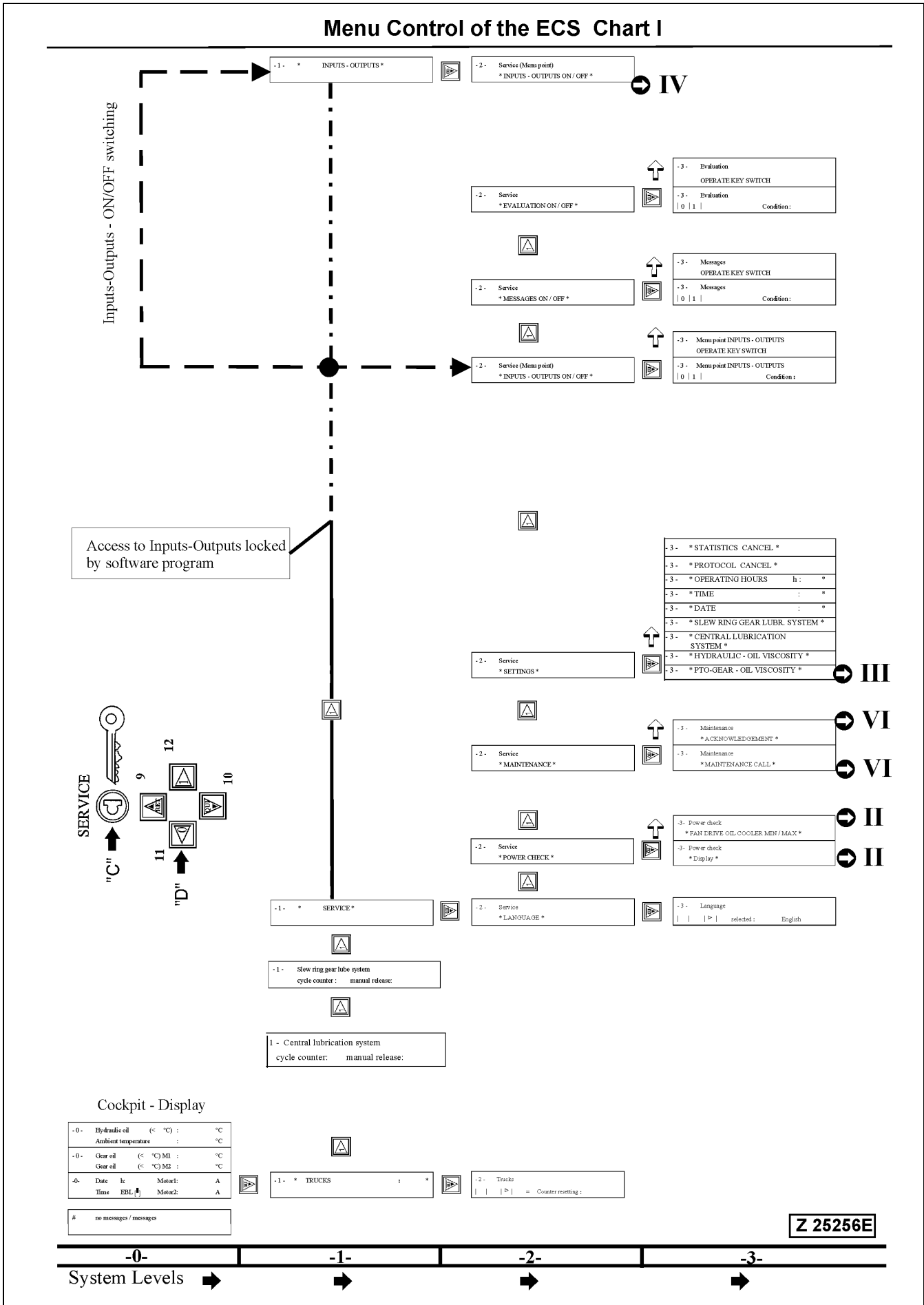
When entering a menu level, always the L.H. main- or sub group will be displayed first. By pressing key (12), all other main groups in the selected level in the R.H. direction can be called up. For returning to the starting group (main or sub group) press key (11).

The Menu Control Charts on the following pages show the structure and contents of each system level. The interconnection of the main groups through all system levels is also shown.

#### Menu Control with Key Switch (C) and Key Group (D)

##### Legend for illust. Z25526

- (C) Key operated switch for enabling setting of operational Data in main group **SERVICE** and for access to the **INPUT-OUTPUT** levels.
- (D) Key group with 4 keys for **menu control** of Service Functions and INPUTS-OUTPUTS.
- (9) Return Key - function:  
Return to previous level of INPUTS-OUTPUTS or Service function.
- (10) QUI Key - functions:  
Used for access to the lower level.  
Acknowledgement of carried out Maintenance  
Calling up of current Truck counter reading and lubrication system cycle counter readings  
Acknowledgement of inputs and setting of new oil viscosity
- (11) "0" Key - functions:  
Selection of horizontal menu items within the respective service or INPUT-OUTPUT level in the L.H. direction  
Selection of the oil viscosity for hydraulic system or PTO gear  
Change of condition of outputs (0-1).
- (12) "1" Key - function:  
Same function as key (11), but in the R.H. selection direction.



**Menu Control with Key Switch (C) and Key Group (D)****Display of Menu Options, see Menu Control Chart I**

**EXAMPLE:** Display of **TRUCK COUNTER READING**, starting from basic display on level -0-

Proceed as follows:

1. Press the "QUI" key (10), the menu level -1- with the current truck counter reading appears on the display.
2. If you want to reset the counter, press the "QUI" key (10) again. Menu level -2- appears on display. Use key (12) for setting the counter to zero.
3. Press "RET" key (9) twice for return to the standard display, level -0-.

**EXAMPLE:** Display of **LUBRICATION SYSTEMS CYCLE COUNTER READINGS**, starting from basic display on level -0-

Proceed as follows:

1. Press the "QUI" key (10), the menu level -1- with the starting item truck counter reading appears on the display.
2. Press key (12) once the Central lubrication system cycle counter reading appears on display. By pressing key (12) again the swing ring gear cycle counter reading is displayed.
3. For returning to the standard display level -0- press "RET" key (9).

**REMARK**

Changing of the lubrication cycle counter settings can be carried out in the main group SERVICE under the section \*SETTINGS\*, see also menu control chart III.

### Menu Control of the ECS Chart II

#### Service / Power Check

**(B)** Display with oil cooler fan maximum speed

- 4 -	Fan drive oil cooler min / max speed			
	OPERATE KEY SWITCH			
- 4 - min	max	Y6A-1: 0	Y6B-1: 0	
0	1	Y6A-2: 0	Y6B-2: 0	

**(A)** Display with oil cooler fan minimum speed

- 4 -	Fan drive oil cooler min / max speed			
	OPERATE KEY SWITCH			
- 4 - min	max	Y6A-1: 1	Y6B-1: 0	
0	1	Y6A-2: 1	Y6B-2: 0	



-3- Power check  
\* FAN DRIVE OIL COOLER MIN / MAX \*



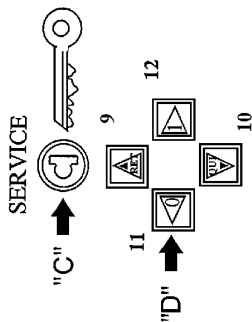
- 4 -	Fan drive oil cooler min / max speed			
	OPERATE KEY SWITCH			
- 4 - min	max	Y6A-1:	Y6B-1:	
0	1	Y6A-2:	Y6B-2:	



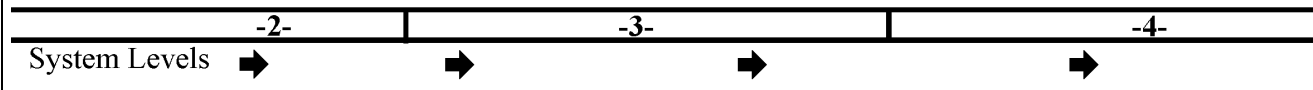
-3- Power check  
\* Display \*



-4- M2:	A	(P1/5:	P2/6:	) bar
(X1.2:	P3/7:	P4/8:	) bar	
-4- M1:	A	(P1/5:	P2/6:	) bar
(X1.1:	P3/7:	P4/8:	) bar	



Z 25257E



## Menu Control with Key Switch (C) and Key Group (D)

### Display of system pressures, menu item Service \*POWER CHECK\*

Starting from the menu level -1-, \*SERVICE\* see menu control charts I and II.

Proceed as follows:

1. Select menu level -1- by pressing "QUI" key (10) the starting menu item \*Truck counter reading:\* appears on the display, see chart I.  
Press key (12) three times, the main group \*SERVICE\* is displayed. Press key (10), level -2- with menu item \*LANGUAGE\* appears on the display.
2. Press key (12) once, the menu point \*POWER CHECK\* appears on the display.
3. Press key (10), Power Check \*DISPLAY\* in level 3, see chart II appears on the display.
4. Press key (10) for display of the present system pressures in level 4.
5. For returning to the standard display level -0- press "RET" key (9) four times.

### Adjust hydraulic oil cooler fan speed

Within the menu point \*POWER CHECK\* the fan speed of the hydraulic oil coolers can be set to minimum or maximum speed as follows:

Select menu point Power Check \*FAN DRIVE OIL COOLER MIN / MAX\* in level 3, chart II. Press key (10) the present speed condition of the cooler fans appears on the display in level 4. To change the fan speed insert service key (C) and select with keys (11 and 12) the condition for minimum speed as shown in display (A) or for maximum speed as shown in display (B).

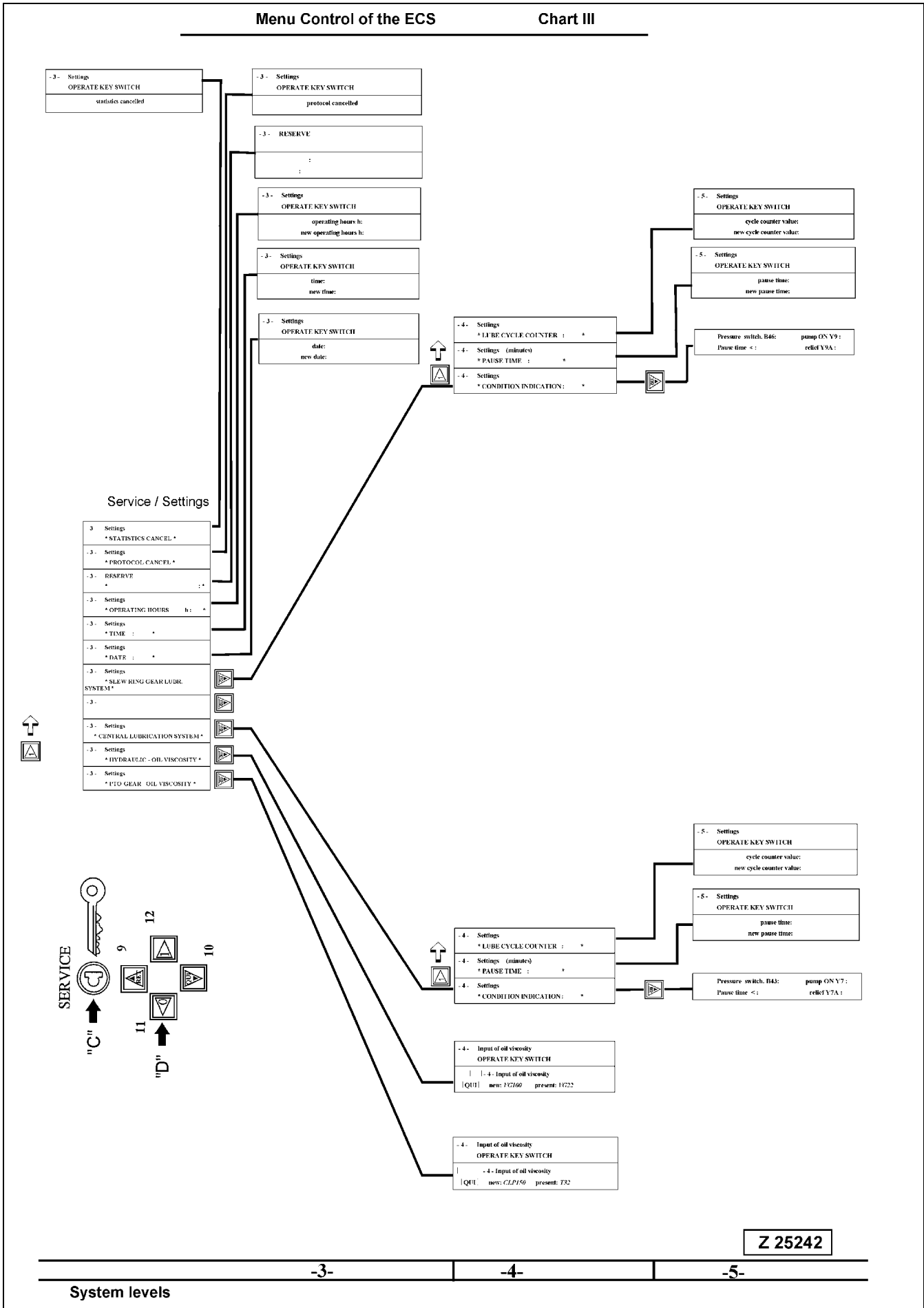
For display of the system pressures with the adjusted fan speed press key (9) the menu point Power Check \*FAN DRIVE OIL COOLER MIN / MAX\* in level 3 appears on the screen. Select menu point Power Check \*DISPLAY\* with key (D) then press key (10) the current system pressures are now displayed in level 4.

### Resetting oil cooler fan speed to normal condition

For resetting the fan speed to normal condition (Evaluation ON) switch off key switch (C) or go back to menu point \*SERVICE\* in level 1 by pressing the Return key (9) three times.

Menu Control of the ECS

Chart III



## Menu Control with Key Switch (C) and Key Group (D)

### Setting of Operational Data, menu item Service \*SETTINGS\*

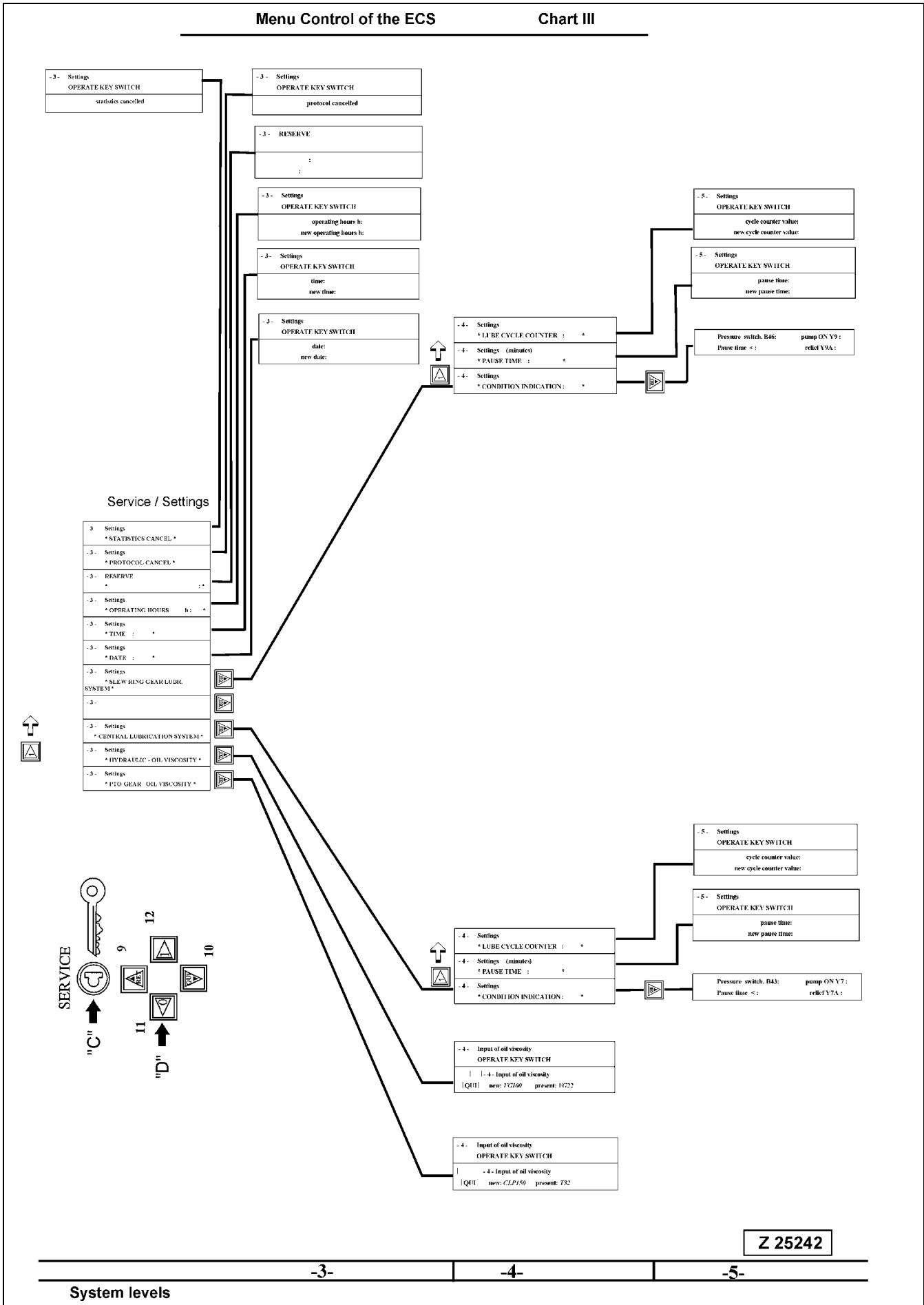
**Example:** Changing the pause time of the Central Lubrication System (on machines with factory installed lube systems only). Starting from the menu level -1-, \*SERVICE\* see menu control charts I and III (Z25242).

Proceed as follows:

1. Select menu level -1- by pressing "QUI" key (10) the starting menu item \*Truck counter reading:\* appears on the display, see chart I.  
Press key (12) three times, the main group \*SERVICE\* is displayed. Press key (10), level -2- with menu item \*LANGUAGE\* appears on the display.
2. Press key (12) three times, the menu point \*SETTINGS\* appears on the display.
3. Press key (10), \*PTO GEAR-OIL VISCOSITY\* in level 3, see chart III appears on the display.
4. Press key (12) two times, the item \*CENTRAL LUBRICATION SYSTEM\* is displayed.
5. Press key (10), level 4 with the starting menu item \*CONDITION INDICATION\* appears on the display.
6. Press key (12) once, the display changes to menu item \*PAUSE TIME\* with the information of the present \*PAUSE TIME (e.g.) 01:00\* appears on the display.
7. Press key (10) again, the display changes to level 5 with the information "Settings OPERATE KEY SWITCH".
8. Operate key switch (C), now the "pause time: 01:00"  
"new pause time: 01:00 "  
is displayed.
9. Use key (4) of the Text display keyboard to position the cursor below the numerical value that shall be changed.
10. Use key (2 and/or 3) "UP/DOWN" of the Text display keyboard for changing the numerical value.
11. Acknowledge the new setting by pressing key (1). The information on the display changes over to the introductory message page -0- or if a message is present to the respective message page.

Menu Control of the ECS

Chart III



Z 25242



## Menu Control with Key Switch (C) and Key Group (D)

### Manual actuation Mode of the Lubrication Systems with Service Key

The manual actuation mode is useful for testing the electrical and hydraulic functions of the lubrication systems. The pause time is reduced to 30 seconds and the holding time to 15 seconds permitting rapid sequences of lubrication cycles. Both lubrication systems can be set to the manual actuation mode.

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**▲ CAUTION**

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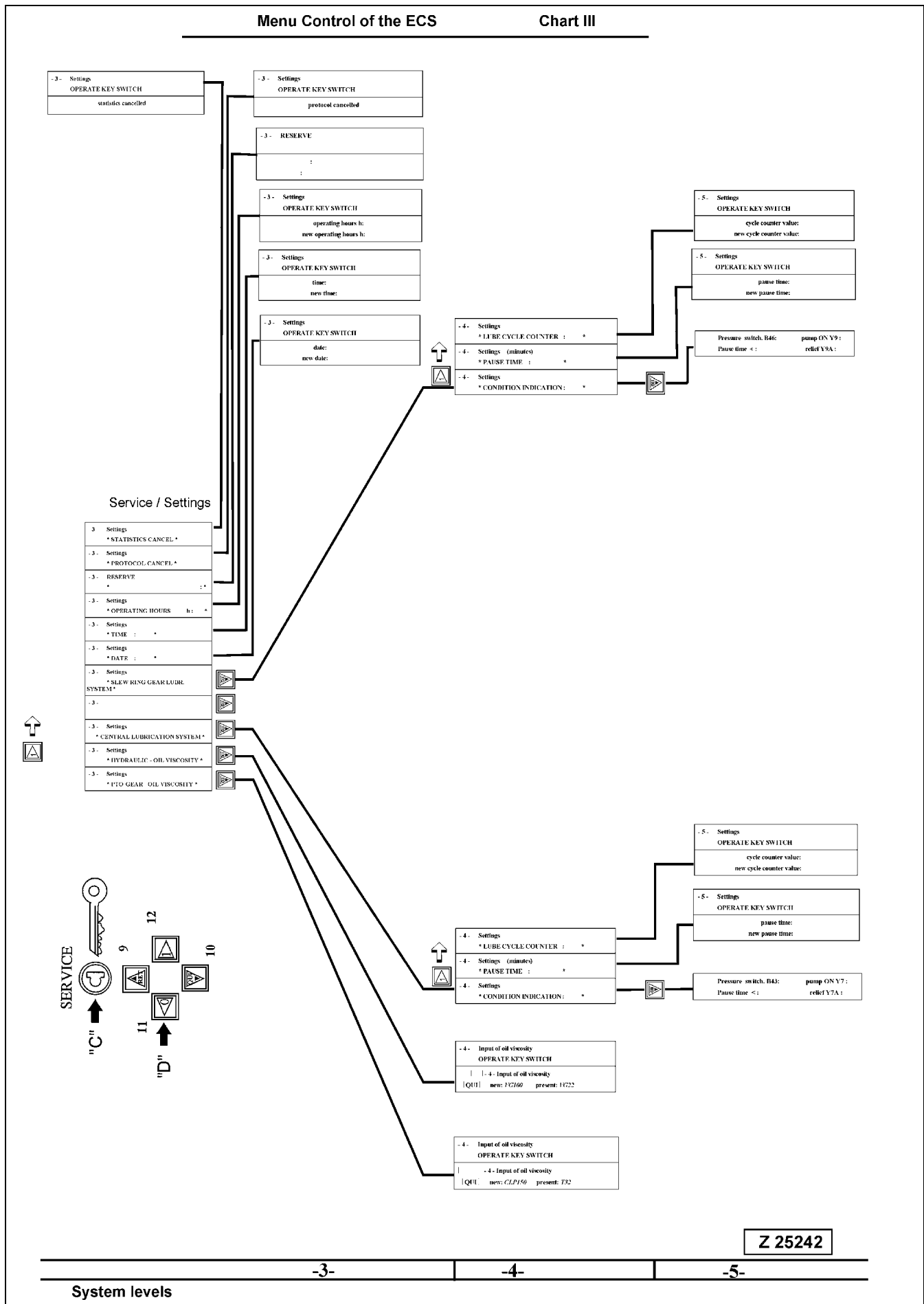
**In the manual actuation mode all monitoring functions of the system are made inoperative and, because of the very short pause and holding times grease will not reach all the lubrication points.**

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#### Carry out manual lubrication by using the service key

1. Insert key into service switch (C) and set to operating position.
2. Actuate the rotary switch on the instrument panel of that lubrication system which has to be tested. The message # SERVICE appears on the display. Up to ten repeated actuation of the switch are possible. The lubrication cycles are counted and displayed in the cycle counter window.
3. After finishing the manual lubrication remove service key (C). The system returns to the normal timer settings.



## Menu Control with Key Switch (C) and Key Group (D)

### Setting of Operational Data, menu item Service \*SETTINGS\*

#### Example: Changing the hydraulic oil viscosity grade

When changing the hydraulic oil, the viscosity grade of the new oil has to be entered in the appropriate "Service/Settings" group, if the viscosity of the new oil is different from that of the drained oil.

#### REMARK

The procedure up to the menu item \*PTO GEAR-OIL VISCOSITY\* is described on page 131 Changing pause time of the Central Lubrication System; item 1. to 3.

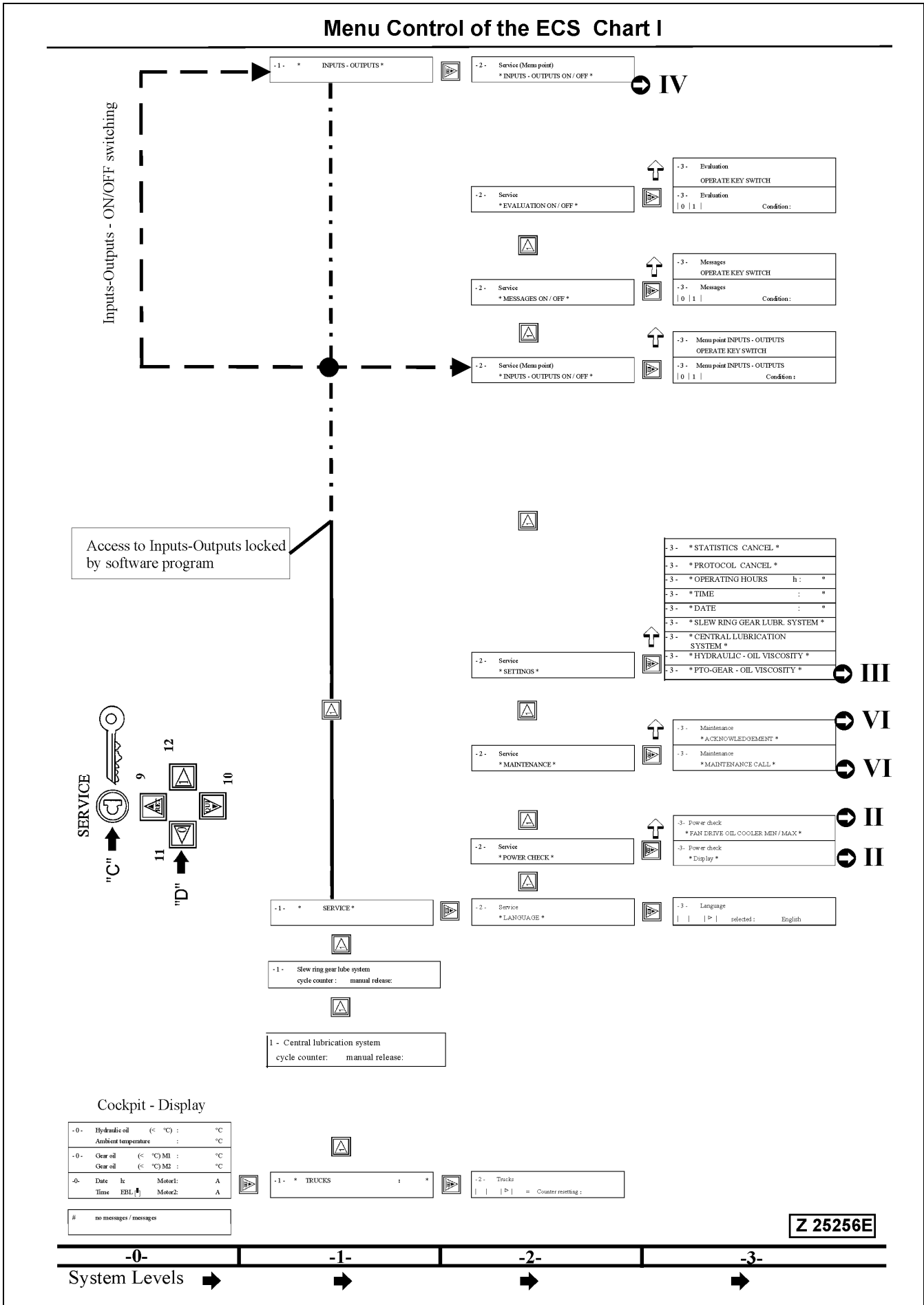
Starting from menu item \*PTO GEAR-OIL VISCOSITY\* in level -3- proceed as follows, see Menu Control Chart III.

1. Press key (12), the item \*HYDRAULIC-OIL VISCOSITY\* is displayed.
2. Press key (10), level -4- Input of viscosity with the information of the present oil viscosity grade appears on the display.
3. Press key (10) once more, the information "OPERATE KEY SWITCH" appears on the display.
4. Operate key switch (C).
5. "Input of oil viscosity" appears on the display. Under **present:** the used oil viscosity grade is indicated. Under **new:** all the viscosity grades available in the system are offered for selection. The example on Chart III shows changing the viscosity grade from **VG 22** to **VG 100**.
6. Press key (12) until in the field **new: VG 100** appears.
7. Press key (10), to acknowledge the new viscosity grade. On the display the information in the field **present:** changes to **VG 100**.

The procedure input of a new hydraulic oil viscosity grade is now finished. For returning to the standard display on level -0- press the key "RET" (9) four times.

#### REMARK

When a battery voltage fault has occurred, the operational data (oil viscosities, timer settings etc.) stored in the Programmable Logic Controller (PLC) can be lost and must be re-entered after the correct battery voltage has been re-established.



## Menu Control with Key Switch (C) and Key Group (D)

### Display of Menu Options

**Example:** Display of **INPUTS-OUTPUTS**, starting from basic display on level -0-, see Menu Control Charts I and IV.

The main group **\*INPUTS-OUTPUTS\*** is basically used for Testing procedures through authorized service staff and therefore locked during normal operation. Access to the **\*INPUTS-OUTPUTS\*** can be obtained in the main group **\*SERVICE\*** as described below.

Proceed as follows:

1. Press the "QUI" key (10), the menu level -1- **\*TRUCKS\*** appears on the display, see Chart I.
2. Press key (12) three times, the main group **\*SERVICE\*** appears on display.
3. Press key (10), the menu level -2- with the starting group **\*Language\*** appears on the display.
4. Press key (12) four times, the group **\*INPUTS-OUTPUTS ON/OFF\*** appears on the display.
5. Press key (10), the menu level -3- with Menu item **INPUTS-OUTPUTS Condition: 0 (OFF)** is displayed.
6. Press key (12), **\*OPERATE KEY SWITCH\*** appears on the display.
7. Operate key switch (C) "Condition: 0 (OFF)" appears on the display.
8. Press key (12) to change the condition from "0" to "1 (**ON**)" Now access to main group **\*INPUTS-OUTPUTS\*** is possible.
9. Press the "RET" key (9) two times for returning to the menu level -1-. The main group **\*SERVICE\*** appears on the display.
10. Press key (12), for display of the main group **"INPUTS-OUTPUTS"**.  
All menu levels and items within the main group **INPUTS-OUTPUTS** are now accessible by means of key group (D), refer to menu control charts on the following pages.

### Menu Control of the ECS Chart IV

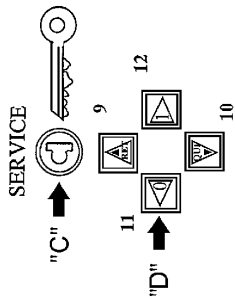
**NOTE:**  
 The designation codes of the units listed in the DIGITAL INPUTS table appear in numerical and then in alphabetical order and are of exemplary nature only. The unit designation and their sequence within the system levels may vary according to the implemented software. For the applying unit designations and their sequence within the system levels, refer to the separate Menu Control List in this section.

#### Inputs - Outputs / DIGITAL INPUTS

9K3 (E14.4):		9K4 (E14.5):
8S344 (E13.8):		9K1 (E14.1):
9K1ff (E14.2):		9K2 (E14.3):
8S82 (E13.4):		8S87 (E13.5):
8S90 (E13.6):		8S324 (E13.7):
8S31 (E12.8):		8S34 (E13.5):
8S44 (E13.2):		8S46 (E13.3):
8S24 (E12.4):		8S26 (E12.5):
8S27 (E12.6):		8S28 (E12.7):
8S7/8S8 (E12.2):		8S23 (E12.3):
8K89 (E8.7):		8K125 (E8.8):
8K200 (E12.1):		
8K74a (E8.3):		8K83 (E8.4):
8K84 (E8.5):		8K88 (E8.6):
8E31 (E7.7):		8F12 (E7.8):
8K70 (E8.1):		8K71ff (E8.2):
8D32/8K125 (E7.5):		8E30 (E7.6):
8B97.2 (E7.3):		8B343 (E7.4):
8B46 (E11.7):		8B48 (E11.8):
8B50 (E7.1):		8B97.1 (E7.2):
8B28.2 (E11.5):		8B43 (E11.6):
8B27.2 (E11.3):		8B28.1 (E11.4):
8B26 (E11.1):		8B27.1 (E11.2):
8B23.1 (E6.5):		8B23.2 (E6.6):
8B24 (E6.7):		8B25 (E6.8):
8B16 (E6.1):		8B17.1 (E6.2):
8B17.2 (E6.3):		8B22 (E6.4):
8B9 (E5.5):		8B10 (E5.6):
8B11 (E5.7):		8B12 (E5.8):
8B5 (E5.1):		8B6 (E5.2):
8B7 (E5.3):		8B8 (E5.4):
5K1 (E10.5):		6B1 (E10.6):
6B2 (E10.7):		8B4 (E10.8):
1U1 (E10.1):		4F16 (E10.2):
4F17 (E10.3):		4F18 (E10.4):
1S2.2 (E4.5):		1S3.1 (E4.6):
1S3.2 (E4.7):		1S5 (E4.8):
1K27 (E4.1):		1K30 (E4.2):
1S1 (E4.3):		1S2.1 (E4.4):
1K14.2 (E3.5):		1K15 (E3.6):
1K17 (E3.7):		1K18 (E3.8):
1K8.2 (E3.1):		1K10 (E3.2):
1K12 (E3.3):		1K14.1 (E3.4):
1K5.2 (E9.5):		1K6.1 (E9.6):
1K6.2 (E9.7):		1K8.1 (E9.8):
1K3.1 (E9.1):		1K3.2 (E9.2):
1K4 (E9.3):		1K5.1 (E9.4):
OS15 (E2.5):		1K1 (E2.6):
1K2.1 (E2.7):		1K2.2 (E2.8):
OS6 (E2.1):		OS7 (E2.2):
OS8 (E2.3.6):		OS12 (E2.4):

#### Inputs - Outputs ON

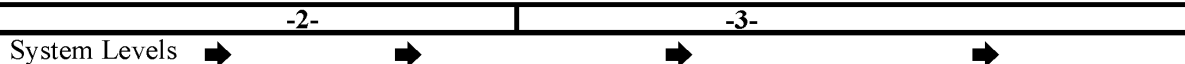
- 2 - Inputs - Outputs  
\* DIGITAL- OUTPUTS \*
- 2 - Inputs - Outputs  
\* DIGITAL- INPUTS \*
- 2 - Inputs - Outputs  
\* ANALOG-INPUTS \*



#### Inputs - Outputs / ANALOG INPUTS

B109	SLS Grease level	(EW3.2):	%
B108	CLS Grease level	(EW3.1):	%
B90	Ambient temp.	(EW1.4):	°C
B87C	Pump 3/7	(EW2.4):	bar
B87D	Pump 4/8	(EW14.1):	bar
B87A	Pump 1/5	(EW2.2):	bar
B87B	Pump 2/6	(EW2.3):	bar
B86	X2-Pressure	(EW2.1):	bar
B85-1	X1.1-Pressure	(EW13.3):	bar
B85-2	X1.2-Pressure	(EW13.4):	bar
B49.2	PTO - gear oil temperature M2	(EW1.3):	°C
B49.1	PTO - gear oil temperature M1	(EW1.2):	°C
B15	Hydraulic oil temperature	(EW1.1):	°C
A38.2	Motor current L1 M2	(EW13.2):	A
A38.1	Motor current L1 M1	(EW13.1):	A

**Z 25271E**



## Menu Control with Key Switch (C) and Key Group (D).

### Display of INPUTS-OUTPUTS

**Example:** Display of menu items in the group **\*ANALOG-INPUTS\***, starting from menu level -2-, see Menu Control Chart IV.

The following menu items shall be displayed:

- Hydraulic oil temperature
- X2 Pilot oil pressure.

Proceed as follows:

1. Starting from display level -2- Inputs-Outputs **\*ANALOG-INPUTS\***; see chart IV.
2. Press key (10), the starting menu item -Motor current L1 M1- in level 3 is displayed.
3. Press key (12) twice on the display appears the menu item "Hydraulic oil temperature" with the input designation (EW1.1): and for example 72°C (present oil temperature). The oil temperature sender unit with the designation "**B15**" is also shown on the display.
4. For display of the X2 pilot oil pressure, press key (12) four times, the following display appears:

**B86 X2 - Pressure (EW2.1): 35 bar**

Pressure may vary depending on operating condition.

5. For returning to the basic display press "RET" key (9) three times.

### NOTICE

**Some designations of electrical units and their sequence within the DIGITAL INPUTS group on chart IV may not comply with the ECS version installed in your machine. However, the method of scrolling through the menu levels and input / output groups applies to all versions of the ECS system. Refer to the menu control list on page 150 for the applying menu version of your machine. All electrical units installed in your machine are listed up on the Table of Inputs and Outputs. This table is attached to the electrical diagram.**

### Menu Control of the ECS Chart IV

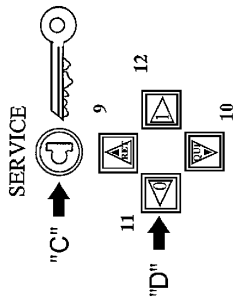
**NOTE:**  
 The designation codes of the units listed in the DIGITAL INPUTS table appear in numerical and then in alphabetical order and are of exemplary nature only. The unit designation and their sequence within the system levels may vary according to the implemented software. For the applying unit designations and their sequence within the system levels, refer to the separate Menu Control List in this section.

#### Inputs - Outputs / DIGITAL INPUTS

9K3 (E14.4):		9K4 (E14.5):
8S344 (E13.8):		9K1 (E14.1):
9K1ff (E14.2):		9K2 (E14.3):
8S82 (E13.4):		8S87 (E13.5):
8S90 (E13.6):		8S324 (E13.7):
8S31 (E12.8):		8S34 (E13.5):
8S44 (E13.2):		8S46 (E13.3):
8S24 (E12.4):		8S26 (E12.5):
8S27 (E12.6):		8S28 (E12.7):
8S7/8S8 (E12.2):		8S23 (E12.3):
8K89 (E8.7):		8K125 (E8.8):
8K200 (E12.1):		
8K74a (E8.3):		8K83 (E8.4):
8K84 (E8.5):		8K88 (E8.6):
8E31 (E7.7):		8F12 (E7.8):
8K70 (E8.1):		8K71ff (E8.2):
8D32/8K125 (E7.5):		8E30 (E7.6):
8B97.2 (E7.3):		8B343 (E7.4):
8B46 (E11.7):		8B48 (E11.8):
8B50 (E7.1):		8B97.1 (E7.2):
8B28.2 (E11.5):		8B43 (E11.6):
8B27.2 (E11.3):		8B28.1 (E11.4):
8B26 (E11.1):		8B27.1 (E11.2):
8B23.1 (E6.5):		8B23.2 (E6.6):
8B24 (E6.7):		8B25 (E6.8):
8B16 (E6.1):		8B17.1 (E6.2):
8B17.2 (E6.3):		8B22 (E6.4):
8B9 (E5.5):		8B10 (E5.6):
8B11 (E5.7):		8B12 (E5.8):
8B5 (E5.1):		8B6 (E5.2):
8B7 (E5.3):		8B8 (E5.4):
5K1 (E10.5):		6B1 (E10.6):
6B2 (E10.7):		8B4 (E10.8):
1U1 (E10.1):		4F16 (E10.2):
4F17 (E10.3):		4F18 (E10.4):
1S2.2 (E4.5):		1S3.1 (E4.6):
1S3.2 (E4.7):		1S5 (E4.8):
1K27 (E4.1):		1K30 (E4.2):
1S1 (E4.3):		1S2.1 (E4.4):
1K14.2 (E3.5):		1K15 (E3.6):
1K17 (E3.7):		1K18 (E3.8):
1K8.2 (E3.1):		1K10 (E3.2):
1K12 (E3.3):		1K14.1 (E3.4):
1K5.2 (E9.5):		1K6.1 (E9.6):
1K6.2 (E9.7):		1K8.1 (E9.8):
1K3.1 (E9.1):		1K3.2 (E9.2):
1K4 (E9.3):		1K5.1 (E9.4):
OS15 (E2.5):		1K1 (E2.6):
1K2.1 (E2.7):		1K2.2 (E2.8):
OS6 (E2.1):		OS7 (E2.2):
OS8 (E2.3.6):		OS12 (E2.4):

#### Inputs - Outputs ON

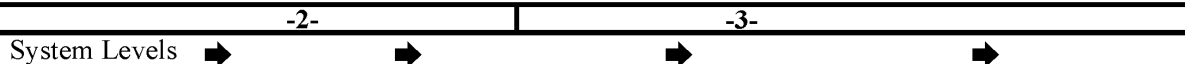
- 2 - Inputs - Outputs  
\* DIGITAL- OUTPUTS \*
- 2 - Inputs - Outputs  
\* DIGITAL- INPUTS \*
- 2 - Inputs - Outputs  
\* ANALOG-INPUTS \*



#### Inputs - Outputs / ANALOG INPUTS

B109	SLS Grease level	(EW3.2):	%
B108	CLS Grease level	(EW3.1):	%
B90	Ambient temp.	(EW1.4):	°C
B87C	Pump 3/7	(EW2.4):	bar
B87D	Pump 4/8	(EW14.1):	bar
B87A	Pump 1/5	(EW2.2):	bar
B87B	Pump 2/6	(EW2.3):	bar
B86	X2-Pressure	(EW2.1):	bar
B85-1	X1.1-Pressure	(EW13.3):	bar
B85-2	X1.2-Pressure	(EW13.4):	bar
B49.2	PTO - gear oil temperature M2	(EW1.3):	°C
B49.1	PTO - gear oil temperature M1	(EW1.2):	°C
B15	Hydraulic oil temperature	(EW1.1):	°C
A38.2	Motor current L1 M2	(EW13.2):	A
A38.1	Motor current L1 M1	(EW13.1):	A

**Z 25271E**





## Menu Control with Key Switch (C) and Key Group (D).

**Example:** Display of menu items in the group **\*DIGITAL-INPUTS\***, starting from menu level -2-, \*ANALOG-INPUTS see Menu Control Chart IV.

The following menu items shall be displayed:

- Condition of differential pressure switch "B7-1" of high pressure filter # 3.
- Condition of differential pressure switch "B22-1" of the pump regulation oil filter 1.

Proceed as follows:

1. Starting from level-2- \*ANALOG-INPUTS\* press key (12) once, the display changes to \*DIGITAL-INPUTS\*:
2. Press "QUI" key (10) the starting menu item "0S33A - 0S33D" (Emergency shut-down switches) in level -3- appears on the display.
3. Press key (12) eleven times for display of the Condition (0 or 1) of differential pressure switch "B7-1" of High Pressure Filter # 3. The following display appears on the screen:

B5-2 (E5.5):	1	B6-1 (E5.6):	1
B6-2 (E5.7):	1	<b>B7-1 (E5.8):</b>	<b>1 *)</b>

\*) In order to know whether the displayed condition **1** is correct or not correct, it is necessary to check the condition on hand of the Electrical Diagram and in connection with the ECS Flow Chart. Depending on the operating status of the machine the displayed conditions can be 1 or 0.

For quick reference of the unit codes (B7.1, B26 etc.) to their unit names in plain text, refer to the "Table of Inputs and Outputs" which is part of the Electrical Diagram.

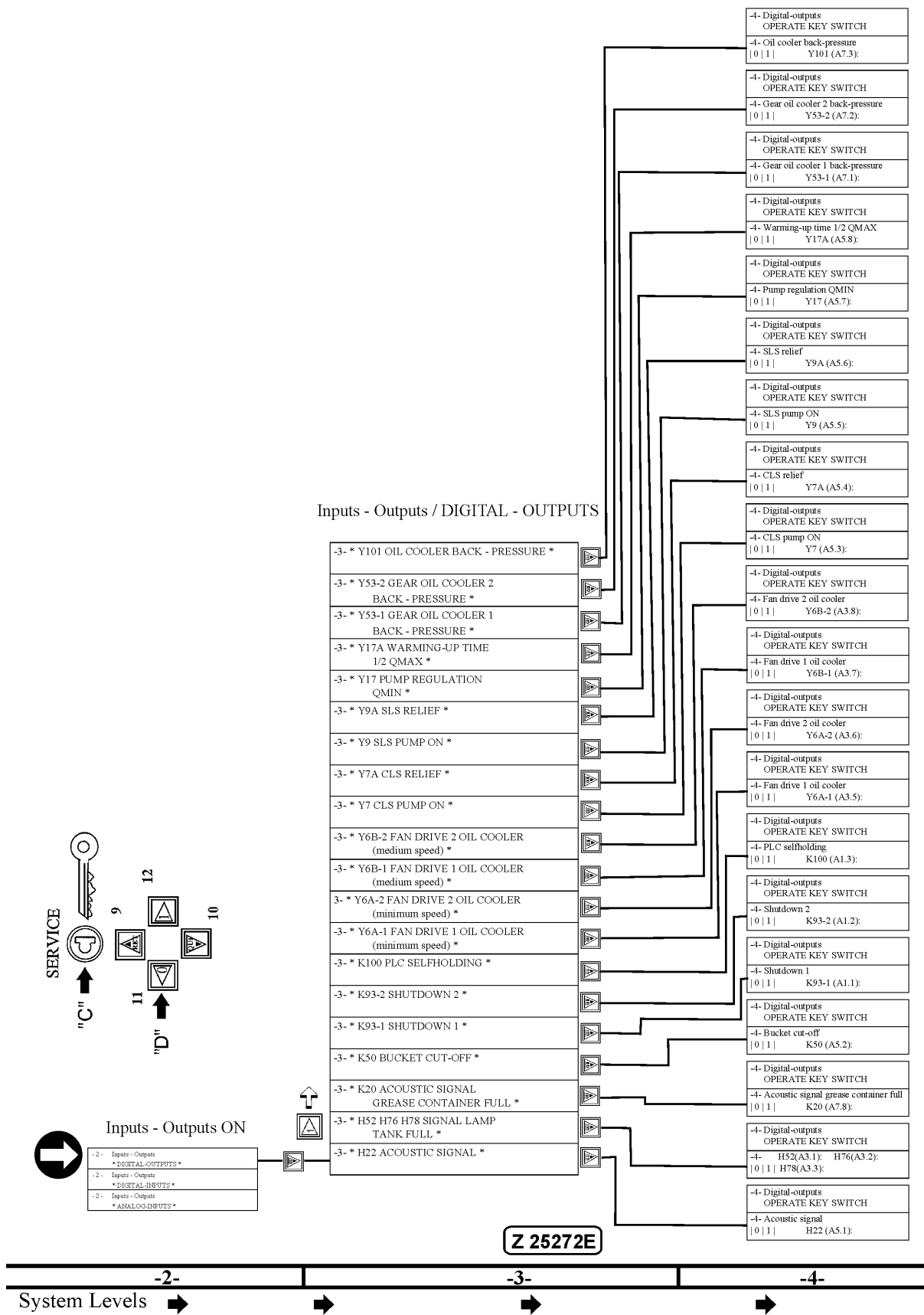
4. For displaying the condition (0 or 1) of pressure switch "B22-1" for pump regulation oil filter 1, press key (12) three times. The following display appears on the screen:

<b>B22-1 (E11.1):</b>	<b>0*)</b>	B22-2 (E11.2):	0
B24 (E11.3):	0	B25 (E11.4):	0

\*) See explanation above.

5. By pressing key (12) all further items of the DIGITAL-INPUTS group can be called up. For going in the opposite direction of the menu items use key (11).
6. For returning to the basic display press "RET" key (9) three times.

### Menu Control of the ECS Chart V



## Menu Control with Switch (C) and Key Group (D)

### Display of DIGITAL-OUTPUTS

**Example:** You want to display the condition of the **Pump Regulation Valve (Qmin) Y17** in the group **\*DIGITAL-OUTPUTS\***, starting from menu level -2-, see Control Chart V.

Proceed as follows:

1. Starting from level -2- **\*ANALOG-INPUTS\*** press key (12) twice, the display changes to **\*DIGITAL-OUTPUTS\***:
2. Press "QUI" key (10) the starting menu item "H22 ACOUSTIC SIGNAL" in level -3- appears on the display, see chart V.
3. Press key (12) until the menu item **\*Y17 PUMP REGULATION QMIN\*** is displayed.
4. Press key (10). Depending on the Operating Condition of the hydraulic system, one of the two following displays (A or B) in level -4- appears on the screen.

**A – Display with main pumps in Qmin position, pause switching active and hydraulic oil cooler fans not running**

```
-4-   Pump regulation Qmin
| 0 | 1 | Y17 ( A5.7):  1
```

**B – Display with hydraulic oil at operating temperature, hydraulic oil cooler fans running and pause switching inactive**

```
-4- Pump regulation Qmin
| 0 | 1 | Y17 ( A5.7):  0
```

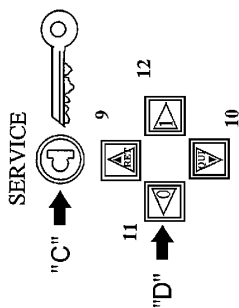
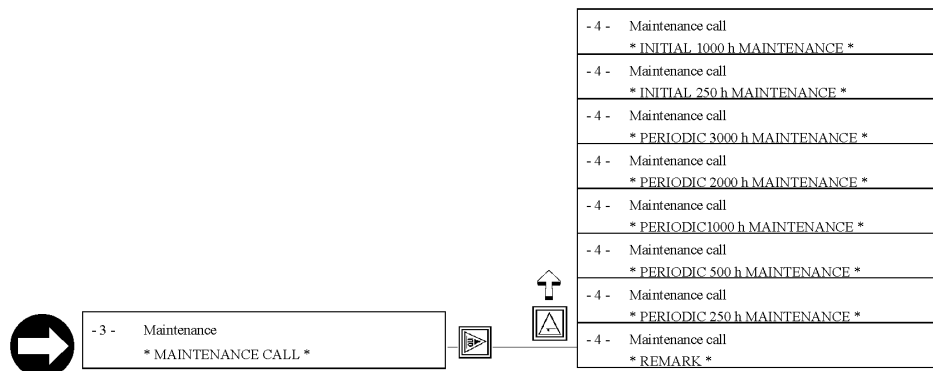
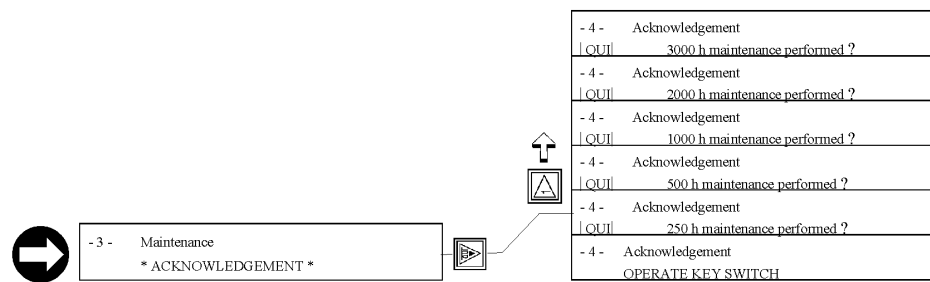
5. For display of further solenoid valve or relay settings go back to level -3- by pressing "RET" key (9). Use key (12 or 11) to select those items you want to be displayed. Press key (10) for display of settings in level -4-.
6. For returning to the basic display in level -0- press key (9) four times.

### ▲ CAUTION

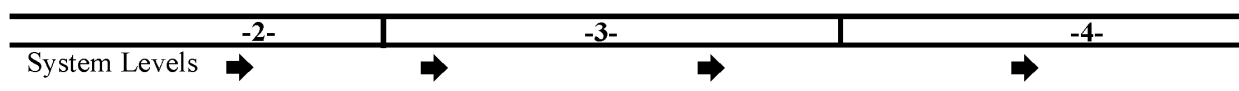
**DO NOT change any settings in the INPUT-OUTPUT groups before having the permission of authorized Service Staff.**

### Menu Control of the ECS Chart VI

#### Service MAINTENANCE



Z 23068



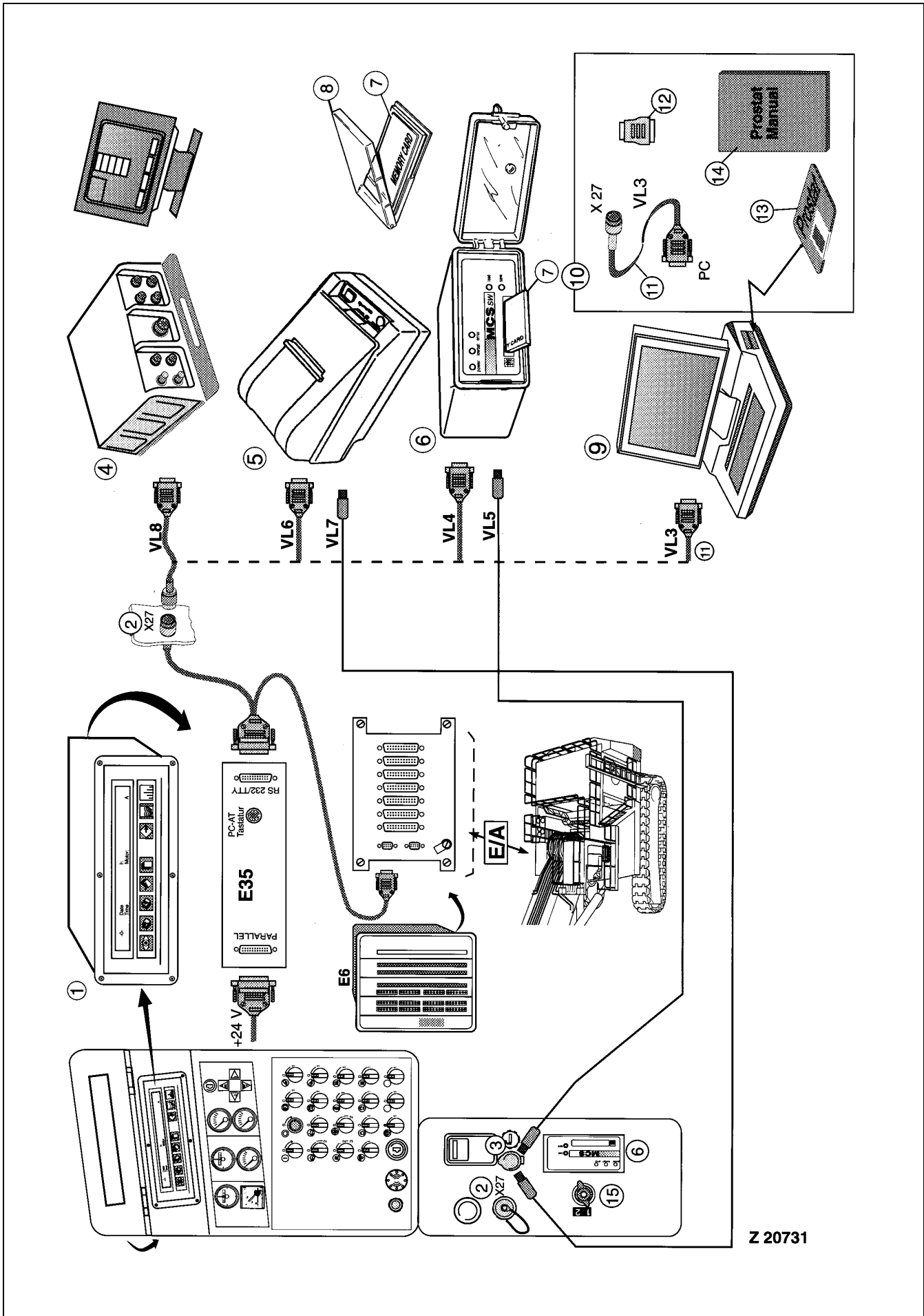
### **Menu Control with Switch (C) and Key Group (D).**

Acknowledgement of carried out Maintenance according to displayed MAINTENANCE CALL, see Menu Control Chart I and VI.

Example:

The Maintenance call **\*INITIAL 250h MAINTENANCE\*** is displayed. Inform the Service Staff for performing the initial 250h maintenance according to the Maintenance Section. Press key (9) four times for returning to the basic display. After the initial 250h maintenance has been carried out, acknowledge the MAINTENANCE CALL as follows:

1. Select menu item Maintenance **\*ACKNOWLEDGEMENT\*** level -3-; see Menu Control Chart I and VI.
2. Press key (10), the menu item "Acknowledgement 250h maintenance performed ?" is displayed, see Menu Control Chart VI, level -4-.
3. Press "QUI" (10), the menu item "Acknowledgement OPERATE KEY SWITCH" appears on the display.
4. Operate key switch (C), the menu item "Acknowledgement 250h maintenance performed ?" is displayed.
5. Press "QUI" (10) to acknowledge the performed maintenance.
6. Press key (9) four times for returning to the basic display.



Z 20731

## Data Transfer from Protocol and Statistics Memory to various Downloading Equipment

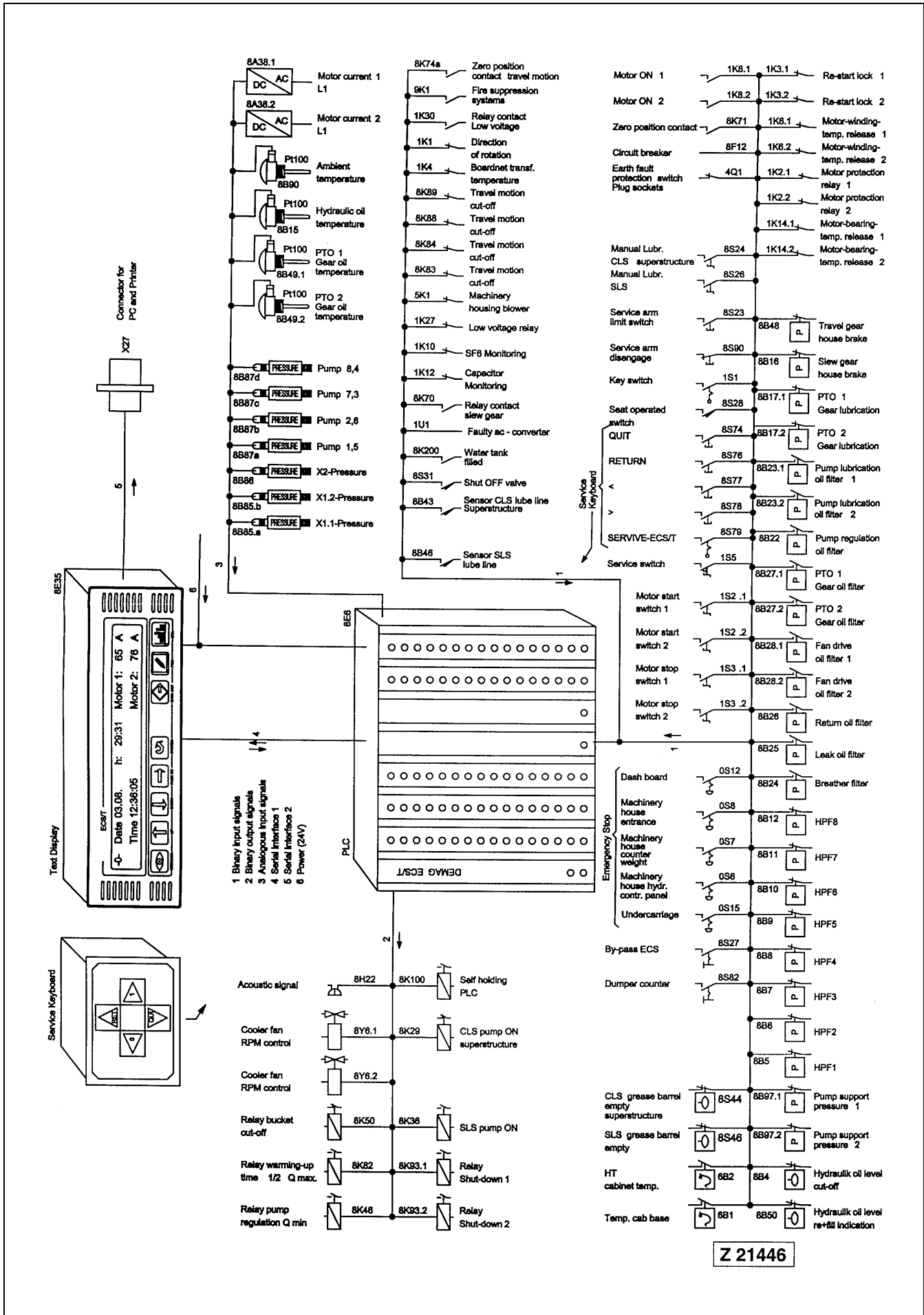
The illustration (Z 20731) shows typical arrangement of several downloading equipment connected to the text display interface plug socket (X27).

### Legend for illust. (Z 20731)

- (1) Text display unit on instrument panel (E35)
- (2) Plug socket (serial interface X27) for connecting data transfer cable to units (4, 5, 6 or 9)
- (3) Plug socket for connecting current supply cable to units (5 or 6)
- (4) MODULAR MINING field computer system "MMS"
- (5) Printer
- (6) Memory Card System "MCS". As a special equipment, this system can also be installed in the instrument panel ex works.
- (7) Memory card
- (8) Protective box for memory card
- (9) Laptop or PC
- (10) Soft- and hardware package for PROSTAT operation program
- (11) Data transfer cable (VL3)
- (12) Adapter for 25 pin interface on PC or laptop
- (13) 3,5" disk PROSTAT software
- (14) Instruction manual PROSTAT (PARTS & SERVICE NEWS No. AH02512)
- (15) Change-over switch for connecting the internal output channel to plug socket (2) or to the onboard MCS system (6) if so equipped
- (E6) Programmable Logic Controller "PLC"
- (VL4) Data transfer cable to Memory card system (6)
- (VL5) Current supply cable to Memory Card System (6)
- (VL6) Data transfer cable to printer (5)
- (VL7) Current supply cable to printer (5)
- (VL8) Data transfer cable to field computer system (4)

### REMARK

The downloading units shown in illust. (Z 20731) are special equipment.  
More information to these units on request.





## **Graphical Diagram**

see illustration Z21446

This illustration shows the components and the signal flow of a typical ECS-System for Shovels powered by two electric motors.

## **Overall View of Menu Control**

All items of the Menu Control are listed up on page 150 in sequence of their Menu Levels.

## **Overall View of Fault Messages and Information Messages**

All fault messages and information messages are listed up on page 167 in sequence of their message page Numbers.

### 3.4.5 MENU CONTROL LIST

**Level 0: Cockpit - Display**

# no messages / messages
--------------------------

-0- Date h: M1: *A
Time EBL M2: *A
- 0 - Gear oil (< °C) M1 : °C
- 0 - Gear oil (< °C) M2 : °C
- 0 - Hydraulic oil (< °C) : °C
- 0 - Ambient temperature : °C : V

**Level 1:**

- 1 - * TRUCKS : *
- 1 - Central lubrication system cycle counter value : manual release :
- 1 - Swing ring gear lube system cycle counter value : manual release :
- 1 - * SERVICE *
- 1 - * INPUTS - OUTPUTS *

**Level 2: TRUCKS**

- 2 - Trucks         = Counter resetting :
---

**Level 2: Service**

- 2 - Service * LANGUAGE *
- 2 - Service * POWER CHECK *
- 2 - Service * MAINTENANCE *
- 2 - Service * SETTINGS *
- 2 - Service (Menu item) * INPUTS - OUTPUTS ON / OFF *
- 2 - Service * MESSAGES ON / OFF *
- 2 - Service * EVALUATION ON / OFF *

**Level 3: Service / LANGUAGE**

- 3 - Language         selected : English
--

**Level 3: Service / POWER CHECK**

- 3 - Power check * DISPLAY *
- 3 - Power check * FAN DRIVE OIL COOLER MIN / MAX *

**Level 4: Service / Power check / DISPLAY**

- 4 - M1: A (P1/6: P2/5: ) bar       (X1.1: P3: P4: ) bar
- 4 - M2: A (P1/6: P2/5: ) bar       (X1.2: P3: P4: ) bar

**Level 4: Service / Power check / FAN DRIVE OIL COOLER,  
minimum / maximum speed**

- 4 - Fan drive oil cooler min / max   OPERATE KEY SWITCH
- 4 - min / max   Y6A-1:   Y6B-1:   0   1   Y6A-2:   Y6B-2:

**Level 3: Service / MAINTENANCE**

- 3 - Maintenance * MAINTENANCE CALL *
- 3 - Maintenance * ACKNOWLEDGEMENT *

**Level 4: Service / Maintenance / MAINTENANCE CALL**

- 4 - Maintenance call * REMARK *
- 4 - Maintenance call * PERIODIC 250 h MAINTENANCE *
- 4 - Maintenance call * PERIODIC 500 h MAINTENANCE *
- 4 - Maintenance call * PERIODIC 1000 h MAINTENANCE *
- 4 - Maintenance call * PERIODIC 2000 h MAINTENANCE *
- 4 - Maintenance call * PERIODIC 3000 h MAINTENANCE *
- 4 - Maintenance call * INITIAL 250 h MAINTENANCE *
- 4 - Maintenance call * INITIAL 1000 h MAINTENANCE *

**Level 4: Service / Maintenance / ACKNOWLEDGEMENT**

- 4 - Acknowledgement OPERATE KEY SWITCH
- 4 - Acknowledgement  QUI  250 h maintenance performed ?
- 4 - Acknowledgement  QUI  500 h maintenance performed ?
- 4 - Acknowledgement  QUI  1000 h maintenance performed ?
- 4 - Acknowledgement  QUI  2000 h maintenance performed ?
- 4 - Acknowledgement  QUI  3000 h maintenance performed ?

**Level 3: Service / SETTINGS**

- 3 - Settings * PTO-GEAR - OIL VISCOSITY *
- 3 - Settings * HYDRAULIC - OIL VISCOSITY *
- 3 - Settings * CENTRAL LUBRICATION SYSTEM *
- 3 - Settings * SWING RING GEAR LUBE SYSTEM *
- 3 - Settings * DATE : *
- 3 - Settings * TIME : *
- 3 - Settings * OPERATING HOURS h : *
- 3 - Settings * PROTOCOL CANCEL *
- 3 - Settings * STATISTICS CANCEL *

**Level 4: Service / Settings / PTO-GEAR - OIL VISCOSITY**

- 4 - Input of oil viscosity OPERATE KEY SWITCH
- 4 - Input of oil viscosity    QUI new: present:

**Level 4: Service / Settings / HYDRAULIC - OIL VISCOSITY**

- 4 - Input of oil viscosity OPERATE KEY SWITCH
- 4 - Input of oil viscosity    QUI new: present:

**Level 4: Service / Settings / CENTRAL LUBRICATION SYSTEM (CLS)**

- 4 - Settings * CONDITION INDICATION *
- 4 - Settings (minutes) * PAUSE TIME : *
- 4 - Settings * LUBE CYCLE COUNTER : *

**Level 5: Service / Settings / CLS / CONDITION INDICATION**

Pressure switch B43: pump ON Y7 : Pause time < : relief Y7A
--

**Level 5: Service / Settings / CLS / PAUSE TIME**

- 5 - Settings OPERATE KEY SWITCH
pause time: new pause time:

**Level 5: Service / Settings / CLS / LUBE CYCLE COUNTER**

- 5 - Settings OPERATE KEY SWITCH
cycle counter value: new cycle counter value:

**Level 4: Service / Settings / SWING RING GEAR LUBE SYSTEM (SLS)**

- 4 - Settings * CONDITION INDICATION *
- 4 - Settings (minutes) * PAUSE TIME : *
- 4 - Settings * LUBE CYCLE COUNTER : *

**Level 5: Service / Settings / SLS / CONDITION INDICATION**

Pressure switch B46 : pump ON Y9 : Pause time < : relief Y9A
---

**Level 5: Service / Settings / SLS / PAUSE TIME**

- 5 - Settings OPERATE KEY SWITCH
pause time: new pause time:

**Level 5: Service / Settings / SLS / LUBE CYCLE COUNTER**

- 5 - Settings OPERATE KEY SWITCH
cycle counter value: new cycle counter value:

**Level 3: Service / Settings / DATE**

- 3 - Settings OPERATE KEY SWITCH
date: new date:

**Level 3: Service / Settings / TIME**

- 3 - Settings OPERATE KEY SWITCH
time: new time:

**Level 3: Service / Settings / OPERATING HOURS**

- 3 - Settings OPERATE KEY SWITCH
operating hours h: new operating hours h:

**Level 3: Service / Settings / PROTOCOL**

- 3 - Settings OPERATE KEY SWITCH
protocol cancelled:

**Level 3: Service / Settings / STATISTICS**

- 3 - Settings OPERATE KEY SWITCH
statistics cancelled

**Level 3: Service / (Menu item) INPUTS - OUTPUTS ON / OFF**

- 3 - Menu item INPUTS - OUTPUTS OPERATE KEY SWITCH
- 3 - Menu item INPUTS - OUTPUTS   0   1   Condition :



**Level 3: Service / MESSAGES ON / OFF**

- 3 - Messages OPERATE KEY SWITCH
- 3 - Messages   0   1   Condition :

**Level 3: Service / EVALUATION ON / OFF**

- 3 - Evaluation OPERATE KEY SWITCH
- 3 - Evaluation   0   1   Condition :

**Level 2: Inputs - Outputs**

- 2 - Inputs - Outputs * ANALOG-INPUTS *
- 2 - Inputs - Outputs * DIGITAL-INPUTS *
- 2 - Inputs - Outputs * DIGITAL-OUTPUTS *

**Level 3: Inputs - Outputs / ANALOG-INPUTS**

A38-1 Motor current L1 M1 (EW13.1): A
A38-2 Motor current L1 M2 (EW13.2): A
B15 Hydraulic oil temperature (EW1.1): °C
B49-1 PTO - gear oil temperature M1 (EW1.2): °C
B49-2 PTO - gear oil temperature M2   (EW1.3): °C
B85-1 X1.1-Pressure (EW13.3): bar
B85-2 X1.2-Pressure (EW13.4): bar B86 X2 -Pressure (EW2.1): bar
B87A Pump 1/6 (EW2.2): bar  B87B Pump 2/5 (EW2.3): bar
B87C Pump 3 (EW2.4): bar B87D Pump 4 (EW14.1): bar
B90 Ambient temperature (EW1.4): °C
B108 CLS grease level (EW3.1): % B109 SLS grease level (EW3.2): %

**Level 3: Inputs - Outputs / DIGITAL-INPUTS**

0S15 (E2.7): 0S33B (E9.1):	0S33A (E2.8): 0S33C (E9.2):
0S33D (E9.3): 0S54 (E9.5):	0S36 (E9.4): 1K1 (E9.6):
1K2-1 (E3.3): 1K3-1 (E3.1):	1K2-2 (E9.8): 1K3-2 (E3.2):
1K4 (E9.7): 1K6-2 (E2.2):	1K6-1 (E2.1): 1K8-1 (E3.4):
1K8-2 (E3.5): 1K12 (E3.7):	1K10 (E3.6): 1K14-1 (E2.3):
1K14-2 (E2.4):	1K15 (E3.8):
1K27 (E4.3): 1S1 (E4.5):	1K30 (E4.4): 1S4-1 (E4.6):
1S4-2 (E4.7): 1S5-2 (E10.1):	1S5-1 (E4.8): 1S58 (E10.2):
1U1 (E10.3): 6B1 (E10.5):	6B2 (E10.6): 9K1/9K3 (E10.7):
9K3 (E5.1): B4 (E5.3):	9K4 (E5.2): B5-1 (E5.4):
B5-2 (E5.5): B6-2 (E9.5):	B6-1 (E5.6): B7-1 (E5.8):
B7-2 (E6.1): B8-2 (E6.3):	B8-1 (E6.2): B16 (E6.6):
B17-1 (E6.7): B22 (E11.1):	B17-2 (E6.8): B24 (E11.3):
B25 (E11.4): B27-1(E11.6):	B26 (E11.5): B27-2 (E11.7):
B28-1(E11.8):	B28-2 (E7.1):
B42 (cool) (E7.2):	B42 (warm) (E7.3):
B43 (E7.4): B48 (E7.6):	B46 (E7.5): B50 (E7.7):
B97-1 (E7.8): B165 (E14.1):	B97-2 (E8.1): D32 (E8.3):
E19.ge (E14.5):	E20.ge (E14.2):
E20.rs (E14.3):	E20.ws (E14.4):
E23.ge (E14.6):	E24.ge (E14.7):
E32.32 (E8.4):	F13 (E8.5):

## Level 3: Inputs - Outputs / DIGITAL-INPUTS

K73 (E8.6): K125 (E8.8):	K76 (E8.7): K151 (E12.1):
K177 (E12.2): K179 (E12.4):	K178 (E12.3): K180 (E12.5):
K195 (E7.8): S10 (E8.2):	S7 (E12.6):
S11.1 (E8.1): S11.3 (E13.8):	S11.2 (E13.7): S23 (E12.7):
S24 (E12.8):	S26 (E13.1):
S27 (E13.2):	S28 (E13.3):
S31 (E13.4):	
S34 (E13.5):	S43 (E13.6):
S59 (E6.4):	S82 (E1.6):
S85 (E4.2):	S86 (E4.1):
S155 Qmax (E2.6):	S155 Qmin (E2.5):

## Level 3: Inputs - Outputs / DIGITAL-OUTPUTS

-3- * H22 ACOUSTIC SIGNAL *
-3- * H52 H76 H78 SIGNAL LAMP TANK FULL *
-3- * K20 ACOUSTIC SIGNAL GREASE CONTAINER FULL *
-3- * K50 RELAY BUCKET CUT-OFF *
-3- * K93-1 RELAY SHUTDOWN 1 *
-3- * K93-2 RELAY SHUTDOWN 2 *

**Level 3: Inputs - Outputs / DIGITAL-OUTPUTS**

-3- * K100 RELAY PLC SELFHOLDING *
-3- * K197 LOWER WINDSCREEN WIPER SLOW *
-3- * K198 LOWER WINDSCREEN WIPER FAST *
-3- * K199 UPPER WINDSCREEN WIPER SLOW *
-3- * K200 UPPER WINDSCREEN WIPER FAST *
-3- * Y6A-1 VALVE FAN DRIVE 1 OIL COOLER (minimum speed)*
-3- * Y6A-2 VALVE FAN DRIVE 2 OIL COOLER (minimum speed)*
-3- * Y6B-1 VALVE FAN DRIVE 1 OIL COOLER (medium speed) *
-3- * Y6B-2 VALVE FAN DRIVE 2 OIL COOLER (medium speed) *
-3- * Y7 VALVE CLS PUMP ON *
-3- * Y7A VALVE CLS RELIEF *
-3- * Y9 VALVE SLS PUMP ON *
-3- * Y9A VALVE SLS RELIEF *
-3- * Y17 VALVE PUMP REGULATION QMIN *
-3- * Y17A VALVE WARMING-UP TIME 1/2 QMAX *
-3- * Y53-1 GEAR OIL COOLER 1 BACK - PRESSURE *
-3- * Y53-2 GEAR OIL COOLER 2 BACK - PRESSURE *
-3- * Y101 VALVE OIL COOLER BACK - PRESSURE *

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ H22 ACOUSTIC SIGNAL**

-4- Output signals   OPERATE KEY SWITCH
-4- Acoustic signal   0   1   H22 (A5.1):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ H52 H76 H78 SIGNAL LAMP TANK FULL**

-4- Output signals   OPERATE KEY SWITCH
-4- H52 (A3.1): H76 (A3.2):   0   1   H78 (A3.3): :

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ K20 ACOUSTIC SIGNAL GREASE CONTAINER FULL**

-4- Output signals   OPERATE KEY SWITCH
-4- Relay acoustic signal grease container full   0   1   K20 (A7.8):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ K50 RELAY BUCKET CUT-OFF**

-4- Output signals   OPERATE KEY SWITCH
-4- Relay bucket cut-off   0   1   K50 (A5.2):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ K93-1 RELAY SHUTDOWN 1**

-4- Output signals   OPERATE KEY SWITCH
-4- Relay shutdown 1   0   1   K93-1 (A1.1):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ K93-2 RELAY SHUTDOWN 2**

-4- Output signals   OPERATE KEY SWITCH
-4- Relay shutdown 2   0   1   K93-2 (A1.2):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ K100 PLC SELFHOLDING**

-4- Output signals   OPERATE KEY SWITCH
-4- Relay PLC selfholding   0   1   K100 (A1.3):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ K197 RELAY LOWER WINDSCREEN WIPER SLOW**

-4- Output signals   OPERATE KEY SWITCH
-4- Relay Lower windscreen wiper slow   0   1   K197 (A3.4):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ K198 RELAY LOWER WINDSCREEN WIPER FAST**

-4- Output signals   OPERATE KEY SWITCH
-4- Relay Lower windscreen wiper fast   0   1   K198 (A3.8):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ K199 RELAY UPPER WINDSCREEN WIPER SLOW**

-4- Output signals   OPERATE KEY SWITCH
-4- Relay Upper windscreen wiper slow   0   1   K199 (A13.6):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS**  
**K200 RELAY UPPER WINDSCREEN WIPER FAST**

-4- Output signals   OPERATE KEY SWITCH
-4- Relay Upper windscreen wiper fast   0   1   K200 (A13.7):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS**  
**/ Y6A-1 VALVE FAN DRIVE 1 OIL COOLER**  
**(minimum speed)**

-4- Output signals   OPERATE KEY SWITCH
-4- Valve fan drive 1 oil cooler   0   1   Y6A-1 (A3.5):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS**  
**/ Y6A-2 VALVE FAN DRIVE 2 OIL COOLER**  
**(minimum speed)**

-4- Output signals   OPERATE KEY SWITCH
-4- Valve fan drive 2 oil cooler   0   1   Y6A-2 (A3.6):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS**  
**/ Y6B-1 VALVE FAN DRIVE 1 OIL COOLER**  
**(medium speed)**

-4- Output signals   OPERATE KEY SWITCH
-4- Valve fan drive 1 oil cooler   0   1   Y6B-1 (A3.7):



**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ Y6B-2 VALVE FAN DRIVE 2 OIL COOLER  
(medium speed)**

-4- Output signals   OPERATE KEY SWITCH
-4- Valve fan drive 2 oil cooler   0   1   Y6B-2 (A3.8):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ Y7 VALVE CLS PUMP ON**

-4- Output signals   OPERATE KEY SWITCH
-4- CLS pump ON   0   1   Y7 (A5.3):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
Y7A VALVE CLS RELIEF**

-4- Output signals   OPERATE KEY SWITCH
-4- CLS valve relief   0   1   Y7A (A5.4):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ Y9 VALVE SLS PUMP ON**

-4- Output signals   OPERATE KEY SWITCH
-4- SLS pump ON   0   1   Y9 (A5.5):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ Y9A VALVE SLS RELIEF**

-4- Output signals   OPERATE KEY SWITCH
-4- SLS relief   0   1   Y9A (A5.6):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ Y17 VALVE PUMP REGULATION QMIN**

-4- Output signals   OPERATE KEY SWITCH
-4- Valve pump regulation Qmin   0   1   Qmin Y17 (A5.7):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ Y17A VALVE WARMING-UP TIME 1/2 QMAX**

-4- Output signals   OPERATE KEY SWITCH
-4- Valve warming-up time   0   1   1/2 Qmax Y17A (A5.8):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ Y53-1 GEAR OIL COOLER 1  
BACK - PRESSURE**

-4- Output signals   OPERATE KEY SWITCH
-4- Gear oil cooler 1 back-pressure   0   1   Y53-1 (A7.1):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ Y53-2 GEAR OIL COOLER 2  
BACK - PRESSURE**

-4- Output signals   OPERATE KEY SWITCH
-4- Gear oil cooler 2 back-pressure   0   1   Y53-2 (A7.2):

**Level 4: Inputs - Outputs / DIGITAL-OUTPUTS  
/ Y101 VALVE OIL COOLER BACK-PRESSURE**

-4- Output signals   OPERATE KEY SWITCH
-4- Valve oil cooler back-pressure   0   1   Y101 (A7.3):

### 3.4.6 FAULT AND INFORMATION MESSAGE LIST

The messages are divided into four groups as follows:

<b>Group 1</b>	The fault messages of group 1 will be stored and result in: <ul style="list-style-type: none"> <li>● Start blocked condition or</li> <li>● Automatic shutdown of the Shovel or</li> <li>● Attention of Service Staff required.</li> </ul>	Message Text Pages: <b>500 - 733</b>
<b>Group 2</b>	The fault messages of group 2 will be stored.	Message Text Pages: <b>734 - 1309</b>
<b>Group 3</b>	The information messages of group 3 will be stored.	Message Text Pages: <b>1310 - 1319</b>
<b>Group 4</b>	The information messages of group 4 will not be stored.	Message Text Pages: <b>1320 - 1535</b>

**Explanation of Control Signs shown at the beginning of the first text line:**

<b>\$ :</b>	The Dollar sign serves as a reference signal for on-line data transfer on machines using the Modular Mining Dispatch System "MMS".
<b># :</b>	Message will not be stored.
<b>? :</b>	Recording of this message in the protocol memory is accomplished with "COMING" registration only.

## Fault and Information Message List

### GROUP 1

#### Fault Message Texts of message pages No. 500 - 733

Fault No. 500:  
(503) \*1)

\$h: Start blocked through main Shut-Off (gate) valve

Help:

Limit switch S31 not closed.  
- Check for broken cables to switch S31.

Fault No. 506:  
(509)

\$h: Start of motor 1 blocked by high pressure filter #1

Help:

Differential pressure switch B5-1 not closed  
- Check cables to differential pressure switch B5-1 .

Fault No. 512:  
(515)

\$h: Shutdown motor 1 by motor protection relay 0F4-1

Help:

- Watch main motor temperature, let motor cool down.  
- Check motor protection relay 0F4-1..

Fault No. 518:  
(521)

\$h: Shutdown motor 2 by motor protection relay 0F4-2

Help:

- Watch main motor temperature, let motor cool down.  
- Check motor protection relay 0F4-2..

Fault No. 524:  
(527)

\$h: High pressure filter #1 restricted. Stop the motor 1

Help:

Differential pressure switch B5-1 not closed  
- Clean or replace filter element.  
- Check pump

\*1) Numbers in brackets are the message page numbers of the second language.

Fault No. 530:  
(533)

\$h: Trip: Motor 1 winding temperature too high

Help:

- Watch main motor temperature, check air cooling system
- Check protection relay 1A3-1, 1A3A-1 and 1A3B-1.

Fault No. 536:  
(539)

\$h: Trip: Motor 2 winding temperature too high

Help:

- Watch main motor temperature, check air cooling system
- Check protection relay 1A3-2, 1A3A-2 and 1A3B-2.

Fault No. 542:  
(545)

\$h: Start blocked by wrong motor rotation

Help:

- Change 2 phases of power supply.
- Check rotation direction relay 1F4.

Fault No. 548:  
(551)

\$h: Motors switched OFF due to closed main Shut-Off (gate) valve

Help:

Main Shut-Off (gate) valve not fully open.  
Open the valve (indicated by S31)

Fault No. 554:  
(557)

\$h: Trip: Motor 1 bearing temperature too high

Help:

- Check main motor bearings.
- Check protection relay 1A4-1 and 1A5-1.

Fault No. 560:  
(563)

\$h: Trip: Motor 2 bearing temperature too high

Help:

- Check main motor bearings.
- Check protection relay 1A4-2 and 1A5-2.

Fault No. 566:  
(569)

\$h:

Help:

Fault No. 572:  
(575)

\$h:

Help:

Fault No. 578:  
(581)

\$h:

Help:

Fault No. 584:  
(587)

\$h:

Help:

Fault No. 590:  
(593)

\$h: Shutdown:  
Hydraulic oil level too low

Help:

- Fill up hydraulic oil.
- Check level sensor B4 and B50.

Fault No. 596:  
(599)

\$h: Shutdown due to pressure increase in low voltage capacitor

Help:

- Pressure increase in low voltage capacitor 0C1-1 or 0C1-2
- Check capacitor.

Fault No. 602:  
(605)

\$h:

Help:

Fault No. 608:  
(611)

\$h:

Help:

Fault No. 614:  
(617)

\$h:

Help:

Fault No. 620:  
(623)

\$h:

Help:

Fault No. 626: (629)	\$h: Start of motor 1 blocked by high pressure filter #2
Help:	Differential pressure switch B6-1 not closed. - Check cables to differential pressure switch B6-1.
Fault No. 632: (635)	\$h: Fire on board (Shutdown)
Help:	Fire suppression system 9K1/9K3 actuated. - Inform the fire brigade. - Evacuate endangered Persons. - Fight the fire and recharge the system
Fault No. 638: (641)	\$h: Start of motor 1 by high pressure filter #3
Help:	Differential pressure switch B7-1 not closed. - Check cables to differential pressure switch B7-1.
Fault No. 644: (647)	\$h: Start of motor 2 blocked by high pressure filter #5
Help:	Differential pressure switch B5-2 not closed. - Check cables to differential pressure switch B5-2.
Fault No. 650: (653)	\$h: Start of motor 2 blocked by high pressure filter #6
Help:	Differential pressure switch B6-2 not closed. - Check cables to differential pressure switch B6-2.
Fault No. 656: (659)	\$h: Start of motor 2 blocked by high pressure filter #6
Help:	Differential pressure switch B7-2 not closed. - Check cables to differential pressure switch B7-2.
Fault No. 662: (665)	\$h: High pressure filter 2 restricted. Stop the motor 1
Help:	Differential pressure switch B6-1 not closed. - Clean or replace filter element. - Check pump

Fault No. 668:  
(671)

\$h: High pressure filter 3 restricted. Stop the motor 1

Help:

- Differential pressure switch B7-1 not closed.
- Clean or replace filter element.
- Check pump

Fault No. 674:  
(677)

\$h: High pressure filter 4 restricted. Stop the motor 2

Help:

- Differential pressure switch B5-2 not closed.
- Clean or replace filter element.
- Check pump

Fault No. 680:  
(683)

\$h: High pressure filter 5 restricted. Stop the motor 2

Help:

- Differential pressure switch B6-2 not closed.
- Clean or replace filter element.
- Check pump.

Fault No. 686:  
(689)

\$h: High pressure filter 6 restricted. Stop the motor 2

Help:

- Differential pressure switch B7-2 not closed.
- Clean or replace filter element.
- Check pump.

Fault No. 692:  
(695)

\$h: High pressure filter 4 restricted. Stop the motor 2

Help:

- Differential pressure switch B5-2 not closed
- Clean or replace filter element.
- Check pump.

Fault No. 698:  
(701)

\$h:

Help:

Fault No. 704:  
(707)

\$h:

Help:

Fault No. 710:  
(713)

\$h:



Help:

Fault No. 716:  
(719)

\$h:

Help:

Fault No. 722:  
(725)

\$h:

Help:

Fault No. 728:  
(731)

Help:

## GROUP 2

**Fault Message Texts of message pages No. 734 - 1309 will be stored**

Fault No. 734:  
(737)

\$h: Faulty monitor channel for pump #1/6 pressure

Help:

Pressure pick up B87A for the pump #1/6 pressure shows inadmissible values.  
- Check sensor and cables.

Fault No. 740:  
(743)

\$h: Faulty monitor channel for pump #2/5 pressure

Help:

Pressure pick up B87B for the pump #2/5 pressure shows inadmissible values.  
- Check sensor and cables.

Fault No. 746  
(749)

\$h: Faulty monitor channel for pump #3 pressure

Help:

Pressure pick up B87C for the pump #3 pressure shows inadmissible values.  
- Check sensor and cables.

Fault No. 752:  
(753)

\$h: Faulty monitor channel for pump #4 pressure

Help:

Pressure pick up B87D for the pump #4 pressure shows inadmissible values.  
- Check sensor and cables.

Fault No. 758:  
(761)

\$h:

Help:

Fault No. 764:  
(767)

\$h:

Help:

Fault No. 770:  
(773)

\$h:

Help:

Fault No. 776:  
(779)

\$h: Shutdown through emergency stop switch S33A

Help:

Emergency stop switch S33A at the machinery house door actuated.  
- Find cause

Fault No. 782:  
(785)

\$h: Shutdown through emergency stop switch S33B

Help:

Emergency stop switch S33B at control valves actuated.  
- Find cause

Fault No. 788:  
(791)

\$h: Shutdown through emergency stop switch S33D.

Help:

Emergency stop switch S33D in machinery house actuated.  
- Find cause

Fault No. 794:  
(797)

\$h:

Help:

Fault No. 800:  
(803)

\$h: Faulty pressure switch for gear oil filter of PTO gear 1

Help:

Closed contact of pressure switch B27-1 for PTO-gear lubrication filter 1 with switched off motor.  
- Check pressure switch and cables.

Fault No. 806:  
(809)      \$h:      Faulty pressure switch for pump regulation oil filter

Help:      Closed contact of pressure switch B22 for pump regulation filter with switched off motor.  
- Check pressure switch and cables.

Fault No. 812:  
(815)      \$h:      Faulty pressure switch for oil tank breather filter

Help:      Closed contact of pressure switch B24 for oil tank breather filter with switched off motor.  
- Check pressure switch and cables.

Fault No. 818:  
(821)      \$h:      Faulty pressure switch for return oil filter

Help:      Closed contact of pressure switch B26 for return oil filter with switched off motor.  
- Check pressure switch and cables.

Fault No. 824:  
(827)      \$h:      Faulty pressure switch for leak oil filter

Help:      Closed contact of pressure switch B25 for leak oil filter with switched off motor.  
- Check pressure switch and cables.

Fault No. 830:  
(833)      \$h:      No 24 V voltage at circuit breaker F13

Help:      No 24 V behind circuit breaker F13.  
- Check circuit breaker F13.  
- Check current supply to circuit breaker.

Fault No. 836  
(839)      \$h:      Faulty pressure switch of fan drive oil filter for oil cooler 1

Help:      Pressure switch B28-1 indicates pressure (contact closed) although main motor 1 is not running.  
- Check pressure switch B28-1 and cables.

Fault No. 842:  
(845)      \$h:      Hydraulic oil far below operating temperature. Wait for warm-up phase!

Help:      The machine was taken into operation although the start viscosity was not attained.  
- Preheat hydraulic oil !

Fault No. 848:  
(851)

\$h: Faulty monitor channel for hydraulic oil temperature

Help:

Sensor B15 shows inadmissible values.  
- Check sensor and cables.

Fault No. 854:  
(857)

\$h: PTO-gear 1 oil filter restricted

Help:

- Replace filter element. (indicated by B27-1)

Fault No. 860:  
(863)

\$h: Pump regulation oil filter restricted

Help:

- Replace filter element. (indicated by B22)

Fault No. 866:  
(869)

\$h: Oil tank breather filter restricted

Help:

- Replace filter element. (indicated by B24)

Fault No. 872:  
(875)

\$h: Return oil filter restricted

Help:

- Replace filter elements. (indicated by B26)

Fault No. 878:  
(881)

\$h: Leak oil filter restricted

Help:

- Replace filter element. (indicated by B25)

Fault No. 884:  
(887)

\$h: Warning: Mains transformer temperature too high.

Help:

Mains transformer temperature too high.  
- Check ventilation system.  
- Check trip relay 1A1.

Fault No. 890:  
(893)

\$h: Fan drive oil filter oil cooler 1 restricted

Help:

- Replace filter element. (indicated by B28-1)

Fault No. 896:  
(899)

\$h: Faulty monitor channel for motor 1 current

Help:

The motor current is beyond the permissible limits.  
- Check monitor channel. (indicated by A38-1)

Fault No. 902:  
(905)

\$h: Faulty monitor channel for motor 2 current

Help:

The motor current is beyond the permissible limits.  
- Check monitor channel. (indicated by A38-2)

Fault No. 908:  
(911)

\$h:

Help:

Fault No. 914:  
(917)

\$h:

Help:

Fault No. 920:  
(923)

\$h: Faulty monitor channel for oil temperature of PTO gear 2

Help:

Temperature sensor B49-2 for PTO gear oil shows inadmissible values.  
- Check sensor and cables.

Fault No. 926: (929)	\$h: Oil temperature of PTO gear 2 too high
Help:	- Check gear oil cooling circuit. - Clean gear oil cooler. (indicated by B49-2)
Fault No. 932: (935)	\$h:
Help:	
Fault No. 938: (941)	\$h: Hydraulic oil temperature too high. Bucket motion switched off.
Help:	Cool off the oil by moving attachment w/o load. - Check hydraulic oil cooling system. - Clean oil cooler. (indicated by B15)
Fault No. 944: (947)	\$h: Faulty monitor channel for oil temperature of PTO gear 1
Help:	Temperature sensor B49-1 for PTO gear oil shows inadmissible values. - Check sensor and cables.
Fault No. 950: (953)	\$h: Oil temperature of PTO gear 1 too high
Help:	- Check gear oil cooling circuit. - Clean gear oil cooler. (indicated by B49-1)
Fault No. 956: (959)	\$h: Faulty monitor channel for ambient temperature
Help:	Temperature sensor B90 for ambient temperature shows inadmissible values. - Check sensor and cables.
Fault No. 962: (965)	\$h: Control pressure X1.1 for the main pumps too high
Help:	- Check / adjust electronic pump regulation. - Check / adjust pressure reduction valve. (indicated by B85-1)

Fault No. 968:  
(971)

\$h: Pilot pressure X2 too low.

Help:

- Check / adjust pressure relief valve. (indicated by B86)

Fault No. 974:  
(977)

\$h: Pilot pressure X2 too high

Help:

- Check / adjust pressure relief valve. (indicated by B86)

Fault No. 980:  
(983)

\$h: Swing gear house brake OFF

Help:

- Check solenoid valve Y5.  
- Check pressure switch B16.

Fault No. 986  
(989)

\$h: Travel gear house brake OFF

Help:

- Check solenoid valve Y16.  
- Check pressure switch B48.

Fault No. 992:  
(995)

\$h: Travel gear house brake ON

Help:

- Check solenoid valve Y16.  
- Check pressure switch B48.

Fault No. 998:  
(1001)

\$h: Faulty pressure switch for strainer oil cooler

Help:

Closed contact of pressure switch B165 of return oil strainer with switched off motor.  
- Check pressure switch and cables.

Fault No. 1004:  
(1007)

\$h: Strainer oil cooler restricted

Help:

- Replace strainer.

Fault No. 1010:  
(1013)

\$h:

Help:

Fault No. 1016:  
(1019)

\$h: Faulty monitor channel for X1.2-pressure

Help:

Pressure pick up B85-2 for the X1.2-pressure shows inadmissible values.  
- Check sensor and cables.

Fault No. 1022:  
(1025)

\$h: Control pressure X1.2 for the main pumps too high

Help:

- Check / adjust electronic pump regulation.  
- Check / adjust pressure reduction valve. (indicated by B85-2)

Fault No. 1028:  
(1031)

\$h: Central lube system grease container empty

Help:

The sensor B108 in the grease container detects no grease. Bucket cut off within 4 hours.  
- Replace or fill grease container.

Fault No. 1034:  
(1037)

\$h: Central lube system failure

Help:

Lube cycle is not performed in the given time.  
- Check valve Y7 and pressure switch B43.  
- Check injectors.

Fault No. 1040:  
(1043)

\$h: Central lube system failure

Help:

The lube lines are not relieved in the given time.  
- Check valve Y7 and pressure switch B43.  
- Check injectors.

Fault No. 1046:  
(1049)

\$h: Swing ring gear lube system grease container empty

Help:

The sensor B109 in the grease container detects no grease. Bucket cut off within 4 hours.  
- Replace or fill grease container.

Fault No. 1052:  
(1055)

\$h: Swing ring gear lube system failure

Help:

Lube cycle is not performed at the given time.  
- Check valve Y9 and pressure switch B46.  
- Check injectors.



Fault No. 1058:  
(1061)

\$h: Swing ring gear lube system failure

Help:

The lube lines are not relieved at the given time.  
- Check valve Y9 and pressure switch B46.  
- Check injectors.

Fault No. 1064:  
(1067)

\$h: Faulty pressure switch of gear oil filter for PTO gear 2

Help:

Closed contact of pressure switch B27-2 for PTO-gear lubrication filter 2 with switched OFF motor.  
- Check pressure switch and connected cables.

Fault No. 1070:  
(1073)

\$h: Faulty pressure switch of fan drive oil filter for oil cooler 2

Help:

Closed contact of pressure switch B28-2 for cooler fan drive filter with switched OFF motor.  
- Check pressure switch and connected cables.

Fault No. 1076:  
(1079)

\$h:

Help:

Fault No. 1082:  
(1085)

\$h:

Help:

Fault No. 1088:  
(1091)

\$h: The ECS is by-passed

Help:

- Reset by-pass switch S27.  
- Remove bridge wires.

Fault No. 1094:  
(1097)

\$h: PTO gear 2 oil filter restricted

Help:

- Replace filter element. (indicated by B27-2)

Fault No. 1100:  
(1103)

\$h: Fan drive oil filter for oil cooler 2 restricted

Help:

- Replace filter element. (indicated by B28-2)

Fault No. 1106:  
(1109)

\$h:

Help:

Fault No. 1112:  
(1115)

\$h:

Help:

Fault No. 1118:  
(1121)

\$h: Electric pilot control system failure

Help:

Pilot control amplifiers energized with control levers in neutral position.  
DANGER of phantom movements!  
- Check safety relay D32 and K125.

Fault No. 1124:  
(1127)

\$h: Faulty pressure switch for lubrication of PTO gear 1

Help:

Open contact of pressure switch B17-1 for PTO-gear 1 lubrication with switched OFF motor.  
- Check pressure switch and connected cables.

Fault No. 1130:  
(1133)

\$h: Faulty pressure switch for lubrication of PTO gear 2

Help:

Open contact of pressure switch B17-2 for PTO-gear 2 lubrication with switched OFF motor.  
- Check pressure switch and connected cables.

Fault No. 1136:  
(1139)

\$h: Lubrication system failure of PTO gear 1

Help:

Oil pressure for lubrication of PTO gear 1 insufficient  
- Check lubrication oil pump and connected lines.  
(indicated by B17-1)

Fault No. 1142:  
(1145)

\$h: Lubrication system failure of PTO gear 2

Help:

Oil pressure for lubrication of PTO gear 2 insufficient.  
- Check lubrication oil pump and connected lines.  
(indicated by B17-2)

Fault No. 1148: (1151)	\$h: Pump back-up pressure X4-1 failure
Help:	Back-up pressure for pumps on motor 1 insufficient - Check valve Y102-1.
Fault No. 1154: (1157)	\$h: Pump back-up pressure X4-2 failure
Help:	Back-up pressure for pumps on motor 2 insufficient - Check valve Y102-2.
Fault No. 1160: (1163)	\$h: Faulty pressure switch for pump back-up pressure X4
Help:	One of the pressure switches B97 is open with switched off motor. - Check pressure switches B97-1 and B97-2.
Fault No. 1166: (1169)	\$h:
Help:	
Fault No. 1172: (1175)	\$h: Earth-fault in the low voltage
Help:	The insulation meter 1F2 has tripped. -Check low voltage for earth fault -Check insulation meter 1F2
Fault No. 1178: (1181)	\$h: Temperature in cab base too high
Help:	Temperature in cab base too high. - Check air conditioning and ventilation. - Check thermostat 6B1.
Fault No. 1184: (1187)	\$h: Temperature in high tension switch cabinet too high
Help:	Temperature in high tension switch cabinet too high. - Check air conditioning and ventilation. - Check thermostat 6B2.

Fault No. 1190: (1193)	\$h:    Faulty monitor channel for X1.1-pressure
Help:	Pressure pick up B85-1 for the X1.1-pressure shows inadmissible values. - Check sensor and cables.
Fault No. 1196: (1199)	\$h:    Faulty monitor channel for pilot pressure X2
Help:	Pressure pick up B86 for the pilot pressure X2 shows inadmissible values. - Check sensor and cables.
Fault No. 1202: (1205)	
Help:	
Fault No. 1208: (1211)	
Help:	
Fault No. 1214: (1217)	\$h:    Low - tension control voltage failure at circuit breaker 1F6
Help:	- Switch on circuit breaker. - Rectify short circuit.
Fault No. 1220: (1223)	\$h:    Power supply for main motors was / is interrupted. Motors stopped.
Help:	Motors stopped by 1K13.
Fault No. 1226: (1229)	\$h:    Inverted rectifier 1U1 reports malfunction
Help:	
Fault No. 1232: (1235)	\$h:    Shutdown through emergency stop switch 0S36.
Help:	Emergency stop switch 0S36 in the cab actuated. - Find cause

Fault No. 1238: (1241)	\$h: Maintenance safety switch 1S58 in machinery house actuated.
Help:	- Find cause
Fault No. 1244: (1247)	\$h: Faulty monitor channel for central lube system level.
Help:	Level sensor B108 shows inadmissible values. - Check monitor channel and sensor.
Fault No. 1250: (1253)	\$h: Bucket motion switched off due to lubrication system failure
Help:	Automatic lubrication suspended for 4 hours. - Perform manually actuated lubrication. - Repair lubrication system.
Fault No. 1256: (1259)	\$h: Faulty switch hydraulic oil level or lack of hydraulic oil
Help:	Stop the motors. - Check level sensor B4 and B50. - Check hydraulic oil level.
Fault No. 1262: (1265)	\$h: Lack of hydraulic oil ! Fill up hydraulic oil !
Help:	Hydraulic oil level too low. - Fill up hydraulic oil. (indicated by B4)
Fault No. 1268: (1271)	\$h: Faulty monitor channel for level swing ring gear-lube system.
Help:	Level sensor B109 shows inadmissible values. - Check monitor channel and sensor.
Fault No. 1274: (1277)	\$h: Problems pump control.
Help:	Problem in the pump control. - If the fault further exist, inform service. (indicated by E32.32)

Fault No. 1280:  
(1283)      \$h:      Shutdown through emergency stop switch 0S33C.

Help:                      Emergency stop 0S33C in pump compartment actuated.  
                                 - Find cause

Fault No. 1286:  
(1289)      \$h:

Help:

Fault No. 1292:  
(1295)      \$h: Emergency Shut-down switch

Help:                      0s15 at undercarriage was actuated  
                                 - unlock before restarting

Fault No. 1298:  
(1301)      \$h:

Help:

Fault No. 1304:  
(1307)      \$h: Faulty switch s86 -> switch off wiper

Help:                      ->check switch s86 -> push -QUI- button

**GROUP 3 Information Message Texts of message pages No. 1310 - 1319 will be stored**

Information No. 1310: (1311)      ? 250 h Maintenance performed

Information No. 1312: (1313)      ? 500 h Maintenance performed

Information No. 1314: (1315)      ? 1000 h Maintenance performed

Information No. 1316: (1317)      ? 2000 h Maintenance performed

Information No. 1318: (1319)      ? 3000 h Maintenance performed

**GROUP 4****Information Message Texts of message pages No. 1320 - 1535 will not be stored**

Information No. 1320:  
(1321)

# Hydraulic oil not at operating temp. !  
Operate with reduced power !

Information No. 1322:  
(1323)

# Swing gear house brake ON

Information No. 1324:  
(1325)

? Motor 2 start h:  
(This message will be stored).

Information No. 1326:  
(1327)

? Motor 2 stop h:  
(This message will be stored).

Information No. 1328:  
(1329)

# Wait ! Start of motor 1 blocked  
during one minute after start of motor 2.

Information No. 1330:  
(1331)

# Wait ! Start of motor 2 blocked  
during one minute after start of motor 1.

Information No. 1332:  
(1333)

# Evaluation switched off.

Information No. 1334:  
(1335)

? Motor 1 start h:  
(This message will be stored).

Information No. 1336:  
(1337)

? Motor 1 stop h:  
(This message will be stored).

Information No. 1338:  
(1339)

# SERVICE: Central lubrication system.

Information No. 1340:  
(1341)

Information No. 1342:  
(1343)

# SERVICE: Swing ring gear lubrication system.

Information No. 1344:  
(1345)

# Messages switched OFF

Information No. 1346:  
(1347)

# Motor shutdown has been actuated from ground man

Information No. 1348:  
(1349)

# Trucks : @ C05

Information No. 1350:  
(1352)

# Pilot control switched OFF.  
Safety lever in locked position or ladder down  
(indicated by S28)

Information No. 1354:  
(1356)

# Switch off wiper  
Remove lower wiper  
Push >QUI< button

Information No. 1358:  
(1360)

# Emergency shut-down switch 0S33D in the power house was actuated.  
Unlock before restarting.

Information No. 1362:  
(1364)

# Emergency shut-down switch 0S33B at the main control valves was actuated.  
Unlock before restarting.

Information No. 1366:  
(1368)

# Emergency shut-down switch 0S36 in the cab was actuated.  
Unlock before restarting.

Information No. 1370:  
(1372)

# Maintenance safety switch 1S58 in the machinery house was actuated.  
Unlock before restarting.

Information No. 1374:  
(1376)

# Start lock, Motor 1 temperature too high. Motor must not be started.  
- Allow motor to cool down.  
- Check motor protection relay 0F4-1.

Information No. 1378:  
(1380)

# Swing ring gear lube system grease container on reserve. - Replace or fill grease container.



Information No. 1382:  
(1384)

# Central lube system grease container on reserve.  
Replace or fill grease container.

Information No. 1386:  
(1388)

# Hydraulic oil below operating temperature!  
Pre-heat hydraulic oil or warm up with reduced power.

Information No. 1390:  
(1392)

# Emergency shut-down switch 0S33A at the machinery house door was actuated.  
Unlock before restarting.

Information No. 1394:  
(1396)

# Emergency shut-down switch 0S33C in the pump compartment was actuated.  
Unlock before restarting.

Information No. 1398:  
(1400)

# Start lock, Motor 2 temperature too high. Motor  
Motor must not be started.  
- Allow motor to cool down.  
- Check motor protection relay 0F4-2.

Information No. 1402:  
(1404)

#

Information No. 1406:  
(1408)

# Faulty switch S85 -> only upper wiper  
-> Check switch S85

Information No. 1410:  
(1412)

#

Information No. 1414:  
(1416)

#

Information No. 1418:  
(1424)

# Emergency shut-down switch 0s15 at undercarriage was actuated  
- Unlock before starting

Information No. 1422:  
(1416)

#

Information No. 1426:  
(1428)

# Superstructure lube system.  
manually released:

Information No. 1430:  
(1432)

#

Information No. 1434:  
(1436)

# Swing ring gear lube system.  
manually released:

Information No. 1440:  
(1445)

# Remark to Maintenance calls.  
The maintenance calls integrated in the ECS system are to be performed according to the maintenance section in the operation and maintenance manual. The routine visual checks, lubrication work and motor maintenance are not called up. Please pay attention to the Service Literature.

Information No. 1450:  
(1455)

# Initial 250 h Maintenance  
Perform initial 250 h Maintenance.

Information No. 1460:  
(1465)

# Initial 1000 h Maintenance  
Perform initial 1000 h Maintenance.  
Perform also the 250 h/ 500 h Maintenance.

Information No. 1470:  
(1475)

# Periodic 250 h Maintenance  
Perform periodic 250 h Maintenance

Information No. 1480:  
(1485)

# Periodic 500 h Maintenance  
Perform periodic 500 h Maintenance.  
Perform also the 250 h Maintenance.

Information No. 1490:  
(1495)

# Periodic 1000 h Maintenance  
Perform periodic 1000 h Maintenance.  
Perform also the 250 h/ 500 h Maintenance.

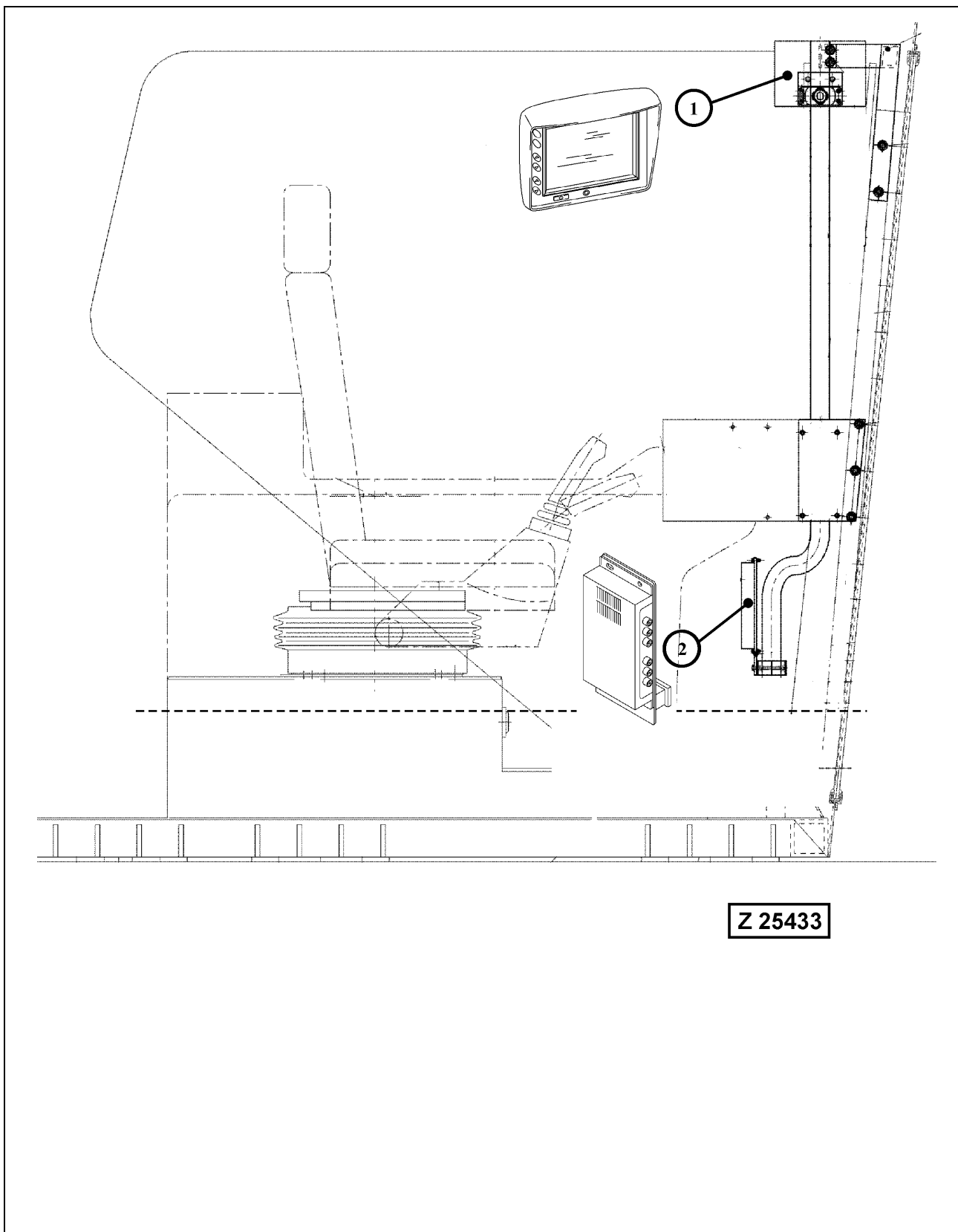
Information No. 1500:  
(1505)

# Periodic 2000 h Maintenance  
Perform periodic 2000 h Maintenance.  
Perform also the 250 h/ 500 h/ 1000 h Maintenance.

Information No. 1510:  
(1515)

# Periodic 3000 h Maintenance  
Perform periodic 3000 h Maintenance.  
Perform also the 250 h/ 500 h/ 1000 h Maintenance.

### 3.5 CAMERA SYSTEM WITH MONITOR



### 3.5.1 LOCATION OF MONITOR AND CONTROL UNIT

#### Legend for illustration Z25433

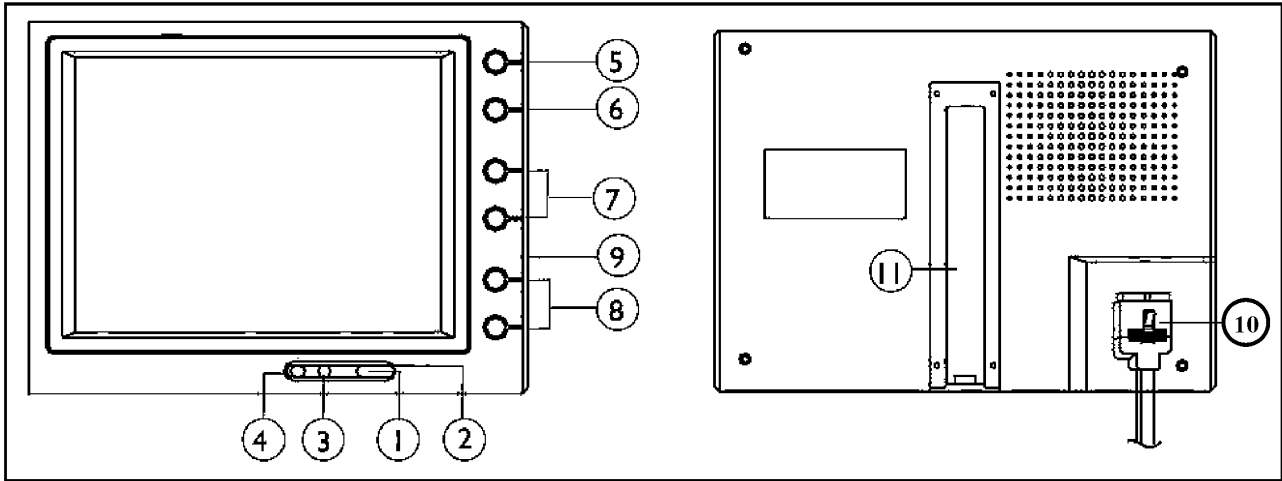
- (1) Monitor for viewing the cable guide
- (2) Control unit for monitor

#### Adjust the position of the monitor

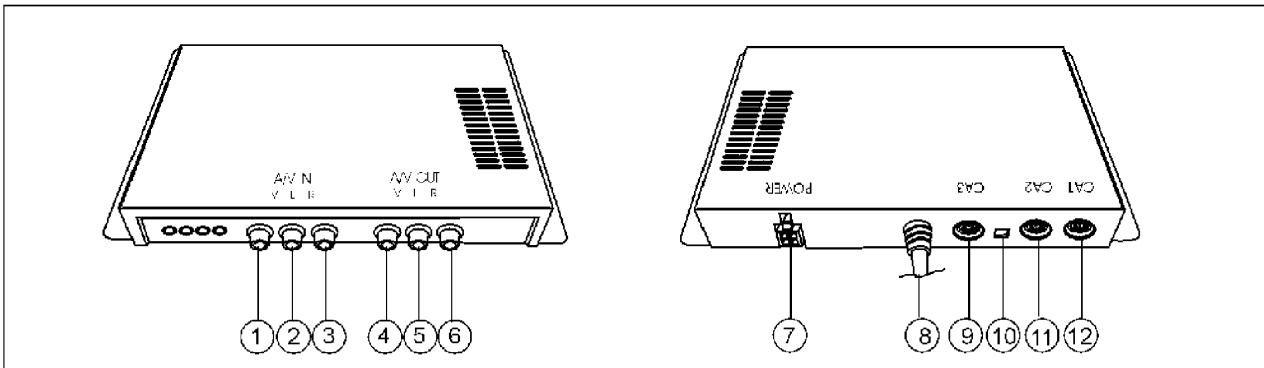
The monitor is fastened by means of a ball joint and can be adjusted in any direction. To adjust the position of the monitor loosen the clamping screw at the ball joint housing and move the monitor into a suitable position. Retighten the clamping screw securely by hand.

Refer to page 195 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)

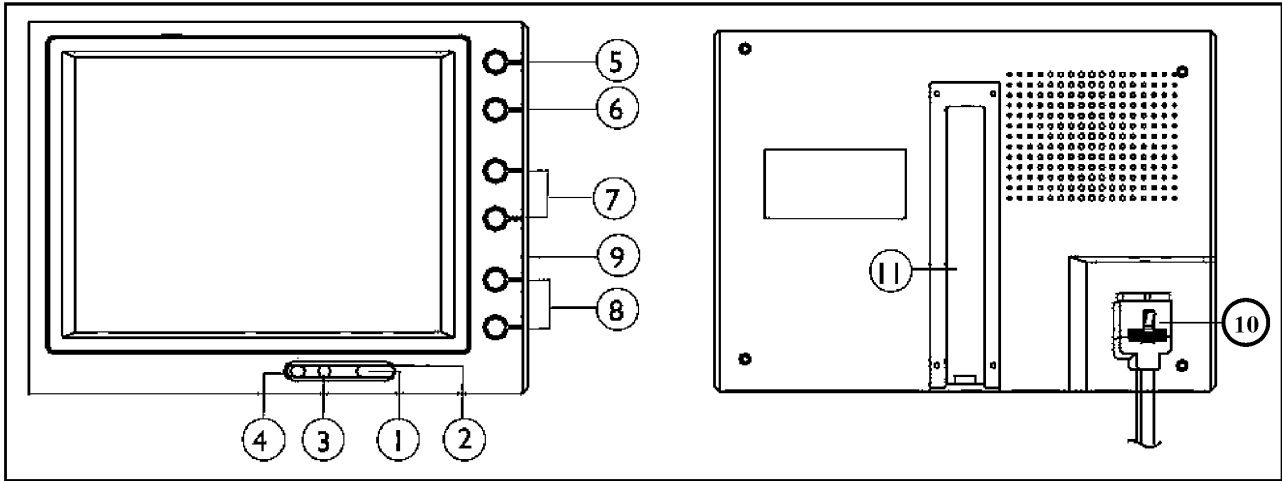
### 2. CAMERA MIRROR CONTROL

Selection of mirror or normal image.

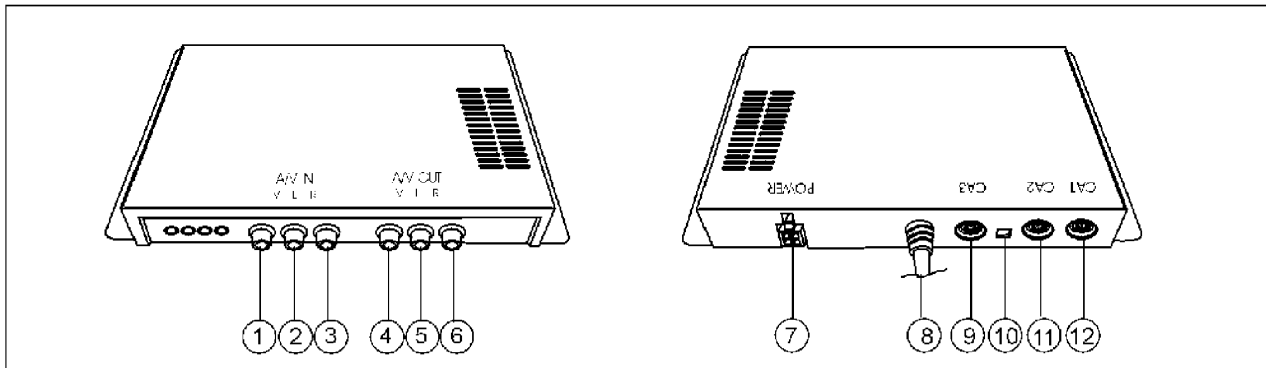
1. Press the MENU button (6).
2. Select CA1 (MIRROR) or CA1 (NORMAL) with buttons CH.
3. Choose the desired function with button CA. SEL.
4. Press the MENU button.

### 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.

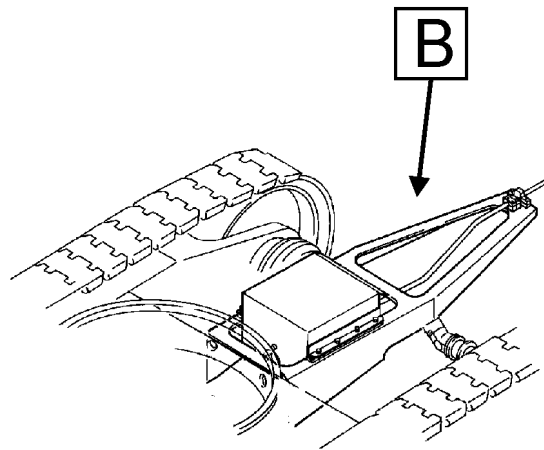
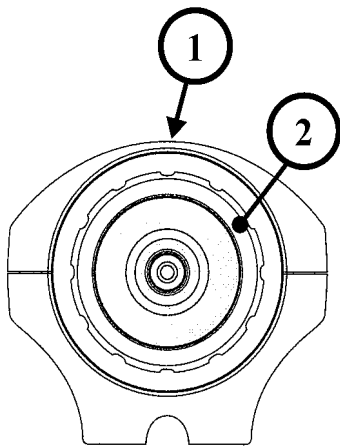
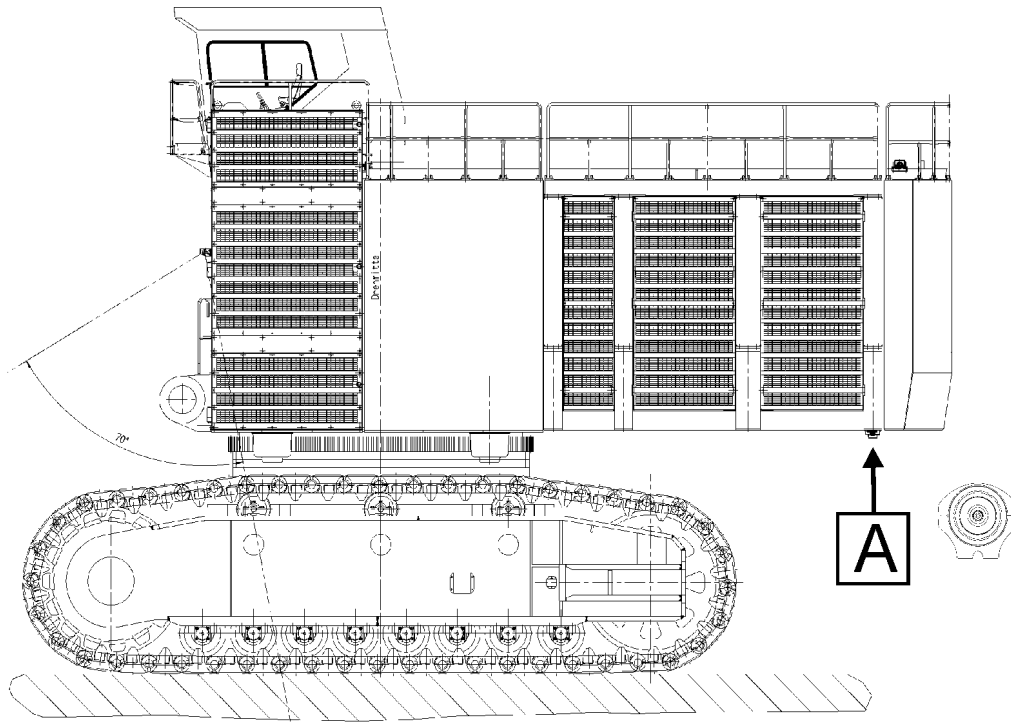
### 6. Contrast setting

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



**Z 25436**

## Arrangement of the Cameras

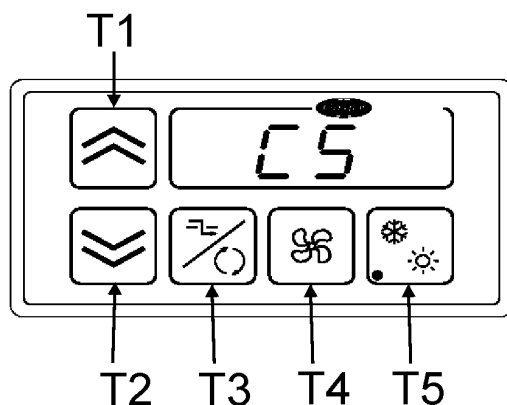
### Legend for illustration Z25436

- (A) Camera mounted on underside of superstructure to observe cable guide.
- (B) Cable guide
- (1) Camera bracket
- (2) Camera
  - View angle horizontal: 70°
  - View angle vertical: 50°

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

**Key T1: Plus Key**

increases interior temperature setpoint by 1 degree per stroke or increases manual blower speed, depending on displayed mode

**Key T2: Minus Key**

decreases interior temperature setpoint by 1 degree per stroke or decreases manual blower speed, depending on displayed mode

**Key T3: Recirculating Air/Fresh Air**

switches from Recirculating 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<sup>1)</sup>-2-3-4-5  
 1<sup>1)</sup> to 5: adjusts the blowers to speeds 20%, 40%, 60%, 80%, 100%.  
 Off<sup>1)</sup>: 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 show the outside temperature for 10 seconds (optional)

**Key T3+T5: Reheat (optional)**

starts Reheat mode for 3 minutes (duration adjustable)

**Key T3+T4: Controller Off**

switches off all control functions and the display.

<sup>1)</sup> The following blower steps are disabled when the automatic climate control is on:

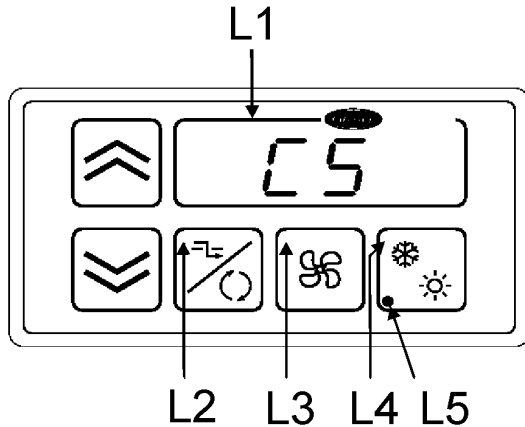
- 2-, 3-step blower: Off
- continuously adjustable blower: Off, 1

Ac1

#### 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**

- LED Field L1: Standard indication is the setpoint temperature
- LED L2: Fresh air operation (green)
- LED L3: Manual blower control "ON" (green)
- LED L4: Cooling/Heating mode (green)
- LED L5: Malfunction cooling unit (red)

**Operating Instructions**

When the engine is running, press any key to activate the Air Conditioning Control Unit. All previously set functions 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 to start interior temperature control.

Press the Plus or Minus keys to set the required interior temperature.

The temperature can be adjusted between 18° und 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 of operation by pressing the blower key.

Press the Plus or Minus keys to define one of 5 different blower steps. The blowers can not be switched OFF when Automatic Climate Control 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 defogging up the windshields. Press and at the same time to activate Reheat. Heating and cooling will be energized on for 3 minutes (adjustable parameter). In addition, the blowers are switched to maximum speed and the fresh air flap is closed. At the end of the pre-set duration time, the functions return to the previously selected settings.

Reheat mode is disabled with outside temperatures below 2°C (adjustable parameter) or when the sensor is not installed or has a failure.

**Temperature Indication**

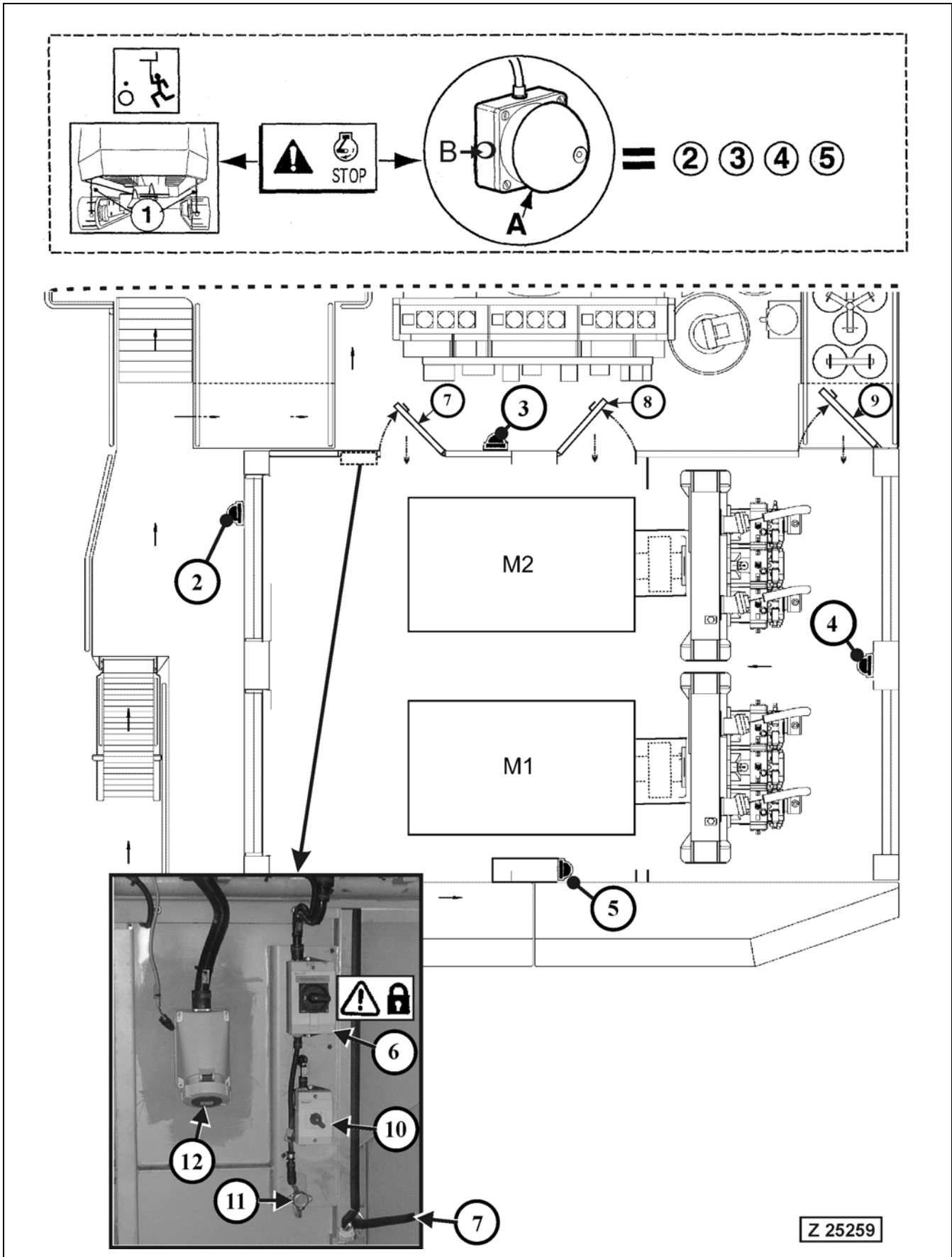
Press and at the same time to display the inside temperature, e.g. "i 22" for 10 seconds.

Optional, the outside temperature, e.g. "o 19", may be displayed when pressing the keys a second time.

A sensor malfunction is displayed by "i - -" or "o - -".

**Ac2**

### 3.7 MACHINERY HOUSE



### 3.7.1 EMERGENCY MOTOR SHUTDOWN SWITCHES

#### Legend for illustration Z25259

- (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 motors, the Operator will be informed by the following message, displayed on the ECS screen:  
" # Motor shut down has been actuated from ground man"
- (2) Emergency motor shutdown switch (S33A) on radiator door
- (3) Emergency motor shutdown switch (S33B) at the main control valves
- (4) Emergency motor shutdown switch (S33C) in pump compartment on center post
- (5) Emergency motor shutdown switch (S33D) at the counterweight
- (A) Push button of emergency shutdown switches (2, 3, 4 and 5) for stopping the motors
- (B) Release button for emergency shut down switch (if so equipped)

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 **WARNING**

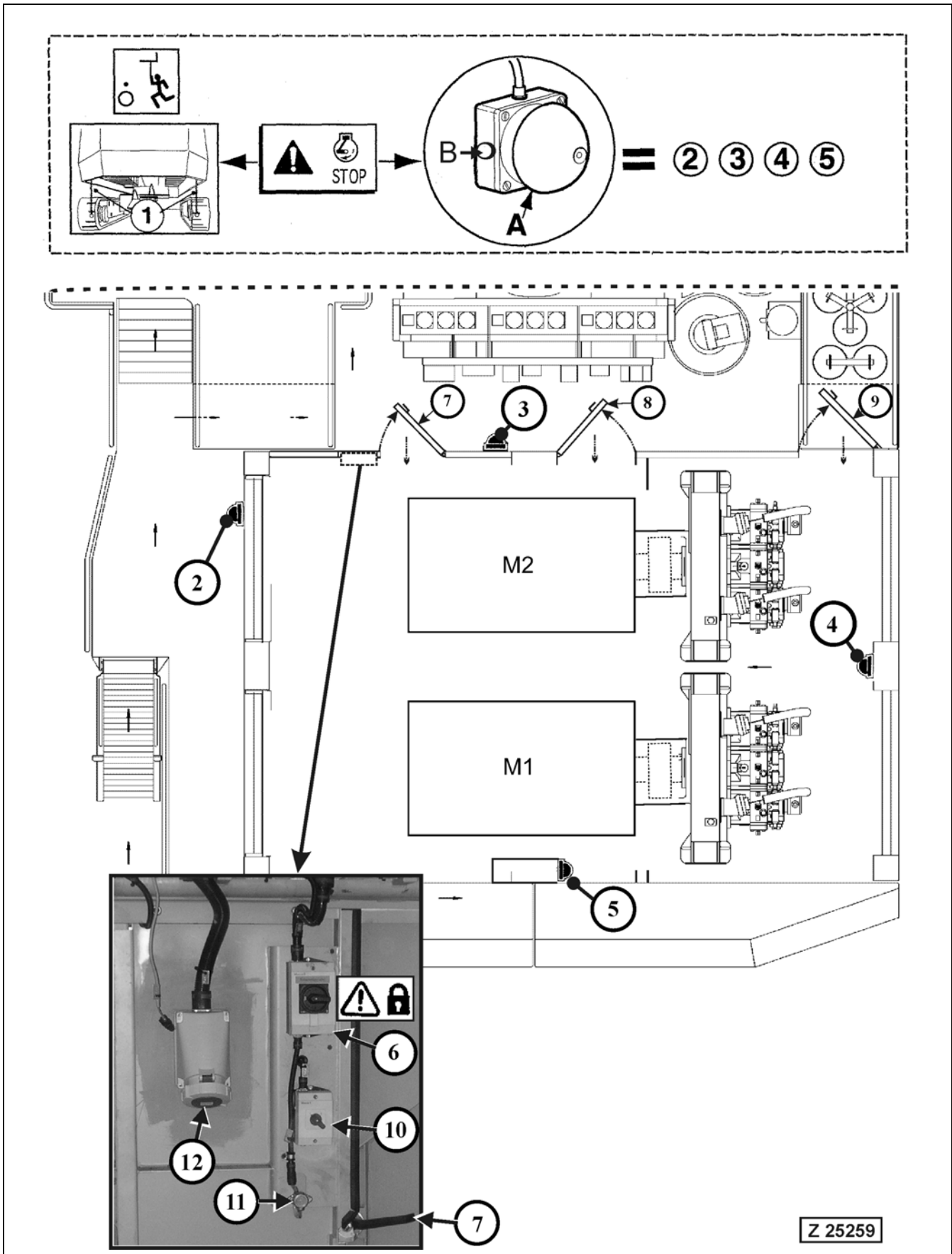
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- In case of emergency push in the button (A) to stop both motors.
  - Do not use the emergency shutdown switches for normal stopping procedure.
- 
- 

#### NOTICE

- For restarting, first push in release button (B). On switches without button (B) pull out button (A) and then start the motors in the normal way at control panel in the operator's cab. The motors can not be started with button (A) in depressed position.
- When one of the Shutdown switches (2 - 5) is activated, the ECS display informs the Operator by a corresponding message.



Z 25259



### 3.7.2 SAFETY SWITCH FOR MAINTENANCE

#### Legend for illustration Z25259

- (6) Maintenance safety switch for start prevention of the motors

**CAUTION**

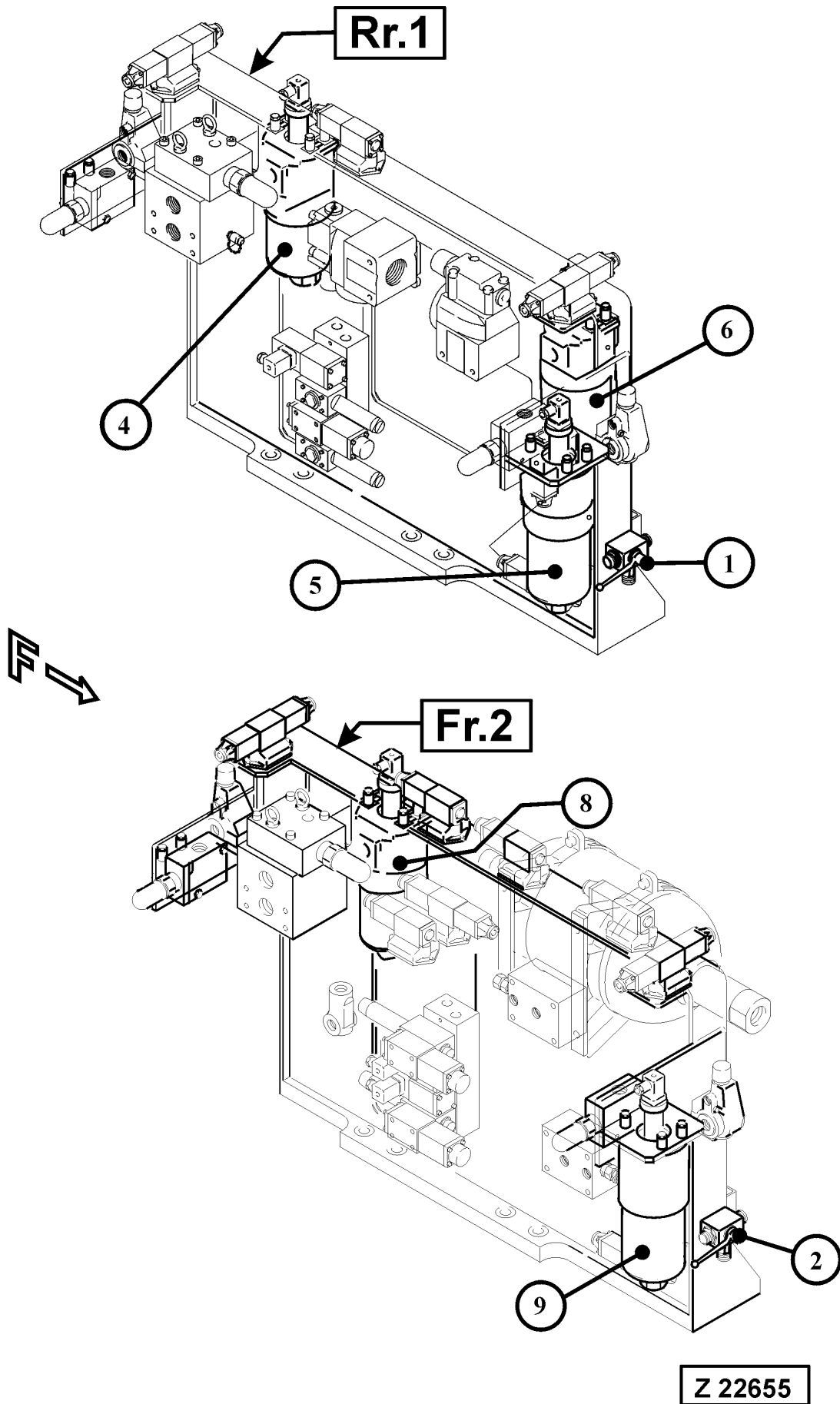
**Before beginning any maintenance operations set the safety switch (6) to \*0\* position to prevent starting of the motors during maintenance. Secure this position by inserting a padlock into the holes of the safety switch. Up to three padlocks can be attached.**

#### Machinery house doors

- (7) Front door  
(8) Center door  
(9) Rear door  
(10) Light switch for interior lighting of the machinery house  
(11) Plug socket 24V DC  
(12) Welding socket 400V

#### NOTICE

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



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

#### Legend for illustration Z22655

- (Rr.1) Control and filter panel of rear power unit, motor 1
- (Fr.2) Control and filter panel of front power unit, motor 2
- (1) Change over valve for operation mode of pump control system for rear power unit, motor 1.
- (2) Change over valve for operation mode of pump control system for front power unit, motor 2.
- (3) Not used.
- (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) Not used
- (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.

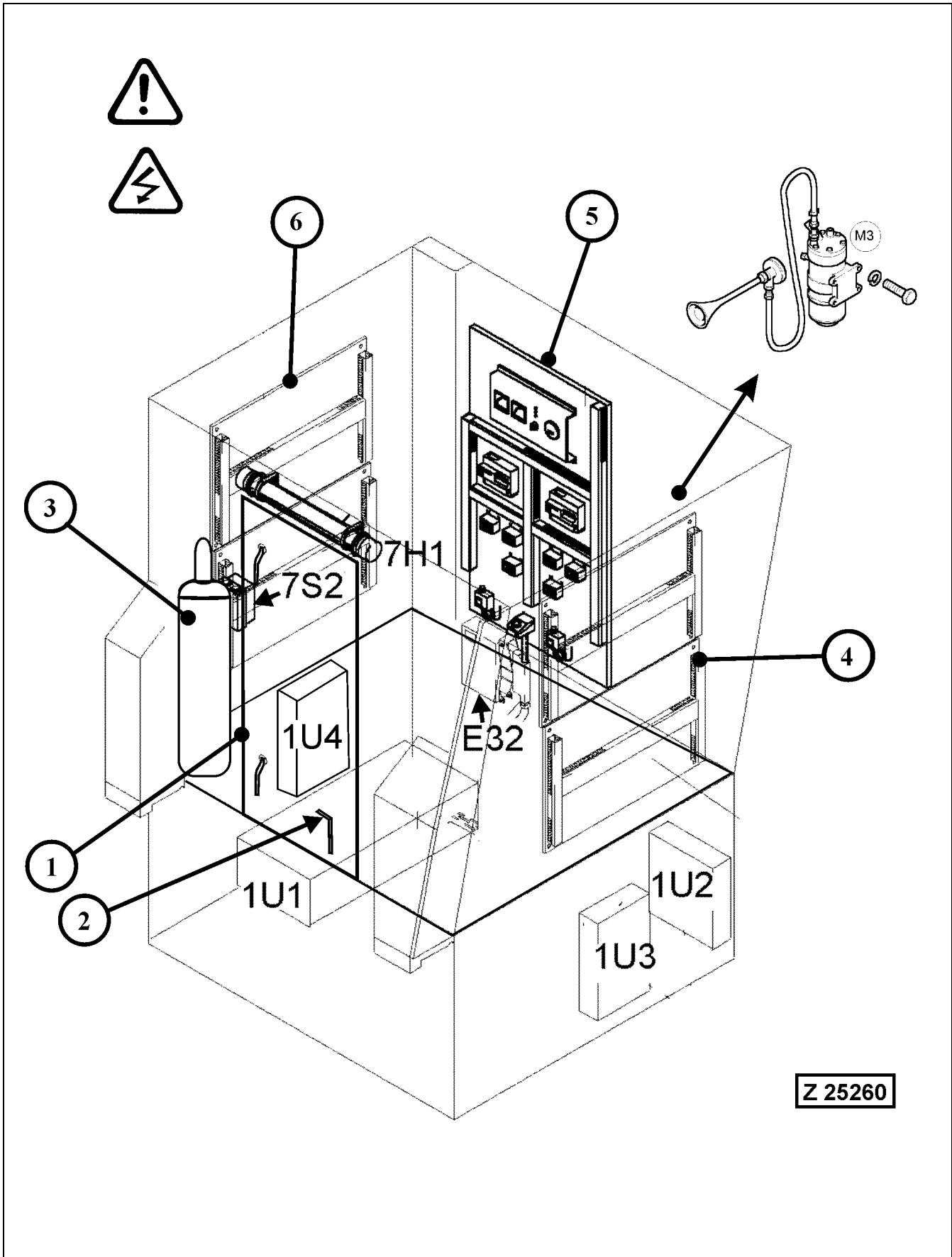
#### Operation Modes of Pump Regulation System

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 also be used for continuing operation.

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

### 3.8 MEDIUM VOLTAGE SWITCH CABINET IN CAB BASE



### 3.8.1 COMPONENTS OF THE MEDIUM VOLTAGE SWITCH CABINET

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**⚠ WARNING**

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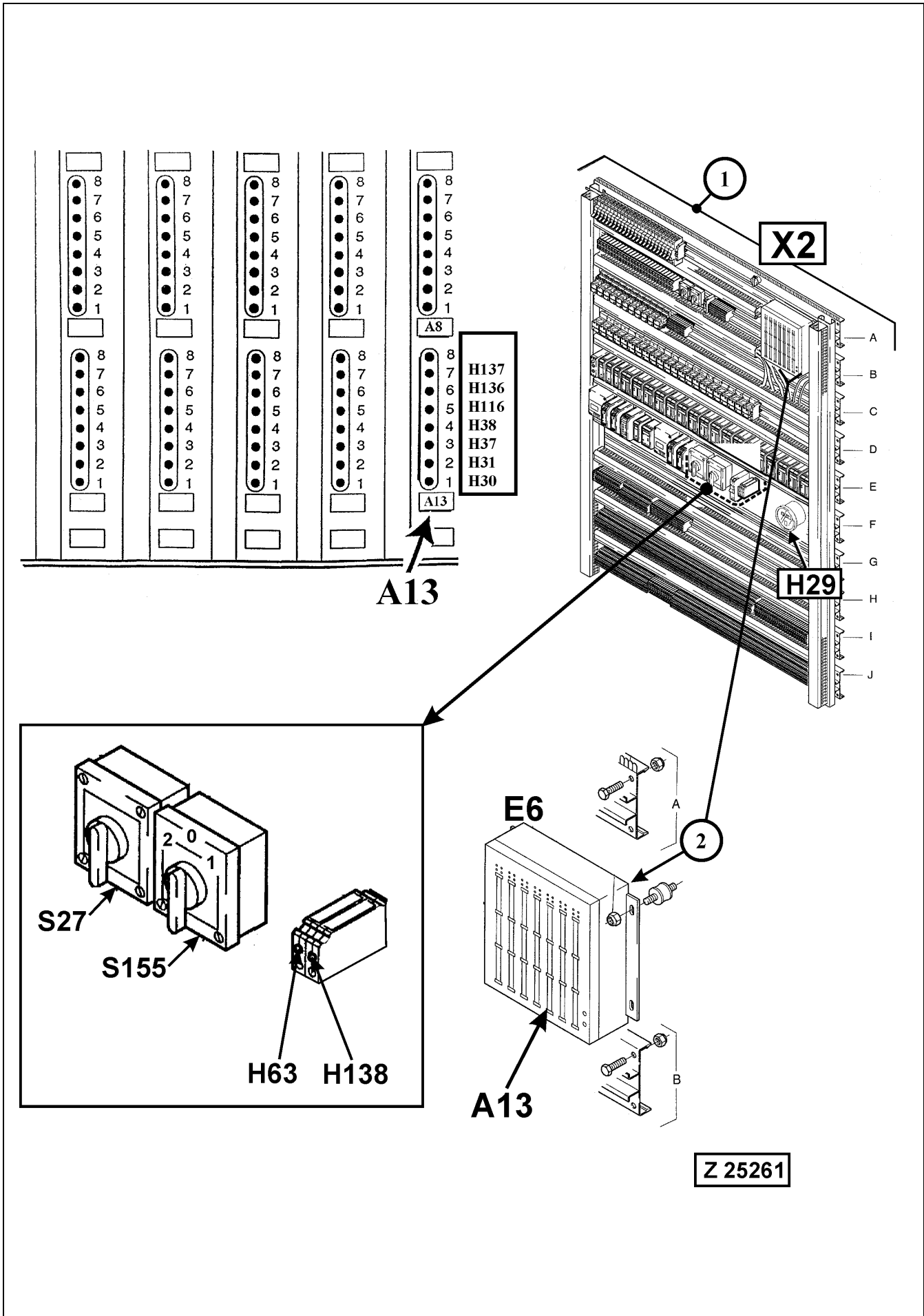
- Access to the medium voltage area for authorized service staff only.
  - The local safety regulations must be observed.
- 
- 

#### Legend for illustration Z 25260

- (1) Cab base door. Keep the door always locked, access to the cab base for authorized personnel only.
- (2) Lock rod for locking the cab base door in open position
- (3) Steel cylinder filled with extinguishing gas Carbon Dioxide. Only on machines equipped with a fire suppression system.
- (4) Switch board "X2". For details refer to page 211.
- (5) Monitor and control panel. For details refer to page 221.
- (6) Switch board medium voltage. For details refer to page 223.
- (1U1) Inverted rectifier. The inverted rectifier is protected by one 2.0AT fuse at the (+) terminal and one 16A circuit breaker at the terminal no. (11). The controls and monitors of the inverted rectifier are located on the panel (5). See page 221 for details. For more information of the inverted rectifier refer to the separate Manual "Inverter 1500VA 24V/110V 50Hz" filed in volume 2 binder.
- (1U2) Battery chargers for main batteries. 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.
- (1U4)
- (1U3) Battery charger for emergency lighting system. 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.
- (E32) Electronic control module (ECM) of the pump control system MC7. The data link adapter for connecting an electronic tool to the pump control module (E32) is located in the operator's cab on the operator's console.
- (M3) Signal horn compressor with signal horn
- (7S2) Light switch
- (7H1) Cab base lighting

#### REMARK

The units (1U1, 1U2, 1U3 and 1U4) are located below the floor plates in the cab base.



### 3.8.2 SWITCH BOARD (X2) IN CAB BASE

#### Legend for illustration Z25261

- (1) Switch board (X2)
- (2) Programmable Logic Controller (E6)
- (H29) Hour meter for travel operation
- (H63) Indicator lamp electronic pump control system (MC7) active and program information
- (H138) This lamp pulses if there is a failure in the electronic pump control system (MC7)
- (S27) Emergency By-pass switch for the shutdown function of the PLC (E6). 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 motors.

#### NOTICE

**This switch can not override motor initiated shutdowns.**

#### ⚠ CAUTION

**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).**

- (S155) **Service Switch for "QMIN" and "QMAX" Control of the Main Hydraulic Pumps**

#### REMARK

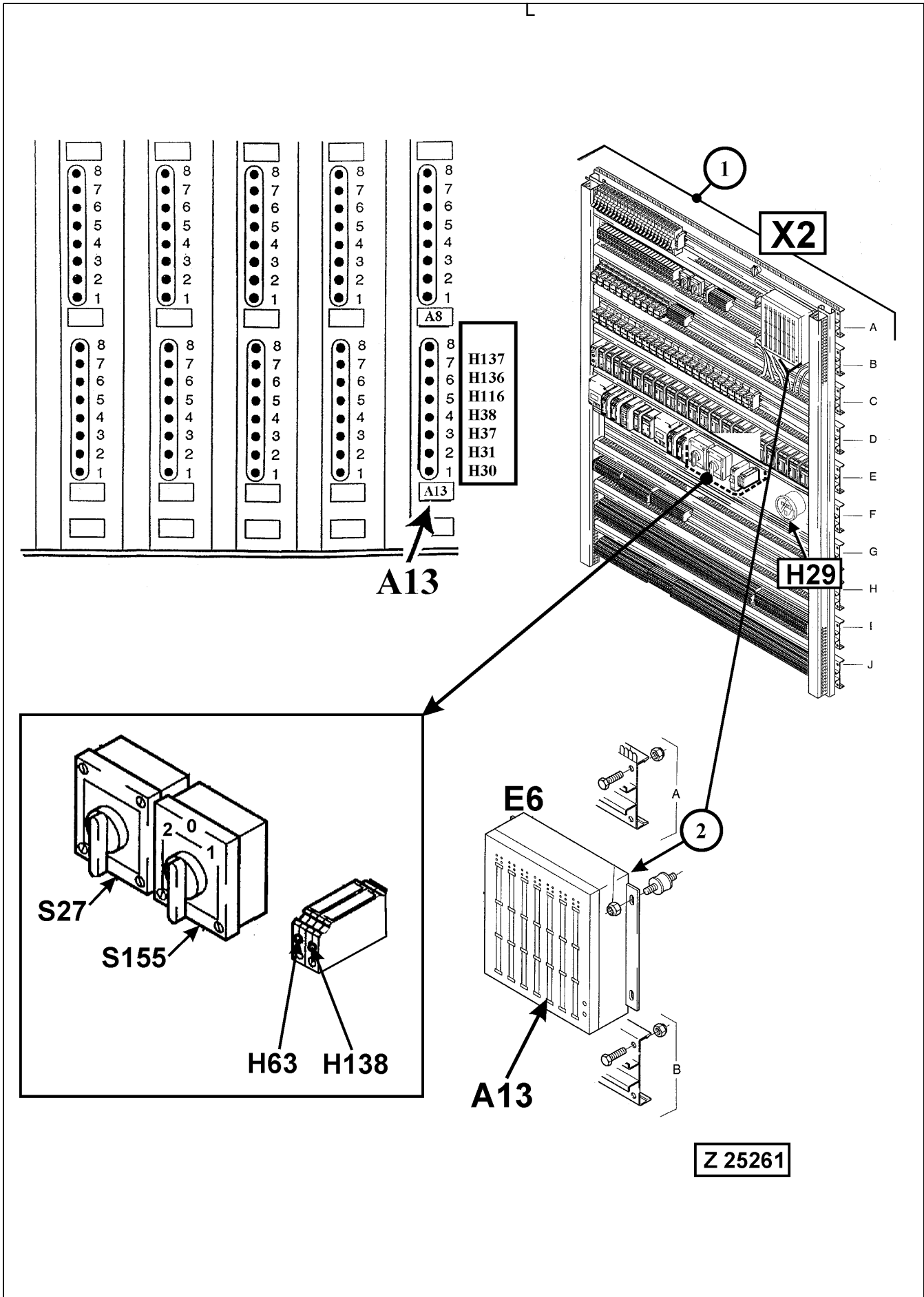
The service switch (S155) is used for testing and adjusting procedures of the hydraulic system and should only be operated through authorized service personnel.

#### Switch positions:

- 0 - Normal operating position
- 1 - Qmax position: In this position the Qmin control is by-passed and the main pumps move to maximum delivery position.
- 2 - Qmin position: In this position the main pumps remain in Qmin position i.e. minimum oil delivery to the hydraulic system.

#### NOTICE

**Make sure that the switch (S155) is set to -0- position as soon as the testing and adjusting procedures of the hydraulic system are finished.**





## Emergency Indication of Operating Conditions

The ECS system is equipped with an emergency indication via LED's on the Programmable Logic Controller "PLC" (E6), illustration Z25261.

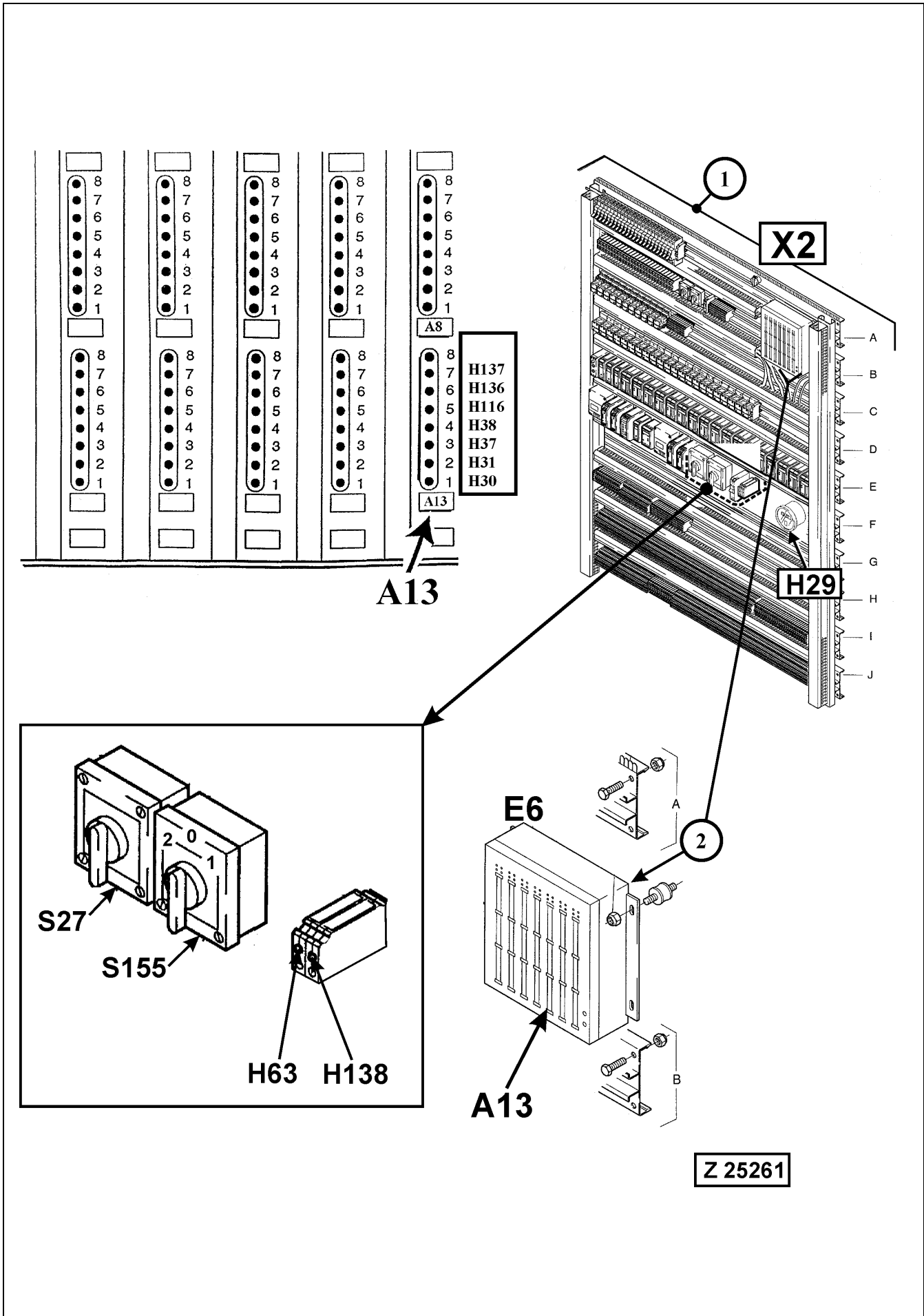
In case of a malfunction of the text display in the operator's cab, the LED's on the "PLC" indicating failures in vital operating systems of the Shovel.

**The following faults are indicated:**

Fault:	LED No.:
The ECS system is by-passed (By-pass switch S27 actuated)	H30
Start of motor 1 and/or motor 2 blocked by one or more of the six high pressure filters.	H31 *)
Start of both motors blocked, resp. motor shut down, due to closed main shut-off (gate) valve hydraulic tank	H37
Faulty monitor channel for hydraulic oil temperature	H38
Emergency shut down switch actuated	H116 *)
Motor shutdown from ground man (if so equipped)	H135
Start of motor 1 and/or motor 2 blocked due to lubrication system failure of PTO gear	H136 *)
Too low hydraulic oil level! Stop the motors	H137

### \*) LED with a flashing diagnostic code

The LED "H31" monitors all six high pressure filters. LED "H116" monitors all five Emergency shutdown switches and H136 monitors the lubrication system of both PTO gear boxes. If a failure condition occurs, the respective LED will begin flashing out a diagnostic code for identification of the concerned filter, emergency switch or PTO gear box. If more than one filter, switch or gear box, send a failure signal at the same time, the respective LED will always show the diagnostic code of that unit with the lowest number. Refer to page 215 for description of the diagnostic codes flashed out by LED "H31", "H116" and "H136".



**High Pressure Filter "HPF"  
Identification Codes of LED H31**

The LED "H31", illust. Z25261, 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.

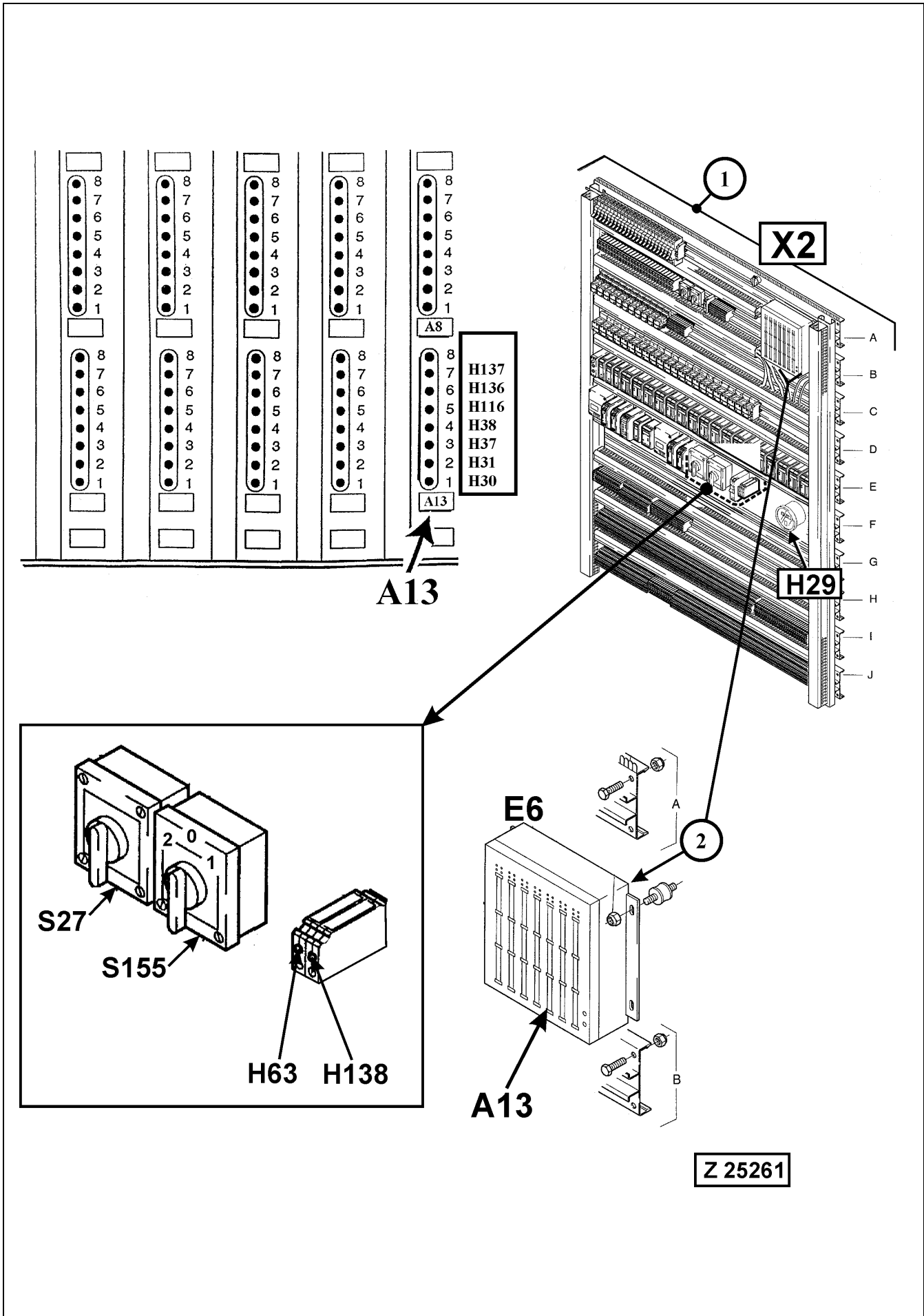
**High Pressure Filter "HPF" number:**

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

**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 respectively to the number of the main pumps.



### Emergency shutdown switches - Identification Codes of LED H116

The LED "H116", illustration Z25261 monitors all five emergency shutdown switches. If an Emergency shutdown switch is actuated, the LED "H116" will begin flashing out a diagnostic code for identification of the concerned switch. If more than one switch send a signal at the same time, the LED will always show the diagnostic code of that switch with the lowest number.

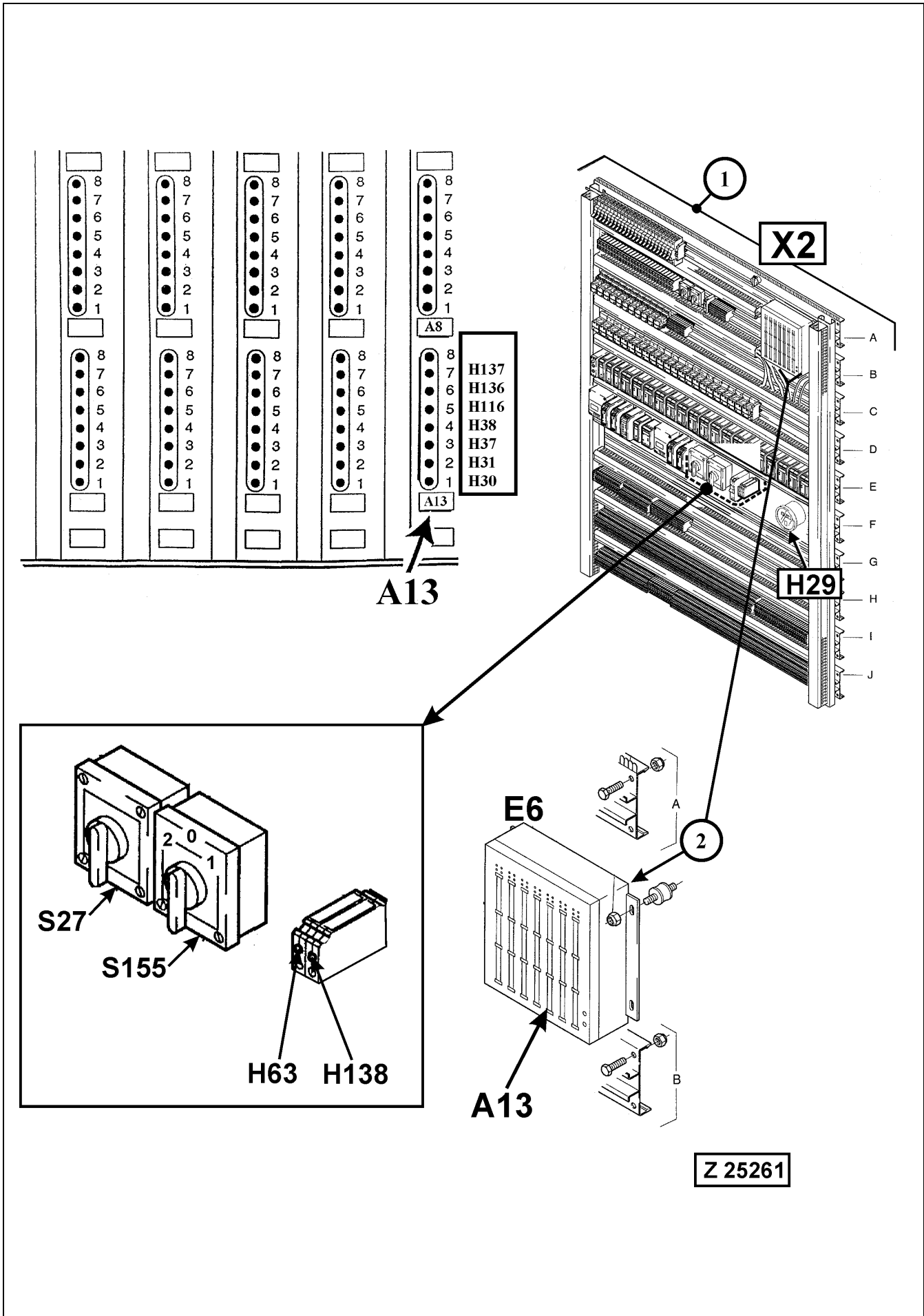
**Emergency shutdown switches:**

Code#1 0S33A	1	1	1	1													
	0.5s	2s															
Code#2 0S33B	1	2	1	2	1	2											
	0.5s	0.5s	0.5s	2s													
Code#3 0S33C	1	2	3	1	2	3	1										
	0.5s	0.5s	0.5s	0.5s	0.5s	2s											
Code#4 0S33D	1	2	3	4	1	2	3	4									
	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	2s									
Code#5 0S36	1	2	3	4	5	1	2	3	4								
	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	2s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s

- 0S33A** Emergency shutdown switch at the power house.
- 0S33B** Emergency shutdown switch opposite the main control valves.
- 0S33C** Emergency shutdown switch in pump compartment.
- 0S33D** Emergency shutdown switch in rear motor compartment.
- 0S36** Emergency shutdown switch on instrument panel in the cab.

**Example: Identification Code for Emergency shutdown switch #4 (0S33D):**

When the Emergency shutdown switch #4 (0S33D) sends the signal "Emergency shut-down switch 0S33D in the rear motor compartment was actuated", the LED H116 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 0.5 seconds interval flashing group corresponds to the number of each Emergency shutdown switch.



**Lubrication System failure of PTO gear boxes  
- Identification Codes of LED H136 -**

The LED "H136", illustration Z25261 monitors both PTO gear boxes. If a failure condition of a PTO gear box occurs, the LED "H136" will begin flashing out a diagnostic code for identification of the concerned gear box. If more than one gear box send a signal at the same time, the LED will always show the diagnostic code of that PTO gear with the lowest number.

**PTO gear boxes:**

Code #1 PTO1												
	0.5s	2s	0.5s	2s	0.5s	2s	0.5s	2s				
Code #2 PTO2												
	0.5s	0.5s	0.5s	2s	0.5s	0.5s	0.5s	2s	0.5s	0.5s	0.5s	2s

**PTO 1** Indicated by B17-1

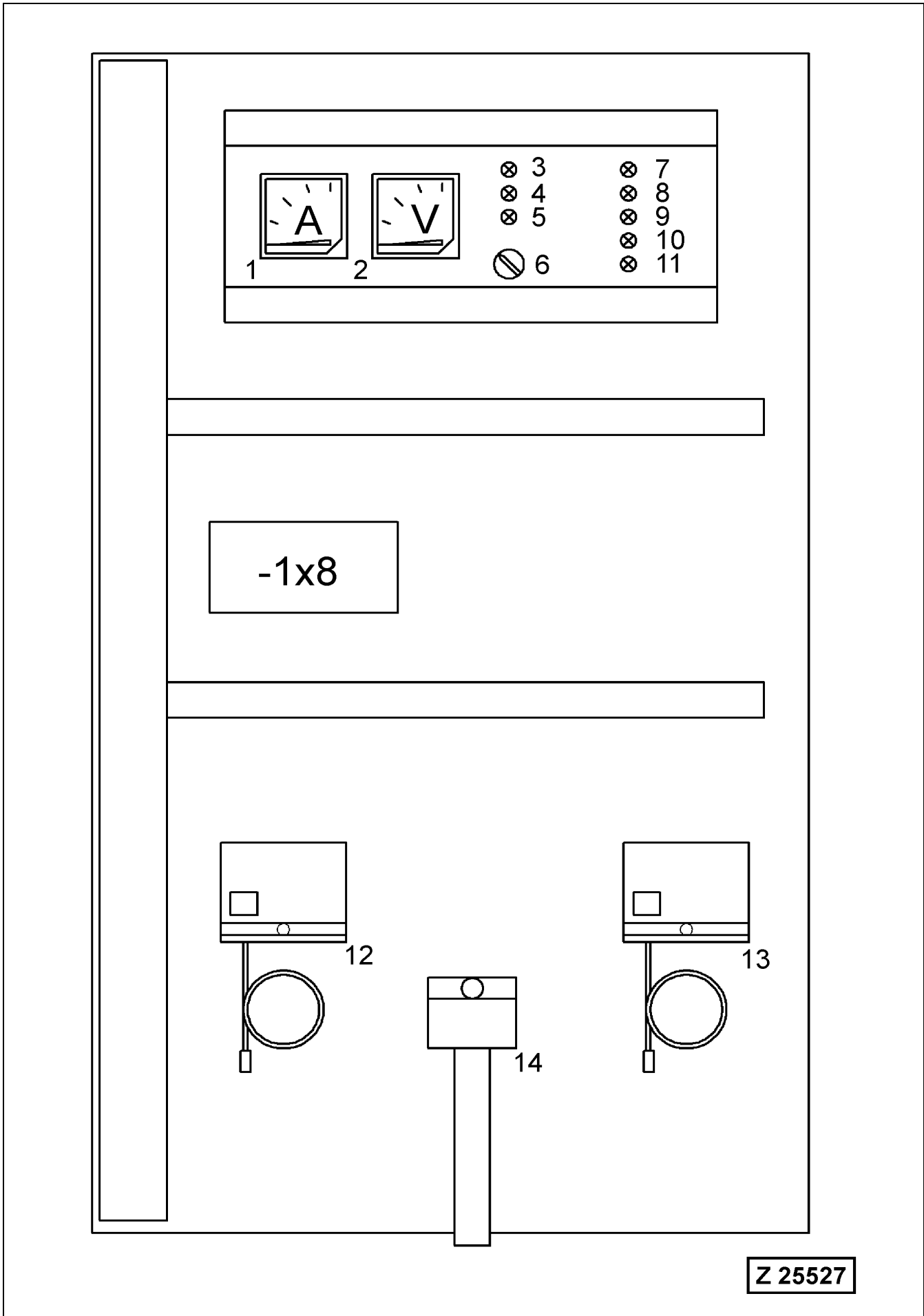
**PTO 2** Indicated by B17-2

**Example:**

**Identification Code for PTO gear box #2 :**

When the PTO gear box #2 sends the signal "Shutdown: Lubrication system failure of PTO gear 2", the LED H136 will flash two times at regular intervals of 0.5 seconds and then after two seconds pause time will start again flashing two times at regular intervals of 0.5 seconds and so on.

The number of the 0.5 seconds interval flashing group corresponds to the number of each PTO gear box.





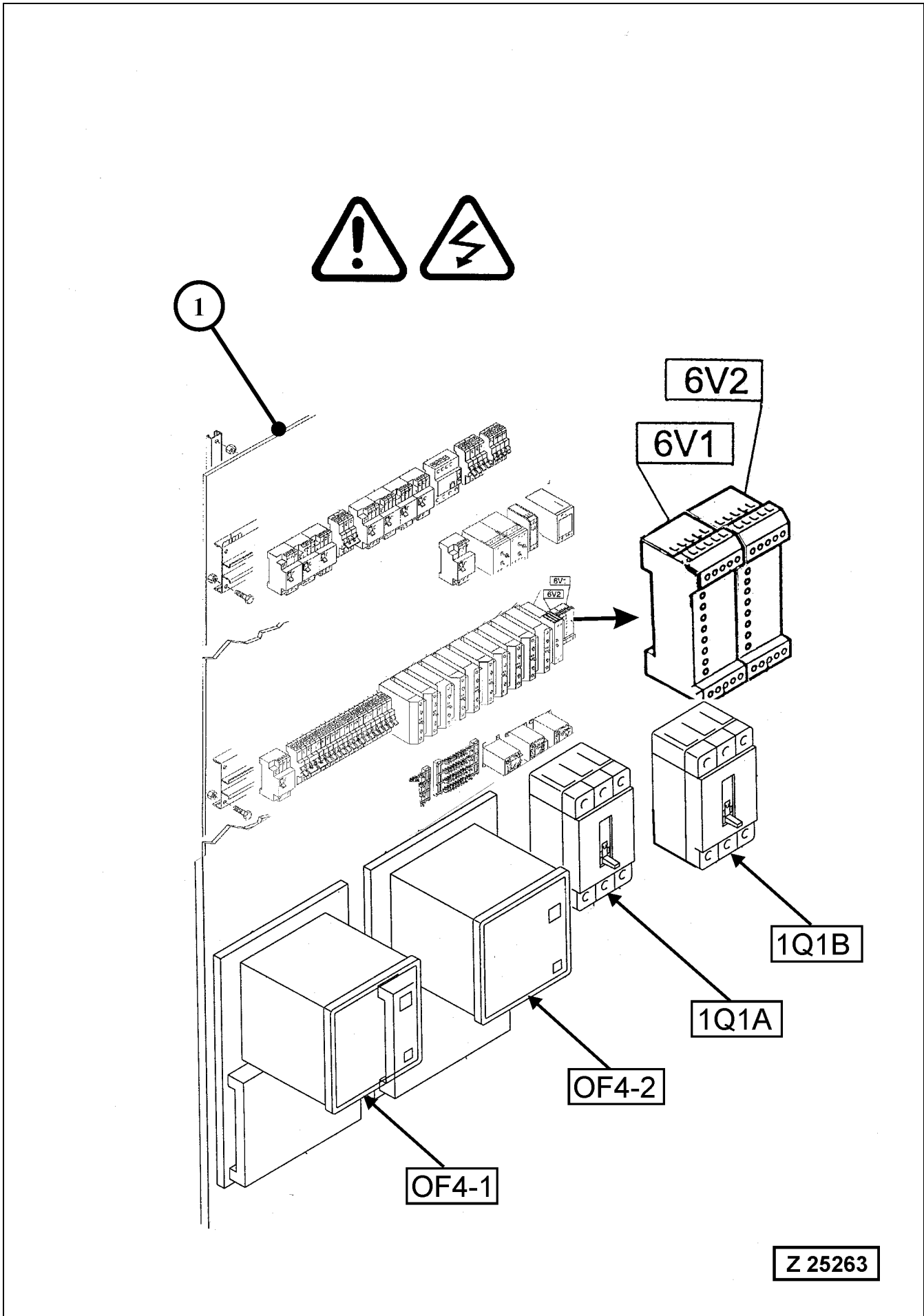
### 3.8.3 MONITOR AND CONTROL PANEL IN CAB BASE

#### Legend for illustration Z25527

- (1) Ammeter (1P1)
- (2) Voltmeter (1P8)
- (3) LED Inverted rectifier 1U1 in operation (1H1)
- (4) LED Inverted rectifier 1U1 DC input under-voltage (1H4)
- (5) LED Inverted rectifier 1U1 AC output under-voltage (1H7)
- (6) Main switch for inverted rectifier 1U1 (1S2)
- (7) LED Inverted rectifier 1U1 fault (1H2)
- (8) LED Inverted rectifier 1U1 DC input over-voltage (1H3)
- (9) LED Inverted rectifier 1U1 AC output over-voltage (1H6)
- (10) LED Inverted rectifier 1U1 excessive temperature (1H5)
- (11) LED Inverted rectifier 1U1 overload (1H8)
- (22) Temperature sensor (2B6A) activates the air conditioning when the temperature exceeds +20°C (factory setting).
- (13) Temperature sensor (6B1) activates the warning light (3) on the LED monitor (6V2) when the temperature in the cab base rises above +50°C (factory setting). The LED monitor is shown on page 223.
- (14) Humidity sensor (2B7A) activates the air conditioning when the air humidity exceeds 70% (factory setting).

#### REMARK

For more information of the inverted rectifier refer to the separate Technical Manual \*Inverter 1500VA 24V/110V 50Hz\* filed in volume 2 binder.

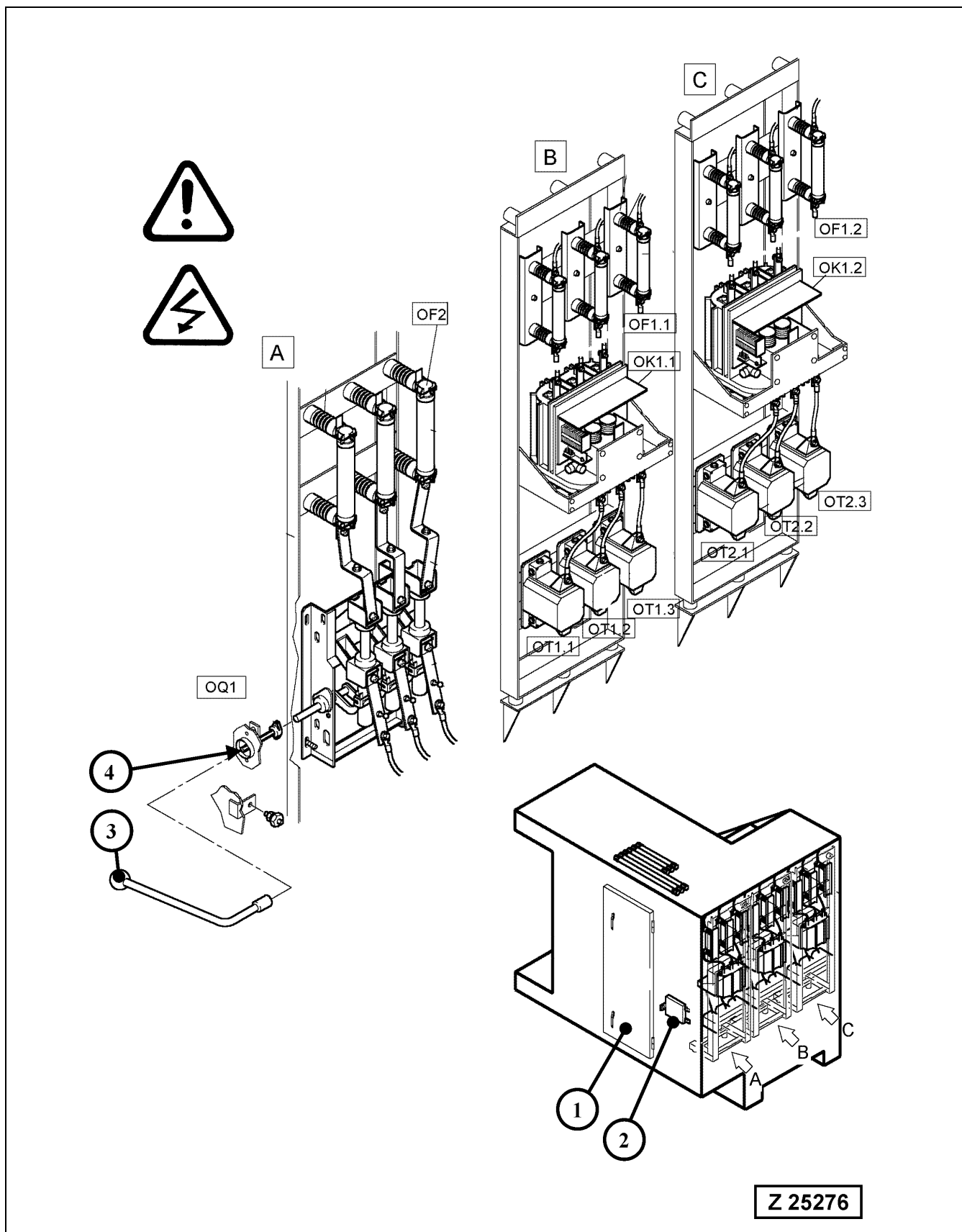


### 3.8.4 SWITCH BOARD - MEDIUM VOLTAGE

#### Legend for illustration Z25263

- (1) Switch board
- (OF4-1) Motor protection relay for main drive motor 1
- (OF4-2) Motor protection relay for main drive motor 2  
Refer to the separate Instruction Manual \*Motor Protection Relay SPAM 150 C\* in volume no 2 binder for operation and maintenance instructions.
- 1Q1A Power switch medium voltage feeding, setting 45A
- 1Q1B Power switch medium voltage feeding, setting 10A
- (6V1) LED monitor unit  
LED number and meaning:  
1 - Main transformer temperature too high  
2 - Wrong direction of rotation  
3 - Overcurrent Motor 1  
4 - Overcurrent Motor 2  
5 - Reserve  
6 - Motor 1 winding temperature too high, Trip  
7 - Motor 2 winding temperature too high, Trip
- (6V2) LED monitor unit  
LED number and meaning  
1 - Restart lock after voltage failure Motor 1  
2 - Restart lock after voltage failure Motor 2  
3 - Temperature in medium voltage switch cabinet too high  
4 - Temperature in high voltage switch cabinet too high  
5 - Motor 1 bearing temperature too high, Trip  
6 - Motor 2 bearing temperature too high, Trip  
7 - Reserve

### 3.9 HIGH VOLTAGE SWITCH CABINET



## High Voltage Switch Cabinet

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 **WARNING**

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- **Access to the high voltage area for authorized personnel only.**
  - **Before opening the door of the high voltage switch cabinet make sure the main power supply from the power station is switched off.**
- 
- 

### Legend for illustration Z 22657

- (1) High voltage switch cabinet door
  - (2) Lockable flap for load cut-off switch
  - (3) Key for load cut-off switch actuator, keep in the switch cabinet.
  - (4) Actuator shaft of the load cut-off switch 0Q1
- 0F2 Fuse 16A
- 0F1.1 Fuse 160A, motor 1  
0F1.2 Fuse 160A, motor 2
- 0K1.1 Main contactor, motor 1  
0k1.2 Main contactor, motor 2
- 0T1.1 Current transformer, motor 1  
0T1.2  
0T1.3
- 0T2.1 Current transformer, motor 2  
0T2.2  
0T2.3

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---

 **WARNING**

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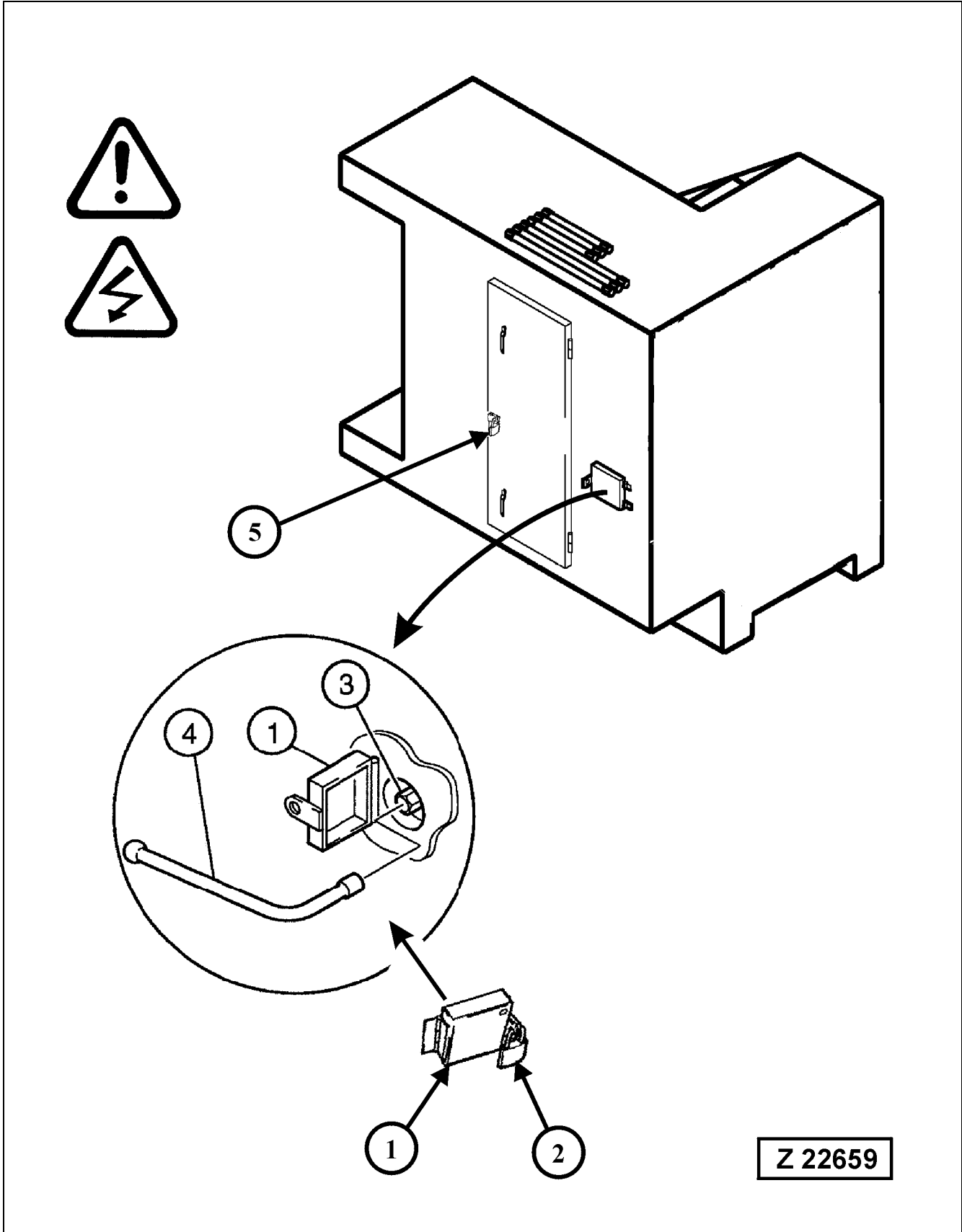
---

**Make sure to lock up door (1) and flap (2) with padlocks to prevent unauthorized access to the high voltage area.**

---

---

### 3.10 CHECKS BEFORE STARTING THE MAIN DRIVE MOTORS



**⚠ CAUTION**

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

---

**Walk-around Inspection**

Check for leakage, loose parts and overall security.

Refer to the maintenance section 4. for the daily inspection items.

**Power Supply**

Make sure the correct power supply (6.9 kV, 50 Hz, 3-Phase) is applied.

**Main Drive Electric Motor**

Read the separate Operation- and Maintenance Manual for the main drive electric motor. Observe the starting and operating instructions.

The Motor Manual is part of Volume no. 2 Binder.

**Start Transformer (if so equipped)**

Read the separate Operation- and Maintenance Manual delivered from the manufacturer of the Start Transformer.

Observe the starting instructions.

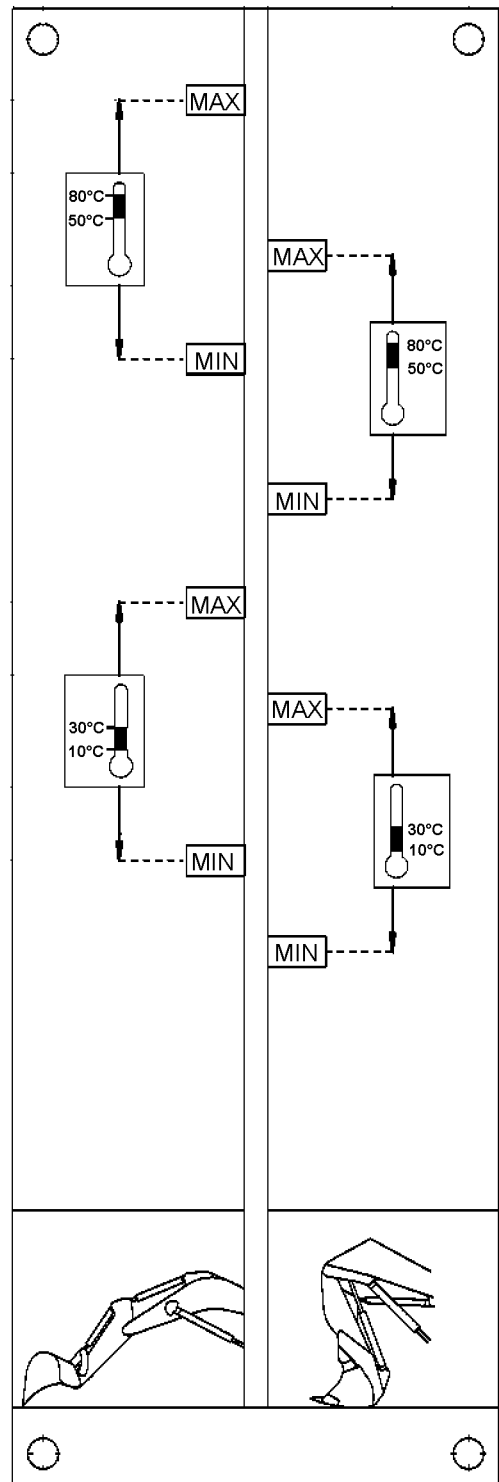
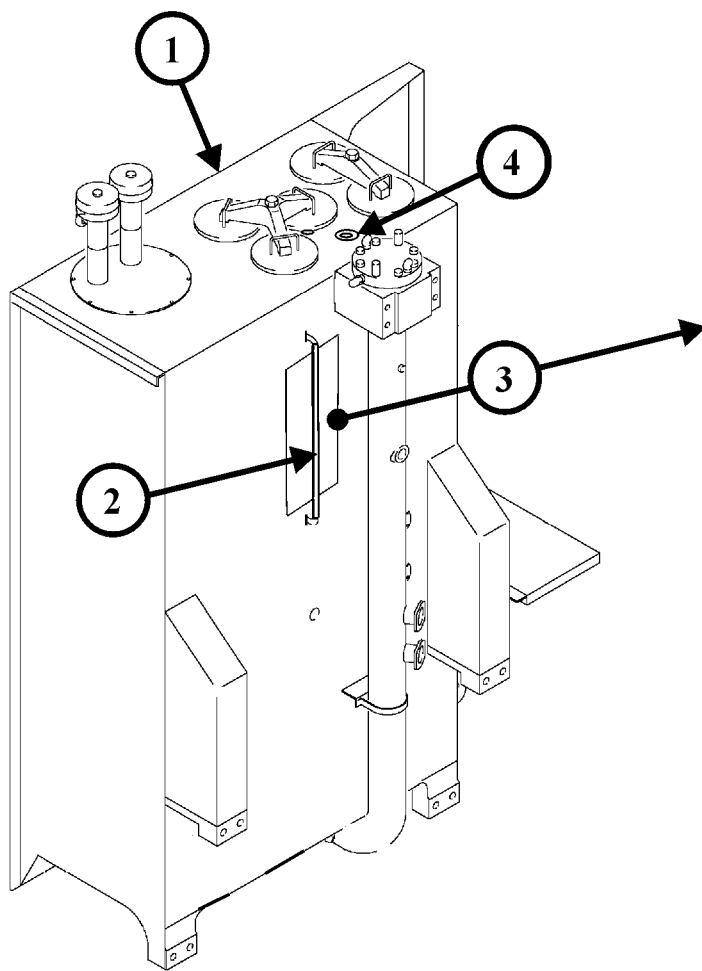
**Load Cut-Off Switch (3), illust. (Z 22659)**

Set this switch to operating position, using key (4).

Close flap (1) and lock-up with padlock (2). Store the key (4) in the switch cabinet.

Make sure the doors of the high voltage switch cabinet and of the cab base are closed and all emergency motor shut-off switches are in released position.

Lock up switch cabinet door with padlock (5).



**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 all machinery house doors are securely closed before starting the motors.

## OPERATOR'S SEAT ADJUSTMENT

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

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 **CAUTION**

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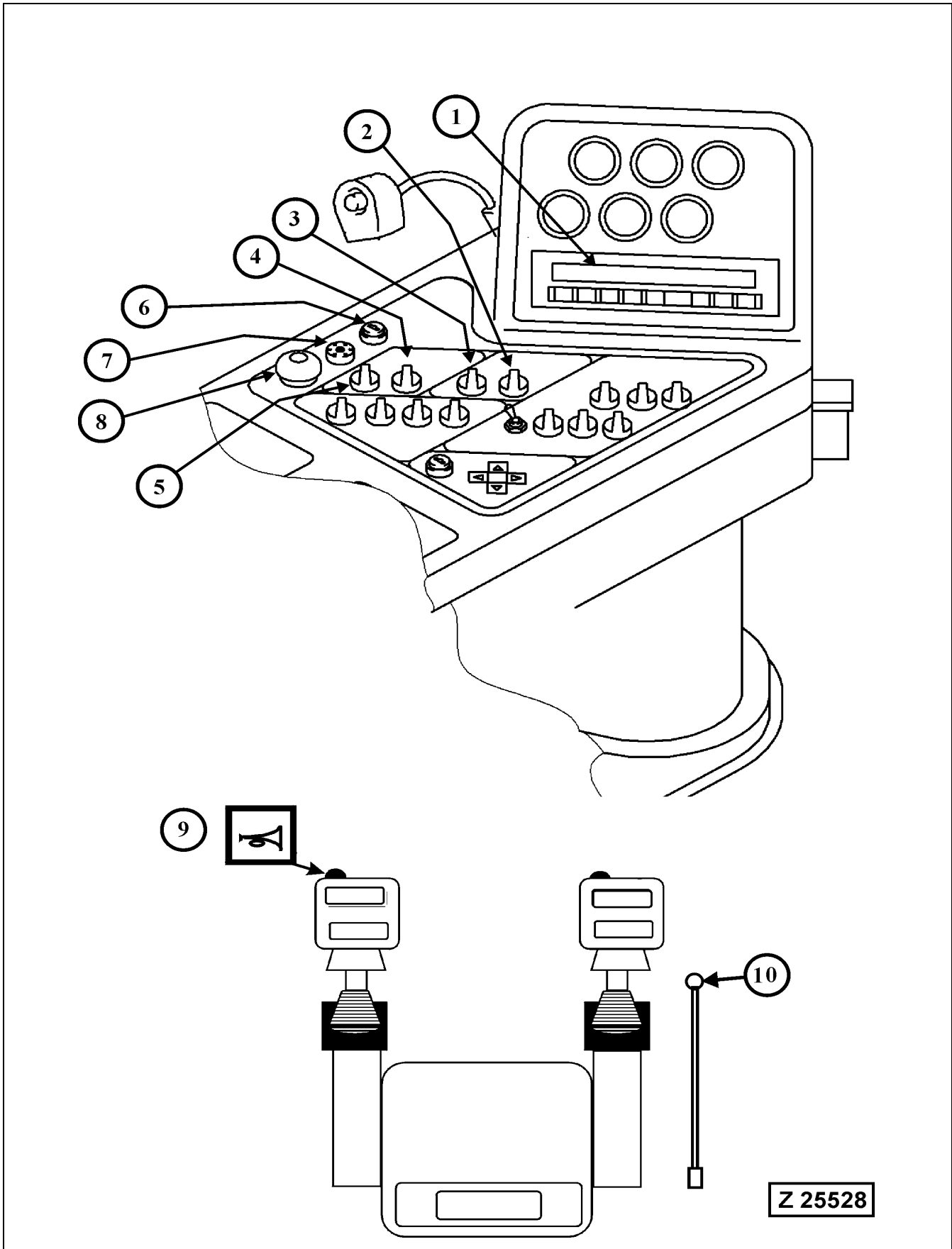
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**Use seat belt in accordance with the local safety regulations and laws.**

---

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### 3.11 STARTING THE MAIN DRIVE MOTORS



**NOTICE**

**Before starting read the Motor Installation, Operation and Maintenance Manual. Observe the instructions for starting the motor.**

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---

**⚠ WARNING**

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- Start the motors from the operator's seat only.
  - 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.
- 
- 

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---

**⚠ CAUTION**

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

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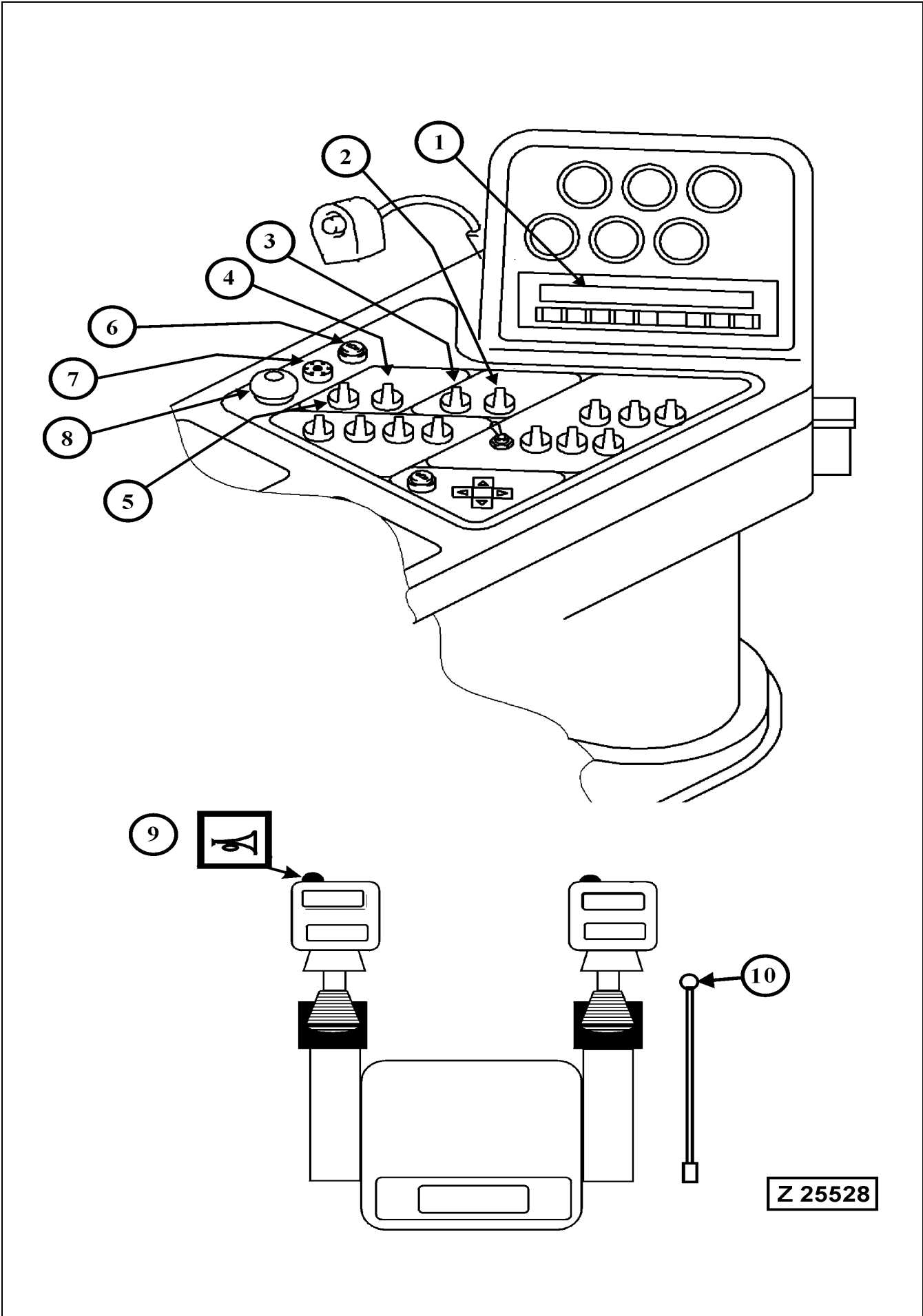
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**Starting Procedure, illustration Z25528****REMARK**

Start the motors with the safety lock lever (10) in the fully rear LOCKED position. When both motors are running move the safety lock lever (10) fully to the front in FREE position. In the FREE position of the safety lever the pilot control system is in working order.

Start the motors one after another, e.g. first rear motor -1- then, after one minute pause time, the front motor -2-. Both motors are started in the same way.

1. Insert battery main switch keys and turn to operating position.
2. Switch on the load cut-off switch, see page 226.
3. Insert key into the switch (6), illustration Z25528 and turn to operating position. The warning buzzer (7) must give an acoustic test signal. If the buzzer fails to function, corrective action must be taken.
4. Observe ECS display (1). Normally the basic display appears on screen (1). If a FAULT message or INFORMATION item is displayed, proceed according to section "ELECTRONIC MONITORING AND CONTROL SYSTEM ECS" on page 88.
5. Sound the signal horn (9).
6. Start the motors by turning starter switches (4 and 2).  
Wait one minute between starting of motor 1 and 2.



**After starting observe the following:**

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

If a FAULT message is displayed on screen (1), illustration Z25528 the acoustic warning signal (7) will sound simultaneously for approximately 1 second. In such a case proceed according to the instructions of the ECS system on page 88.

Warning buzzer (7) will sound continuously when the hydraulic oil level is too low. In this case, stop the motors, locate and correct the cause immediately. Fill up hydraulic oil to the correct level.

**Automatic motor shut down system (safety chain)**

The motor(s) will be stopped automatically if a serious trouble condition occurs. The operator will be informed about the trouble condition by a corresponding message displayed on screen (1).

**Emergency By-pass Switch for the ECS- Shut-down Function.**

The unit is equipped with an Emergency By-pass Switch for the ECS-system.

This switch is located on the \*X2\* switch board in the cab base compartment and marked with \*S27\*.

If an automatic shut-down of the Shovel happens, with a dangerous situation for man or machine, which needs the Shovel to be operable to overcome the dangerous situation, actuate this switch to override the shut-down function of the system and to enable a restart of the motors.

**NOTICE**

**This switch can not override motor initiated shutdowns.**

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**▲ CAUTION**

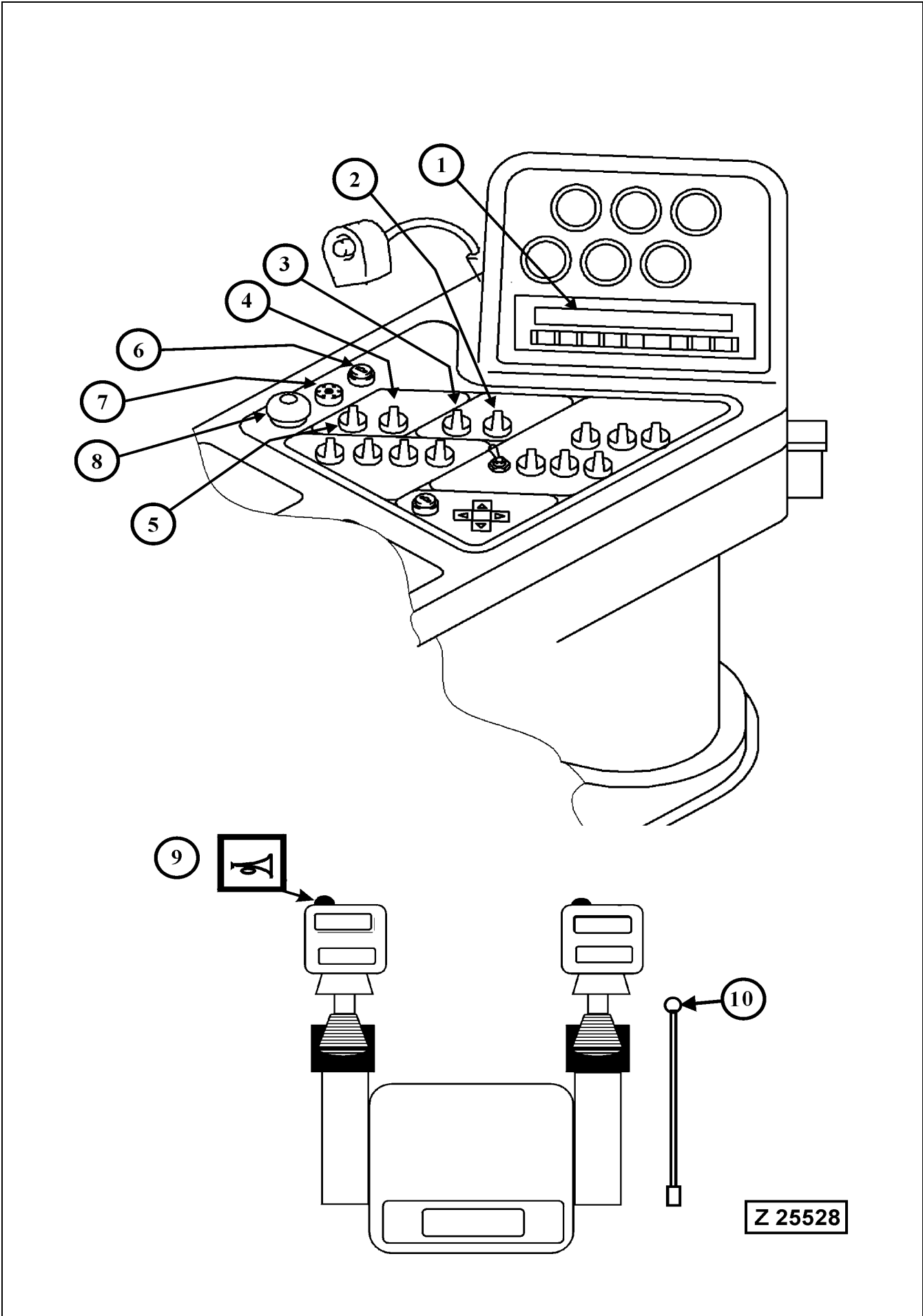
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**As soon as the immediate situation of danger is over, shut down the unit. Correct the fault that caused the shut down and re-set the emergency by-pass switch.**

---

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### Hydraulic oil warm-up

- On machines without hydraulic oil pre-heating system:  
DO NOT start the motors if the ambient temperature (oil temperature) is below the starting temperature shown in column "1" of the hydraulic oil viscosity chart on page 236 in this section.
- On machines with hydraulic oil pre-heating system:  
Before starting the motor, warm-up the hydraulic oil to the starting temperature shown in column "1" of the hydraulic oil viscosity chart.

### Messages displayed with hydraulic oil too cold:

Fault

Hydraulic oil far below operating temp. Wait for warm-up phase!
--

Help:

The machine was taken into operation although the start viscosity was not attained.  
- Preheat hydraulic oil!

Information

# Hydraulic oil not at operating temp.! Operate with reduced power! (Main pump delivery 50% of total capacity)
--

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 page 236.

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

Information

# Hydraulic oil below operating temperature! Pre-heat hydraulic oil or warm up at reduced power.
---

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
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

#### 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"

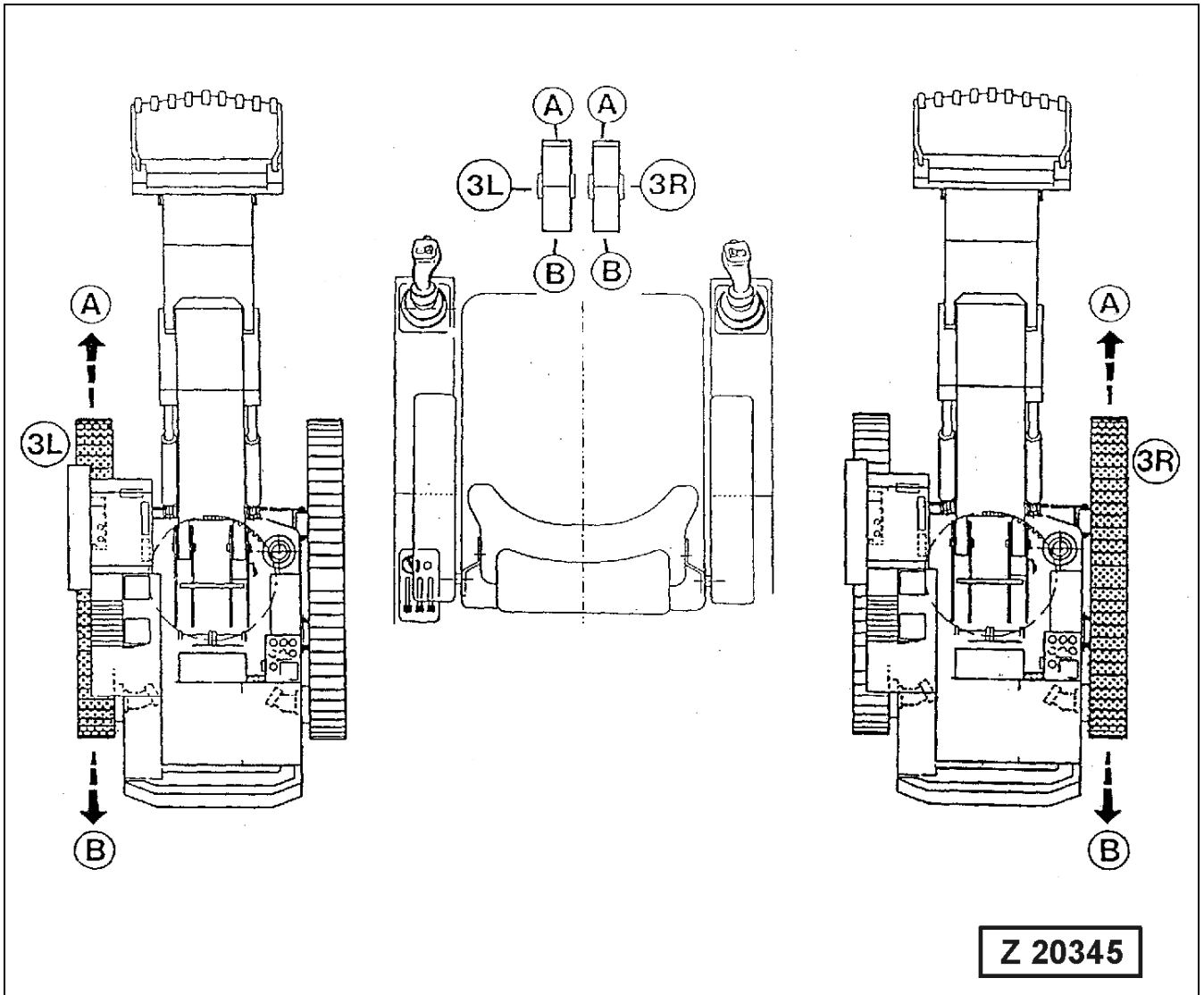


### 3.12 MOVING THE SHOVEL

#### 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.



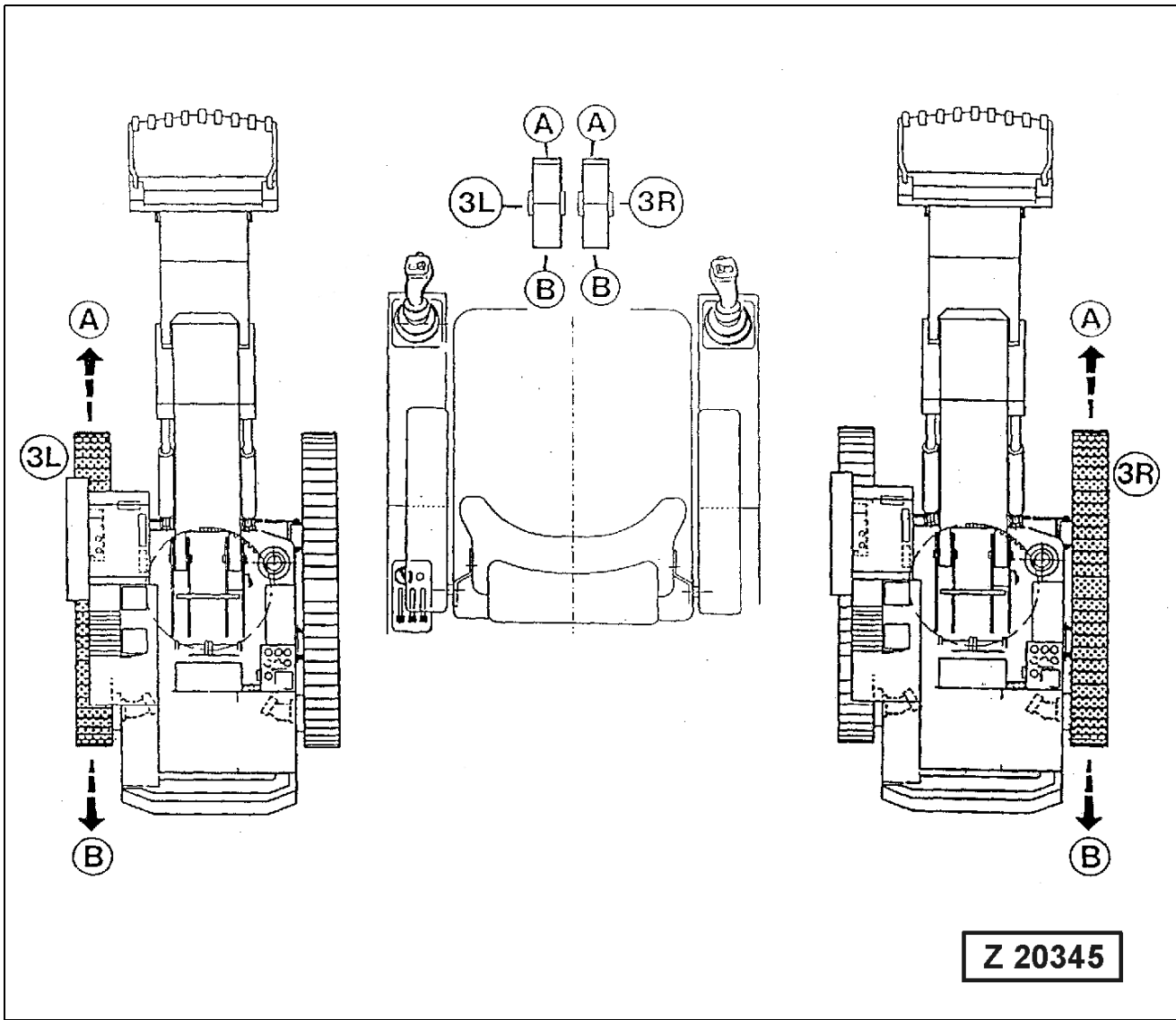
Legend for illustration Z 20345

- (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)

---

**▲ 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.

## 3.13 SLEWING AND BRAKING THE SUPERSTRUCTURE

### 3.13.1 SLEWING THE SUPERSTRUCTURE

#### MACHINES WITH "EURO" CONTROL

Legend for illustration Z25222

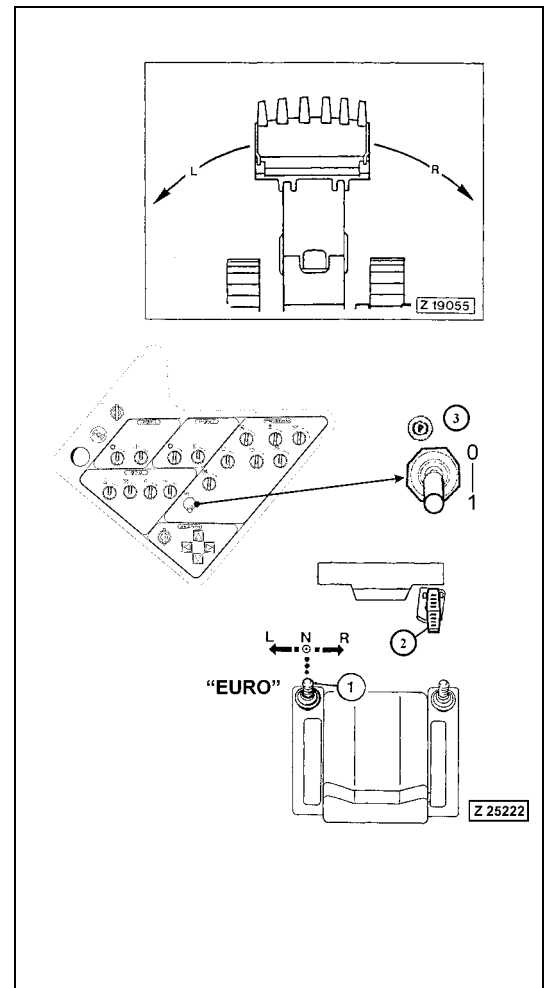
"L" CCW- Lever (1) to the left "L"

"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

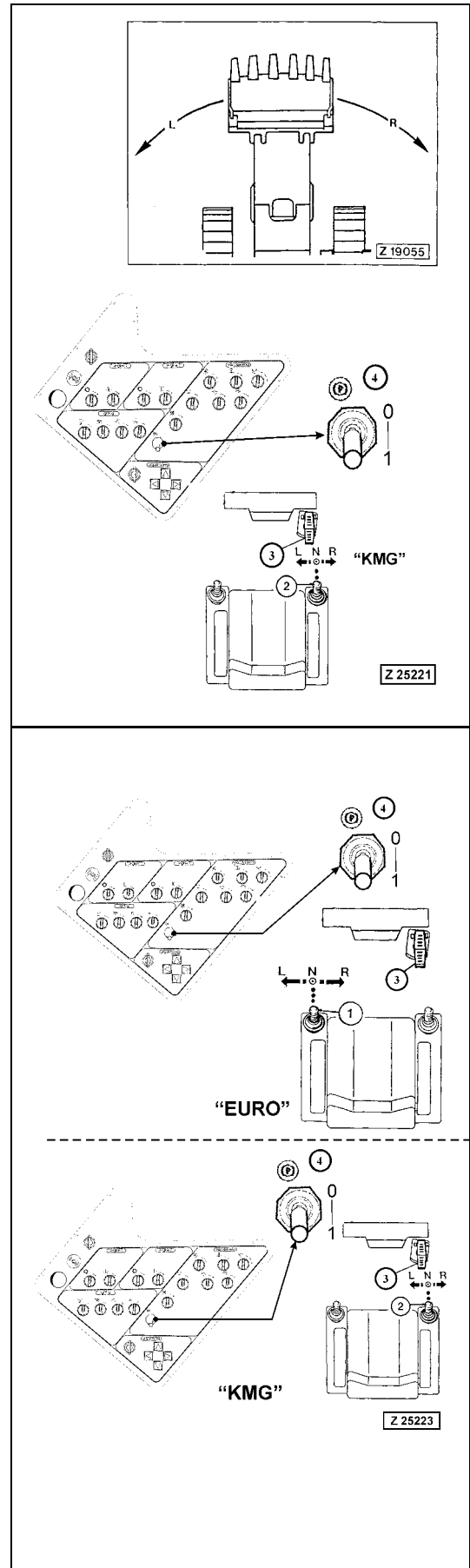
The parking brake for the swing gears is a spring loaded disk type brake. This brake is switched ON and OFF with toggle switch (4).

#### 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**

The hydraulic swing brake will be applied automatically when the access ladder 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

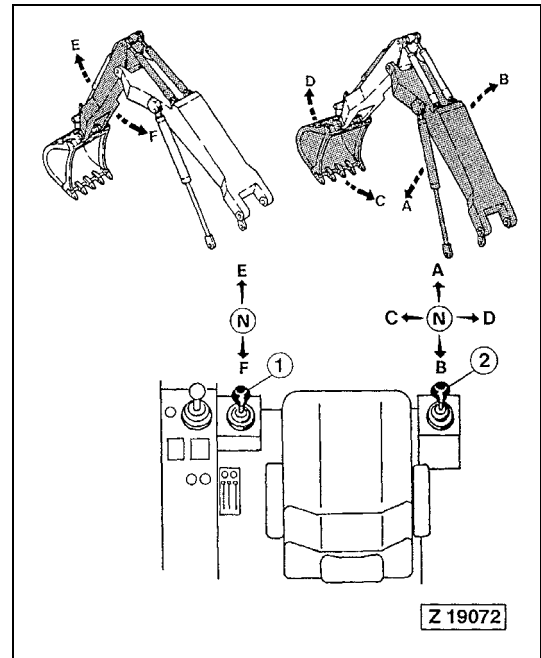
## 3.14.1 MACHINES EQUIPPED WITH "EURO" CONTROL SYSTEM

**NOTICE**

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

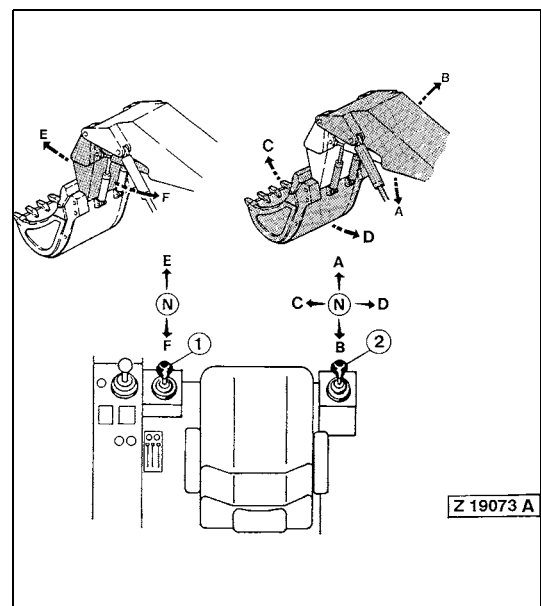
### BACKHOE

- |                     |                                  |
|---------------------|----------------------------------|
| 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 motor at standstill. If, for example, the motor 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 motor, relieve the pressure in the hydraulic system.

For more information → See "STOPPING THE MAIN DRIVE MOTORS" on page 256.



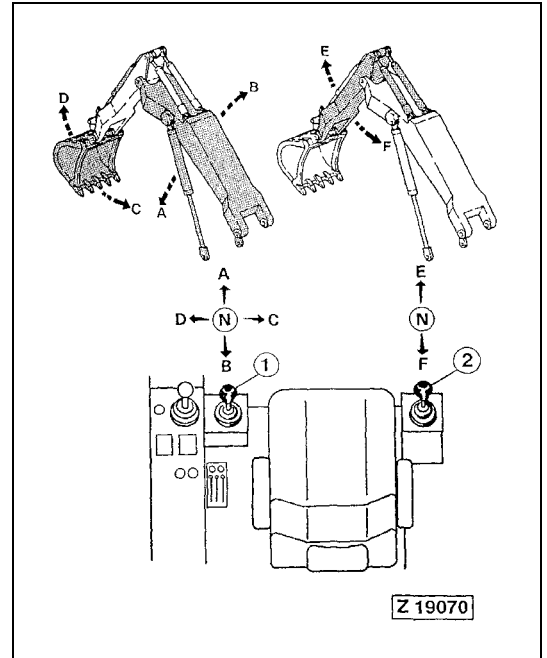
### 3.14.2 MACHINES EQUIPPED WITH "KMG" CONTROL SYSTEM

**NOTICE**

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

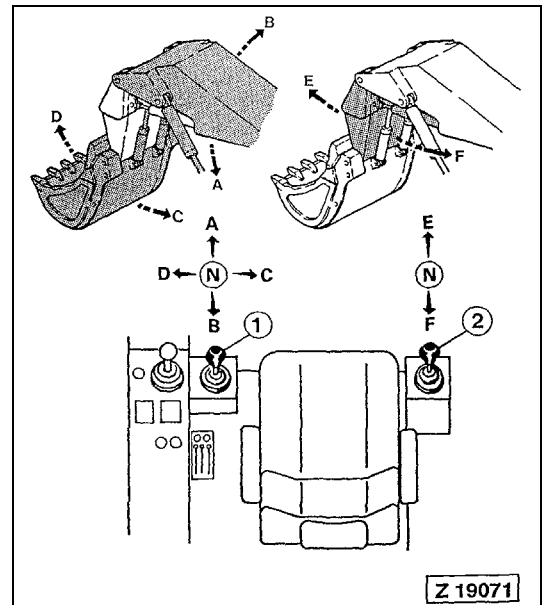
**BACKHOE**

- |                                  |                        |
|----------------------------------|------------------------|
| 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 motor at standstill. If, for example, the motor 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 motor, relieve the pressure in the hydraulic system.

For more information → See "STOPPING THE MAIN DRIVE MOTORS" on page 256.

### 3.14.3 BOTTOM DUMP BUCKET

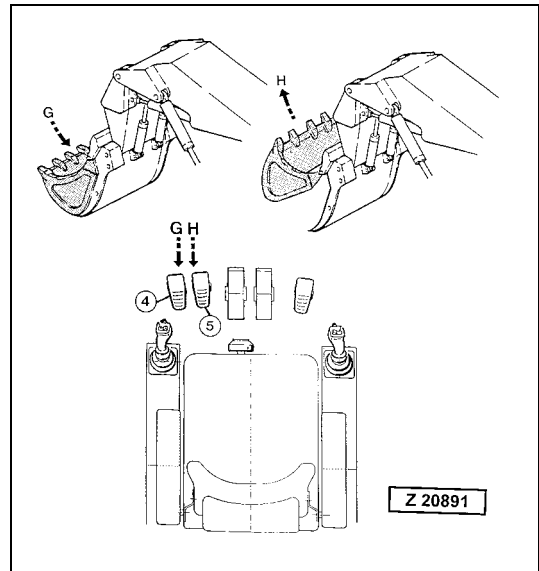
**NOTICE**

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)

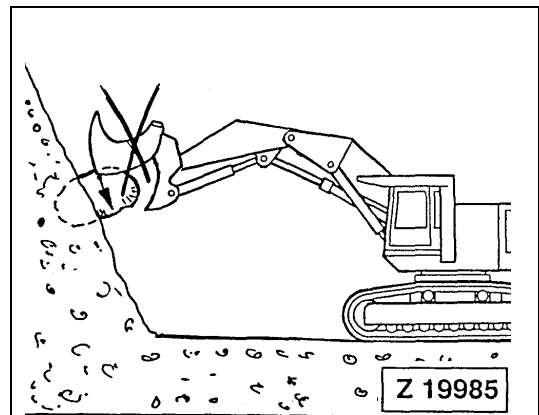
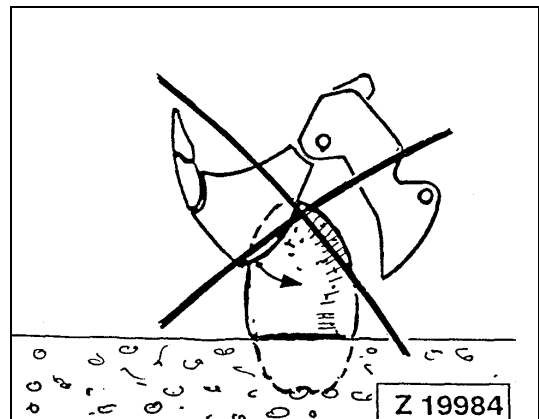


**CAUTION**

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**

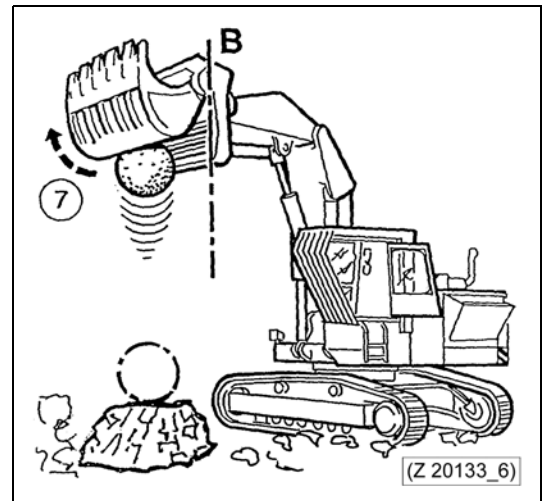
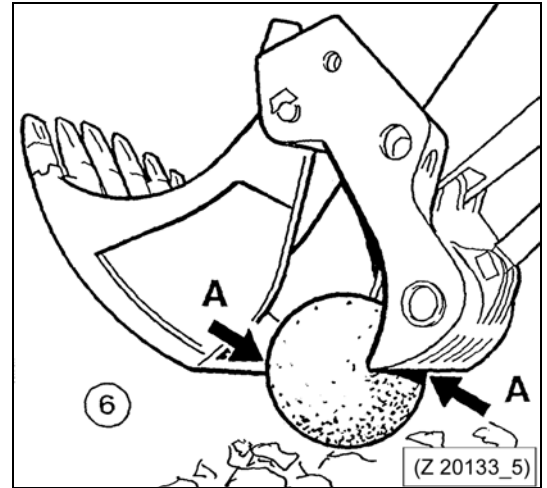
DO NOT use the bucket clam for loosening or removing anchored rocks or other solid objects (illust. Z 19984 and Z 19985), since such operations may result in severe damage to the clam pivot bearings.



### 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.



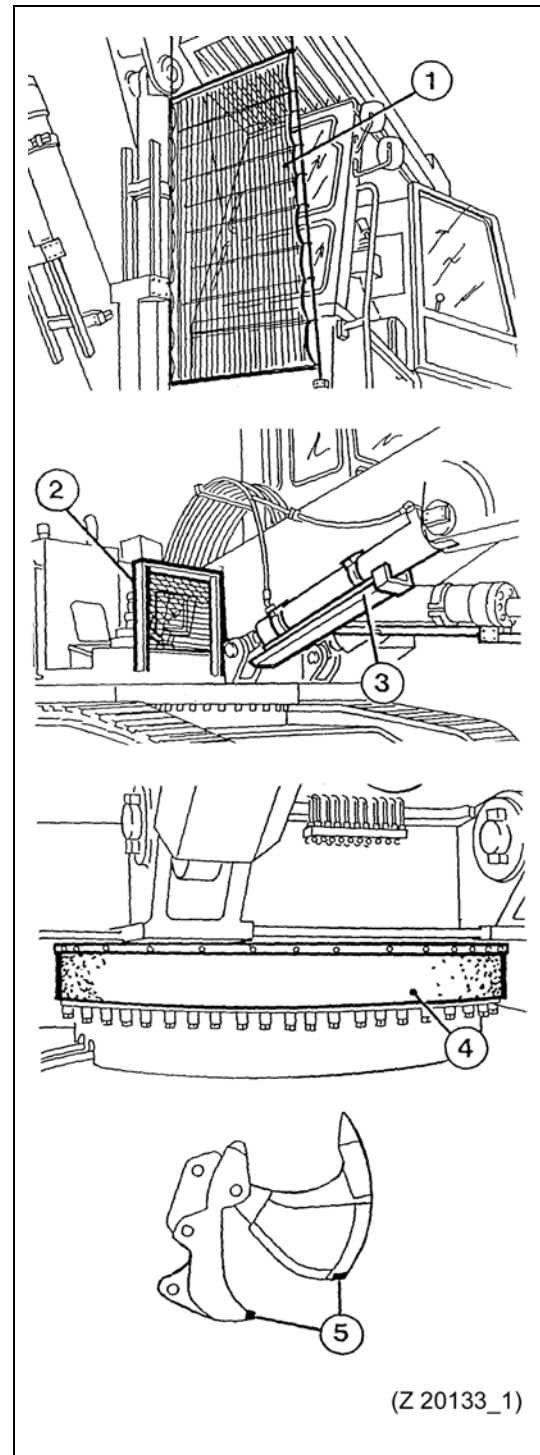
## SAFETY DEVICES (SPECIAL EQUIPMENT)

### 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

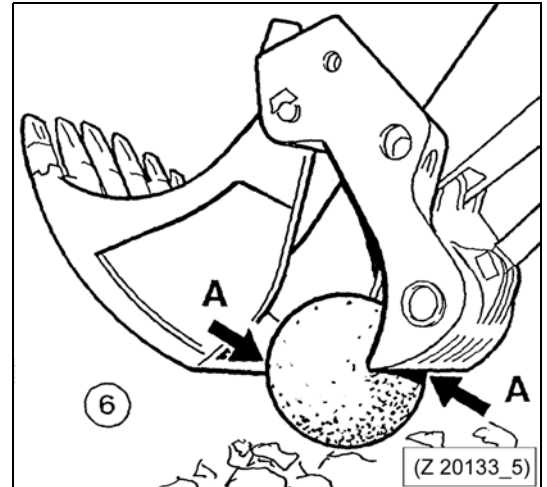
### NOTICE

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

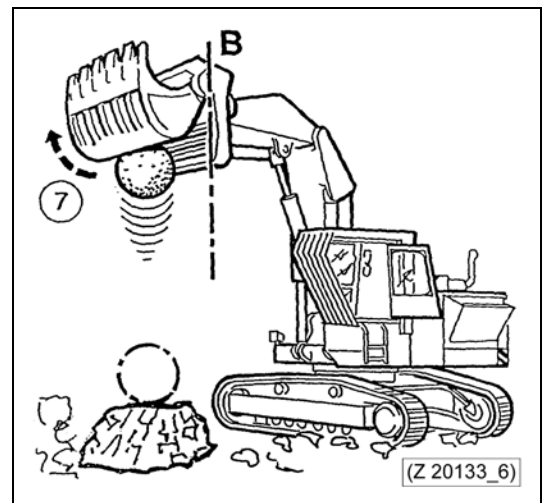


**Legend for illustration Z 20133\_5**

- (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 switched 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

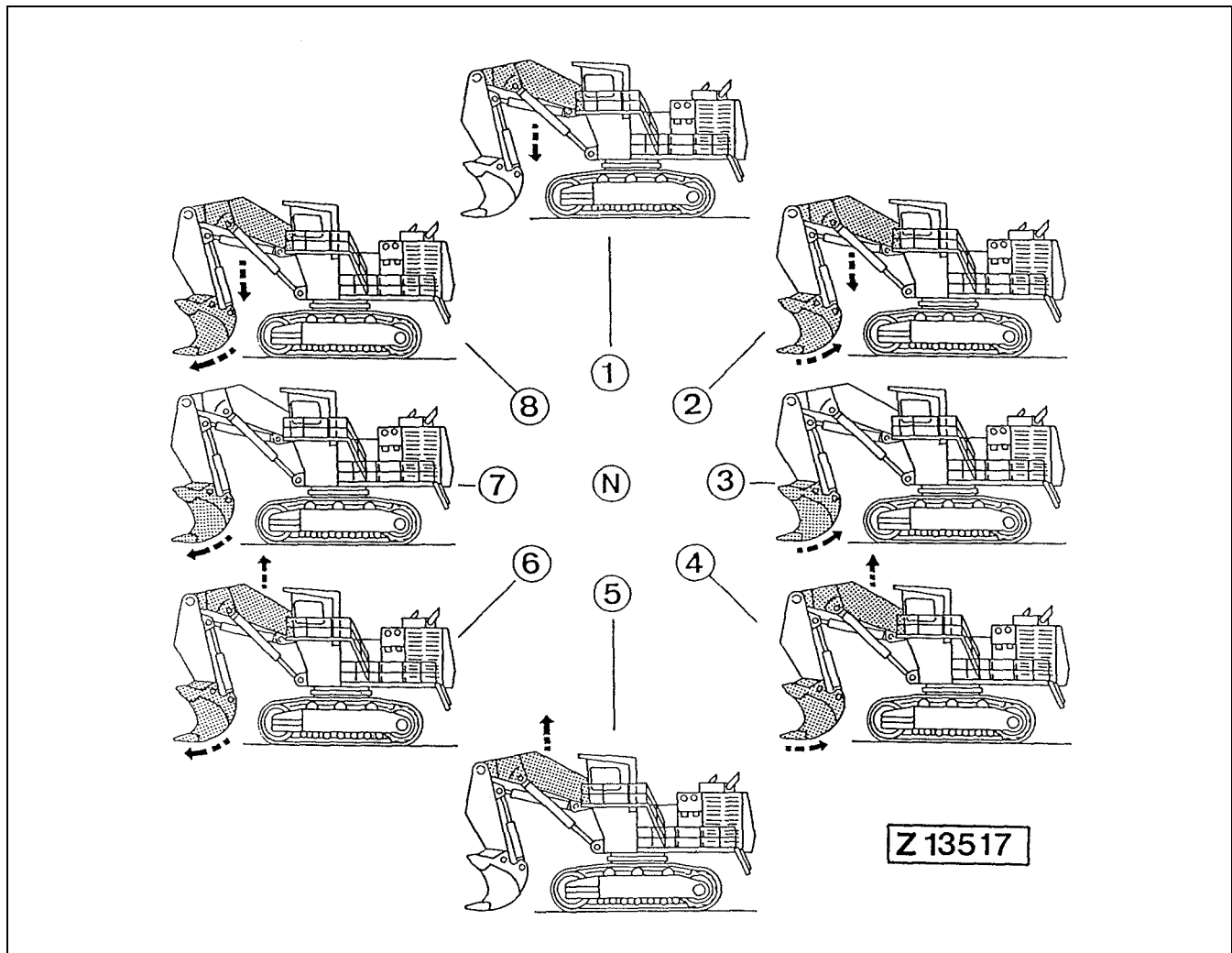
With each of the control levers, two operation cycles can be initiated simultaneously. In order to obtain efficient operation, always select intermediate control lever positions in relation to work load.

**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**

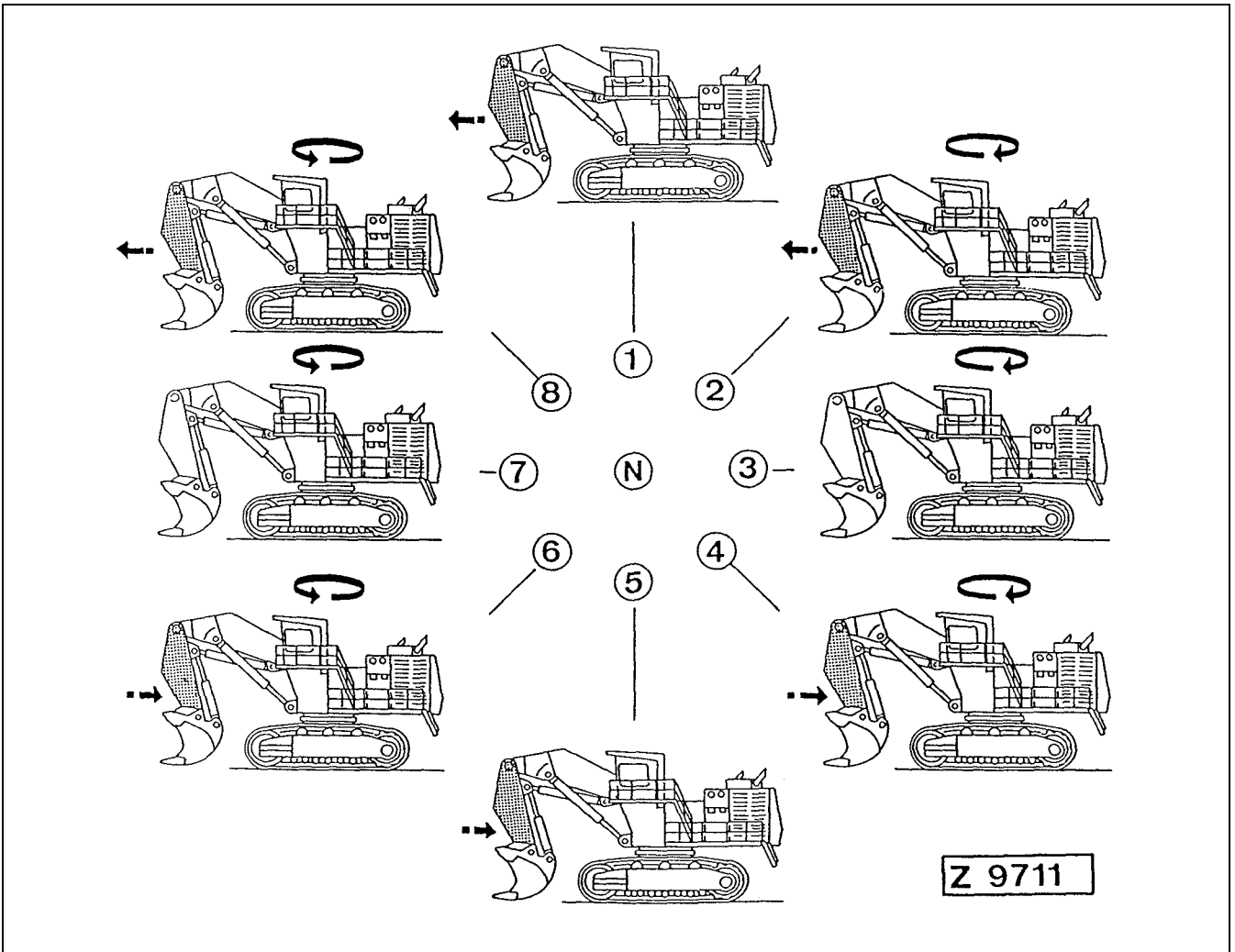
- |     |                                   |     |                                  |
|-----|-----------------------------------|-----|----------------------------------|
| (N) | Neutral position                  | (5) | Raising boom                     |
| (1) | Lowering boom                     | (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.

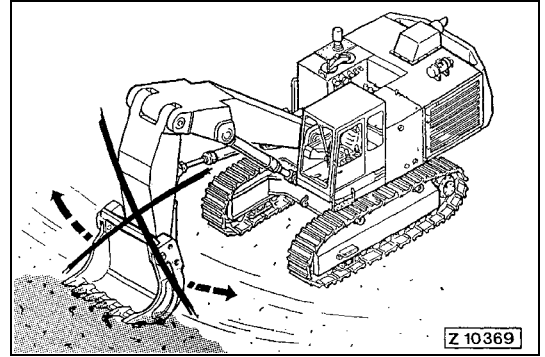
### 3.15.2 SHOVEL OPERATION

- 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.**



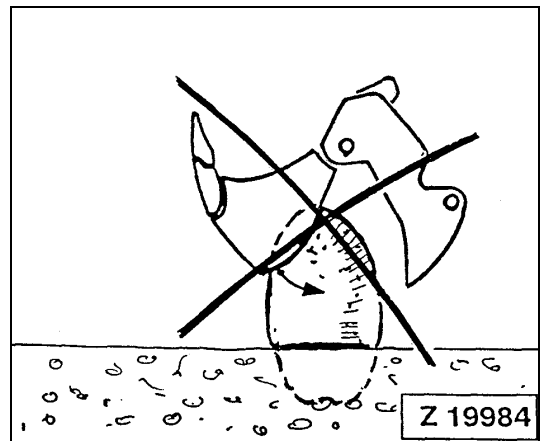
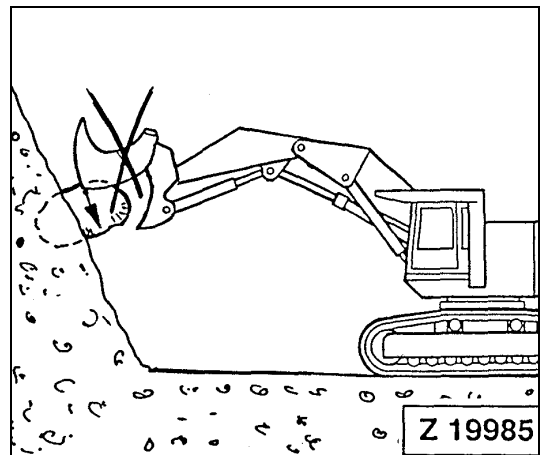
**CAUTION**

**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**

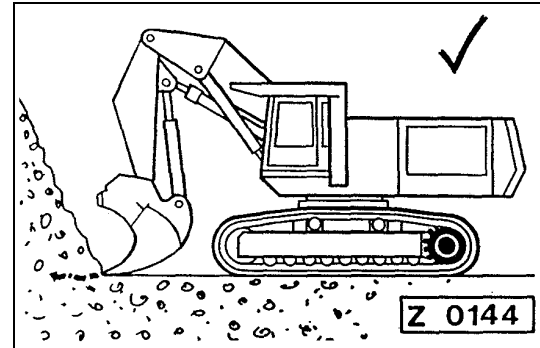
Do not operate the hydraulic cylinders of the working attachment to the end of their strokes. This will bring excessive force onto the inner stoppers of the cylinders and will reduce the lifetime of the cylinders.

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.

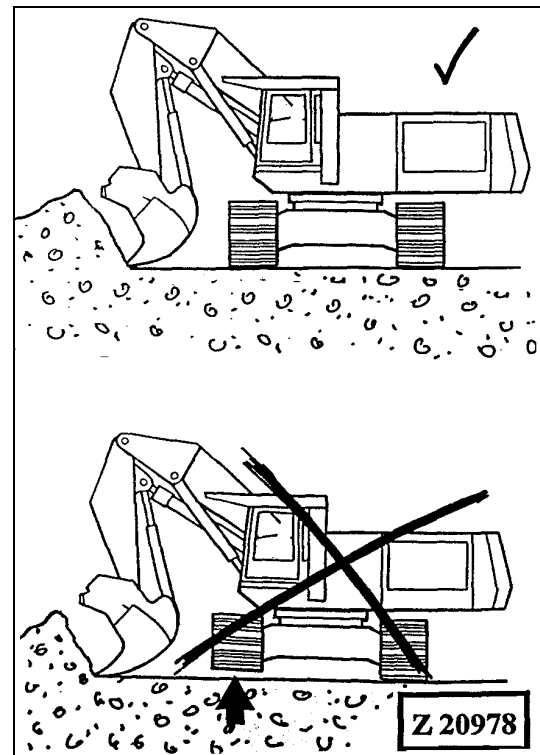


- When working with the loader in a cross direction to the track group, be sure that the track is not raised off the ground, illust. (Z 20978). This can cause the track to set-off from the rollers when it is lowered down on the ground. Also the flanges of the track rollers and the track shoes can be 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 motors and relieve the pressure in the hydraulic system, see page 259 for more information.
- Move the safety lock lever fully to the rear in locked position.

### **WARNING**

**DO NOT leave the Operator's Cab when the motors 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

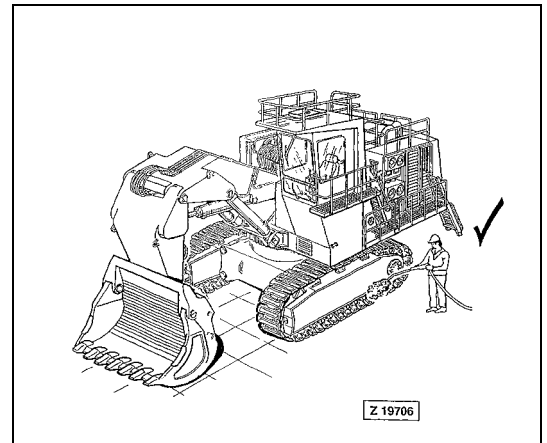
Under working conditions with excessive material build up on the crawler components, cleaning of the crawlers is very important to prevent damage.

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.

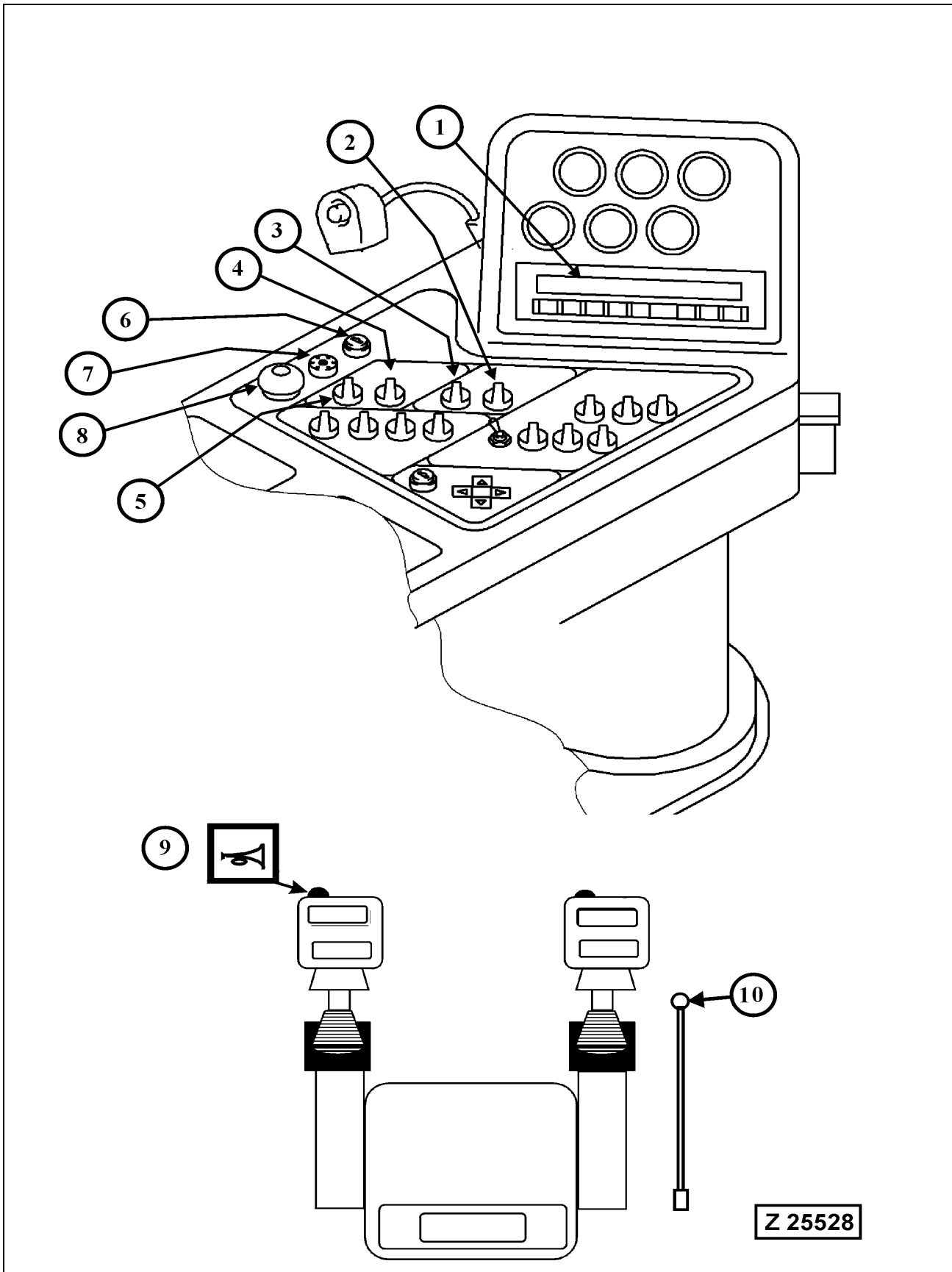
If there is danger of frost, the tracks must also be cleaned.

#### NOTICE

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



### 3.17 STOPPING THE MAIN DRIVE MOTORS



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**⚠ CAUTION**

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For **EMERGENCY SHUTDOWN** of **BOTH MOTORS**, use **STRIKE BUTTON (8)**.

Additional emergency shut-down switches are located on the machinery house. For more information → See "**MACHINERY HOUSE**" on page 202.

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**Stopping procedure, see illustration Z25528.**

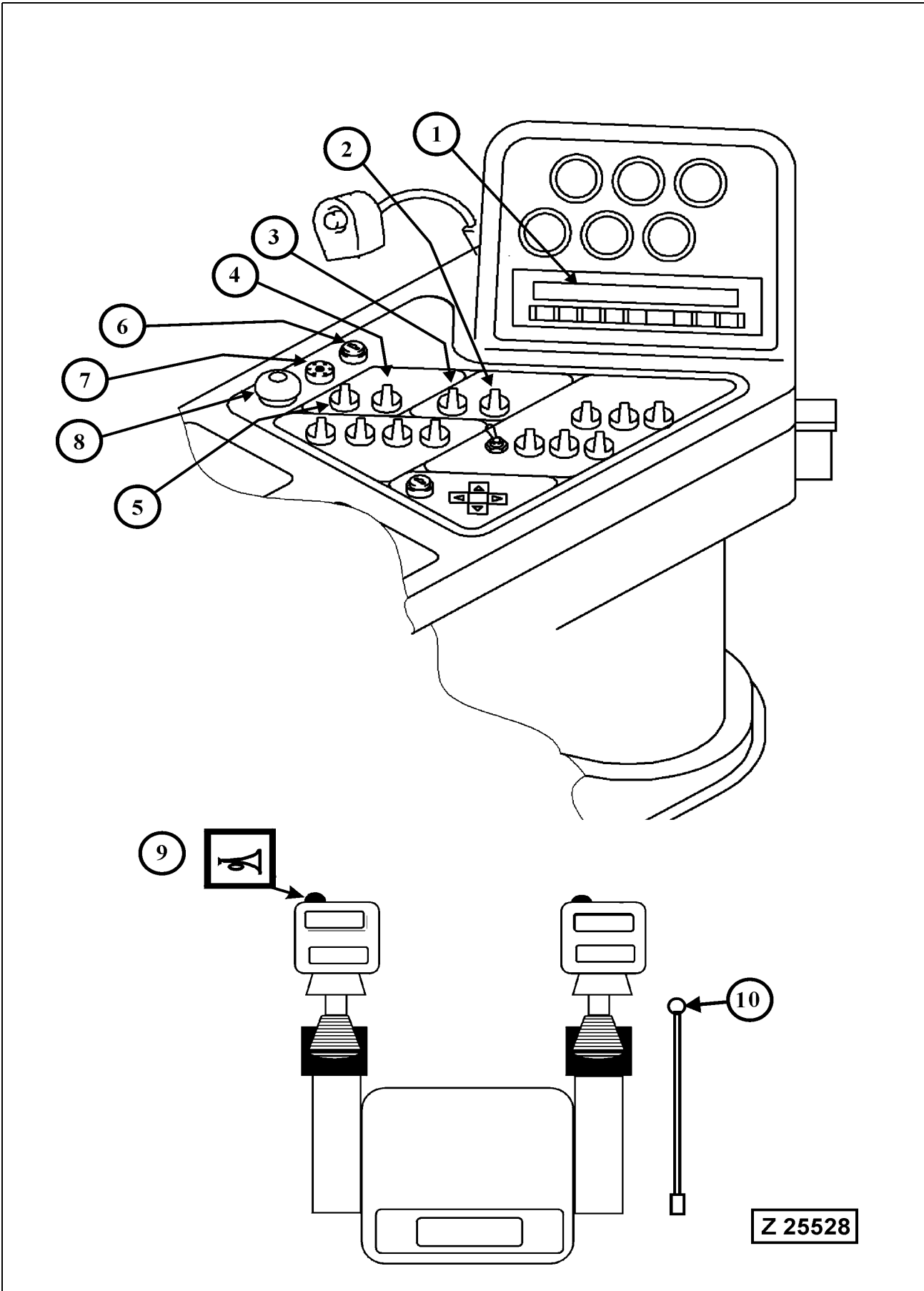
1. Park the Shovel at a safe place on level and solid ground.

**For more information → See "PARKING THE SHOVEL" on page 255.**

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. Turn switches (5 and 3) clockwise to stop position. After the motors have come to standstill, relieve the pressure in the hydraulic system.



### 3.17.1 RELIEVE PRESSURE IN THE HYDRAULIC SYSTEM

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**▲ WARNING**

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With the motors at standstill and main switch (6) 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.

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**NOTICE**

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

5. Set main switch key (6) to "0" position and remove.
6. Set safety lock lever (10) fully to the rear in LOCKED position.
7. Switch off the battery main switches and remove keys.

## 3.18 OPERATION OF THE LUBRICATION SYSTEM

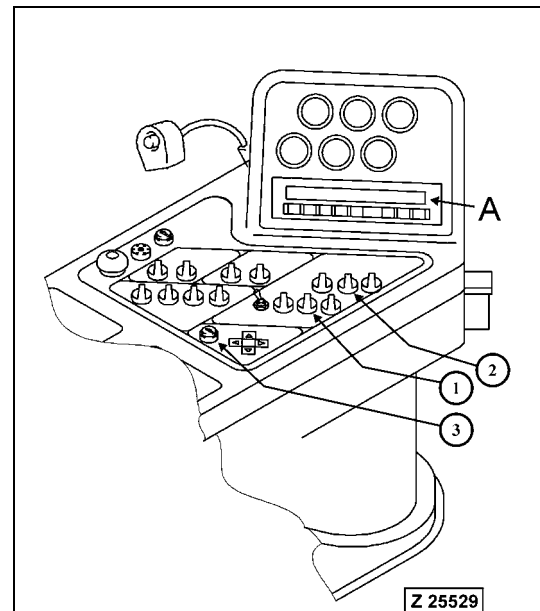
### 3.18.1 CENTRAL LUBRICATION SYSTEM -CLS- FOR SUPERSTRUCTURE AND ATTACHMENT

The central lubrication system works automatically as soon as the motor is running.

The ECS System monitors the function of the central lubrication system. Trouble conditions of the lubrication system are indicated through fault messages on display (A).

#### Legend for illustration Z25529

- (1) Switch, manual actuation of central lubrication system
- (2) Switch, manual actuation of swing ring gear pinion lubrication system
- (3) Key operated service switch
- (A) ECS display



#### Manual actuation of the central lubrication system

Manual actuation of the central lubrication system overrides the adjusted pause time (factory setting 60 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 menu control of the ECS system, see page 125 for more information.

#### 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 of four hours automatic bucket motion cut off can happen depending on the installed ECS soft ware. Repair the system as soon as possible.**



## ADJUSTMENTS OF THE CENTRAL LUBRICATION SYSTEM

### Manual actuation Mode of the Lubrication System with Service Key

The manual actuation in the Service mode is useful for testing the electrical and hydraulic functions of the of the lubrication system. The pause time is reduced to 30 seconds and the holding time to 15 seconds permitting rapid sequences of lubrication cycles. Both lubrication systems can be set to the manual actuation mode.

**CAUTION**

**In the manual actuation mode all monitoring functions of the system are made inoperative and, because of the very short pause and holding times, grease will not reach to all lubrication points.**

#### Carry out manual lubrication by using the service key

1. Insert key into service switch (3) and set to operating position.
2. Actuate the rotary switch (1) on the instrument panel. The message # SERVICE appears on the display. Up to ten repeated actuation of the switch are possible. The lubrication cycles are counted and displayed in the cycle counter window.
3. After finishing the manual lubrication remove service key. The system returns to the normal timer settings.

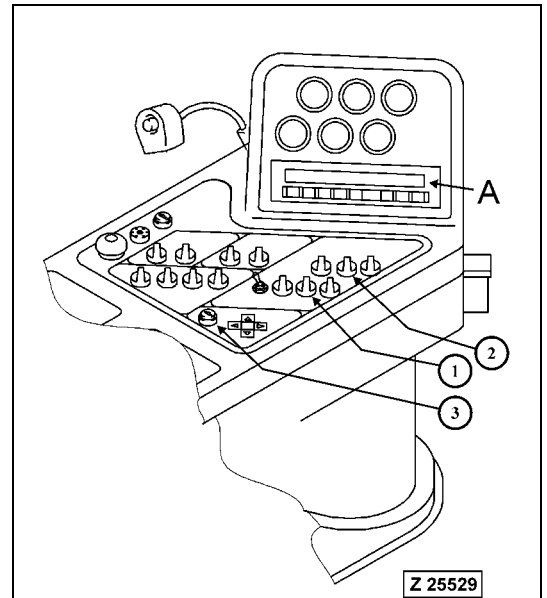
#### Adjustments of the Central Lubrication System

The following adjustments can be made with the menu control of the ECS system:

##### Level 4: Service / Settings

- 4 - Settings * CONDITION INDICATION *
- 4 - Settings (minutes) * PAUSE TIME : *
- 4 - Settings * LUBE CYCLE COUNTER : *

Refer to section "ELECTRONIC MONITORING AND CONTROL SYSTEM ECS" for description of adjustment procedure.

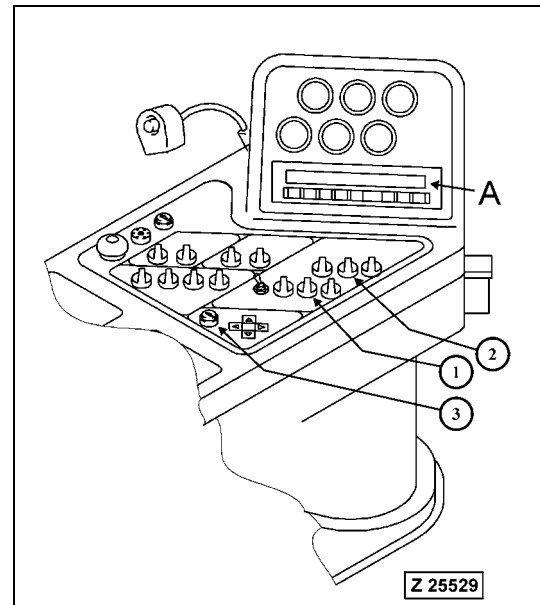


### 3.18.2 SWING CIRCLE PINION LUBRICATION SYSTEM "SLS"

This system works automatically as soon as the motor is running. The ECS System monitors the function of the swing circle lubrication system. Trouble conditions of the lubrication system are indicated through fault messages on ECS display (A).

#### Legend for illustration Z25529

- (1) Switch, manual actuation of central lubrication system
- (2) Switch, manual actuation of swing ring gear pinion lubrication system
- (3) Key operated service switch
- (A) ECS display



#### 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 menu control of the ECS system, see page 125 for more information.

#### 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 of four hours automatic bucket motion cut off can happen depending on the installed ECS soft ware. Repair the system as soon as possible.**

**SWING CIRCLE LUBRICATION SYSTEM "SLS"**

**Manual actuation Mode of the Lubrication System with Service Key**

The manual actuation in the Service mode is useful for testing the electrical and hydraulic functions of the lubrication system. The pause time is reduced to 30 seconds and the holding time to 15 seconds permitting rapid sequences of lubrication cycles.

**CAUTION**

**In the manual actuation mode all monitoring functions of the system are made inoperative and, because of the very short pause and holding times grease will not reach to all lubrication points.**

**Carry out manual lubrication by using the service key**

**REMARK**

The swing ring lubrication system works only during slewing of the superstructure.

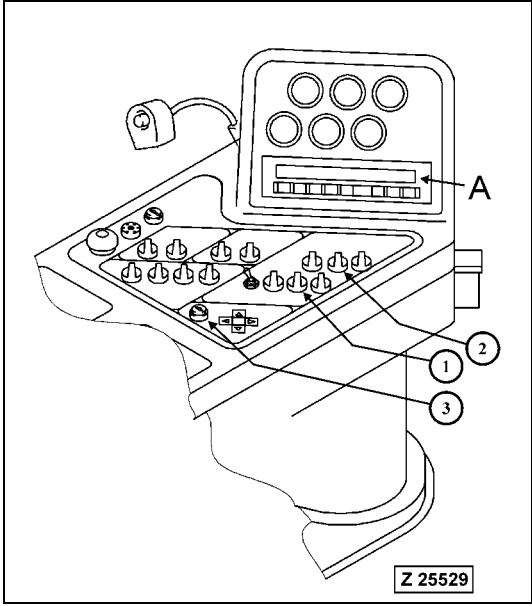
1. Insert key into service switch (3) and set to operating position.
2. Actuate the rotary switch (2) of the swing ring gear lubrication system. The message # SERVICE appears on the display. Up to ten repeated actuation of the switch are possible. The lubrication cycles are counted and displayed in the cycle counter window.
3. After finishing the manual lubrication remove service key. The system returns to the normal timer settings.

**ADJUSTMENTS OF THE SWING CIRCLE LUBRICATION SYSTEM**

The following adjustments can be made in the service menu of the ECS system:

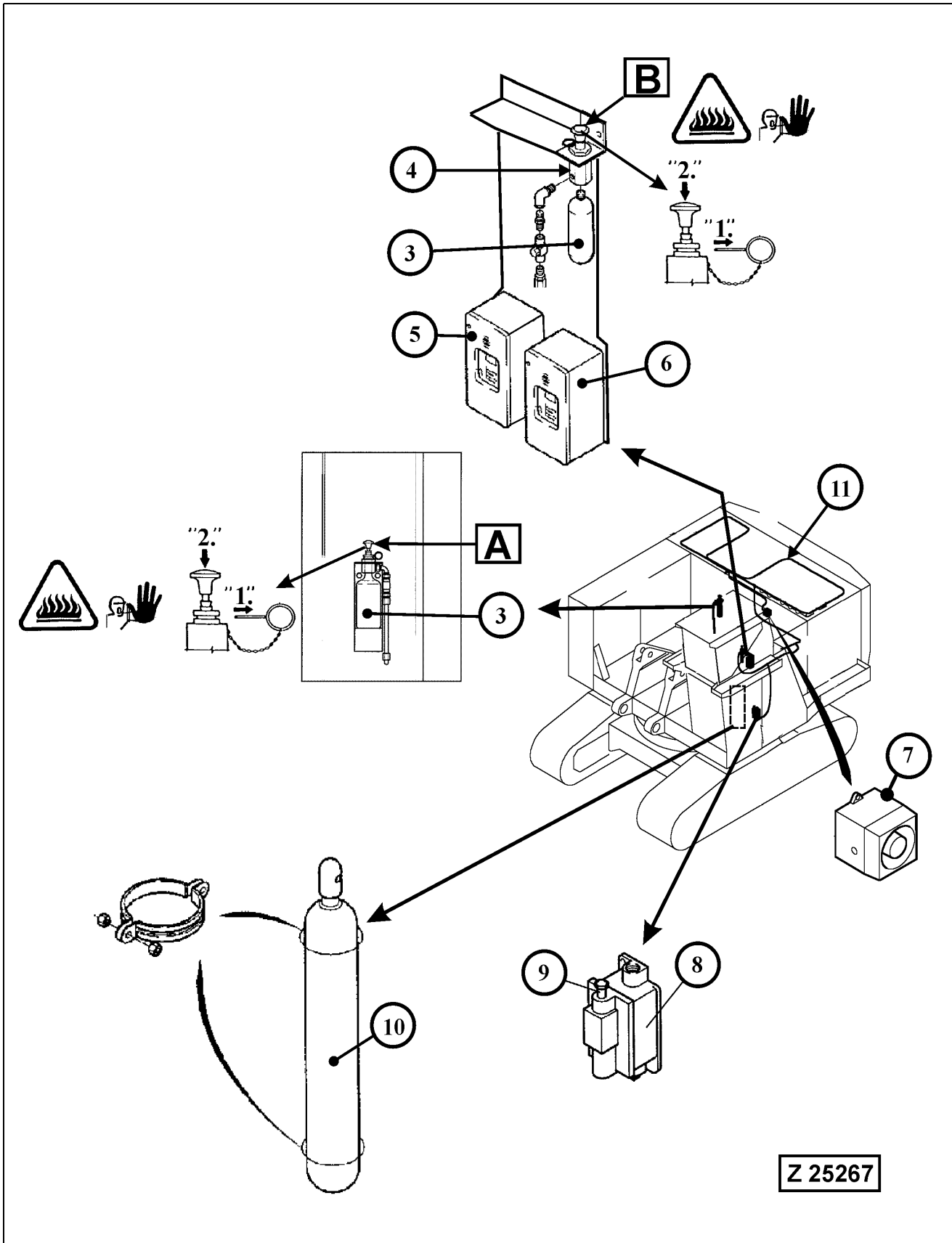
**Level 4: Service Menu / Settings**

- 4 - Settings * CONDITION INDICATION *
- 4 - Settings (minutes) * PAUSE TIME : *
- 4 - Settings * LUBE CYCLE COUNTER : *



Refer to section "ELECTRONIC MONITORING AND CONTROL SYSTEM ECS" for description of adjustment procedure.

### 3.19 FIRE DETECTION, ACTUATION AND SUPPRESSION SYSTEM



### 3.19.1 CONTROL UNITS FOR THE FIRE DETECTION, ACTUATION AND SUPPRESSION SYSTEMS

The excavator is equipped with two different systems, illustration Z25267.

I – CHECKFIRE **SC-N** electric detection and actuation system which controls the Carbon Dioxide fire suppression system for the following areas:

- Slip ring unit.
- High voltage switch cabinet.
- Medium voltage and low voltage switch cabinet in the cab base.

The CHECKFIRE SC-N electric detection and actuation system consists of control module (5), manual actuators (A and B), automatic actuator (4), remote high level alarm (7), explosion-proof pressure switch (8) and thermal spot detectors located in the protected areas.

The Carbon Dioxide fire suppression system consists of a steel cylinder (10) filled with extinguishing gas Carbon Dioxide, piping and discharge nozzles located in the protected areas.

#### Personnel Safety

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 **WARNING**

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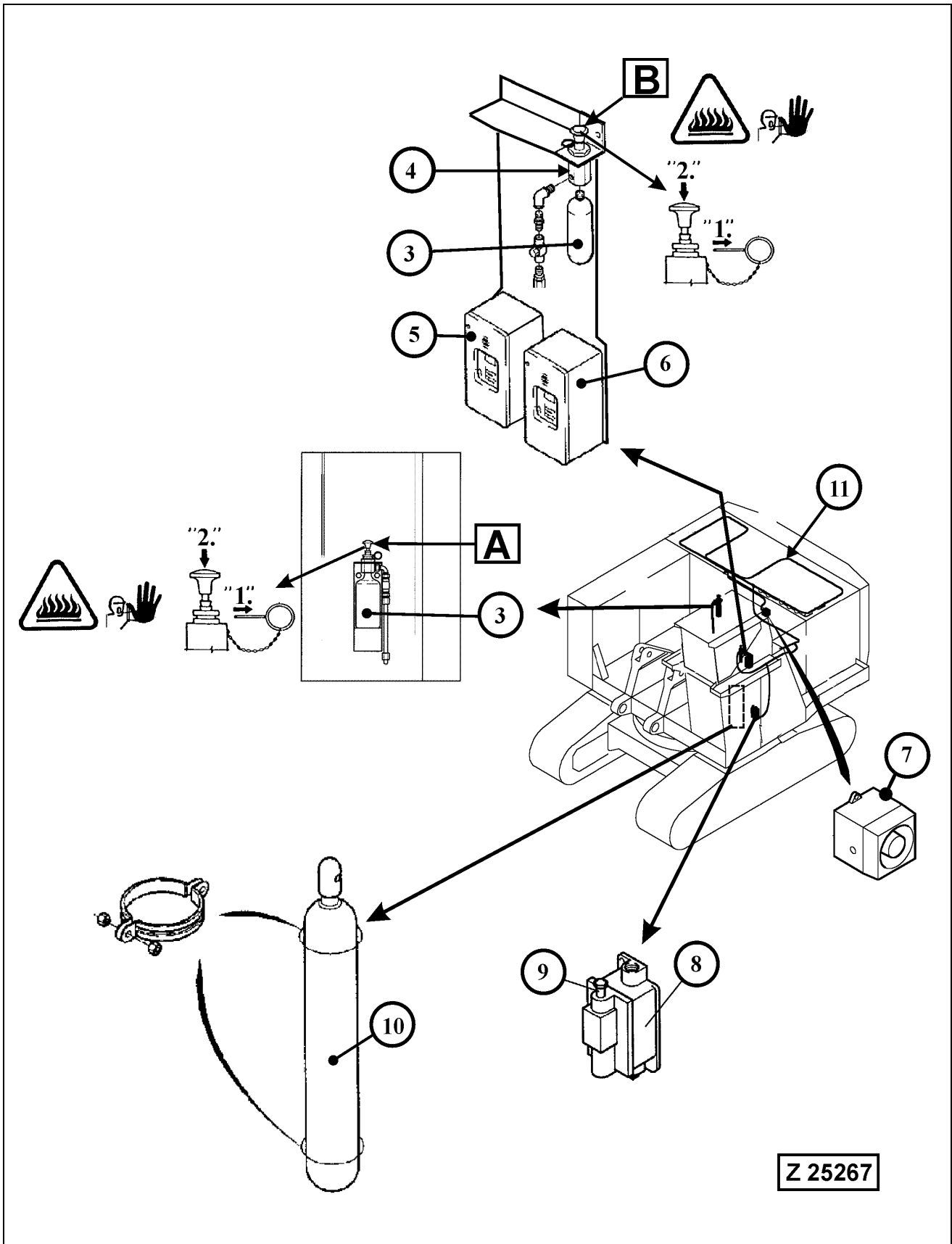
- **The discharge of Carbon Dioxide into an enclosed space can create dangerous oxygen deficiency. It can also reduce visibility to a point where exits are difficult to locate by persons attempting to evacuate the area.**
  - **The use of Carbon Dioxide in an occupied space should provide for the prompt evacuation of personnel and resuscitation of anyone trapped in the hazard area. Time delays, training, signs, alarms and breathing apparatus should be provided to the personnel involved.**
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II – CHECKFIRE **SC-N** electric detection and warning system which monitors the machinery house via a linear detection wire (11) routed in the machinery house.

The CHECKFIRE SC-N electric detection and warning system consists of control module (6) and the linear detection wire (11) routed in the machinery house.

#### REMARK

The machinery house is not equipped with a fire suppression system.



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**CAUTION**


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**Before operating the Excavator make sure the Fire Detection, Actuation and Suppression systems are operative. Carry out inspection and maintenance according to the separate Manual >CHECKFIRE SC-N ELECTRIC DETECTION AND ACTUATION SYSTEM<. This manual is filed in volume 2 binder.**

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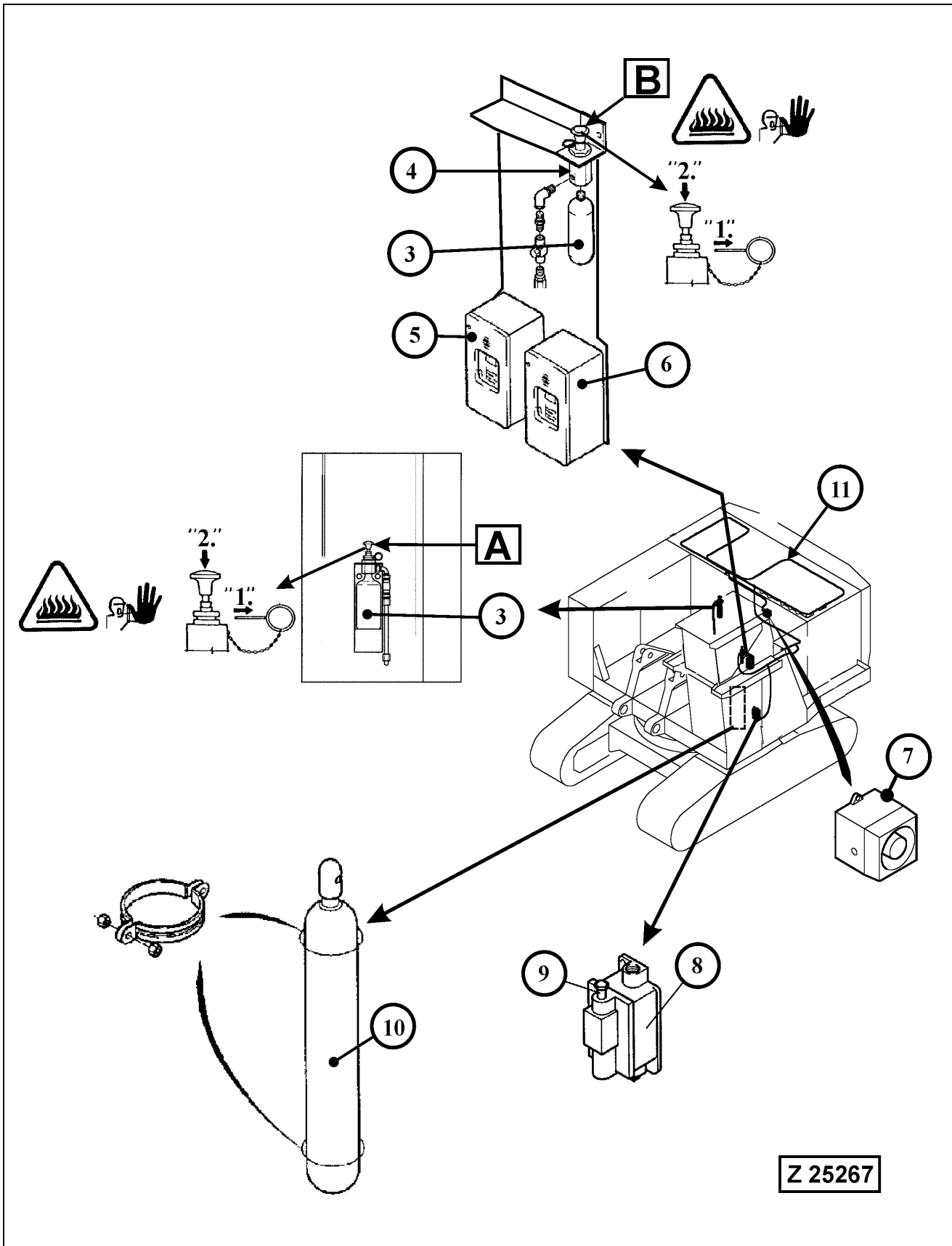
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**NOTICE**

**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 covered in the separate manual.**

**Legend for illustration Z25267**

- (A) Strike button of the manual actuator, located next to the cab base door, for manual actuation of the Carbon Dioxide fire suppression system -I-.
- (B) Strike button of the manual actuator in the operator's cab for manual actuation of the Carbon Dioxide fire suppression system -I-.
- (3) Expellant gas cartridges, must be replaced after actuation.
- (4) Automatic actuator (gas motor) of the Carbon Dioxide fire suppression system -I-. If there is an automatic actuation of the fire suppression system, pressurized gas will shutdown the main drive motors via pressure switch (8) immediately and opens the extinguishing gas cylinder (10) after the pre-adjusted discharge delay.
- (5) Control module of the CHECKFIRE **SC-N** electric detection and actuation system. Refer to the separate Manual >CHECKFIRE **SC-N** ELECTRIC DETECTION AND ACTUATION SYSTEM< for all information concerning - Operational Modes, Daily Inspection, Maintenance and System Conditions. This manual is filed in volume 2 binder.
- (6) Control module of the CHECKFIRE **SC-N** electric detection and warning system -II-. Refer to the separate Manual >CHECKFIRE **SC-N** ELECTRIC DETECTION AND ACTUATION SYSTEM< for all information concerning - Operational Modes, Daily Inspection, Maintenance and System Conditions. This manual is filed in volume 2 binder.
- (7) Remote high level alarm located outside on the Operator's cab, this alarm will sound when the system detects a fire.
- (8) Explosion-proof pressure switch – DPST located in the cab base. This switch shuts off the motors immediately when the fire detection system has a fire detected. The reset plunger (9) moves out into its upper position. When the fire suppression system has been recharged, push in the reset plunger.
- (9) Reset plunger, be sure to push in this plunger as soon as the fire suppression system has been recharged after actuation of the system.
- (10) Steel cylinder filled with extinguishing gas Carbon Dioxide, located inside the cab base.
- (11) Linear detection wire routed in the machinery house





### 3.19.2 REMOTE HIGH LEVEL ALARM \*FIRE\* LOCATED ON THE CAB

The alarm (7), illustration Z25267 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.

#### Motor shut-down

When the fire detection system detects a fire, a shutdown function for the motors will be actuated through pressure switch (8).

### 3.19.3 ACTUATION MODES OF THE FIRE SUPPRESSION SYSTEM:

**Manual actuation** via strike button (A) of the manual actuator at the cab base door or strike button (B) in operator's cab.

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**⚠ WARNING**

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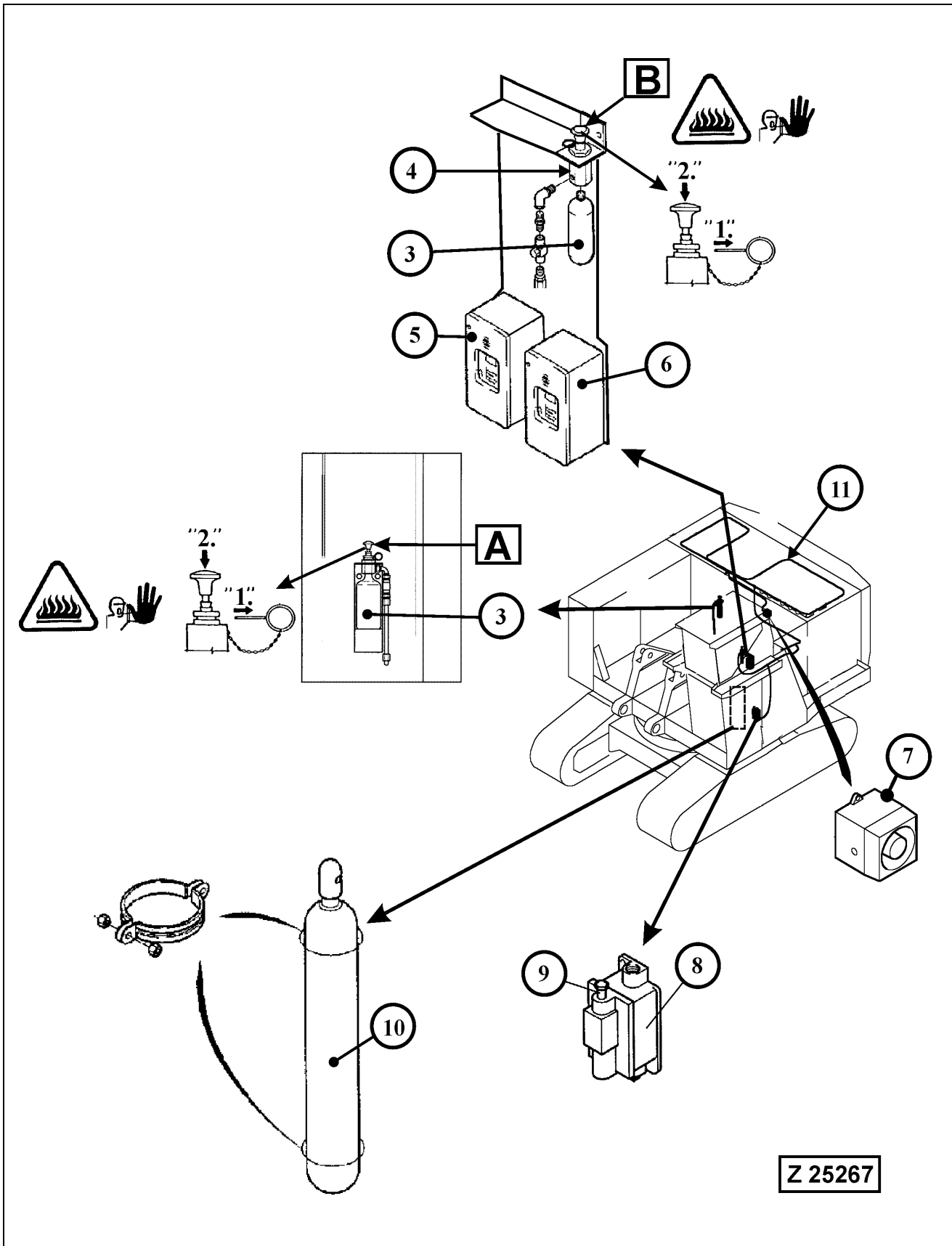
- **Manual actuation will result in immediate system discharge which may obscure vision. Make certain the Excavator is stopped safely before manually actuating the system. Manual actuation will bypass all auxiliary shut-down and alarm functions.**
  - **The discharge of Carbon Dioxide into an enclosed space can create dangerous oxygen deficiency. It can also reduce visibility to a point where exits are difficult to locate by persons attempting to evacuate the area.**
  - **The use of Carbon Dioxide in an occupied space should provide for the prompt evacuation of personnel and resuscitation of anyone trapped in the hazard area. Time delays, training, signs, alarms and breathing apparatus should be provided to the personnel involved.**
- 
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For manual actuation via actuators (A or B), pull ring "1" and strike button "2".

**Automatic actuation** via fire detectors located in the protected areas. The following areas are protected by the Fire Suppression System:

- Slip ring unit.
- High voltage switch cabinet.
- Medium voltage and low voltage switch cabinet in the cab base.

The machinery house is not equipped with a Fire Suppression System. The machinery house is monitored by the **Fire Detection and Warning System II** via a fire wire, which informs the operator in case of a fire through control unit (6). Simultaneously the main drive motors will be stopped.



### **Indication of Alarm Condition at Control Module (5), illustration Z25267 in case of an AUTOMATIC Actuation of the Fire Suppression System -I-:**

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 will pulse at a rate of 4 times per second.

#### **Timer Setting (factory adjustment)**

Alarm to Shutdown: 0 seconds

Shutdown to Discharge: 15 seconds

### **3.19.4 IN CASE OF FIRE**

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**▲ WARNING**

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- Act according to the circumstances and the applying safety regulations.
  - Evacuate area to lessen risk of injury from flames, heat, extinguishing gas Carbon Dioxide, hazardous vapours, explosions, or other hazards that may be created.
  - Evacuate endangered Persons. Use breathing apparatus to prevent suffocation caused through the extinguishing gas Carbon Dioxide.
  - Inform the fire brigade.
  - Fight the fire.
- 
- 

#### **REMARK**

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

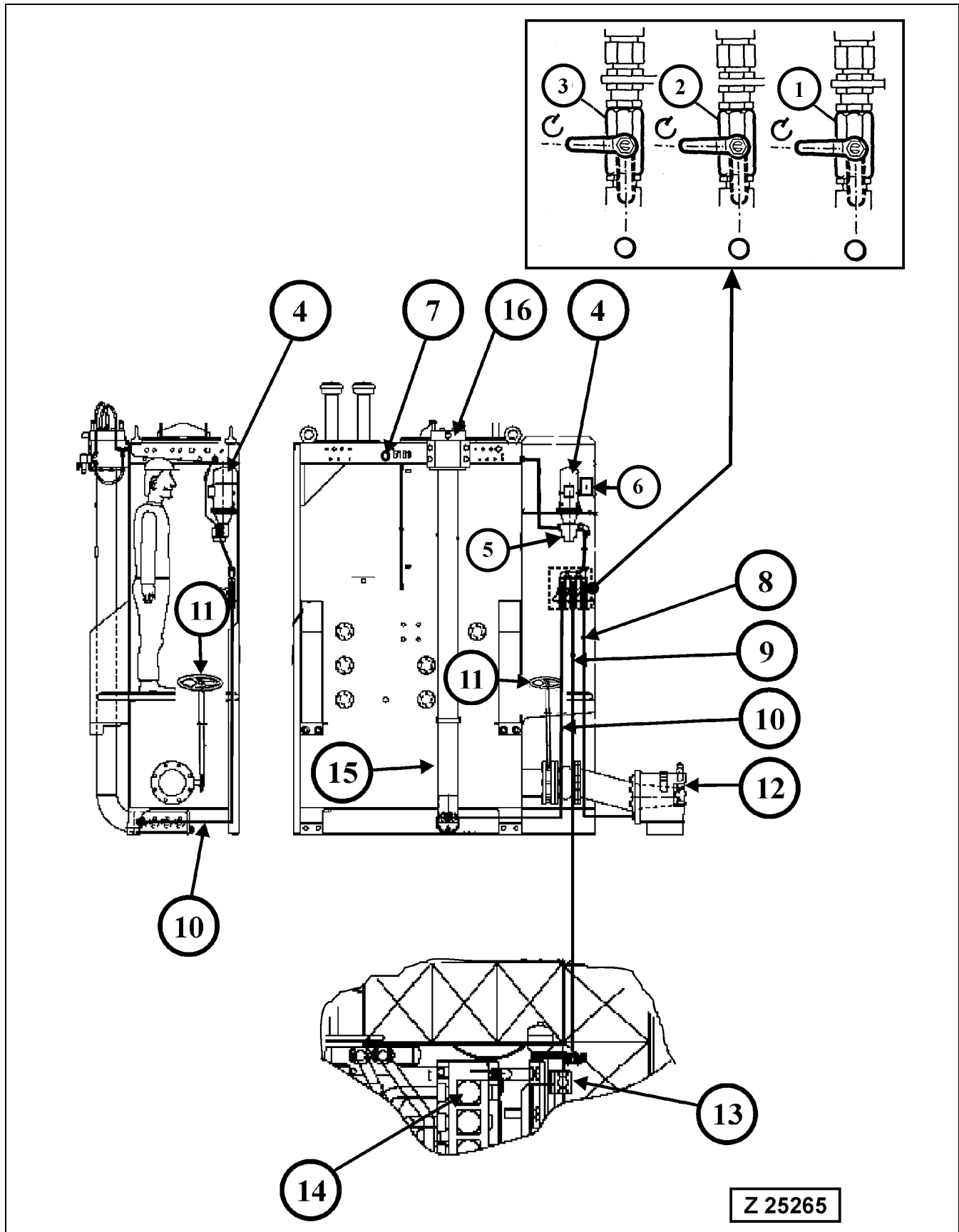
### **Indication of Alarm Condition at Control Module (6) when the electric Detection and Warning System -II- detects a Fire in the Machinery House:**

The RED alarm LED and the audio alarm will pulse at a rate of 4 times per second.

Proceed according to the paragraph **\*In Case of Fire\***.

### 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.

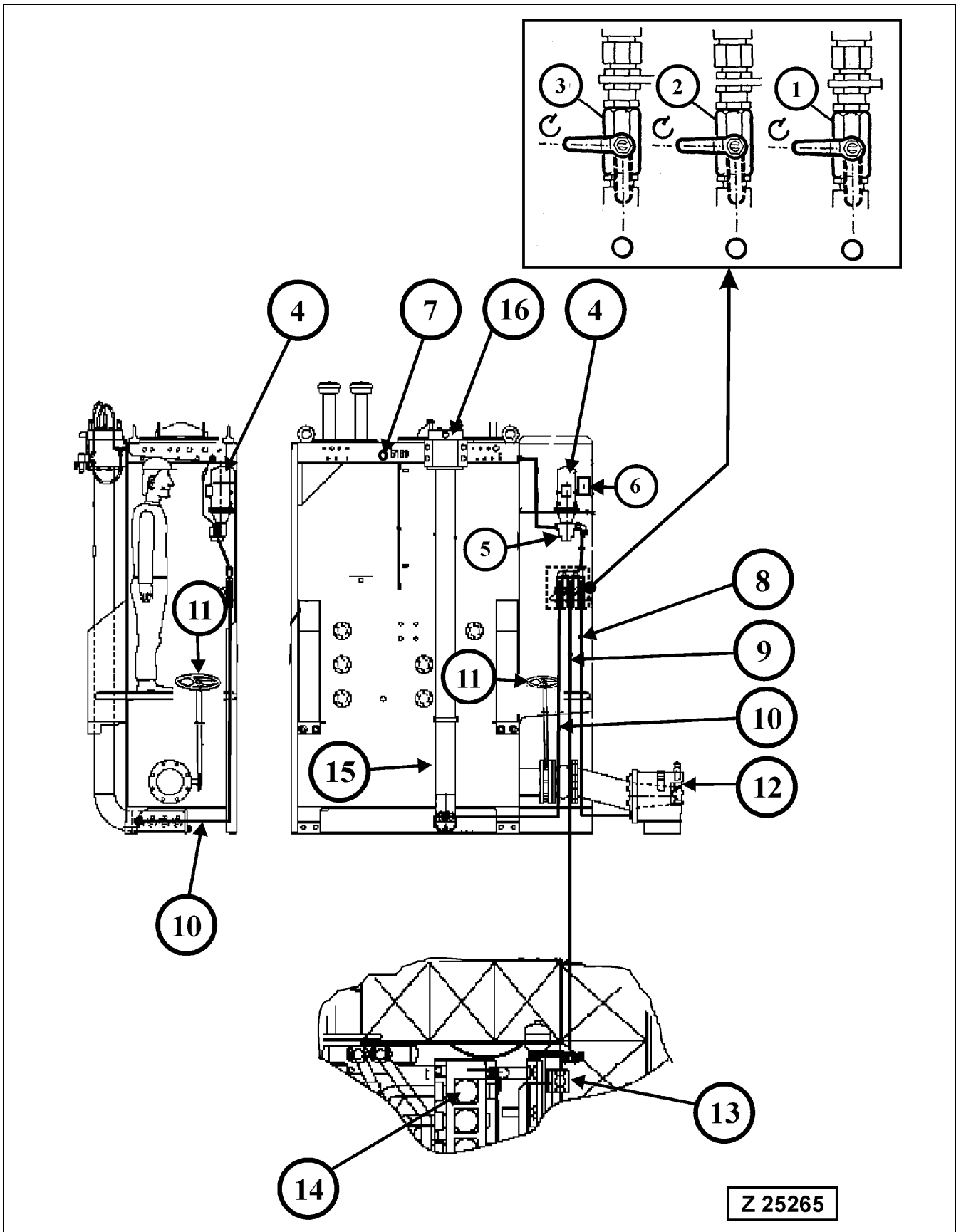
- (1) Cock for suction oil reservoir (12)
- (2) Cock for return oil collector pipe (13)
- (3) Cock for back-pressure valve pipe (15)
  - C - Closed
  - O - Open
- (4) Electric motor of the transfer pump
- (5) Transfer pump
- (6) Operating switch (S35) for transfer pump (4)
- (7) Level switch (B169) turns off the transfer pump (4) when the oil level in the main oil reservoir has reached maximum permissible height. The pump will be switched on again when the oil level sinks below the maximum height.
- (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 ECS screen in the Operator's cab.

**CAUTION**

**Before starting the motors 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 refilling panel connector, see page 278 for details). Prior 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).

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 **CAUTION**

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**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 motors.**

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#### NOTICE

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

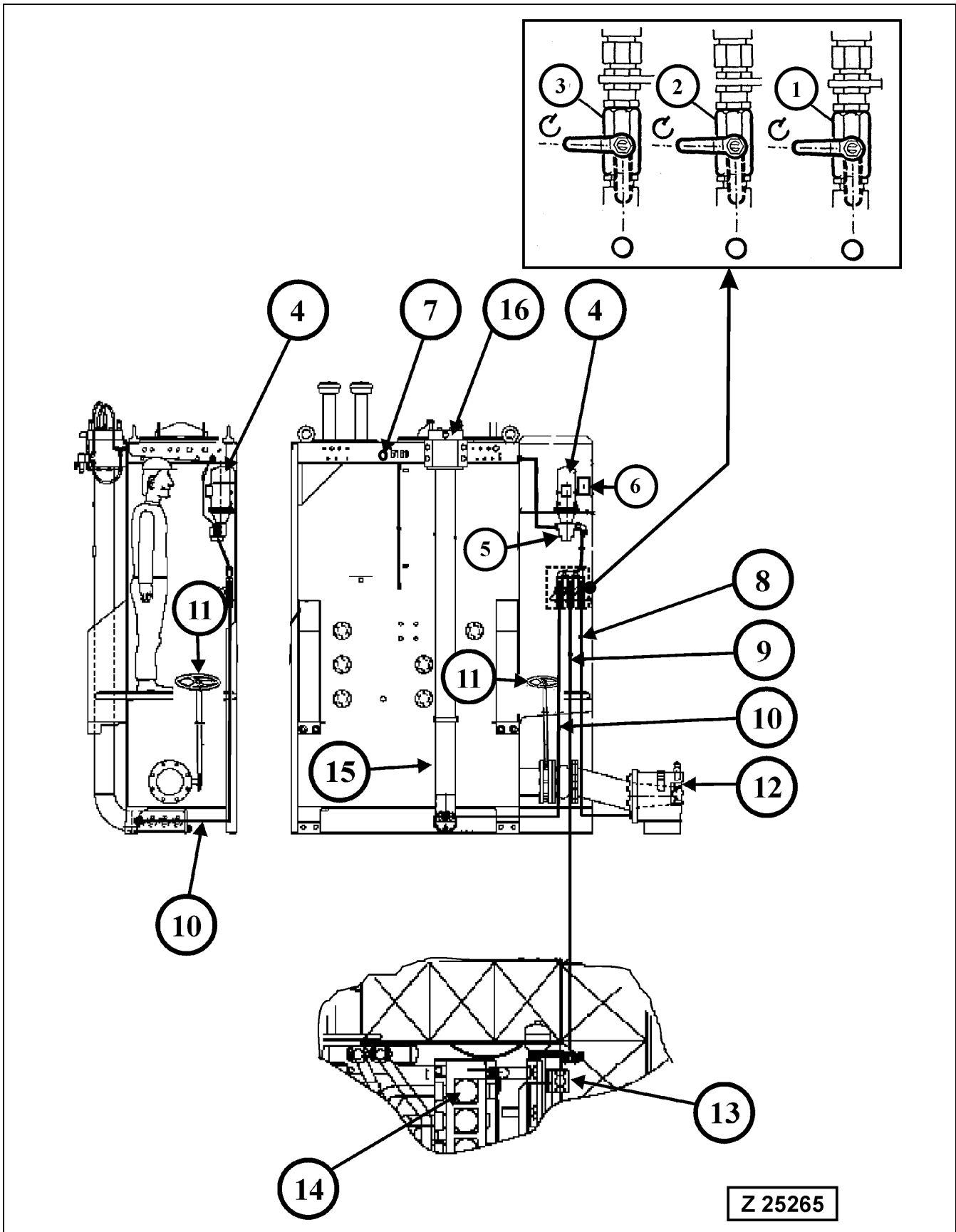
#### **A - Pumping the oil from the Suction Oil Reservoir (12) into the Main Oil Reservoir**

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).  
The level switch (7) turns off transfer pump (4) when the oil level in the main reservoir has reached maximum height. The pump will be switched on again when the oil level sinks below the maximum level. When changing the hydraulic oil, be sure to evacuate the main oil reservoir via the refilling panel connector simultaneously with the transfusion procedure. Otherwise the level switch (7) would switch off the transfer pump preventing overfilling of the main oil reservoir.
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 417 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 motors and run without load to allow trapped air to be removed from the hydraulic system.

---

**⚠ CAUTION**

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**DO NOT start the motors when the suction oil reservoir is empty.**

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**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. Switch on pump with switch (6).
4. 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).
5. To empty the back-pressure valve pipe (15), open cock (3).
6. Switch on pump with switch (6).
7. 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).
8. Install filler plug on top of main reservoir.

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**⚠ CAUTION**

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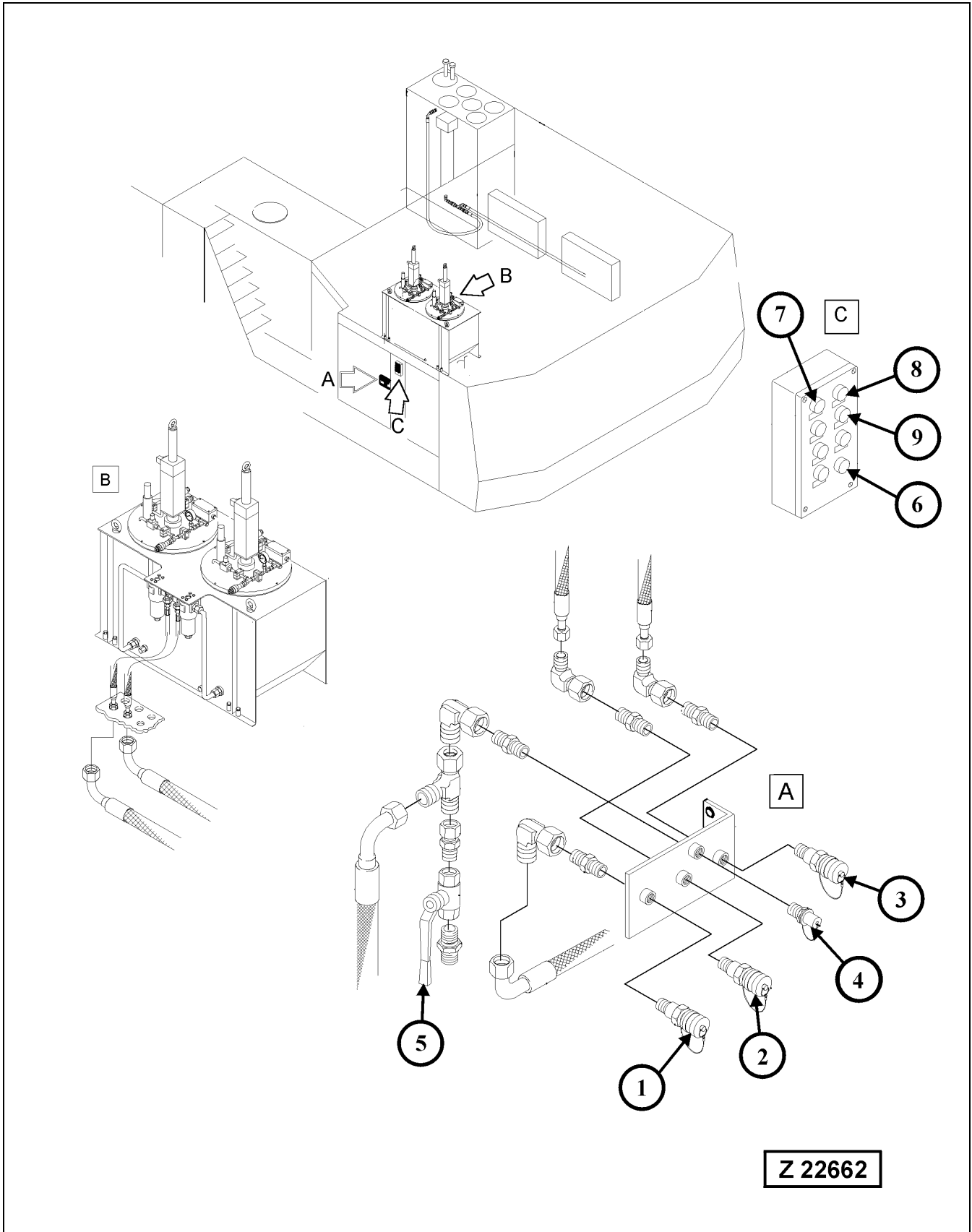
**DO NOT start the motors during servicing.**

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# 3.21 CENTRAL REFILLING SYSTEM

(Special Equipment)



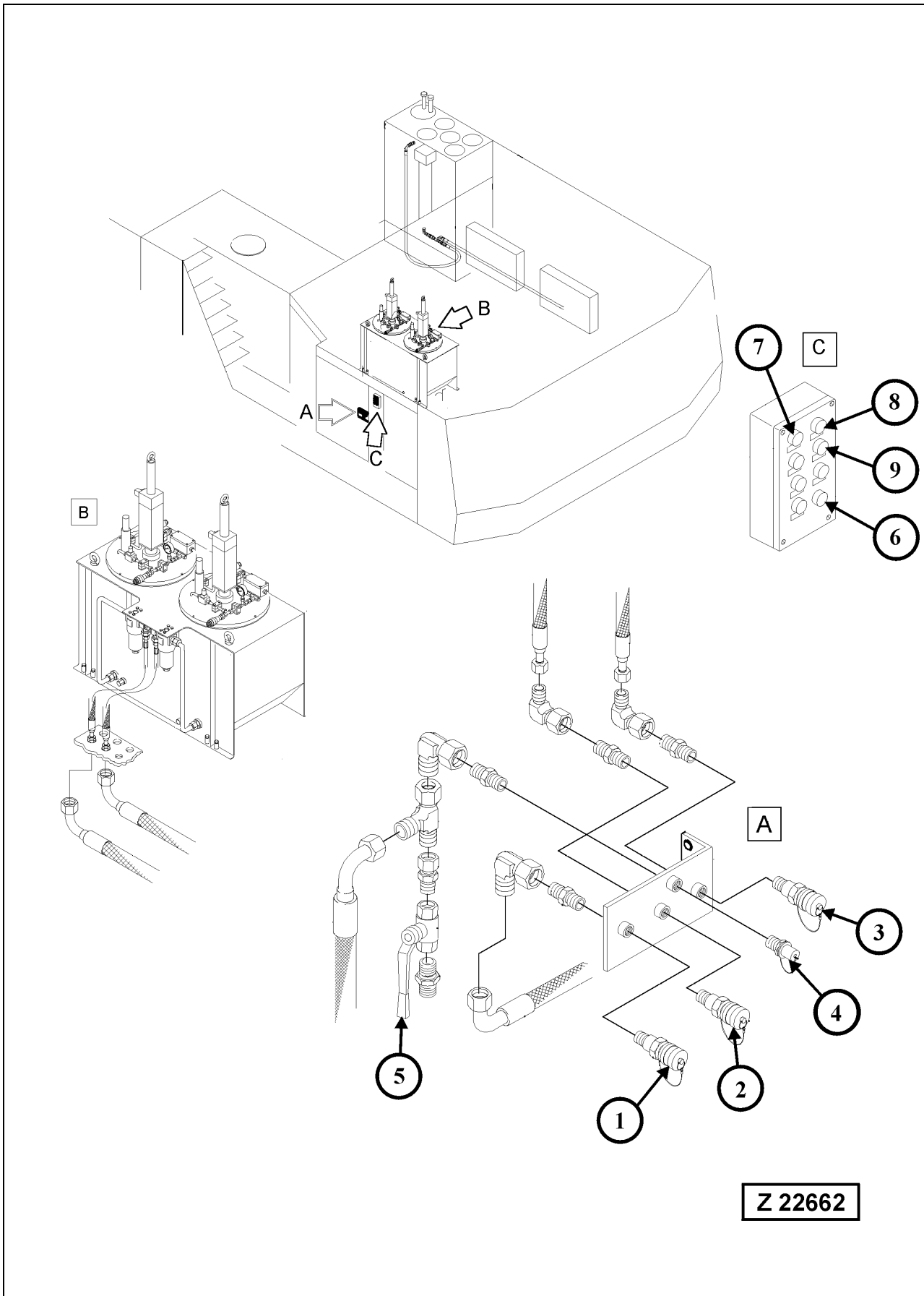
### 3.21.1 SYSTEMS CONNECTED TO THE REFILLING SYSTEM

The following systems are connected to the receiver panel (A), illust. (Z 22662):

- Main Hydraulic Oil Reservoir
- Central Lubrication System (CLS)
- Swing circle pinion Lubrication System (SLS)
- Water Tank for Hand Wash Sink in the Operator's Cab

#### Legend for illustration Z 22662

- (A) Receiver panel with Wiggins connectors
- (B) Grease container with pump units of the automatic lubrication systems
- (C) Monitor and control box
- (1) 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 (7).
- (2) 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 (9).
- (3) 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).
- (4) 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 (5). 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.
- (5) Drain cock for water tank in the operator's cab
- (6) Push button for testing lamps (7, 8 and 9). Push the button, all lamps must light up. If a lamp does not light up, corrective action must be taken.
- (7) Indicator lamp, main hydraulic oil reservoir FULL. Recheck hydraulic oil level at the sight gauge before operating the machine.
- (8) Indicator lamp, grease container of Swing circle pinion Lubrication System FULL
- (9) Indicator lamp, grease container of Central lubrication System FULL



## Refilling Procedure:

### Water tank in the Operator's cab

#### NOTICE

If freezing temperatures are expected, drain the water from the water tank filling line by opening the drain cock(5), illust. (Z 22662). If so equipped, switch on the motor-independent auxiliary cab heater during standstill periods to prevent freezing of the water in the cab water tank.

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#### WARNING

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

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

**For motor Lubricants refer to the separate motor Operation & Maintenance Manual filed in Volume 2 Binder.**

- Connect supply lines to the respective adapters.
- Monitor the respective fluid/lubricant level at the indicator lights (7, 8 and 9).
- After finishing the refilling operation, cover the adapters with the protection caps provided.

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#### CAUTION

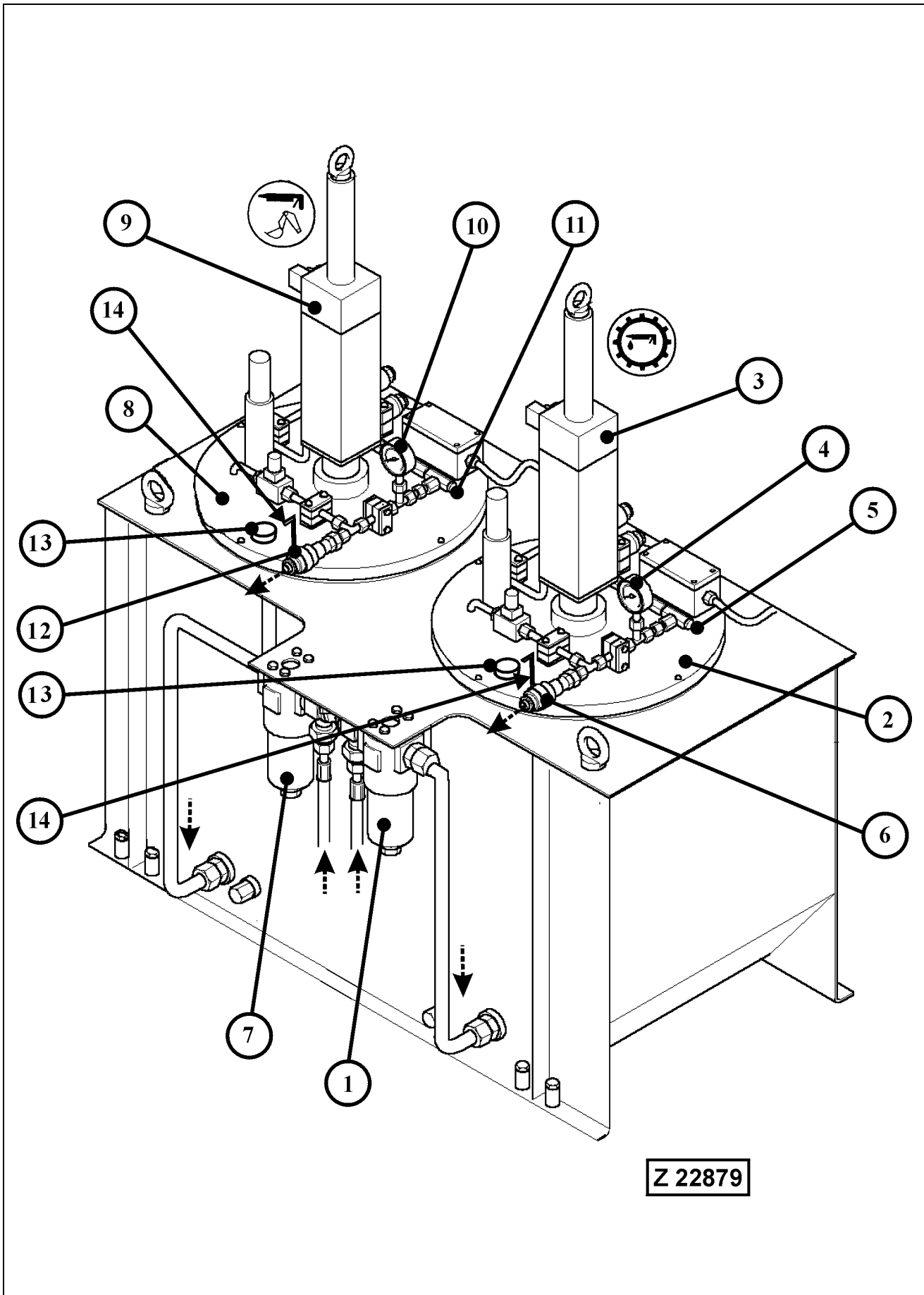
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**Recheck fluid levels before operating the machine.**

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### 3.21.2 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

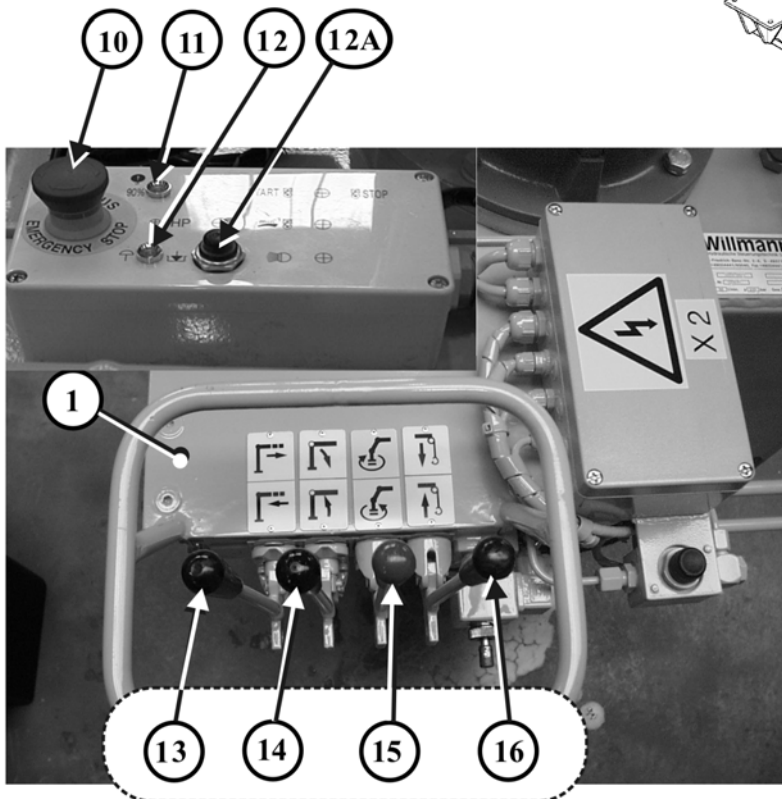
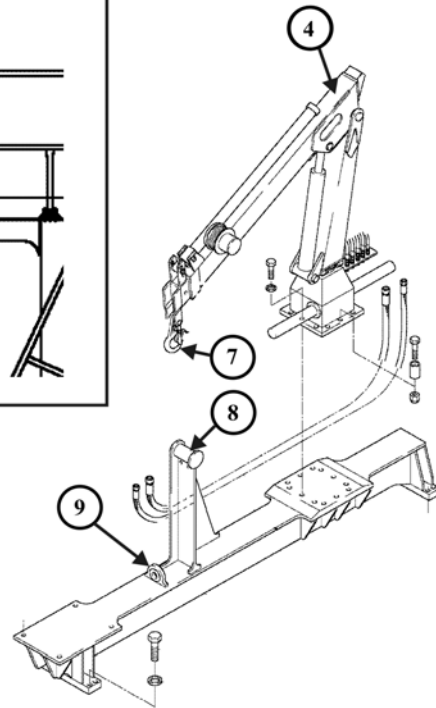
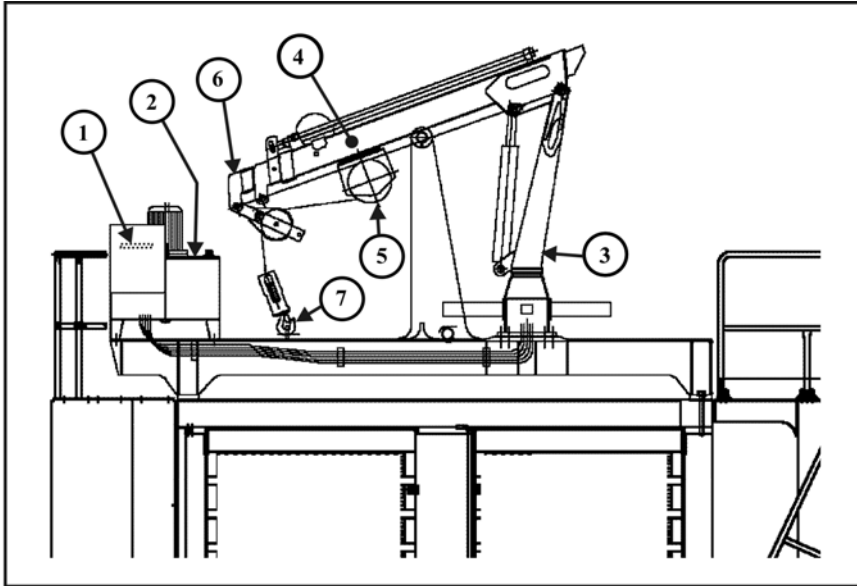
Refill the respective grease container, when the Fault message "Central lube system grease container on reserve" or "Swing circle lube system grease container on reserve" is being displayed on the ECS monitor.

#### 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 (8 or 9), illust. (Z 22662) 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 SERVICE CRANE (SPECIAL EQUIPMENT)



Z 22979



### 3.22.1 OPERATING THE CRANE

#### **⚠ WARNING**

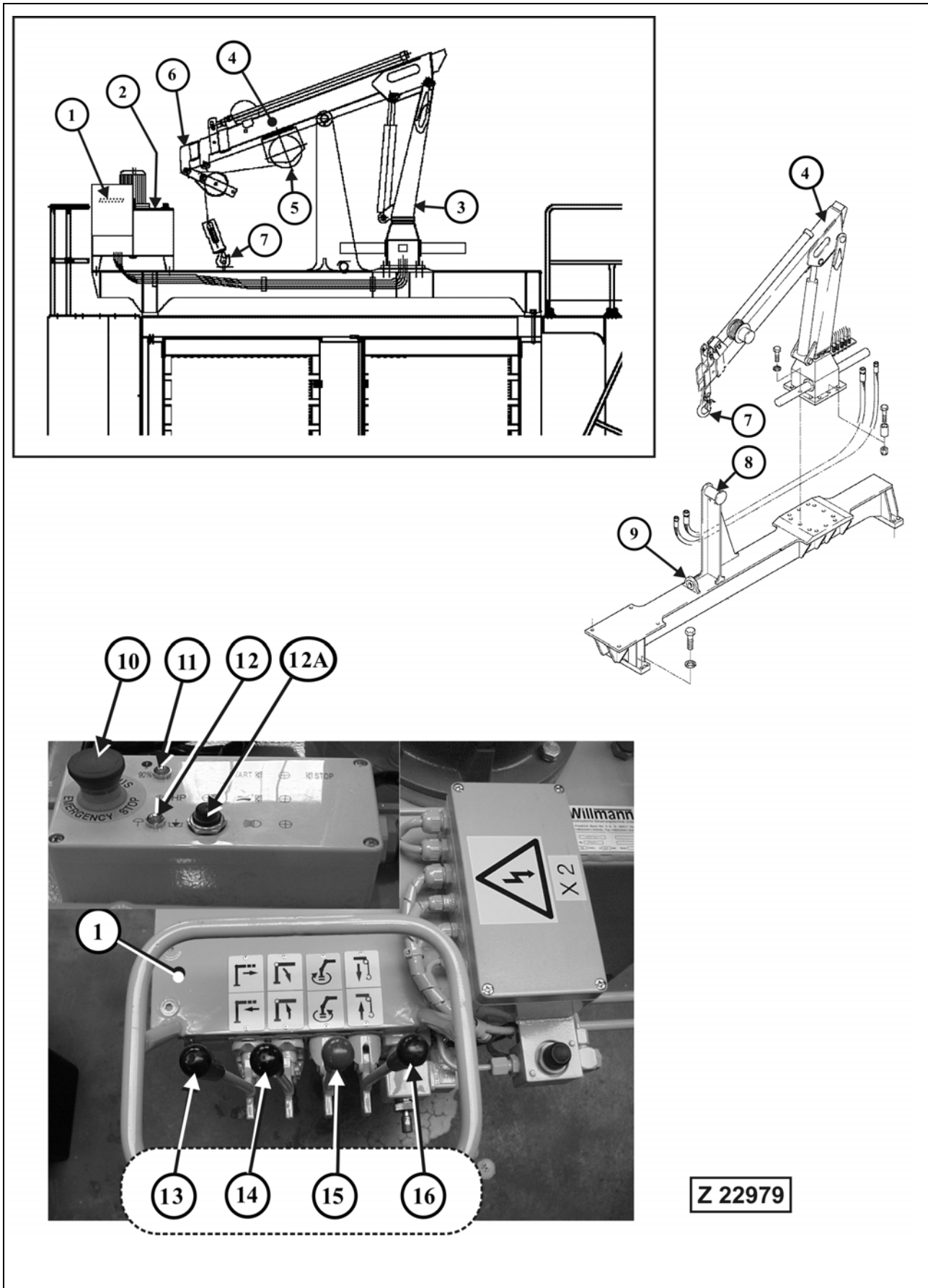
- Before operating the crane, check condition and fastening of the crane structure and base.
- Read the separate Instruction Manual "CRANE TYPE HMK 60 Ta1" before operating the Crane. The Crane Instruction Manual is filed in volume 2 Binder.

#### **NOTICE**

- DO NOT exceed maximum payload of 1000 kg.
- DO NOT lift the hook block to the stop.
- Carry out inspection and maintenance according to the separate Crane Instruction Manuals.  
Check security and tightening torque of all mounting bolts after the first 100 operating hours and thereafter every 1000 operating hours. Refer to the maintenance section for the tightening torque specifications.

#### **Legend for illustration Z22979:**

1	Control panel.
2	Electric – hydraulic power unit
3	Rotating boom
4	Lift boom
5	Hydraulic rope winch
6	Lift boom extensions
7	Load hook
8	Support for lift boom (4) in home position
9	Securing eye for load hook (7) in home position
10	Emergency stop switch for all hydraulic operations of the crane
11	Warning light, if this light comes on the crane has reached 90% of its maximum permissible lifting capacity. This light is used as a pre-warning to indicate a possible overload condition.
12	Indicator light automatic cut-off of the hydraulic winch. Use button (12A) to reactivate winch.
12A	Push button. This button is used to override an automatic cut-off of the hydraulic winch. If a minimum of three windings of rope are left on the winch drum, the winch rope cut-off device automatically stops the winch. To reactivate the winch push in the button while simultaneously rewinding the winch rope.
13	Control lever for lift boom extensions EXTEND - RETRACT
14	Control lever for lift boom RAISE - LOWER
15	Control lever for rotating boom SLEW LEFT - SLEW RIGHT
16	Control lever for winch rope UP - DOWN



## Operating the Service Crane (continued)

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**▲ WARNING**

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- **Make sure everyone is in the clear before lifting or lowering a load with the crane. Never swing or position a load over personnel.  
DO NOT exceed the maximum permissible lifting load of 1000 kg.**
  - **Be sure to secure the crane in rest position by lowering the lift boom (4), illustration (Z 22979) onto support (8) and fastening load hook (7) to eye (9).**
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For more information of correct crane operation and maintenance refer to the separate Instruction Manual "CRANE TYPE HMK 60 Ta1". The Crane Instruction Manual is filed in volume 2 Binder.

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## 3.23 WORK ON THE LOADER ATTACHMENT

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### WARNING

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- **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 motor and cycle all hydraulic control levers to relieve all pressure before disconnecting hydraulic lines.

**For more information → See "STOPPING THE MAIN DRIVE MOTORS" on page 256**

- 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.

## 3.24 TRANSPORTATION AND LIFTING OF THE SHOVEL

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**▲ WARNING**

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**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.**

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### 3.24.1 DISASSEMBLING OF THE SHOVEL

The Shovel is being transported disassembled into its main components.

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**▲ WARNING**

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**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.**

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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.

### 3.24.2 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.

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**▲ WARNING**

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- **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.**
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## 3.25 RETRIEVAL PROCEDURE

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**▲ WARNING**

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- 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.
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**▲ CAUTION**

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

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**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.

## 3.26 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.**

### 3.26.1 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 Motor Operation and Maintenance Manual for motor storage procedure.
3. Seal the electrical components and breather on the hydraulic oil reservoir to prevent dirt and moisture from entering.
4. 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.
5. Loosen all drive belts.
6. Repaint areas that have paint damage with a good quality paint. Grease all machined unpainted surfaces with good quality grease to prevent rust.
7. Drain condensation from hydraulic oil reservoir. If necessary, add hydraulic oil.
8. Attach a tag to the instrument panel to indicate what work has been done.

### 3.26.2 ONE MONTH REPETITIVE SERVICE PERIOD

1. Service the motor according to the motor manual.
2. Check all oil levels according to the lubrication chart.
3. Drain condensation from hydraulic oil reservoir.
4. Operate air conditioning for approx.  $\frac{1}{2}$  hour.

### 3.26.3 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. 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.
4. Prepare the motor for operation according to the motor manual. Tighten all drive belts. Install fully charged batteries. Make sure the correct voltage is applied.
5. Remove coverings from electrical components and breathers on the hydraulic reservoir.
6. Start the motors.
7. Operate heater unit and air conditioning.
8. Operate the central lubricating system and swing ring gear lubrication system. Check the lubrication results at the respective lubrication points.
9. Carry out several complete working cycles with the loader attachment.
10. Stop the motors. Install all coverings which have been removed according to step 5. Service the motor according to the motor manual. Lubricate all machined surfaces. Remove Batteries and store as described under "Preparing for Storage". Loosen all drive belts.

### 3.26.4 PREPARING FOR OPERATION

1. Remove grease from all machined unpainted surfaces (piston rods).
2. Install fully charged batteries.
3. Remove all coverings.
4. Service the motor according to the motor manual. Tighten all drive belts.
5. Carry out the maintenance according to the maintenance section 4 in this manual.
6. Start the motors. DO NOT place the Shovel under load before the normal operating values are indicated.
7. 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.).



## 3.27 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.

### 3.27.1 MAIN DRIVE ELECTRIC MOTOR

#### NOTICE

Refer to the trouble shooting chart in the separate motor maintenance manual. This manual is part of volume 2 binder.

### 3.27.2 HYDRAULIC SYSTEM

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

### 3.27.3 FINAL DRIVES AND SWING GEAR

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

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



# **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. motor, 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 PRECAUTIONS FOR MAINTENANCE

- Before starting any lubrication or maintenance work read the Fundamental Safety Instructions on page 16.
- Park the Excavator at a safe place on level ground. Proceed according to the instructions on page 255 "Parking the Excavator". Lower the attachment flat onto the ground. Move all control levers to neutral position.
- Stop the motors and move all control levers through their shift positions to relieve the pressure in the hydraulic system. Refer to page 256 "Stopping the Motors" for detailed description of the stopping procedure.
- Before any maintenance work is started, set the maintenance safety switch to 0 position. Refer to page 205 for location of the maintenance safety switch. In the 0 position the motors 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.
- 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 motor 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 switch and remove key, before working on the electrical system.
- 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 the hydraulic system.

**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 FUEL AND LUBRICANTS

Point of Lubrication	Lubricant	Ambient Temperature °C	Viscosity Grades	Quality Grades DIN/API	
Main Drive Motors	Refer to MOTOR OPERATION AND MAINTENANCE MANUAL for Lubricant Specifications.				
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	or 32 - 68	
		- 6 to + 31	46		
		0 to + 40	68		
		+ 5 to + 48	100	-	
Travel gears, Final drives and Swing gears	Hydraulic oil "HLP"	- 40 to + 10	HLP T32	DIN 51524. T.2 and T.3- HLP	
	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		
	or Hydraulic oil		HLP 22 or HLP 32	DIN 51524T.2 and T.3- HLP	
PTO's (Pump distributor gears) and pump drive shaft housings	Hydraulic oil "HLP"	- 40 to + 10	HLP T32	DIN 51524. T.2 and T.3- HLP	
	Gear oil "CLP" *2)	-15 to + 50	CLP 150	DIN 51517 3 - CLP	
Fan bearing housings of Hydraulic oil coolers	Gear oil "CLP"	all	CLP 150	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" 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 barake discs are lubricated by splash oil from the gear box.**

**REMARK**

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	Gear oil "CLP"	all	CLP 220	DIN 51517 3 CLP
Air conditioning system	Refrigerant		R 134a	<b>REMARK</b> The Air Conditioning is prepared for Refrigerant "R134a" only. Observe Notice below.
Refrigerant compressor	Special oil See Note 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.

**Main Drive Electric Motor – Bearing Lubrication**

(Excerpt of the Motor Maintenance Manual)

**Explanation of Abbreviations: D-end bearing = Drive end  
N-end bearing = Non-drive end**

**8 MAINTENANCE OF THE MACHINE**

**8.1 Bearings and lubrication**

**8.1.1 Antifriction bearings**

**Bearing solutions**

The bearing constructions for different bearing solutions are shown in appendices 2-6. Deep groove ball bearings both in the D-end the N-end is the standard solution. When great radial forces appear, for example in belt drives, a cylindrical roller bearing can be fitted in the D-end. The complete bearing types are stamped on the rating plate.

The bearing in the D-end is axially fixed for horizontal machines when ball bearings are used in both ends. This means that the thermal growth will happen towards the N-end.

The bearing in the N-end is axially fixed for horizontal machines, when a cylindrical roller bearing is used in the D-end. In this case the thermal growth will happen towards the D-end. This should be considered when adjusting the coupling.

The bearing in the N-end is axially fixed downwards for vertical machines. In this case the thermal growth will happen in the D-end. This should be considered when adjusting the coupling and moving the machine.

**Lubrication**

The lubricating system of the machine is shown in appendices 2-5. Grease is injected to the inner side of the bearing through the grease passage. After filling the free space in the bearing, excessive grease will be discharged out from the bearing passing the grease valve. The excessive grease comes out through the opening in the bottom of the bearing construction.

The machines are equipped with a greasing nipple in both ends for lubricating the bearings. The grease nipples are located on side of the machine in both ends. The amount of grease and the interval of greasing are stamped on the relubrication plate. These can also be read from tables 3 and 4.

Table 3. Relubrication intervals and amount of grease for horizontally mounted machines.

Bearing type	Amount of grease [g]	Lubrication intervals in running hours at different speeds [rpm]					
		3600	3000	1800-1500	1200-1000	900-750	600-500
6317	35	800	2200	8800	8800	8800	8800
6319	45	400	1600	6600	8800	8800	8800
6322	60			6600	8800	8800	8800
6324	70			4400	8800	8800	8800
6326	80			4400	8800	8800	8800
*) 6330	100			1000	6600	8800	8800
NU317	35	400	1100	4400	8800	8800	8800
NU319	45			3300	6600	8800	8800
NU322	60			3300	6600	8800	8800
NU324	70			2200	6600	8800	8800
NU326	80			2200	6600	8800	8800
NU330	100			2200	3300	6600	8800

\*) D-end and N-end bearing

### Main Drive Electric Motor – Bearing Lubrication

(Excerpt of the Motor Maintenance Manual, for more information refer to Motor Manual)

Table 5. Recommended standard lubricants.

Manufacturer	Quality	Thickener	Base oil	Temperature range [°C]	Kinematic viscosity of base oil [mm <sup>2</sup> /s, cSt at 40°C]	Kinematic viscosity of base oil [mm <sup>2</sup> /s, cSt at 100°C]	Consistency [NLGI scale]
ESSO	UNIREX N2	Li	Mineral	-30 to +165	115	12.2	2
ESSO	UNIREX N3	Li	Mineral	-30 to +165	115	12.2	3
ESSO	BEACON 2	Li	Mineral	-40 to +120	100	9.5	2
SKF	LGMT 2	Li	Mineral	-30 to +120	92	9.6	2
MOBIL OIL	Mobilux 2	Li	Mineral	-30 to +120	100	10.0	2
SHELL	Alvania Grease G2	Li/Ca	Mineral	-25 to +140	100	11	2
SHELL	Alvania Grease G3	Li/Ca	Mineral	-20 to +150	100	11	2
TEBOIL	Multi-Purpose Grease	Li	Mineral	-30 to +110	110	10.5	2
BP	Energrease LS 2	Li	Mineral	-30 to +110	92	9.5	2
STATOIL	Uniway Li 42	Li	Mineral	-30 to +120	100	12.0	2

**Note!** AMA machines are lubricated in the factory with ESSO UNIREX N2, if nothing else is specified.

Table 6. Recommended high temperature greases.

Manufacturer	Quality	Thickener	Base oil	Temperature range [°C]	Kinematic viscosity of base oil [mm <sup>2</sup> /s, cSt at 40°C]	Kinematic viscosity of base oil [mm <sup>2</sup> /s, cSt at 100°C]	Consistency [NLGI scale]
ESSO	UNIREX N3	Li-comp.	Mineral	-30 to +165	115	12.2	3
SKF	LGHT 3	Li-comp.	Mineral	-30 to +150	110	13.0	3
MOBIL OIL	Mobiltemp SHC 100	Inorga.	Synthetic	-40 to +200	100	12.5	2
SHELL	Syntix 100	Li-comp.	Synthetic	-40 to +150	100	21.0	2
TEBOIL	Syntex Grease	Li-comp.	Synthetic	-40 to +140	150	20.0	2
STATOIL	Uniway LIX 42 PA	Li-comp.	Polyalfa	-35 to +150	100	18.0	2
CHEVRON	SRI 2	Polyr.	Mineral	-30 to +150	115	14.0	2
NESTE	Rasva 606	Li-comp.	Synthetic	-40 to +150	150	20.0	2

#### Mixing properties

It is important to consider the miscibility of greases if it is necessary to change from one grease to another. If incompatible greases are mixed, the consistency can change dramatically and the maximum operating temperature of the grease mix can be so low compared to the original grease, that bearing damage cannot be ruled out.

Greases having the same thickener and similar base oils can generally be mixed without any detrimental consequences, e.g. a lithium base grease can be mixed with another

lithium base grease. Calcium and lithium base greases are generally miscible with each other but not with sodium base greases. However, mixtures of compatible greases may have a consistency which is less than either of the component greases, although the lubricating properties are not necessarily impaired.

#### Control of the bearings when running

One way of detecting bearing damages is to measure the shock pulse generated by impacts as damaged surfaces are overrolled. Measuring devices for this kind of measuring

## 4.4 FILLING CAPACITIES

Unit or System	Liter (approx.)	Unit or System	Liter (approx.)
Hydraulic Oil Reservoir	3600.0 *1)	Travel Gears, each:	155.0
Total Hydraulic System	6600.0	Motor Adapter Housings, each	2.0
Pump Distributor Gears, each:	95.0	<b>REMARK</b> The travel gear brakes are dry type multiple disk brakes. DO NOT fill the housings with oil.	
Oil Collector Reservoir, Auxiliary Hydraulic Pumps:	1.0	Final drive housings, each	165.0
Main Hydraulic Pumps, Drive Shaft Housing	1.5	Guide Wheels, each	3.2
Swing Gears made by <b>L&amp;S</b> , each:	42.0	Support Rollers, each	7.0
Motor Adapter Housings	0.6	Track Rollers, each	2,7
Swing Gears made by <b>Sie-benhaar</b> , each:	60.0	Water tank for hand wash sink in Operator's cab	50.0
Motor Adapter Housings	*2)	Water reservoir for windshield washer	7.0
Brake Housings	*2)		

\*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.

**REMARK**

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 413 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 ECS screen.

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
<b>When necessary</b>	Swing circle toothing	Immediately apply grease if bare spots are visible	page 315
	Automatic lubrication systems	Fill grease containers Clean or replace filter elements	page 317
	Track rollers	If leakage occurs replace floating seals and fill with GL	page 321
	Carrier rollers		
	Guide wheels	ISO VG CLP 220	
<b>Every 10 operating hours or daily</b>	Shovel	Walk-around inspection	page 323
	Working attachment	Check grease injectors of automatic lubrication system. Check for proper lubrication.	page 327
	Swing circle	Check grease injectors of automatic lubrication system. Check for proper lubrication.	page 331
	Track groups	Clean, esp. in winter	page 333
	Main drive motors	Checks	(1)
	Fire detection and actuation system (if so equipped)	Inspection	(2)
	Service crane	Inspection	(4)
<b>Every 50 operating hours or weekly</b>	Swing gears and Motor adapter housings	Check oil levels	page 335
	Travel gears, Motor adapter housings and Final drives	Check oil levels	page 339
	PTO's (Pump distributor gears)	Check oil level	page 345
	Hydraulic access ladder	Check safety sensor	page 349
	Hydraulic oil cooler	Check and clean as necessary	page 351

- (1) Perform maintenance according to separate Motor 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.
- (4) Perform inspection, cleaning and lubrication according to the separate Instruction Manual "CRANE HMK 60 Ta1" filed in volume 2 binder.



Service Intervals	Service Point	Service	See
<b>Every 250 operating hours or monthly</b>	Signal horn compressor	Lubricate	page 353
	Oil cooler fan bearing housings	Check for leakages and clean breather filters	page 353
	Automatic lubrication systems	Clean in-line grease screens	page 355
	Cab, air filter	Clean or replace filter element	page 357
	Air conditioning for operator's cab and switch cabinets	Inspection, refer also to the separate manual (3)	page 359
	Windshield washer system	Check fluid level	page 363
	Main drive motors	Checks	(1)
	Fire suppression system (if so equipped)	Inspection	(2)
<b>Every 500 operating hours or quarterly</b>	Batteries	Check fluid level	page 365
	Crawler tracks	Inspection	page 367
	Fire detection and actuation system (if so equipped)	Maintenance	(2)

- (1) Perform maintenance according to separate Motor Operation and 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.

**CAUTION**

**Carry out initial service according to item 4.6.1.**

Service Intervals	Service Point	Service	See
<b>Every 1000 operating hours or every 6 months</b>	High strength bolt connections	Check for correct tightening torque and security	page 373
	Hydraulic system	- Replace return and pressure filter elements - Clean or replace high pressure filter elements - Replace breather filter elements - Drain sediments	page 429
	PTO's (Pump distributor gears) Swing gears and Travel gears	Oil sample analysis	page 443
	Signal horn compressor	Clean and lubricate	page 445
	Hydraulic track tensioning system	Check pressure accumulators	page 447
	Water filter for hand wash sink in Operator's cab	Replace carbon filter cartridge	page 449
	Hydraulic oil cooler doors and machinery house doors	Inspect and lubricate door hinges	page 451
	Slip ring unit	Lubricate	page 455
	Main drive motors	Bearing lubrication	(1)
	Fire suppression system	Maintenance	(2)
	Air conditioning	Inspect the complete system	(3)

- (1) Perform maintenance according to separate Motor Operation and 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
<b>Every 2000 operating hours or yearly.</b>	Hydraulic system	- Change oil (*) - Replace suction strainers (*) - Replace pulsation damper	page 457
	Emergency escape ladder	Inspect	page 469
	Fire detection and actuation system	Maintenance	(3)
<b>Every 3000 operating hours however at least once a year.</b>	Swing gears and Motor adapter housings	Change oil	page 471
	Travel gears, Motor adapter housings and Final drives	Change oil	page 479
	PTO's (Pump distributor gears)	Change oil	page 483
	Main drive motors	Inspection	(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 Motor Operation an Maintenance Manual filed in volume 2 binder.
- (3) Perform inspections according to the separate Manual FIRE SUPPRESSION SYSTEM filed in volume 2 binder.

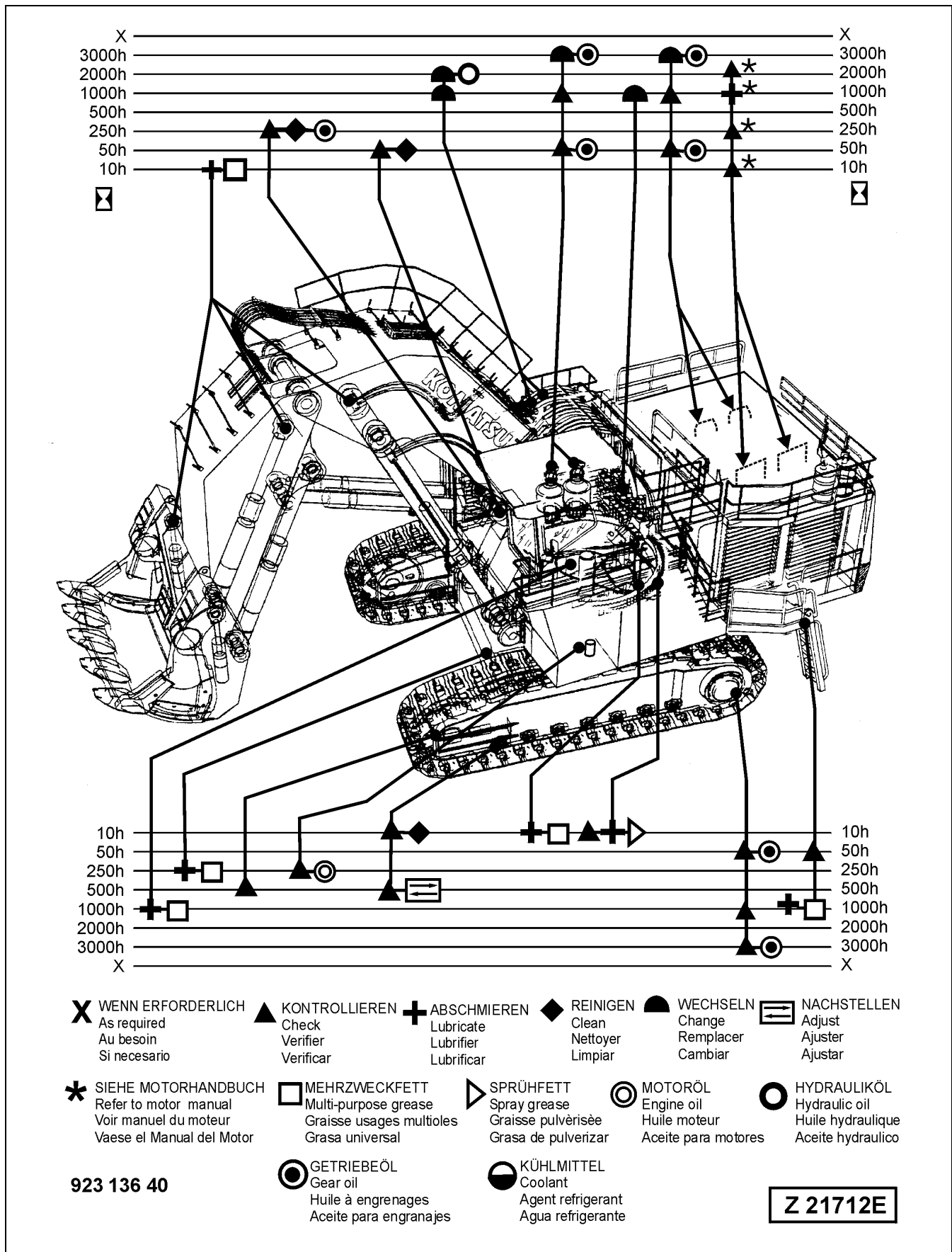
**NOTICE**

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

**4.6.4 MAINTENANCE OF THE MAIN DRIVE MOTORS**

- All maintenance has to be carried out in accordance with the separate Installation and Maintenance Manual "Horizontal and Vertical Mounted Three Phase Squirrel Cage Induction Machines Type AMA 400 - 500". This manual is part of the volume 2 binder "Motor and Equipment Manuals".
- The lubrication interval, the amount and type of grease for the Drive end and Non-drive end bearings of the rotor shaft are given on the rating plate located on each motor. Follow these instructions for bearing lubrication.

Lubrication Chart



## REPLACEMENT OF HYDRAULIC HOSE LINES

Hydraulic Hose lines are subjected to natural aging. Hence, their usable lifetime is limited to maximum 6 years.

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**▲ CAUTION**

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**The maximum permissible storage time of hydraulic hose lines 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 shall be installed, the remaining service life of the hose line is 5 years. The production year and the ordering number of the hydraulic hose lines is stamped on the hose fittings.**

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All hydraulic hose lines of the Excavator have to be replaced after every 6 years at the latest, even if there are no visible damages.

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**▲ WARNING**

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**Repairs on hydraulic hoses and hose lines are not allowed. Use ONLY GENUINE KMG Replacement Hydraulic Hose Lines.**

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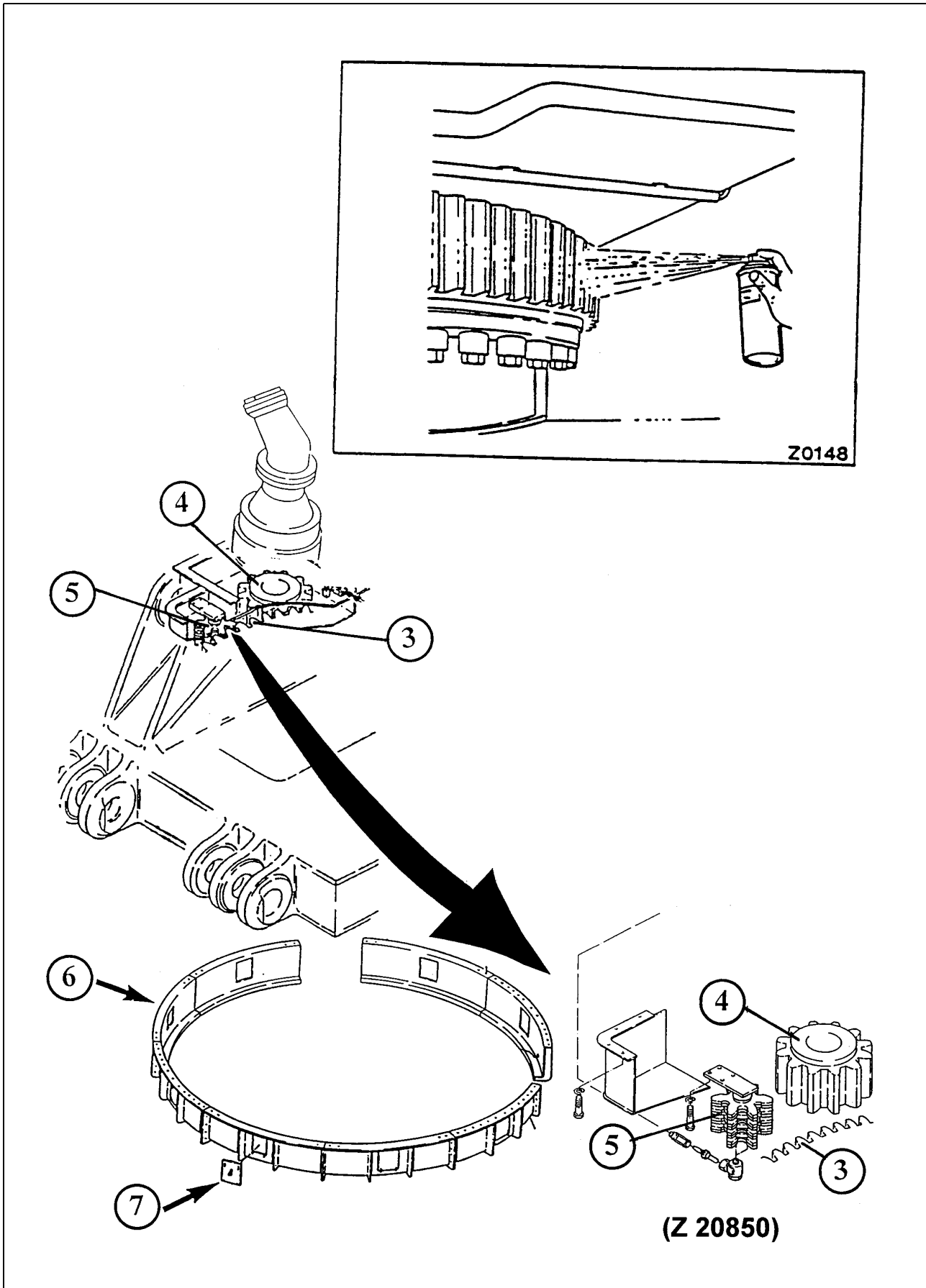
## INSPECTION OF HYDRAULIC HOSE LINES

Inspect all hoses, hose lines and fittings periodically. Check for leaks and damages. Replace damaged parts without delay. Hydraulic fluid escaping under pressure can cause serious injuries and fire break out.

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

- Damages on 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 bent, e.g. disintegration of hose layers or blistering.
- Leaks
- Detachment of hose and fitting. Damaged hose fitting

# 4.7 WHEN NECESSARY



## 4.7.1 SWING CIRCLE TOOTHING LUBRICATION

See illustration Z 20850

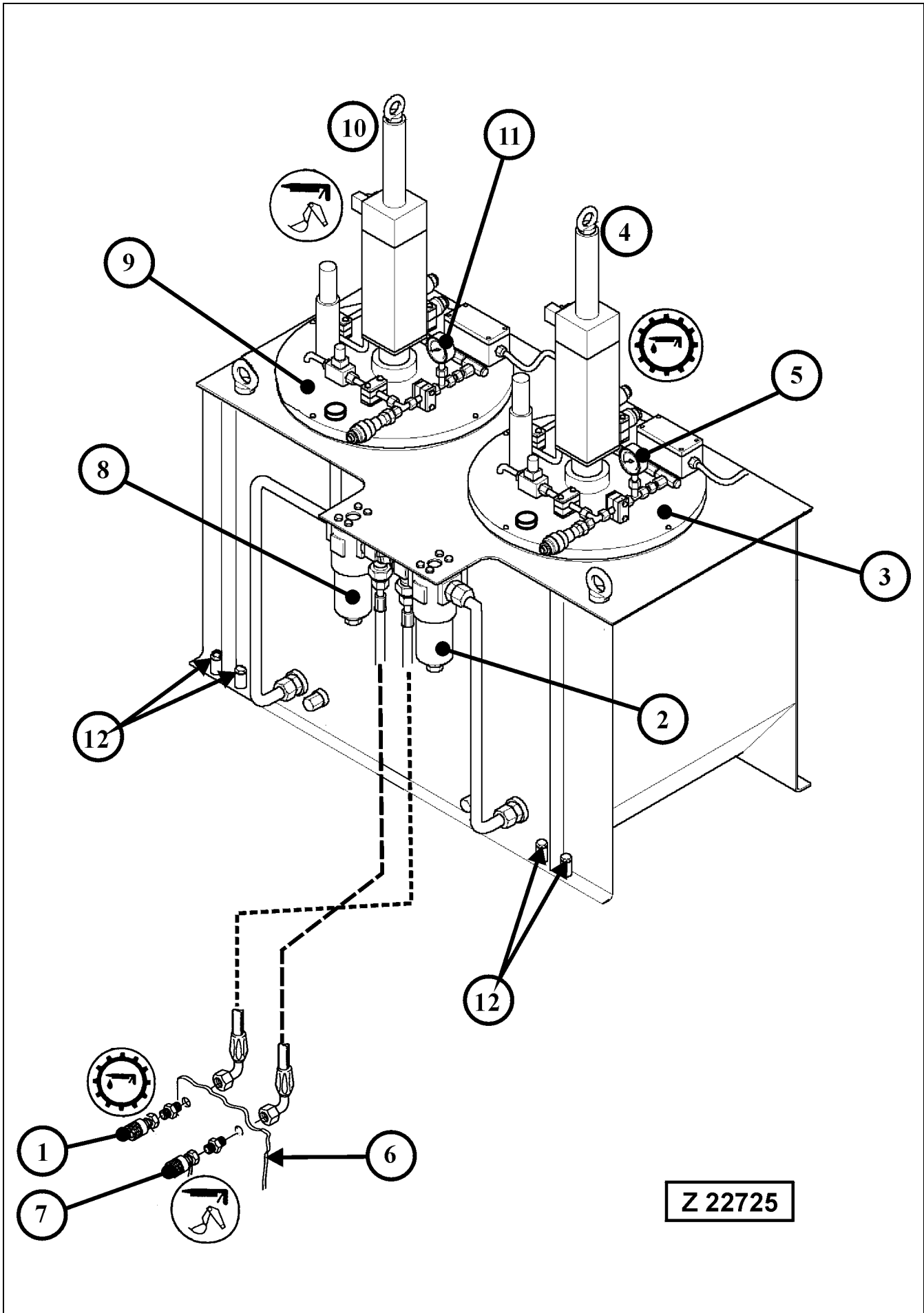
All teeth of the ring gear (3) must be completely covered with grease.

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.**



Z 22725



## 4.7.2 AUTOMATIC LUBRICATION SYSTEMS FILL GREASE CONTAINERS

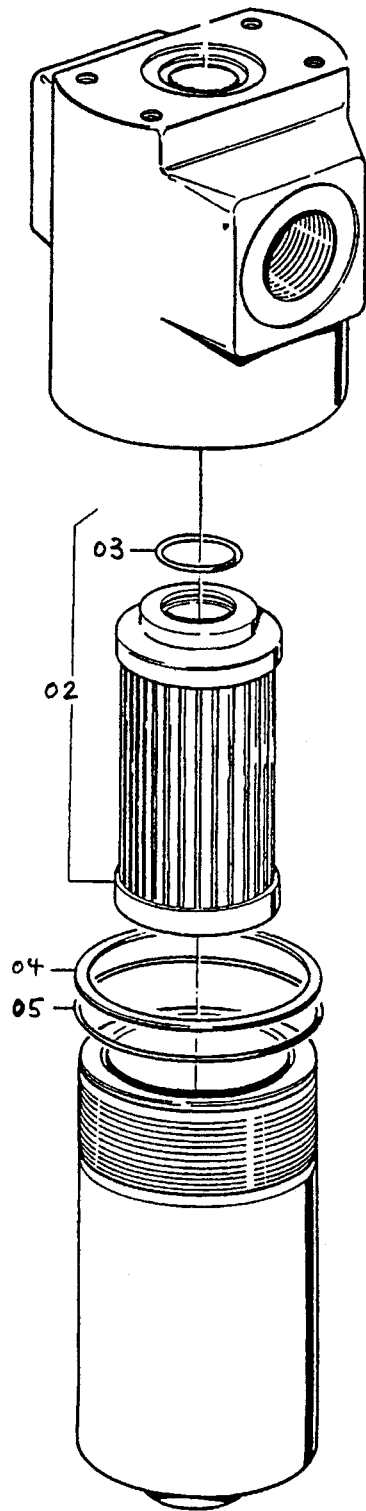
Fill the grease containers of the Central Lubrication System and Swing circle pinion Lubrication System when the corresponding message "grease container on reserve" is displayed on the ECS screen. Make sure the grease filters in the filling lines are not obstructed. If necessary service the Grease Filters.

Legend for illustration Z 22725

- (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 319.
  - (3) Grease container of the Swing circle gear Lubrication System "SLS"
  - (4) Hydraulic motor with pump unit
  - (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 319.
  - (9) Grease container of the Central Lubrication System "CLS"
  - (10) Hydraulic motor with pump unit
  - (11) Grease pressure gauge for "CLS"
  - (12) Mounting bolts of the grease container housing
- Fill the grease containers according to the instructions on page 278.

### 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.

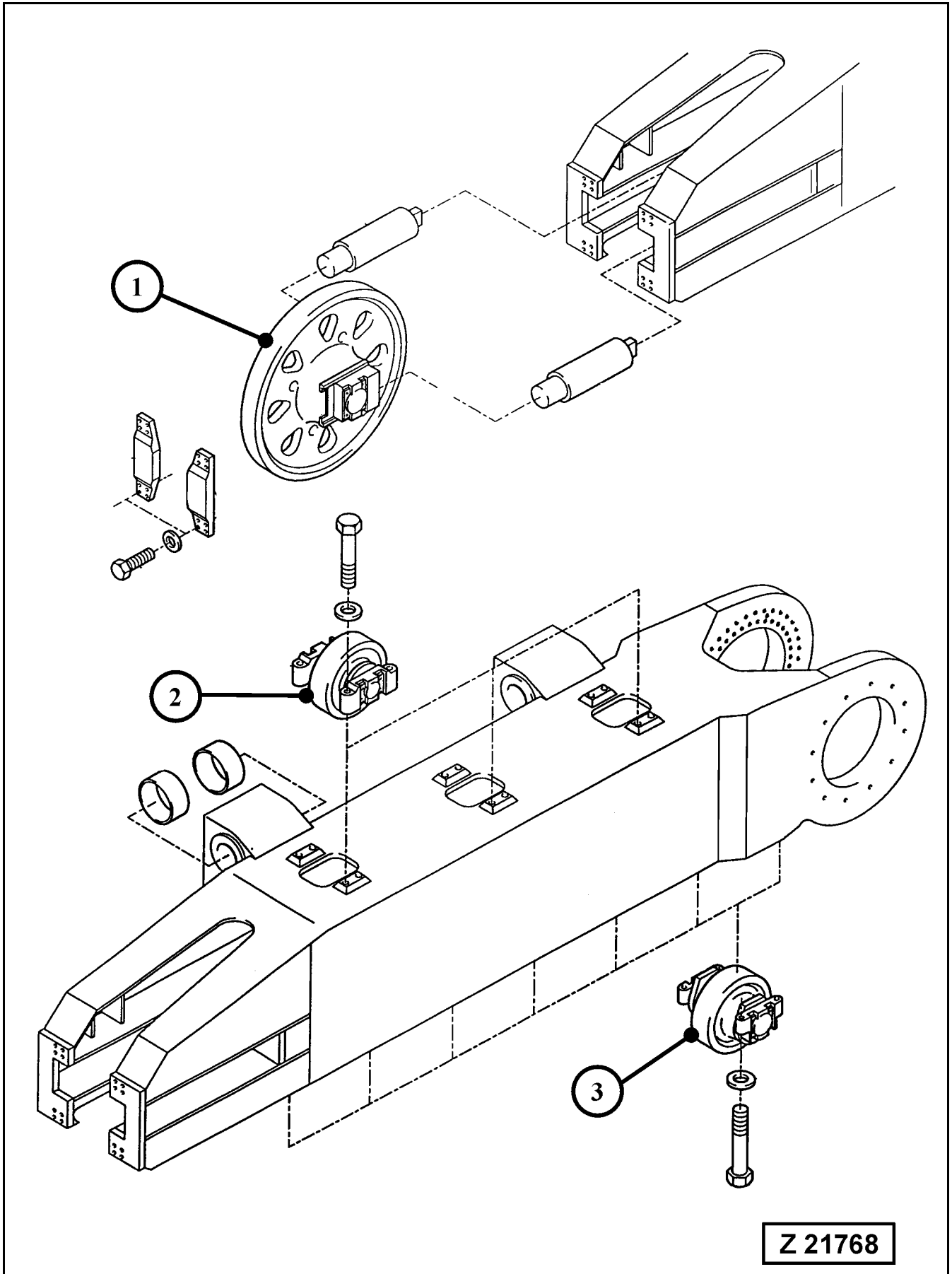
**NOTICE**

**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.**

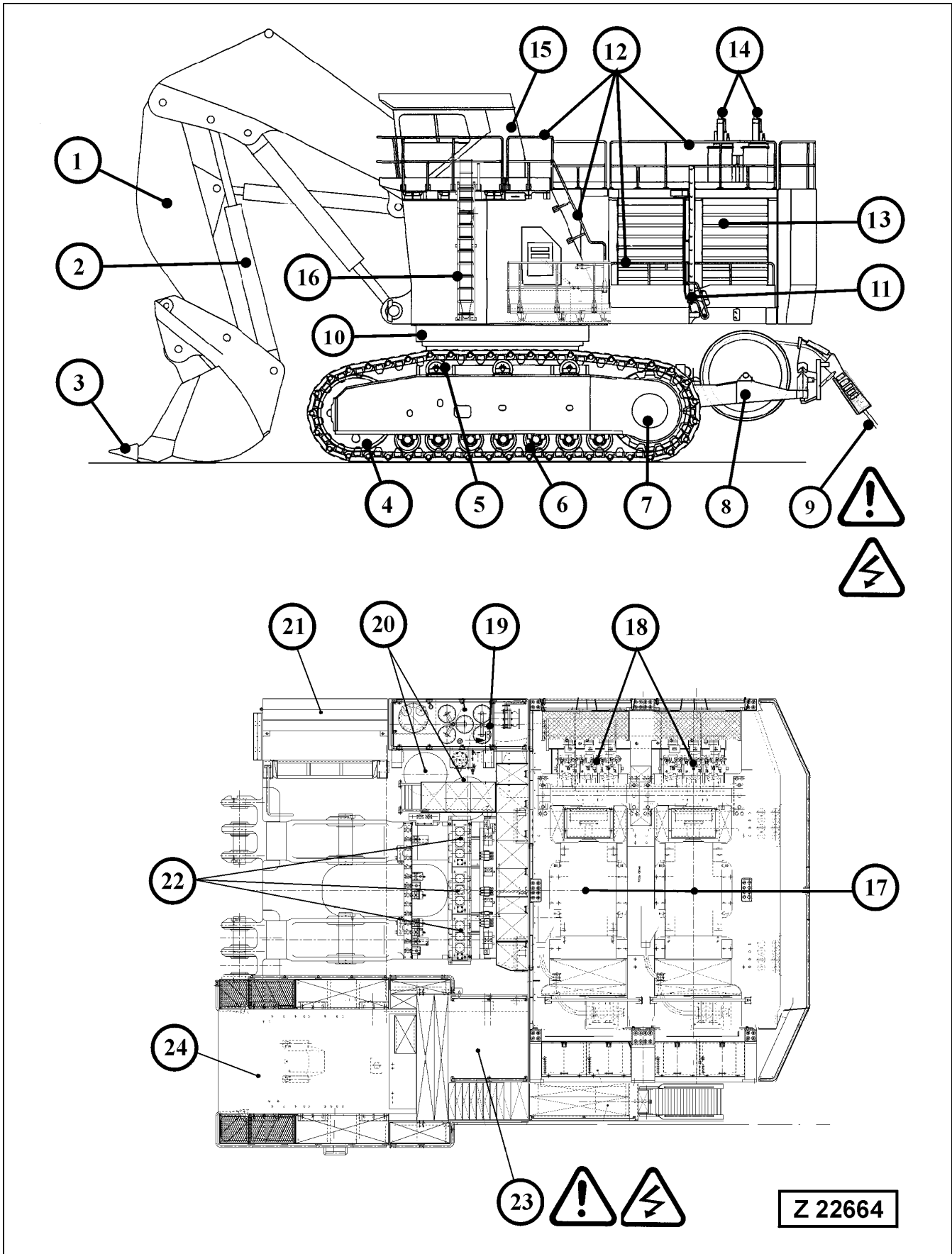


### **4.7.3 TRACK ROLLERS AND GUIDE WHEELS - REPLACE FLOATING SEALS**

#### **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.

# 4.8 EVERY 10 OPERATING HOURS OR DAILY



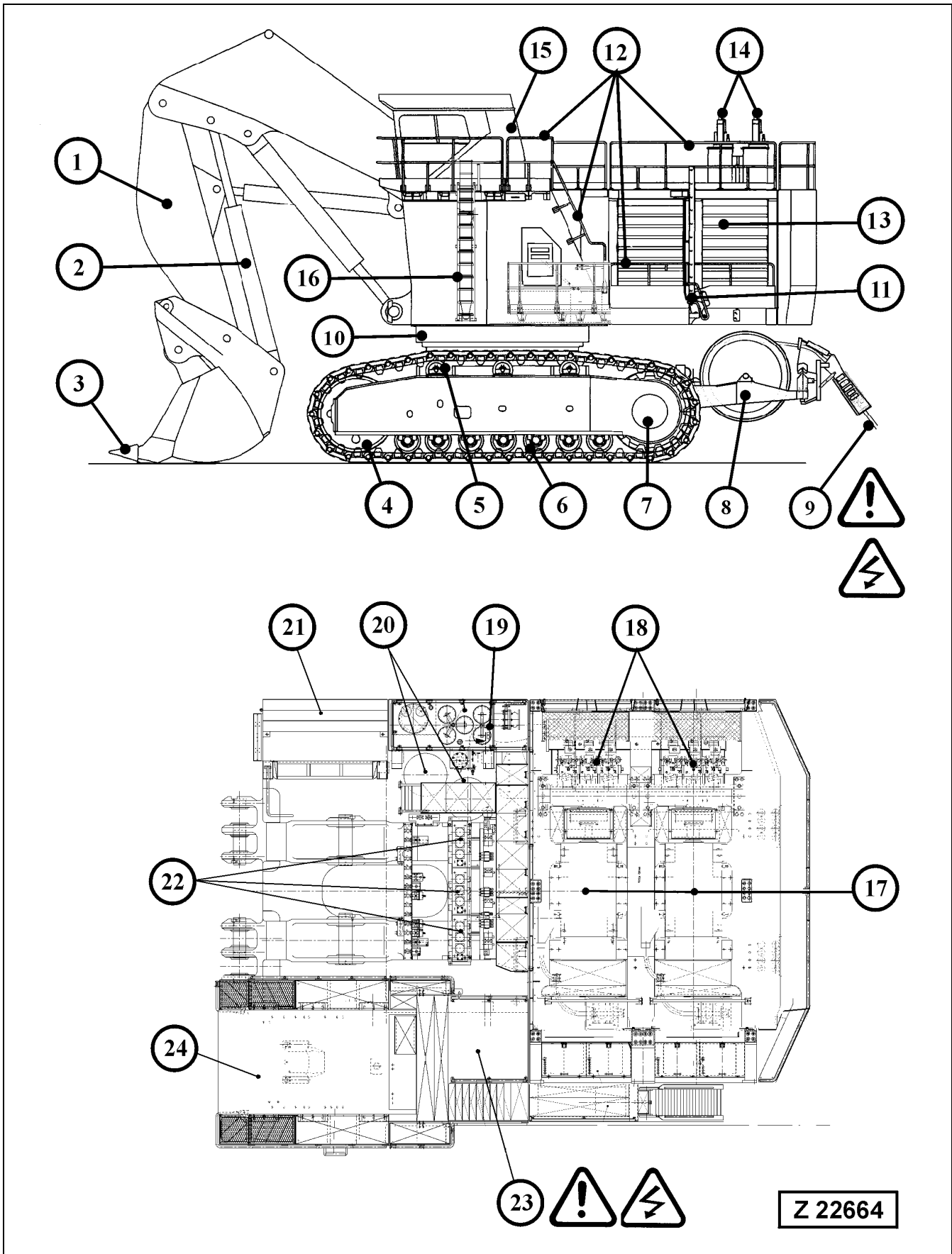
## 4.8.1 WALK - AROUND INSPECTION

### 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 Z22664

- (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 travel gears for leakage
- (8) Check condition, fastening and security of cable drum
- (9) Check condition and security of power cable
- (10) Check swing circle tothing for adequate lubrication.
- (11) Check condition, fastening and security of access ladders.
- (12) Check condition, fastening and security of all walk-ways, steps, railings and hand rails.
- (13) Make a visual inspection of the machinery house.
- (14) Check condition and fastening of automatic lubrication system
- (15) Check condition of the Operator's cab, check door lock for correct functioning.



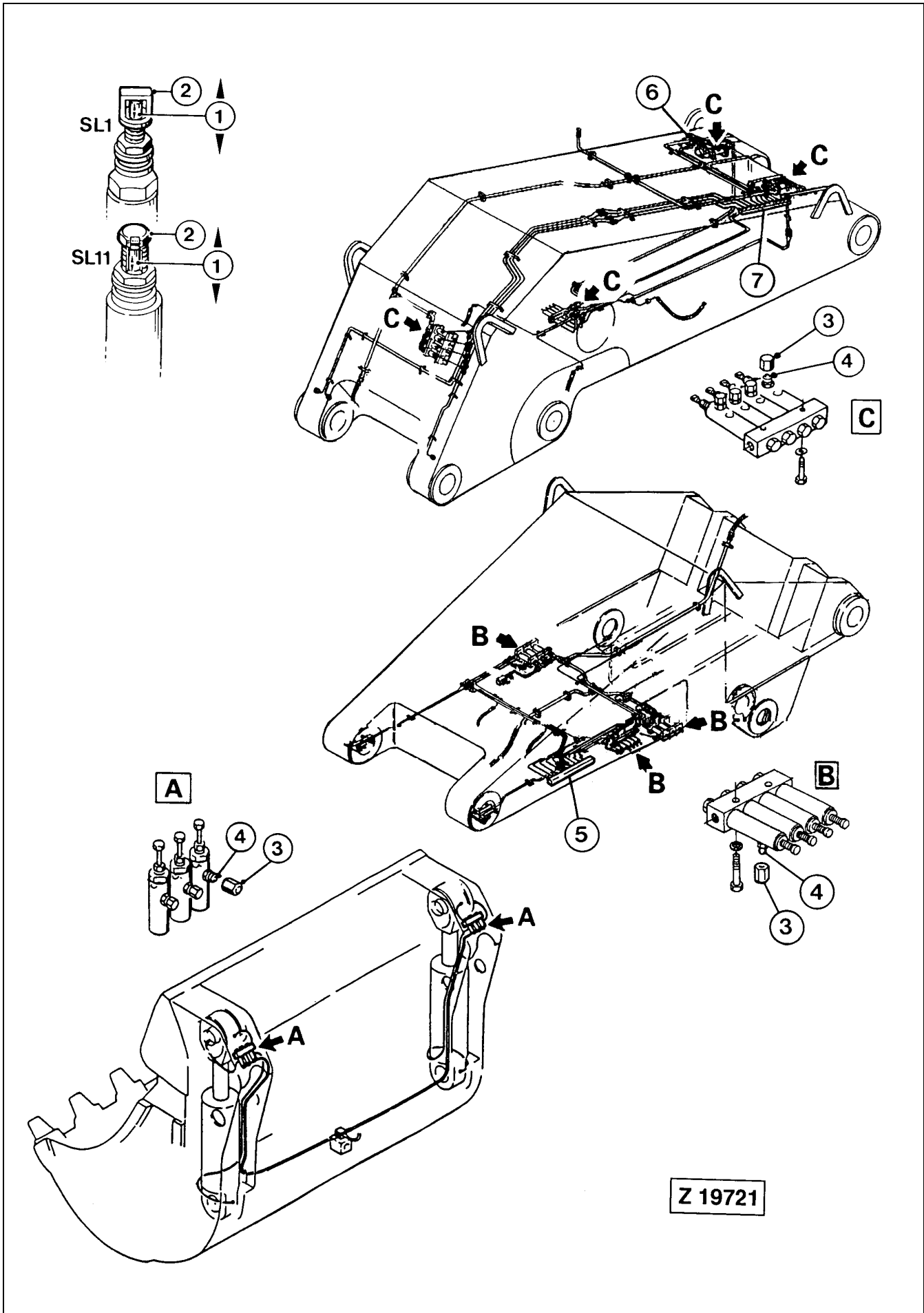


**Legend for illustration Z22664 (continued)**

- (16) Check condition, fastening and security of emergency escape ladder
- (17) Check condition of the main drive motors. See separate motor manual for more information
- (18) Check condition and fastening of pump distributor gears and hydraulic pumps
- (19) Check hydraulic oil level
- (20) Check condition and fastening of swing gears
- (21) Check condition and fastening of hydraulic oil coolers
- (22) Check condition and fastening of main control valves
- (23) Check to make sure that the high voltage switch cabinet door is locked
- (24) Check function of controls and monitors in the operator's cab

**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

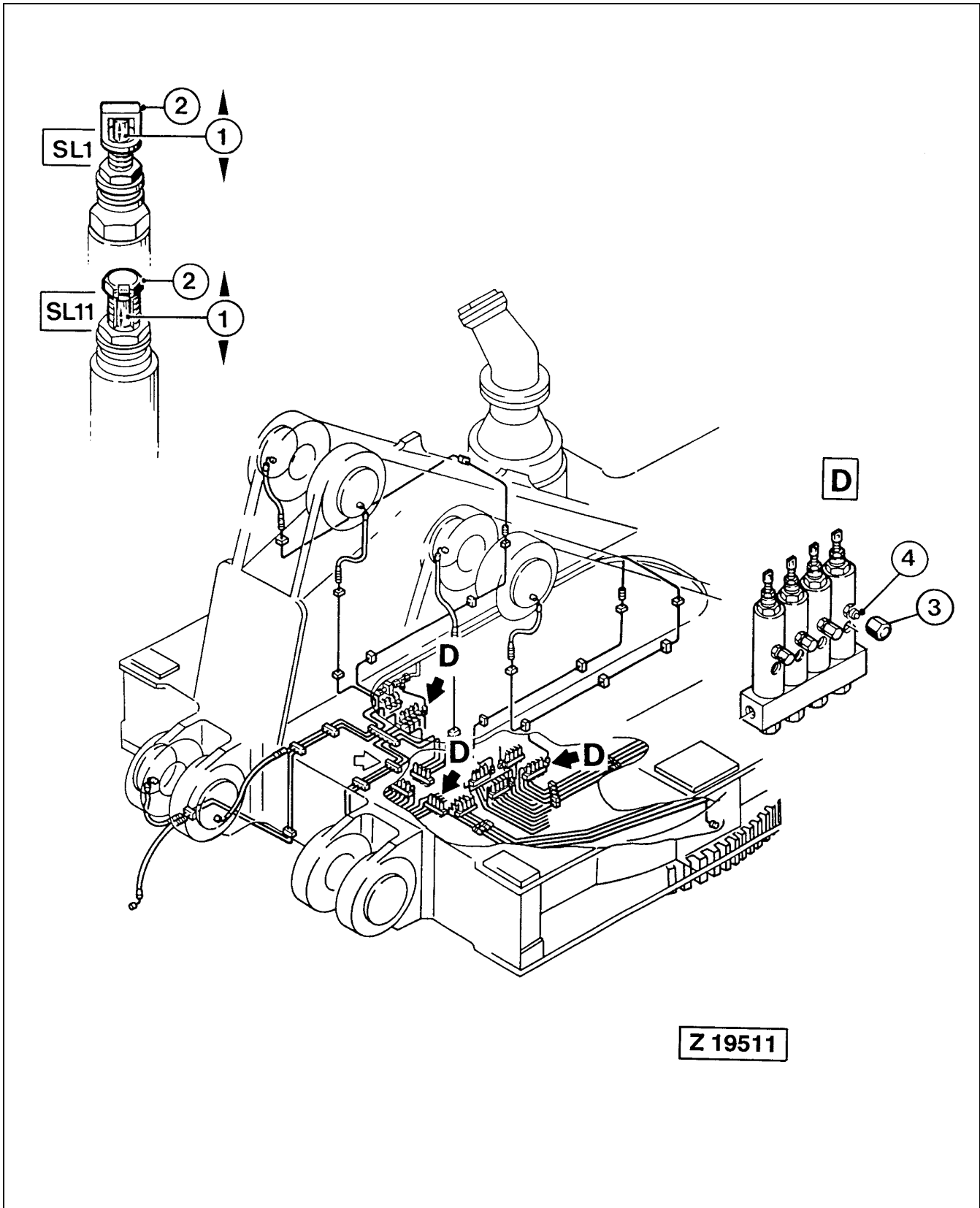
- A Injectors on bucket
- B Injectors on stick
- C Injectors on boom
- (1) Indicator stem for visual indication of injector operation
- (2) Output adjusting screw
- (3) Protection cap
- (4) Grease fitting
- (5) Distributor ledge, stick
- (6) Boom
- (7) Distributor ledge, boom

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

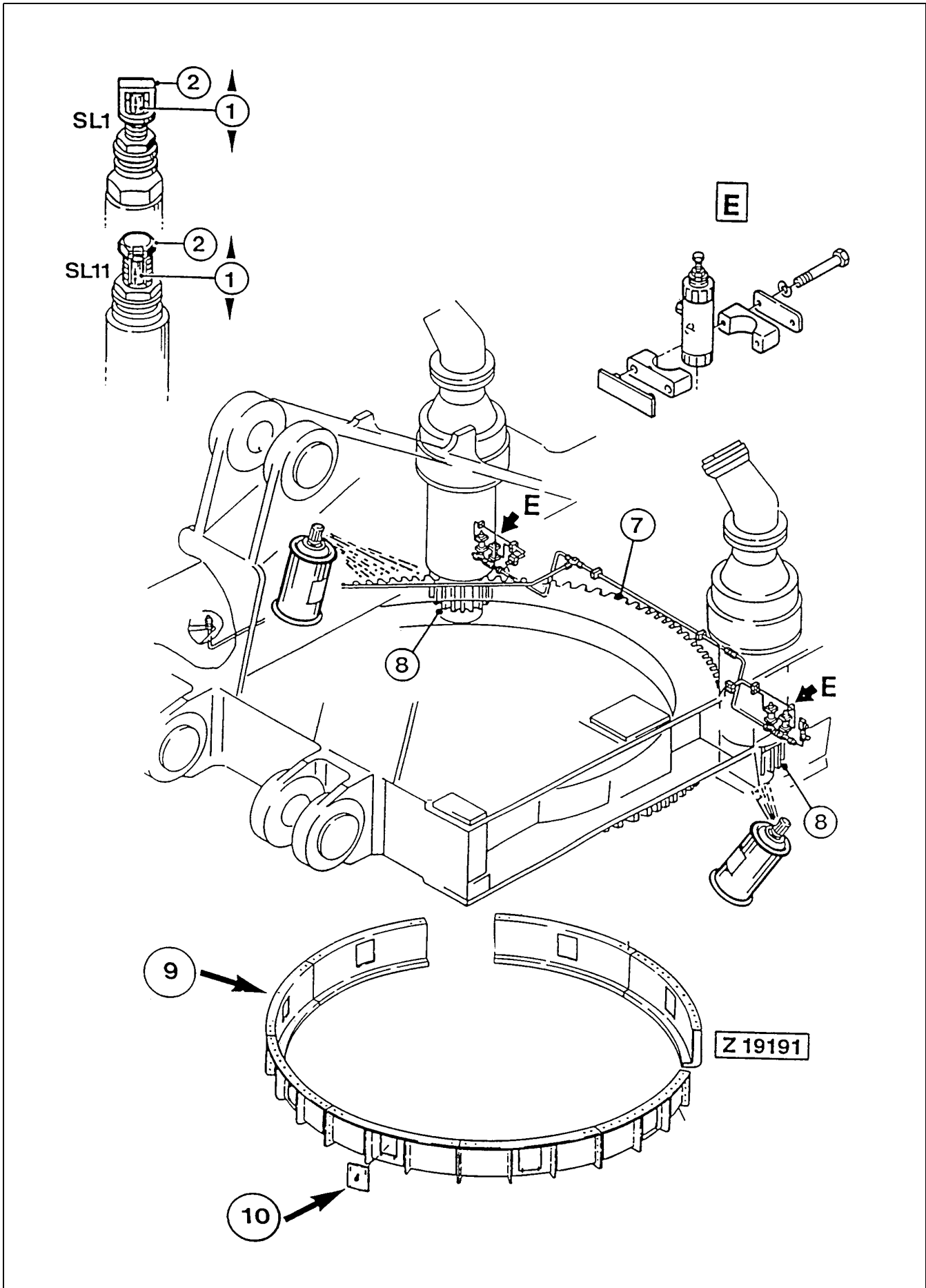
**If the failure is caused through a defective central lubrication system, manually lubricate at grease fittings (4) after removal of caps (3).**

## 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

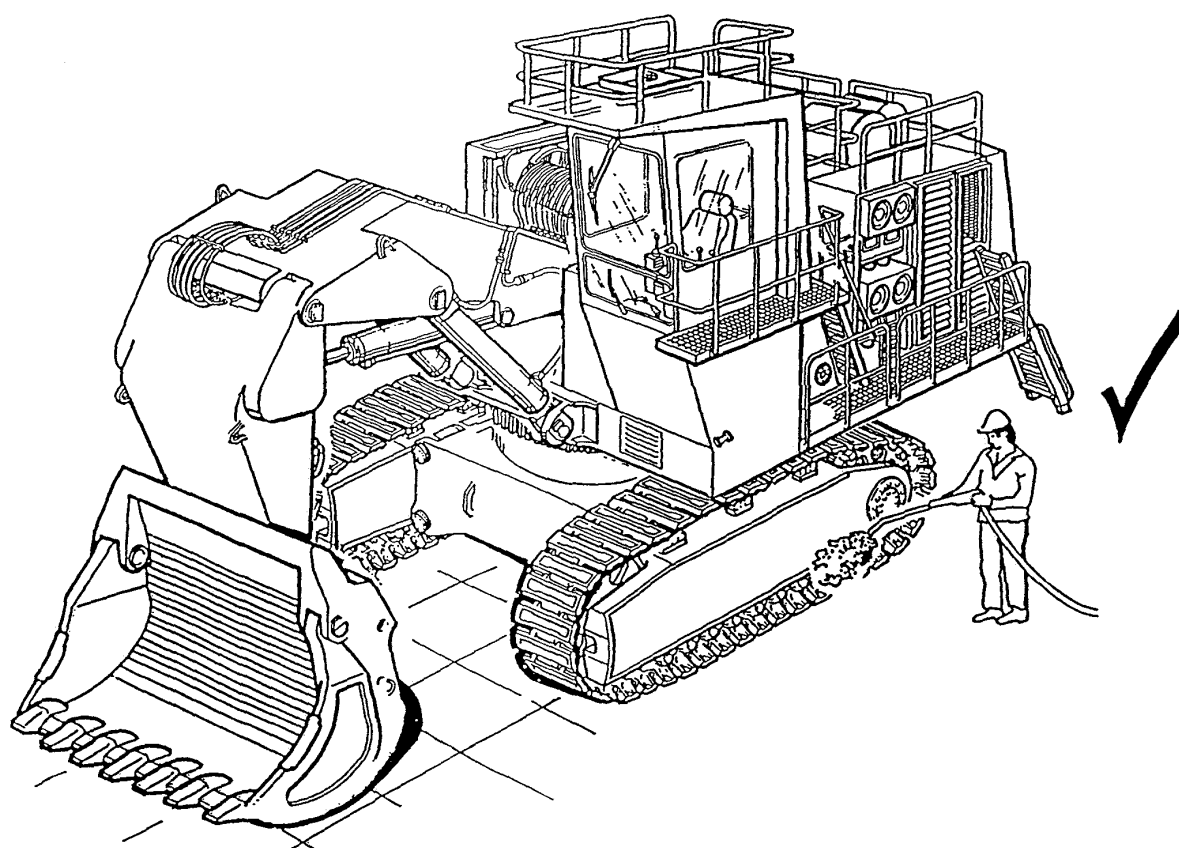
### Legend for illustration Z 19191

- 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.



Z 19706



## 4.8.2 TRACK GROUPS - CLEAN

Illustration Z 19706

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

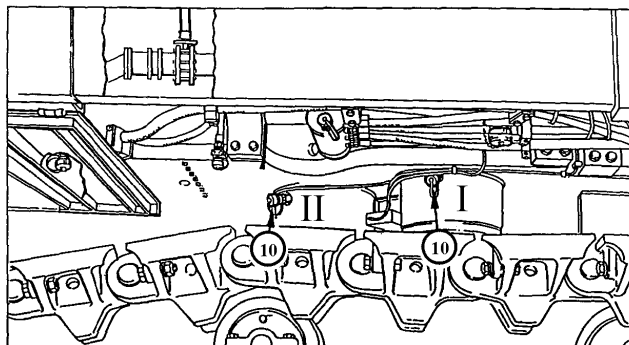
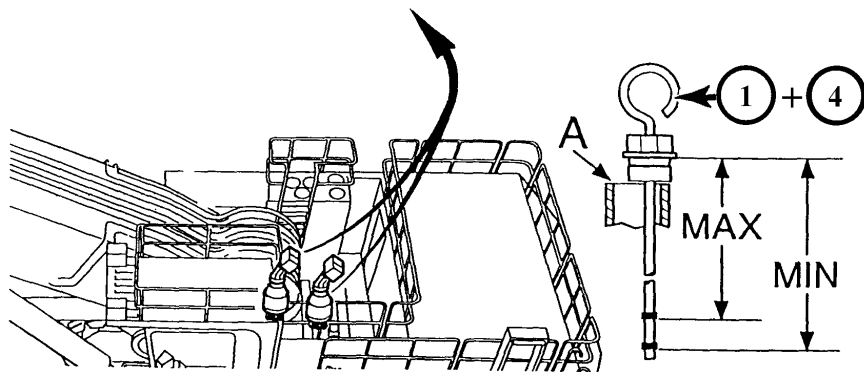
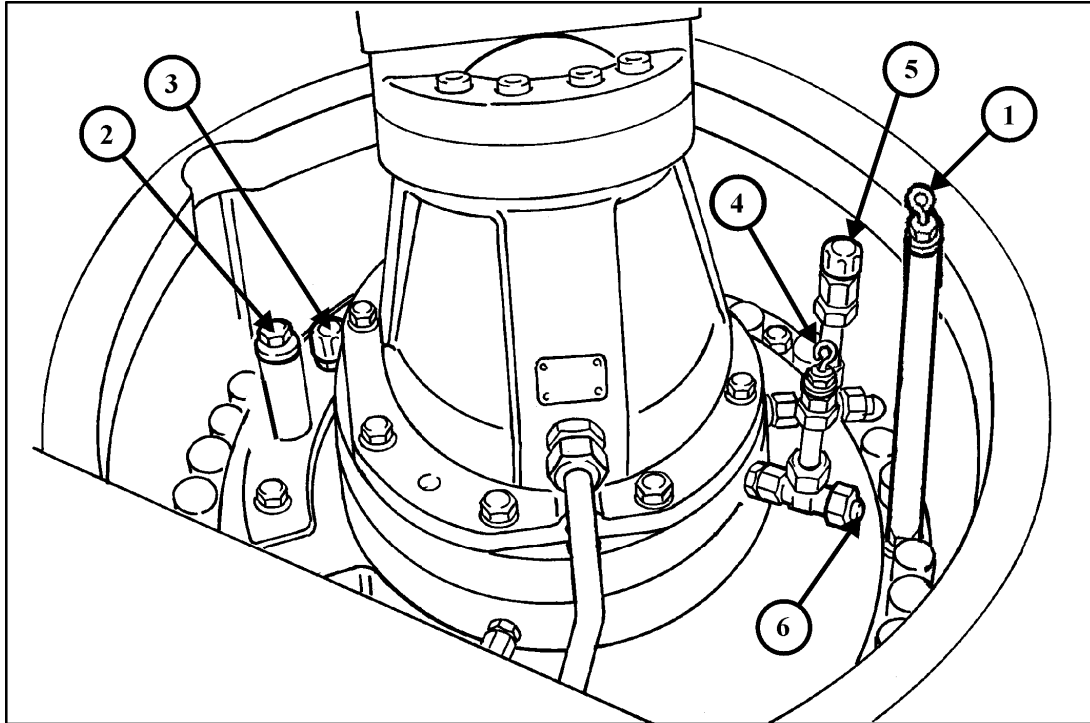
Material build up on guide wheels, drive sprockets and tracks can lead to over tensioning of the tracks, resulting in severe damage to these components.

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.**

# 4.9 EVERY 50 OPERATING HOURS OR WEEKLY



Z 22882

## 4.9.1 SWING GEARS AND MOTOR ADAPTER HOUSINGS - CHECK OIL LEVELS

### REMARK

The machine can be equipped either with a swing gear of manufacturer "L&S" or of manufacturer "Siebenhaar". Refer to the data plate on each swing gear housing to find out the manufacturer of the swing gear.

### Swing Gear manufactured by "L&S"

I Front Swing gear

II Rear Swing gear

### Legend for illustration Z22882

#### Swing gears

- (A) Position of oil level gauge for checking the oil levels
- (1) Oil level gauge
- (2) Oil filler plug
- (3) Breather filter
- (10) Drain coupling or evacuation nozzles for Wiggins system

#### Motor Adapter Housing

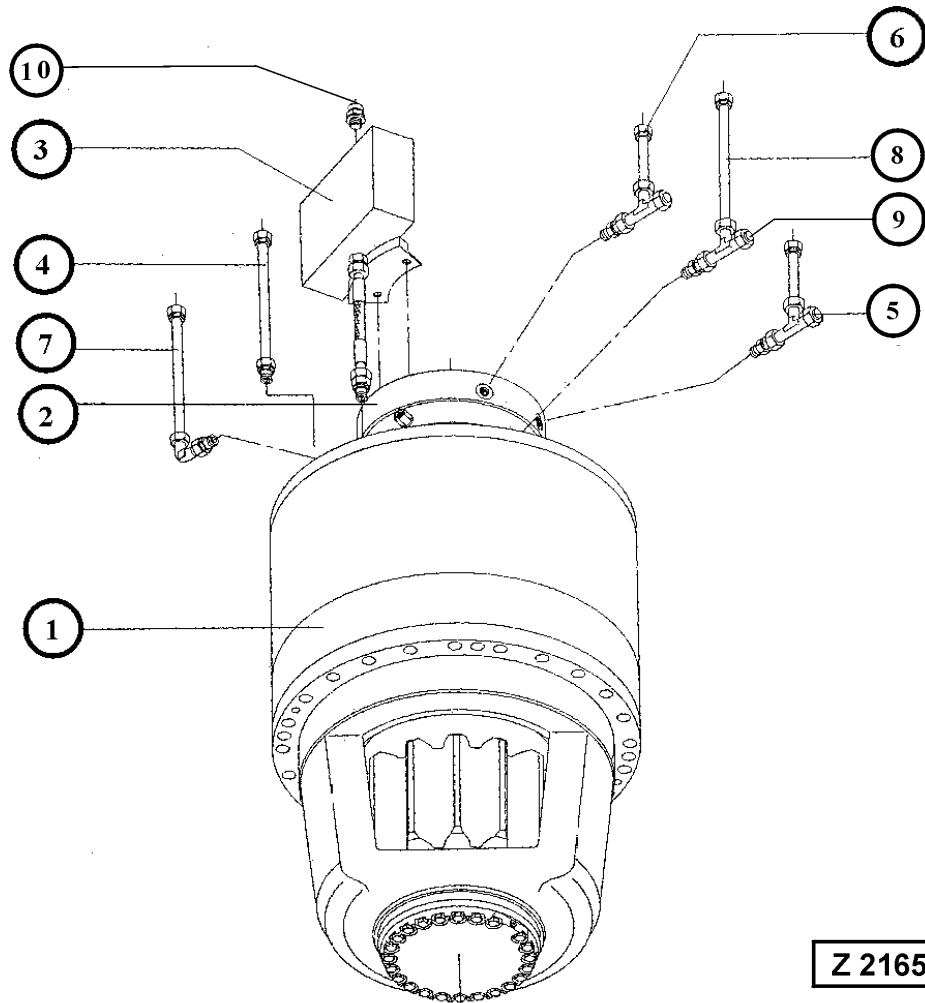
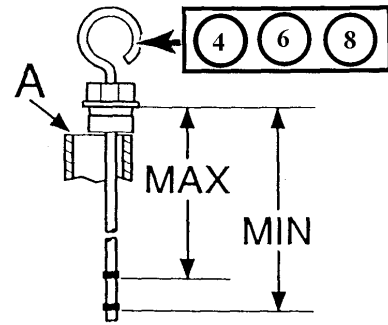
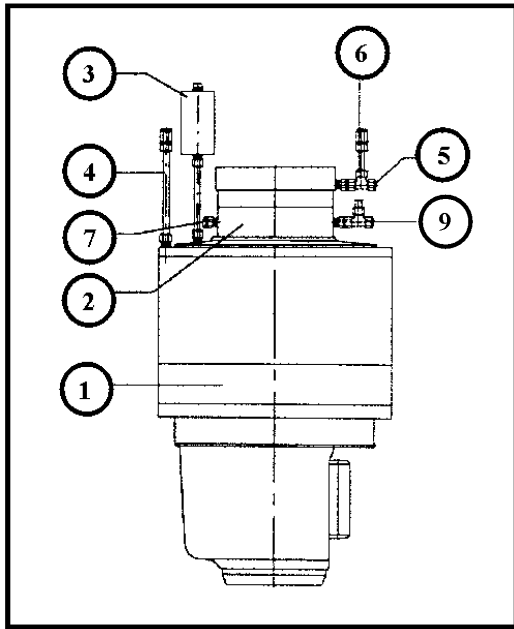
- (4) Oil level gauge and filler opening. This opening can also be used for connecting a suction pump when changing the oil.
- (5) Breather filter
- (6) Oil drain plug

## CHECK SWING GEAR OIL LEVEL

Remove oil level gauge (1), illustration Z22882 and wipe it clean. Insert the gauge but DO NOT screw in, see detail "A". Remove the gauge. The oil level should be at the upper mark of gauge (1). If necessary add the specified gear oil through filler opening (2). Remove breather filter (3). Blow out with compressed air from inside to outside and reinstall.

## CHECK MOTOR ADAPTER HOUSING OIL LEVEL

Remove oil level gauge (4) and wipe it clean. Insert the gauge but DO NOT screw in, see detail "A". Remove the gauge. The oil level should be at the upper mark of gauge (4). If necessary add the specified oil through filler opening (4). Remove breather filter (5). Blow out with compressed air from inside to outside and reinstall.



Z 21656

## Swing gear manufactured by "Siebenhaar"

### Legend for illustration Z 21656

- (A) Position of oil level gauge for checking the oil levels
- (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

### CHECK SWING GEAR OIL LEVEL

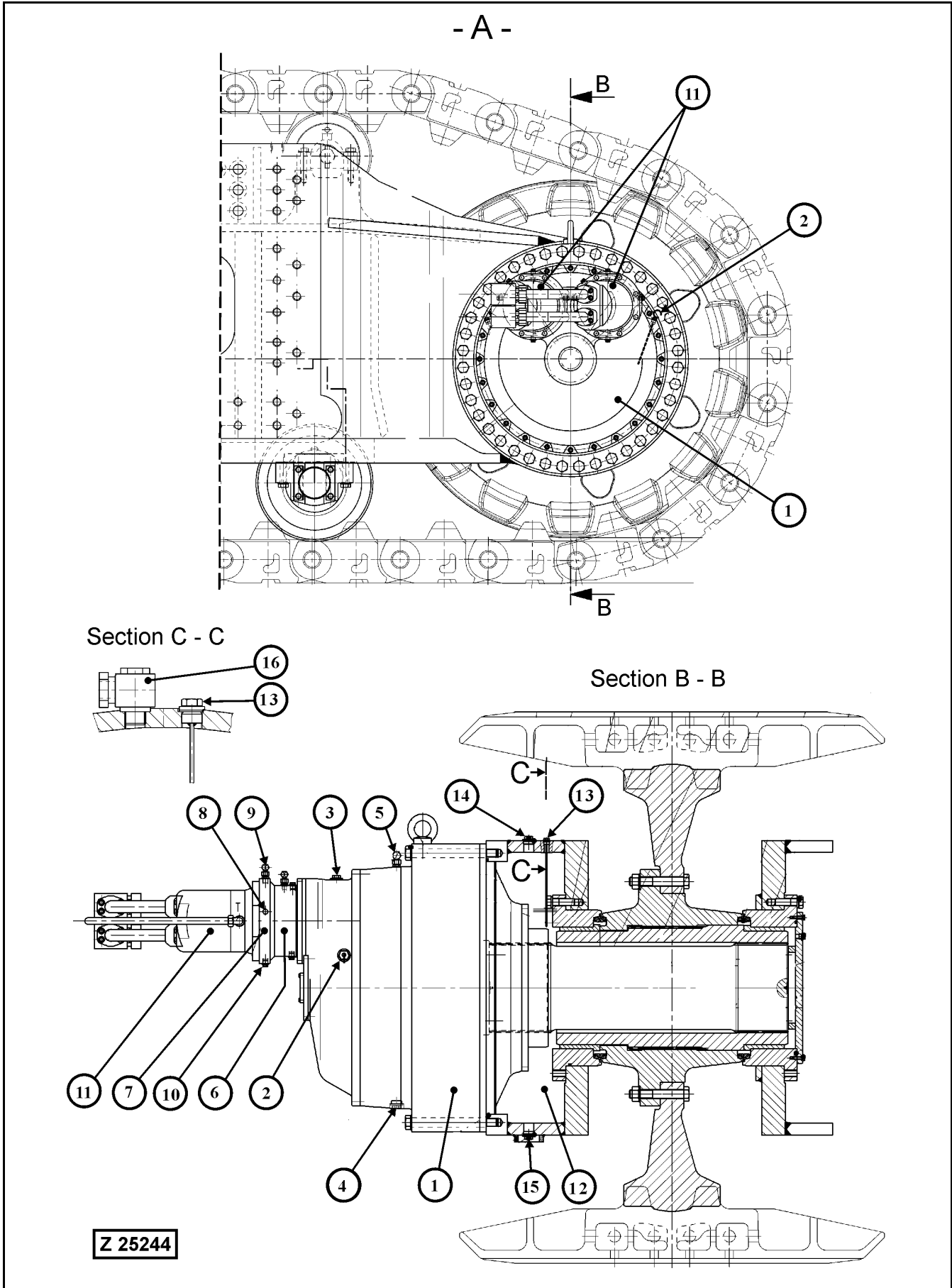
Remove oil level gauge (4) and wipe it clean. Insert the gauge but DO NOT screw in, see detail "A". Remove the gauge. The oil level should be at the upper mark of gauge (4). If necessary add the specified gear oil through filler pipe. Remove breather filter (10). Blow out with compressed air from inside to outside and reinstall.

### CHECK BRAKE HOUSING OIL LEVEL

Remove oil level gauge (8) and wipe it clean. Insert the gauge but DO NOT screw in, see detail "A". Remove the gauge. The oil level should be at the upper mark of gauge (8).  
If necessary add the specified oil through filler opening.  
Remove breather filter from pipe (7). Blow out with compressed air from inside to outside and reinstall.

### CHECK MOTOR ADAPTER HOUSING OIL LEVEL

Remove oil level gauge (6) and wipe it clean. Insert the gauge but DO NOT screw in, see detail "A". Remove the gauge. The oil level should be at the upper mark of gauge (6). If necessary add the specified oil through filler opening.



## 4.9.2 TRAVEL GEARS, MOTOR ADAPTER HOUSINGS AND FINAL DRIVES CHECK OIL LEVELS

### Legend for illustration Z25244

- A - View of the RH Final drive. The configuration of the LH Final drive is the same.

#### (1) Travel gear

(2) Oil level gauge

(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 343.

(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 343. The port of connector (9) is also used as oil filler opening.

(10) Oil drain plug

(11) Hydraulic motors

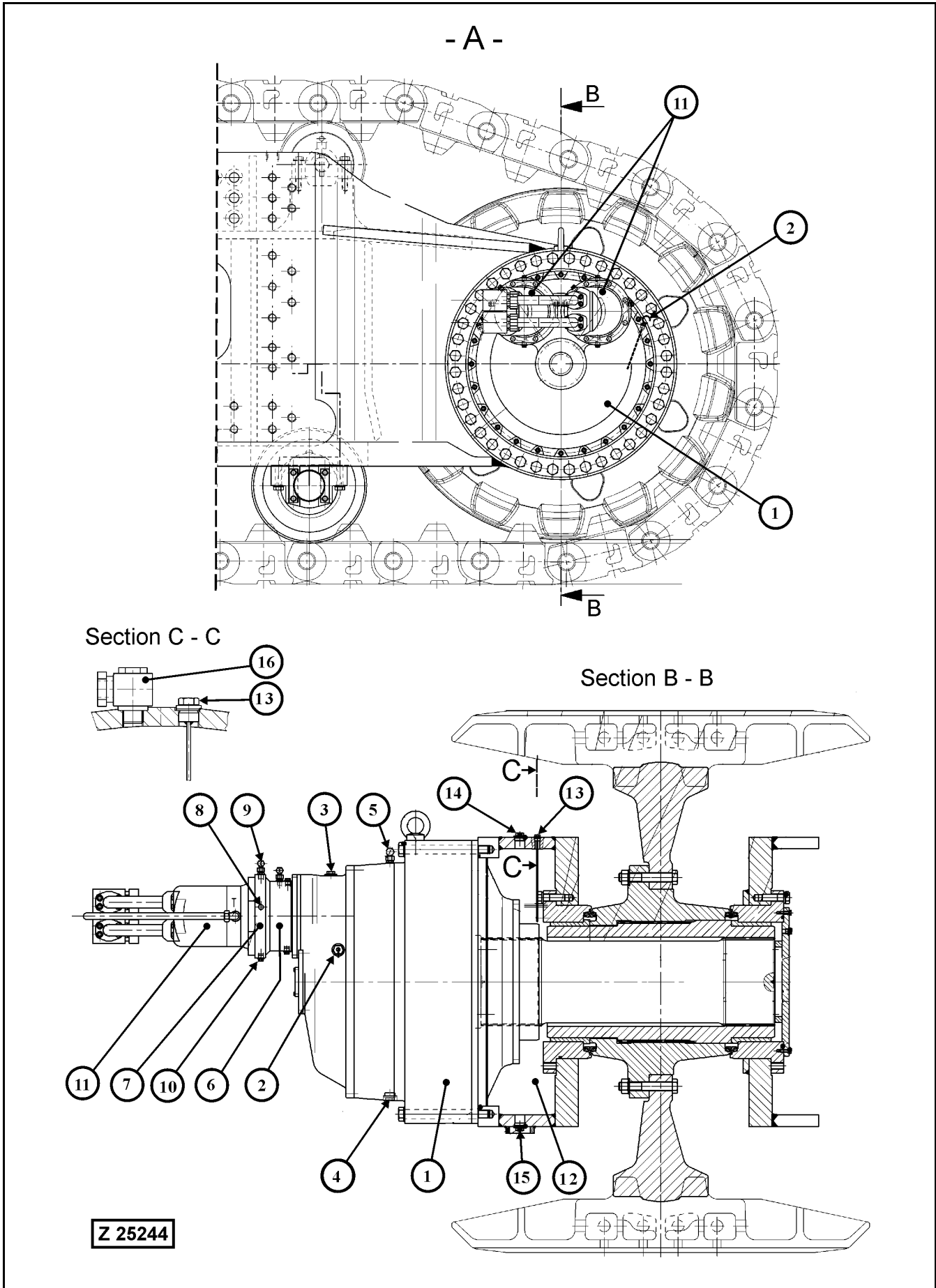
#### (12) Final drive housing contains the lubricating oil for sprocket bearing lubrication.

(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 343.





## **TRAVEL GEAR BOX - CHECK OIL LEVEL**

Illustration Z25244:

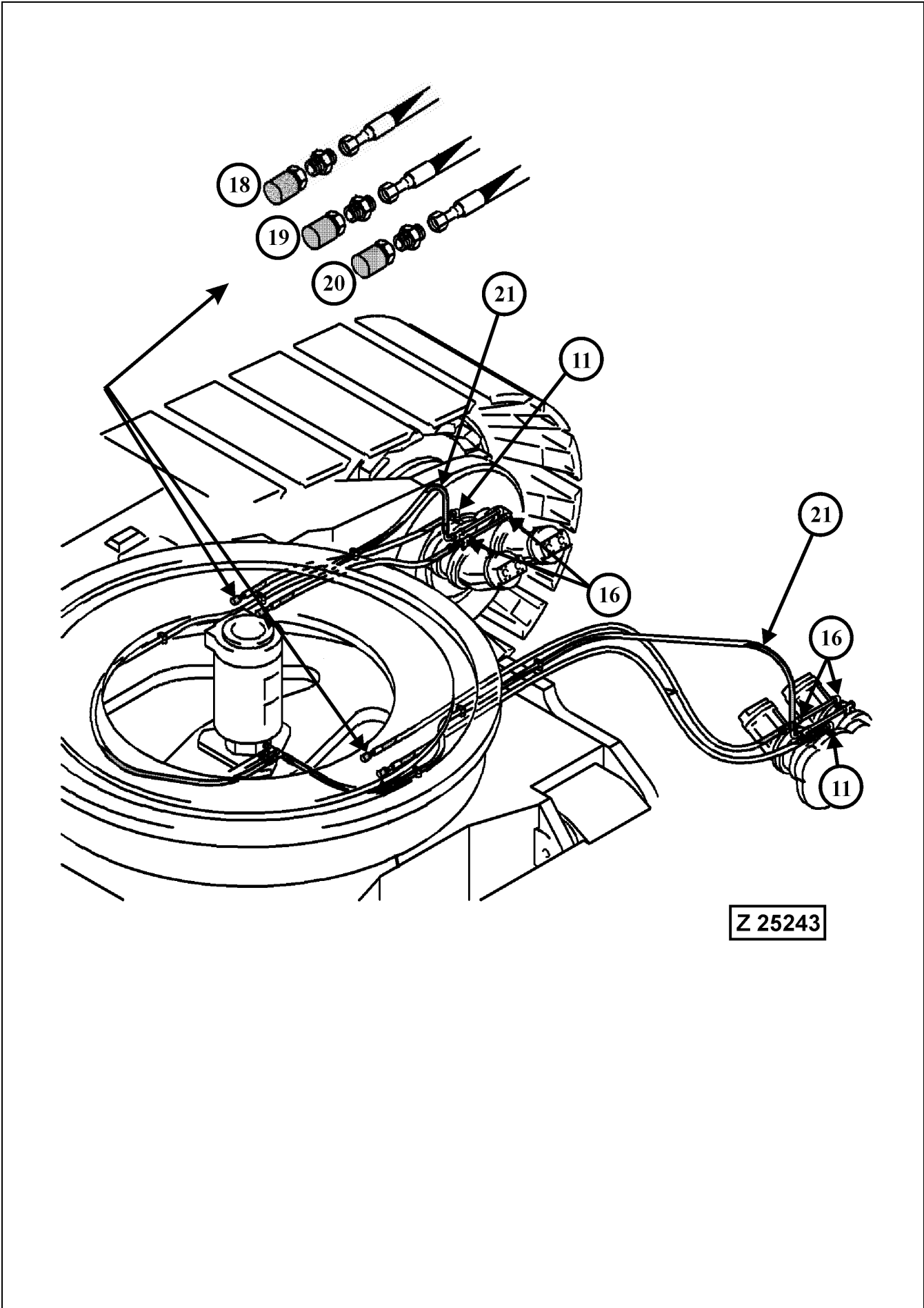
Remove oil level gauge (2) and wipe it clean. Screw in the gauge and remove again. Oil level should be at the upper mark of gauge (2). If necessary add oil through filler opening (3). Insert gauge (2) and filler plug (3) and tighten securely. Check breather filter (18), illustration Z25243 on page 343 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 343 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 343 for restriction. If necessary, remove breather filters, blow out with compressed air from inside to outside and reinstall.

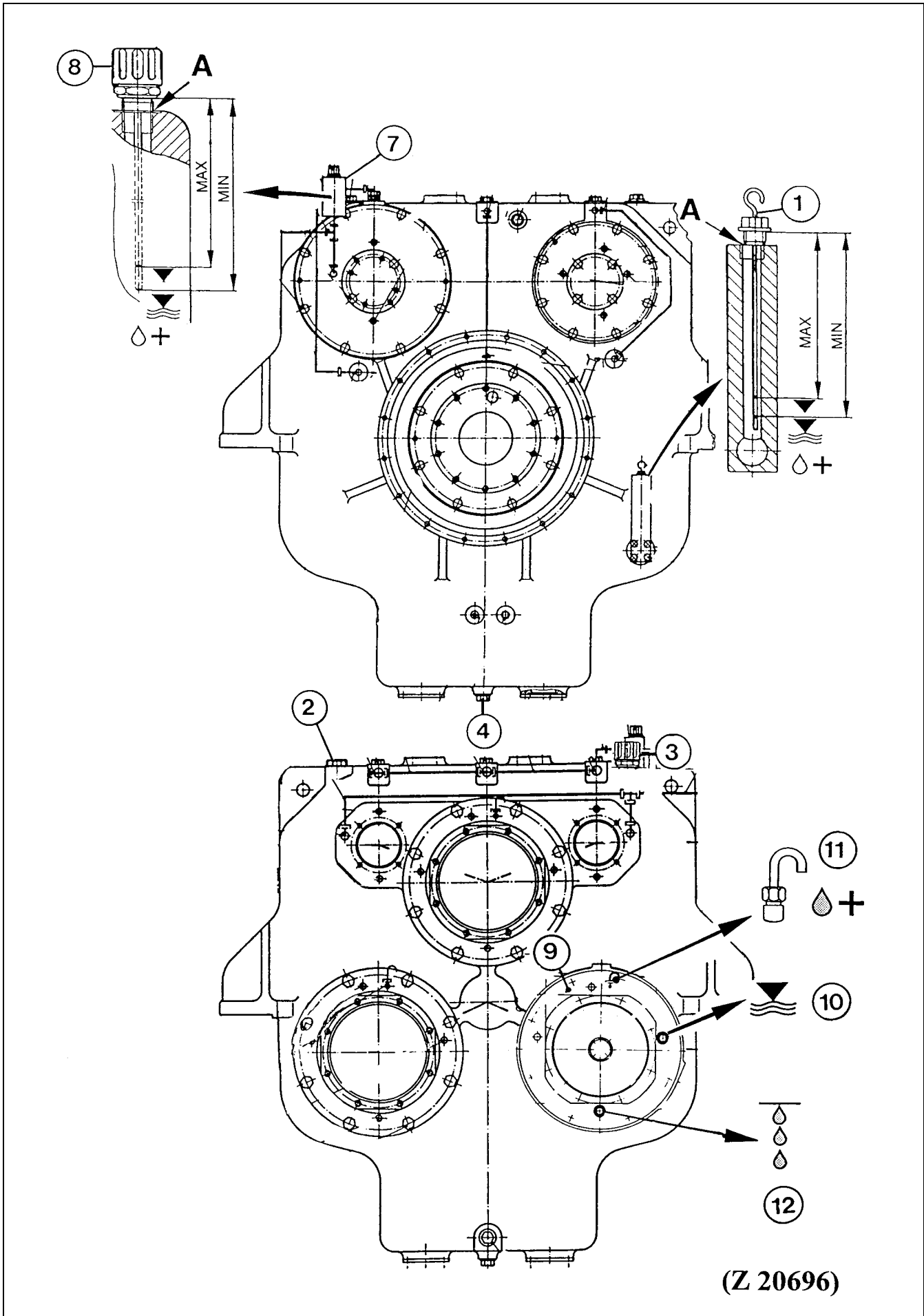


## **TRAVEL GEARS, MOTOR ADAPTER HOUSINGS AND FINAL DRIVES - CHECK BREATHER FILTERS**

### **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

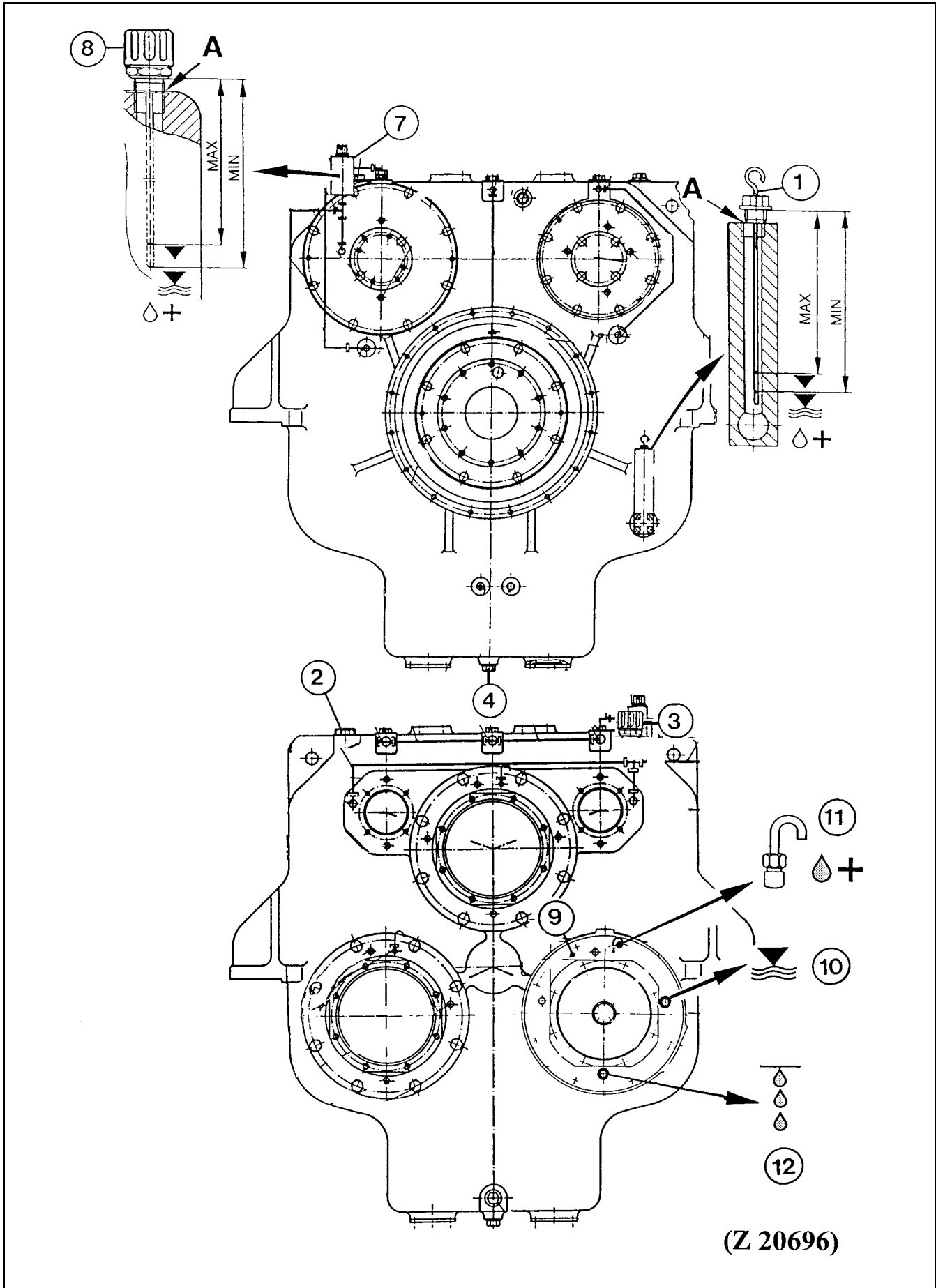
#### PUMP DISTRIBUTOR GEARS, CHECK OIL LEVEL:

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).

#### 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. 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**

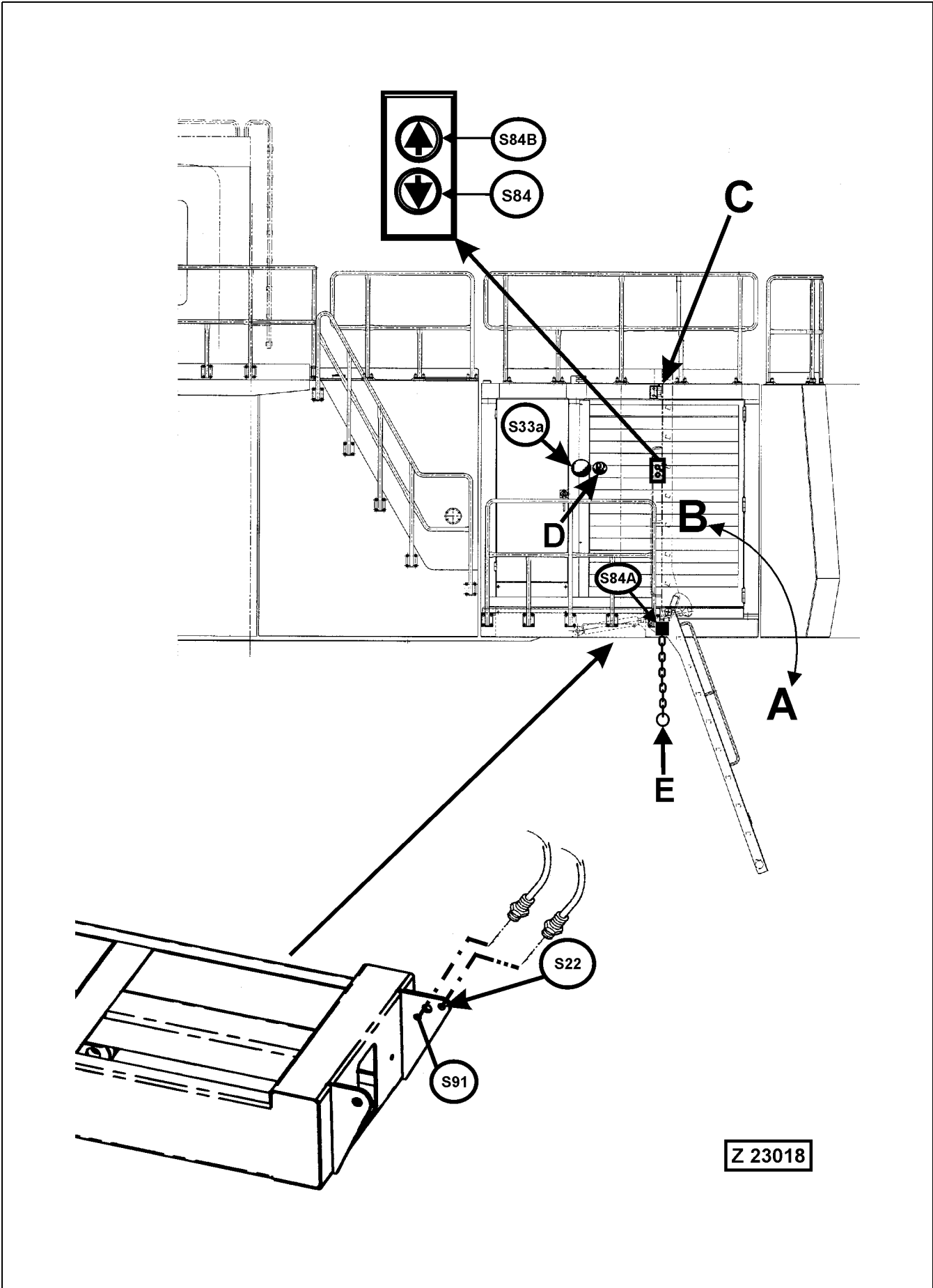
The Oil level should be at the lower edge of level plug opening (10). If necessary remove filler plug with breather pipe (11) and add Gear Oil through the filler opening up to the level opening (10).

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 23018



## 4.9.4 HYDRAULIC ACCESS LADDER - CHECK SAFETY SENSOR

### Legend for illustration Z 23018

- (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.**

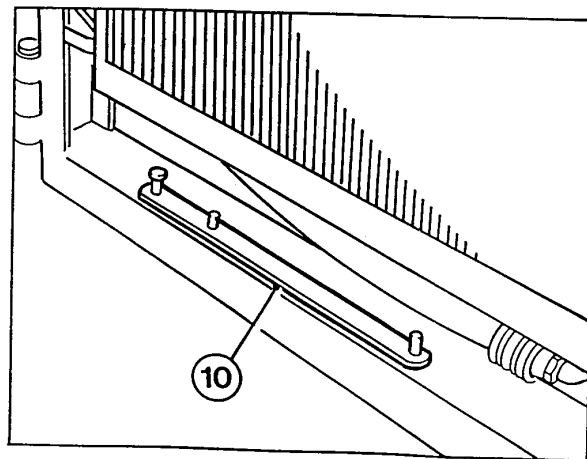
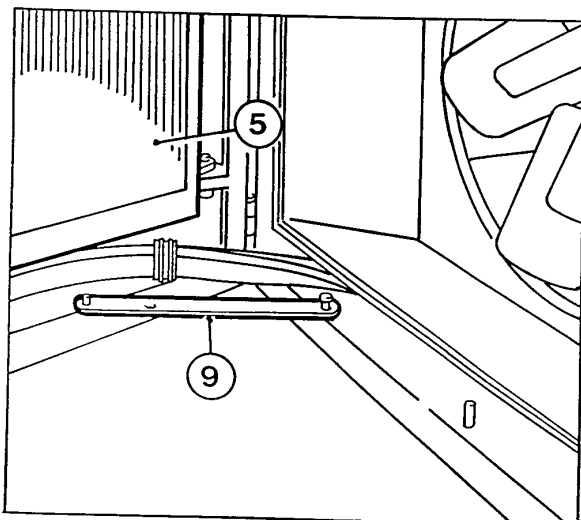
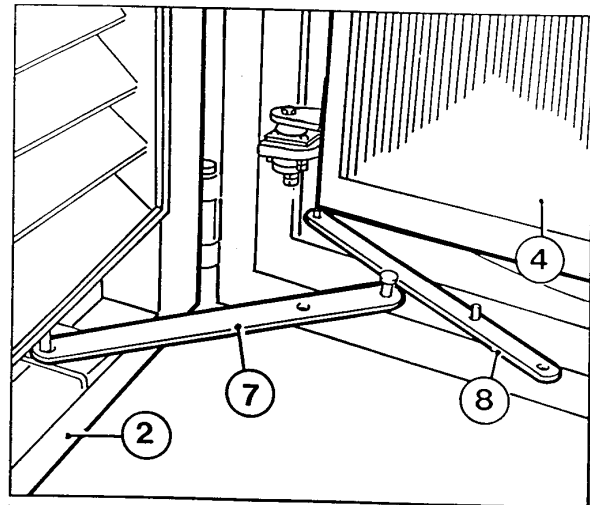
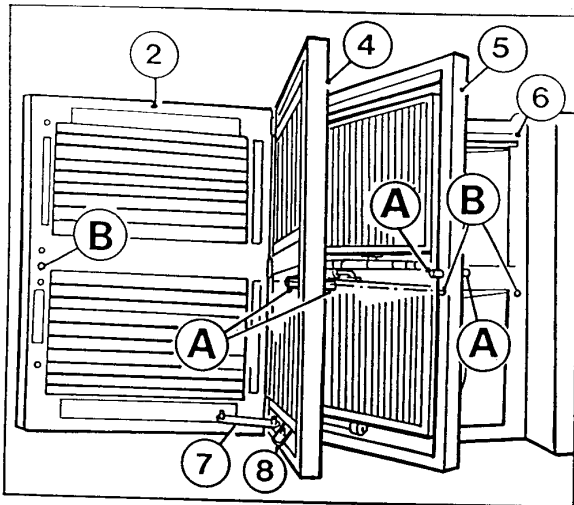
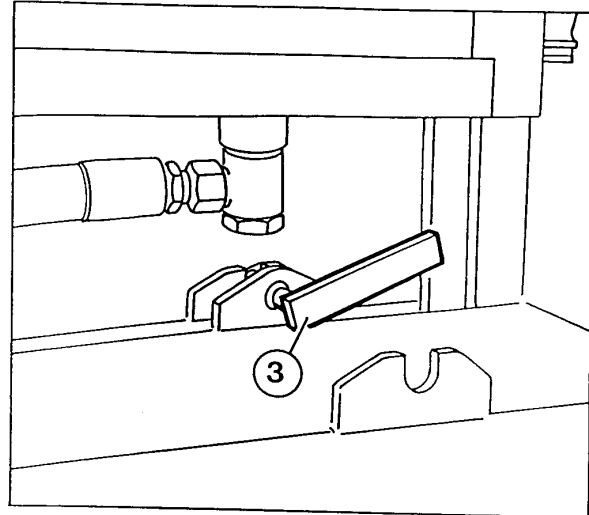
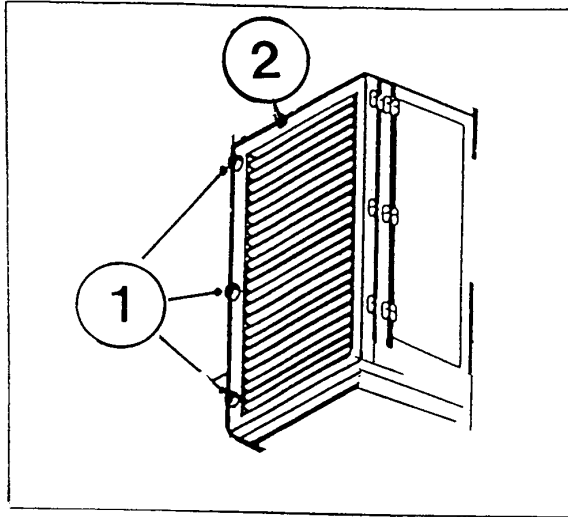
- (S84) Ladder control switch for lowering the ladder
- (S84B) Ladder control switch for lifting the ladder
- (S84A) Safety switch for emergency lowering of the access ladder. When the chain (E) is being pulled down with the motor running, the pilot control system is made inoperative, preventing further 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 motors

### Check Safety Sensor (S22) as follows:

With the ladder completely lowered (position A) start the motor.  
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

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**⚠ WARNING**

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- 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.

- 
1. Loosen mounting bolts (1).
  2. Open door (2).

**REMARK**

Details (A and B) i show LH hinge mounted oil coolers. The description below applies also to RH mounted oil coolers.

3. Loosen fasteners (3) and swing out oil coolers (4 and 5).
4. Secure door (2) and oil coolers (4 and 5) with locking bars (7, 8 and 9).
5. Clean the oil coolers with compressed air. Direct the air flow from inside to outside.
6. After cleaning, bring back the oil coolers to their home position.

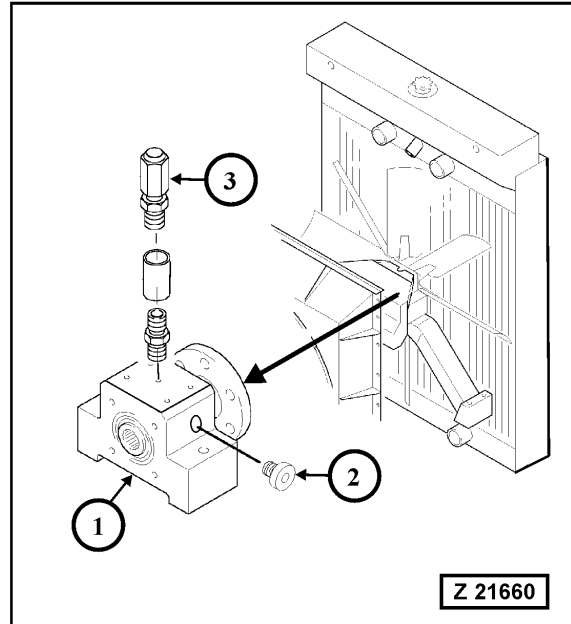
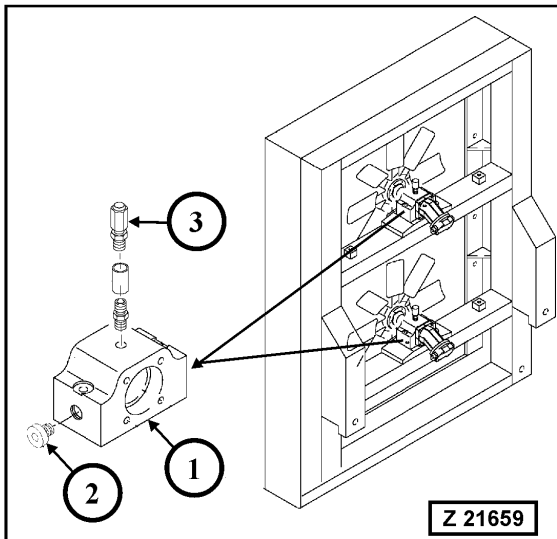
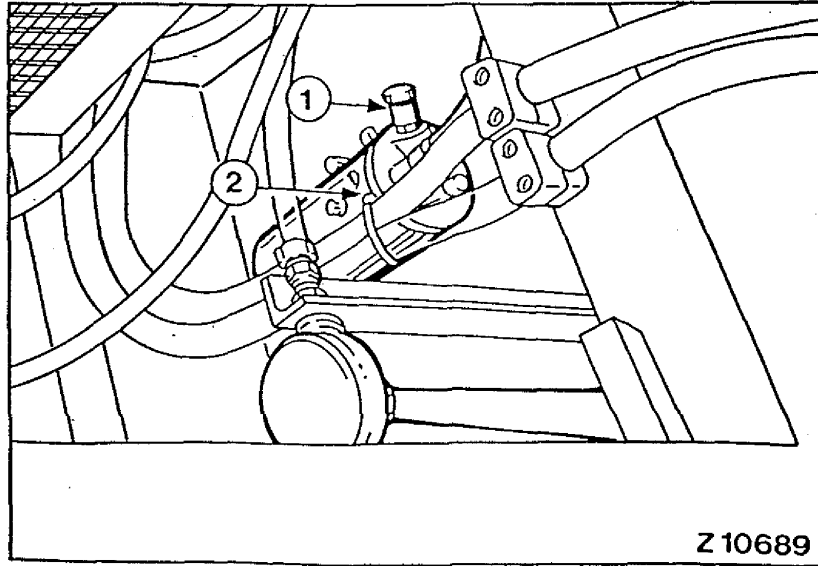
**PROCEED AS FOLLOWS**

- Disengage locking bars (7, 8 and 9) and bring 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.

**NOTICE**

**When cleaning the oil coolers, inspect also laying and fastening of the hydraulic oil lines.**

# 4.10 EVERY 250 OPERATING HOURS OR MONTHLY



### **4.10.1 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.

### **4.10.2 HYDRAULIC OIL COOLER FAN BEARINGS - CHECK FOR LEAKAGE AND CLEAN BREATHER FILTER**

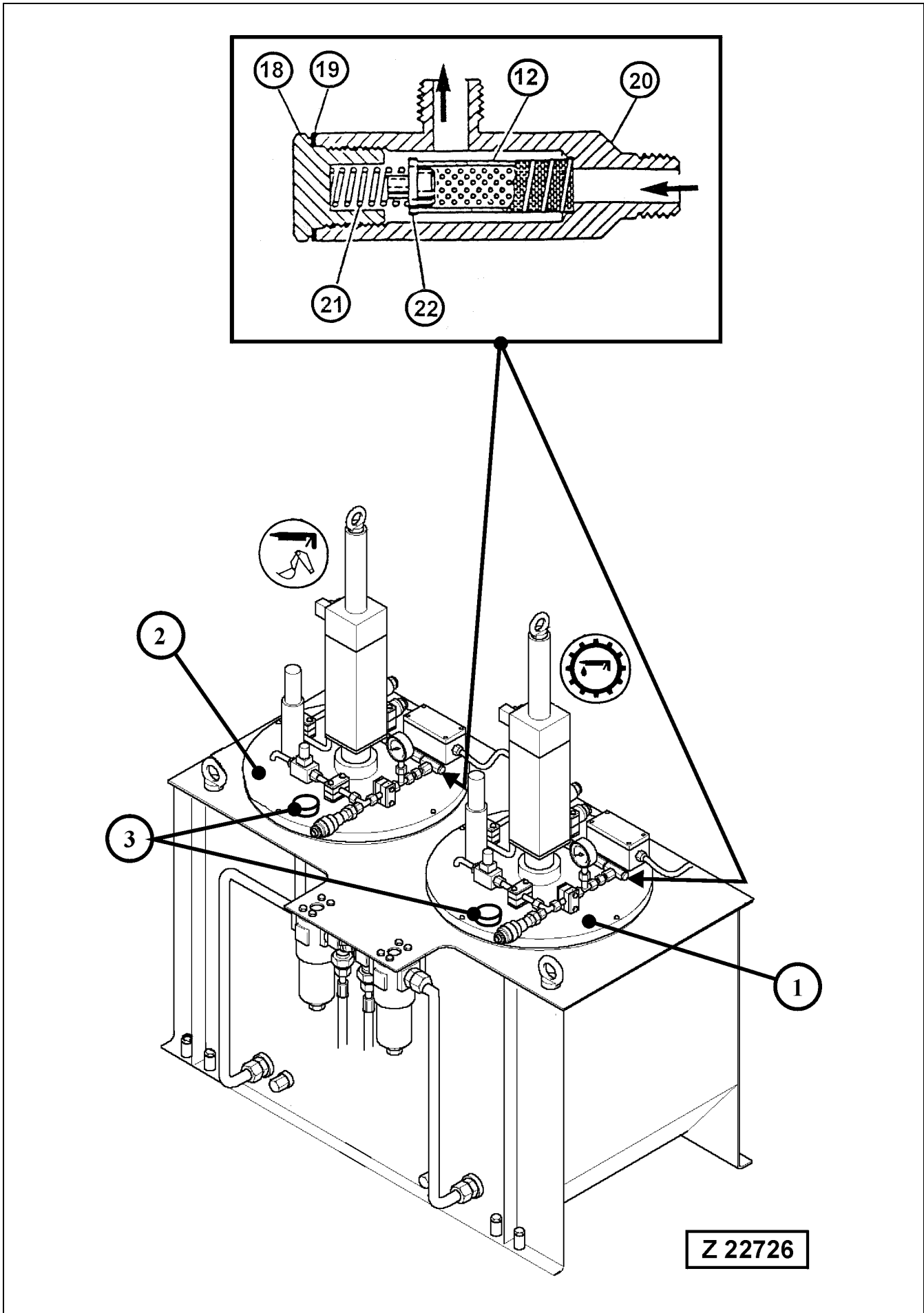
See illustration Z 21659

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.

### **4.10.3 RADIATOR FAN BEARINGS - CHECK FOR LEAKAGE AND CLEAN BREATHER FILTER (DIESEL VERSION ONLY)**

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.



Z 22726

## 4.10.4 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).**

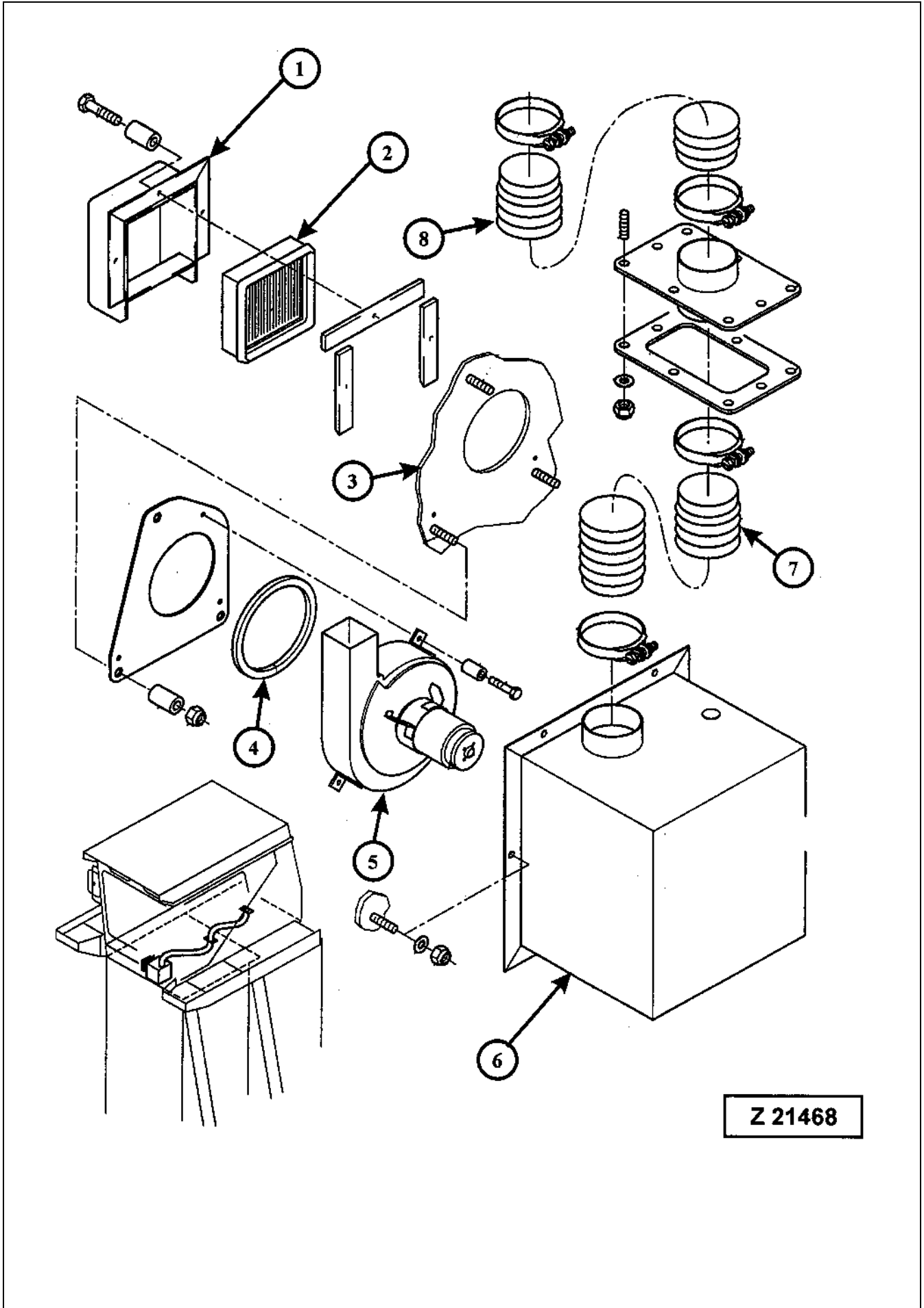
A blocked filter can disintegrate under pressure and damage the automatic lube system.

### 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.





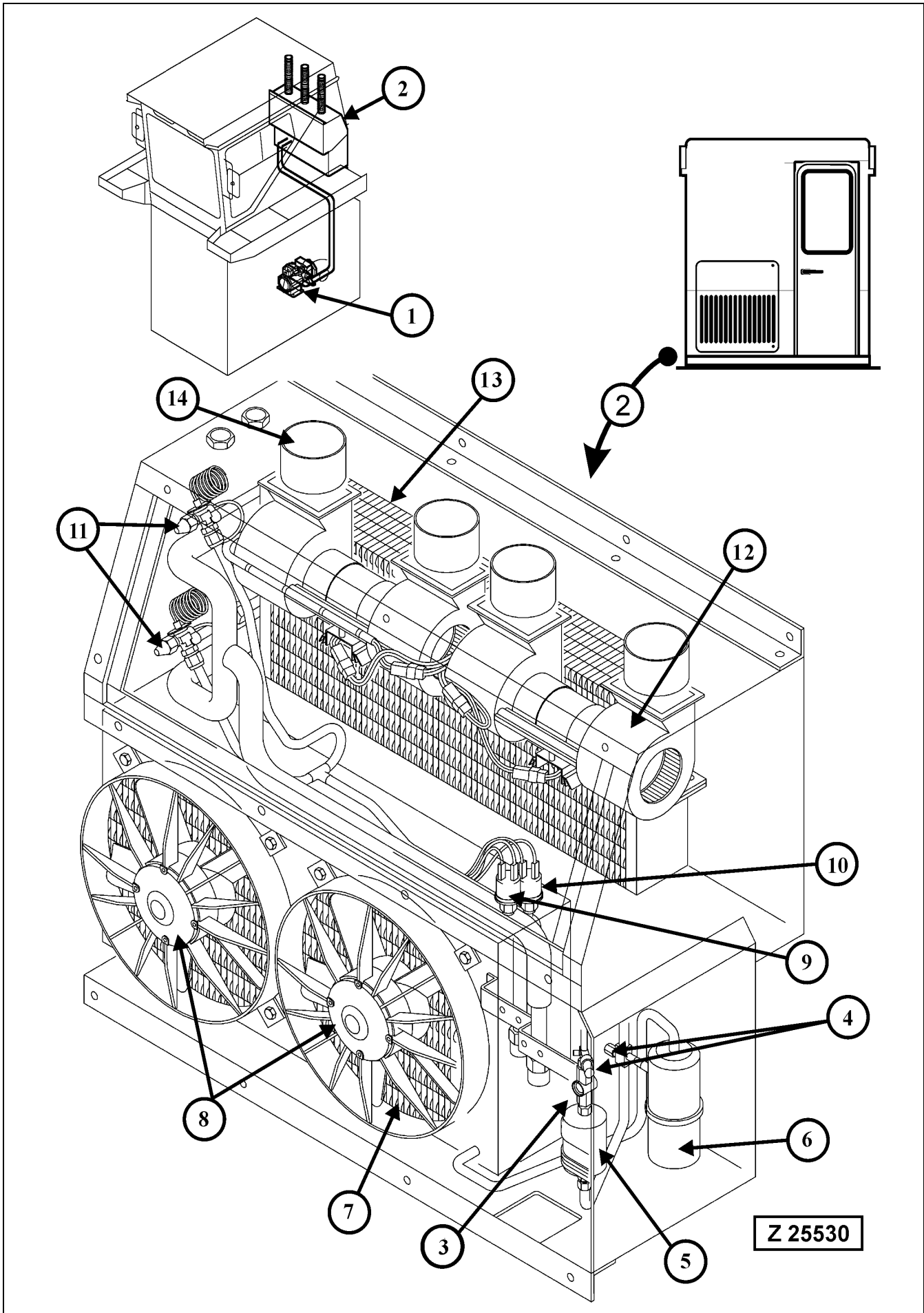
## 4.10.5 CAB AIR CLEANER - CLEAN OR REPLACE FILTER ELEMENT

### 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 useable 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.



## 4.10.6 AIR CONDITIONING FOR OPERATOR'S CAB AND SWITCH CABINETS

### Air conditioning for Operator's Cab

#### Legend for illustration Z 25530

- (1) Refrigerant compressor Type 4FC-5.2Y. Carry out maintenance according to the separate Operating Instructions "KB-100-1" filed in volume 2 binder.
- (2) Air conditioner unit
- (3) Sight glass for checking refrigerant filling
- (4) Shut-off valves each side of 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).

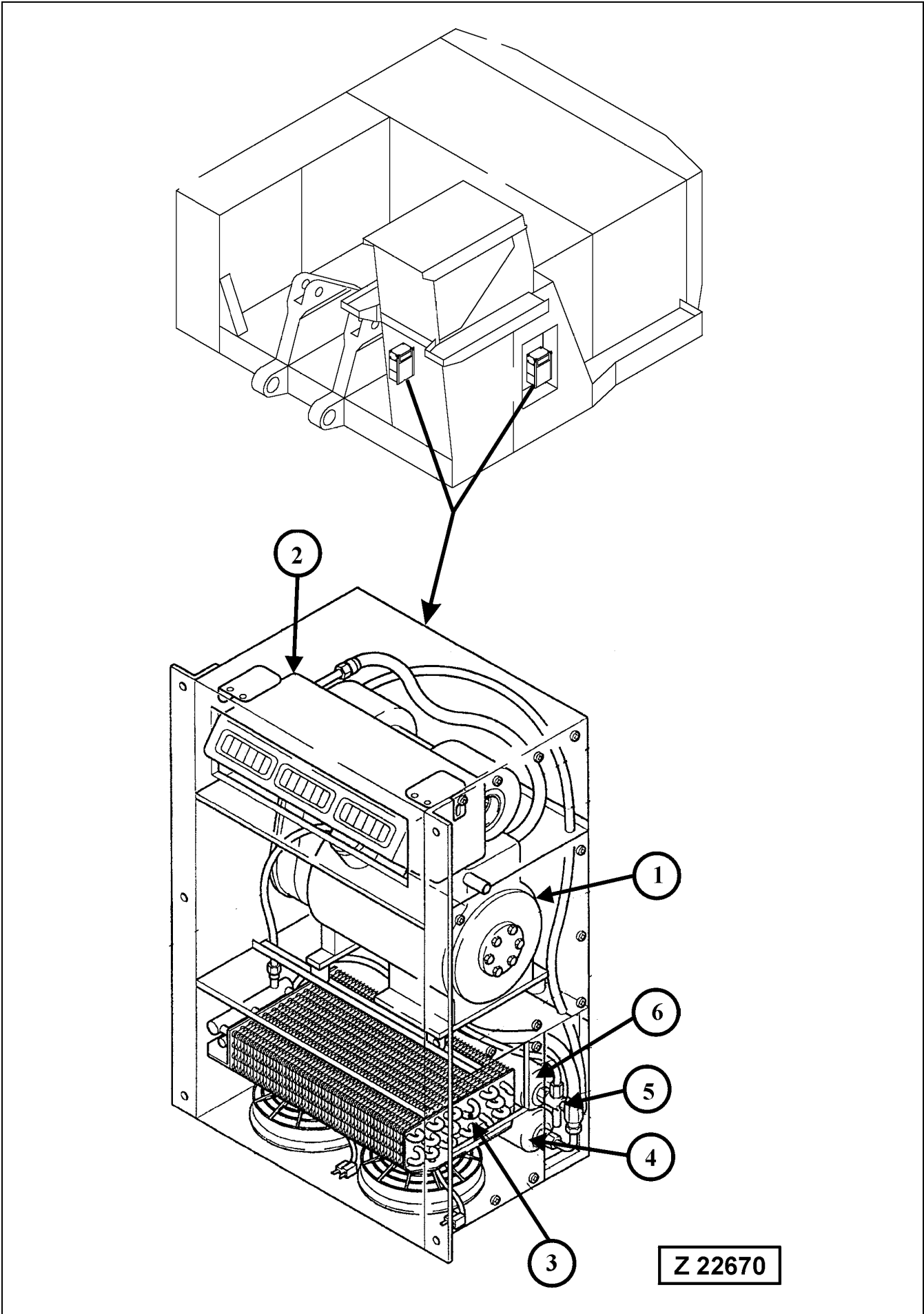
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**CAUTION**

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**Servicing of the air conditioning systems is restricted to workshops especially equipped for this purpose. Refer to the separate manual "AIR CONDITIONING" in Service Literature Binder – Volume 2 for more information.**

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## Air Conditioning for medium and high Voltage Switch Cabinets

### Legend for illustration Z 22670

- (1) Refrigerant compressor
- (2) Control and Evaporator unit
- (3) Condenser unit
- (4) Dryer cartridge
- (5) Sight glass for checking refrigerant filling. The sight glass can be seen through an opening on the front panel of the air conditioner housing.
- (6) Collector reservoir

### Checking the refrigerant level

Switch on air conditioning equipment and run at maximum capacity for approx. 5 minutes.

Observe inspection glass (5) at refrigerant tank. 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 of refrigerant. If more than 200 grams per year are lost, the oil level of the refrigerant compressor (1) 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 (6) must be replaced after every 1000 operating hours or once a year by refrigeration specialists.

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 **CAUTION**

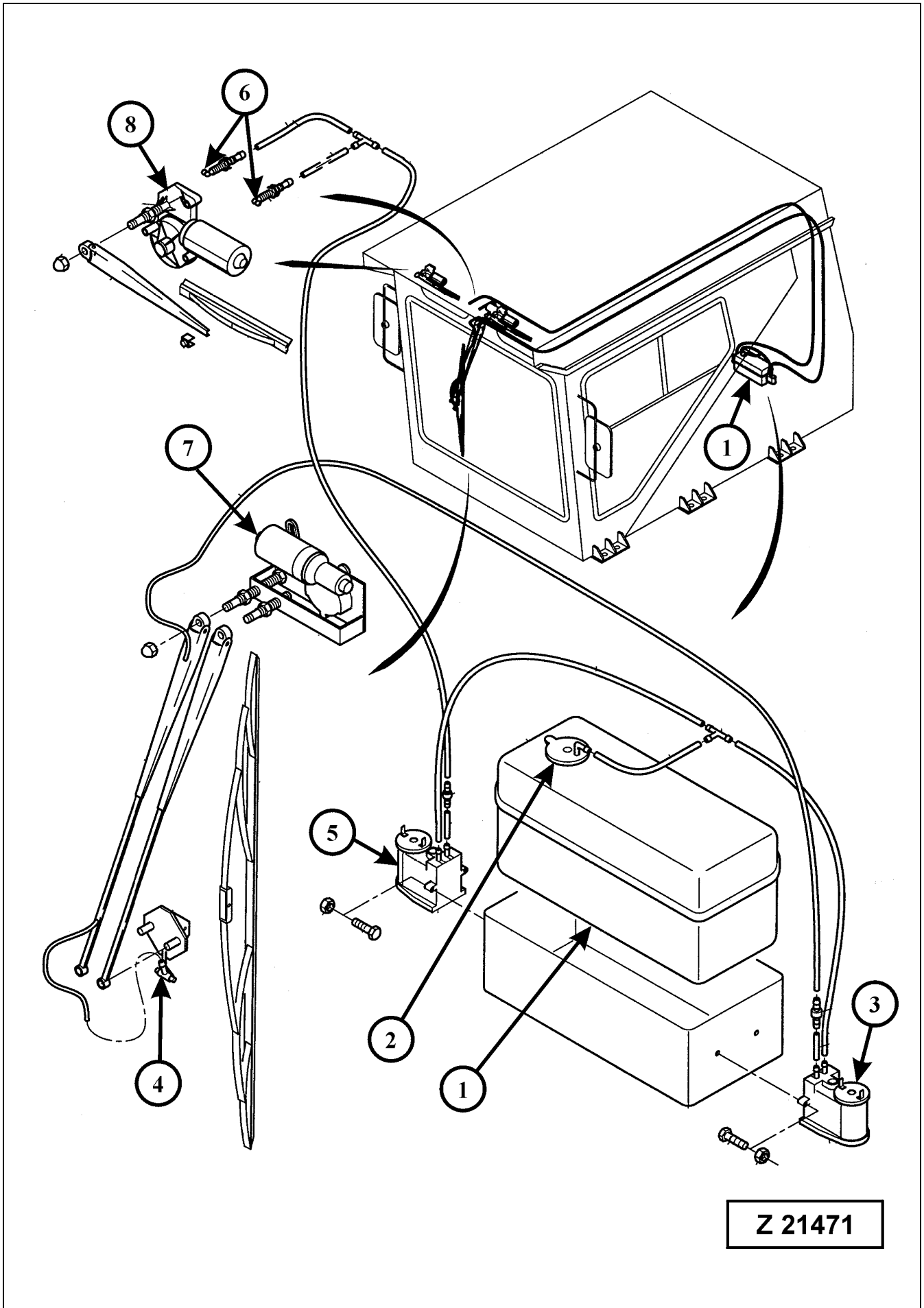
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**Servicing of the air conditioning systems is restricted to workshops especially equipped for this purpose. Refer to the separate booklet "AIR CONDITIONING" in Service Literature Binder – Volume 2 for more information.**

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## 4.10.7 WINDSHIELD WASHER SYSTEM - CHECK FLUID LEVEL

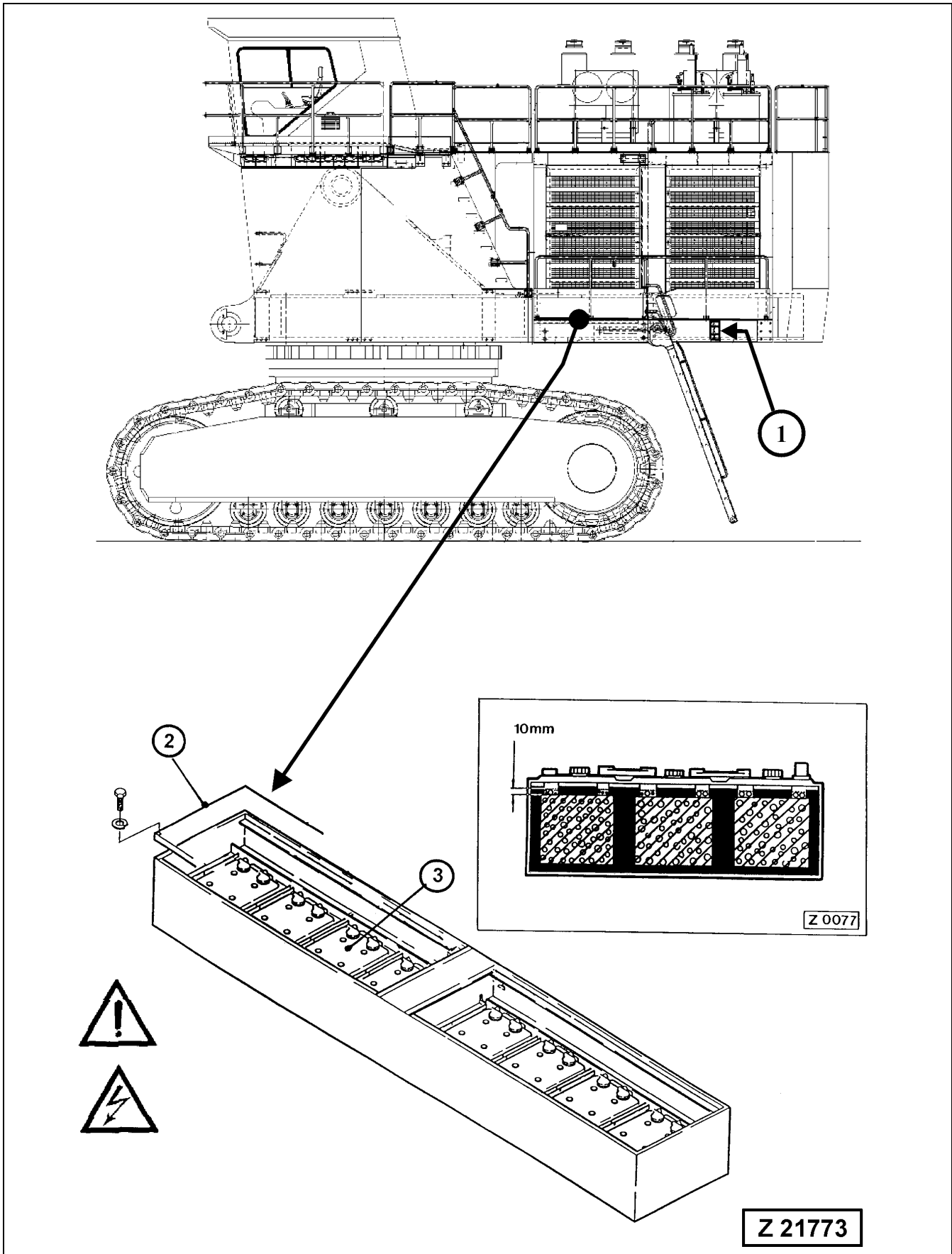
### Legend for illustration Z 21471

- (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) Not used
- (6) Not used
- (7) Wiper motor for windshield wiper
- (8) Not used

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

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**⚠ WARNING**

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- 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.

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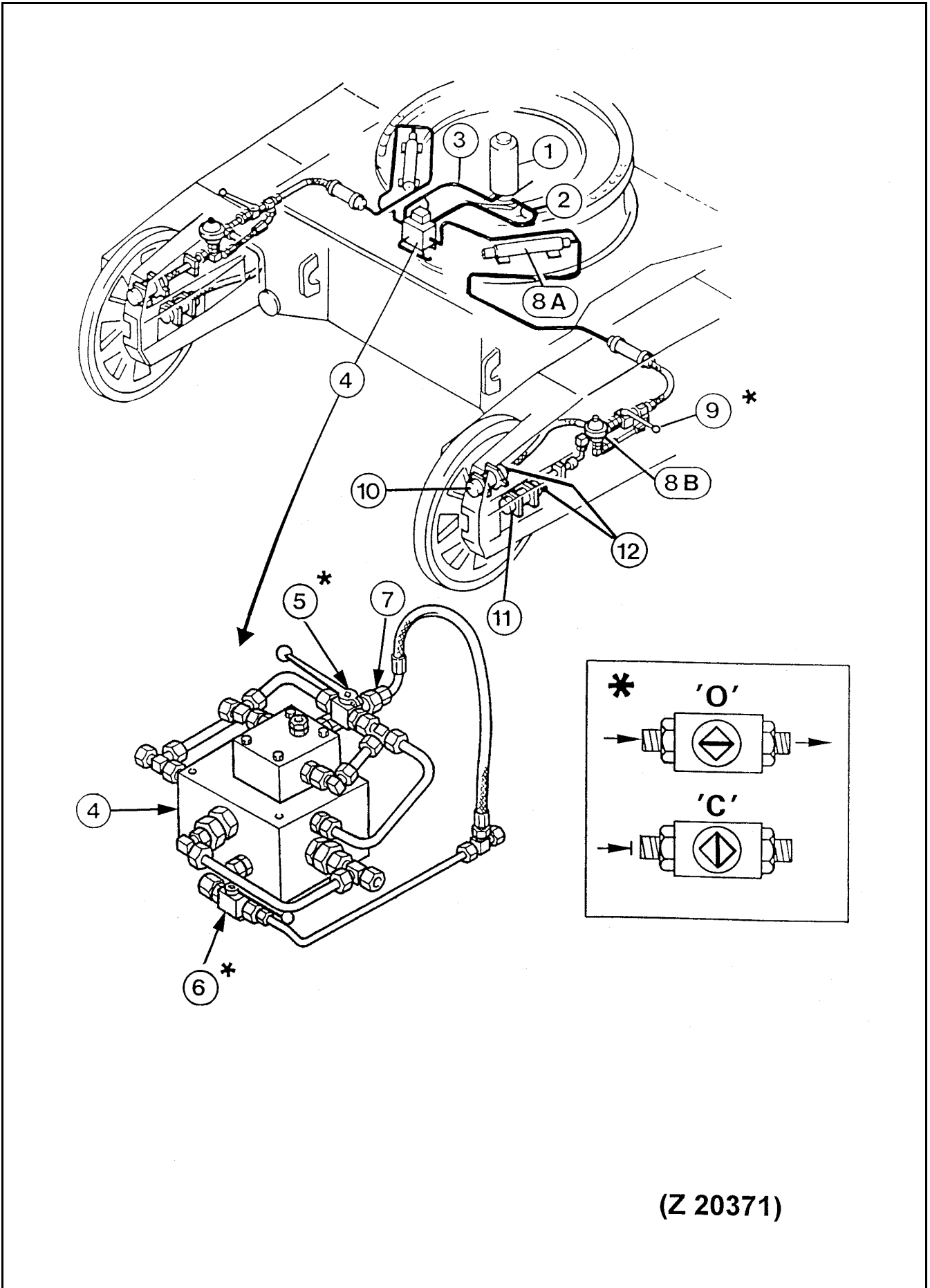
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**⚠ WARNING**

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- 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.
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## 4.11.2 CRAWLER TRACK - INSPECTION

### CHECK ADJUSTING RANGE OF GUIDE WHEELS

(Track retensioning range)

#### GENERAL

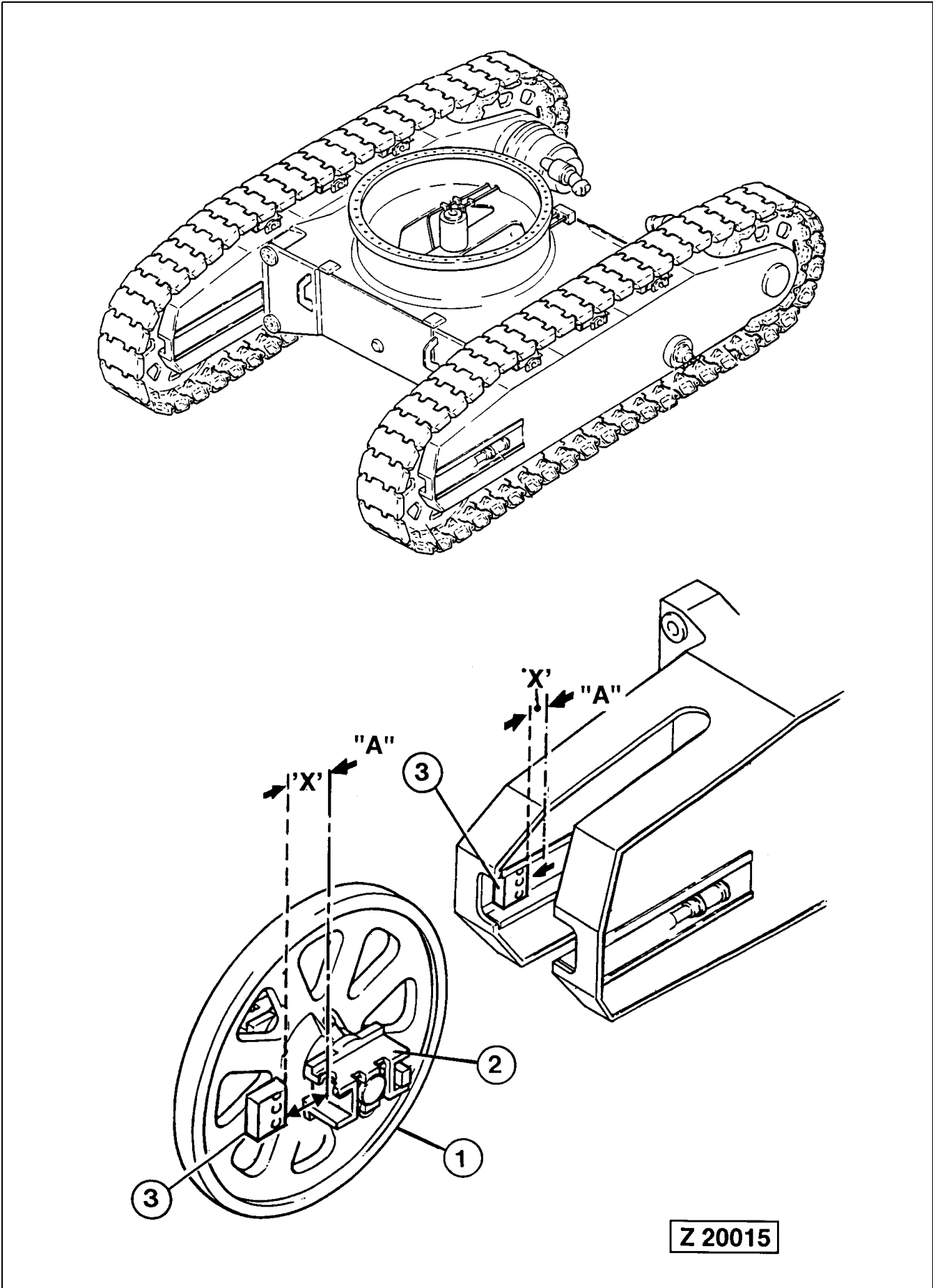
The hydraulic track tensioning system, illust. Z 20371 maintains automatically the correct track tension. The pilot pressure oil of the travel brake release circuit is used, to pressurize the four adjusting cylinders (10) and (11). The resulting force moves the guide wheels toward the front, until the 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  
"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.

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**⚠ WARNING**

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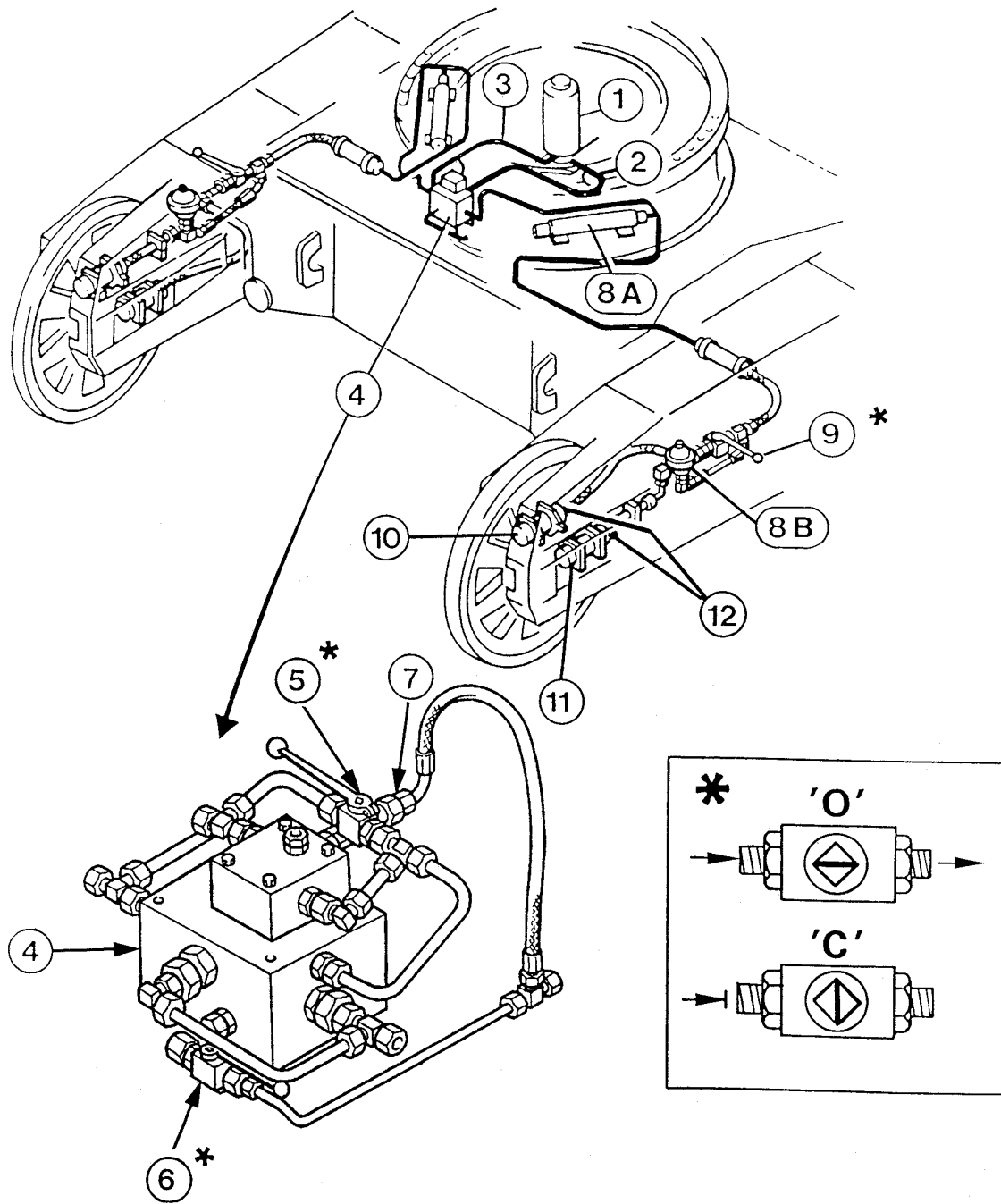
**Before working on the track adjusting system, relieve all pressure in the system by opening the pressure relief cock (5), see illust. Z 20371 on previous page.**

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### 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.

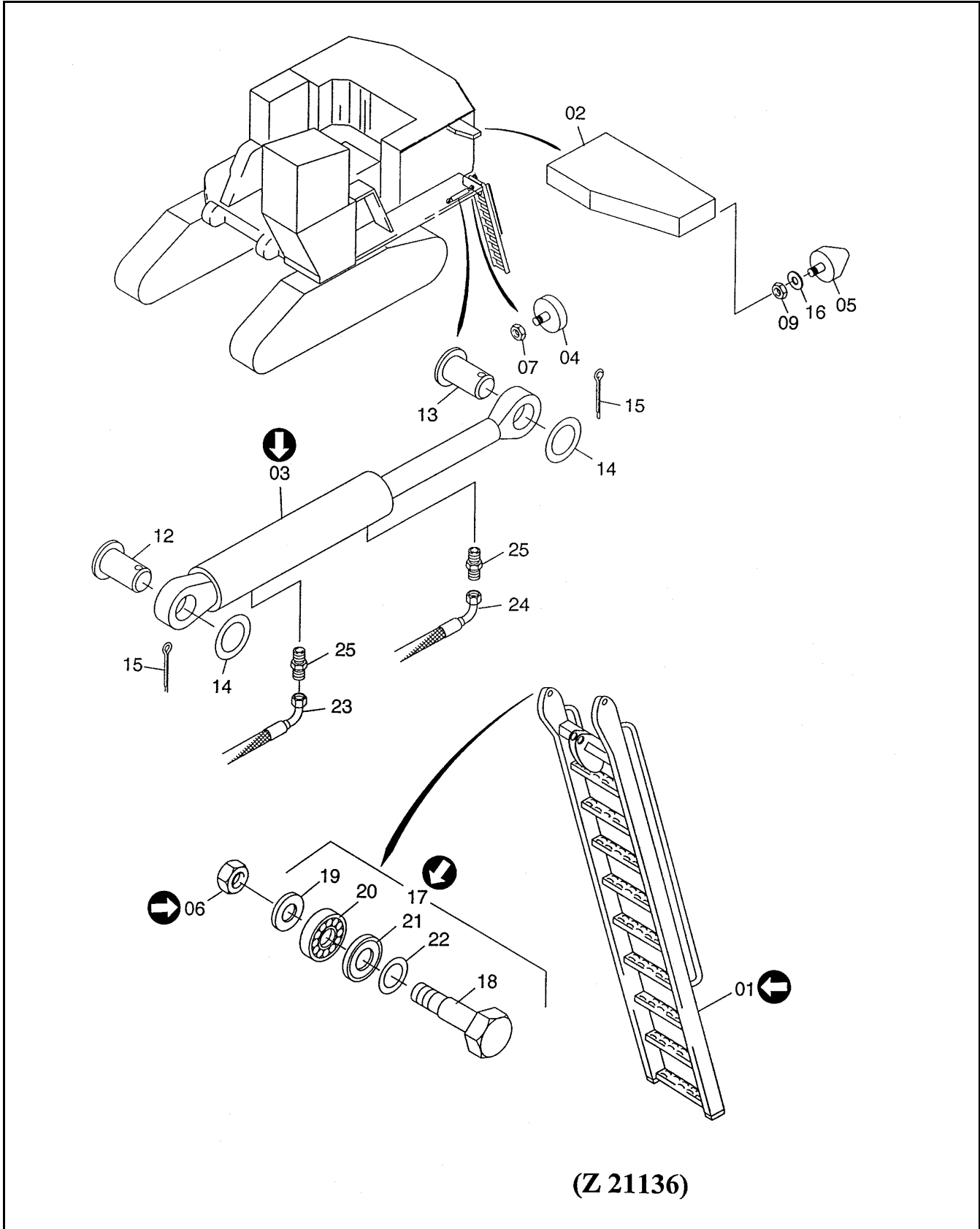
### Bleeding the System

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.

# 4.12 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):

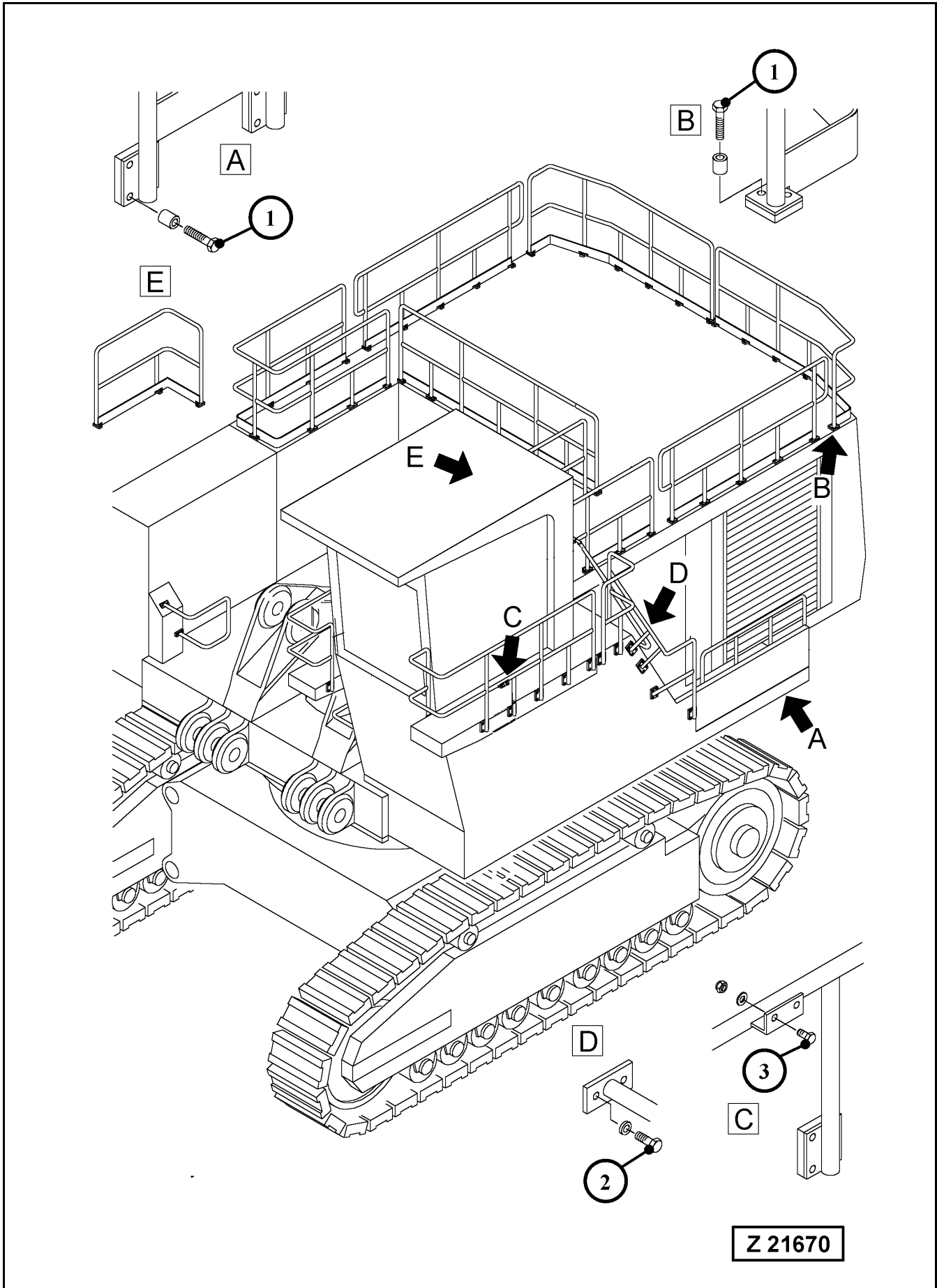
- New nut: 1000 Nm
- Used nut: 800 Nm

### 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

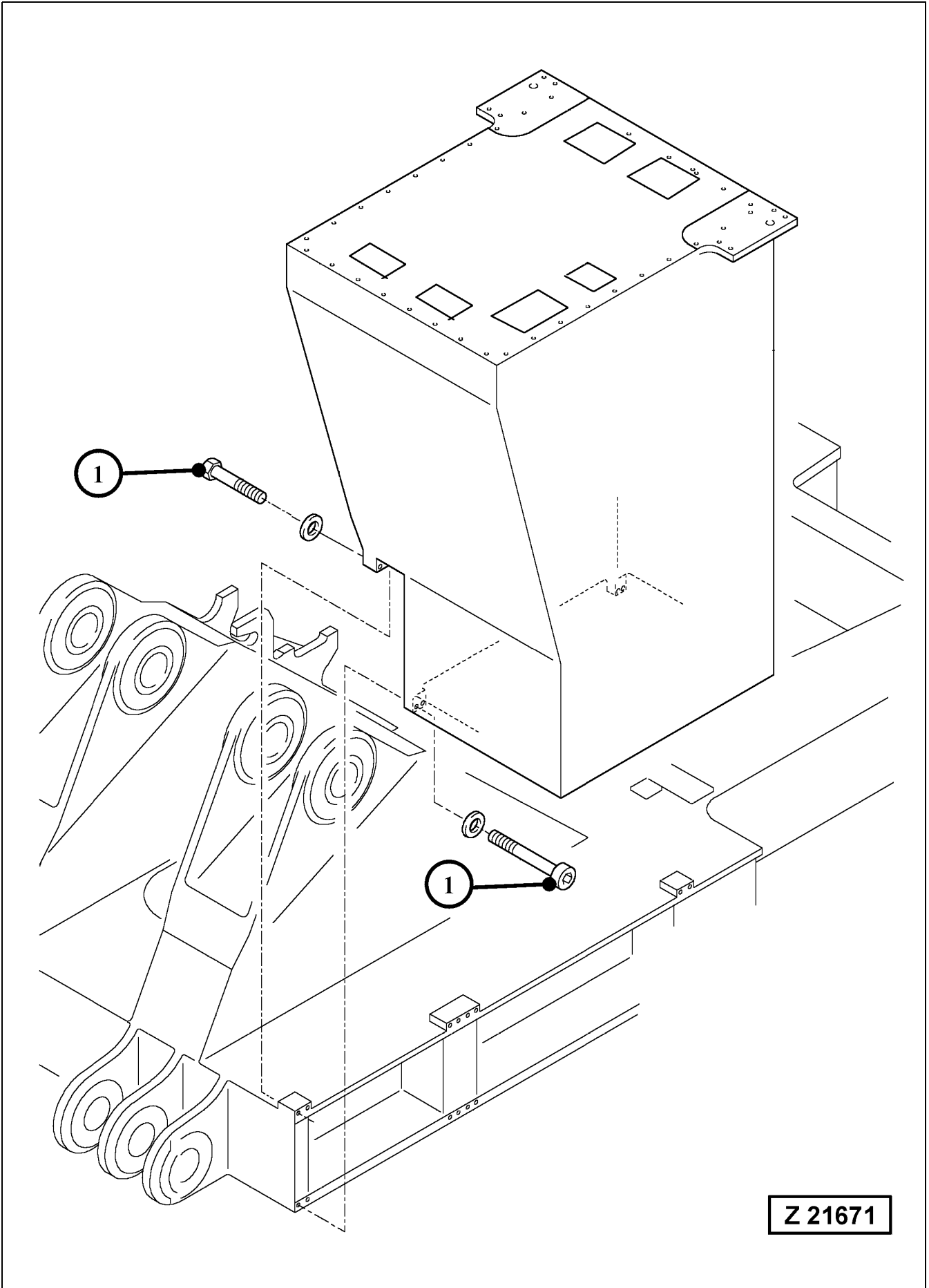
Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm
(1)	M12	8.8	19	74
(2)	M12	8.8	19	74
(3)	M10	8.8	17	43

\* SW = Wrench size

### 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.



Z 21671

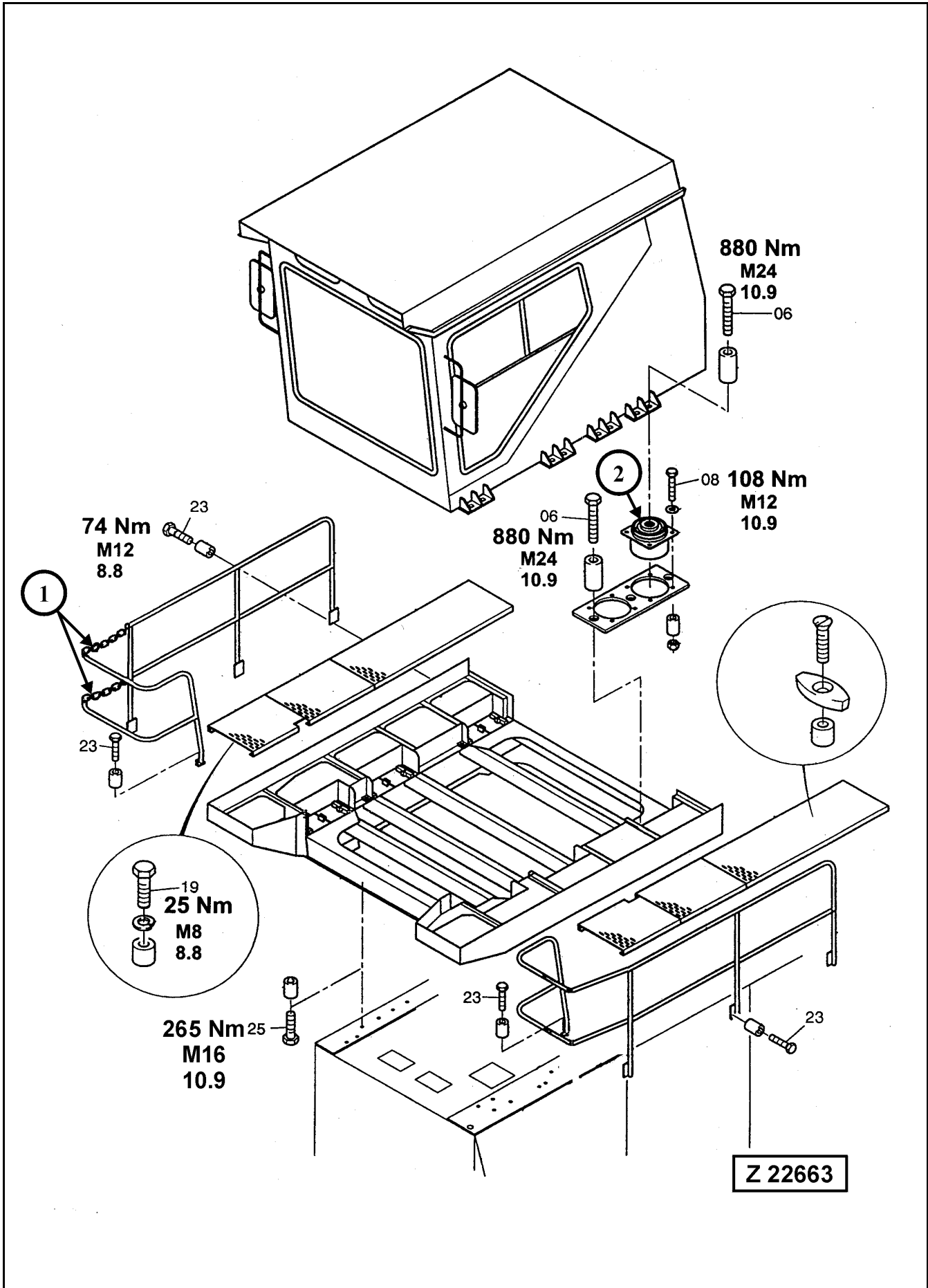
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**High-Strength Bolt Connections (continued)****Check fastening and condition of cab base, illust. Z 21671**

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(1)	M36	10.9	55	3100	8

\* SW = Wrench size\*

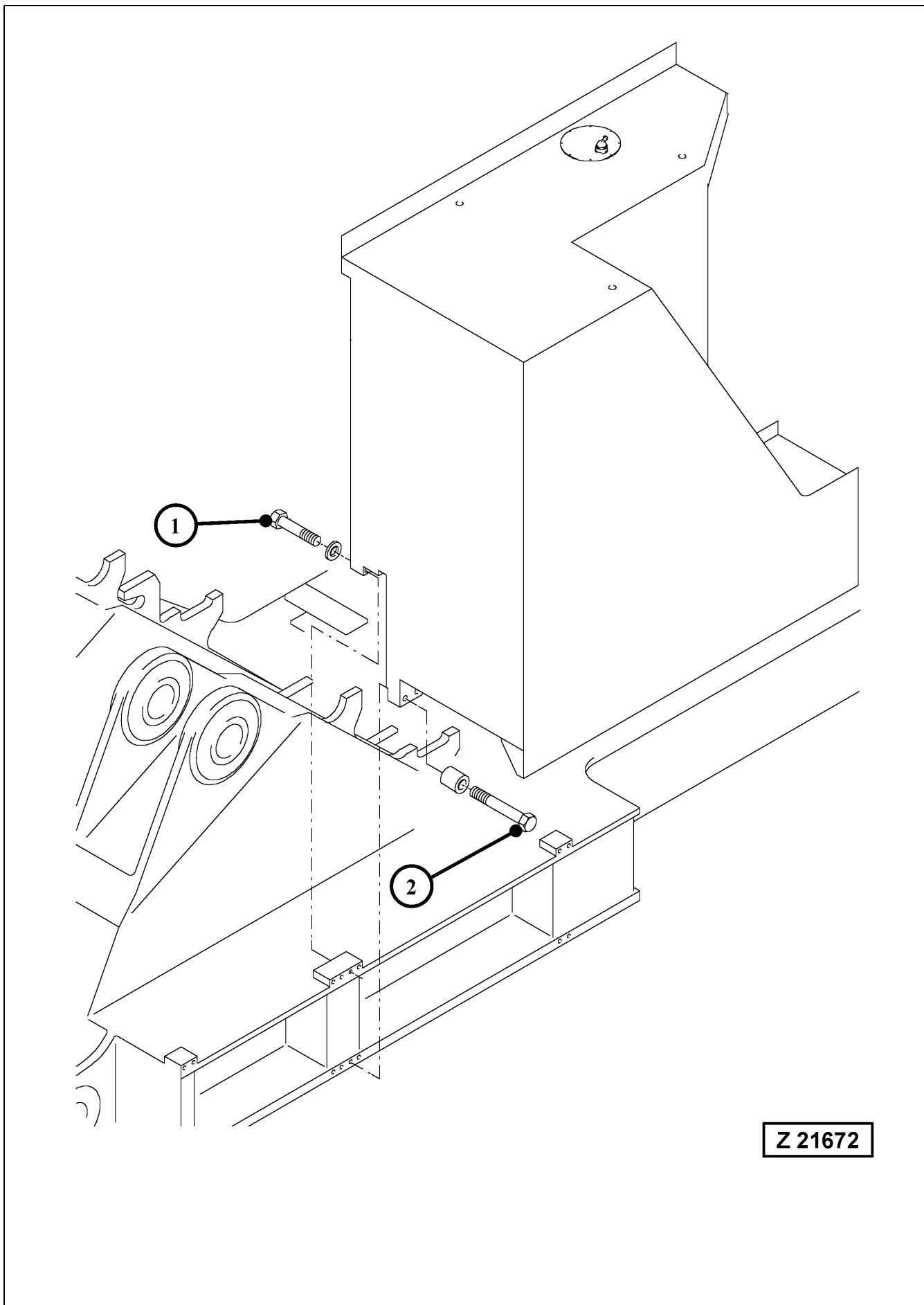
- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.



## 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.





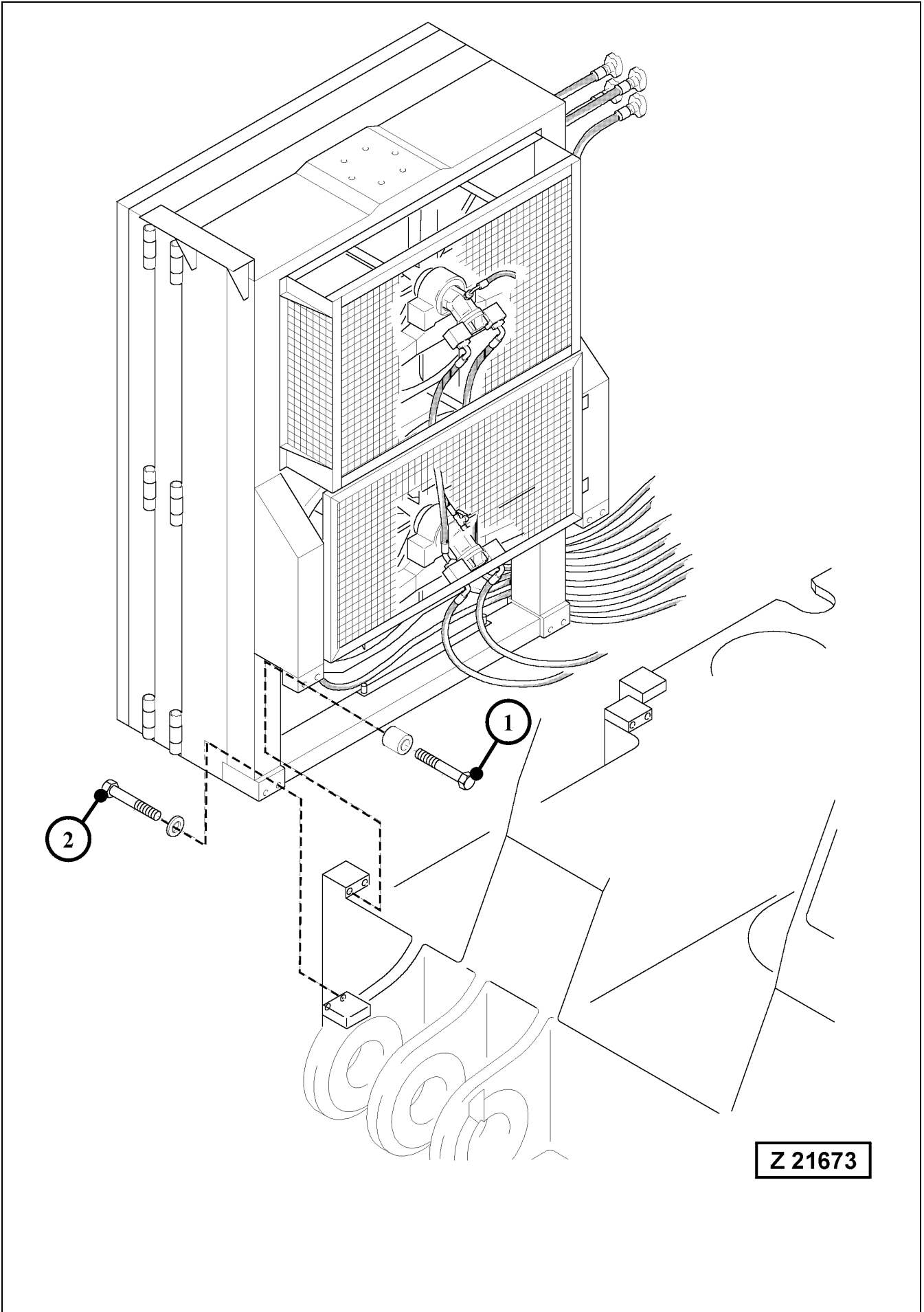
**High-Strength Bolt Connections (continued)**

Check fastening and condition of high voltage switch cabinet, illust. Z 21672

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\* SW = Wrench size

- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.



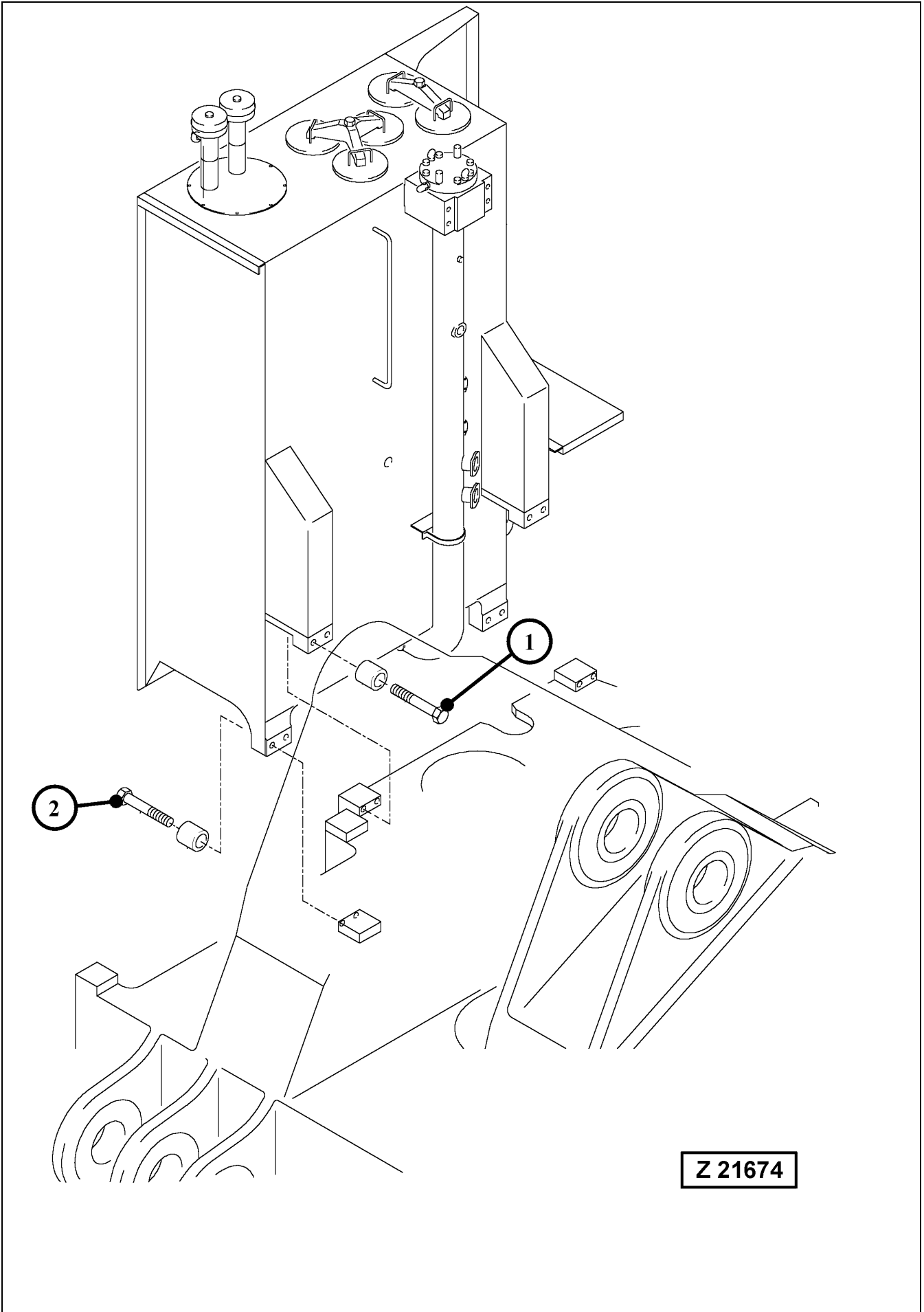
**High-Strength Bolt Connections (continued)**

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

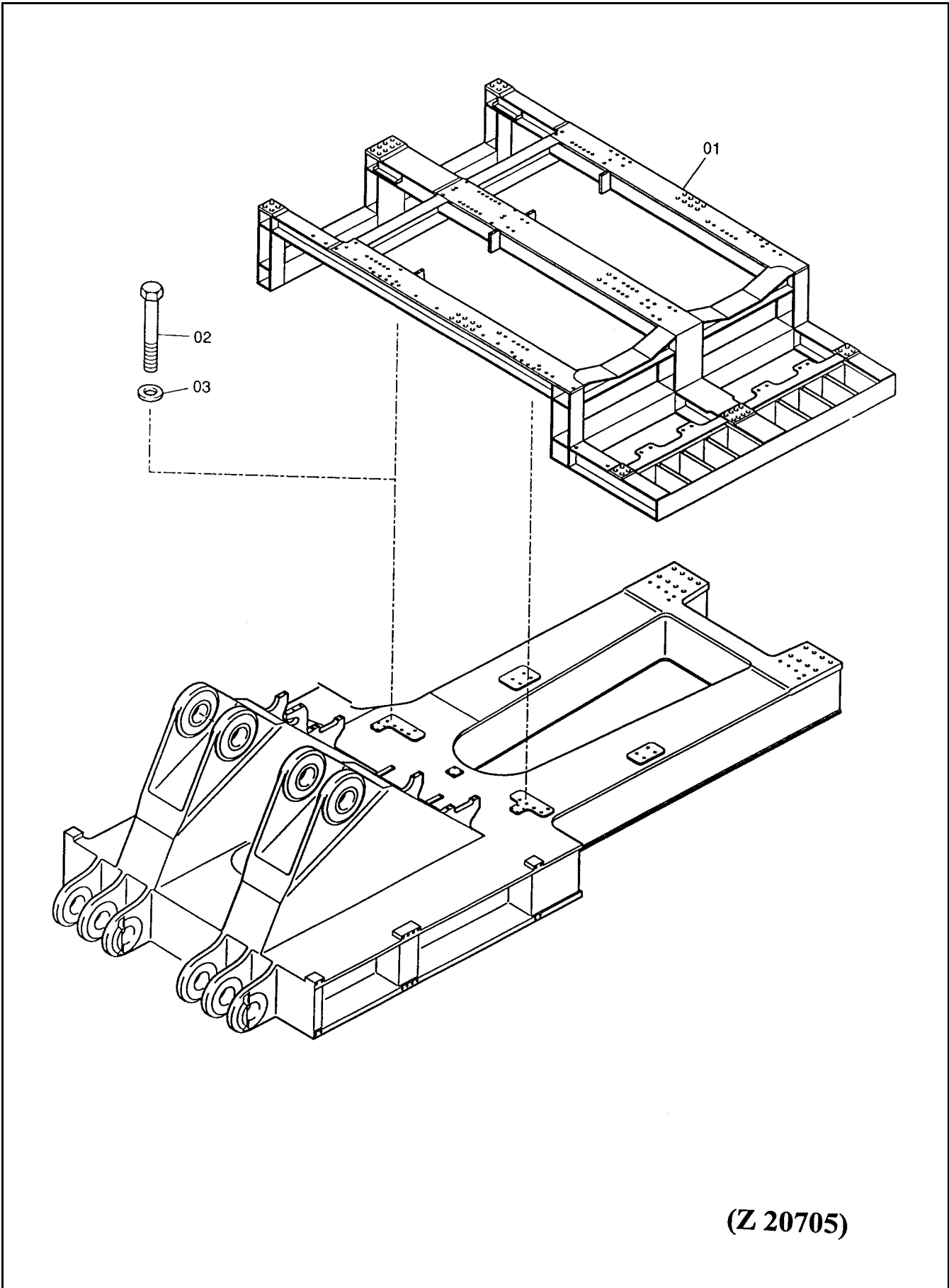
**High-Strength Bolt Connections (continued)**

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.



**(Z 20705)**

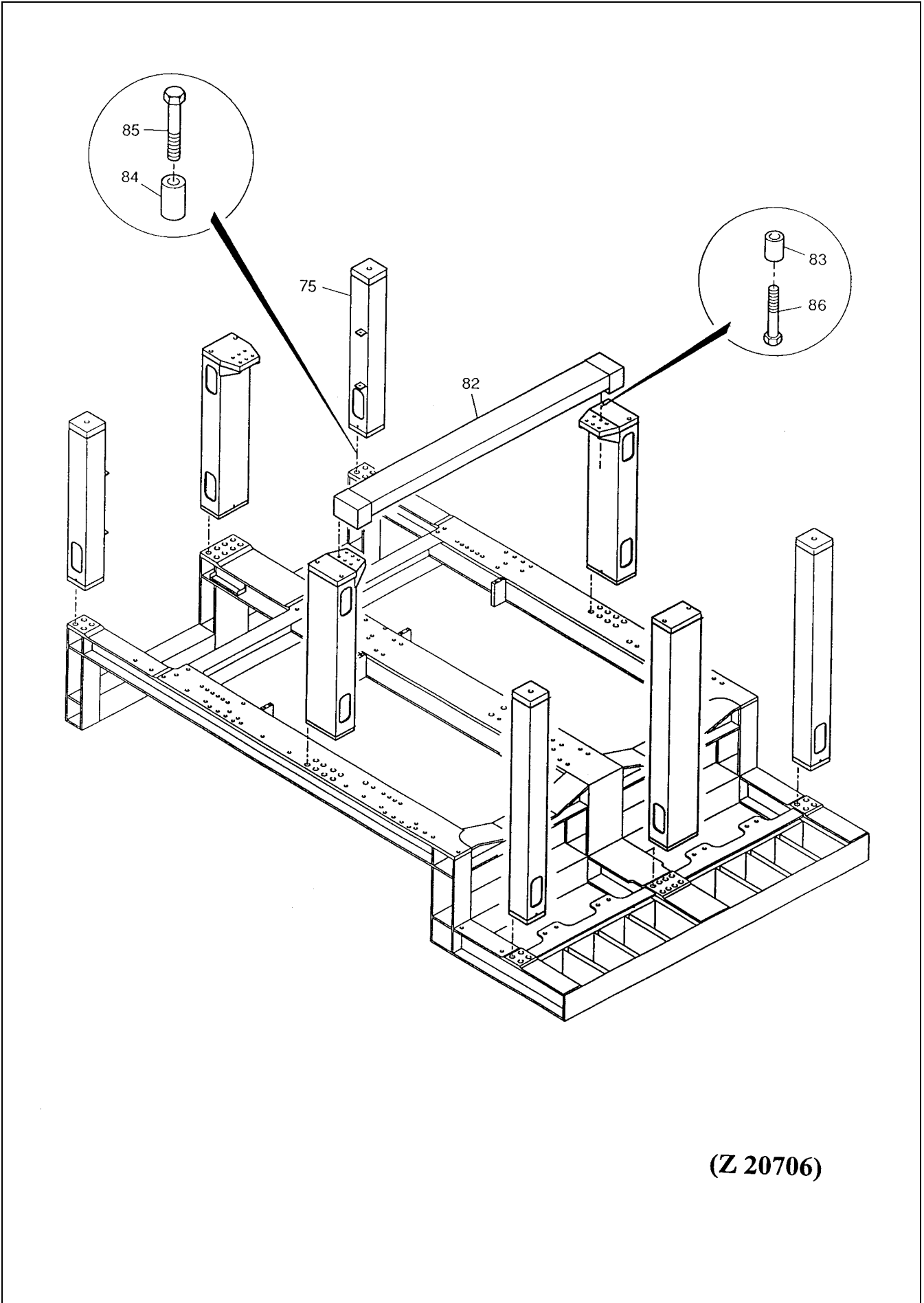
## High-Strength Bolt Connections (continued)

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)



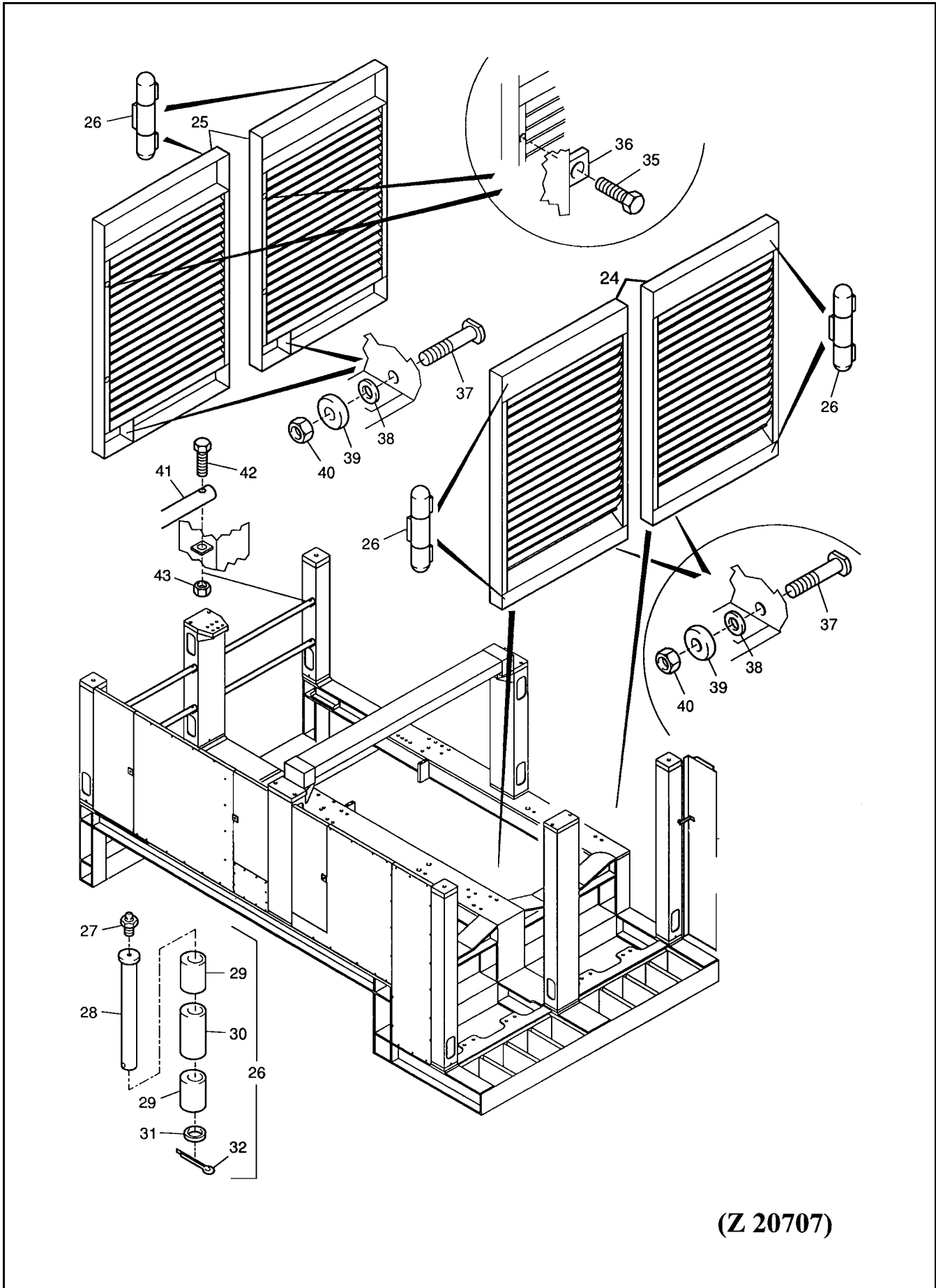
## High-Strength Bolt Connections (continued)

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.

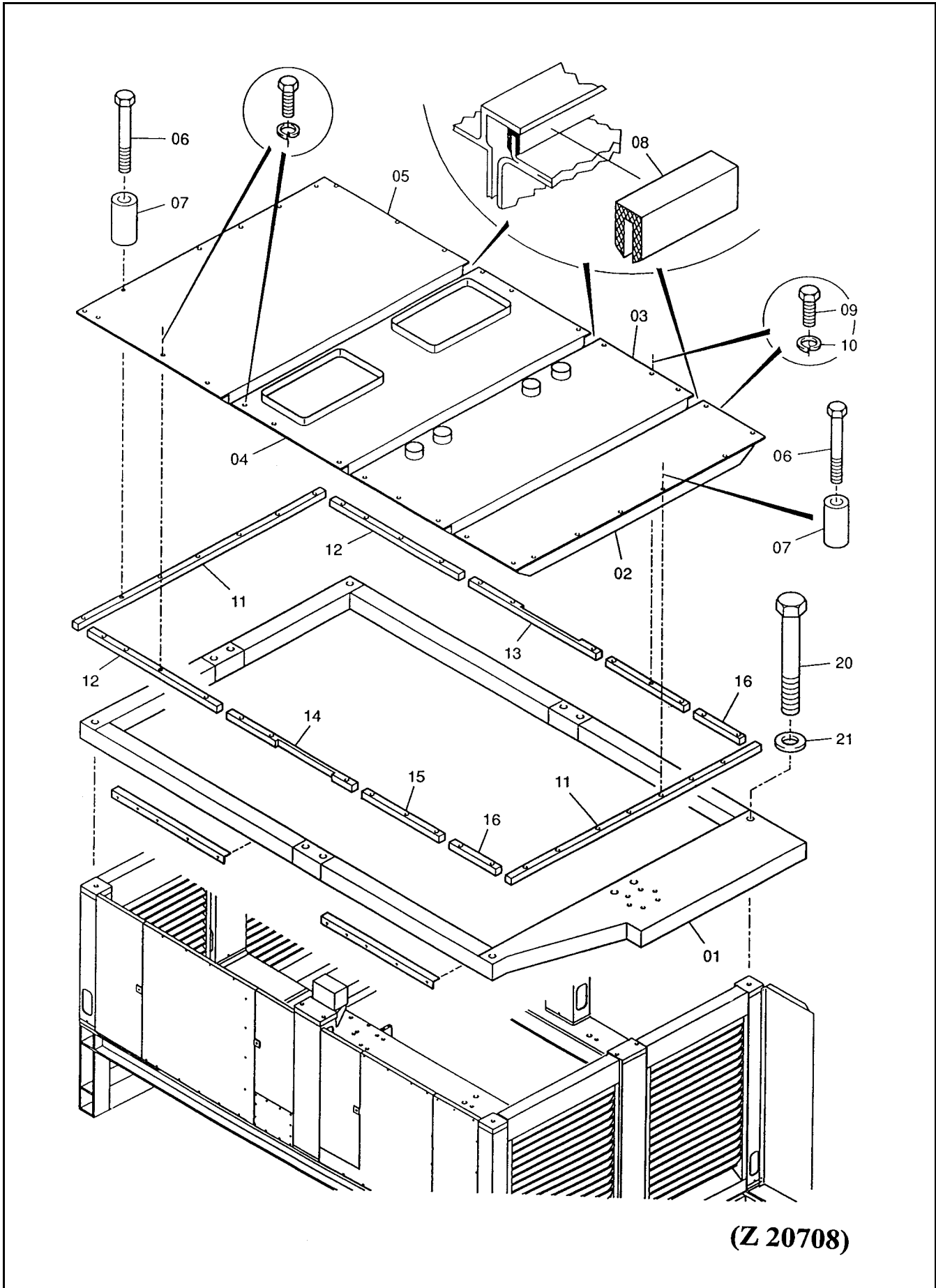


(Z 20707)

## 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).



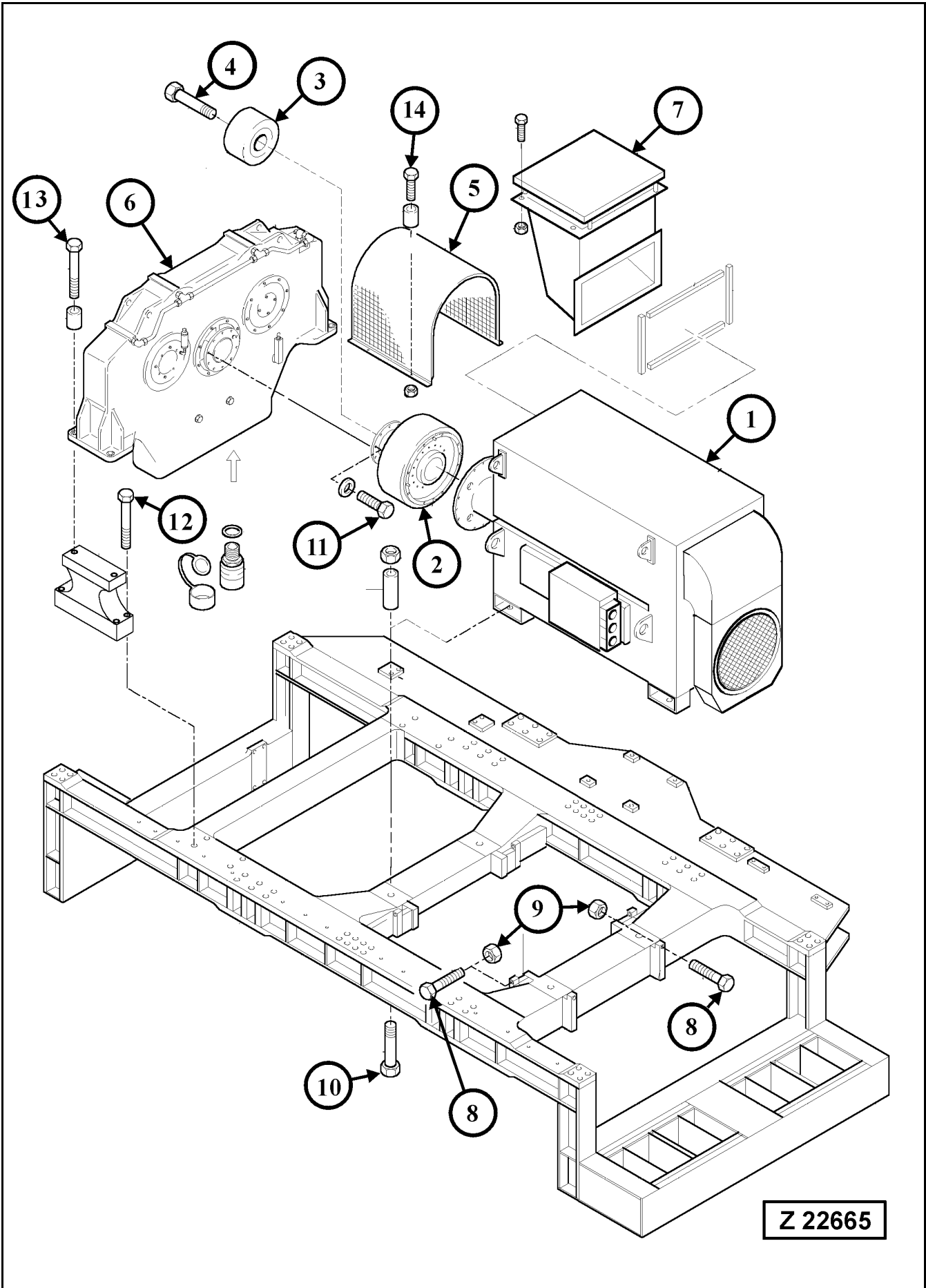
**Power house Roof, illust. Z 20708**

- 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 main drive motors and pump distributor gears, illust. Z 22665**

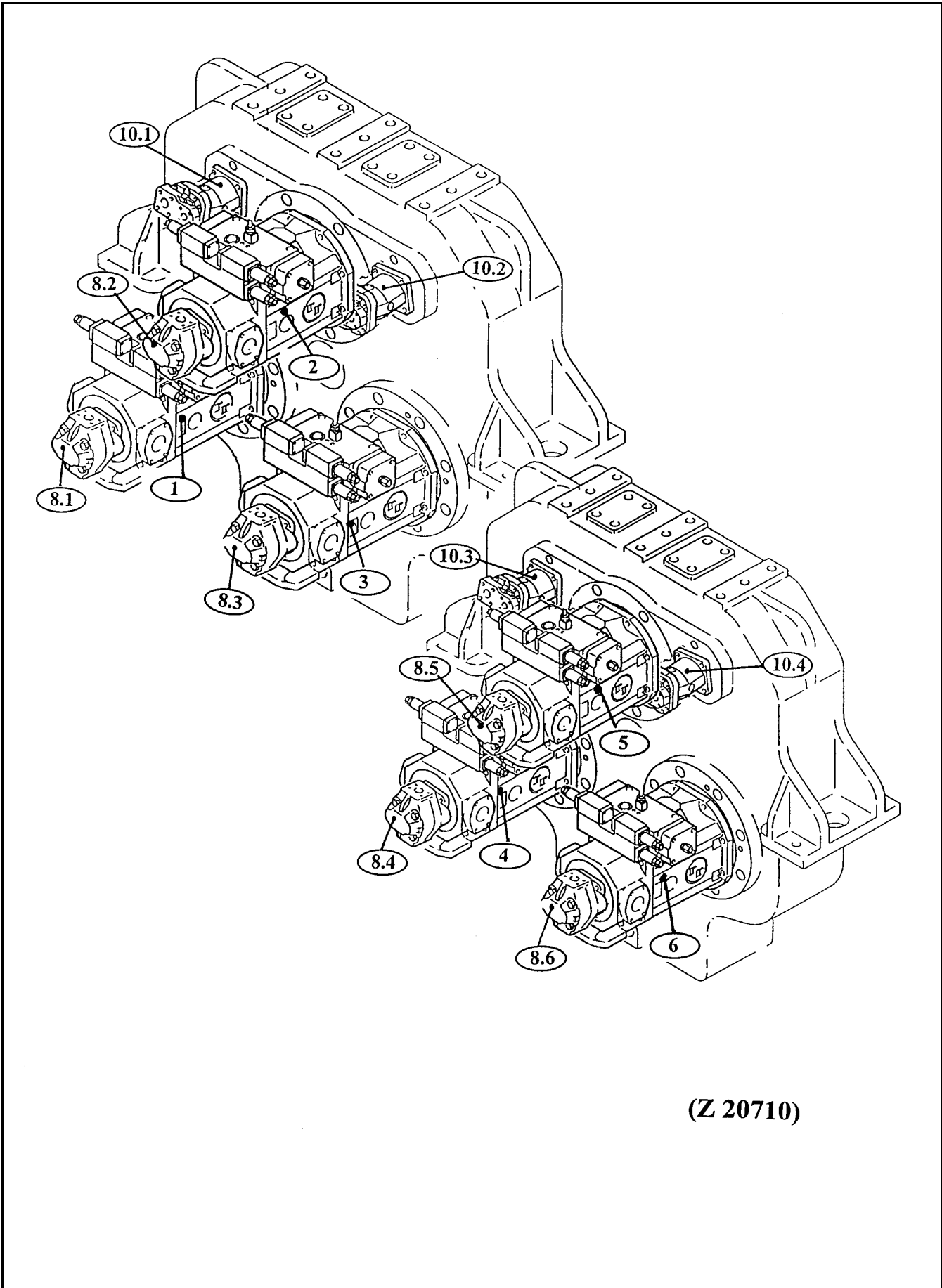
**Legend for illustration Z 22665**

- (1) Main drive motor
- (2) Flexible coupling
- (3) Thrust ring for fastening coupling hub onto motor shaft
- (4) Thrust ring mounting bolt secured with Loctite
- (5) Coupling guard
- (6) Pump distributor gear
- (7) Cooling air outlet duct

**Check the following mounting bolts for correct tightening torque**

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty. both power units
(8) Adjusting bolts	M20	10.9	30	510	12
(9) Lock nuts	M20				12
(10)	M36	10.9	55	3100	8
(11)	M18	10.9	27	360	20
(12)	M30	10.9	46	1770	16
(13)	M30	10.9	46	1770	8
(14)	M12	8.8	19	74	8

- \* SW = Wrench size
- Re-tighten mounting bolts to their correct torque and replace missing or damaged bolts.



(Z 20710)

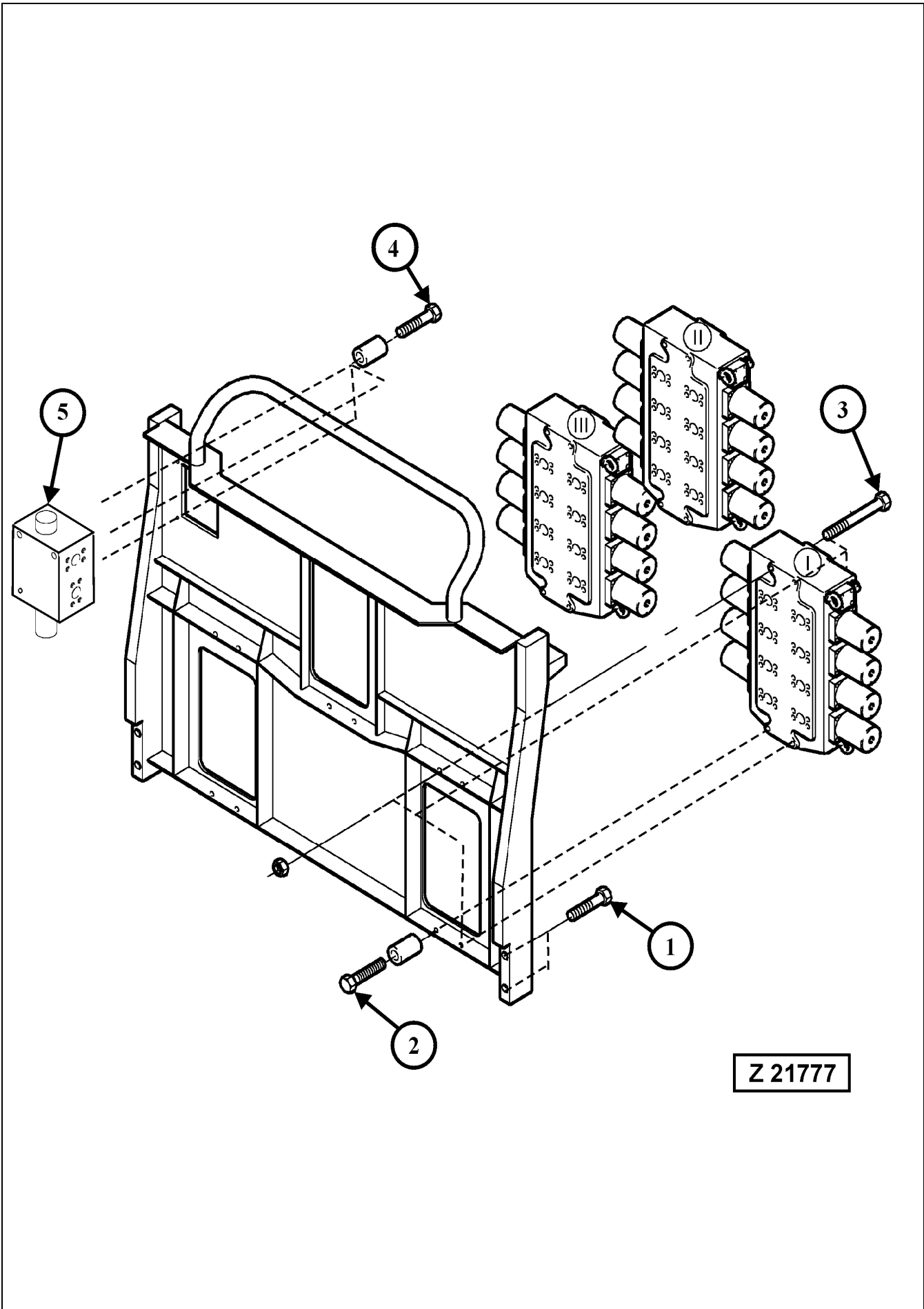


**High-Strength Bolt Connections (continued)**

- 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.



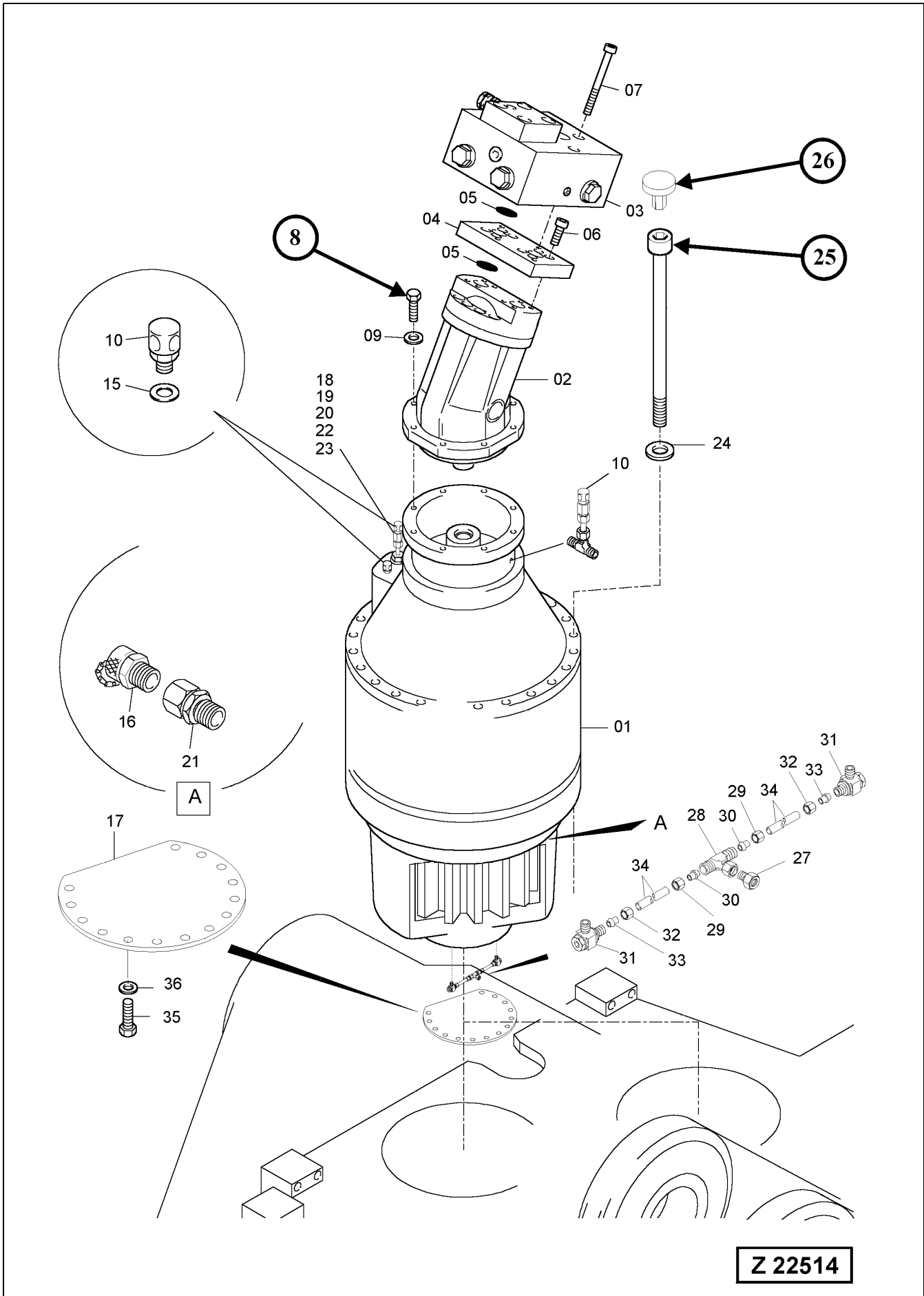
## High-Strength Bolt Connections (continued)

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

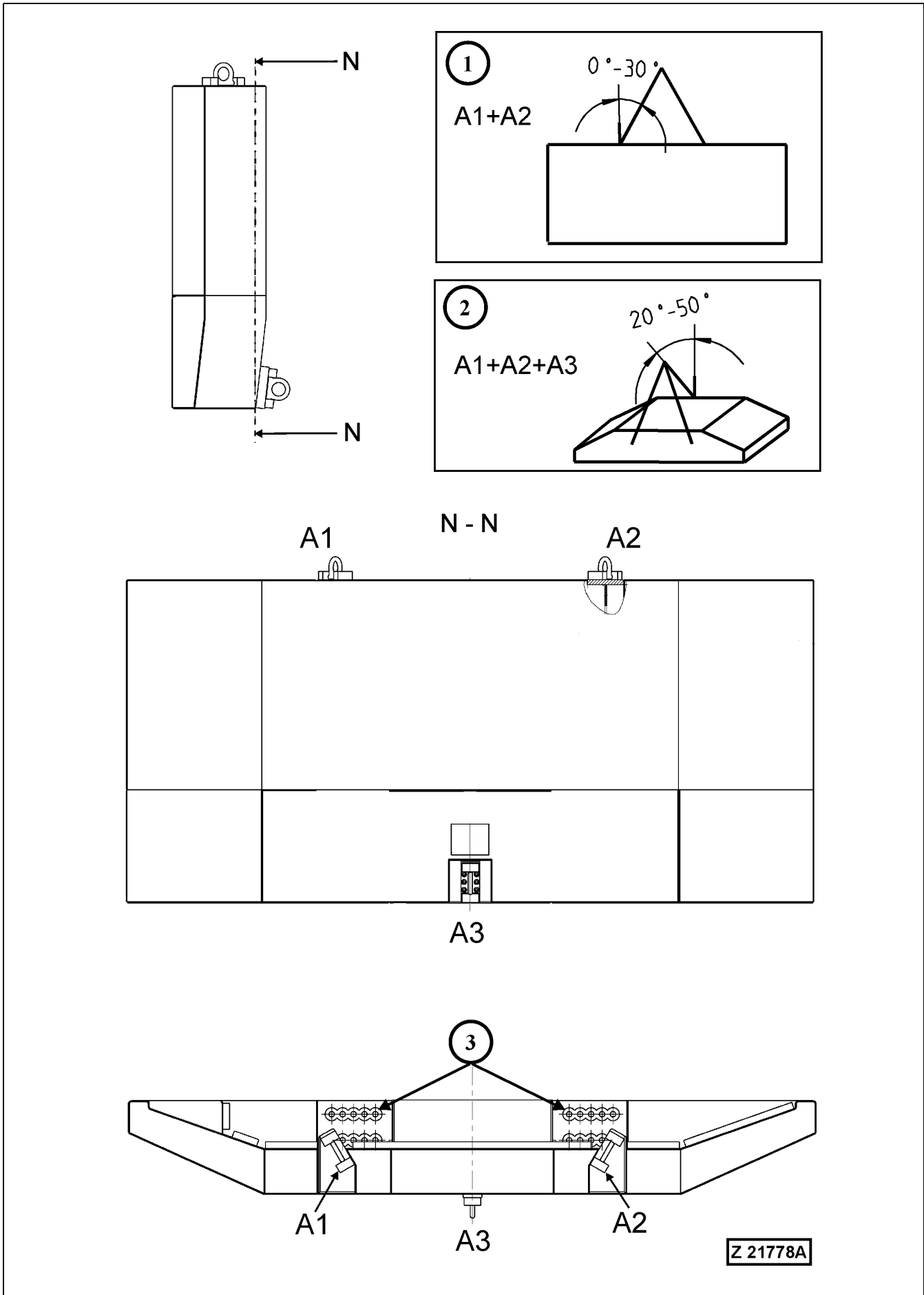
Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(8)	M 16	10.9	24	265	16
(25)	M 24	12.9	19	1030	34

\* 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.

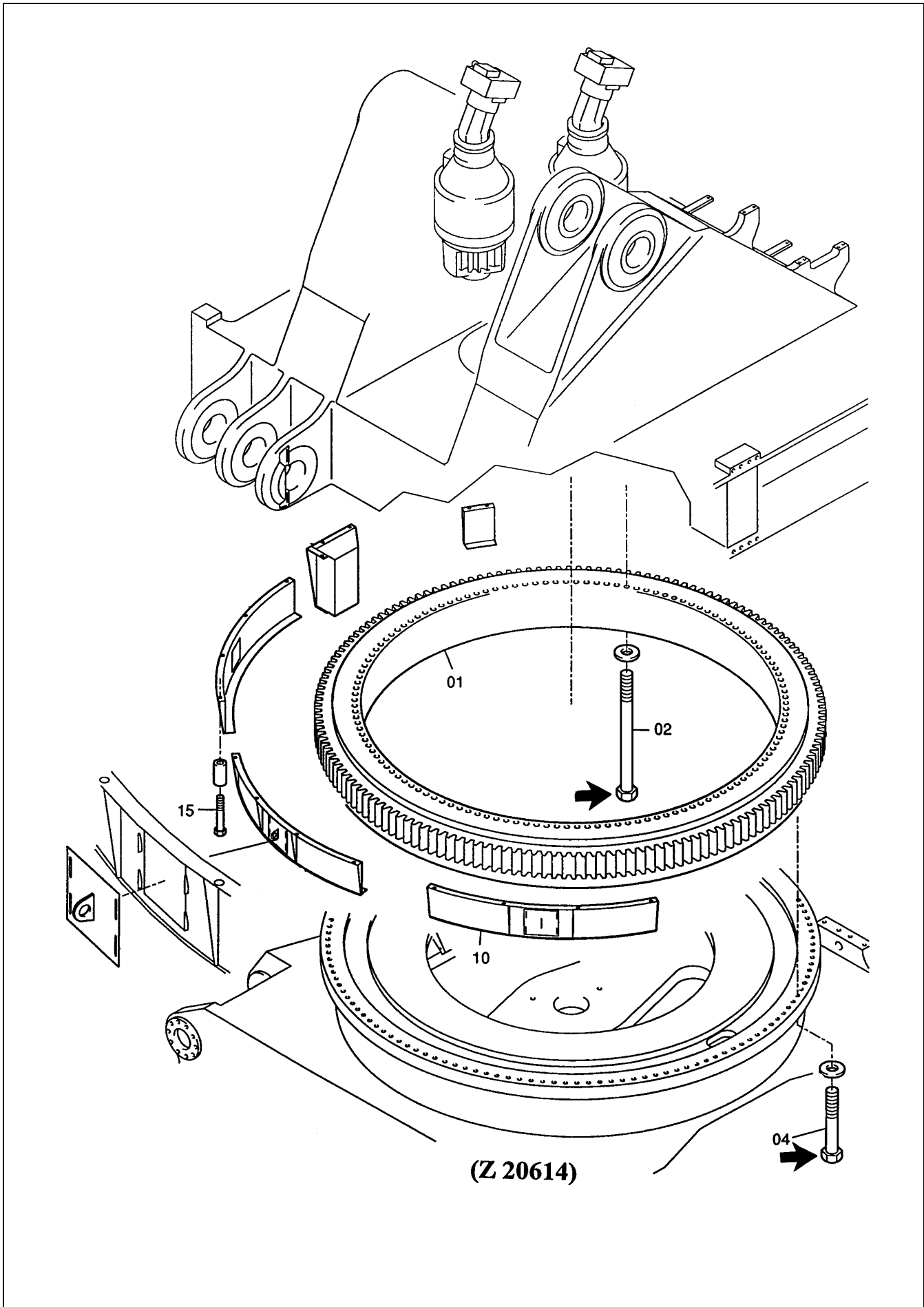
#### Guideline for transportation and lifting of the counterweight illustration Z 21778A

- (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)

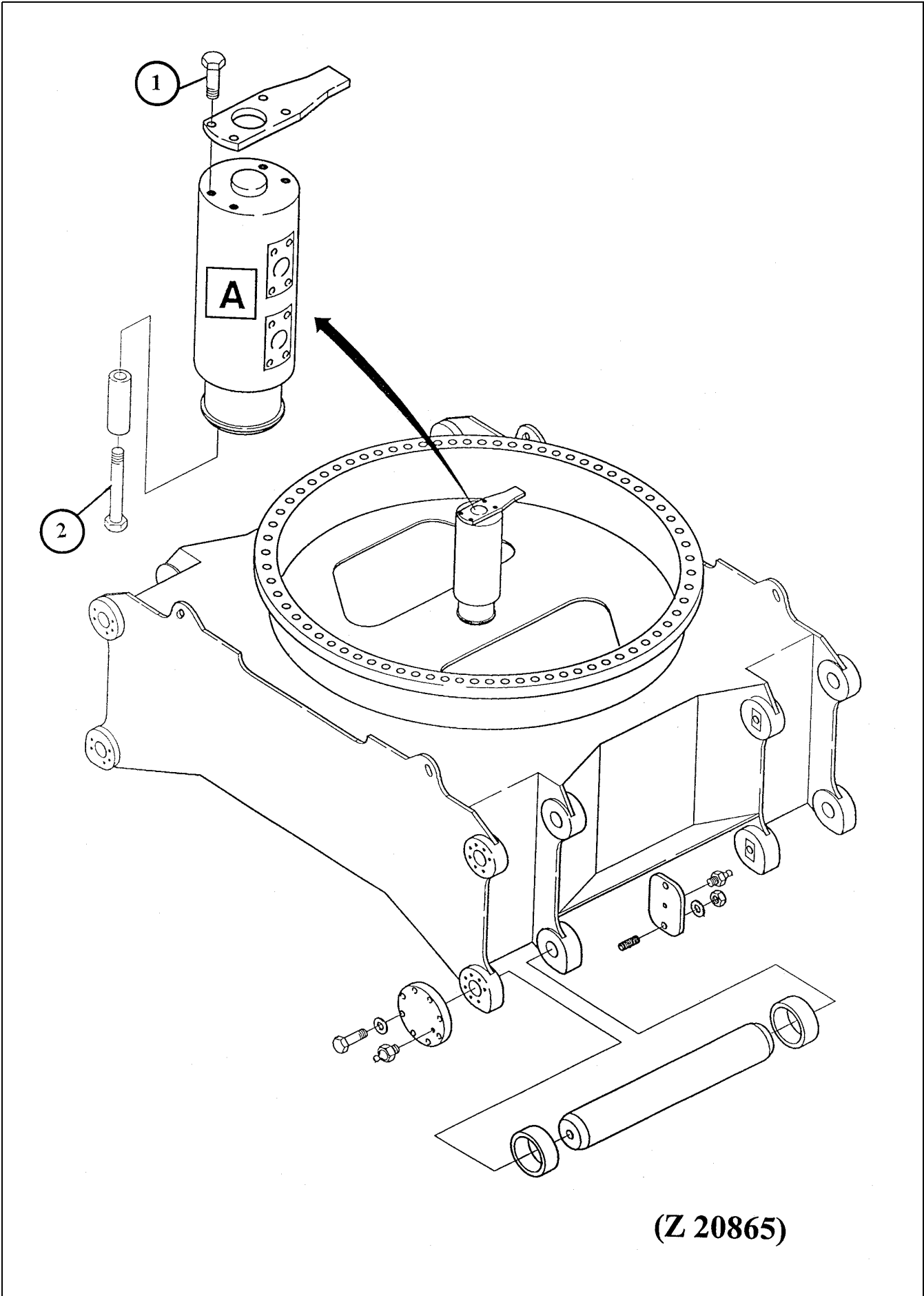
### Swing circle, illust. Z 20614

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)**

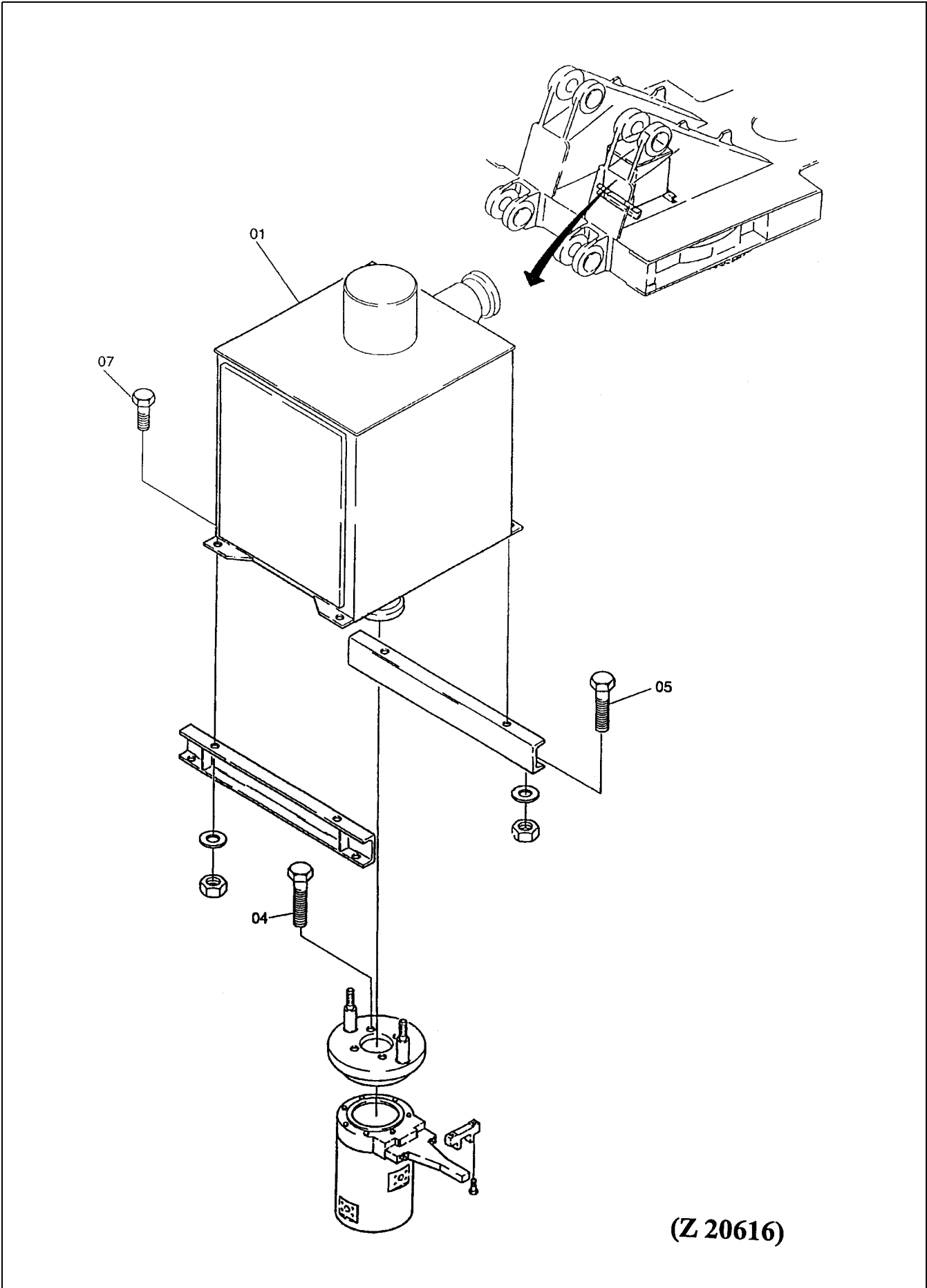
## High-Strength Bolt Connections (continued)

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.



(Z 20616)

## High-Strength Bolt Connections (continued)

### Excavators with Electric Prime Mover

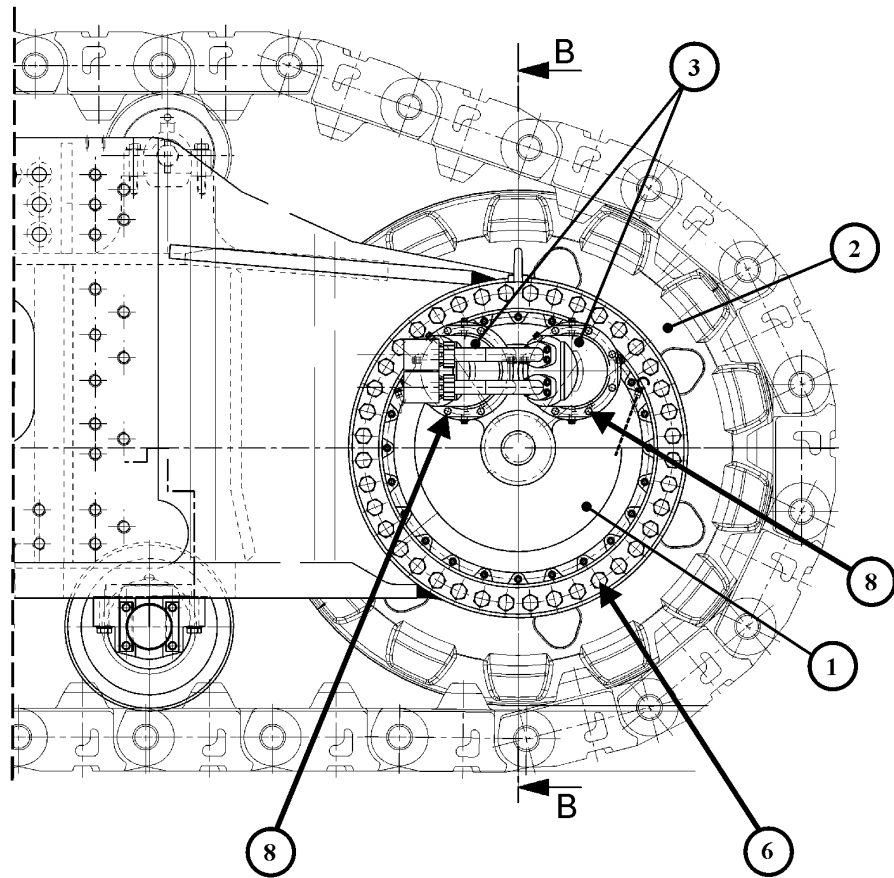
Check condition and fastening of slip ring unit (01),  
illust. Z 20616

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

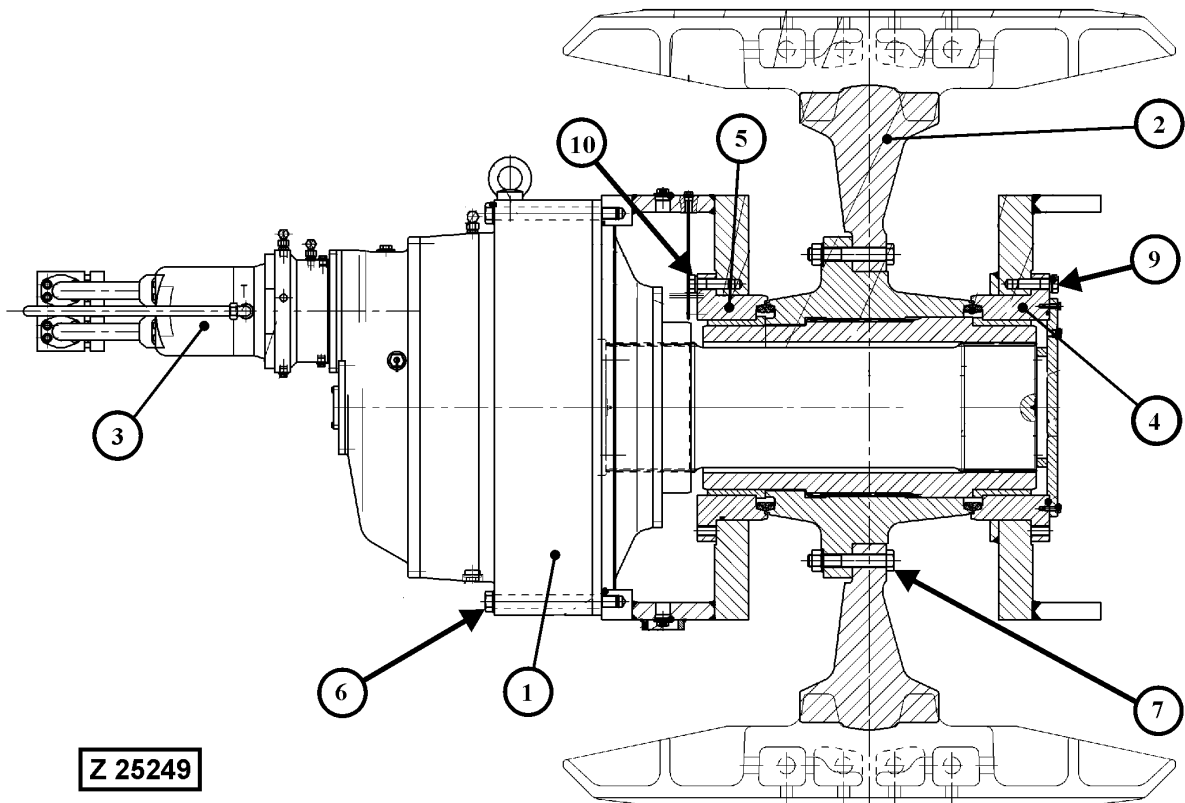
\* = Wrench size

- 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

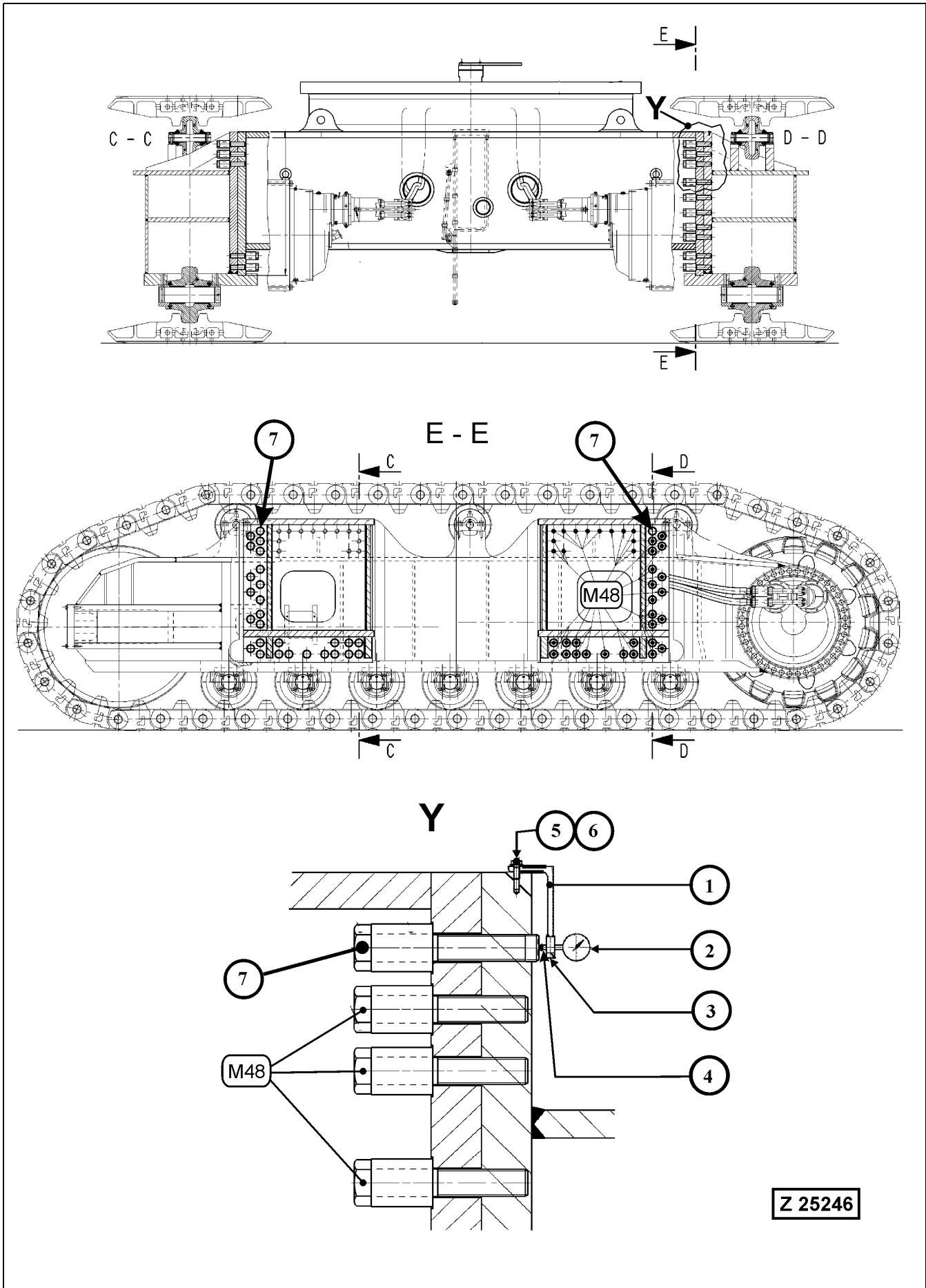
\*1) SW = Wrench size

\*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**

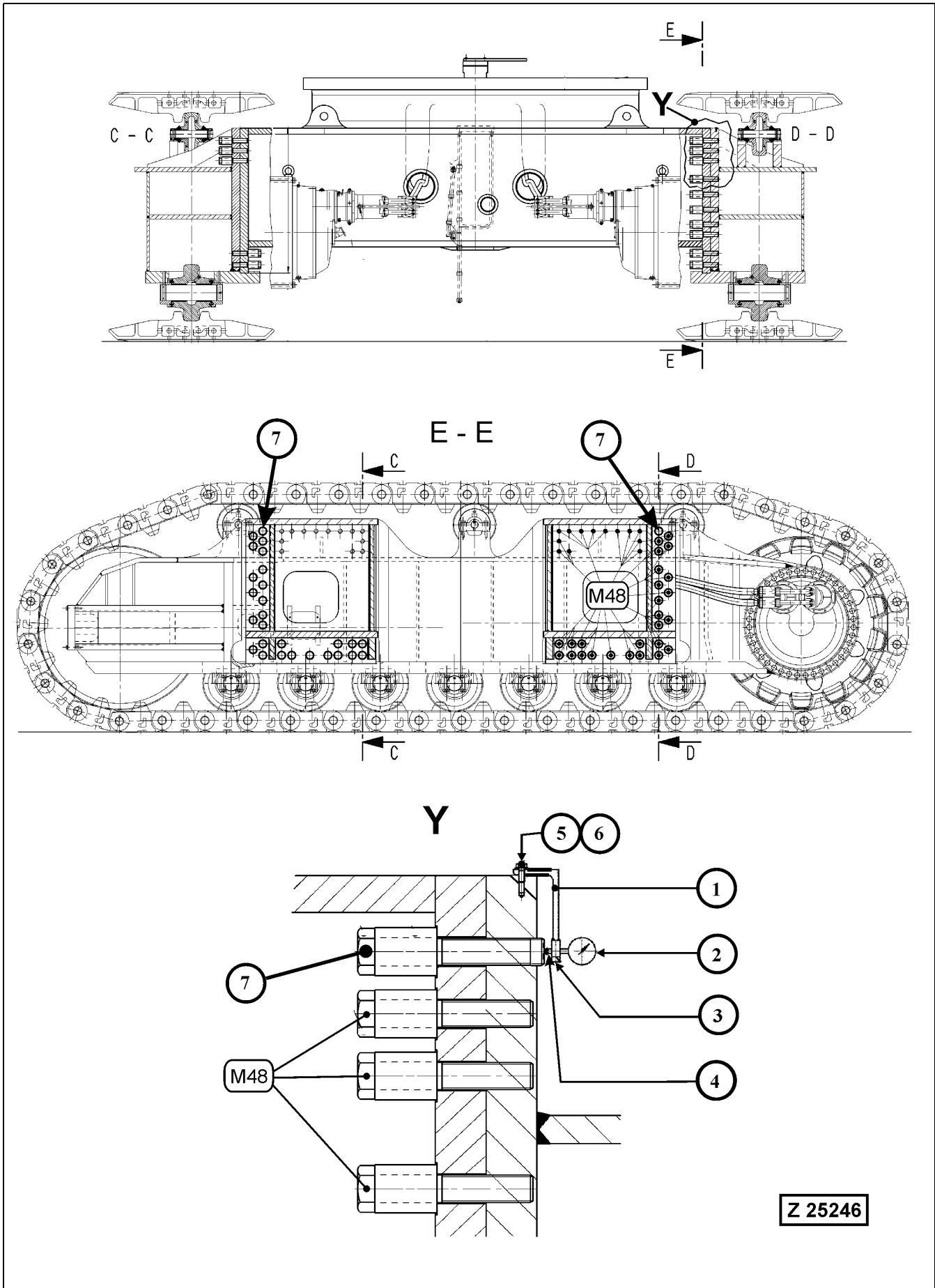
The required tightening torque for all mounting bolts (M48), illustration Z25246 has to be determined with the four measuring bolts (7), which dimension is analogous to the mounting bolts. The required axial tensioning force of the bolts (M48) is determined by means of the elongation of the bolts. For 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 417. 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.

---

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**▲ CAUTION**

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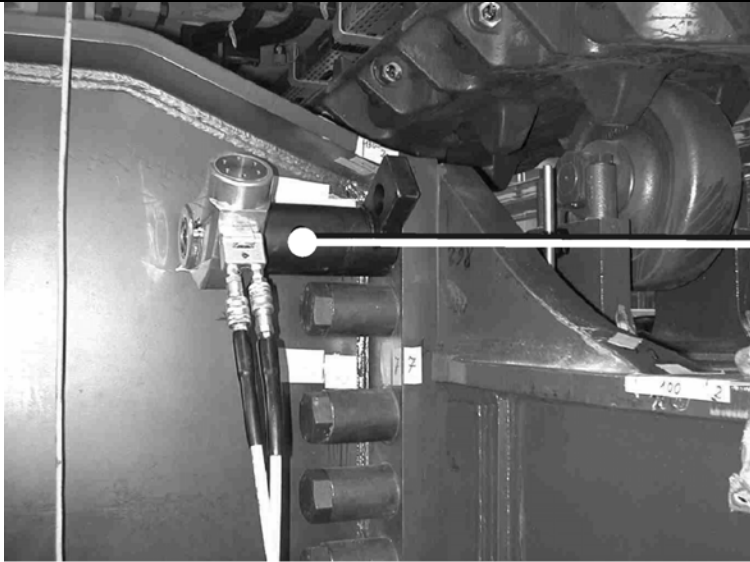
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**DO NOT loosen more than one bolt at the same time.  
DO NOT lubricate the bolts (M48).**

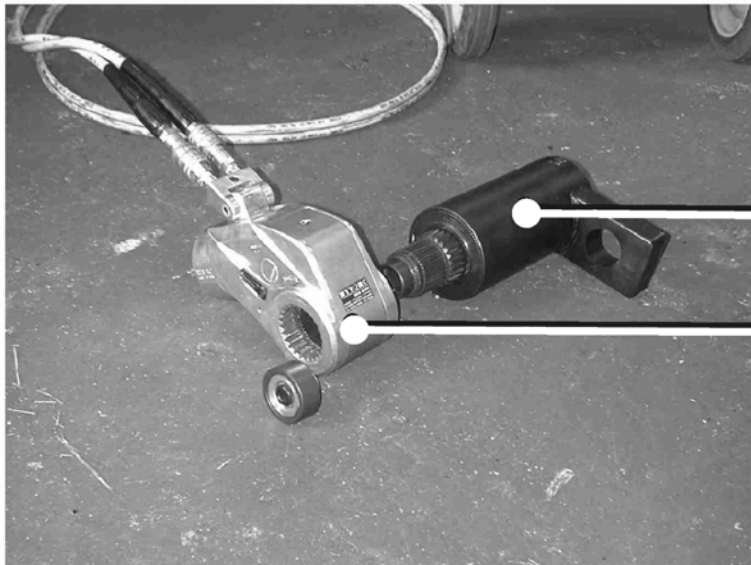
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13. Repeat this procedure step by step at all of the 156 mounting bolts (M48) .



1



2

3



4

Z 24072

## High-Strength Bolt Connections (continued)

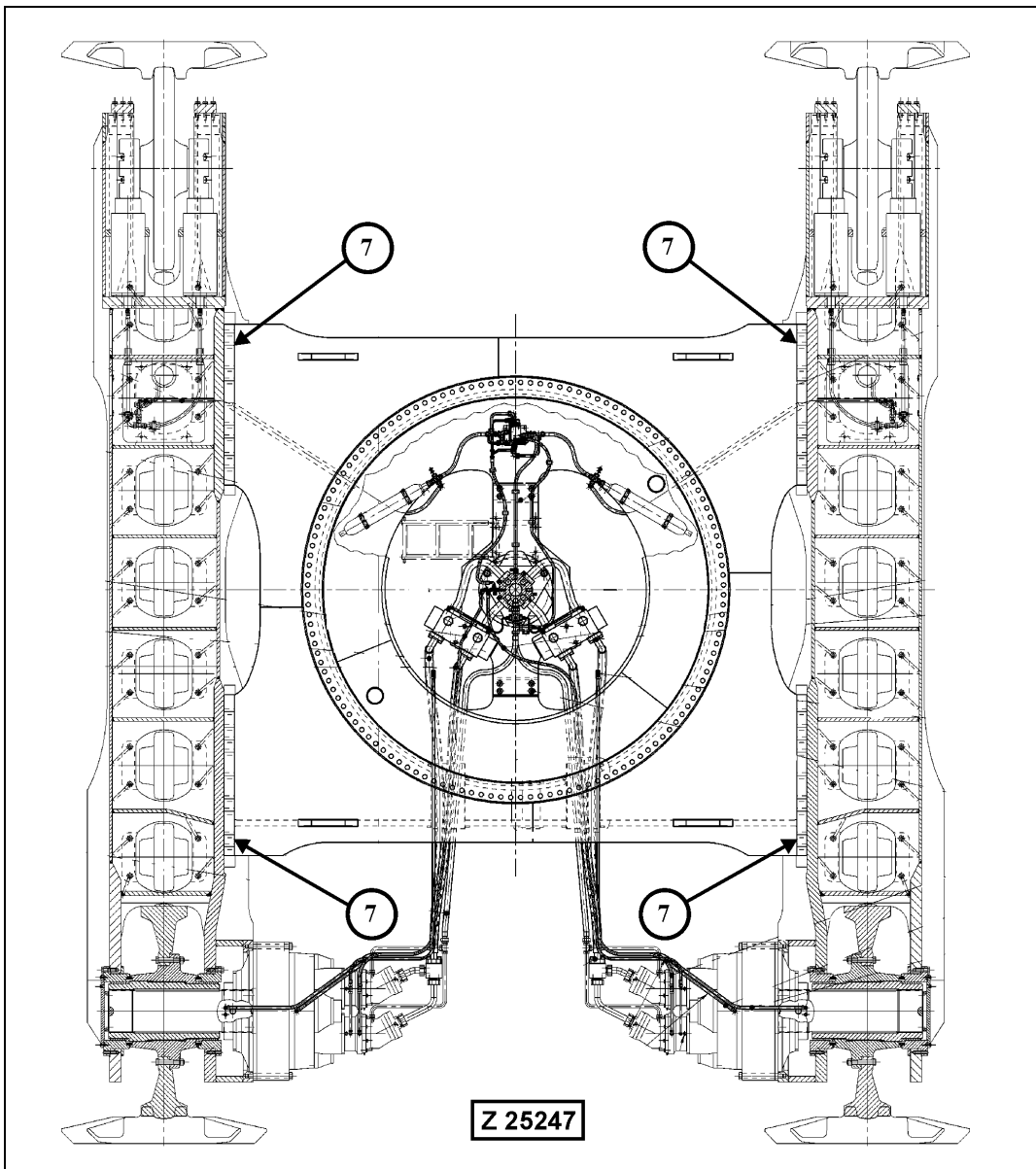
### Special hydraulic torque wrench

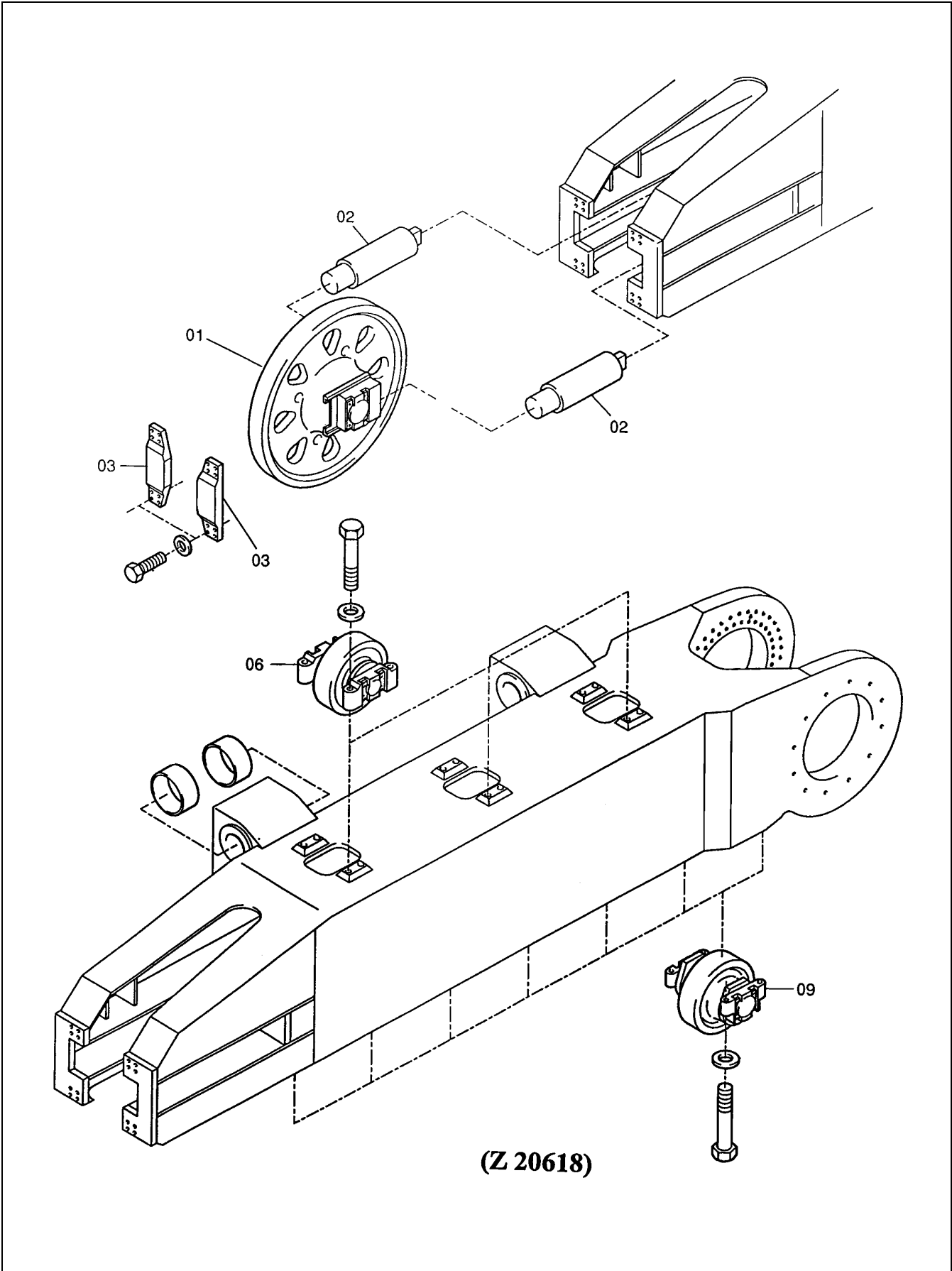
#### Legend for illustration Z24072:

- (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





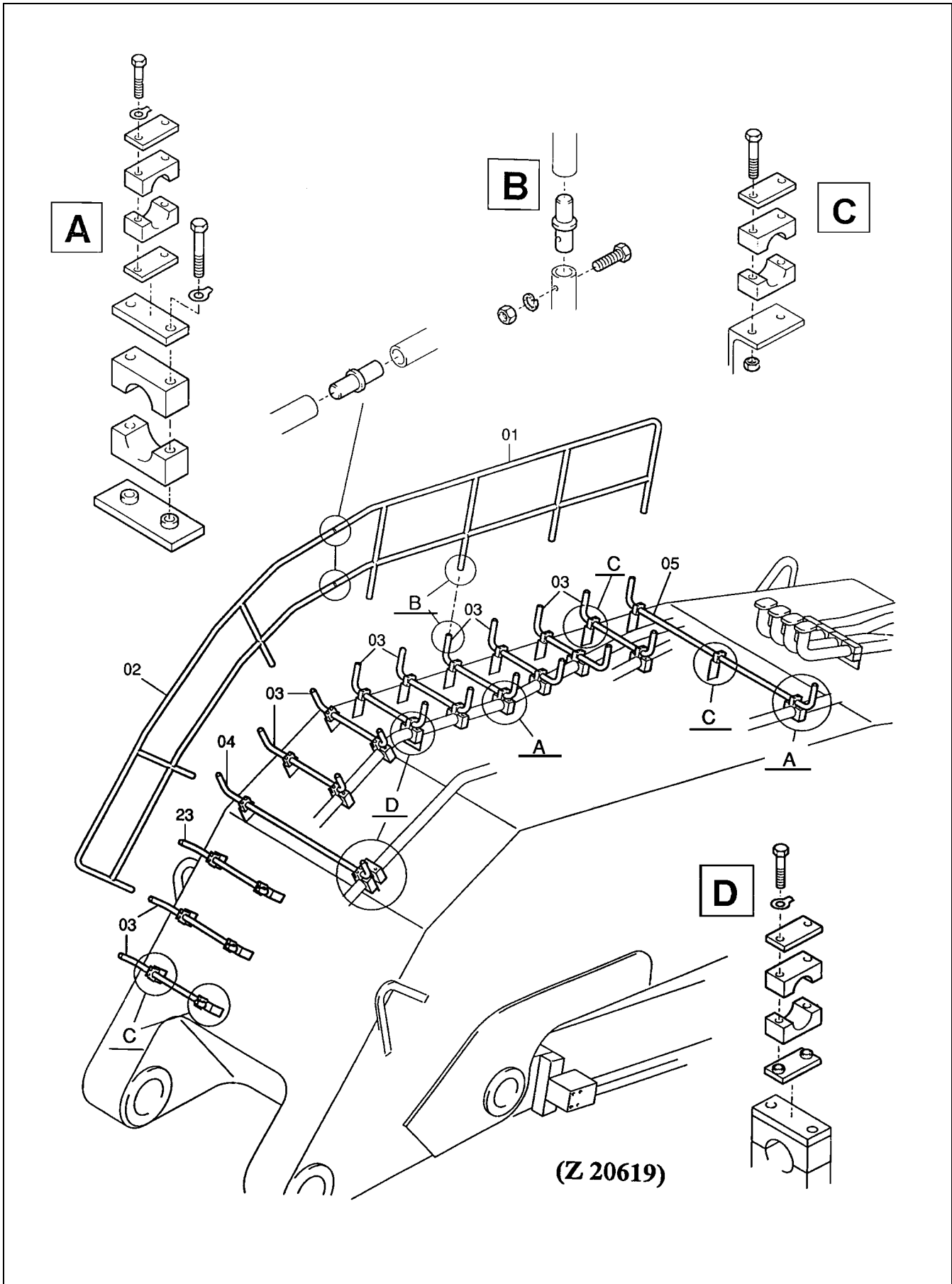
## High-Strength Bolt Connections (continued)

### 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





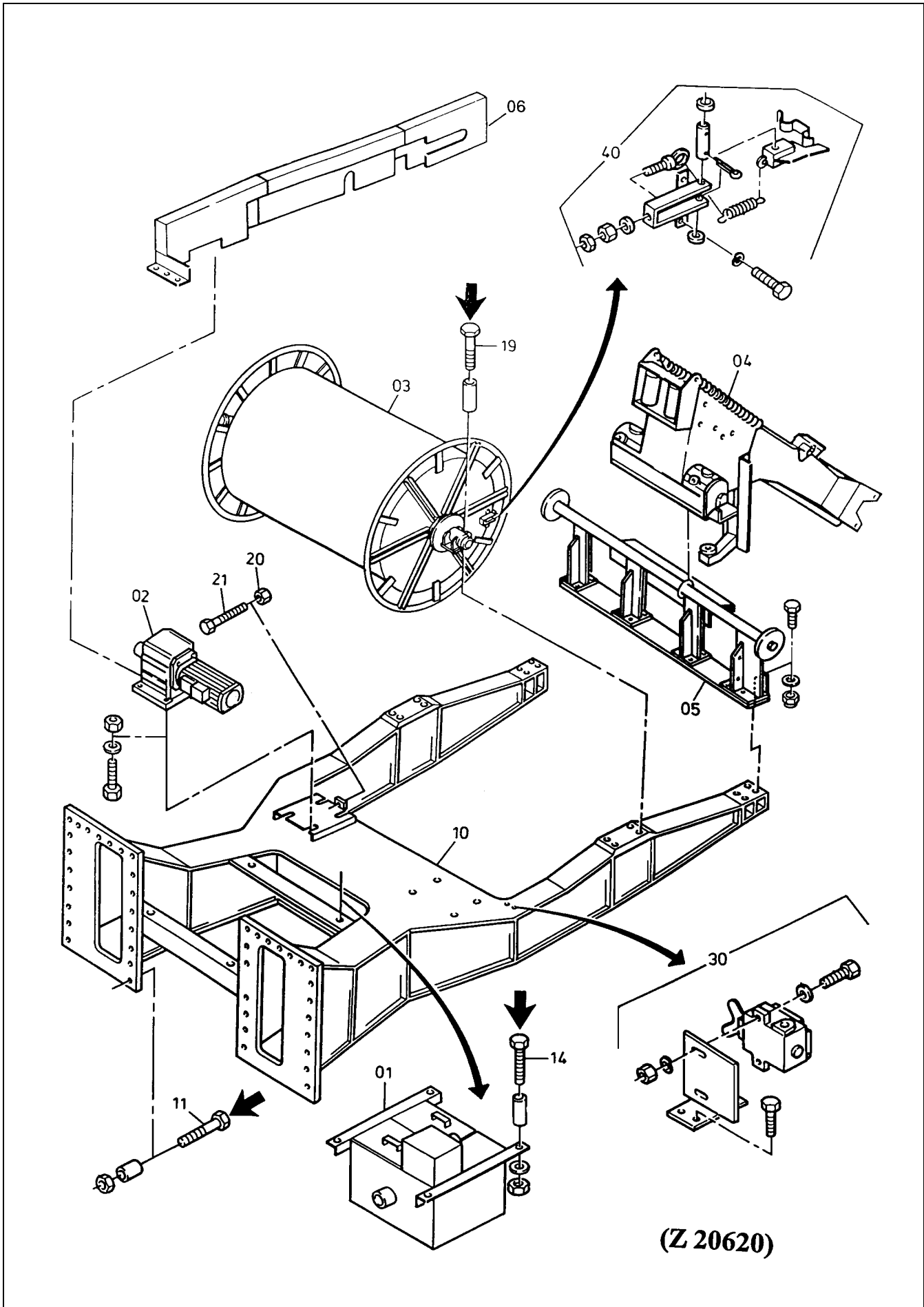
## High-Strength Bolt Connections (continued)

**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



(Z 20620)

## 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

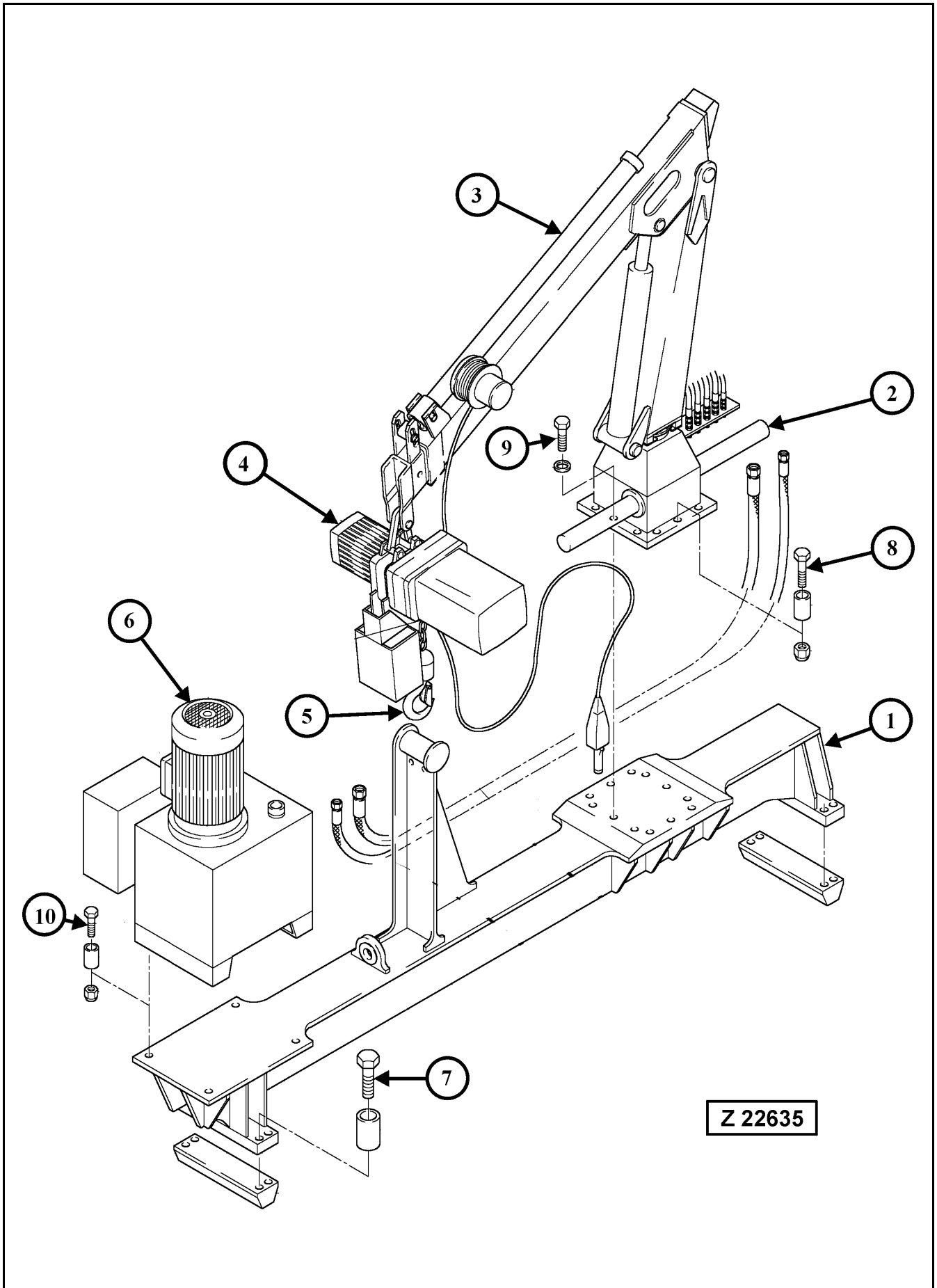
#### Legend for illust. Z 20620

- (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

#### 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

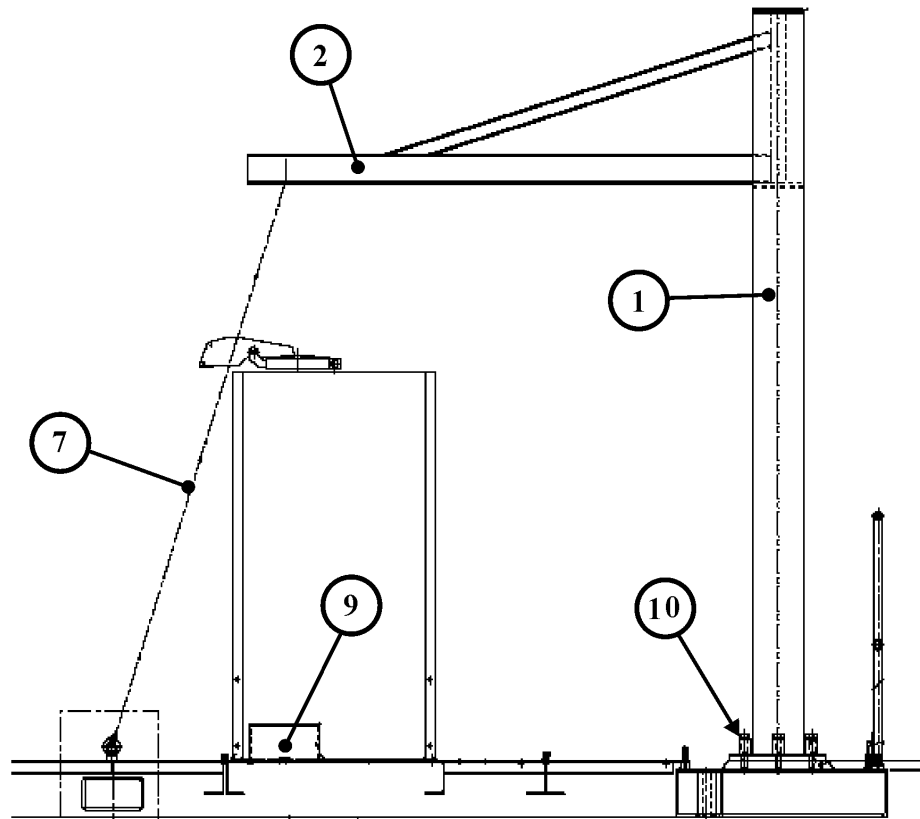
Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(7)	M24	10.9	36	880	8
(8)	M20	10.9	30	510	10
(9)	M20	10.9	30	510	2
(10)	M12	8.8	19	74	16

\* SW Wrench size

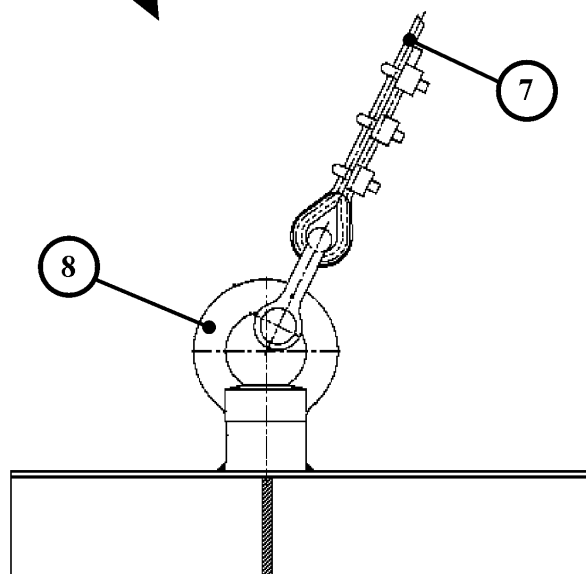
- Re-tighten loose mounting bolts and replace missing bolts.
- Replace self locking nuts which have lost their clamping torque.

#### 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

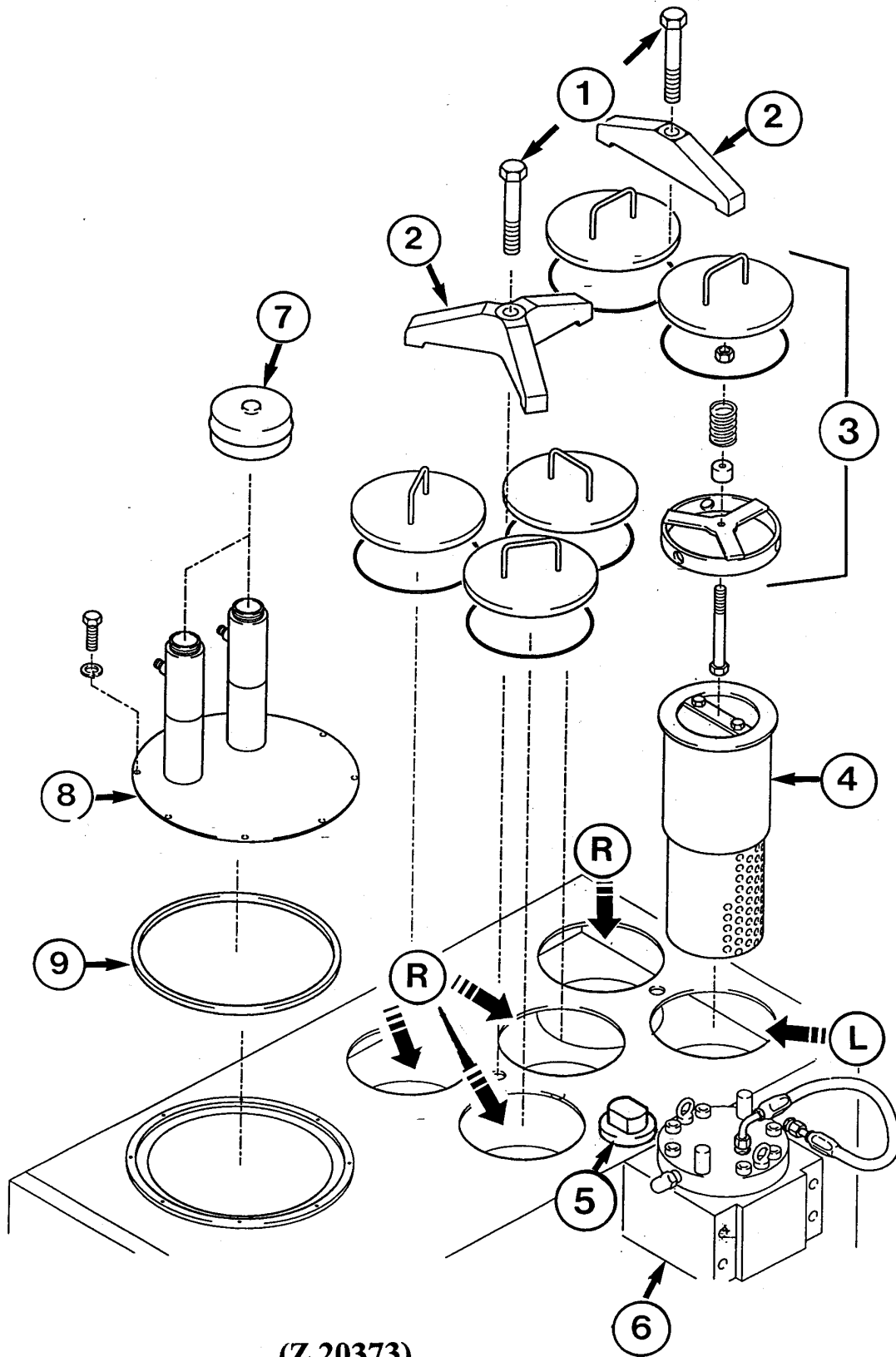
## High-Strength Bolt Connections (continued)

### Roof-mounted crane for grease barrel replacement 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

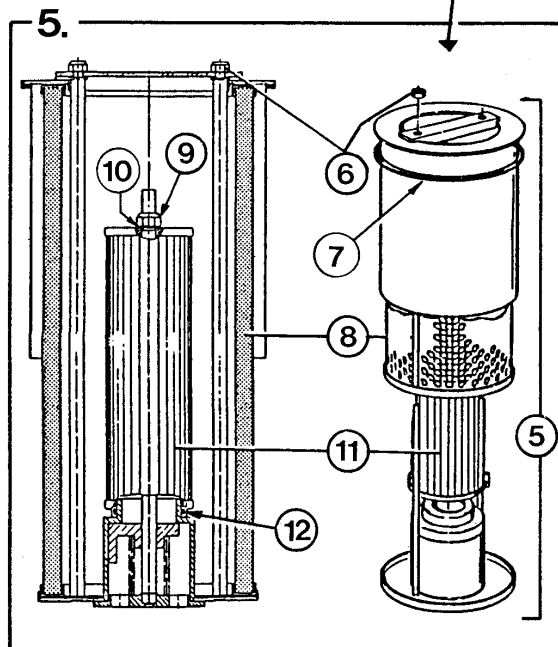
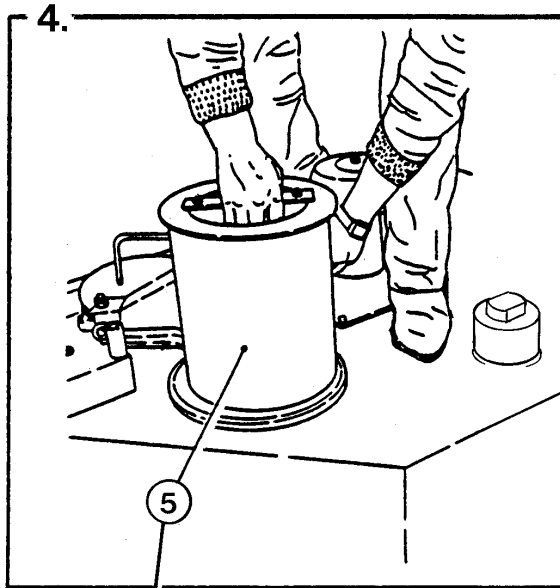
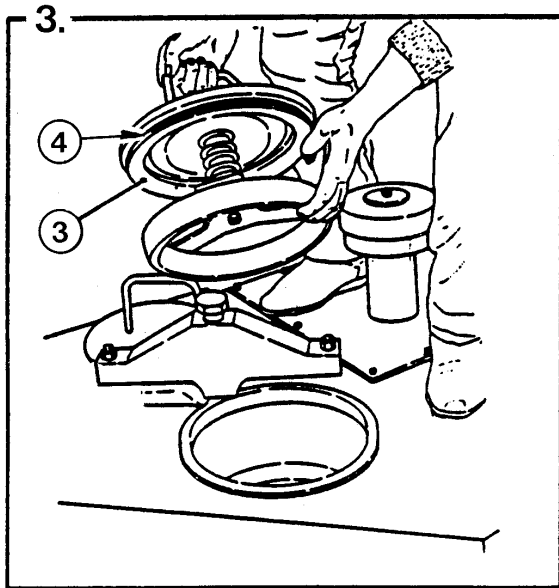
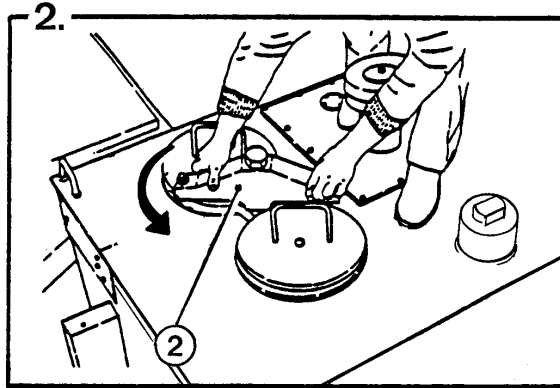
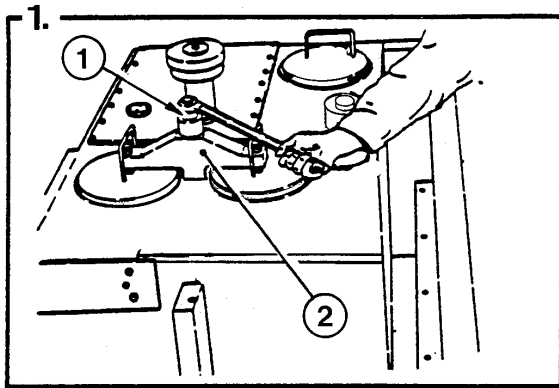
### Legend for illust. Z 20373

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 431
- Breather filter, see page 433
- High pressure filters, see page 435
- Pressure filters on central control and filter frame, see page 439



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.

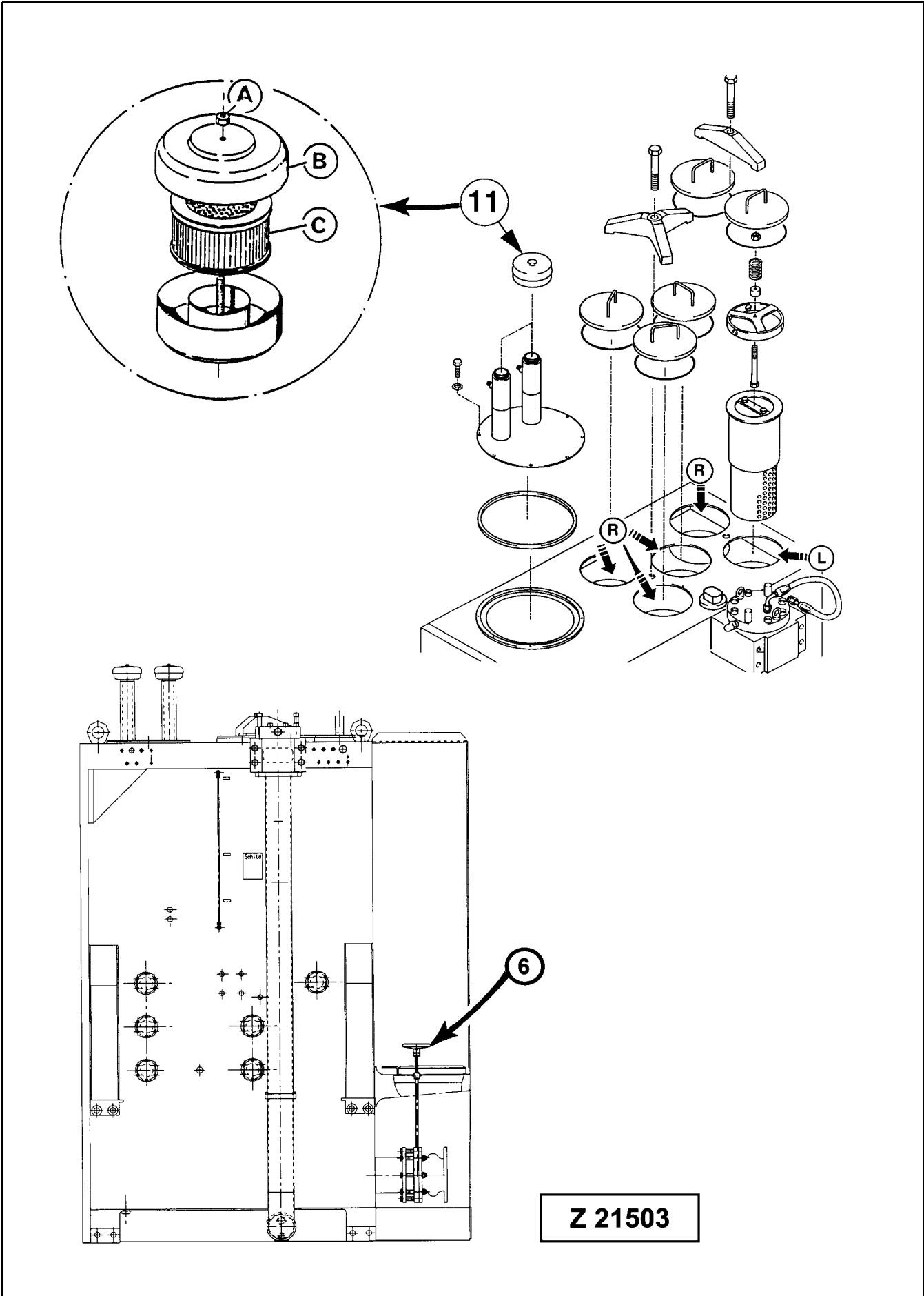
### NOTICE

**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 ECS 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 ECS screen in the Operator's cab.

#### REMARK

Before starting the motor, make sure the shut-off valve is completely open by turning hand wheel (6) fully to the left (CCW).

- (11) Breather filter

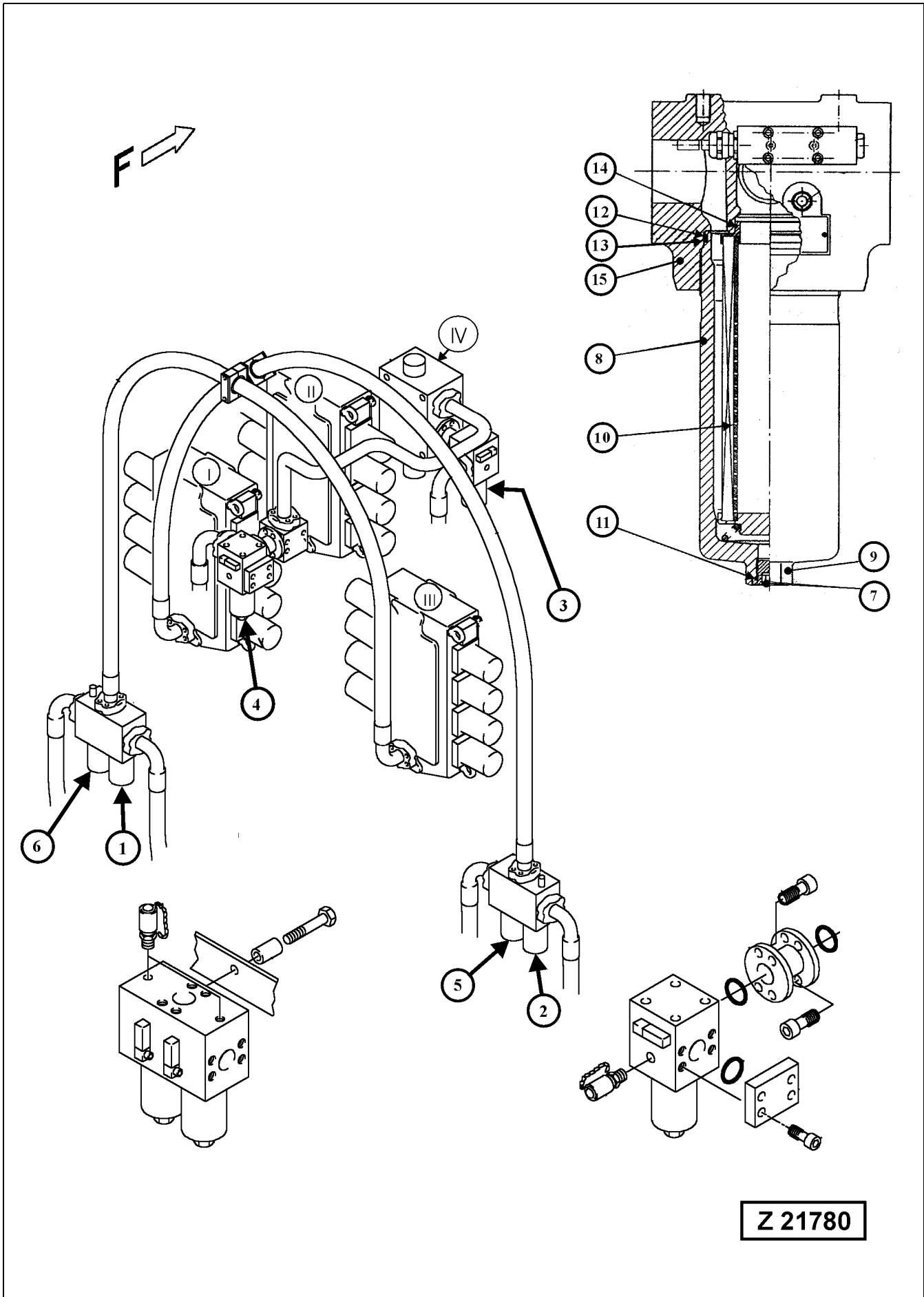
### Replace Element (C) of Breather Filter (11).

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 278 for evacuation procedure.



## FILTER SERVICE

### High Pressure Filters "HPF", illustration Z 21780

#### NOTICE

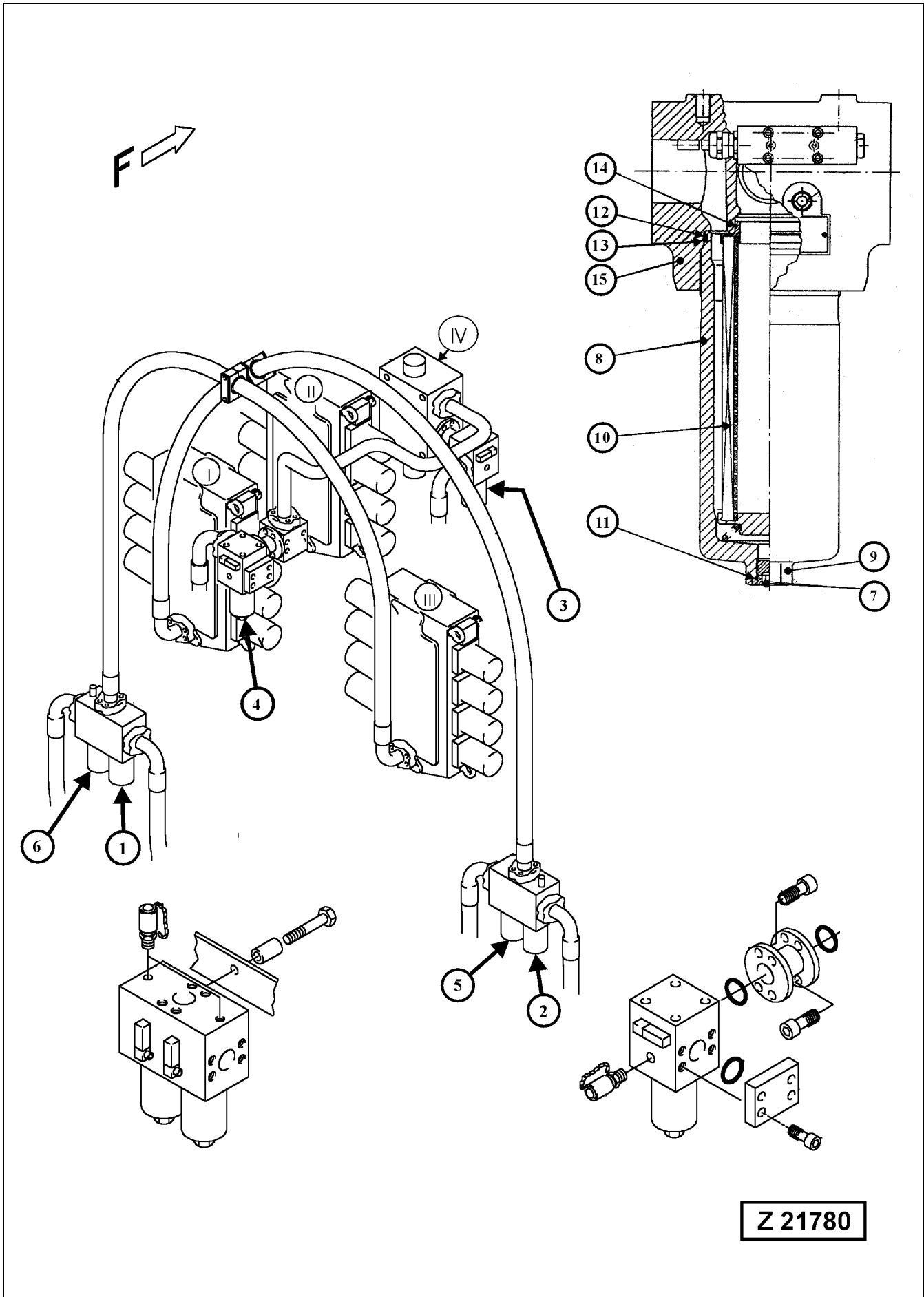
- The filter reference numbers (1 - 6) correspond to the numbering of the main pumps.
- If, for example, the fault message "High pressure filter #5 restricted" is being displayed on the ECS screen, the filter number (5) in the illustration has to be serviced. Stop work and inform Service staff about 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 motors.  
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).





## 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.

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**⚠ CAUTION**

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**In case filter element (10) is soiled by metal chips, examine hydraulic pump for damages. Install new element (10).**

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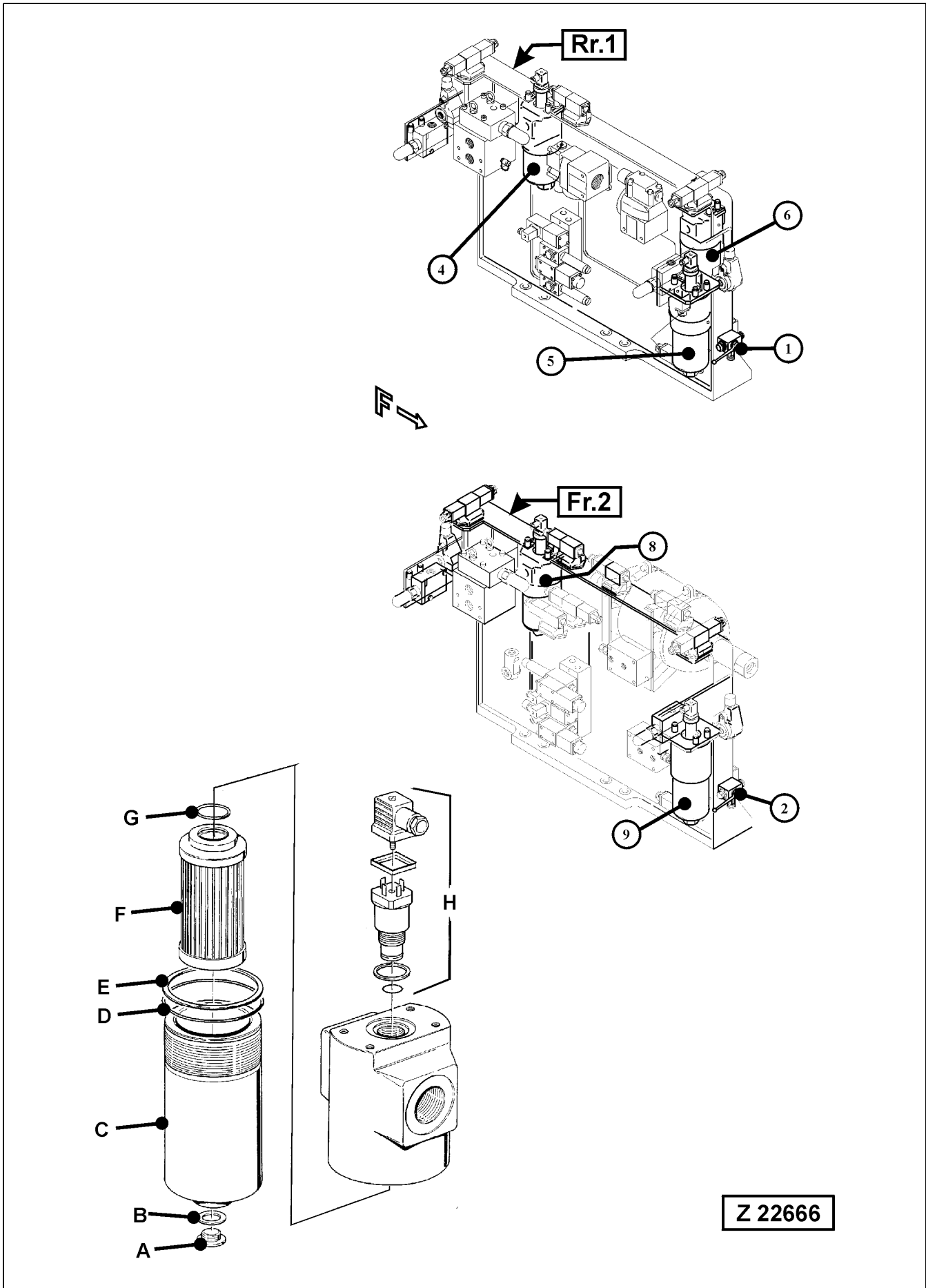
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#### NOTICE

**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

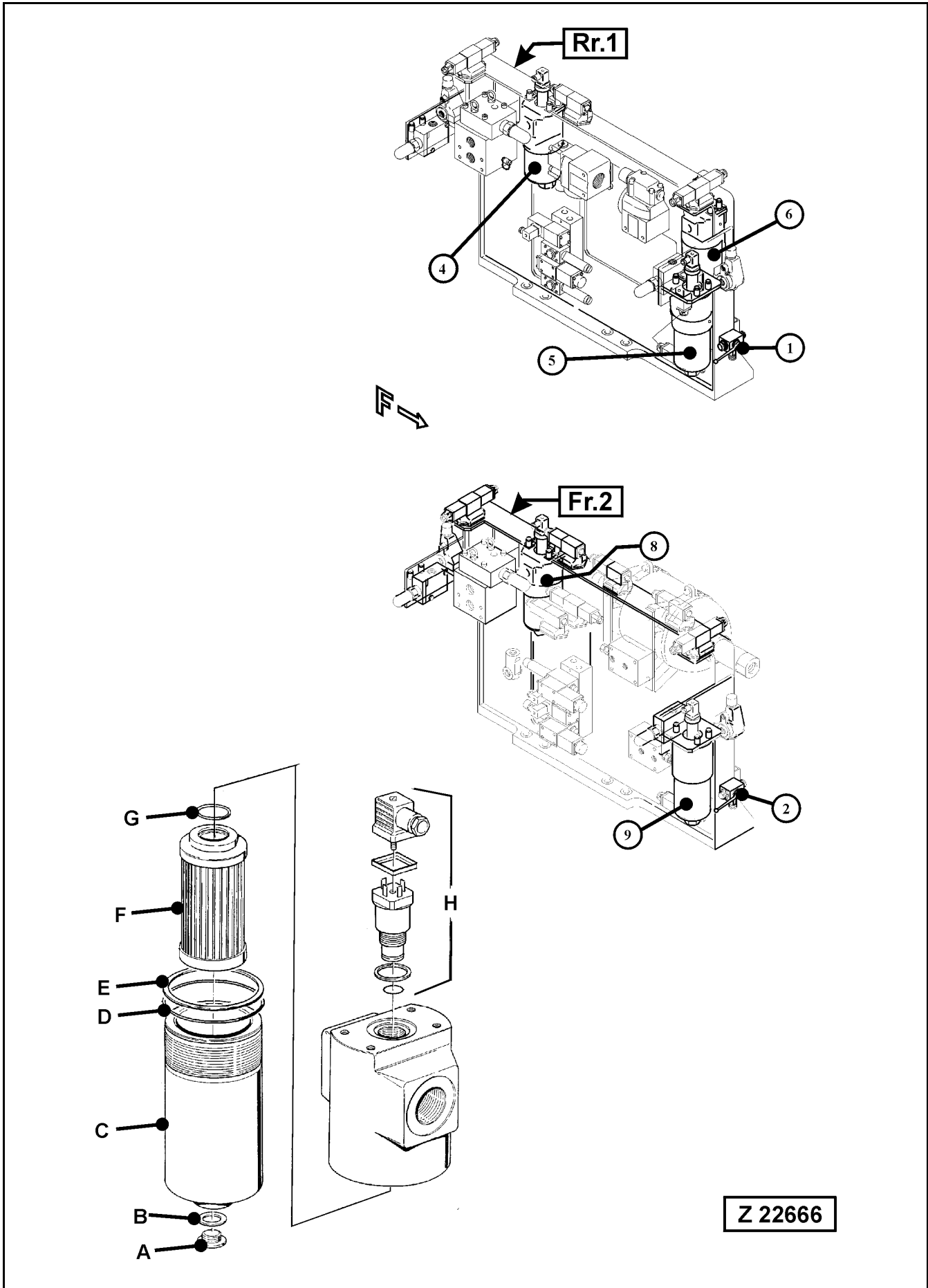
### Replace filter elements of the hydraulic oil pressure filters

#### NOTICE

**When a fault message "Pressure Filter restricted" is displayed, stop work and replace element of the corresponding pressure filter.**

#### Legend for illust. Z 22666

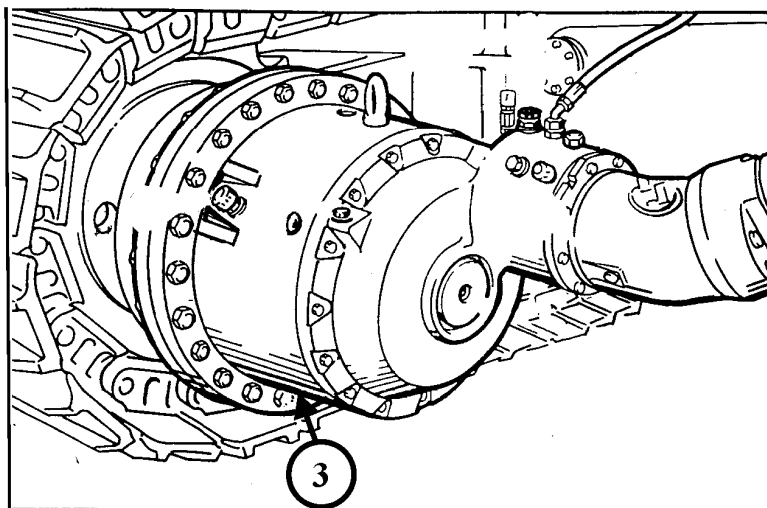
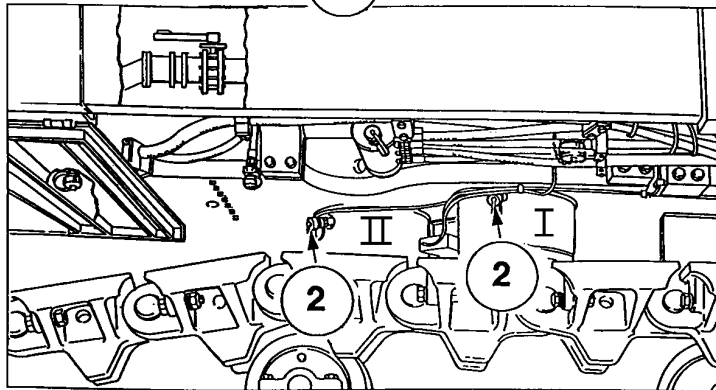
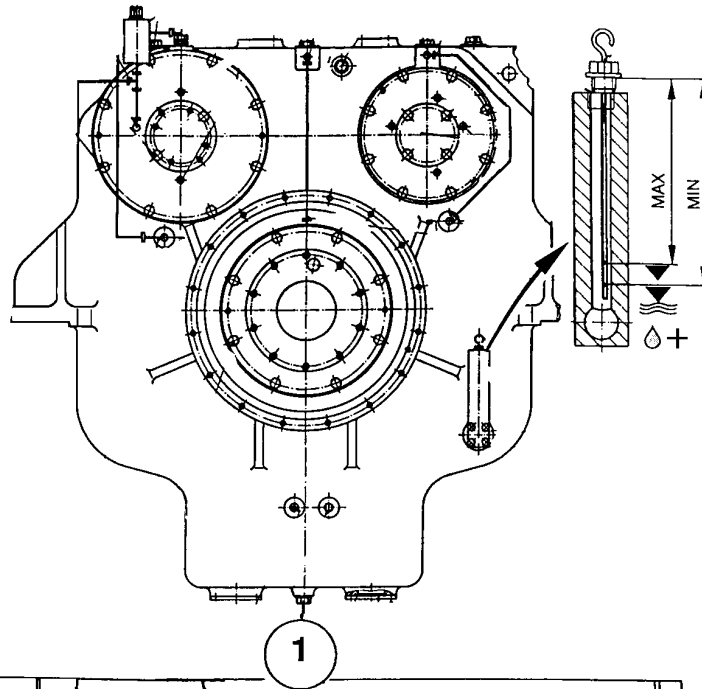
- (Rr.1) Control and filter panel of rear power unit, motor 1
- (Fr.2) Control and filter panel of front power unit, motor 2
- (1) Change over valve for operation mode of pump control system for rear power unit, motor 1.
- (2) Change over valve for operation mode of pump control system for front power unit, motor 2.
- (3) Not used.
- (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) Not used
- (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.



## **FILTER SERVICE**

### **Replace pressure filter elements, illust. Z 22666, as follows:**

1. Place working equipment on the ground and shut-off the motors.  
Relieve pressure in the hydraulic system according to page 256 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.
5. Discard element (F) with O-ring (G).
6. Inspect O-ring (D) and back-up ring (E), 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 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.



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

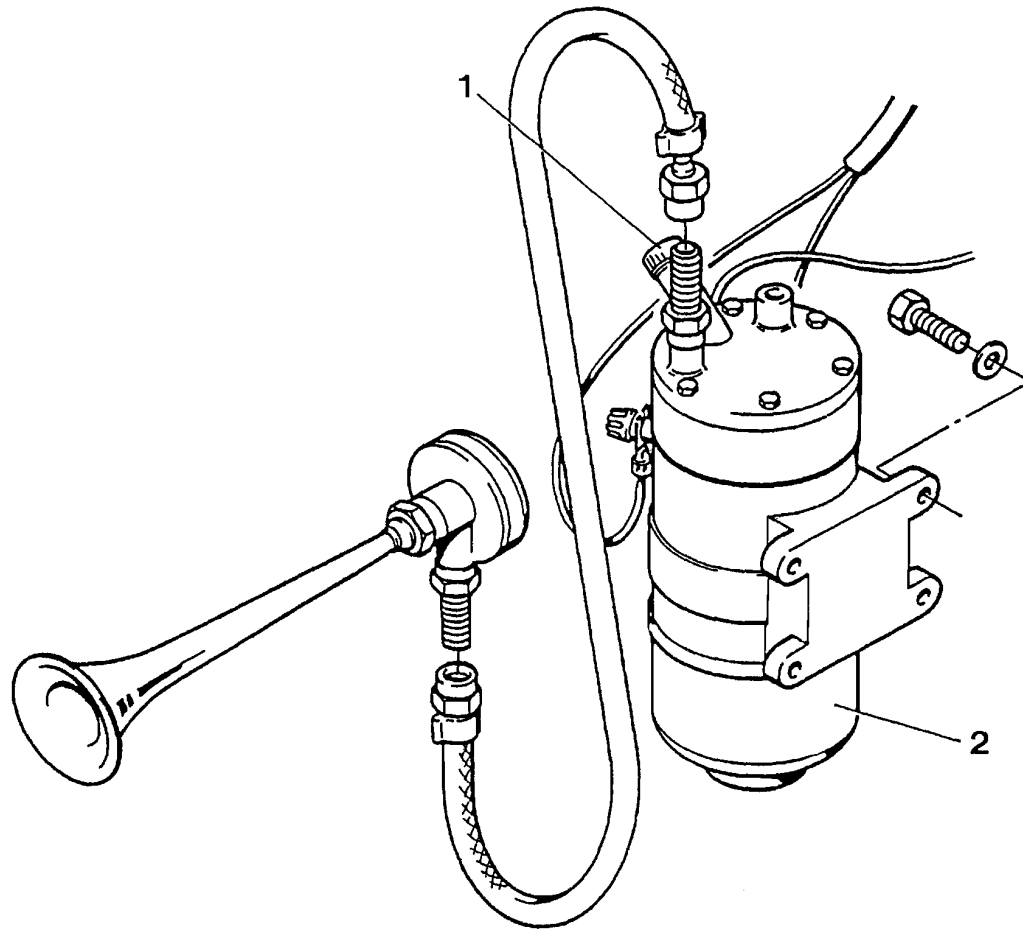
#### SWING GEARS AND TRAVEL GEARS

(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**



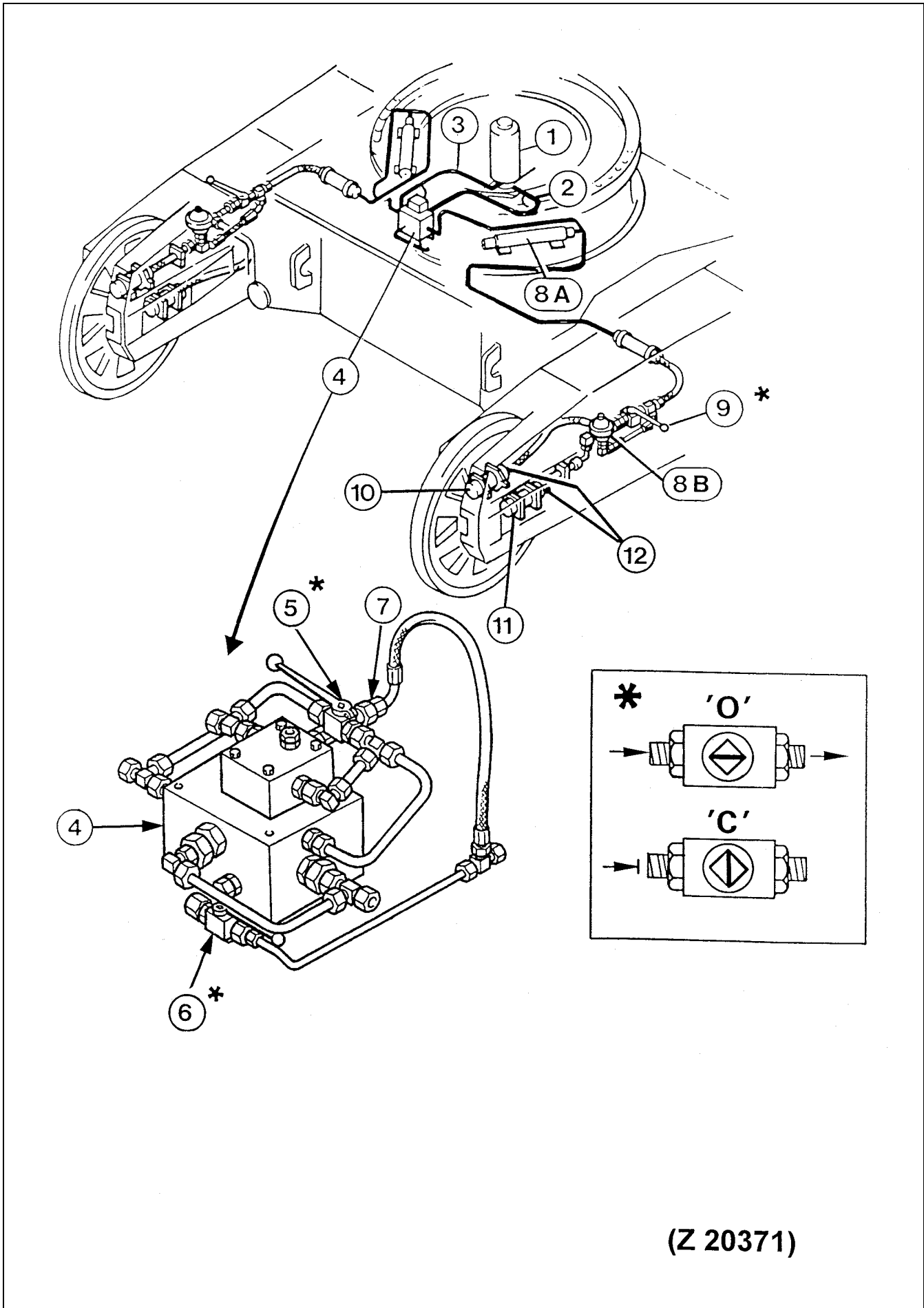
#### **4.12.4 SIGNAL HORN COMPRESSOR - CLEAN AND LUBRICATE**

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.



(Z 20371)

## 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.

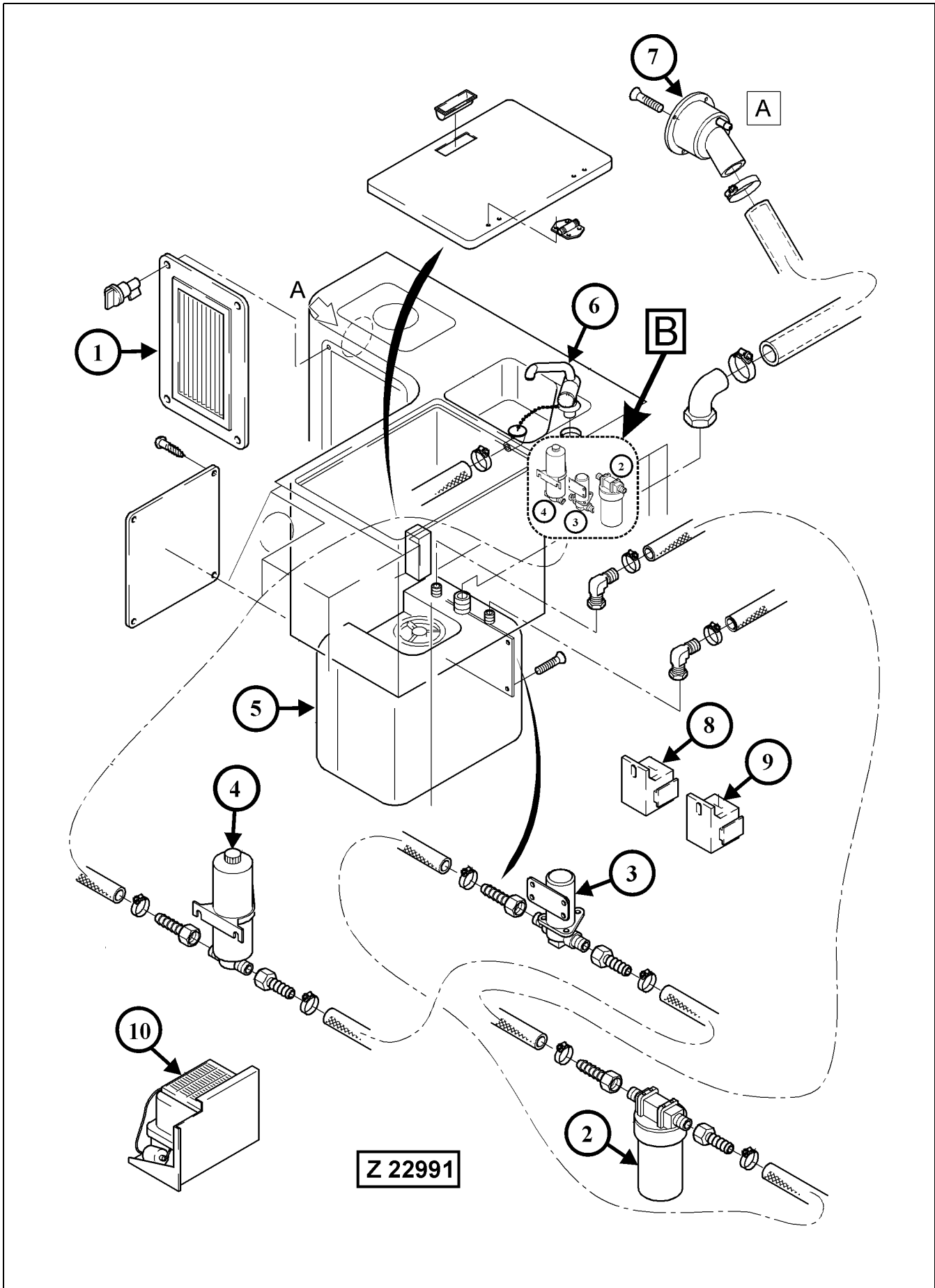
### NOTICE

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  
     "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.

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**⚠ WARNING**

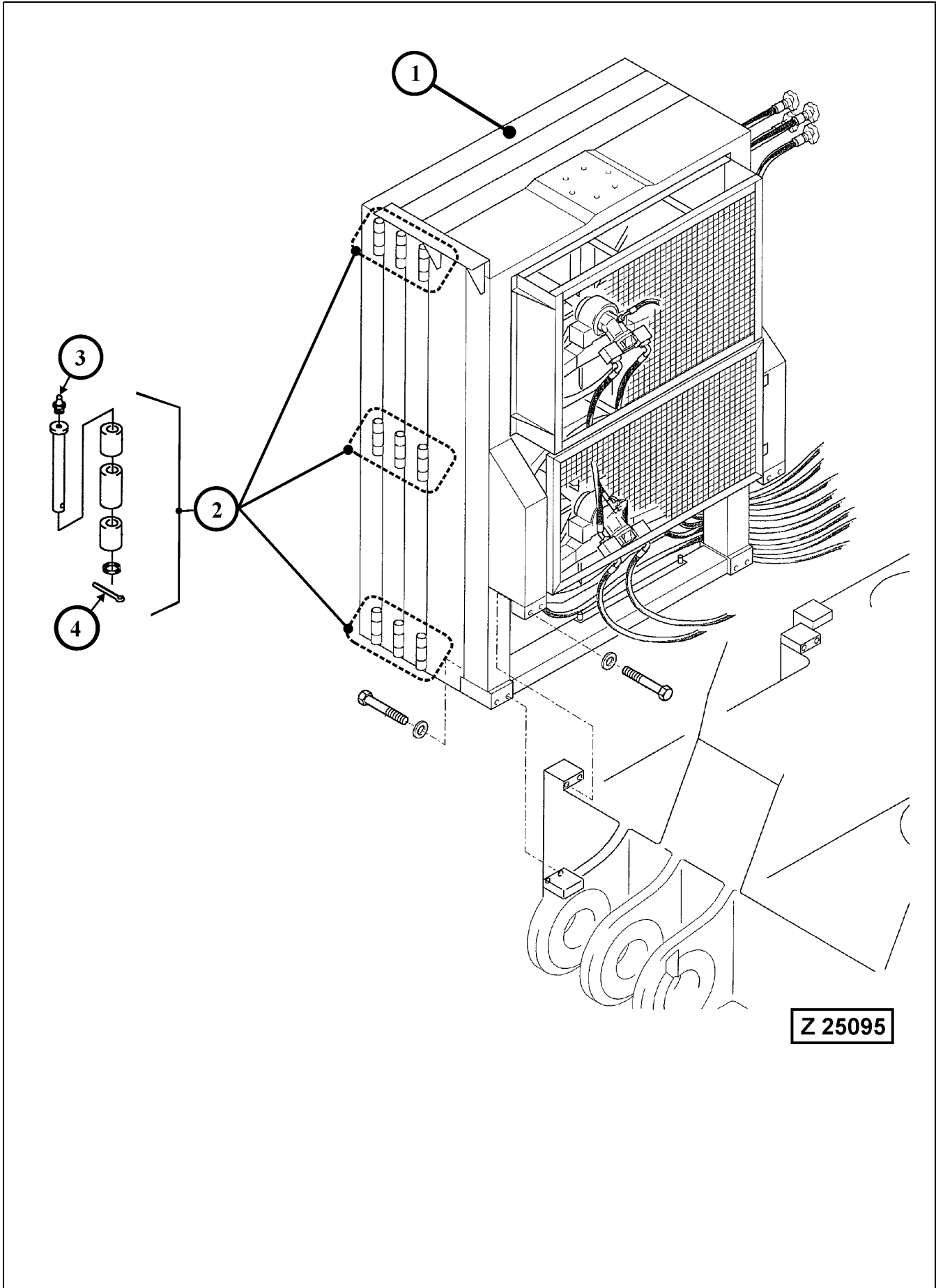
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**DO NOT drink the water of the cab water system. The cab water system is not constructed as a drinking water system.**

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## 4.12.7 HYDRAULIC OIL COOLER - INSPECT AND LUBRICATE DOOR HINGES

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**⚠ WARNING**

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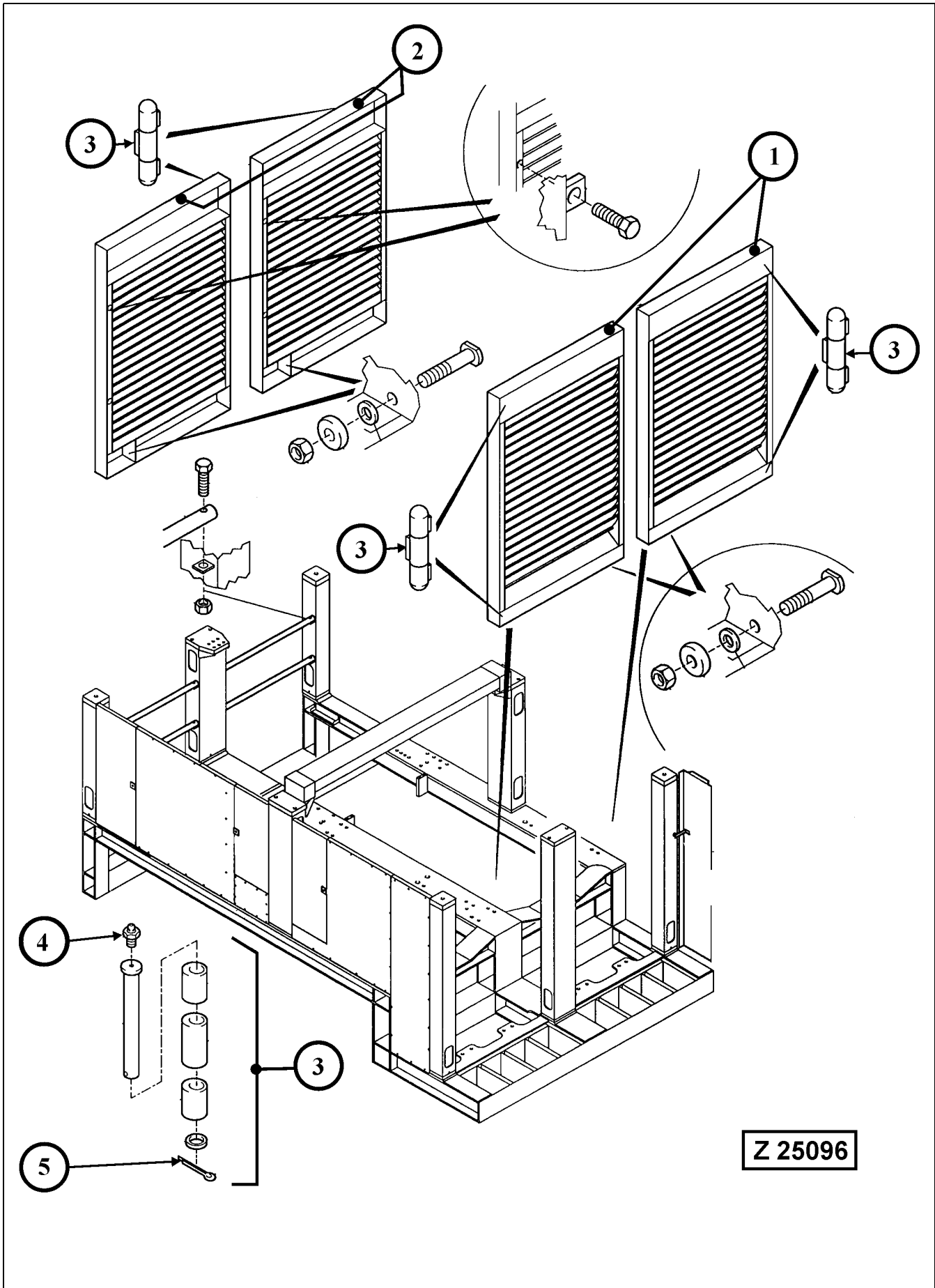
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- Provide adequate working platform for safe access to the hydraulic oil cooler.
  - Check all door hinges (2) for good condition and proper fastening to their carrier frames. If cracks or distortion at the weld area of the hinges are found corrective 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

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**⚠ WARNING**

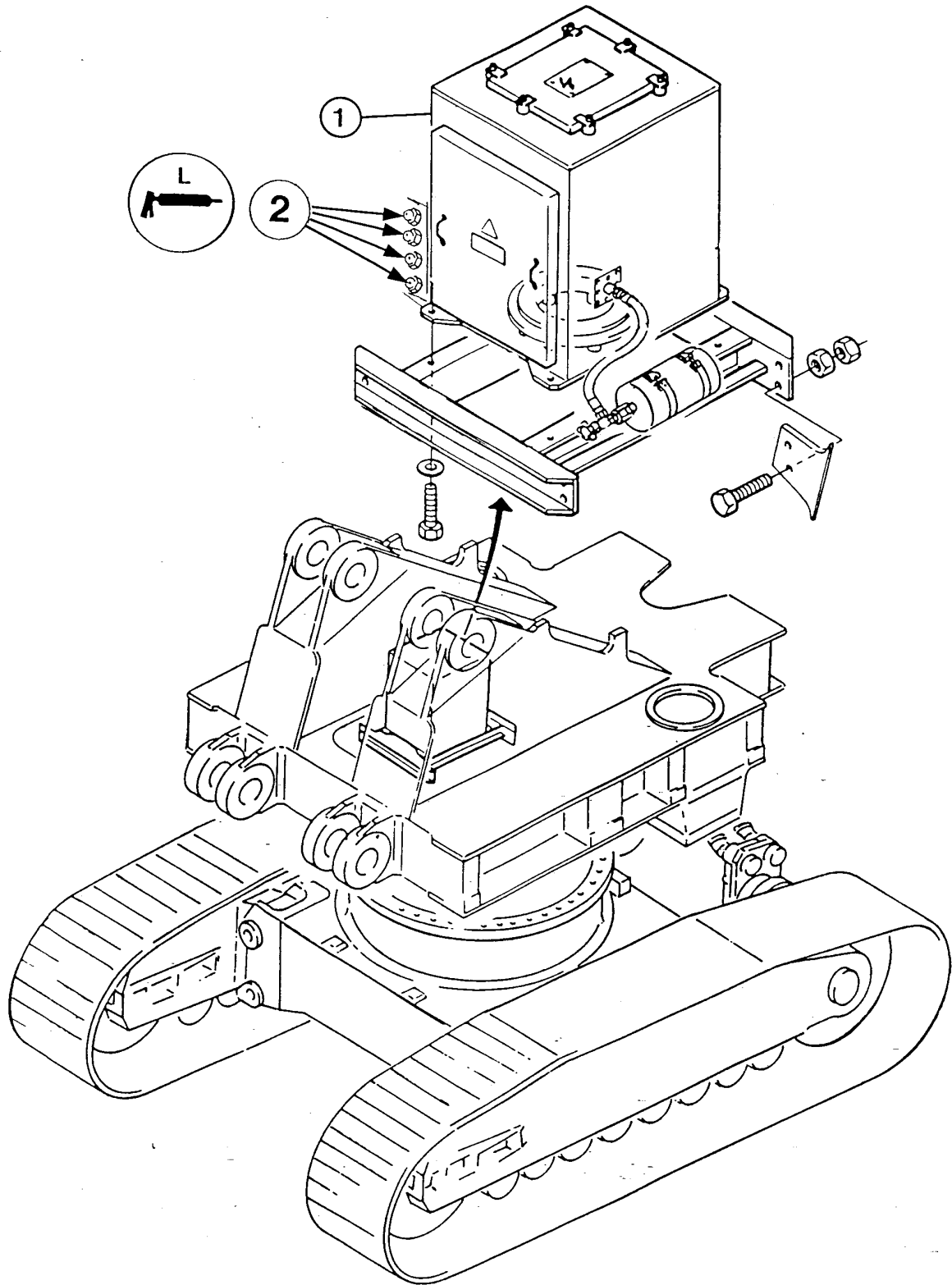
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- Provide adequate working platform for safe access to the rear machinery house doors (2).
  - Check all door hinges (3) for good condition and proper fastening to their carrier frames. If cracks or distortion at the weld area of the hinges are found 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).



(Z 20378)

### 4.12.9 SLIP RING UNIT - LUBRICATE

- Lubricate ball bearing of slip ring bearing (1), illustration Z 20378 at the four grease fittings (2).
- Check condition, fastening and security of the slip ring unit.

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**⚠ WARNING**

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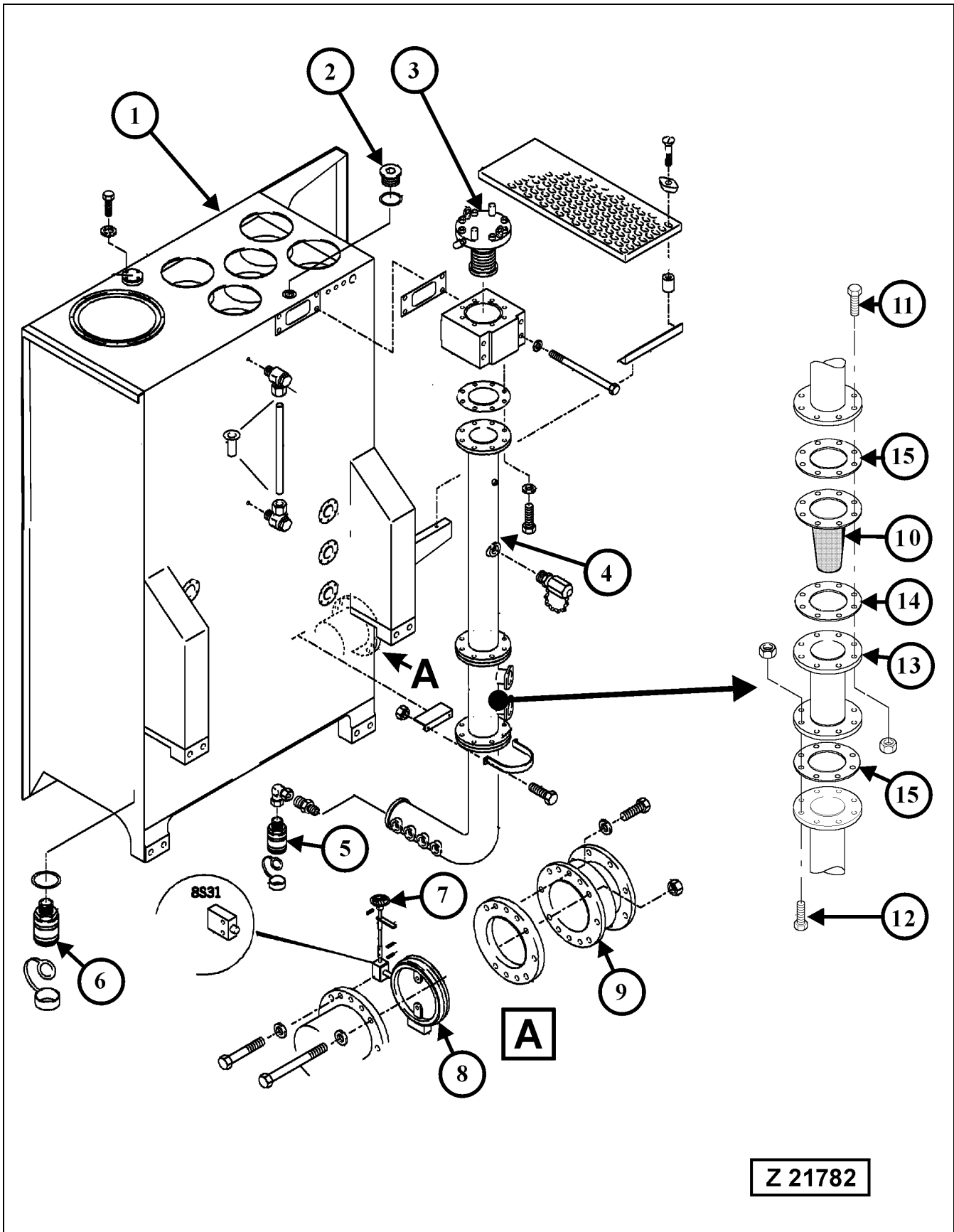
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**Make sure the main power supply is switched off prior to open the slip ring housing or work on the unit.**

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# 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

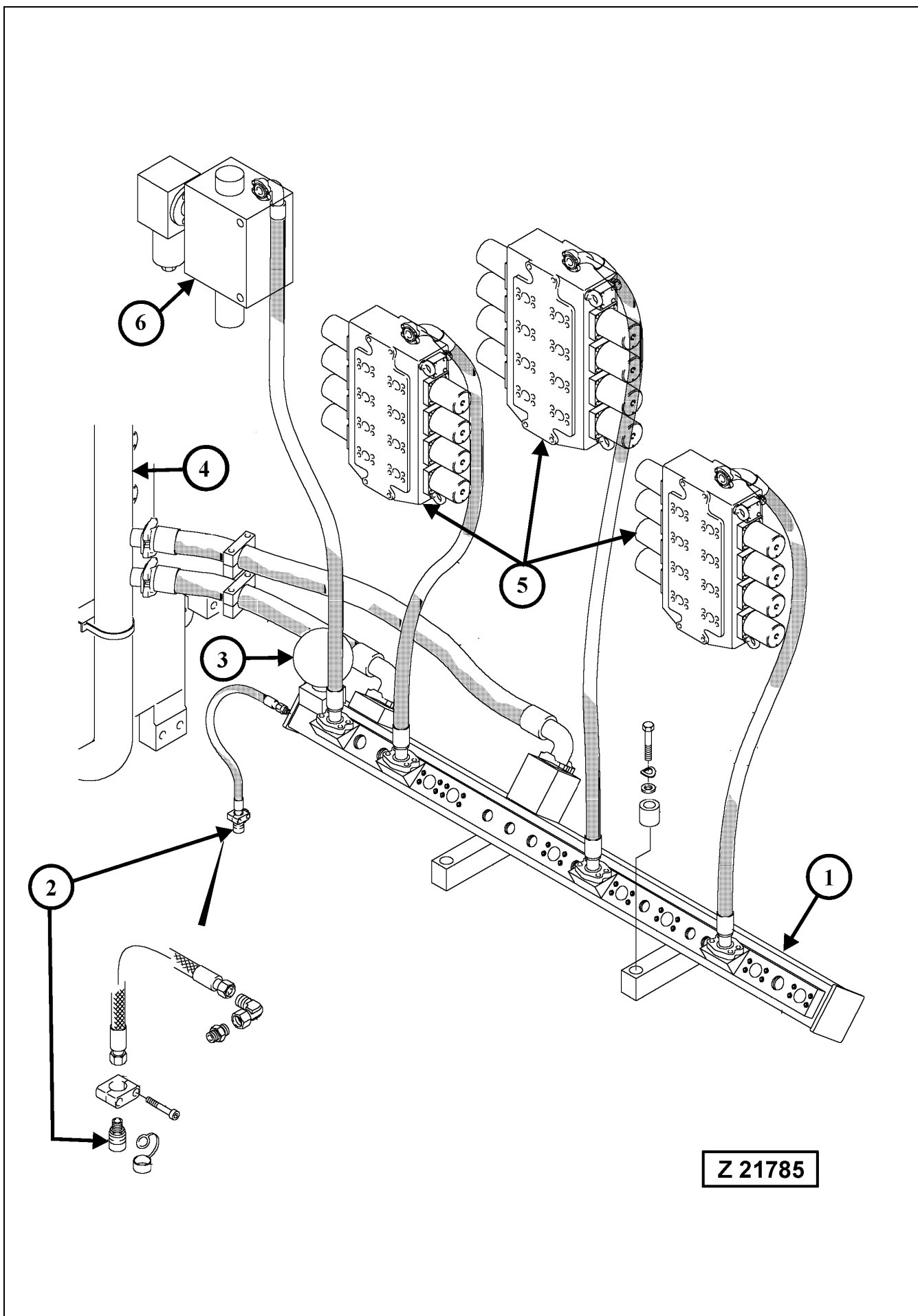
Evacuate main hydraulic oil reservoir according to section Central Refilling System on page 278.

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.



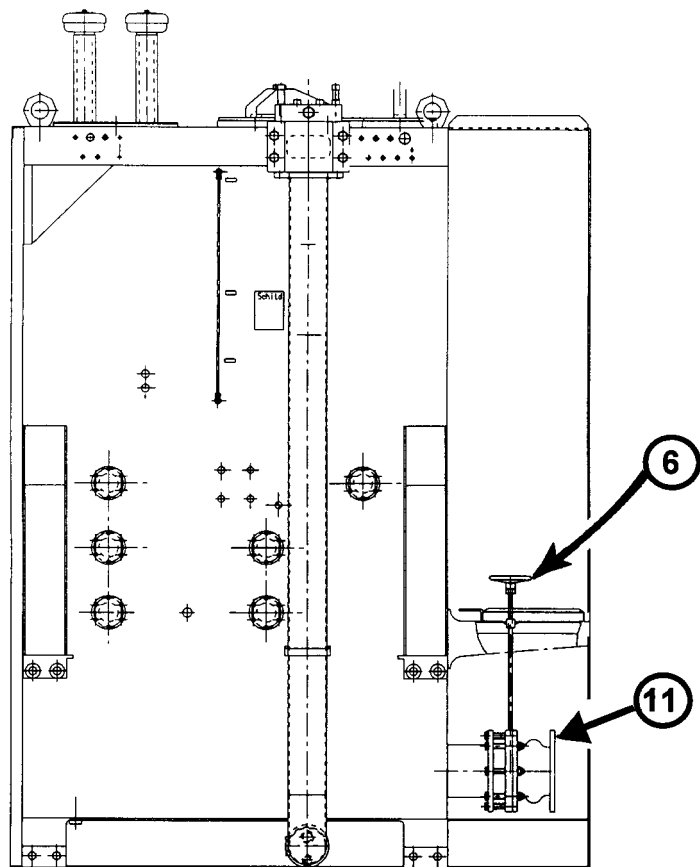
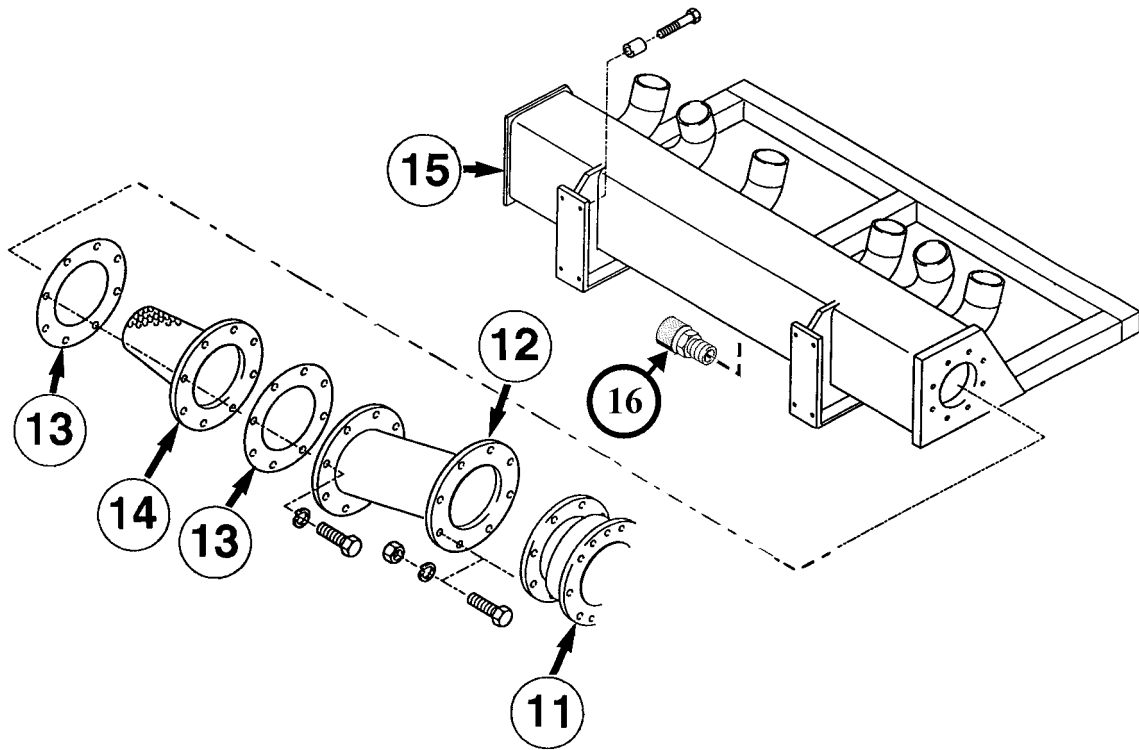
## HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER

### 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

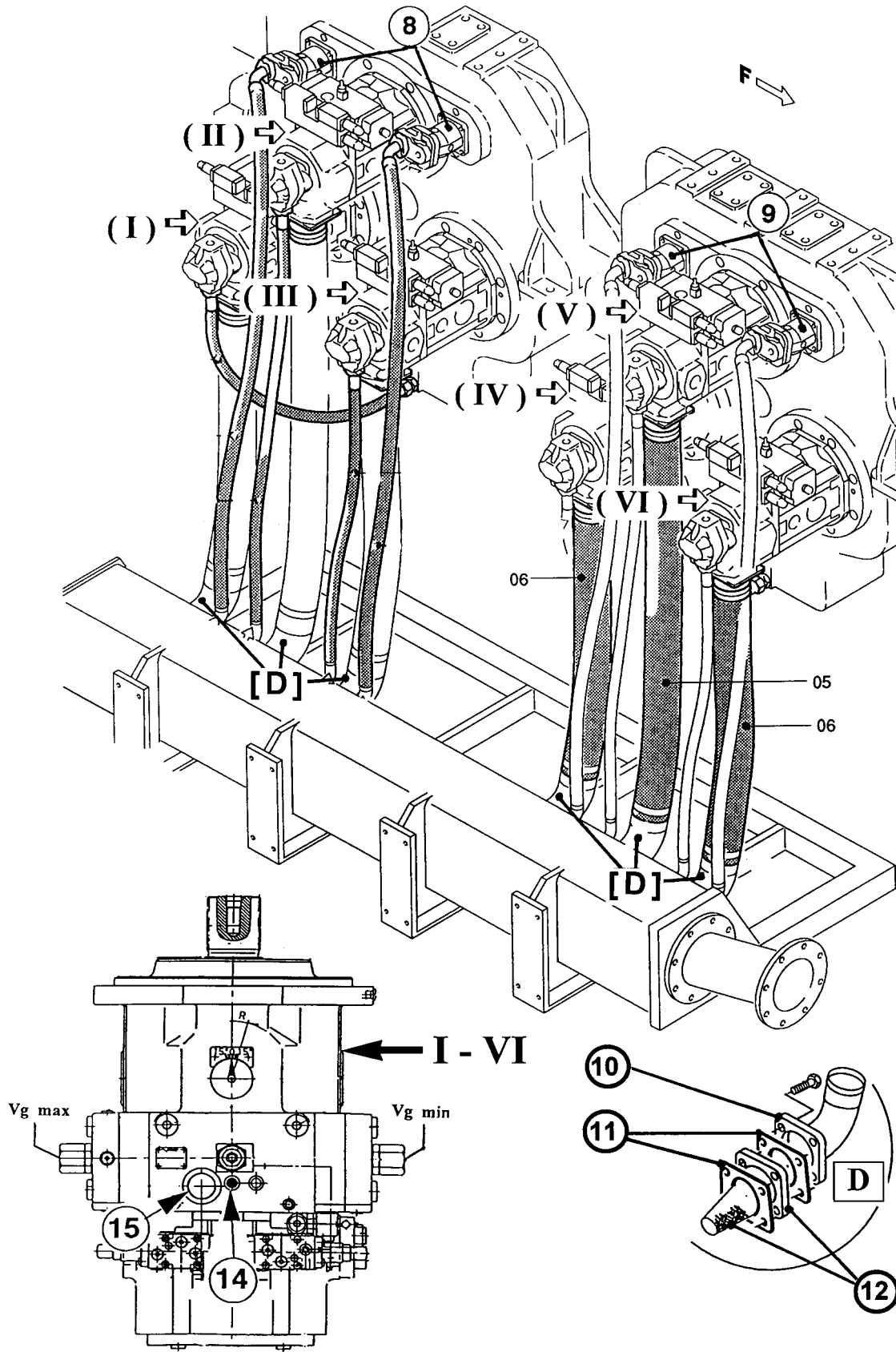
**Before starting the motors, make sure the shut off valve is completely open by turning the hand wheel (6) fully to the left (CCW).**

- (11) Compensator  
(12) Intermediate pipe  
(13) Gaskets  
(14) Suction oil strainer  
(15) Suction oil reservoir  
(16) Drain coupling

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

There are six further strainers installed in the suction oil reservoir (15). Refer to page 463 for replacement instructions.



(Z 21171)

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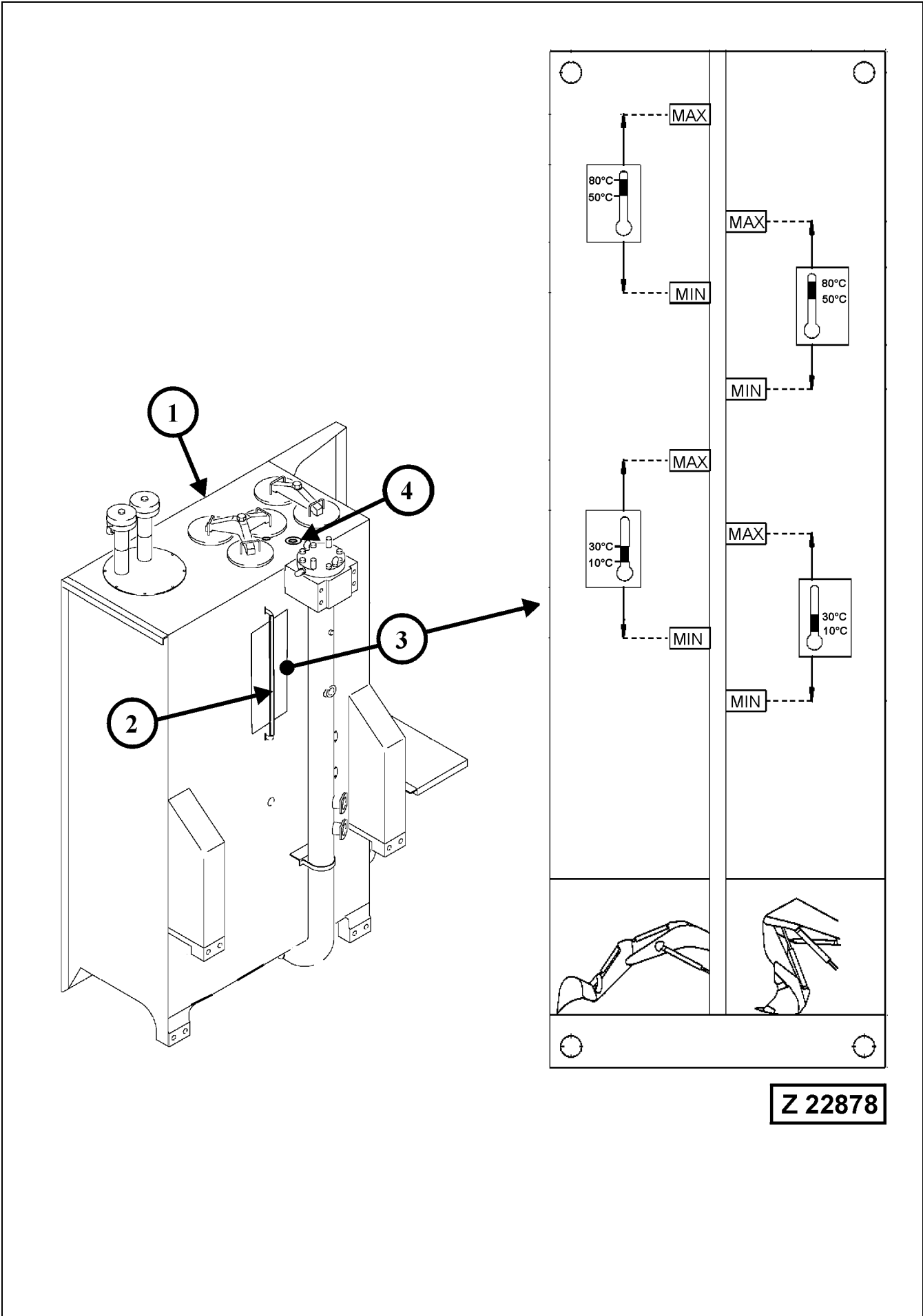
## HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER

### 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

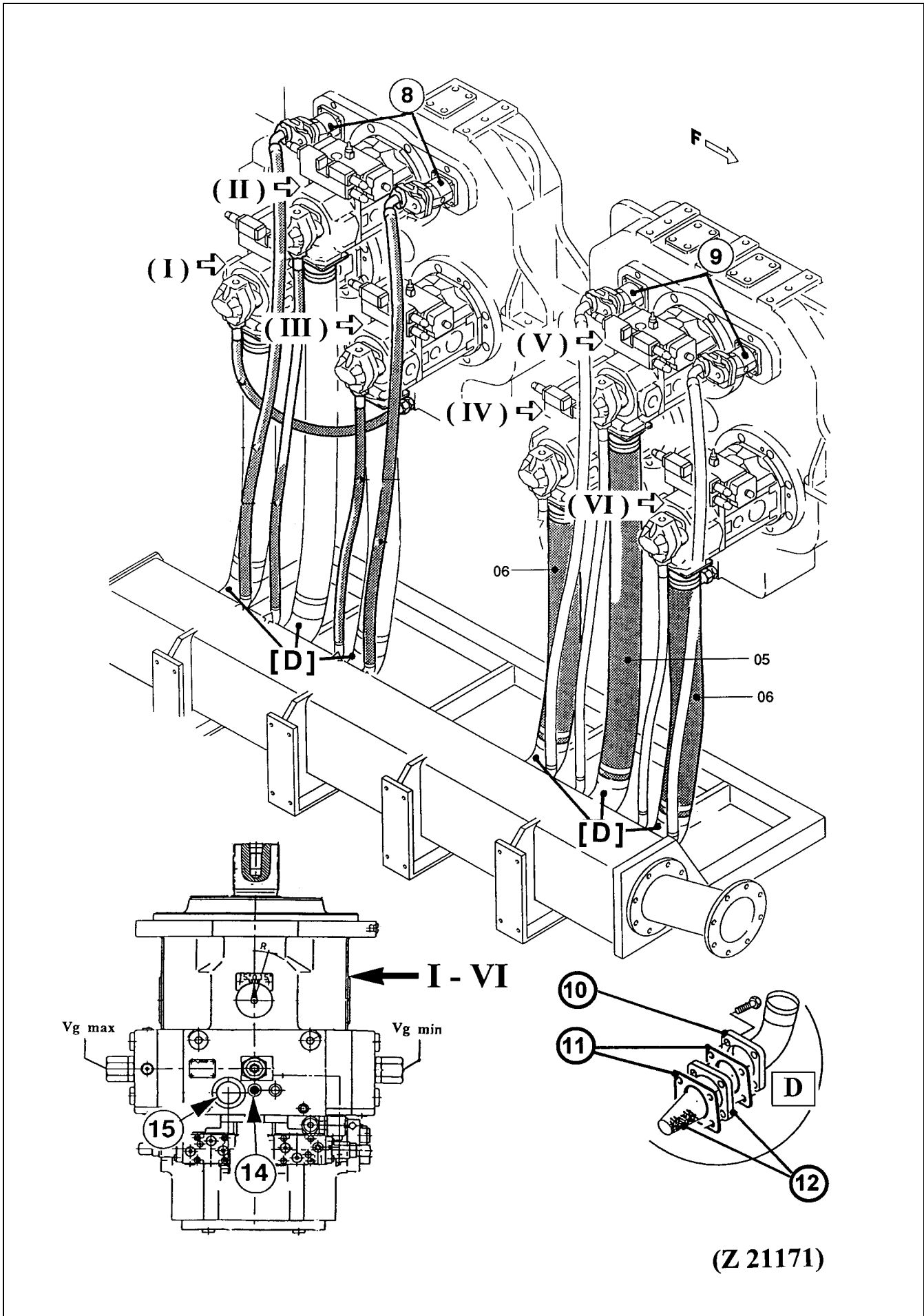
Select hydraulic oil viscosity grade according to ambient temperatures.

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 "**Excavator Components**" group of the ECS Menu Control.

2. On machines equipped with Central Refilling System fill main hydraulic oil reservoir according to section "Central Refilling System" on page 278.  
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).

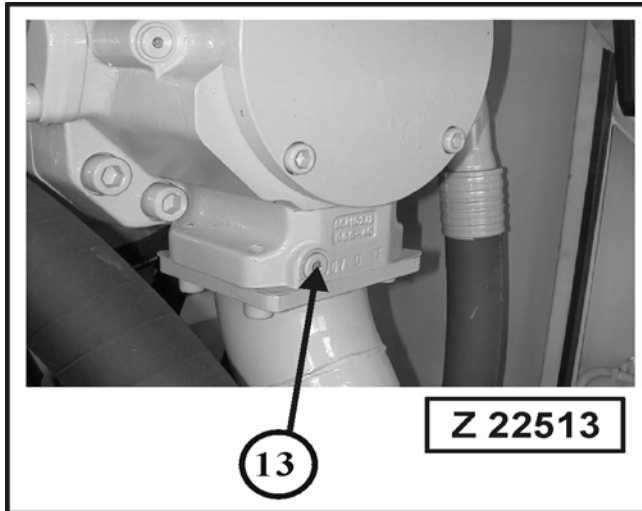
#### Legend for illustration Z22878

- |     |                                 |
|-----|---------------------------------|
| (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



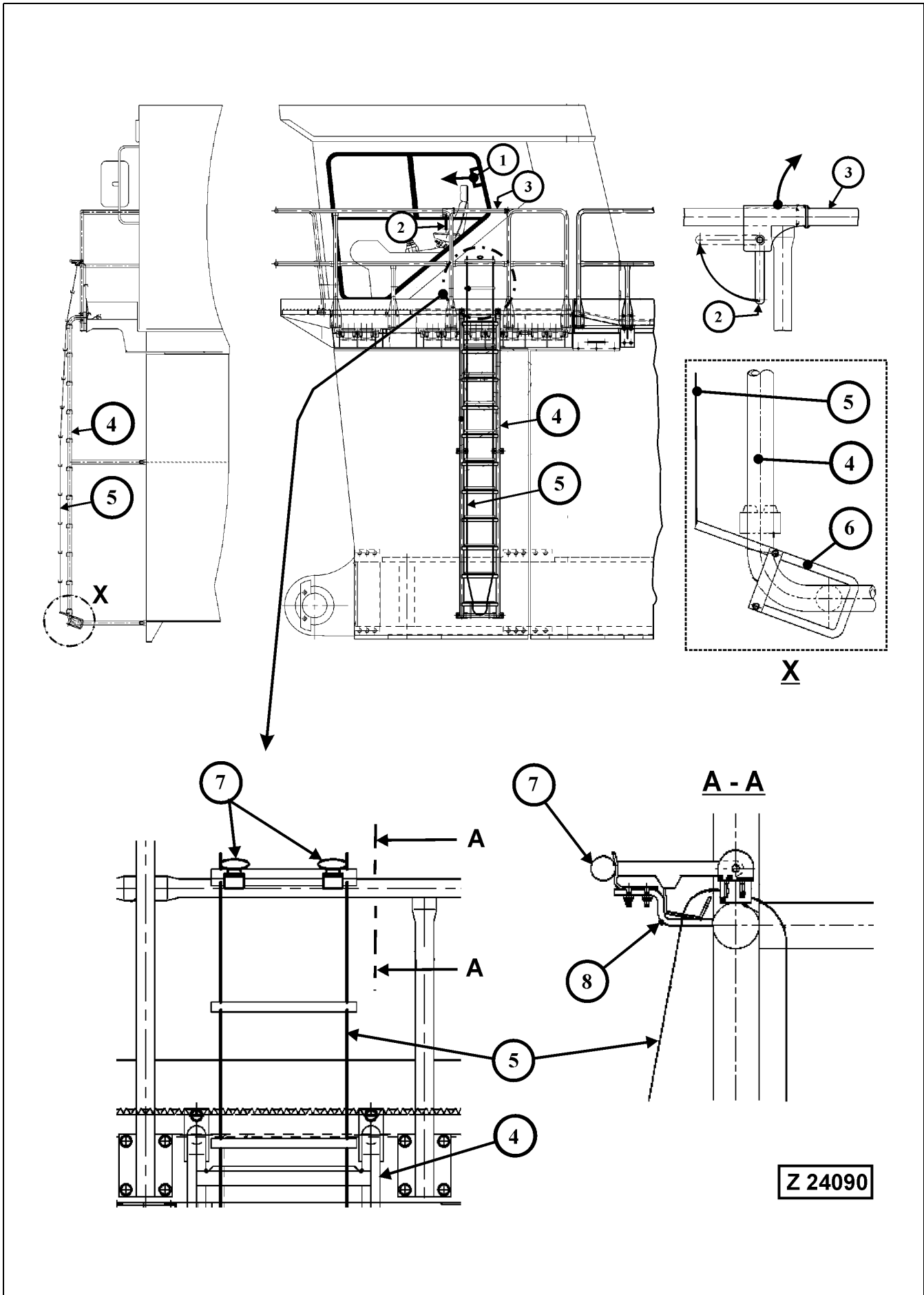
1. Open vent plug (13), illust. Z 22513 on the pump suction port of all six main pumps.
2. As soon as bubble free oil flows out, tighten the vent plug (13).
3. Open vent screw on secondary pumps (8 and 9), illustration Z 21171. Close vent screw as soon as bubble free oil flows out.
4. Open vent plug (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

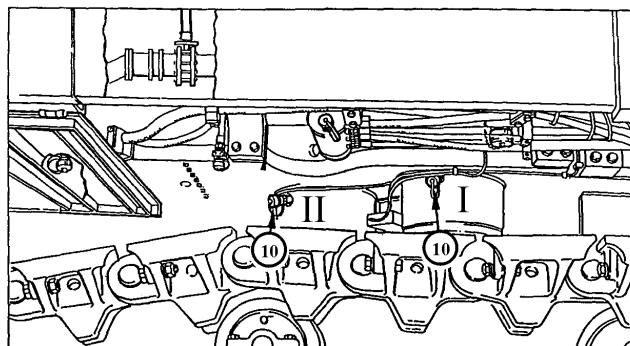
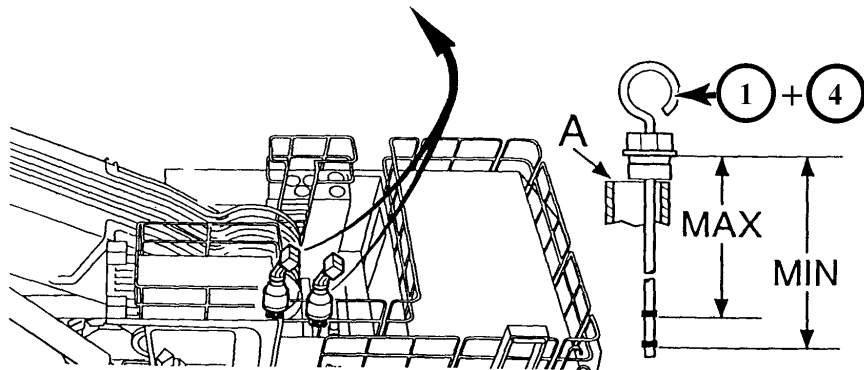
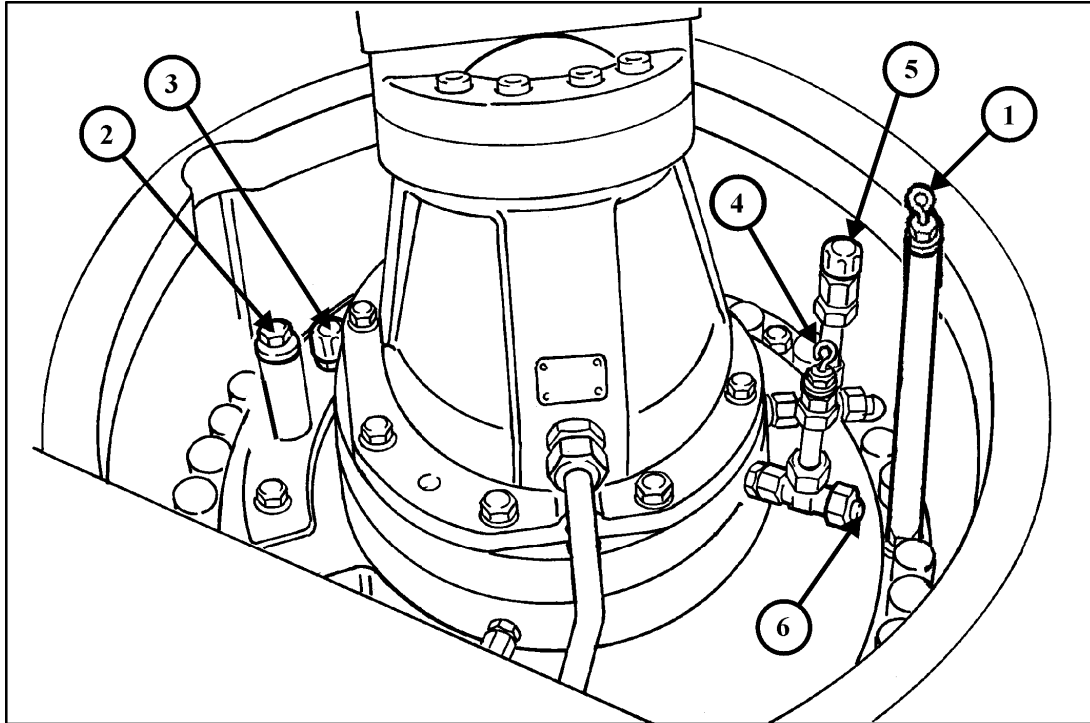
### Legend for illust. Z24090

- (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 22882

## 4.14.1 SWING GEARS AND MOTOR ADAPTER HOUSING - CHANGE OIL

### REMARK

The machine can be equipped either with a swing gear of manufacturer "L&S" or of manufacturer "Siebenhaar". Refer to the data plate on each swing gear housing to find out the manufacturer of the swing gear.

### Swing gear manufactured by "L&S"

#### Legend for illustration Z22882

##### Swing gears

- (A) Position of oil level gauge for checking the oil levels
- (1) Oil level gauge
- (2) Oil filler plug
- (3) Breather filter
- (10) Drain couplings or evacuation nozzles for Wiggins system

##### Motor Adapter Housing

- (4) Oil level gauge and filler opening. This opening can also be used for connecting a suction pump when changing the oil.
- (5) Breather filter
- (6) Oil drain plug

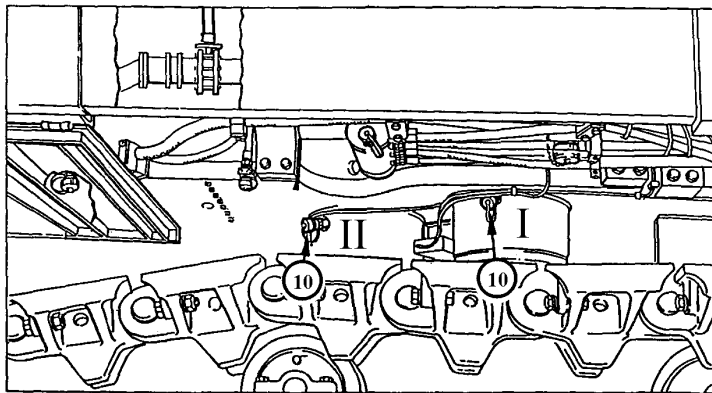
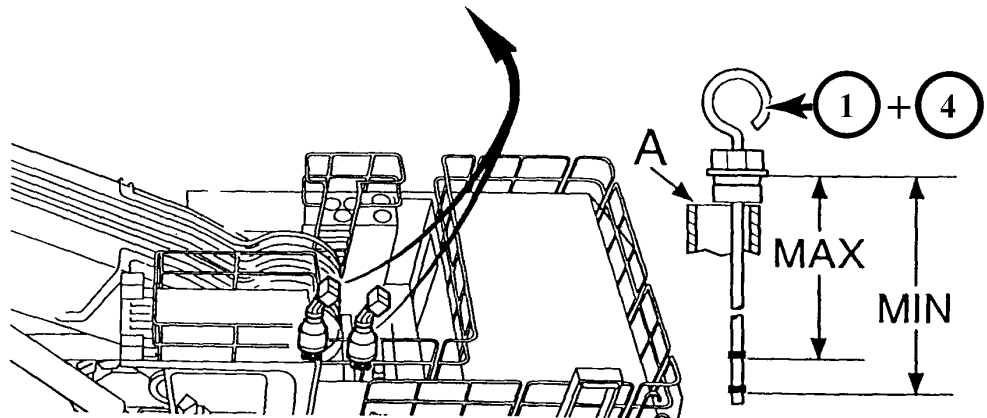
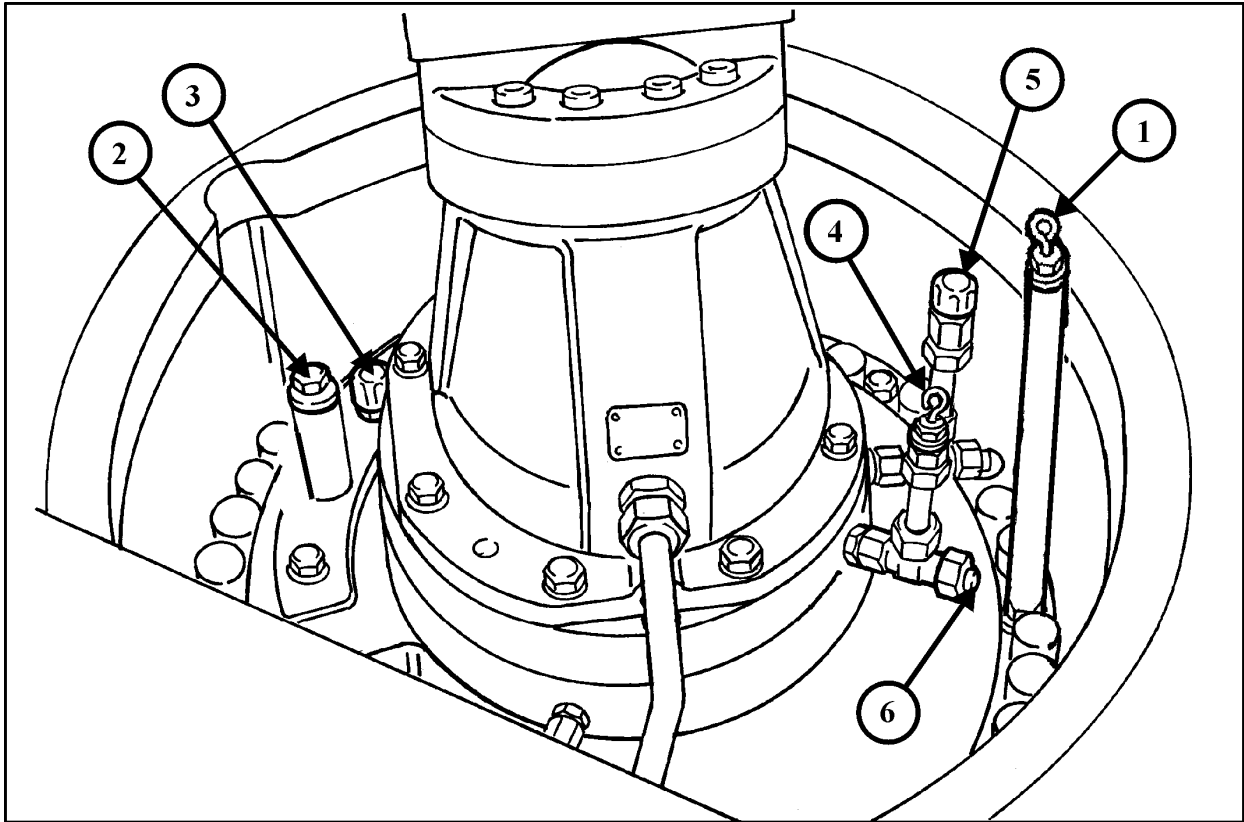
### Swing Gears, change oil:

1. Use adequate working platform for draining the oil. Place receptacles of sufficient capacity (approx. 100 liter) below drain couplings (10). Attach drain hose (part of tool set) to drain coupling (10). Remove parts (1, 2 and 3) to speed up draining. On swing gears with evacuation nozzle (10), use the Wiggins system for changing the oil.
2. Clean breather filter (3) 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 (10) and attach the protection cap onto the drain coupling.
5. Fill gear housing through filler opening (2) up to the "MAX" mark on level gauge (1) with fresh oil and re-install plug (2).

### NOTICE

**For checking the oil level insert the level gauge (1) but DO NOT screw in, see detail (A).**

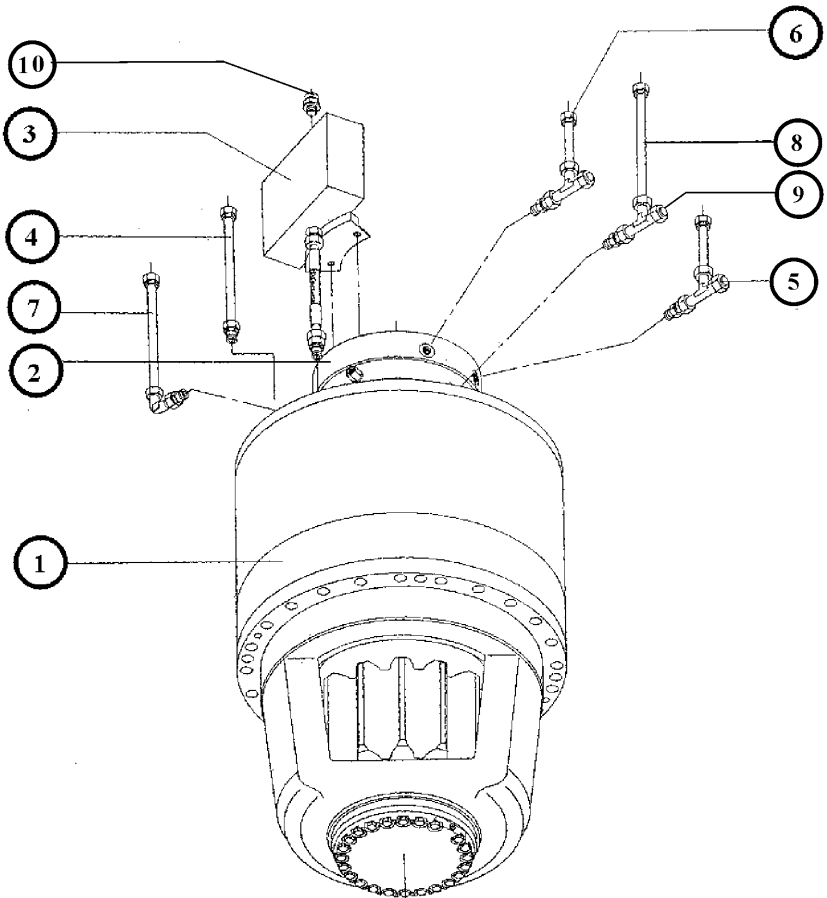
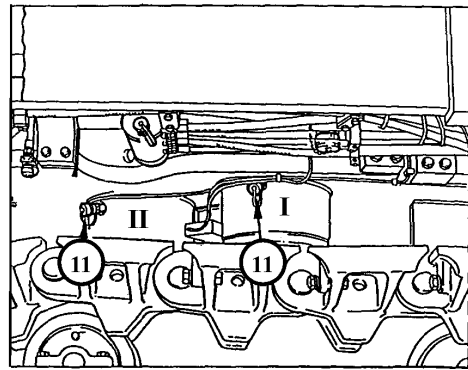
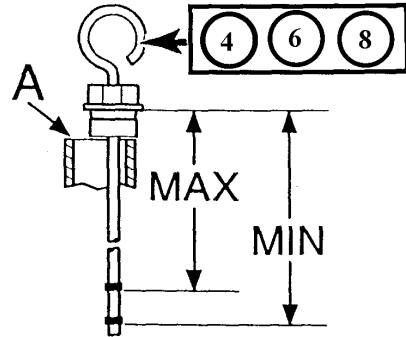
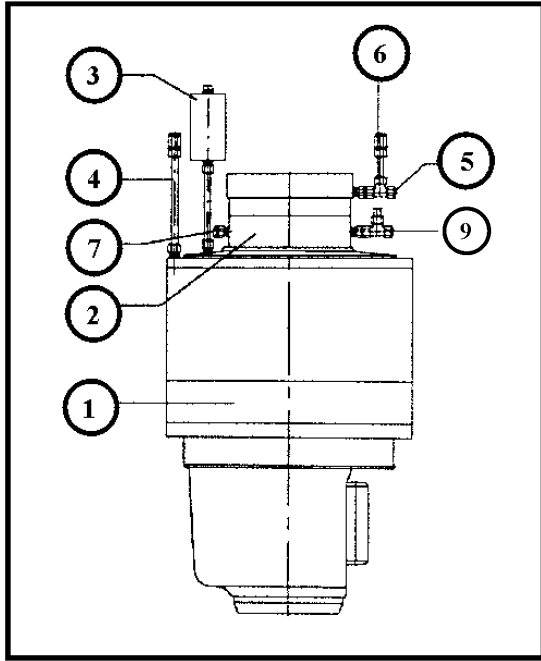
6. After short operating period check oil level and housings for leaks.



Z 22882

**Motor Adapter Housing, Change Oil:**

1. Remove level gauge (4) and breather filter (5). Insert the hose of a suction pump into the gauge pipe (4) until the hose end just touches the bottom of the T-union. Place the oil outlet hose of the suction pump into a receptacle. Switch on the pump and completely suck off the oil from the motor housing. If a suction pump is not available, place a receptacle below drain plug (6).  
Remove plug (6) and drain the oil completely.
2. Clean breather filter (5) with compressed air from inside to outside and re-install.
3. If removed, install drain plug (6) and fill-up gear oil through filler opening (4), up to the "MAX" mark on level gauge (4) and install the level gauge.
4. After short operating period check oil level and housing for leaks.



Z 24091

## **SWING GEAR MANUFACTURED BY "SIEBENHAAR"**

### **Legend for illustration Z24091**

- (A) Position of oil level gauge for checking the oil levels
- (1) Swing gear (RH and LH)
- (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

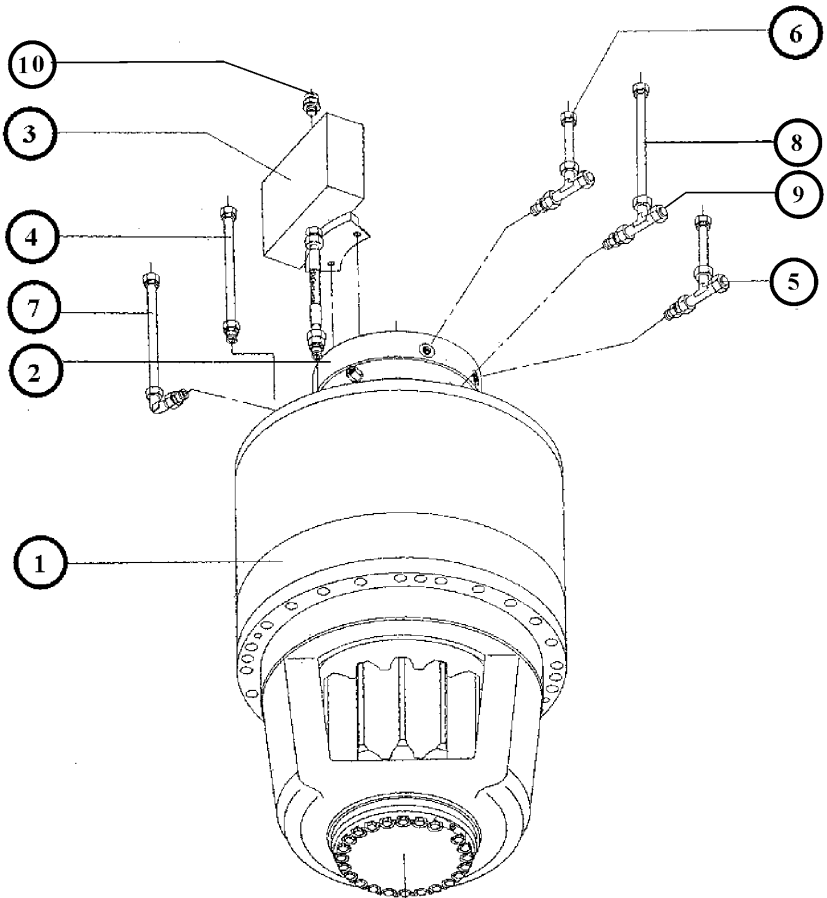
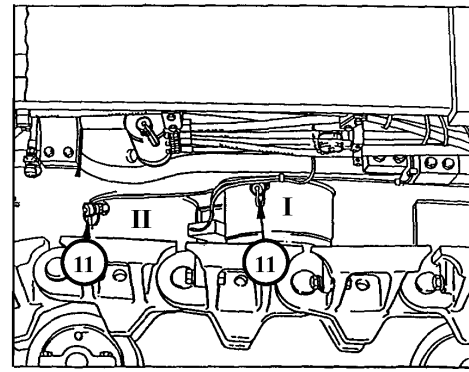
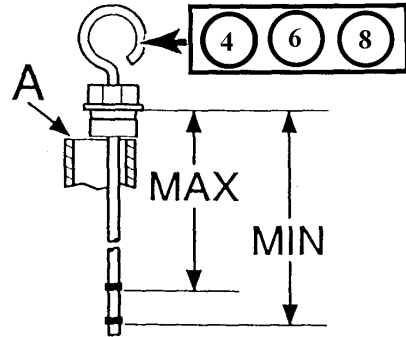
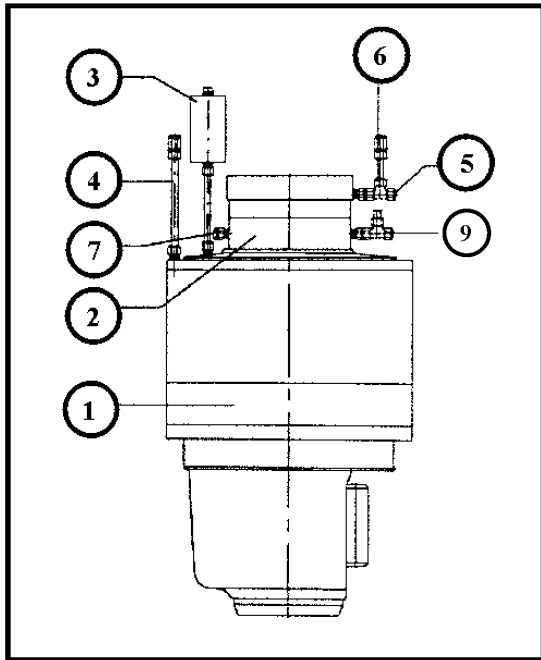
### **SWING GEAR - CHANGE OIL (SIEBENHAAR)**

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 opening up to the "MAX" mark on level gauge (4) with fresh oil and re-install oil filler plug.

#### **NOTICE**

**For checking the oil level insert the level gauge (4) but DO NOT screw in, see detail (A).**

6. After short operating period check oil level and housings for leaks.



Z 24091



**Brake Housing - Change Oil (Siebenhaar)**

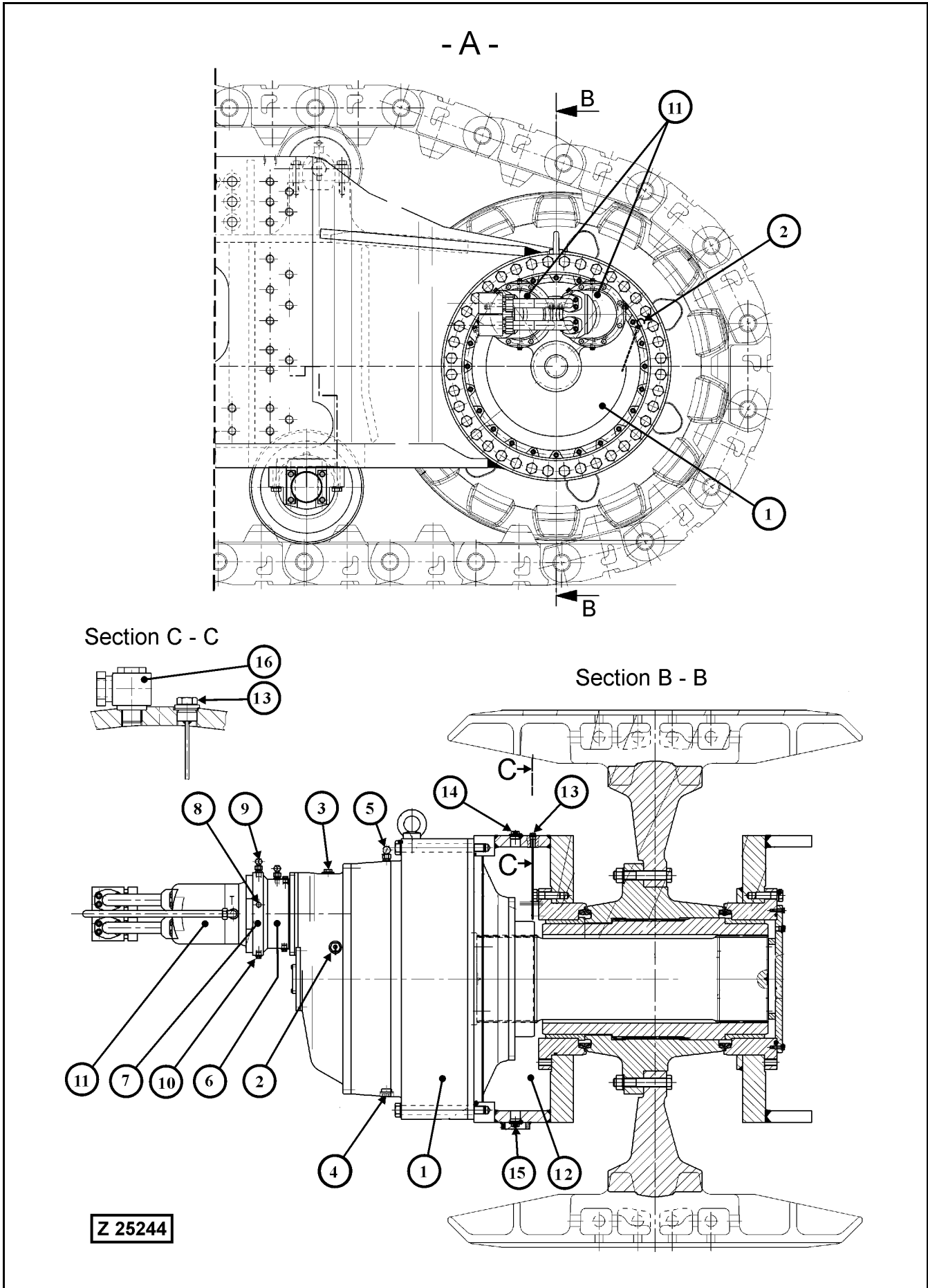
1. Remove level gauge (8), illustration Z24091, drain plug (9) and breather filter (7). Drain the oil into a receptacle of approx. 5 liter capacity.
2. Clean breather filter (7) with compressed air from inside to outside and re-install.
3. Install drain plug (9) and fill-up engine or hydraulic oil through filler opening, up to the "MAX" mark on level gauge (8) and install the level gauge.
4. After short operating period check oil level and housing for leaks.

**NOTICE**

**Be sure to fill the brake housing and motor adapter housing with engine oil or hydraulic oil as specified on page 301.**

**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 or hydraulic oil through filler opening, up to the "MAX" mark on level gauge (6) and install the level gauge.
3. After short operating period check oil level and housing for leaks.



## 4.14.2 TRAVEL GEARS, MOTOR ADAPTER HOUSINGS AND FINAL DRIVES CHANGE OIL

### Legend for illustration Z25244

- A - View of the RH Final drive. The configuration of the LH Final drive is the same.

**(1) Travel gear**

(2) Oil level gauge

(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 343.

(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 343. The port of connector (9) is also used as oil filler opening.

(10) Oil drain plug

(11) Hydraulic motors

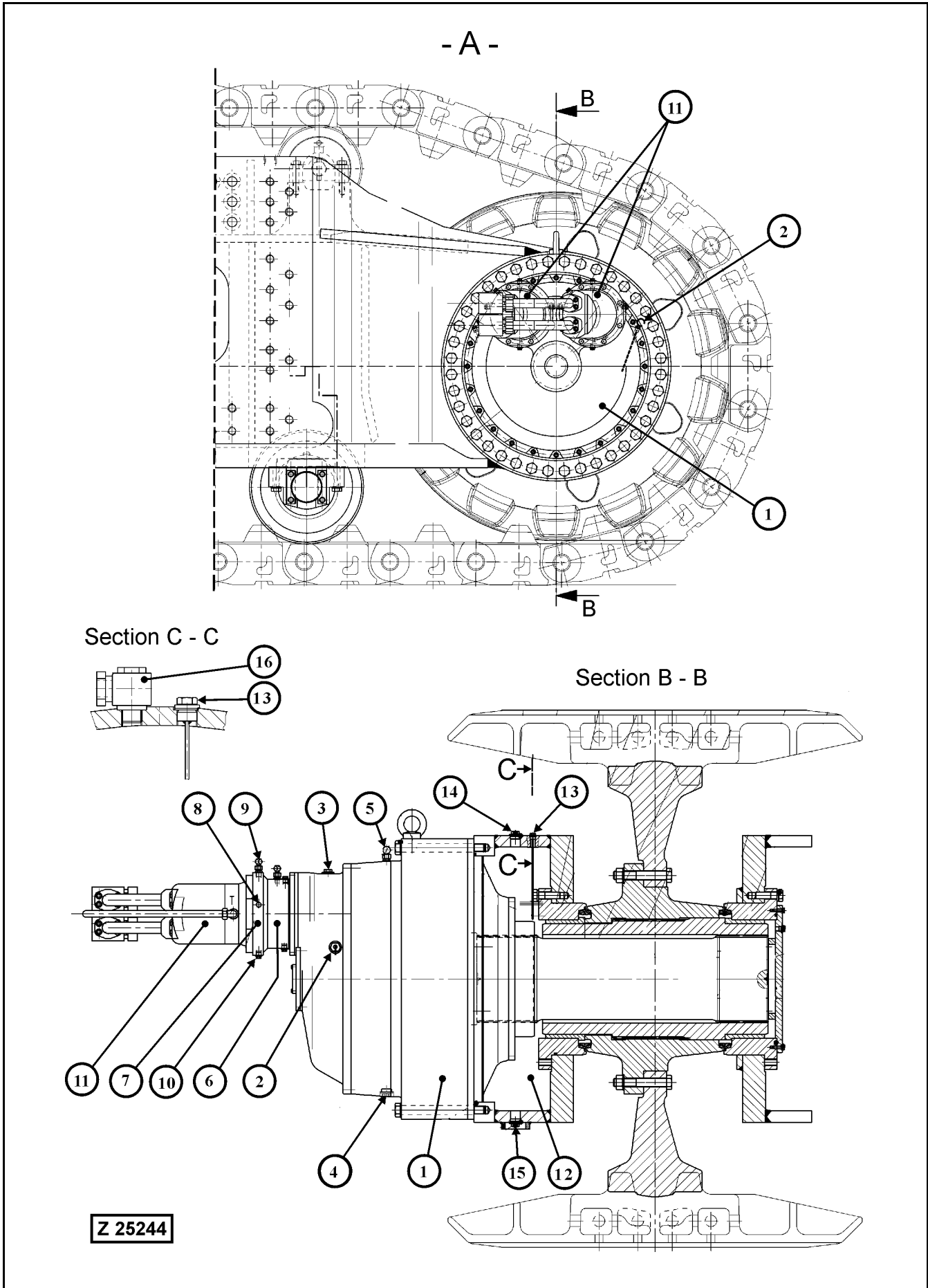
**(12) Final drive housing contains the lubricating oil for sprocket bearing lubrication.**

(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 343.



## **TRAVEL GEARS - CHANGE OIL**

Illustration Z25244:

### **REMARK**

The breather filters for the travel gears are mounted inside the center frame and connected with extension hoses.

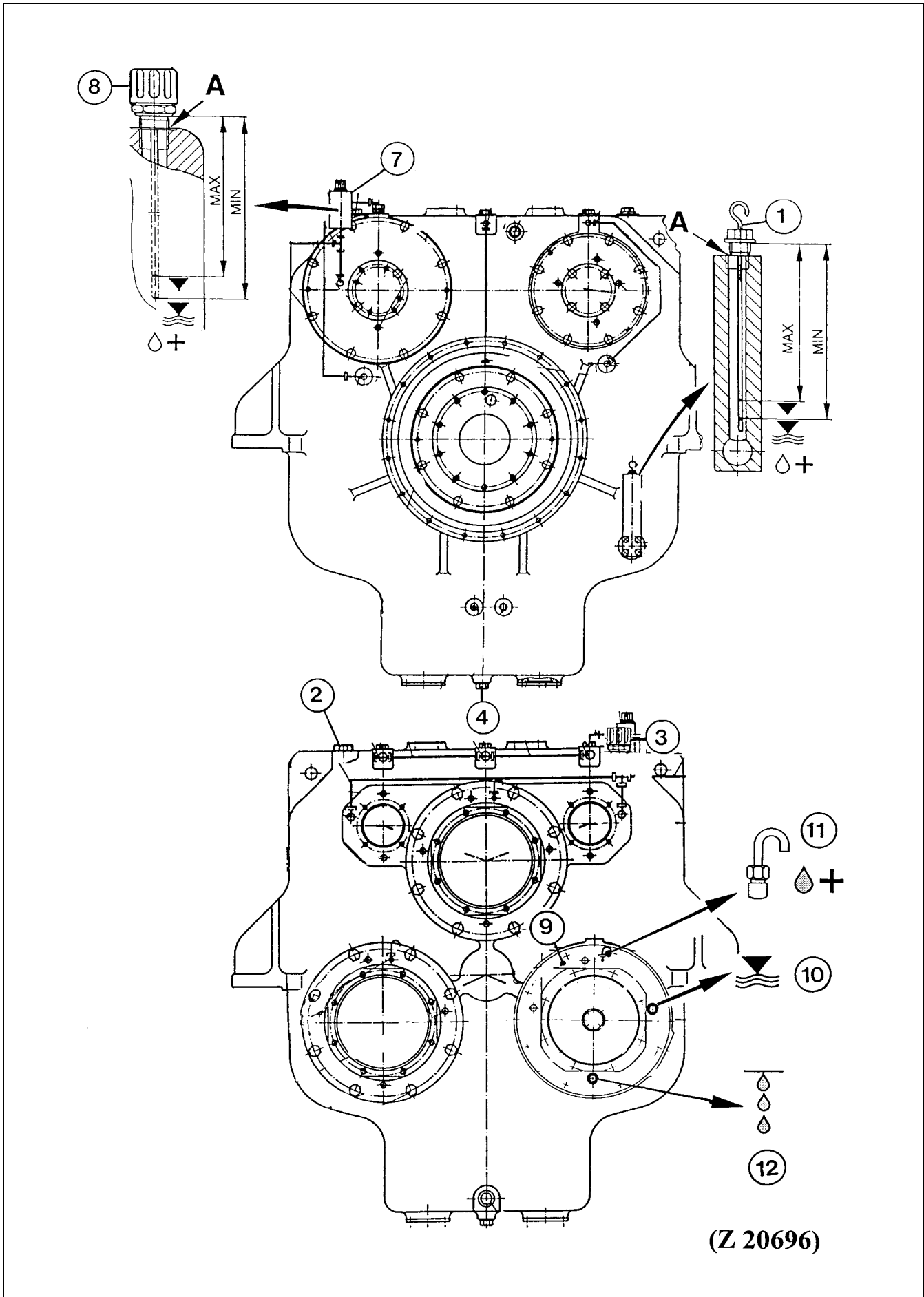
1. Remove drain plugs (4), filler plug (3) and oil level gauge (2). Check breather filter, mounted inside center frame, and clean as necessary.
2. After the oil is completely drained, flush the gear with the regular gear oil and reinstall drain plugs (4).
3. Fill the gear with fresh oil through filler opening (3) up to the Max mark on oil level gauge (2).
4. Install filler plug (3) and gauge (2).
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

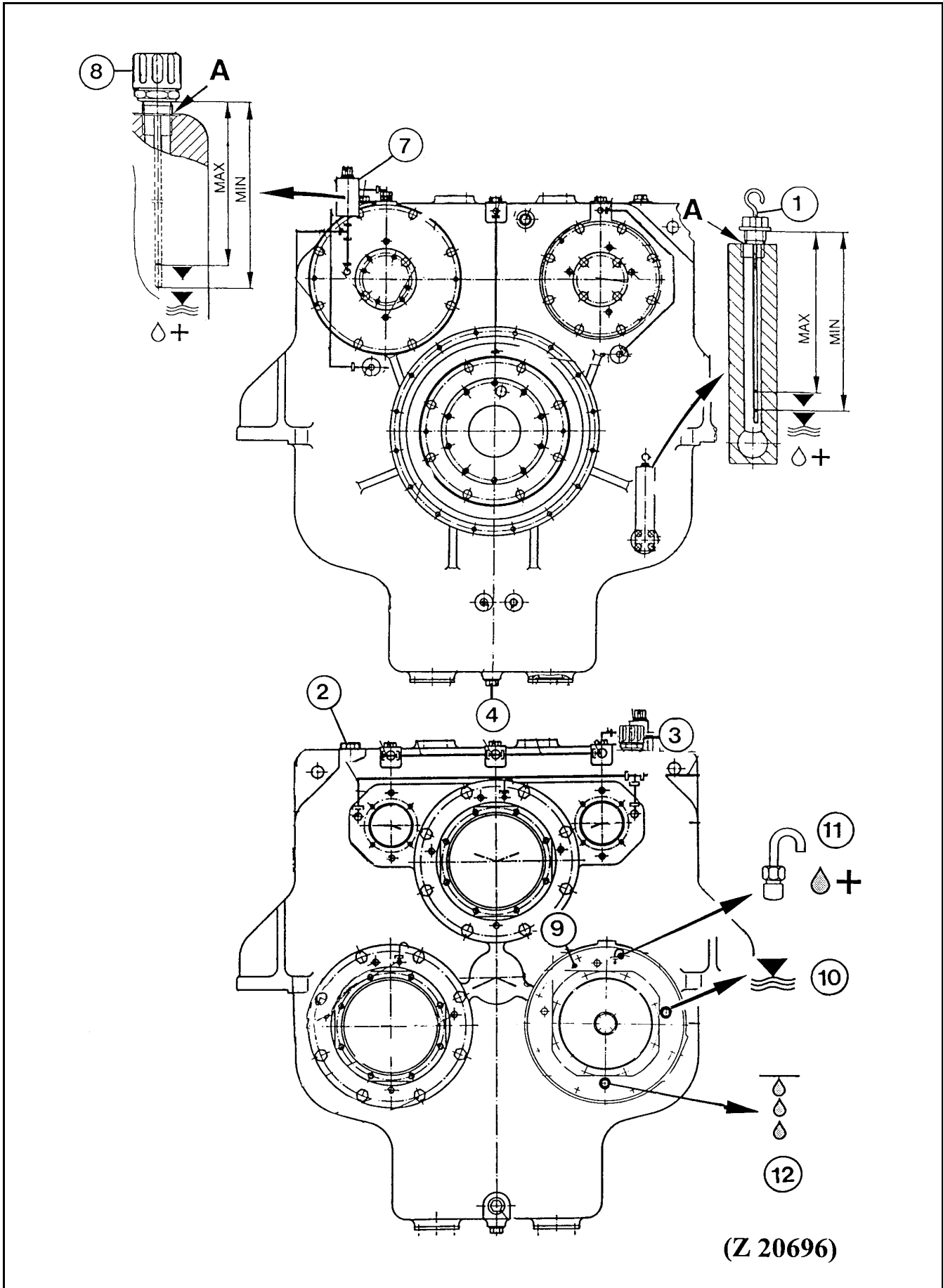
Select gear oil viscosity grade according to ambient temperatures.

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 88 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).**





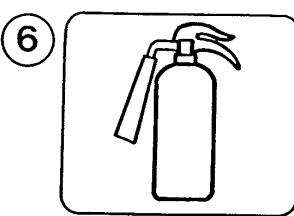
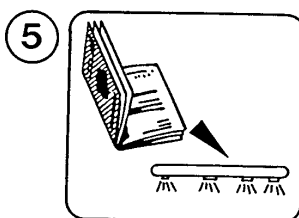
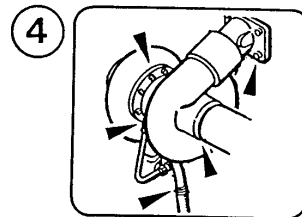
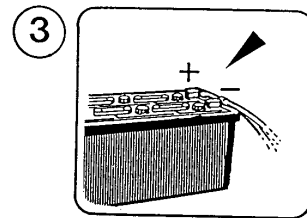
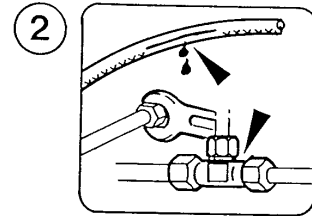
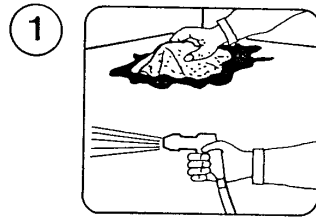
**Change the Oil**

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 278.
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 by means of a steam jet.
2. Clean motor compartment, hydraulic pump compartment and service platform of the superstructure.  
Thereafter check 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

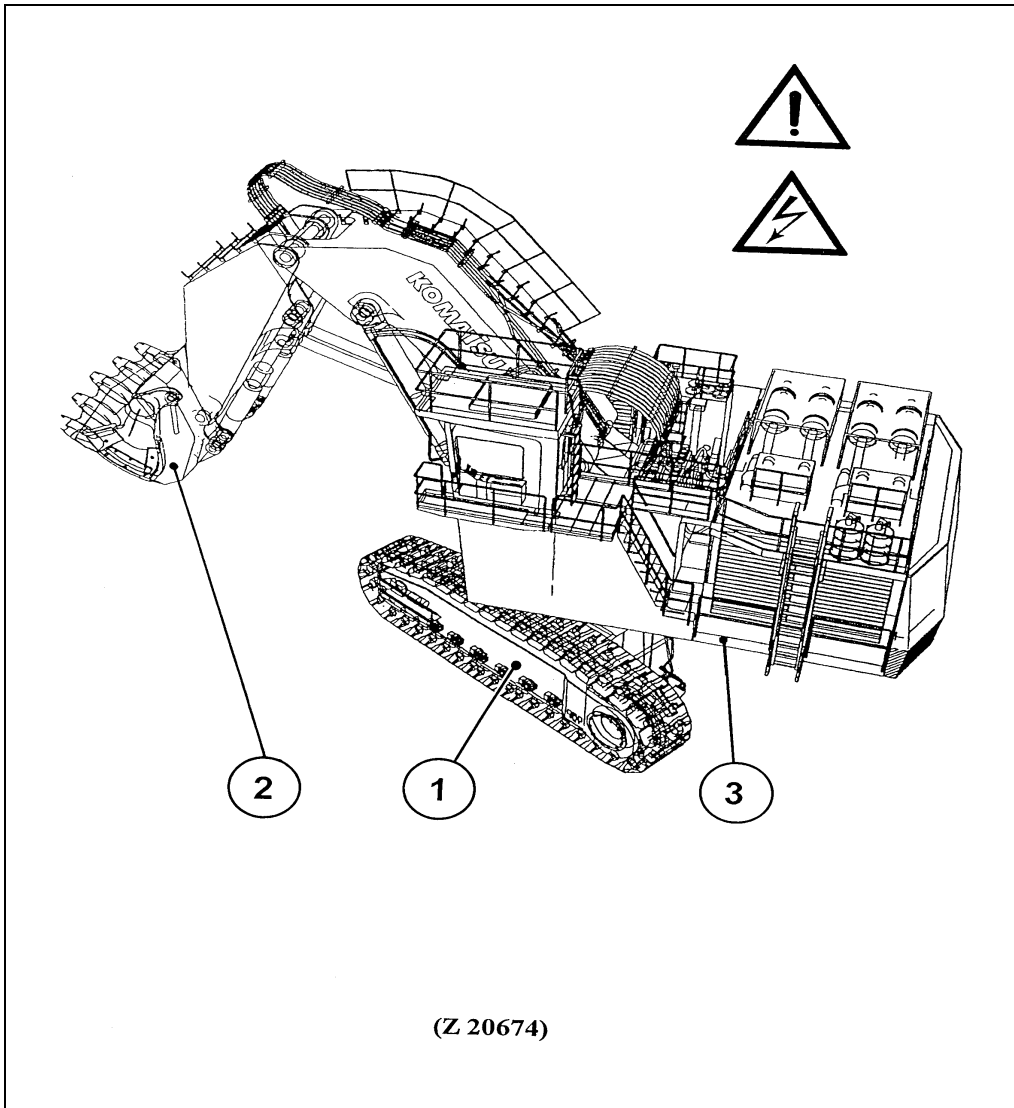
**When cleaning the power house take care the heat detection sensors do not come in contact with hot steam or other hot agent. Otherwise the fire suppression system may be triggered.**

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

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**⚠ WARNING**

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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.

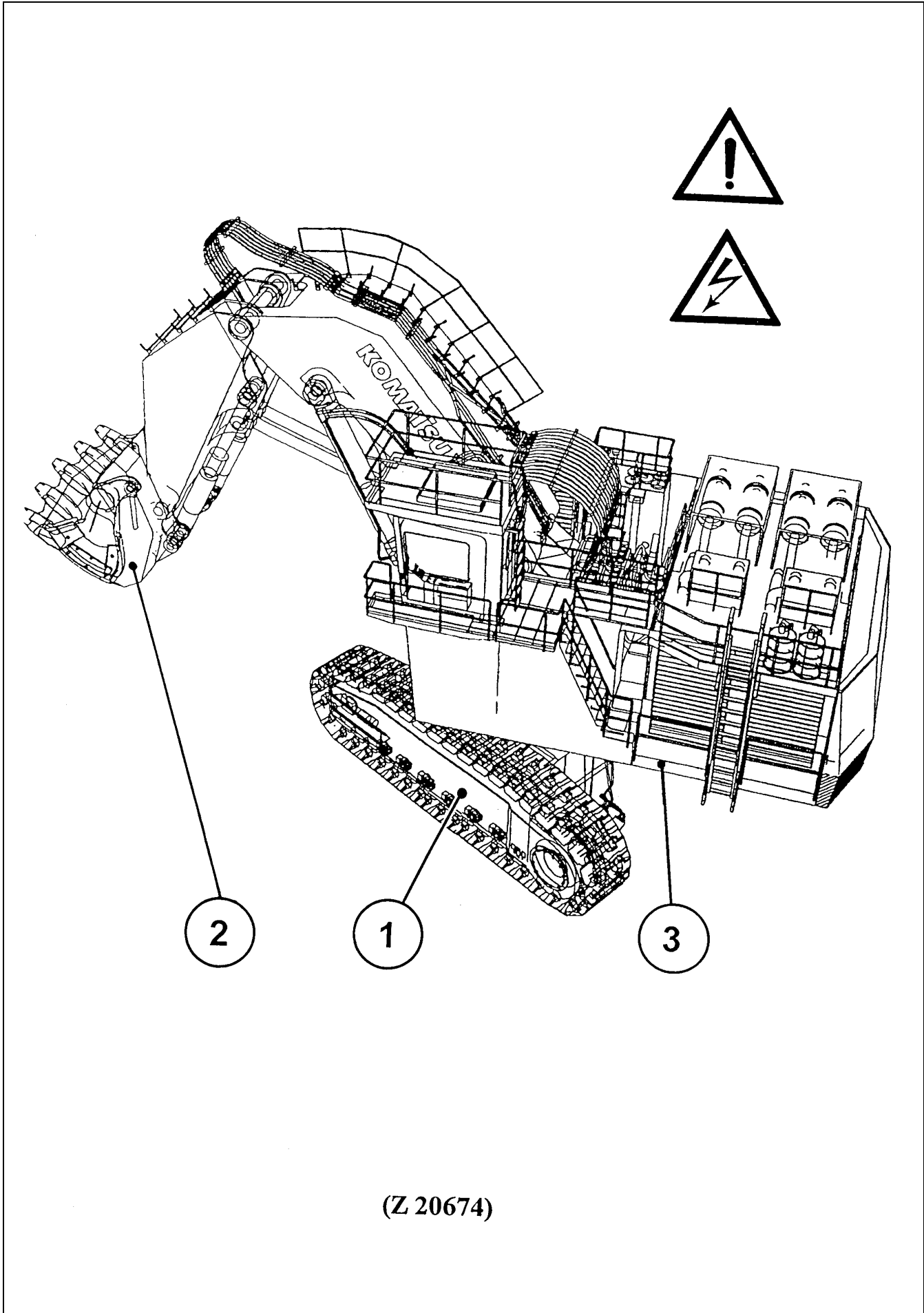
Follow the instructions given in **PARTS & SERVICE NEWS No. AH04518** for expelling the gases from the counterweight chambers.

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### Legend for illustration Z 20674

- (1) Undercarriage, refer to page 491 for protective measures.
- (2) Loader attachment, refer to page 493 for protective measures.
- (3) Superstructure, refer to page 495 for protective measures.



(Z 20674)

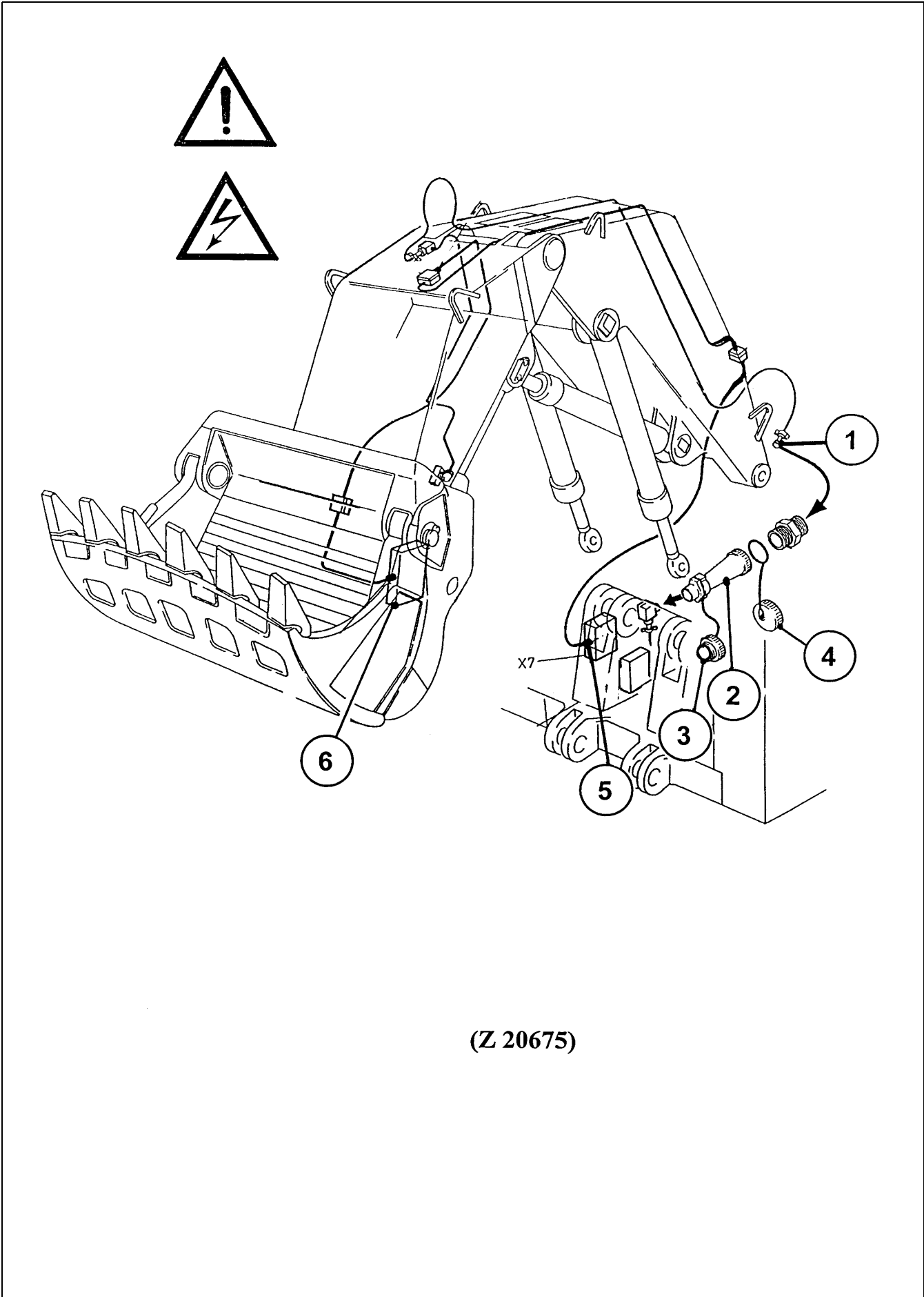
### **4.16.1 PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE UNDERCARRIAGE**

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.





## 4.16.2 PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE LOADER ATTACHMENT

### Legend for illustration Z 20675

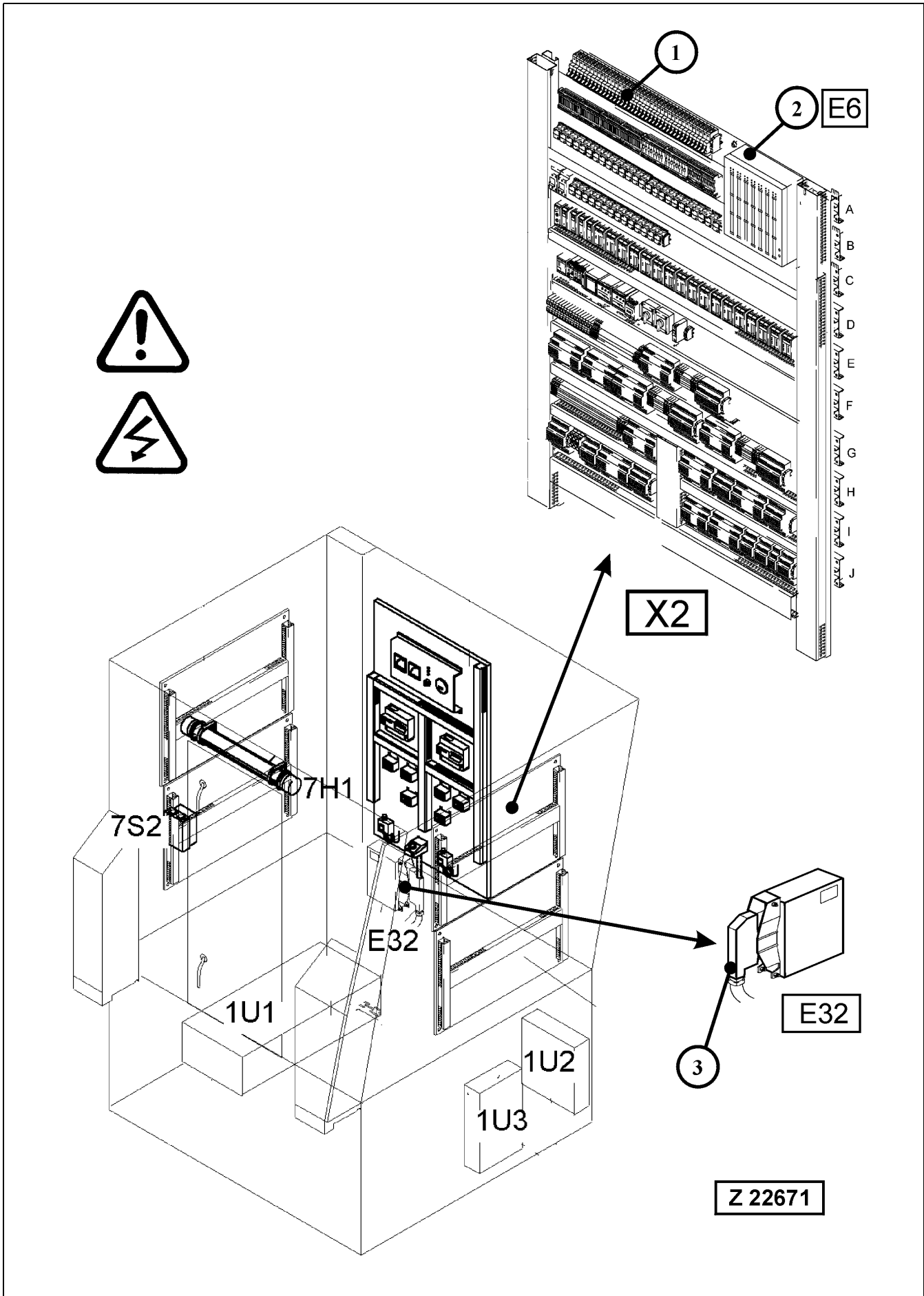
- (1) Electrical cable connector of the end-line pressure switch for the central lubrication system
- (2) Plug socket
- (3) Protection cap for (2)
- (4) Protection cap for (1)
- (5) Switch box of the electronic bucket levelling system "EBL", (Special Equipment)
- (6) Bucket position detector box for 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

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**⚠ WARNING**

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Weld repair procedures on the superstructure require special preventive measures to avoid damage to electric and electronic components. Isolation of the electrical and electronic systems of the shovel has to be carried out by authorized Electricians with special knowledge of the equipment. The weld repair job should be carried out by skilled welders only. It is advisable to contact your local Komatsu Service Station for support prior to start weld repairs on the superstructure.

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- Switch of battery main switches.

#### Components in the cab base, illustration Z 22671

1. Switch off all circuit breakers (1) on switch board "X2".
2. Disconnect all plugs on the programmable logic controller (2).
3. Remove the wiring harness connector (3) from electronic pump control module (E32).

### 4.16.4 AFTER FINISHING THE REPAIR WELDINGS ON THE SUPERSTRUCTURE

After finishing the weld repairs connect all cable connectors which have been disconnected. Switch on all circuit breakers. When all electrical connections are established insert the battery main switch keys.



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