

Operation & Maintenance Manual

PC3000-6

HYDRAULIC MINING SHOVEL

SERIAL NUMBER 06253

This material is proprietary to Komatsu Mining Germany GmbH and is not to be reproduced, used, or disclosed except in accordance with written authorization from Komatsu Mining Germany GmbH. It is our policy to improve our products whenever it is possible and practical to do so. We reserve the right to make changes or add improvements at any time without incurring any obligation to install such changes on products sold previously.

Due to this continuous program of research and development, periodic revisions may be made to this publication. It is recommended that customer contact their distributor for information on the latest revision.

November 2007

Copyright 2007

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

Komatsu Mining Germany GmbH

Service Information
Department 8151.40
P.O. Box 18 03 61
D - 40570 Düsseldorf
GERMANY

1.3 DESIGNATED USE OF THE SHOVEL

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

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

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

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

 **WARNING**

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

1.4 DELIVERY OF THE SHOVEL

The Shovel is being delivered disassembled into its main components.

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

⚠ WARNING

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

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

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

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

NOTICE

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

SPARE PARTS

For your spare part orders refer to the Parts Catalogue.

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

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

SERVICE

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

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

1.5 EXPLANATION OF ABBREVIATIONS

ABB.	Definition
A	Ampere
AC	Alternating Current
API	American Petroleum Institute
cSt	Centistoke
°C	Degree Celsius
CENTRY	Engine Electronic Control System
CLS	Central Lubrication System
DC	Direct Current
DIN	German Institute for Standardization
ETM	Electronic Text Monitoring System
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
MPG	Multi-Purpose Grease
N	Newton
Nm	Newton meter
PM	Planned Maintenance
ppm	parts per million
PRO	Protocol memory of the ETM
PTO	Power Take-Off (Pump Distributor Gear)
SAE	Society of Automotive Engineers
SLS	Swing circle pinion Lubrication System
STA	Statistics memory of ETM
V	Volt
1/min	Revolutions Per Minute (RPM)

1.6 TABLE OF CONTENTS

1. INTRODUCTION	3
1.1 CONTENTS OF THE BINDER	4
1.2 DIVISION OF THE BINDER	5
1.3 DESIGNATED USE OF THE SHOVEL	6
1.4 DELIVERY OF THE SHOVEL	7
1.5 EXPLANATION OF ABBREVIATIONS	8
1.6 TABLE OF CONTENTS	9
2. SAFETY	15
2.1 SAFETY INSTRUCTIONS	16
2.1.1 WARNINGS AND SYMBOLS	16
2.1.2 BASIC OPERATION AND DESIGNATED USE OF THE HYDRAULIC SHOVEL	16
2.1.3 ORGANIZATIONAL MEASURES	17
2.1.4 SELECTION AND QUALIFICATION OF PERSONNEL - BASIC RESPONSIBILITIES	19
2.1.5 SAFETY INSTRUCTIONS GOVERNING SPECIFIC OPERATIONAL PHASES	20
2.1.6 WARNING OF SPECIAL DANGERS	23
2.1.7 TRANSPORTING AND TOWING -RECOMMISSIONING	25
2.1.8 SPECIAL SAFETY EQUIPMENT	25
2.1.9 SAFETY HARNESS IN CONFORMITY WITH EN 361 (EUROPEAN STANDARD)	29
3. OPERATION	37
3.1 FOREWORD	38
3.2 CONSTRUCTION OF THE SHOVEL	39
3.2.1 OVERALL VIEW	39
3.2.2 UNDERCARRIAGE AND SUPERSTRUCTURE	40
3.2.3 HYDRAULICALLY OPERATED ACCESS LADDER	46
3.2.4 EMERGENCY ESCAPE LADDER	50
3.2.5 EMERGENCY ESCAPE LADDER AND ESCAPE HATCH IN THE MACHINERY HOUSE (SPECIAL EQUIPMENT)	52
3.2.6 EMERGENCY ENGINE SHUTDOWN FROM GROUND MAN OR OPERATOR WARNING SYSTEM	54
3.2.7 OPERATOR'S CAB WITH INTEGRATED FALLING OBJECT PROTECTIVE STRUCTURE (FOPS)	56
3.2.8 ENGINE OIL MANAGEMENT SYSTEM	64

3.3	OPERATOR'S CAB - CONTROLS	72
3.3.1	CONTROLS WITH BACKHOE ATTACHMENT	72
3.3.2	CONTROLS WITH BOTTOM DUMP BUCKET	76
3.3.3	OPERATOR'S CONSOLE	81
3.4	ELECTRONIC TEXT MONITORING SYSTEM ETM	88
3.4.1	INTRODUCTION	89
3.4.2	SYSTEM COMPONENTS	93
3.4.3	FUNCTIONS OF THE ETM SYSTEM	95
3.4.4	DISPLAY THE CONTENTS OF THE RECORD (PROTOCOL) MEMORY	99
3.4.5	SEVERAL MESSAGE CONDITIONS OCCUR AT THE SAME TIME	111
3.4.6	SETTINGS OF THE TEXT DISPLAY UNIT	113
3.5	OPERATING THE HEATER, VENTILATION AND AIR CONDITIONING	128
3.5.1	CONTROL MODULE FOR AUXILIARY CAB HEATER (IF SO EQUIPPED)	133
3.5.2	AUXILIARY HEATER FOR OPERATORS CAB (IF SO EQUIPPED)	135
3.5.3	AUXILLIARY HEATER FOR OPERATORS CAB (IF SO EQUIPPED)	137
3.5.4	FUEL PUMP ARRANGEMENT	139
3.6	MACHINERY HOUSE	140
3.6.1	EMERGENCY ENGINE SHUTDOWN SWITCHES	141
3.7	ELECTRICAL EQUIPMENT IN CAB BASE	142
3.7.1	SWITCH BOX (X2) IN CAB BASE	147
3.7.2	COMPONENTS OF ELECTRICAL PREHEATING SYSTEM IN CAB BASE	151
3.8	PREHEATING SYSTEMS	156
3.8.1	FOR OIL, COOLANT AND BATTERIES	156
3.8.2	HEATERS FOR MACHINERY HOUSE (SPECIAL EQUIPMENT)	162
3.9	CHECKS BEFORE STARTING THE ENGINE	164
3.10	STARTING THE ENGINE	170
3.10.1	STARTING PROCEDURE	171
3.10.2	STARTING PROCEDURE AT AMBIENT TEMPERATURE UP TO -25°	173
3.11	MOVING THE SHOVEL	182
3.11.1	TRAVEL CONTROL WITH FOOT PEDALS	182
3.11.2	TRAVELLING INSTRUCTIONS	185
3.12	SLEWING AND BRAKING THE SUPERSTRUCTURE	186
3.12.1	SLEWING THE SUPERSTRUCTURE	186
3.13	WORKING WITH THE ATTACHMENT	189
3.13.1	MACHINES EQUIPPED WITH"EURO" CONTROL SYSTEM	189
3.13.2	MACHINES EQUIPPED WITH"KMG" CONTROL SYSTEM	190
3.13.3	BOTTOM DUMP BUCKET	191
3.13.4	DROP BALL OPERATION	192
3.13.5	COMBINED OPERATION CYCLES	195

3.14	WORKING INSTRUCTIONS	197
3.14.1	STABILITY OF THE SHOVEL	197
3.14.2	SHOVEL OPERATION	197
3.15	PARKING THE SHOVEL	200
3.16	STOPPING THE ENGINE	202
3.16.1	RELIEVE PRESSURE IN THE HYDRAULIC SYSTEM	205
3.17	AUTOMATIC LUBRICATION SYSTEMS	206
3.17.1	OPERATION OF THE AUTOMATIC LUBRICATION SYSTEMS	207
3.18	FIRE DETECTION AND SUPPRESSION SYSTEM	210
3.18.1	HIGH LEVEL ALARM "FIRE"	213
3.18.2	ENGINE SHUT-DOWN THROUGH FUEL SHUT-OFF SOLENOID VALVE	213
3.18.3	ACTUATION MODES OF THE FIRE SUPPRESSION SYSTEM	213
3.18.4	INDICATION OF OPERATIONAL MODES AT CONTROL MODULE, AFTER AUTOMATIC ACTUATION OF THE FIRE SUPPRESSION SYSTEM	215
3.18.5	LOCATION OF THE EXTINGUISHING AGENT TANK ASSEMBLIES AND EXPELLANT GAS CARTRIDGES ON POWER HOUSE ROOF	217
3.19	CENTRAL REFILLING SYSTEM	218
3.19.1	SYSTEMS CONNECTED TO THE REFILLING SYSTEM	219
3.19.2	OPERATING THE HYDRAULIC SERVICE ARM	221
3.19.3	RECEIVER PANEL WITH MONITOR BOX	223
3.19.4	REFILLABLE GREASE CONTAINERS OF THE AUTOMATIC LUBRICATION SYSTEMS ... 227	
3.20	TRANSFER PUMP FOR HYDRAULIC OIL	228
3.20.1	OPERATING THE TRANSFER PUMP	229
3.20.2	FUNCTIONS OF THE TRANSFER PUMP	229
3.21	WORK ON THE LOADER ATTACHMENT	232
3.22	TRANSPORTATION AND LIFTING OF THE SHOVEL	233
3.22.1	DISASSEMBLING OF THE SHOVEL	233
3.22.2	TRANSPORTATION AND LIFTING	233
3.23	RETRIEVAL PROCEDURE	234
3.24	SHOVEL STORAGE	235
3.24.1	PREPARING FOR STORAGE	235
3.24.2	ONE MONTH REPETITIVE SERVICE PERIOD	236
3.24.3	SIX MONTH REPETITIVE SERVICE PERIOD	236
3.24.4	PREPARING FOR OPERATION	237
3.25	TROUBLE SHOOTING	238
3.25.1	ENGINE	238
3.25.2	HYDRAULIC SYSTEM	239
3.25.3	FINAL DRIVES AND SWING GEAR	240
3.25.4	CRAWLER TRACKS	240

4.	MAINTENANCE	241
4.1	FOREWORD	242
4.2	PRECAUTIONS FOR MAINTENANCE	243
4.3	FLUIDS AND LUBRICANTS	245
4.3.1	LUBRICANTS FOR OPERATION IN COLD AND ARCTIC CLIMATES	245
4.3.2	FLUIDS AND LUBRICANTS FOR MODERATE AND HOT CLIMATES	246
4.4	FILLING CAPACITIES	248
4.5	STANDARD TORQUE LIST	249
4.6	LUBRICATION AND MAINTENANCE SCHEDULE	250
4.6.1	INITIAL SERVICING	250
4.6.2	PERIODIC SERVICING INTERVALS	250
4.6.3	PERIODIC SERVICING SCHEDULE	251
4.6.4	PERIODIC REPLACEMENT OF SAFETY CRITICAL PARTS	257
4.6.5	EXTENDED SERVICE INTERVALS FOR ENGINES WITH ENGINE OIL MANAGEMENT SYSTEM	261
4.6.6	RESETTING THE ENGINE OIL BURNING SYSTEM CENTINEL	263
4.6.7	MAINTENANCE OF THE ENGINE	267
4.7	WHEN NECESSARY	268
4.7.1	ENGINE AIR CLEANER MAINTENANCE	269
4.7.2	SWING CIRCLE TOOTHING LUBRICATION	273
4.7.3	AUTOMATIC LUBRICATION SYSTEMS FILL GREASE CONTAINERS	275
4.7.4	TRACK ROLLERS AND GUIDE WHEELS - REPLACE FLOATING SEALS	279
4.7.5	COLD STARTING AID, REPLACE FLUID CYLINDER	281
4.8	EVERY 10 OPERATING HOURS OR DAILY	282
4.8.1	WALK - AROUND INSPECTION	283
4.8.2	AIR CLEANER - CLEAN PRE-CLEANER	295
4.8.3	RADIATOR - CHECK COOLANT LEVEL	297
4.8.4	TRACK GROUPS - CLEAN	297
4.8.5	FUEL SYSTEM WATER SEPARATOR - DRAIN WATER	299
4.9	EVERY 50 OPERATING HOURS OR WEEKLY	300
4.9.1	SWING GEAR AND MOTOR ADAPTER HOUSING - CHECK OIL LEVEL	301
4.9.2	TRAVEL GEARS, BRAKE HOUSINGS AND MOTOR ADAPTER HOUSINGS - CHECK OIL LEVELS	305
4.9.3	PTO (PUMP DISTRIBUTOR GEAR) - CHECK OIL LEVEL	309
4.9.4	HYDRAULIC ACCESS LADDER - CHECK SAFETY SENSOR	311
4.9.5	HYDRAULIC OIL COOLERS - INSPECT AND CLEAN IF NECESSARY	313
4.10	EVERY 250 OPERATING HOURS OR MONTHLY	314
4.10.1	AIR CONDITIONING COMPRESSOR - CHECK DRIVE BELT TENSION	315
4.10.2	RADIATOR FAN BELT AND AUTOMATIC BELT TENSIONER - MAINTENANCE CHECK ..	317
4.10.3	GENERATOR - CHECK BELT TENSION	321

4.10.4	SIGNAL HORN COMPRESSOR - LUBRICATE	323
4.10.5	HYDRAULIC OIL COOLER FAN - CHECK CONDITION AND FASTENING	323
4.10.6	AUTOMATIC LUBRICATION SYSTEMS - CLEAN IN-LINE GREASE FILTER AND CHECK BREATHING FILTER	325
4.10.7	CAB AIR CLEANER - CLEAN OR REPLACE FILTER ELEMENT	329
4.10.8	WINDSHIELD WASHER RESERVOIR - CHECK FLUID LEVEL	331
4.10.9	AIR CONDITIONING FOR OPERATOR'S CAB - CHECK REFRIGERANT LEVEL	331
4.11	EVERY 500 OPERATING HOURS OR MONTHLY	332
4.11.1	BATTERIES - CHECK FLUID LEVEL	333
4.11.2	FLEXIBLE DRIVE COUPLING - CHECK OIL LEVEL	335
4.11.3	FUEL TANK - DRAIN CONDENSATION	337
4.11.4	CRAWLER TRACK - INSPECTION	339
4.12	EVERY 1000 OPERATING HOURS OR EVERY 6 MONTH	344
4.12.1	HIGH STRENGTH BOLT CONNECTIONS - CHECK TORQUE LOAD	345
4.12.2	HYDRAULIC SYSTEM - FILTER SERVICE	377
4.12.3	PTO (PUMP DISTRIBUTOR GEAR), SWING GEAR AND TRAVEL GEARS - OIL SAMPLE ANALYSIS	391
4.12.4	SIGNAL HORN COMPRESSOR - CLEAN AND LUBRICATE	393
4.12.5	HYDRAULIC TRACK TENSIONING SYSTEM - CHECK PRESSURE ACCUMULATORS 395	
4.12.6	HYDRAULIC OIL COOLER - INSPECT AND LUBRICATE DOOR HINGES	397
4.12.7	MACHINERY HOUSE DOORS - INSPECT AND LUBRICATE DOOR HINGES	397
4.13	EVERY 2000 OPERATING HOURS OR YEARLY	398
4.13.1	HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER	399
4.13.2	EMERGENCY ESCAPE LADDER - INSPECTION	413
4.14	EVERY 3000 OPERATING HOURS HOWEVER AT LEAST ONCE A YEAR	414
4.14.1	SWING GEAR AND MOTOR ADAPTER HOUSING - CHANGE OIL	415
4.14.2	TRAVEL GEARS, BRAKE AND MOTOR ADAPTER HOUSINGS - CHANGE OIL	423
4.14.3	PTO (PUMP DISTRIBUTOR GEAR) - CHANGE OIL	427
4.15	FIRE PREVENTION	430
4.16	WELD REPAIRS	432
4.16.1	PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE UNDERCARRIAGE	435
4.16.2	PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE LOADER ATTACHMENT	437
4.16.3	PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE SUPERSTRUCTURE	439
4.16.4	AFTER FINISHING THE REPAIR WELDINGS ON THE SUPERSTRUCTURE	441

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.

-
- 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

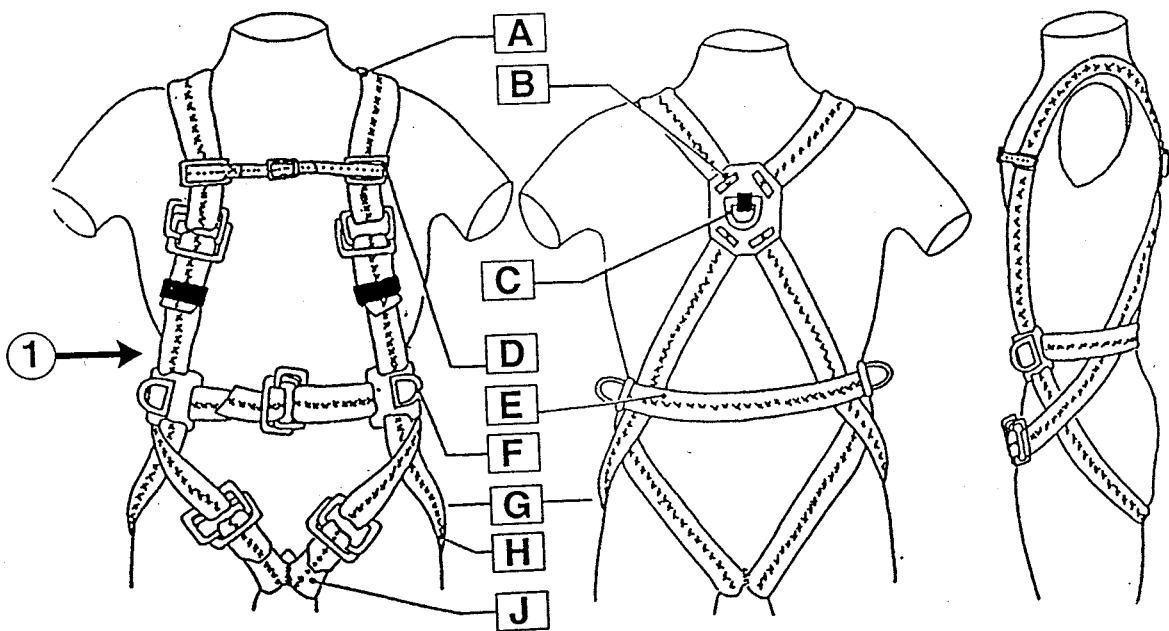
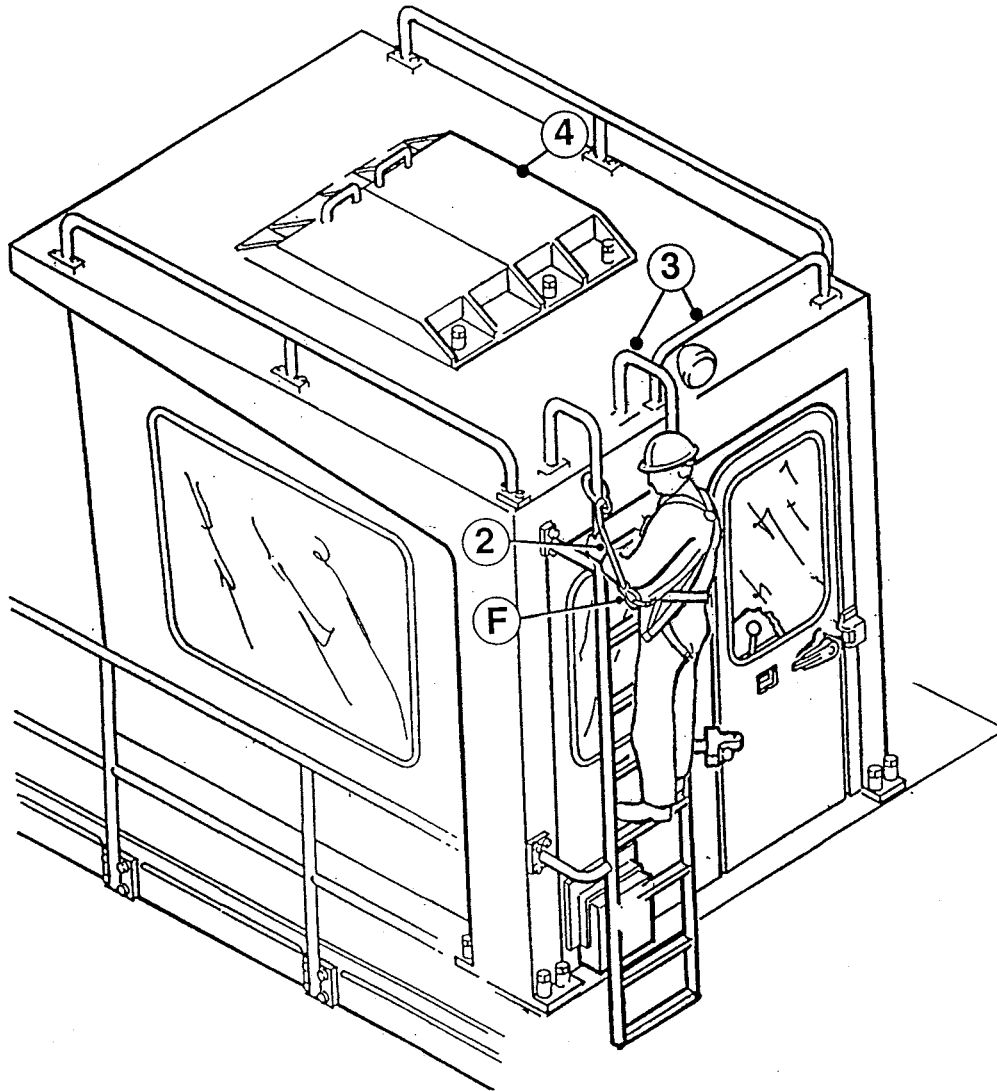
The Shovel can be retrofitted with a warning beacon which is fitted on the cab roof by means of a magnetic bracket.

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.

This page left intentionally blank



Z 20885

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

⚠ WARNING

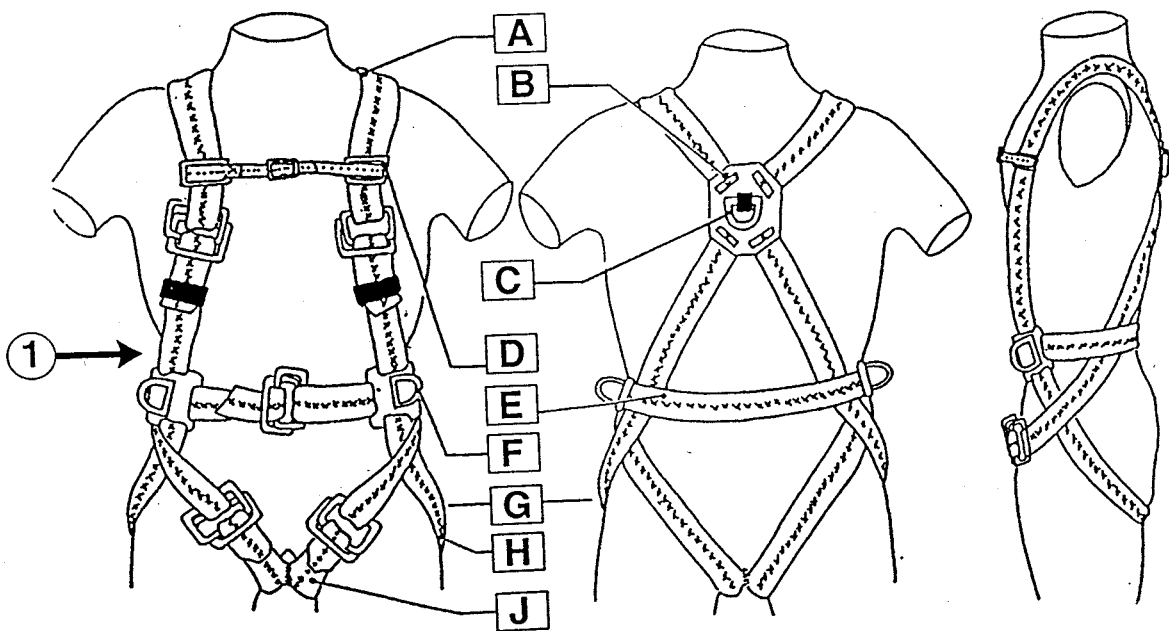
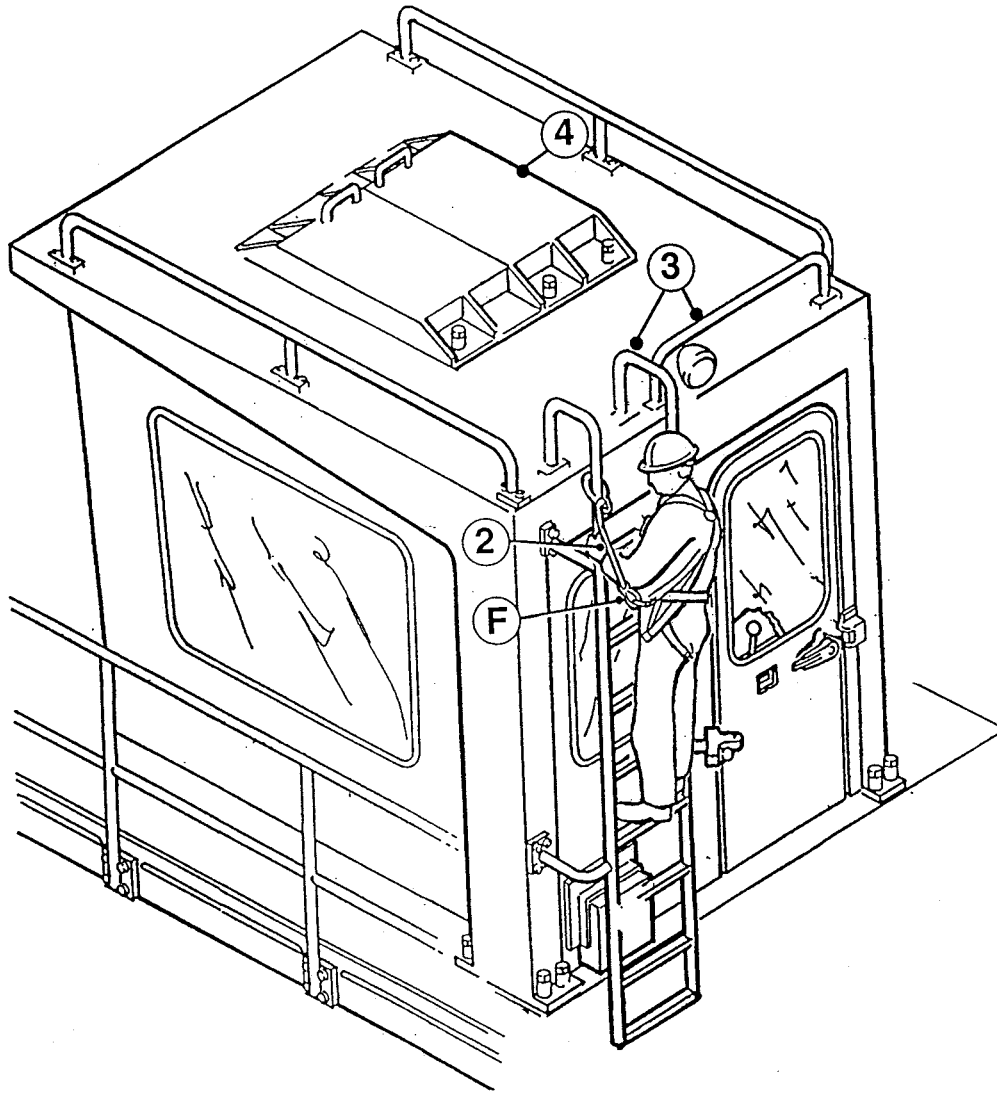
Always use the Safety Harness (1) in conjunction with strap type Fall Absorber (2), illust. (Z 20885) before mounting onto the loader attachment or other unsecured places of the Shovel.

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

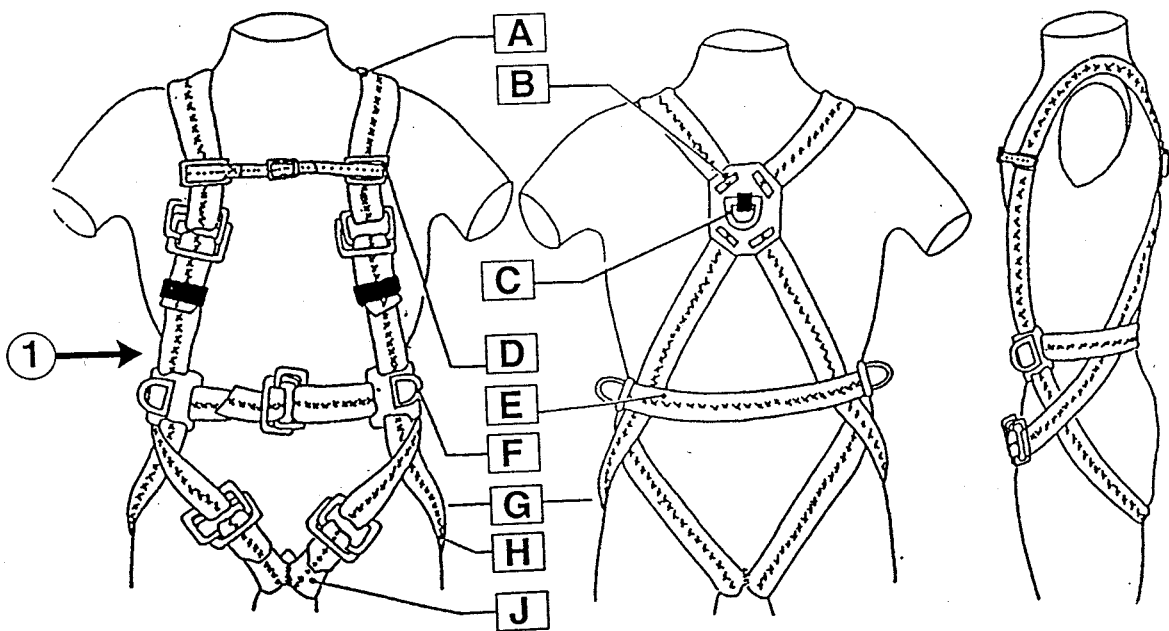
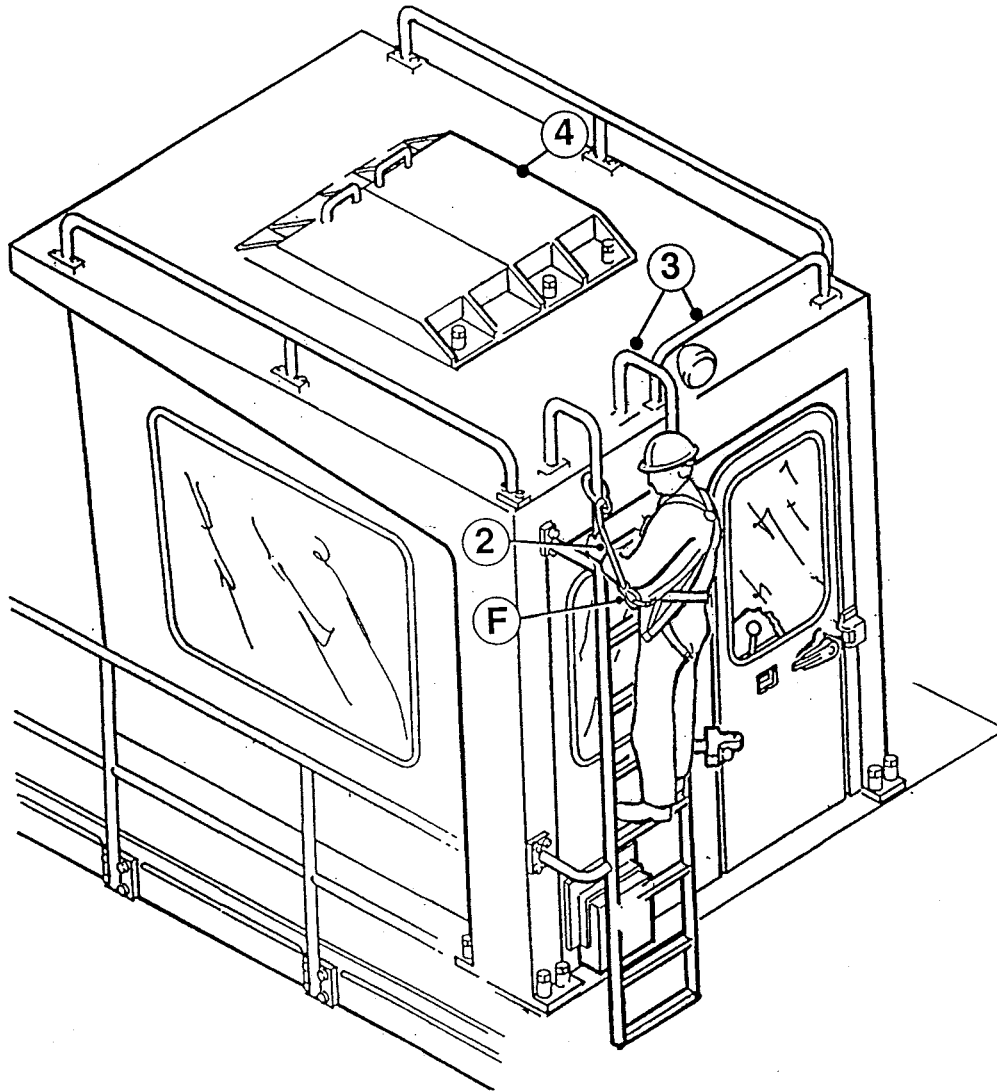
Open the lock, lift the harness by the catch hook (C), the blue straps (leg straps J) are below. The harness is being put on just like a jacket. Pull the belly strap (E) through the lock, as shown on the illustration, and secure it.

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.

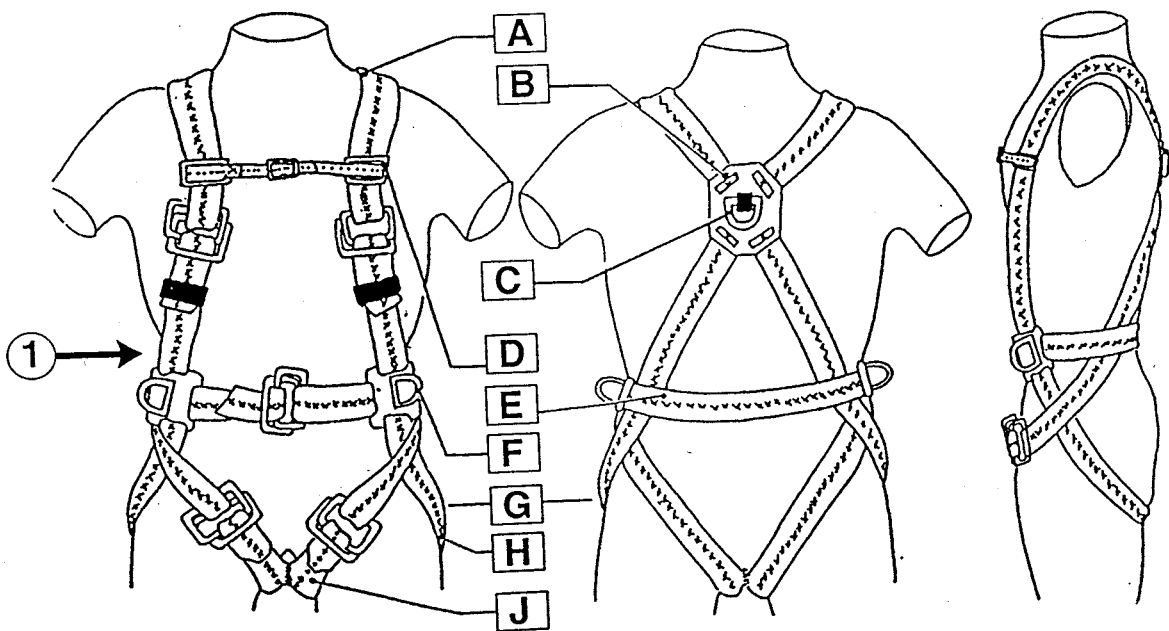
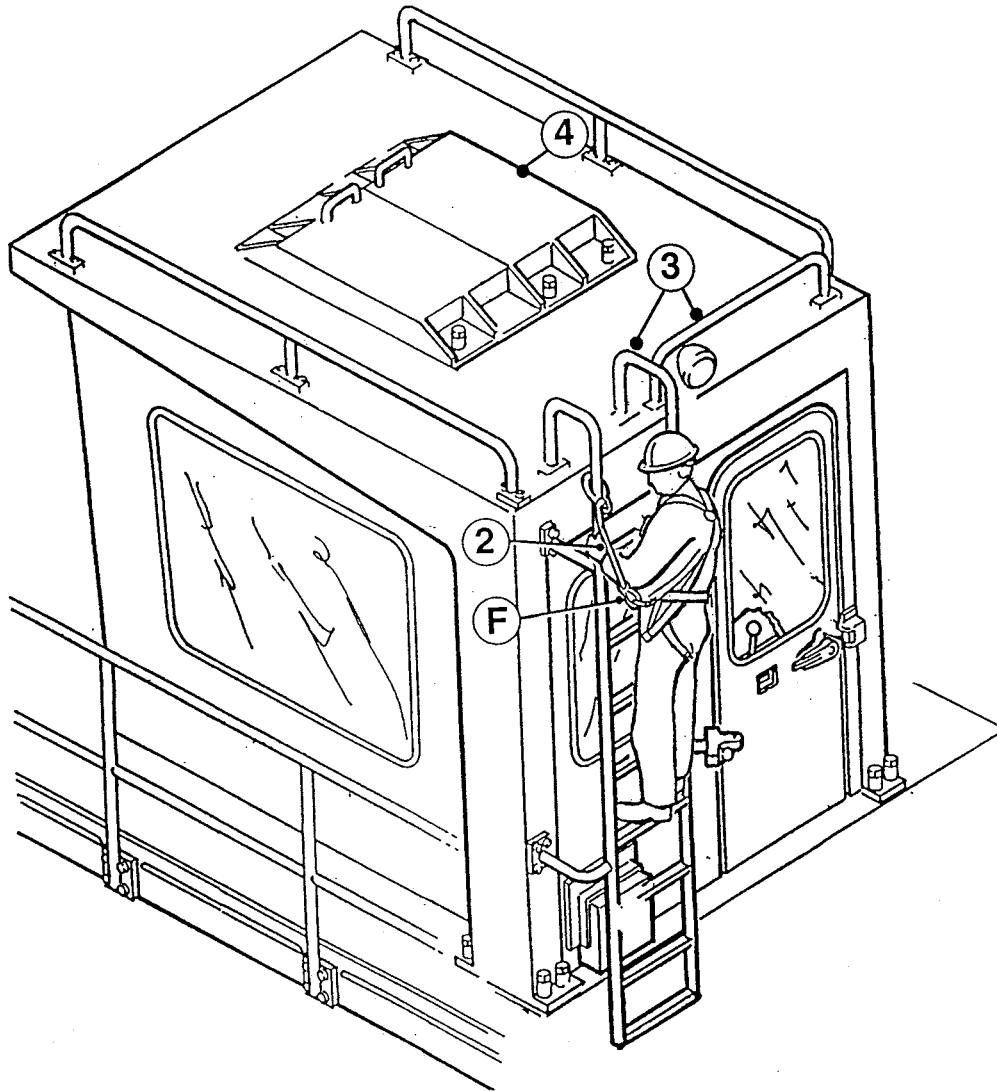
At least every 12 months, the safety harness and its components have to be inspected by a competent person authorized by the manufacturer and maintained, if the manufacturer considers it necessary.

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.

▲ WARNING

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

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

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

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

Observe the instructions in this manual for:

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

▲ WARNING

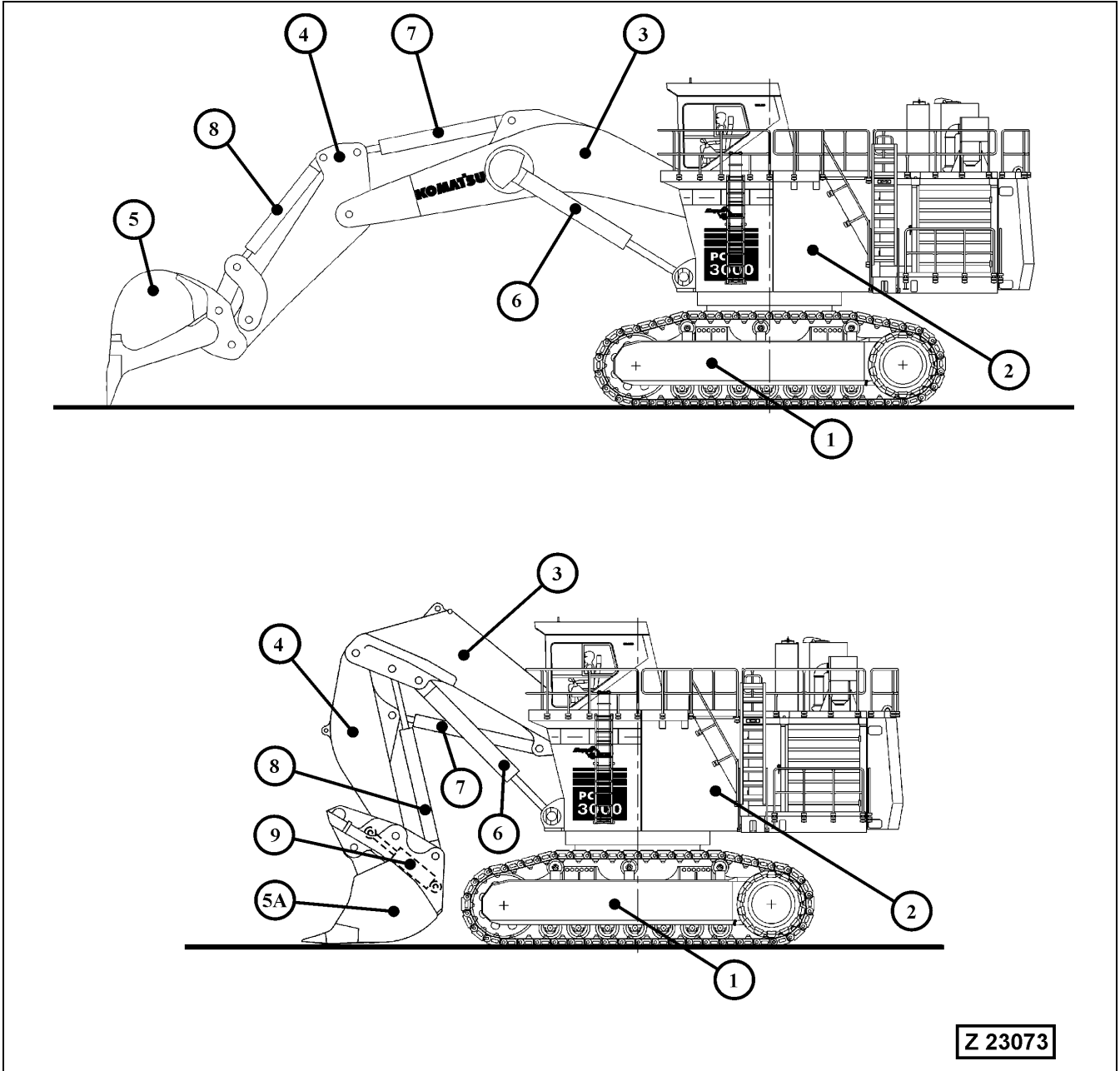
Improper operation of this machine can cause injury or death.

NOTICE

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

3.2 CONSTRUCTION OF THE SHOVEL

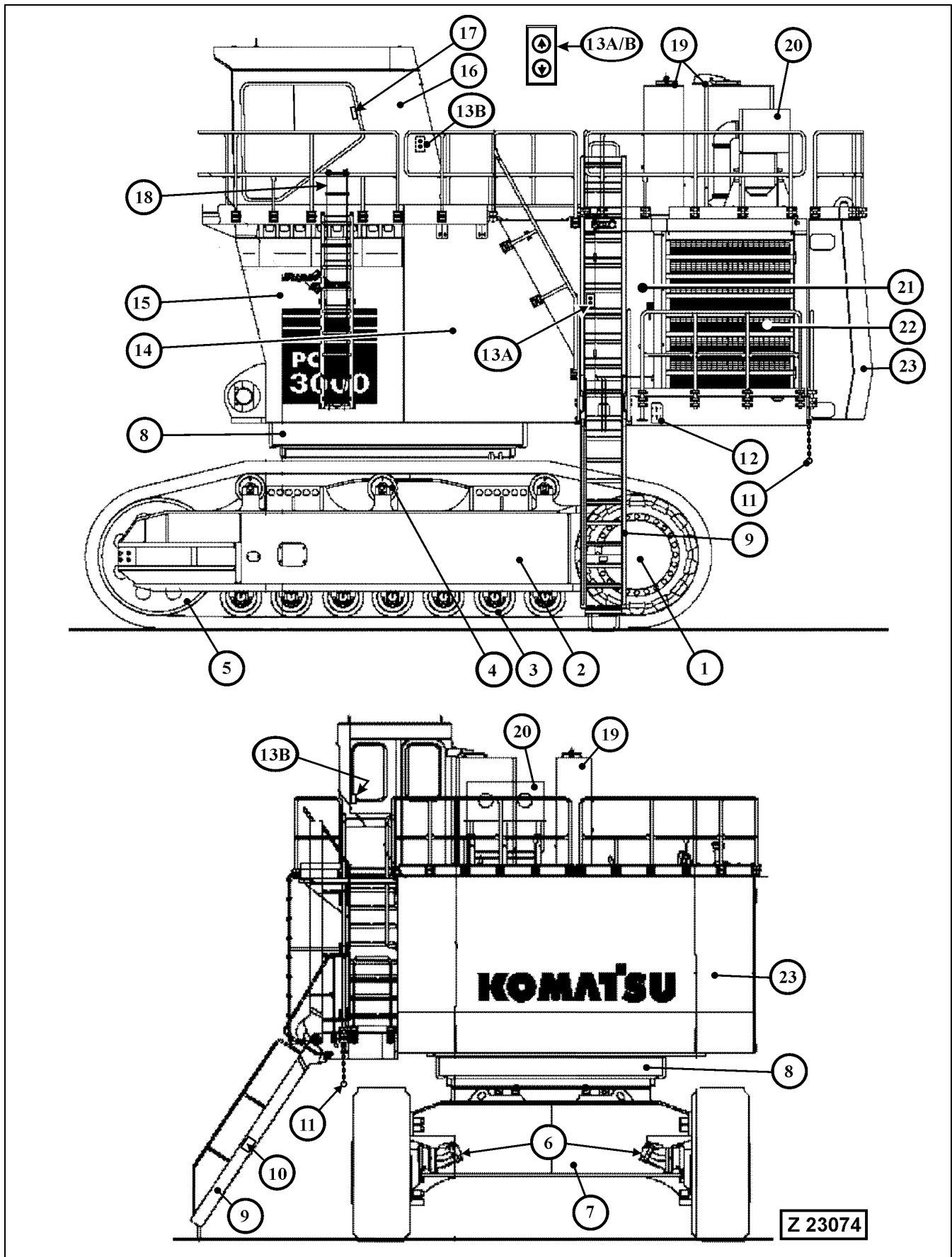
3.2.1 OVERALL VIEW



Legend for illustration Z23073

- | | | | |
|-----|----------------|------|--------------------------|
| (1) | Undercarriage | (5A) | Bottom dump bucket |
| (2) | Superstructure | (6) | Boom cylinders |
| (3) | Boom | (7) | Stick cylinders |
| (4) | Stick | (8) | Bucket cylinders |
| (5) | Backhoe bucket | (9) | Bucket opening cylinders |

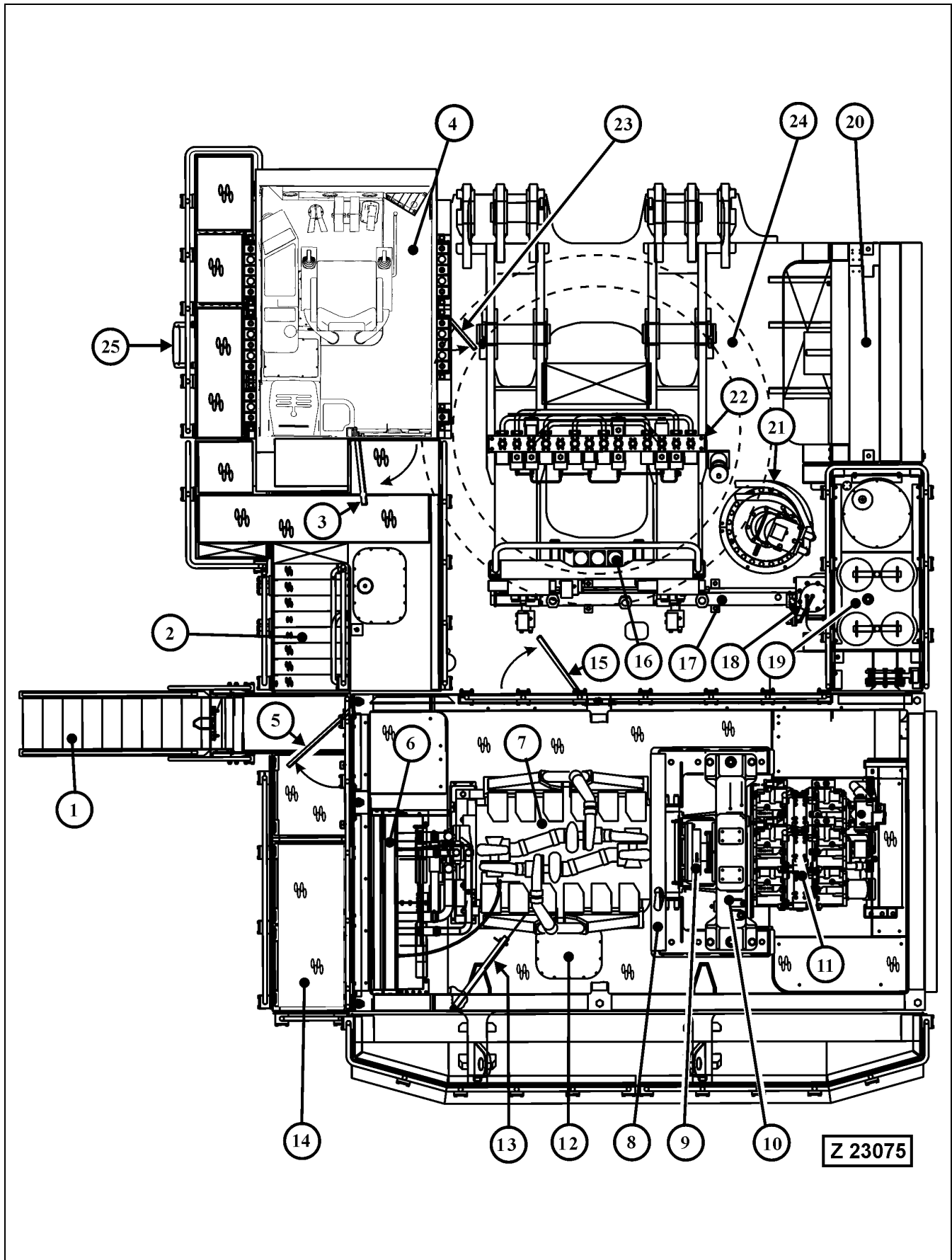
3.2.2 UNDERCARRIAGE AND SUPERSTRUCTURE



Legend for illustration Z23074

- (1) Final drive, hub type travel gear
- (2) Crawler carrier
- (3) Track roller
- (4) Carrier roller
- (5) Guide wheel
- (6) Travel motors
- (7) Center frame
- (8) Swing circle guard
- (9) Hydraulically operated access ladder, see page 46 for more information
- (10) Light switch for access area lighting
- (11) Pull chain for emergency lowering of the access ladder, see page 46 for more information
- (12) Battery main switches
- (13A) Control switch for access ladder at machinery house door
- (13B) Control switch for access ladder at operator's cab
- (14) Fuel tank
- (15) Cab base, see page 142 for more information
- (16) Operator's cab
- (17) Sliding window for emergency exit from operator's cab, see page 50 for more information
- (18) Emergency escape ladder, see page 50 for more information
- (19) Exhaust muffler
- (20) Engine air cleaners
- (21) Machinery house door, see page 140 for more information
- (22) Radiator grill door
- (23) Counterweight

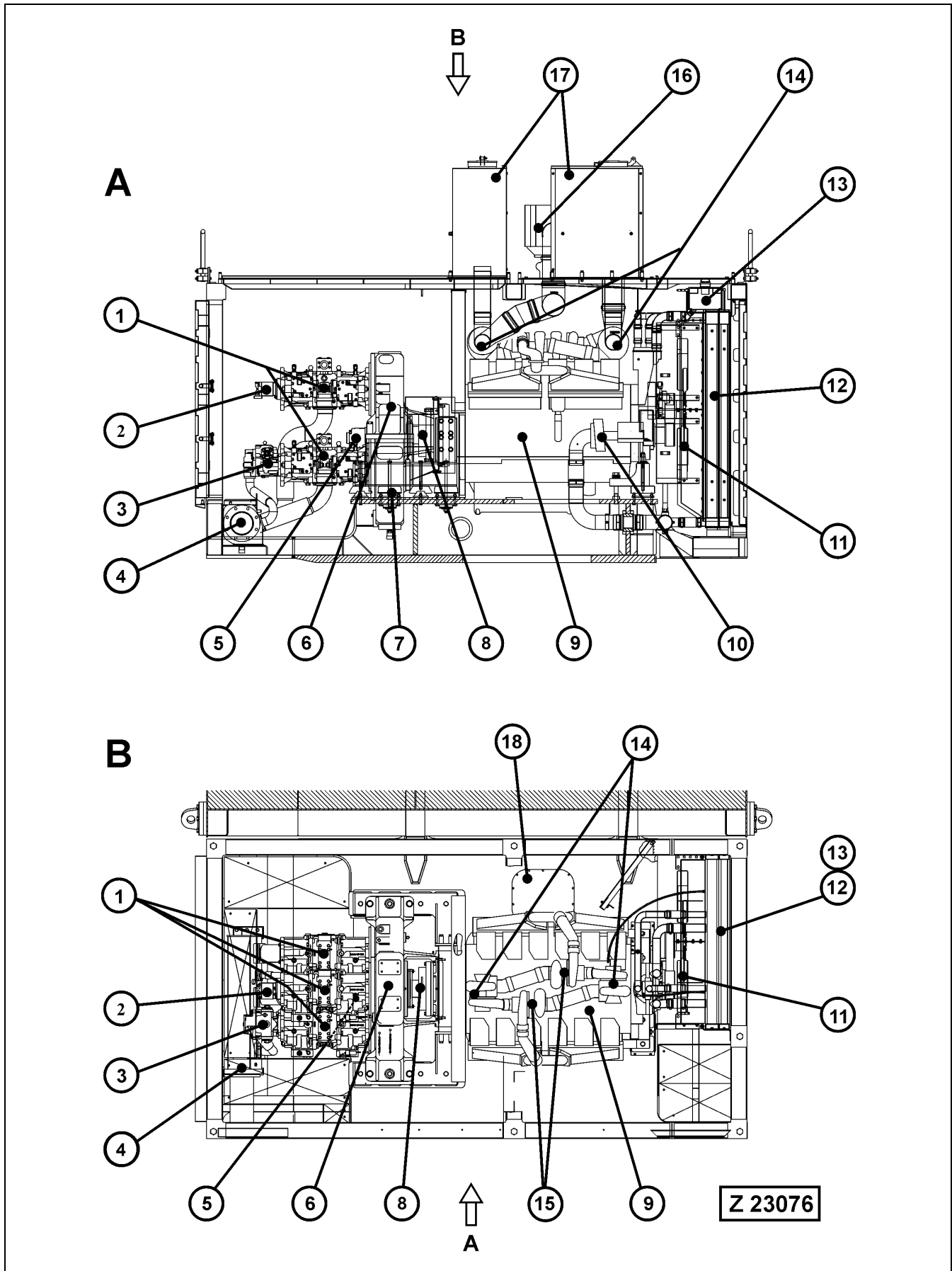
SUPERSTRUCTURE - TOP VIEW



Legend for illustration Z23075

- (1) Hydraulically operated access ladder, see page 46 for more information
- (2) Stair to operator's cab
- (3) Operator's cab door, see page 56 for more information
- (4) Operator's cab, see page 56 for more information
- (5) Machinery house door, main access, see page 140 for more information
- (6) Coolant radiator
- (7) Diesel engine
- (8) Fire wall
- (9) Flexible coupling, oil filled
- (10) PTO (pump distributor gear)
- (11) Main hydraulic pumps
- (12) Engine oil reserve tank only on machines equipped with the Engine Oil Management System, see page 64 for more information
- (13) Radiator fan guard
- (14) Battery box below the walkway gratings
- (15) Front machinery house door
- (16) Main control valves
- (17) Return oil collector pipe
- (18) Back-pressure valve
- (19) Main hydraulic oil reservoir
- (20) Hydraulic oil cooler
- (21) Swing gear
- (22) Distributor manifold
- (23) Cab base door
- (24) Slewing connection
- (25) Emergency escape ladder, see page 50 for more information

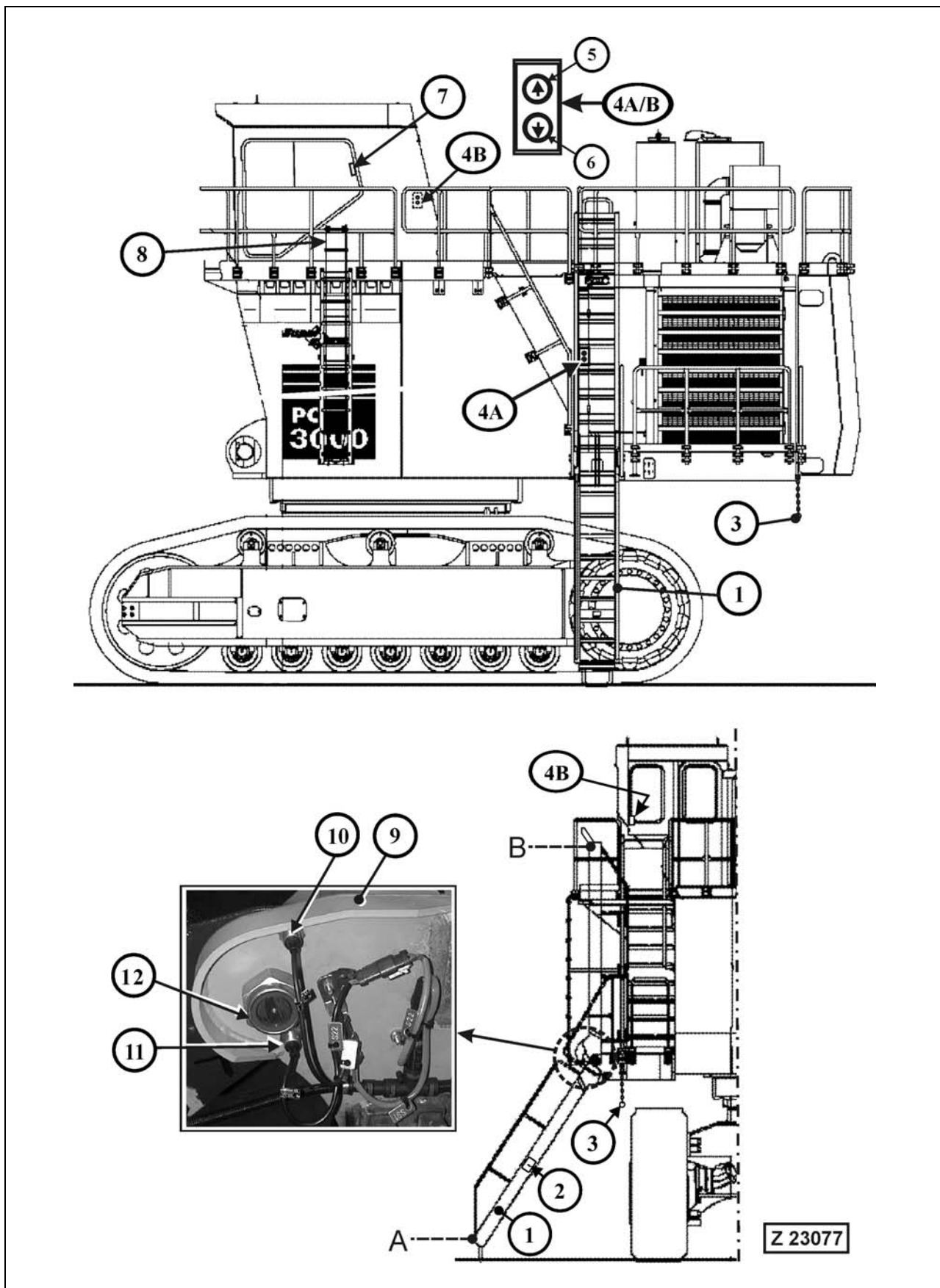
MACHINERY HOUSE



Legend for illustration Z23076

- A** Side view from main control blocks (front)
- B** Top view
- 1 Main hydraulic pumps (three tandem swash plate type pumps)
- 2 PTO lubrication pump
- 3 Hydraulic oil cooler fan drive pump
- 4 Suction oil reservoir
- 5 Control oil pump (pilot oil circuit)
- 6 PTO (pump distributor gear)
- 7 Elastic mounts
- 8 Flexible coupling, oil filled
- 9 Diesel engine
- 10 Coolant pump
- 11 Radiator fan
- 12 Coolant radiator
- 13 Expansion tank for radiator
- 14 Turbocharger, low stage
- 15 Turbocharger, high stage
- 16 Engine air cleaner
- 17 Exhaust muffler
- 18 Engine oil reserve tank, integrated part of main frame, Only used on machines equipped with the Engine Oil Management System.

3.2.3 HYDRAULICALLY OPERATED ACCESS LADDER



Legend for illustration Z23077

- (A) Access ladder in lowered position
- (B) Access ladder in upper position (Working position)
- (1) Access ladder
- (2) Light switch for access area lighting
- (3) Pull chain for emergency lowering of the access ladder

⚠ WARNING

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

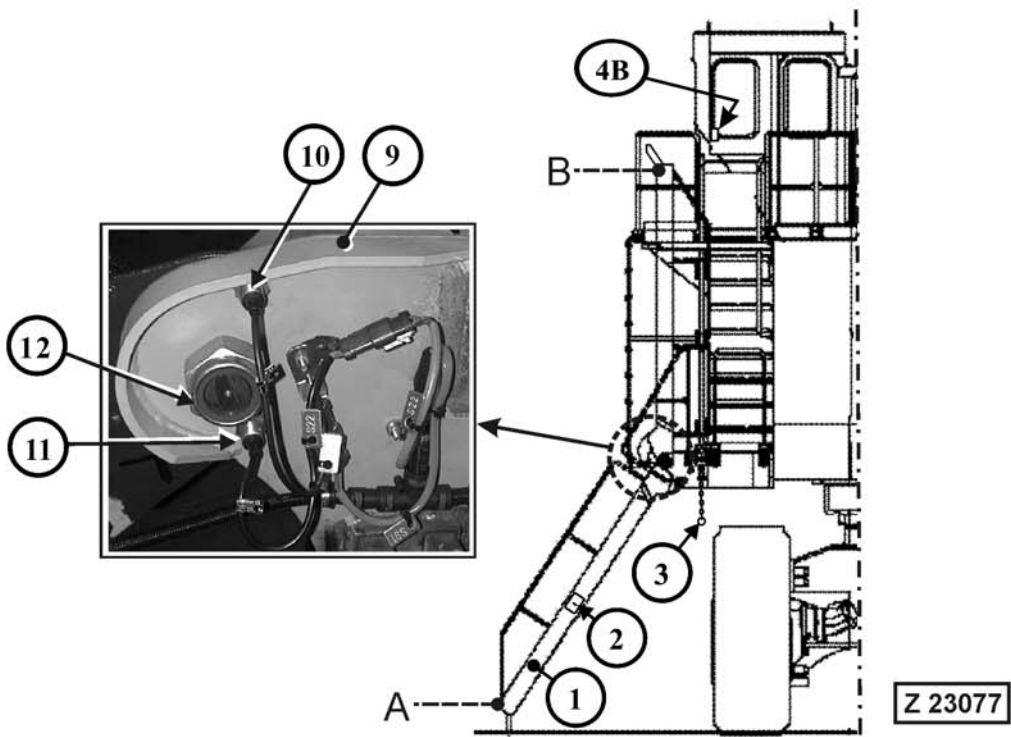
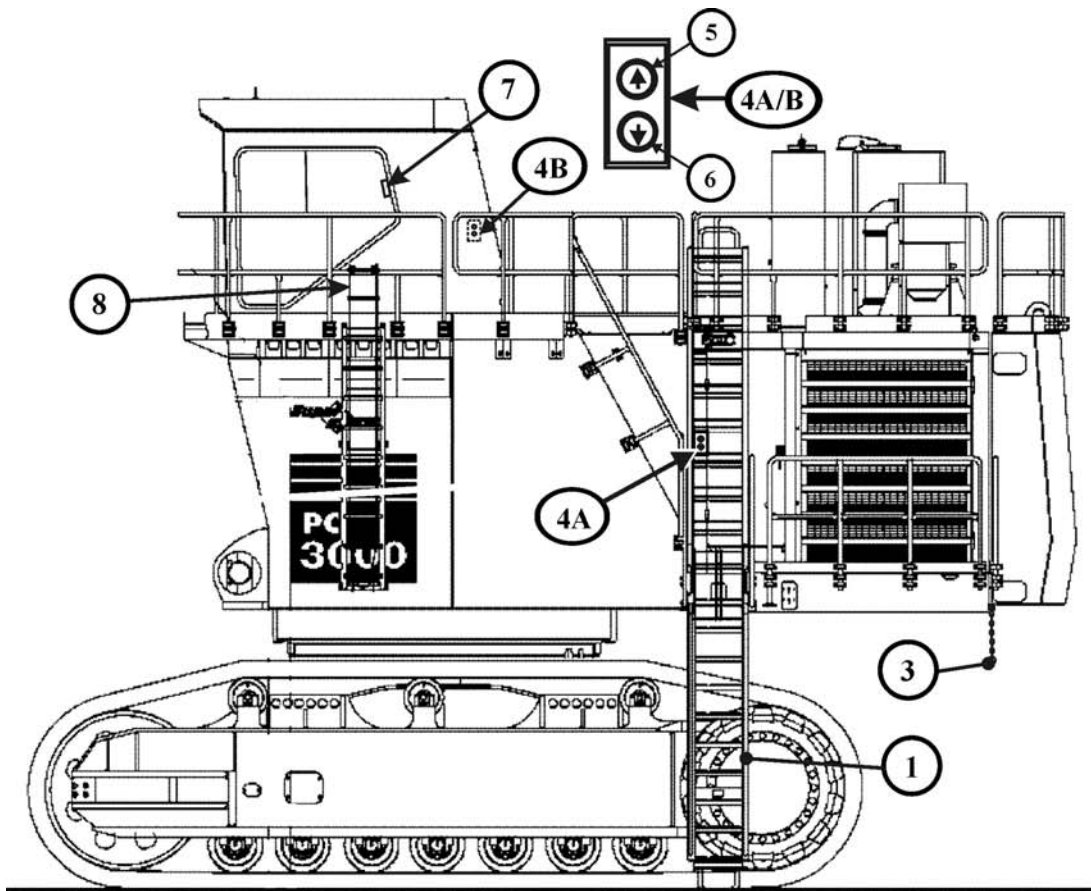
When the chain (E) is being pulled down with the engine running, the pilot control system is made inoperative, preventing further movements of the Shovel.

- (4A) Control switch for access ladder at machinery house door
- (4B) Control switch for access ladder at operator's cab
- (5) Push button for lifting the ladder
- (6) Push button for lowering the ladder
- (7) Sliding window for emergency exit from operator's cab
- (8) Emergency escape ladder
- (9) Ladder pivot bracket
- (10) Monitor and control sensor (S91). 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.
- (11) Safety sensor (S22), 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.
- (12) Lock nut for ladder pivot ball bearing

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 button (5) 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. (Z23077)**Raise the ladder**

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

Start the engine.

For starting procedure → See "STARTING THE ENGINE" on page 170.

Go back to the ladder control switch (4B).

Raise the ladder by pressing button (5) until the ladder is in fully lifted position (B).

Lowering the ladder

The ladder can be lowered with the engine running or with the engine at standstill.

For stopping the engine → See "STOPPING THE ENGINE" on page 202.

Lower the ladder by pressing push button (6). With the engine at standstill, it can be necessary to push the ladder slightly until it starts moving down by its own weight.

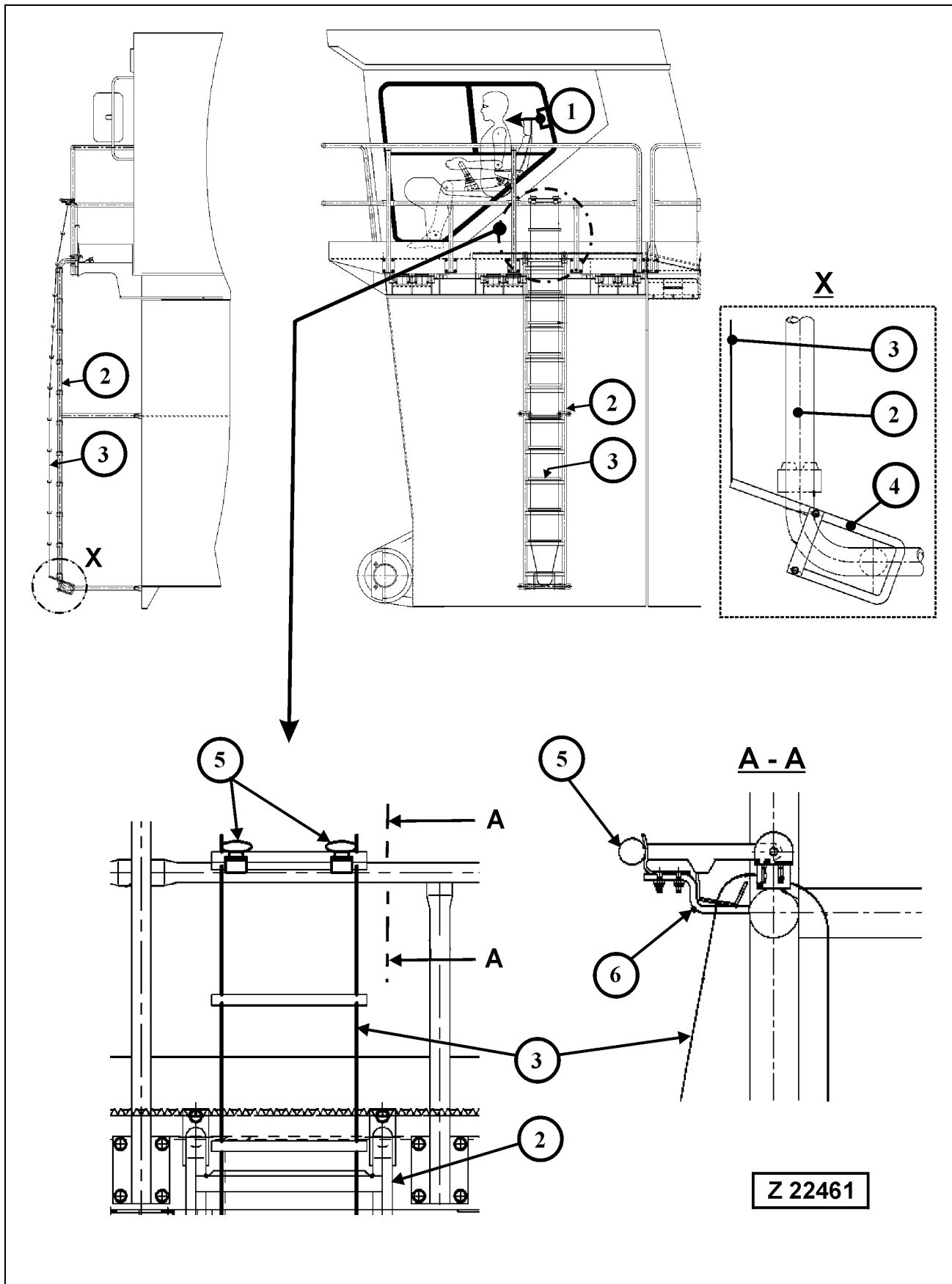
⚠ WARNING

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

NOTICE

Check safety sensor (11) of access ladder for correct function after every 50 operating hours or once a week. Refer to Maintenance Section 4, for checking procedure.

3.2.4 EMERGENCY ESCAPE LADDER



Legend for illust. Z 22461

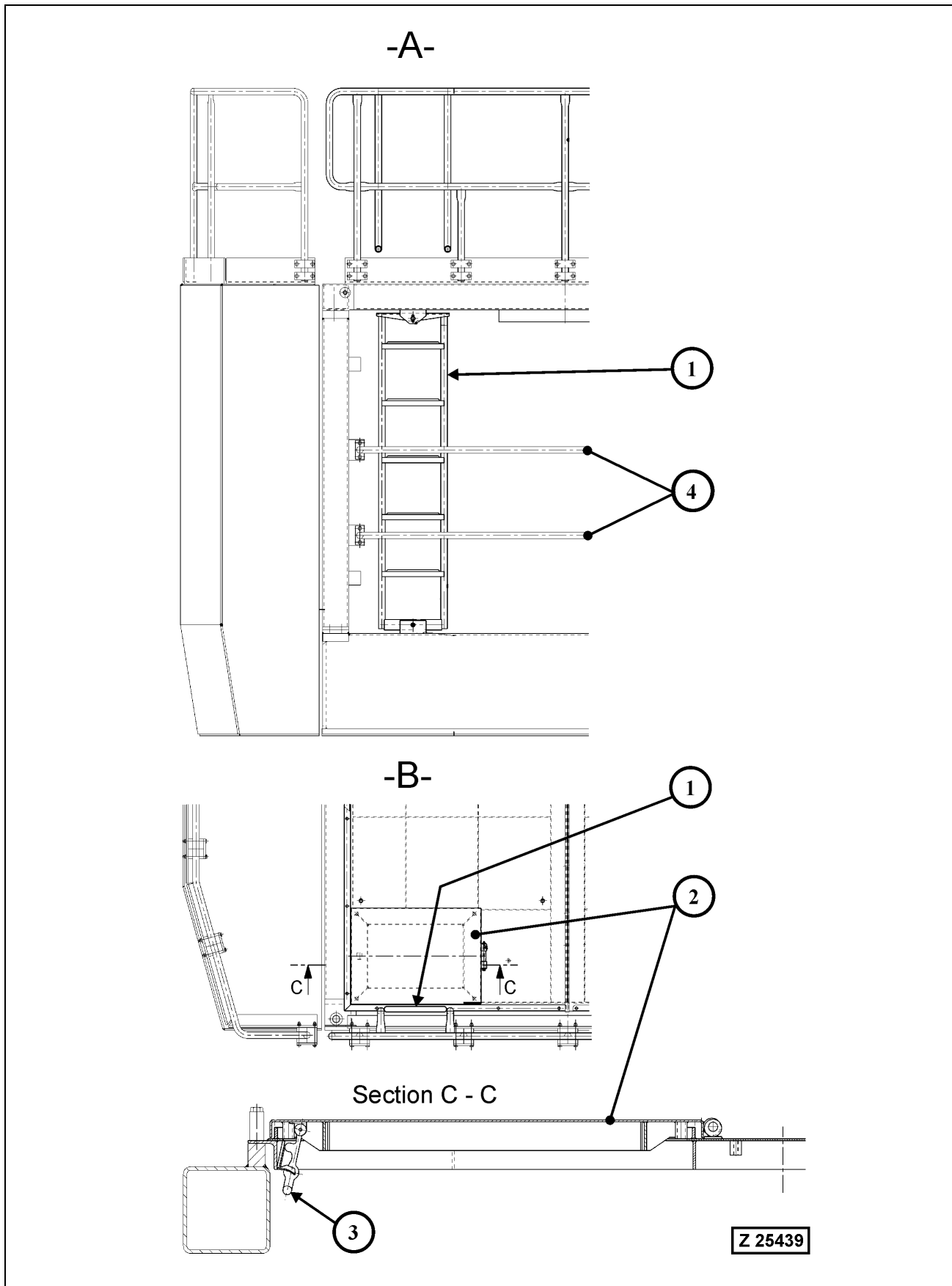
- (1) Sliding window, serves for emergency exit
- REMARK**
If the operator's cab is equipped with external sun visors, disengage the four catches and push out the sun visor panel.
- (2) Rigidly mounted emergency escape ladder
 - (3) Rope ladder. The upper end of the rope ladder is fixed onto the lower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

Using the emergency escape ladder

In case of emergency with normal walkways obstructed use escape ladder (2) and (3) for leaving the machine. Proceed as follows:

1. Unhook fasteners (5) and take out rope ladder rung from brackets (6).
2. 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 (2).
3. Use the rigid ladder (2) and then the rope ladder (3) for leaving the shovel.

3.2.5 EMERGENCY ESCAPE LADDER AND ESCAPE HATCH IN THE MACHINERY HOUSE (SPECIAL EQUIPMENT)



Legend for illust. Z25439

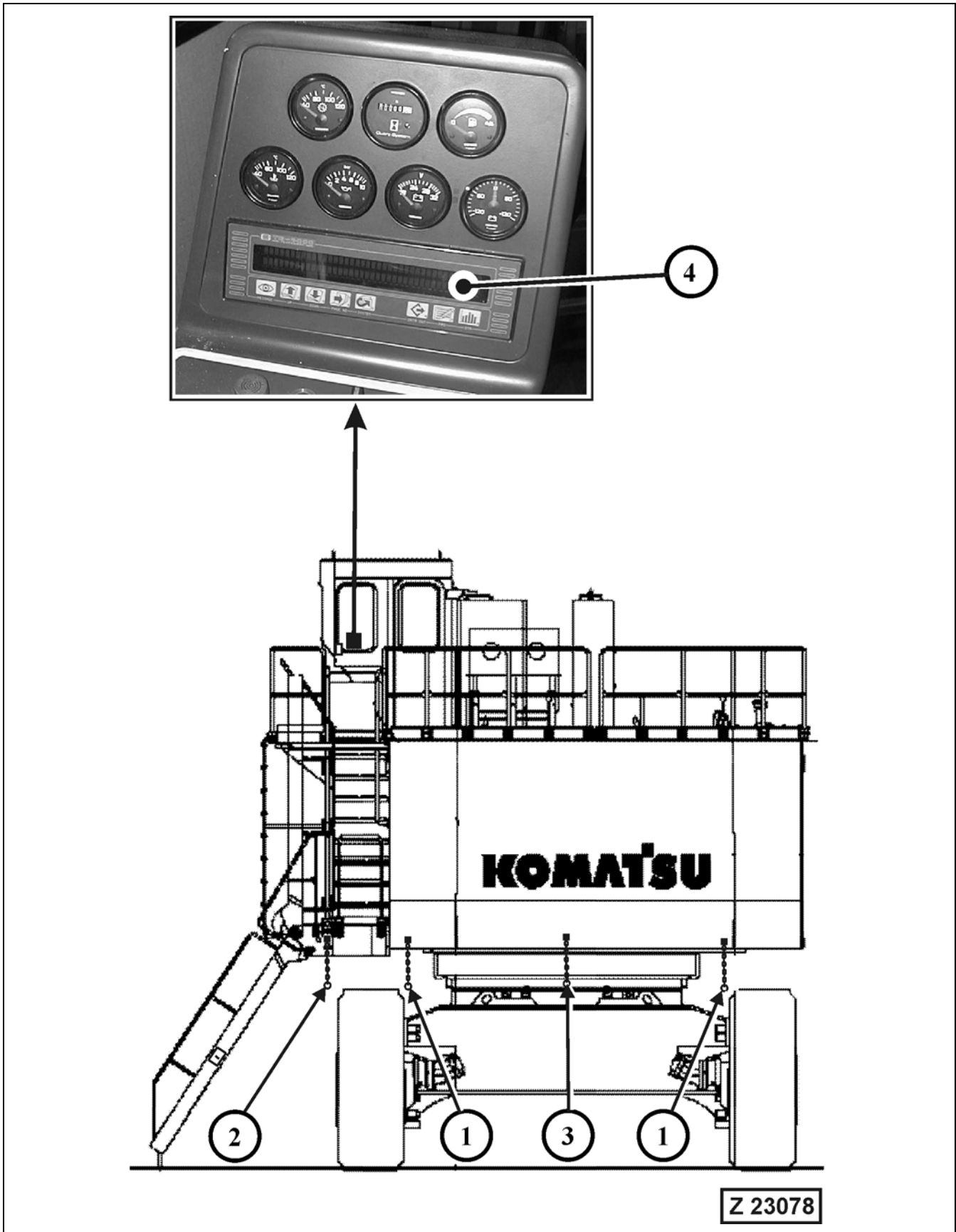
- (A) View from rear machinery house doors onto the emergency escape ladder (1)
- (B) Top view of the machinery house roof
- (1) Emergency escape ladder in front of the rear machinery house doors
- (2) Emergency escape hatch
- (3) Rubber toggle
- (4) Safety rods of rear machinery house doors

Using the emergency escape ladder

In case of emergency with normal walkways obstructed use escape ladder (1) and hatch (2) for leaving the machinery house.

1. Disengage toggle (3).
2. Open the hatch (2) and get up on the upper deck.
3. Depending on the situation, use the emergency escape ladder at the operator's cab or the normal ground access ladder for leaving the shovel.

3.2.6 EMERGENCY ENGINE SHUTDOWN FROM GROUND MAN OR OPERATOR WARNING SYSTEM



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

Legend for illust. Z23078

- (1) Actuating chains for emergency shut down of the engine. To stop the engine, pull down one of the chains (1).
- (2) Pull chain for emergency lowering of the access ladder
- (3) Actuating chain for hydraulically operated service arm.
- (4) Display of the Electronic Text Monitoring System (ETM) on the instrument panel in the Operator's cab. When one of the chains (1) is being pulled down from ground man, the engine will be stopped and the following message will be displayed on the screen (4):
Engine shutdown: pull switch from ground man actuated.

CAUTION

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

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

Operator Warning System (Special Equipment)

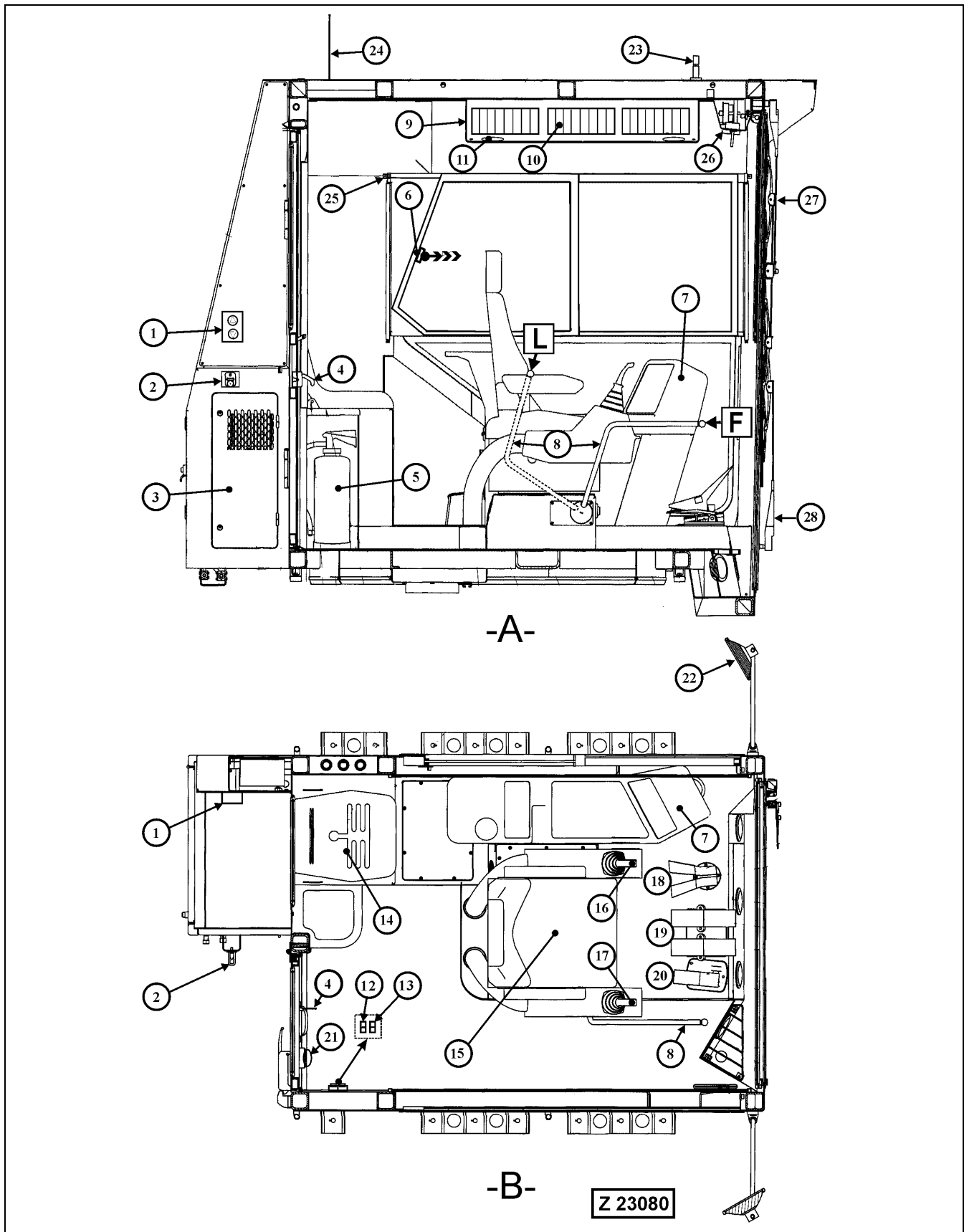
This system is used to inform the Operator that someone wants to enter the Shovel or to draw the Operator's attention to special circumstances requiring his action.

Legend for illust. (Z23078):

- (1) Actuating chains for the Operator warning system
- (2) Pull chain for emergency lowering of the access ladder
- (3) Actuating chain for hydraulically operated service arm.
- (4) Display of the Electronic Text Monitoring System (ETM) on the instrument panel in the Operator's cab. When one of the chains (1) is being pulled down from ground man, the following message will be displayed on the screen (4):
Caution: 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 23080**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**Left View of Operator's Cab**

- (1) Control switch for hydraulically operated access ladder
- (2) Door fastener, engages into the door latch when the cab door is fully opened.
- (3) Access door to the air filter of the operator's cab
- (4) Release lever inside the cab for door fastener (2)
- (5) Portable fire extinguisher. Make sure the fire extinguisher is always charged and ready for use
- (6) Handle of the sliding window

REMARK

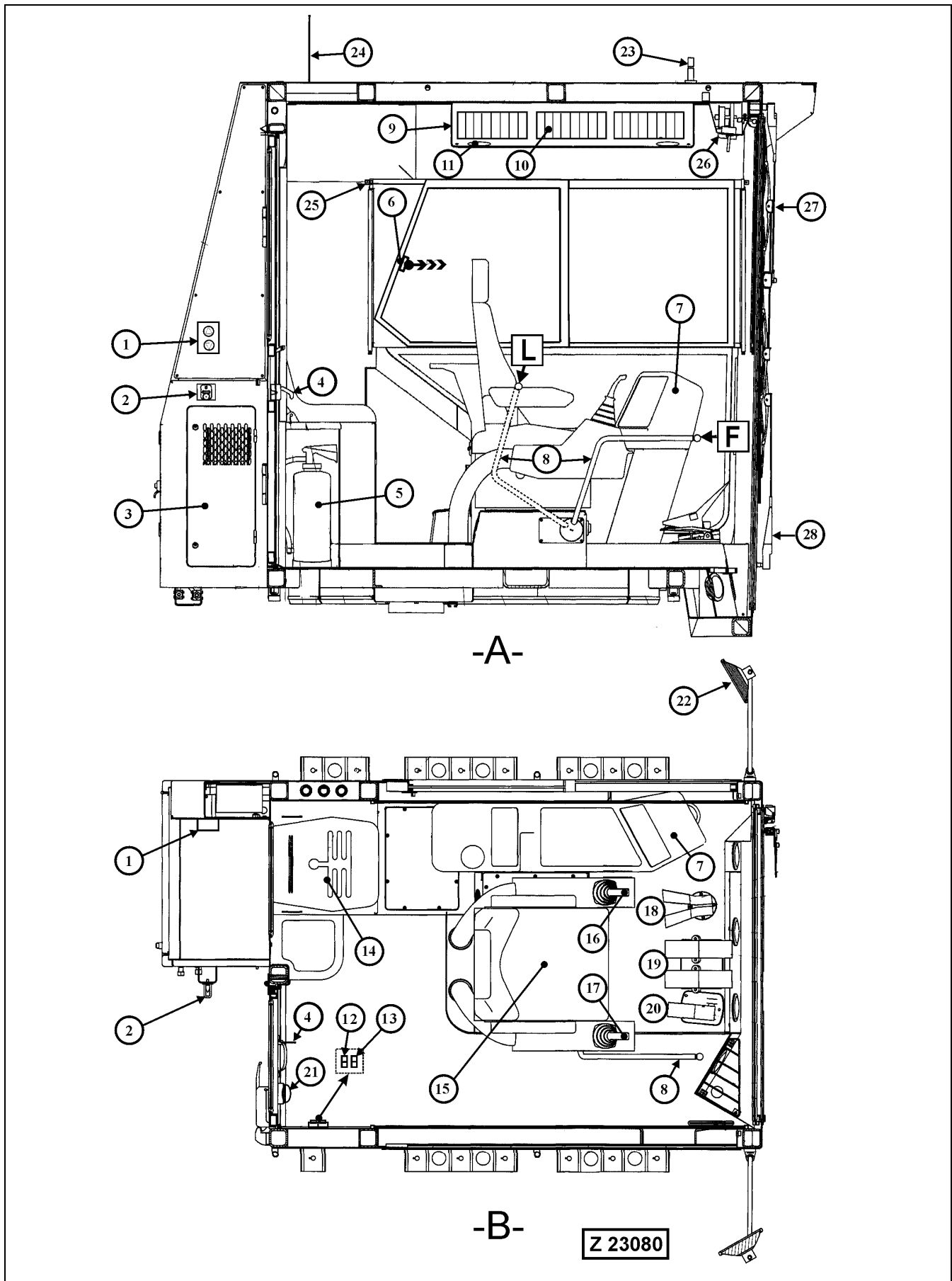
The sliding window serves as emergency exit and should always be closed when working with the shovel to prevent dust from getting into the cab.

- (7) Operator's console, see page 81 for more information.
- (8) Lock lever.
 - This lever locks the controls for working equipment, swing and travel drive when placed in the fully rear position (L).
 - Start the engine with lock lever in LOCKED position (L). Thereafter set the lock lever to free position (F) in order to enable operation of the hydraulic control system.

▲ WARNING

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

- (9) Air conditioner condenser unit
- (10) Air flow control louvers adjustable
- (11) Air flow jets adjustable
- (23) Adapter for warning beacon
- (24) Aerial
- (25) Sun visor
- (26) Main wiper Motor
- (27) Main windshield wiper
- (28) Auxiliary windshield wiper



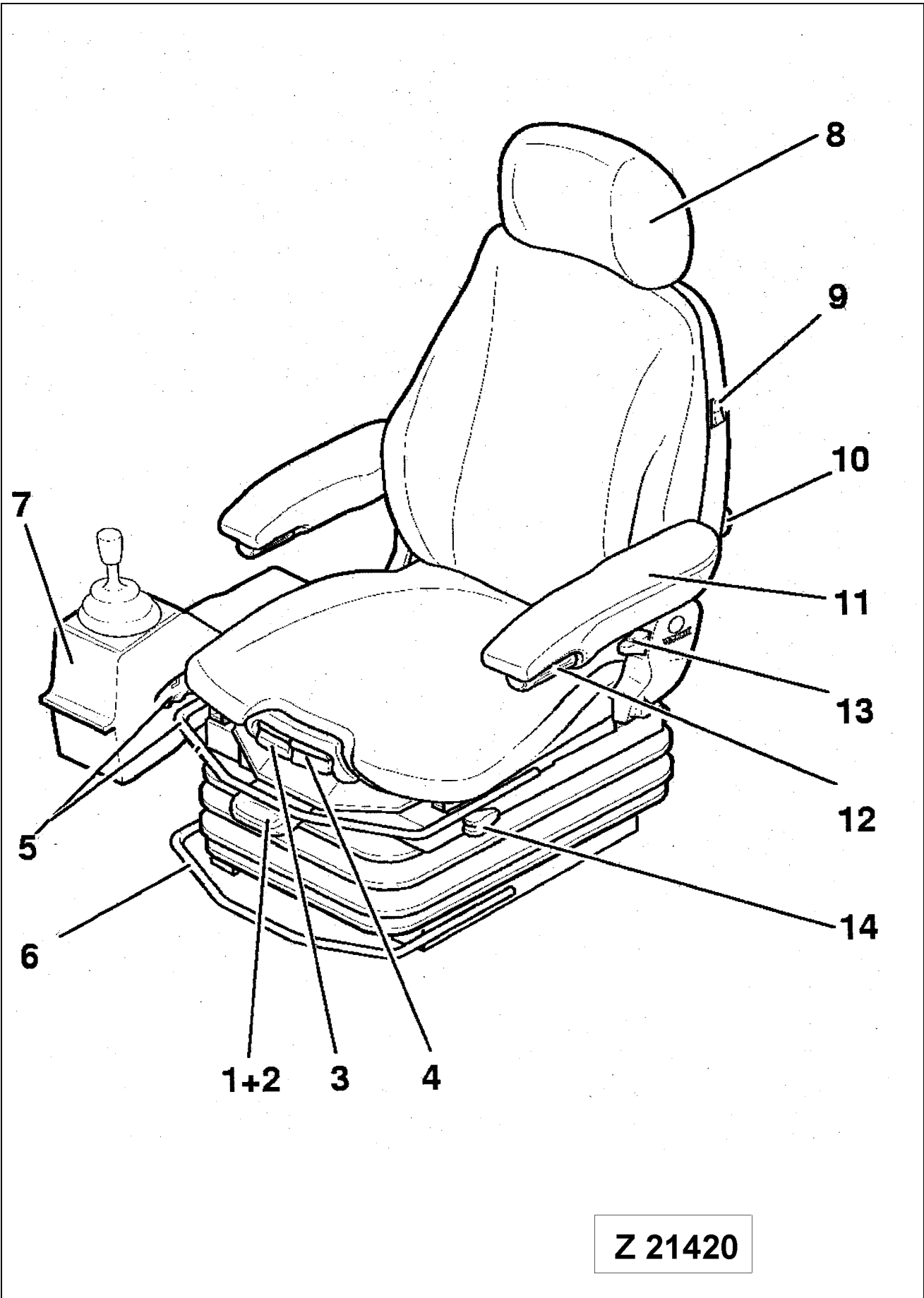
Operator's Cab (continued)

Legend for illust. Z 23080

- B** **Top View of Operator's Cab**
- (1) Control switch for hydraulically operated access ladder
 - (2) Door fastener, engages into the door latch when the cab door is fully opened.
 - (4) Release lever inside the cab for door fastener (2)
 - (7) Operator's console
 - (8) Lock lever
 - (12) Light switch for access area lighting
 - (13) Light switch for interior cab lighting
 - (14) Co-driver's seat, refer to page 62 for more information
 - (15) Operator's seat, refer to page page 61 for more information
 - (16) Left control lever
 - With EURO control system for stick and swing gear.
 - With DEMAG control system for boom and bucket.
 - (17) Right control lever
 - With EURO control system for boom and bucket.
 - With DEMAG control system for stick and swing gear.
 - (18) Control pedals for opening and closing of the bottom dump bucket (Face shovel only)
 - (19) Travel control pedals
 - (20) Swing brake pedal
 - (21) Door opener push button, from inside the cab door.
 - (22) Outside mirrors with integrated heaters.

▲ WARNING

- **Make sure the cab door is always closed when working with the Shovel.**
 - **Lock the door in open position by engaging the door latch into fastener (2).**
-



Operator's Seat Adjustment

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

Legend for illust. (Z 21420):

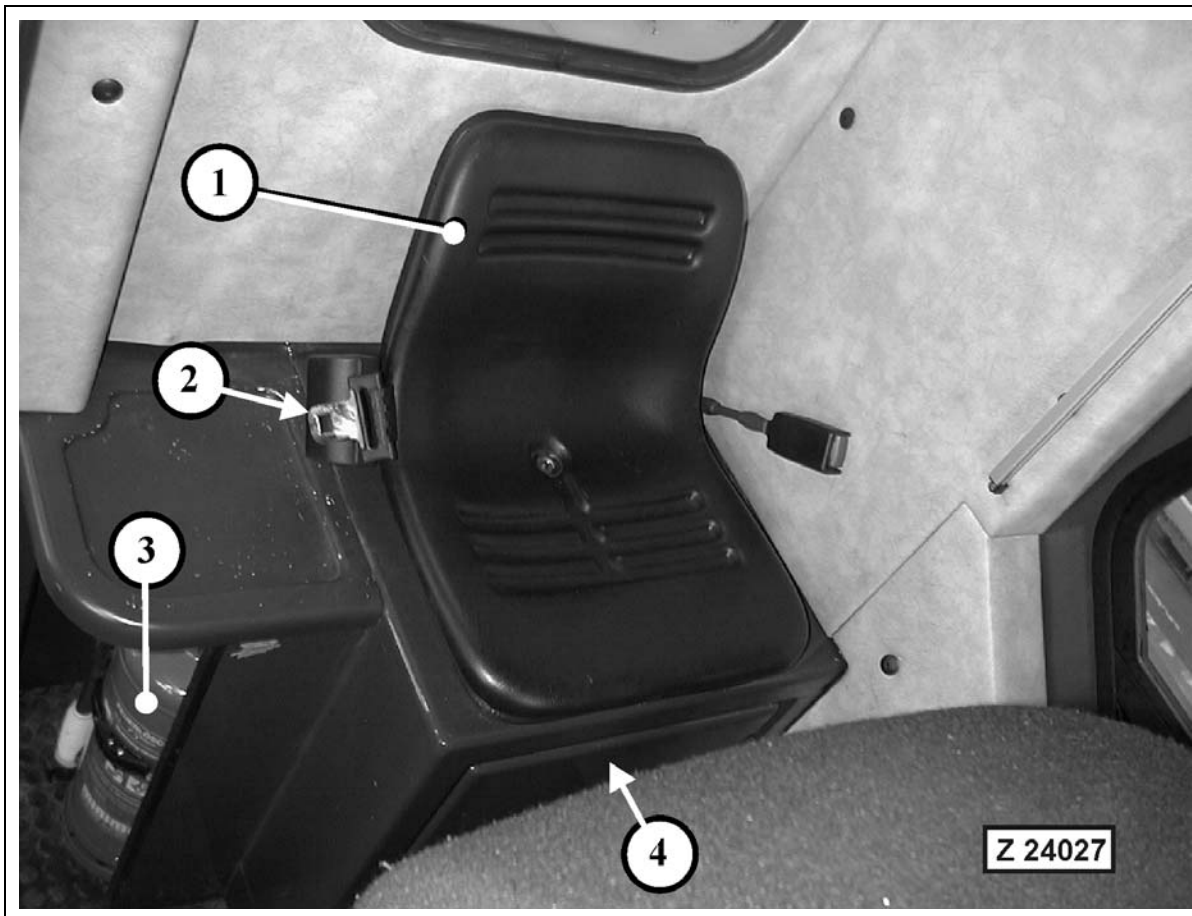
- (1) Seat suspension adjustment (firm to soft ride)
 - (2) Height adjustment
 - (3) Seat depth adjustment
 - (4) Seat cushion tilt adjustment
 - (5) Fore/aft adjustment
 - (6) Not used on this model
 - (7) Control lever carrier
 - (8) Headrest (optional)
 - (9) Seat heater switch (optional)
 - (10)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

⚠ WARNING

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

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

Co-driver's Seat



Legend for illust. Z 24027

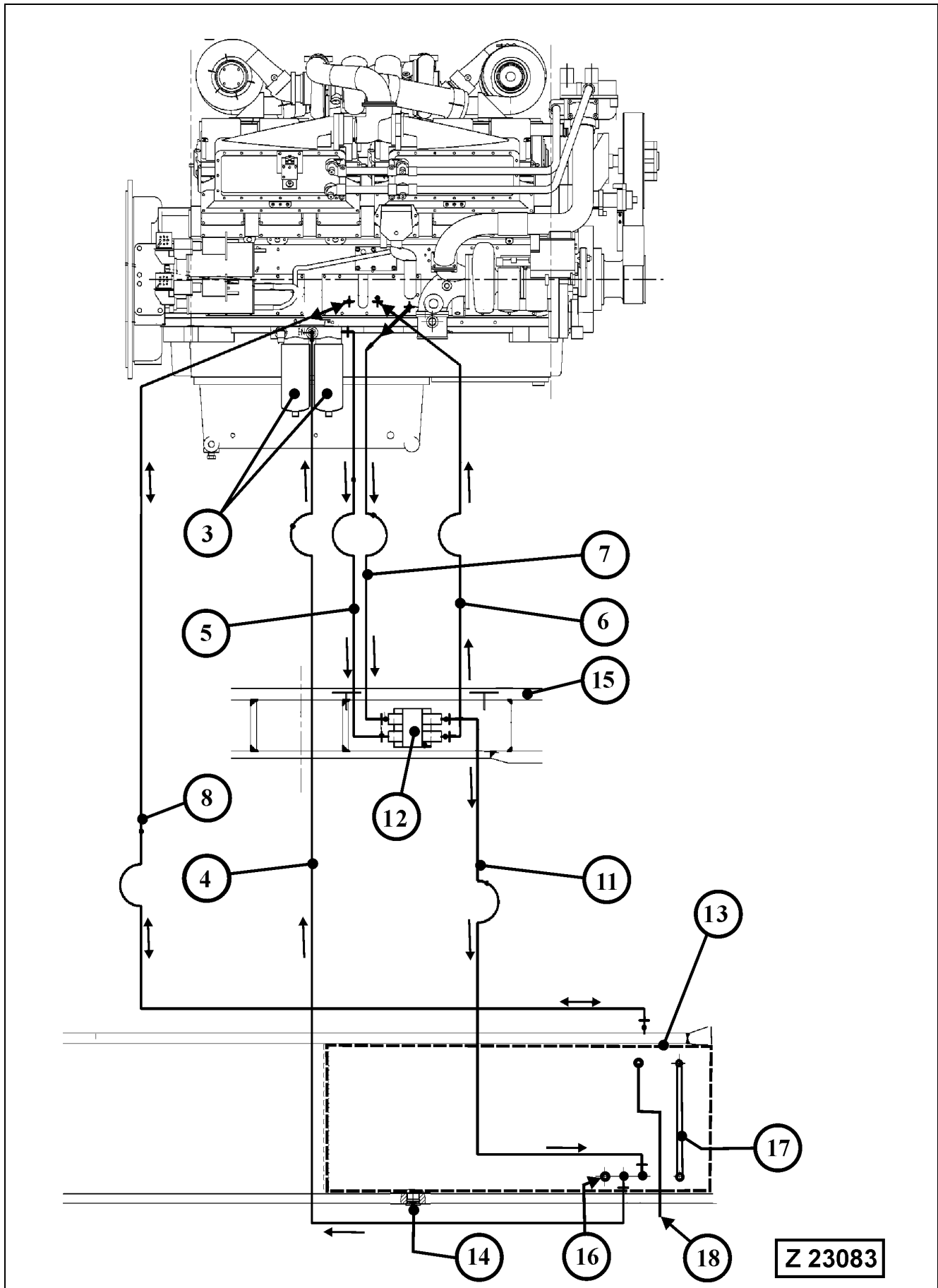
- | | |
|----------------------|--------------------------------|
| (1) Co-driver's seat | (3) Portable fire extinguisher |
| (2) Seat belt | (4) Cabinet door |

▲ WARNING

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

This page left intentionally blank

3.2.8 ENGINE OIL MANAGEMENT SYSTEM



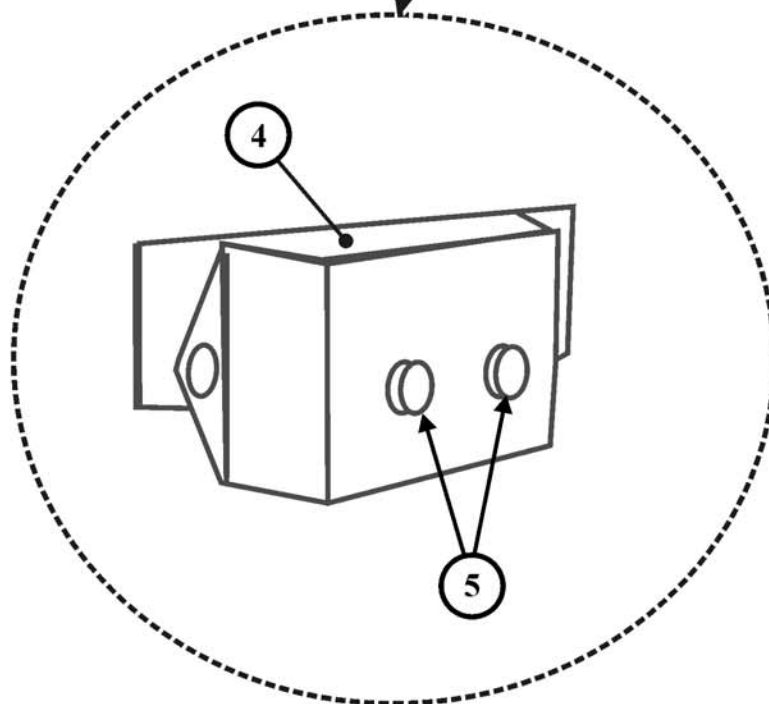
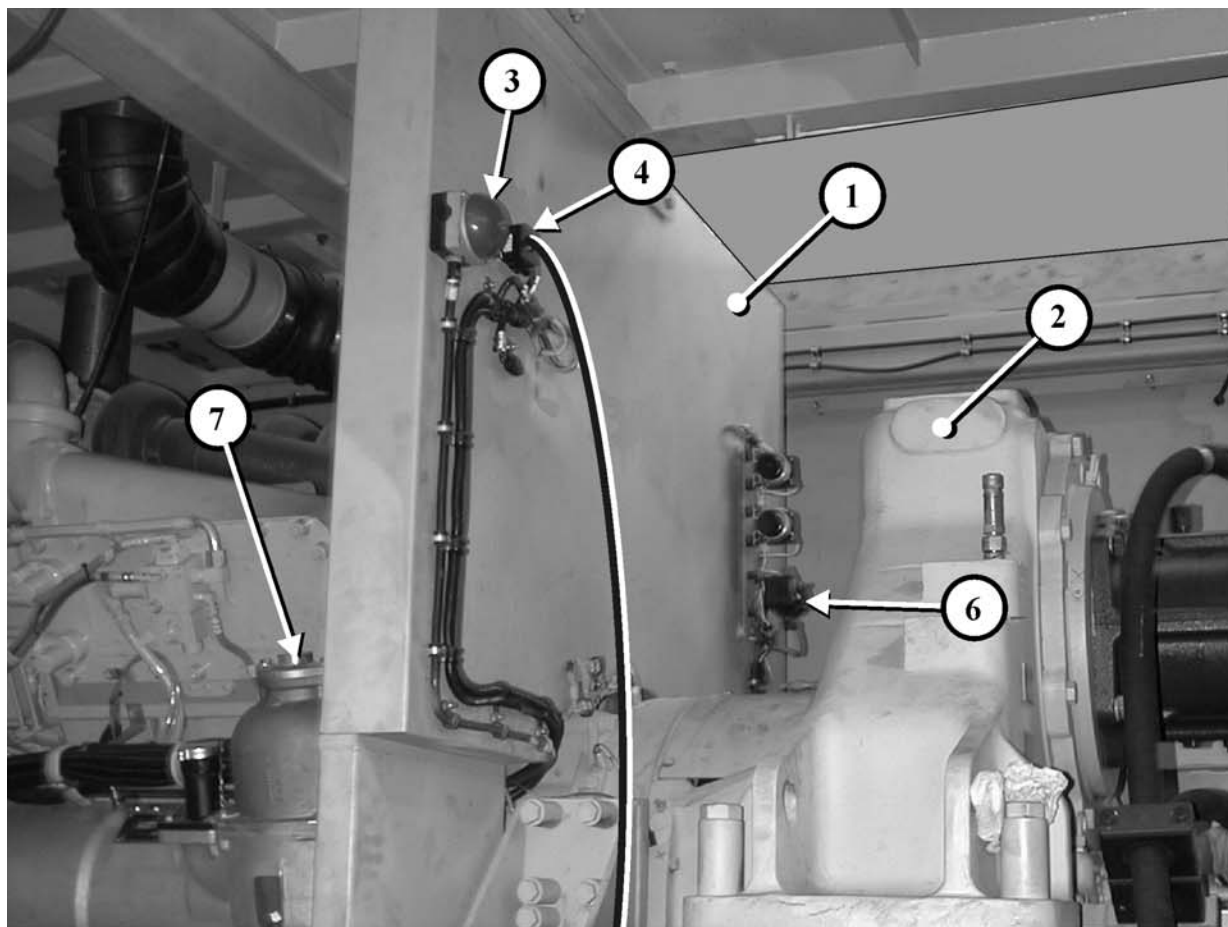
Engine Oil Management System

(Special Equipment)

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

Reserve System Oil Flow Schematic, illust. Z 23083

- (3) Oil filters for the engine oil reserve system
- (4) Suction line from reserve tank
- (5) Suction line to pumping unit
- (6) Supply line from pumping unit to crankcase
- (7) Withdrawal oil line from engine oil pan to pump
- (8) Ventilation line for reserve tank
- (11) Oil feed-back line to reserve tank
- (12) Pumping unit, located on the cross member below the fire wall. The pump unit works automatically as soon as the engine speed is above 300 RPM. The pump unit consists of a pumping element for feeding oil from tank (13) into the engine oil pan. The second pumping element withdraws oil from the engine oil pan and feeds it back into the reserve tank when the oil level in the oil pan exceeds the maximum running oil level. The combined operation of the pumping elements maintains an optimal oil level in the engine oil pan. Oil drawn off by the Centinel burn system is also replaced through the supply system “Reserve”.
- (13) Reserve oil tank. The reserve oil tank is an integrated part of the main frame cross member.
- (14) Drain plug
- (15) Cross member below the fire wall
- (16) Plug (on shovels with KIM Hot start heating system a thermostat is installed in place of the plug).
- (17) Oil level sight gauge
- (18) Refilling line from swing down service arm



Z 23084

Centinel Diagnostic Lamps

Legend for illust. (Z 23084)

View from counterweight side

- (1) Fire wall between engine room and pump compartment
- (2) Pump distributor gear (PTO)
- (3) Emergency engine shut down switch
- (4) Centinel monitor box (designation in electrical diagram: 3H10-1)
- (5) Centinel diagnostic lamps
- (6) Pre-lube time relay (designation in electrical diagram: 3D30)
- (7) Centrifugal separator of the engine oil Eliminator filter

Check Centinel Diagnostic Lamps for faults

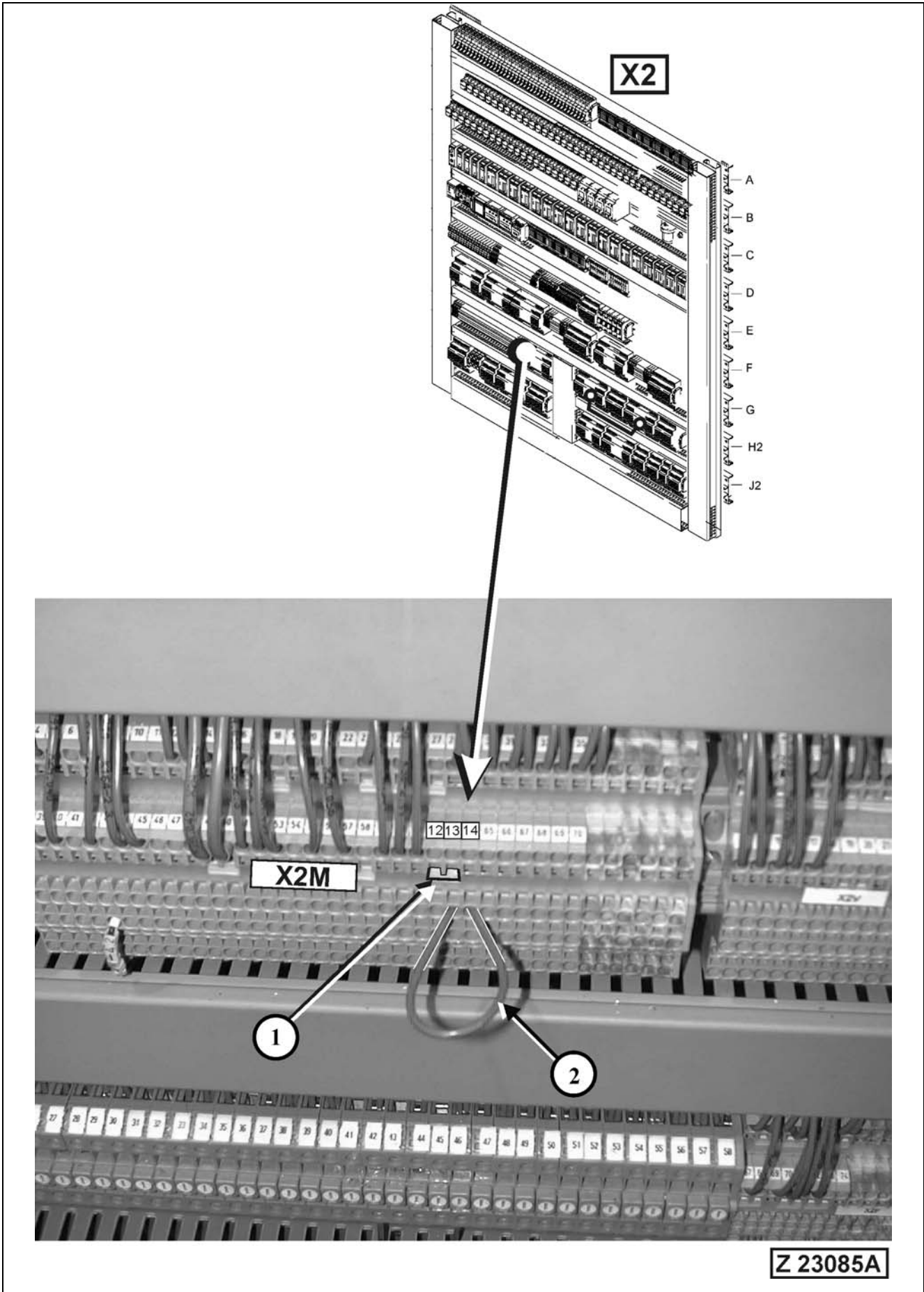
The Centinel system of the engine is monitored by two diagnostic lamps (5). The green lamp indicates the Centinel system has power and is operating. The red lamp indicates that a system parameter is not within specification. Check the diagnostic lamps at regular intervals. If the red lamp is illuminated, stop the engine and turn key switch to OFF position. Turn key switch to ON position. To prevent starting of the engine, remove plug from pre-lube time relay (6).

Turn starter switch and release.

Look at the red lamp, it should start flashing a three-digit code. This code will be associated with a fault code. The codes are read as follows:

1. If the red lamp flashes three times, the first digit is "3", the number of flashes will indicate the first digit of the code.
2. There will be a pause.
3. If the red lamp flashes four times, the second digit of the fault code will be "4", the number of flashes will indicate the second digit of the code.
4. There will be another pause.
5. If the red lamp flashes two times, the third digit of the fault code is "2", the number of flashes will indicate the third digit of the code.
6. In this example, the code is 3-4-2. Fault code 342 is a Centinel Control Module Calibration fault.

At this point, there will be a longer pause before the fault code will be flashed again. This process will occur four times. After the fourth time, the fault lamp will stay red if the fault is still active. To read the code again, turn the key switch to OFF position and back to ON position. Turn starter switch and release. Once the correct fault code is identified, refer to the Master Repair Manual CENTINEL filed in volume 2 binder for fault code explanation, and inform your Komatsu Service Organization about the trouble condition.



Clearing Active Faults and Reset the Centinel System to Operational Condition

Legend for illustration (Z23085A)

The illustration shows the terminal configuration on the (X2) switch board in the cab base

- (1) Calibration Plug for Engine Oil Quality
- (2) Bridge wire for resetting the Centinel system to operational condition

Resetting of the Centinel system is necessary:

- After every engine oil change.
- Whenever the engine oil reserve tank has been allowed to run empty.
- After repairs on the Centinel system.

Proceed as follows:

1. Turn key switch to ON position. To prevent starting of the engine, remove plug from pre-lube time relay 3D30, see page 67 for location of the relay. Turn starter switch and release.
2. For resetting the Centinel system bridge the contacts no. 13 and 14 at the terminal block (X2M) by inserting bridge wire (2). Remove the bridge wire (2).
For additional information refer also to the electrical diagram, page CENTINEL CONTROL MODULE (C1).

Check the Centinel System for proper Operation

1. Install plug to pre-lube time relay 3D30.
2. Start the engine. Look at the indicator lights (5) on monitor box (4), see page 67 for more information. The green light must be illuminated with the engine running.

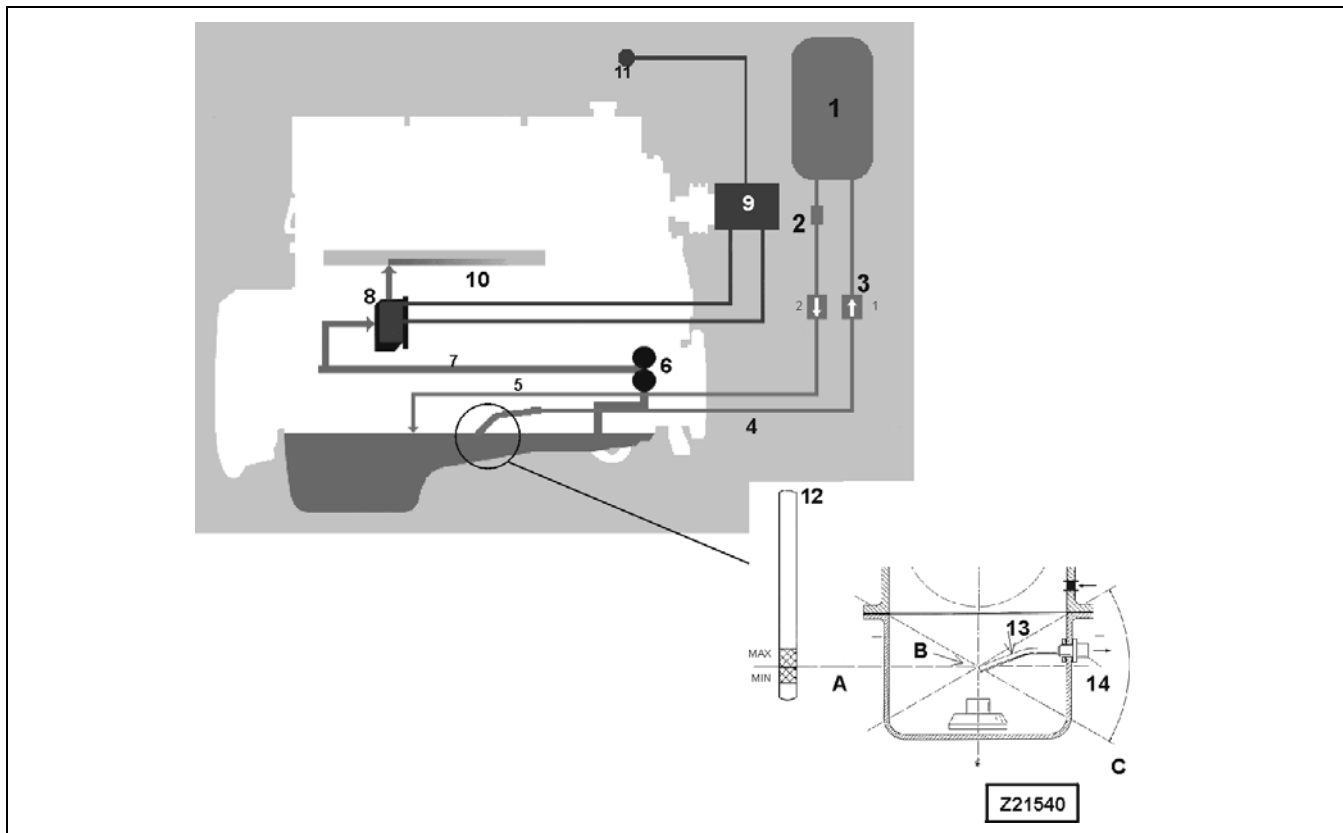
Calibration Plug for Engine Oil Quality

Ex works the calibration plug (1) is installed for Centinel operation with Mineral engine oil as shown in the illustration. When changing the engine oil quality from Mineral oil to Synthetic oil, the calibration plug (1) must be replaced accordingly. Remove calibration plug from contacts 12/13 at the terminal block (X2M) and insert to contacts 13/14. Be sure to re-position the calibration plug when changing back to Mineral engine oil. Use only engine oils as specified in the Engine Operation and Maintenance Manual.

REMARK

If Synthetic engine oil is used, plug (1) in position 13/14, then reset the Centinel system by attaching bridge wire to terminals 12/13.

Oil Burning System “Centinel” combined with Oil Supply System “Reserve”



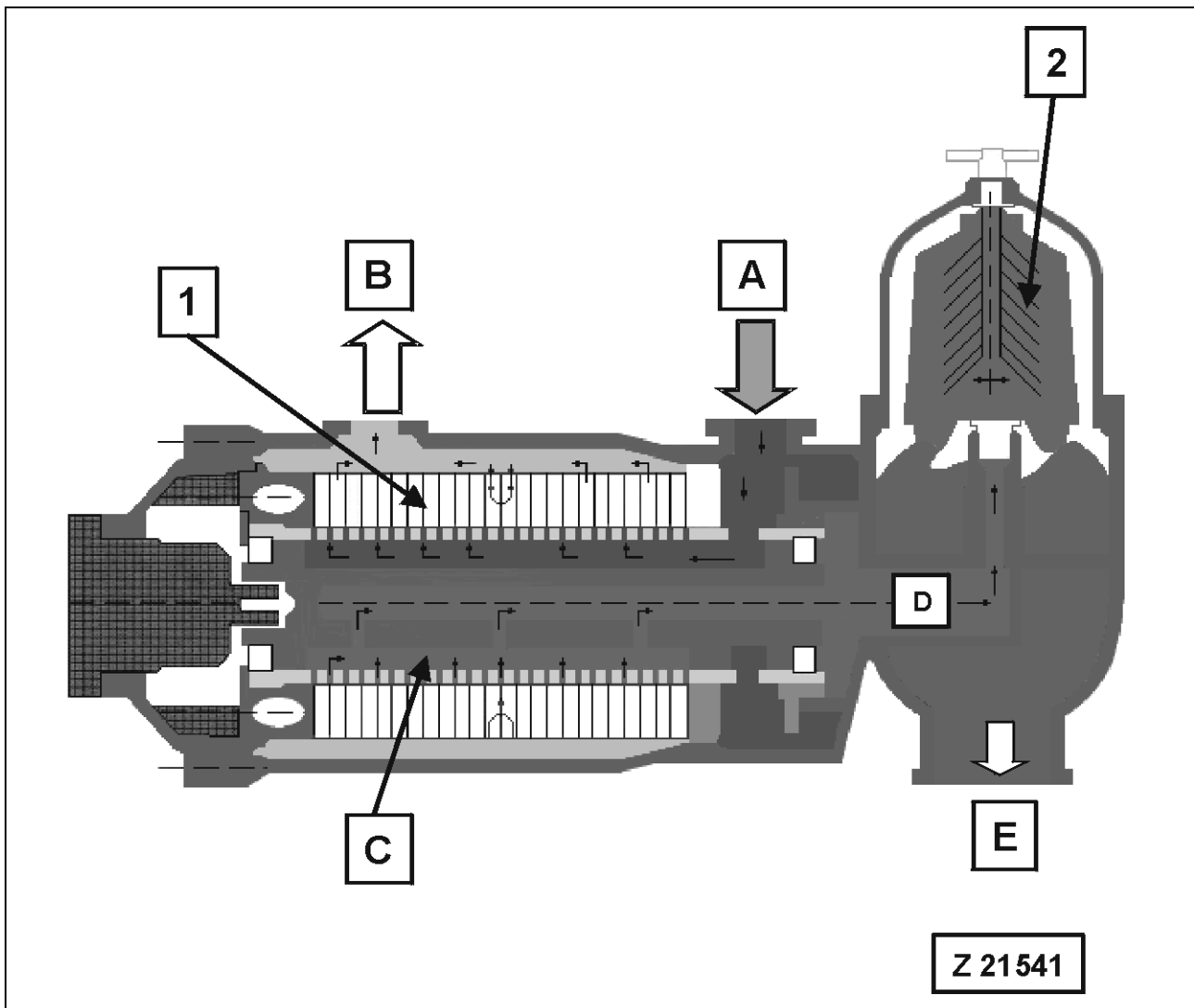
Legend for illust. Z 21473 (schematic illustration)

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

Brief description of system function

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

Eliminator Engine Oil Filtration System

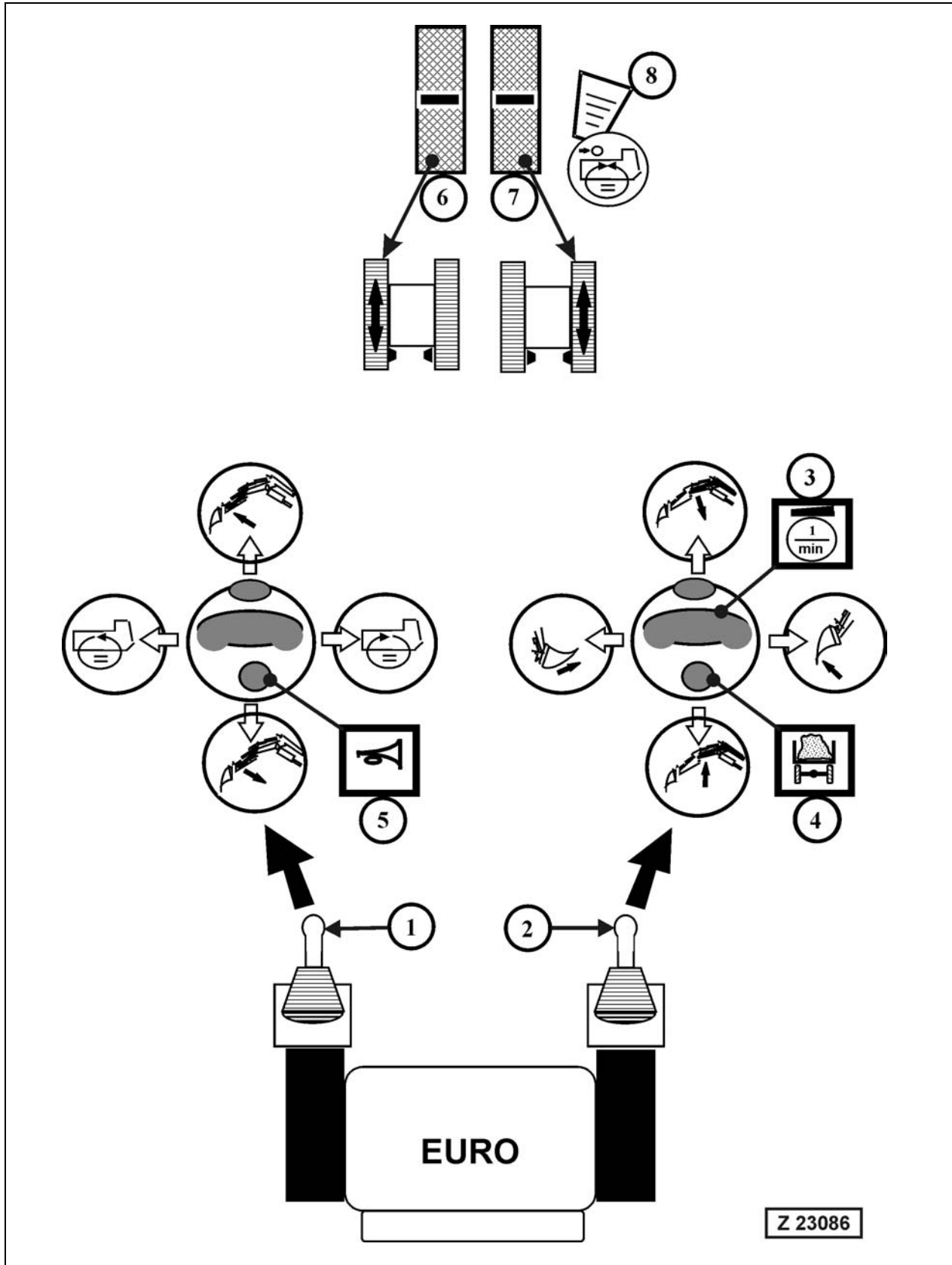


Legend for illust. Z 21541 (schematic illustration)

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

3.3 OPERATOR'S CAB - CONTROLS

3.3.1 CONTROLS WITH BACKHOE ATTACHMENT



Z 23086

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 189.

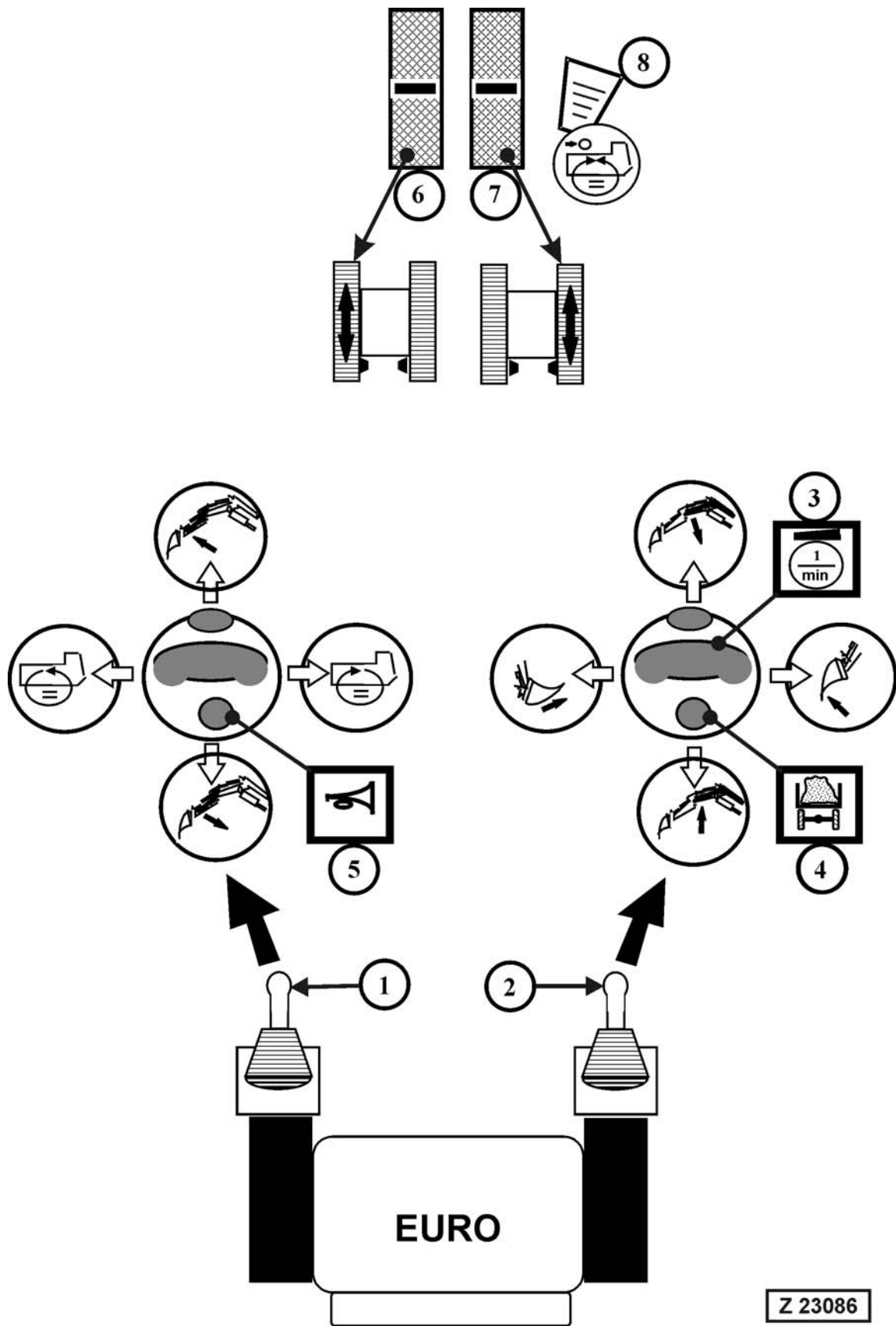
WARNING

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

Safety Circuit for Controls

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

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



Z 23086

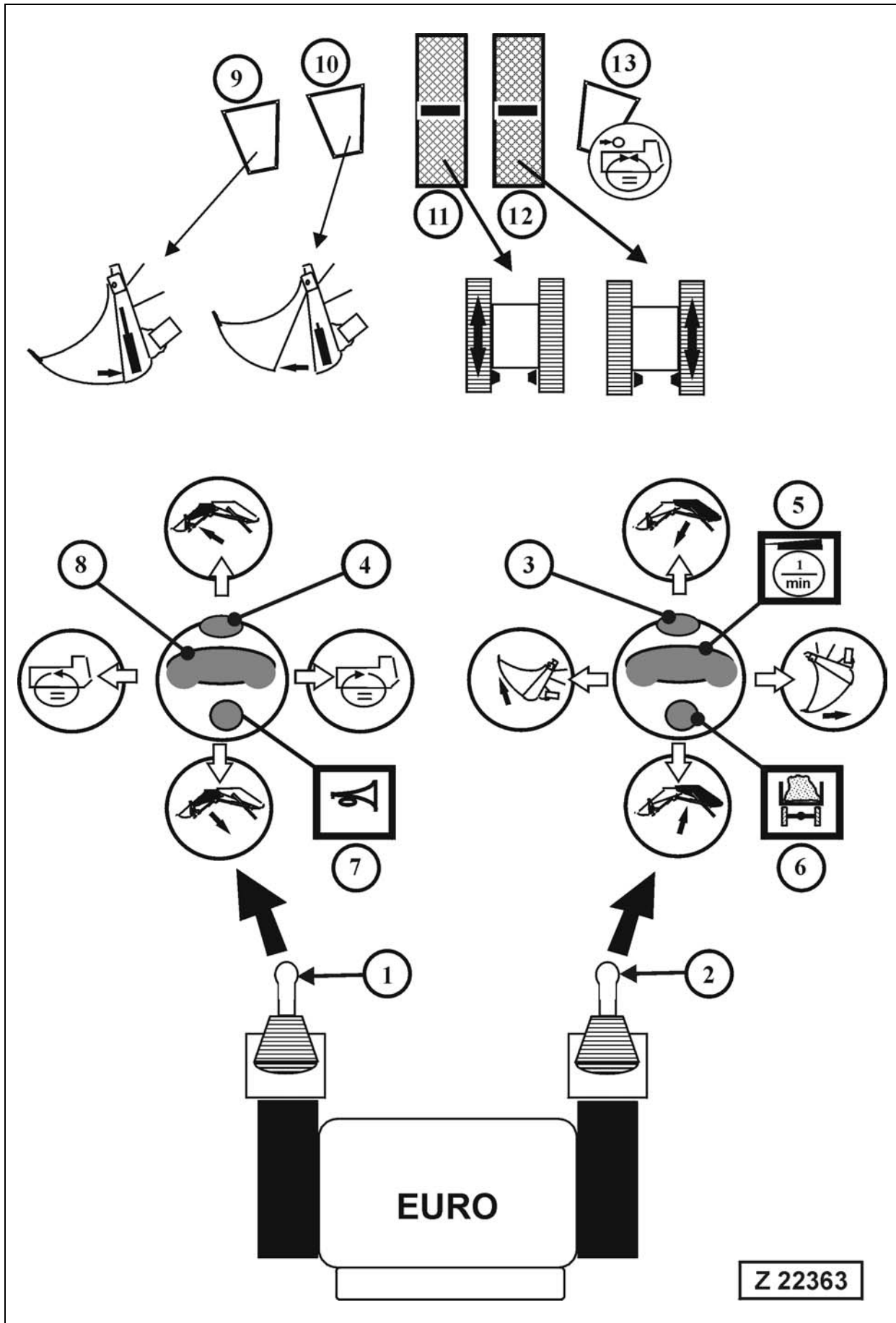
EURO Control Pattern

Legend for illustration (Z 23086)

- (1) Control lever for stick and swing machinery
- (2) Control lever for boom and bucket
- (3) Toggle switch for engine speed selection
Low idle – High idle
- (4) Push button for Truck counter.
For counting loaded trucks press this button. The total number of trucks loaded is recorded in the ETM system and can be called up, refer to page 88 for more information.
- (5) Signal horn button
- (6) Travel control pedal, left track forward - reverse
- (7) Travel control pedal, right track forward - reverse
- (8) Swing brake pedal

For more information → See "WORKING WITH THE ATTACHMENT" on page 189.

3.3.2 CONTROLS WITH BOTTOM DUMP BUCKET



Z 22363

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 189.

WARNING

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

Safety Circuit for Controls

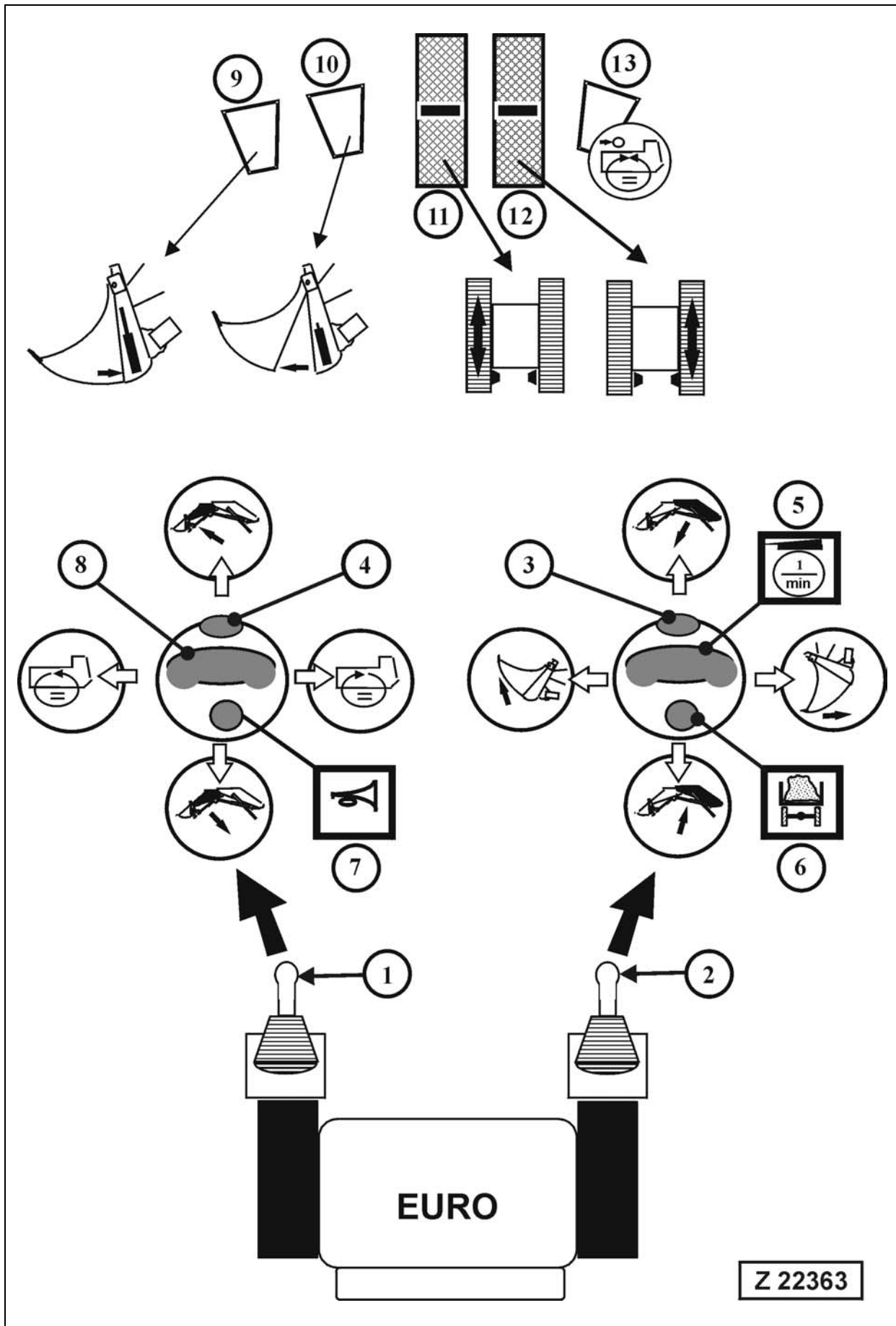
(Pilot control system cut-out and actuation of hydraulic swing parking brake)

This system is controlled through the lock lever at the operator's seat, the hydraulic access ladder and the service arm of the central refilling system. It prevents movements of the Shovel and its attachment as long as the lock lever is in the upper locked position and/or the 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 both buttons (3 and 4) and keep depressed as long as the float position shall be deactivated. When releasing the buttons the float position is activated again.

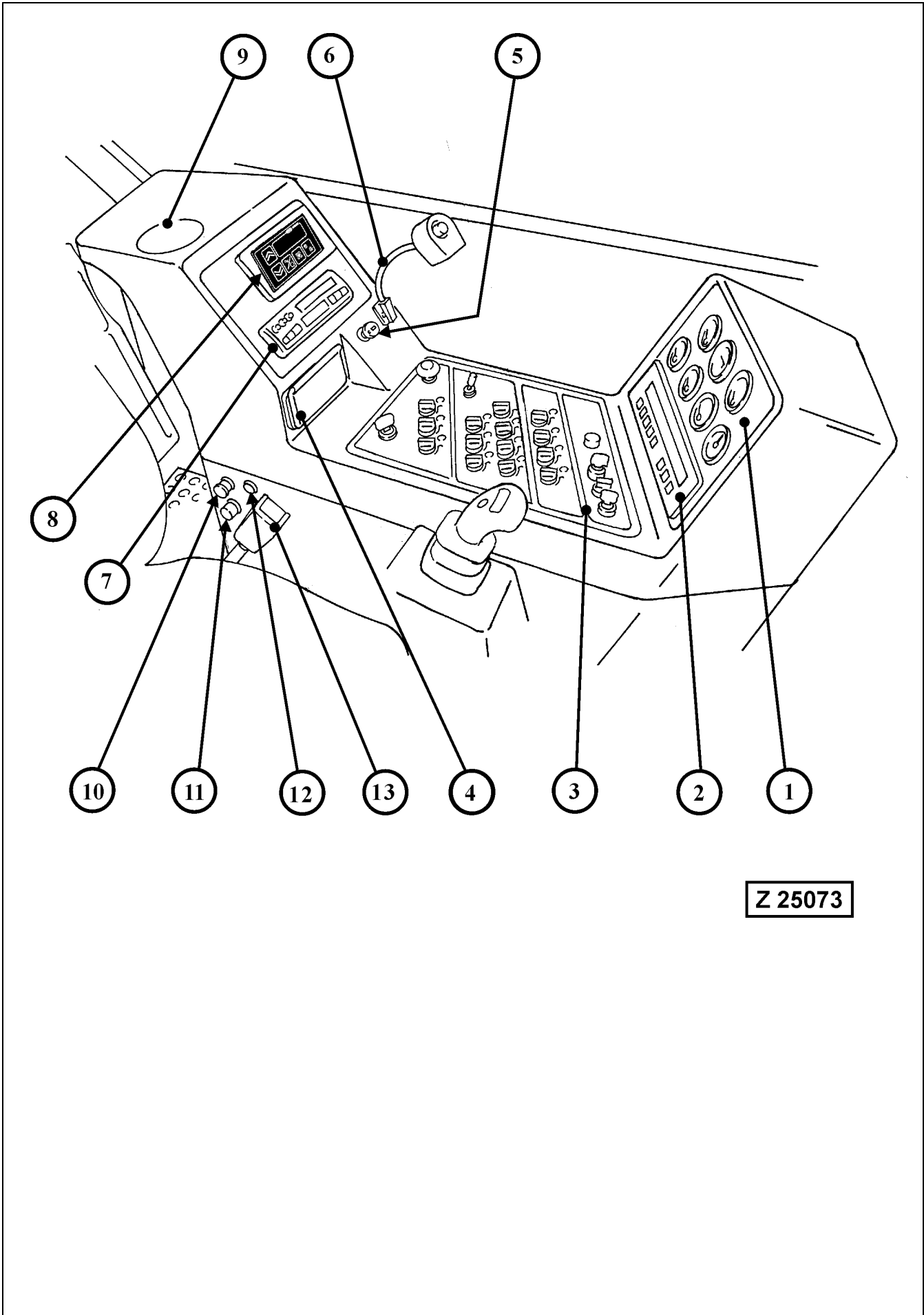


EURO Control Pattern

Legend for illustration (Z 22363)

- (1) Control lever for stick and swing 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) Toggle switch for engine speed selection
Low idle – High idle
- (6) Push button for Truck counter
For counting loaded trucks press this button. The total number of trucks loaded is recorded in the ETM system and can be called up, refer to page 88 for more information.
- (7) Signal horn button
- (8) Not used
- (9) Pedal for closing the bottom dump bucket
- (10) Pedal for opening the bottom dump bucket
- (11) Travel control pedal, left track forward - reverse
- (12) Travel control pedal, right track forward - reverse
- (13) Swing brake pedal

For more information → See "WORKING WITH THE ATTACHMENT" on page 189.



3.3.3 OPERATOR'S CONSOLE

Legend for illust. Z25073

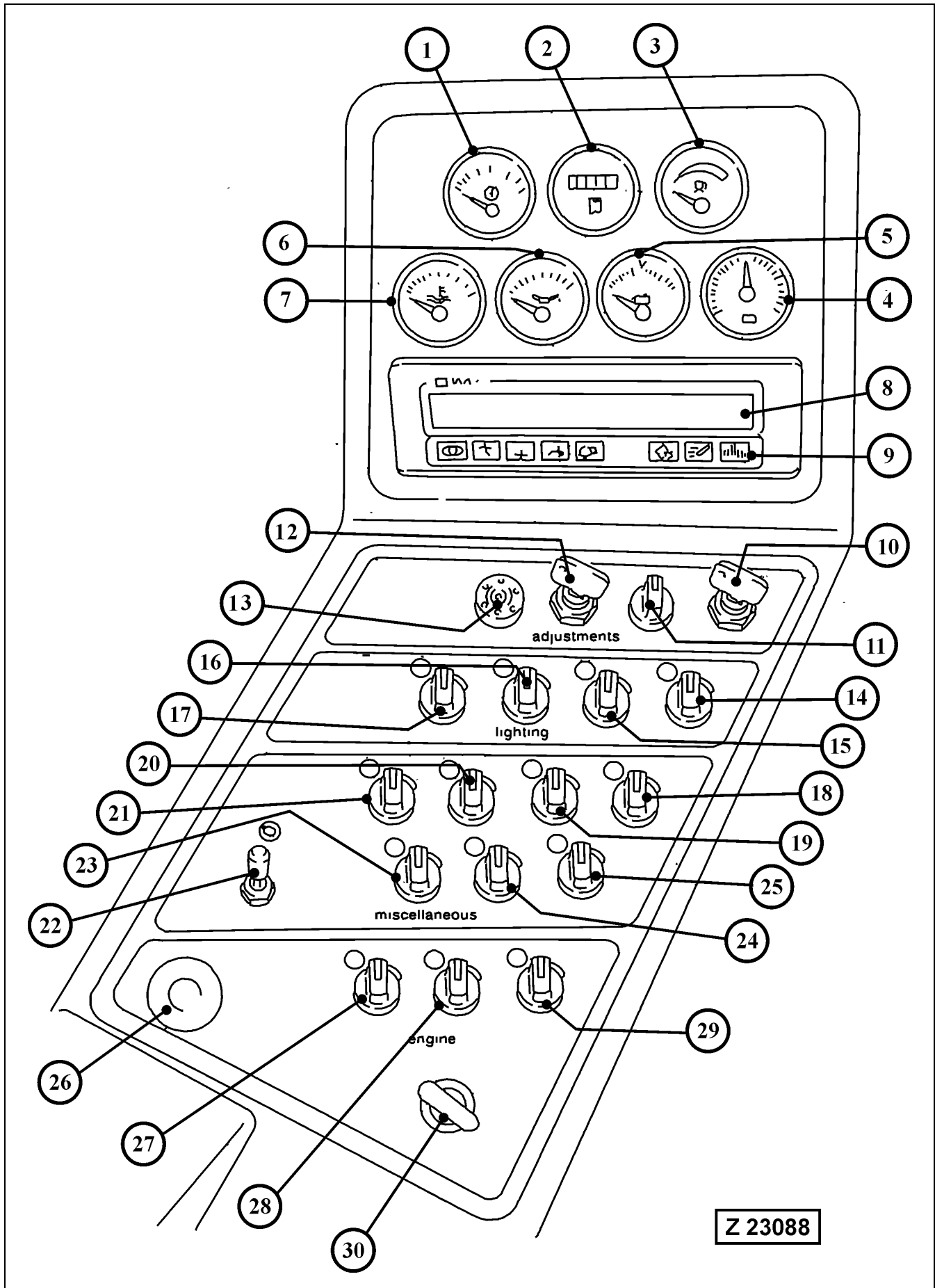
- (1) Analogous gauges, see page 83 for more information
- (2) Text display with key board of the Electronic Text Monitoring System "ETM". Refer to page 88 for more information.
- (3) Switch board, see page 83 for more information
- (4) Ashtray
- (5) Cigarette lighter
- (6) Switch board lighting with flexible arm
- (7) Radio (if so equipped)
- (8) Heater and air conditioning control panel, see page 128 for more information
- (9) Cup holder
- (10) Plug socket (X27) for download of ETM data from protocol and statistics memory
- (11) Plug socket (X13) for electronic pump control diagnostic, refer to service manual for more information.
- (12) Plug socket 24V DC
- (13) Seat belt

⚠ WARNING

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

⚠ CAUTION

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



Control Panel

Legend for illust. Z 23088

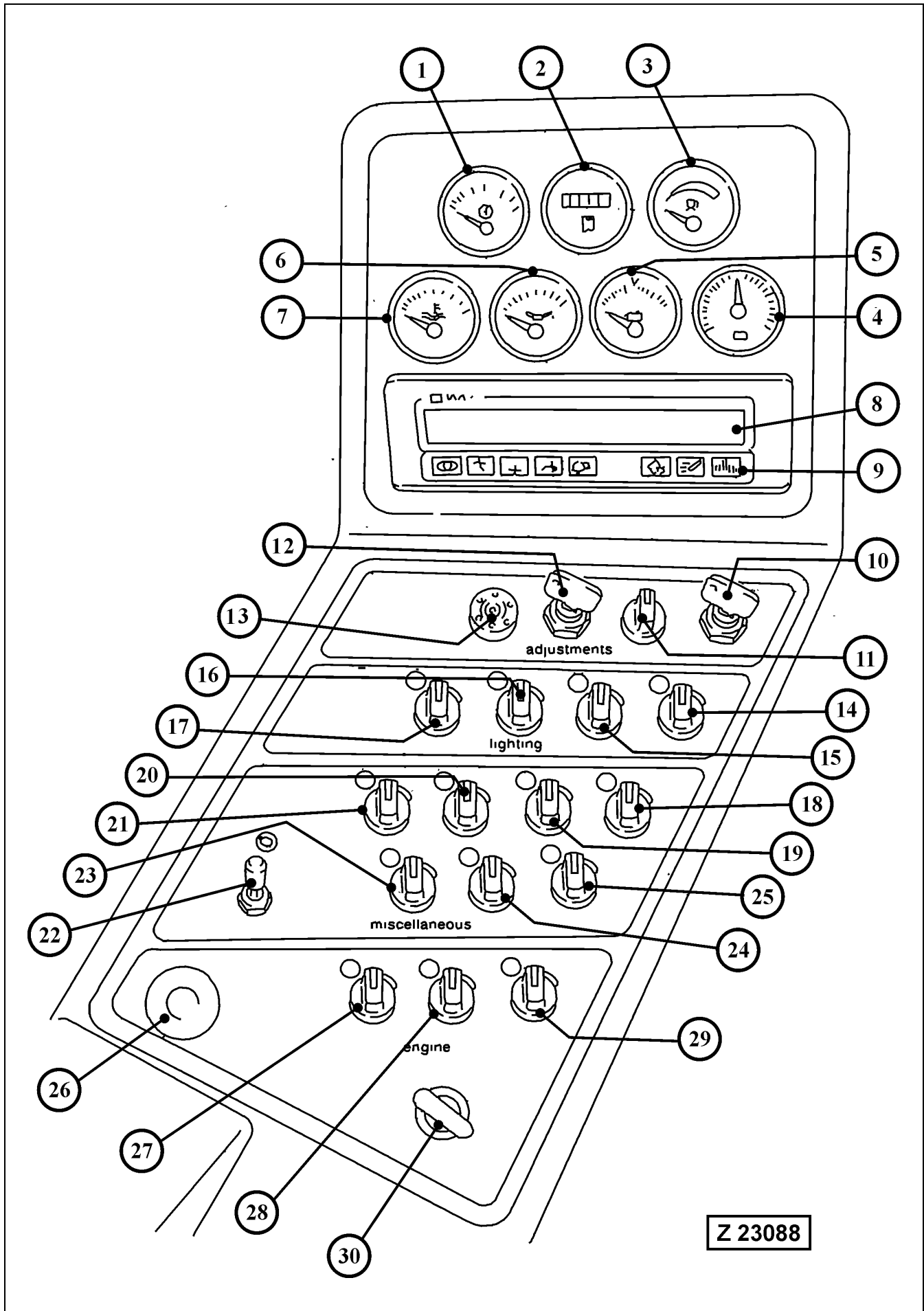
- (1) Hydraulic oil temperature gauge
- (2) Hourmeter. The hourmeter indicates the total number of hours of engine operation. A second hourmeter indicating the hours of traveling operation is installed in the X2 switch box, see page 147 for more information.
- (3) Fuel level gauge
- (4) Ammeter
- (5) Voltmeter
- (6) Engine oil pressure gauge
- (7) Engine coolant temperature gauge
- (8) Text display of the Electronic Text Monitoring system ETM, refer to page 88 for operating instructions.
- (9) Keyboard with 8 keys, used to switch the screen and for input of data
- (10) Service key switch for deletion of ETM memory data
- (11) Selector switch for ETM settings
- (12) Key operated switch for enabling settings of the ETM system
- (13) Acoustic warning signal

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

CAUTION

In case of too low hydraulic oil level this signal sounds continuously. Shut down the Shovel, locate and correct the cause immediately. Fill up hydraulic oil to the correct level. For the correct checking procedure → See "CHECKS BEFORE STARTING THE ENGINE" on page 164.

- (14) Switch for main working lights
- (15) Switch for dashboard illumination
- (16) Switch for interior illumination
- (17) Switch for warning beacon on cab roof (if so equipped)
- (18) Switch for upper and lower windshield wiper
Switch positions:
0 - Off
1 - Interval stage
2 - Slow stage
3 - Fast stage
- (19) Switch for windshield washer



Control Panel (continued)

Legend for illust. Z 23088

- (20) Enable switch for hydraulic service arm operation. Set this switch to ON position "1" before lowering the service arm. With this switch in ON position, the pilot control system is made inoperative and the hydraulic swing brake is applied. After completion of replenishment procedure, swing back the service arm to its home position and set switch (20) to OFF position "0".
- (21) Switch for mirror heating
- (22) Toggle switch for swing parking brake
- "0" Parking brake released - UP
 - "1" Parking brake applied - DOWN.

CAUTION

The parking brake must only be applied with superstructure at complete standstill, except in case of emergency. Refer to page 186 for more information.

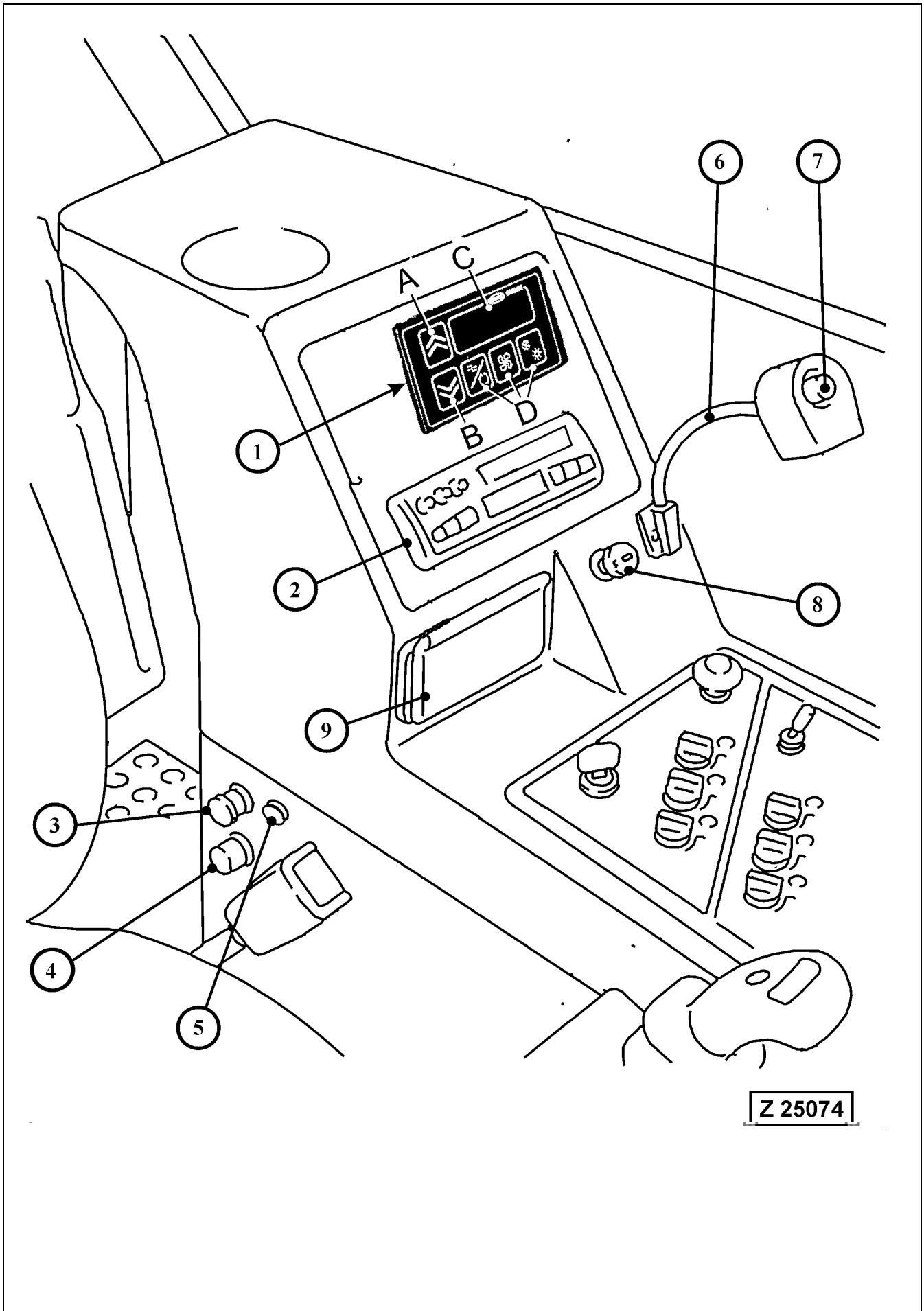
- (23) Switch for manual actuation of central lubrication system
- (24) Switch for manual actuation of swing ring gear pinion lubrication system
- (25) Switch for cab ventilation blower. Blower runs with low speed, even with switch in "0" position. (Cab pressurizing prevents ingress of dust).
- (26) Strike button for emergency shut down of the engine and pilot control system cut out.

WARNING

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

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

- (27) Rotary switch for starting the engine
- (28) Rotary switch for start pilot (cold starting aid)
- (29) Rotary switch for stopping the engine
- (30) Key operated main switch



Rear Panel Controls

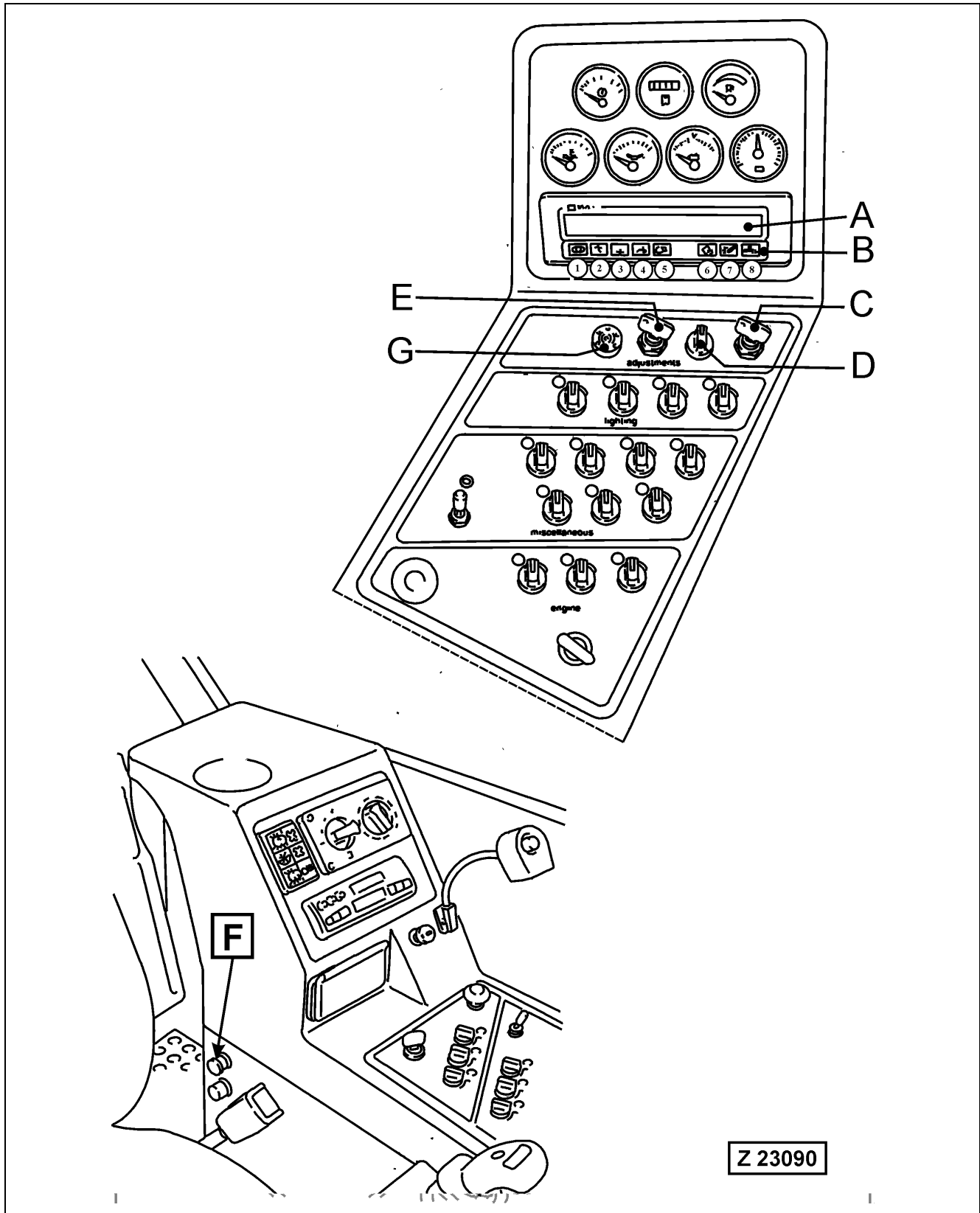
Legend for illust. Z25074

- (1) Control unit for air conditioning and heating, see page 128 for more information.
 - A - Plus key
 - B - Minus key
 - C - Digital display
 - D - Selector keys and LED indication
- (2) Radio
- (3) Plug socket (X27) for download of ETM data from protocol and statistics memory
- (4) Plug socket (X13) for electronic pump control diagnostic, refer to service manual for more information.
- (5) Plug socket 24V DC
- (6) Flexible switch board lighting
- (7) Light switch
- (8) Cigarette lighter
- (9) Ashtray

REMARK

For more information of the air conditioning refer also to the separate Instruction Manual -CARRIER SÜTRAK- filed in volume 2 binder:

3.4 ELECTRONIC TEXT MONITORING SYSTEM ETM



3.4.1 INTRODUCTION

The ETM system with plaintext display provides continuous monitoring of all Excavator functions and operating conditions.

The ETM has the capability to cover a total amount of 60 different messages, the text messages can be selected in English or German language.

Further features of the ETM System

- The ETM system is equipped with a PROTOCOL Memory for recording of the fault messages and a STATISTICS Memory for registration of duration and frequency of each single fault that has occurred.
- Up to 1300 messages can be stored in the record memory and registered in the statistics memory.
- The ETM works in the last (most important) message mode. The messages are divided into four groups according to their importance. The last message received by the ETM will be displayed. If there are several messages at the same time, the most important message will be displayed. The other messages are kept in the background. They are indicated by a flashing number on the screen and can be called up.
- Recording of the messages is accomplished with "COMING-GOING" registration.
- The statistics memory counts the frequency of COMING messages and establishes their total amount.

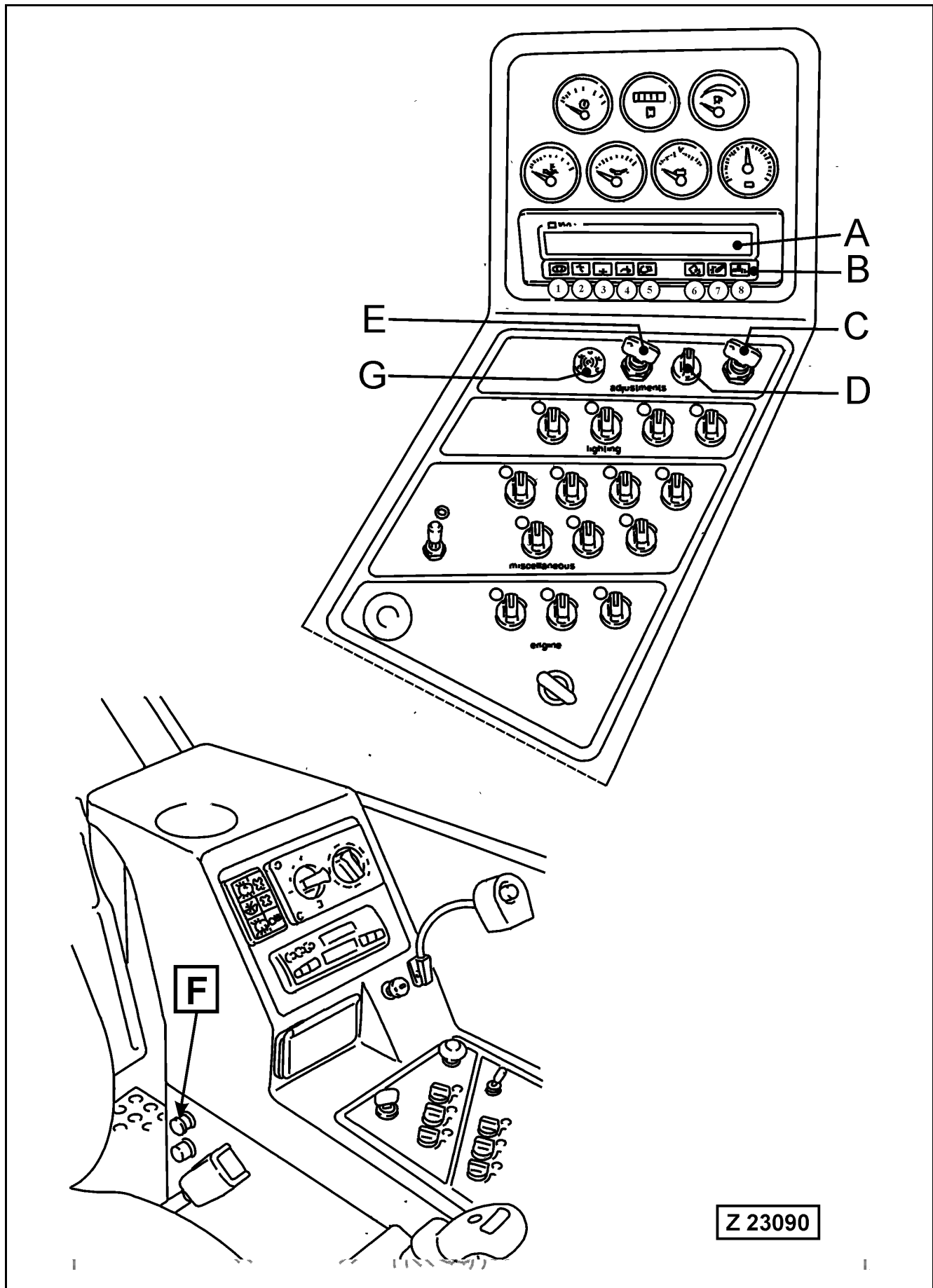
The Messages are divided into two Main Groups as follows:

1. FAULT MESSAGES
Fault messages indicate a trouble condition, e.g.
Low idle: High pressure filter 1 restricted.

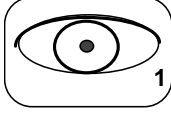


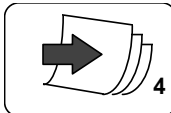
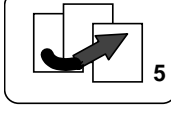

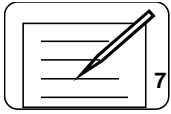
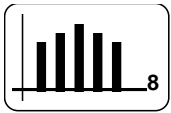
REMARK

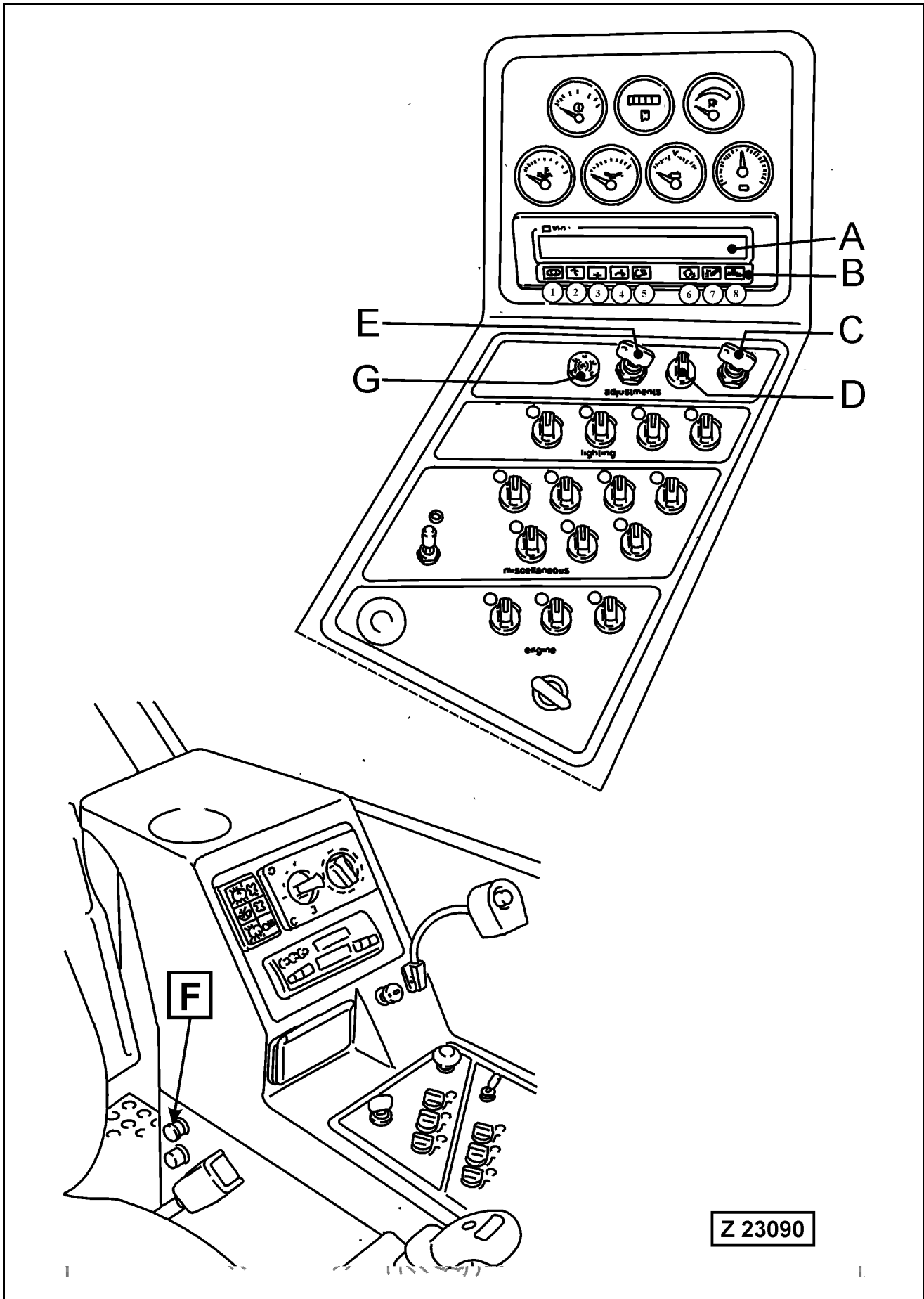
Serious faults resulting in an automatic engine shut down, refer to Fault- and Message list on page 116 for details.

2. INFORMATION MESSAGES
An information message indicates an operating condition, e.g.
Caution: Slew gear brake on.



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

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



3.4.2 SYSTEM COMPONENTS

see illust. Z 23090

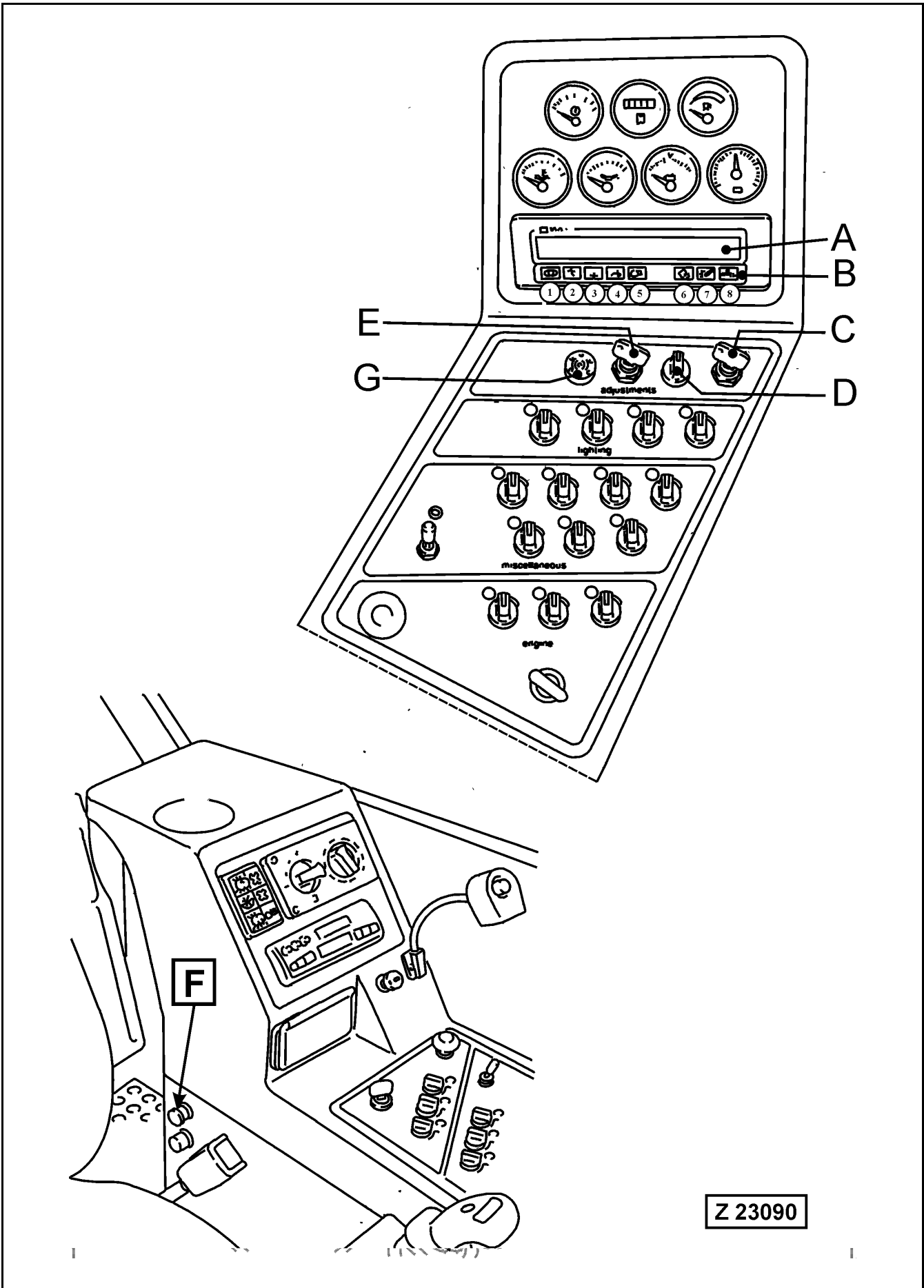
- | | |
|---|---|
| <p>(A) Text Display Unit</p> <p>(B) Key board with 8 keys</p> <p>(G) Acoustic warning signal</p> <p>(F) Connector for printer</p> | <ul style="list-style-type: none">● Plaintext messages● Multi-lingual text display● Text store for all available texts● Record memory capacity for max. 1300 messages● Statistics memory for frequency and total time period of the messages
● Function of the keys, refer to page 91
● Indicates fault messages
● Special equipment |
|---|---|

Switches for the adjustments of the ETM system

- (C) "Service" key switch for deletion of Record - and Statistics memory contents
- The erasure function is stored under message no. 30.
- (D) Pre-selector switch for the following settings:
- "0" - Off
 - "1" - Setting of Date
 - "2" - Setting of Time of day
 - "3" - Setting of Operating Hours
- (E) Key switch, enables the settings selected with switch (D). The adjustments are stored under message nos. 27, 28 and 29.

NOTICE

Settings with key switches (C and E) must only be done by authorized Service Personnel. Refer to page 113 for setting procedure.



Message Classification

The 60 possible messages are classified as follows:

- Fault messages are stored in the record memory and also kept in the statistics memory. When these messages are displayed, an acoustic signal is heard.
- Information messages are identified by the sign (#) in the upper LH corner of screen (A). Information messages are not stored.
- The message pages (number 27 to 30) are used for settings of the ETM.

REMARK

The messages are divided into four groups according to their priority.

3.4.3 FUNCTIONS OF THE ETM SYSTEM

After switching on the excavator's key operated main switch, the name of the manufacturer will be displayed for a period of 5 seconds.

NOTICE

If during this period a key is being actuated, the manufacturer's name remains on the screen for further 20 seconds.

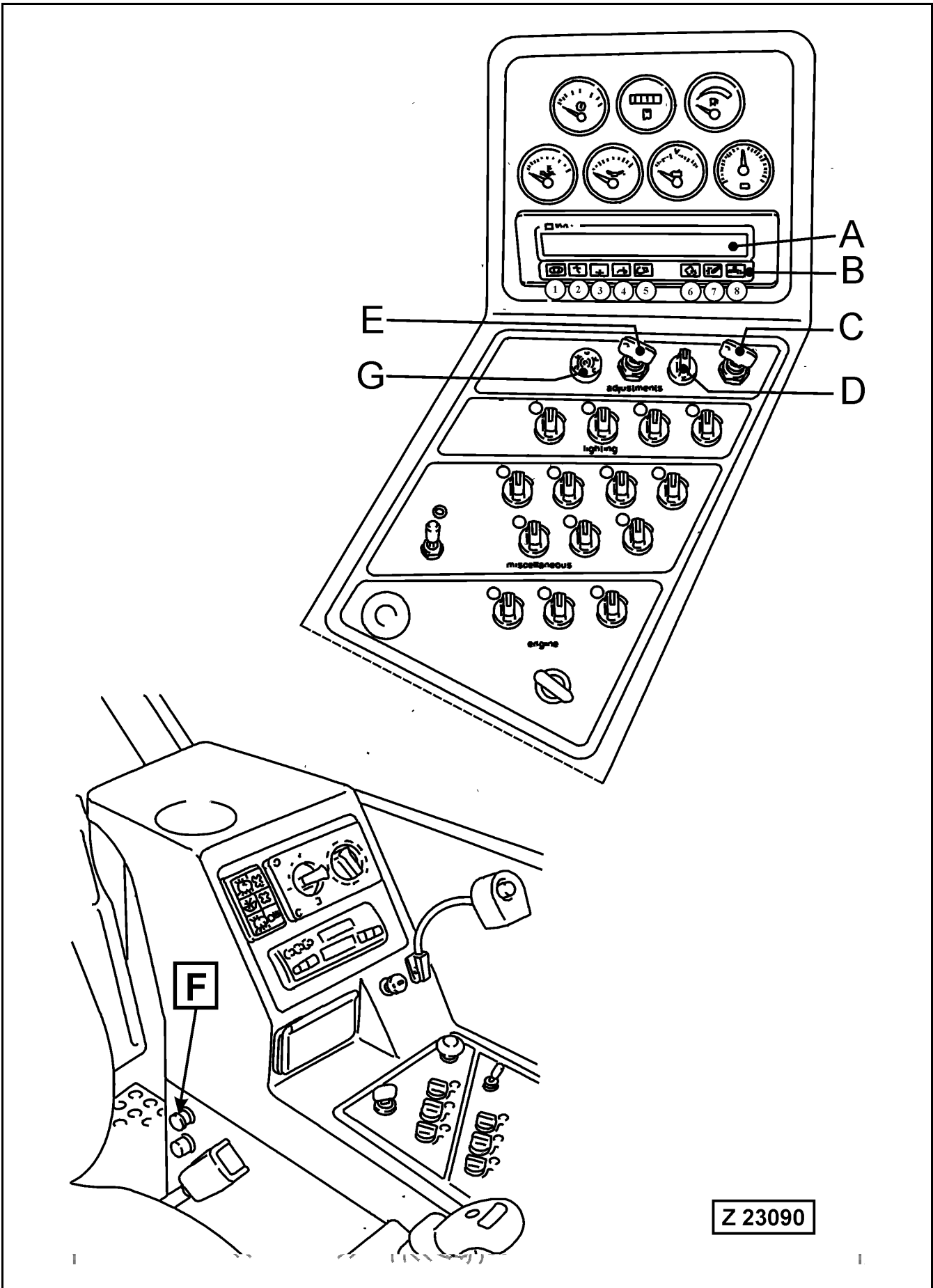
Thereafter the basic ETM display appears on the screen. This display is for general information during operation.

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, the message will be displayed if it is more important than the present message on the screen, so that the operator is always shown the latest, most important message. A flashing number on the screen shows the total number of the current messages. The message text provides the operator with an explanation of the condition in standard texts as listed in the annexes "Message Texts". When a fault message is displayed the number of operating hours is displayed at the same time.

Information conditions are held as long as they occur, but are not stored.

Basic Display (message page no. 0):

DATE:	TIME OF DAY:	OPERATING HOURS (h):
		ENGINE RPM (1/min):
		TRUCK COUNTER:



NOTICE

The steps for operating the ETM keyboard are indicated by the key symbols.

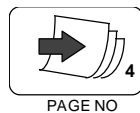
Call up the Basic Display from any message

If a fault condition occurs (e.g. message 21) it is possible to call up the basic display for information of current time or engine speed.

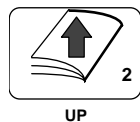
Example: Message 21

**\$h: 5200:27 Central lubrication system:
grease barrel empty**

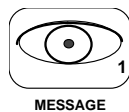
The grease consumption can be determined, when the operating hours at the time of the last refilling or replacement of the grease barrel have been recorded.



Page 21 displayed



Press, until **page 0** appears

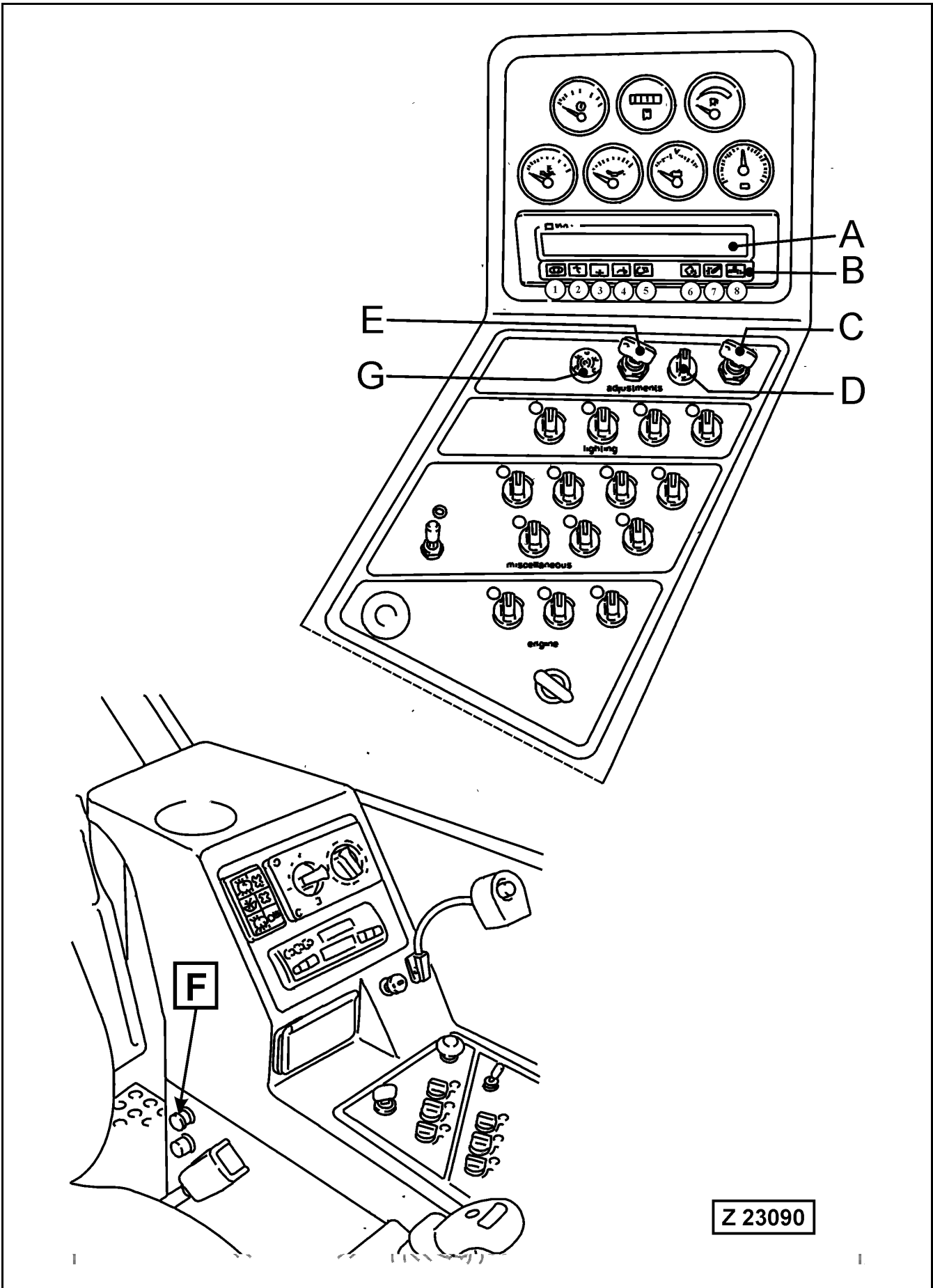


Press, to display **message 0** (basic display)

On the screen appears the basic display, e.g.:

15.07.07	14 : 36: 39	h: 5200:27
		1/min: 1800

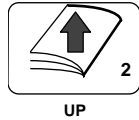
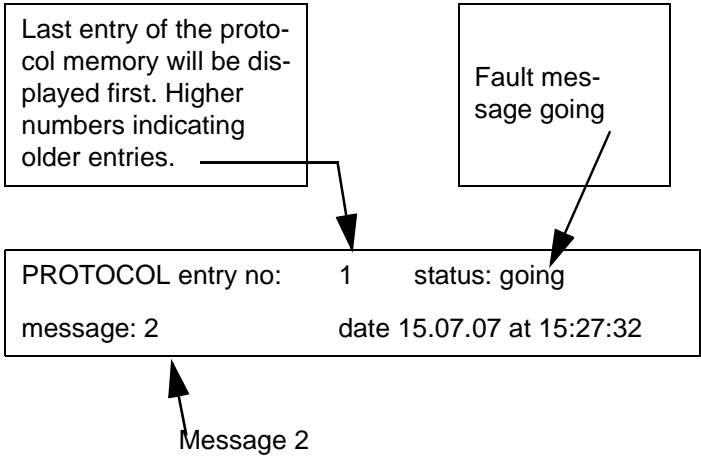
Message 0 will only be displayed for a few seconds, then the display returns to the current message.



3.4.4 DISPLAY THE CONTENTS OF THE RECORD (PROTOCOL) MEMORY



Press to display Protocol memory.

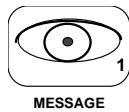
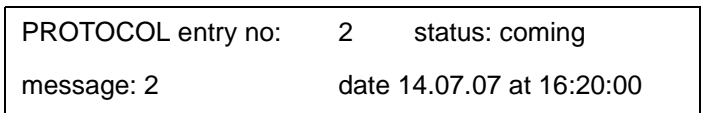


or



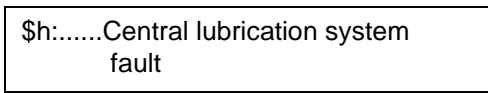
Press until the desired entry no. (entry No. 2) appears

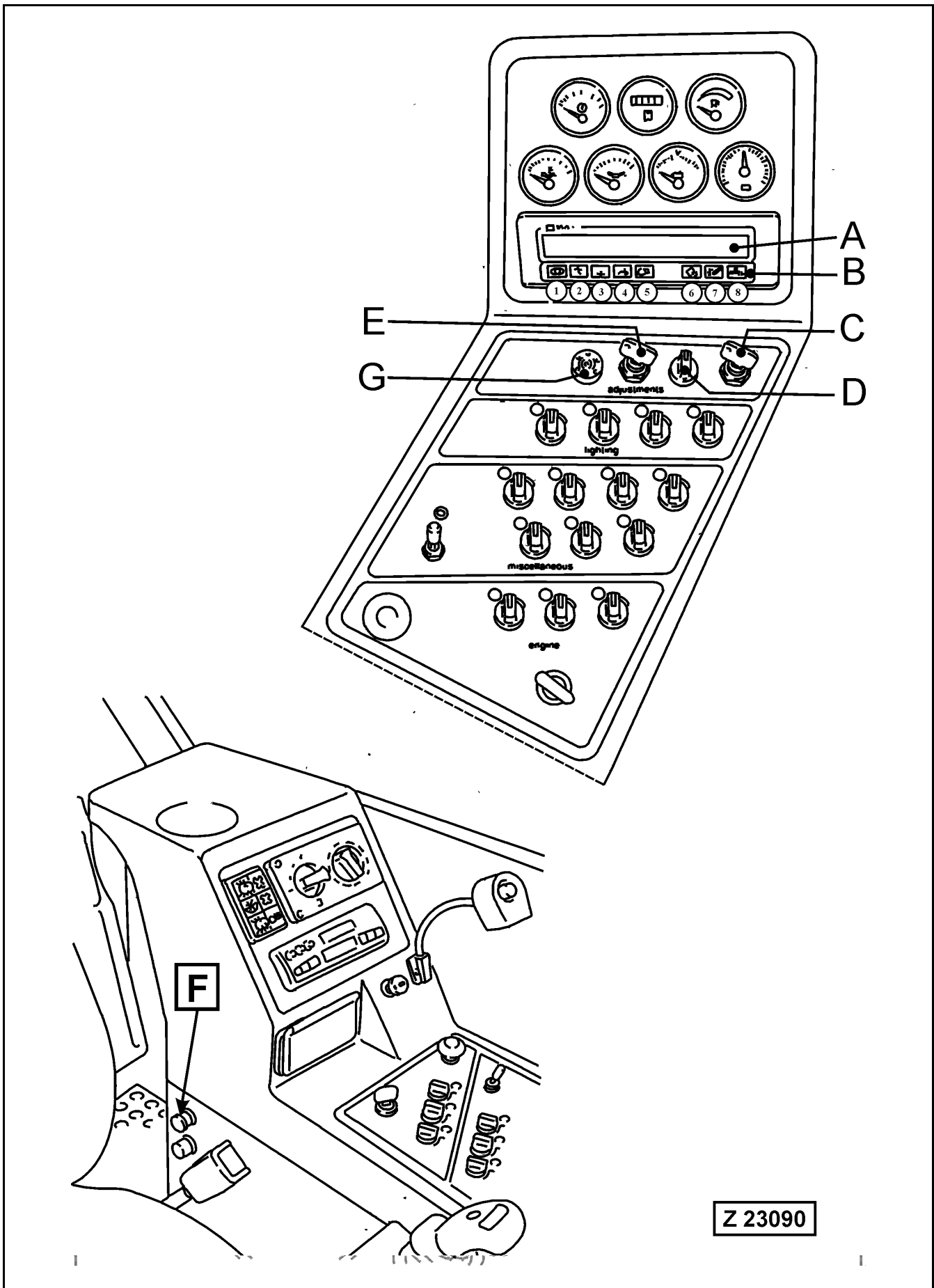
Example (entry no. 2)



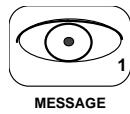
Press to display message 2.

Display:

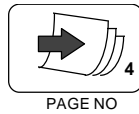




Display the Contents of Record Memory



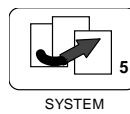
or



Press to return to the last message text.

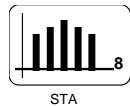
Display:

PROTOCOL entry no:	2	status:	coming
message:	2	date	14.06.07 at 16:20:00



Press to return to the basic display.

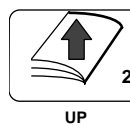
Display the Contents of Statistics Memory



Press to display statistics memory.

Display:

STATISTICS Appeared:	4	= 80.0%
Error: 1 Elapsed:	00:02:40	= 100.0%



or



Press to leaf through all recorded messages.

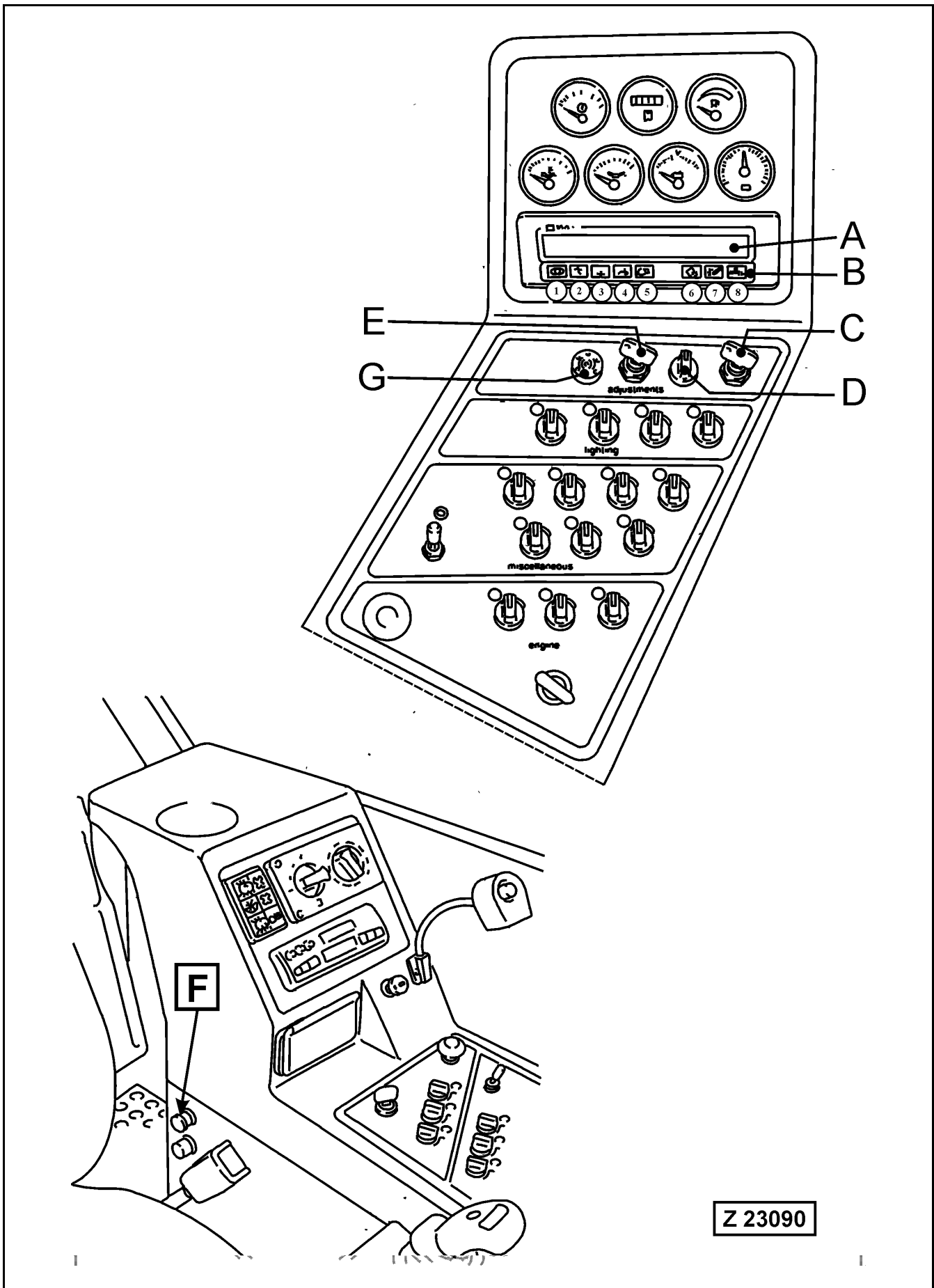
Indication in percent how often the fault has occurred in relation to the total number of faults = 100%.

STATISTICS	Appeared: 1	= 20.0%
Error: 2	Elapsed: 00:03:40	= 74.5%

Message 2

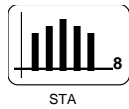
Duration of the fault

Fault portion in percent of the total error time



Print out Contents of Statistics Memory:

15.06.07	14: 36: 39	h: 1351:20 1/min: 1800
----------	------------	---------------------------



The complete statistics are now being printed out.

Display:

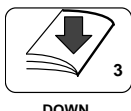
*****STATISTICS PRINTOUT*****
Printing statistics table, please wait.....

NOTICE

it is recommended to erase all entries in the statistics memory with key switch (C) after each main service period in order to keep the statistics clear. Prior to delete the statistics, print out or record the contents of the statistics memory in the table on page page 105 to ensure complete service record of the excavator. The date and operating hours should also be recorded.

Print out Contents of Record (PROTOCOL) memory:

Print out the complete Contents of Record (PROTOCOL) Memory



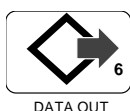
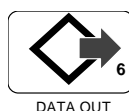
Press until the maximum amount of entries (39) is reached

Display:

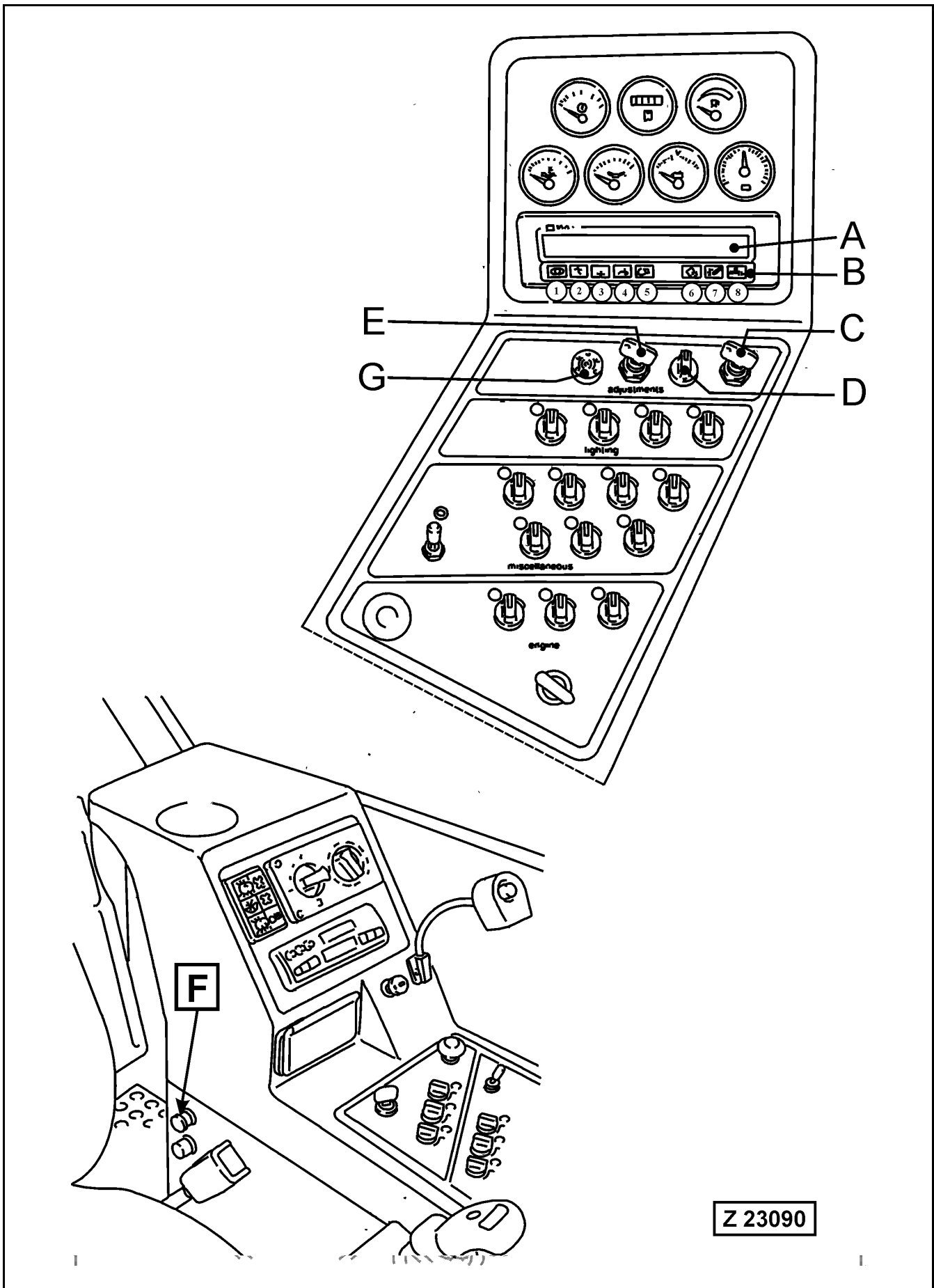
Print from the last	>	1< PRO entries
page no all * PRO has		39 entries *P*



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

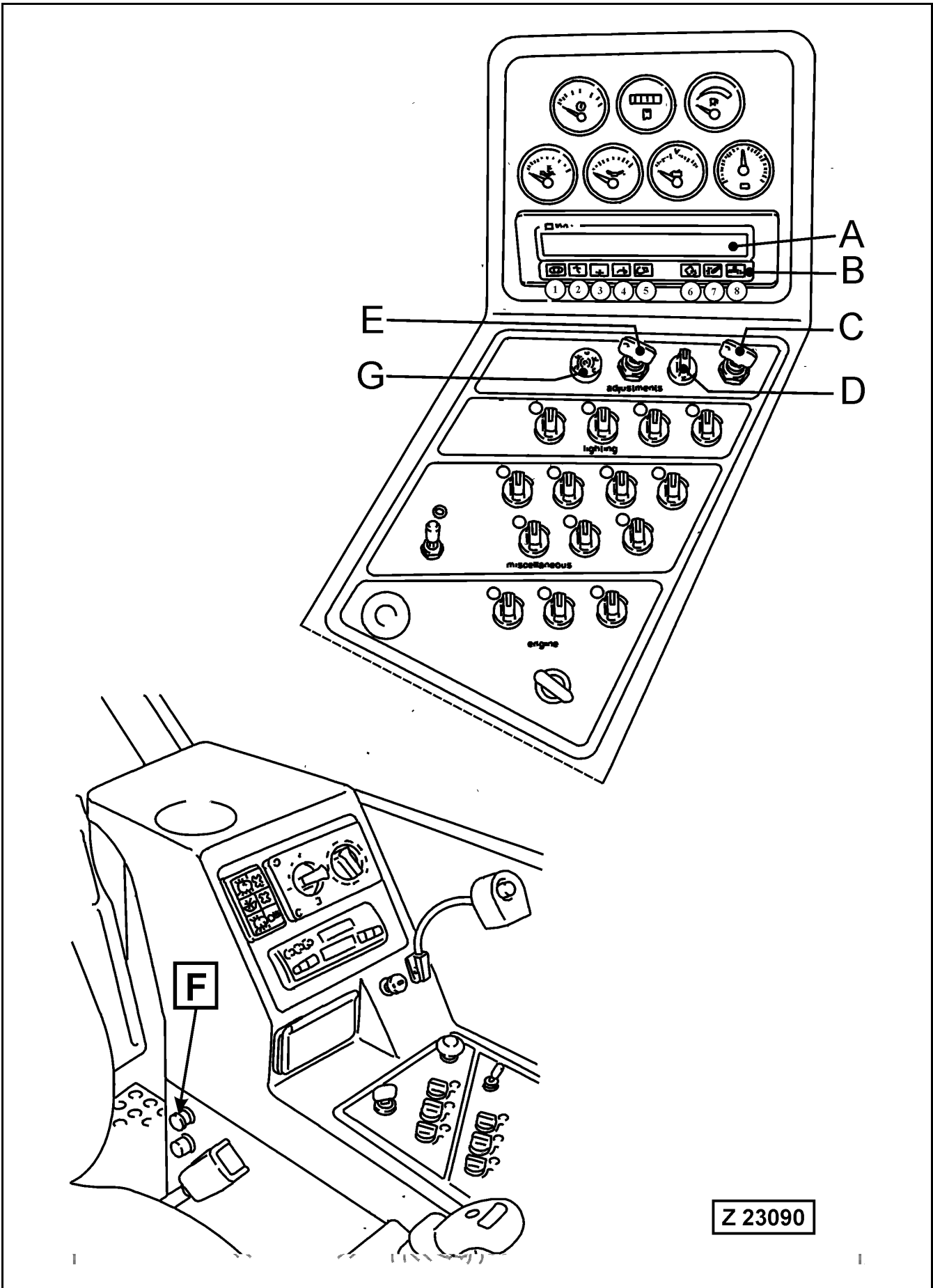


The complete PROTOCOL is now being printed out.



STA START: Date
STA PRINT: Date
Operating hours:.....h

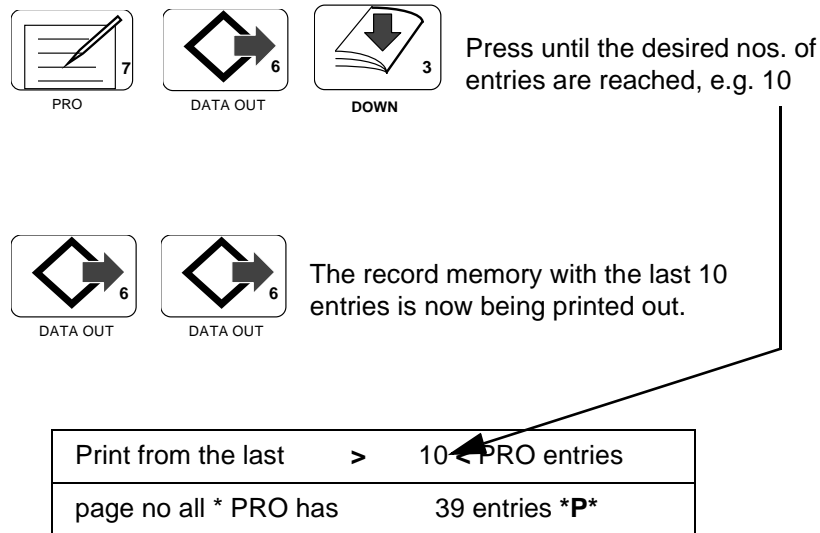
Good:	=	%	=	%
1.	=	%	=	%
2:	=	%	=	%
3:	=	%	=	%
4:	=	%	=	%
5.	=	%	=	%
6:	=	%	=	%
7:	=	%	=	%
8:	=	%	=	%
9:	=	%	=	%
10:	=	%	=	%
11	=	%	=	%
12:	=	%	=	%
13:	=	%	=	%
15:	=	%	=	%
17:	=	%	=	%
18:	=	%	=	%
19:	=	%	=	%
20:	=	%	=	%
21:	=	%	=	%
22:	=	%	=	%
23:	=	%	=	%
30:	=	%	=	%
31:	=	%	=	%
32:	=	%	=	%
33:	=	%	=	%
34:	=	%	=	%
35:	=	%	=	%
36:	=	%	=	%
Err.:				



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

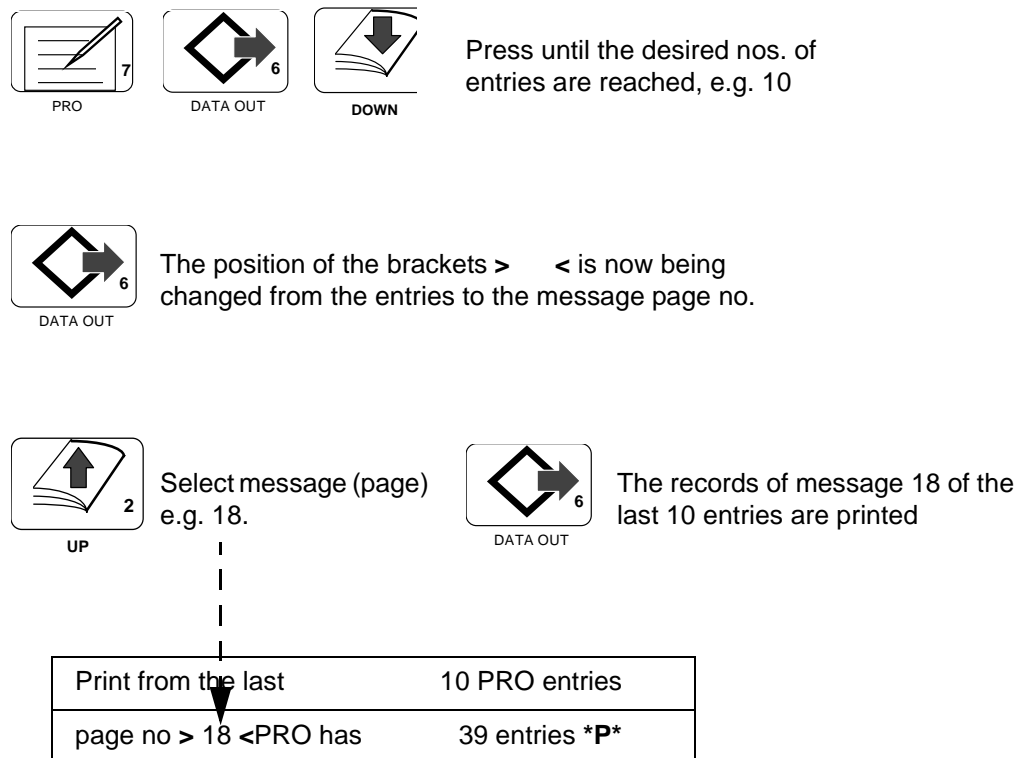
1st. Possibility - The last X Entries under consideration of all Messages

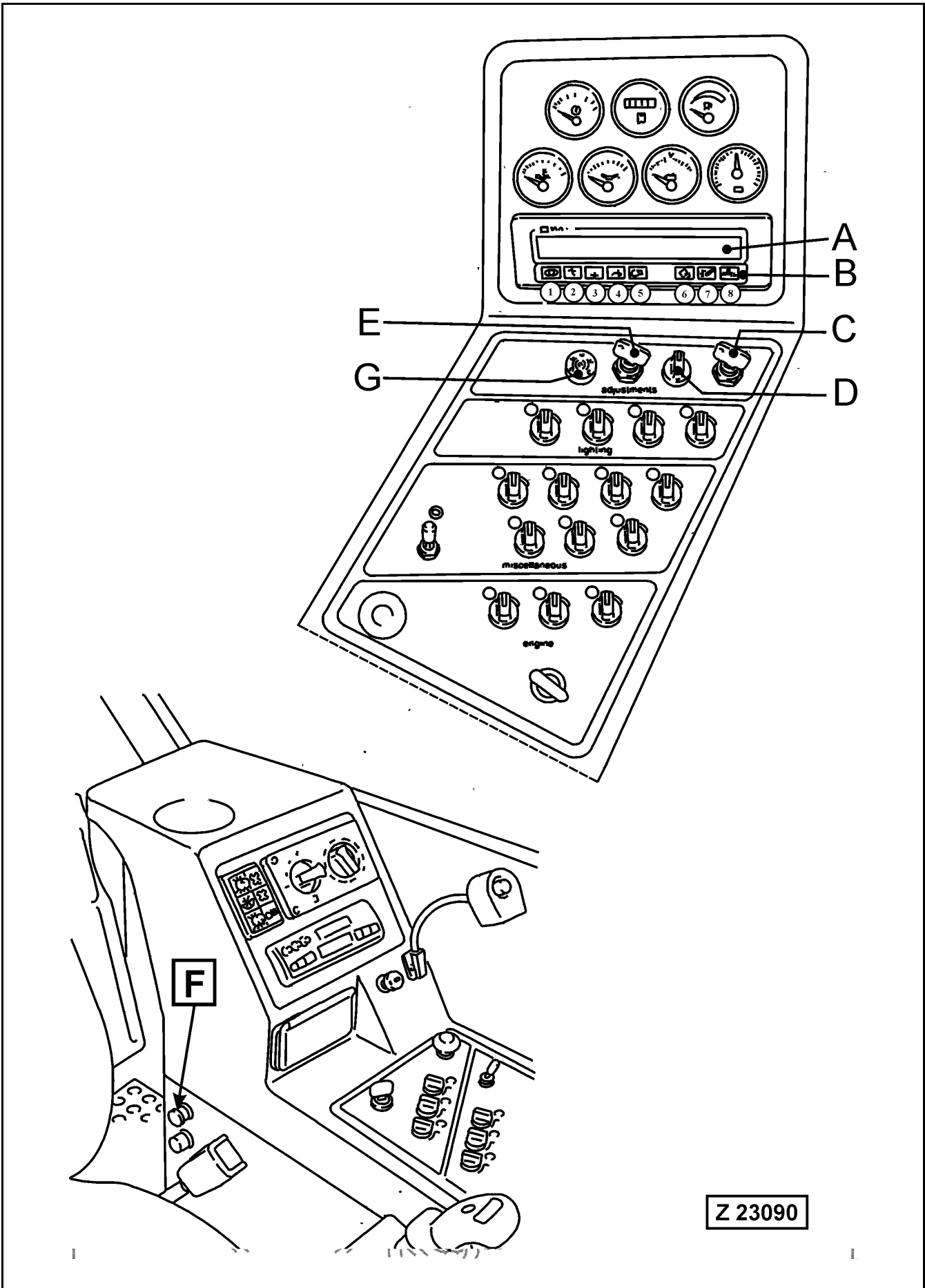
X = desired number of the last entries e.g. 10 (the last 10 entries of 39 total entries)



2nd. 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.



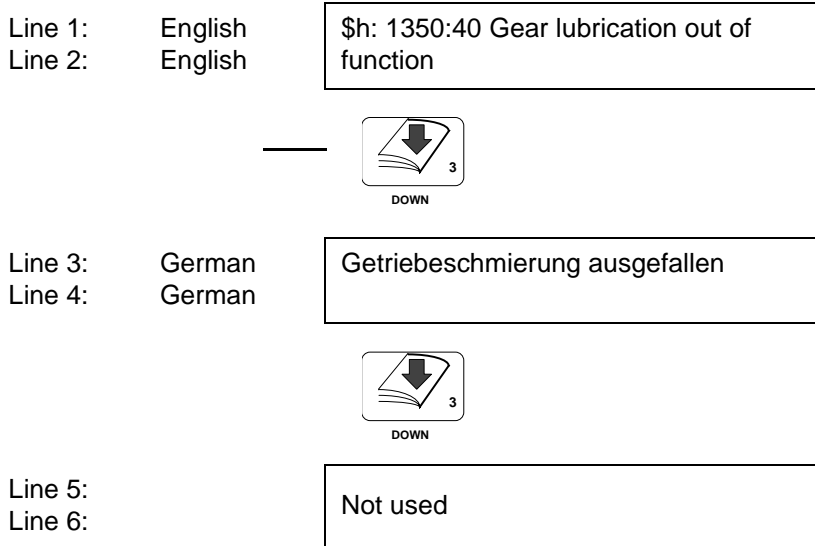


Change - over from English to German Language

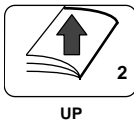


Six text lines are provided for each message. Use key 3 for changing the message text.

Example

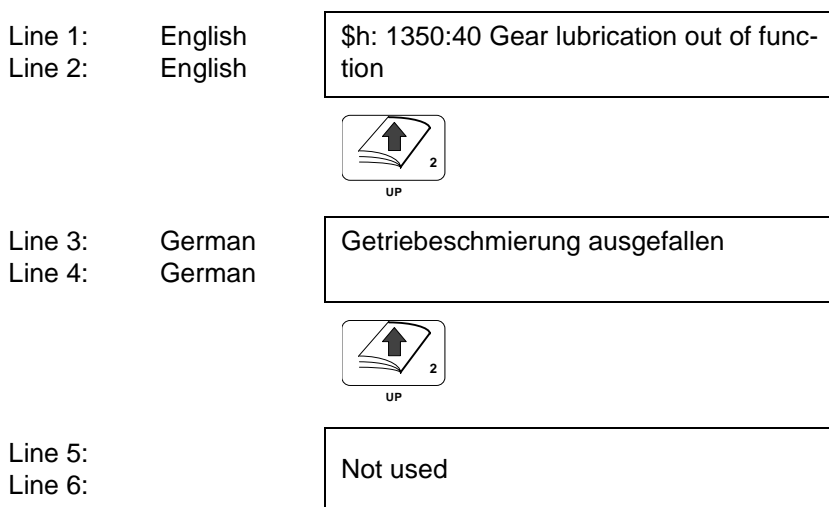


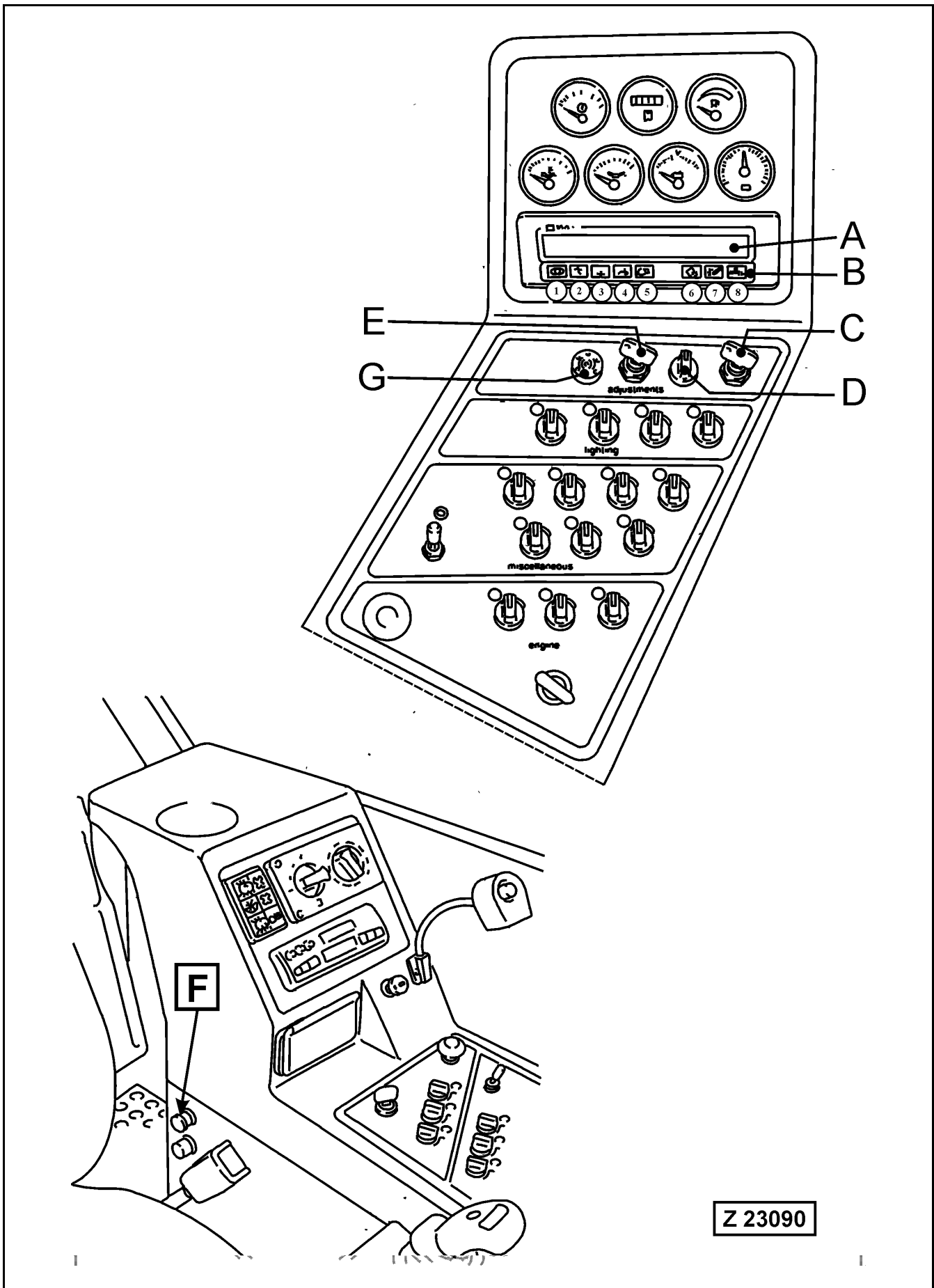
Change-over from German to English Language



Six text lines are provided for each message. Use key 2 for changing the message text.

Example

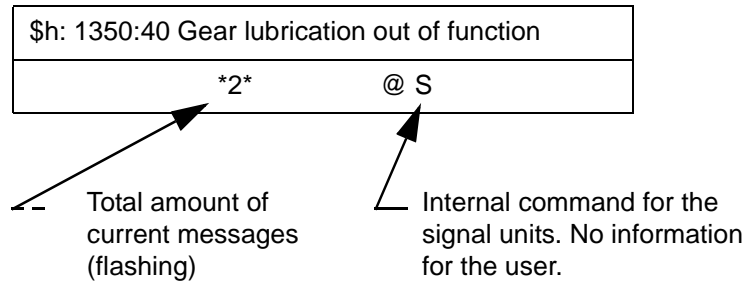




3.4.5 SEVERAL MESSAGE CONDITIONS OCCUR AT THE SAME TIME

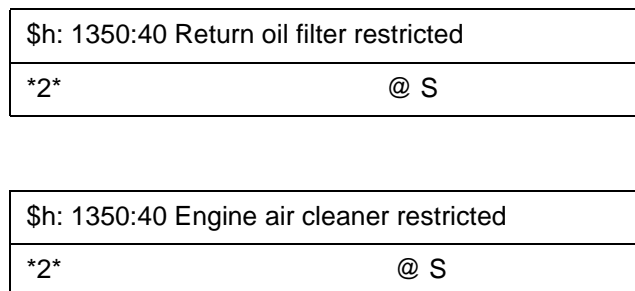
The last message received will be displayed with regard to the priority (importance) of the condition. The displayed message can be switched-over (English / German). All other current messages are kept in the background.

Example:



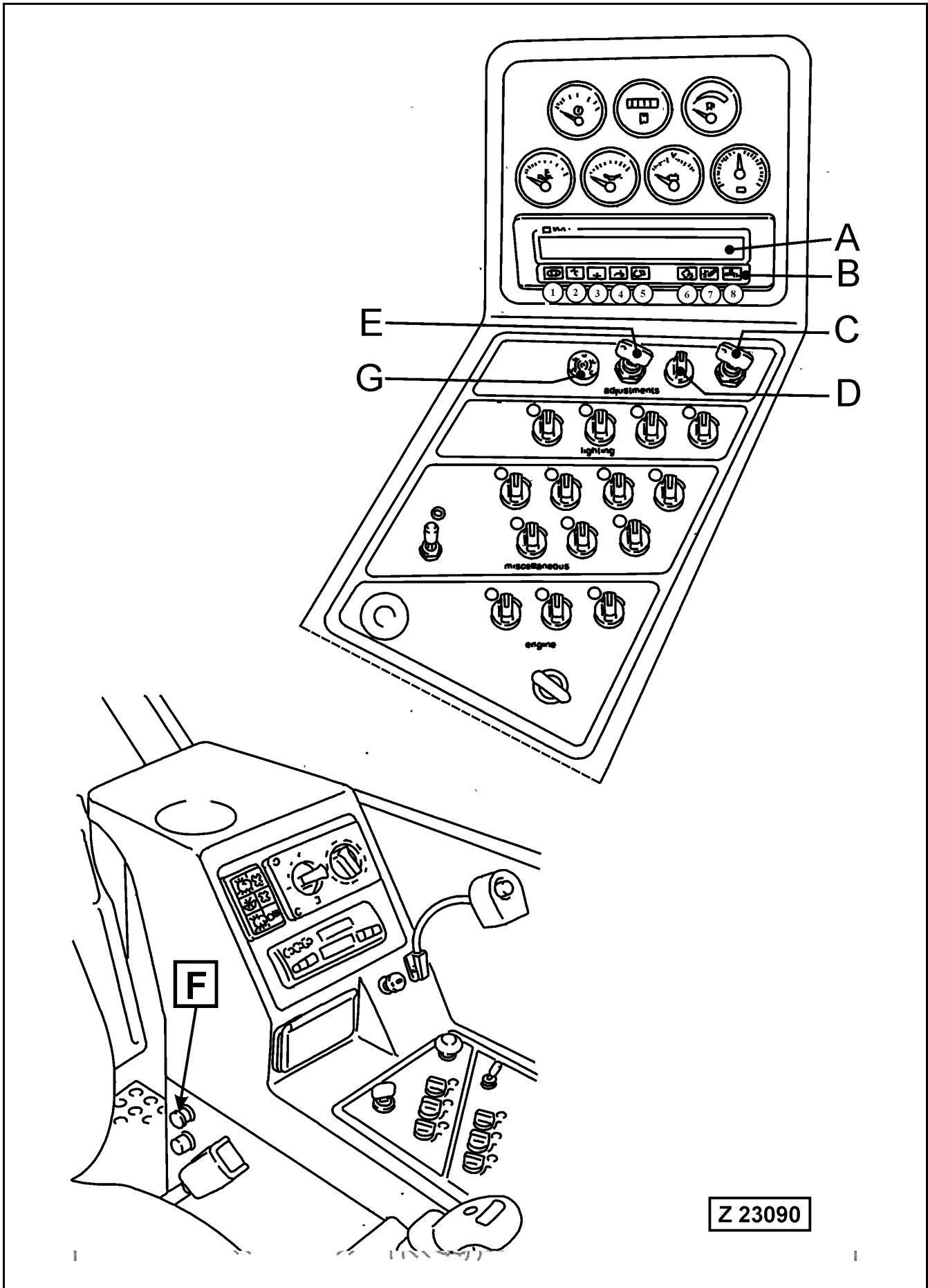
The current messages kept in the background are indicated by a flashing number on the screen. They can be called up with key 1 (MESSAGE). The flashing number changes from central position to the left. Press key 2 (UP) or 3 (DOWN) to view current messages.

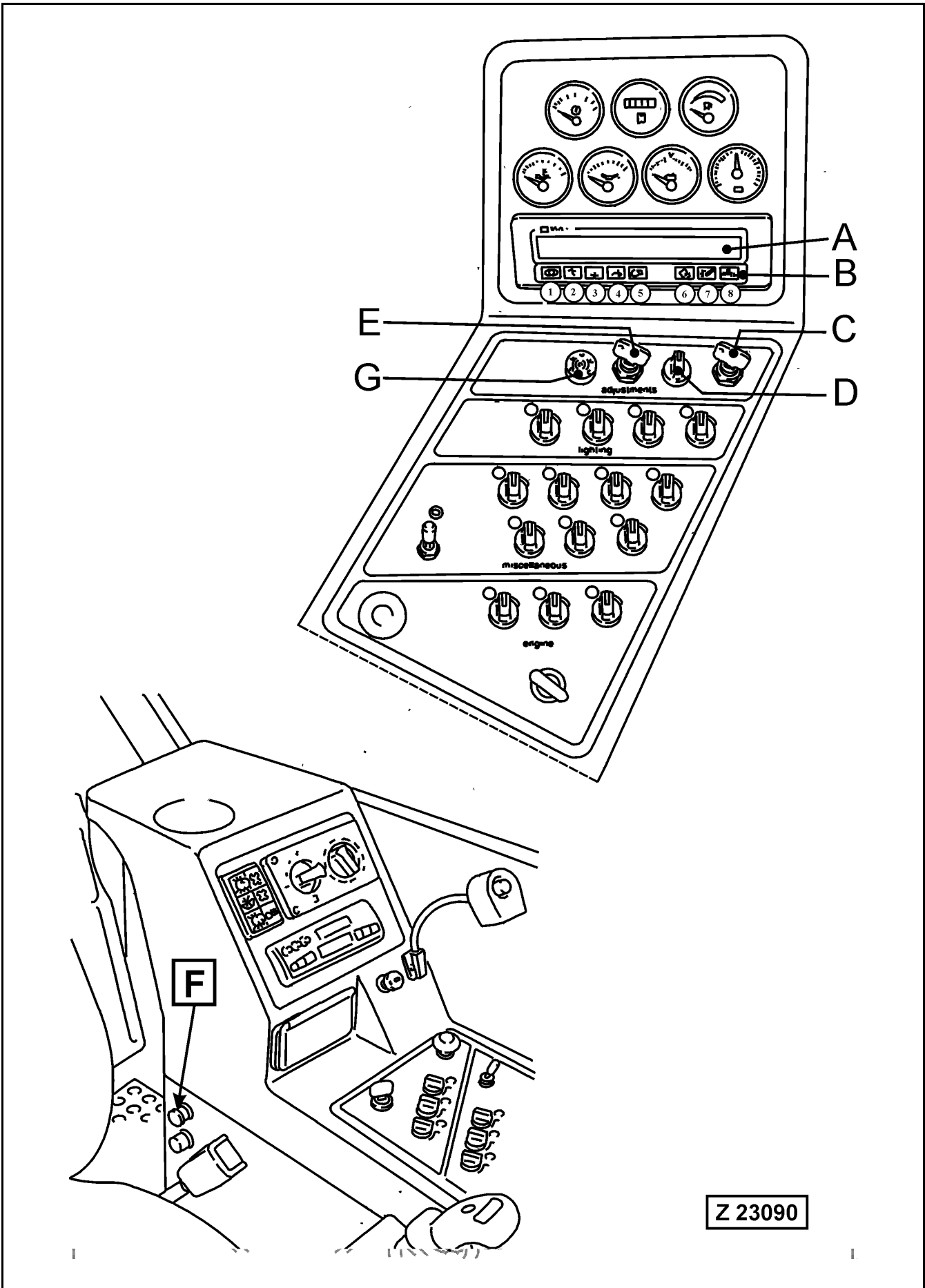
Example:



To change the language of the called up messages, it is necessary to return to the operating text store by pressing key 4 (PAGE NO).

By pressing keys 2 and 3 all text lines of the message pages can now be selected.





Settings of the Text Display Unit (continued)

Erase: RECORD (PROTOCOL) AND STATISTICS memory (page 30)

Set key switch "Service" (C) to ON position.
The contents of both memories will be erased.

Display:

#	protocol cancelled statistics cancelled
---	--

**** No protocol entry recorded ****

Call up and reset the lubrication cycle counter of automatic lubrication systems and resetting of the truck counter

- Input: Cycle counter Central Lubrication System "CLS" Message Page 62
- Input: Cycle counter Slew Ring Gear Lubrication system "SLS" Message Page 63
- Input: Truck Counter Message Page 64

Call up the corresponding message page with key (4), then press key (1). The counter reading appears on screen (A). If the counter reading is for information only, press key (5) for returning to the basic display. If the counter shall be re-set to "0", press key (1 or 6). The system returns automatically to the basic display.

NOTICE

The message pages 62, 63 and 64 are not called up automatically. They have always to be called up manually.

Return to SYSTEM level:

(Display of the last message received)
Operation of the ETM keyboard (B) has no influence on the recording of input messages. For example, if the record memory is called up via keyboard (B), the ETM unit 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) press key 5 (SYSTEM).

Setting of Screen Brightness

Increase brightness: Press keys (5 and 2) simultaneously.
Decrease brightness: Press keys (5 and 3) simultaneously.

REMARK

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).

TABLE OF MESSAGES

Basic Display (message page no. 0):

DATE.	TIME OF DAY:	OPERATING HOURS	(h):
		ENGINE RPM	(1/min):
		TRUCK COUNTER:	

Message Pages Number 1 to 7.

(Page No.)

1:	\$h:	Gear Lubrication out of function Getriebeschmierung ausgefallen
----	------	--

2:	\$h:	Engine air filter restricted Motor-Luftfilter verschmutzt
----	------	--

3:	\$h:	Oil filter for control oil restricted Oelfilter für Steueroel verschmutzt
----	------	--

4:	\$h:	Oil tank breather filter restricted Luftfilter Hydraulikoel verschmutzt
----	------	--

5:	\$h:	Return oil filter restricted Rücklauföelfilter verschmutzt
----	------	---

6:	\$h:	Leak oil filter restricted Leckoelfilter verschmutzt
----	------	---

7:	\$h:	Hydraulic oil temperature too high *1) Hydraulikoeltemperatur zu hoch
----	------	--

NOTICE

***1) When this message is being displayed on the ETM screen, the bucket motion will be switched off automatically.**

Message Pages Number 8 to 15.**(Page No.)**

8:		Not used
----	--	----------

9:	\$h:	Low idle speed: coolant temperature too high
		Niedriger Leerlauf Kühlwassertemperatur zu hoch

10:	\$h:	Engine shutdown: engine oil pressure too low
		Motorabschaltung: Motoroeldruck zu niedrig

11:	\$h:	Low idle speed: High pressure filter #1 restricted
		Niedriger Leerlauf: Hochdruckfilter 1 verschmutzt

12:	\$h:	Low idle speed: High pressure filter #2 restricted
		Niedriger Leerlauf: Hochdruckfilter 2 verschmutzt

13:	\$h:	Low idle speed: High pressure filter #3 restricted
		Niedriger Leerlauf: Hochdruckfilter 3 verschmutzt

14:	\$h:	Hydraulic oil level too low! Stop the engine!
		Hydraulikoelstand zu niedrig ! Motor abstellen !

15:		# Caution, slew gear house brake ON
		Achtung, Drehwerkbremse geschlossen

Message Pages Number 16 to 24.**(Page No.)**

16:	# Caution, travel gear house brake ON Achtung, Fahrwerkbremse geschlossen
-----	--

17:	# No clearance for starting: shift engine to low idle Keine Startfreigabe: Motor auf niedrigen Leerlauf schalten
-----	---

18:	\$h: Central lubrication system fault Zentralschmieranlage gestoert
-----	--

19:	\$h: Slew ring gear lubrication system fault Drehkranz-Schmieranlage gestoert
-----	--

20:	Not used
-----	----------

21:	\$h: Central lubrication system: empty grease barrel Zentralschmieranlage: Fettbehaelter leer
-----	---

22:	\$h: Slew ring gear lubrication system: empty grease barrel Drehkranz-Schmieranlage: Fettbehaelter leer
-----	---

23:	# Automatic engine after-running Automatischer Motornachlauf
-----	---

24:	Not used
-----	----------

Message Pages Number 25 to 34.**(Page No.)**

25:	Not used
26:	Not used
27:	# date: new date
28:	# time: new time
29:	# operating hours h: new operating hours
30:	# protocol cancelled statistics cancelled
31:	Not used
32:	\$h: PTO gear lubrication filter restricted Oelfilter für Getriebebeschmierung verschmutzt
33:	\$h: Cooler fan drive filter restricted Oelfilter für Lüfterantrieb verschmutzt
34:	Not used

Message Pages Number 35 to 43.**(Page No.)**

35: Not used

36: \$h: Oil filter for clamshell rotation restricted
Oelfilter für Greifer drehen verschmutzt

37: Not used

38: Not used

39: \$h: Engine shutdown: main shut-off (gate)
valve closed
Motorabschaltung: Absperrklappe Oelbehälter

40: \$h: Engine shutdown: overspeed
Motorabschaltung: Überdrehzahl

41: Not used

42: \$h: Low idle speed: too low coolant pressure
Niedriger Leerlauf: Kühlwasserdruck zu niedrig

43: \$h: Engine shutdown: emergency stop
switch actuated
Motorabschaltung: Not-Aus Schalter betätigt

Message Pages Number 44 to 51.**(Page No.)**

44:	\$h:	Engine shutdown: Safety maintenance switch actuated Motorabschaltung: Sicherheitsschalter betätigt
-----	------	---

45:		Not used
-----	--	----------

46:	\$h:	Warning signal from engine control module Warnsignal vom Motorrechner
-----	------	--

47:	\$h:	Engine shutdown by engine control module Motorabschaltung durch Motorrechner
-----	------	---

48:	\$h:	Too high PTO-gear oil temperature Temperatur Getriebeoel zu hoch
-----	------	---

49:		Not used
-----	--	----------

50:		# Caution, pull switch from ground man actuated Achtung, Zugschalter vom Boden aus betätigt
-----	--	--

51:	\$h:	Engine shutdown: pull switch from ground man actuated Motorabschaltung: Zugschalter vom Boden aus betätigt
-----	------	---

NOTICE

If message no. 46 is displayed, the onboard engine diagnostic can be carried out according to page 147.

If there exists an active fault, a diagnostic code will be indicated through lamp (H97).

Message Pages Number 52 to 60.**(Page No.**

52:	\$h:	Load limiting for bucket clam defective Druckabschneidung für Schaufelklappe defekt
-----	------	--

53:	#	Pressure switch of the central lubrication system actuated Druckwächter der Zentralschmieranlage betätigt
-----	---	--

54:	#	Pressure switch of the slew ring gear lubrication system actuated Druckwächter der Drehkransschmieranlage betätigt
-----	---	---

55:	\$h:	Refill hydraulic oil Hydrauliköl nachfüllen
-----	------	--

56:	#	Engine oil reserve tank empty Motoröltank leer
-----	---	---

57:	\$h:	Load limit regulation fault Grenzlastregelung Störung
-----	------	--

58:	\$h:	Oil cooler strainer restricted Grobfilter Ölkühler verschmutzt
-----	------	---

59:	#	Central lubrication system, refill grease barrel Zentralschmieranlage, Fettbehälter auffüllen
-----	---	--

60:	#	Slew ring gear lubrication system, refill grease barrel Drehkransschmieranlage, Fettbehälter auffüllen
-----	---	---

Message Pages Number 61 to 64.**(Page No.**

61:	Program Identification Number: XXXXXX
-----	---------------------------------------

62:	Central Lubrication System "CLS" cycle counter resetting Counter reading: "CLS" cycle counter
-----	---

63:	Slew ring gear lubrication System "SLS" cycle counter resetting Counter reading: "SLS" cycle counter
-----	--

64:	Truck counter resetting Counter reading: Truck counter
-----	--

NOTICE

The Dollar symbol (\$) at the beginning of the first text line of fault messages serves as a reference signal for on-line data transfer on machines using the Modular Mining System "MMS".

Grouping of the Messages according to their Priority

The messages are divided into four priority groups. A Message of a higher priority group remains on the display, even if further messages of a lower priority group occur. These messages are registered and statistically analyzed, although they are not displayed.

1st Priority Group:

- Fault messages resulting in automatic shifting to low idle speed respectively, shutdown of the engine
- System adjustments

Page number:

9:	Low idle speed: coolant temperature too high
11:	Low idle speed: High pressure filter #1 restricted
12:	Low idle speed: High pressure filter #2 restricted
13:	Low idle speed: High pressure filter #3 restricted
27:	# Date: (adjustment)
28:	# Time: (adjustment)
29:	# Hours of operation: (adjustment)
30:	# Protocol and statistics cancelled (adjustment)
39:	Engine shutdown: main shut-Off (gate) valve closed
40:	Engine shutdown: overspeed
42:	Low idle speed: too low coolant pressure
43:	Engine shutdown: emergency stop switch actuated
47	Engine shutdown by engine control module
51:	Engine shutdown: pull switch from ground man actuated

2nd Priority Group:

Page number:

10:	Engine shutdown: engine oil pressure too low
57	Load limit regulation fault

NOTICE

If a fault message of priority group 1 or 2 is displayed, move the shovel to a safe place, shut down the engine and inform your service staff about the trouble condition.

3rd Priority Group:**Page number:**

- 1: Gear lubrication out of function *1)
- 2: Engine air filter restricted *2)
- 3: Oil filter for control oil restricted *2)
- 4: Oil tank breather filter restricted *2)
- 5: Return oil filter restricted *2)
- 6: Leak oil filter restricted *2)
- 7: Hydraulic oil temperature too high (Bucket motion cutout, operate without load until the oil temperature is within the operating range) *2)
- 14: Hydraulic oil level too low! Stop the engine *1)
- 18: Central lubrication system fault *2)
- 19: Slew ring lubrication system fault *2)
- 21: Central lubrication system, grease barrel empty *2)
- 22: Slew ring lubrication system, grease barrel empty *2)
- 32: PTO-gear lubrication filter restricted *2)
- 33: Cooler fan drive filter restricted *2)
- 46: Warning signal from engine control module *1)
- 48: Too high PTO-gear oil temperature (operate without load until the oil temperature is within the operating range) *2)
- 52: Load limiting bucket clam defective *1)
- 55: Refill hydraulic oil *1)
- 58: Strainer hydraulic oil cooler restricted *2)

- ***1) Move the shovel to a safe place, shut down the engine and inform your service staff about the trouble condition.**
- ***2) Continue work until shift end. Inform your service staff about the trouble condition**

4th Priority Group

Information messages

Page number:

- 15: # Caution, slew gear brake ON
- 16: # Caution, travel gear brake ON
- 17: # No clearance for starting, shift engine to low idle
- 23: # Automatic engine after-running

- 50: # Caution, pull switch from ground man actuated
- 53: # Pressure switch for central lubrication system actuated
- 54: # Pressure switch for slew ring lubrication system actuated
- 56: # Engine reserve oil tank empty
- 59: # Central lubrication system, refill grease barrel
- 60: # Slew ring gear lubrication system, refill grease barrel

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%
1:	1	= 14.3%	01:00:00	= 25.0%
2:	1	= 14.3%	01:00:00	= 25.0%
3:	3	= 42.6%	02:30:00	= 62.5%
4:	2	= 28.6%	01:00:00	= 25.0%
Err:	7	= 100.0%	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 1, 2 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. 3 has occurred 3 times. In line "Err" (Error) the number of fault 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.

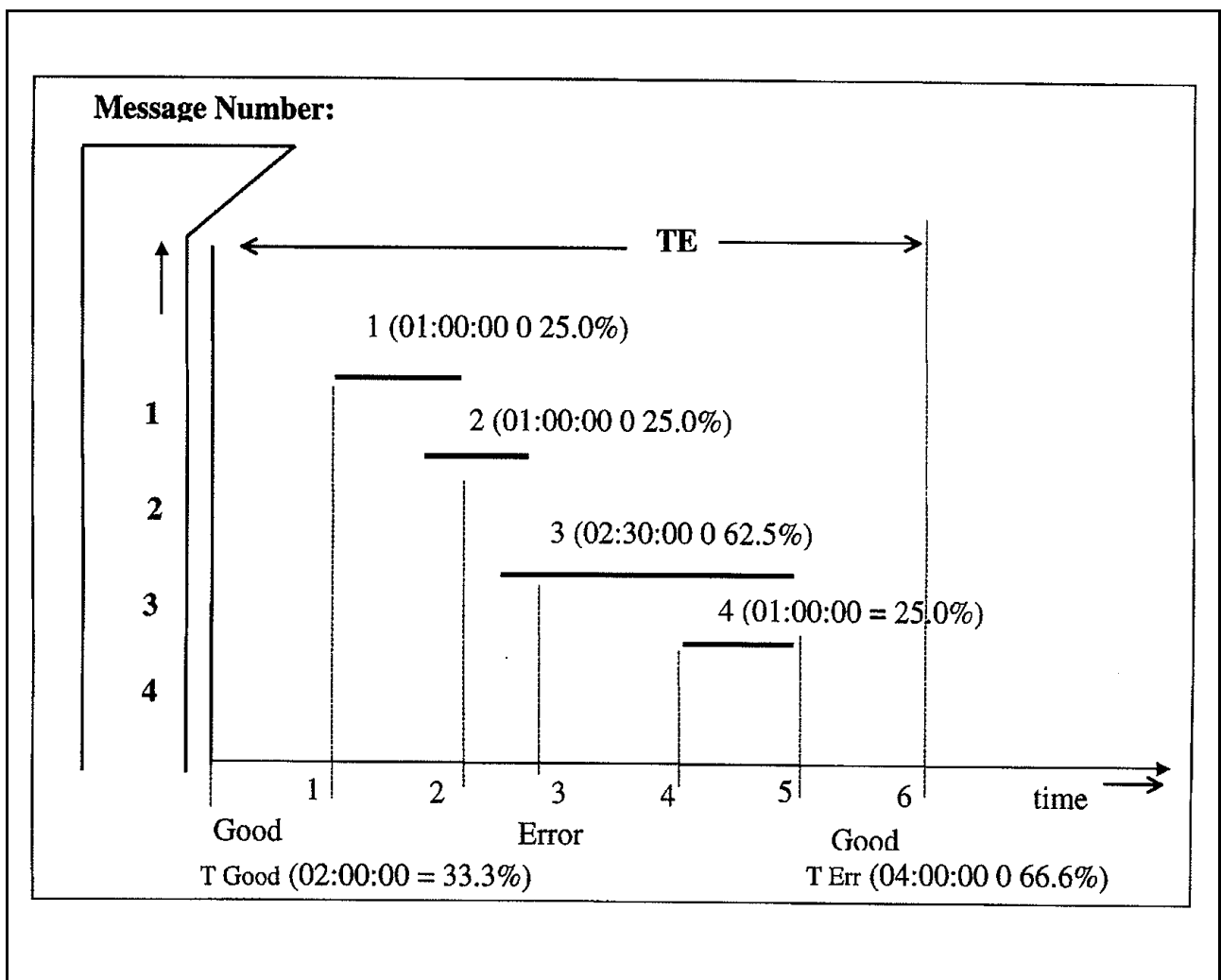
Column 5:

The duration of the fault applying to the total time with fault (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 for more information.

Time Diagram of Statistics Print

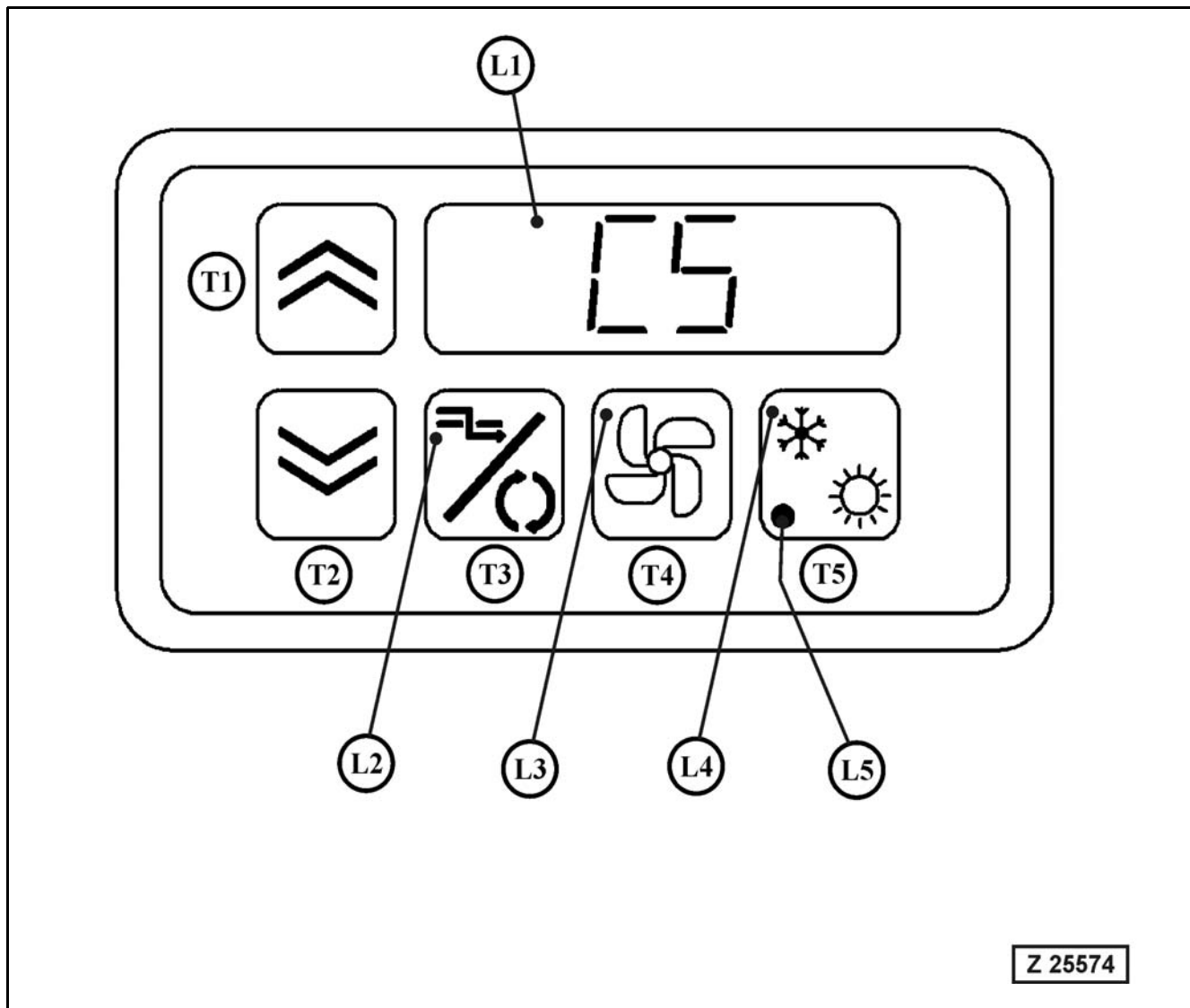
The diagram below shows an example, how the time without faults (Good) and the time faults (Err) could be distributed within the total operating time of the ETM.

- TE: Total operation time of the ETM
- T1/T2/T3/T4: Total time of a message
- T Err: Total time of all messages
- T Good: Total time without messages



3.5 OPERATING THE HEATER, VENTILATION AND AIR CONDITIONING

Digital Display



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

Key T1: Plus Key

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

Key 2: Minus Key

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

Key T3: Recirculating Air/Fresh Air

Switches from recirculated air to fresh air and vice versa.

Key T4: Blower Control

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

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

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

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

Key T5: Automatic climate control

Switches on the automatic temperature control.

Key T2+T3: Temperature indication.

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

Key T3+T5: Reheat (optional)

Starts reheat mode for 3 minutes. (Duration adjustable)

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

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

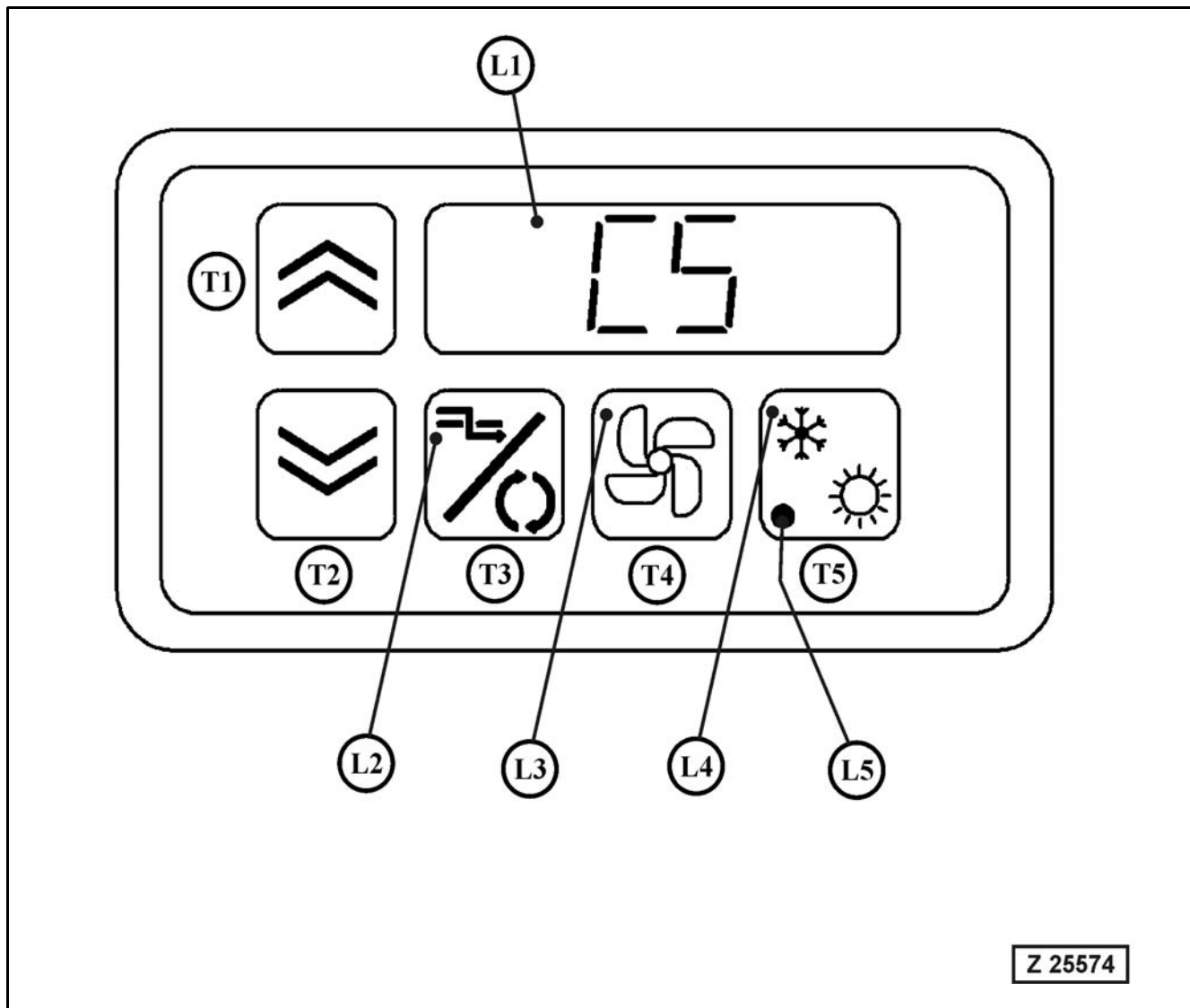
2-,3-Step: off

continuously adjustable blower: Off, 1

Air Flow Control

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

Luminous Indication.



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

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

Operating Instructions.

When the engine is running, press any key to activate the air conditioning control unit.
All previous settings are reactivated.

Display

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

Interior Temperature Control.

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

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

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

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

Ventilation

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

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

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

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

Reheat (optional)

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

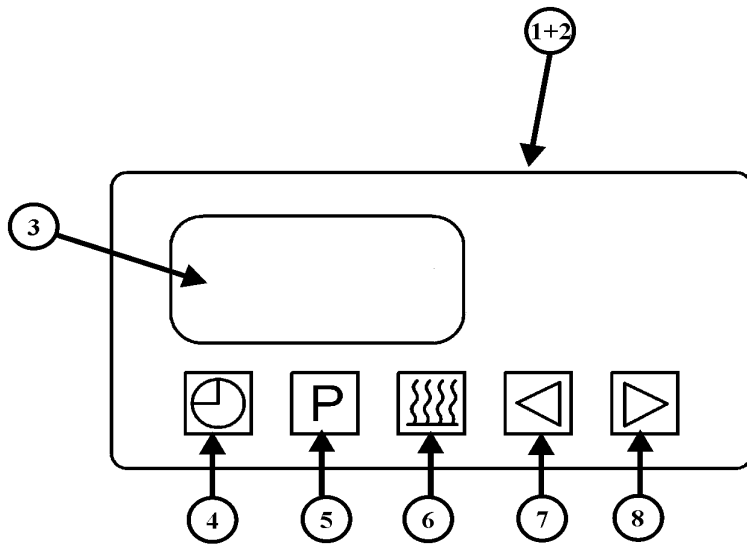
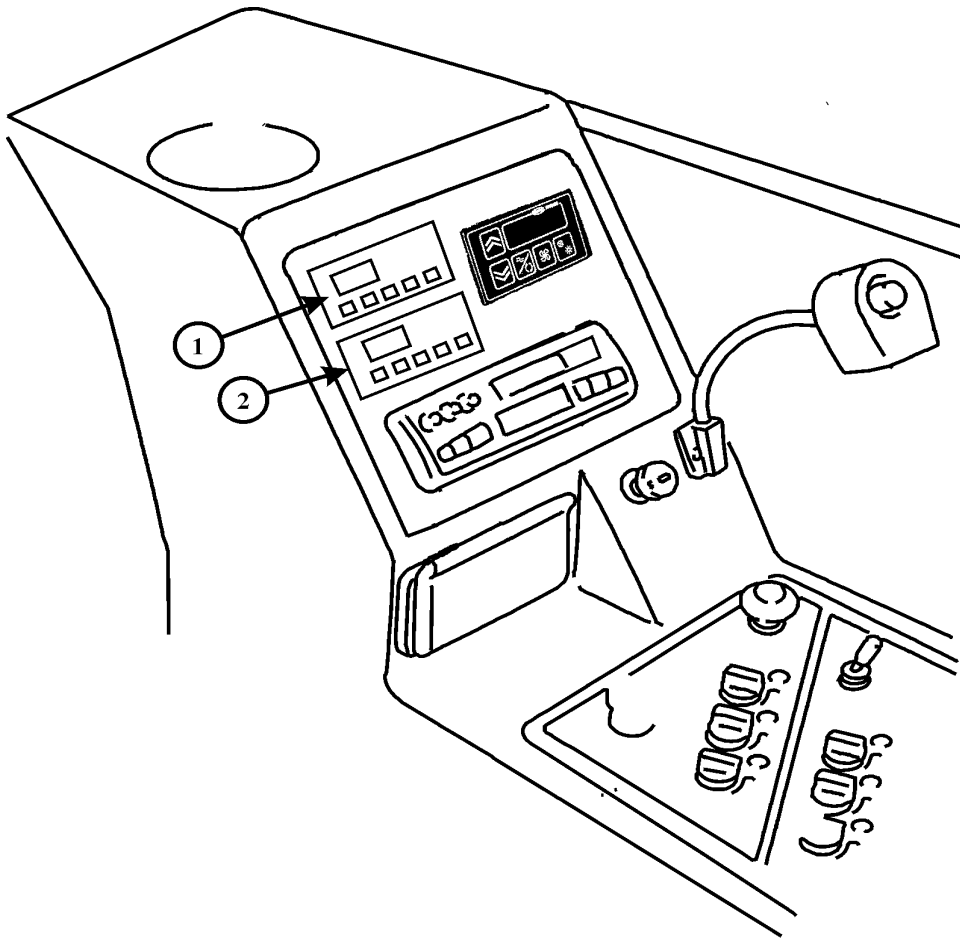
Reheat mode is disabled when outside temperatures are below 2°C (adjustable parameter) or when the sensor is not installed or is defective.

Temperature indication

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

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

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

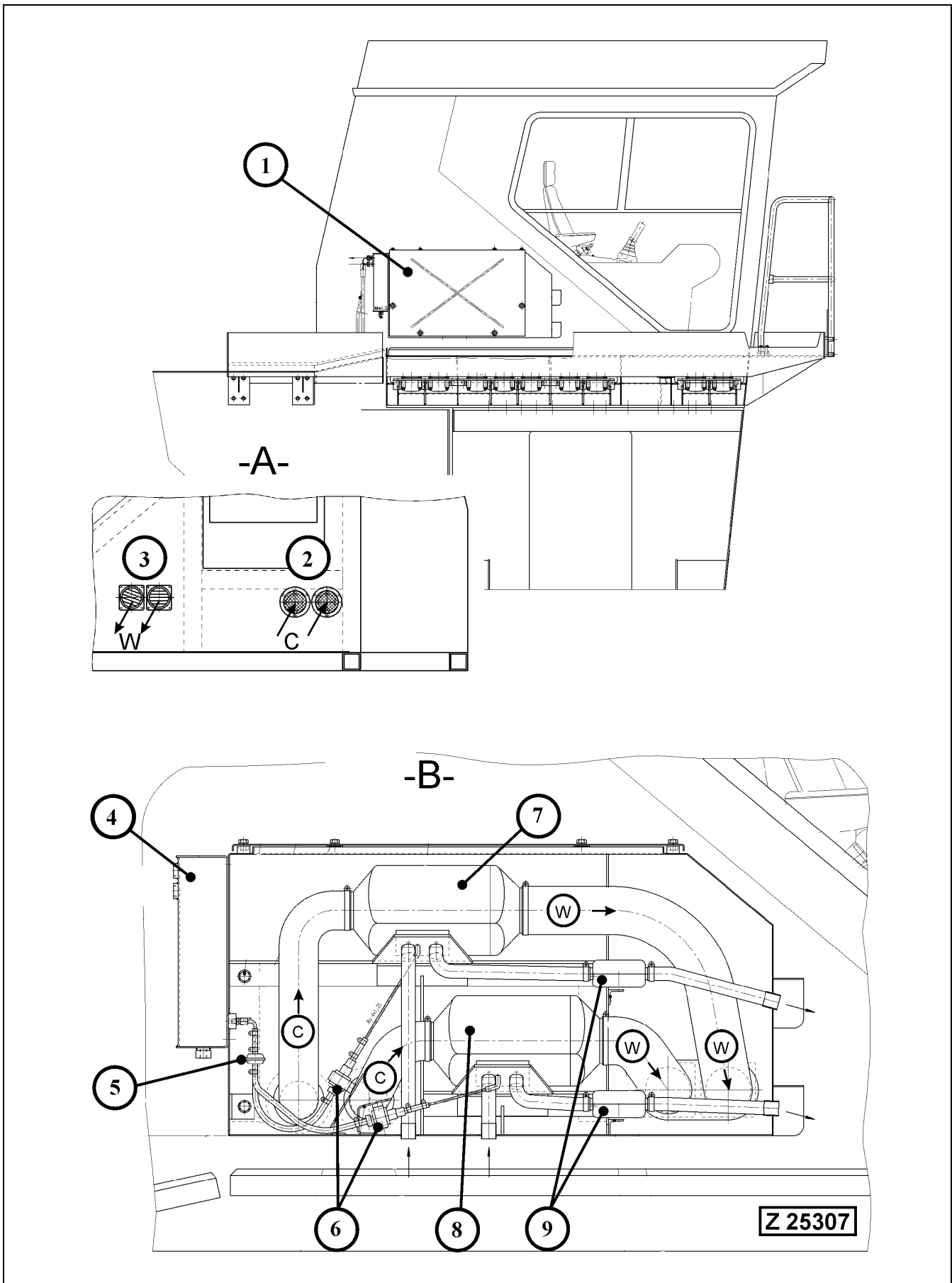


Z 25479

3.5.1 CONTROL MODULE FOR AUXILIARY CAB HEATER (IF SO EQUIPPED)

Legend for illustration Z25479

- (1) Control module for the engine independent auxiliary cab heater (upper heater. see position 7 on illustration Z25307 on page 135). This module is used for switching the auxiliary cab heater ON and OFF during shovel operations with the diesel engine running. It is also used to pre-select heater start times and heating duration periods whilst the engine is switched off. For detailed setting instructions for the control module, refer to the separate operating instructions in binder volume 2
- (2) Control module for the engine independent auxiliary cab heater (lower heater. see position 8 on illustration Z25307 on page 135).
- (3) Display showing the operating condition of the heater
- (4) Button for actual time indication
- (5) Button for heating time pre-selection
- (6) Button for heating indication
- (7) Button for backward settings
- (8) Button for forward settings



3.5.2 AUXILIARY HEATER FOR OPERATORS CAB (IF SO EQUIPPED)

Legend for illust. Z25307

- (1) Auxiliary heater unit mounted on RH cab side
- (A) View from inside cab onto the RH wall below co-drivers seat
- (2) Openings for cold air (C) to auxiliary heaters (7 and 8)
- (3) Air flow louvers adjustable for warm air (W) from the auxiliary heaters (7 and 8) into the cab
- (B) Auxiliary heater unit shown with covering removed
- (4) Fuel return tank
- (5) Fuel strainers
- (6) Fuel dosing pumps
- (7) Upper auxiliary cab heater (E201). For operating and maintenance instructions of the heater, refer to the separate manual AIRTRONIC Type D4, 24V, filed in volume 2 binder.
- (8) Lower auxiliary cab heater (E301). Same type as number (7).
- (9) Exhaust silencer

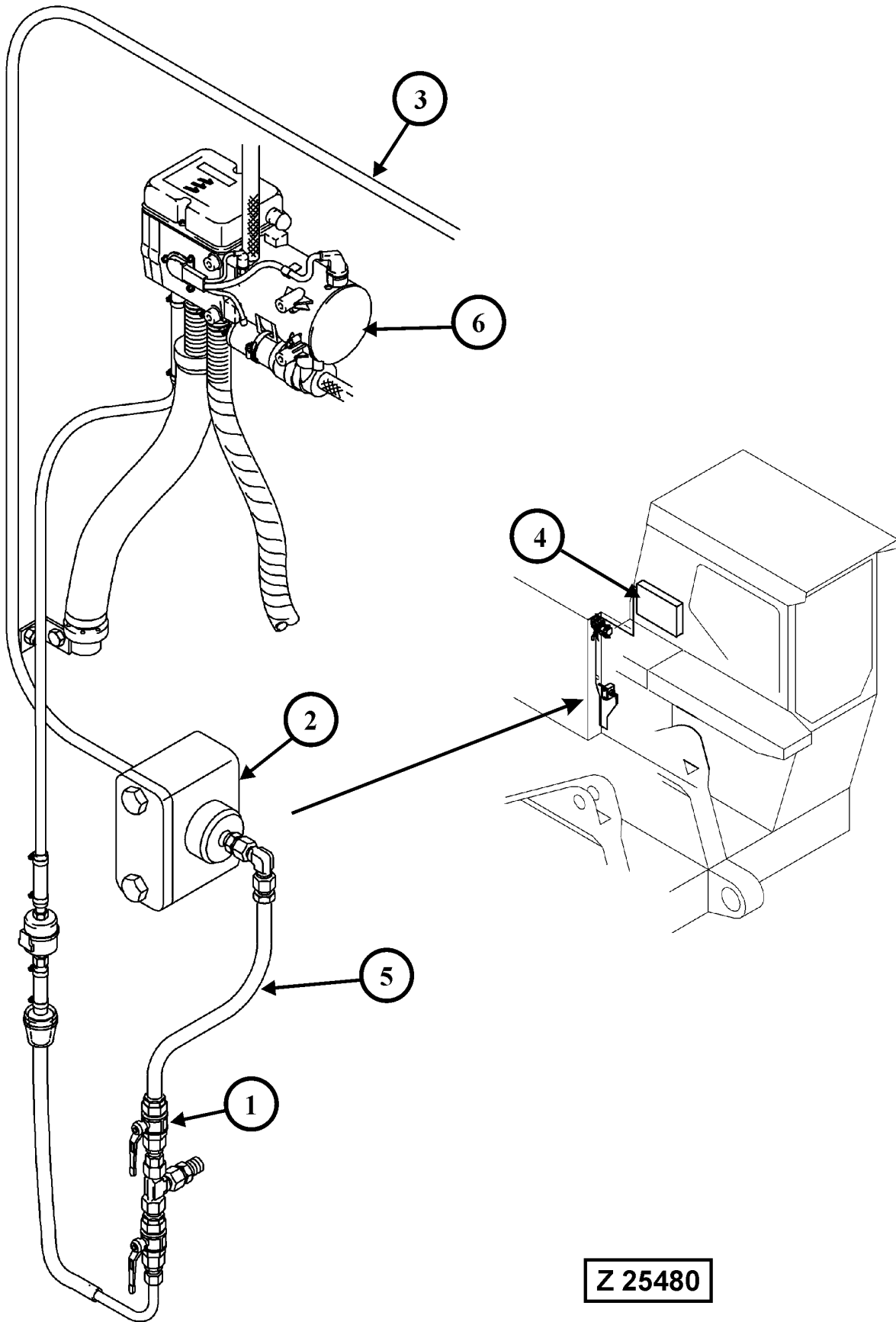
3.5.3 AUXILLIARY HEATER FOR OPERATORS CAB (IF SO EQUIPPED)

REMARK

The auxilliary cab heater is located on the inside of the fuel tank. Illustration Z25388 shows the arrangement of components and the flow of water, fuel and air.

Legend for illustration Z25388

- (1) Fuel tank
- (2) Heater unit HYDRONIC 10. Refer to the seperate operating manual HYDRONIC 10 for all operating and maintenance instructions. This manual is filed in binder volume 2
- (3) Water supply line from engine
- (4) Water return line
- (5) Water line to auxilliary heater
- (6) Hot water line from auxilliary heater to cab heater
- (7) Fuel shut-off cock for fuel supply to heater
- (8) Fuel strainer
- (9) Fuel supply line
- (10) Fuel dosing pump
- (11) Combustion air intake line
- 12) Exhaust
- (13) Heater supply
- (14) Heater return
- (15) Cab heater
- (16) Mechanical thermostat

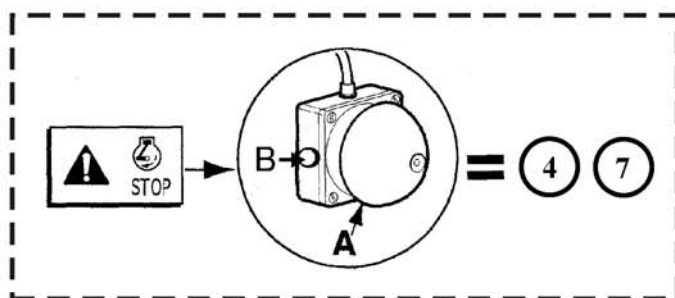
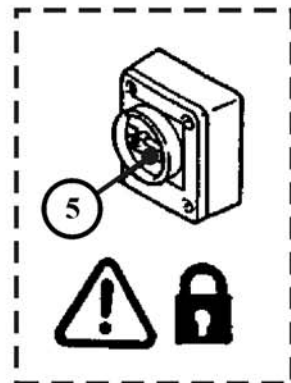
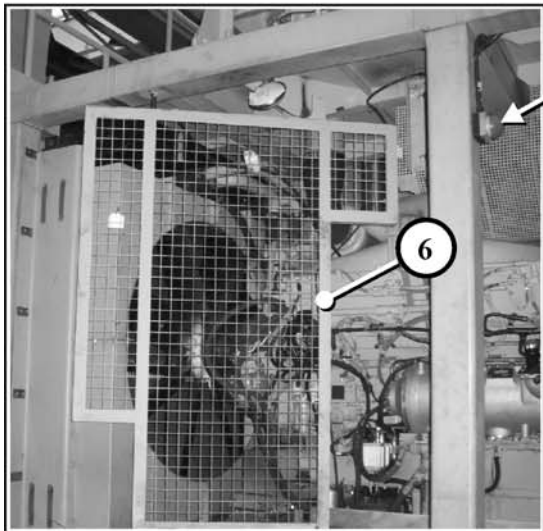
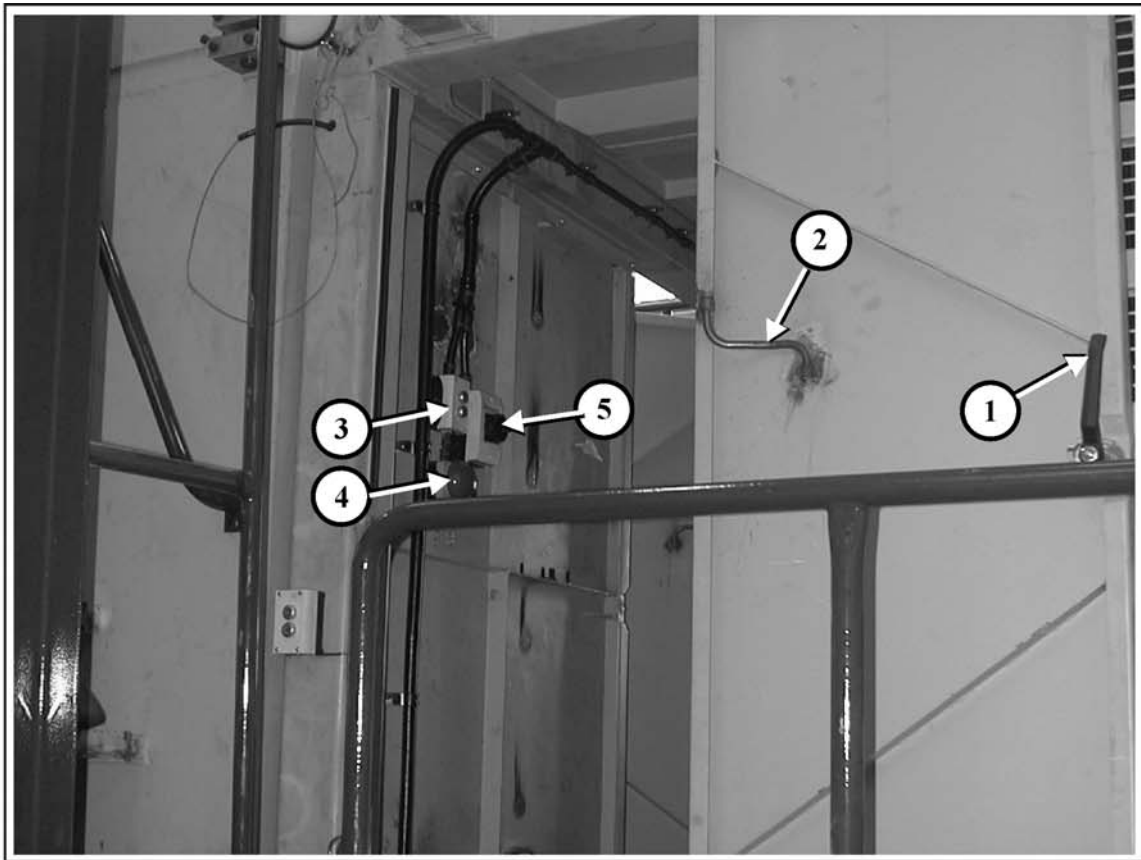


3.5.4 FUEL PUMP ARRANGEMENT

Legend for illustration Z25480

- (1) Fuel shut-off cock for fuel supply to heater
- (2) Fuel pump
- (3) Fuel supply line to heater
- (4) Auxiliary cab heater (E201). For operating and maintenance instructions of the heater, refer to the separate manual AIRTRONIC Type D4, 24V, filed in volume 2 binder.
- (5) Fuel line from fuel tank to pump
- (6) Heater unit HYDRONIC 10. Refer to the separate operating manual HYDRONIC 10 for all operating and maintenance instructions. This manual is filed in binder volume 2

3.6 MACHINERY HOUSE



Z 25076A

3.6.1 EMERGENCY ENGINE SHUTDOWN SWITCHES

Legend for illustration Z25076A

- (1) Handle of machinery house door
- (2) Door fastener, secure the machinery house door in open position by inserting fastener (2) into the sleeve on the door
- (3) Light switch
- (4) Emergency engine shutdown switch
- (5) Maintenance safety switch for start prevention of the engine
- (6) Radiator fan guard door
- (7) Emergency engine shutdown switch
- (A) Push button of emergency shutdown switches (4 and 7) for stopping the engine
- (B) Release button for emergency shut down switch (if so equipped)

Emergency engine shut down switches (4 and 7)

WARNING

In case of emergency push in the button (A) to stop the engine.

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

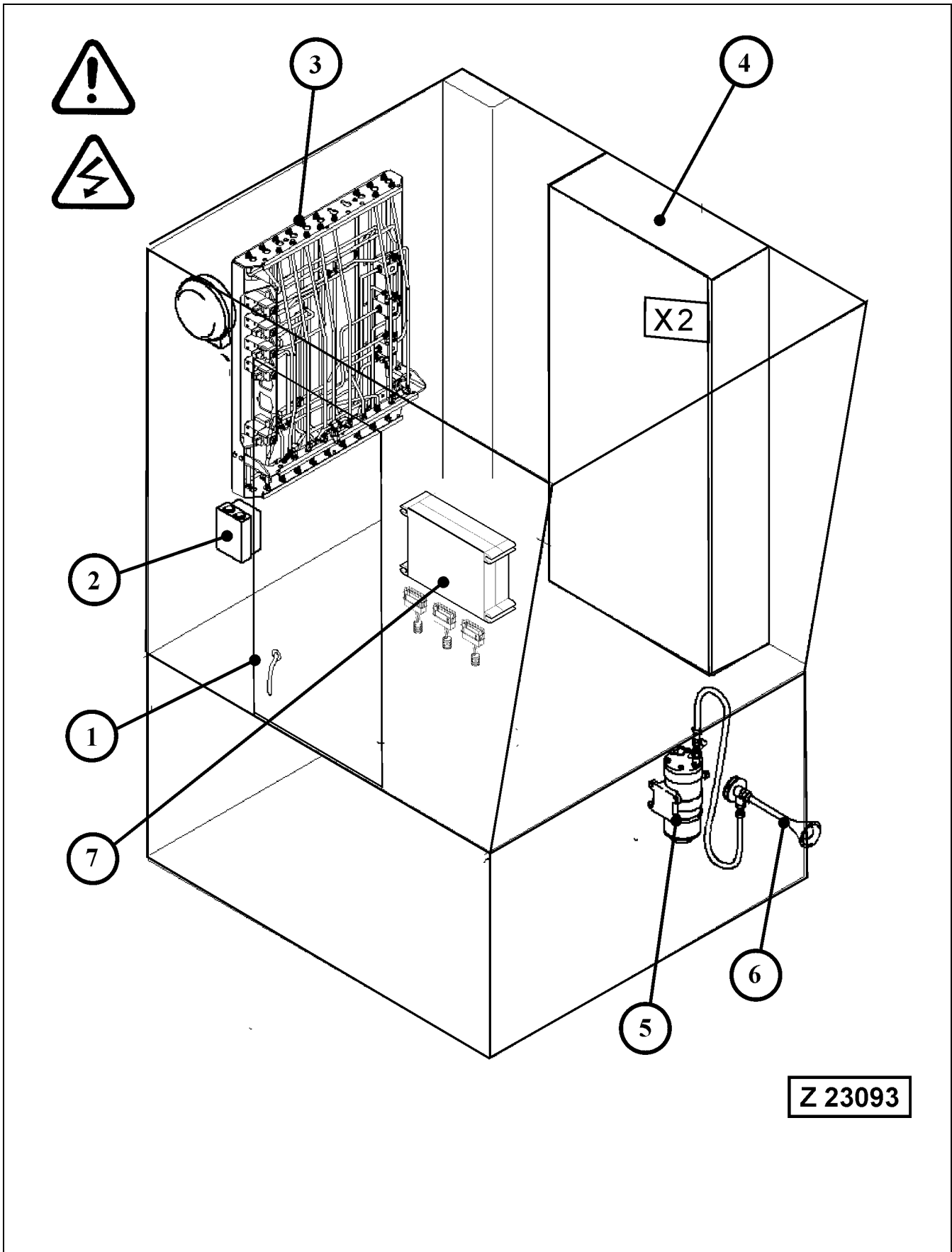
For restarting, first push in release button (B). On switches without button (B) pull out button (A) and then start the engine in the normal way at control panel in the operator's cab. The engine can not be started with button (A) in depressed position. When one of the Shutdown switches (4 and 7) is activated, the ETM display informs the Operator by a corresponding message.

Maintenance safety switch (5)

WARNING

Before any maintenance work is started, set the safety switch (5) to 0 position. In this position the engine 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.

3.7 ELECTRICAL EQUIPMENT IN CAB BASE



⚠ WARNING

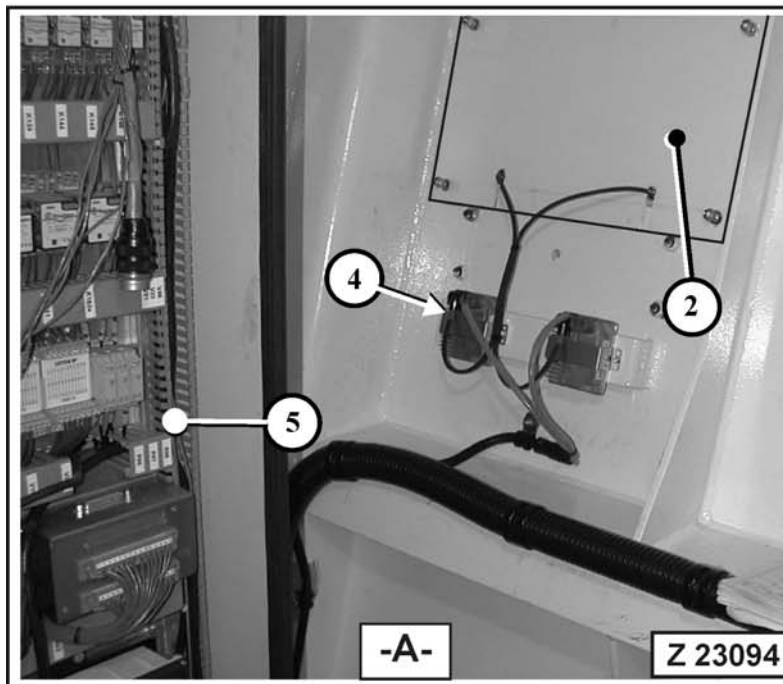
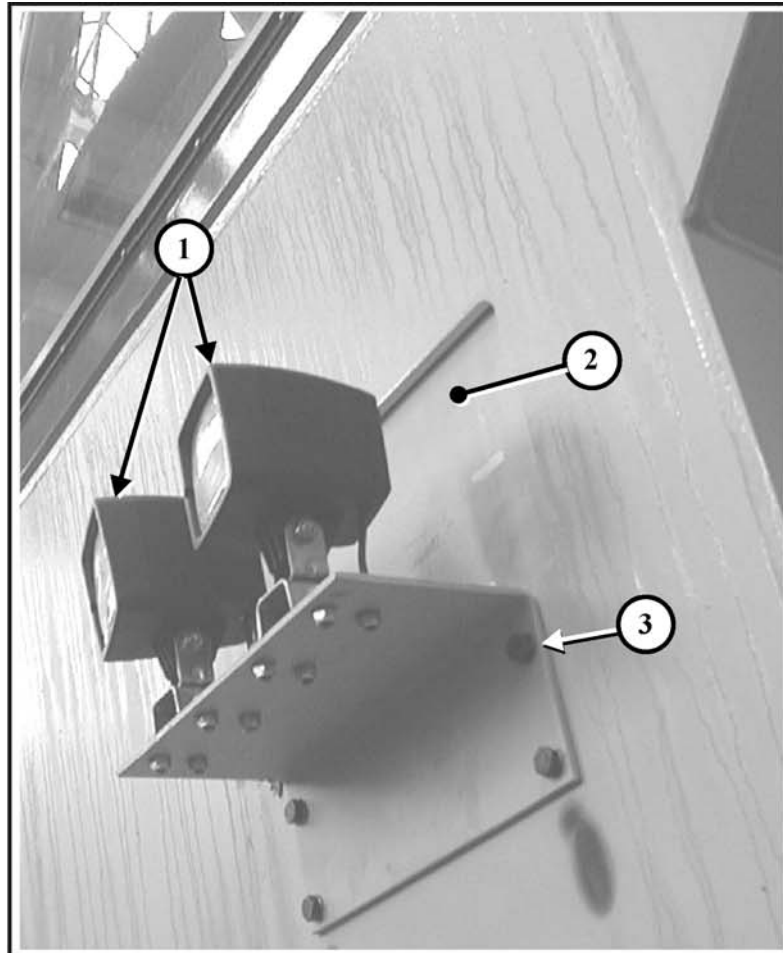
- **The cab base may contain high voltage electrical appliances. Access to the cab base for authorized service staff only.**
 - **All cables of the 24V board net system are blue in color. All other cable colors indicate a higher voltage. Do not touch these cables, their terminals and connected components. Always contact authorized electricians who are qualified to work on medium and high voltage systems.**
-

REMARK

There are additional components in the cab base for shovels equipped with electrical pre-heating systems. Refer to page 156 for more information.

Legend for illustration Z 23093

- (1) Cab base door
- (2) Light switch
- (3) Pilot control frame
- (4) Box of the main switch board (X2). See page 147 for more information.
- (5) Compressor for signal horn
- (6) Signal horn
- (7) Controller (E61) for the electronic pump control system CR700



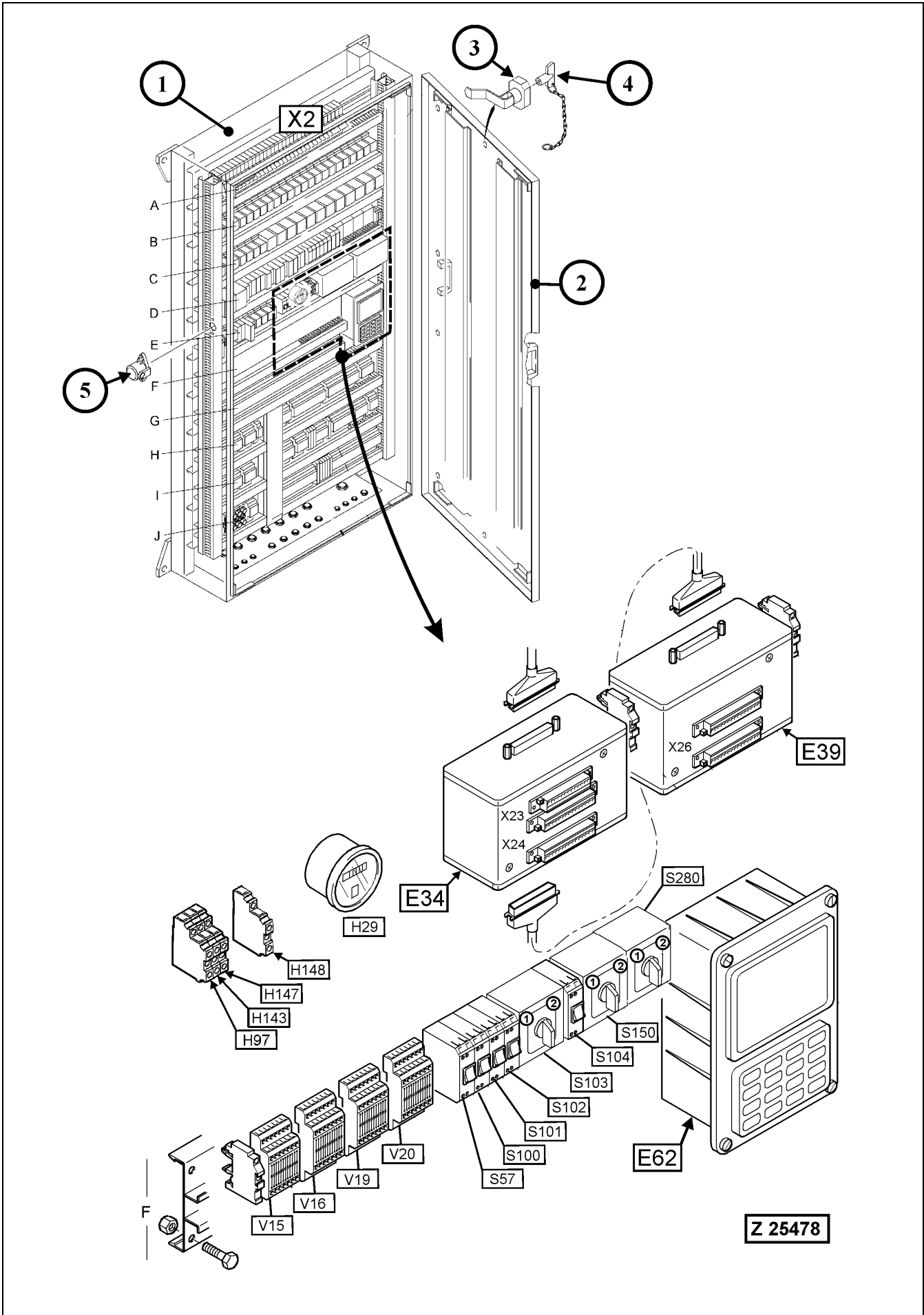
Access Cover for the Headlights mounted on Cab Base

Legend for illustration Z 23094

- (A) View from inside the cab base
- (1) Head lights (Xenon) on cab base
- (2) Access cover to the headlights from inside the cab base
- (3) Headlight mounting bracket
- (4) Voltage amplifier for the headlights
- (5) Main switch board (X2)

For access to the headlights remove cover (2).

When mounting the access cover (2) ensure that the power supply cables to the headlights are correctly routed through the slots in cover (2).



3.7.1 SWITCH BOX (X2) IN CAB BASE

Legend for illustration Z25478

- (1) Main switch board (X2)
- (2) Cover
- (3) Cover fastener
- (4) Key
- (5) Plug socket 24V
- (E34) Master input signal module for the ETM
- (E39) Slave input signal module for the ETM
- (E62) Multi monitor for diagnostic of the electronic pump control system CR700
- (H29) Hour meter for travel operation. The hour meter indicates the total number of hours of travelling operation.
- (H97) Fault lamp for flashing out diagnostic fault codes of the engine Centry system, see next page for more information.
- (H143) Monitoring light of the automatic engine oil supply system -Reserve- (if so equipped)
 - Steady light: oil is pumped from engine oil pan to reserve oil tank.
 - Regular blinking: oil is pumped from reserve oil tank to engine oil pan.
 - Irregular blinking: oil is pumped in both directions, oil level in engine oil pan is correct.

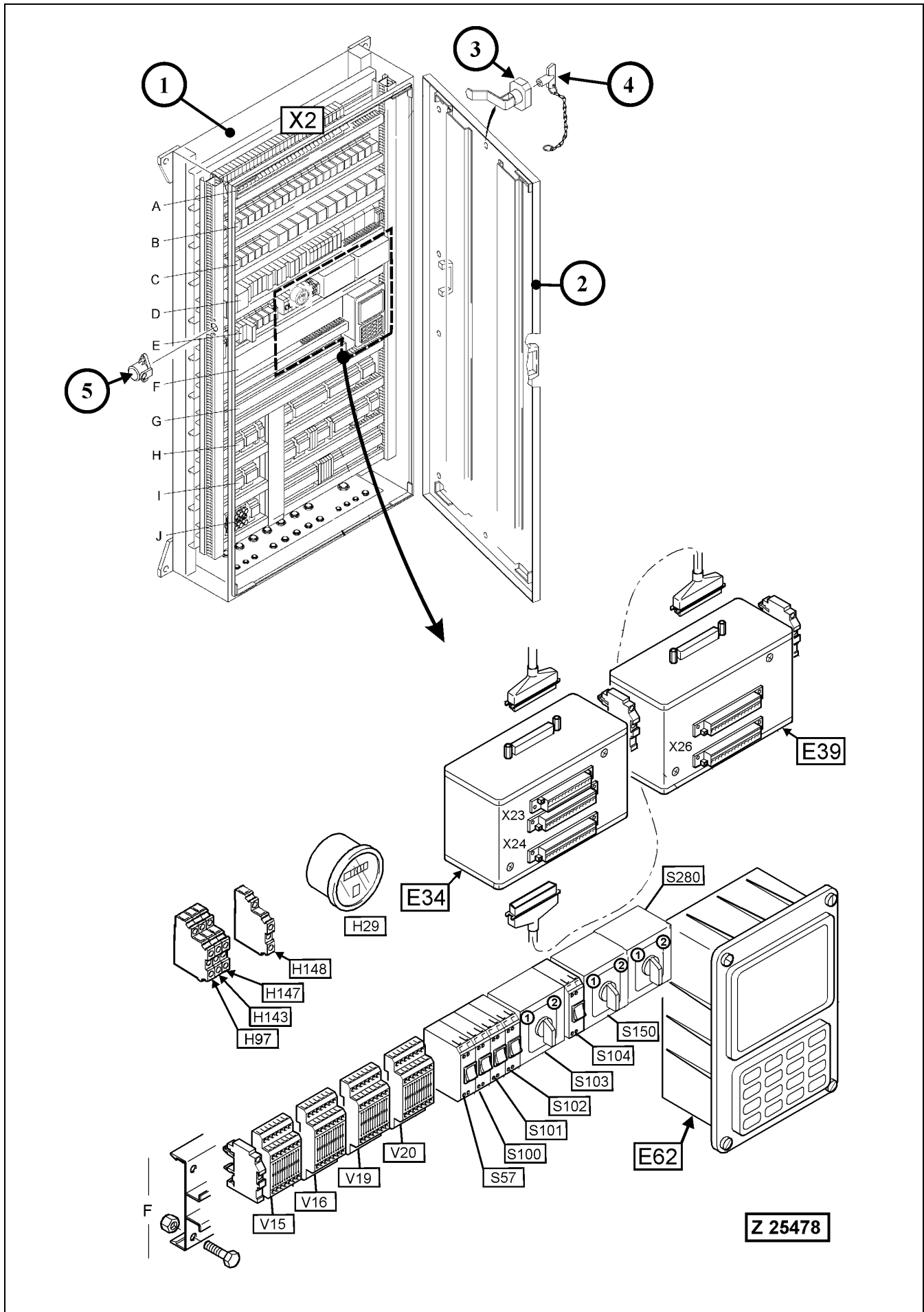
REMARK

If the indicator light (H143) is off with the engine running, there is a failure in the reserve system. Have the reserve system checked and repaired through authorized service personnel.

- (H147 - H148) Fault lamps for the electronic pump control system CR700
- (S57) Diagnostic switch for flashing out fault codes via lamp (H97) of the engine electronic control system Centry, see next page for more information.
- (S100) Service switch for the electronic pump control system CR700 (adjustment mode)
- (S101) Service switch for the electronic pump control system CR700 (selection down)
- (S102) Service switch for the electronic pump control system CR700 (selection up)
- (S103) Service switch for the electronic pump control system CR700 (test mode selection position 2)
- (S104) Service switch for the electronic pump control system CR700 (primary P-factor)
- (S150) Service switch for Qmin position of main hydraulic pumps. Position 1 normal pump regulation. Position 2 Qmin position.
- (S280) Switch for increasing low idle speed of engine from 800 RPM to 1100 RPM. Increase the low idle speed at beginning of the cold season (ambient temperatures constantly below -15°C). (Not used)
- V15,V16 Diode arrays
, V19,
V20

REMARK

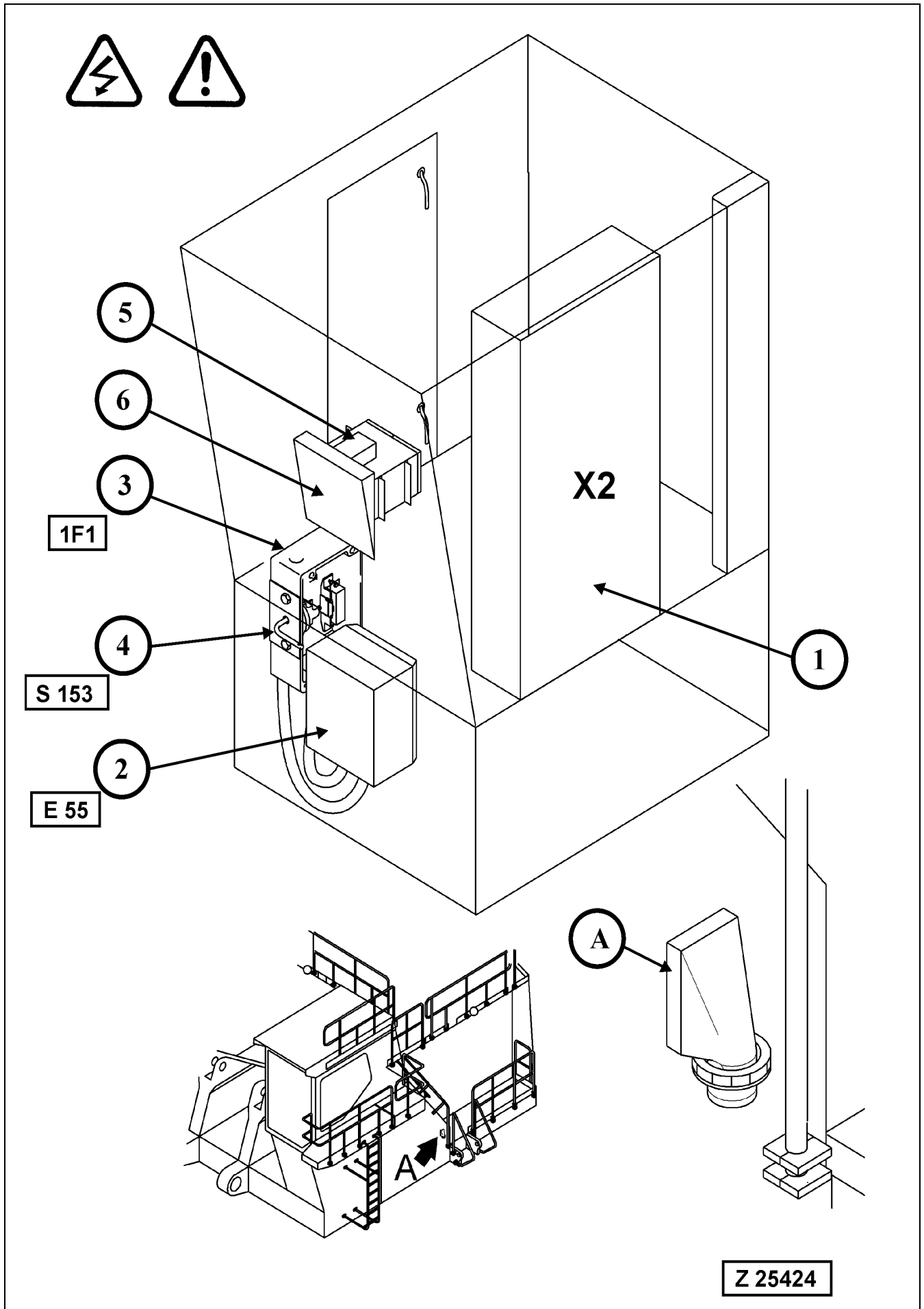
The Service switches (S100 to S150) are used for testing and adjustment procedures of the hydraulic system and should only be operated through authorized service personnel. For more information refer to the Service Manual PC3000-6.



Diagnostic Fault Codes of the Engine Centry System

The fault lamp (H97), illustration Z25478 will light for about 2 seconds after main key switch-on and then go out when no faults are detected. When a fault exists, the fault lamp will turn "ON" for warning faults, and "ON FLASHING" for more severe faults that can affect engine operation and need immediate attention. To determine if a fault is active, shut off the engine and turn main key switch to "ON" position (engine not running). Press diagnostic switch (S57) for 1 to 2 seconds and then release. If the fault lamp (H97) illuminates while the diagnostic switch is held depressed, there is an active fault or faults. Active faults **MUST** be corrected as soon as possible.

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



3.7.2 COMPONENTS OF ELECTRICAL PREHEATING SYSTEM IN CAB BASE

⚠ WARNING

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

General

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

The following systems are equipped with heaters:

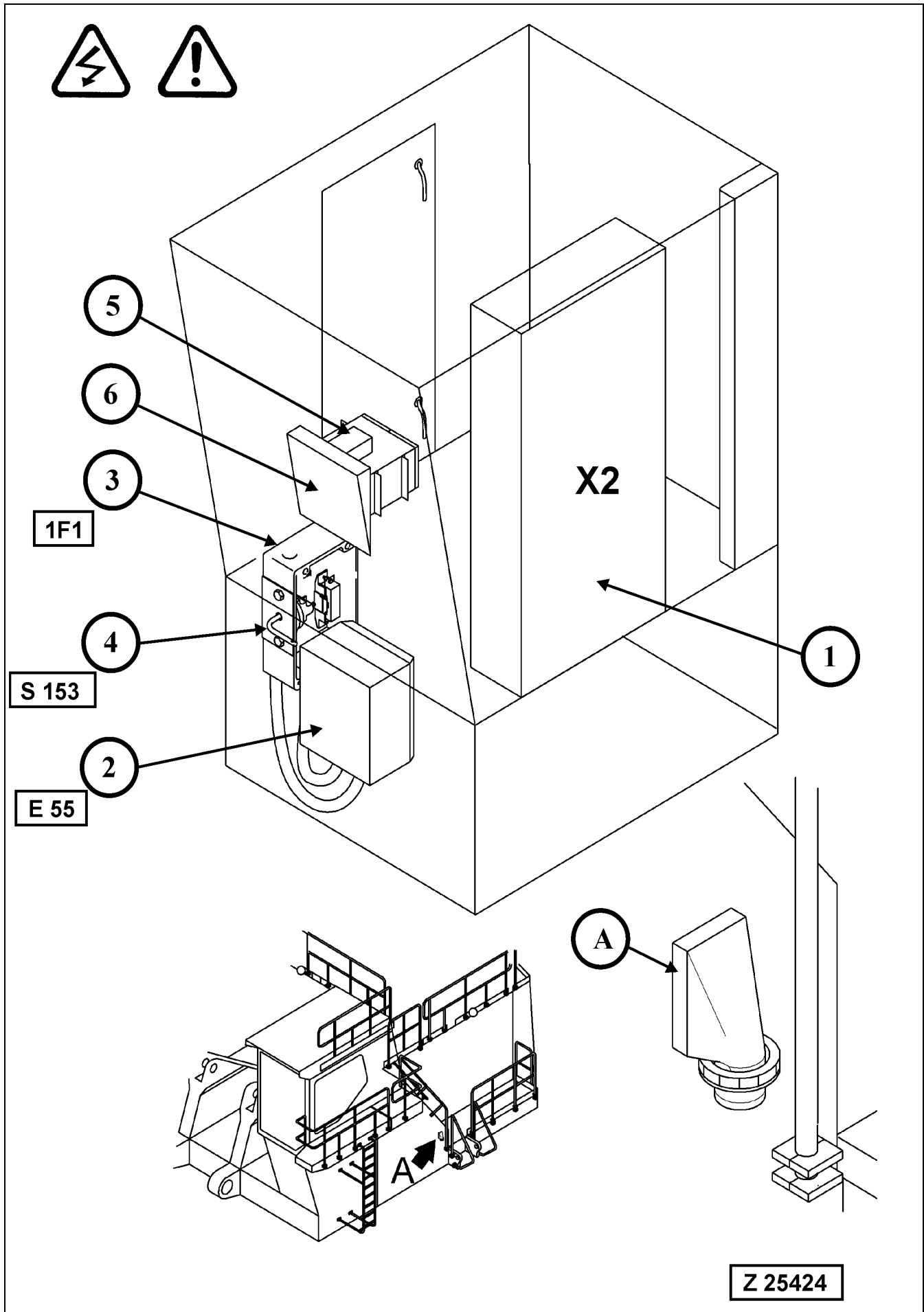
- Engine cooling system
- Engine lubricating system
- Hydraulic system (main and suction oil reservoir)
- PTO's (pump distributor gears)
- Storage batteries

REMARK

The auxiliary heater unit in the cab base (5), illust. Z25424 and the battery charger (2) are also connected to the external power supply.

Legend for illustration Z25386

- (1) Main switch board box (X2). See page 147 for more information
- (2) Battery charger E55
- (3) Fuse box with circuit breaker 1F1 - 125A for battery charger
- (4) Key switch for battery charger S153 (2)
- (5) Heater unit for cab base
- (6) Wall bracket for heater unit
- (A) External power socket for battery charger



Components of Electrical Preheating System in Cab Base (continued)

⚠ WARNING

Be sure to switch off main switch (2), (see page 161) and to disconnect the power supply cable from external power source before working on any part of the heating system.

Operating the Preheating System

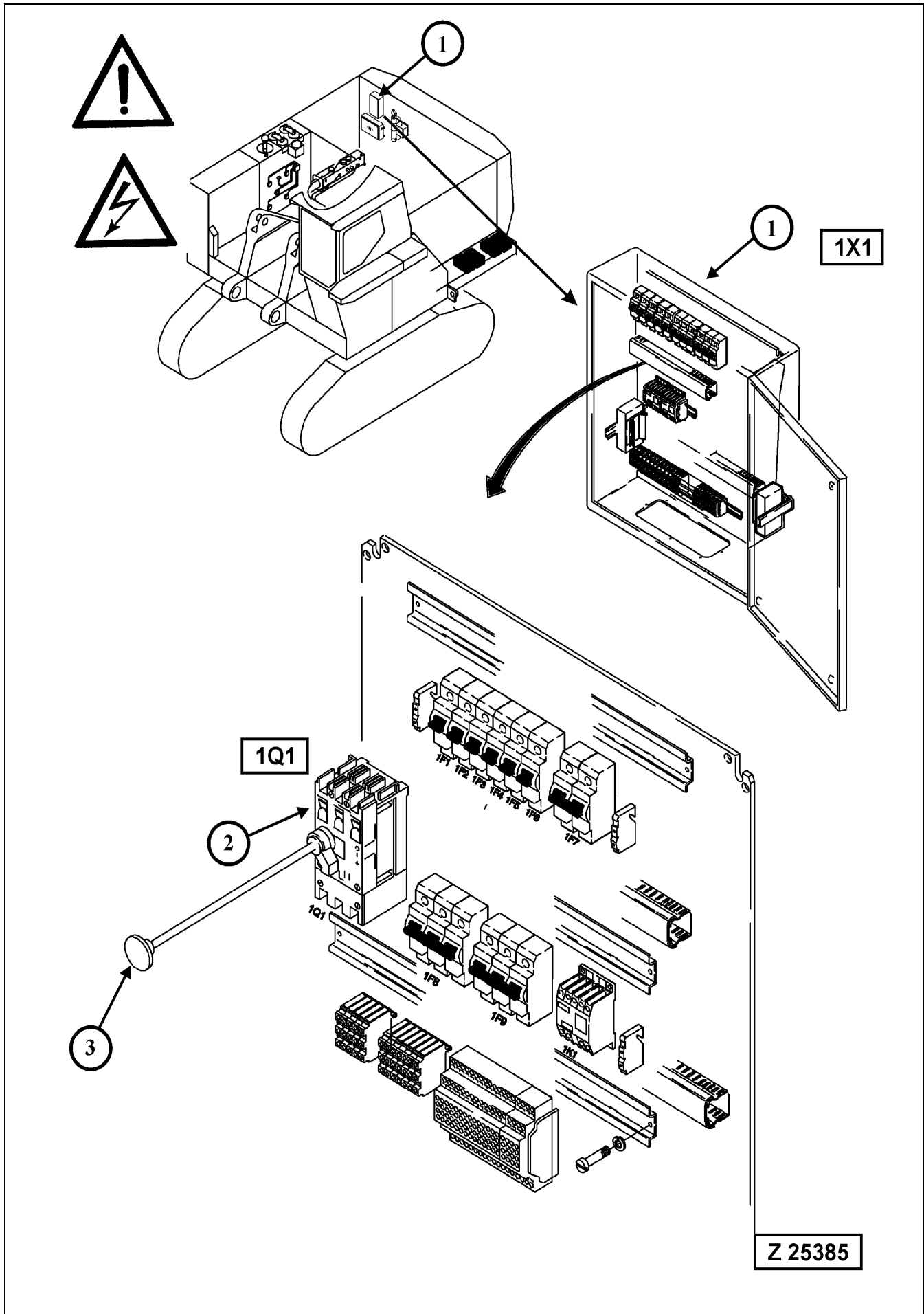
Use the preheating system during stand-still periods e.g. over night and low ambient temperatures.

The heating system should be energized as soon as the engines are shut down. This allows the heating system to maintain the desired temperature with minimum power usage.

The preheating systems for hydraulic oil and engine coolant are equipped with additional control boxes with separate ON/OFF switches. See following pages for more information.

Battery Charger (2)

Power supply to the battery charger is provided by the generator set or an external power source connected to the 1X2 plug socket at the cab stairway. The batteries of the shovel are charged by the battery charger (2). The battery charger is switched ON and OFF with main switch (4) and 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.



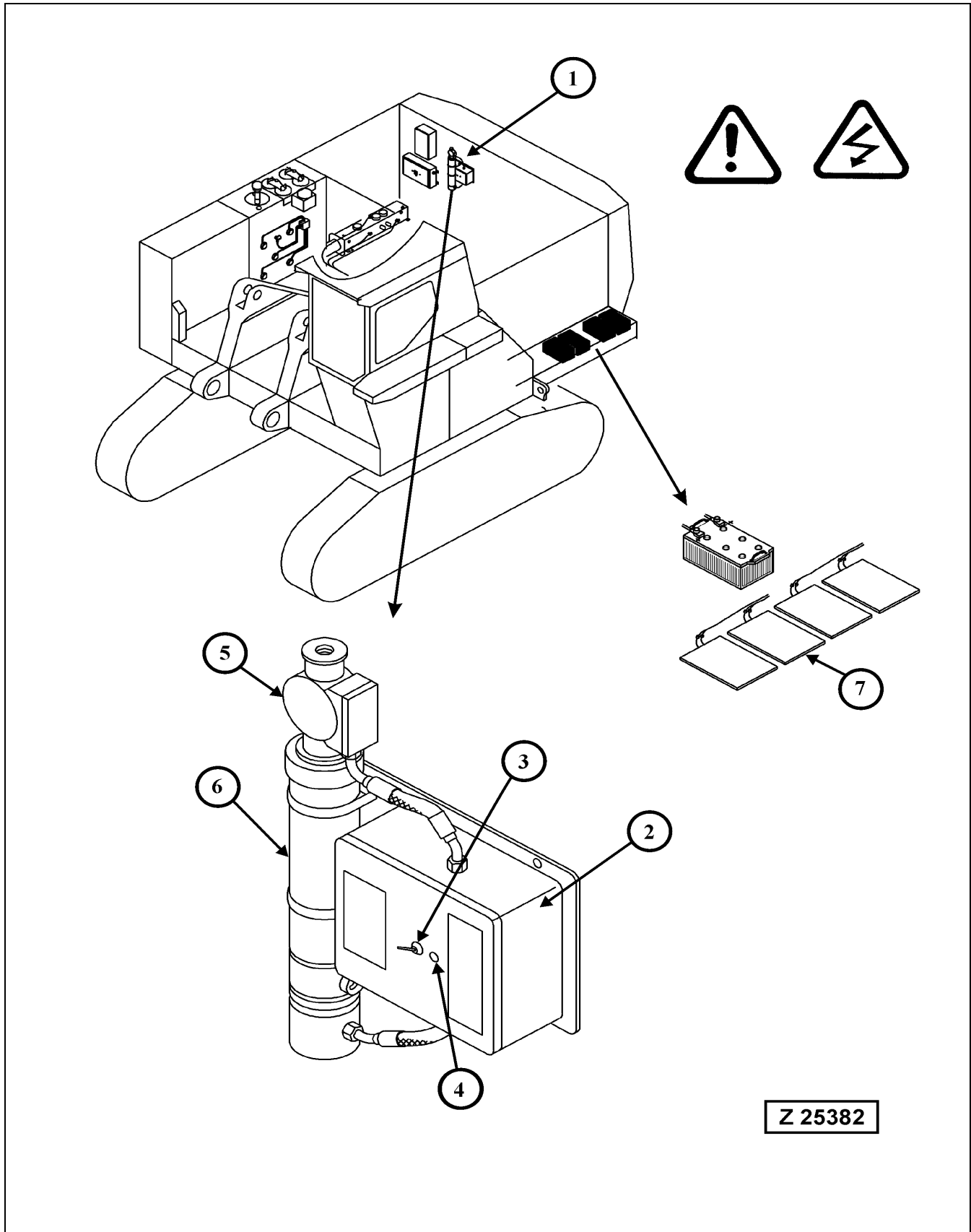
Switchboard for Preheating

Legend for illustration Z 25385

- (1) Main switchboard (1X1) for the preheating systems located on the inner wall of the counterweight-
- (2) Main switch (1Q1) for all system heaters
- (3) Extended rod for main switch (1Q1) with external access switch

3.8 PREHEATING SYSTEMS

3.8.1 FOR OIL, COOLANT AND BATTERIES



Engine Coolant Heating

Legend for illustration Z 25382

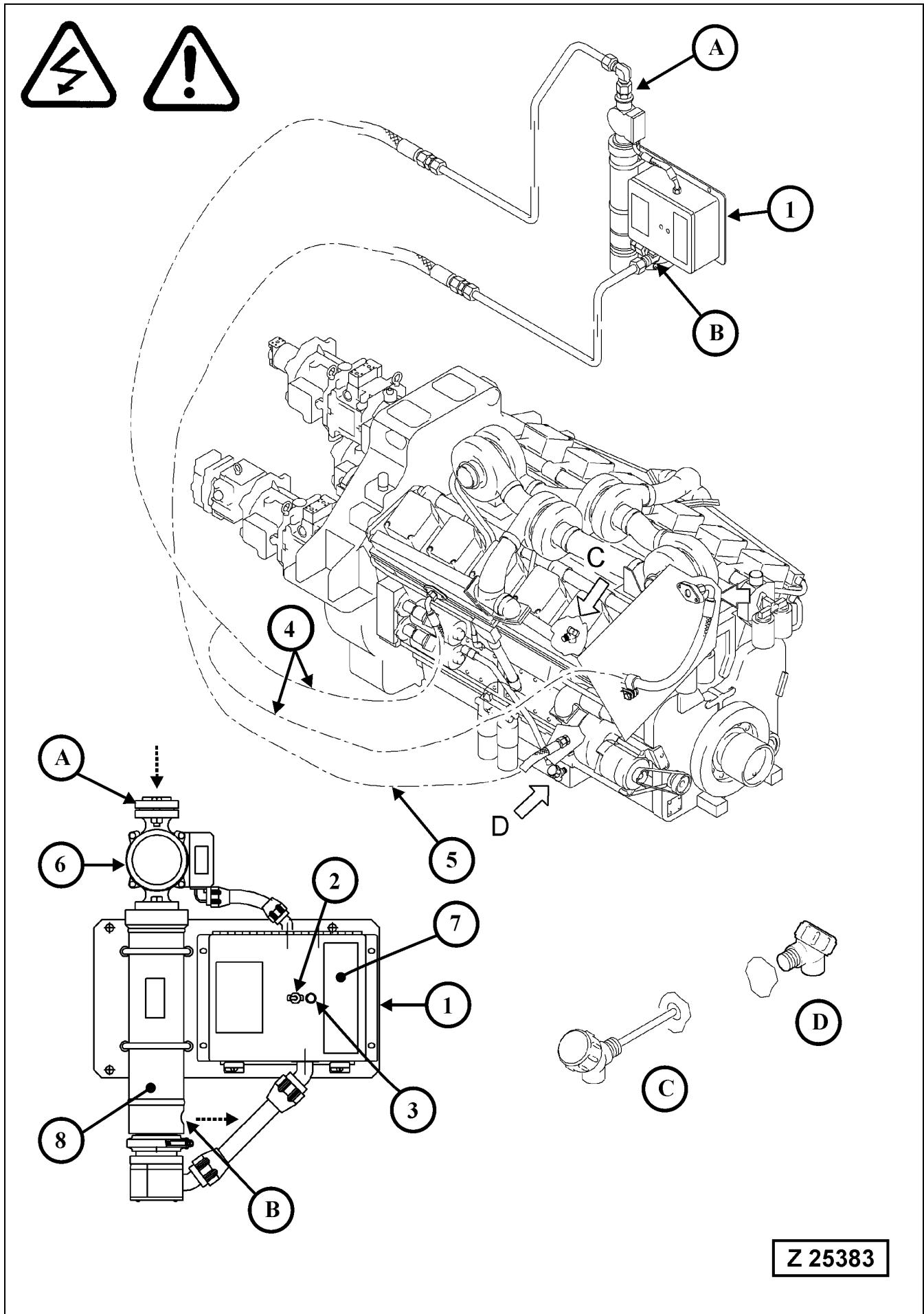
- (1) Coolant heating for engine, vertically mounted on inside of counterweight
- (2) Control box for coolant heating
- (3) Switch, coolant heater ON/OFF
- (4) Indicator light, coolant heating ON
- (5) Water pump with motor
- (6) Coolant heating element and tank
- (7) Battery heater plates

To activate the coolant heating, set main switch (1Q1) page 161, on the switch board on the inside of the counterweight to the ON position. The coolant heating can then be switched on with switch (3) on the control panel. The lamp (4) illuminates with coolant heating ON.

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

REMARK

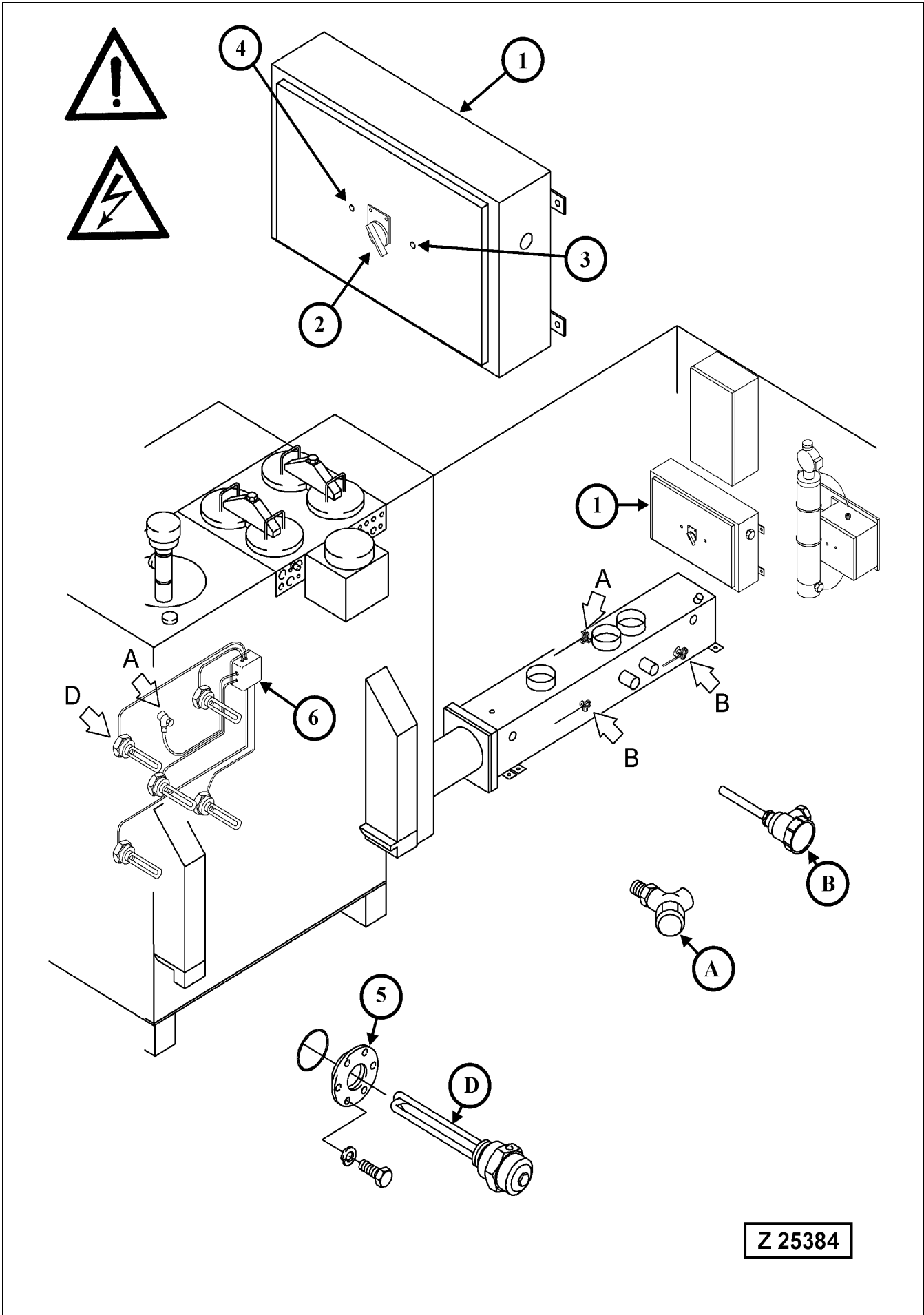
For more information about the coolant heating system, refer to the operation manual "Coolant Heating System" filed in volume 2 binder.



Engine Coolant and Engine Oil Heatings

Legend for illustration Z 25383

- (1) Coolant heating system, vertically mounted on inside of counterweight
- (2) Switch, coolant heater ON/OFF
- (3) Indicator light, coolant heating ON
- (4) Coolant hoses, from the engine to the heater
- (5) Coolant hose, from the heater to the engine
- (6) Pump
- (7) Control panel
- (8) Coolant heating element and tank
- (A) Coolant inlet
- (B) Coolant outlet
- (C) Engine oil heaters installed in the engine oil pan
- (D) Thermostats for engine oil heaters installed in the engine oil pan

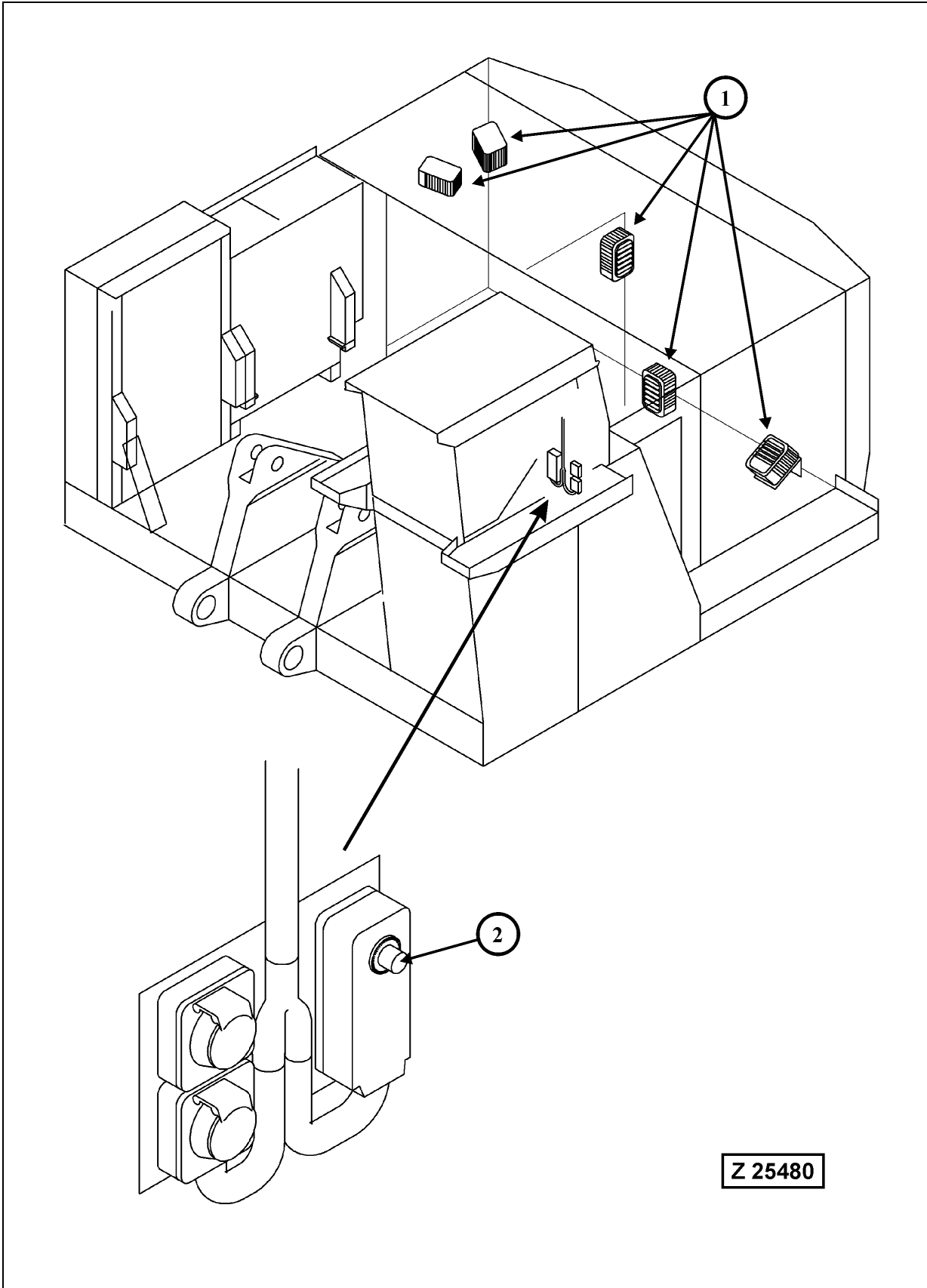


Hydraulic Oil and PTO Gear Oil Heatings

Junction Box for Hydraulic Oil Heating and Location of Heaters and Thermostats, illustration Z 25384

- (1) Junction box for hydraulic oil heating
- (2) Switch, hydraulic oil heating ON/OFF
- (3) Warning light, heating system failure
- (4) Indicator light, hydraulic oil heating ON
- (5) Adapter flange for heater element
- (6) Distribution box
- (A) Thermostats installed in the main oil reservoir, suction oil reservoir and in the PTO's (pump distributor gears)
- (B) Immersion heaters installed in the suction oil reservoir
- (D) Immersion heaters installed on the main oil reservoir

3.8.2 HEATERS FOR MACHINERY HOUSE (SPECIAL EQUIPMENT)

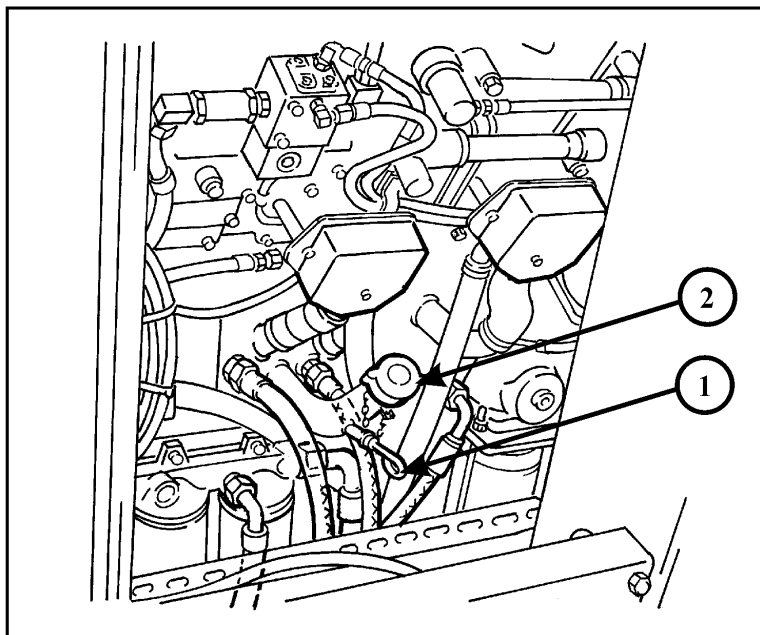
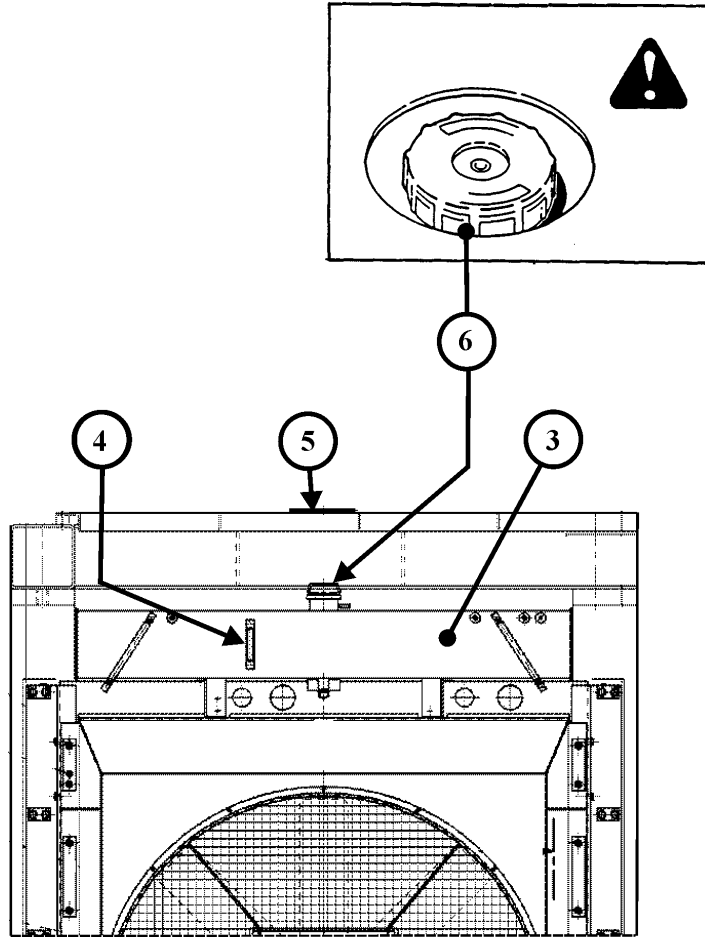


USE OF THE HEATERS

To ensure optimal functionality of the machinery in the machinery house during extreme cold weather conditions, a working temperature has to be achieved. It is therefore necessary to preheat the machinery house. Strategically placed heaters inside the machinery house are used for this purpose. The positions of the heaters are shown in Illust. Z25480

- (1) Heaters
- (2) Heater control button. This button allows the operator to set the temperature inside the machinery house. The control button regulates the temperature of all five heaters together.

3.9 CHECKS BEFORE STARTING THE ENGINE



Z 23098

⚠ CAUTION

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

CHECK THE FOLLOWING ITEMS

Legend for illustration Z23098

- (1) Engine oil pan dipstick oil level gauge
- (2) Oil filler tube for engine oil pan
- (3) Coolant expansion tank of engine radiator
- (4) Coolant level sight gauge on coolant expansion tank
- (5) Cover plate on power house roof above the radiator pressure cap
- (6) Radiator pressure cap

Walk-around Inspection

Make a "Walk-around" inspection of the Shovel. Refer to Maintenance Section 4. for the daily inspection items.

Check engine oil level in oil pan

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

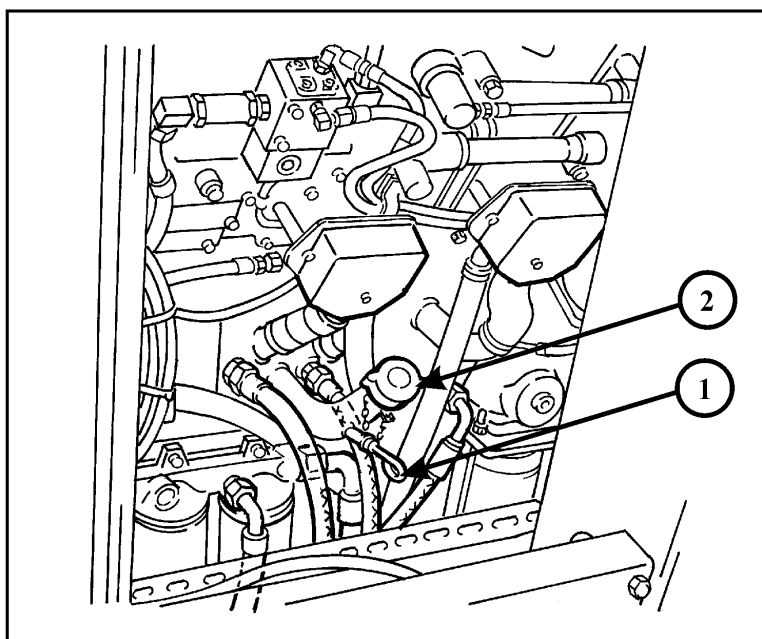
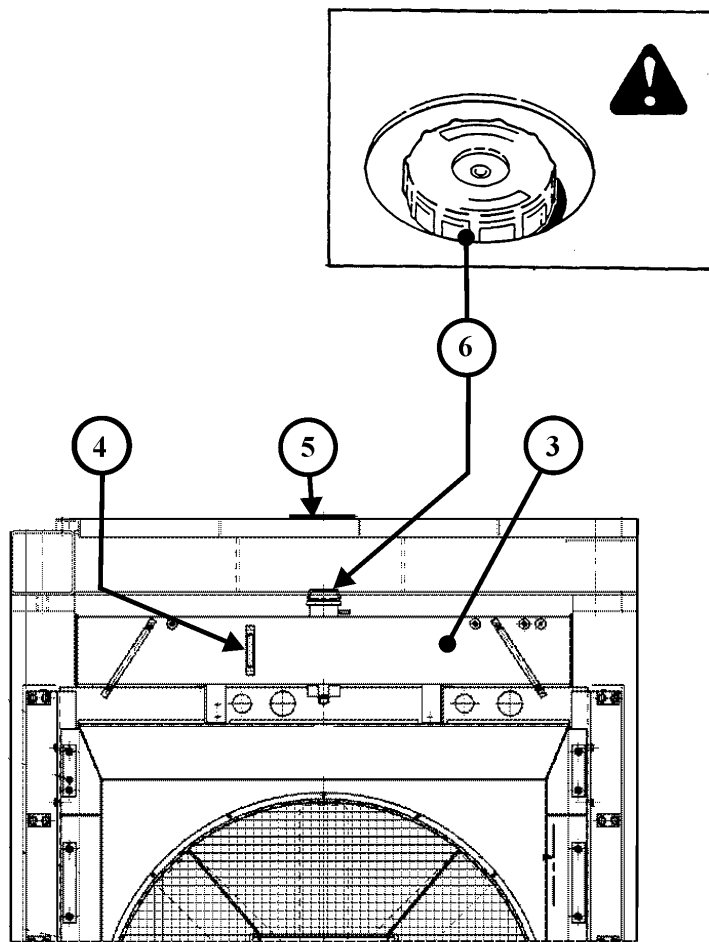
Check engine oil level on shovels equipped with the engine oil reserve system

The oil level in the engine oil pan can vary between the MIN and MAX marking on gauge (1) depending on the operating condition of the reserve system when the engine was stopped.

With sufficient oil in the reserve tank and with the reserve system in proper working order, there is no need to fill the engine oil pan even with the oil level at the MIN mark on gauge (1). If the oil level is below the MIN marking on the gauge, corrective action must be taken. Fill the reserve tank and check the reserve system. The function of the reserve system is monitored by an indicator light located on the "X2" switch board in the cab base. See section "SWITCH BOX (X2) IN CAB BASE" on page 147 for more information.

REMARK

Check also the engine oil level in the engine oil reserve tank, see page 64 for more information.



Z 23098

Coolant Level

⚠ WARNING

DO NOT remove the radiator pressure cap (6), illust. Z23098 from a hot engine. Wait until the temperature is below 50°C before removing the pressure cap (6). Failure to do so can result in personal injury from heated coolant spray or steam. Turn the radiator cap (6) slowly counterclockwise to the safety stop to allow the pressure to escape, then continue to turn until cap is free to be removed.

The coolant level should be in the upper field of the sight gauges (4). If necessary add coolant.

REMARK

Refer to the Engine Manual for the correct coolant composition.

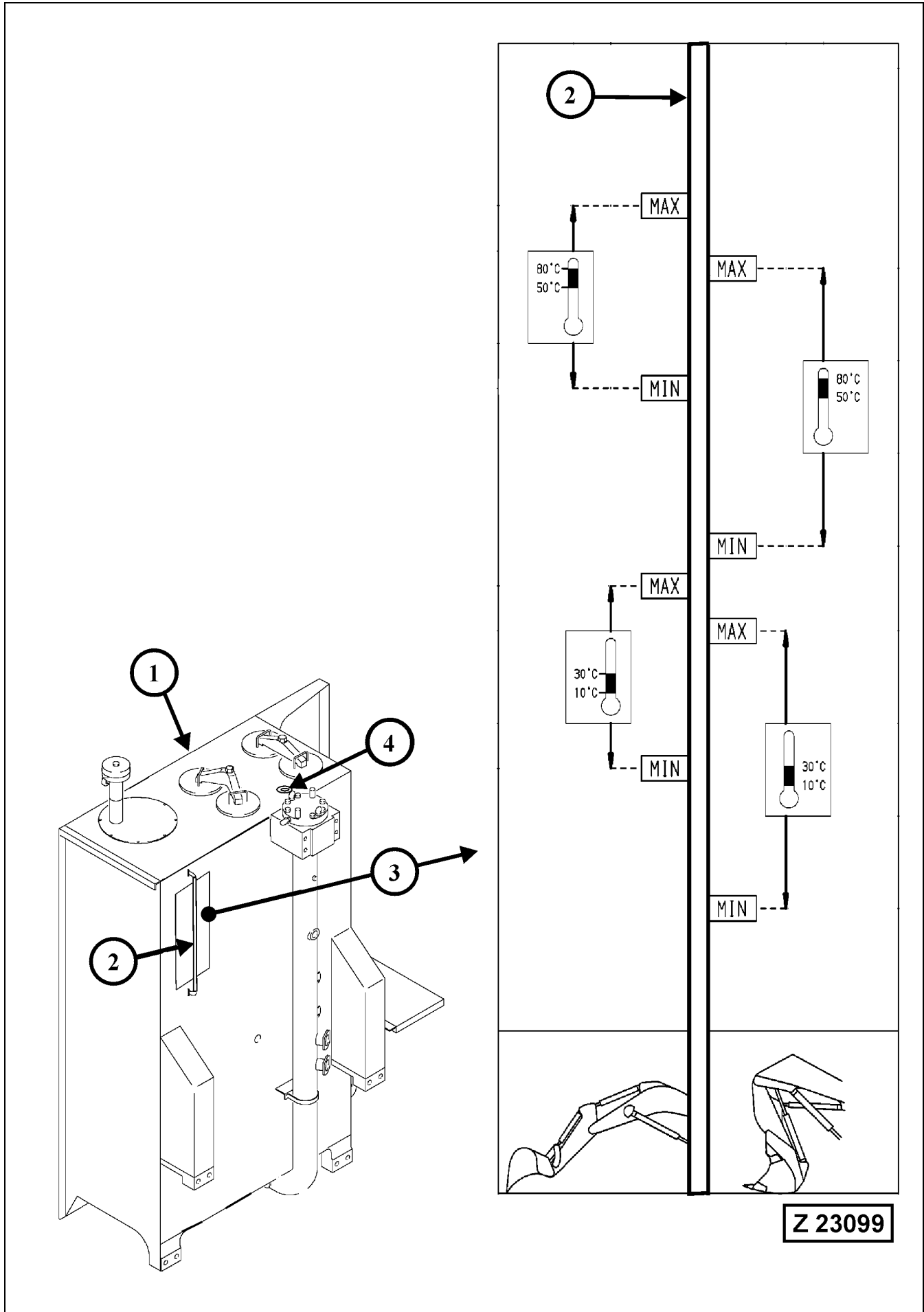
Fill Engine Fuel Tank

⚠ WARNING

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

Fill the fuel tank at the end of the of the shift to prevent condensation from forming. See engine operation and maintenance manual for fuel specifications.

Be sure to install and lock the fuel filler caps after re-fuelling. Check the breather filter at the filler neck and clean if necessary.



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 Z23099

- (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 Z23099.

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.

NOTICE

Make sure that all doors of the machinery house, cab base and cab are securely closed before starting the engine.

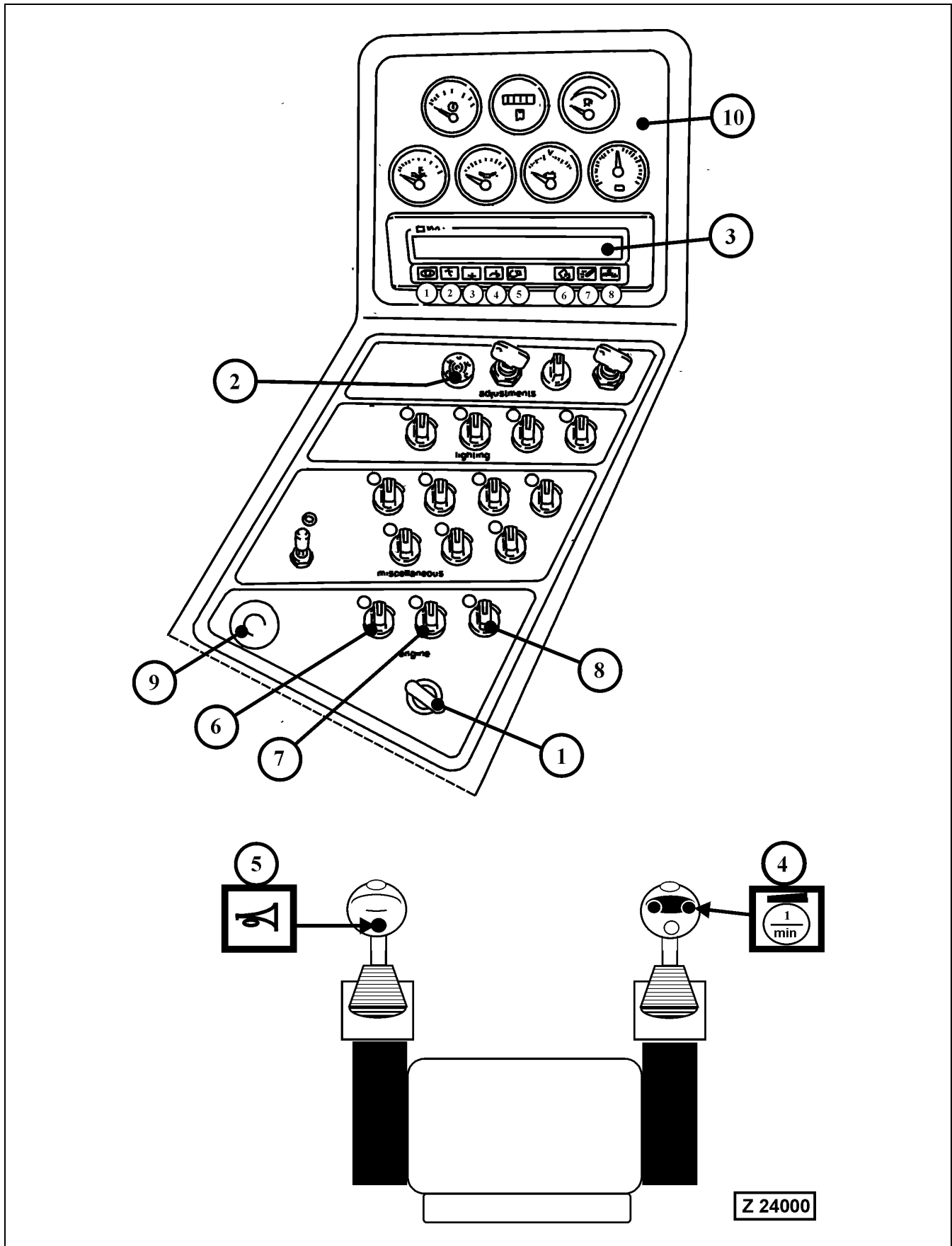
OPERATOR'S SEAT ADJUSTMENT

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

▲ CAUTION

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

3.10 STARTING THE ENGINE



3.10.1 STARTING PROCEDURE

NOTICE

Machines destined for areas with very low ambient temperatures are equipped with electronic pre-heating systems. These pre-heating systems have to be activated as soon as the engine has been stopped.

REMARK

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

WARNING

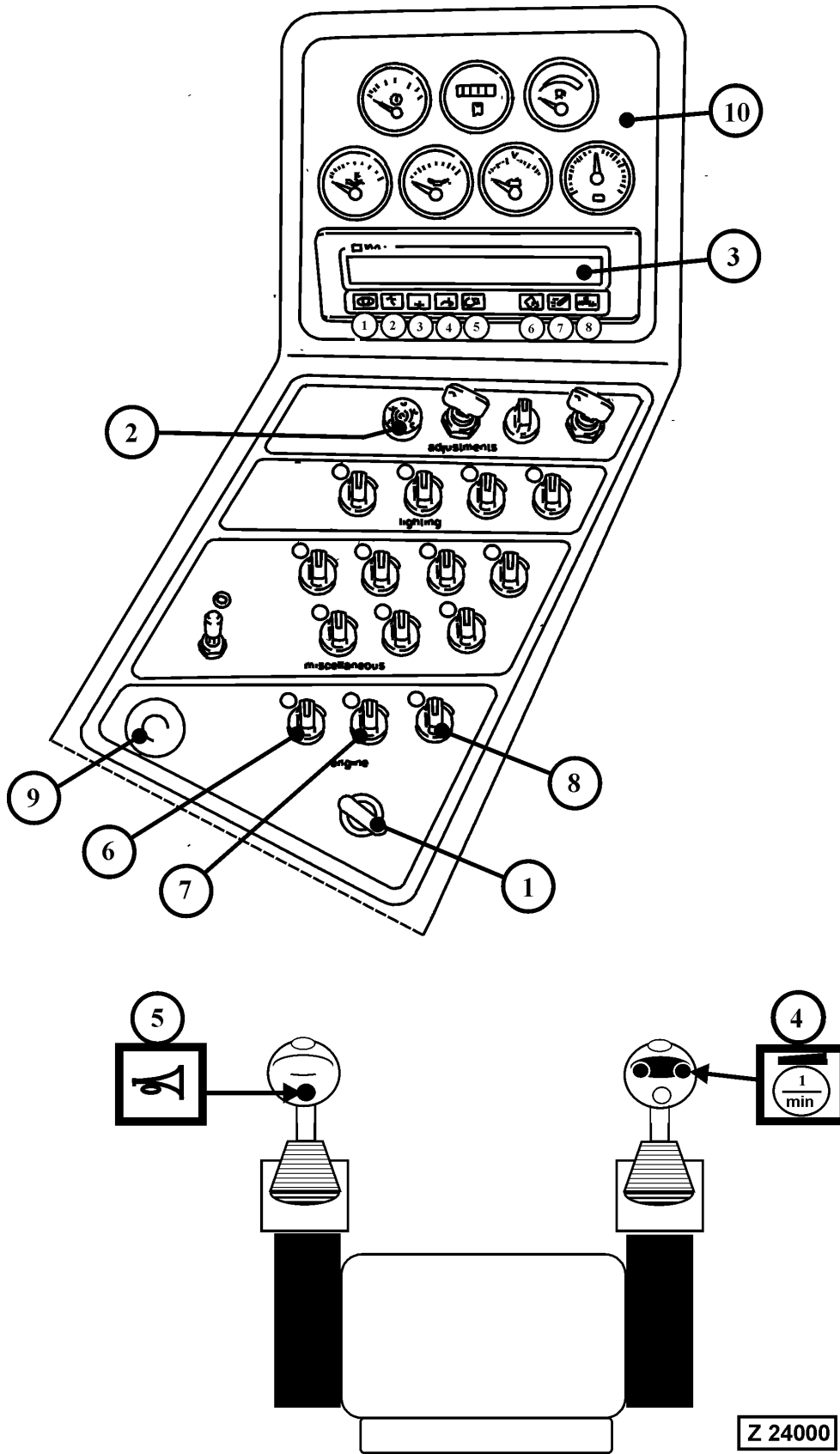
- After repairs on the Diesel Engine or Starter Motor, make sure that the ground cables are correctly connected before starting the Engines.
 - Start the engine from the operator's seat only. Never attempt to start the engine by shorting across starter terminals. This can cause fire, serious injury or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

NOTICE

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

Legend for illustration Z 25400

- (1) Key operated main switch
- (2) Acoustic warning signal
- (3) ETM text display
- (4) Engine speed selector switch
 - Low idle - High idle
- (5) Signal horn button
- (6) Rotary switch - engine start
- (7) Rotary switch -engine stop
- (8) Rotary switch - engine start pilot, cold starting aid
- (9) Strike button - emergency engine shutdown and cut-out of pilot control system
- (10) Panel with analogue gauges



3.10.2 STARTING PROCEDURE AT AMBIENT TEMPERATURE UP TO -25°

▲ CAUTION

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

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

REMARK

Start the engine with the lock lever in the fully rear LOCKED position. When the engine is running, move the lock lever to the front in the FREE position.

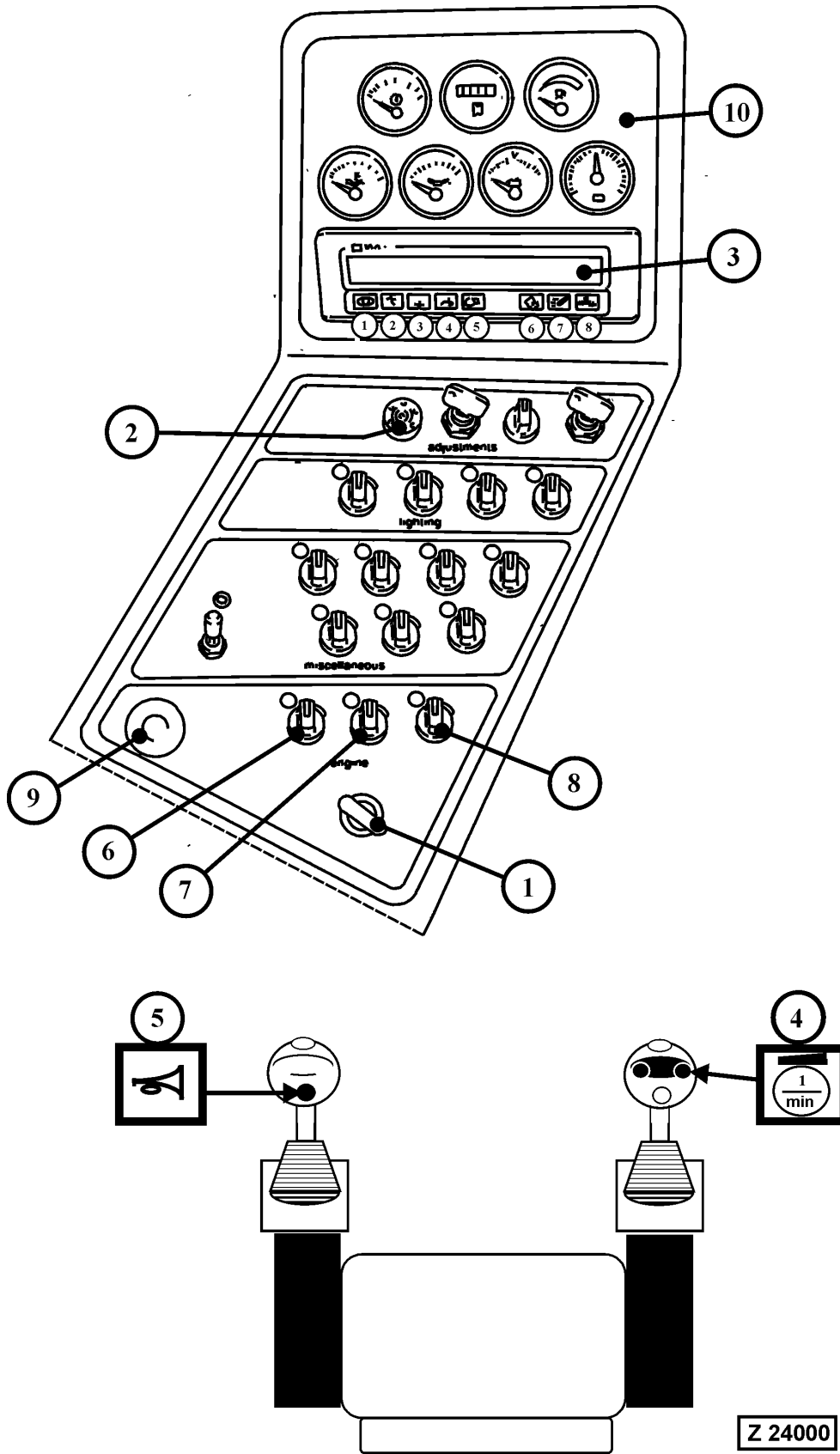
2. Insert key into the switch (1), illustration Z 25400 and turn to operating position. The warning buzzer (2) must give an acoustic test signal. If the buzzer fails to function, corrective action must be taken.
3. Observe ECS display (3). Normally the basic display appears on screen (3). If a FAULT message or INFORMATION item is displayed, proceed according to section "ELECTRONIC TEXT MONITORING SYSTEM ETM" on page 88.
4. Set toggle switch (4) to low idle speed position.
5. Sound the signal horn (5).
6. Start the engine by turning starter switches (6).

REMARK

The engine is equipped with a prelubrication system which is activated by the starter switch (6). Turning and holding the switch in the start position sends current to the prelubrication starter solenoid which then prelubricates the engine. This solenoid timer prevents current from flowing to the conventional starting motor until 17 kPa (2.5 psi) oil pressure has been achieved in the cam oil rifle. After a subsequent 3 second delay, current is then directed to the starting motors for cranking the engine.

7a. Cold Weather Starting at ambient Temperatures below 0°C to -25°C

To facilitate starting at low outside temperatures (below 0° C) and with the engine cold, use the cold starting aid. Take into account, that the prelubrication period will be longer at low ambient temperatures. Inject starting fluid only after the prelubrication period is finished and the engine starts to crank. Engage the starter and while cranking, apply metered amounts of starting fluid using switch (8) until the engine idles smoothly.



CAUTION

Use the cold starting aid only during starting and with the engine cold.

REMARK

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

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

CAUTION

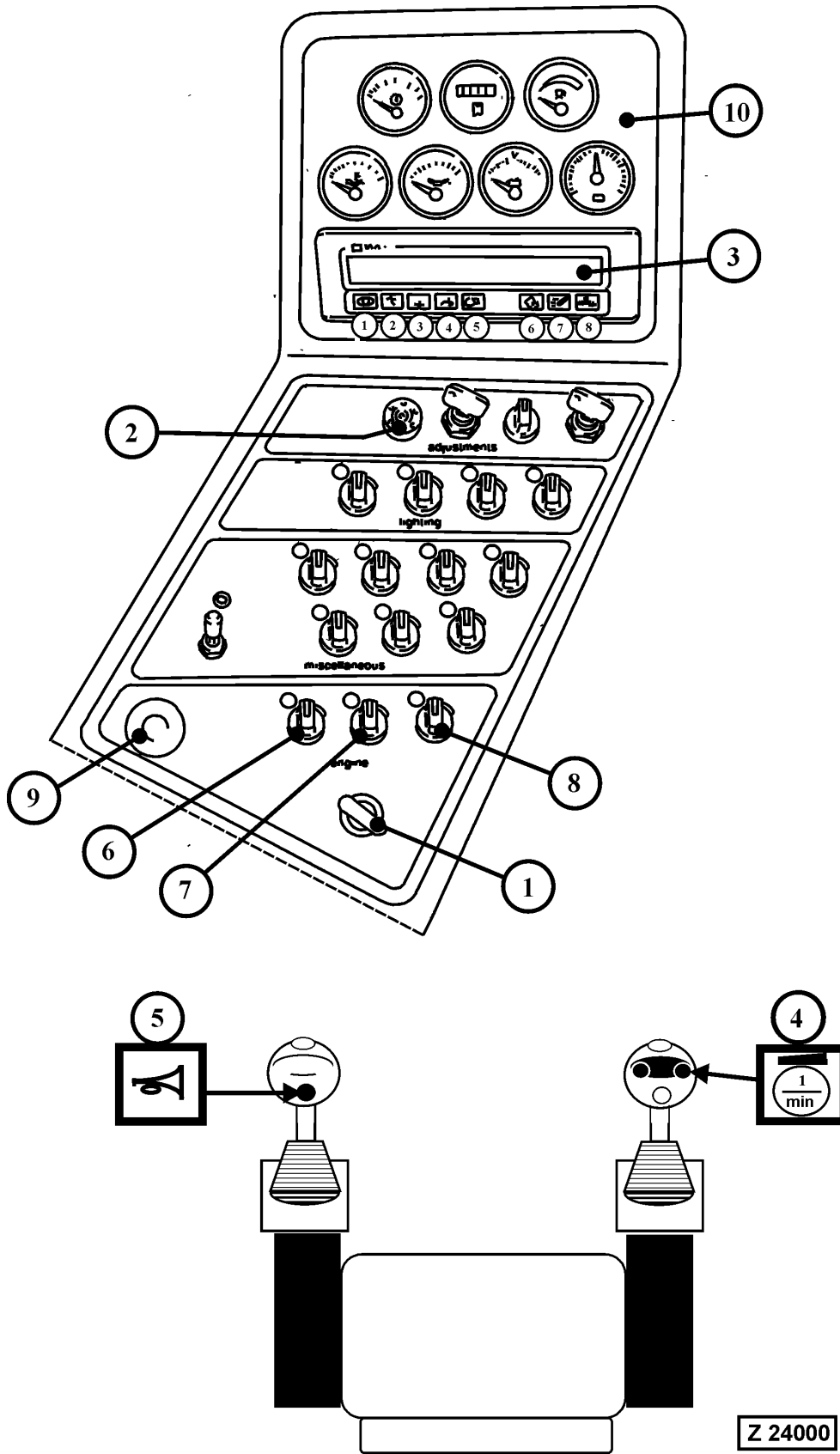
When starting the engine at such extremely low temperatures, it is vital to proceed according to the following start-up procedure. The reliability of the machine and equipment will be seriously impaired if the following procedure is not properly carried out

1. Record the Outside Ambient Temperature. If it is colder than –40°C, then **DO NOT start the Machine and keep the electrical preheating systems activated.**

If the customer decides to start the machine at temperatures below –40°C it will be at the customer's own risks in terms of potential structural damages and components failures. It must be understood, that KMG will decline any warranty claims which would result from starting or operating the machine when the ambient temperatures are below –40°C.

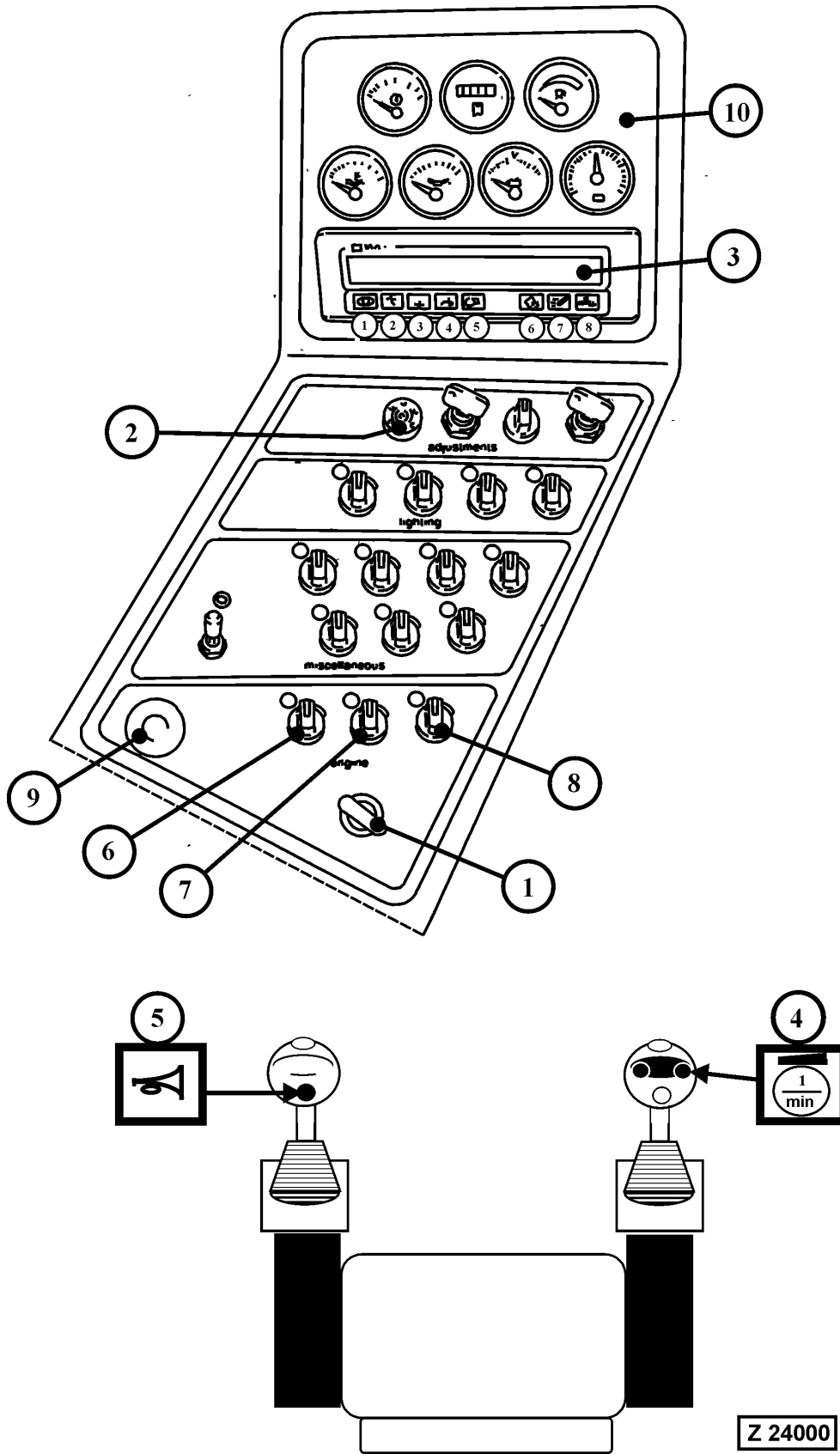
2. If the Outside Ambient Temperature is between –40°C and –25°C, then check that the preheating systems are duly energized and that all the heaters are functioning properly. Also close the radiator shutters (if so equipped).
3. Let the preheating systems warm the hydraulic oil and the engine coolant up to a temperature of –25°C or warmer. These temperatures are indicated on the temperature gauges on the dashboard.
(With Heaters properly functioning, these temperatures should never fall below –25°C).

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



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

4. When the hydraulic oil and the engine coolant have been warmed-up to the minimum starting temperature of -25°C , switch off the engine coolant pre-heating systems. All other heating systems remain active.
5. Crank the engine up to three times without activating the starting aid fluid switch.
6. If the Engine does not start, activate the Diesel starting aid fluid switch, while cranking.
7. Release immediately the starting aid fluid switch once the Engine starts.
8. If Engine fails to start, go back to step 5.
9. Once the Engine is started, keep it at low idle speed for five minutes, then shift Engine to high idle speed in order to warm-up the Engine.
10. Once the Engine is up to working temperature, switch OFF the remaining electrical preheating systems and, if an external power source is used, disconnect the power supply cable. Carefully start moving the attachment by operating controls very slowly. Follow the steps below:
 - 10.1 Raise the attachment slightly off the ground and start by holding the clam closed function over relief. Keeping in mind not to hold over relief for long periods of time as it may damage the relief valve due to overheating.
 - 10.2 After holding clam closed function over relief, slowly open clam and hold open function over relief. Continue working clam and holding over relief until the hydraulic oil temperature gauge begins to move and then proceed on to the bucket functions.
 - 10.3 While holding the bucket functions over relief, continue to work the clam to keep the oil flowing through the circuit.
 - 10.4 As the temperature of the hydraulic oil rises, move on to the stick and then to the boom functions, keeping other functions in motion as well. Once the hydraulic oil temperature is approximately $+30^{\circ}\text{C}$, start adding swing functions into motion.



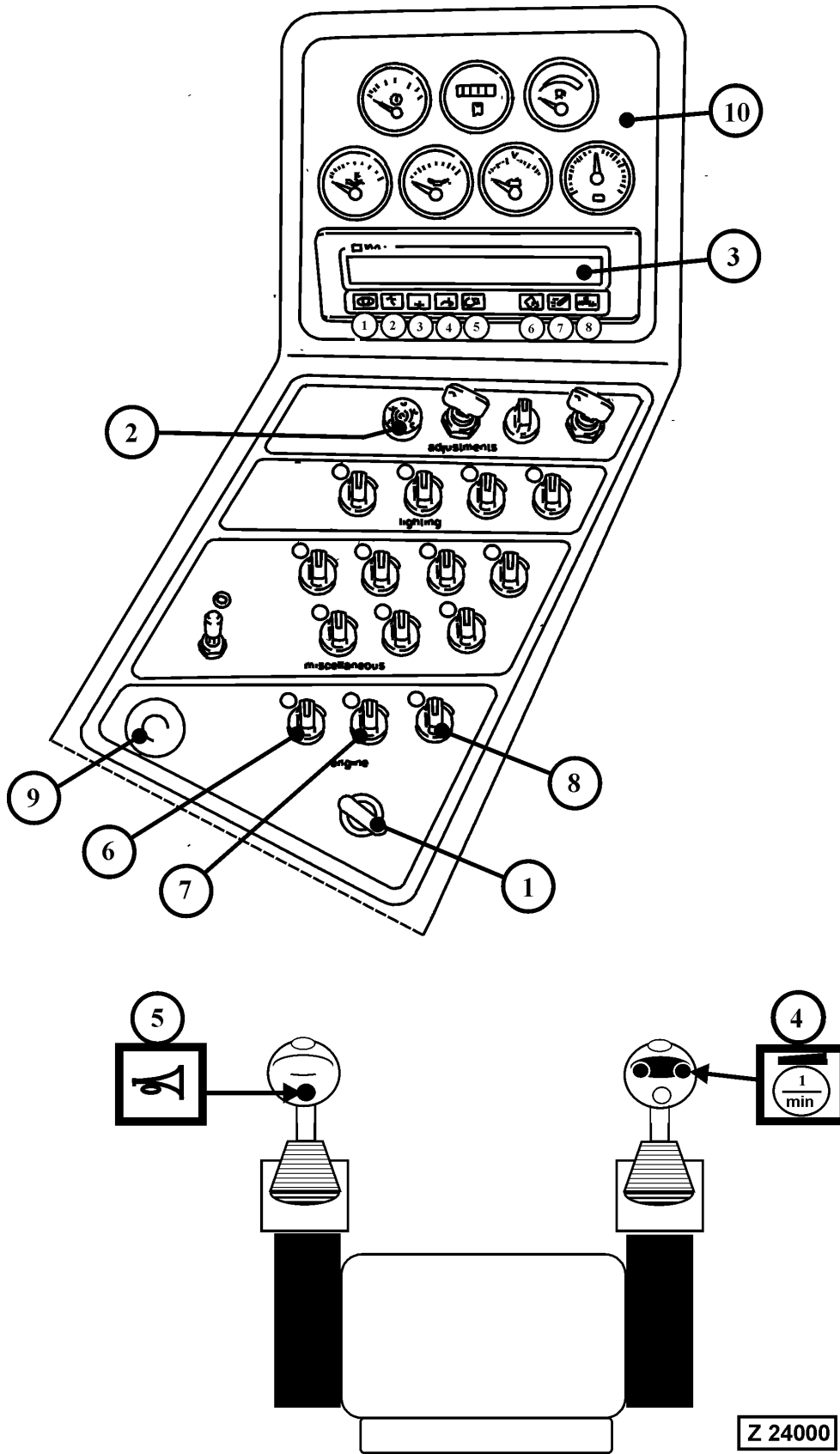
10.5 Once the hydraulic oil is close to working temperature swing over one track, raise the track off of the ground with the attachment, and slowly rotate the raised track to remove cold oil from the circuit. The running surfaces of track pads must be unobstructed with dirt, mud, or other debris. Once the track has been rotated in both directions for a few minutes, lower the track and repeat the same procedure with the opposite track.

11. Operate the Shovel normally but smoothly, avoiding shocks and jerky movements, as hydraulic hoses may burst when the outside ambient temperature is extremely low. Operators must be more careful as temperature goes down to the limit of -40°C .

REMARK

Continuous operation with low coolant temperature below $+60^{\circ}\text{C}$ can damage the engine. To increase coolant temperature switch on the heater blowers in the machinery house. Load the hydraulic system.

12. IF DURING OPERATION, THE AMBIENT TEMPERATURE DROPS BELOW -40°C , STOP WORK, MOVE THE LOADER ATTACHMENT IN THE CORRECT PARKING POSITION, SHUT DOWN THE ENGINE AND SWITCH ON THE ELECTRICAL PREHEATING SYSTEMS.



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-
	°C	°C
ISO VG		
Shell Tellus Arctic 32 *1)	- 32	10 - 85
Shell Tellus arctic 32 *2)	- 34	5 - 81
HLP 22	-20	8 - 55
HLP 32	-14	16 - 70
HLP 46	-6	25 - 80
HLP 68	0	32 - 85
HLP 100	+5	39 - 85

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

REMARK

The starting and operating temperatures in the above chart depend on the hydraulic oil viscosity grade used in the system. Refer to section ELECTRONIC MONITORING AND CONTROL SYSTEM; menu control chart II for the viscosity grade of the present oil filling.

For example:

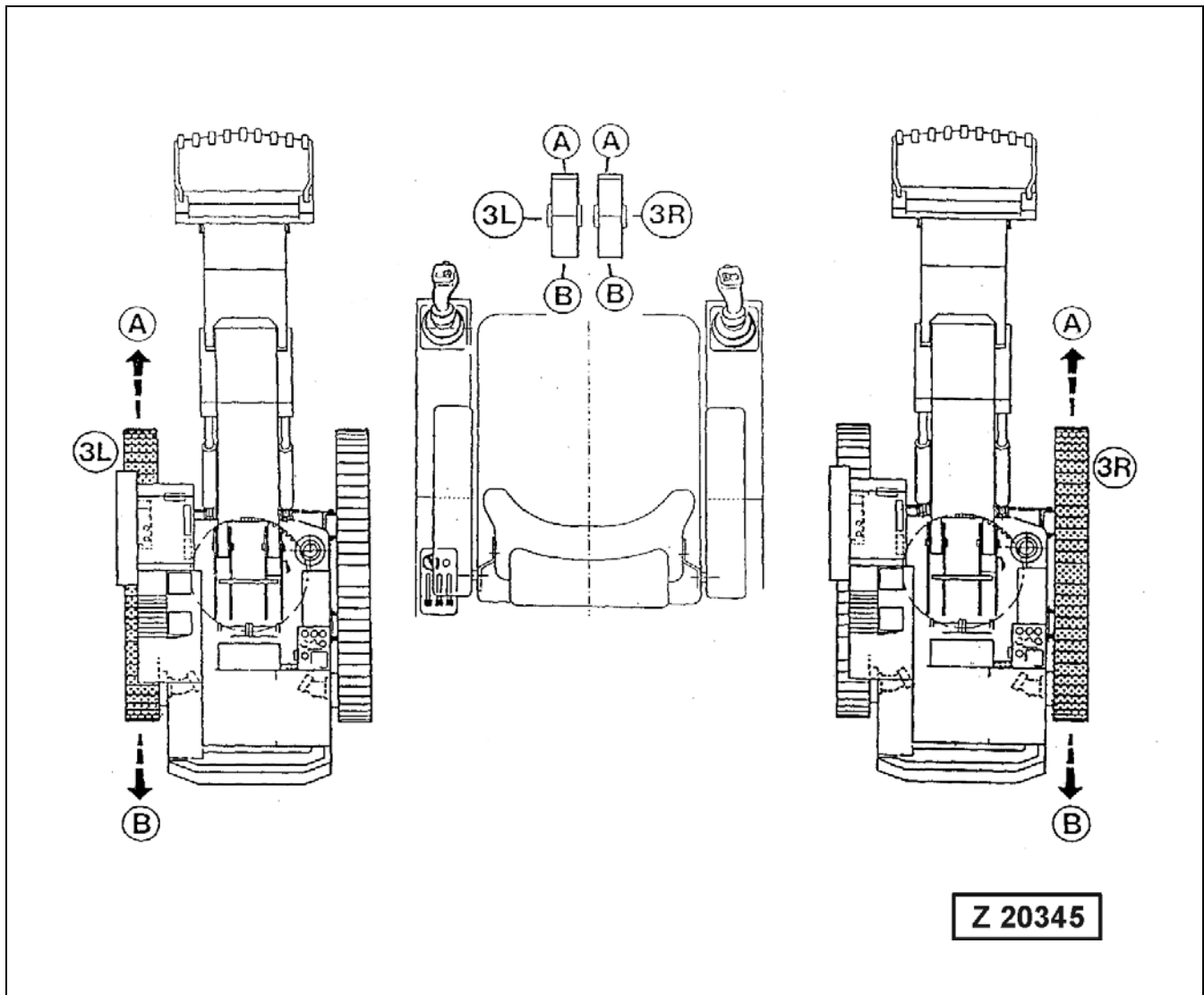
Hydraulic system filled with **ISO VG 22** viscosity grade oil.

- Lowest permissible starting temperature:
-20°C, see column "1"
- Operating temperature:
min. + 9° C
max. + 58° C, see column "2"

3.11 MOVING THE SHOVEL

3.11.1 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.

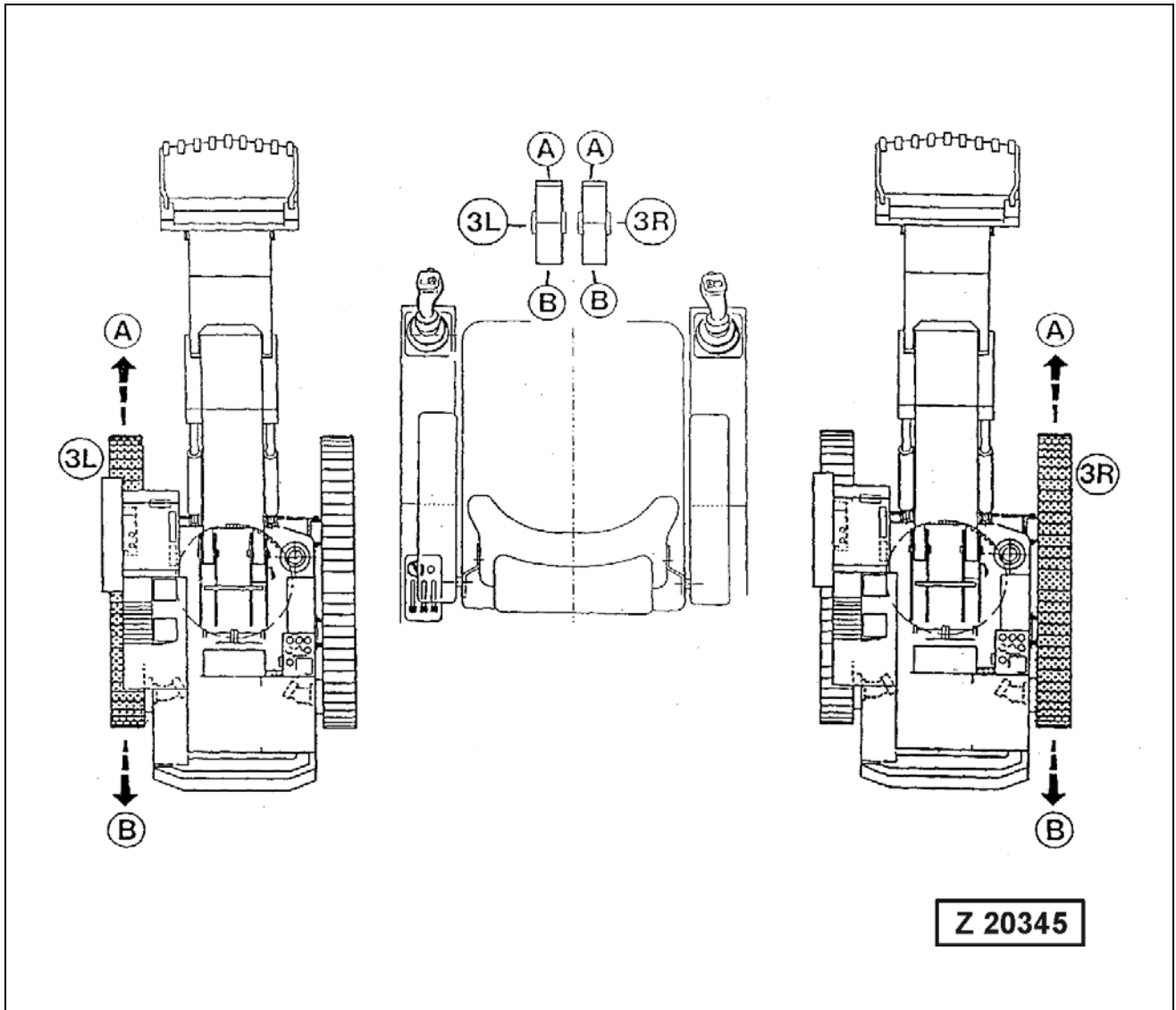


Legend for illustration Z 20345

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

WARNING

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



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

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

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

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

⚠ WARNING

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

NOTICE**Two Speed Range Travel Drive**

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

Never go downhill with fast speed range engaged.

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

PARKING BRAKE

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

TRAVEL ALARM / BACK-UP ALARM

(Special equipment)

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

3.11.2 TRAVELLING INSTRUCTIONS

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

3.12 SLEWING AND BRAKING THE SUPERSTRUCTURE

3.12.1 SLEWING THE SUPERSTRUCTURE

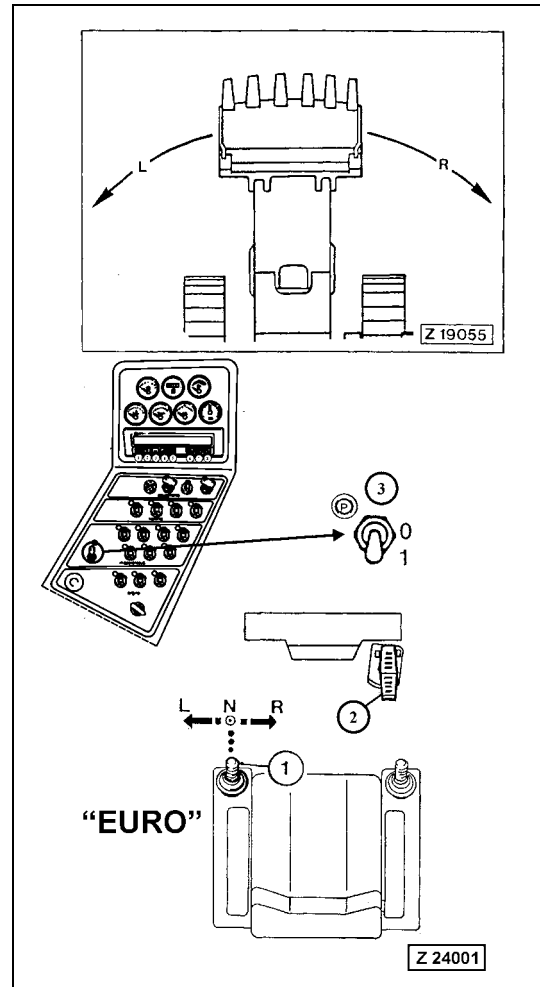
MACHINES WITH “EURO” CONTROL

Legend for illustration Z24001

- ”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 Z24002

- ”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 Z24003 to the neutral position (N). This procedure can be shortened by depressing pedal (3).

Swing Parking Brake

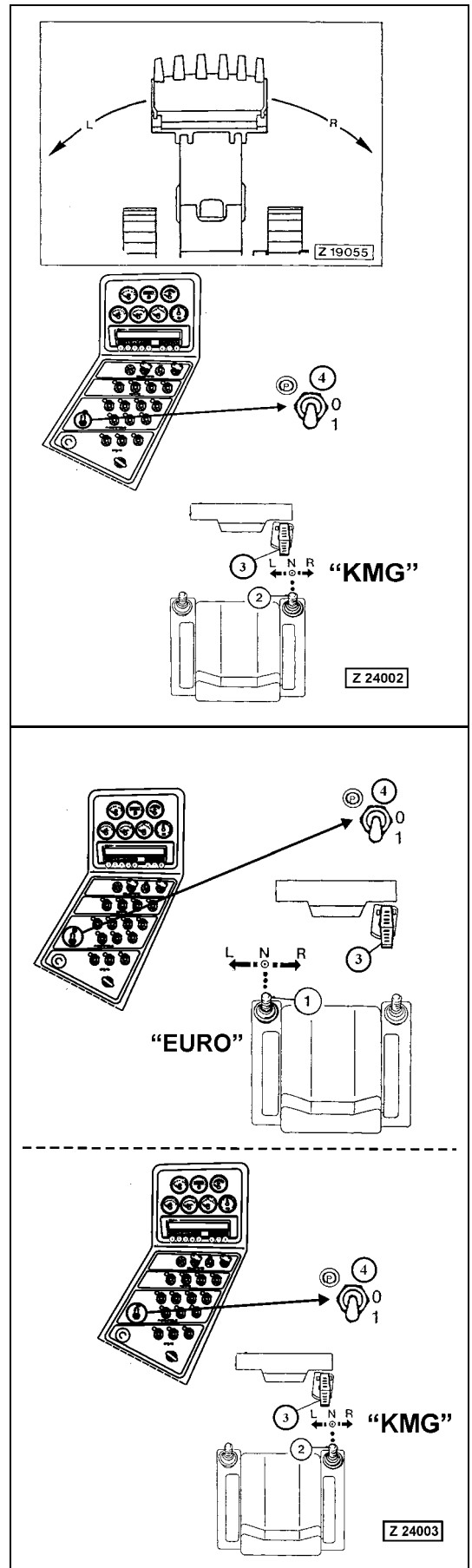
The parking brake for the swing gears is a spring loaded disk type brake. This brake is switched ON and OFF with toggle switch (4).

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 the swing gear inspected and repaired if necessary. Contact your Komatsu dealer for support.



Switch Positions

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

Applying the Parking Brake

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

Releasing the Parking Brake

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

NOTICE

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

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

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

Important Instructions for Slewing the Superstructure



WARNING

- **DO NOT** swing over persons or over the unprotected cab of a truck.
- **DO NOT** level the ground in front of the Shovel by turning superstructure back and forth.
- **DO NOT** jump off the rotating superstructure.
- **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.**

3.13 WORKING WITH THE ATTACHMENT

3.13.1 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)

E Extending stick

F Retracting stick

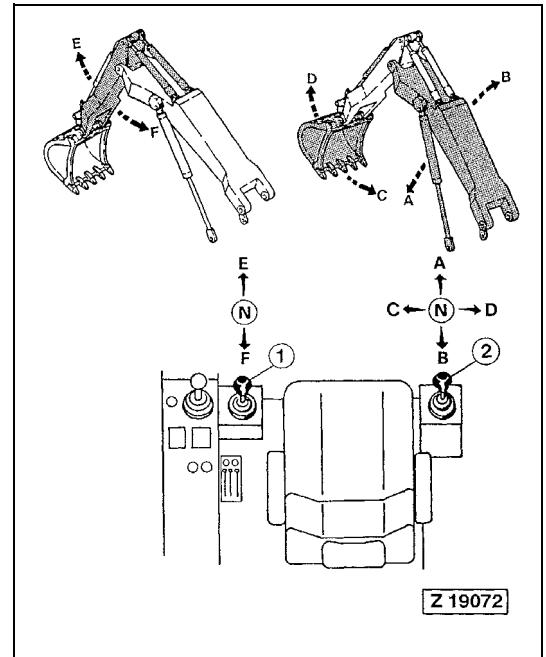
RH control lever (2)

A Lowering boom

B Lifting boom

C Filling bucket
(roll back)

D Emptying bucket
(roll forward)



Z 19072

FACE SHOVEL

LH control lever (1)

E Extending stick

F Retracting stick

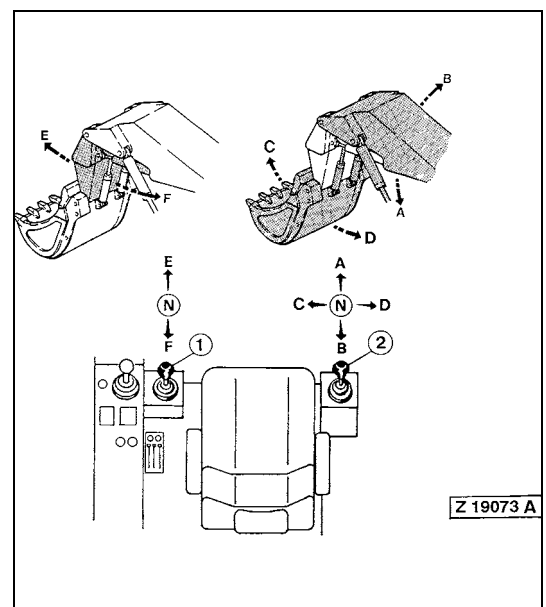
RH control lever (2)

A Lowering boom

B Lifting boom

C Filling bucket
(roll forward)

D Emptying bucket
(roll back)



Z 19073 A

NOTICE

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

For more information → See "STOPPING THE ENGINE" on page 202.

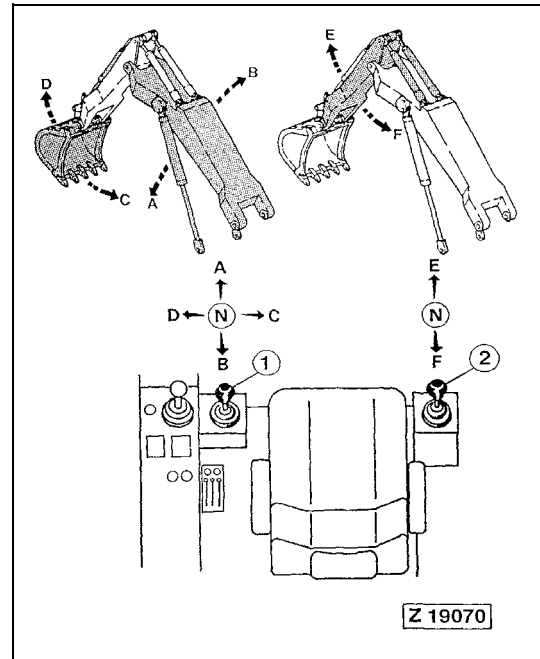
3.13.2 MACHINES EQUIPPED WITH "KMG" CONTROL SYSTEM

NOTICE

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

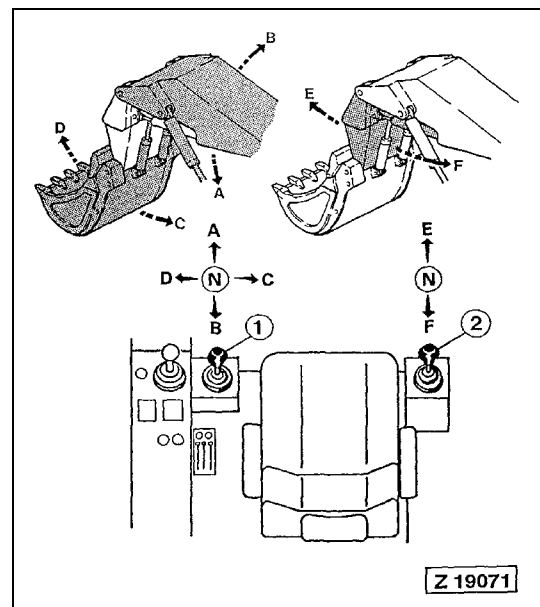
BACKHOE

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



FACE SHOVEL

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



NOTICE

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

For more information → See "STOPPING THE ENGINE" on page 202.

3.13.3 BOTTOM DUMP BUCKET

NOTICE

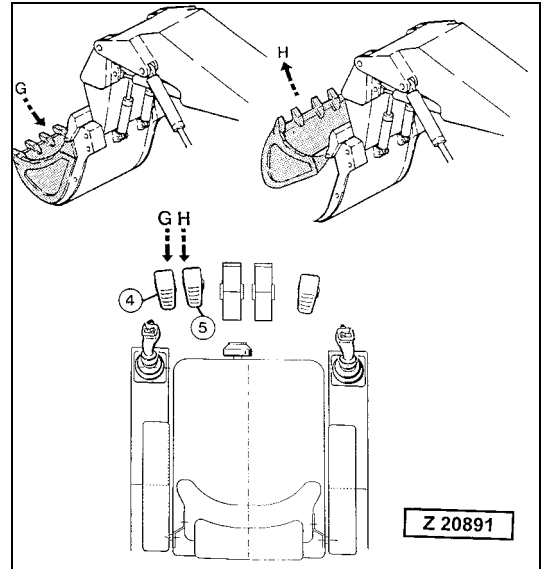
The illustration shows a typical construction of control stand and working attachment. However, the shown operation- and working movements apply to this machine.

OPERATING THE BUCKET CLAM

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

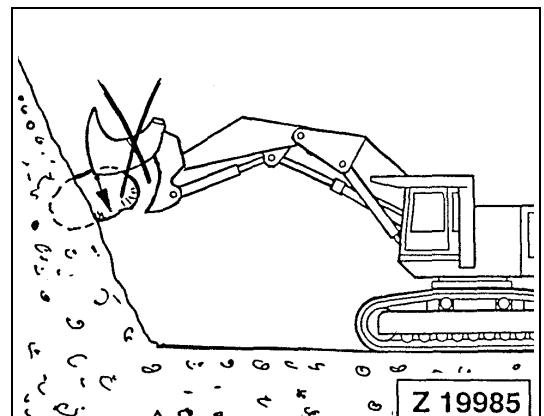
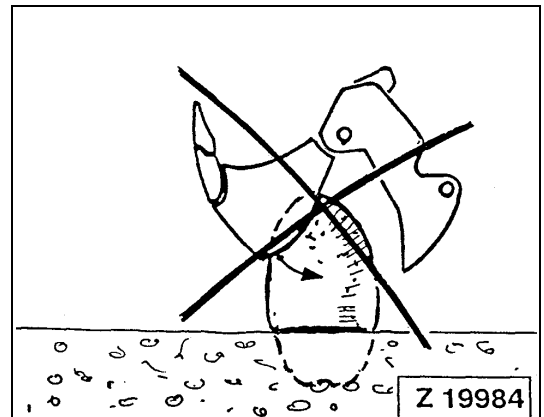
CAUTION

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

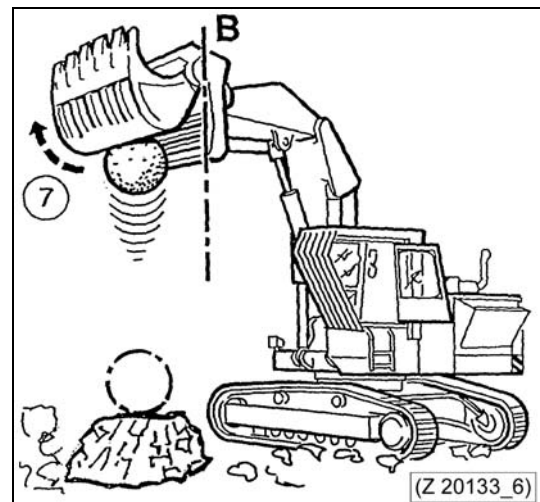
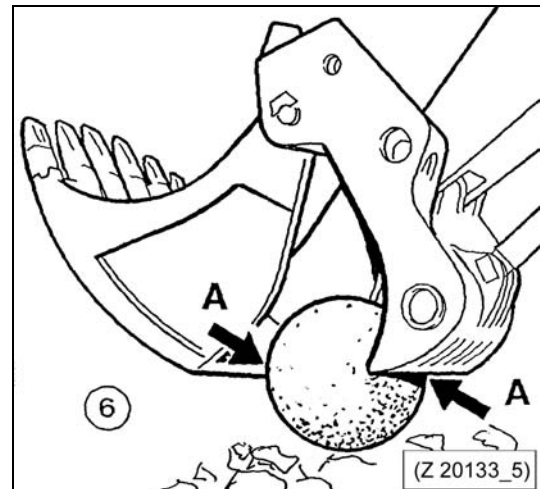
DO NOT use the bucket clam for loosening or removing anchored rocks or other solid objects (illust. Z 19984 and Z 19985), since such operations may result in severe damage to the clam pivot bearings.



3.13.4 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.



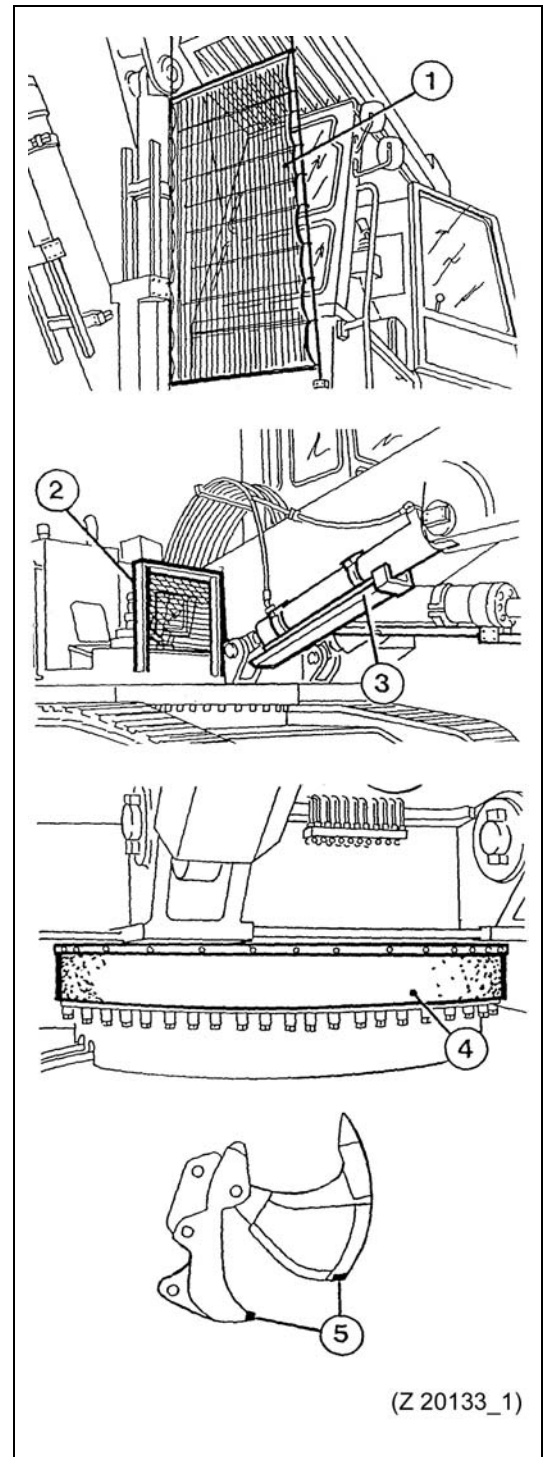
SAFETY DEVICES (SPECIAL EQUIPMENT)

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

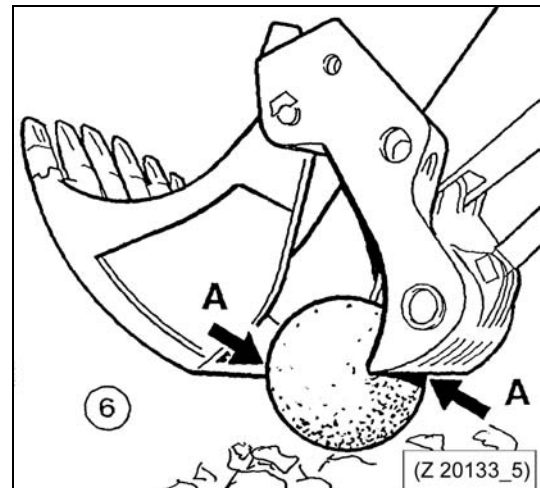
NOTICE

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

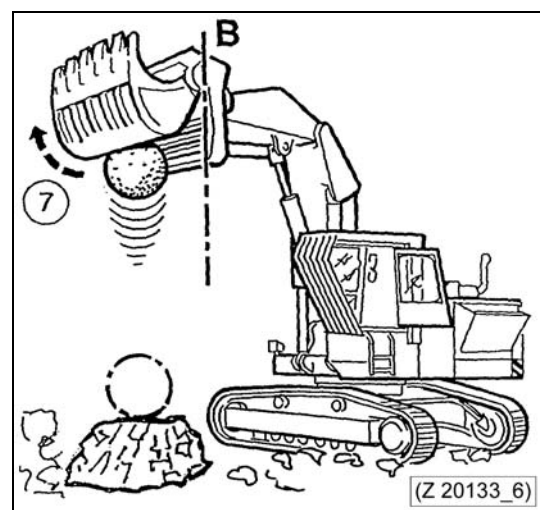


Legend for illustration Z 20133_5

- (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.

3.13.5 COMBINED OPERATION CYCLES

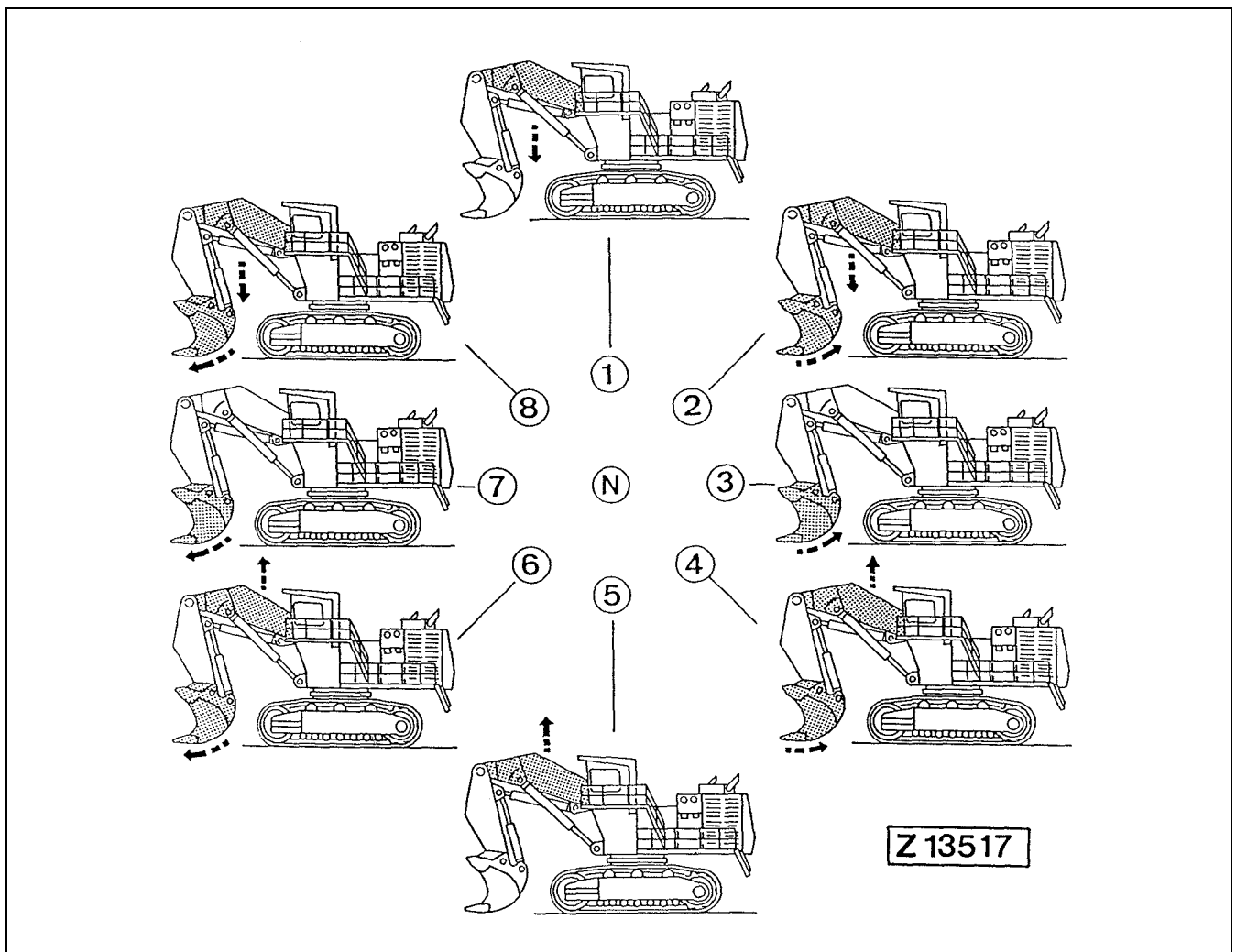
With each of the control levers, two operation cycles can be initiated simultaneously. In order to obtain efficient operation, always select intermediate control lever positions in relation to work load.

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

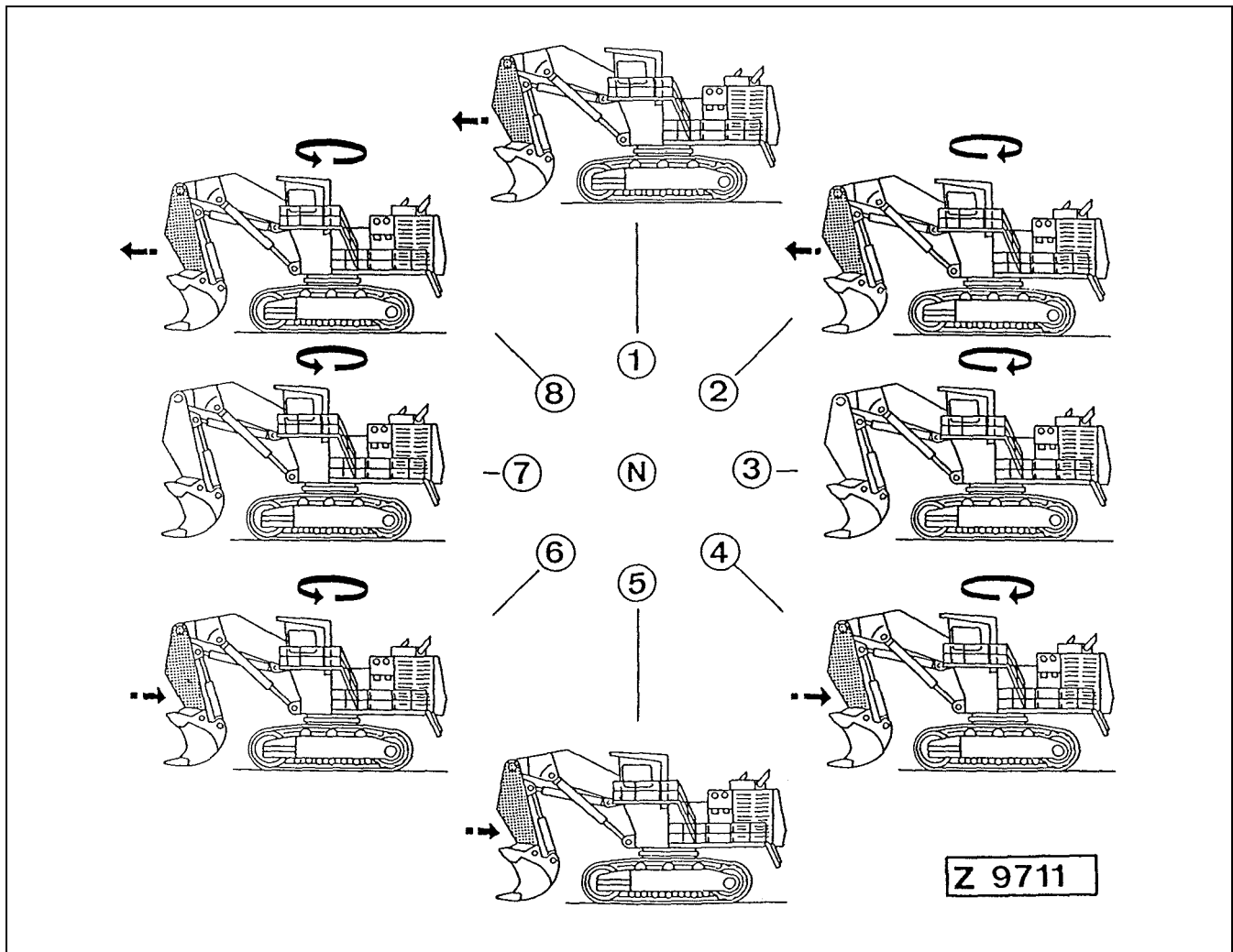
- | | | | |
|-----|-----------------------------------|-----|----------------------------------|
| (N) | Neutral position | (5) | Raising boom |
| (1) | Lowering boom | (6) | Raising boom and filling bucket |
| (2) | Lowering boom and emptying bucket | (7) | Filling bucket |
| (3) | Emptying bucket |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

3.14 WORKING INSTRUCTIONS

3.14.1 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:

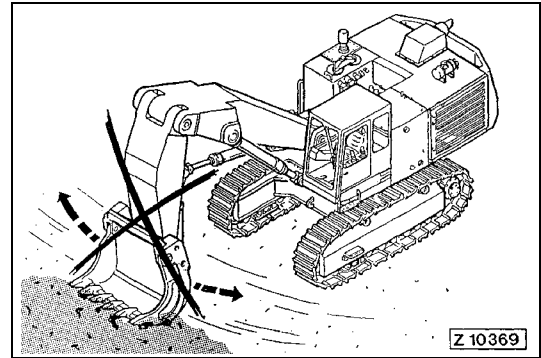
- Overloading of the Shovel (Bucket overfilled).
- Ground conditions such as loose sand or wet soil (possibility of a cave-in).
- Jerky acceleration or deceleration of working- and travel motions.
- Operating on a slope.

3.14.2 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.

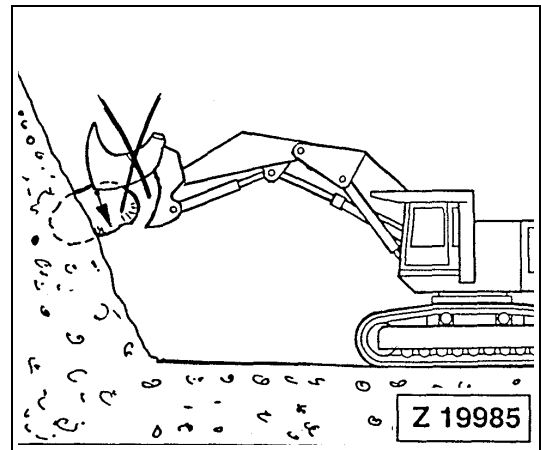
CAUTION

DO NOT “Sweep” with the loader attachment, illust. (Z10369), as this may result in severe damage on swing gear components.



CAUTION

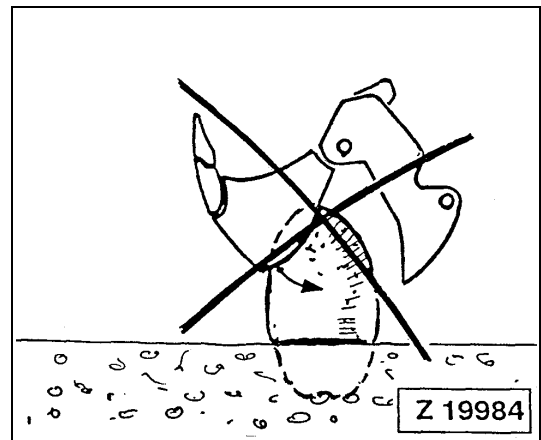
DO NOT use the bucket clam for loosening or removing anchored rocks or other solid objects (illust. Z 19984 and Z 19985), since such operations may result in severe damage to the clam pivot bearings.



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.

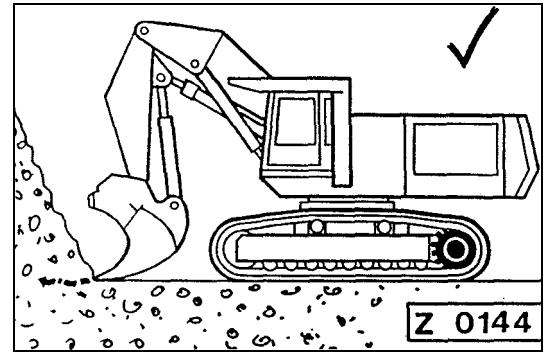
To prevent this, move the control levers to neutral position before the cylinders reach their end of stroke.



- 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.

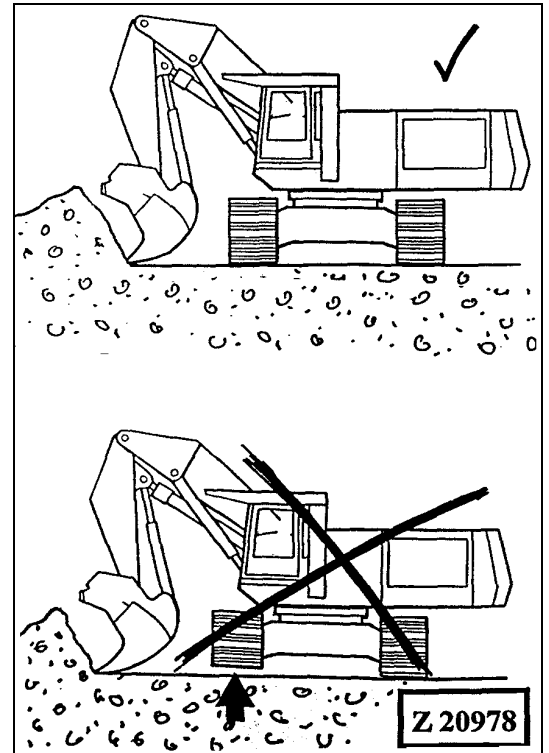


- When working with the loader in a cross direction to the track group, be sure that the track is not raised off the ground, illust. (Z 20978). This can cause the track to set-off from the rollers when it is lowered down on the ground. Also the flanges of the track rollers and the track shoes can be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



3.15 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 engine and relieve the pressure in the hydraulic system, see "STOPPING THE ENGINE" on page 202 for more information.
- Move the lock lever fully to the rear in locked position.

WARNING

DO NOT leave the Operator's Cab when the engine is 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

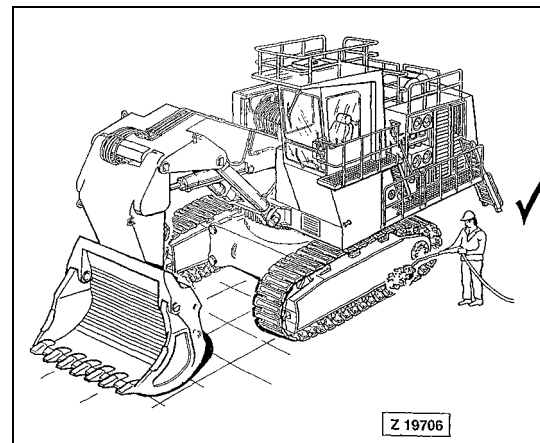
Under working conditions with excessive material build up on the crawler components, cleaning of the crawlers is very important to prevent damage.

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.

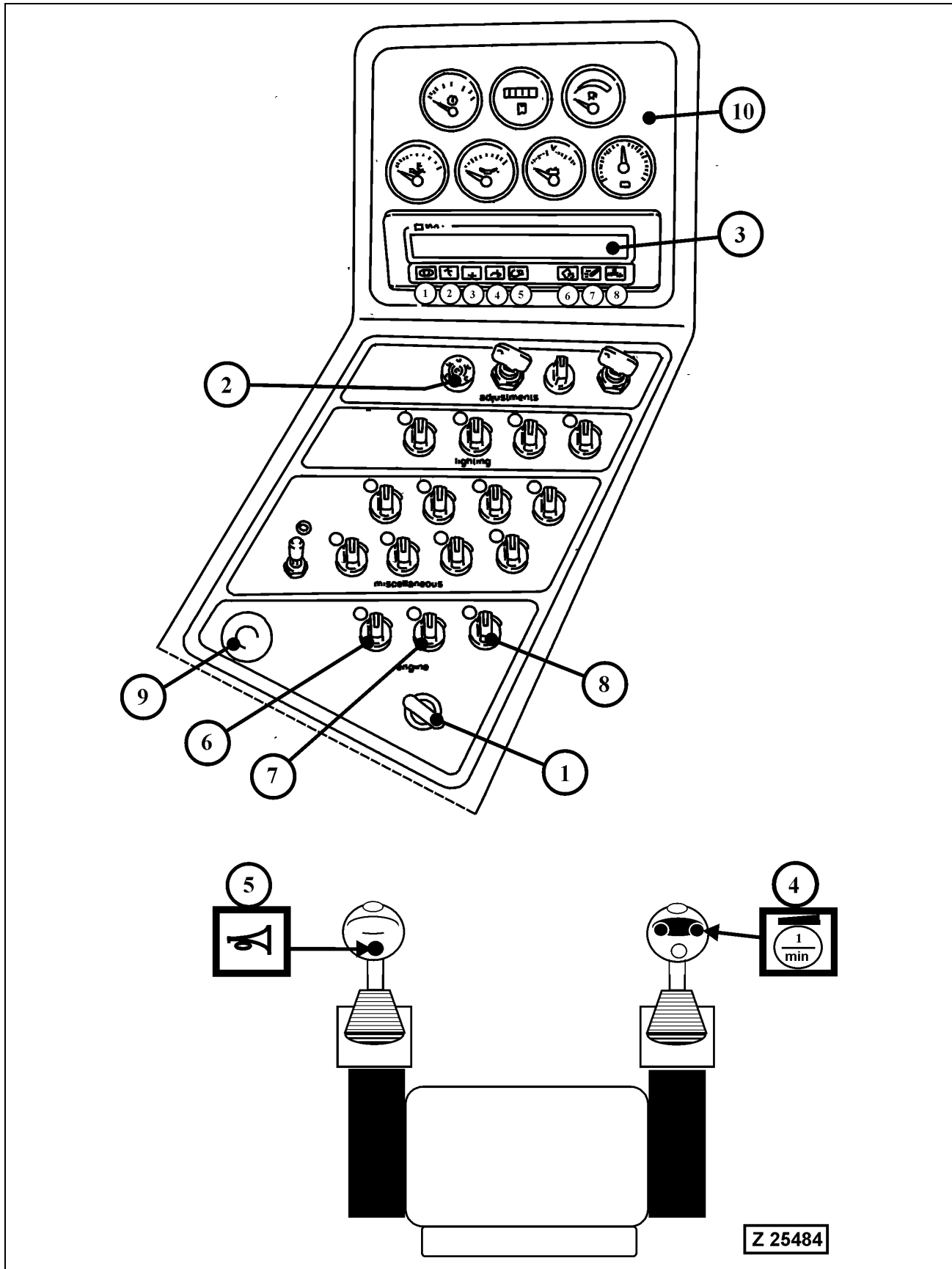
NOTICE

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



This page left intentionally blank

3.16 STOPPING THE ENGINE



CAUTION

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

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

CAUTION

For EMERGENCY SHUTDOWN of the Engine, use STRIKE BUTTON (9).

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

Stopping procedure, see illustration Z25484.

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

For more information → See "PARKING THE SHOVEL" on page 200.

2. Deposit the working attachment onto the ground, proceed as follows:

A - Backhoe Attachment

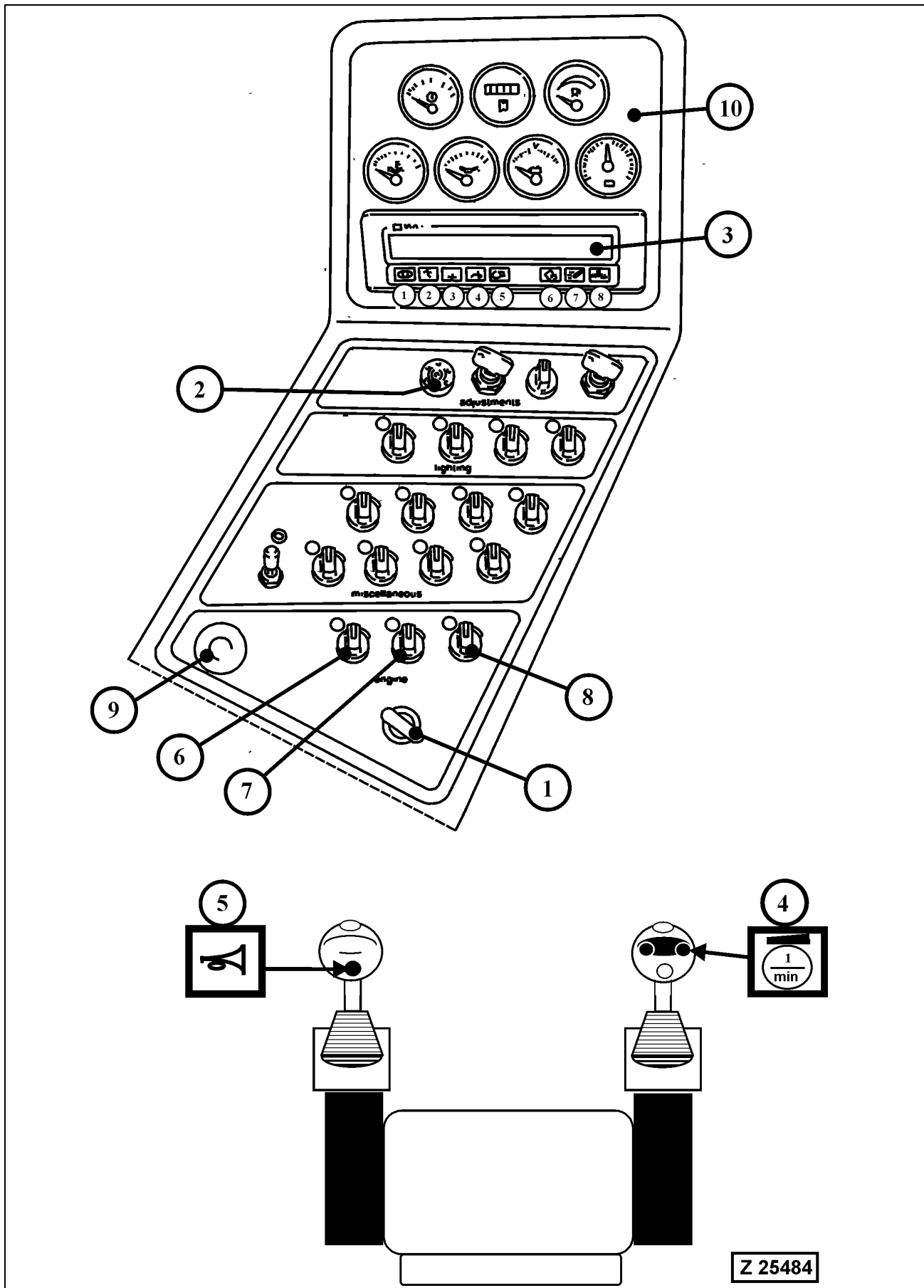
Lower the backhoe attachment fully extended onto the ground in a position as shown on the oil level plate at the hydraulic oil reservoir, see page 169 for more information.

B - Bottom Dump Bucket Attachment

Lower the bottom dump bucket attachment onto the ground in a position as shown on the oil level plate at the hydraulic oil reservoir, i.e. the stick cylinders are fully retracted and the bucket is fully rolled back so that the bucket back wall contacts the stick.

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 procedure of the hydraulic oil level.

3. Move all controls into neutral position.
4. Set toggle switch (4) to low idle speed position. Let the engine idle for about five minutes without load.
5. Turn switches (8) clockwise to stop position. After the engine has come to standstill, relieve the pressure in the hydraulic system.



3.16.1 RELIEVE PRESSURE IN THE HYDRAULIC SYSTEM

▲ WARNING

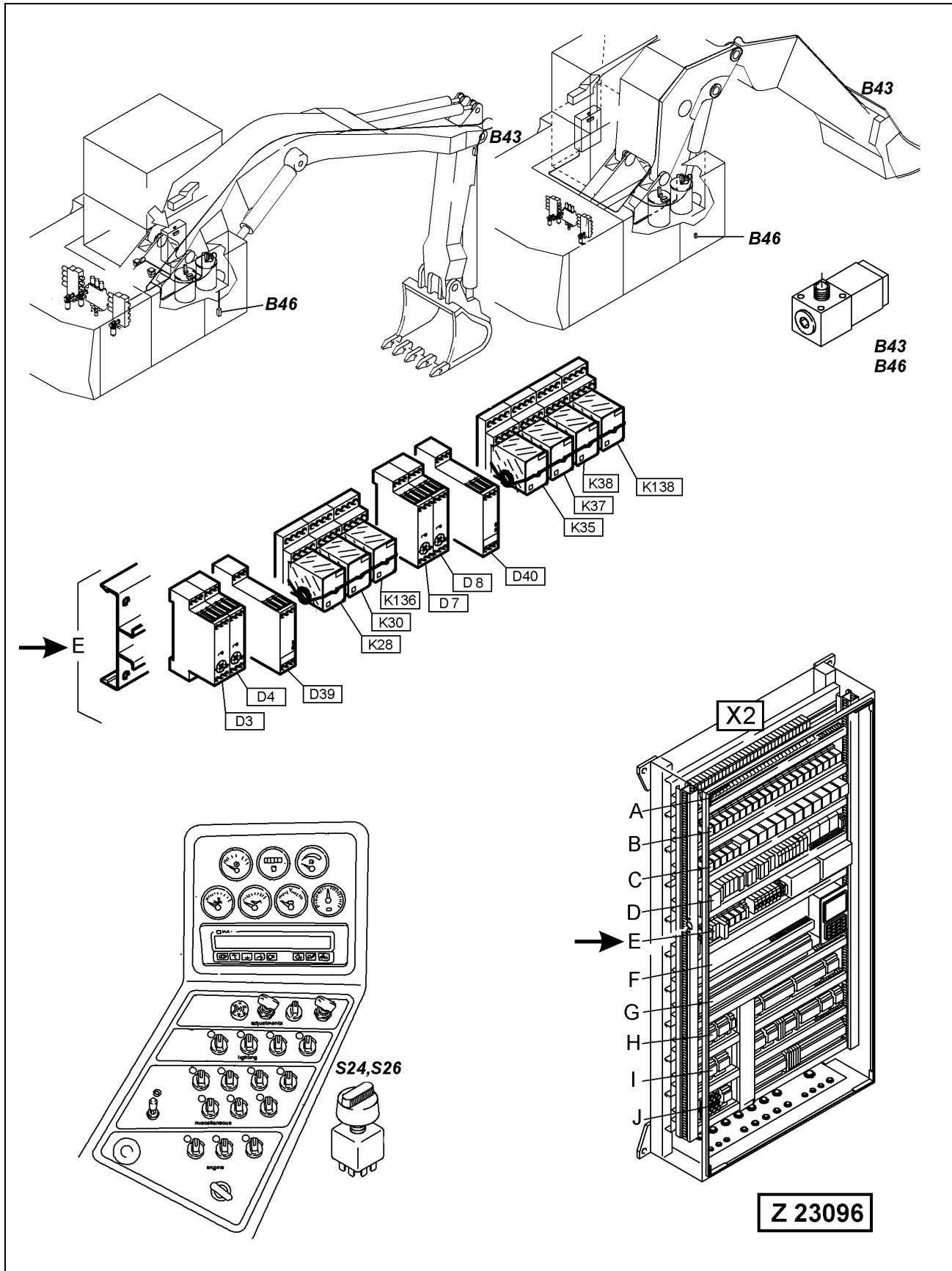
With the engine at standstill and main switch (1) in ON position, move all controls for working attachment and crawlers several times through all shift positions to relieve the pressure in the hydraulic system. The necessary oil pressure for shifting the spools of the main control valves is provided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

NOTICE

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

6. Set main switch key (1) to "0" position and remove.
7. Set lock lever to the rear in LOCKED position.
8. Switch off the battery main switches and remove keys.

3.17 AUTOMATIC LUBRICATION SYSTEMS



3.17.1 OPERATION OF THE AUTOMATIC LUBRICATION SYSTEMS

The shovel is equipped with two automatic lubrication systems:

1. Central Lubrication System (CLS) for lubrication of the attachment bearings, the slewing connection bearing and the slew gear bearing.
2. Slew ring gear pinion Lubrication System (SLS) for lubrication of the slew ring teeth.

These systems work automatically as soon as the engine is running at high idle speed. The slew ring gear lubrication system is only activated during slewing movement of the superstructure. The ETM System monitors the function of both lubrication systems. Trouble conditions of the lubrication systems are indicated through fault messages on the ETM display.

Legend for illustration Z 23096

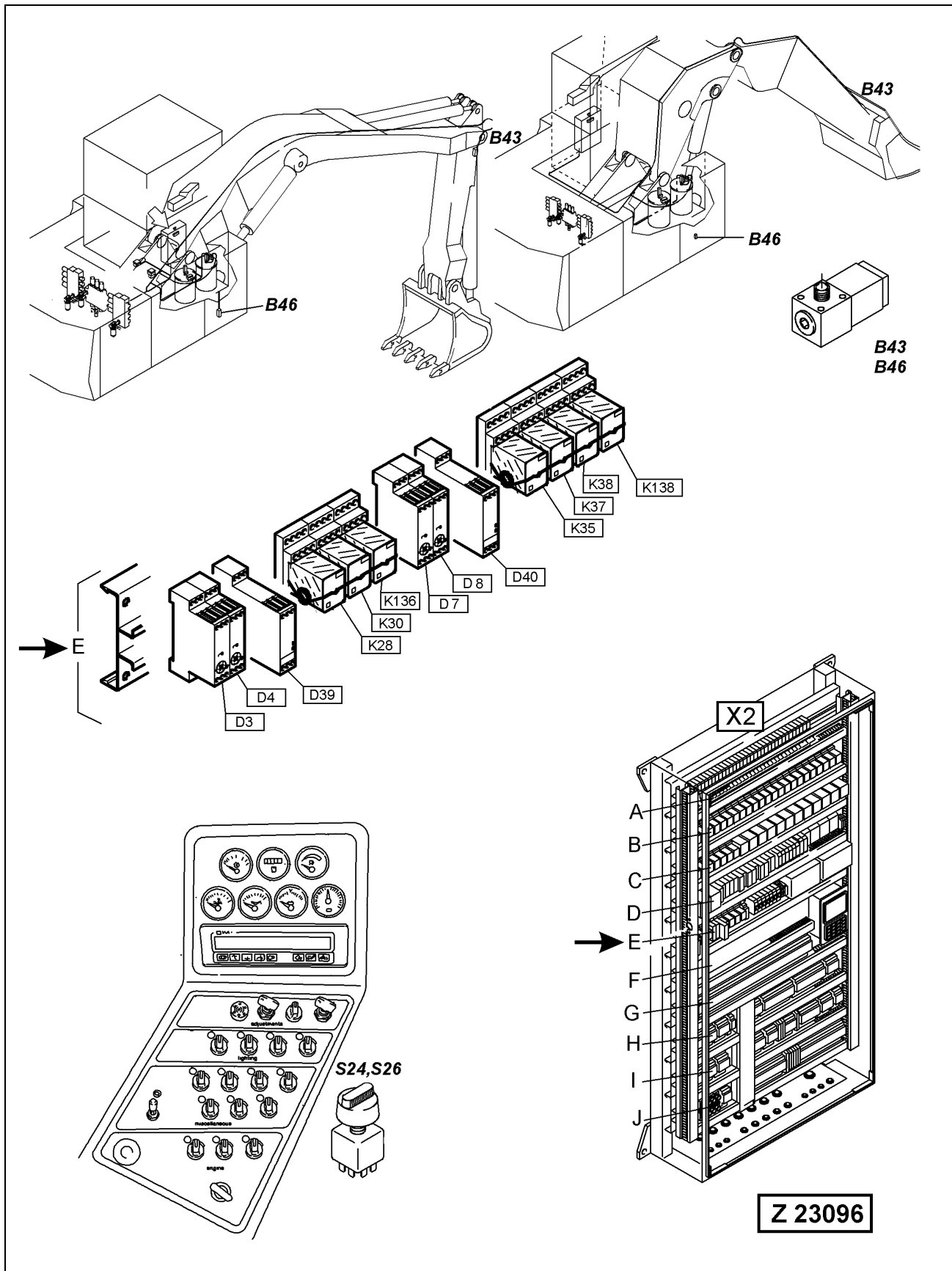
Electrical components of the Central Lubrication System (CLS) located on the X2 switch board in the cab base

- D3 Pause time relay, factory setting 60 minutes
- D4 Monitoring time relay, factory setting 3 minutes
- D39 Time relay for switching off the bucket motion if the lubrication system fails to function over a period longer than 4.2 hours
- K28 Relay initiates a fault message if power supply to the lubrication system is interrupted
- K30 Relay initiates a fault message if the lubrication cycle is not carried out in the adjusted time period
- K136 Relay initiates a fault message if the grease barrel is empty

Electrical components of the Slew ring gear Lubrication System (SLS)

- D7 Pause time relay, factory setting 9 minutes
- D8 Monitoring time relay, factory setting 2 minutes
- D40 Time relay for switching off the bucket motion if the lubrication system fails to function over a period longer than 4.2 hours
- K35 Relay initiates a fault message if power supply to the lubrication system is interrupted
- K37 Relay activates the slew ring gear lubrication system during slewing of the superstructure
- K38 Relay initiates a fault message if the lubrication cycle is not carried out in the adjusted time period
- K138 Relay initiates a fault message if the grease barrel is empty

- B43 Line pressure switch of CLS interrupts lubrication cycle
- B46 Line pressure switch of SLS interrupts lubrication cycle
- S24 Rotary switch for manual actuation of the CLS
- S26 Rotary switch for manual actuation of the SLS



Operation of the automatic Lubrication Systems (continued)**⚠ CAUTION**

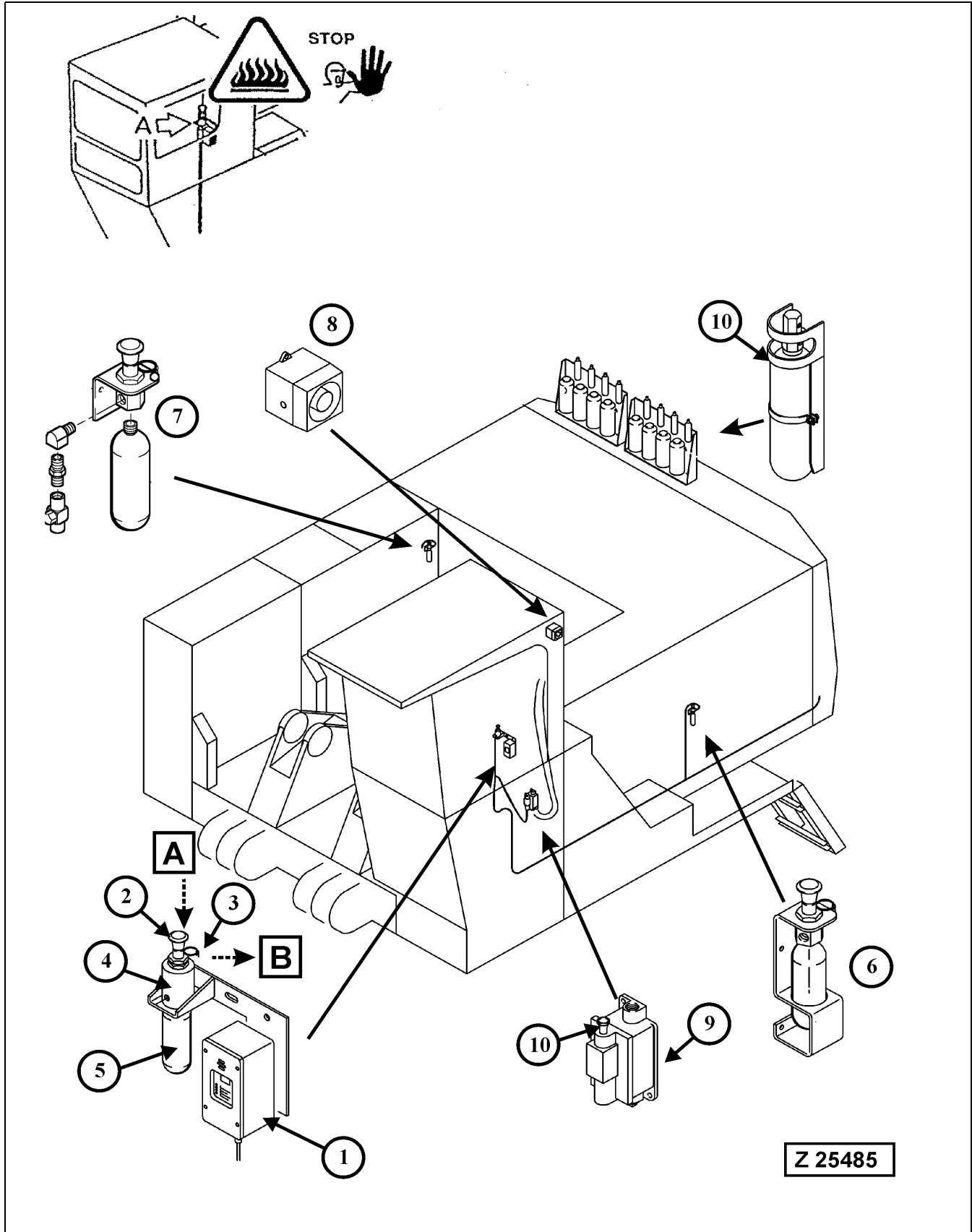
If one of the automatic lubrication systems fails to work for a period longer than 4.2 hours automatic bucket motion cut off will happen. Repair the system as soon as possible.

NOTICE

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

3.18 FIRE DETECTION AND SUPPRESSION SYSTEM

(Special Equipment)



FIRE DETECTION AND SUPPRESSION SYSTEM

⚠ WARNING

Before operating the Shovel make sure the Fire Detection, Actuation and Suppression system is operative.

Carry out inspection and maintenance according to the separate manuals "Fire Detection and Actuation System" and "Fire Suppression System" in volume 2 binder.

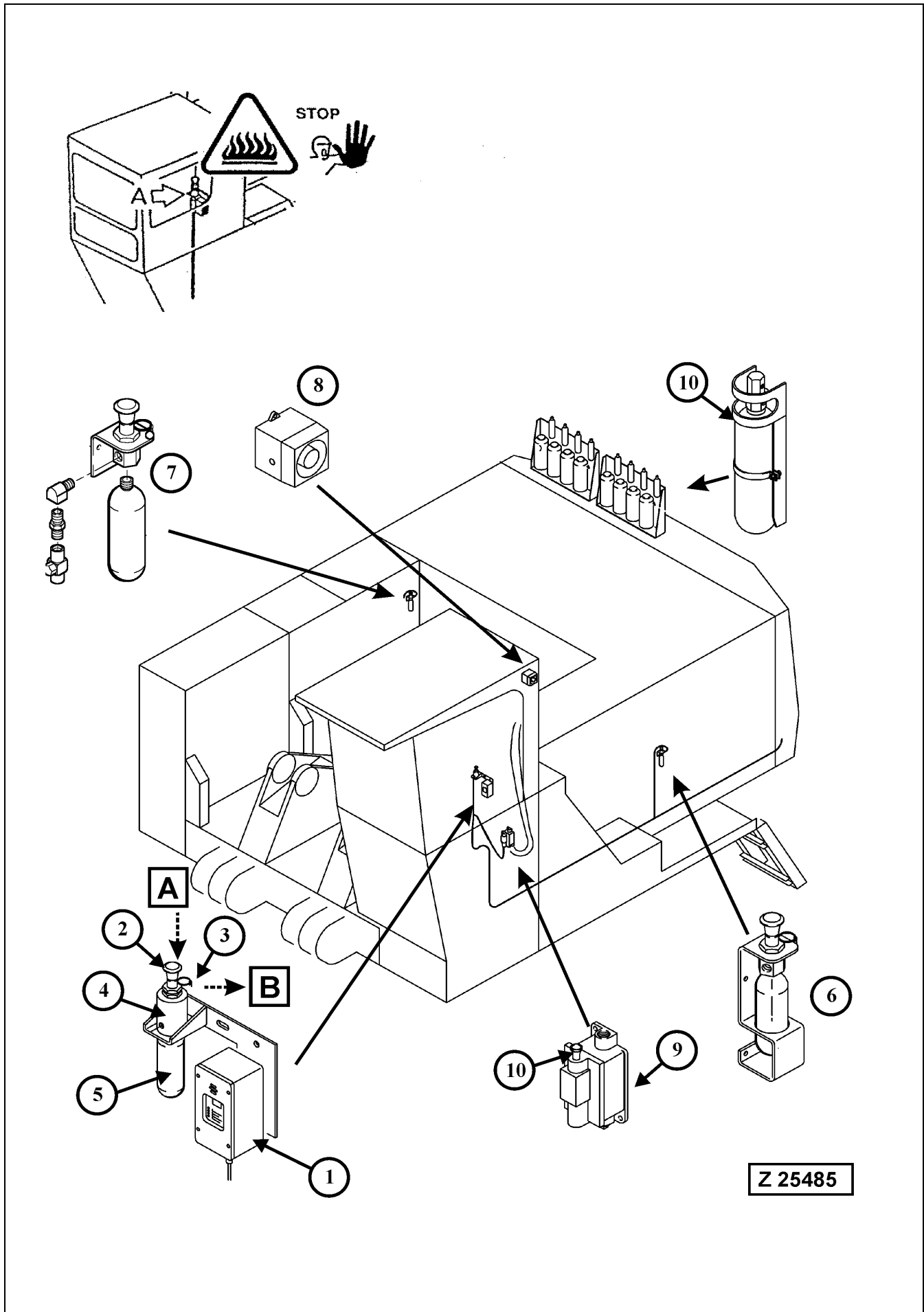
⚠ CAUTION

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

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

Legend for illustration Z 25485

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



3.18.1 HIGH LEVEL ALARM "FIRE"

The high level alarm (8), illust. Z 25485 will sound approximately 15 seconds before discharge of the fire suppression system in case of automatic actuation of the system. Act according to the circumstances and the applying safety regulations. Evacuate area to lessen risk of injury from flames.

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

The fuel shut-off solenoid valve for the engine is actuated through pressure switch (9), illust. Z 25485.

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

3.18.3 ACTUATION MODES OF THE FIRE SUPPRESSION SYSTEM

MANUAL ACTUATION

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

▲ WARNING

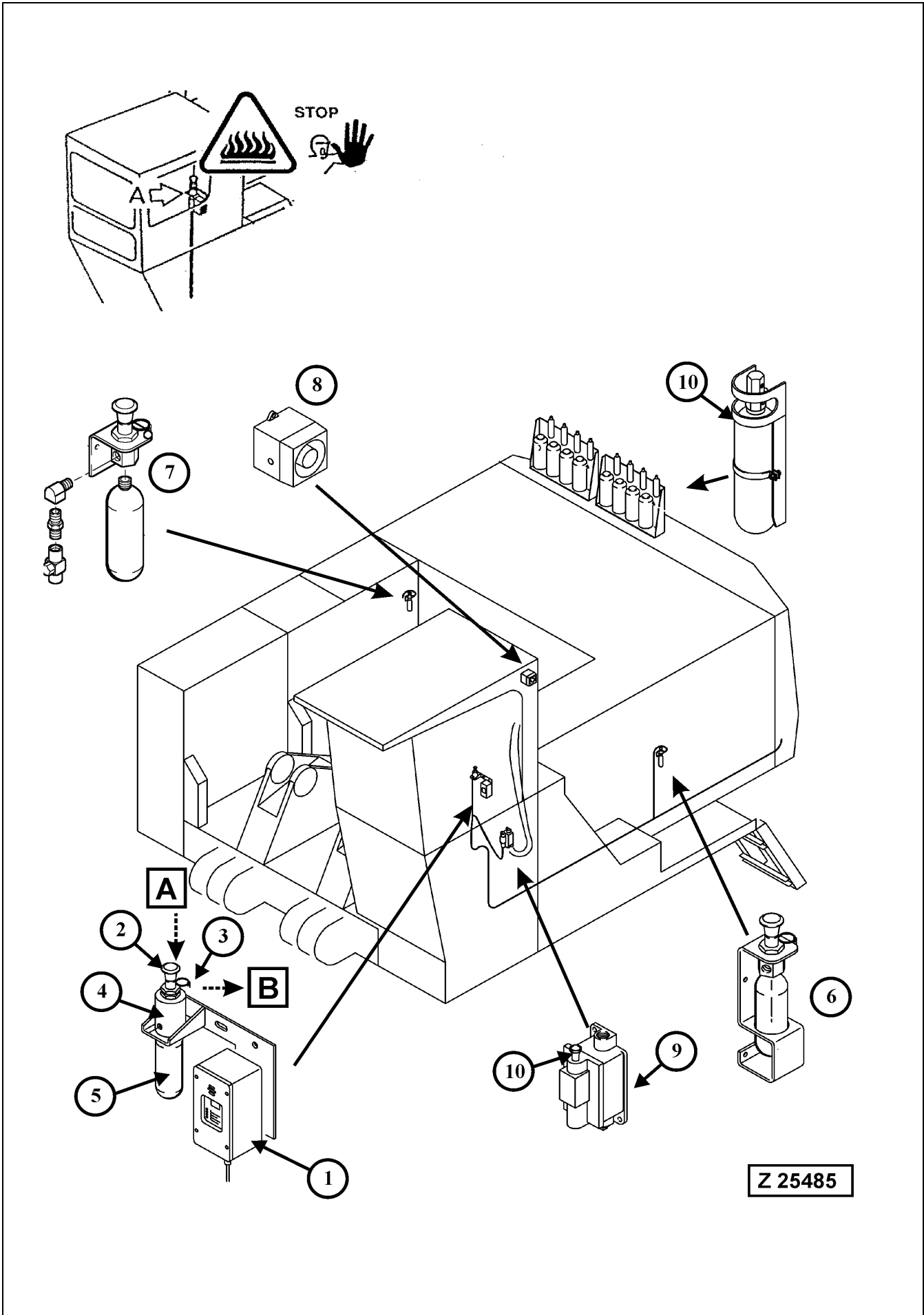
Manual actuation will result in immediate system discharge which may obscure vision. Make certain the Shovel is stopped safely before manually actuating the system. Manual actuation will bypass all auxiliary shutdown and alarm functions.

NOTICE

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

AUTOMATIC ACTUATION

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



3.18.4 INDICATION OF OPERATIONAL MODES AT CONTROL MODULE, AFTER AUTOMATIC ACTUATION OF THE FIRE SUPPRESSION SYSTEM

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

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

Timer Setting (factory adjustment)

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

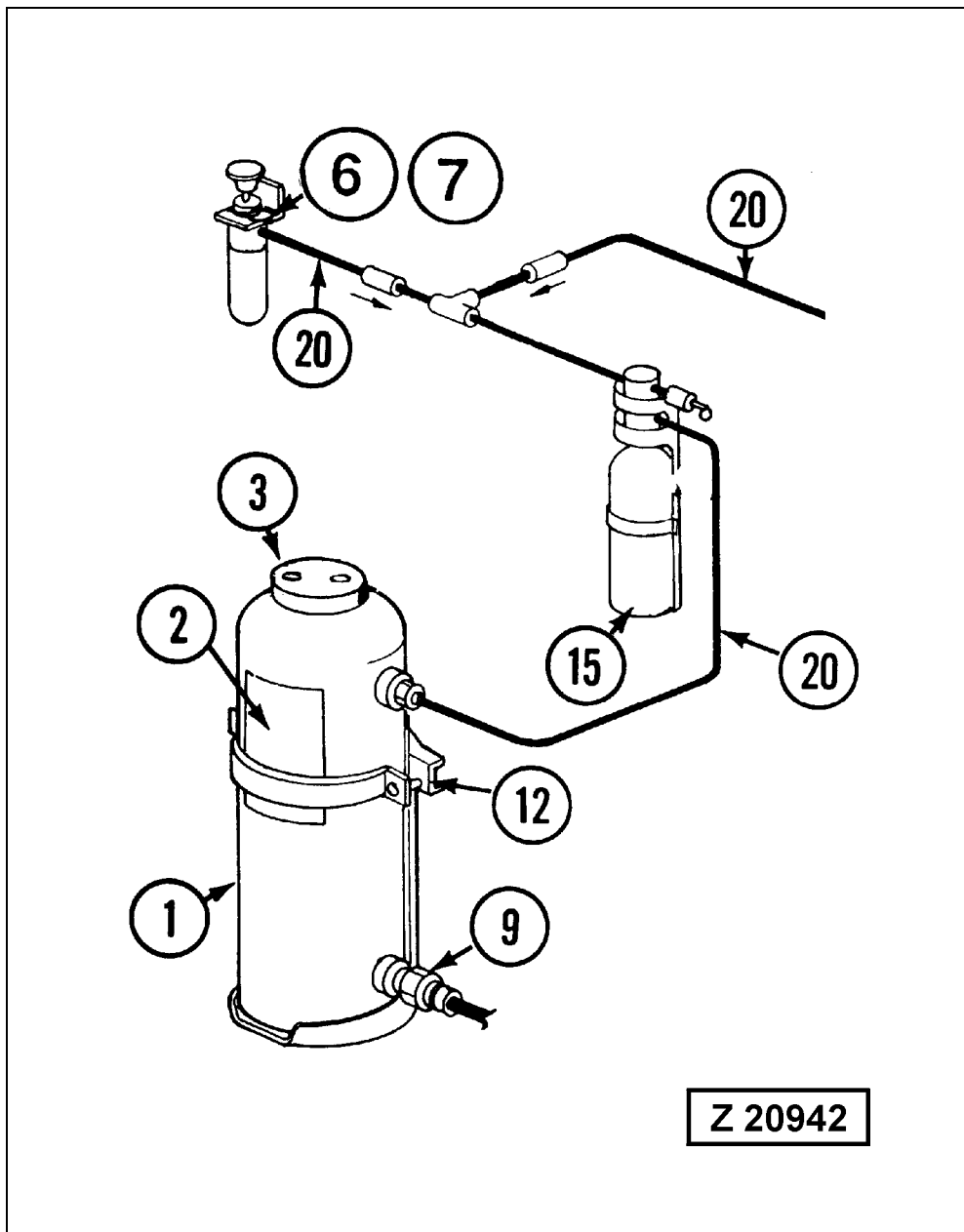
▲ WARNING

In Case of Fire

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

▲ CAUTION

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



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

REMARK

All extinguishing agent tank assemblies with their expellant gas cartridges are located on the rear railing of the power house roof.

Legend for illustration Z 20942

- (1) Extinguishing agent tank assembly
- (2) Name plate
- (3) Fill cap
- (6) Manual actuator switch at the radiator door
- (7) Manual actuator switch at the rear power house entrance
- (9) Extinguishing agent outlet to nozzle
- (12) Mounting clamp
- (15) Expellant gas cartridge
- (20) Pneumatic actuation line

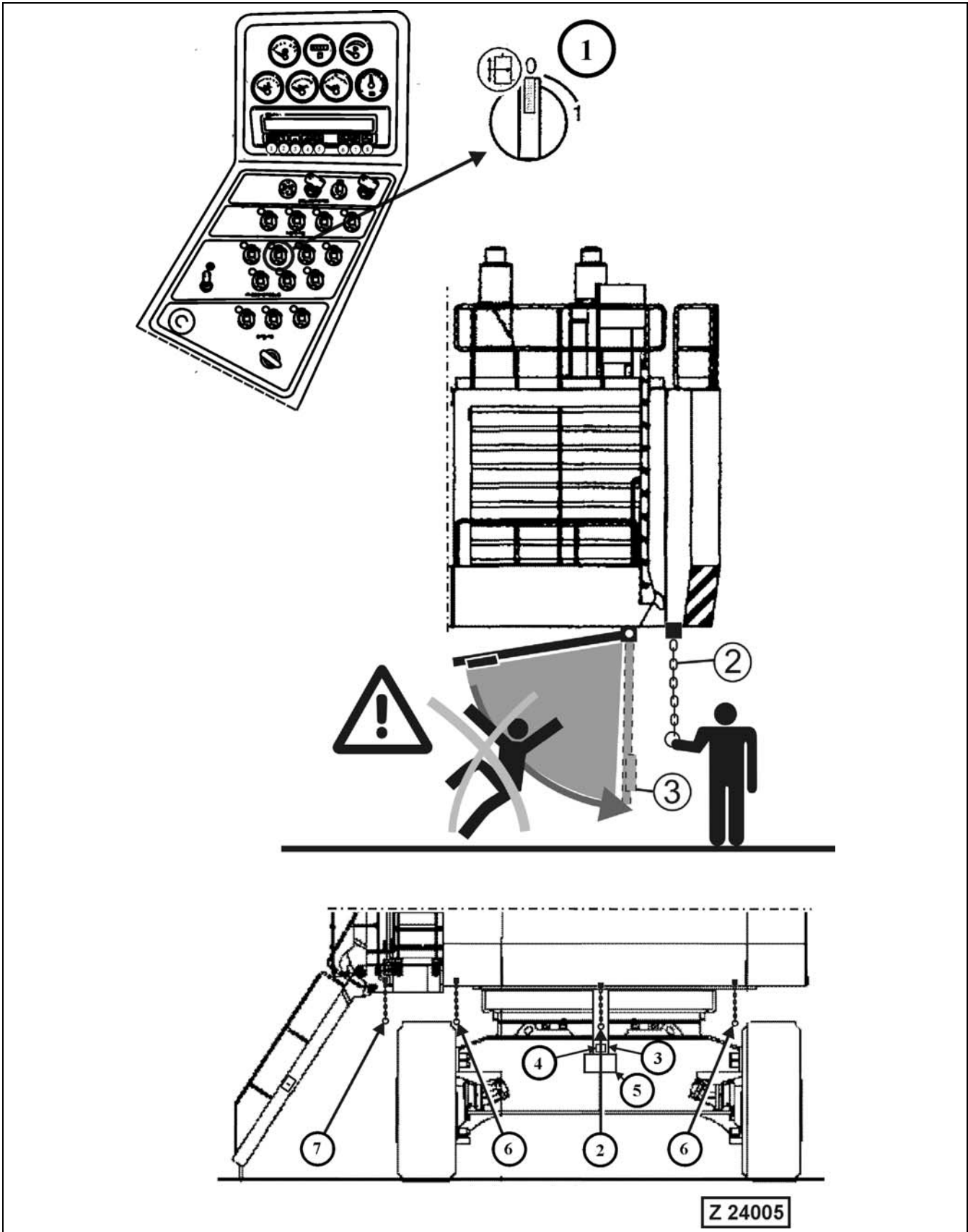
REMARK

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

Check filling level of Extinguishing agent tank assemblies (1) according to the instructions in the separate Inspection and Maintenance manual "A-101 VEHICLE FIRE SUPPRESSION SYSTEM".

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

3.19 CENTRAL REFILLING SYSTEM



3.19.1 SYSTEMS CONNECTED TO THE REFILLING SYSTEM

The following systems are connected to the receiver panel (5) of service arm (3), illust. (Z24005):

- Fuel Tank
- Engine Oil Pan
- Engine Oil Reserve Tank (if so equipped)
- Engine Coolant Radiator
- Main Hydraulic Oil Reservoir
- Central Lubrication System (CLS)
- Swing circle pinion Lubrication System (SLS)

Legend for illustration Z24005

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

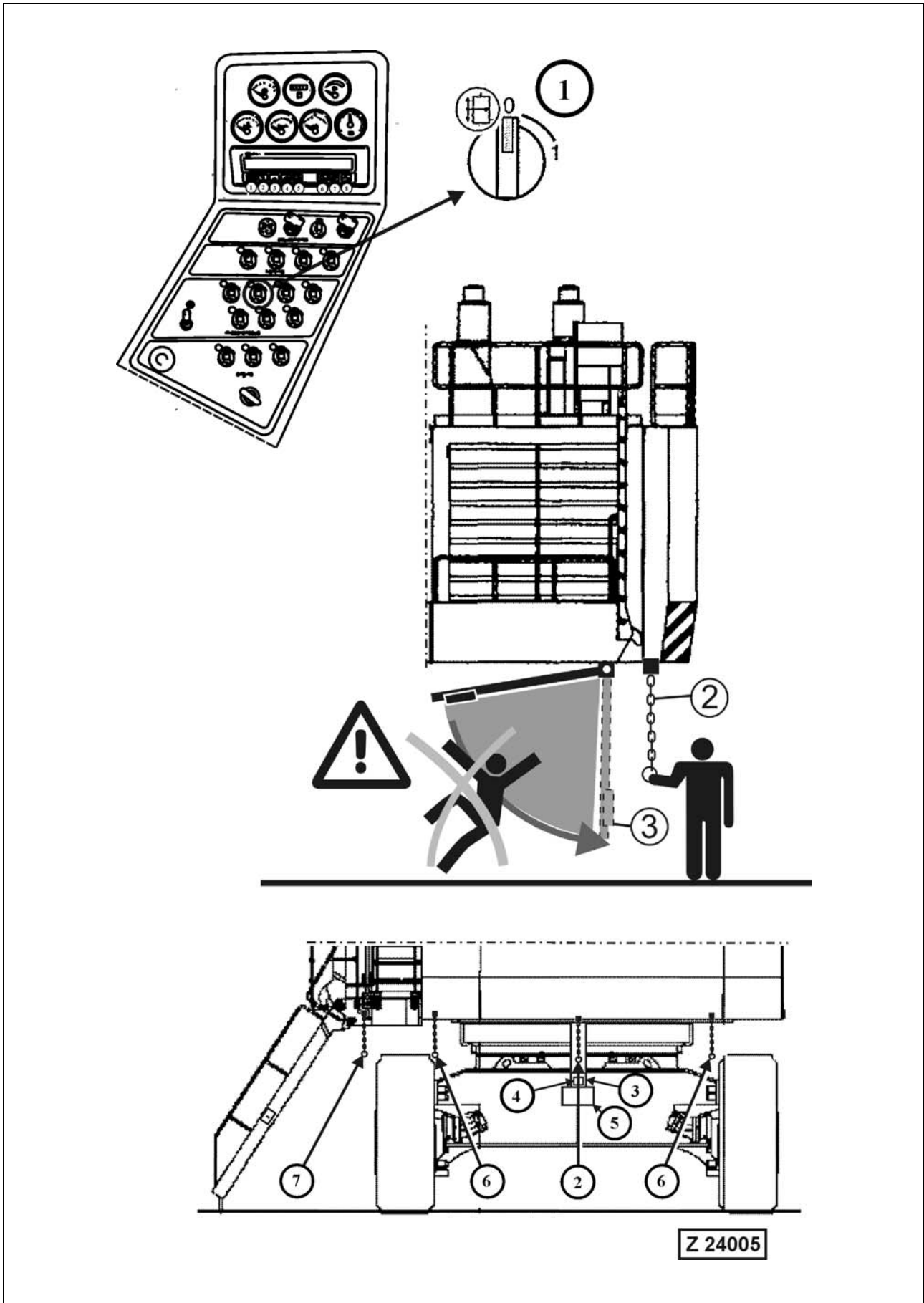
Operation of the hydraulic Service Arm

⚠ WARNING

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

REMARK

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



3.19.2 OPERATING THE HYDRAULIC SERVICE ARM

A - Diesel Engine OFF

The Service Arm can only be lowered.

Proceed as follows:

1. Turn main key switch to ON position.
2. Turn enabling switch (1), illust. (Z24005) to ON position "1".
3. For lowering the Service Arm (3) pull down chain (2).
4. Release chain (2) when arm (3) is in fully lowered position.

REMARK

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

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

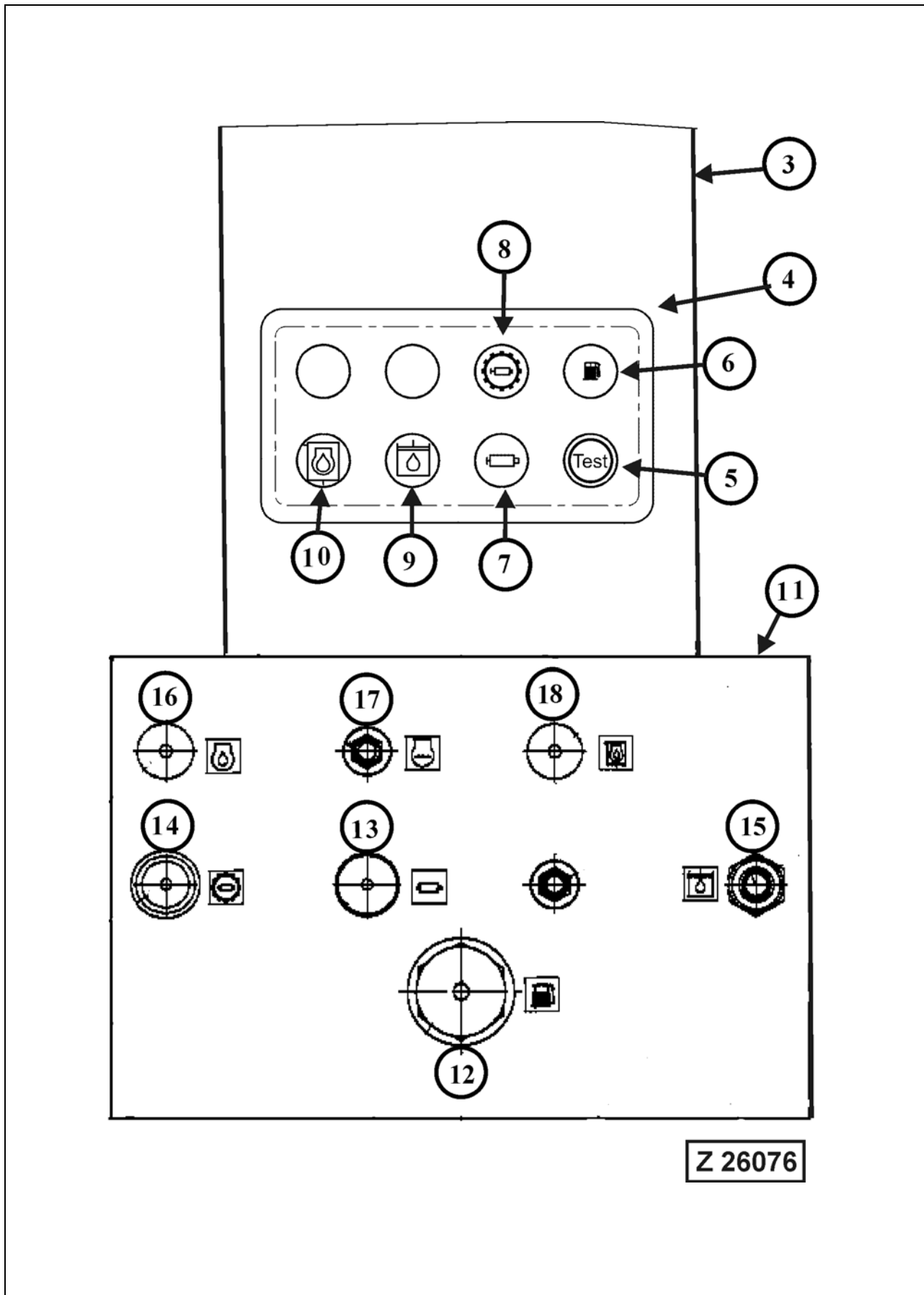
B - Diesel Engine running

Control the Service Arm as follows:

1. Turn enabling switch (1), illust. (Z24005) to ON position "1".
2. To lower the service arm (3) pull chain (2) and hold until the service arm is in fully lowered position. For reversing moving direction of service arm release the chain (2) to stop service arm movement and then pull chain (2) again.
3. To lift the service arm pull chain (2) and hold until the service arm is completely lifted into its home position.

NOTICE

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

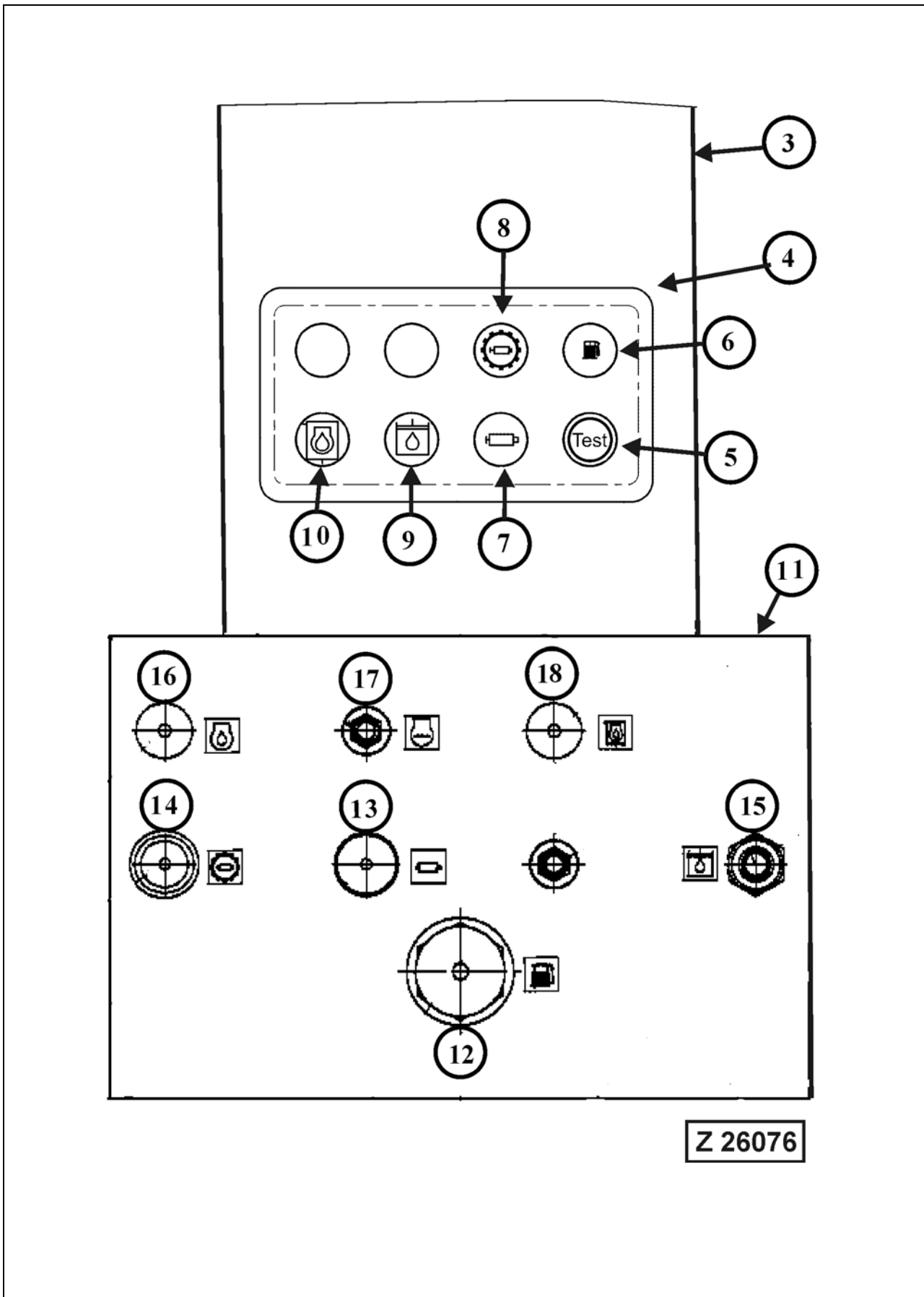


Z 26076

3.19.3 RECEIVER PANEL WITH MONITOR BOX

Legend for illustration Z26076:

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



Legend for illustration Z26076

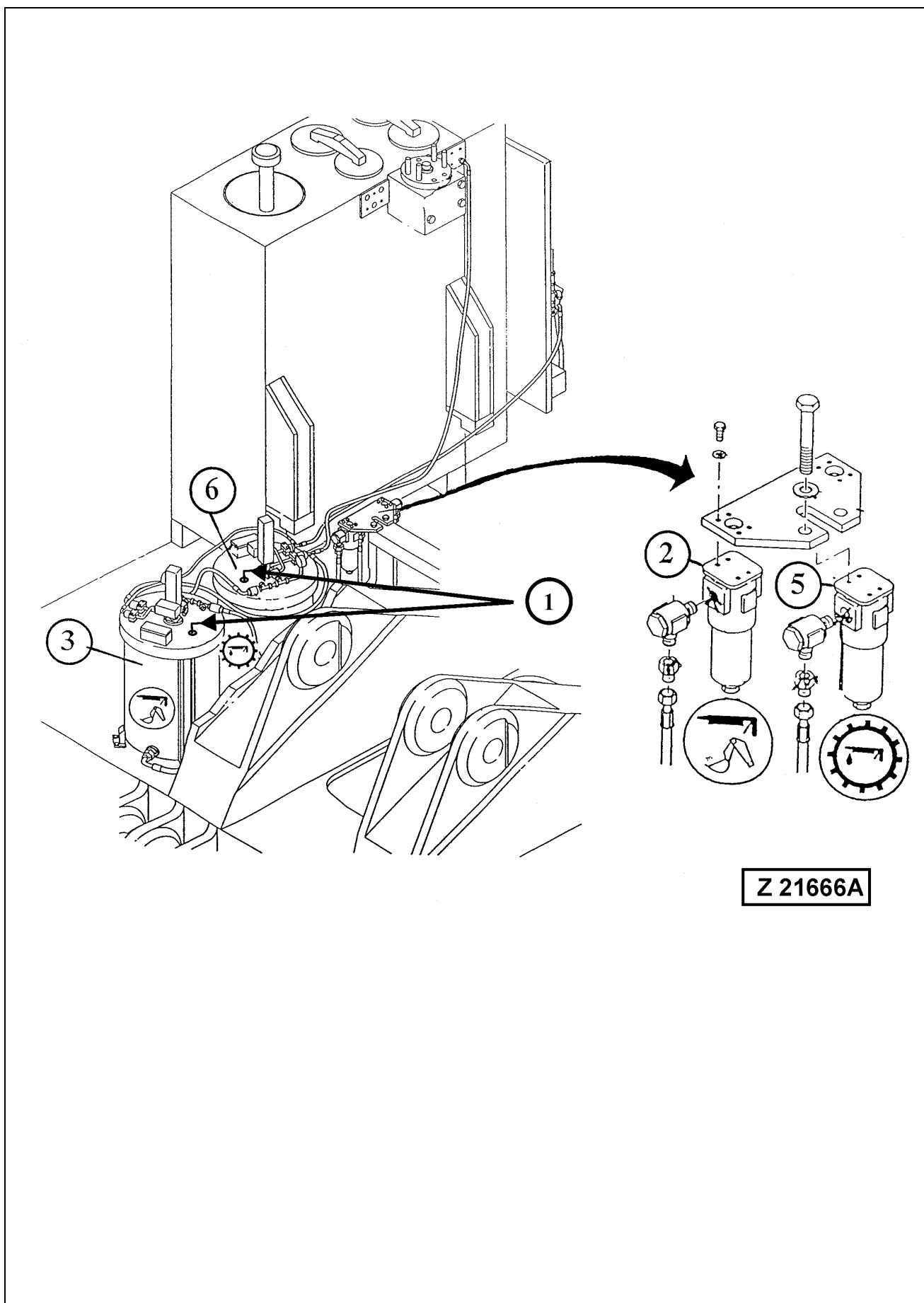
16	Oil evacuation and filling adapter for engine oil pan. Monitor oil level at level gauge.
17	Radiator coolant draining and filling adapter. Monitor coolant level at radiator sight gauge.
	<p>NOTICE</p> <ul style="list-style-type: none"> ● The two-loop type cooling system of the engine is equipped with two radiators. One radiator for the engine crankcase and cylinder heads and one radiator for the low temperature aftercooler (LTA) system. The radiators are connected with a pipe on the bottom side. This pipe contains a check valve which allows coolant flow from rear radiator to the front LTA radiator only. For draining the coolant from the front mounted LTA radiator, it is necessary to open the shut-off cock in the draining/filling hose line just below the radiators. Refer to the engine Operation and Maintenance Manual in volume 2 binder for the maintenance instructions of the cooling system. ● Be sure to close the shut-off cock on the bottom side of the radiators as soon as the maintenance of the cooling system is finished.
18	Engine oil evacuation and filling adapter for the reserve tank. Observe the indicator lamp (10).

Refilling Procedure:**REMARK**

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

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

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



3.19.4 REFILLABLE GREASE CONTAINERS OF THE AUTOMATIC LUBRICATION SYSTEMS

Legend for illustration Z21666A

- (1) Grease level gauges for manual checking of the grease level
- (2) 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.
- (3) Grease container of the central lubrication system
- (5) 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.
- (6) Grease container of the swing circle pinion lubrication system

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

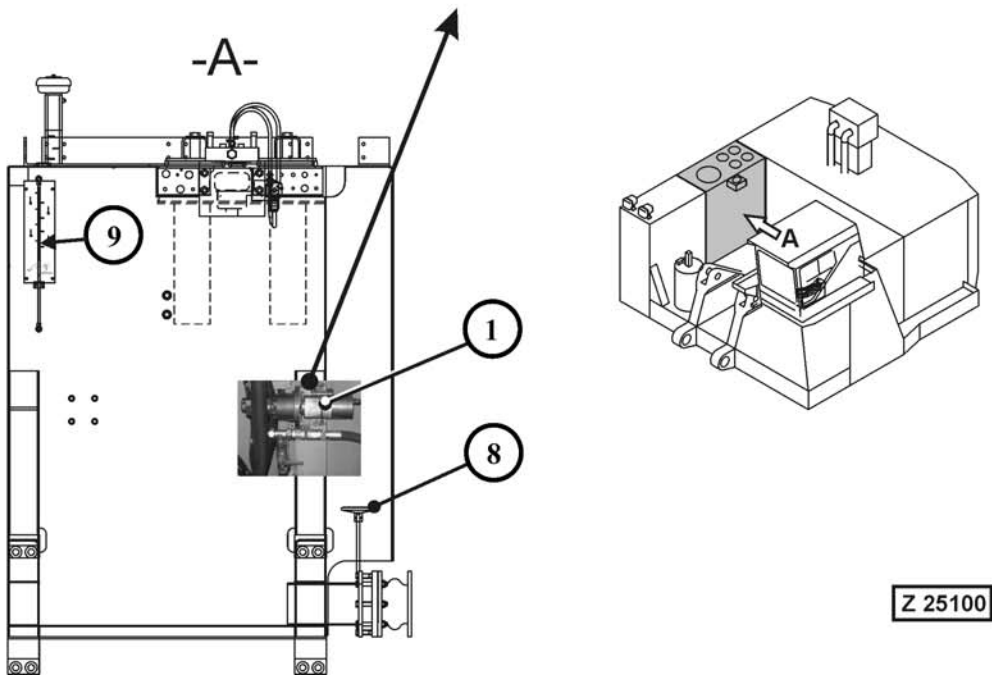
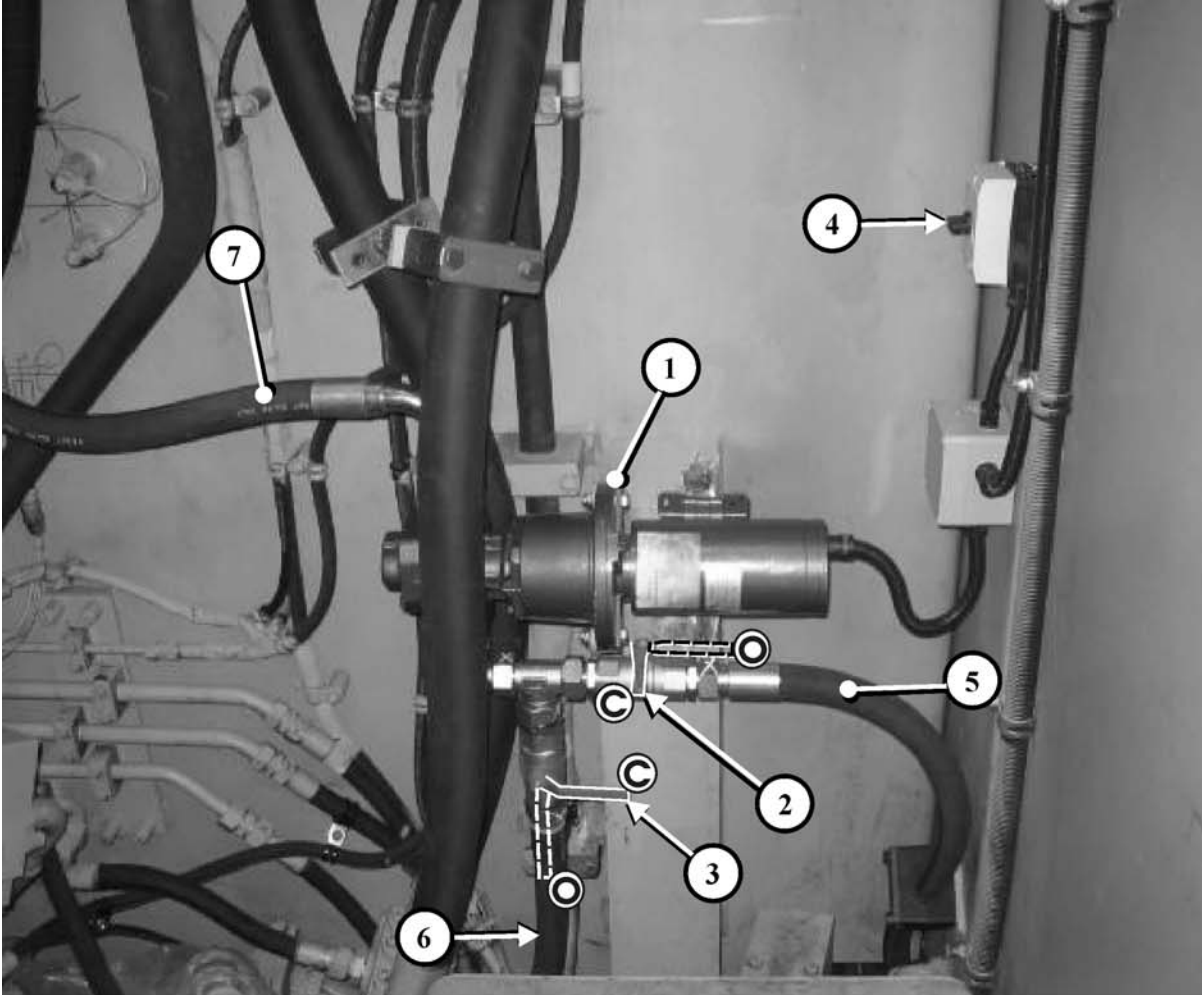
As soon as a grease container is filled up to the correct level the corresponding indicator lamp (6 or 7), illust. (Z25112) lights up and the signal horn sounds. In order to ensure proper operation of the lubrication systems carry out the periodic maintenance of the grease filters (2 and 5), illust. (Z21666A). Refer to maintenance section 4 for more information.

Periodic inspection of the grease pumps 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.

3.20 TRANSFER PUMP FOR HYDRAULIC OIL

Special Equipment



3.20.1 OPERATING THE TRANSFER PUMP

Legend for illust. Z25100

REMARK

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

- (1) Transfer pump with electric motor
- (2) Cock for suction oil reservoir
- (3) Cock for return oil collector pipe
 - C - Closed
 - O - Open
- (4) Operating switch for transfer pump
- (5) Suction line to suction oil reservoir
- (6) Suction line to return oil collector pipe
- (7) Feed back line to main oil reservoir
- (8) Hand wheel of main shut-off valve between suction oil reservoir and main oil reservoir
 - To OPEN the valve turn hand wheel (8) CCW to the stop.
 - To CLOSE the valve turn hand wheel (8) 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 ETM screen in the Operator's cab.

CAUTION

Before starting the engines make sure the shut-off valve is completely open by turning hand wheel (8) fully to the left (CCW).

- (9) Oil level sight gauge

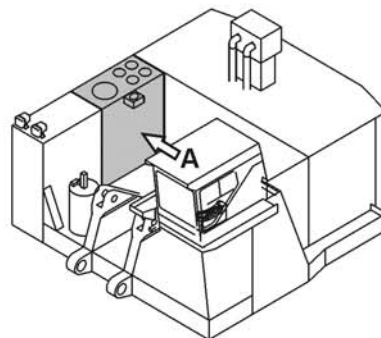
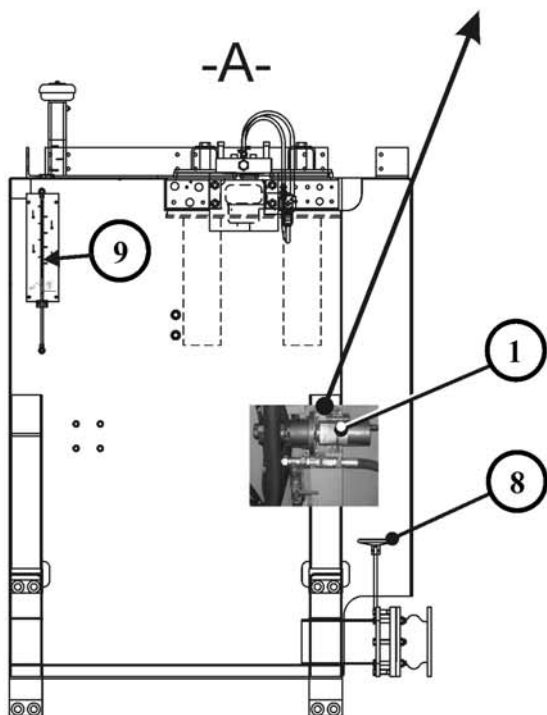
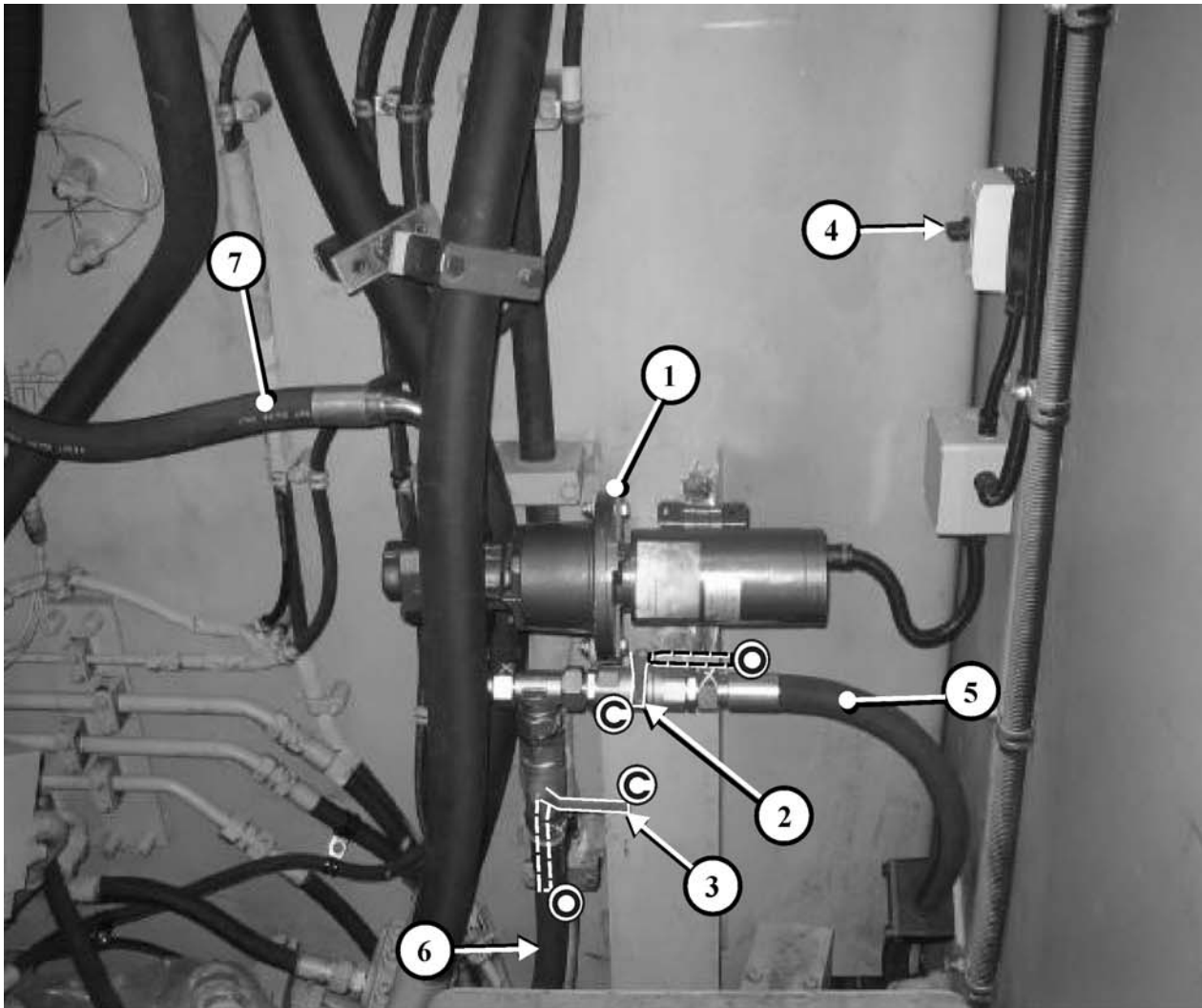
3.20.2 FUNCTIONS OF THE TRANSFER PUMP

A - Transfusing oil from the suction oil reservoir into the main oil reservoir. Necessary for evacuation of the suction oil reservoir, when changing the hydraulic oil (the main oil reservoir will be evacuated via service arm connector, see page 219 for details). Before servicing the main hydraulic pumps it is advisable to empty the suction oil reservoir partially.

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

CAUTION

Before operating the transfer pump lower the attachment onto the ground in a position as shown on the oil level plate. Shut down the engine.



Z 25100

A - Pumping the oil from the Suction Oil Reservoir into the Main Oil Reservoir

1. Close main valve (8), illustration Z25100.
2. Open cock (2), position (O).

REMARK

In order to prevent build-up of a vacuum in the suction system, open the vent plug on the suction pipe of each main hydraulic pump, see page 411 for more information.

3. Switch on pump (1) with switch (4).
When changing the hydraulic oil, be sure to evacuate the main oil reservoir via the service arm connector simultaneously with the transfusion procedure. Otherwise overfilling of the main oil reservoir. Observe oil level at sight gauge (9).
4. When the suction oil reservoir is empty or after completion of the maintenance job switch off transfer pump (1) with switch (4). Close cock (2), position (C) and open main valve (8).
5. With the main shut-off valve (8) open, the suction oil reservoir will be filled with oil from the main oil reservoir. Let the vent plugs on the main pumps open to allow the air to escape from the suction oil reservoir and hoses.
6. The suction oil reservoir and the suction hoses are filled, when bubble free oil flows out at the vent plugs on each main pump. Close the vent plugs.
7. Check oil level in the main reservoir. Fill up with new hydraulic oil as necessary.
8. Start the engine and run at low idle speed to allow trapped air to be removed from the hydraulic system.

CAUTION

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

B - Pumping the Oil from the Return Oil Collector Pipe into the Main Reservoir

1. To empty the return oil collector pipe, open cock (3).
2. Switch on transfer pump with switch (4).
3. Observe oil level at sight gauge (9). As soon as the oil level remains constant the return oil collector pipe is empty. Now switch off the transfer pump (1) and close cock (3).

NOTICE

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

3.21 WORK ON THE LOADER ATTACHMENT

WARNING

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

OBSERVE THE FOLLOWING INSTRUCTIONS

- Wear safety clothing, goggles, respirator and other safety devices, whenever working conditions make this necessary.
- Provide hoists of sufficient capacity to lift heavy units. Refer to the separate booklet "Specifications" in volume 2 binder for weight specifications.
- Be sure to observe the instructions in the "Assembly Procedure Manual" which is also attached in volume 2 binder.
- Before working on the loader attachment lower it to the ground, stop the engine and cycle all hydraulic control levers to relieve all pressure before disconnecting hydraulic lines.

For more information → See "STOPPING THE ENGINE" on page 202

- 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.

3.22 TRANSPORTATION AND LIFTING OF THE SHOVEL

⚠ WARNING

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

3.22.1 DISASSEMBLING OF THE SHOVEL

The Shovel is being transported disassembled into its main components.

⚠ WARNING

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

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

3.22.2 TRANSPORTATION AND LIFTING

The transport dimensions and weights of the Shovel's components are listed in the separate booklet "Specifications" in volume 2 binder.

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

⚠ WARNING

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

3.23 RETRIEVAL PROCEDURE

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

GENERAL

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

Provide adequate crane and lifting gear with sufficient lifting capacity, refer to the separate booklet "Specifications" in volume 2 binder for component weights.

3.24 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.

3.24.1 PREPARING FOR STORAGE

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

3.24.2 ONE MONTH REPETITIVE SERVICE PERIOD

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

3.24.3 SIX MONTH REPETITIVE SERVICE PERIOD

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

3.24.4 PREPARING FOR OPERATION

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

3.25 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.

3.25.1 ENGINE

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

NOTICE

Refer to the engine manual for more detailed information.

3.25.2 HYDRAULIC SYSTEM

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

3.25.3 FINAL DRIVES AND SWING GEAR

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

3.25.4 CRAWLER TRACKS

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

4. MAINTENANCE

4.1 FOREWORD

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

NOTICE

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

DEFINITIONS

Service point

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

Service intervals

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

GENERAL RECOMMENDATIONS

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

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

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

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



WARNING

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

4.2 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 200. "Parking the Excavator". Lower the attachment flat onto the ground. Move all control levers to neutral position.
- Stop the engine and move all control levers through their shift positions to relieve the pressure in the hydraulic system. Refer to page 202 "Stopping the Engine" for detailed description of the stopping procedure.
- A warning plate "CAUTION MACHINE MAINTENANCE" must be fixed in the Operator's cab before any lubrication or maintenance work is started.
- Before any maintenance work is started, set the maintenance safety switch to 0 position. Refer to page 141 for location of the maintenance safety switch. In the 0 position the engine 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.

NOTICE

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

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

- Block the machine to prevent machine movement
- Always use safety devices to block hydraulic cylinders. Never rely on the machine hydraulic system to hold when working on the loader attachment. A hydraulic line or cylinder could fail or someone could accidentally strike the control levers causing the loader to fall.
- Relieve all pressure in the hydraulic system before servicing the hydraulic system.
- Oily cloth and inflammable material must be removed from the machine. Clean the excavator before starting maintenance work.
- Switch-off battery main 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 fuel system, engine and hydraulic system.

**WARNING**

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

NOTICE

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

4.3 FLUIDS AND LUBRICANTS

4.3.1 LUBRICANTS FOR OPERATION IN COLD AND ARCTIC CLIMATES

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

4.3.2 FLUIDS AND LUBRICANTS FOR MODERATE AND HOT CLIMATES

Point of Lubrication	Lubricant	Ambient Temperature °C	Viscosity Grades	Quality Grades DIN/API
Engines	Refer to ENGINE OPERATION AND MAINTENANCE MANUAL for Specifications of Engine Oil, Coolant and Fuel.			
Hydraulic System	Hydraulic oil HLP or HLPD with ZINC anti-wear additives *1)	- 20 to + 11	22	DIN 51524 T.2 and T.3-HLP
		-14 to + 21	32	
		- 6 to + 31	46	
		0 to + 40	68	
		+ 5 to + 48	100	
Travel gears, Final drives and Swing gear	Gear oil CLP *2)	-15 to + 50	CLP 220	DIN 51517 3 - CLP
Brake housings and Motor adapter housings of Travel Gears and Swing Gear *3)	Engine oil	all	SAE 10	DIN 51524T.2 and T.3- HLP
	or Hydraulic oil		HLP 22 or HLP 32	
PTO (Pump distributor gear)	Gear oil CLP *2)	-15 to + 50	CLP 150	DIN 51517 3 - CLP
Pump drive shaft housings	Hydraulic oil	all	HLP 32	DIN 51524T.2 and T.3- HLP
Fan bearing housings of Hydraulic oil cooler	Gear oil CLP	all	CLP 220	DIN 51517 3 - CLP

NOTICE

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

Point of Lubrication	Lubricant	Ambient Temperature °C	Viscosity Grades	Quality Grades
				DIN/API
Grease Fittings (manual lubrication) Central Lubrication System	Multi-Purpose Grease "MPG"	Refer to the Lubricant Chart in volume 2 binder for the recommended Multi-Purpose Greases. The part numbers of recommended Multi-Purpose Greases are listed in the Parts Catalog.		
Swing Circle Teeth (manual lubrication) Swing Circle Pinion Lubrication System				
Track rollers, Carrier rollers and Idler wheels	Adhesive Lubricant	all	CLP 220	DIN 51517 3 CLP
Flexible coupling	Engine oil API	all	SAE 15W-40	API Category CG-4SH
Air conditioning system	Refrigerant		R 134a	REMARK The Air Conditioning is prepared for Refrigerant "R134a" only. Observe Notice below.
Refrigerant compressor	Special oil See Note below.			

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

4.4 FILLING CAPACITIES

Unit or System	Liter (approx.)
Engine cooling system	360.0
Engine oil pan	190.0
Engine oil reserve tank (special equipment)	510.0 (424.0 Refill)
Fuel tank	4500.0
Hydraulic oil reservoir	2900,0
Hydraulic system	4400.0
Flexible coupling between engine and PTO	1.45
PTO (Pump distributor gear) - Manufacturer L&S	87.0
PTO (Pump distributor gear - Manufacturer Stiebel)	63.0
Pump drive shaft housings on PTO	*1)
Swing gear (Manufacturer L&S)	42.0
Motor adapter housing	0.6
Swing gear (Manufacturer Siebenhaar)	60.0
Motor adapter housing	0.6
Brake housing	0.3
Travel gears, each:	
Planetary gear housing	60.0
Spur gear housing	7.5
Motor adapter housing	1.5
Brake housing	0.12
Track rollers, each	2.1
Guide wheels, each	2.7
Support rollers, each	4.0
Water tank for windshield washer system	7.0

REMARK

Capacities listed above are approximate values.
For proper checking use level plugs, dipsticks, and inspection openings, provided for this purpose.

*1) Fill up to lower edge of level plug opening.

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 gear, Travel gears and PTO (pump distributor gear). 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 369 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.**

REMARK

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.

4.6.3 PERIODIC SERVICING SCHEDULE

Service Intervals	Service Point	Service	See
When necessary	Engine Air Cleaners	Maintenance	page 269
	Swing circle toothing	Immediately apply grease if bare spots are visible	page 273
	Automatic lubrication systems	Fill grease containers Clean or replace filter elements	page 275
	Track rollers	If leakage occurs replace	page 279
	Carrier rollers	floating seals and fill with GL	
	Guide wheels	ISO VG CLP 220	
	Cold starting aid	Replace fluid cartridge	page 281
Every 10 operating hours or daily	Excavator	Walk-around inspection	page 283
	Working attachment	Check grease injectors of automatic lubrication system. Check for proper lubrication.	page 287
	Swing circle	Check grease injectors of automatic lubrication system. Check for proper lubrication.	page 291
	Air cleaner	Clean pre-cleaner	page 295
	Radiator	Check coolant level	page 297
	Track groups	Clean, especially in winter	page 297
	Fuel system water separator	Drain water	page 299
	Ground cables for engine and cab	Check connection	page 293
	Engine	Check oil level	(1)
Fire detection and actuation system	Inspections	(2)	
Every 50 operating hours or weekly	Swing gear and Motor adapter housing	Check oil levels	page 301
	Travel gears, Brake housings and Motor adapter housings	Check oil levels	page 305
	PTO (Pump distributor gear)	Check oil level	page 309
	Hydraulic access ladder	Check safety sensor	page 311
	Hydraulic oil cooler and radiator	Check and clean as necessary	page 313

(1) Perform maintenance according to separate Engine Operation and Maintenance Manual filed in volume 2 binder.

- (2) Perform inspections according to the separate Manual "FIRE DETECTION AND ACTUATION SYSTEM" filed in volume 2 binder.

Service Intervals	Service Point	Service	See
Every 250 operating hours or monthly	Refrigerant compressor	Check drive belt tension	page 315
	Radiator fan belt and automatic belt tensioner	Maintenance check	page 317
	Generator	Check drive belt tension	page 321
	Signal horn compressor	Lubricate	page 323
	Oil cooler fans	Check condition and fastening	page 323
	Automatic lube systems	Clean in-line grease screens and breather filters	page 325
	Cab, air filter	Clean or replace filter element	page 329
	Windshield washer reservoir	Check fluid level	page 331
	Air conditioning for Operator's cab	Inspection	page 331
	Engine	Maintenance	(1)
	Fire suppression system	Inspection	(2)
	Eliminator filter	Maintenance check	(4)
Every 500 operating hours or quarterly	Batteries	Check fluid level	page 333
	Flexible Coupling	Check oil level	page 335
	Fuel tank	Drain condensation	page 337
	Crawler tracks	Inspection	page 339
	Fire detection and actuation system	Maintenance	(2)

- (1) Perform maintenance according to separate Engine 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.
- (4) Perform maintenance according to separate Service Bulletin "Eliminator Filter" filed in volume 2 binder.

CAUTION

Carry out initial service according to item 4.6.1.

Service Intervals	Service Point	Service	See
Every 1000 operating hours or every 6 months	High strength bolt connections	Check for correct tightening torque and security	page 345
	Hydraulic system	Replace return and pressure filter elements Clean or replace high pressure filter elements Replace breather filter elements Drain sediments	page 377
	PTO (Pump distributor gear) Swing gear and Travel gears	Oil sample analysis	page 391
	Signal horn compressor	Clean and lubricate	page 393
	Hydraulic track tensioning system	Check pressure accumulators	page 395
	Hydraulic oil cooler doors and machinery house doors	Inspect and lubricate door hinges	page 397
	Engine	Maintenance	(1)
	Fire suppression system	Maintenance	(2)
	Air conditioning	Inspect the complete system	(3)

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

CAUTION

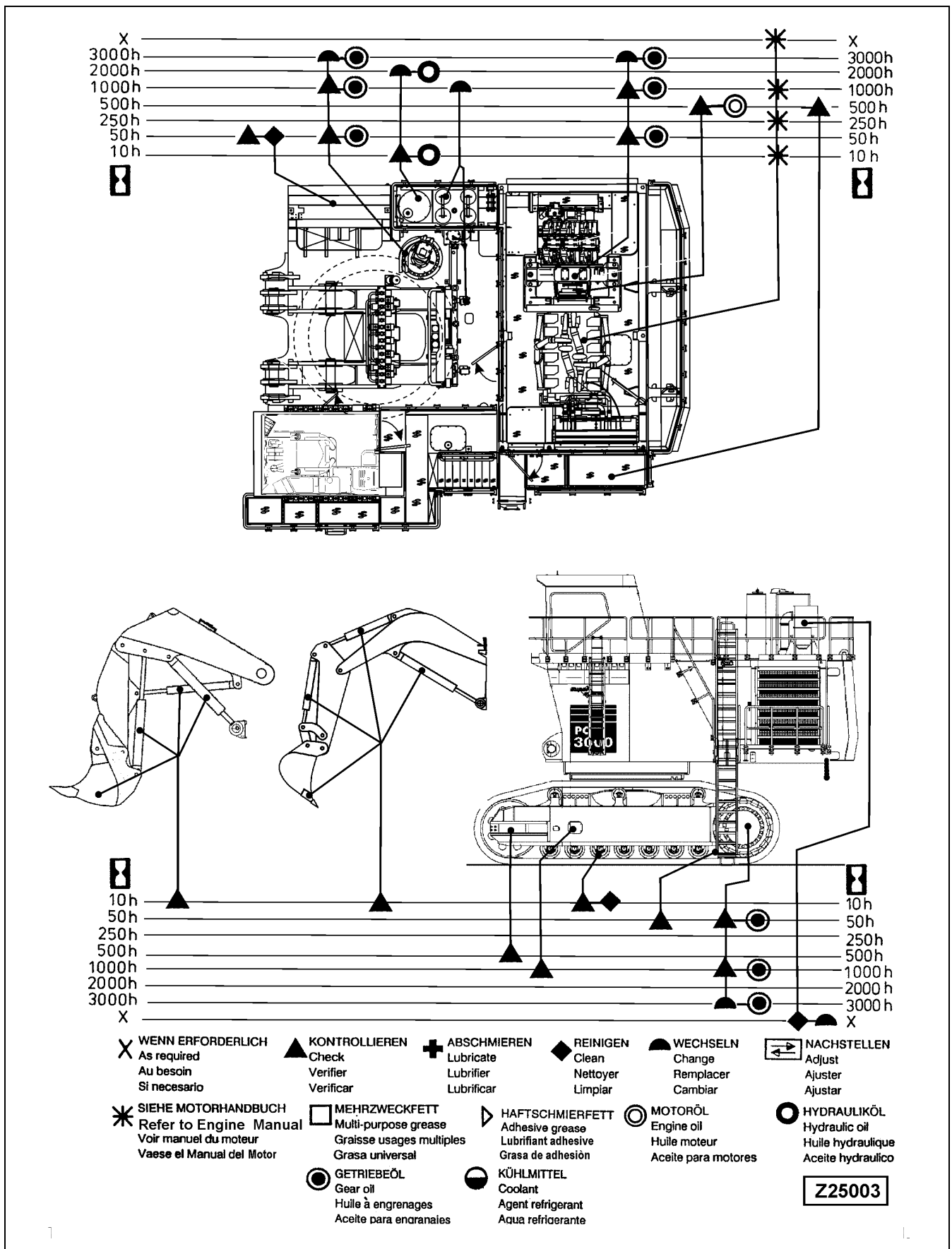
Carry out initial service according to item 4.6.1.

Service Intervals	Service Point	Service	See
Every 2000 operating hours or yearly.	Hydraulic system	Change oil (*) Replace suction strainers (*) Replace pulsation damper	page 399
	Emergency escape ladder	Inspect	page 413
	Fire detection and actuation system	Maintenance	(3)
Every 3000 operating hours however at least once a year.	Swing gear and Motor adapter housing	Change oil	page 415
	Travel gears, Brake housings and Motor adapter housings	Change oil	page 423
	PTO (Pump distributor gear)	Change oil	page 427
	Engine	Maintenance	(1)

- (*) The hydraulic oil change intervals can be extended for a further time period, when an oil sample analysis shows a positive result. When extending the oil change interval, it is necessary to carry out an oil sample analysis after every 1000 operating hours. However, it is recommended to change the hydraulic oil and the suction strainers after 6000 operating hours at the latest.
- (1) Perform maintenance according to separate Engine 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 Pump for Pump Distributor Gear Lubrication should be replaced with a new pump after every 5000 OPERATING HOURS.

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.

CAUTION

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.

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.

WARNING

Repairs on hydraulic hoses and hose lines are not allowed. Use ONLY GENUINE KMG Replacement Hydraulic Hose Lines.

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

4.6.4 PERIODIC REPLACEMENT OF SAFETY CRITICAL PARTS

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

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

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

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

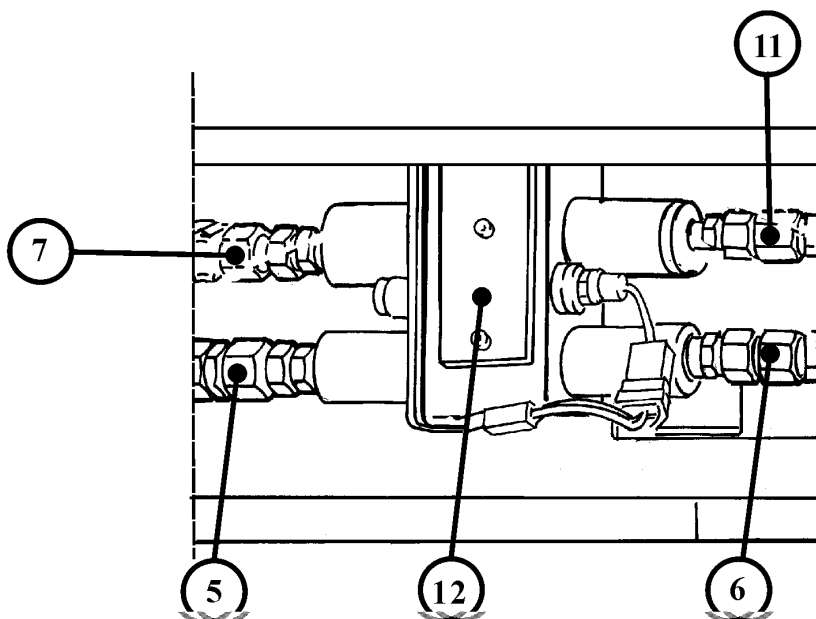
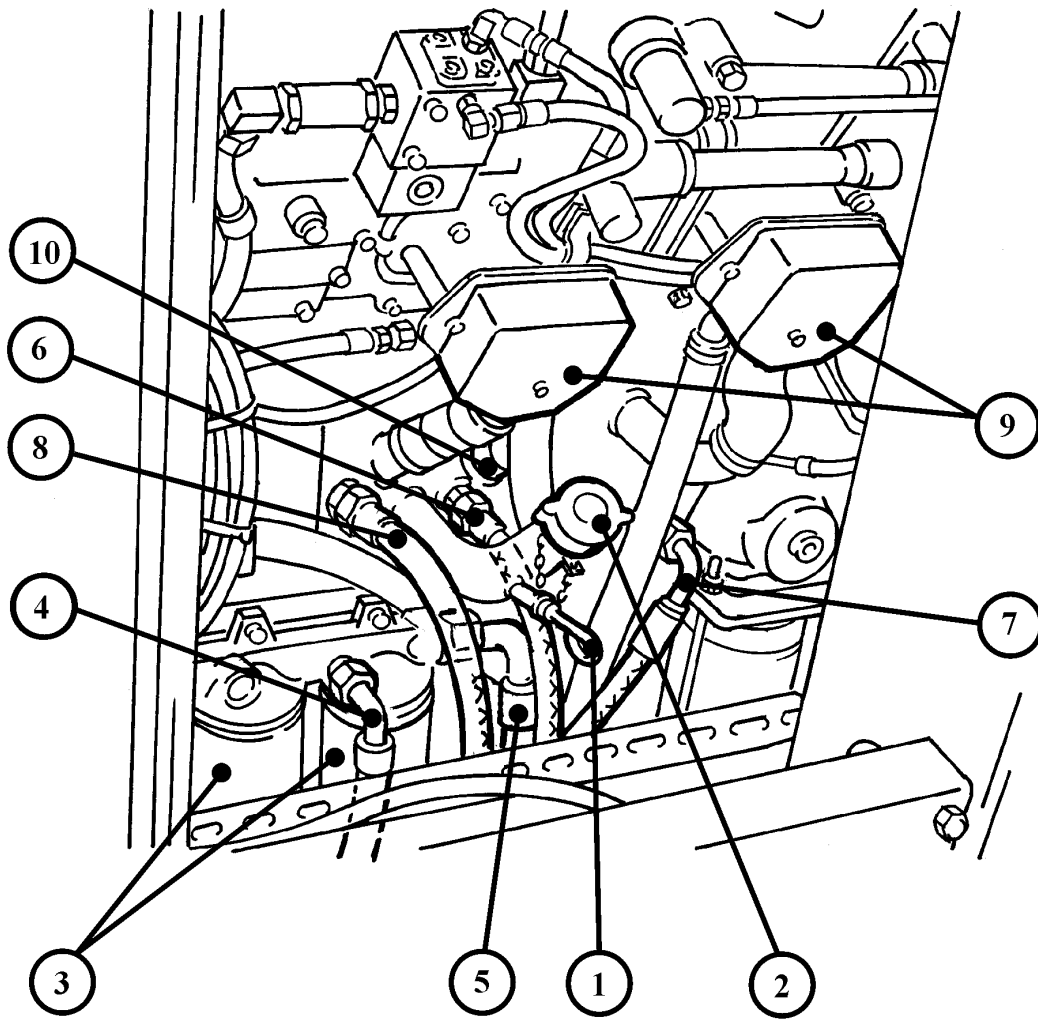
When replacing the hoses, always replace the O-rings, gaskets, and other such parts at the same time.

Ask your Komatsu distributor to replace safety critical parts.

Safety critical parts

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

This Page Left Intentionally Blank



Z 24049

4.6.5 EXTENDED SERVICE INTERVALS FOR ENGINES WITH ENGINE OIL MANAGEMENT SYSTEM

REMARK

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

Legend for illustration Z24049

- (1) Engine oil level gauge
- (2) Oil filler tube
- (3) Oil filters for the engine oil reserve system
- (4) Suction line from reserve tank
- (5) Suction line to pumping unit
- (6) Supply line from pumping unit to crankcase
- (7) Withdrawal oil line from engine oil pan to pump
- (8) Ventilation line for reserve tank
- (9) Breather filters
- (10) Plug
- (11) Oil feed-back line to reserve tank
- (12) Pumping unit, located on the cross member below the fire wall.

Servicing Intervals

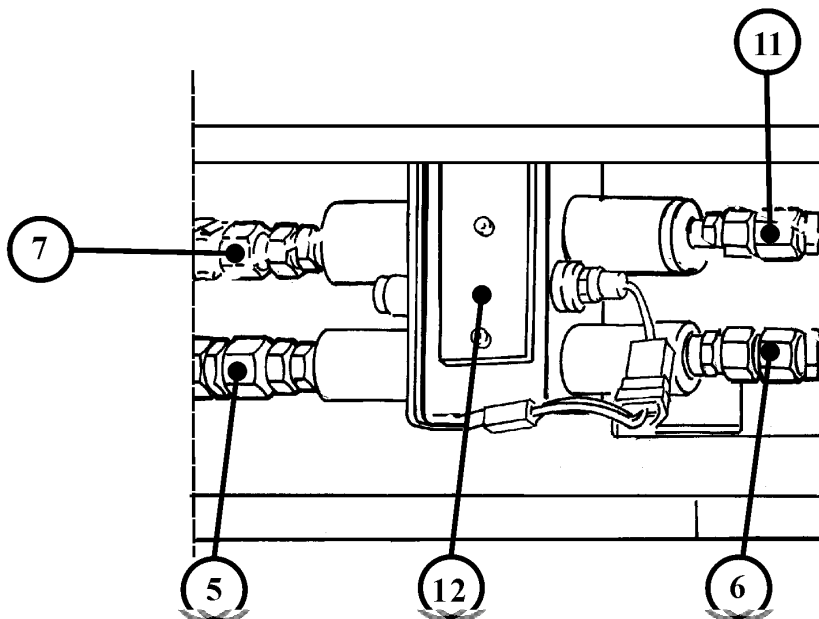
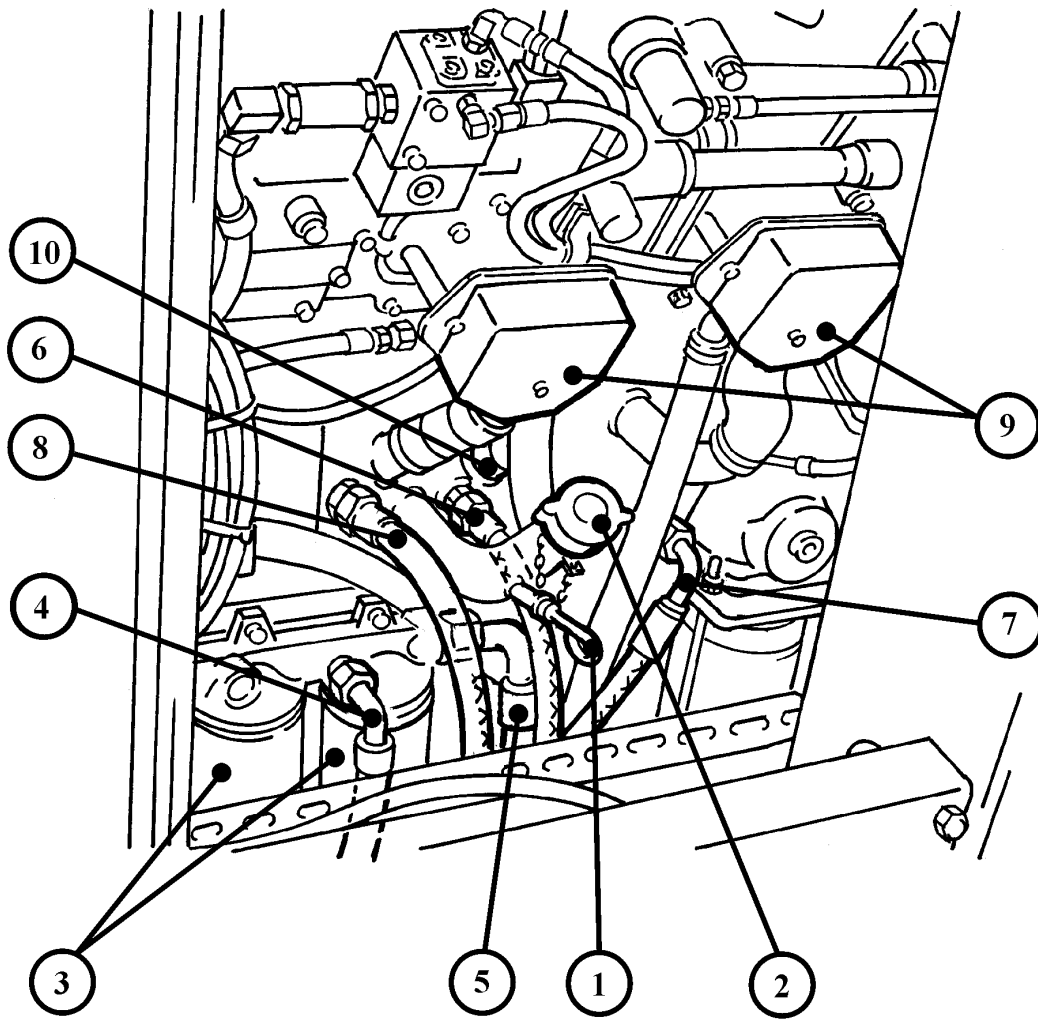
- **Every 10 operating hours**

Check oil level in the engine oil pan with Excavator standing on level ground, using oil level gauge (1). Check also oil level in the reserve tank, see illust. Z23083.

REMARK

The oil level in the engine oil pan can vary between the MIN and MAX marking on gauge (1) depending on the operating condition of the reserve system when the engine was stopped. With sufficient oil in the reserve tank and with the reserve system in proper working order, there is no need to fill the engine oil pan even with the oil level at the MIN mark on gauge (1). If the oil level is below the MIN marking on the gauge, corrective action must be taken. Fill the reserve tank and check the reserve system. The function of pumping unit (12) is monitored by an indicator light located on the "X2" switch board in the cab base. See section "SWITCH BOX (X2) IN CAB BASE" for more information.

Be sure to fill the reserve tank when the information message "**Engine oil reserve tank empty**" is being displayed on the ETM screen in the operator's cab.



Z 24049

Extended Service Intervals for Engines with Engine Oil Management System

- **Every 500 operating hours**

The contents of the engine oil reserve tank is sufficient for approximately 500 hours of operation. The oil level in the reserve tank is also monitored by the ETM system. Be sure to fill the reserve tank when the information message **"Engine oil reserve tank empty"**

is being displayed on the ETM screen.

Fill the reserve tank via the swing down service arm.

Use engine oil according to the specifications in the Engine Operation and Maintenance Manual.

Change both oil filter cartridges (3) of the reserve system.

- **Every 4000 operating hours**

Change engine oil. Drain the oil from the engine oil pan and from the engine oil reserve tank. See illustration Z23083 on page page 265 for location of the drain plug on the reserve tank. It is recommended to change the oil when the oil level in the reserve tank is near the minimum level.

NOTICE

After the engine oil has been drained from the engine oil pan and from the reserve tank, fill the engine oil pan and the reserve tank via the swing down service arm.

See section "Central Refilling System" on page 218 for more information.

DO NOT use the oil in the reserve tank to fill the engine oil pan after an oil change.

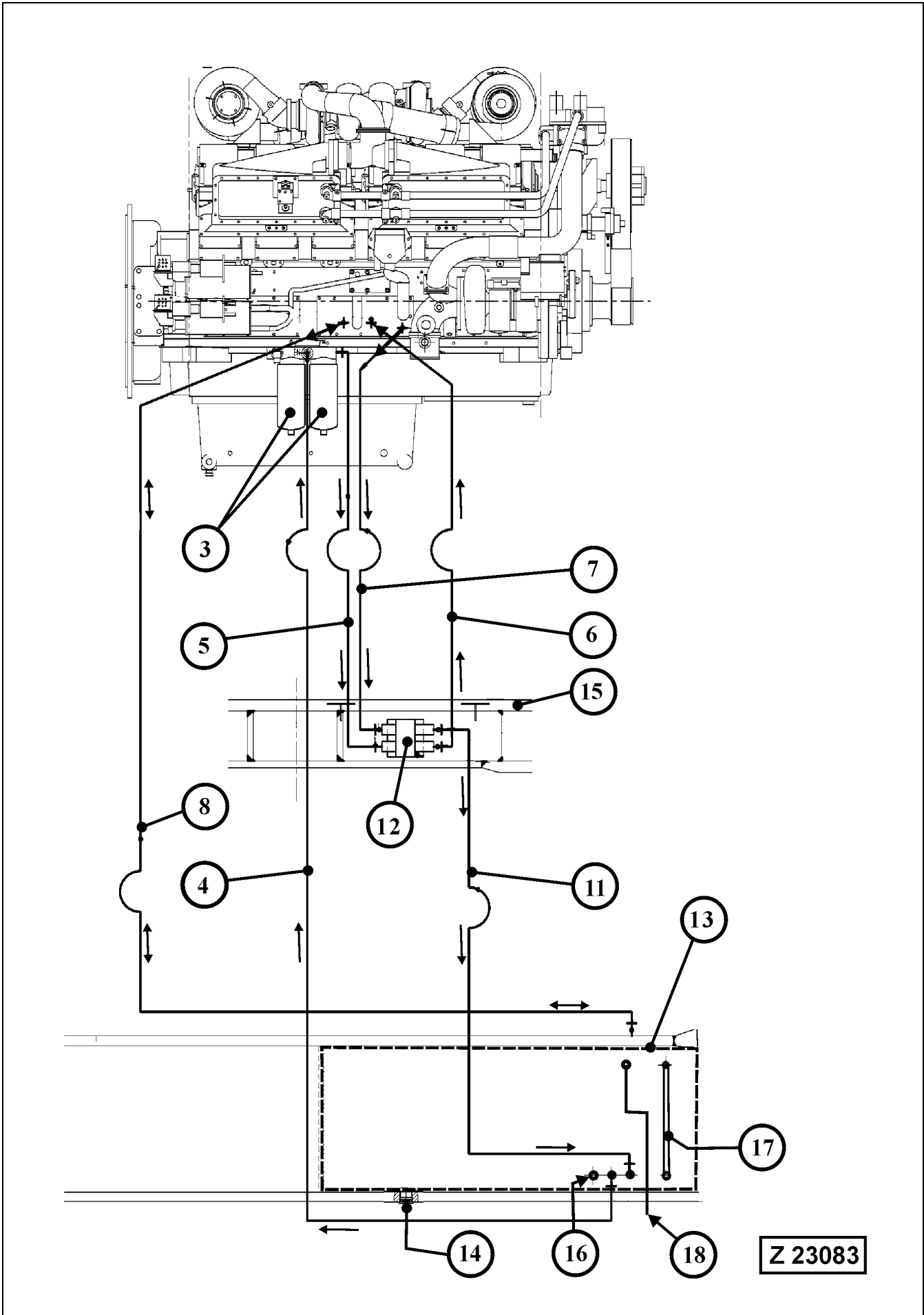
Refer also to the Engine Operation and Maintenance Manual for oil change procedure and oil specifications.

4.6.6 RESETTING THE ENGINE OIL BURNING SYSTEM CENTINEL

Resetting of the Centinel system is necessary in the following cases:

- After every engine oil change.
- Whenever the engine oil reserve tank has been allowed to run empty.
- After repairs on the Centinel system.
- When changing the engine oil quality from Mineral oil to Synthetic oil and vice versa.

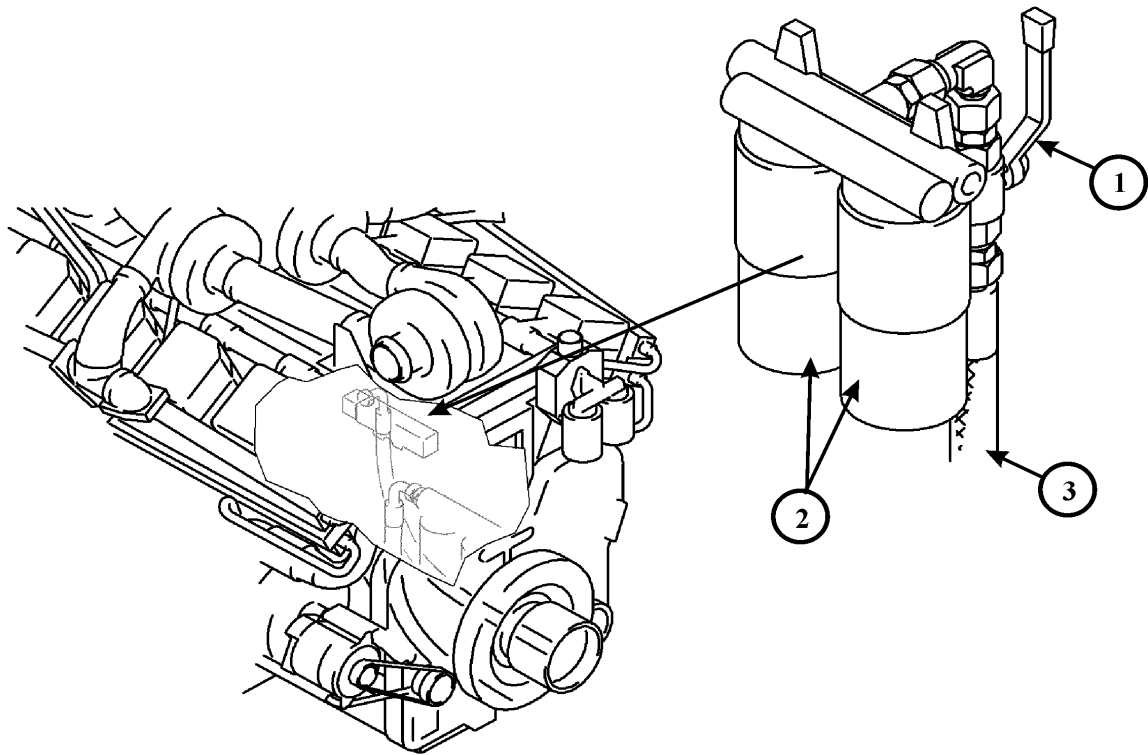
For resetting procedure refer to page 69 in section 3.2



Extended Service Intervals for Engines with Engine Oil Management System

Reserve System Oil Flow Schematic, illust. Z23083

- (3) Oil filters for the engine oil reserve system
- (4) Suction line from reserve tank
- (5) Suction line to pumping unit
- (6) Supply line from pumping unit to crankcase
- (7) Withdrawal oil line from engine oil pan to pump
- (8) Ventilation line for reserve tank
- (11) Oil feed-back line to reserve tank
- (12) Pumping unit, located on the cross member below the fire wall. The pump unit works automatically as soon as the engine speed is above 300 RPM. The pump unit consists of a pumping element for feeding oil from tank (13) into the engine oil pan. The second pumping element withdraws oil from the engine oil pan and feeds it back into the reserve tank when the oil level in the oil pan exceeds the maximum running oil level. The combined operation of the pumping elements maintains an optimal oil level in the engine oil pan. Oil drawn off by the Centinel burn system is also replaced through the supply system "Reserve".
- (13) Reserve oil tank. The reserve oil tank is an integrated part of the main frame cross member.
- (14) Drain plug
- (15) Cross member below the fire wall
- (16) Plug. On shovels with KIM Hot start heating system a thermostat is installed in place of plug (16).
- (17) Oil level sight gauge. Be sure to add engine oil via the swing down service arm before the oil level is at the MIN marking on the sight gauge.
- (18) Refilling line from swing down service arm



Z 25476

4.6.7 MAINTENANCE OF THE ENGINE

Fuel Cut-Off Cock

Legend for illustration Z25476

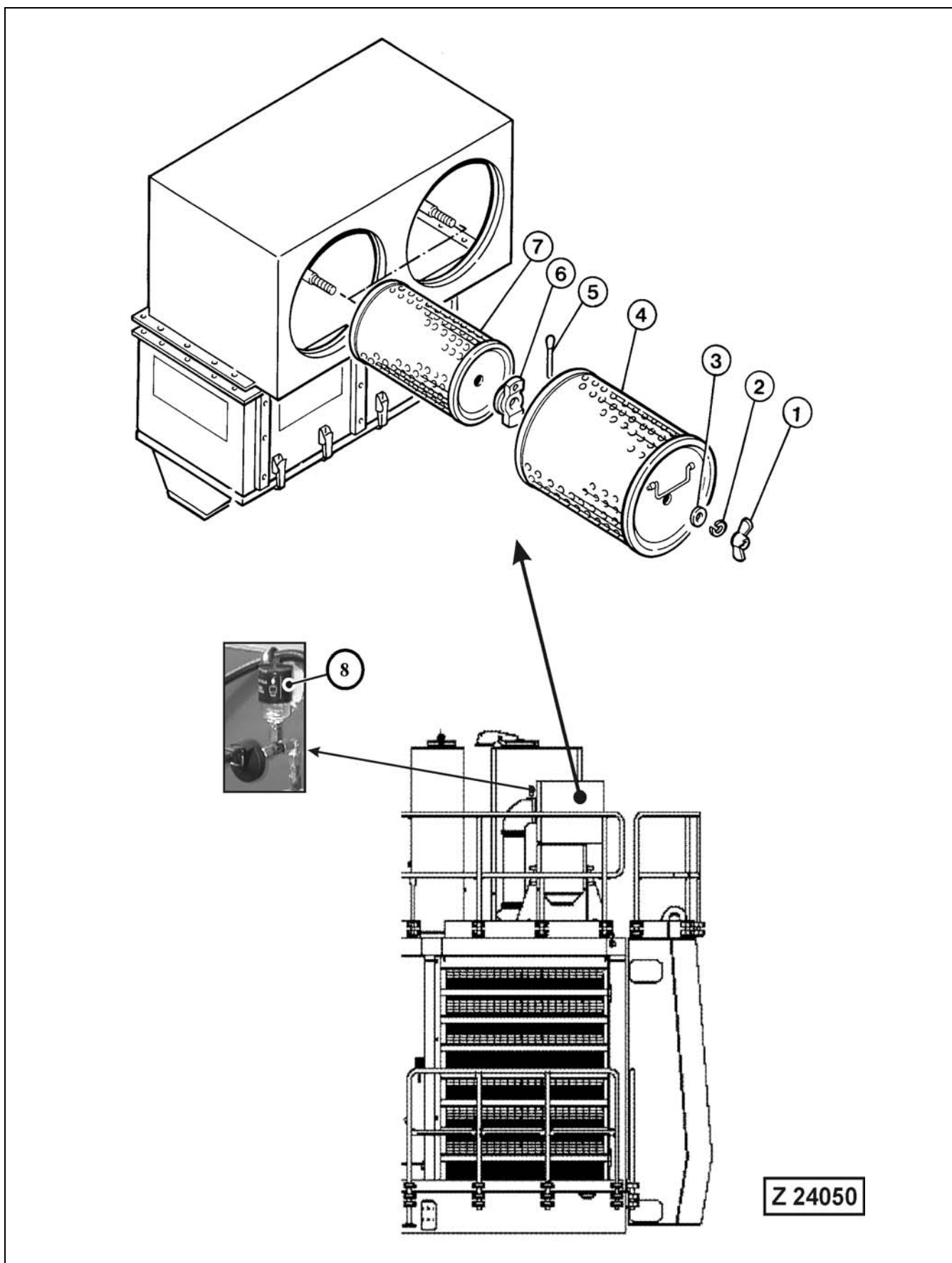
- (1) Ball cock
- (2) Fuel filter
- (3) Fuel supply line

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

REMARK

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

4.7 WHEN NECESSARY



4.7.1 ENGINE AIR CLEANER MAINTENANCE

NOTICE

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

Servicing the main filter elements, illust. Z24050:

 CAUTION

Never service air cleaner while engine is running. Clean main filter elements when the fault message "Air cleaner element restricted" is displayed on the ETM screen or when the service indicator (8) at the air outlet pipe connection shows a red signal. Replace elements after 3 cleanings or annually, whichever occurs first.

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

Compressed air:

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

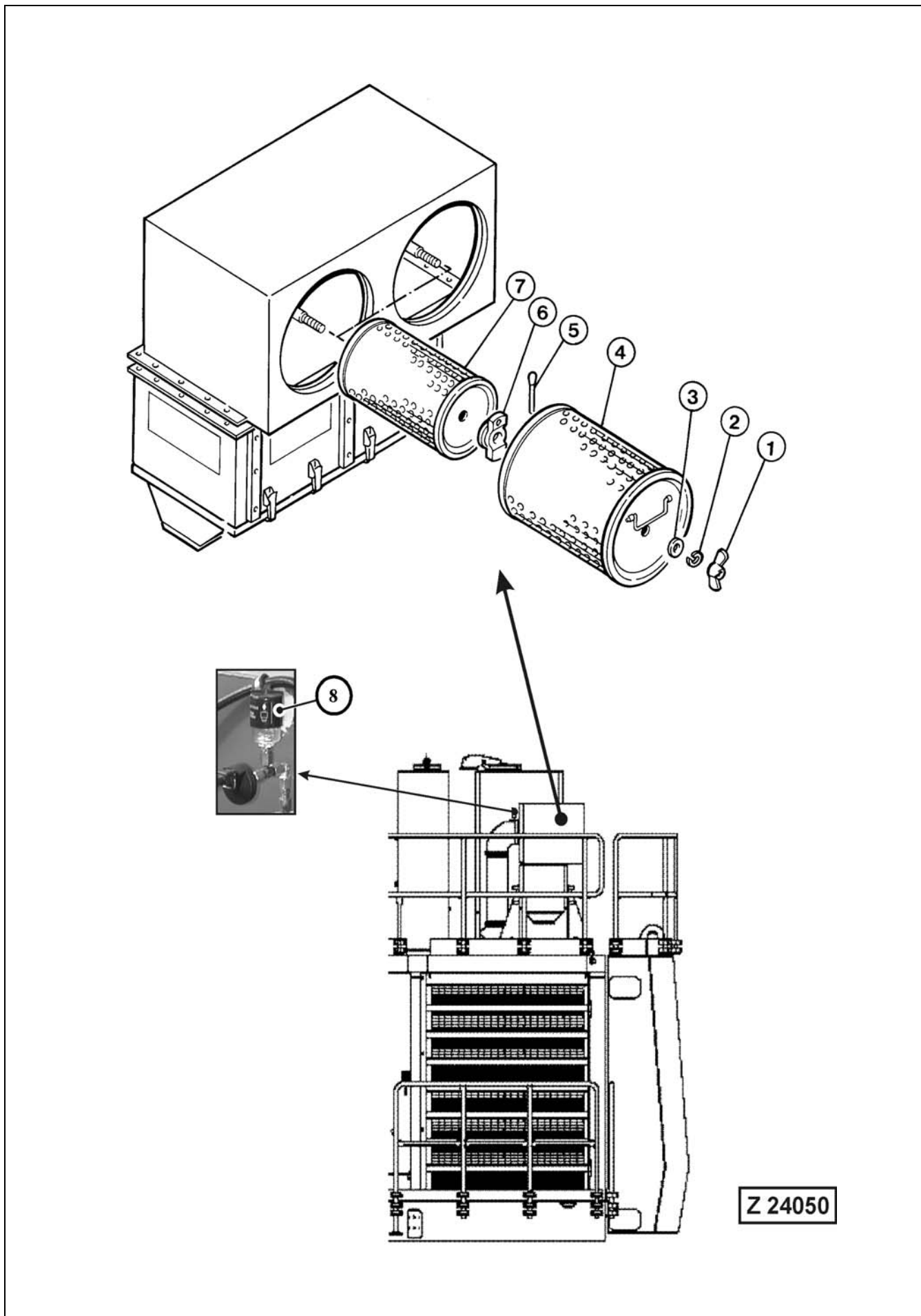
Washing:

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

REMARK

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

4. Install main filter elements (4).



Air Cleaner Maintenance, illustration Z24050

NOTICE

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

Replacing the safety filter element (7):

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

 **WARNING**

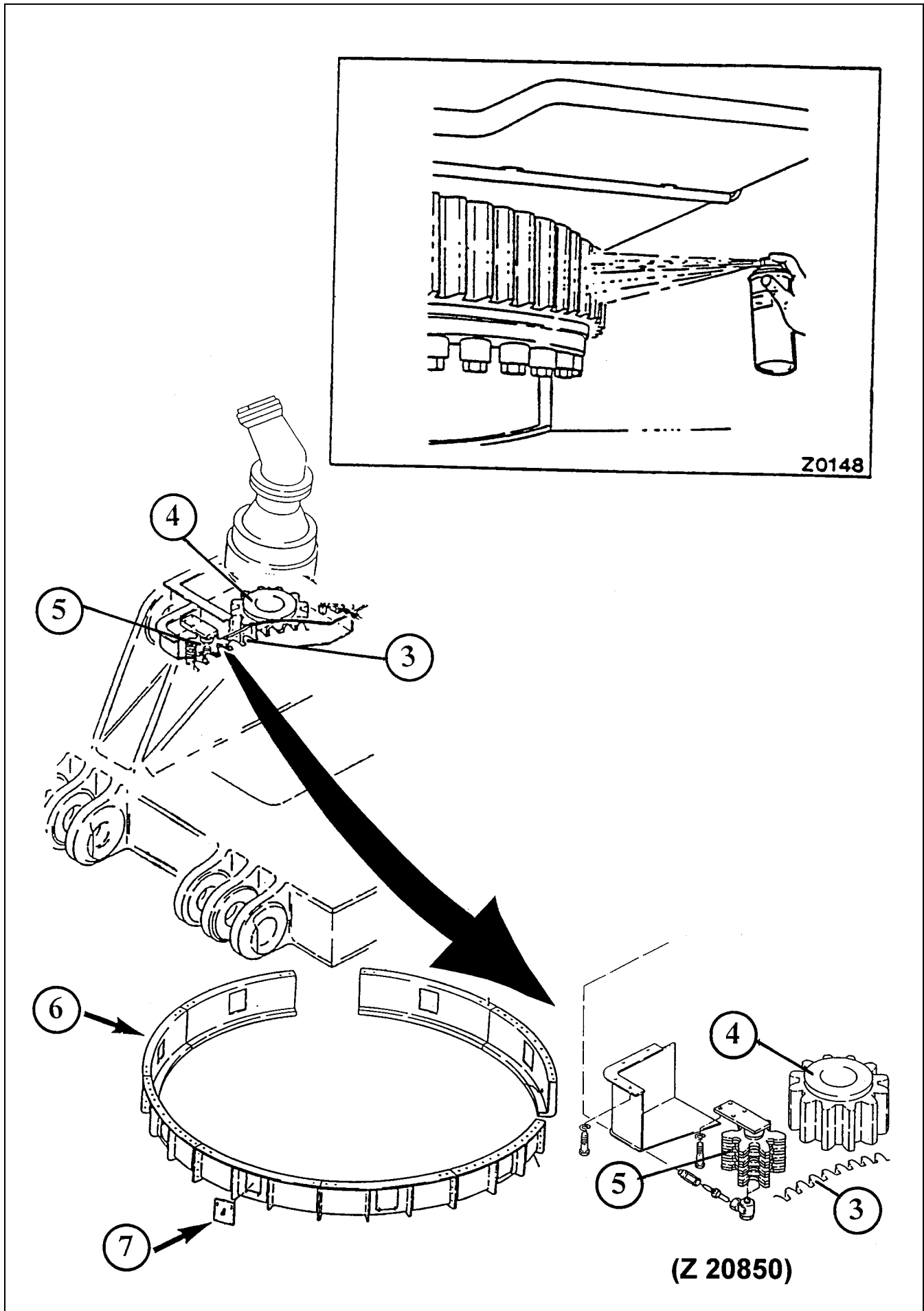
The safety filter element may not be cleaned and re-used

4. Remove cover from air intake opening.
5. Install safety and main filter element, take care service indicator (6) is correctly secured by cotter pin (5).
6. Reset service indicator (8).

General Service Tips

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

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



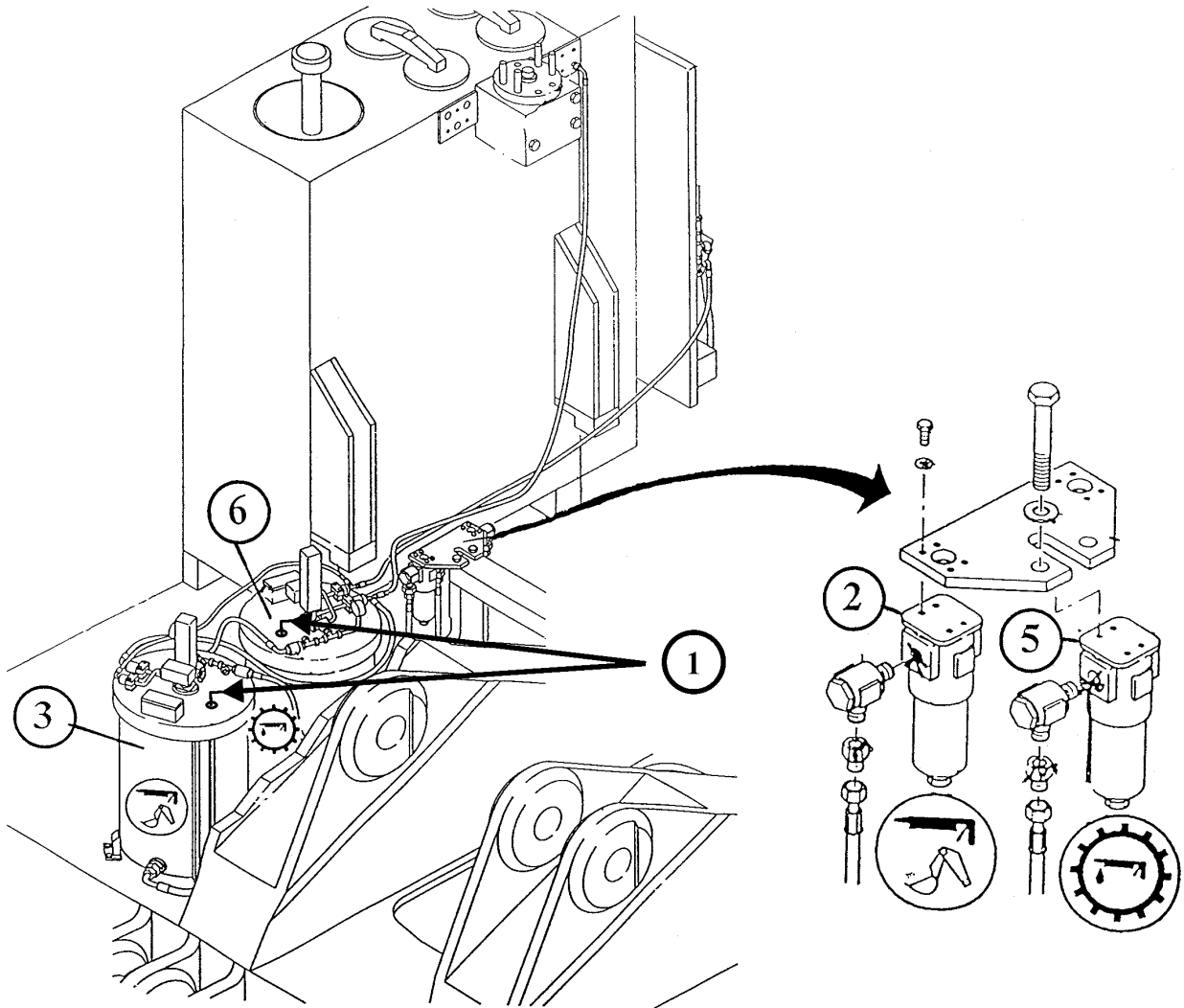
4.7.2 SWING CIRCLE TOOTHING LUBRICATION

See illustration Z 20850

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

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 tothing fails to function for more than four operating hours, bucket motion cut-off will occur. Repair the lubrication system as soon as possible to prevent damage to the gear ring, drive pinion (4) and lubrication pinion (5). As an interim measure lubricate the tothing 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.**
- **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 21666A

4.7.3 AUTOMATIC LUBRICATION SYSTEMS FILL GREASE CONTAINERS

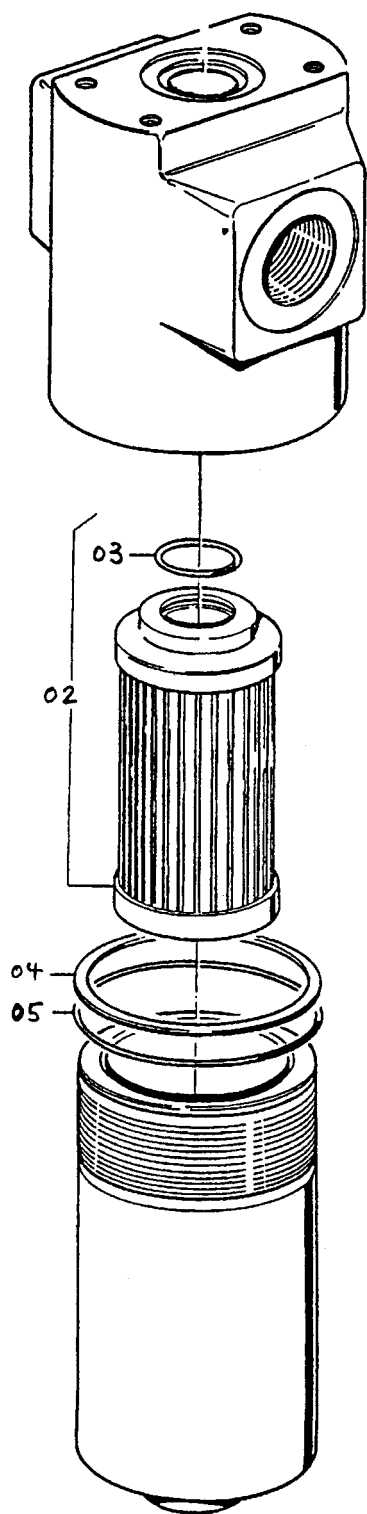
Fill the grease containers of the Central Lubrication System and Swing circle pinion Lubrication System when the corresponding message "grease container empty" is displayed on the ETM screen. Make sure the grease filters in the filling lines are not obstructed. If necessary service the Grease Filters.

Legend for illustration Z21666A

- (1) Grease level gauges for manual checking of the grease level
 - (2) 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 on next page.
 - (3) Grease container of the central lubrication system
 - (5) 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 on next page.
 - (6) Grease container of the swing circle pinion lubrication system
- Fill the grease containers according to the instructions on page 192.

REMARK

Check condition and fastening of both grease containers.



(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.

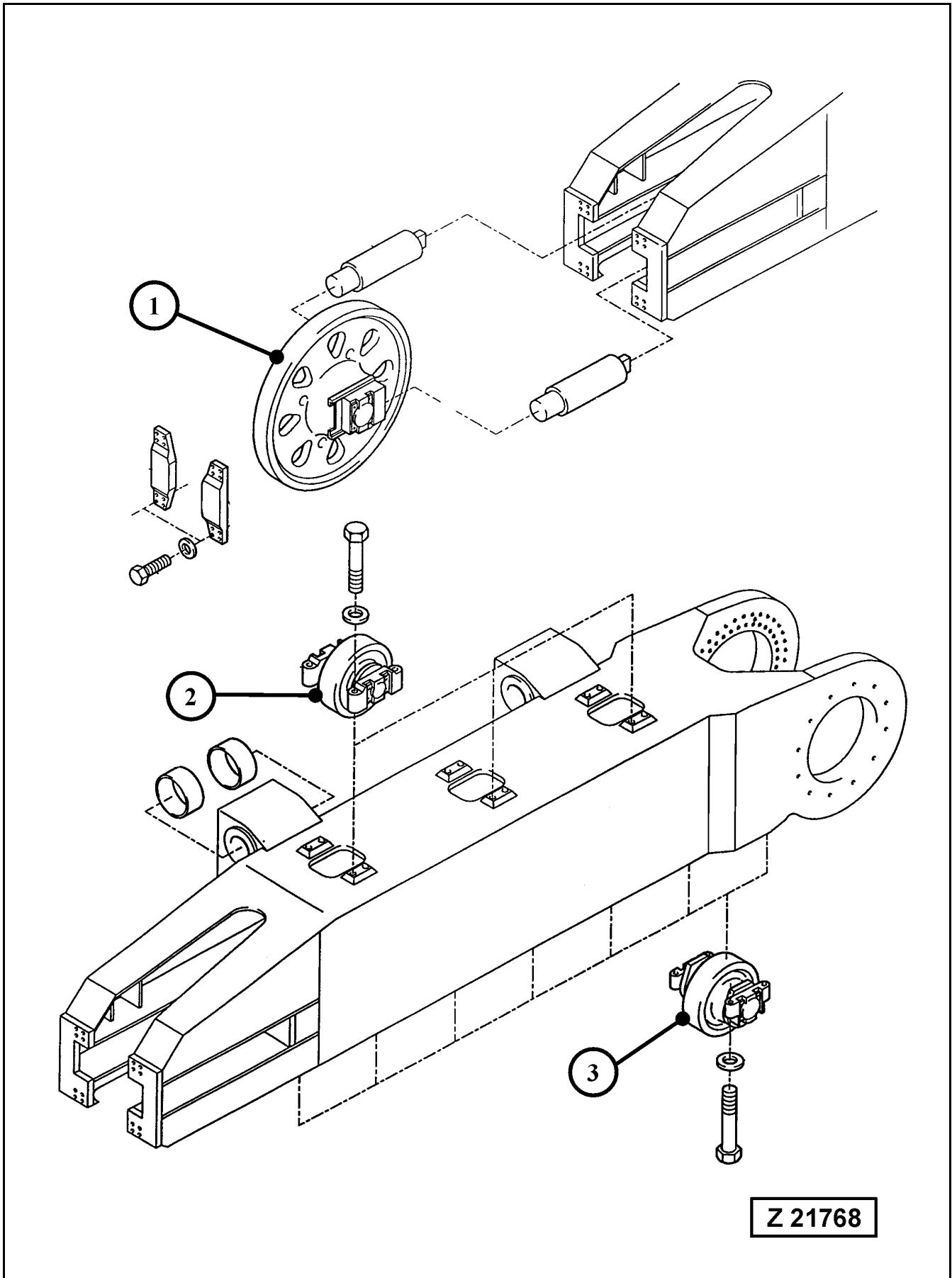
NOTICE

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

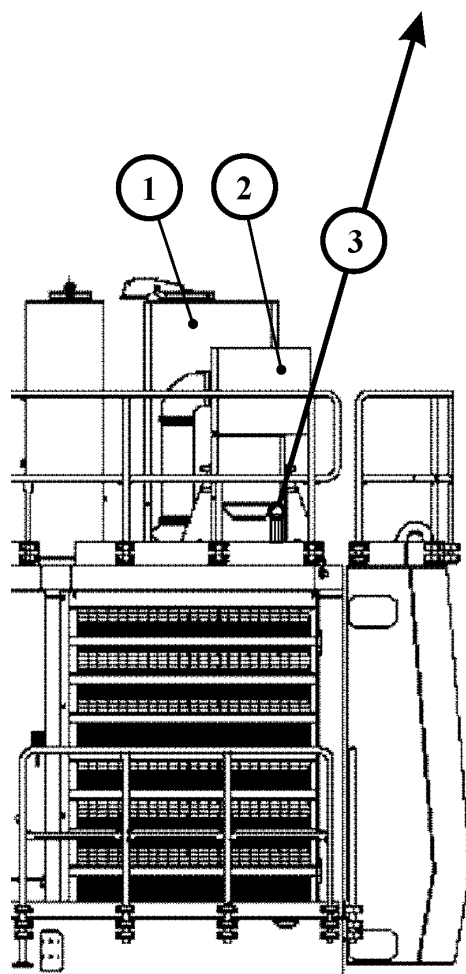
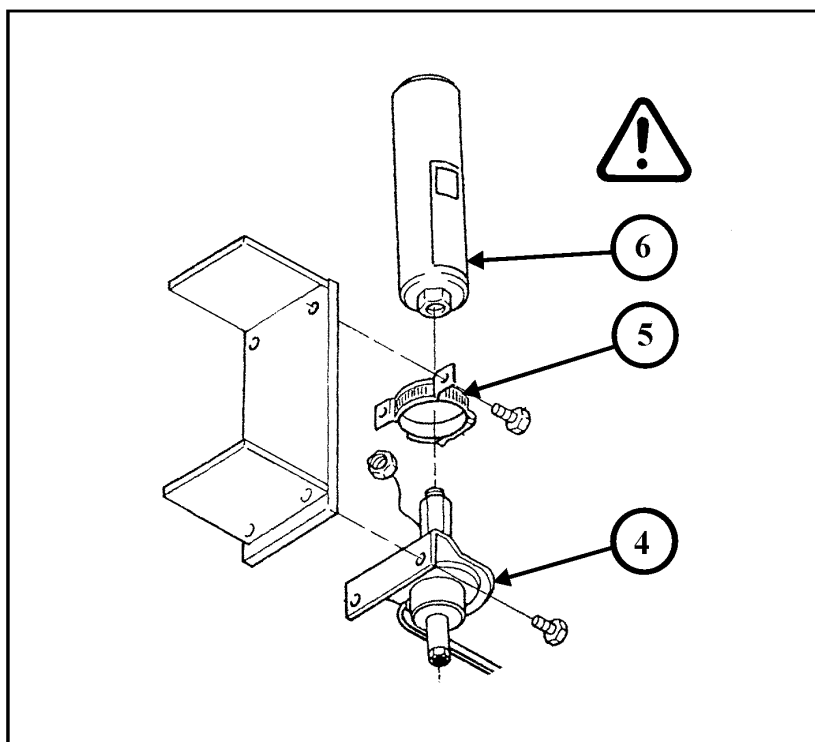
Replace element (02) after three cleanings or after every 5000 operating hours, whichever occurs first.



4.7.4 TRACK ROLLERS AND GUIDE WHEELS - REPLACE FLOATING SEALS

Legend for illustration Z 21768

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



Z 24051

4.7.5 COLD STARTING AID, REPLACE FLUID CYLINDER

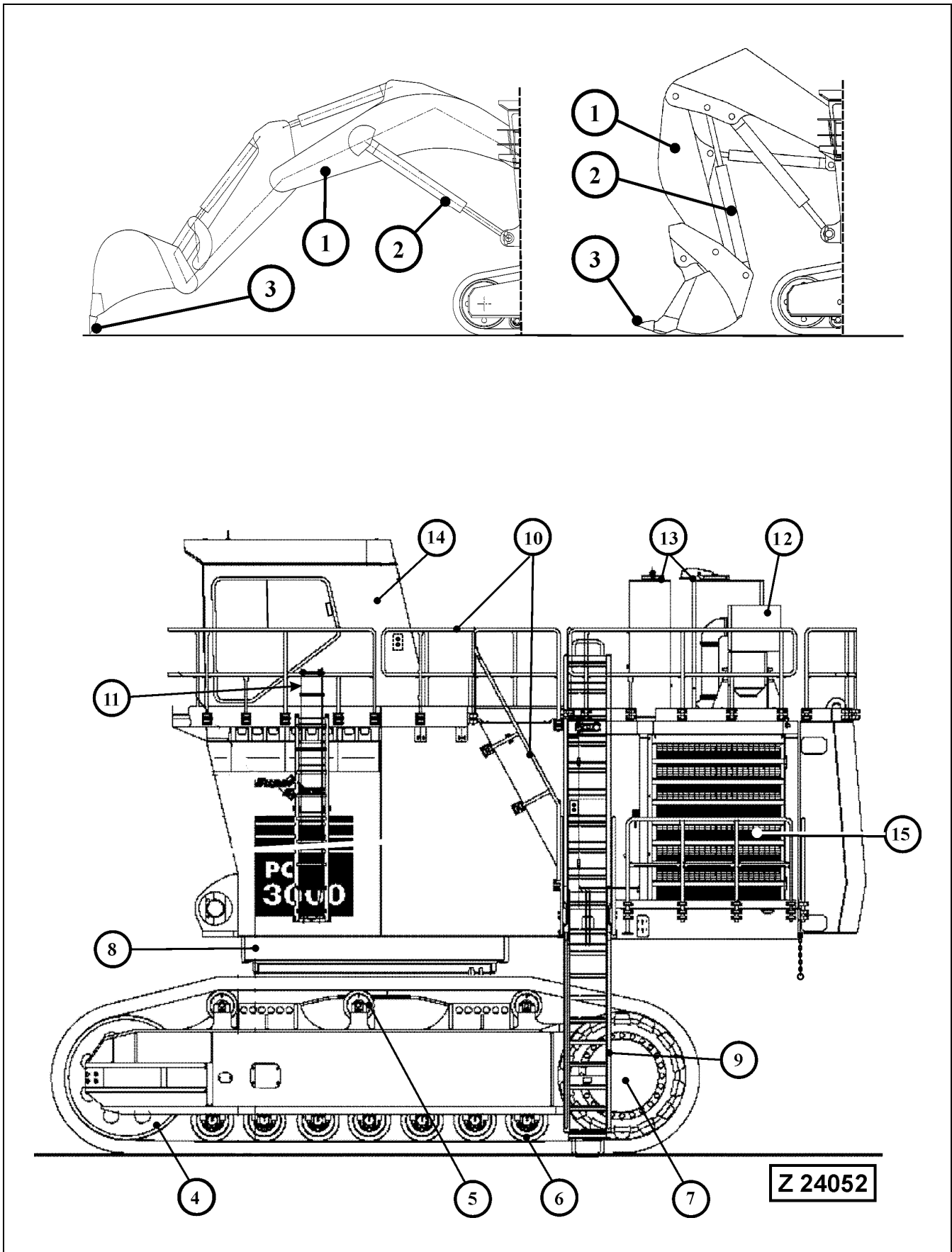
Legend for illustration Z 24051

- (1) Rear exhaust muffler
- (2) Engine air cleaner
- (3) Cold starting aid mounted on the air cleaner frame
- (4) Electrically operated valve
- (5) Mounting clamp
- (6) Cold start fluid cylinder

▲ WARNING

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

4.8 EVERY 10 OPERATING HOURS OR DAILY



4.8.1 WALK - AROUND INSPECTION

WARNING

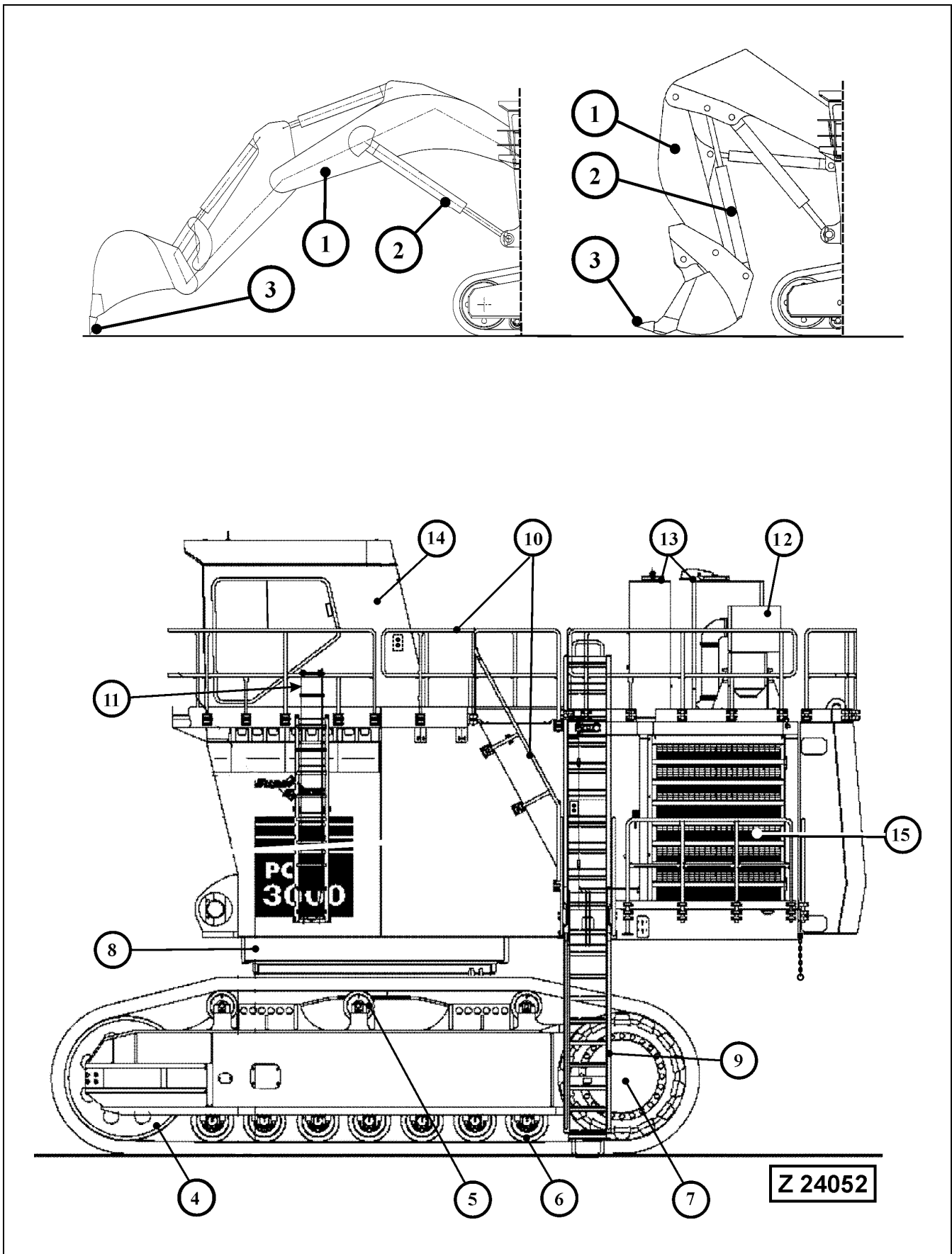
Before carry out any maintenance on this machine, make sure the mounting ladder, handrails and walkways are properly installed and in good condition. Keep the ladder, steps, handrails and walkways free of mud, oil and grease.

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

Legend for illustration Z24052

- (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.

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

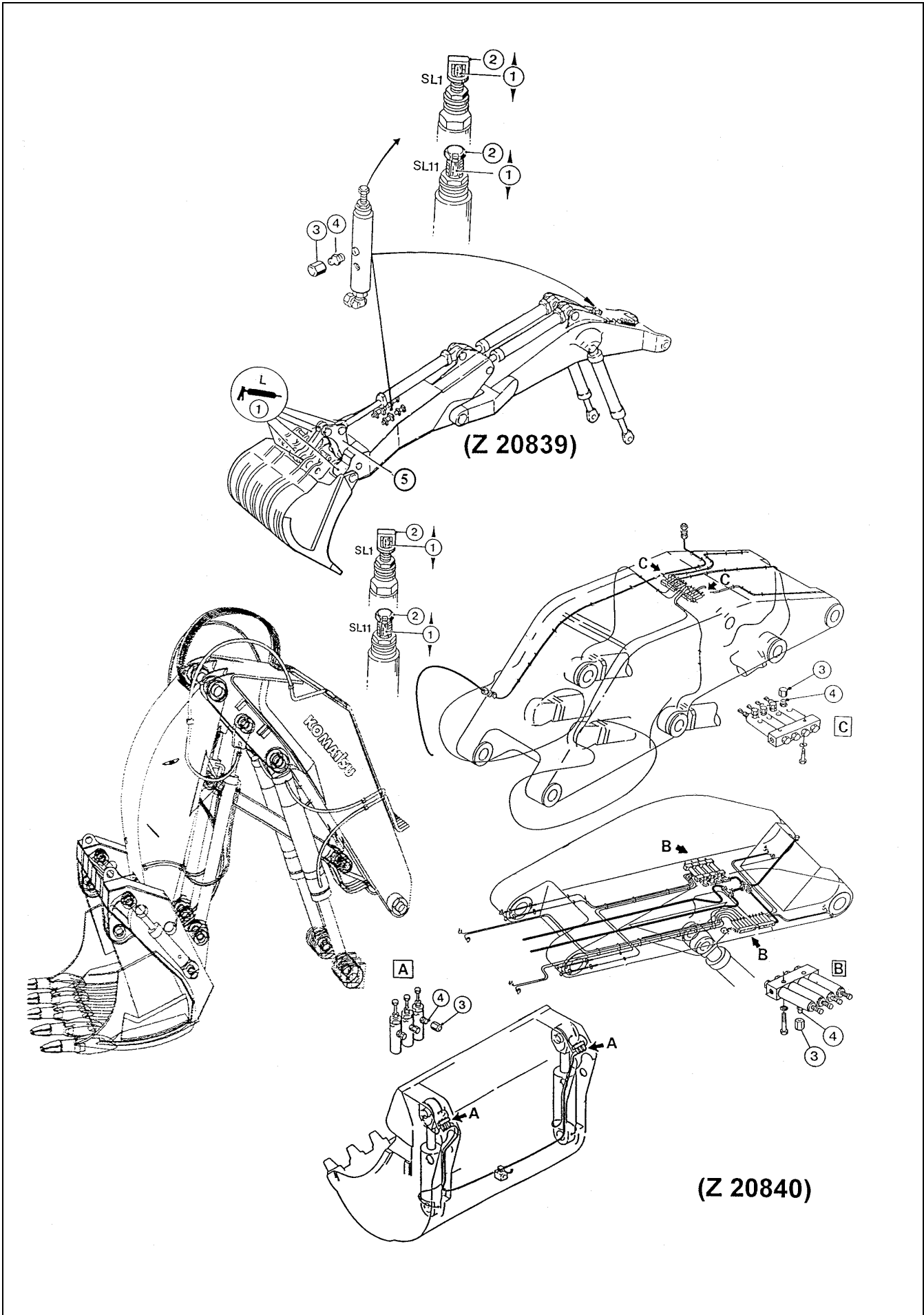


I

- (11) Check condition, fastening and security of emergency escape ladder
- (13) Check condition and fastening of exhaust mufflers
- (14) Check condition, fastening and security of the automatic lubrication system grease container.
- (15) Make a visual inspection of the engine room. Check engine oil level and coolant level.
- Check engine for good condition and security. Check for oil and fuel leakages. Check fuel hoses, hose lines and fittings for leakage and damage.
- Engine mounts, check for good condition and correct fastening.
- Check radiator coolant level. Check cooling system for leakage, damaged hoses and connections.
- Check housing of radiator fan bearing for leakage. Check fan guards and coverings for correct installation, good condition and security.
- Check flexible coupling between engine and PTO for leakage.
- Check condition and mounting of PTO and hydraulic pumps. Check hydraulic hoses, hose lines and fittings for leakage and damage.
- Check housing of oil cooler fan bearing for leakage. Check fan guards and coverings for correct installation, good condition and security. Check hydraulic hoses, hose lines and fittings for leakage and damage.
- Check hydraulic oil cooler for plugged cores.
- Check hydraulic oil level. Check hydraulic oil reservoir for leakage, damaged hoses and connections.
- Check condition and fastening of control valves. Check hydraulic hoses, hose lines and fittings for leakage and damage.
- Check engine for good condition and security. Check for oil and fuel leakages. Check fuel hoses, hose lines and fittings for leakage and damage.

NOTICE

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



WORKING ATTACHMENT - CHECK GREASE INJECTORS FOR PROPER OPERATION

NOTICE

There are two types of grease injectors installed "SL1" and "SL11" injectors, see illust. (Z 20840).

Legend for illustration Z 20840

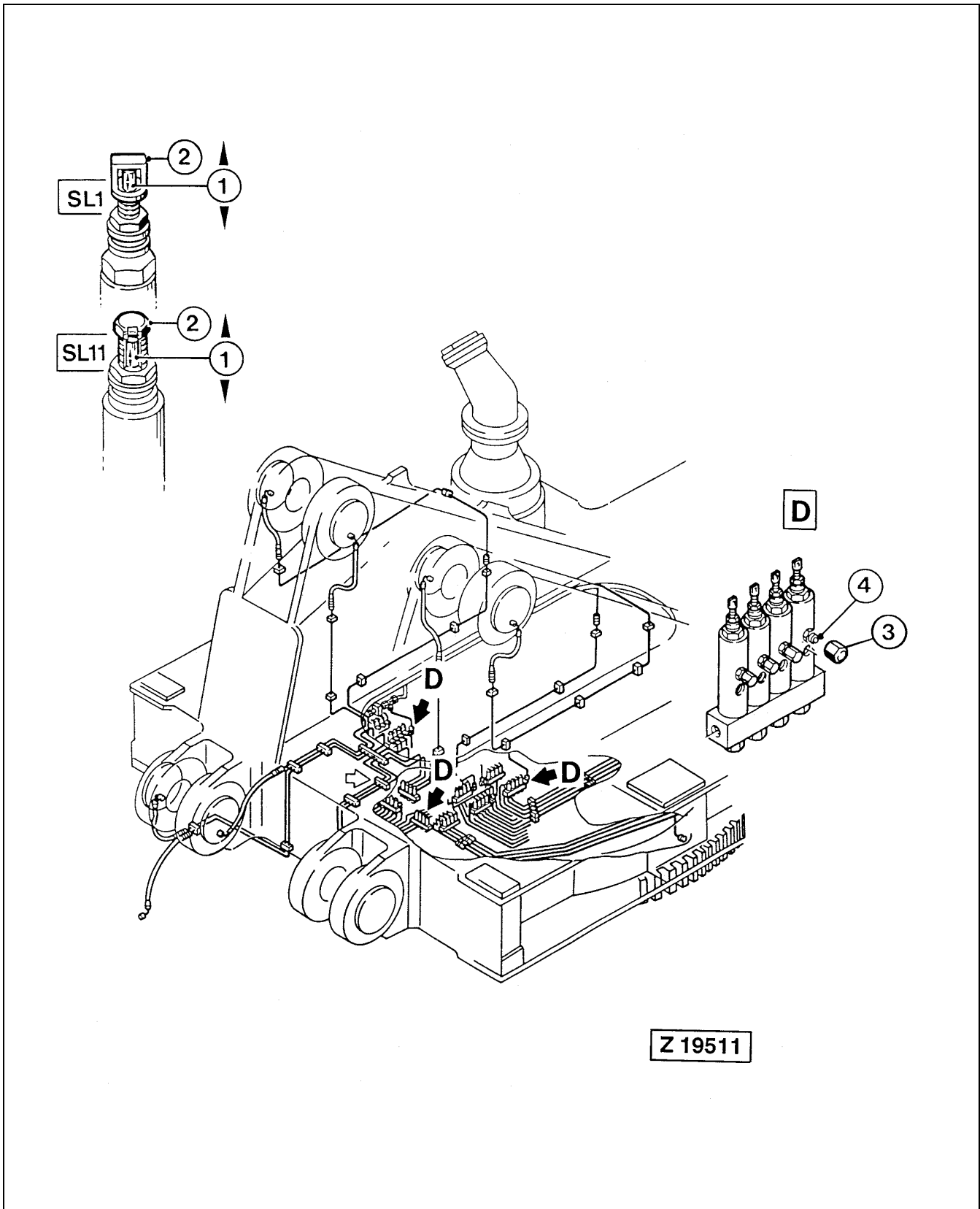
- A Injectors on bucket
- B Injectors on stick
- C Injectors on boom
- (1) Indicator stem for visual indication of injector operation
- (2) Output adjusting screw
- (3) Protection cap
- (4) Grease fitting
- (5) Backhoe bucket wishbone

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

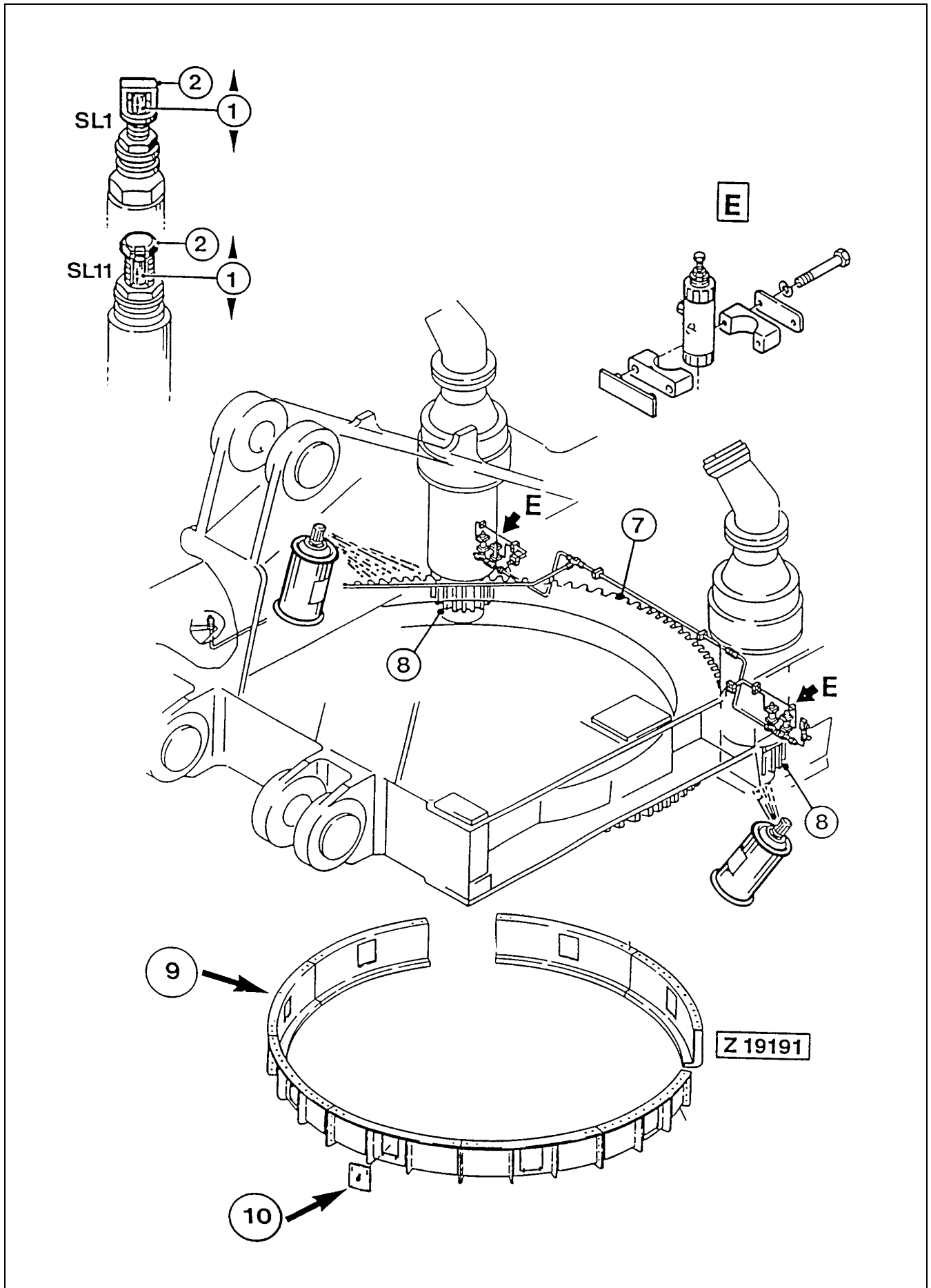
If the failure is caused through a defective central lubrication system, manually lubricate at grease fittings (4) after removal of caps (3).

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

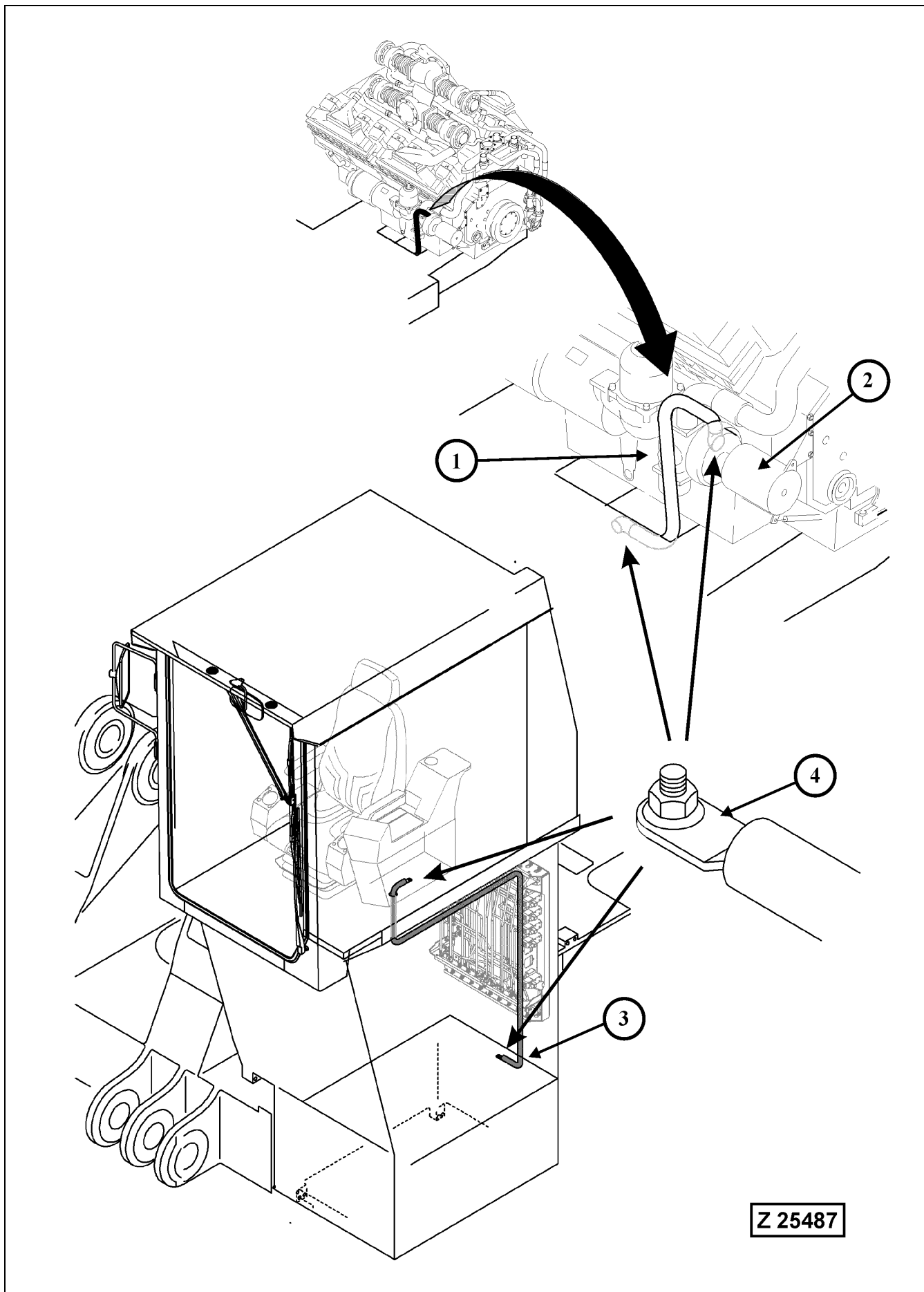
Legend for illustration Z 19191

- 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.

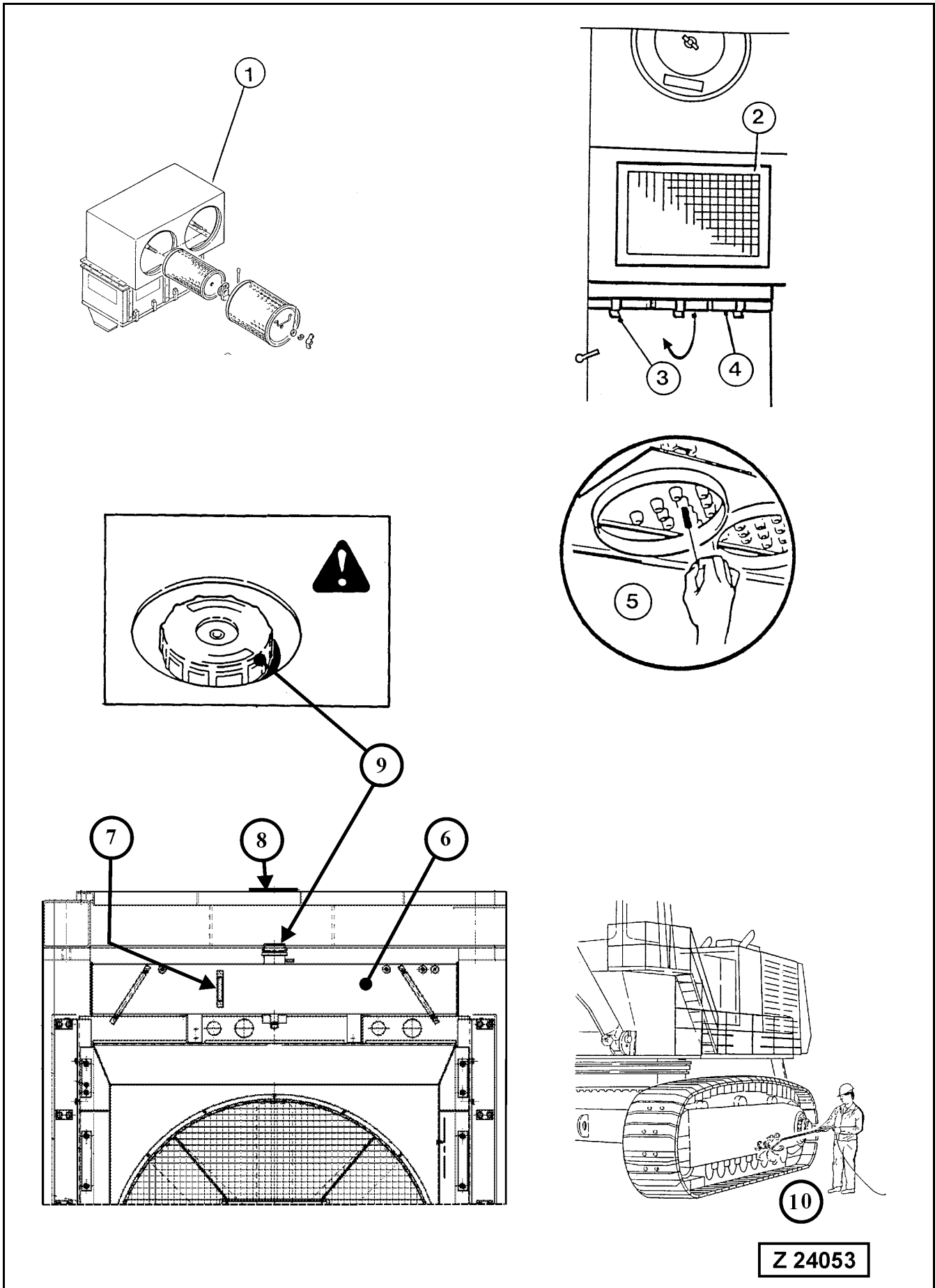


GROUND CABLES - CHECK CONNECTION POINTS

Legend for illustration Z25487

- (1) Ground cable from alternator to platform
- (2) Alternator
- (3) Ground cable from operating panel in cabin to floor of cabin support
- (4) Contact point and ground bolt

Check that the contact between ground cables and ground bolts is secure and shows no defects.



Z 24053

4.8.2 AIR CLEANER - CLEAN PRE-CLEANER

Clean dust cups of pre-cleaners

Legend for illust. Z24053:

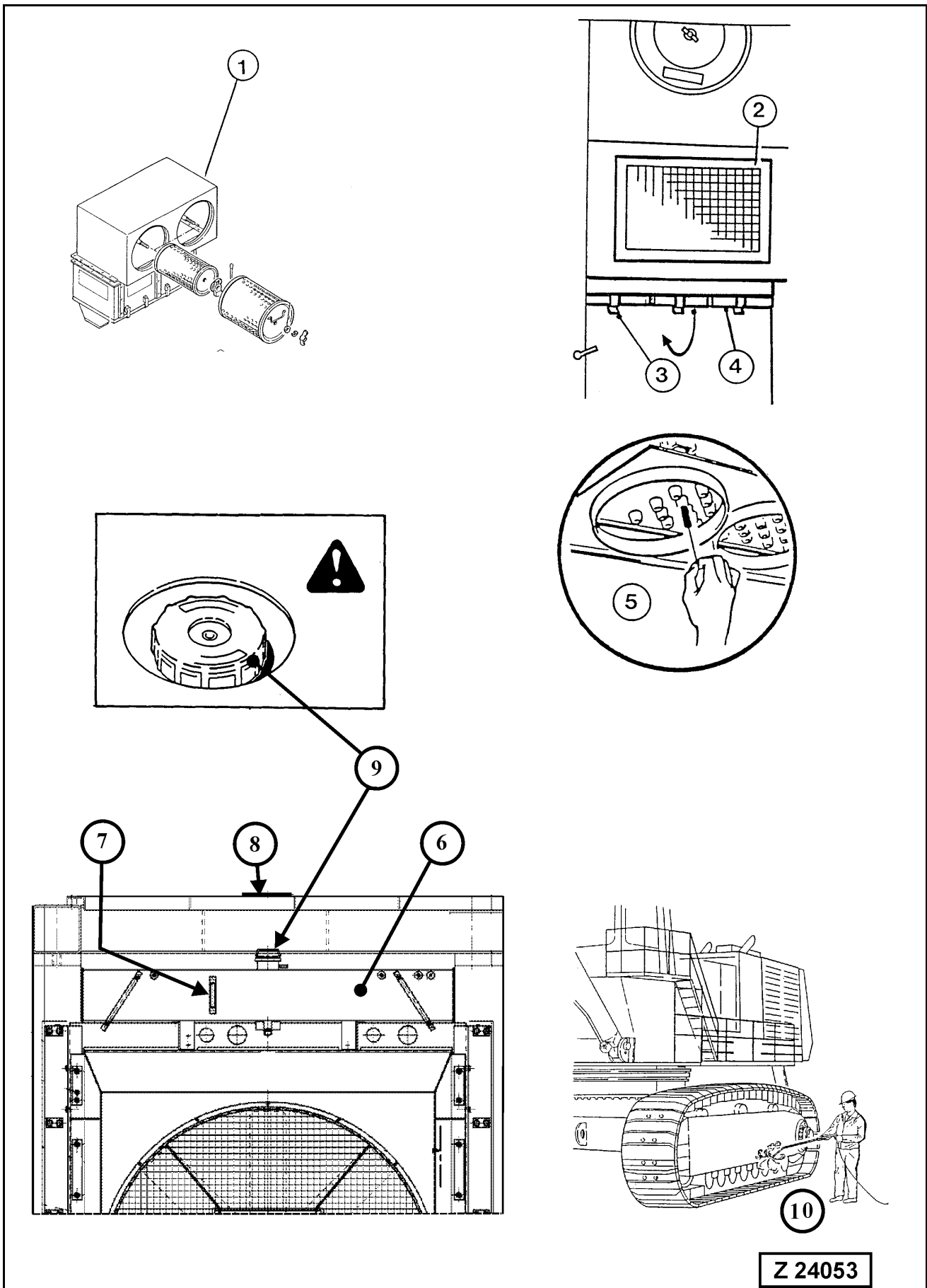
- (1) Roof mounted air cleaner units
- (2) Air intake screen
- (3) Clamps
- (4) Dust cups
- (5) Jet tubes

1. Provide suitable container for collecting the dust before opening the dust cups (4).
2. Loosen the clamps and swing down dust cups (4).
3. Remove dust from pre-cleaner dust cups.
4. Check condition of the dust cup gaskets and replace if necessary.
5. Swing back dust cups (4) to closed position and secure with the clamps provided.
6. Check air cleaner mounting parts for tight fit and security.

NOTICE

When operating the machine under very dusty conditions, check pre-cleaner jet tubes (5) for plugging. Dust plugging of tubes can be removed with a stiff fiber brush.

Never clean tubes with compressed air unless both the primary and safety elements are installed in the air cleaner. Do not steam-clean tubes.



Z 24053

4.8.3 RADIATOR - CHECK COOLANT LEVEL

Legend for illustration Z24053

- (6) Coolant expansion tank of the engine radiator
- (7) Coolant level sight gauge on coolant expansion tank
- (8) Cover plate on power house roof above the radiator pressure cap
- (9) Radiator pressure cap

⚠ WARNING

DO NOT remove the radiator pressure cap (9), illust. Z24053 from a hot engine. Wait until the temperature is below 50°C before removing the pressure cap (9). Failure to do so can result in personal injury from heated coolant spray or steam. Turn the radiator cap (9) slowly counterclockwise to the safety stop to allow the pressure to escape, then continue to turn until cap is free to be removed.

The coolant level should be in the upper field of the sight gauges (7). If necessary add coolant.

REMARK

Refer to the Engine Operation and Maintenance Manual for the correct coolant composition.

4.8.4 TRACK GROUPS - CLEAN

See (10), illustration Z24053.

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

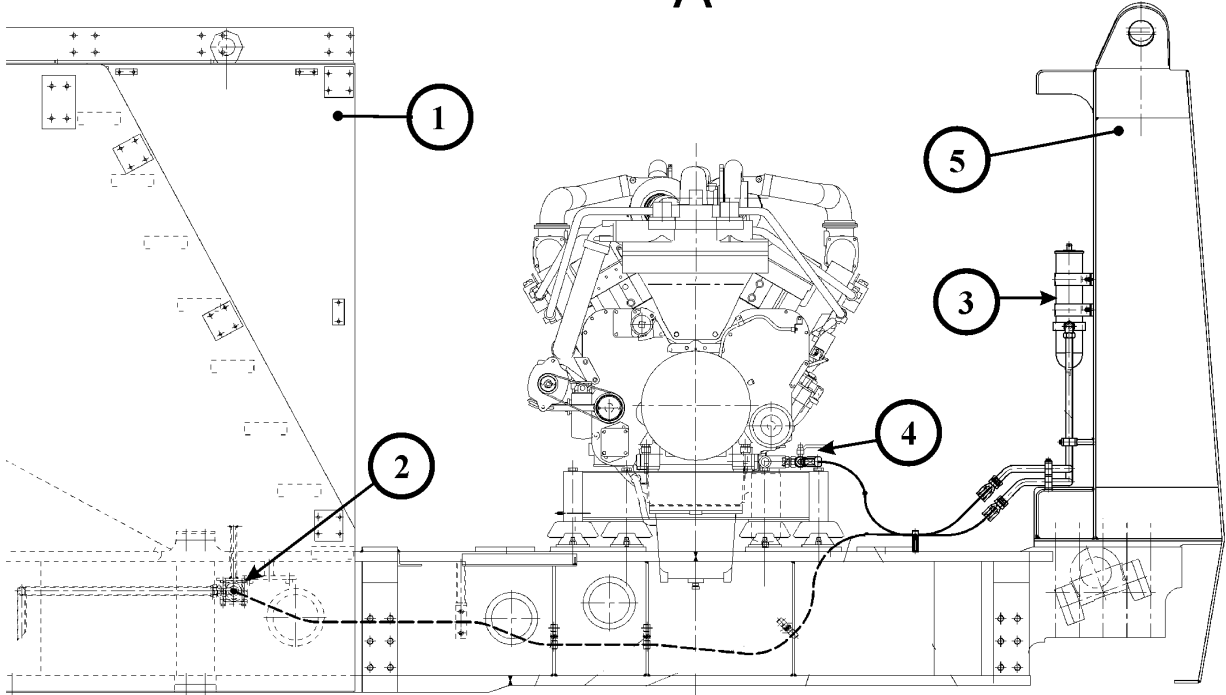
Material build up on guide wheels, drive sprockets and tracks can lead to over tensioning of the tracks, resulting in severe damage to these components.

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

NOTICE

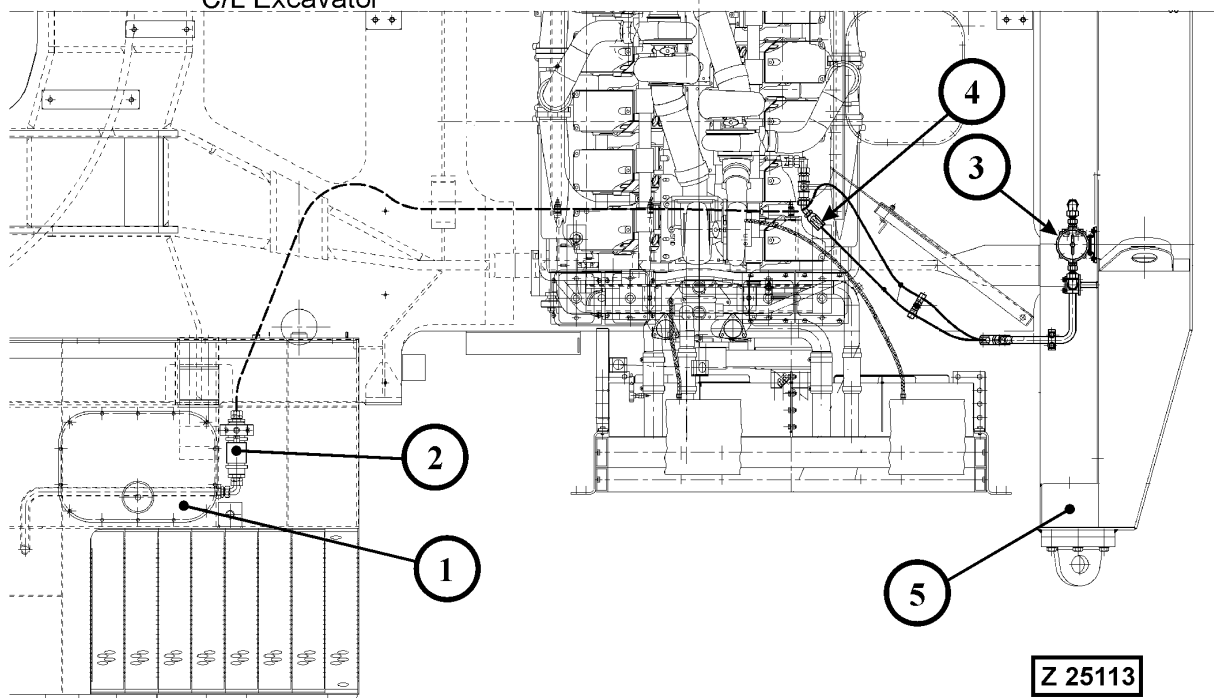
Use a suitable cleaning device for removing dirt, mud and debris from the tracks, rollers, guide wheels and sprockets.

-A-



-B-

C/L Excavator



4.8.5 FUEL SYSTEM WATER SEPARATOR - DRAIN WATER

Special Equipment

Legend for illustration Z25113

- (A) Front view of the engine
- (B) Top view of engine compartment
- (1) Fuel tank
- (2) Fuel shut-off solenoid valve. This solenoid valve cuts-off fuel supply to the engine when the stop switch on the instrument panel is actuated.
- (3) Water separator filter
- (4) Fuel shut off cock
- (5) Counterweight

Draining Water

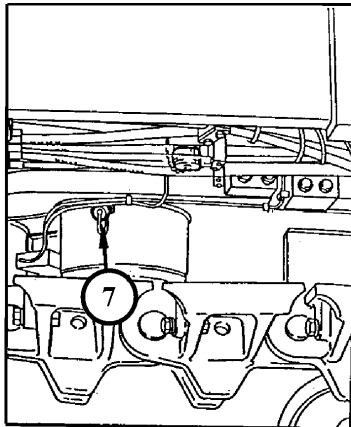
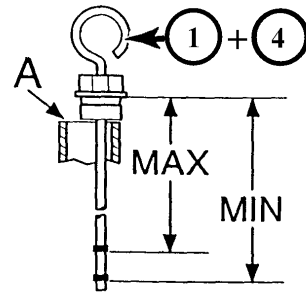
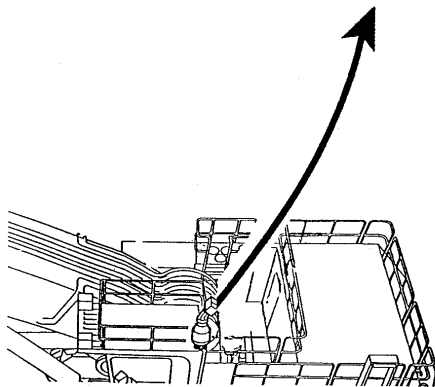
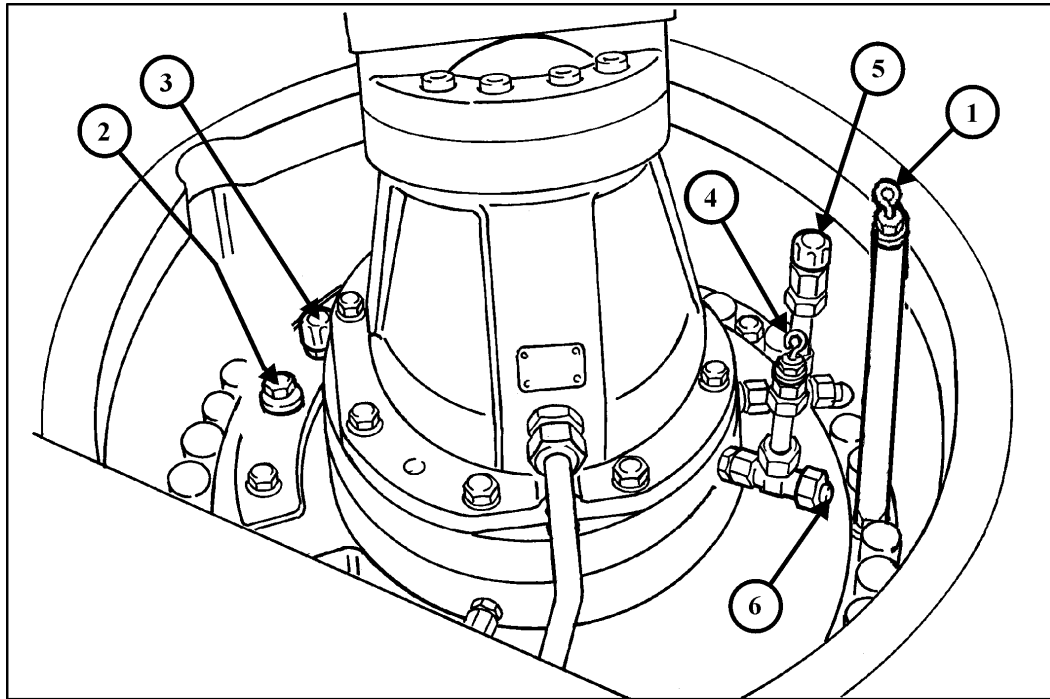
Frequency of water draining is determined by the contamination of the fuel. Inspect or drain the collection bowl of water daily or as necessary. The collection bowl must be drained before contaminants reach the top of the turbine.

Refer to separate Instruction booklet -Fuel Filter/Water Separator- filed in volume 2 binder for draining procedure.

Filter Element Replacement

Frequency of element replacement is determined by the contamination of the fuel. Replace the elements after every 500 operating hours, if power loss is noticed or annually, which ever comes first. Refer to separate Instruction booklet -Fuel Filter/Water Separator- filed in volume 2 binder for replacement procedure.

4.9 EVERY 50 OPERATING HOURS OR WEEKLY



Z 22913

4.9.1 SWING GEAR AND MOTOR ADAPTER HOUSING - CHECK OIL LEVEL

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 the swing gear housing to find out the manufacturer of the swing gear.

Swing gear manufactured by "L&S"

Legend for illustration Z22913

Swing gear

- (A) Position of oil level gauge for checking the oil levels
- (1) Oil level gauge
- (2) Oil filler plug
- (3) Breather filter
- (7) Drain coupling or evacuation nozzle for Wiggins system

Motor Adapter Housing

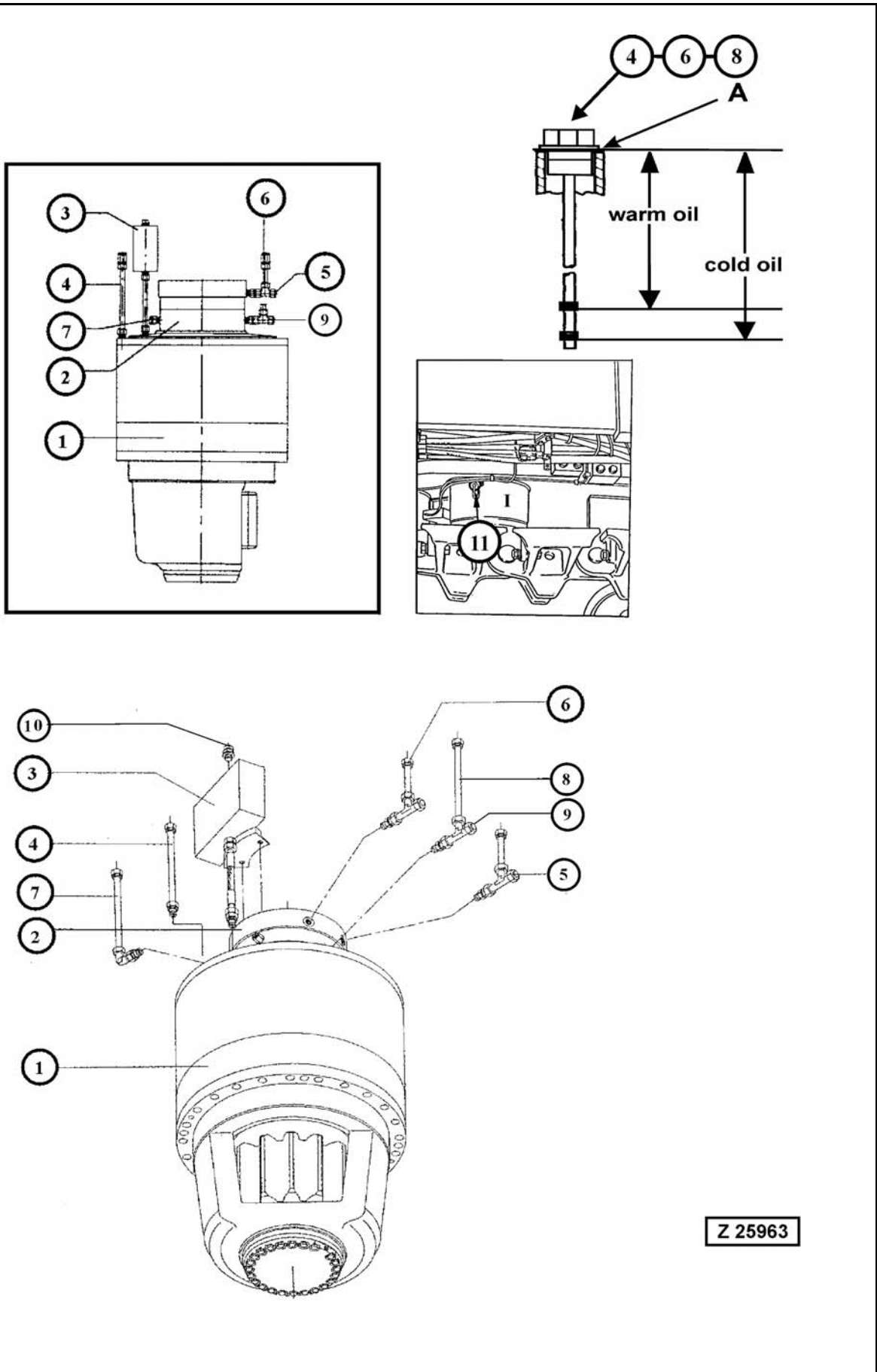
- (4) Oil level gauge and filler opening. This opening can also be used for connecting a suction pump when changing the oil.
- (5) Breather filter
- (6) Oil drain plug

CHECK SWING GEAR OIL LEVEL

Remove oil level gauge (1), illustration Z22913 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.



Swing Gear manufactured by "Siebenhaar"

Legend for illustration Z 25963

- (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 and screw it 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 upper mark on gauge (8) indicates the correct oil level with the oil hot. The lower mark indicates the correct oil level with the oil cold.

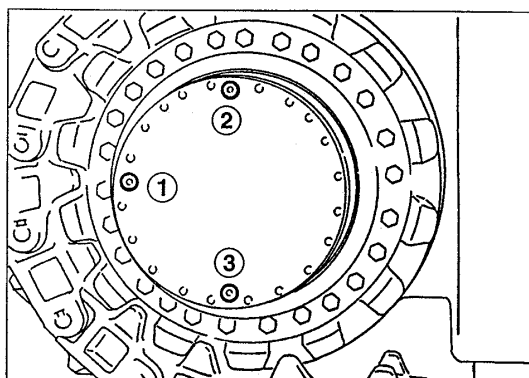
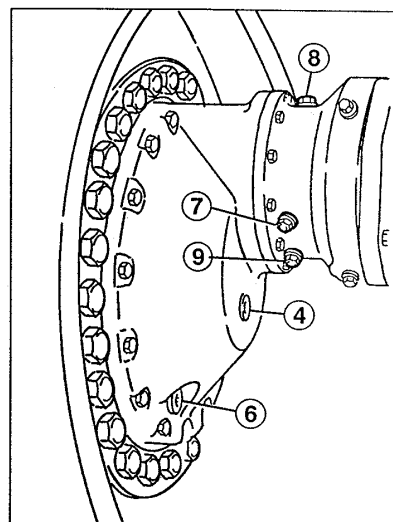
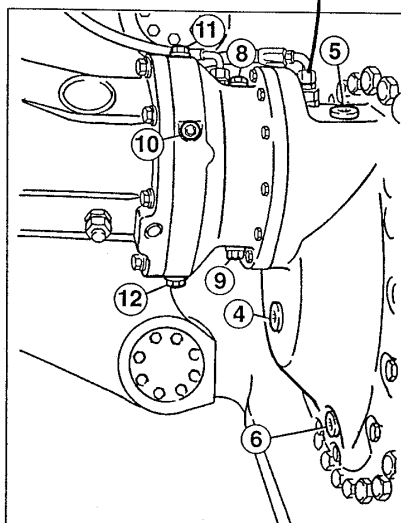
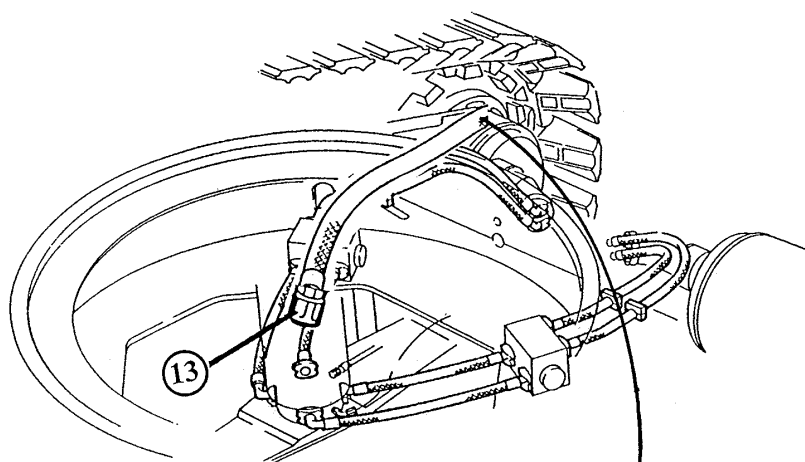
If necessary add engine oil SAE 10 or hydraulic oil HLP 32 through filler opening.
Remove breather filter from pipe (7). Blow out with compressed air from inside to outside and reinstall.

CHECK MOTOR ADAPTER HOUSING OIL LEVEL

Remove oil level gauge (6) and wipe it clean. Insert the gauge and screw it 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.

NOTICE

Swing gear, Brake- and Motor adapter housings have to be filled with different types of oil. Refer to page 245 for the correct oil specifications.



(Z 20836)

4.9.2 TRAVEL GEARS, BRAKE HOUSINGS AND MOTOR ADAPTER HOUSINGS - CHECK OIL LEVELS

- Planetary Gear Box
- Spur Gear Box
- Brake Housing
- Motor Adapter Housing

Legend for illustration Z20836

Planetary gear box:

- (1) Oil level plug
- (2) Oil filler plug
- (3) Drain plug
- (13) Breather filter, the breather filter is located inside the center frame.

Spur gear box:

- (4) Oil level plug
- (5) Oil filler plug
- (6) Oil drain plug

Brake housing:

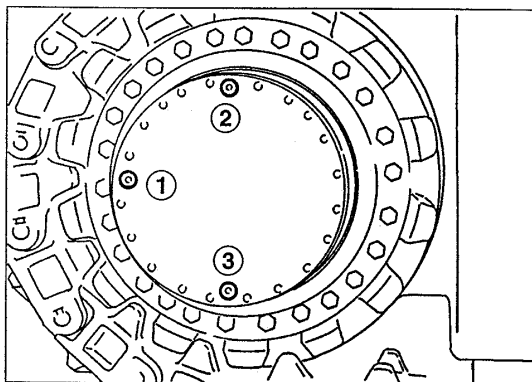
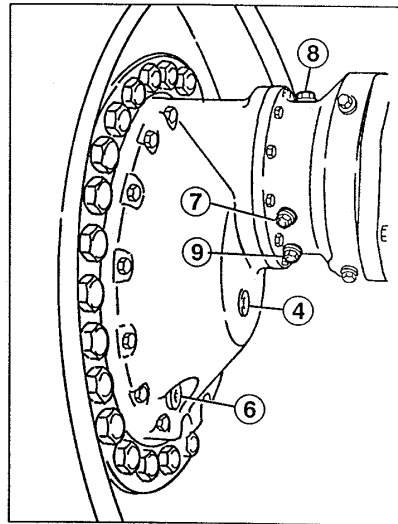
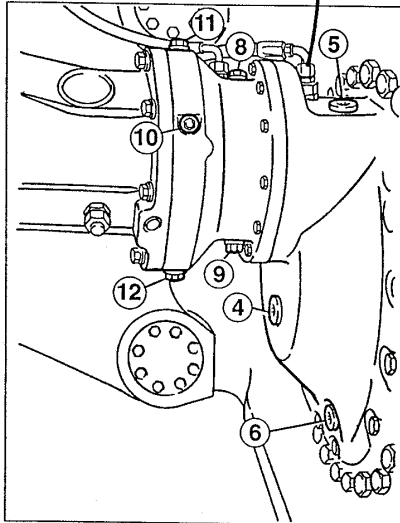
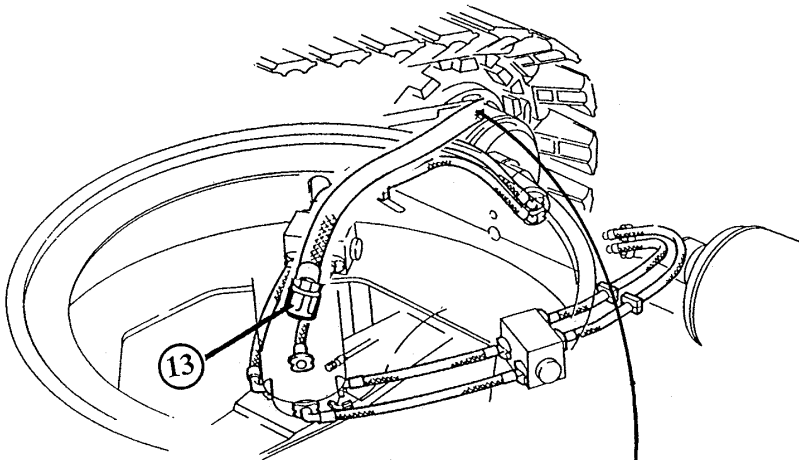
- (7) Oil level plug
- (8) Oil filler plug
- (9) Oil drain plug

Motor adapter housing:

- (10) Oil level plug
- (11) Connector for breather filter line, the breather filter is located inside the center frame. The port of connector (11) is also used as oil filler opening.
- (12) Oil drain plug

PLANETARY GEAR BOX - CHECK OIL LEVEL

Move the Excavator so, that the planetary gear box is in a position as shown in illustration (Z20836). The filler plug (2) is in 12 o'clock position and the level plug (1) is above the center line of the gear box. Remove plug (1). The oil level should be at lower edge of opening (1). If necessary add oil through filler opening (2). Insert both plugs (1 and 2) and tighten securely.



(Z 20836)

SPUR GEAR BOX - CHECK OIL LEVEL

Check oil level by removing oil level plug (4).

Oil level should be at lower edge of opening (4), if necessary add oil through filler opening (5). Install level and filler plug (4 and 5). Check breather filter (13) for restriction. If necessary, remove breather filter, blow out with compressed air from inside to outside and reinstall.

BRAKE HOUSINGS - CHECK OIL LEVEL

Check oil level by removing oil level plug (7). Oil level should be at lower edge of opening (7). If necessary Add oil through filler openings (8) and install plugs (7) and (8).

MOTOR ADAPTER HOUSING - CHECK OIL LEVEL

Check oil level by removing oil level plug (10).

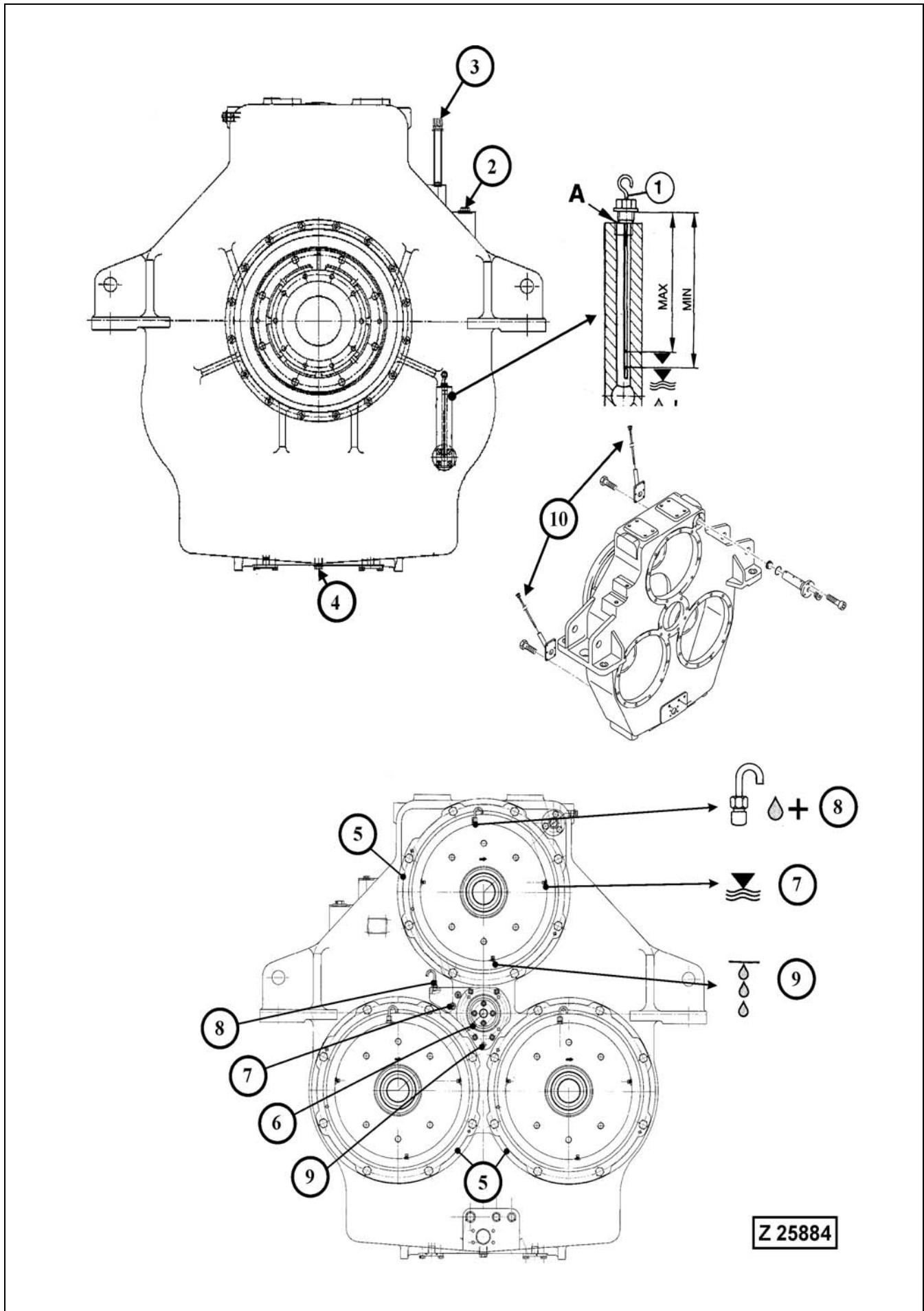
Oil level should be at lower edge of opening (10). If necessary, remove connector (11) for breather filter line and add oil through filler opening. Install level plug (10) and screw in breather filter line connector (11). Check breather filter inside the center frame for restriction. If necessary, remove breather filter, blow out with compressed air from inside to outside and reinstall.

MILEAGE INDICATOR (Special Equipment)

The mileage indicator is fitted to the center bore of the spur gear box.

NOTICE

Travel gears, Brake- and Motor adapter housings have to be filled with different types of oil. Refer to page 245 for the correct oil specifications.



4.9.3 PTO (PUMP DISTRIBUTOR GEAR) - CHECK OIL LEVEL

Legend for illustration Z25884

- (1) Oil level gauge
- (2) Oil filler plug
- (3) Breather filter
- (4) Oil drain plug
- (5) Adapter housings for main hydraulic pumps
- (6) Adapter housing for pilot oil pump
- (7) Oil level plug
- (8) Oil filler plug with breather pipe
- (9) Oil drain plug
- (10) Positions of oil level gauges on PTOs manufactured by **Stiebel**

REMARK

Check PTO oil level just after the engine is stopped and with the oil at operating temperature.

1. Unscrew level gauge (1) and wipe it clean. Insert gauge (1), but DO NOT tighten, see detail (A). Remove level gauge and read the oil level. The oil level should be between the "MIN" and "MAX" mark. If necessary, add oil through filler opening (2) up to the "MAX" mark on gauge (1).

REMARK

If the oil level is above the "MAX" mark, drain the oil down until the oil level is at the "MAX" mark. Too much oil in the pump distributor gear will cause aeration of the oil.

2. Insert gauge (1) and tighten securely. Remove breather filter (3). Blow out with compressed air from inside to outside and reinstall.

Main Hydraulic Pumps - Check Oil Level in Drive Shaft Housings

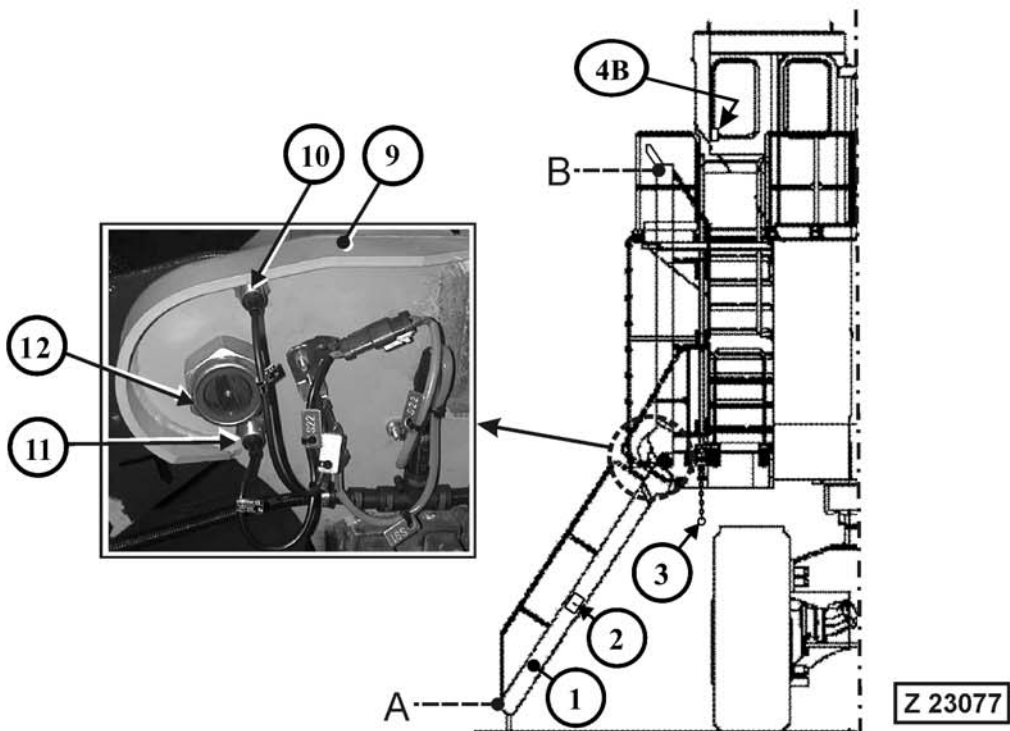
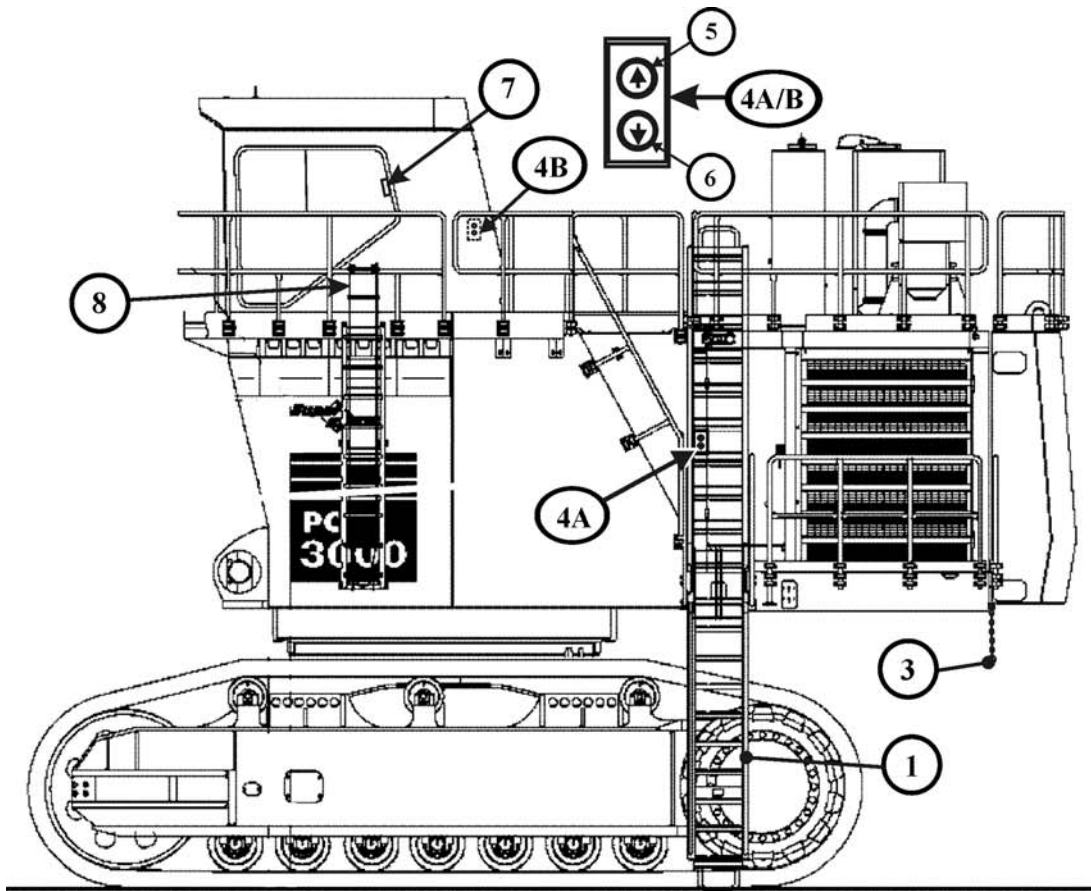
The Oil level should be at the lower edge of level plug opening (7). If necessary remove filler plug with breather pipe (8) and add Gear Oil through the filler opening up to the level opening (7). Re-install plugs (7 and 8) and tighten securely.

Check breather pipe for obstruction. If necessary, blow out with compressed air.

If pump removal becomes necessary, drain the drive shaft housing oil by removing drain plug (9). Be sure to fill the drive shaft housing up to the filler opening (7) after mounting of the pump.

REMARK

If oil starts dripping out at one of the breather pipes (8), the oil seal ring of the respective pump drive shaft must be checked and replaced if necessary.



4.9.4 HYDRAULIC ACCESS LADDER - CHECK SAFETY SENSOR

Legend for illustration Z23077

- (A) Access ladder in lowered position
- (B) Access ladder in upper position (Working position)
- (1) Access ladder
- (2) Light switch for access area lighting
- (3) Pull chain for emergency lowering of the access ladder

⚠ WARNING

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

When the chain (E) is being pulled down with the engine running, the pilot control system is made inoperative, preventing further movements of the Shovel.

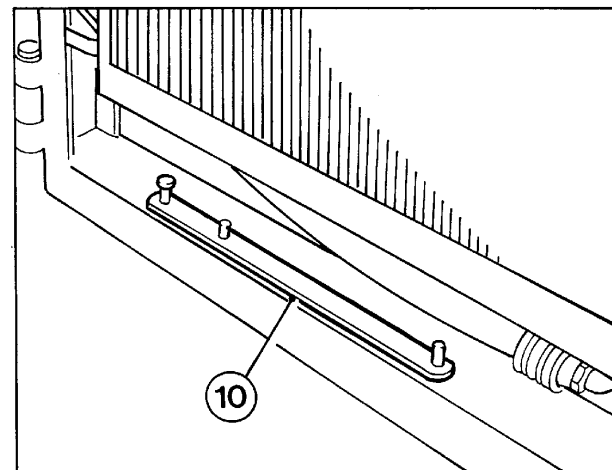
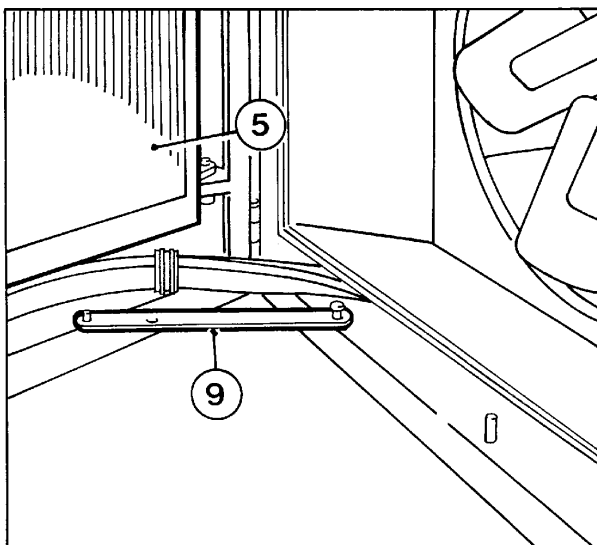
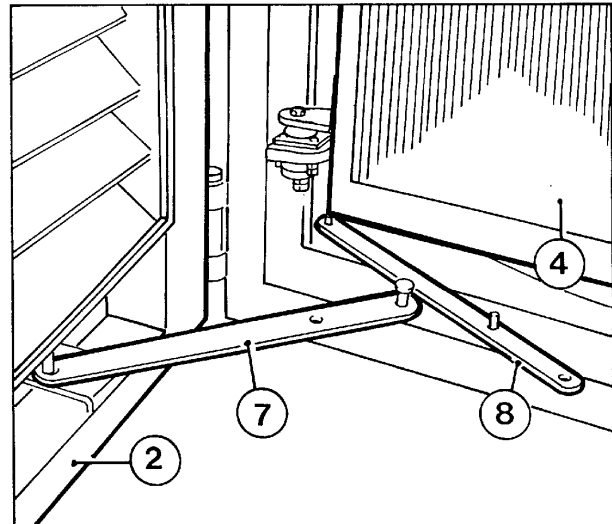
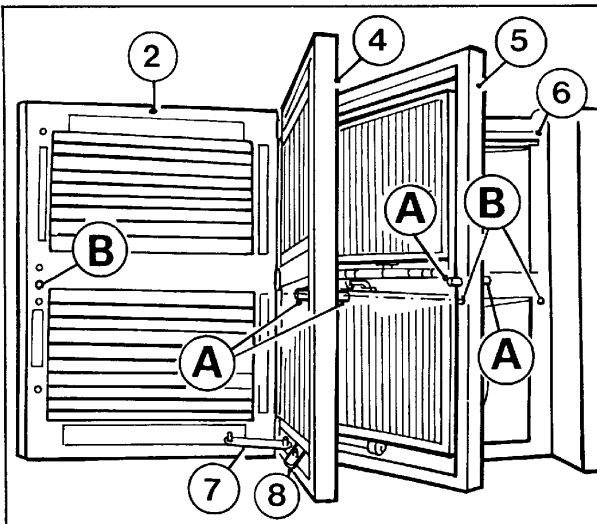
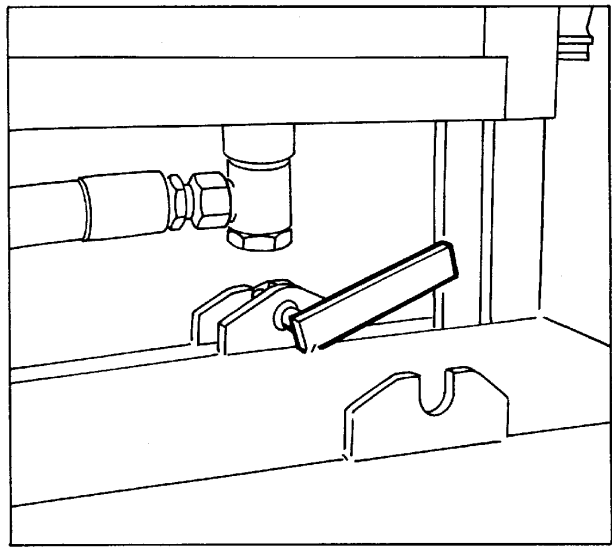
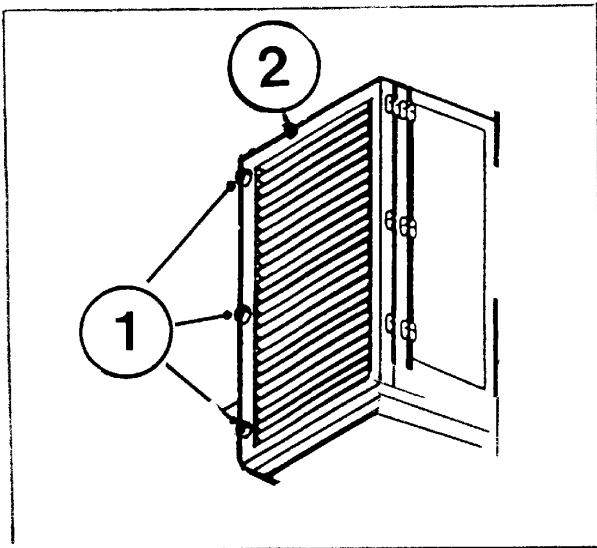
- (4A) Control switch for access ladder at machinery house door
- (4B) Control switch for access ladder at operator's cab
- (5) Push button for lifting the ladder
- (6) Push button for lowering the ladder
- (7) Sliding window for emergency exit from operator's cab
- (8) Emergency escape ladder
- (9) Ladder pivot bracket
- (10) Monitor and control sensor (S91). 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.
- (11) Safety sensor (S22), 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.
- (12) Lock nut for ladder pivot ball bearing

Check Safety Sensor (11)

With the ladder completely lowered (position A) start the engine.
Move the bucket control lever to ROLL BACK position.
The bucket must NOT start to move.
If the bucket starts to move, the safety sensor and/or its circuit is defective.

⚠ 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 24056

4.9.5 HYDRAULIC OIL COOLERS - INSPECT AND CLEAN IF NECESSARY

See illustration Z24056

⚠ WARNING

- Provide adequate working platform for safe access to the hydraulic oil coolers.
- Before removing mounting bolts (1) of the hydraulic oil cooler door (2) check to make sure that all door hinges are in good condition and properly fastened on their carrier frames. If cracks are found at the welded joints of the hinges, DO NOT remove mounting bolts (1) otherwise the cooler door may become detached and fall off. Danger of accidents. Have the damage repaired as soon as possible.

⚠ CAUTION

Never clean the oil coolers with the engine running or with the cooler fans still rotating.

1. Loosen mounting bolts (1). Open door (2)

REMARK

Details (A and B) show LH hinge mounted oil coolers. The description below applies also to RH mounted oil coolers.

2. Swing out oil coolers (4 and 5) and secure door (2) and oil coolers (4 and 5) with locking bars (7, 8 and 9).
3. Clean the oil coolers with compressed air. Direct the air flow from inside to outside.

⚠ CAUTION

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

4. After cleaning, bring back the oil coolers to their home position.

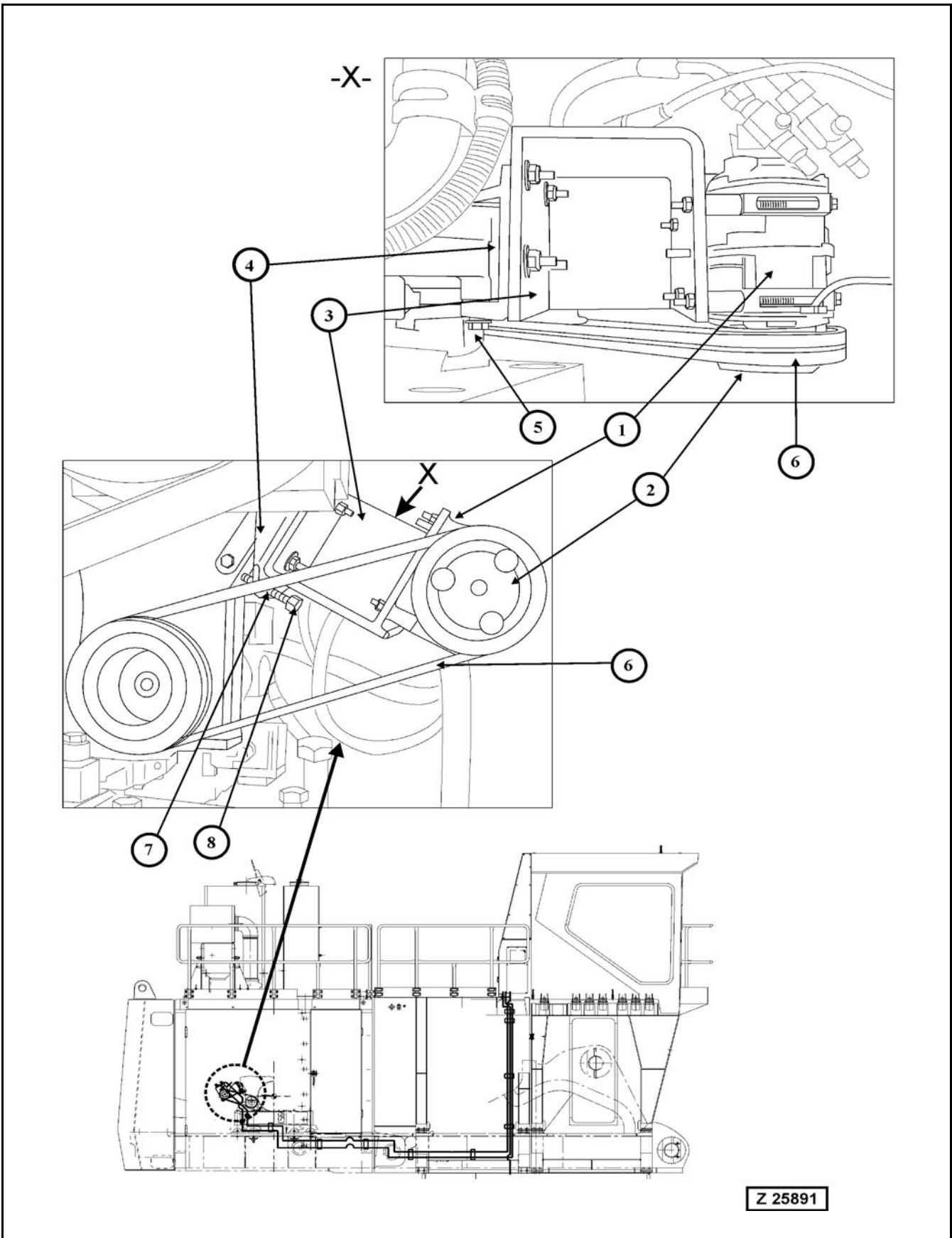
PROCEED AS FOLLOWS

- Disengage locking bars (7, 8, 9). Put them in storage position (10).
- Swing back inner cooler (5). Take care guide pin (A) fits into hole (B) of main frame (6).
- Swing back outer cooler (4); observe (A - B).
- Close door (2); observe (B - A). Install mounting bolts (1) and tighten securely.

NOTICE

When cleaning the oil coolers, also inspect laying and fastening of the hydraulic oil lines.

4.10 EVERY 250 OPERATING HOURS OR MONTHLY



4.10.1 AIR CONDITIONING COMPRESSOR - CHECK DRIVE BELT TENSION

WARNING

Be sure to set the maintenance safety switch to 0 position before to start the checking procedure. Refer to page 133 for the location of the maintenance safety switch. In the 0 position the engine 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.

REMARK

Open the radiator fan guard door as shown on page 317.

Legend for illustration Z25891

- (1) Refrigerant compressor
- (2) Electromagnetic clutch
- (3) Compressor carrier
- (4) Swivel bracket
- (5) Pivot bolt, loosen for adjusting belt tension
- (6) Drive belts
- (7) Lock nut
- (8) Adjusting bolt for belt tension

Check tension of each belt

The tension is correct if the belt can be depressed with 110 N (25 lb.) force approximately 15 to 20 mm midway between the belt pulleys.

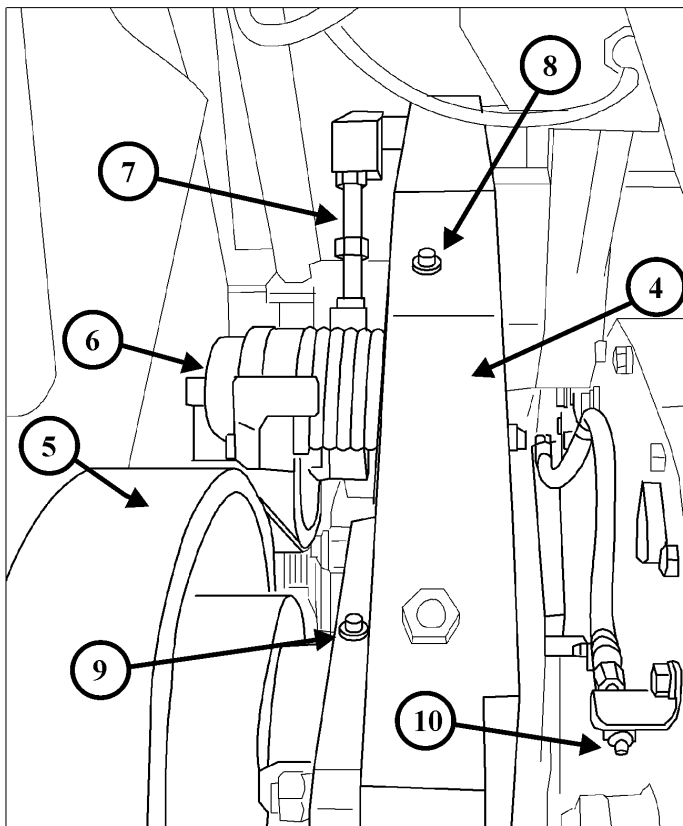
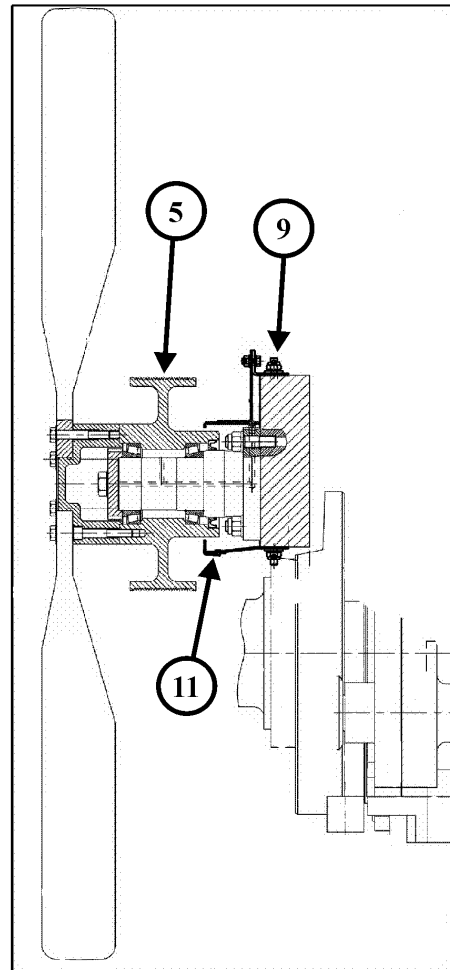
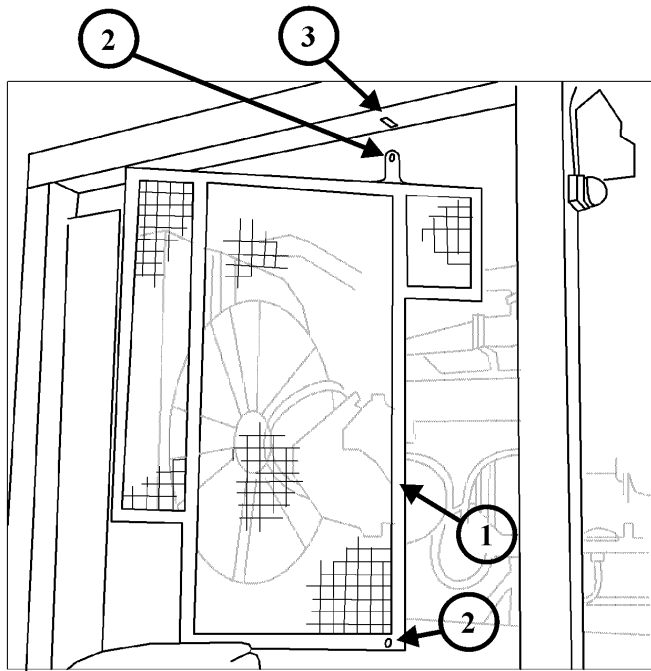
Excessive belt tension causes undue wear on the bearings. After a new belt has been in use for approximately 20 minutes, check the tension and adjust again if necessary.

NOTICE

Always replace the belts in complete sets.

Adjust belt tension

1. Loosen pivot bolt (5)
2. Loosen lock nut (7)
3. Turn adjusting bolt (8) until correct belt deflection is obtained.
Tighten lock nut (7)
4. Tighten pivot bolt (5) and check the belt adjustment.
5. Close the radiator fan guard door, see page 317 for details.



Z 25518

4.10.2 RADIATOR FAN BELT AND AUTOMATIC BELT TENSIONER - MAINTENANCE CHECK

WARNING

Before starting the maintenance check, set the maintenance safety switch to 0. Refer to page 131 for location. In the 0 position the engine cannot be started. Secure by inserting a padlock into the holes of the switch. Up to three padlocks can be attached.

Legend for illustration Z25518

- (1) Radiator fan guard door
- (2) Nuts
- (3) Stud for fastening the guard door in open position
- (4) Fan hub carrier
- (5) Fan belt
- (6) Fan belt tensioner spring
- (7) Control rod (turn buckle) of the fan belt tensioner
- (8) Grease fitting for lubrication of the belt tensioner spring
- (9) Grease fitting for lubrication of the fan hub
- (10) Grease fitting for lubrication of the engine support bracket
- (11) Sump for collecting excess lubricant

Fan Belt Inspection

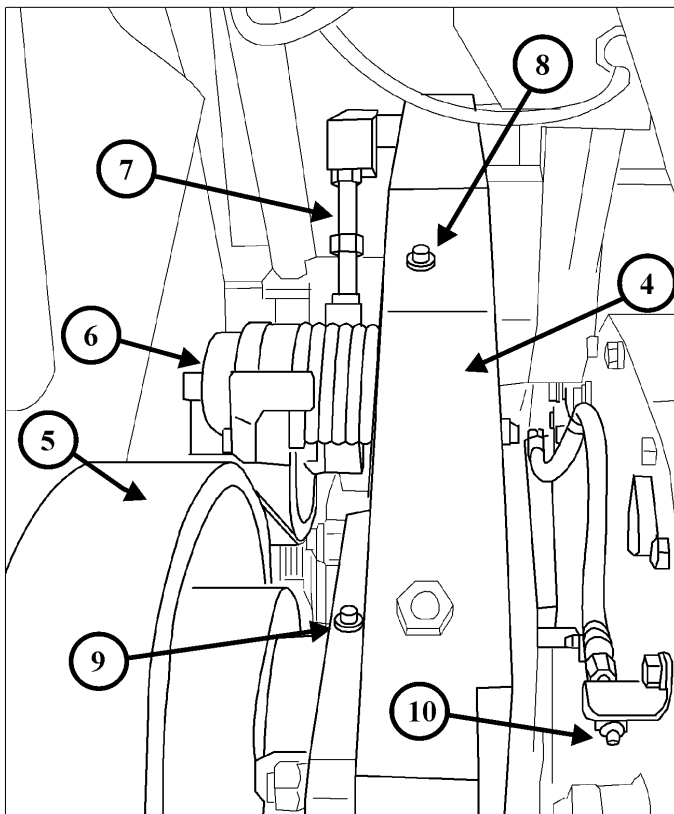
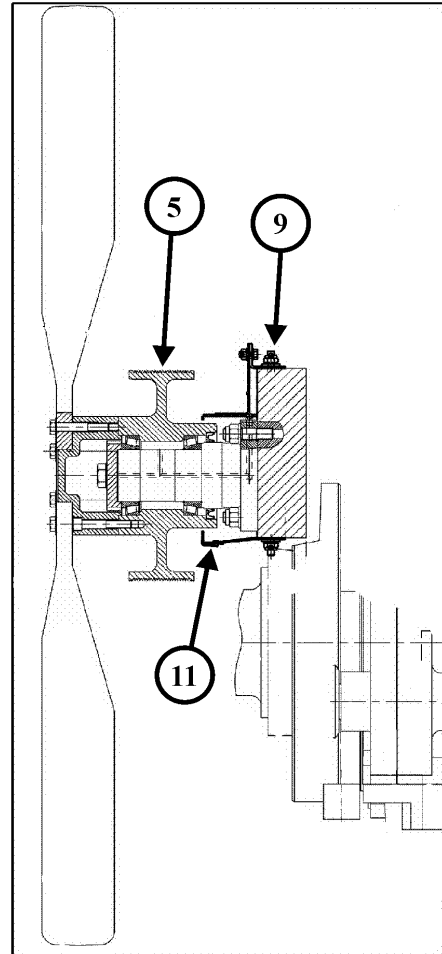
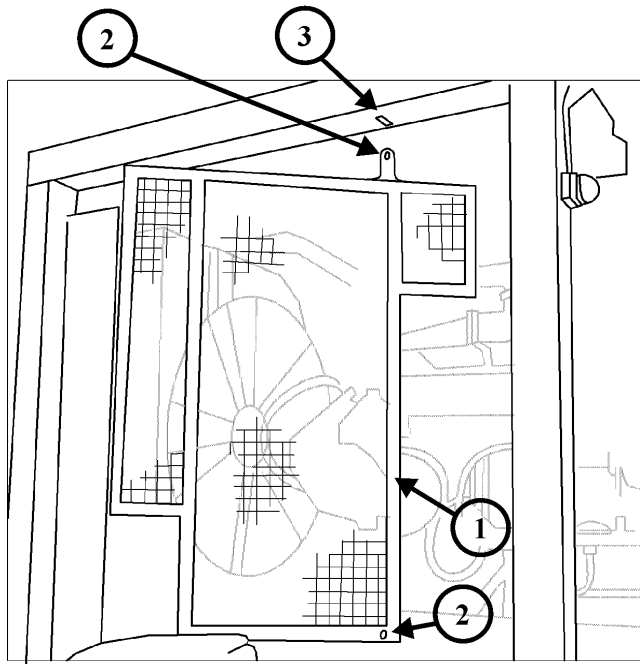
1. Remove nuts (2) and open the fan guard door (1) until the upper hole (2) engages on stud (3). Fasten the door in this position by attaching one of the removed nuts to stud (3).
2. Check the Poly-Vee belt (5) for intersecting cracks. Longitudinal (direction of belt length) cracks that intersect with transverse cracks are not acceptable. Replace the belt if it is frayed or has pieces of material missing. Refer to the Engine Operation and Maintenance Manual filed in volume 2 binder for replacement procedure.

Fan Bearing Lubrication

The bearings of fan hub can be lubricated via grease fitting (9). Lubrication should only be done, if there are signs of grease loss. Before removing the sump (11), clear the area of excess or overflowing grease. Apply grease gun to the fitting (9) and fill the bearing with one or two strokes of the grease gun.

REMARK

DO NOT overfill with grease otherwise the seal ring of the hub could be damaged.



Z 25518

RADIATOR FAN BELT AND AUTOMATIC BELT TENSIONER - MAINTENANCE CHECK (continued)

Automatic Belt Tensioner Inspection

Check belt tensioner pulley, spring assembly (6) and control rod (7) illustration (Z25518) for good condition and alignment. If a pulley is worn or damaged, it should be replaced.

⚠ WARNING

The fan belt tensioner pulley is under tension. Do not allow hands to get between the pulley, fan or the fan hub. Failure to do so can result in personal injury.

When replacing belt and pulleys, pulley alignment must be checked under belt tensioned condition.

A misalignment that can be detected by the naked eye is detrimental to belt performance. Refer to the Engine Operation and Maintenance Manual filed in volume 2 binder for adjustment, repair and replacement procedures.

Lubrication of Tensioner Spring Assembly and Engine Support Bracket

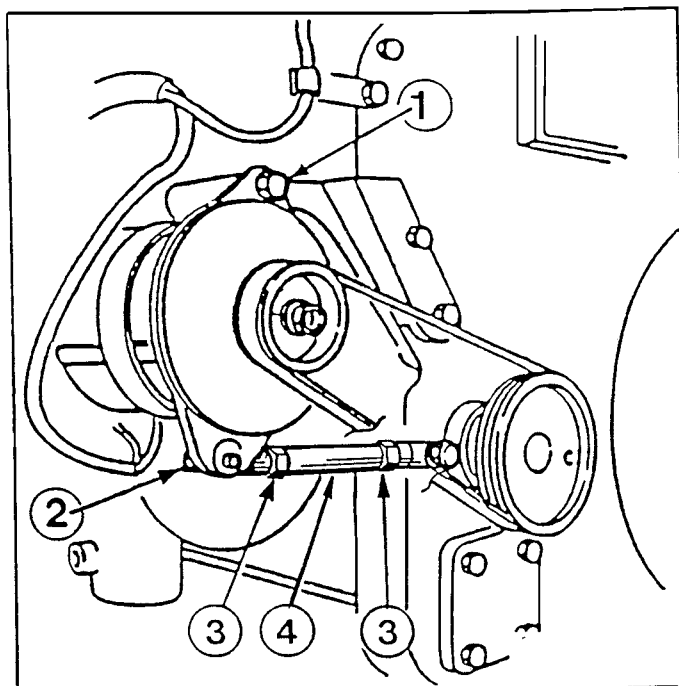
Lubricate the spring assy (6) via grease fitting (8) and the engine support bracket via grease fitting (10) after every 1500 operating hours or once a year whichever comes first.

See Engine Operation and Maintenance Manual filed in volume 2 binder for lubrication procedure and grease specification.

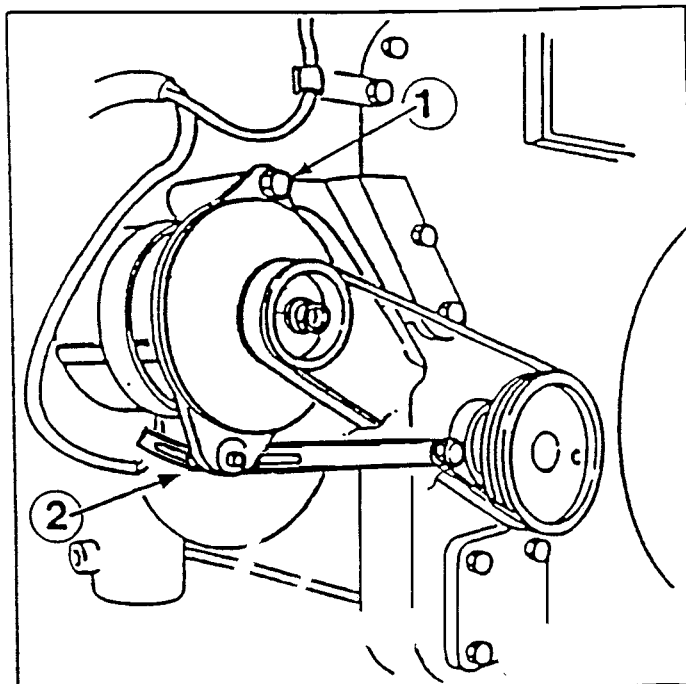
NOTICE

Be sure to close the fan guard door (1) after finishing the maintenance check. Secure the closed door with the two nuts (2).

Version A



Version B



Z 25103

4.10.3 GENERATOR - CHECK BELT TENSION

REMARK

For the correct belt tension and belt tension gauge refer to the **Drive Belt Tension Chart** in the Engine Operation and Maintenance Manual, Section V, page 19.

The engine can be equipped with one of the two versions of belt tensioning systems.

Version A with turn buckle, illust. Z 25103**Adjustment:**

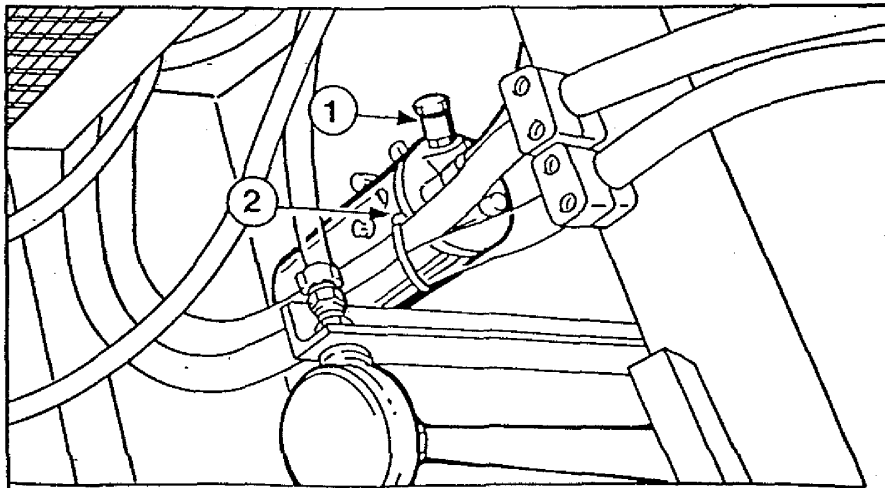
1. Remove generator belt guard.
2. Loosen bolts (1 and 2).
3. Loosen lock nuts (3) and adjust belt tension with turn buckle (4).
4. Tighten lock nuts (3) and bolts (2 and 1) in this sequence.
5. Install generator belt guard.

Version B with slotted bar, illust. Z 25103**Adjustment:**

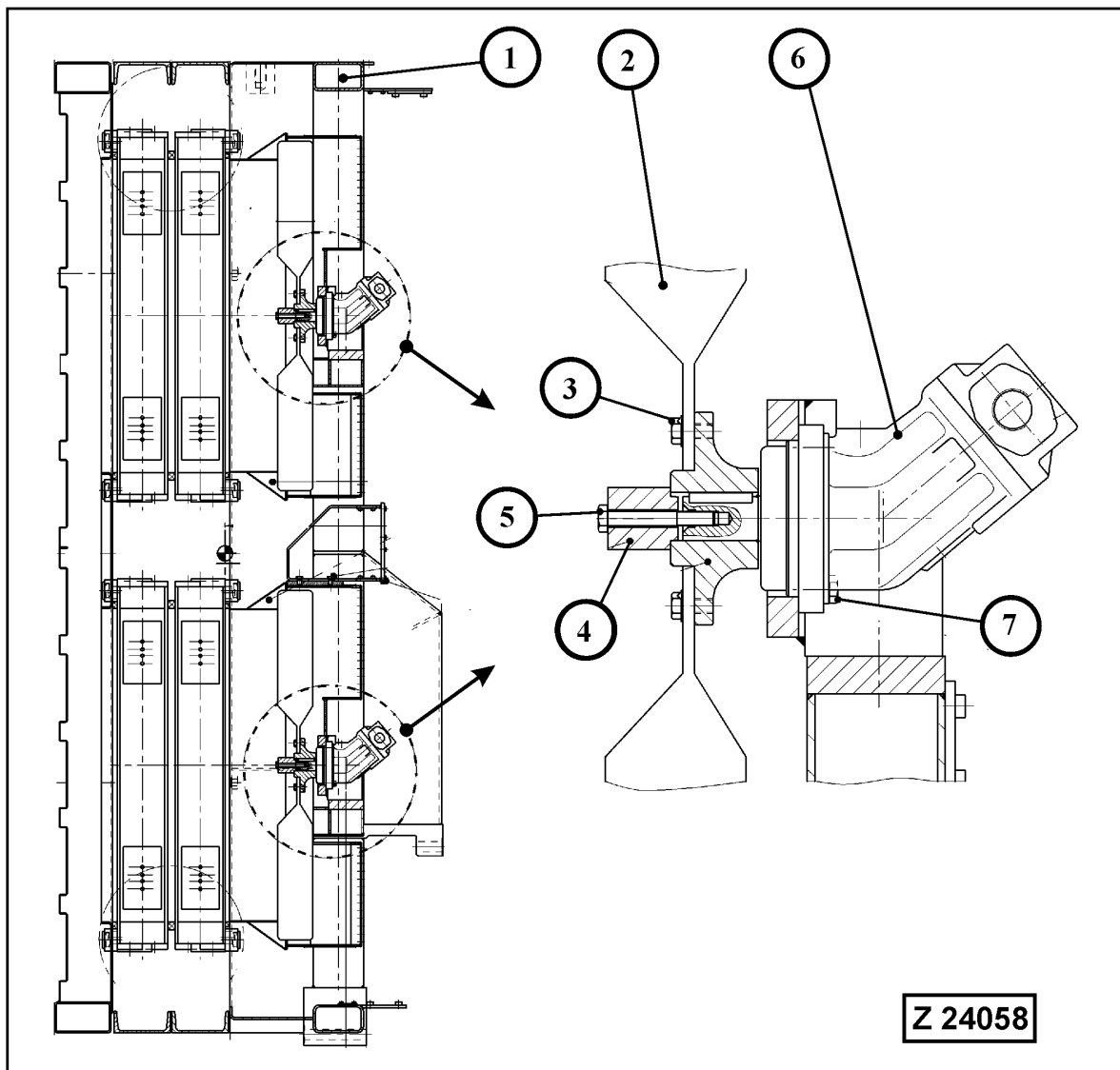
1. Remove generator belt guard.
2. Loosen bolts (1 and 2).
3. Pull the generator until the required belt tension is obtained and tighten bolts (2 and 1) in this sequence.
4. Install generator belt guard.

NOTICE

Check the belt tension after 10 minutes running time and readjust if necessary.



Z 10689



Z 24058

4.10.4 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).

NOTICE

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.

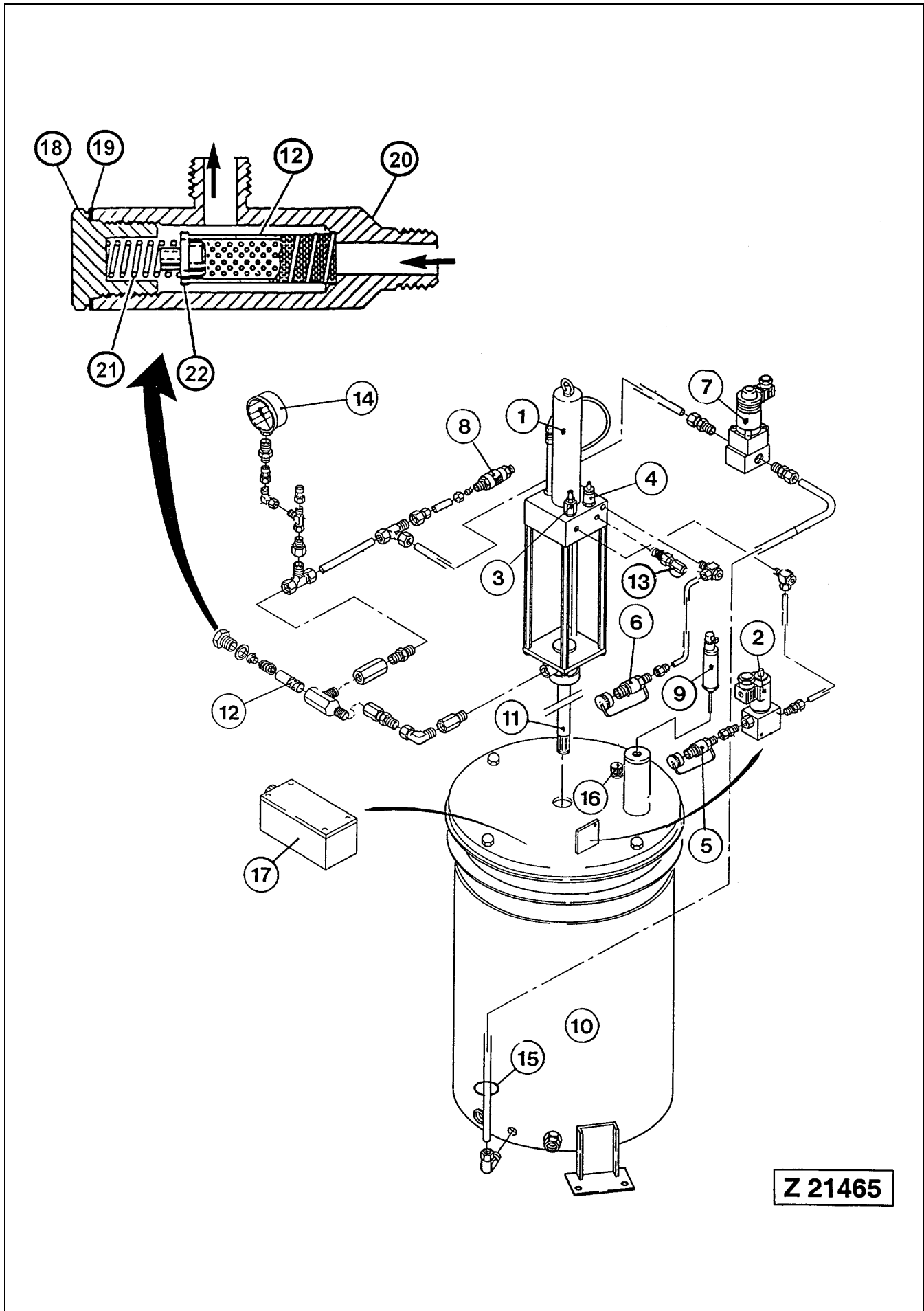
4.10.5 HYDRAULIC OIL COOLER FAN - CHECK CONDITION AND FASTENING

Legend for illustration Z24058

- (1) Oil cooler carrier
- (2) Cooler fan
- (3) Mounting bolt
- (4) Thrust block
- (5) Mounting bolt
- (6) Hydraulic motor
- (7) Mounting bolt

- Check condition of cooler fan (2). Make sure all bolts (3) are in place and correctly tightened.
- Check hub mounting bolt (5) for correct tightening torque.
- Check hydraulic motor (6) for leakage. Make sure all bolts (7) are in place and correctly tightened.

Refer to Standard Torque List on page 249 for bolt tightening torques.



Z 21465

4.10.6 AUTOMATIC LUBRICATION SYSTEMS - CLEAN IN-LINE GREASE FILTER AND CHECK BREATHER FILTER

Legend for illustration Z 21465

- (1) Grease pump drive (Hydraulic cylinder)
- (2) Solenoid valve (Oil pressure supply)
- (3) Flow control valve
- (4) Pressure reducing valve
- (5) Hydraulic oil supply line (Pilot pressure)
- (6) Hydraulic oil return line
- (7) Vent valve (Solenoid valve, de-energized open to barrel)
- (8) Grease supply line to injectors
- (9) Lubricant level indication
- (10) Grease barrel
- (11) Pump mechanism
- (12) Grease filter element
- (13) Hydraulic pressure test plug (Operating pressure)
- (14) Grease pressure gauge (Operating pressure)
- (15) Vent line to barrel
- (16) Breather
- (17) Electrical terminal box

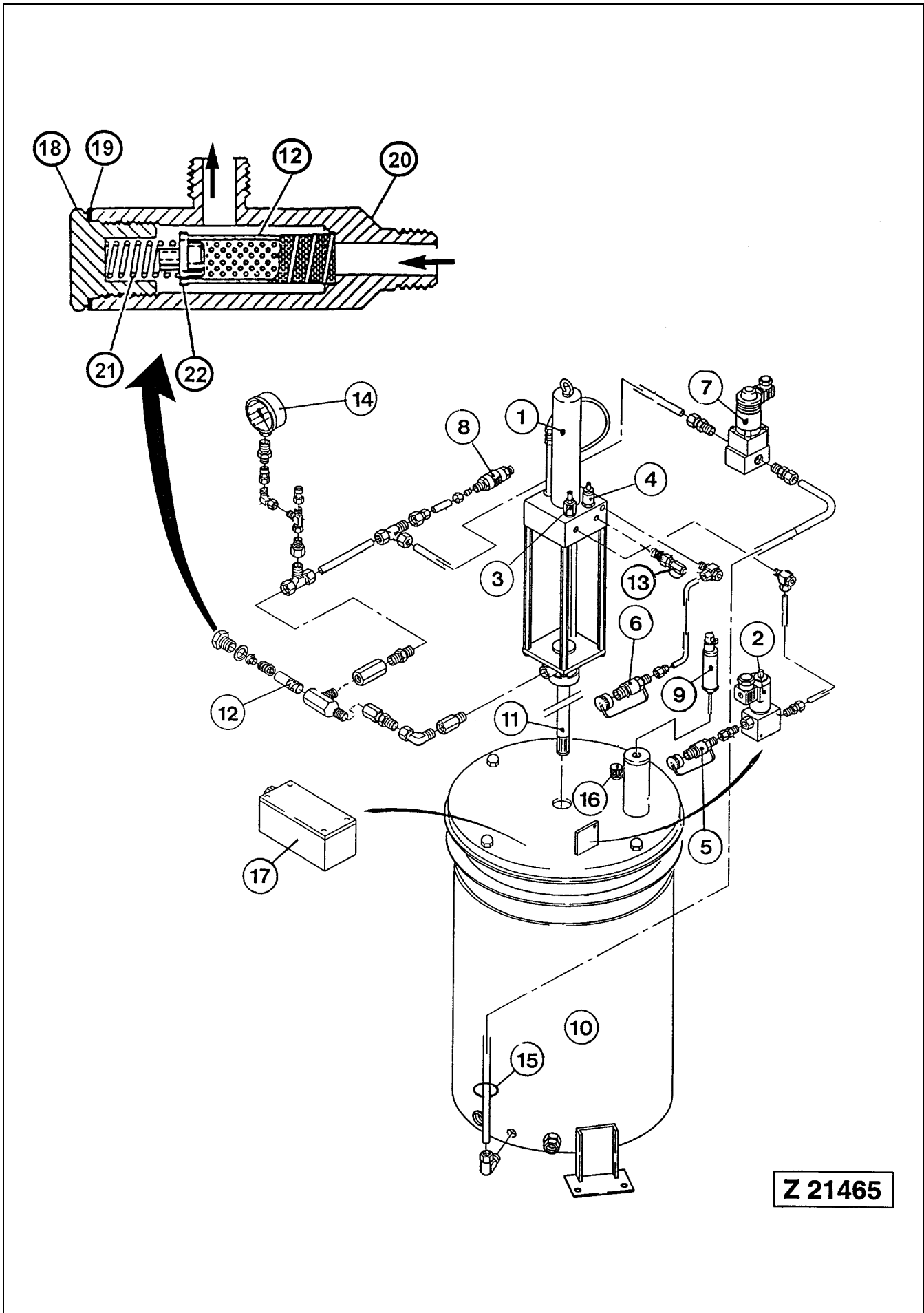
Components of the In-Line-Grease-Filter:

- (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 as follows:

1. Unscrew plug (18), illustration Z 21465, using 36 mm width wrench and remove packing ring (19).
2. Take out spring (21), spring guide (22) and element (12).
3. Clean all parts and inspect for damage. Replace as necessary.
4. Assemble all parts according to the illustration. Make sure all sealing surfaces are clean. Take care for proper position of spring guide (22).
5. Install plug screw (18) with new packing ring (19) and tighten with a wrench.

Check breather filter (16)

Check condition and fastening of breather filter (16). 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 tightened before lowering the cover onto the container.

4.10.7 CAB AIR CLEANER - CLEAN OR REPLACE FILTER ELEMENT

Legend for illustration Z25486

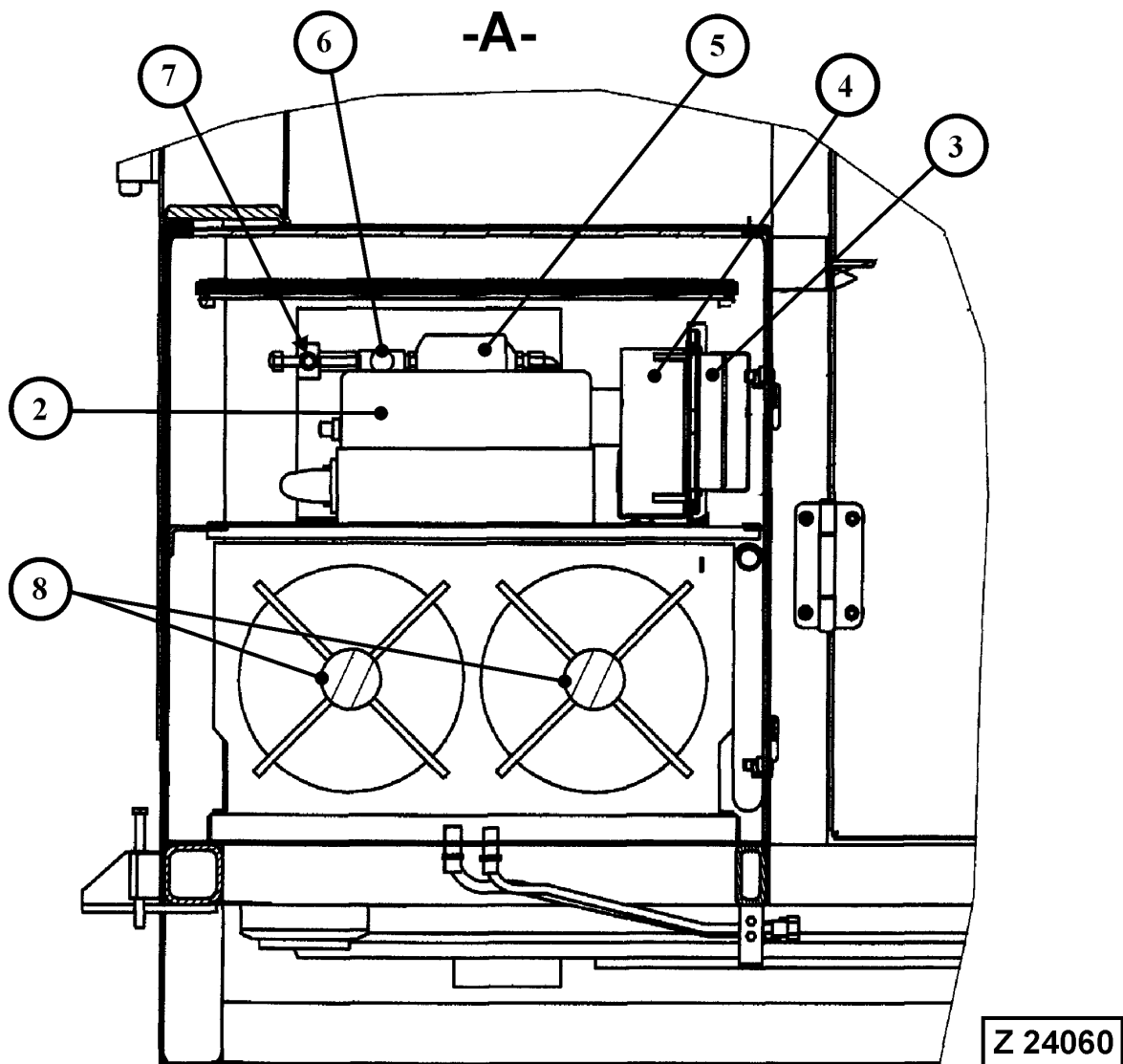
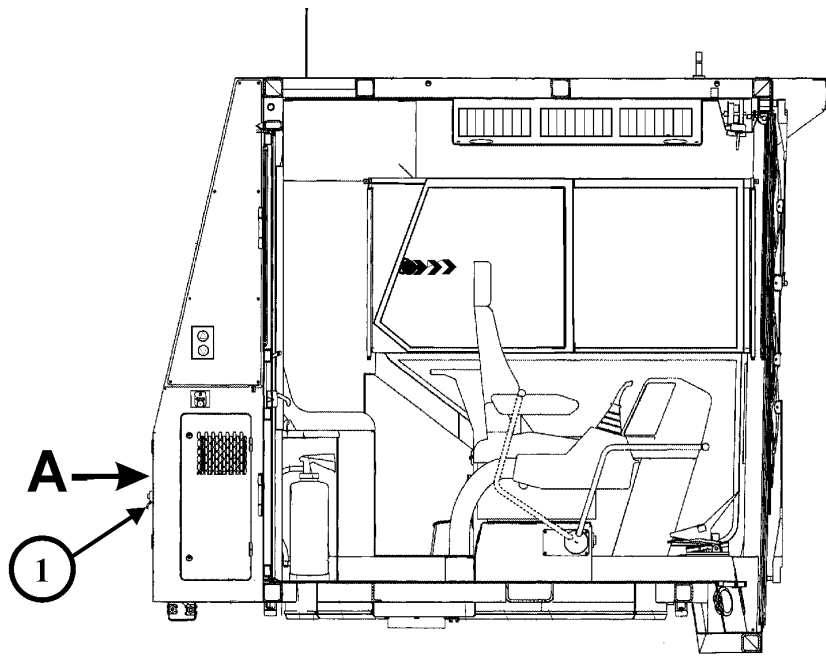
- (1) Access door to cab air cleaner
- (2) Air cleaner housing
- (3) Filter element
- (4) Carrier
- (5) Seal ring
- (6) Cab blower
- (6) Blower housing
- (7) Air conditioning condenser
- (8) Access door to the water tank of the windshield washer system and to the dryer cartridge of the air conditioning
- (9) Cover grid for the air conditioner filter mat
- (10) Air conditioner filter mat
- (11) Condensor blower for air conditioning

Clean and inspect filter element (3) as follows:

1. Open door (1).
2. Remove air cleaner housing (2).
3. Remove and inspect element (3). If any rupture, holes or damaged gaskets are discovered replace the element.
4. If the element is usable clean with compressed air from inside to outside and re-install.
5. Inspect seal ring (5) and replace if necessary.
6. Check blower (6) for correct fastening and tightness.

Clean and inspect filter element (10) as follows:

1. Unscrew cover grid (9).
2. Remove and inspect filter mat (10). If any rupture, holes or damaged is discovered replace the element.
3. If the element is usable, clean and re-install.



4.10.8 WINDSHIELD WASHER RESERVOIR - CHECK FLUID LEVEL

Legend for illustration Z24060

- (1) Access door to the water reservoir of the windshield washer system and to the dryer cartridge of the air conditioning
 - (2) Water reservoir for windshield washer
 - (3) Cab air filter
 - (4) Cab blower
 - (5) Dryer cartridge of the air conditioning
 - (6) Sight glass for checking refrigerant filling
 - (7) Shut-off valve for dryer cartridge replacement
 - (8) Condenser blower
- Fill the water reservoir (2) with clear water, add antifreeze and cleaning agent as necessary. Filling capacity of the reservoir approximately 7 liter. Check washer and wiper system for leakages and carry out a functional test of both systems.

4.10.9 AIR CONDITIONING FOR OPERATOR'S CAB - CHECK REFRIGERANT LEVEL

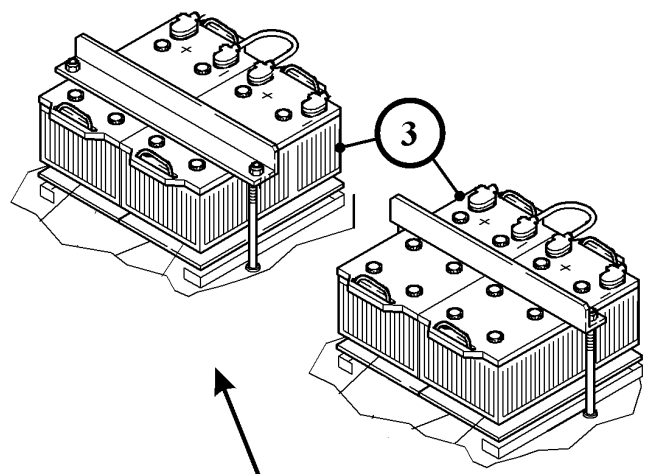
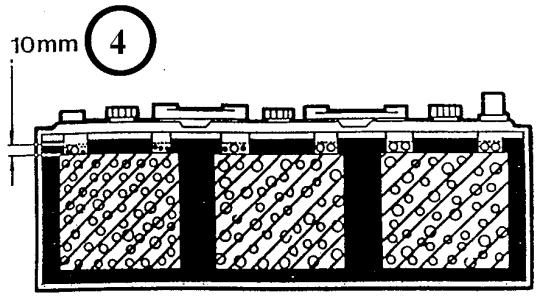
Checking the refrigerant level, illustration Z24060:

- Switch on air conditioning equipment and run at maximum capacity for approx. 5 minutes.
- Observe inspection glass (6). 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 mat of condenser blowers (8).

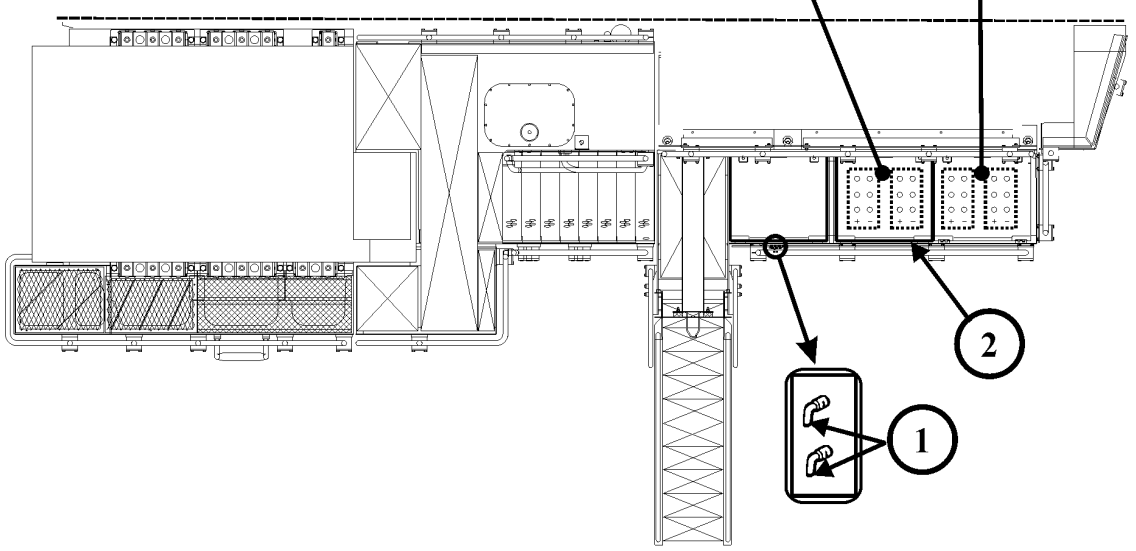
REMARK

Servicing of the air conditioning systems is restricted to workshops especially equipped for this purpose. Refer to the separate booklet "AIR CONDITIONING" in Service Literature Binder – Volume 2 for more information.

4.11 EVERY 500 OPERATING HOURS OR MONTHLY



-A-



Z 24061

4.11.1 BATTERIES - CHECK FLUID LEVEL

See illustration Z24061

A - Top view of access area

⚠ WARNING

- **Batteries give off highly inflammable gas! Never allow sparks or open flame near the batteries!**
 - **Avoid spilling any electrolyte on hands or clothing. Repair or replace all broken wires immediately. All terminals must be clean and securely fastened; never paint connections.**
 - **DO NOT short across or ground any terminals of the batteries.**
-
-

Check electrolyte level:

NOTICE

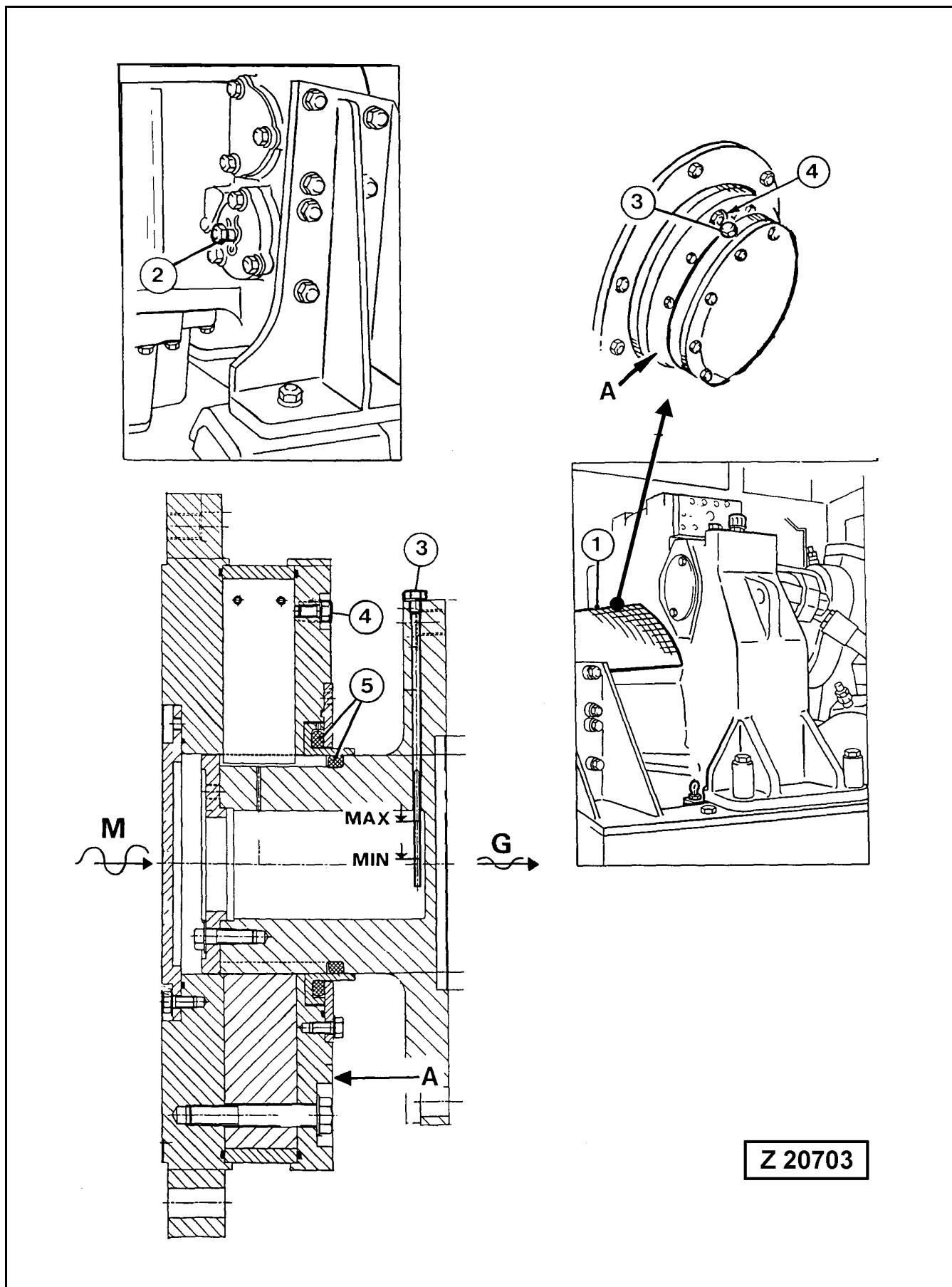
The batteries are located below the walkway floor in two separate boxes. To get access to the batteries remove floor plate fastening bolts and open the hinged floor plates.

Secure the open floor plates against falling down with the safety chains provided.

1. Remove the two battery main switch keys (1).
2. Open floor plates (2).
3. Check electrolyte level (4) of batteries (3).
4. If necessary remove filler and breather caps and top up with clean distilled water.
5. See that contact surfaces of battery terminals are bright. Clean if necessary and apply some vaseline to the terminal posts.

⚠ WARNING

- **Care must be taken that the batteries are not overfilled as the electrolyte will expand and overflow when the temperature rises.**
 - **On removal always disconnect the ground (-) cables first. When re-installing the batteries connect the positive (+) cables first.**
-
-



4.11.2 FLEXIBLE DRIVE COUPLING - CHECK OIL LEVEL

See illustration Z 20703

NOTICE

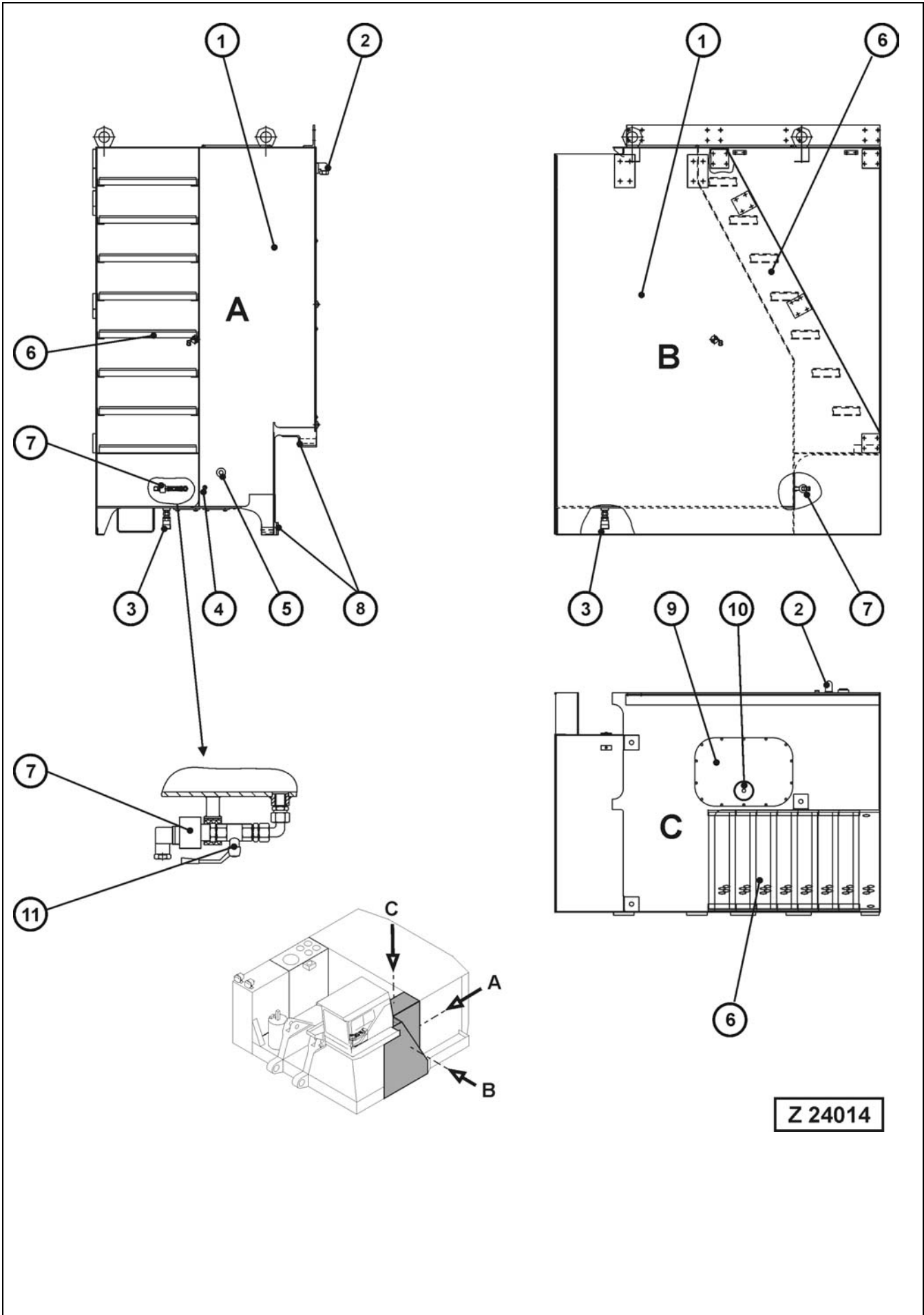
The Engine must be out of operation for approximately 30 minutes before checking the oil level. This period is necessary for settling of the oil in the lower part of the coupling housing.

1. Remove guard (1).
2. Turn flexible coupling by using barring device (2) to bring oil level gauge (3) in its uppermost (12 o'clock) position.

REMARK

To use the barring device, remove the clip and push the device shaft toward the flywheel. The barring device must be rotated counterclockwise to turn the flywheel (flexible coupling) in the direction of normal rotation.

3. Unscrew gauge (3), wipe it clean and insert into the gauge opening.
DO NOT screw in. Pull out gauge (3) and read the oil level.
4. If necessary add oil through gauge opening to bring the oil level up to the "MAX" mark on gauge (3). To speed-up the filling procedure, remove bleeder screw (4) and warm up the oil to approximately +30°C.
5. Insert gauge (3) with packing ring and bleeder screw (4) with packing ring and tighten securely.
6. Check area (A) for leakage. If oil leakage is found (radial traces of oil), O-rings (5) must be checked for damage and replaced if necessary.
7. Install guard (1).



4.11.3 FUEL TANK - DRAIN CONDENSATION

Legend for illustration Z24014

- (A) Rear view of fuel tank
- (B) Left view
- (C) Top view
- (1) Fuel tank
- (2) Fuel return port (engine fuel pump return line)
- (3) Drain coupling
- (4) Fuel outlet port for auxiliary user (Generator set)
- (5) Fuel outlet port to engine fuel pump
- (6) Stair to cab
- (7) Pressure transducer for level indication
- (8) Mounting brackets
- (9) Cover
- (10) Fuel filler neck
- (11) Shut-off cock for pressure transducer (7). Close this cock when replacing the pressure transducer (7).

 **WARNING**

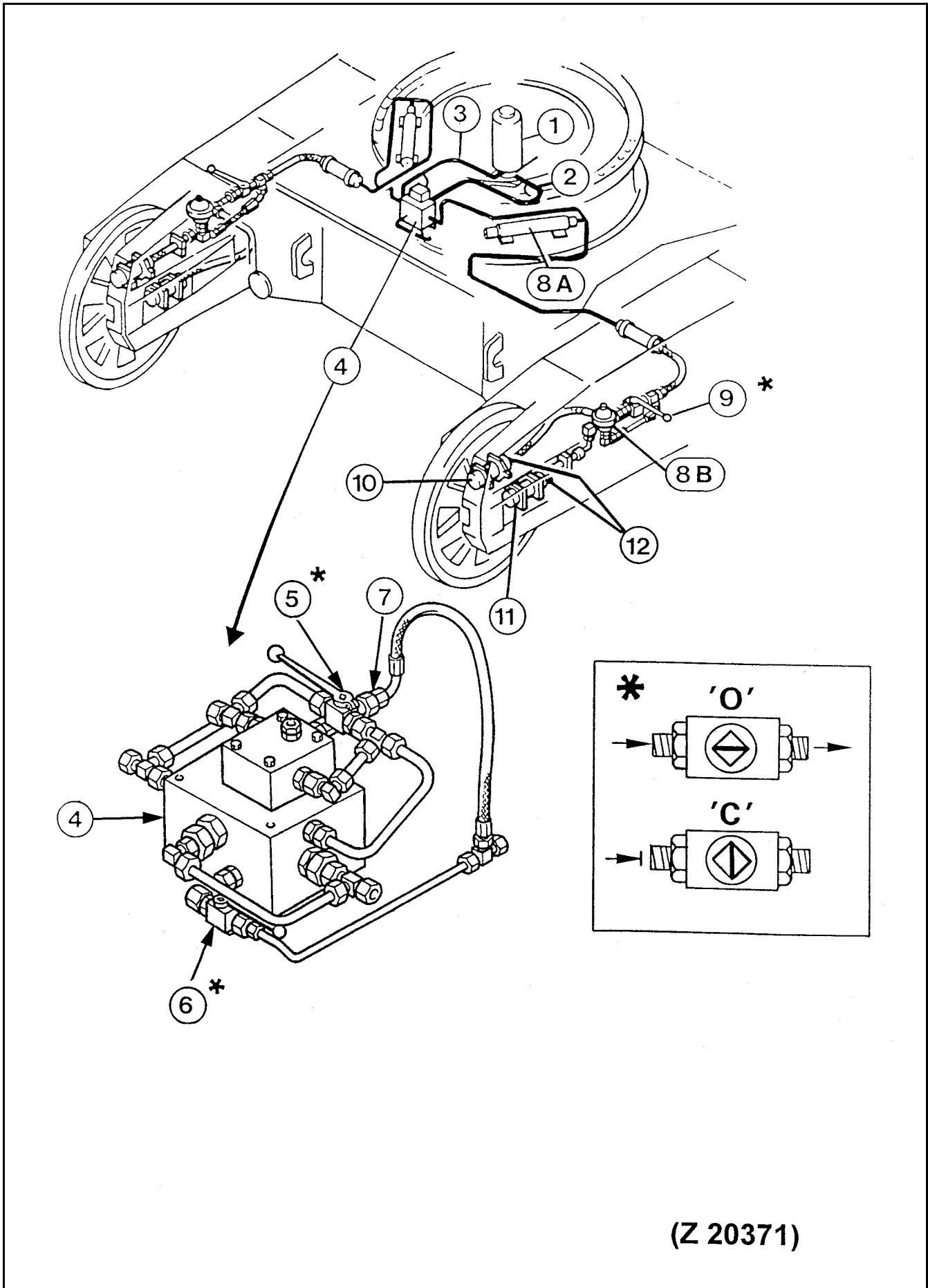
DO NOT smoke or use an open flame when working around inflammable fuels.

Drain Water and Sediments from Fuel Tank.

Open the hinged cover below the fuel tank.
Attach drain hose and open drain coupling (3). Collect outflowing sediments in a suitable container.

REMARK

A solenoid valve mounted to port (5) shuts off fuel supply to the engine as soon as the engine stop switch or any emergency shutdown switch is actuated.



4.11.4 CRAWLER TRACK - INSPECTION

CHECK ADJUSTING RANGE OF GUIDE WHEELS

(Track retensioning range)

GENERAL

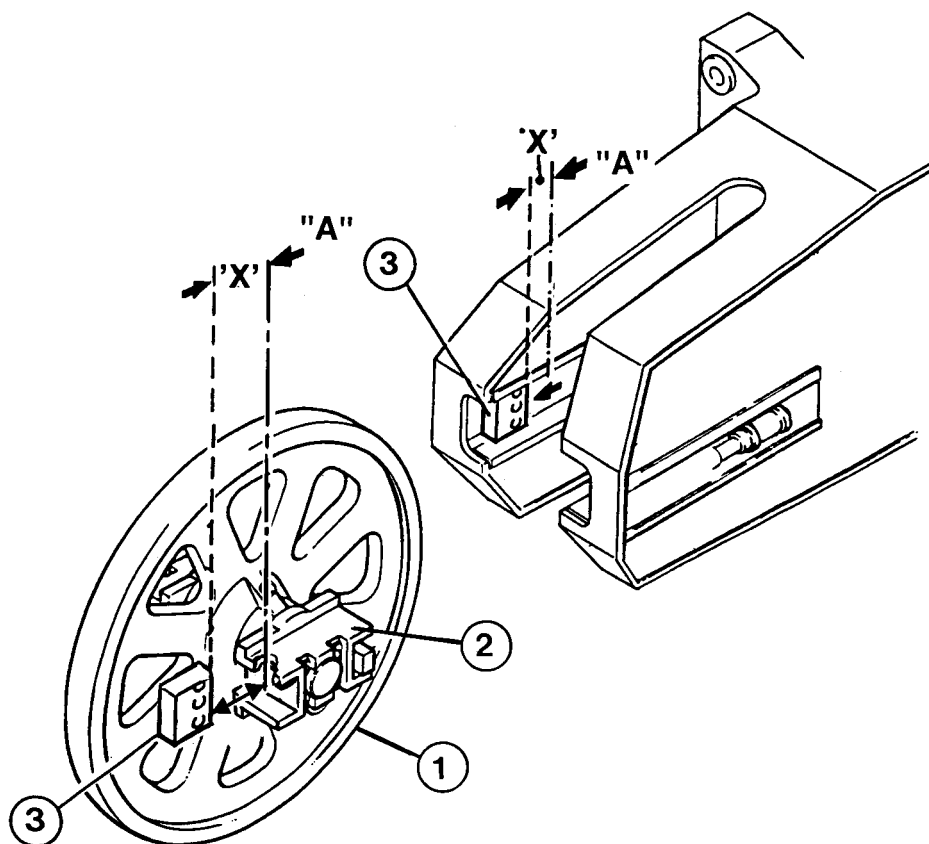
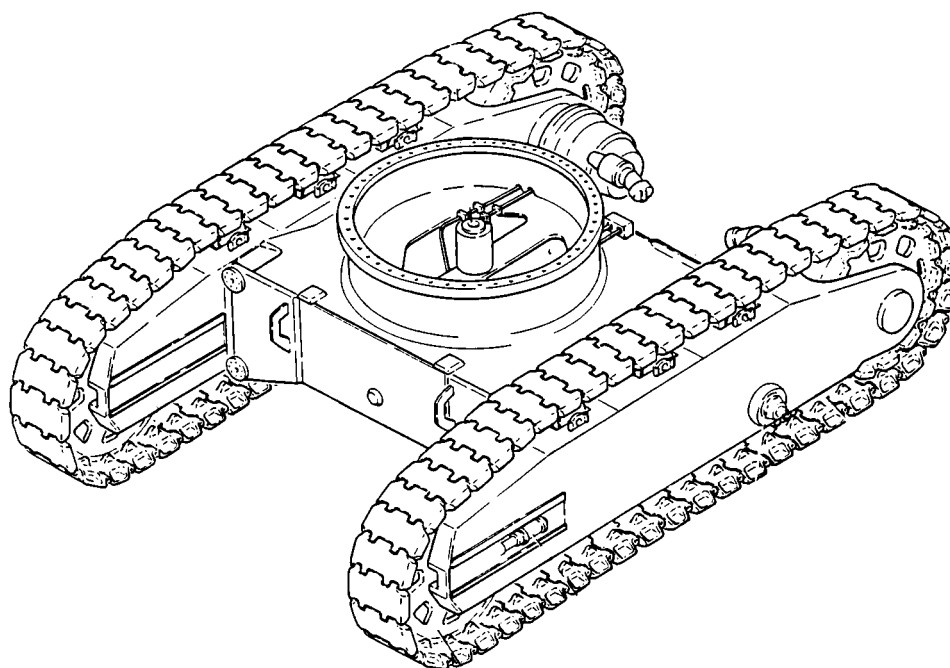
The hydraulic track tensioning system, illust. Z 20371 maintains automatically the correct track tension. The pilot pressure oil of the travel brake release circuit is used, to pressurize the four adjusting cylinders (10) and (11). The resulting force moves the guide wheels toward the front, until the 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

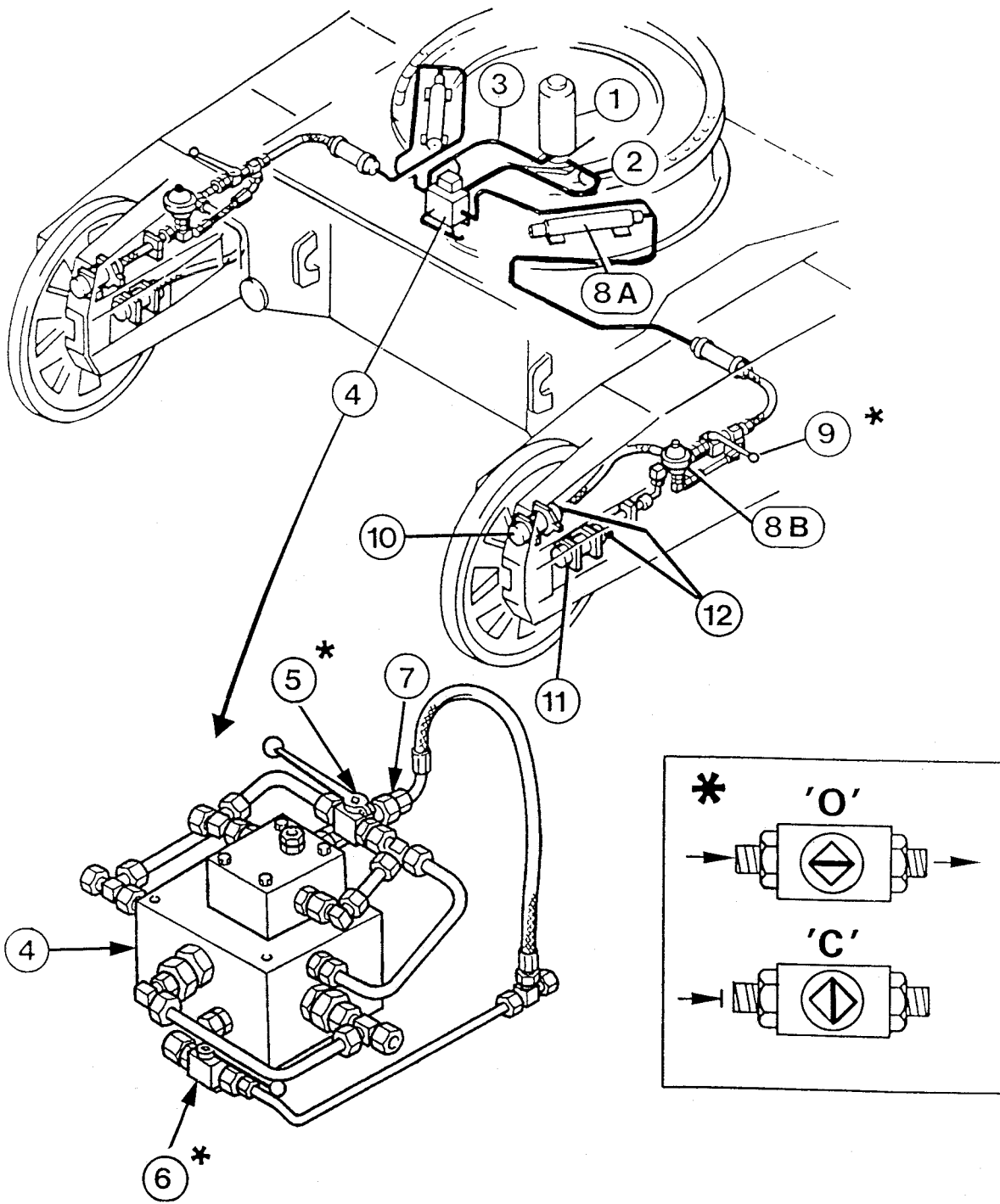
The adjusting range for track tension is the distance “X” between guide wheel slide block (2) and stop plate (3). Depending on lengthening of the track the slide block (2) may come in contact with stop plate (3). In such a case, it must be ensured that the track does not become too loose. Depending on track condition, the removal of one track pad will restore the adjusting range “X”. If necessary contact our Service Department for more information.

⚠ WARNING

Before working on the track adjusting system, relieve all pressure in the system by opening the pressure relief cock (5), see illust. Z 20371 on previous page.

NOTICE

- If removal of a track pad becomes necessary, it must be done on both tracks in order to maintain the same length of both tracks.
- During operation, the pressure relief cock (5) must always be in CLOSED position. Open cock (5) for pressure relieve prior servicing any part of the system, e.g. removal of a track pad.



(Z 20371)

CHECK ADJUSTING RANGE FOR GUIDE WHEELS

NOTICE

The cocks (9), illust. Z 20371 must always be in OPEN position. Close only in such cases, when the adjusting cylinders (10 and 11) must remain under pressure while servicing other components of the system.

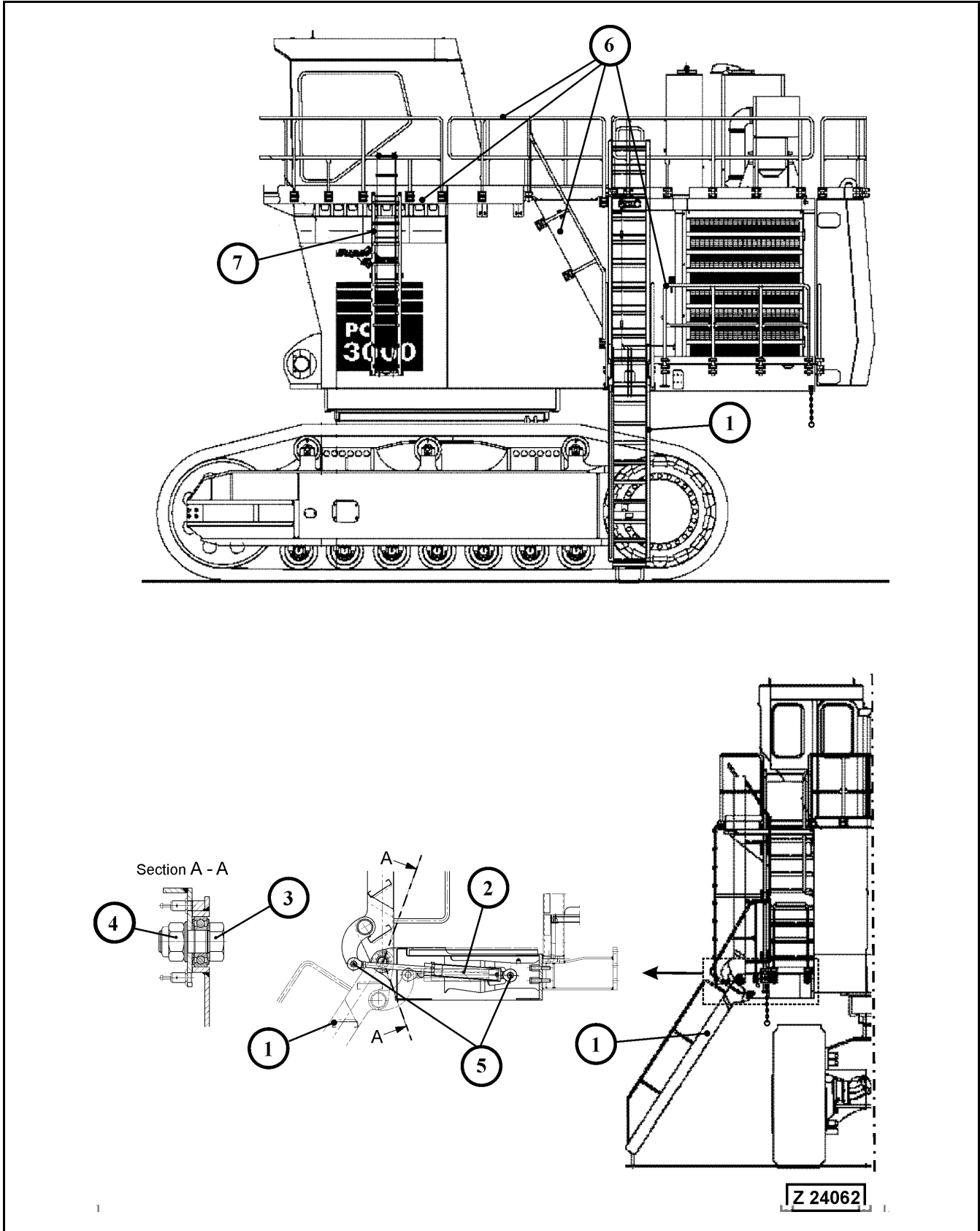
Bleeding the System

1. Make sure pressure relief cock (5) illust. Z 20371 is in closed position "C"; and shutoff cocks (6 and 9) are in open position "O".
2. Start the engine/motor.
3. Slowly open vent valves (12) on all four adjusting cylinders until bubble free oil flows out. Close the vent valves (12).
4. Move the machine forward and reverse to distribute tension.
5. Check adjusting range "X" according to Illust. (Z 20015) on previous page.
6. Check the complete system for leakages.

NOTICE

Further track group inspection and wear measurement procedures should be carried out according to Parts and Service News Bulletin No. AH02521 filed in volume 2 binder.

4.12 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

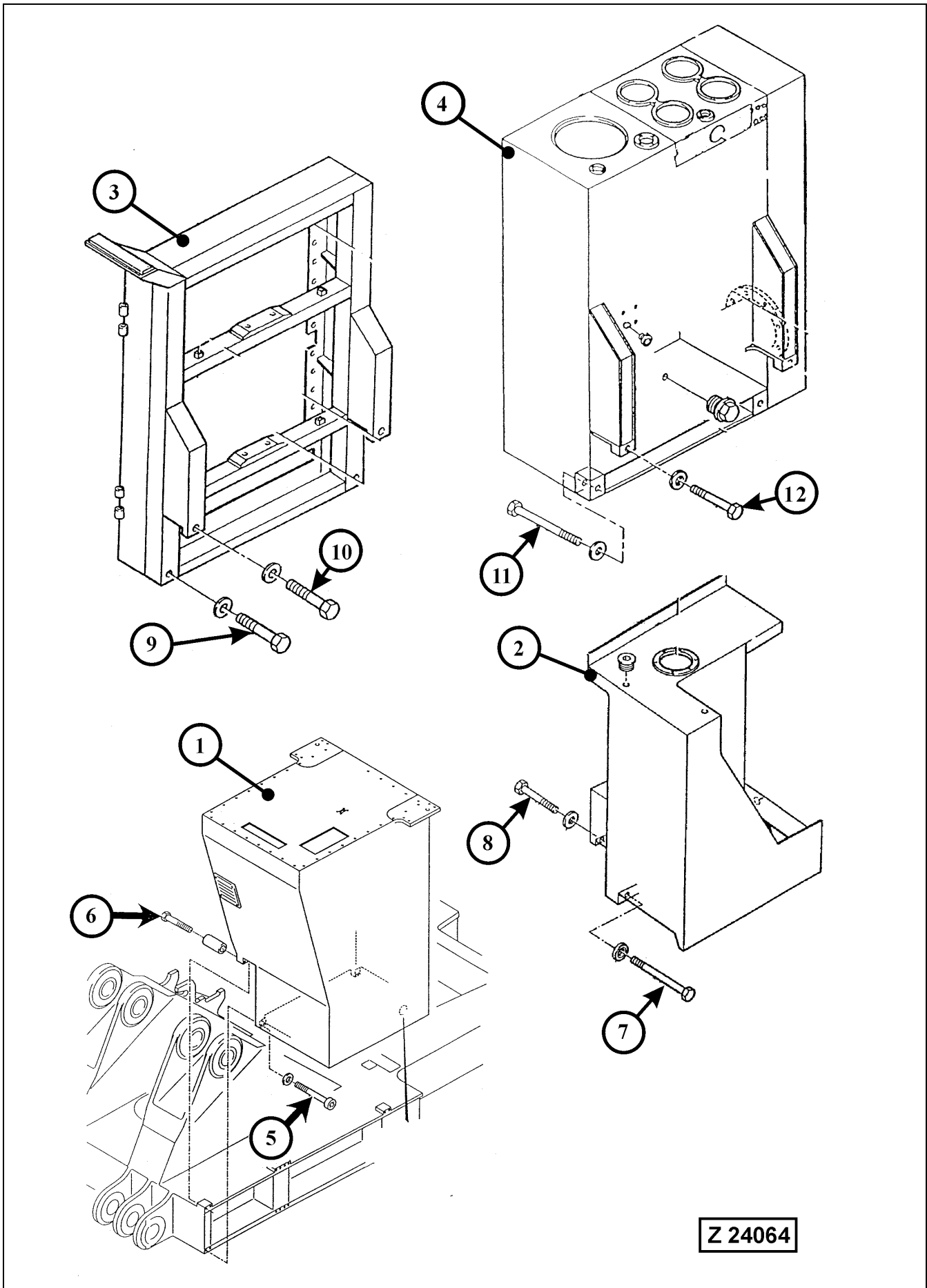
Hydraulic Access Ladder, illust. Z24062

- (1) Ladder
- (2) Ladder lifting cylinder
- (3) Ladder bearing assembly
- (4) Self locking nut
- (5) Pivot pins
- (6) Railings, steps and platforms
- (7) Emergency escape ladder

- Check condition and fastening of ladder (1), bearing assembly (3) and hydraulic cylinder (2). Make sure the self locking nuts (4) are correctly tightened and have not lost their clamping torque.
- Lubricate both eyes of hydraulic cylinder (2). Make sure both pivot pins (5) are properly secured with cotter pins. Check hydraulic lines for leakage and damage. Replace as necessary.

Check fastening and condition of all railings, steps and platforms (6) and of emergency escape ladder (7).

- Retighten loose mounting bolts and replace missing or damaged mounting bolts.
- Make sure the rope wire emergency escape ladder (7) is in place and correctly fastened.



High-Strength Bolt Connections (continued)

Check fastening and condition of

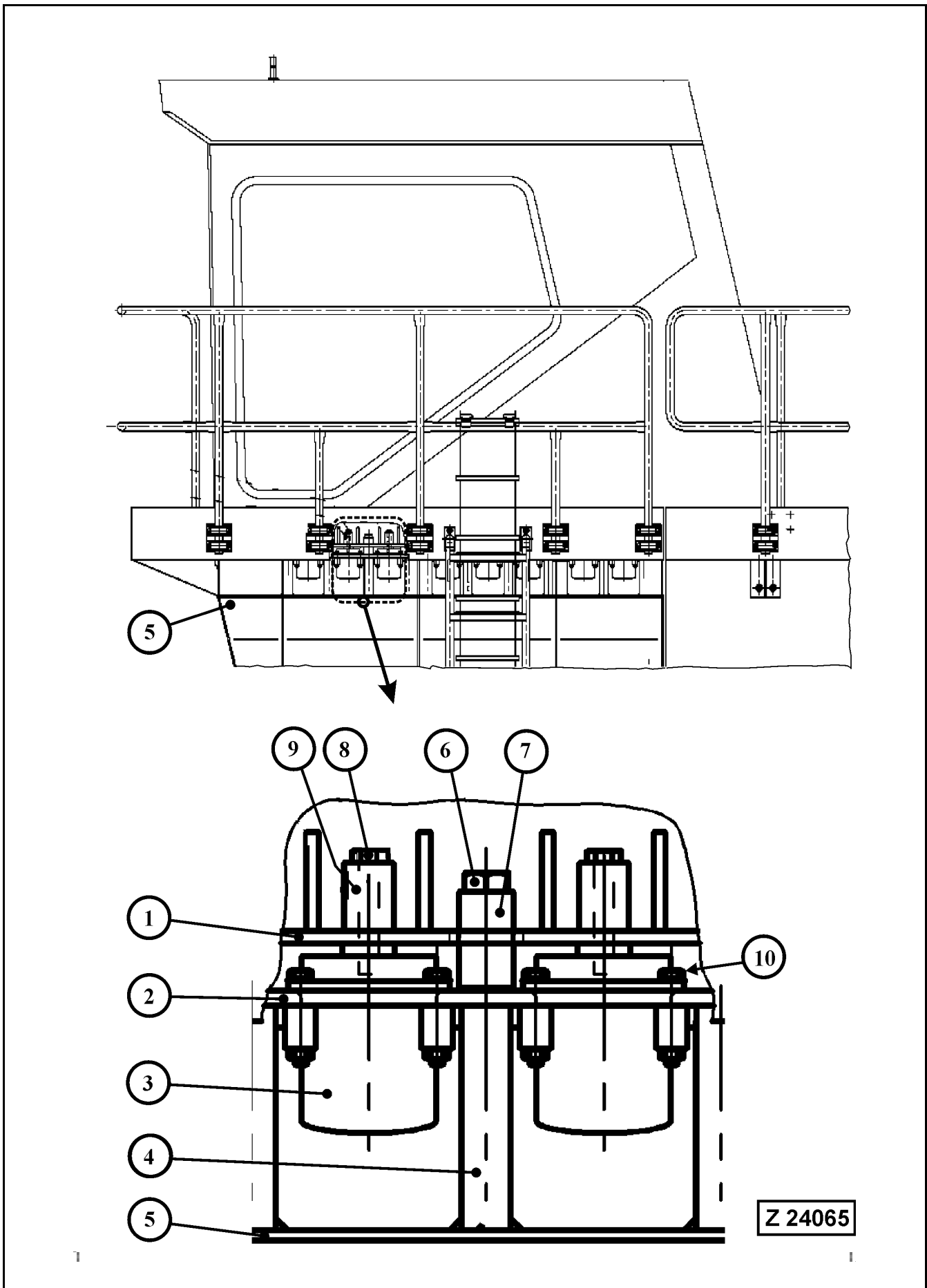
- Cab base (1)
- Fuel tank (2)
- Hydraulic oil cooler carrier (3) and
- Main hydraulic oil reservoir (4)

see illustration Z24064

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(5 and 6)	M36	10.9	55	3100	8
(7 and 8)	M30	10.9	46	1770	4
(9 and 10)	M30	10.9	46	1770	4
(11 and 12)	M30	10.9	46	1770	4

* SW = Wrench size*

- Check all mounting bolts for correct tightening torque.
- Re-tighten loose mounting bolts and replace missing or damaged bolts.



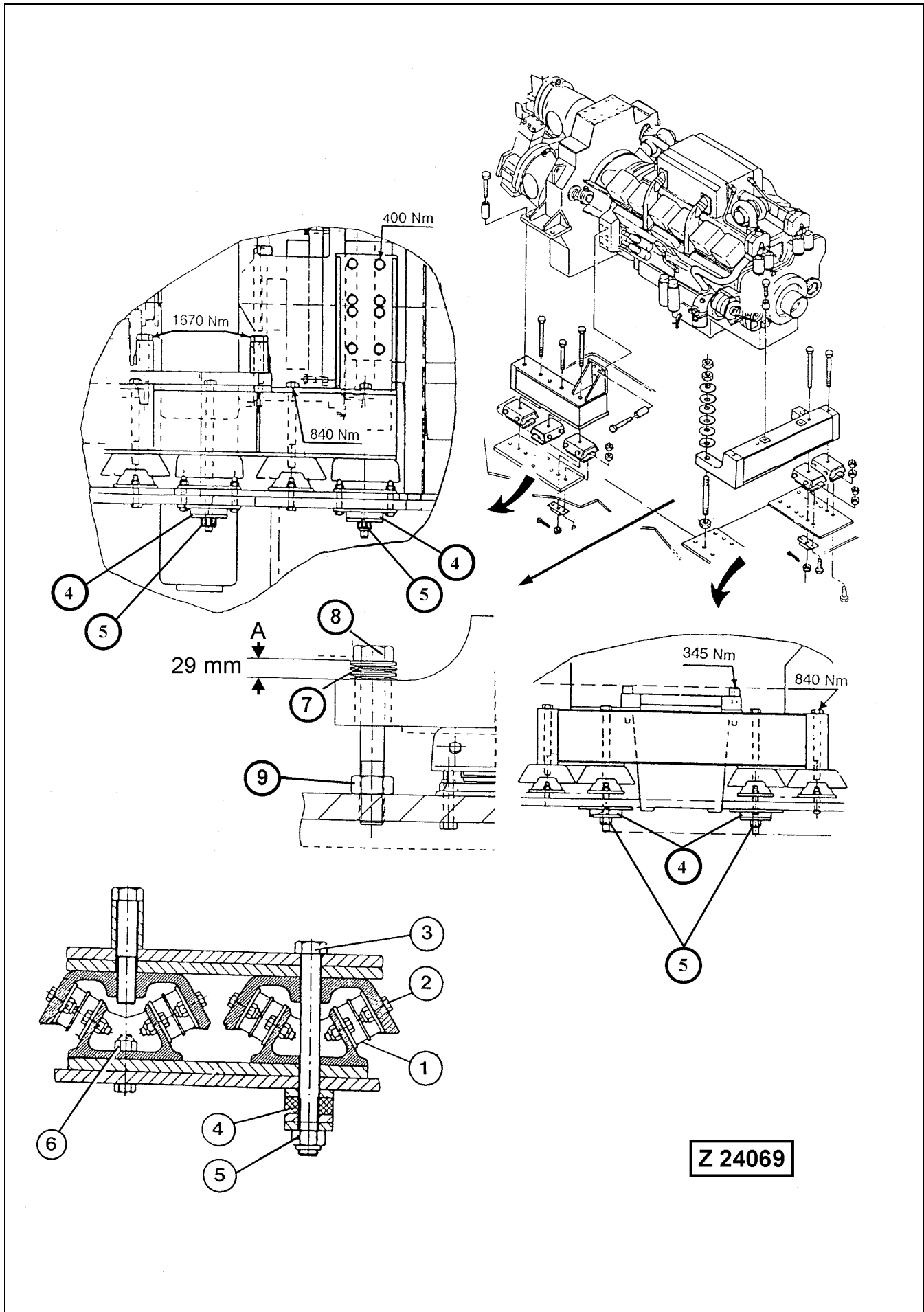
High-Strength Bolt Connections (continued)

Check mounting of Operator's cab

Legend for illustration Z24065

- (1) Cab brackets
- (2) Cab carrier plates
- (3) Viscous mounts, filled with silicon oil
- (4) Support bars with inner thread on cab base
- (5) Cab base
- (6) Mounting bolts carrier plates (2) to support bars (4)
- (7) Resilient sleeves
- (8) Mounting bolts cab brackets (1) to viscous mounts (3)
- (9) Resilient sleeves
- (10) Mounting bolts for viscous mounts

- Check all mounting bolts for correct tightening torque.
- Re-tighten loose mounting bolts and replace missing or damaged bolts.
- Check the silicone oil filled viscous mounts (3) for leakage and signs of fatigue.



High-Strength Bolt Connections (continued)

Check mounting and security of the Diesel engine and pump distributor gear, illustration Z24069

- Check all flexible bearings (1) for engine and pump distributor gear.
 - Check the flexible bearings for damage and signs of fatigue. Make sure that there is no contact between the upper and lower metal brackets of the flexible bearings (1). Replace the bearings if necessary.
After new flexible bearings have been installed, check distance (A) on both torque supports.

NOTICE

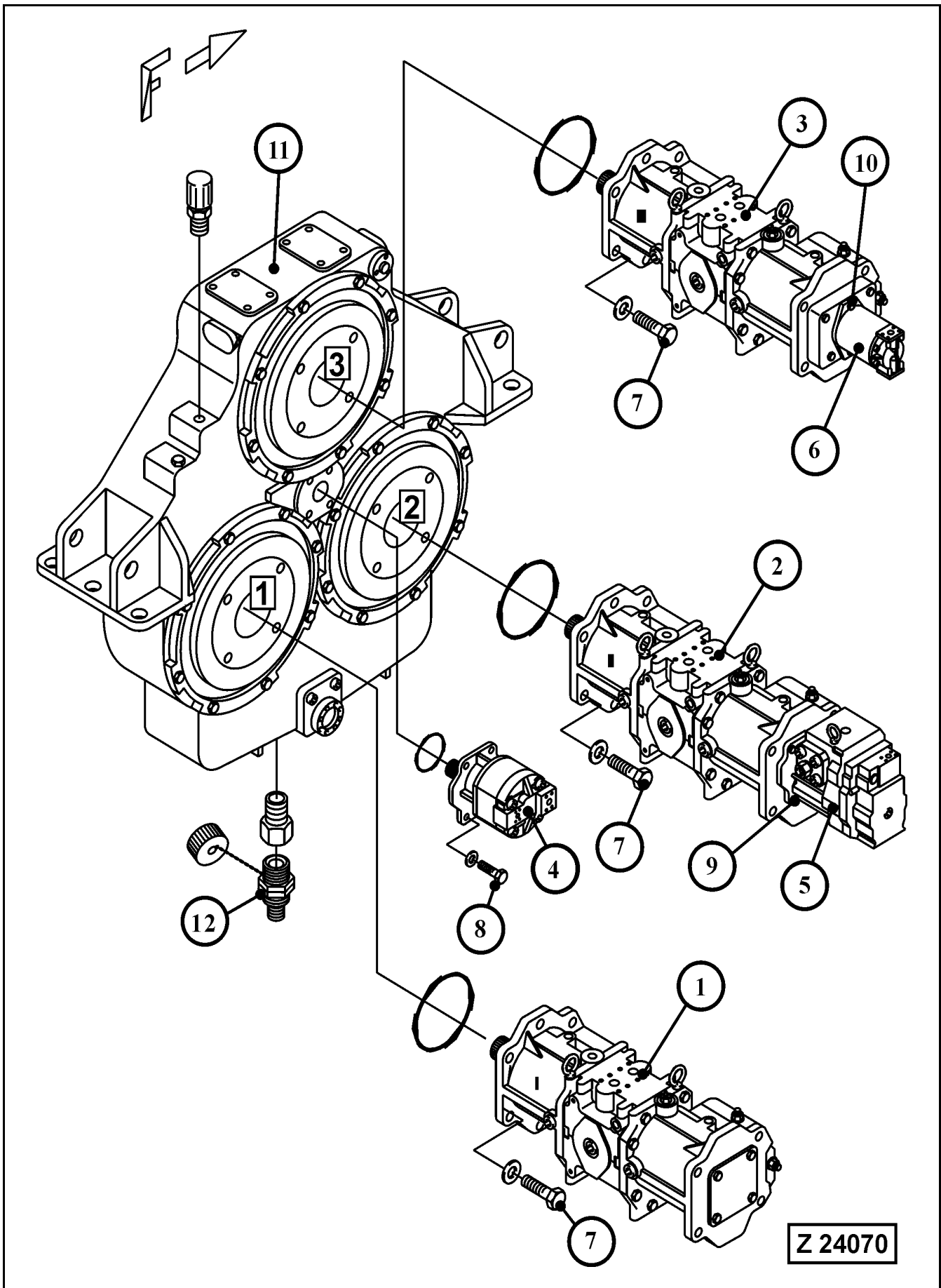
All flexible bearings (1) and all rubber-bounded metal bars (4) should be replaced during engine overhaul.

- Check distance (A) between torque support and stop bolt (8).
 - With setting of the flexible engine bearings (1) the distance (A) increases and must be adjusted. To do this, loosen lock nut (9) and tighten stop bolt (8) until the correct distance (A) is obtained. Tighten lock nut (9) and recheck distance (A).
If new flexible engine bearings (1) have been installed, replace also cup springs (7) and adjust distance (A) to 29 mm.
- Check tie bolts (3) on front and rear carrier units for looseness.
 - Check to make sure that the self locking retainer nuts (5) are tight and that there is no gap between nut and rubber-bounded metal bar (4).
If necessary retighten retainer nuts (5) snugly.
Check rubber-bounded metal bars (4) for signs of fatigue and damage.
Replace as necessary.

NOTICE

- **Check all bolt connections for correct tightening torque.**

Check condition of engine carrier and brackets. If any damages, failures or wrong condition are found, corrective action must be taken.

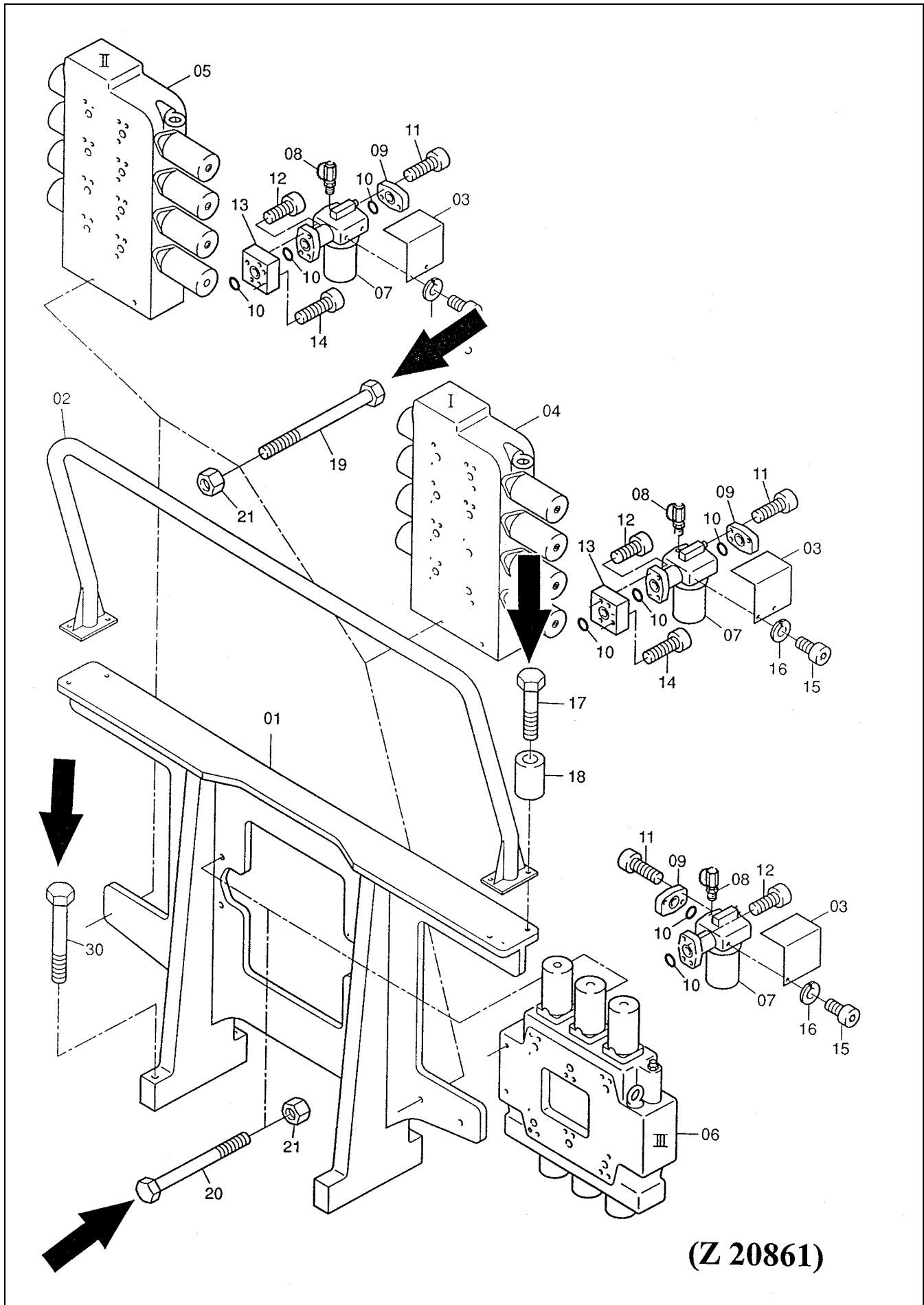


High-Strength Bolt Connections (continued)

- Check fastening and condition of main hydraulic pumps (1-3), illustration Z24070.
- Check fastening and condition of auxiliary pumps (4 - 6).

Legend for illustration Z24070

- (1-3) Main hydraulic pumps, swash plate type for all working and travelling motions.
 - (4) Control oil pump (pilot oil circuit)
 - (5) Hydraulic oil cooler fan drive pump
 - (6) PTO lubrication oil pump
 - (7) Mounting bolts, main pumps
 - (8) Mounting bolts, control oil pump
 - (9) Mounting bolts, hydraulic oil cooler fan drive pump
 - (10) Mounting bolts, PTO lubrication oil pump
 - (11) PTO (pump distributor gear)
 - (12) Drain coupling with protection cap
- Check all mounting bolts (7, 8, 9 and 10) for correct tightening torque.
 - Re-tighten loose mounting bolts and replace missing or damaged bolts.



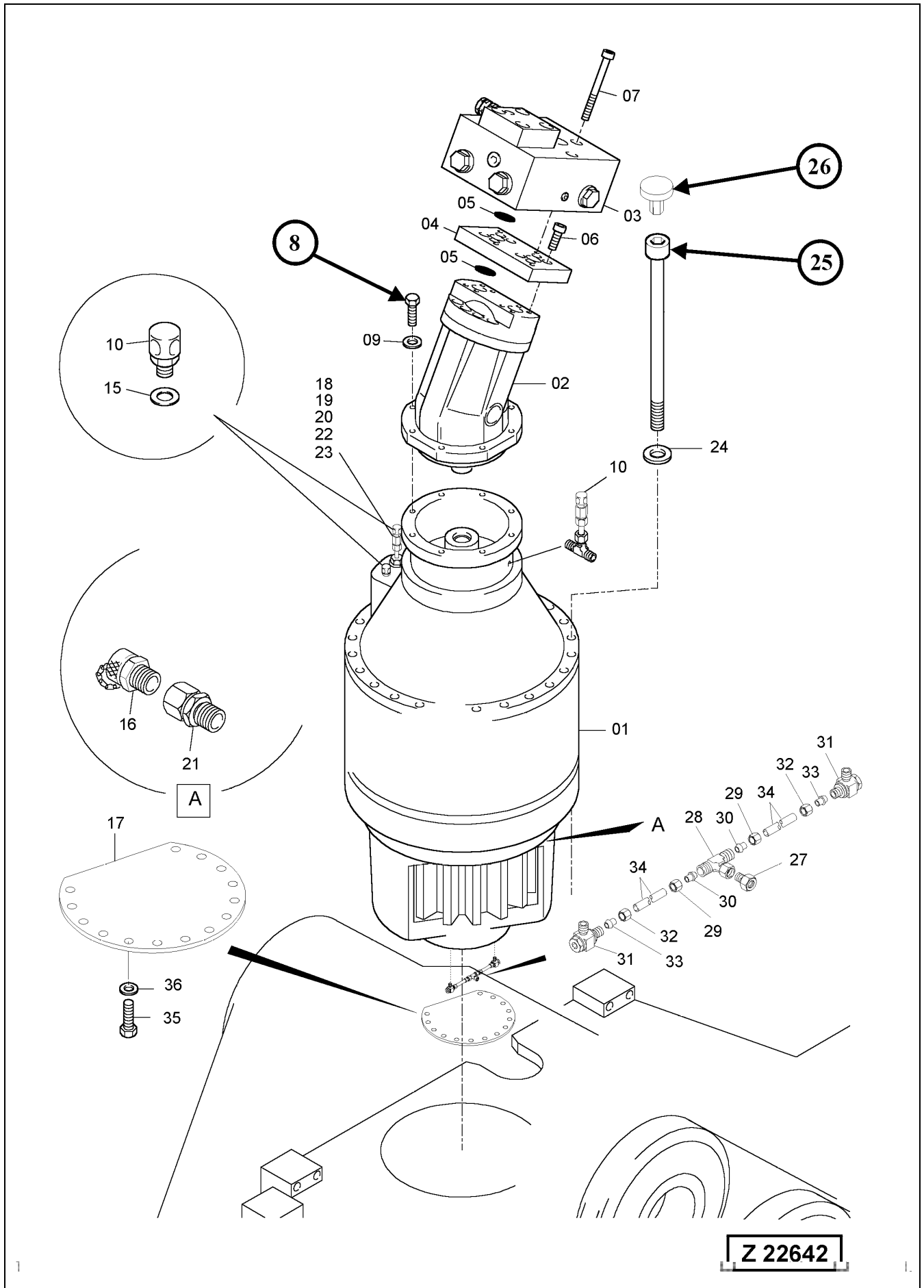
High-Strength Bolt Connections (continued)

Check fastening and condition of control valve carrier (01), main control valves (04 - 06) and hose support (02), illustration Z20861

* SW = Wrench size

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(17)	M12	8.8	19	74	8
(19)	M16	8.8	24	179	6
(20)	M16	8.8	24	179	3
(30)	M20	10.9	30	510	4

- Check all mounting bolts (17, 19, 20 and 30) for correct tightening torque.
- Re-tighten loose mounting bolts and replace missing or damaged bolts.



High-Strength Bolt Connections (continued)

Check condition and fastening of the swing gear (01) and swing motor (02), illustration Z22642

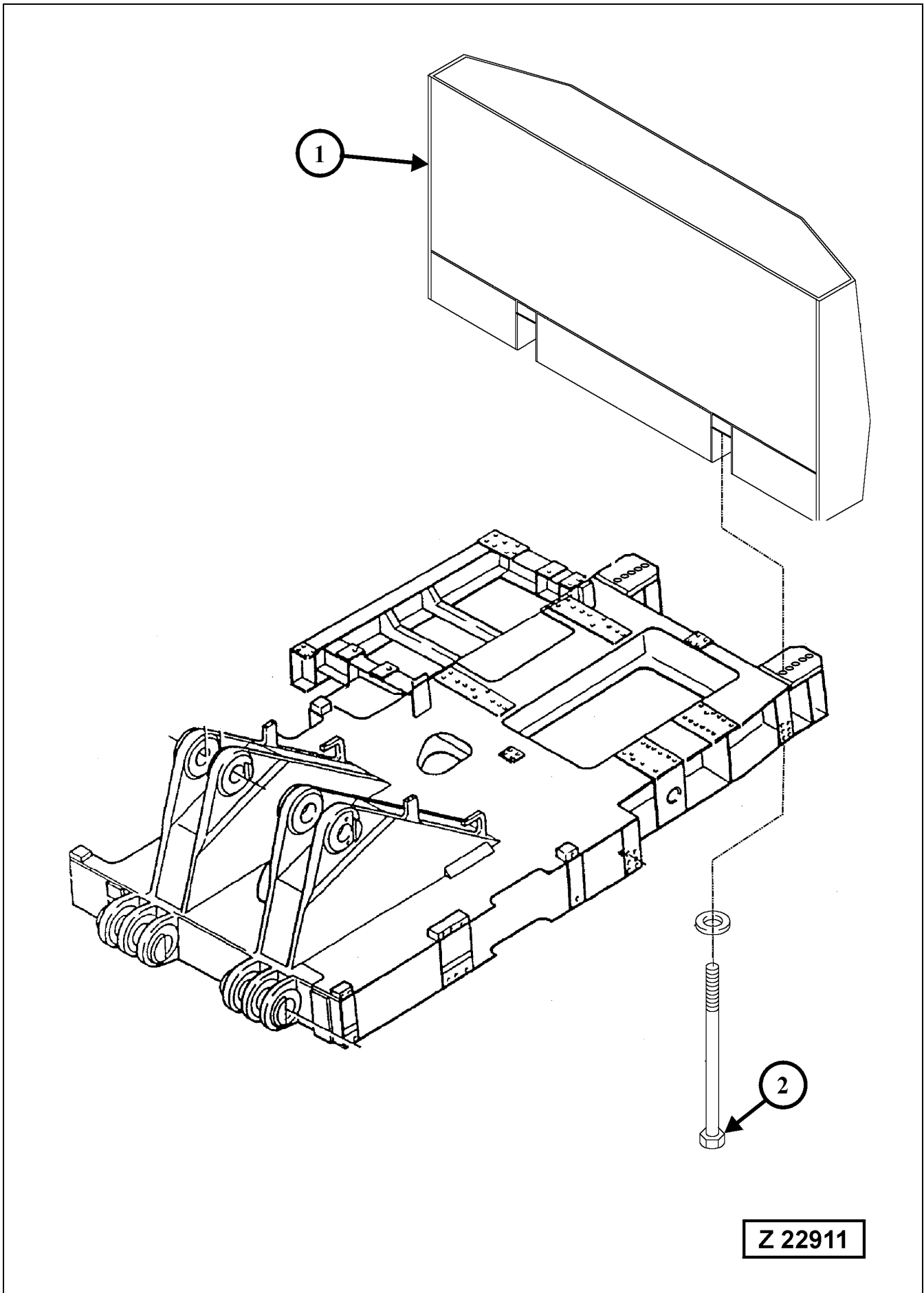
* SW = Wrench size

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(8)	M 16	10.9	24	265	16
(25) Socket head cap screw	M 24	12.9	19	1030	24

- Check all mounting bolts (8 and 25) for correct tightening torque.
- Re-tighten loose mounting bolts 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.



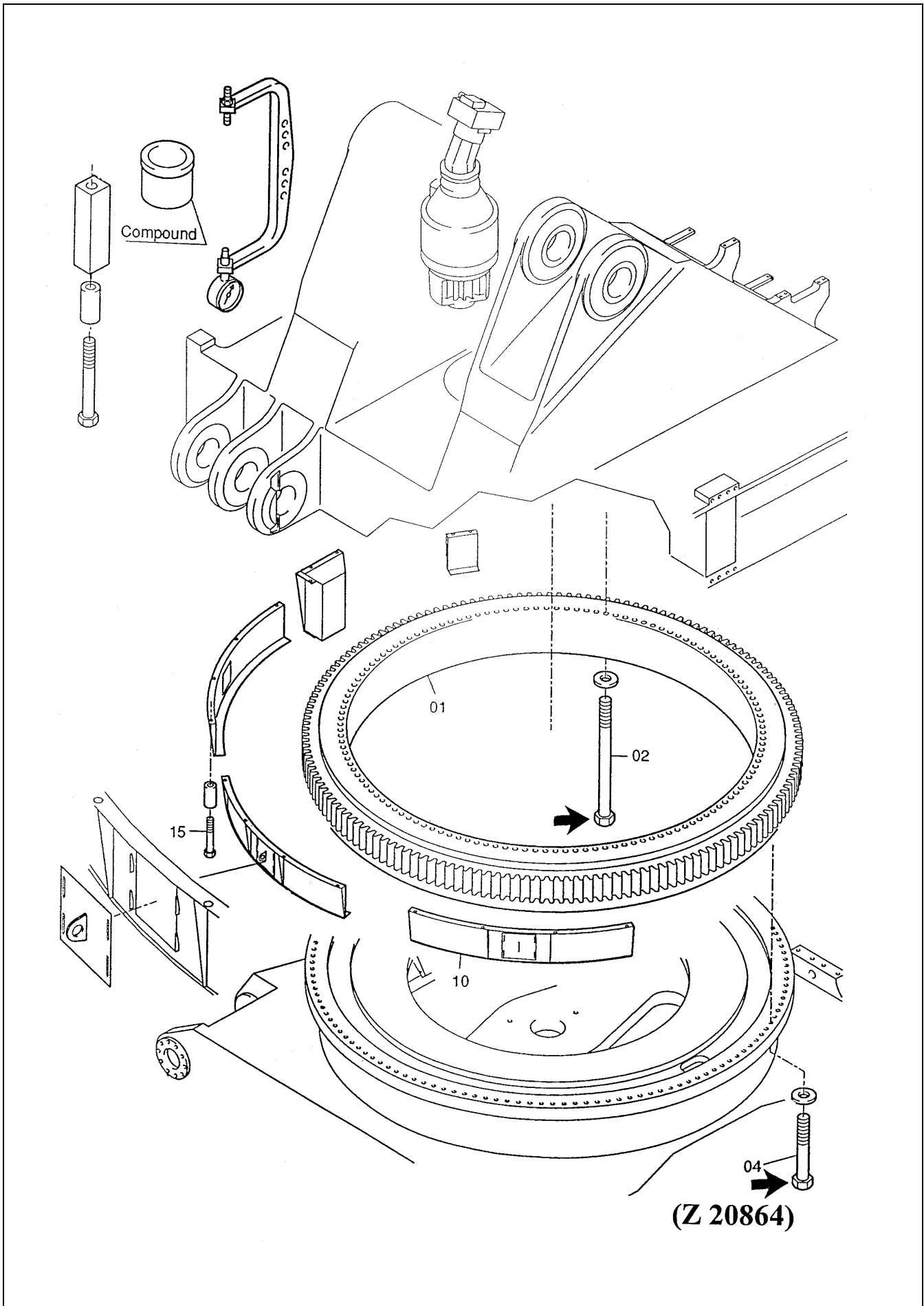
High-Strength Bolt Connections (continued)

Check tightening torque of the mounting bolts (2) for counterweight (1), illustration Z22911

* SW = Wrench size

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(2)	M42	10.9	65	4950	10

- Check all mounting bolts (2) for correct tightening torque.
- Re-tighten loose mounting bolts and replace missing or damaged bolts.



High-Strength Bolt Connections (continued)

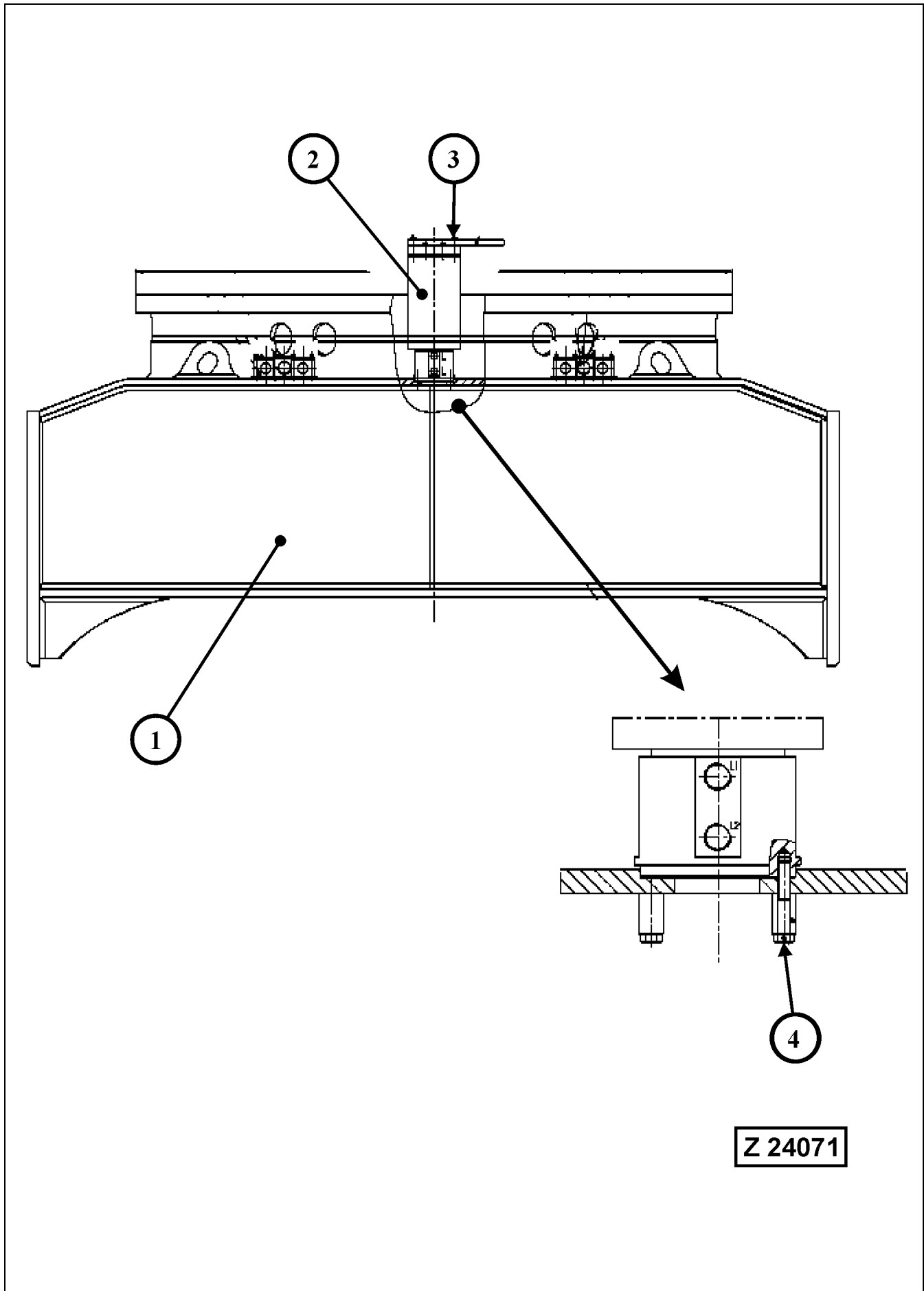
Swing circle (01), illustration Z20864

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).



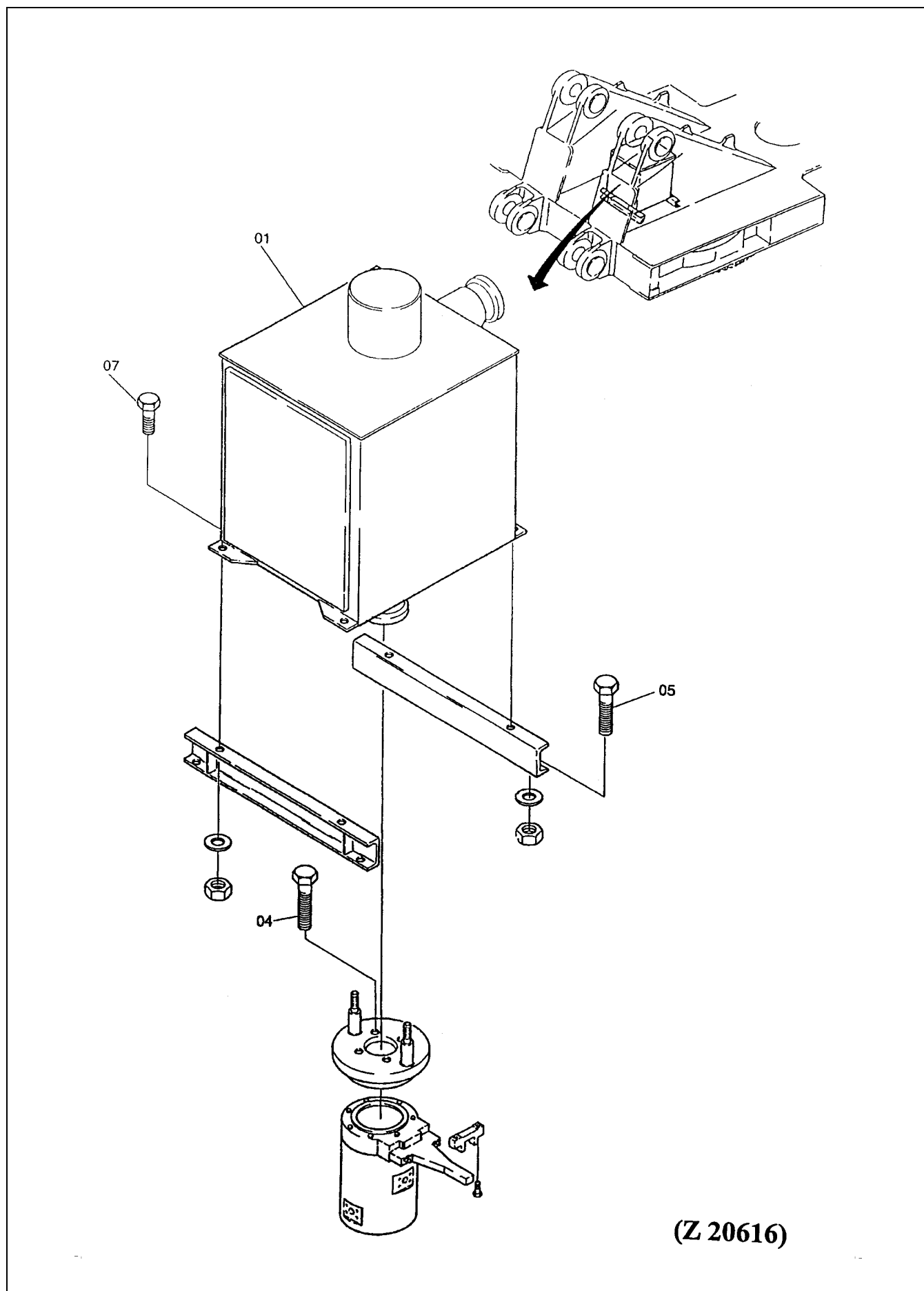
High-Strength Bolt Connections (continued)

Center frame (1), check condition and fastening of swivel joint (2), illustration Z24071

* SW = Wrench size

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(3)	M 16	10.9	24	265	4
(4)	M 16	10.9	24	265	8

- Check all mounting bolts (3 and 4) for correct tightening torque.
- Re-tighten loose mounting bolts and replace missing or damaged bolts.



High-Strength Bolt Connections (continued)

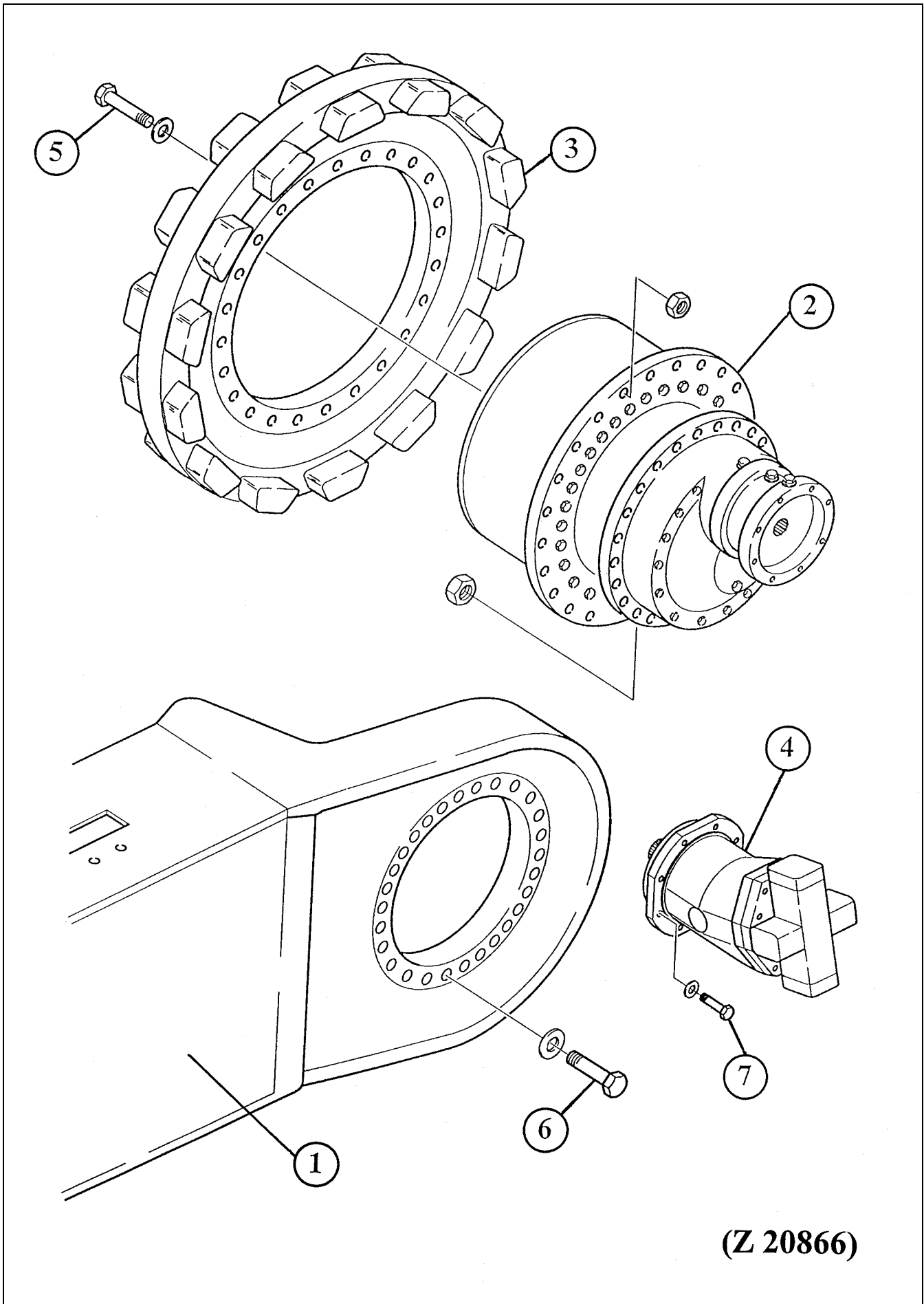
Excavators with Electric Prime Mover

Check condition and fastening of slip ring unit (01),
illust. Z 20616 Check all mounting bolts (04, 05 and 07) for

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

correct tightening torque.

- Re-tighten loose mounting bolts and replace missing or damaged bolts.



High-Strength Bolt Connections (continued)

Check condition and fastening of travel gears, sprockets and travel motors

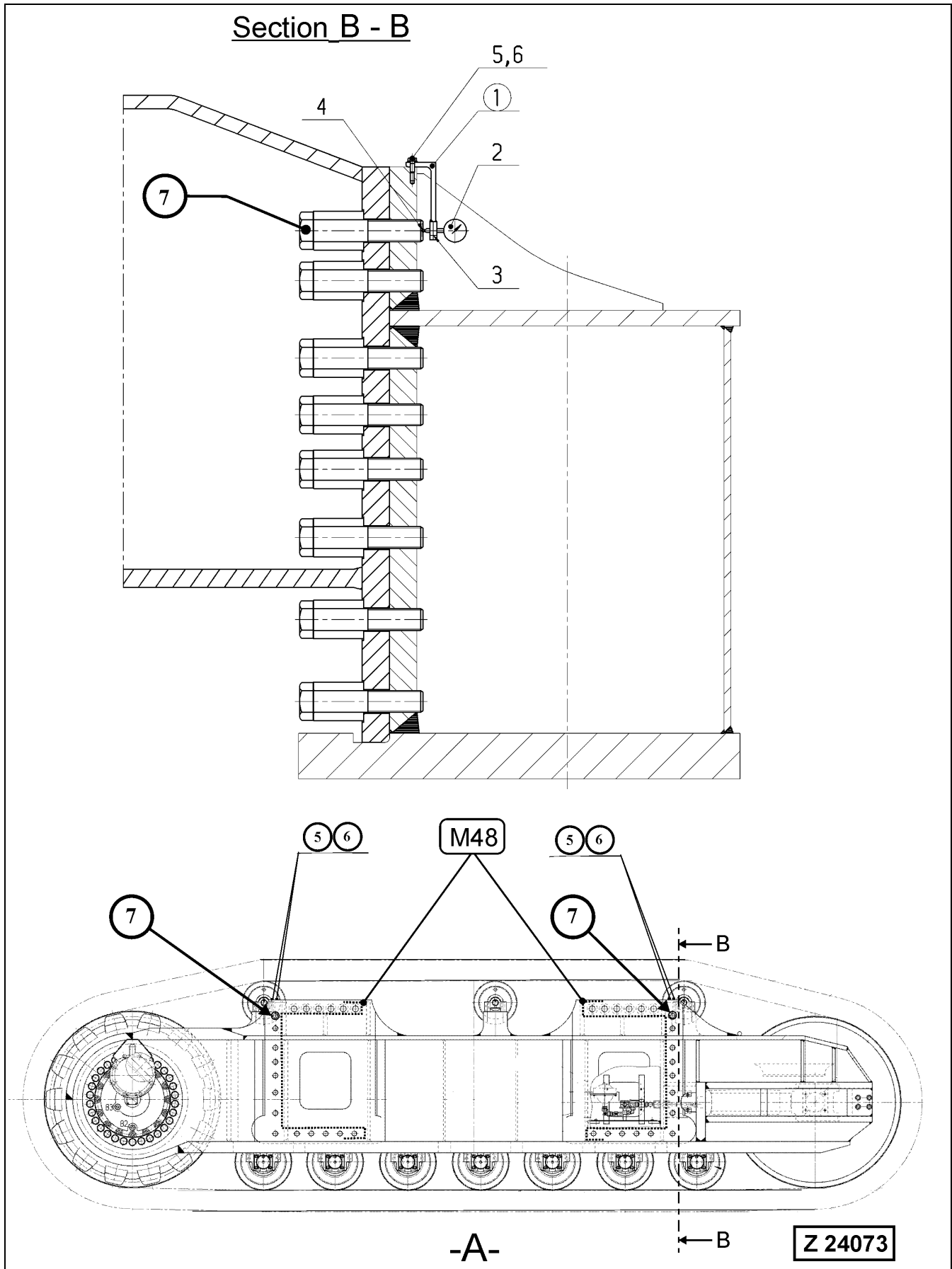
Legend for illustration Z20866:

- (1) Crawler carrier
- (2) Travel gear
- (3) Sprocket
- (4) Travel motor
- (5) Mounting bolts for sprocket to travel gear
- (6) Mounting bolts for travel gear to crawler carrier
- (7) Mounting bolts for travel motors

Reference No.:	Bolt size mm	Grade	SW * mm	Tightening torque Nm	Qty.
(5)	M36	10.9	55	3100	48
(6)	M36	10.9	55	3100	60
(7)	M20	10.9	30	510	16

* SW = Wrench size

- Check all mounting bolts (5, 6 and 7) for correct tightening torque.
- Re-tighten loose mounting bolts and replace missing or damaged bolts.



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 Z24073 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 (A). The measuring bolts can be identified by the centering dot at the bolt head and at the shaft end.

Necessary equipment for the retightening procedure:

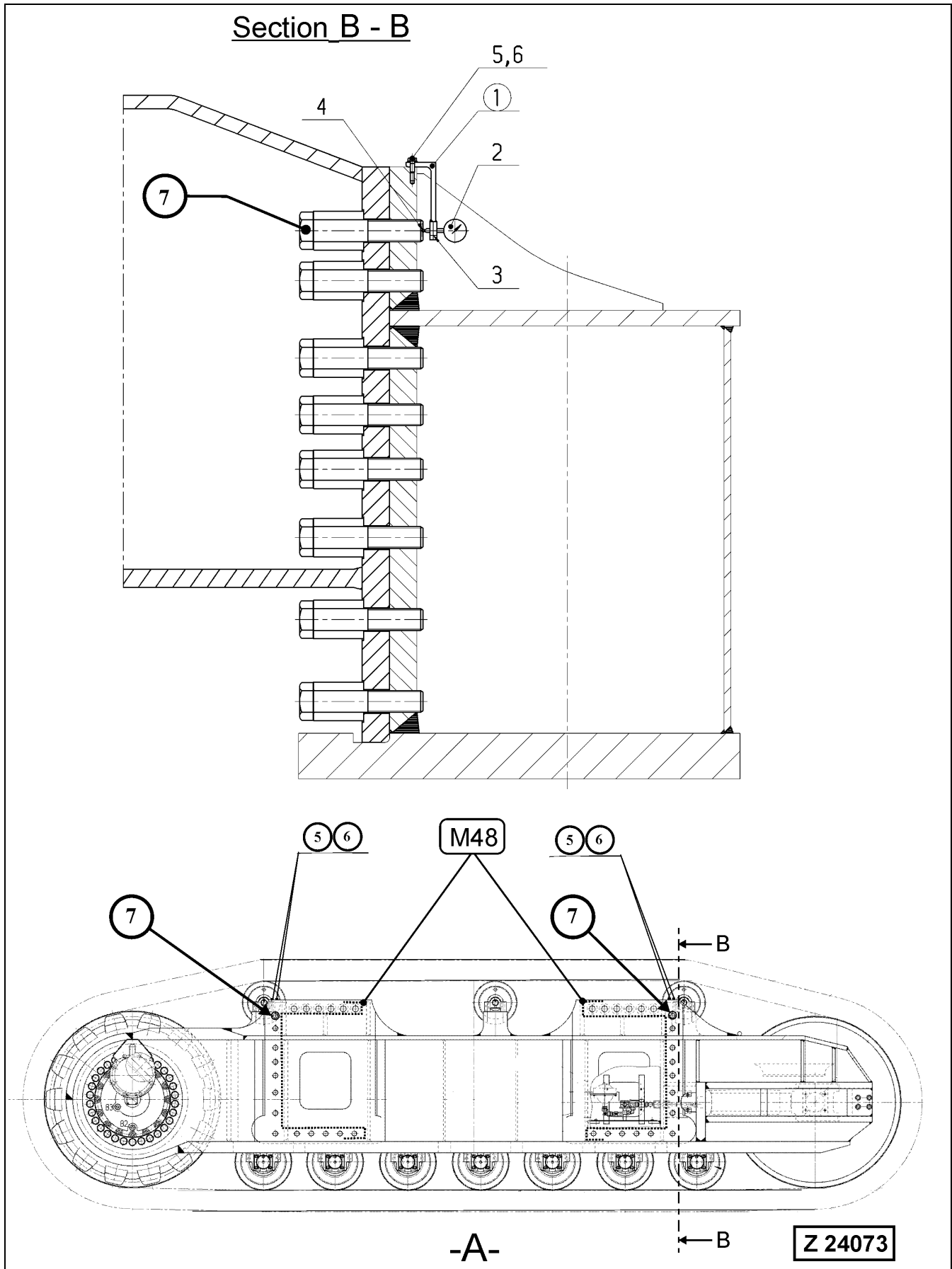
- Measuring device (1 - 6) delivered with the new machine, see table below.
- Special hydraulic torque wrench, see illustration Z24072 on page 373. This tool will be provided by your Komatsu dealer.

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 bolt (installed)	928 477 40	4

REMARK

The illustration Z24073 shows the left crawler carrier seen from the carbody side.



High-Strength Bolt Connections (continued)

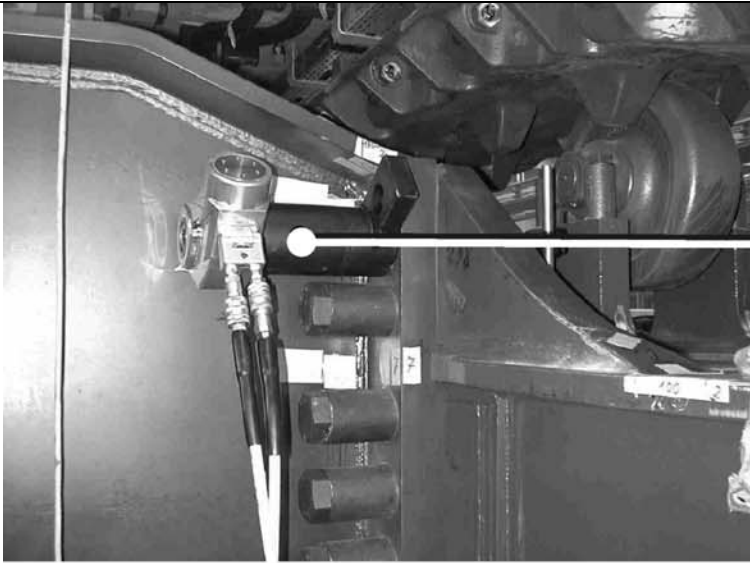
Procedure for determination of the tightening torque for the crawler carrier mounting bolts after the first 1000 operating hours, see illustration Z24073

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 one of the mounting bolts (M48) and tighten up to the determined average pressure.

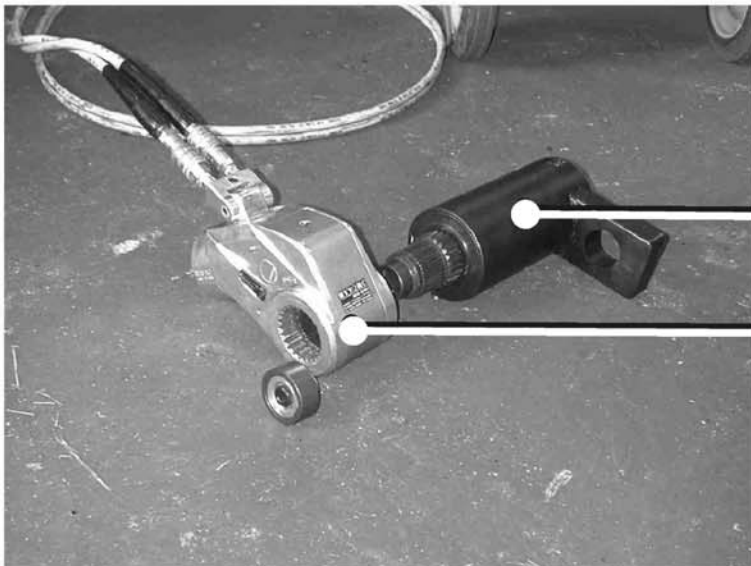
CAUTION

**DO NOT loosen more than one bolt at the same time.
DO NOT lubricate the bolts (M48).**

13. Repeat this procedure at all bolts (M48) step by step.



1



2

3



4

Z 24072

High-Strength Bolt Connections (continued)

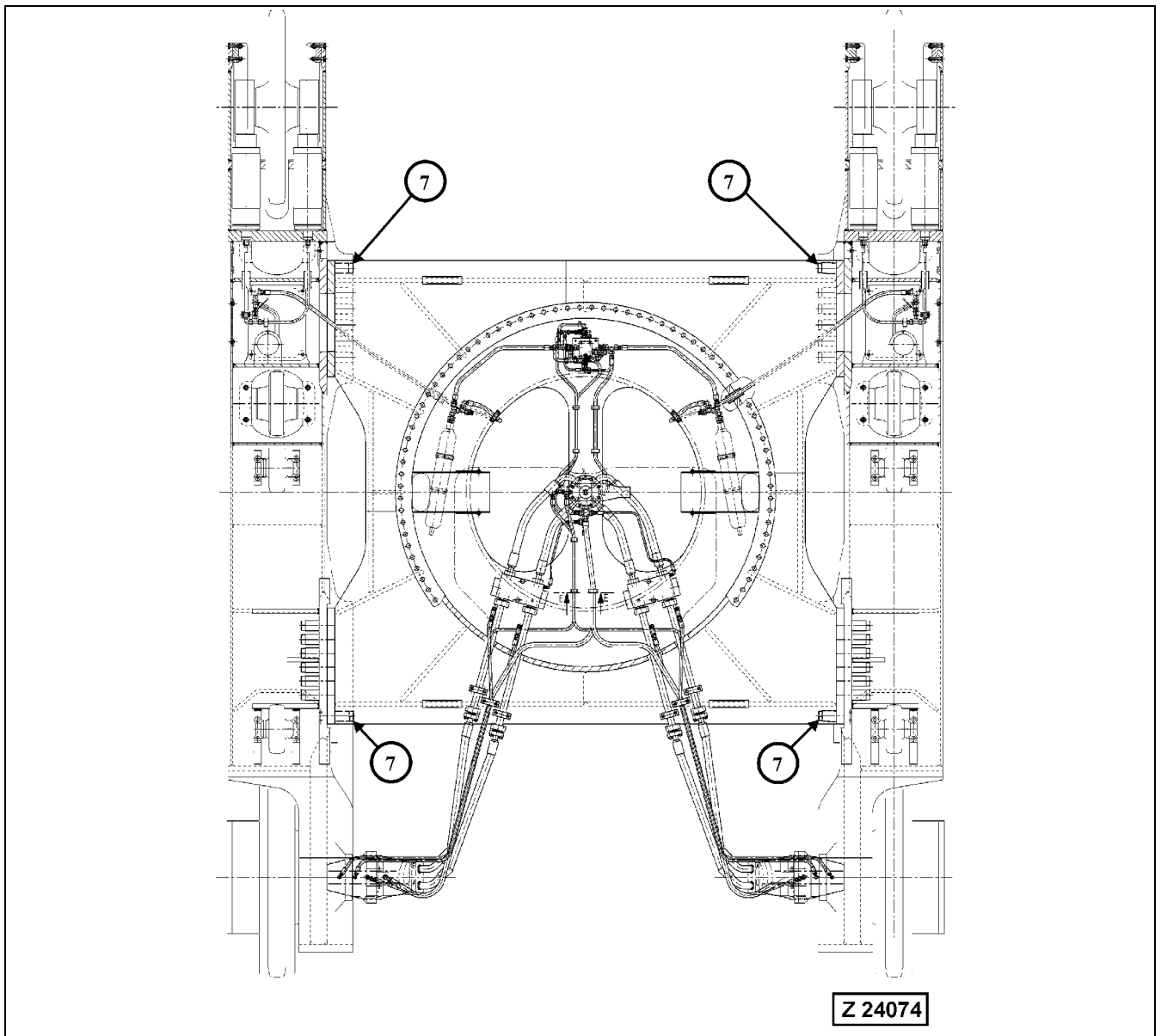
Special hydraulic torque wrench

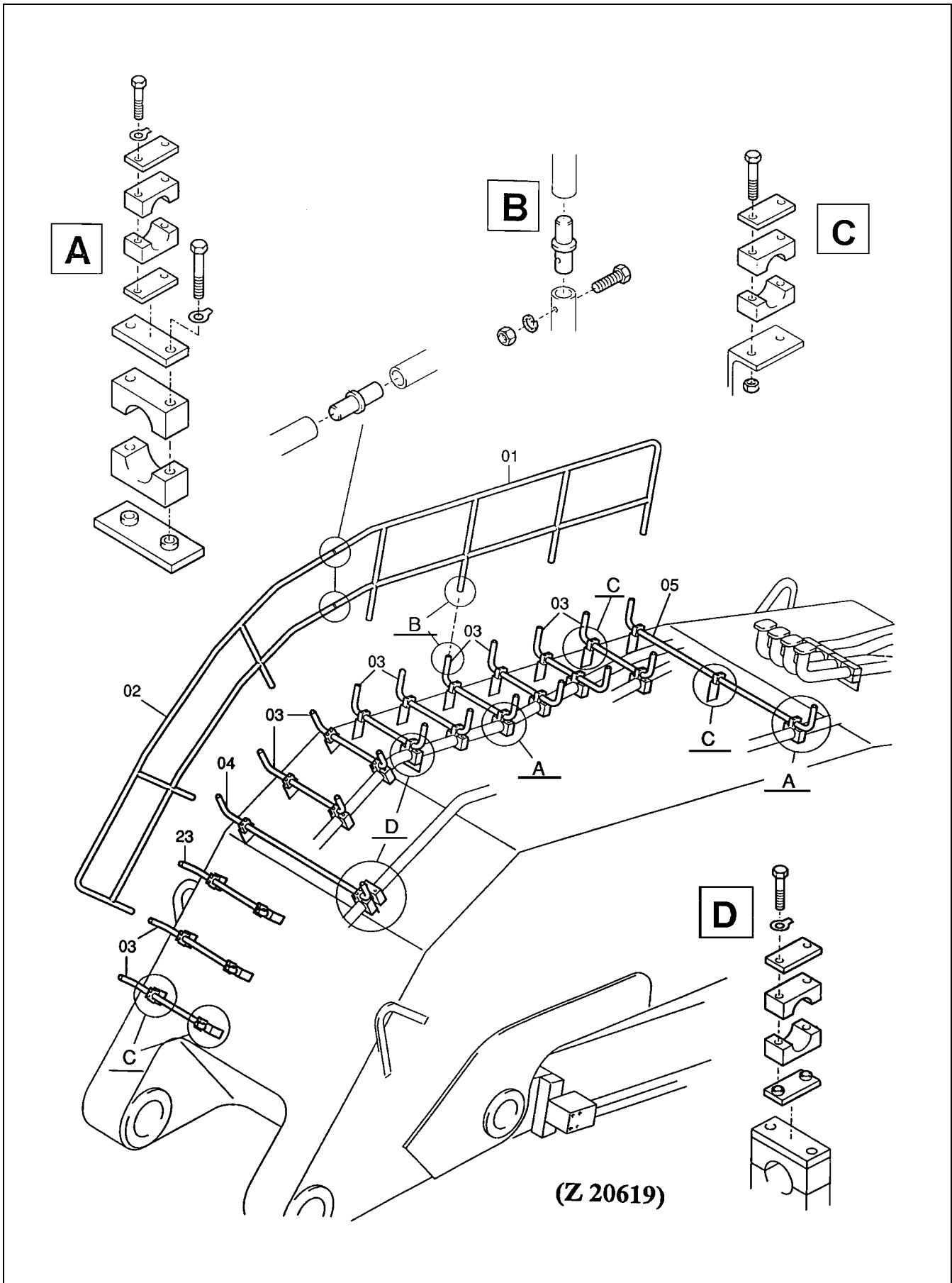
Legend for illustration Z24072:

- (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 Z24074





High-Strength Bolt Connections (continued)

Check condition and fastening of railings (01/02) and of steps (03, 04, 05 and 23).

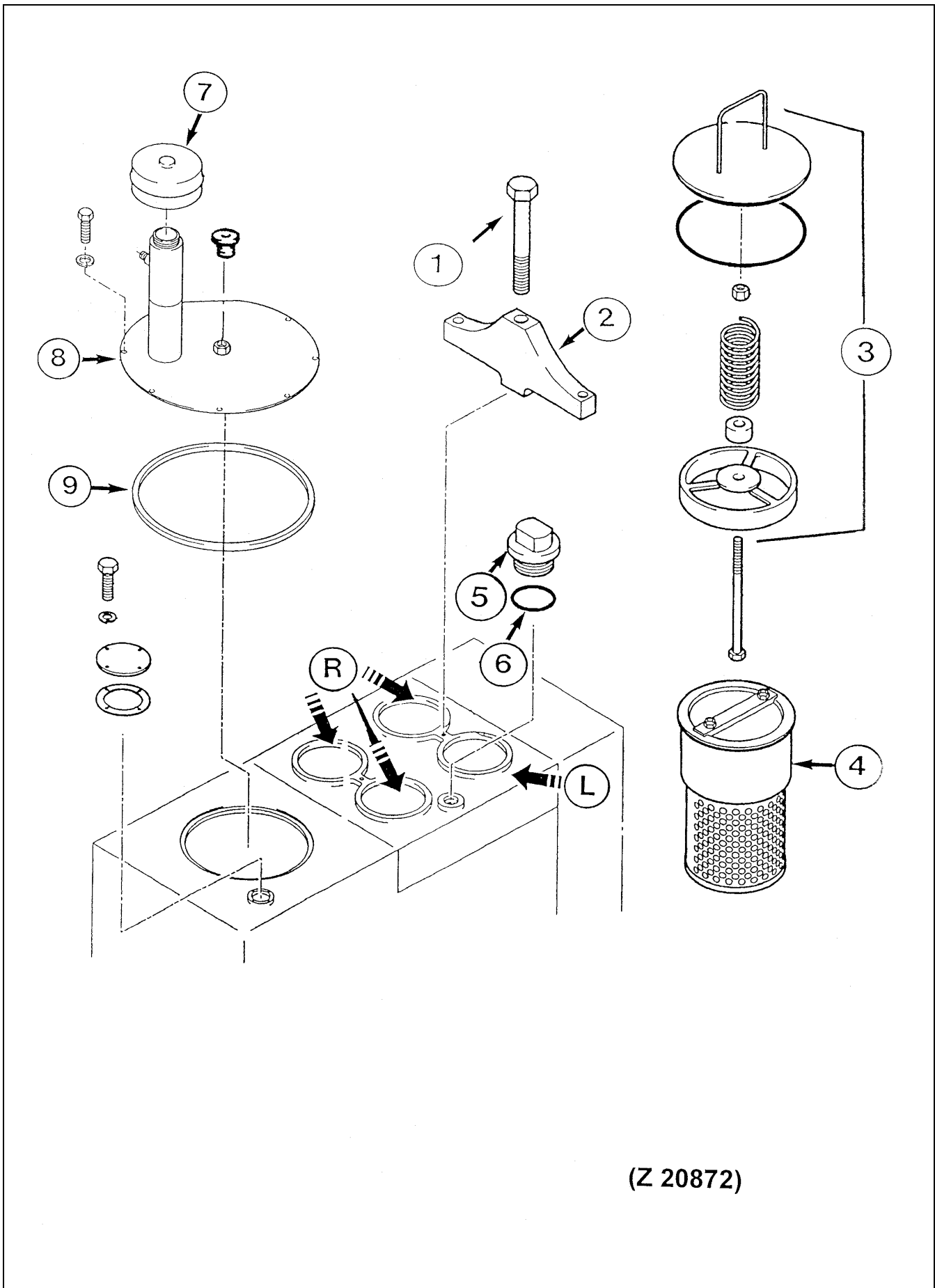
See details (A - D) for mounting parts arrangement.

⚠ WARNING

Always use the safety harness in conjunction with the strap type fall absorber when mounting onto the loader attachment. See section SAFETY INSTRUCTIONS page 29 for more information.

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
- Re-tighten loose mounting bolts and replace missing or damaged bolts.



4.12.2 HYDRAULIC SYSTEM - FILTER SERVICE

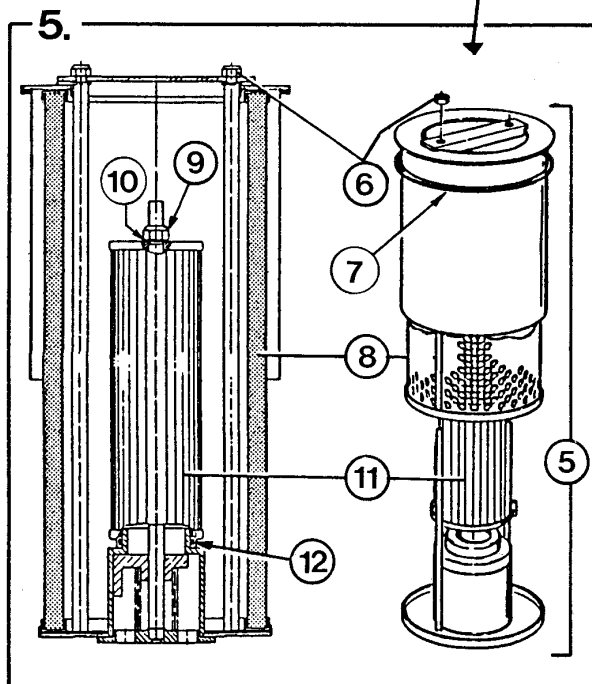
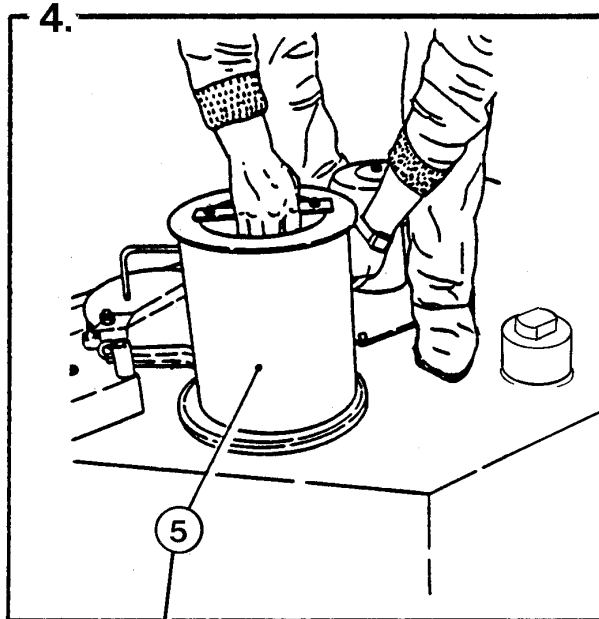
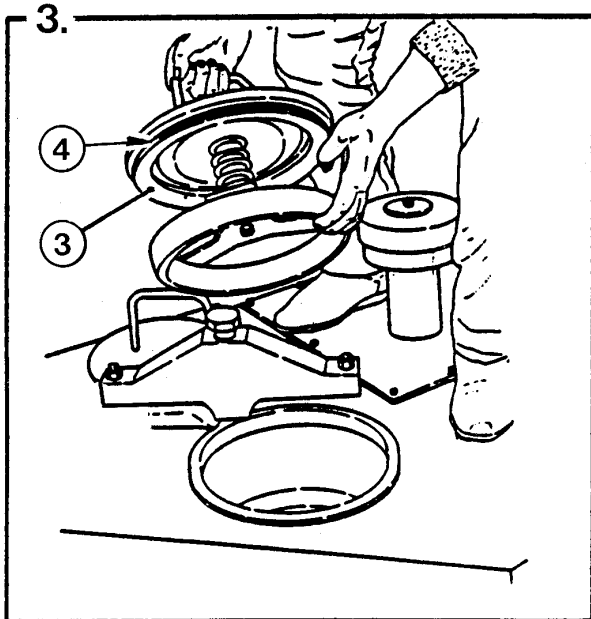
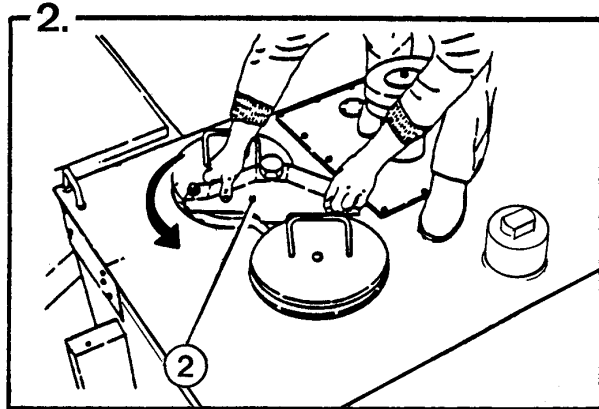
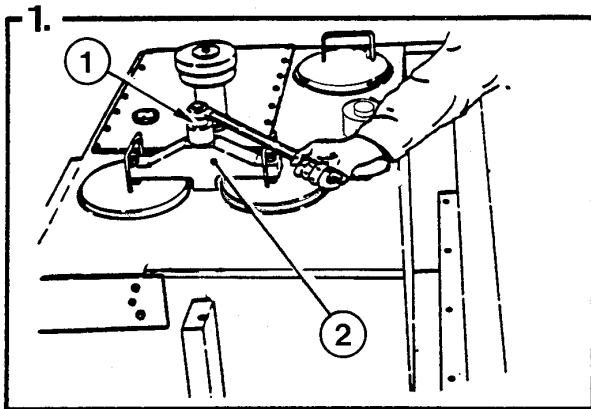
Legend for illust. Z20872

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)	O-ring
(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 379
- Breather filter, see page 381
- High pressure filters, see page 383
- Pressure filters on central control and filter frame, see page 387



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.

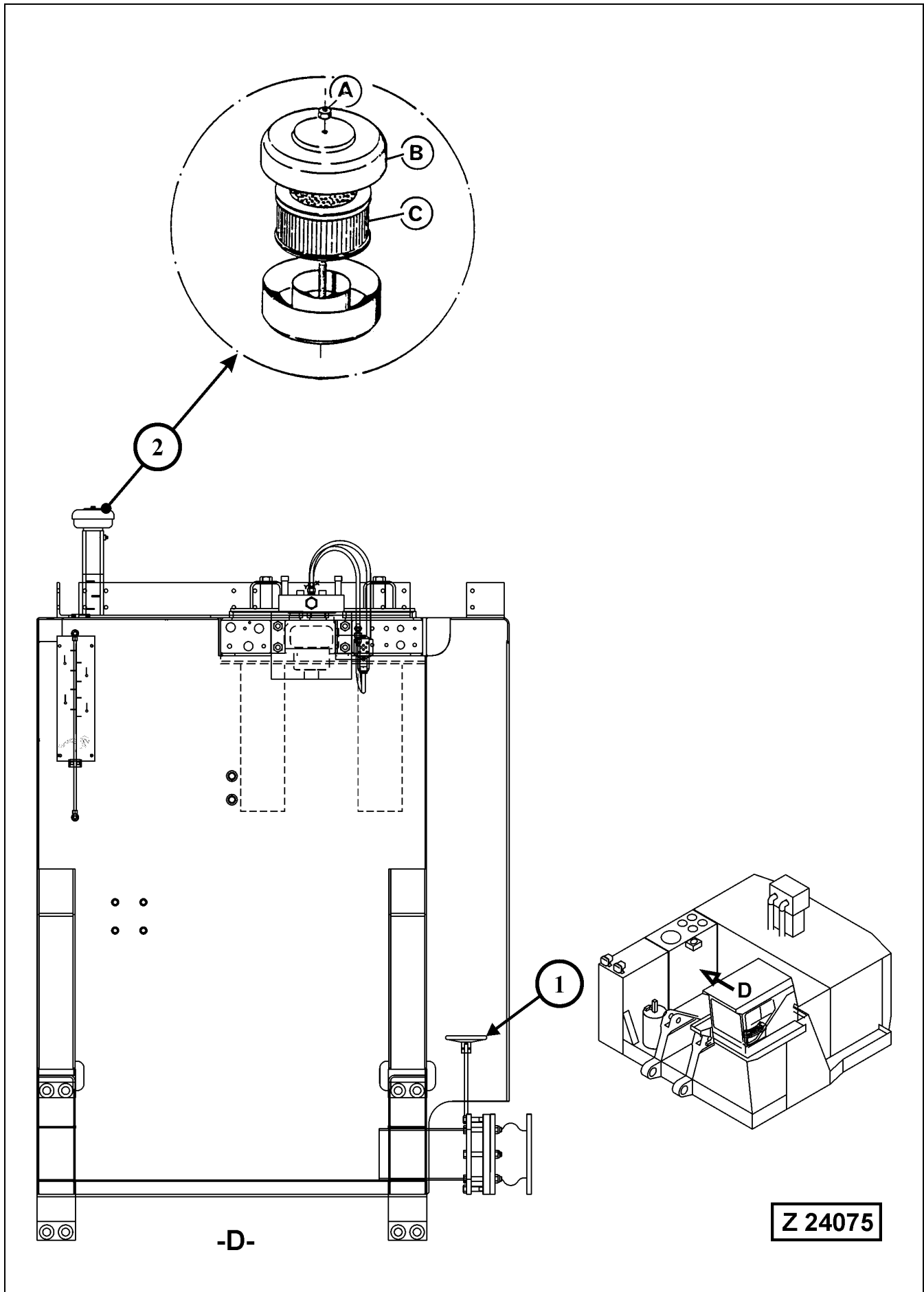
NOTICE

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 ETM 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. Z24075

- (1) Hand wheel of main shut-off valve located between suction oil reservoir and main oil reservoir
- To OPEN the valve, turn hand wheel (1) 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 ETM screen in the Operator's cab.

REMARK

Before starting the engine, make sure the shut-off valve is completely open by turning hand wheel (1) fully to the left (CCW).

- (2) Breather filter

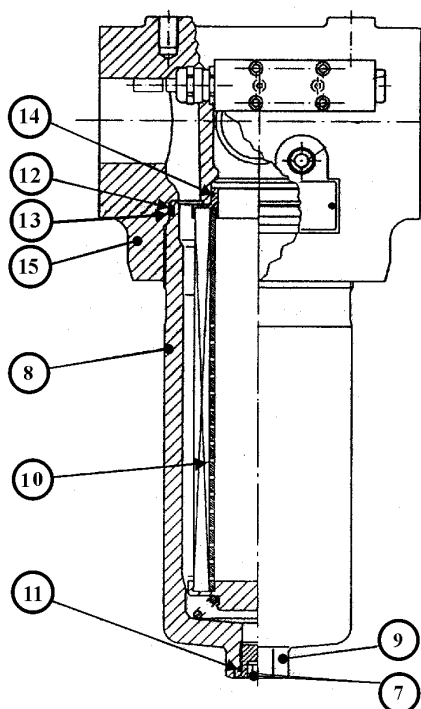
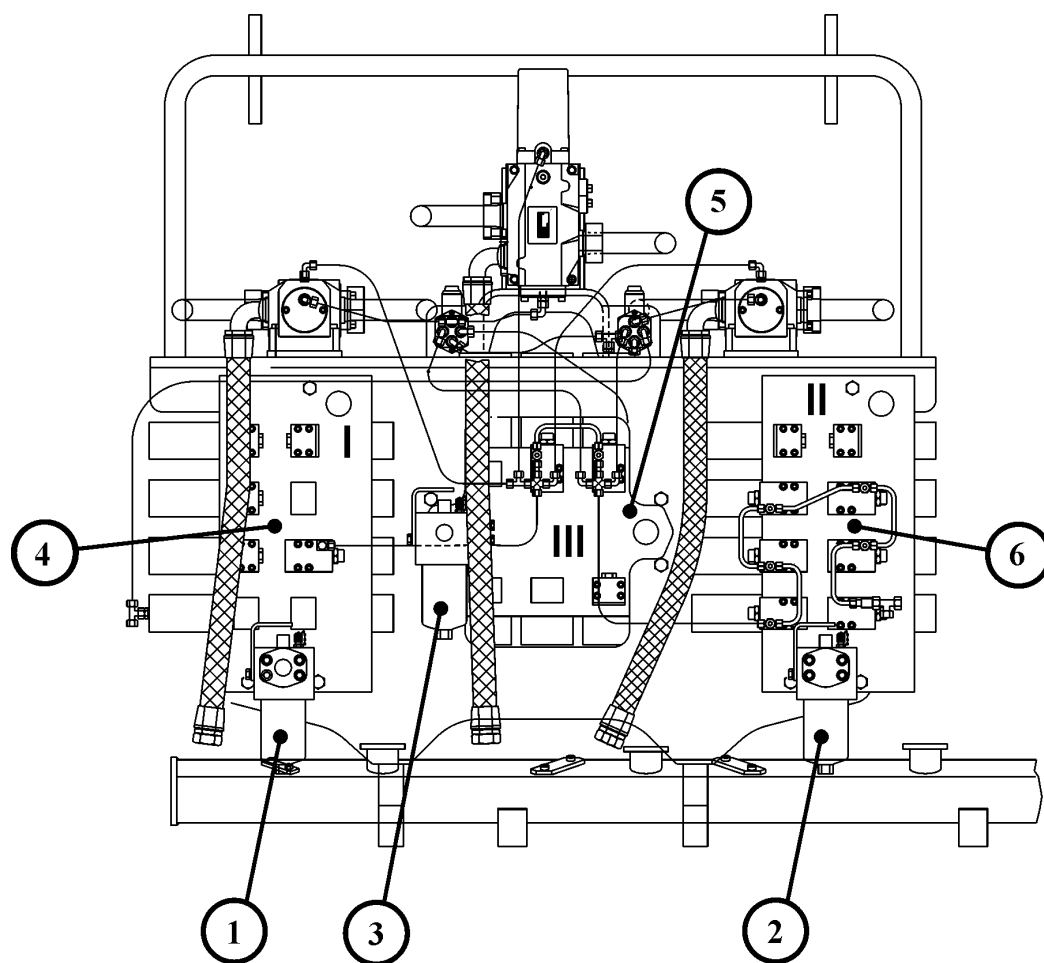
Replace Element (C) of Breather Filter (2).

1. Remove nut (A).
2. Remove cover (B).
3. Remove filter element (C).
4. Insert new filter element and reassemble the breather filter (2).

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 218 for evacuation procedure.



Z 24076

FILTER SERVICE

High Pressure Filters "HPF", illustration Z24076

NOTICE

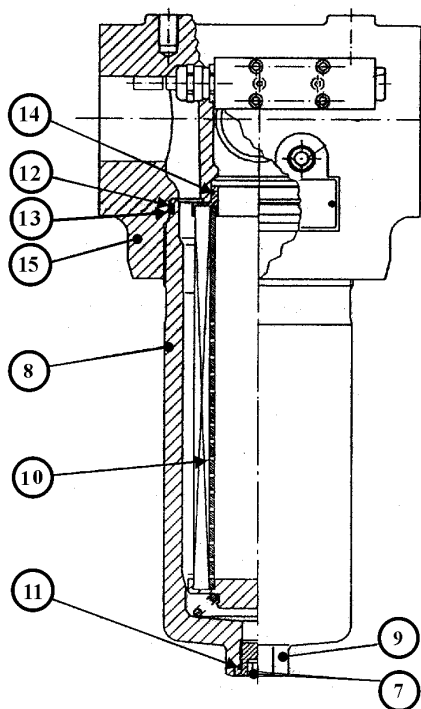
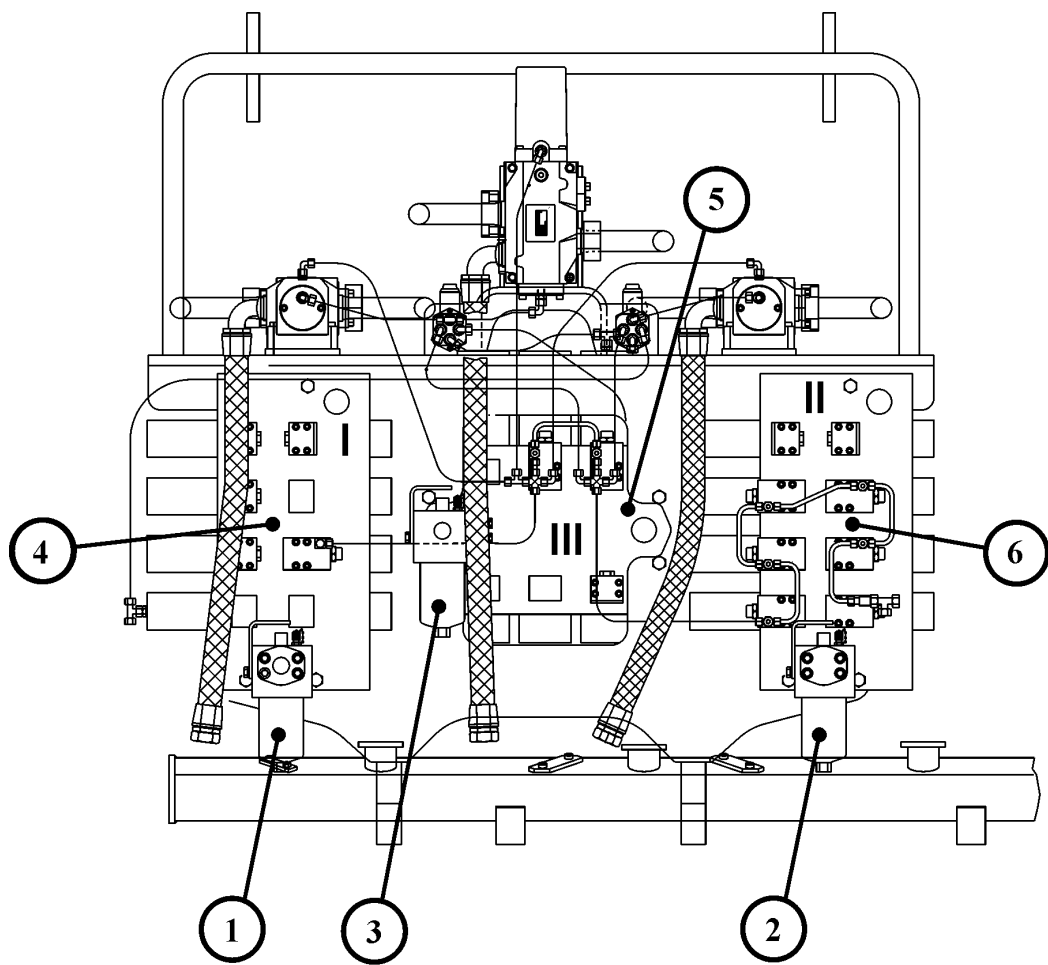
- The filter reference numbers (1 - 3) correspond to the numbering of the main pumps.
- If, for example, the fault message "High pressure filter #3 restricted" is being displayed on the ETM screen, the filter number (3) in the illustration has to be serviced. The engine will be shifted automatically to low idle speed. Stop work and inform Service staff about the fault message.

Legend for illustration Z24076

- (1) HPF for pump 1
- (2) HPF for pump 2
- (3) HPF for pump 3
- (4) Main control valve I
- (5) Main control valve II
- (6) Main control valve III
- (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 engine.
Relieve pressure in the hydraulic system with several movements of the control levers.
2. Place a suitable container below the filter in order to collect outflowing oil.
3. Remove plug (7) and drain the oil.
4. Screw off filter case (8).



Z 24076

FILTER SERVICE

High Pressure Filters "HPF", illustration Z24076

NOTICE

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

5. Remove element (10) and clean. Take care not to contaminate the "Clean" inside of the element when flushing.
6. Inspect O-rings (12 and 14) and back-up ring (13). Replace if necessary.
7. Install drain plug (7) with new packing ring (11). Fill filter case (8) half way up with clean hydraulic oil and re-assemble the filter. Make sure element (10) is properly seated in the filter head.
8. After short operating period check filter units for leakage.

CAUTION

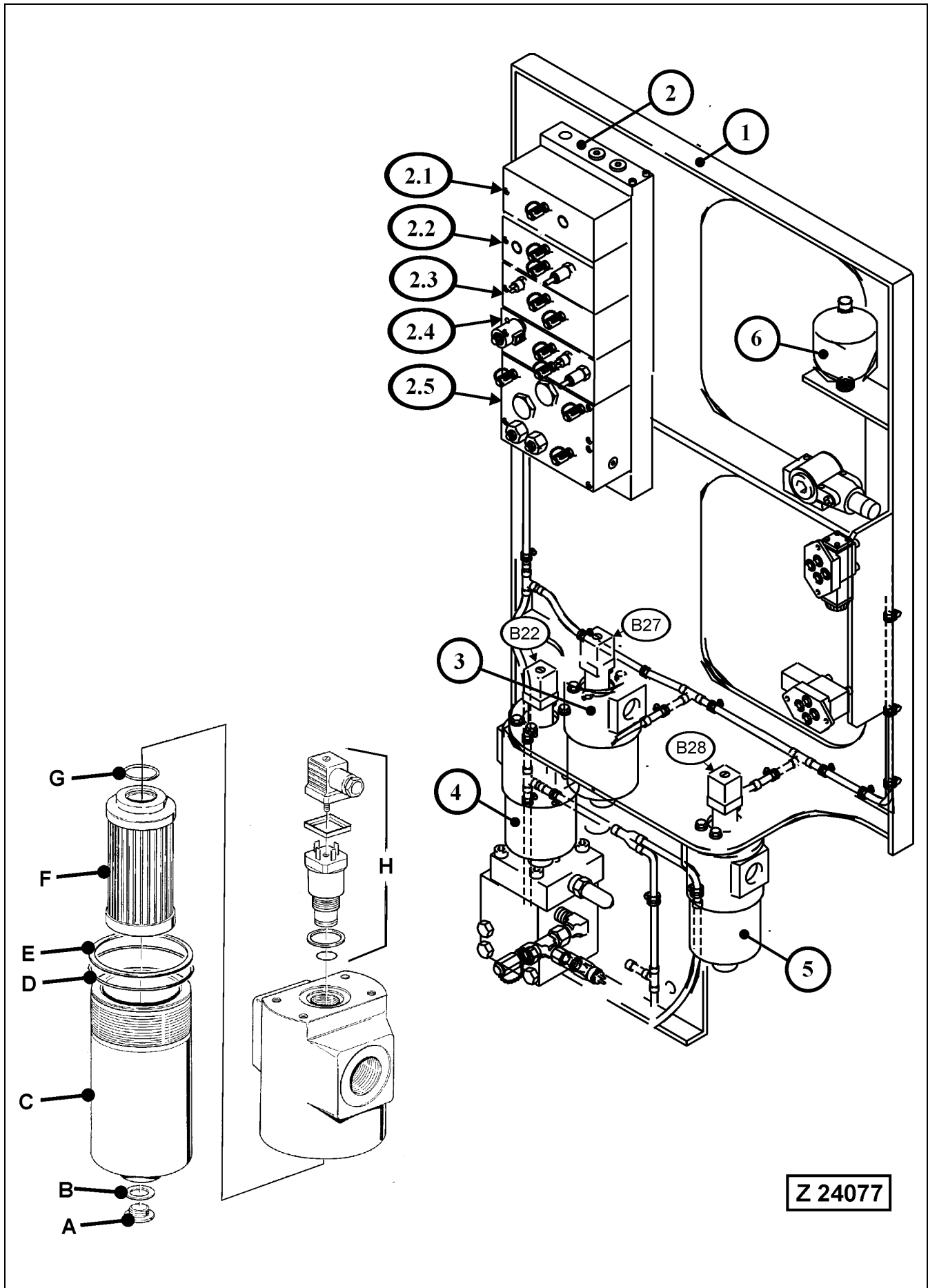
In case filter element (10) is soiled by metal chips, examine hydraulic pump for damages. Install new element (10).

NOTICE

If after cleaning of the filter element, the message "High pressure filter restricted" is displayed again, replace the filter element.

Replace elements (10) after three cleanings or after every 5000 operating hours, whichever occurs first.

After pump repairs all high pressure filter elements must be replaced.



FILTER SERVICE

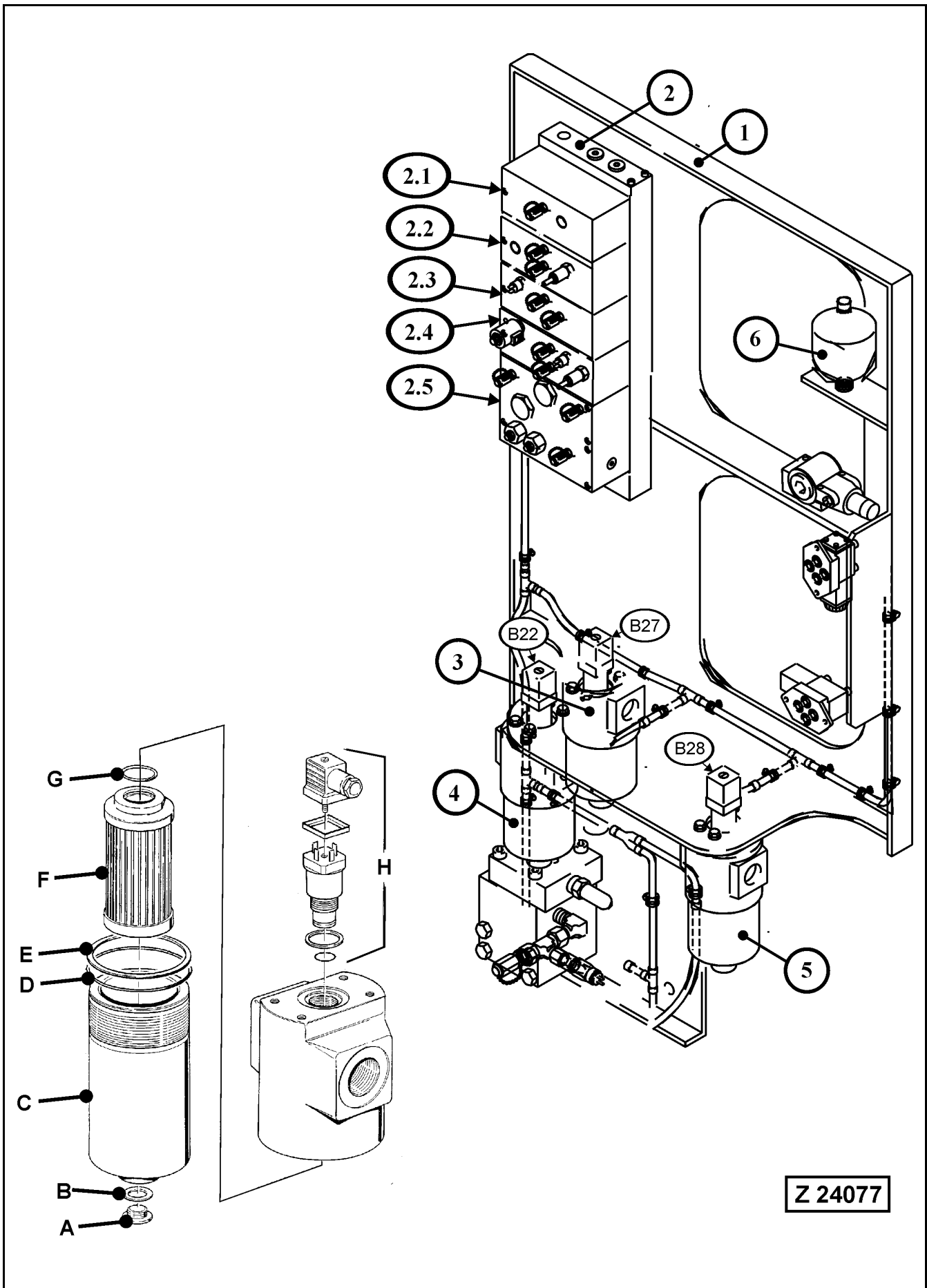
Replace filter elements of the hydraulic oil pressure filters

NOTICE

When a fault message "Pressure Filter restricted" is displayed, stop work and replace element of the corresponding pressure filter.

Legend for illust. Z24077

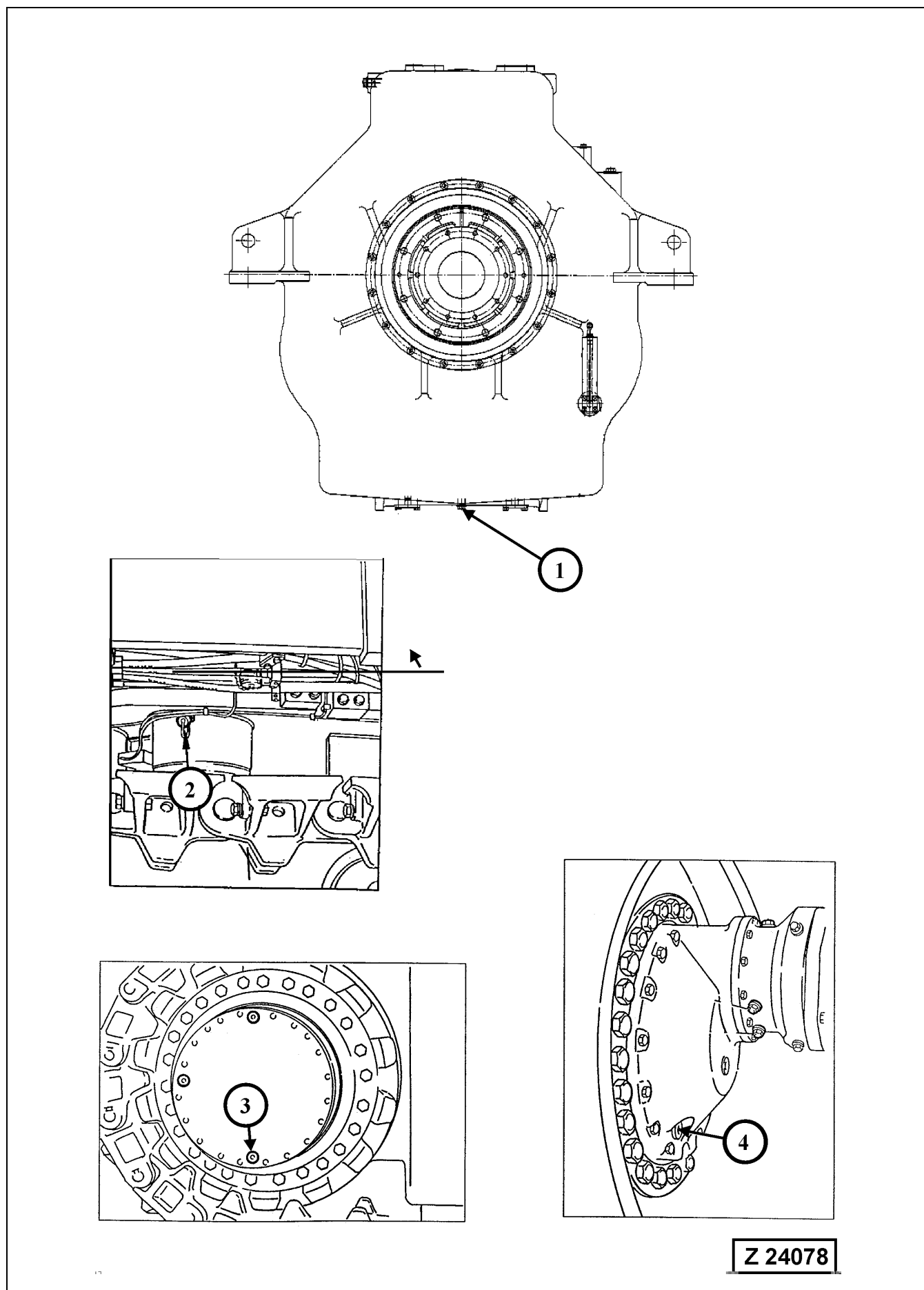
- (1) Central control and filter panel
- (2) Valve bank
- (2.1) Valve block, hydraulic swing down service arm circuit
- (2.2) Valve block, hydraulic access ladder circuit
- (2.3) Valve block, swing circuit
- (2.4) Valve block, travel brake circuit
- (2.5) Valve block, pilot oil circuit
- (3) Pressure oil filter for pump distributor gear PTO lubricating oil. Filter restriction monitored by differential pressure switch B27.
- (4) Pressure oil filter for pilot- and pump control oil circuit. Filter restriction monitored by differential pressure switch B22.
- (5) Pressure oil filter for fan drive motor of hydraulic oil cooler . Filter restriction monitored by differential pressure switch B28.
- (6) Pressure accumulator for pilot oil circuit



FILTER SERVICE

Replace pressure filter elements, illust. Z24077, as follows:

1. Place working equipment on the ground and shut-off the engine.
Relieve pressure in the hydraulic system according to page 202 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.



4.12.3 PTO (PUMP DISTRIBUTOR GEAR), SWING GEAR 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 Z24078

- (1) PTO (Pump distributor gear)
- (2) Swing gear
- (3) Travel gears, planetary box
- (4) Travel gears, spur gear box

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

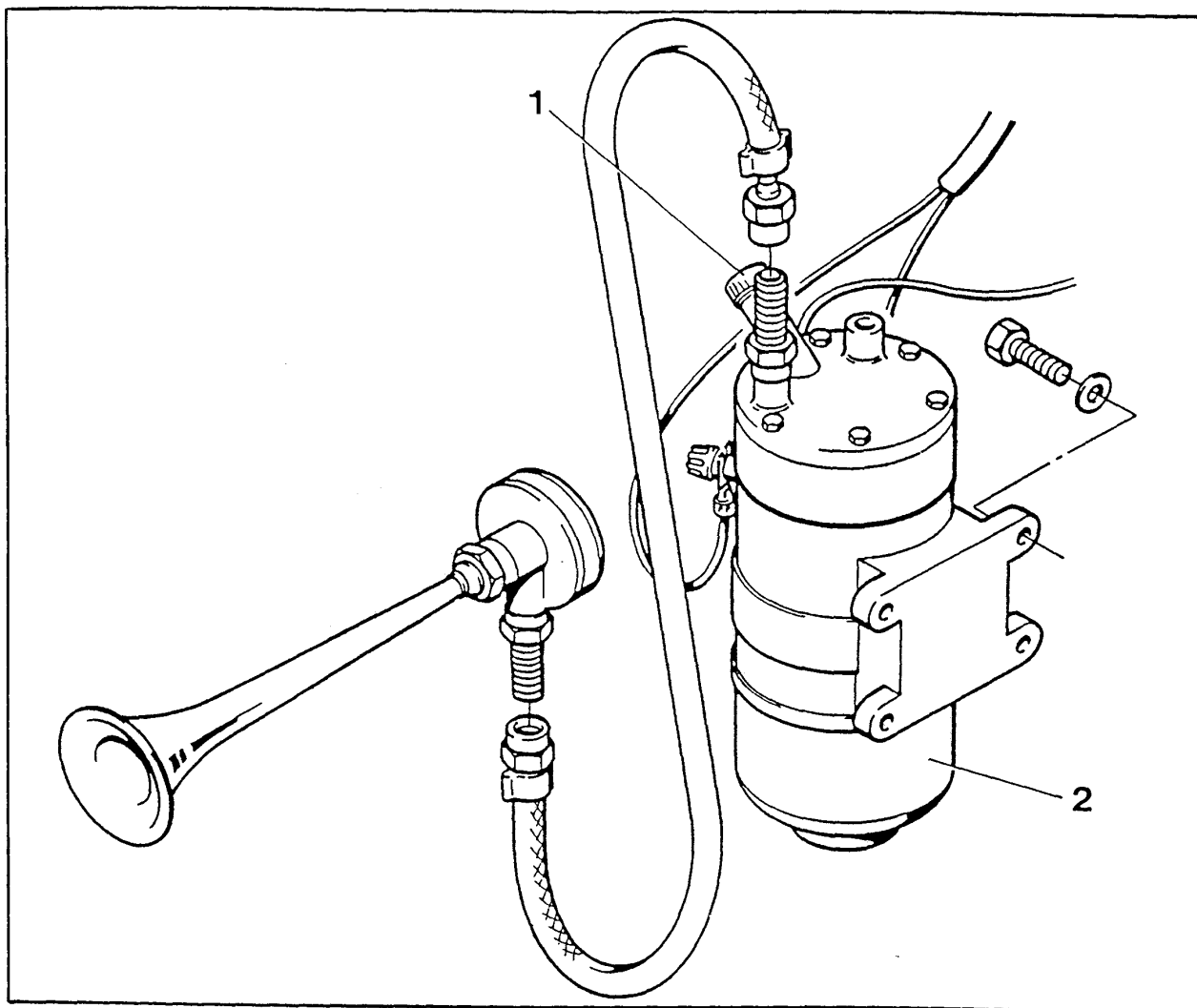
SWING GEAR AND TRAVEL GEARS

(Oil contamination)

Element		Normal	Increased		Critical
Iron	<	400 ppm	400 - 700 ppm	>	700 ppm
Copper	<	25 ppm	25 - 60 ppm	>	60 ppm
Chromium	<	5 ppm	5 - 15 ppm	>	15 ppm
Silicon	<	40 ppm	40 - 60 ppm	>	60 ppm

NOTICE

If the grade of contamination approaches to the “critical” values in the above tables, change the gear oil. However, the regular oil changes must be carried out every 3000 operating hours or once a year, whichever occurs first.



Z9543

4.12.4 SIGNAL HORN COMPRESSOR - CLEAN AND LUBRICATE

See illustration Z 9543

Unscrew collector protection cap (2).

Unscrew ball bearing cover and fill it half way up with grease.

If the fins of the collector are very strongly blackened or coated with verdigris, clean them with emery cloth.

4.12.5 HYDRAULIC TRACK TENSIONING SYSTEM - CHECK PRESSURE ACCUMULATORS

WARNING

Before working on any part of the hydraulic track tensioning system relieve all pressure in the system by opening pressure relief cock (5), illustration Z 20371.

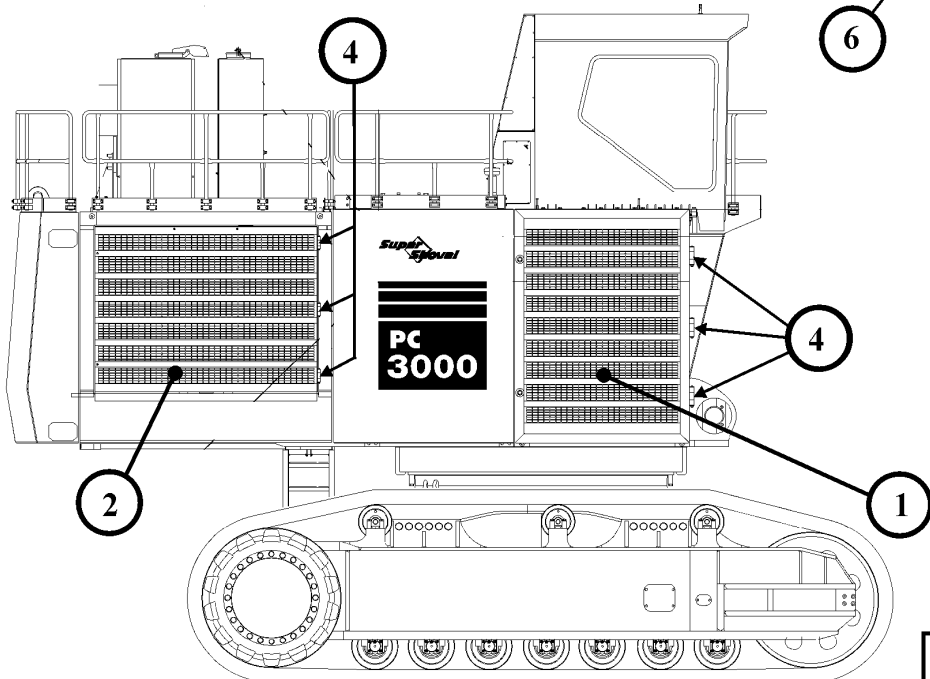
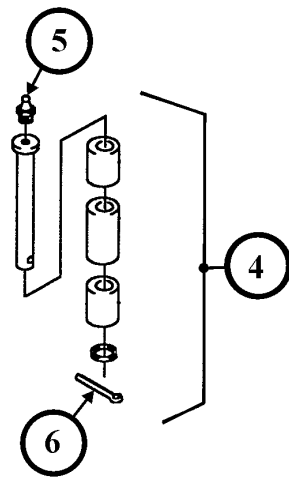
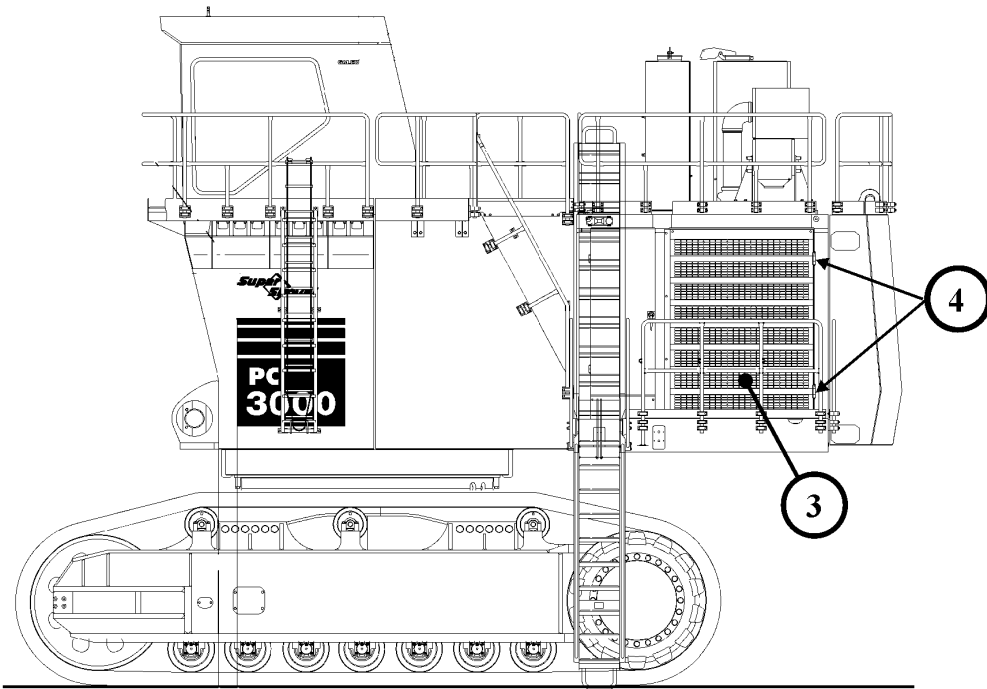
NOTICE

For checking the charging pressure a special testing and filling device must be used. This device can be ordered from your Komatsu Dealer.

The testing and filling procedure of the pressure accumulators has to be carried out in accordance with Service Bulletin No. AH01531 filed in volume 2 binder.

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



Z 25099

4.12.6 HYDRAULIC OIL COOLER - INSPECT AND LUBRICATE DOOR HINGES

⚠ WARNING

- Provide adequate working platform for safe access to the hydraulic oil cooler (1).
 - Check all door hinges (4) 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. Z25099

- (1) Hydraulic oil cooler
- (2) Rear door of machinery house
- (3) Radiator door
- (4) Hinges
- (5) Grease fitting
- (6) Cotter pin

- Lubricate all cooler hinges (4) at grease fittings (5).
- Check to make sure that the hinge pins are properly secured with cotter pins (6).

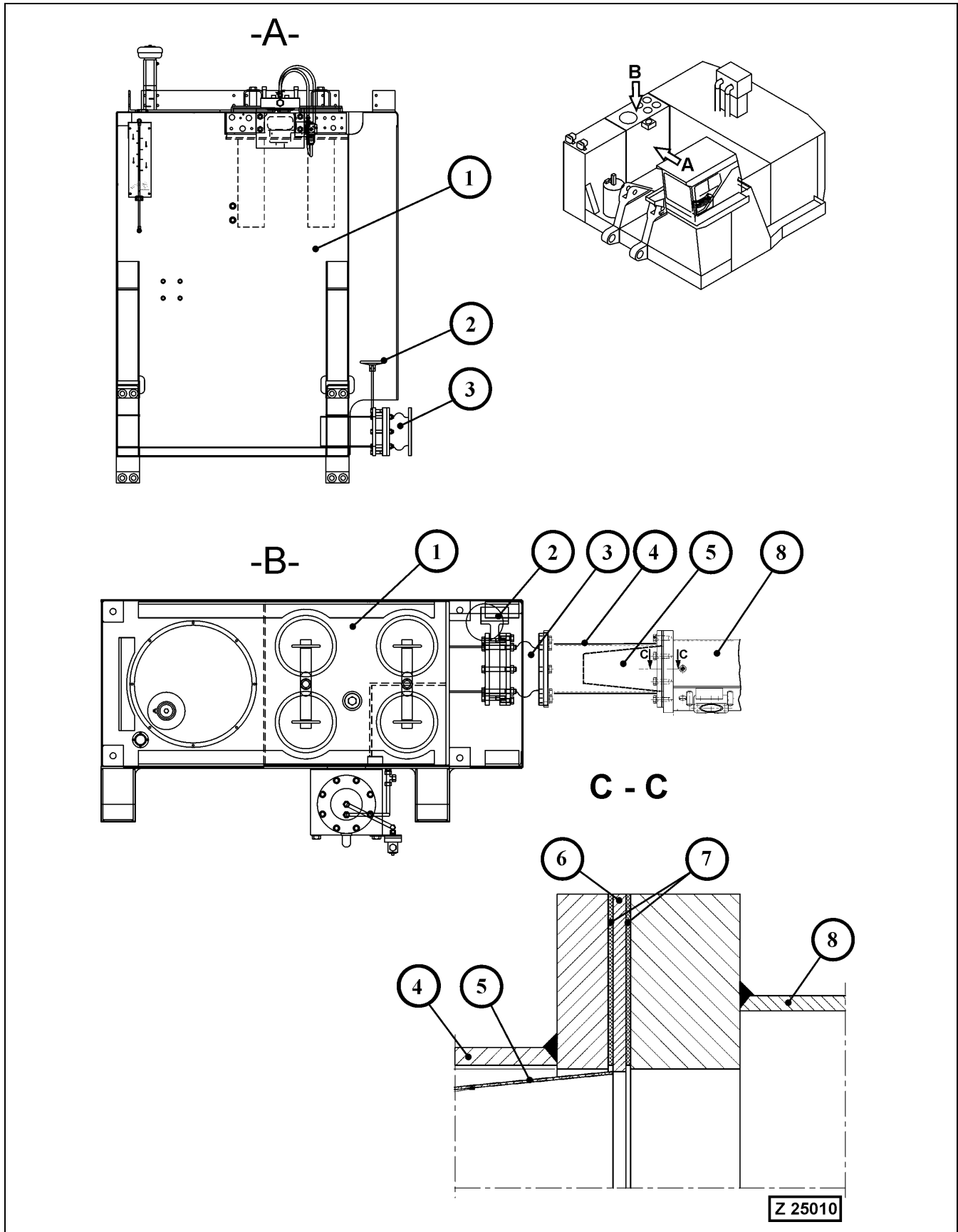
4.12.7 MACHINERY HOUSE DOORS - INSPECT AND LUBRICATE DOOR HINGES

⚠ WARNING

- Provide adequate working platform for safe access to the rear machinery house door (2).
 - Check all door hinges (4) 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.
-
-

- Lubricate all door hinges (4) at grease fittings (5).
- Check to make sure that the hinge pins are properly secured with cotter pins (6).

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. Z25010

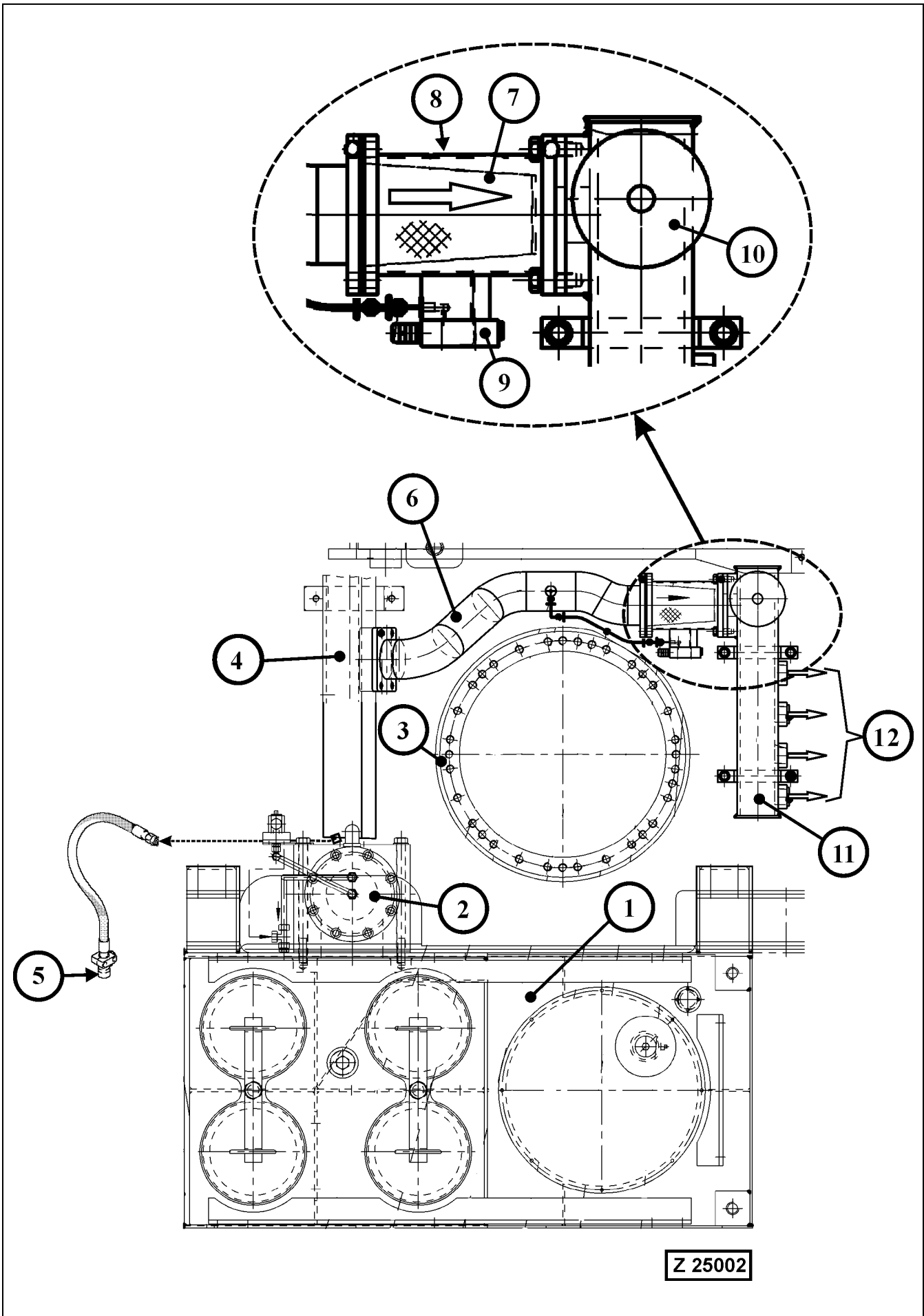
- (1) Main oil reservoir
- (2) Hand wheel of main shut-off valve
- (3) Compensator. Check condition and tightness of compensator and connected parts.
- (4) Intermediate pipe
- (5) Suction strainer
- (6) Suction strainer flange
- (7) Gaskets
- (8) Suction oil reservoir

Sequence of Servicing

- Evacuate main hydraulic oil reservoir. Proceed according to section "Central Refilling System" on page 218.
- Drain the oil from return oil manifold, see page 401 for more information.
- Drain the oil from suction oil reservoir, see page 403 for more information.
- Replace main suction strainer (5) with gaskets (7), illustration Z25010.
- Replace suction strainers of the hydraulic pumps, see page 403 for more information.
- Replace oil cooler strainer and pulsation damper, see page 401 for more information.

REMARK

With hydraulic oil reservoir empty, service the return oil filters and leakage oil filter. Inspect the reservoir for sediments. Clean the reservoir if necessary.

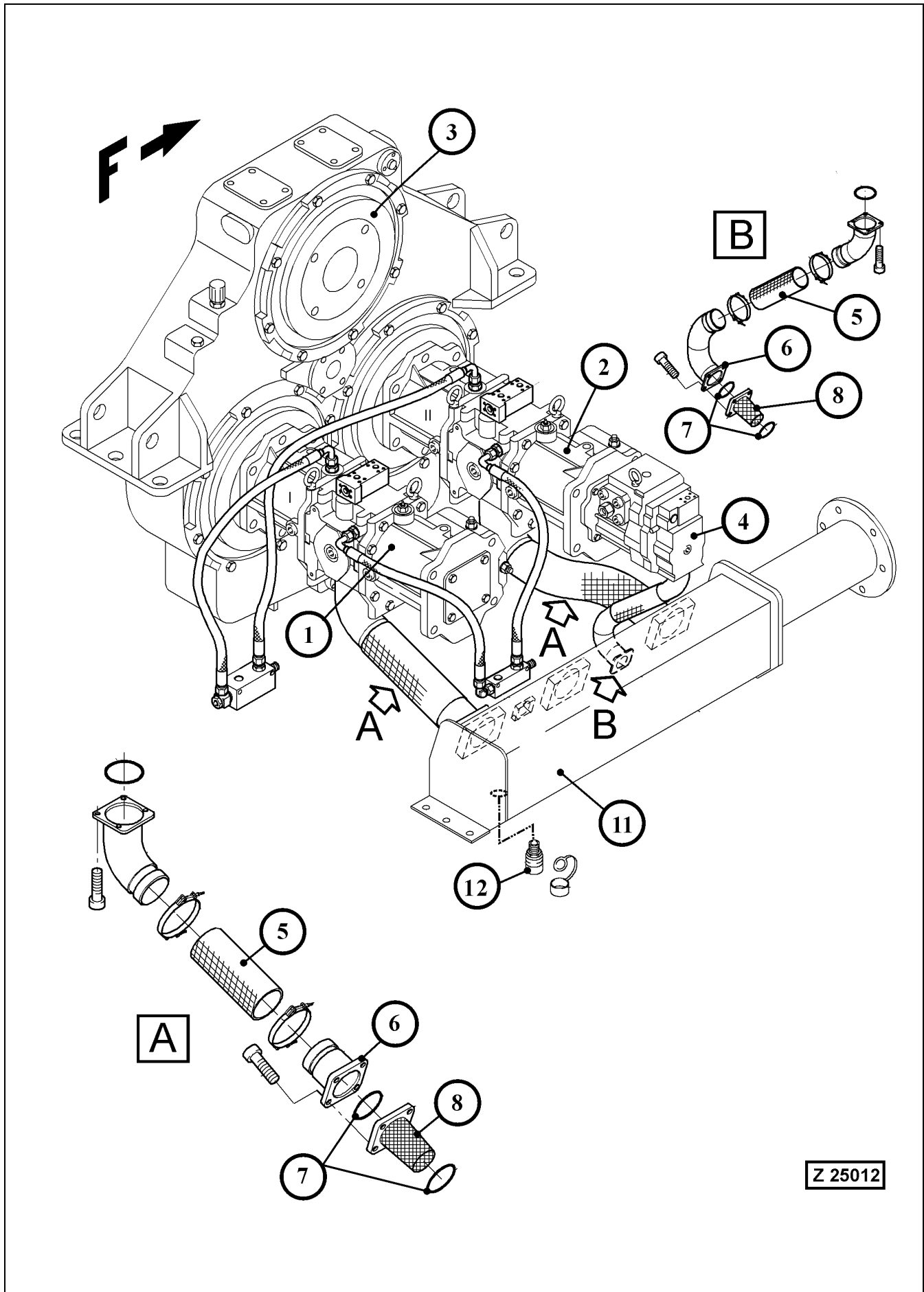


HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER

Legend for illust. Z25002

- (1) Main hydraulic oil reservoir
- (2) Back-pressure valve
- (3) Swing gear location
- (4) Return oil collector manifold
- (5) Drain coupling of the return oil collector manifold
- (6) Branch pipe
- (7) Strainer of the oil cooler circuit
- (8) Intermediate pipe
- (9) Differential pressure switch
- (10) Pulsation damper
- (11) Distributor manifold
- (12) Oil flow to cooler

- Drain the oil from manifold (4) by attaching the drain hose (part of tool set) to coupling (5).
- Remove pipe (8) with strainer (7). Insert new strainer and install pipe (8) with new gaskets.
- Remove pulsation damper (10) and install new pulsation damper with new O-ring.



HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER

Legend for illustration Z25012

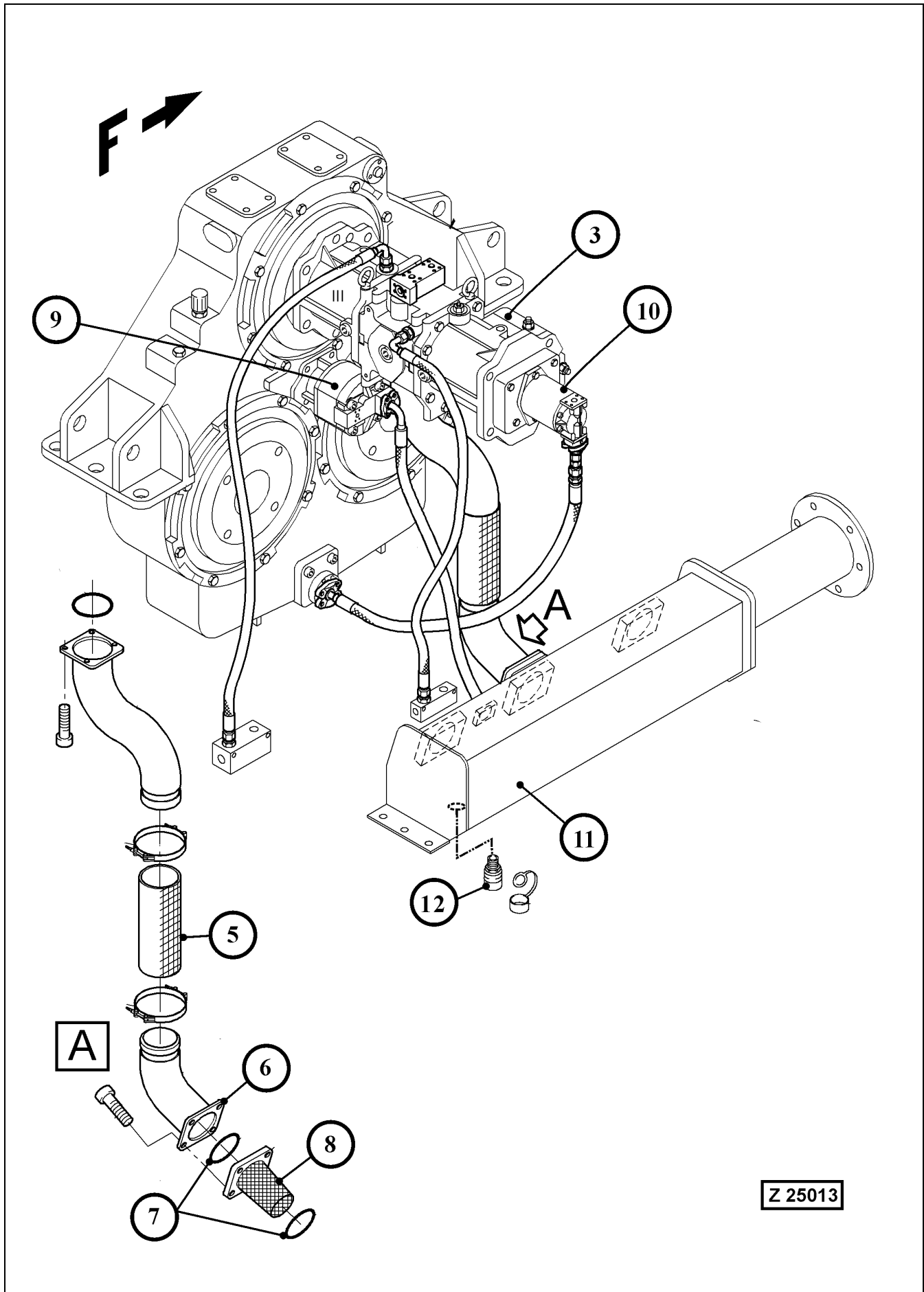
- (1) Main hydraulic pump -1-
- (2) Main hydraulic pump -2-
- (3) Location of main hydraulic pump -3- (shown on next page)
- (4) Hydraulic oil cooler fan drive pump
- (5) Flexible hoses
- (6) Flange
- (7) O-rings
- (8) Suction strainer
- (11) Suction oil reservoir
- (12) Drain coupling

Drain oil from suction reservoir

Drain the oil from suction reservoir (11) by attaching the drain hose (part of tool set) to coupling (12).

Replace suction strainers of the hydraulic pumps

1. Remove mounting bolts of flange (6).
2. Move away flexible hose (5) with flange (6).
3. Remove strainer (8) with O-rings (7) and discard.
4. Install new strainer (8) with new O-rings (7).
5. Locate flange (6) above the strainer and tighten the mounting bolts of flange (6).
6. Check to make sure that the hose clamps of the suction hoses are in good condition and properly fitted.



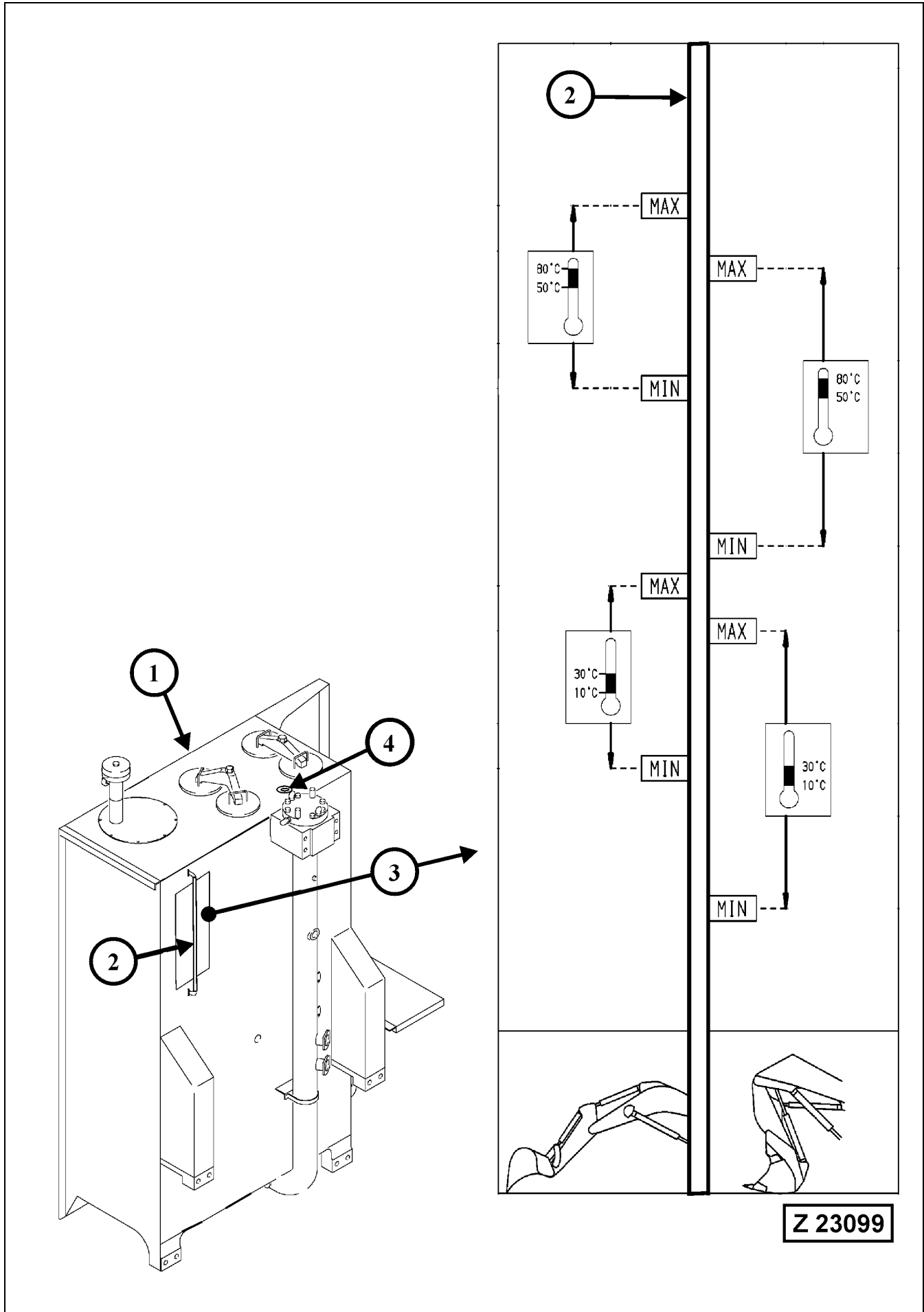
HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER

Legend for illustration Z25013

- (3) Main hydraulic pump -3-
- (5) Flexible hoses
- (6) Flange
- (7) O-rings
- (8) Suction strainer
- (9) Control oil pump (pilot oil circuit)
- (10) PTO gear lubrication pump
- (11) Suction oil reservoir
- (12) Drain coupling

Replace Suction Strainer of Main Pump (3)

1. Remove mounting bolts of flange (6).
2. Move away flexible hose (5) with flange (6).
3. Remove strainer (8) with O-rings (7) and discard.
4. Install new strainer (8) with new O-rings (7).
5. Locate flange (6) above the strainer and tighten the mounting bolts of flange (6).
6. Check to make sure that the hose clamps of the suction hoses 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 (2), see illustration Z25010 on page 398, is in open position.
2. Check to make sure that all connections are securely tightened.

REMARK

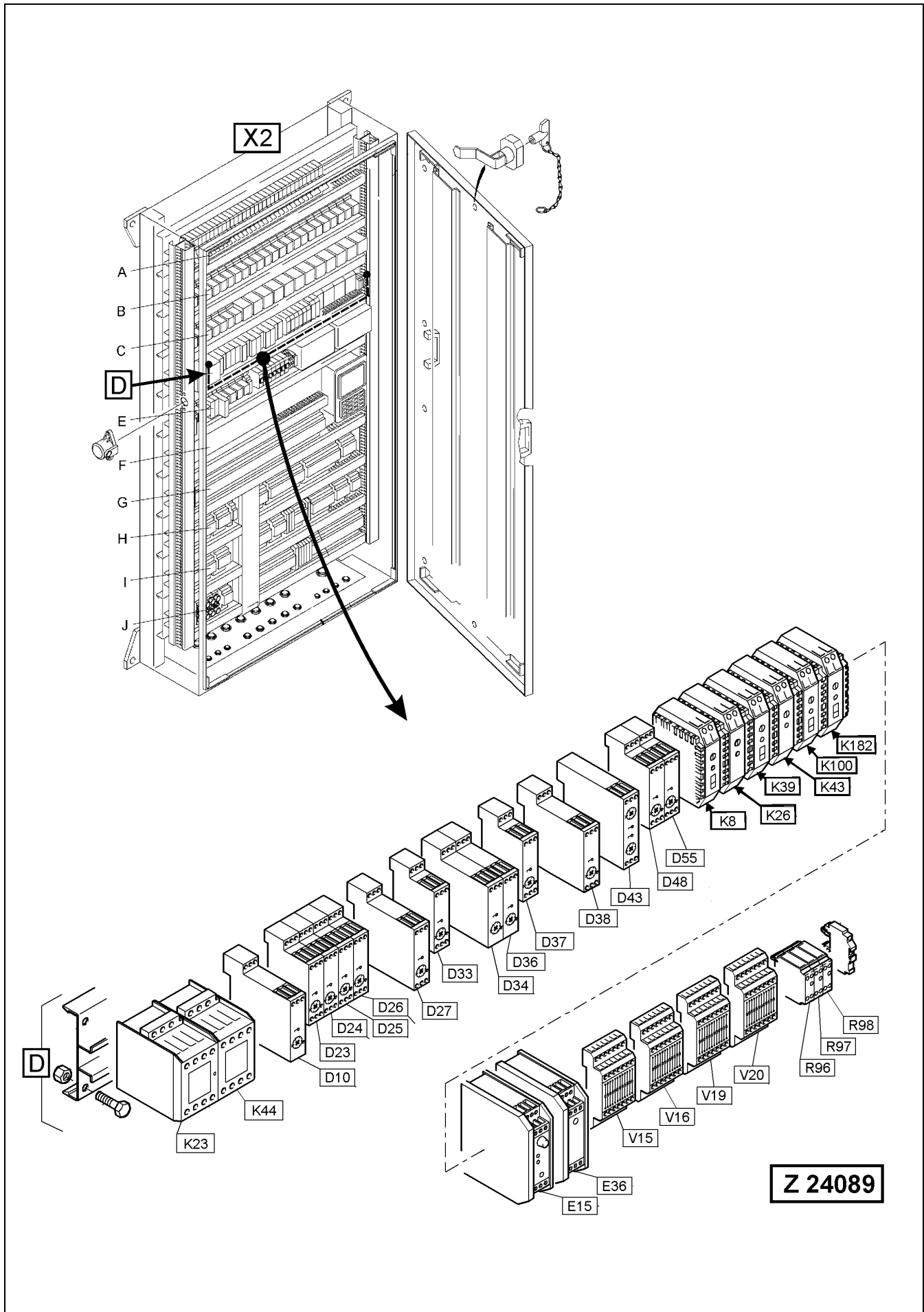
Select hydraulic oil viscosity grade according to ambient temperatures.

If the new hydraulic oil has a different viscosity grade compared with the drained oil it is necessary to adjust the temperature switch units according to the table on page 409.

3. On machines equipped with Central Refilling System fill main hydraulic oil reservoir according to section -Central Refilling System- on page 218.
On machine without central refilling system fill main oil reservoir through opening (4), illustration Z23099. 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).
4. Remove the air from the hydraulic system according to the instructions on page 411.

Legend for illustration Z23099

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



Hydraulic oil viscosity and adjustment of temperature switch units

If the new hydraulic oil has a different viscosity grade compared with the drained oil it is necessary to adjust the temperature limit values at switch units (K26, K39 and K100), illustration Z24089 in accordance with the viscosity grade of the new hydraulic oil. The switch units are located in the X2 switch box in the cab base.

Legend for illustration Z24089

K26 - Switch unit for hydraulic oil cooler fan speed control.

K39 - Switch unit for hydraulic oil temperature warning message "Hydraulic Oil Temperature too high".

K100 - Switch unit for pre-load of hydraulic oil cooler circuit

Adjust switch units to the respective oil viscosity grade as follows:

Oil viscosity grade according to ISO	VG 22	VG 32	VG 46	VG 68	VG 100	SHELL SL0851
-K26- Adjust temperature limit value to switching point °C	+32°	+41°	+50°	+58°	+67°	+39°
-K39- Adjust temperature limit value to switching point °C	+58°	+69°	+79°	+85°	+85°	+81°
-K100- Adjust temperature limit value to switching point °C	+9°C	+16°C	+25°C	+32°C	+39°C	+39°C

Adjustment procedure for (K26, K39 and K100):

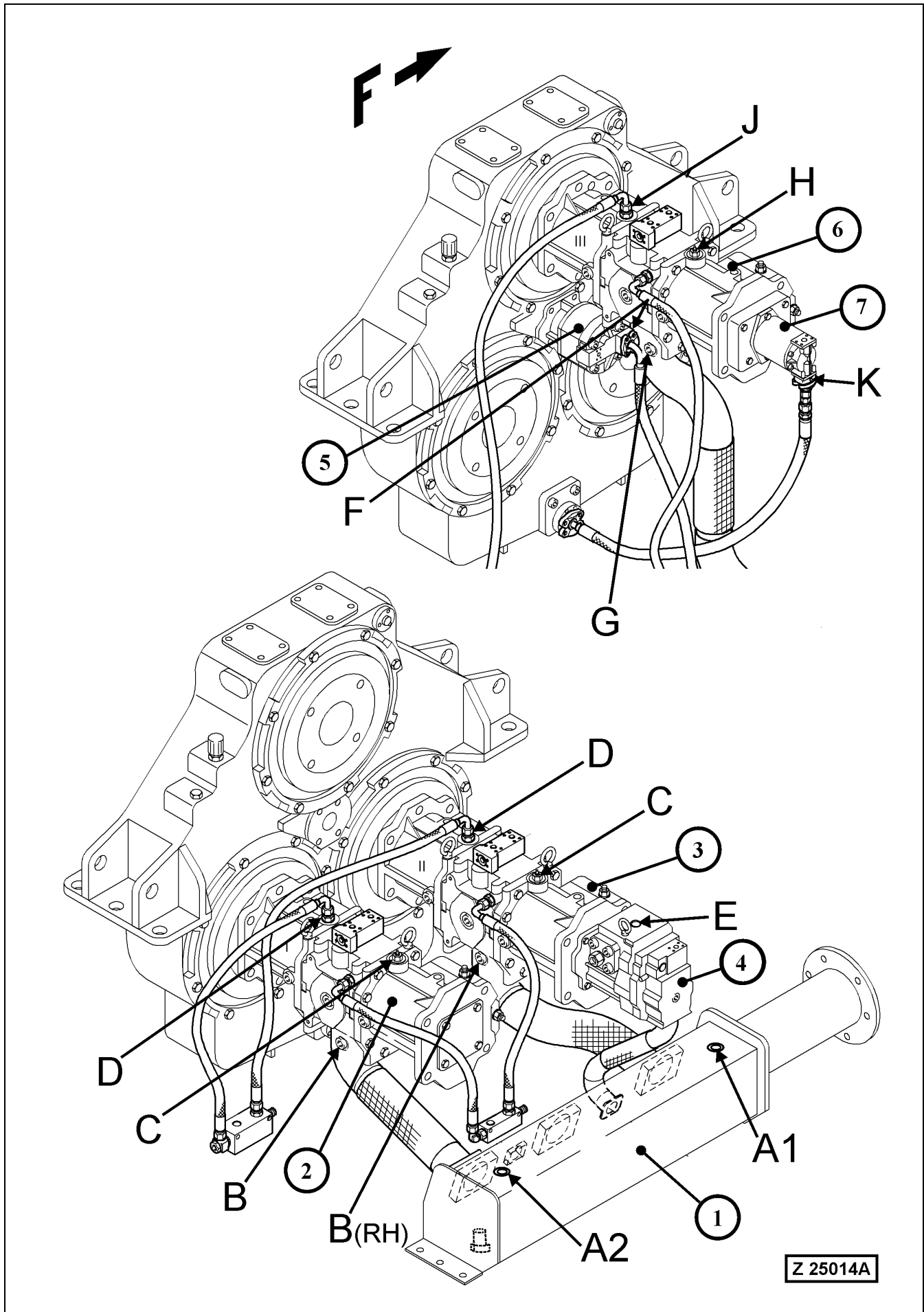
Adjust the temperature limit value at the cogwheel next to the drum scale on switch unit front cover.

NOTICE

Turn the cogwheel sensitively. **DO NOT** turn beyond the **STOP** marking, otherwise the internal potentiometer driver pin will disengage resulting in wrong value transmission. Refer to Service Bulletin No. AH02508b for functional test of the switch unit.

REMARK

The switch unit (K8) is used for engine coolant temperature warning message. **DO NOT** change the setting of this unit. The switch units (K43) and (K182) are used for adjustment of the pump distributor gear oil viscosity.



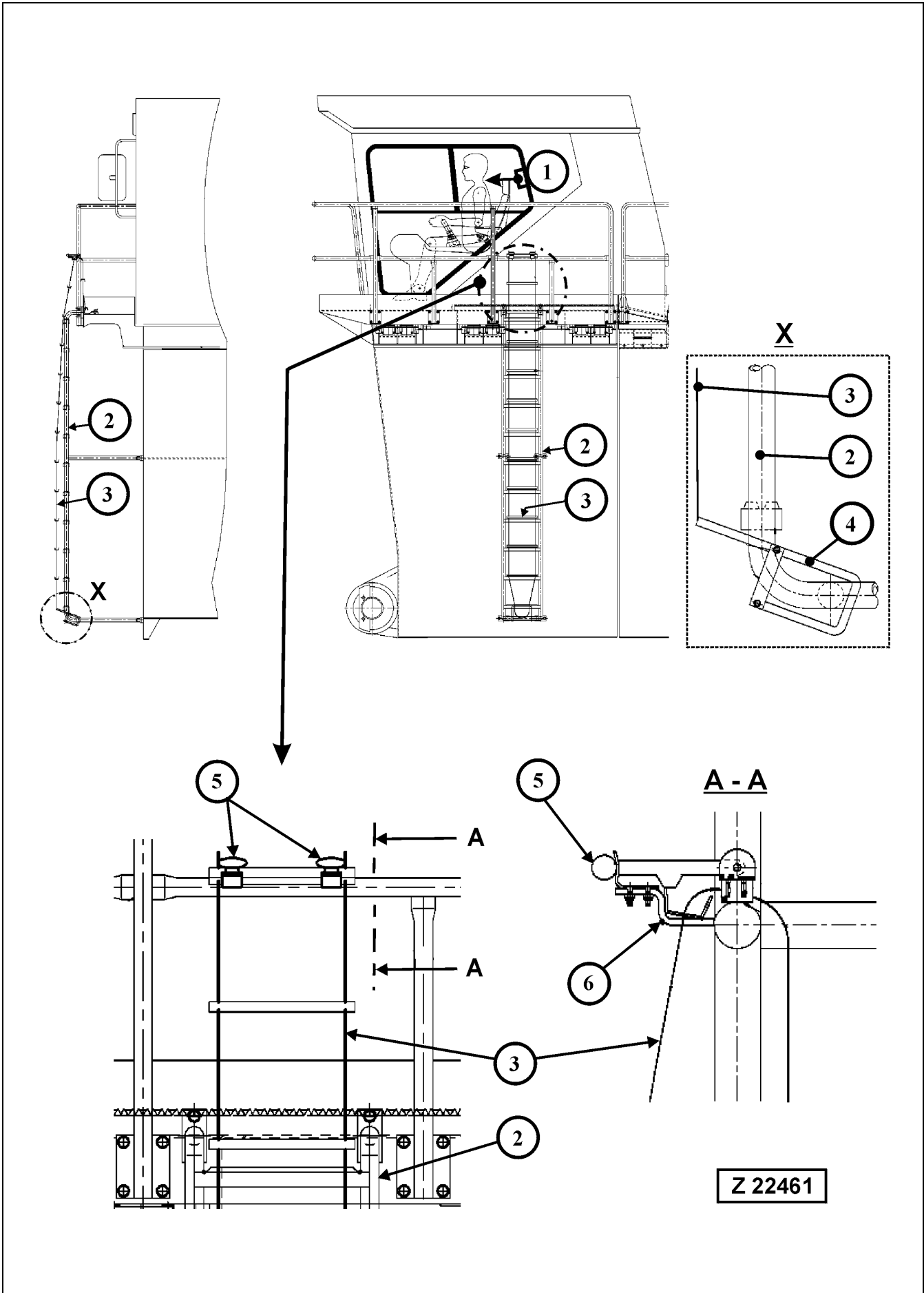
HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER

Vent Suction Oil Reservoir and Hydraulic Pumps, illustration Z25014A

1. Loosen vent plugs (A1 and A2) of suction oil reservoir (1). Retighten vent plugs (A1 and A2) when the outflowing oil is free of air bubbles.
2. Vent main pump (2) by opening first vent plug (B) at the suction pipe just below the pump flange. When the outflowing oil is free of air bubbles close vent plug (B). Open vent valve (C) and loosen leakage oil line connector (D). Retighten (C) and (D) when the outflowing oil is free of air bubbles.
3. Vent main pump (3) by opening first vent plug (B) located at the RH side of the suction pipe just below the pump flange. When the outflowing oil is free of air bubbles close vent plug (B). Open vent valve (C) and loosen leakage oil line connector (D). Retighten (C) and (D) when the outflowing oil is free of air bubbles.
4. Vent oil cooler fan drive pump (4) by loosening leakage oil line connector (E). Retighten (E) when the outflowing oil is free of air bubbles.
5. Vent control oil pump (5) by loosening vent plug (F) at the suction line flange. Retighten (F) when the outflowing oil is free of air bubbles.
6. Vent main pump (6) by opening first vent plug (G) at the suction pipe just below the pump flange. When the outflowing oil is free of air bubbles close vent plug (G). Open vent valve (H) and loosen leakage oil line connector (J). Retighten (H) and (J) when the outflowing oil is free of air bubbles.
7. Start the engine and run at low idle for five minutes. Stop the engine.
8. Loosen vent valves (C and H) of main pumps (2, 3 and 6) by one or two turns and close the valves when the outflowing oil is free of air bubbles.
9. Check hydraulic oil level and the whole hydraulic system for leakage.
10. At the first start up after an oil change carry out several operating cycles of all hydraulic movements without load. Operate the cylinders slowly. Do not operate the cylinders to stroke end.

REMARK

After changing the oil of the PTO gear vent the PTO lubrication pump (7) by opening vent plug (K) at the suction hose flange. Retighten (K) when the outflowing oil is free of air bubbles.



4.13.2 EMERGENCY ESCAPE LADDER - INSPECTION

See illustration Z 22461

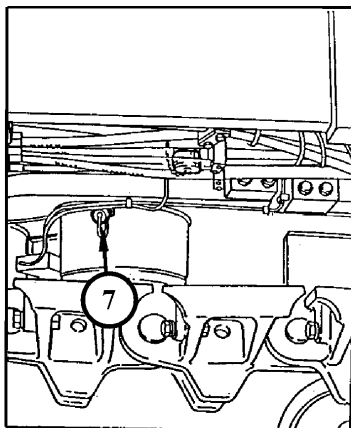
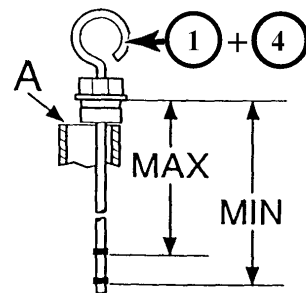
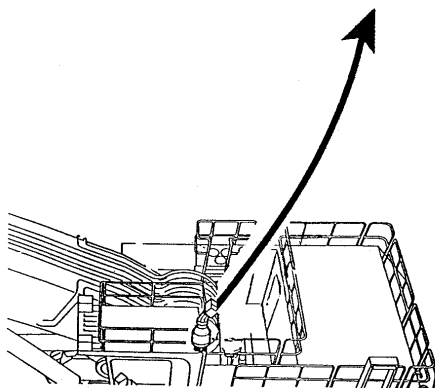
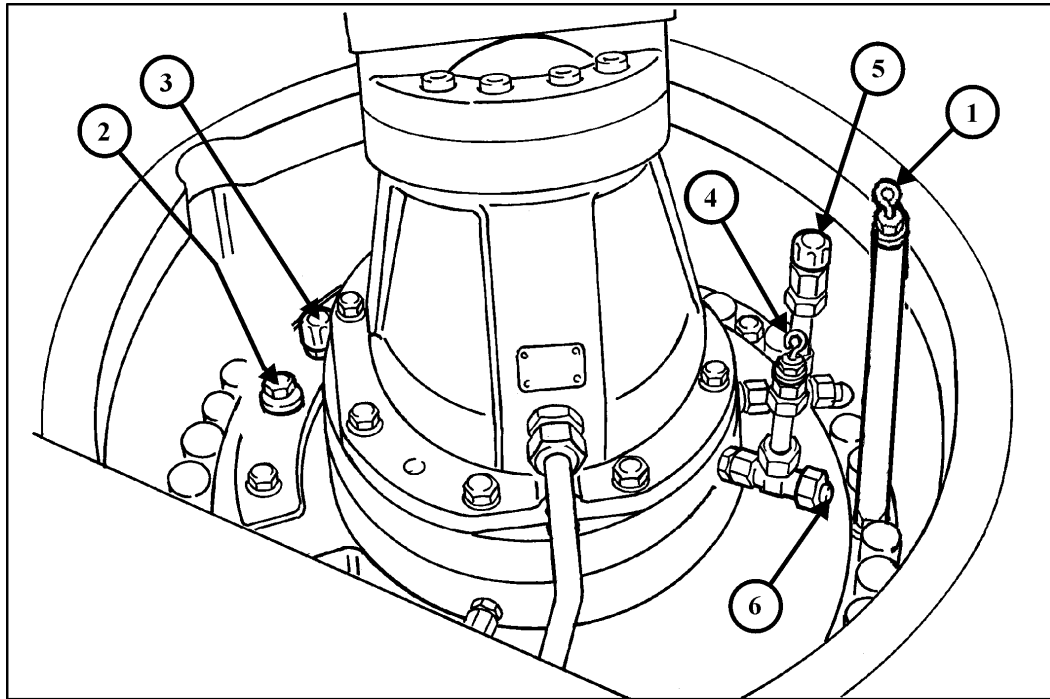
(1)	Sliding window, serves also for emergency exit
(2)	Rigidly mounted emergency escape ladder
(3)	Rope ladder. The upper end of the rope ladder is fixed onto the lower rung of the rigid escape ladder (2) by means of the fasteners (4), see detail (X). The lower end of the rope ladder is fixed on brackets (6) and secured with rubber fasteners (5), see section (A-A).
(4)	Hooks for fastening the rope ladder onto the rigid ladder (2)
(5)	Rubber fasteners for rope ladder in lifted position
(6)	Bracket for rope ladder in lifted position. The lower rung of the rope ladder is hooked up into the brackets (6)
(1)	Sliding window, serves also for emergency exit

Check rigidly mounted emergency escape ladder (2) for good condition and proper fastening.

Check rope ladder (3) 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 22913

4.14.1 SWING GEAR 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 the swing gear housing to find out the manufacturer of the swing gear.

Swing gear manufactured by "L&S"

Legend for illustration Z22913

Swing gear

- (A) Position of oil level gauge for checking the oil levels
- (1) Oil level gauge
- (2) Oil filler plug
- (3) Breather filter
- (7) Drain coupling or evacuation nozzle 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

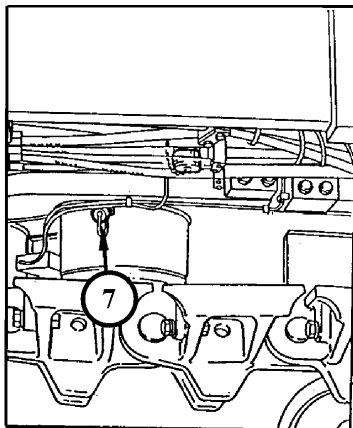
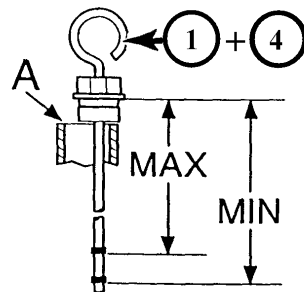
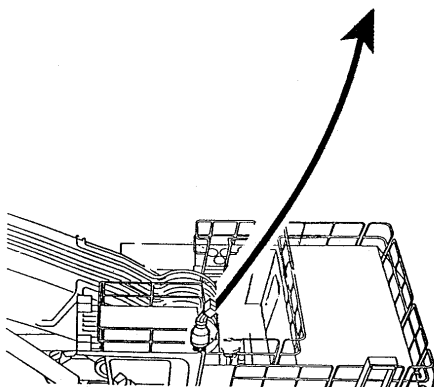
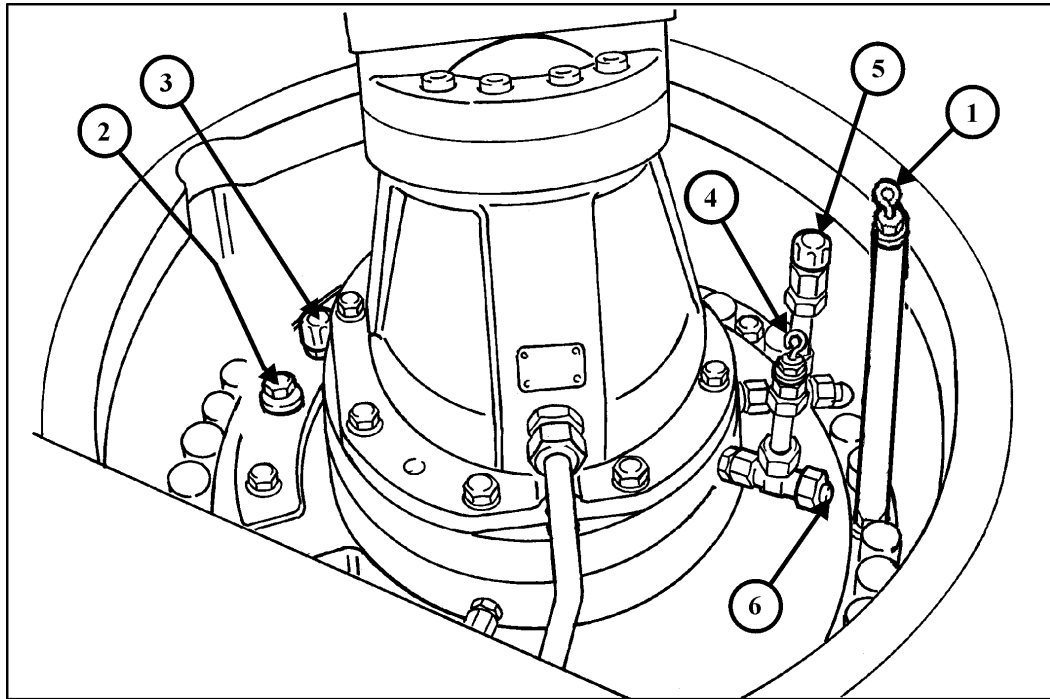
Swing Gear, change oil:

1. Use adequate working platform for draining the oil. Place receptacles of sufficient capacity (approx. 60 liter) below drain couplings (7). Attach drain hose (part of tool set) to drain coupling (7). Remove parts (1, 2 and 3) to speed up draining. On swing gears with evacuation nozzle (7), 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 (7) 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).

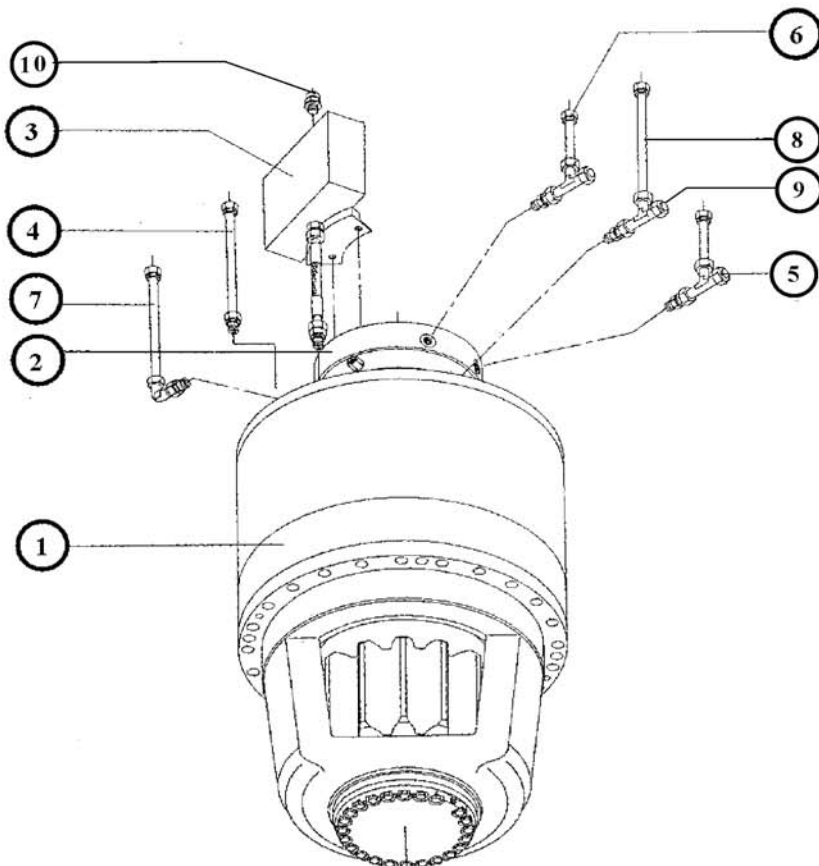
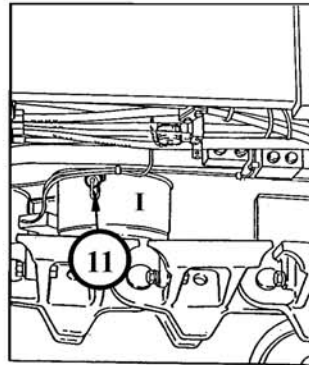
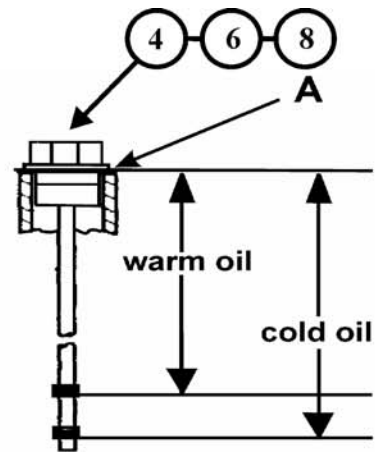
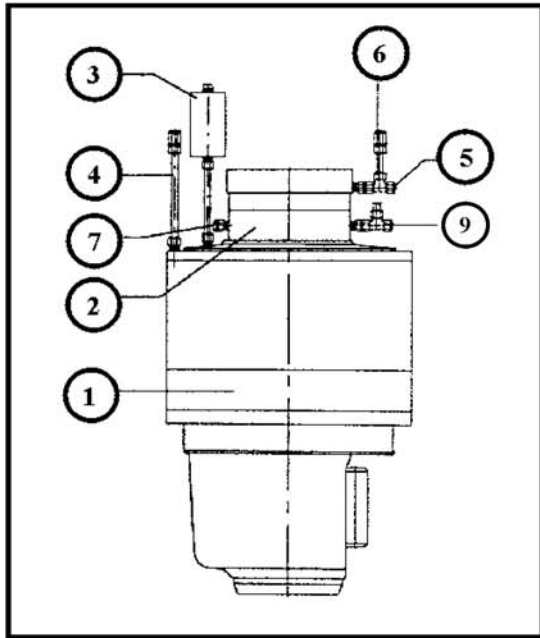
6. After short operating period check oil level and housing for leaks.



Z 22913

Motor Adapter Housing, Change Oil (L&S)

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 25963

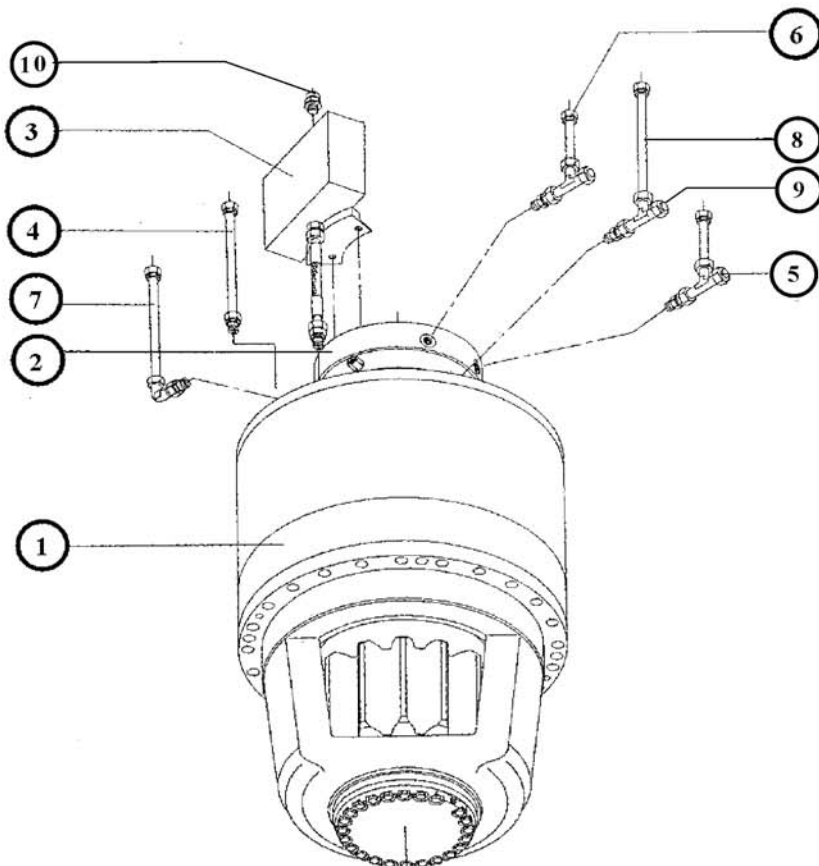
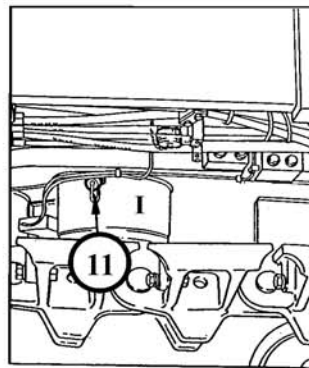
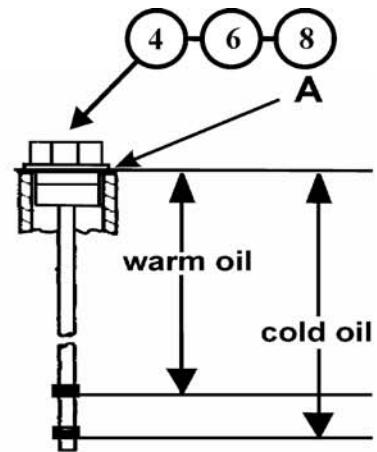
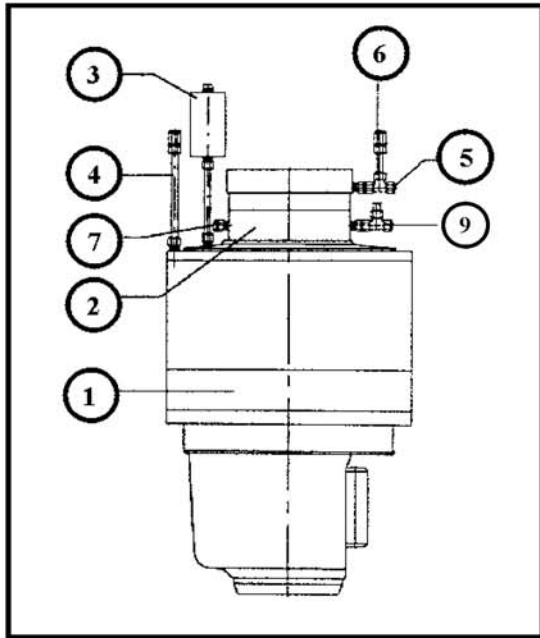
SWING GEAR MANUFACTURED BY "SIEBENHAAR"

Legend for illustration Z 25963

- (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
- (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. 70 liter) below 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.
6. After short operating period check oil level and housing for leaks.



Z 25963

Brake Housing - Change Oil (Siebenhaar)

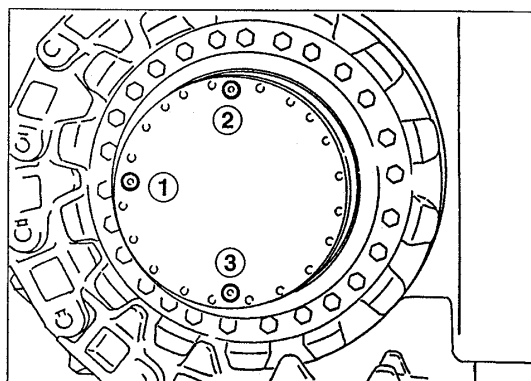
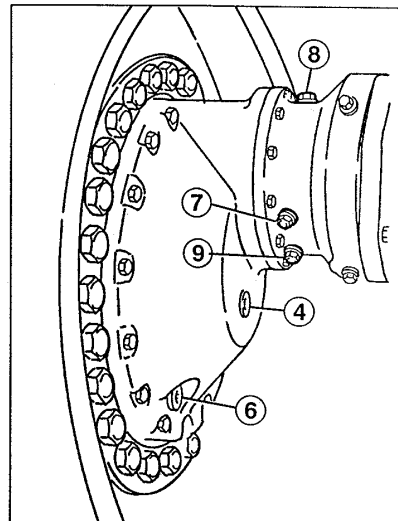
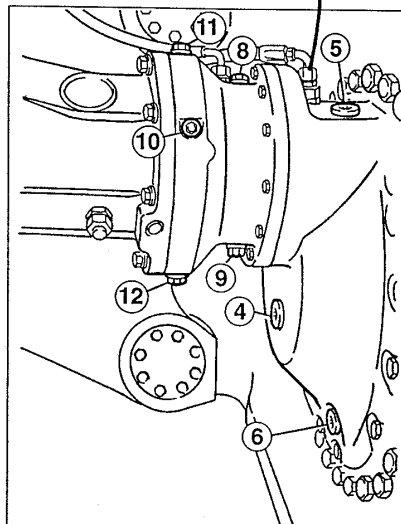
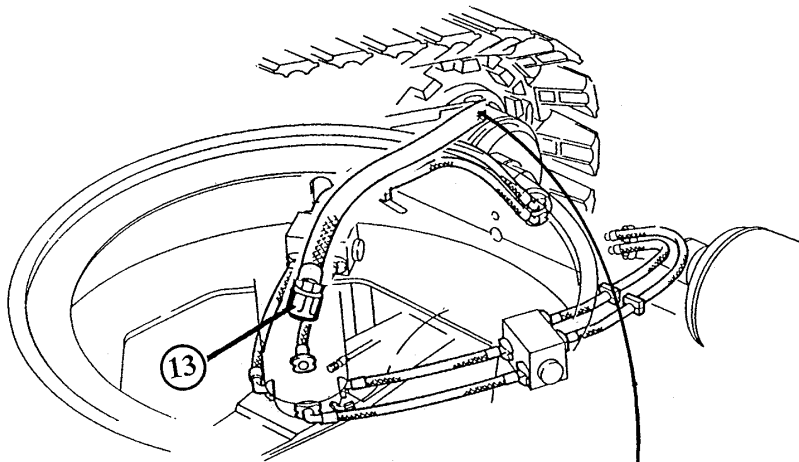
1. Remove level gauge (8), illustration Z 25963, drain plug (9) and breather filter (7). Drain the oil into a receptacle of approx. 5 liter capacity.
2. Clean breather filter (7) with compressed air from inside to outside and re-install.
3. Install drain plug (9) and fill-up engine oil SAE 10 or hydraulic oil HLP 32 through filler opening up to the lower mark on level gauge (8) and install the level gauge. DO NOT overfill the brake housing, otherwise the brake could be damaged due to overheating.
4. After short operating period check oil level and housing for leaks.

NOTICE

Be sure to fill the brake housing and motor adapter housing with engine oil or hydraulic oil as specified on page 245.

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.



(Z 20836)

4.14.2 TRAVEL GEARS, BRAKE AND MOTOR ADAPTER HOUSINGS - CHANGE OIL

- Planetary Gear Box
- Spur Gear Box
- Brake Housing
- Motor Adapter Housing

Legend for illustration Z20836

Planetary gear box

- (1) Oil level plug
- (2) Oil filler plug
- (3) Drain plug
- (13) Breather filter, the breather filter is located inside the center frame.

Spur gear box

- (4) Oil level plug
- (5) Oil filler plug
- (6) Oil drain plug

Brake housing

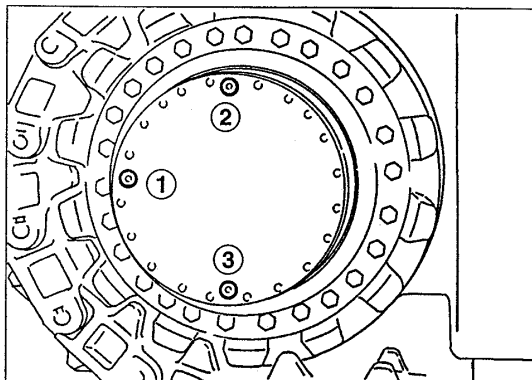
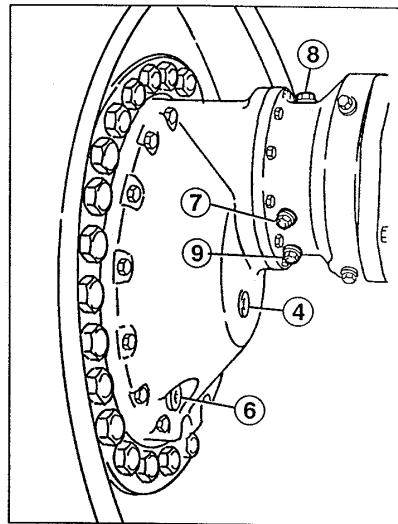
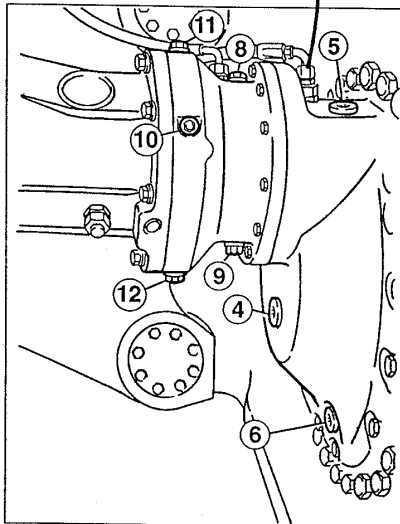
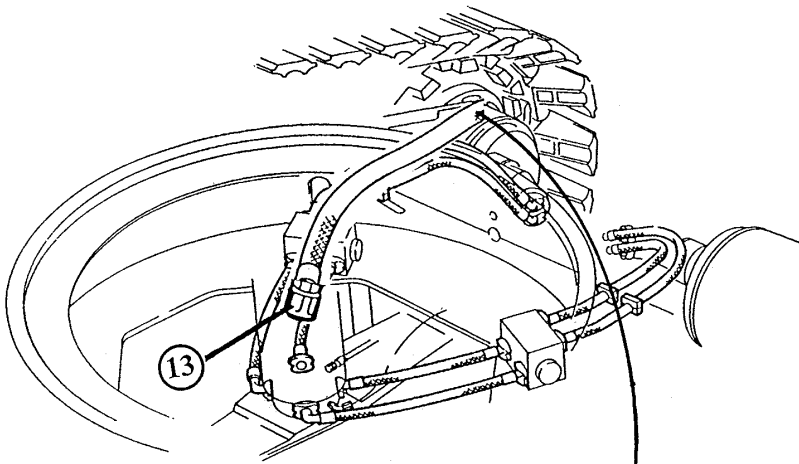
- (7) Oil level plug
- (8) Oil filler plug
- (9) Oil drain plug

Motor adapter housing

- (10) Oil level plug
- (11) Connector for breather filter line, the breather filter is located inside the center frame. The port of connector (11) is also used as oil filler opening.
- (12) Oil drain plug

REMARK

Planetary gear and spur gear stage have separate oil compartments.



(Z 20836)

TRAVEL GEARS - CHANGE OIL

Illustration Z20836

1. Move the Excavator so, that the drain plug (3) is in the lowest and filler plug (3) is in the uppermost position.
The oil level plug (1) is then correctly positioned.
2. Place suitable receptacles below drain plugs (3 and 6).
3. Remove filler, level and drain plugs (1 - 6) and drain the oil completely into the receptacles.
4. After the oil is completely drained, flush both gear boxes with the regular gear oil.
5. Install drain plugs (3 and 6).
6. Fill planetary gear box with specified gear oil through filler opening (2) up to level opening (1). Install plugs (1 and 2).
7. Fill spur gear box with specified gear oil through filler opening (5) up to level opening (4). Install plugs (4 and 5).
8. Remove breather filter (11) and blow out with compressed air from inside to outside. Install breather filter (11).

BRAKE HOUSINGS - CHANGE OIL

NOTICE

The brakes must be released for changing the oil.

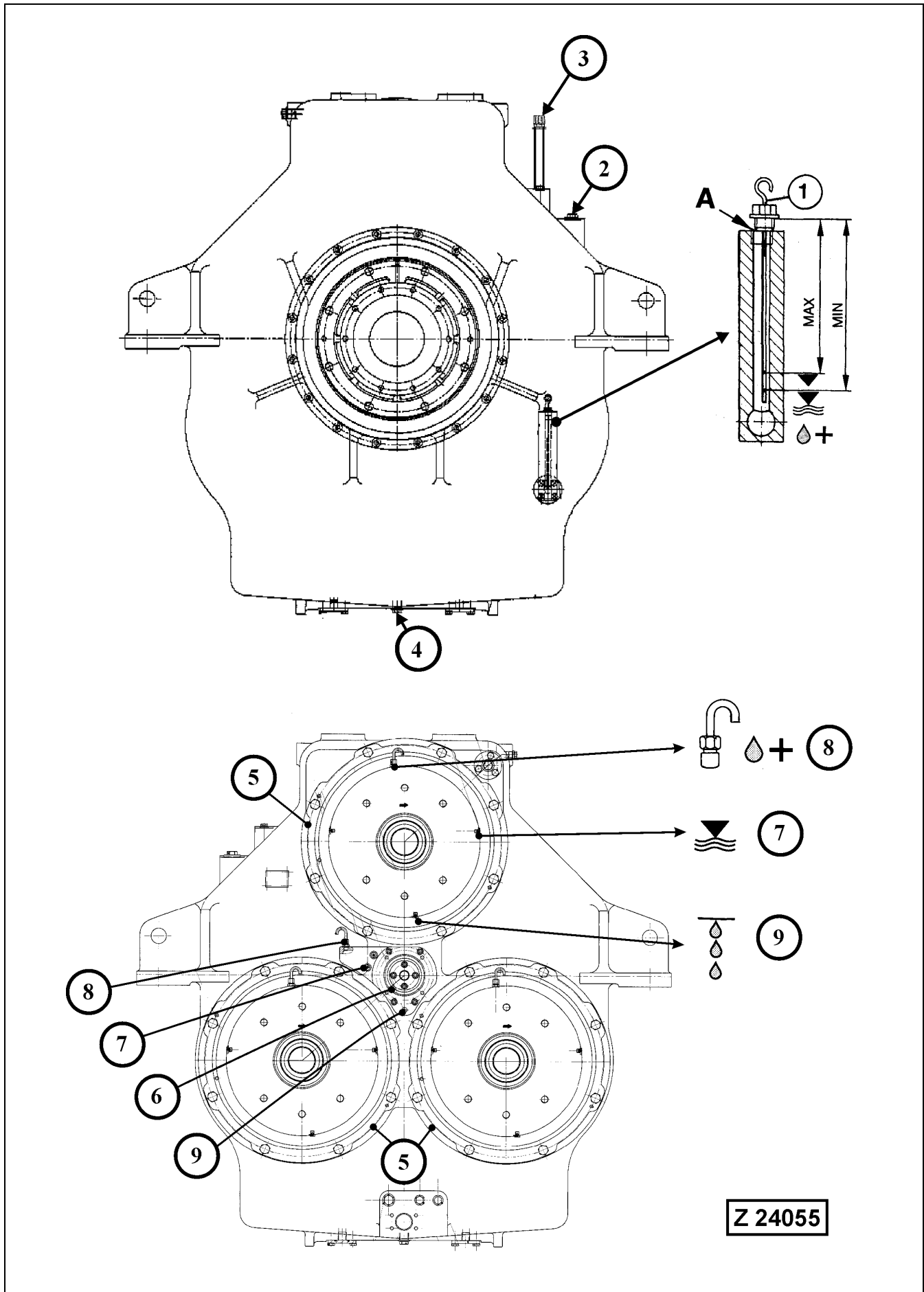
1. Place wedges at front and rear side of both crawlers.
2. Start the engine and lower the bucket onto the ground.
3. Have a second person for control in the operator's cab.
4. Change the oil. Remove parts (7 to 9) and drain the oil. Install plug (9) and fill in fresh engine or hydraulic oil up to level openings (7). Install plugs (7 and 8).
5. Shut down the engine.

NOTICE

Be sure to fill the brake housings and motor adapter housings with engine oil or hydraulic oil as specified on page 245.

MOTOR ADAPTER HOUSINGS - CHANGE OIL

1. Remove plugs (10 to 12) and drain the oil completely.
2. Install drain plug (12) and fill-up engine or hydraulic oil to level openings (10). Install plugs (10 and 11).



4.14.3 PTO (PUMP DISTRIBUTOR GEAR) - CHANGE OIL

Legend for illustration Z24055

- (1) Oil level gauge
- (2) Oil filler plug
- (3) Breather filter
- (4) Oil drain plug
- (5) Adapter housings for main hydraulic pumps
- (6) Adapter housing for pilot oil pump
- (7) Oil level plug
- (8) Oil filler plug with breather pipe
- (9) 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 adjust the temperature switch units according to the table on page 429.

REMARK

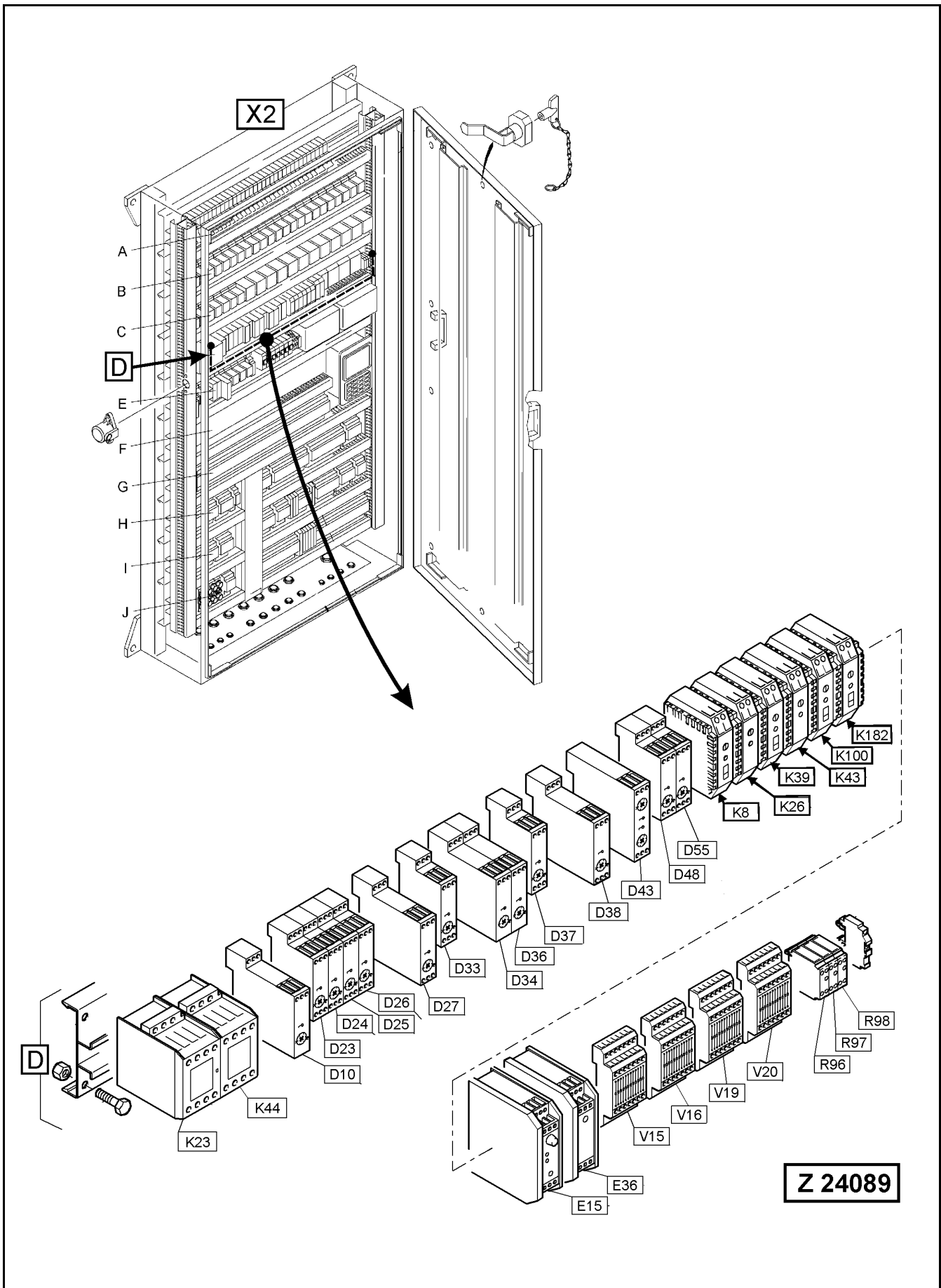
Before opening the access covers from below the pump distributor gear provide an adequate working platform with sufficient space for the oil collecting container (approx. 100 liters).

Change the Oil

1. Remove drain plug (4), gauge (1) and filler plug (2).
2. Remove breather filter (3), blow out 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 and reinstall drain plug (4).
4. Fill in new oil through opening (2) up to the "MAX" mark on gauge (1).
5. Re-install parts (1 and 2).
6. Vent the PTO lubrication pump, see page 411 for more information.
7. After short operating period, check oil level and housing for leakage.

REMARK

If the oil level is above the "MAX" mark, drain the oil down until the oil level is at the "MAX" mark. Too much oil in the pump distributor gear will cause aeration of the oil.



PTO gear oil viscosity and adjustment of temperature switch units

If the new gear oil has a different viscosity grade compared with the drained oil it is necessary to adjust the temperature limit values at switch units (K43 and K182), illustration Z24089 in accordance with the viscosity grade of the new gear oil. The switch units are located in the X2 switch box in the cab base.

Legend for illustration Z24089

K43 - Switch unit for gear oil temperature warning message "PTO oil Temperature too high".

K182 - Switch unit for pre-load of gear oil cooler circuit

Adjust switch units to the respective oil viscosity grade as follows:

Oil viscosity grade according to ISO	HLP T32	CLP 150	SAE 75W-90
-K43- Adjust temperature limit value to switching point °C	+60°	+95°	+95°
-K182- Adjust temperature limit value to switching point °C	+48°	+15°	+54°

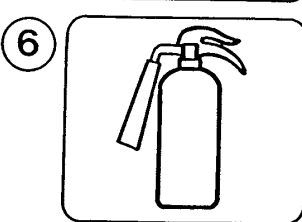
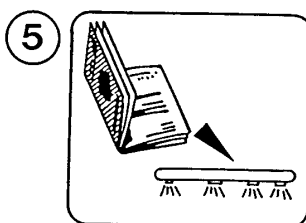
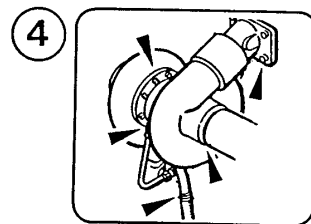
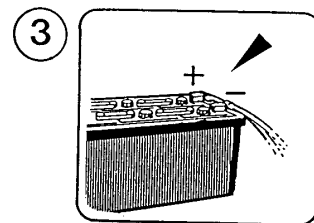
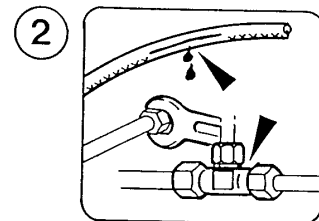
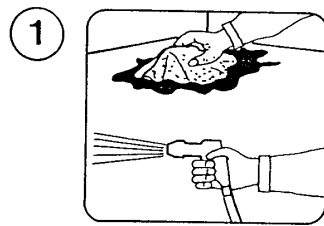
Adjustment procedure for (K43 and K182):

Adjust the temperature limit value at the cogwheel next to the drum scale on switch unit front cover.

NOTICE

Turn the cogwheel sensitively. **DO NOT** turn beyond the **STOP** marking, otherwise the internal potentiometer driver pin will disengage resulting in wrong value transmission. Refer to Service Bulletin No. AH02508b for functional test of the switch unit.

4.15 FIRE PREVENTION



Z 19360

PRECAUTIONS

See illustration Z 19360

In order to prevent risks of possible fire break out observe the following items:

1. Keep the excavator clean, especially from inflammable materials.
Clean the excavator after servicing the hydraulic system, engine and fuel system by means of a steam jet.
2. Clean engine compartment, hydraulic pump compartment and service platform of the superstructure.
Thereafter check fuel lines, engine oil lines and hydraulic oil lines for leakage, loose fastenings and damage.
If any leakage, damage or loose fastening is found, corrective action must be taken immediately.
3. Check all electrical cables, terminals and connections for loose fastenings, damage and wear.
Replace or repair defective or worn parts without delay.
4. Check the turbocharger for correct mounting and tight exhaust, intake and lube oil connections.
Carry out all necessary repairs without delay.
5. **On machines equipped with a fire detection, actuation and suppression system:**
Refer to the manufacturers service manuals in volume 2 binder for correct maintenance and inspection of the systems.
When checking the filling level of the dry chemical tanks, make sure that the extinguishing powder (Ansul FORAY dry chemical agent) is not compacted.
Stir up the extinguishing powder with a suitable stick until it is in a free flowing condition.

NOTICE

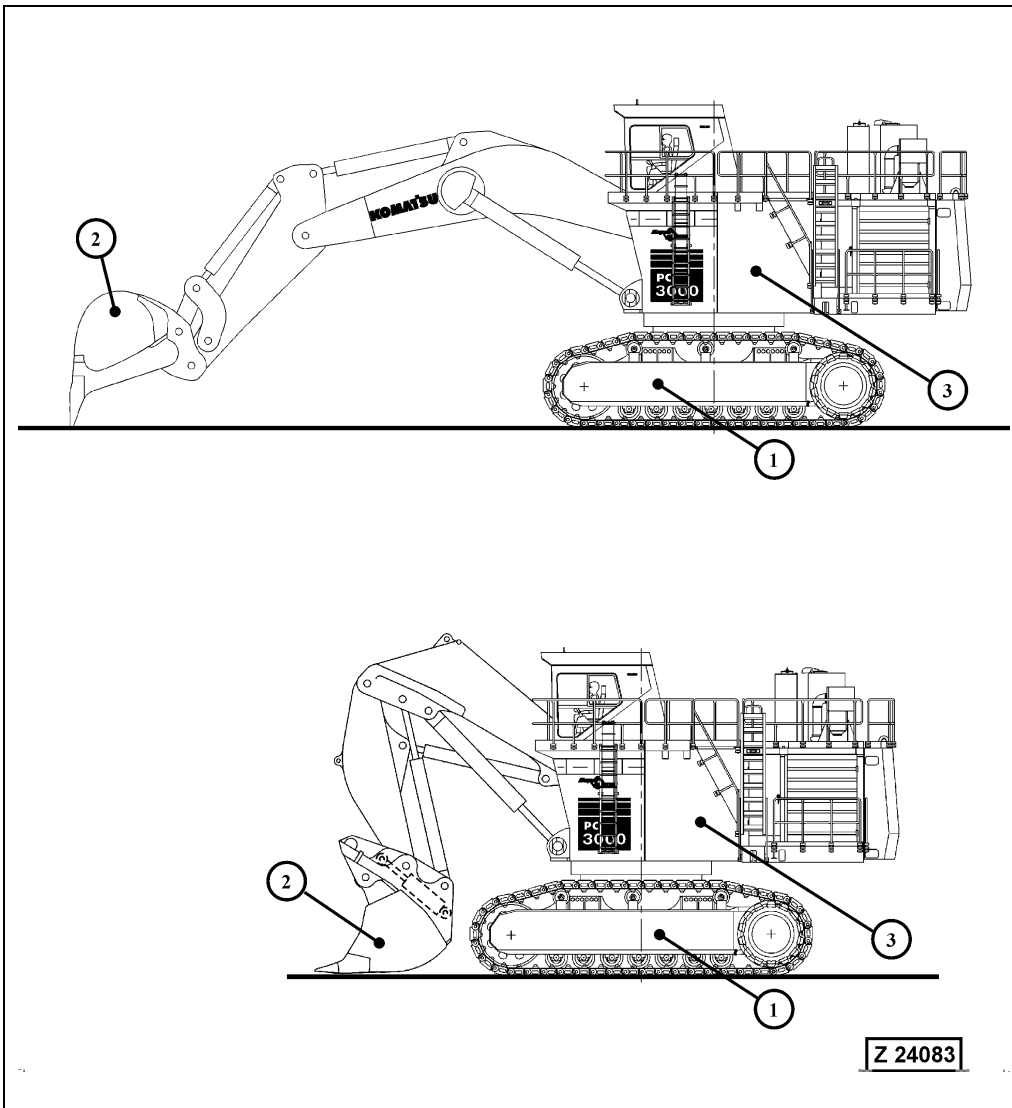
When cleaning the power house take care the heat detection sensors do not come in contact with hot steam or other hot agent. Otherwise the fire suppression system may be triggered.

6. Make sure fire extinguishers are charged and ready for use.

NOTICE

**After cleaning lubricate all lubrication points by means of central lube system or manually.
Lubricate swing circle gear after drying by means of the automatic lube system or manually.**

4.16 WELD REPAIRS



CAUTION

Before carry out weld repairs, contact our Service Department EXCAVATORS in order to avoid improper welding procedures. Weld repairs can cause severe damage to an entire structure if performed incorrectly. If cracks are found in the steel construction of your excavator, please inform our Service Department as soon as possible. Attach suitable information material (photos, catalog drawings etc.) showing the location and nature of the crack.

GENERAL INFORMATION

Welding operations can cause damage to electronic components. (Computers, Control Units, Sensors etc.), in case the welding current goes through these units. Therefore protective measures are necessary before any weld repair is started.

GENERAL PROTECTIVE MEASURES

- A. Observe the prevailing safety and fire prevention regulations.

Before any weld repair is started, a survey should be made of the area and all safety considerations satisfied such as fuel tanks, oil lines, electrical cables and synthetic materials.

- B. Attach the welding ground directly to the part that is being repaired. Do not allow welding current to go through bearings. Welding current could arc the bearings, resulting in severe damage to the bearing.

WELD REPAIRS ON MAJOR COMPONENTS OF THE EXCAVATOR

COUNTERWEIGHT

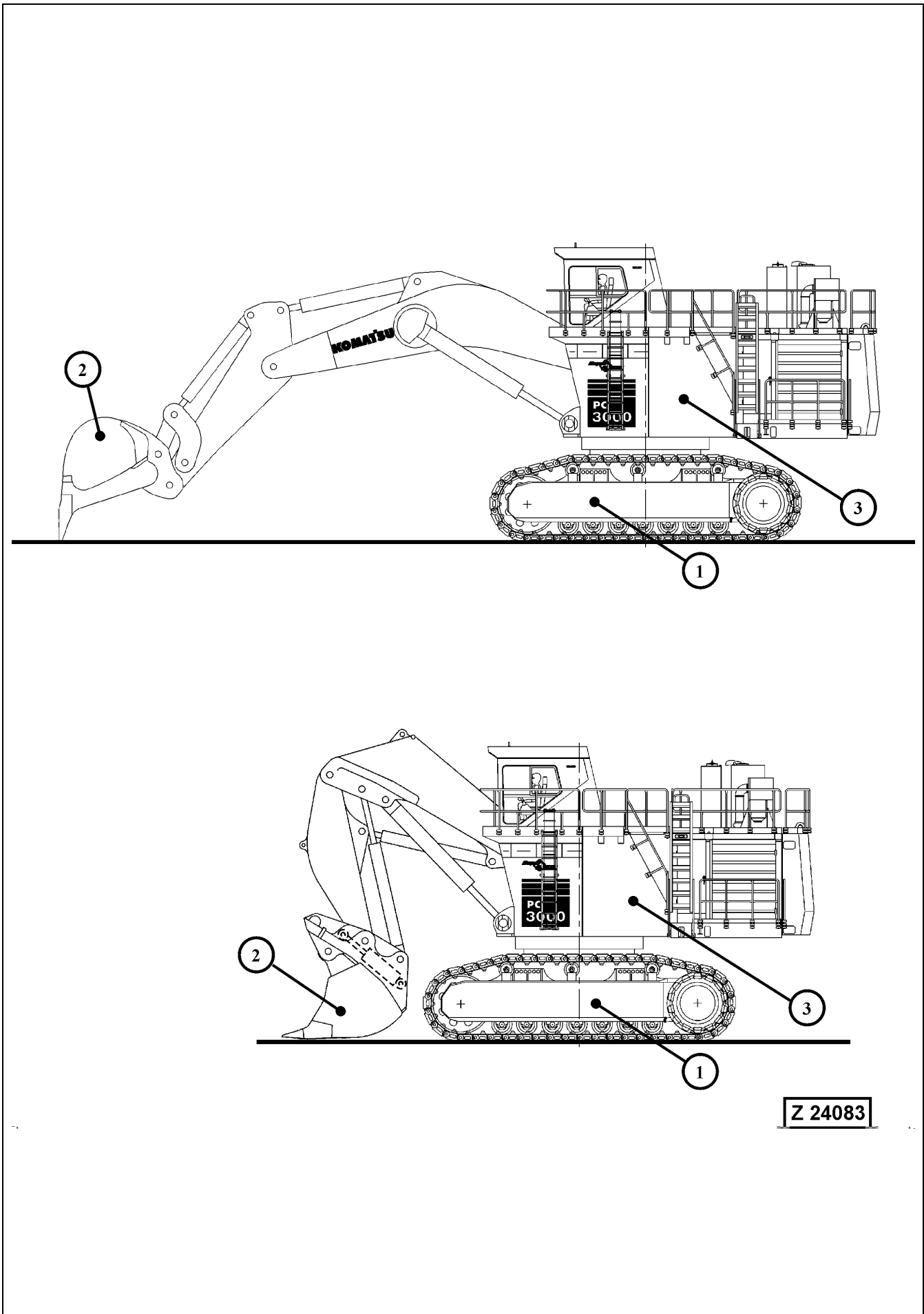
▲ WARNING

The chambers of the counterweight are filled with a mixture of concrete, granulated ore and steel pellets. This mixture can create explosive gases which will accumulate in the chambers of the counterweight. Before any welding, flame-cutting, grinding or drilling procedures are carried out on the counterweight it is vital to expel these gases from the counterweight chambers. Failure to properly expel the gases from the counterweight chambers can result in an explosion with serious personal injury or death.

Follow the instructions given in **PARTS & SERVICE NEWS No. AH04518** for expelling the gases from the counterweight chambers.

Legend for illustration Z24083

- (1) Undercarriage, refer to page 435 for protective measures.
- (2) Loader attachment, refer to page 437 for protective measures.
- (3) Superstructure, refer to page 439 for protective measures.



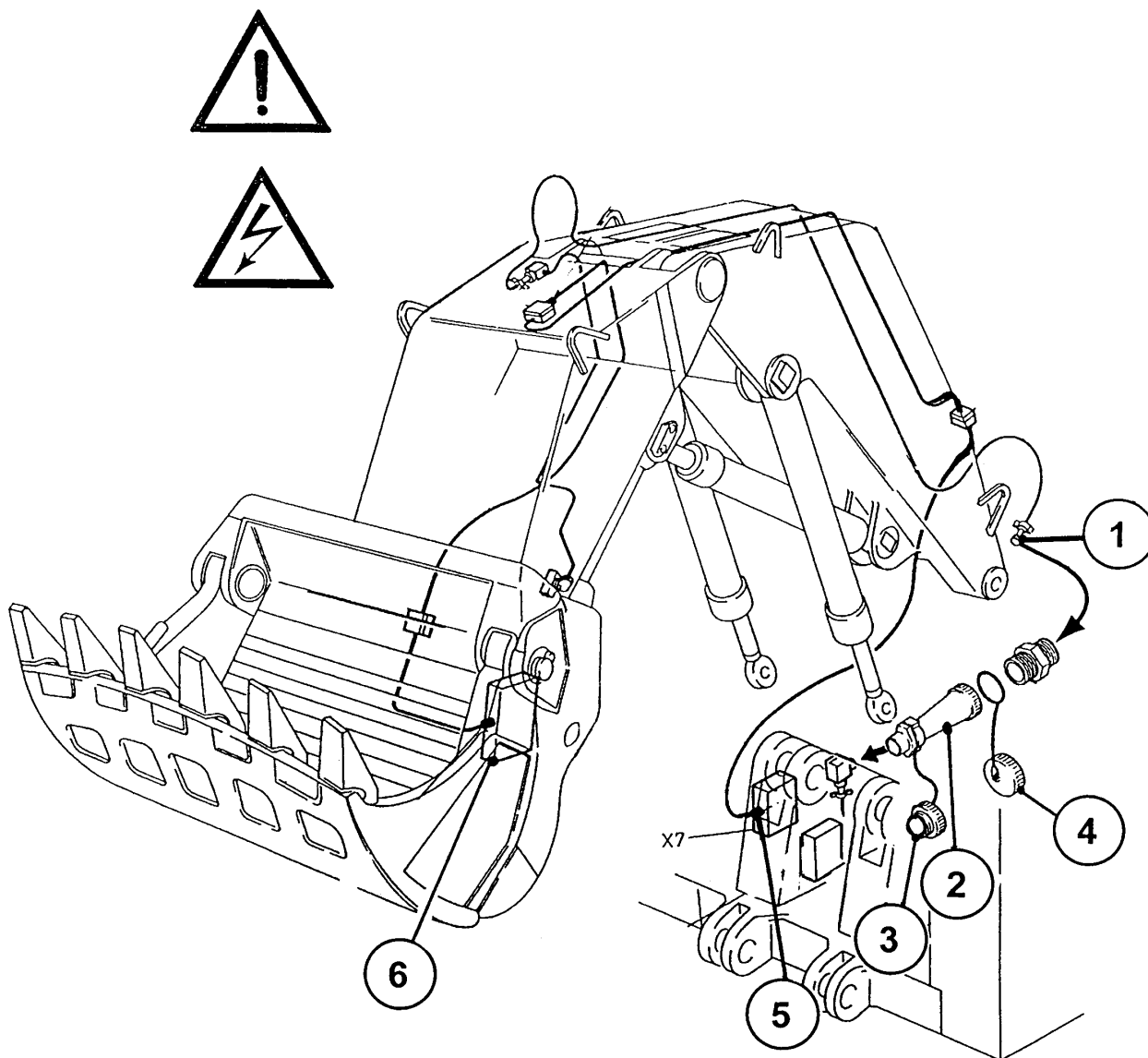
4.16.1 PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE UNDERCARRIAGE

See illustration Z24083

On standard Excavators there are no special protective measures necessary.

However, the general protective measures (A and B) must be observed.

On Excavators with a power unit (generator set) mounted to the undercarriage, all electrical connections between the Excavator and the power unit have to be disconnected.



(Z 20675)

4.16.2 PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE LOADER ATTACHMENT

Legend for illustration Z 20675

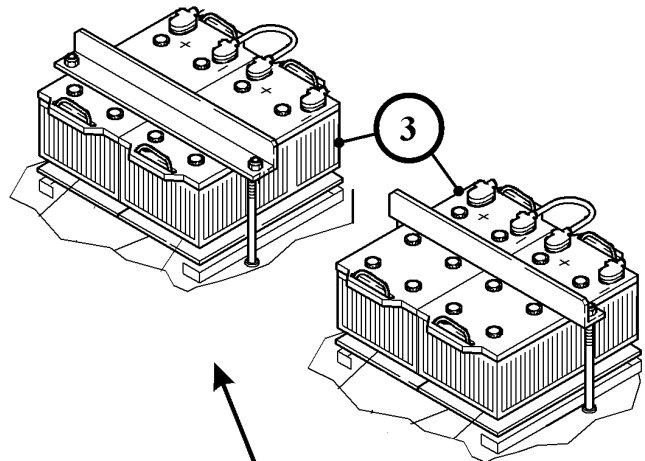
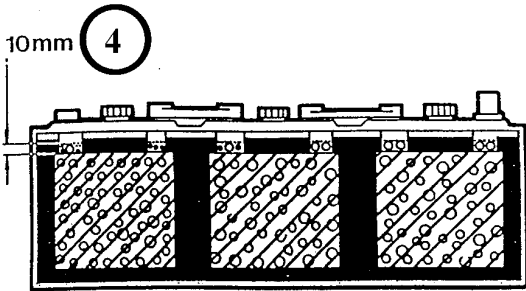
- (1) Electrical cable connector of the end-line pressure switch for the central lubrication system
- (2) Plug socket
- (3) Protection cap for (2)
- (4) Protection cap for (1)
- (5) Switch box of the electronic bucket levelling system "EBL", (Special Equipment)
- (6) Bucket position detector box for the "EBL" system (Special Equipment)

NOTICE

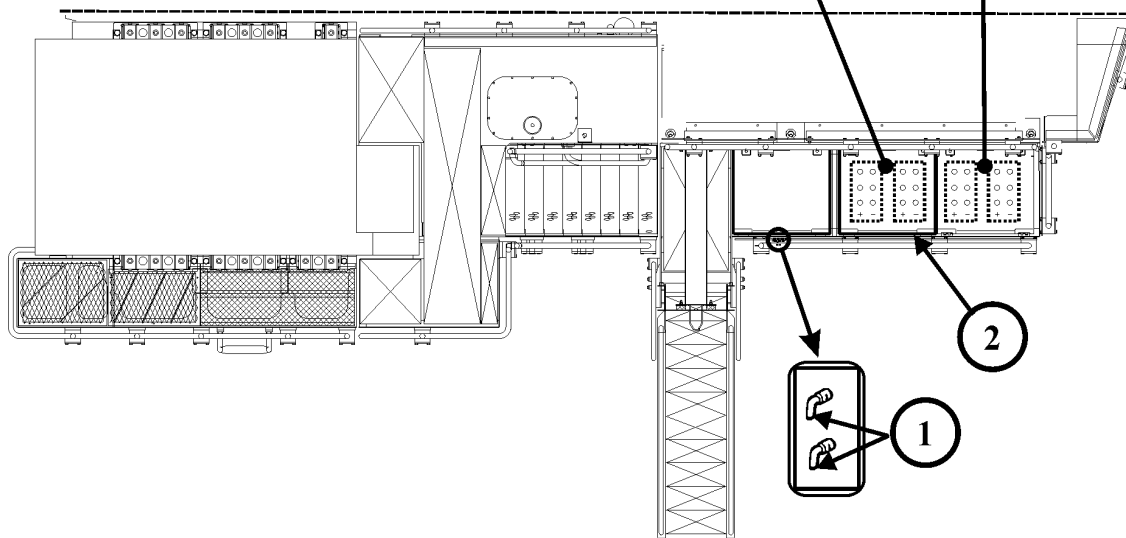
If weld repairs have to be carried out on the Loader Attachment (Bucket, Stick and/or Boom) disconnect the end line pressure switch cable connector (1) from socket (2) and close the openings with caps (3 and 4).

If the Excavator is equipped with an electronic Bucket Levelling System, disconnect also the cable connector on switch box (5).

Be sure to disconnect electrical connections of working lights and other electrical equipment mounted on the loader attachment.



-A-



Z 24061

4.16.3 PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE SUPERSTRUCTURE

Legend for illustration Z24061

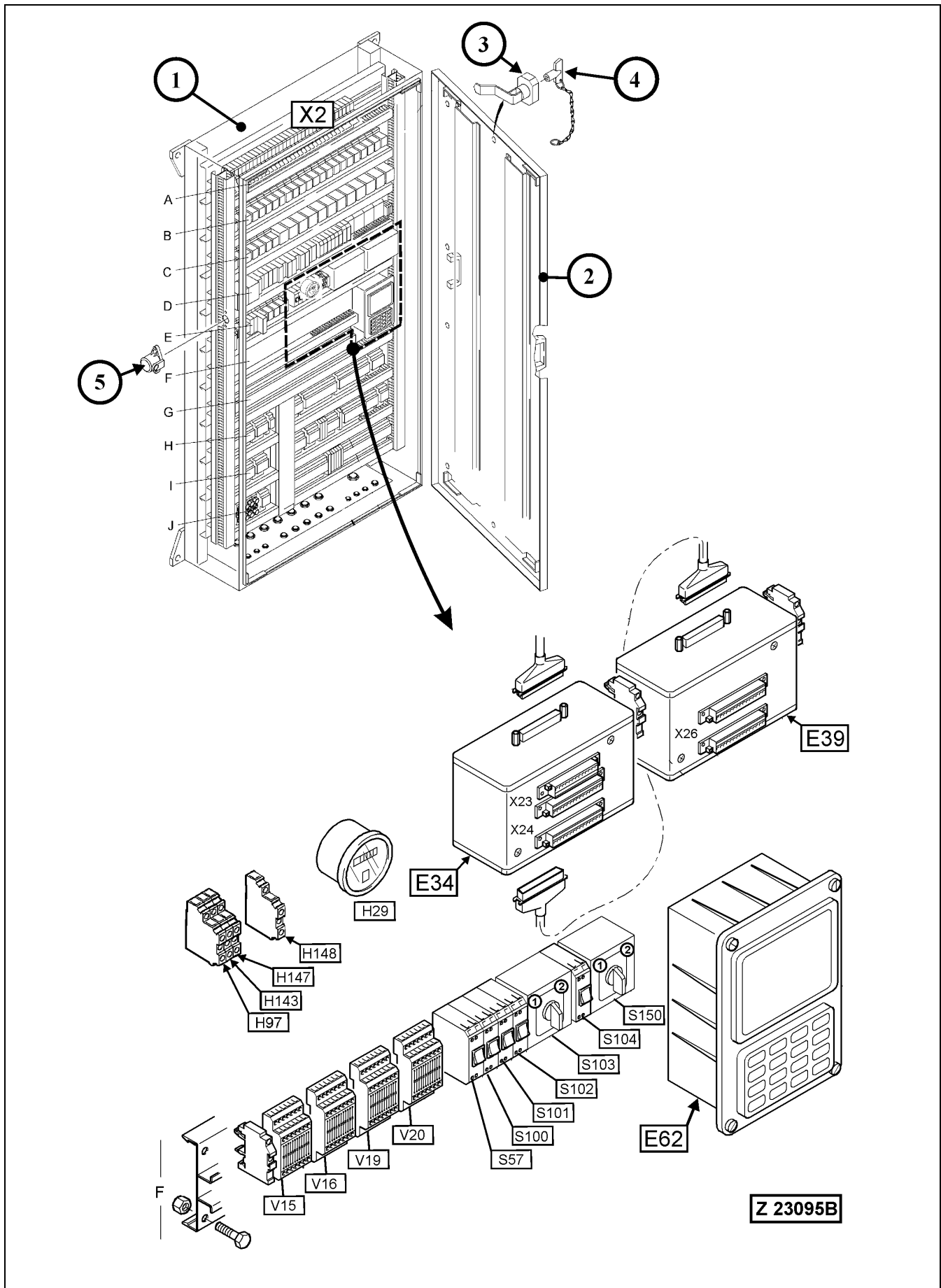
- (A) Top view of access area
- (1) Battery main switch keys
- (2) Battery box cover underneath the cat walk
- (3) Batteries
- (4) Fluid level

Remove keys (1) of the two battery main switches.

 **WARNING**

Batteries give off highly inflammable gas! Never allow sparks or open flame near the batteries! Avoid spilling any electrolyte on hands or clothing. repair or replace all broken wires immediately. All terminals must be clean and securely fastened; never paint connections.

DO NOT short across or ground any terminals of the batteries.



Electrical Units in Cab Base, illustration Z23095B

1. Switch off all circuit breakers in the switch box (X2).
2. Remove the three green plugs from the sockets (X23 and X24) on the master input signal module (E34). Remove the two green plugs from the socket (X26) on the slave input signal module (E39).
3. Disconnect all plugs on the back of the multi monitor (E62)
4. Remove the wiring harness connector from electronic pump controller CR700 (E61).

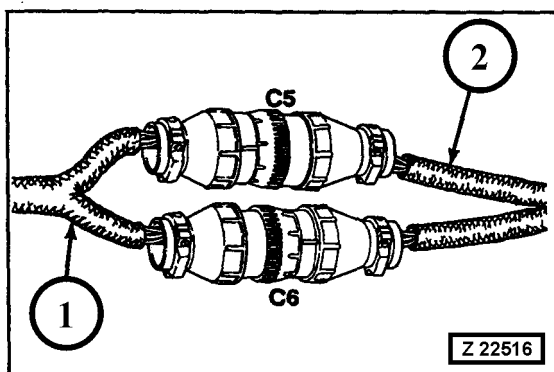
REMARK

Be sure to isolate Electronic Components of Special Equipment.

Engine Electronics

Disconnect the two Deutsch connectors (C5 and C6), illustration Z 22516. The connectors are located on the LH engine side near the flywheel housing.

For more information refer to the Operation and Maintenance Manual CENTRY System, filed in Volume 2 Binder.



(1) - Engine harness

(2) - Shovel harness

4.16.4 AFTER FINISHING THE REPAIR WELDINGS ON THE SUPERSTRUCTURE

After finishing the weld repairs connect all cable connectors which have been disconnected. When connecting the two Deutsch connectors (C5 and C6), make sure you hear a click.

When all electrical connections are established insert the battery main switch keys.

1. INTRODUCTION	3
1.1 CONTENTS OF THE BINDER	4
1.2 DIVISION OF THE BINDER	5
1.3 DESIGNATED USE OF THE SHOVEL	6
1.4 DELIVERY OF THE SHOVEL	7
1.5 EXPLANATION OF ABBREVIATIONS	8
1.6 TABLE OF CONTENTS	9
2. SAFETY	15
2.1 SAFETY INSTRUCTIONS	16
2.1.1 WARNINGS AND SYMBOLS	16
2.1.2 BASIC OPERATION AND DESIGNATED USE OF THE HYDRAULIC SHOVEL	16
2.1.3 ORGANIZATIONAL MEASURES	17
2.1.4 SELECTION AND QUALIFICATION OF PERSONNEL - BASIC RESPONSIBILITIES	19
2.1.5 SAFETY INSTRUCTIONS GOVERNING SPECIFIC OPERATIONAL PHASES	20
2.1.6 WARNING OF SPECIAL DANGERS	23
2.1.7 TRANSPORTING AND TOWING -RECOMMISSIONING	25
2.1.8 SPECIAL SAFETY EQUIPMENT	25
2.1.9 SAFETY HARNESS IN CONFORMITY WITH EN 361 (EUROPEAN STANDARD)	29
3. OPERATION	37
3.1 FOREWORD	38
3.2 CONSTRUCTION OF THE SHOVEL	39
3.2.1 OVERALL VIEW	39
3.2.2 UNDERCARRIAGE AND SUPERSTRUCTURE	40
3.2.3 HYDRAULICALLY OPERATED ACCESS LADDER	46
3.2.4 EMERGENCY ESCAPE LADDER	50
3.2.5 EMERGENCY ESCAPE LADDER AND ESCAPE HATCH IN THE MACHINERY HOUSE (SPECIAL EQUIPMENT)	52
3.2.6 EMERGENCY ENGINE SHUTDOWN FROM GROUND MAN OR OPERATOR WARNING SYSTEM	54
3.2.7 OPERATOR'S CAB WITH INTEGRATED FALLING OBJECT PROTECTIVE STRUCTURE (FOPS)	56
3.2.8 ENGINE OIL MANAGEMENT SYSTEM	64
3.3 OPERATOR'S CAB - CONTROLS	72
3.3.1 CONTROLS WITH BACKHOE ATTACHMENT	72
3.3.2 CONTROLS WITH BOTTOM DUMP BUCKET	76
3.3.3 OPERATOR'S CONSOLE	81

3.4	ELECTRONIC TEXT MONITORING SYSTEM ETM	88
3.4.1	INTRODUCTION	89
3.4.2	SYSTEM COMPONENTS	93
3.4.3	FUNCTIONS OF THE ETM SYSTEM	95
3.4.4	DISPLAY THE CONTENTS OF THE RECORD (PROTOCOL) MEMORY	99
3.4.5	SEVERAL MESSAGE CONDITIONS OCCUR AT THE SAME TIME	111
3.4.6	SETTINGS OF THE TEXT DISPLAY UNIT	113
3.5	OPERATING THE HEATER, VENTILATION AND AIR CONDITIONING	128
3.5.1	CONTROL MODULE FOR AUXILIARY CAB HEATER (IF SO EQUIPPED)	133
3.5.2	AUXILIARY HEATER FOR OPERATORS CAB (IF SO EQUIPPED)	135
3.5.3	AUXILLIARY HEATER FOR OPERATORS CAB (IF SO EQUIPPED)	137
3.5.4	FUEL PUMP ARRANGEMENT	139
3.6	MACHINERY HOUSE	140
3.6.1	EMERGENCY ENGINE SHUTDOWN SWITCHES	141
3.7	ELECTRICAL EQUIPMENT IN CAB BASE	142
3.7.1	SWITCH BOX (X2) IN CAB BASE	147
3.7.2	COMPONENTS OF ELECTRICAL PREHEATING SYSTEM IN CAB BASE	151
3.8	PREHEATING SYSTEMS	156
3.8.1	FOR OIL, COOLANT AND BATTERIES	156
3.8.2	HEATERS FOR MACHINERY HOUSE (SPECIAL EQUIPMENT)	162
3.9	CHECKS BEFORE STARTING THE ENGINE	164
3.10	STARTING THE ENGINE	170
3.10.1	STARTING PROCEDURE	171
3.10.2	STARTING PROCEDURE AT AMBIENT TEMPERATURE UP TO -25°	173
3.11	MOVING THE SHOVEL	182
3.11.1	TRAVEL CONTROL WITH FOOT PEDALS	182
3.11.2	TRAVELLING INSTRUCTIONS	185
3.12	SLEWING AND BRAKING THE SUPERSTRUCTURE	186
3.12.1	SLEWING THE SUPERSTRUCTURE	186
3.13	WORKING WITH THE ATTACHMENT	189
3.13.1	MACHINES EQUIPPED WITH"EURO" CONTROL SYSTEM	189
3.13.2	MACHINES EQUIPPED WITH"KMG" CONTROL SYSTEM	190
3.13.3	BOTTOM DUMP BUCKET	191
3.13.4	DROP BALL OPERATION	192
3.13.5	COMBINED OPERATION CYCLES	195
3.14	WORKING INSTRUCTIONS	197
3.14.1	STABILITY OF THE SHOVEL	197
3.14.2	SHOVEL OPERATION	197

3.15	PARKING THE SHOVEL	200
3.16	STOPPING THE ENGINE	202
3.16.1	RELIEVE PRESSURE IN THE HYDRAULIC SYSTEM	205
3.17	AUTOMATIC LUBRICATION SYSTEMS	206
3.17.1	OPERATION OF THE AUTOMATIC LUBRICATION SYSTEMS	207
3.18	FIRE DETECTION AND SUPPRESSION SYSTEM	210
3.18.1	HIGH LEVEL ALARM "FIRE"	213
3.18.2	ENGINE SHUT-DOWN THROUGH FUEL SHUT-OFF SOLENOID VALVE	213
3.18.3	ACTUATION MODES OF THE FIRE SUPPRESSION SYSTEM	213
3.18.4	INDICATION OF OPERATIONAL MODES AT CONTROL MODULE, AFTER AUTOMATIC ACTUATION OF THE FIRE SUPPRESSION SYSTEM	215
3.18.5	LOCATION OF THE EXTINGUISHING AGENT TANK ASSEMBLIES AND EXPELLANT GAS CARTRIDGES ON POWER HOUSE ROOF	217
3.19	CENTRAL REFILLING SYSTEM	218
3.19.1	SYSTEMS CONNECTED TO THE REFILLING SYSTEM	219
3.19.2	OPERATING THE HYDRAULIC SERVICE ARM	221
3.19.3	RECEIVER PANEL WITH MONITOR BOX	223
3.19.4	REFILLABLE GREASE CONTAINERS OF THE AUTOMATIC LUBRICATION SYSTEMS ...	227
3.20	TRANSFER PUMP FOR HYDRAULIC OIL	228
3.20.1	OPERATING THE TRANSFER PUMP	229
3.20.2	FUNCTIONS OF THE TRANSFER PUMP	229
3.21	WORK ON THE LOADER ATTACHMENT	232
3.22	TRANSPORTATION AND LIFTING OF THE SHOVEL	233
3.22.1	DISASSEMBLING OF THE SHOVEL	233
3.22.2	TRANSPORTATION AND LIFTING	233
3.23	RETRIEVAL PROCEDURE	234
3.24	SHOVEL STORAGE	235
3.24.1	PREPARING FOR STORAGE	235
3.24.2	ONE MONTH REPETITIVE SERVICE PERIOD	236
3.24.3	SIX MONTH REPETITIVE SERVICE PERIOD	236
3.24.4	PREPARING FOR OPERATION	237
3.25	TROUBLE SHOOTING	238
3.25.1	ENGINE	238
3.25.2	HYDRAULIC SYSTEM	239
3.25.3	FINAL DRIVES AND SWING GEAR	240
3.25.4	CRAWLER TRACKS	240

4. MAINTENANCE 241

4.1	FOREWORD	242
4.2	PRECAUTIONS FOR MAINTENANCE	243
4.3	FLUIDS AND LUBRICANTS	245
4.3.1	LUBRICANTS FOR OPERATION IN COLD AND ARCTIC CLIMATES	245
4.3.2	FLUIDS AND LUBRICANTS FOR MODERATE AND HOT CLIMATES	246
4.4	FILLING CAPACITIES	248
4.5	STANDARD TORQUE LIST	249
4.6	LUBRICATION AND MAINTENANCE SCHEDULE	250
4.6.1	INITIAL SERVICING	250
4.6.2	PERIODIC SERVICING INTERVALS	250
4.6.3	PERIODIC SERVICING SCHEDULE	251
4.6.4	PERIODIC REPLACEMENT OF SAFETY CRITICAL PARTS	257
4.6.5	EXTENDED SERVICE INTERVALS FOR ENGINES WITH ENGINE OIL MANAGEMENT SYSTEM	261
4.6.6	RESETTING THE ENGINE OIL BURNING SYSTEM CENTINEL	263
4.6.7	MAINTENANCE OF THE ENGINE	267
4.7	WHEN NECESSARY	268
4.7.1	ENGINE AIR CLEANER MAINTENANCE	269
4.7.2	SWING CIRCLE TOOTHING LUBRICATION	273
4.7.3	AUTOMATIC LUBRICATION SYSTEMS FILL GREASE CONTAINERS	275
4.7.4	TRACK ROLLERS AND GUIDE WHEELS - REPLACE FLOATING SEALS	279
4.7.5	COLD STARTING AID, REPLACE FLUID CYLINDER	281
4.8	EVERY 10 OPERATING HOURS OR DAILY	282
4.8.1	WALK - AROUND INSPECTION	283
4.8.2	AIR CLEANER - CLEAN PRE-CLEANER	295
4.8.3	RADIATOR - CHECK COOLANT LEVEL	297
4.8.4	TRACK GROUPS - CLEAN	297
4.8.5	FUEL SYSTEM WATER SEPARATOR - DRAIN WATER	299
4.9	EVERY 50 OPERATING HOURS OR WEEKLY	300
4.9.1	SWING GEAR AND MOTOR ADAPTER HOUSING - CHECK OIL LEVEL	301
4.9.2	TRAVEL GEARS, BRAKE HOUSINGS AND MOTOR ADAPTER HOUSINGS - CHECK OIL LEVELS	305
4.9.3	PTO (PUMP DISTRIBUTOR GEAR) - CHECK OIL LEVEL	309
4.9.4	HYDRAULIC ACCESS LADDER - CHECK SAFETY SENSOR	311
4.9.5	HYDRAULIC OIL COOLERS - INSPECT AND CLEAN IF NECESSARY	313
4.10	EVERY 250 OPERATING HOURS OR MONTHLY	314
4.10.1	AIR CONDITIONING COMPRESSOR - CHECK DRIVE BELT TENSION	315
4.10.2	RADIATOR FAN BELT AND AUTOMATIC BELT TENSIONER - MAINTENANCE CHECK .. 317	317
4.10.3	GENERATOR - CHECK BELT TENSION	321
4.10.4	SIGNAL HORN COMPRESSOR - LUBRICATE	323
4.10.5	HYDRAULIC OIL COOLER FAN - CHECK CONDITION AND FASTENING	323

4.10.6	AUTOMATIC LUBRICATION SYSTEMS - CLEAN IN-LINE GREASE FILTER AND CHECK BREATHER FILTER	325
4.10.7	CAB AIR CLEANER - CLEAN OR REPLACE FILTER ELEMENT	329
4.10.8	WINDSHIELD WASHER RESERVOIR - CHECK FLUID LEVEL	331
4.10.9	AIR CONDITIONING FOR OPERATOR'S CAB - CHECK REFRIGERANT LEVEL	331
4.11	EVERY 500 OPERATING HOURS OR MONTHLY	332
4.11.1	BATTERIES - CHECK FLUID LEVEL	333
4.11.2	FLEXIBLE DRIVE COUPLING - CHECK OIL LEVEL	335
4.11.3	FUEL TANK - DRAIN CONDENSATION	337
4.11.4	CRAWLER TRACK - INSPECTION	339
4.12	EVERY 1000 OPERATING HOURS OR EVERY 6 MONTH	344
4.12.1	HIGH STRENGTH BOLT CONNECTIONS - CHECK TORQUE LOAD	345
4.12.2	HYDRAULIC SYSTEM - FILTER SERVICE	377
4.12.3	PTO (PUMP DISTRIBUTOR GEAR), SWING GEAR AND TRAVEL GEARS - OIL SAMPLE ANALYSIS	391
4.12.4	SIGNAL HORN COMPRESSOR - CLEAN AND LUBRICATE	393
4.12.5	HYDRAULIC TRACK TENSIONING SYSTEM - CHECK PRESSURE ACCUMULATORS	395
4.12.6	HYDRAULIC OIL COOLER - INSPECT AND LUBRICATE DOOR HINGES	397
4.12.7	MACHINERY HOUSE DOORS - INSPECT AND LUBRICATE DOOR HINGES	397
4.13	EVERY 2000 OPERATING HOURS OR YEARLY	398
4.13.1	HYDRAULIC SYSTEM - CHANGE OIL, REPLACE SUCTION STRAINERS AND PULSATION DAMPER	399
4.13.2	EMERGENCY ESCAPE LADDER - INSPECTION	413
4.14	EVERY 3000 OPERATING HOURS HOWEVER AT LEAST ONCE A YEAR	414
4.14.1	SWING GEAR AND MOTOR ADAPTER HOUSING - CHANGE OIL	415
4.14.2	TRAVEL GEARS, BRAKE AND MOTOR ADAPTER HOUSINGS - CHANGE OIL	423
4.14.3	PTO (PUMP DISTRIBUTOR GEAR) - CHANGE OIL	427
4.15	FIRE PREVENTION	430
4.16	WELD REPAIRS	432
4.16.1	PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE UNDERCARRIAGE	435
4.16.2	PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE LOADER ATTACHMENT	437
4.16.3	PROTECTIVE MEASURES BEFORE STARTING WELD REPAIRS ON THE SUPERSTRUCTURE	439
4.16.4	AFTER FINISHING THE REPAIR WELDINGS ON THE SUPERSTRUCTURE	441