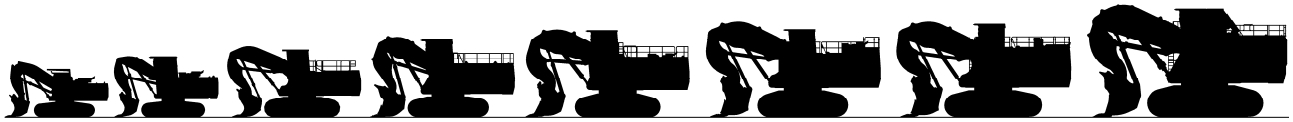
Operating Instructions

CE

Hydraulic Excavator

RH 90C No.

Bucyrus HEX GmbH



1 INTRODUCTION

	Operating instructions	Target group
Part 1	**INTRODUCTION** **FUNDAMENTAL** **SAFETY INSTRUCTIONS**	**Operating personnel** **+** **Inspection and servicing personnel** **+** **Repair personnel**
Part 2	**OPERATION**	**Operating personnel** The operating personnel must have know-how relevant to the operation and the application of this or comparable machines.
Part 3	**INSPECTION AND SERVICING**	**Inspection and servicing personnel** The inspection and servicing personnel must have know-how relevant to the inspection and servicing of this or comparable machines.
Part 4	**REPAIR WORK**	**Repair personnel** The repair personnel must have know-how and experience relevant to the repair of this or comparable machines.
Part 5	**ANNEX**	**Operating personnel** **+** **Inspection and servicing personnel** **+** **Repair personnel**
Part 6	**INDEX**	**Operating personnel** **+** **Inspection and servicing personnel** **+** **Repair personnel**

Gas, dust, steam and smoke

Always start and operate the engine in a well-vented area;

If in an enclosed area, vent the exhaust to the outside;

Do not modify or tamper with the exhaust system

Diesel engine exhaust and some of its constituents are known to cause cancer, birth defects, and other reproductive harm

Operate 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.

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).

California Proposizion 65 Warning

Diesel fuel and Diesel engine exhaust and some of its constituents are known in the State of California to cause cancer, birth defects, and other reproductive harm.

Hydraulic equipment

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) to be removed in accordance with the specific instructions for the unit concerned before carrying out any repair work.

Hydraulic 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 of the machine must be closed.

Always wear the prescribed ear protectors.

Oil, grease and other chemical substances

When handling oil, grease or other chemical substances, observe the product-related safety regulations (see safety specifications).

Be careful when handling hot consumables (risk of burning or scalding).

Transporting and recommissioning

The machine must be loaded and transported only in accordance with the operating instructions.

Use only appropriate means of transport and lifting gear of adequate capacity.

The recommisioning procedure must be strictly in accordance with the operating instructions.

Excavator layout

Fig. 2-1:

Undercarriage

1 - Track drive
2 – Idler
3 - Track roller
4 - support roller
5 - Crawler track
6 - Track tensioner
7 - Swing ring
8 - Ladder

Superstructure

11 – Engine
12 - Radiator (engine cooling liquid)
13 - Air-intake system
14 - Exhaust system
15 - Fuel Tank
17 - Hydraulic oil reservoir
18 – Hydraulic oil cooler
20 – Pump transfer gearbox
21 - Working pump
22 – Cooling oil pump
23 - Servo system pump
27 – Swing pump
29 - Swing gear
30 - Travel block and rotor
31 - Driver's cab
32 - Control stand with BCS
33 - Control-cabinet
34 - Air conditioner
35 - Fire-extinguisher
36 - Control-cabinet with battery main switch
37 – Batteries
44 – Grease container of central lubricating system
45 – Tool cabinet (optional)
46 – Ladder
47 – Ladder
48 - Counterweight

Loading bucket

51 – Boom
52 - TriPower linkage
53 – Stick
54 - Bottom-dump bucket
55 - Boom cylinder
56 - Stick cylinder
57 - Tipping cylinder
58 - Bottom-dump cylinder
64 - Control valves
65 - Quick-action valve

Backhoe bucket

53 - Stick
55 - Boom cylinder
56 - Stick cylinder
59 - Monoblock boom
60 - Backhoe bucket
61 - Backhoe cylinder
62 - Toggle link
63 - Toggle lever
64 - Control valves
65 - Quick-action valve

Automatic fire-extinguishing system (optional)

The automatic fire-extinguishing system (Fig. 2-18:) prevents fire from spreading. It is, however, assumed that the machine is thoroughly cleaned of combustible and easily flammable substances.

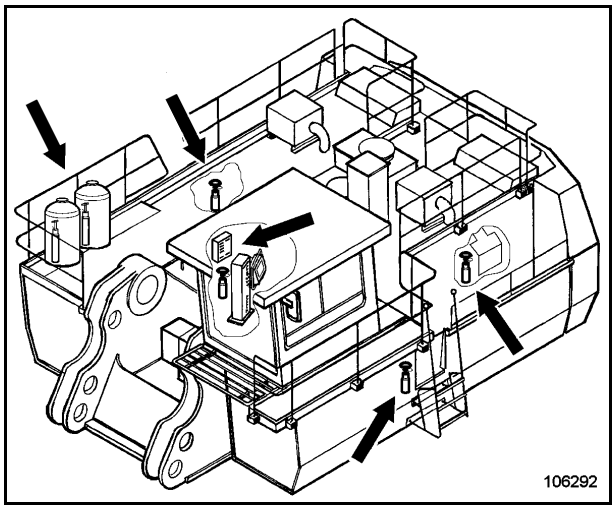


Fig. 2-18:

The excavator operator and the maintenance personnel must familiarize themselves with the automatic fire-extinguishing system.

Such instruction should be given by a qualified instructor.

The fire-extinguishing system is activated automatically in an emergency.

Refill extinguishers immediately after use ready for further deployment.

In an emergency the fire-extinguishing system is actuated automatically.

Nevertheless particular extinguishing circuit e. g. engine 1 or 2 (LH or RH) can be actuated manually.

Inspection

Have the extinguishing system inspected regularly by an expert. This is required by authorities and insurance companies and is in the interest of your own safety.

Have the fire-extinguishing system checked at the prescribed intervals by authorized testing agencies.

Manual activation

- Pull out ring (1, Fig. 2-19:) on activating unit for corresponding extinguishing circuit.
- Strike knob (2) hard.

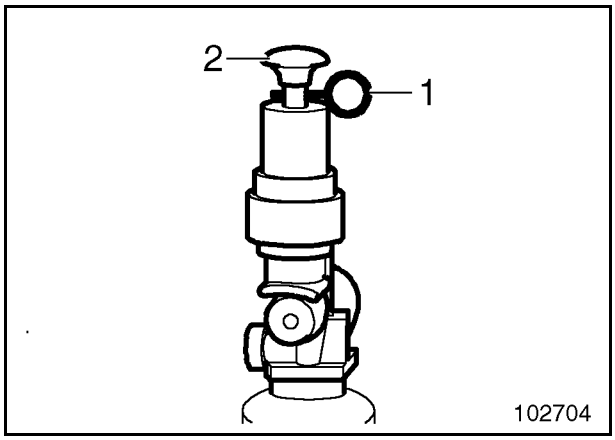


Fig. 2-19:

Fig. 2-20: shows a activating unit.

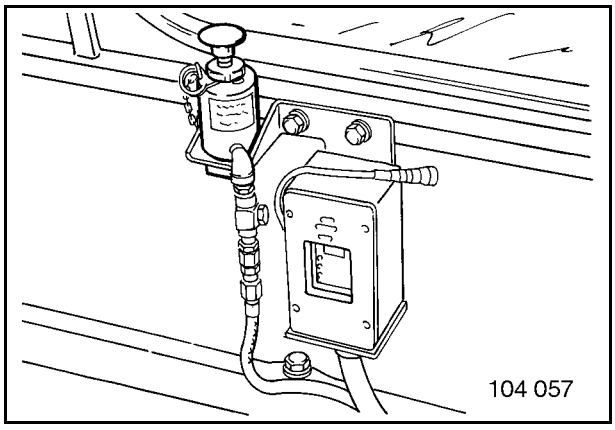


Fig. 2-20:

Fig. 2-34:

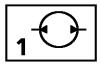
No.	Element	Function	Symbol
33	**Buzzer (continued)**	**Gives an acoustic warning signal if a fault is reported:** ▪ Engine oil level (engine 1 and / or 2; left and / or right) too low ▪ Distributor gearbox (1 and / or 2; left and / or right) contaminated ▪ Working pump (1, 2, 3, and / or 4; left and / or right) contaminated ▪ Swing motor (1 and / or 2) contaminated ▪ Swing circuit temperature (1 and / or 2) too high ▪ Lubricating system pressure too low ▪ Grease level in lubricating system too low ▪ On-board voltage 24 V too low **The buzzer (33) continues to sound until the fault has been rectified.**	
34	**Buzzer**	Gives an acoutic warning signal when the stick/boom angle is to too small.	

Fig. 2-39:

No.	Element		Function	Symbol
81	**Switch**		Not connected	
82	**Switch**	**Superstructure holding brake**	Blocks the superstructure **Actuate switch only when the excavator is stationary.** **Do not use as service brake.**	
83	**Switch**	**Windscreen wiper**	Activates permanent / intermittent wiping	
84	**Switch**	**Screen washer**	Activates the wipe / wash function	
85	**Switch**	**Floodlamps**	Switches on the floodlamps on the driver´s cab	
86	**Switch**	**Floodlamps**	Switches on the floodlamps on the hydraulic oil cooler	
87	**Switch**	**Floodlamps**	Switches on the floodlamps on the counter-weight	
88	**Switch**	**Floodlamps**	Switches on the floodlamps on the platform	

Fig. 2-44:

(Optional)

No.	Element	Function	Symbol
151	**Warning lamp** **Swing pump 1 contaminated**	Lights up when the swing pump is contaminated with metal particles.	
152	**Warning lamp** **Swing pump 2 contaminated**	Lights up when the swing pump is contaminated with metal particles.	
153	**Warning lamp**	Not connected	
154	**Warning lamp**	Not connected	
155	**Warning lamp** **Main pump 1 contaminated**	Lights up when the main pump is contaminated with metal particles.	
156	**Warning lamp** **Main pump 2 contaminated**	Lights up when the main pump is contaminated with metal particles.	
157	**Warning lamp** **Distributor gearbox 1 left contaminated**	Lights up when the distributor gearbox is contaminated with metal particles.	
158	**Warning lamp** **Swing pump 1 temperature**	Lights up when the temperature in the swing pump is too high	
159	**Warning lamp** **Swing pump 2 temperature**	Lights up when the temperature in the swing pump is too high	
160	**Warning lamp**	Not connected	
161	**Warning lamp**	Not connected	
162	**Warning lamp** **Main pump 3 contaminated**	Lights up when the main pump is contaminated with metal particles.	
163	**Warning lamp** **Main pump 4 contaminated**	Lights up when the main pump is contaminated with metal particles.	
164	**Warning lamp** **Distributor gearbox 2 right contaminated**	Lights up when the distributor gearbox is contaminated with metal particles.	

Switching the electrical system on and off

The electrical system is switched on with key-switch (32, Fig. 2-60:). Insert key into key-switch and turn to the right.

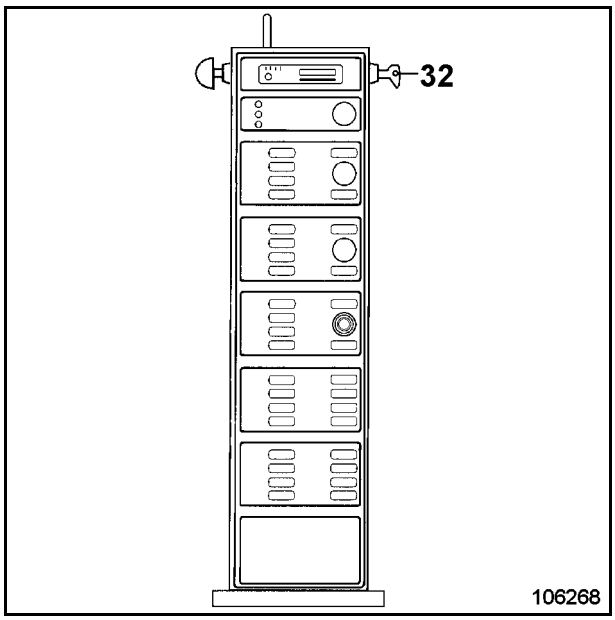


Fig. 2-60:

Battery main switch

The battery main switch is installed in the control cabinet (1, Fig. 2-61:) behind the hydraulic reservoir. The battery main switch disconnect the complete electrical system from the batteries. In the "OFF" position, the battery main switch

- prevent unauthorized starting of the engines,
- protect the batteries against inadvertent discharge.

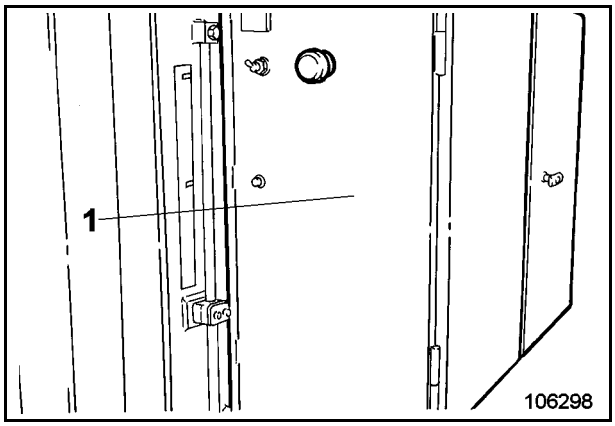


Fig. 2-61:

Only the automatic fire-extinguishing system (optional) remains connected to the power supply even when the battery main switch is in the "OFF" position.

The battery main switch is automatically set to OFF when the the electrical system is switched off with key switch (32, Fig. 2-60:).

Regulating the travelling speed

Travelling on level ground

Regulate the travelling speed with

- ➲ pedals (112 and 113, Fig. 2-81:) and
- ➲ Turn speed regulator (56 and 66) fully clock-vice (full-throttled position)

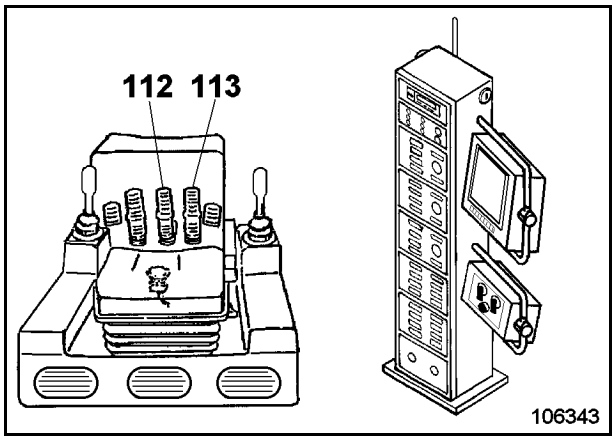


Fig. 2-81:

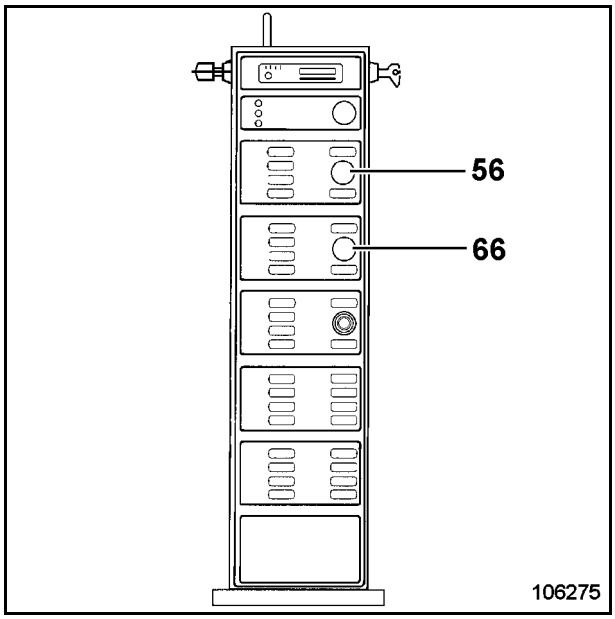


Fig. 2-82:

Travelling uphill and downhill

Read and observe the "Travelling - Safety instructions" chapter.

- ➲ Depress padals (112 and 113, Fig. 2-81:) fully to the limit stop.
- ➲ Regulate the travel speed only with the engines speed control.

When travelling downhill, the travel retarder valve acts as a speed limiter.

The travel retarder valve works correctly if pedals (112 and 113) are fully depressed down to the limit stop.

Should the travelling speed become too high when travelling downhill release pedals (112 and 113) to stop the excavator.

ASSEMBLING WORKING EQUIPMENT - SAFETY INSTRUCTIONS

Personel

Assembly work may be carried out only by operating or maintenance personnel who have the necessary know-how at their disposal.

If such know-how is lacking, meticulous instruction must be given by experienced personnel, e.g. from Terex|O&K.

The operating manual, and in particular the section headed "Fundamental Safety Instructions", must have been read and understood.

Only such persons may start up the machine during assembly work in order to adjust the attachments.

Incorrect operation of the machine or the attachments may give rise to life-threatening situations.

Personal protective gear and working clothes

Wear closely fitting working clothing when working on the machine. Loose, wide garments may catch on machine parts and result in injury.

Wear a safety helmet, safety footwear and gloves.

Tools and auxiliaries

Tools, hoists, slings, trestles and other devices must be in a reliable, safe state.

Metal splinters may cause injury when accessory bolts are being driven in or out. A brass or copper mandrel should therefore be used for this purpose, and goggles must be worn.

Use only the steps, platforms and handrails when climbing onto or off the machine.

Always keep steps and platforms in a non-slip state. Remove any oil, grease, earth, clay, snow, ice and other foreign matter immediately.

Securing the working equipment

Stand working equipment on the ground in such a way that no movements can be made if mechanical or hydraulic connections become detached.

Secure any equipment or component which is to be mounted or dismantled, or whose position is to be changed, with hoists or appropriate slinging/supporting devices to prevent them from moving, slipping or falling inadvertently.

Relieving residual pressure in the hydraulic system

Only unpressurized hydraulic systems may be opened. Even when a machine is parked on a horizontal surface with ist attachments supported on the ground and its driving motors switched off, there may still be substantial residual pressure in parts of the hydraulic system, e.g. primary pressure from the last hydraulic movements prior to stopping the machine.

Residual pressure is reduced only gradually. If an intervention into the hydraulic system is to be undertaken

immediately after stopping, the system must be depressurzized:

(do not leave the driver's seat)

- Stand working equipment on the ground
- Shut off the engines
- Move all control levers and pedals repeatedly into all ndirections.

Screwed connections, piping, hydraulic hoses

Repair any leakage in the piping and hose system immediately.

A fine, highly pressurized jet of hydraulic oil can penetrate the skin.

Never search for leakages with the fingers, but use a piece of cardboard and always wear goggles.

If oil has penetrated into the skin, consult a doctor immediately.

Never repair damaged piping; always replace them.

Replace hydraulic hoses immediately on detecting any damage or moist areas.

Tighten leaking screw plugs only when the system is depressurized.

Escaping oil is an environmental hazard.

Plan N

Plan N – After initial commissioning and during the running-in period

Location	Servicing work	Quantity/ No.
After 100 Bh		
Engine		
- Bearing		
- Fastening screws	Check for tightness	
Cooling system		
Cooling liquid	Carry out cooling liquid analysis after 500 OH, see: Engine Operation and Maintenance Manual	
Radiator		
- Bearing		
- Fastening screws	Check for tightness	
Hydraulic system		
Oil cooler		
- Bearing		
- Fastening screws	Check for tightness	
Return-flow filter	Replace	4
Magnetic rod	Clean	1
Pressure accumulator – emergency lowering	Check function	1
Pump transfer gearbox	Change oil	2 [3]
Swing gearbox	Change oil	2 [3]
Fastening screws	Check for tightness	
Travel gearbox	Change oil	2 [3]
Fastening screws	Check for tightness	

[3] see “Filling quantities – Oil“ table

Plan A - after every 250 OH
(at 250, 750, 1250 ... OH)

Plan B - after every 500 OH
(at 500, 1500, 2500 ... OH)

Plan C - after every 1000 OH
(at 1000, 2000, 3000, 4000 ... OH)

Plan D - after every 5000 OH
(at 5000, 15000, 25000 ... OH)

Plan E - after every 10000 OH
(at 10000, 20000, 30000, ... OH)

Location	Servicing work	Menge / No.	Plan A	Plan B	Plan C	Plan D	Plan E
Central lubricating system (grease container)	Check function			●	●	●	●
Grease sieve	Check / clean	2		●	●	●	●
Breather filter	Check / change	1			●	●	●
Oilfilter (hydraulic circuit grease pump)	Check for contamination and damage	1			●	●	●
	Replace	1				●	●
Central lubricating system (grease container optional)	Check function			●	●	●	●
Oilfilter (hydraulic circuit grease pump)	Check for contamination and damage	1			●	●	●
	Replace	1				●	●
Grease filter (filling grease container)	Check for contamination and damage	1			●	●	●
	Replace	1					●
Grease filter (grease lines)	Check for contamination and damage	1			●	●	●
	Replace	1					●
Grease sieve	Check / clean	2		●	●	●	●
Air conditioner resp. heating	(see “Manual Air Conditioner“)	1			●	●	●
- Air suction (Backside driver`s seat)							
- Filter mat	Change	3			●	●	●
Steel components	Carry out visual check				●	●	●
Modules							
– Fastening screws	Check for tightness				●	●	●
All articulated joints and hinges	Grease				●	●	●

III.a Oils for pump gearboxes

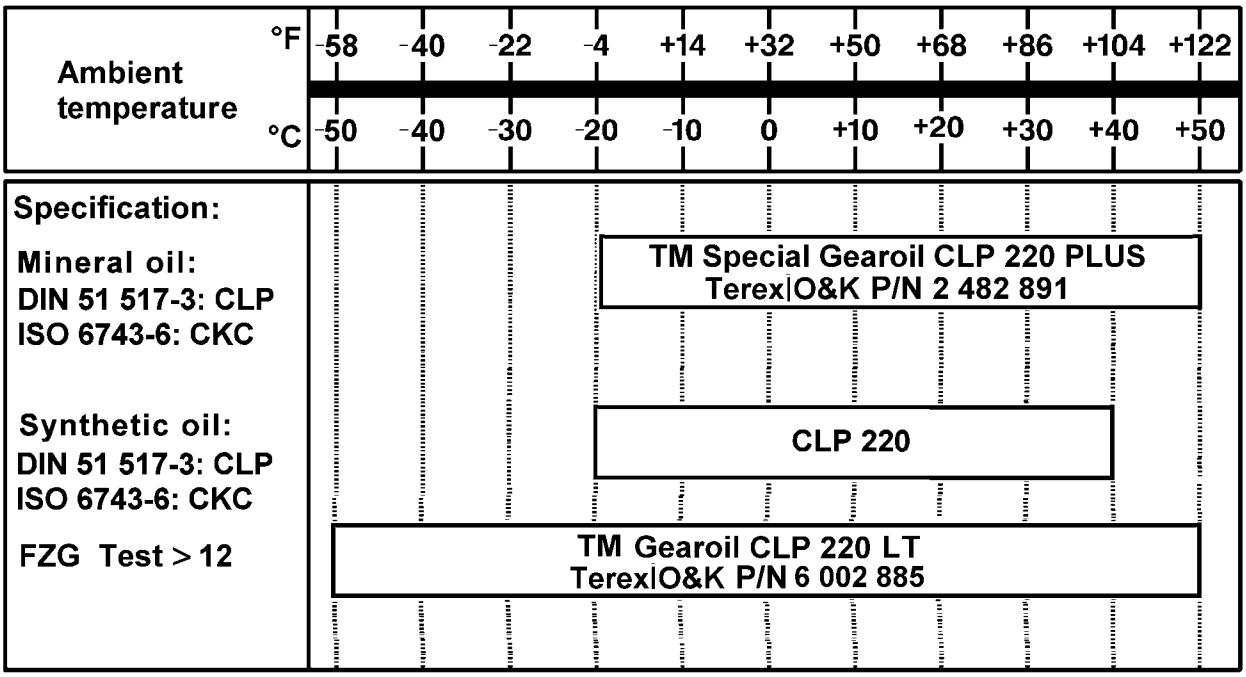


Fig. 3-6:

COOLING SYSTEM

Read and observe: "Inspection and servicing - Safety instructions".

Secure the machine as described in the "Securing the machine" section.

Shut off the engines and allow to cool down.

Risk of scalding from hot cooling liquid.

Collect escaping cooling liquid and discard without polluting the environment.

Protect the skin from contact with cooling liquid.

Skin contact with cooling liquid is a potential health hazard.

Wear protective gloves and firm working clothing.

Temperature

The cooling liquid circuit is controlled by a thermostat. The max. admissible temperature is ca. 100° C (212°F). In case of higher temperatures, the BCS displays a warning on the screen (2, Fig. 3-24:).

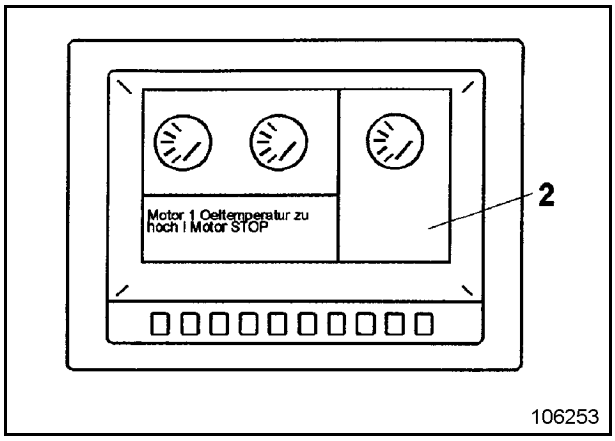


Fig. 3-24:

➲ Fill in fuel through the strainer in filler tube (1, Fig. 3-43:)

➲ Fuel can also be filled into both fuel tanks through the service station (1, Fig. 3-44:).

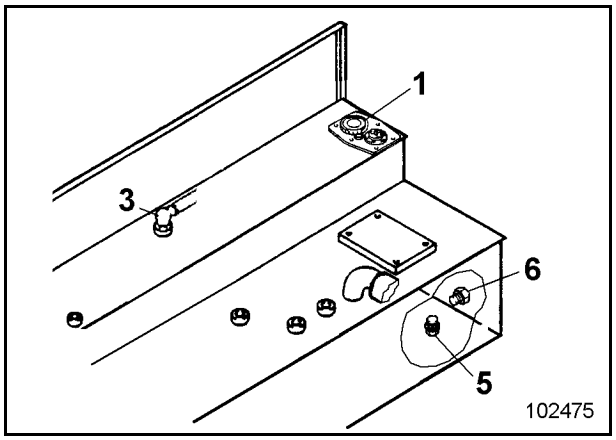


Fig. 3-43:

➲ Unscrew cap of express coupling. Connect filling hose of the service vehicle.

The hose line and its use are described in the „Hose line for oil and cooling liquid change" section.

The filling level is displayed on the BCS screen (Fig. 3-45:).

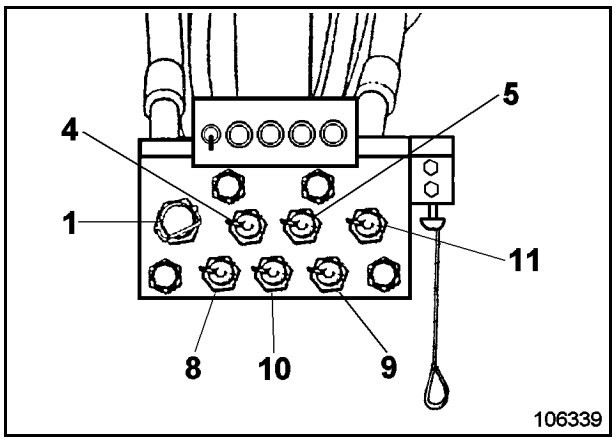


Fig. 3-44:

➲ Remove filling hose.
The express coupling closes automatically.

➲ Screw on protective cap.

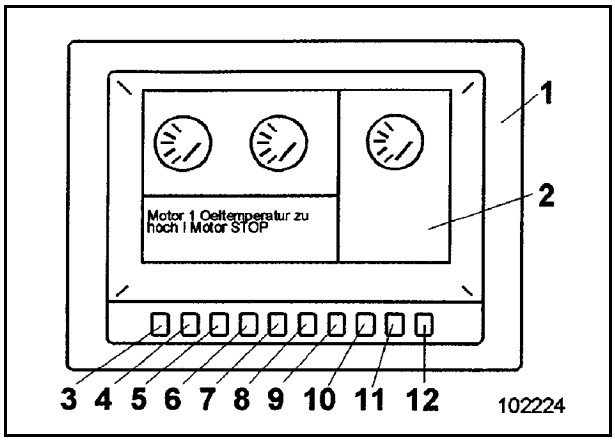


Fig. 3-45:

Examples of system sections:

1) working hydraulics
2) servo control circuit
3) precharged return-flow line

Depressurizing

- ➲ Park the excavator on a horizontal surface.
- ➲ Set the working equipment on the ground.
- ➲ Shut off the drive engines.
- ➲ Do not switch off the electrical system

Sections 1 and 2: servo control and working hydraulics

- Shift both control levers repeatedly into all directions (Fig. 3-57:).

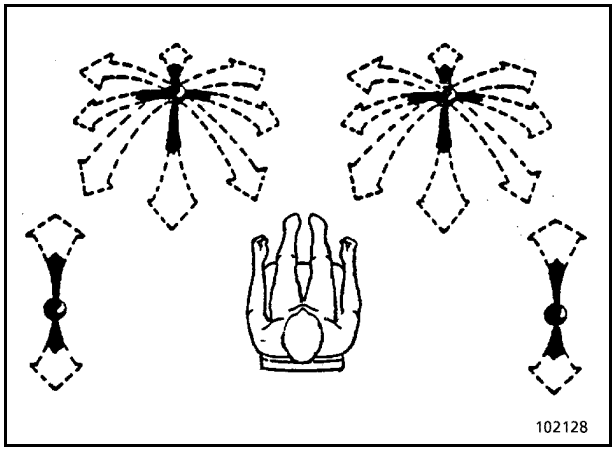


Fig. 3-57:

Section 3: Return-flow line

After shutting down the engine, the precharging pressure decreases rapidly through the precharging valve. No measures are required before opening the return-flow line.

Checking the hydraulic oil level

- ➲ Bring hydraulic oil to operating temperature (abt. 50 °C / 122°F).
- ➲ Park the machine on a horizontal surface.
- ➲ Move all hydraulic cylinders to their central positions.

The oil level must lie between the ½ and ¾ marks of the inspection glass (1, Fig. 3-58:).

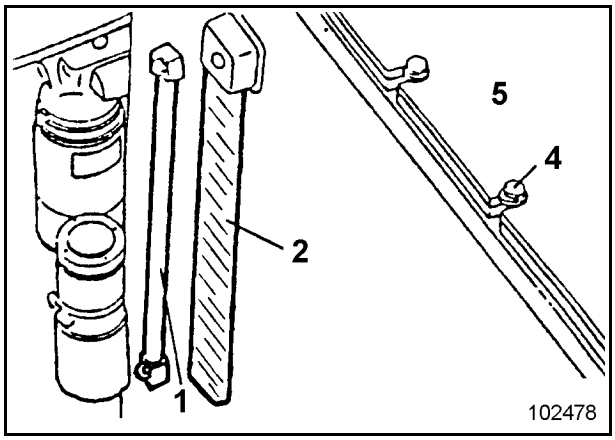


Fig. 3-58:

The hydraulic oil level is monitored by the BCS. The BCS displays a warning on the screen (Fig. 3-59:) if the hydraulic oil level is too low or too high.
Shut off the engines, locate cause and rectify.

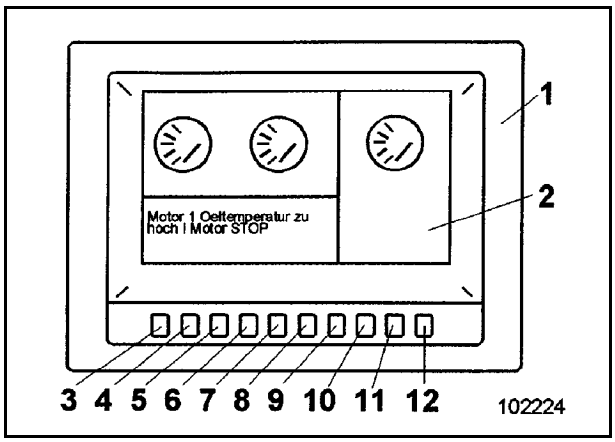


Fig. 3-59:

Drawing off hydaulic oil

The hydraulic oil can also be drawn off through the service station (Fig. 3-78:).

- ➲ Bring hydraulic oil to operating temperature (ca. 50° C / 122°F).
- ➲ Retract hydraulic cylinders as far as possible and stand working equipment on the ground.
- ➲ Shut off the engines.
- ➲ Unscrew cap of express coupling (10).
- ➲ Connect hose line of the service vehicle.

The hose line and its use are described in the „Hose line for oil and cooling liquid change" section.

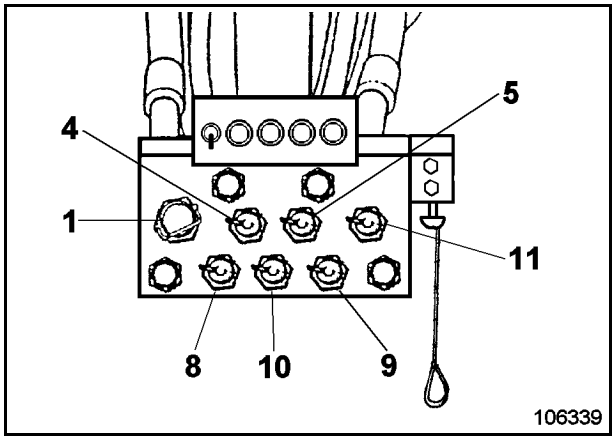


Fig. 3-78:

- ➲ Remove hose line. The coupling closes automatically.
- ➲ Screw on protective cap.

Cleaning the hydraulic oil reservoir

Explosion hazard.

Read and observe the "Inspection and servicing - Safety instructions" chapter.

Shut off the engines.

Do not use white spirit, paraffin oil or other solvents for cleaning.

Use diesel fuel or a special flushing oil.

Avoid skin contact.

Skin contact with hydraulic oil may cause skin injury.

Wear protective gloves and firm working clothing.

Dispose of contaminated hydraulic oil without polluting the environment and separately from other waste.

- ➲ Drain off hydraulic oil as described under "Draining off the hydraulic oil".
- ➲ Remove cap (3, Fig. 3-79:)..
- ➲ Detach the return-flow filter.

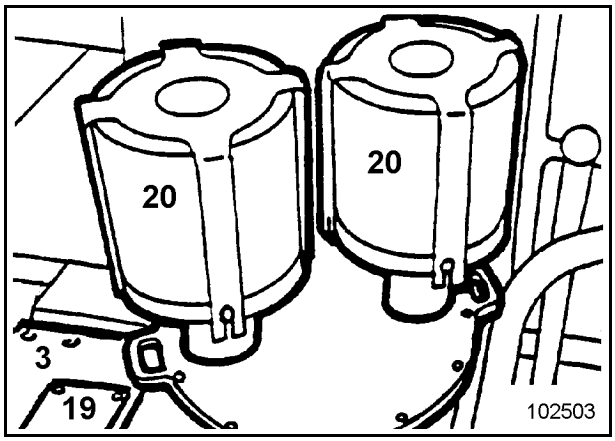


Fig. 3-79:

- ➲ Place a collecting recipient for the flushing oil under the hydraulic oil reservoir.
- ➲ Clean the inside of the hydraulic oil reservoir with diesel fuel or flushing oil.
  Remove all sediments and also the residues of the cleaning agent thoroughly
- ➲ Refit cap (3).

Drain valve (7, Fig. 3-97:) is accessible from the undercarriage.

➲ Remove hose. The oil drain valve closes automatically.

➲ Screw on protective cap.

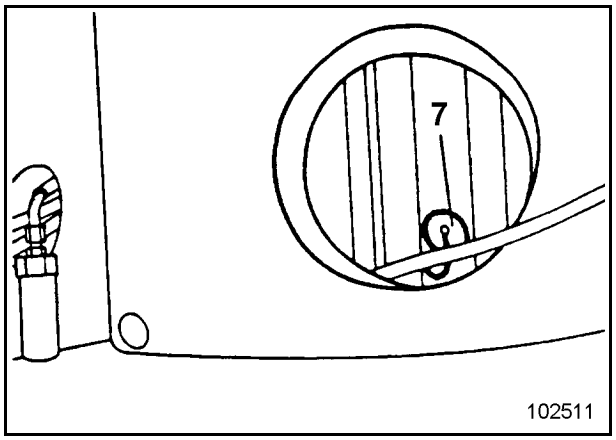


Fig. 3-97:

Filling in new oil / Topping up

➲ Unscrew cap (8, Fig. 3-98:) and fill in new oil through expansion tank (6). The expansion tank (6) must be filled with gearbox oil up to abt. 1/3.

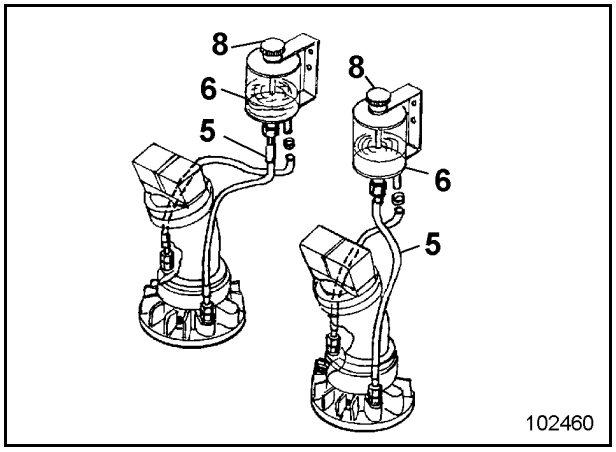


Fig. 3-98:

Gearbox venting

The gearbox is vented through cap (8, Fig. 3-98:).

Replacing the grease container

- Detach lines (5, 6 and 7, Fig. 3-116:).
- Loosen wing nuts (12) and lift off holder (3).

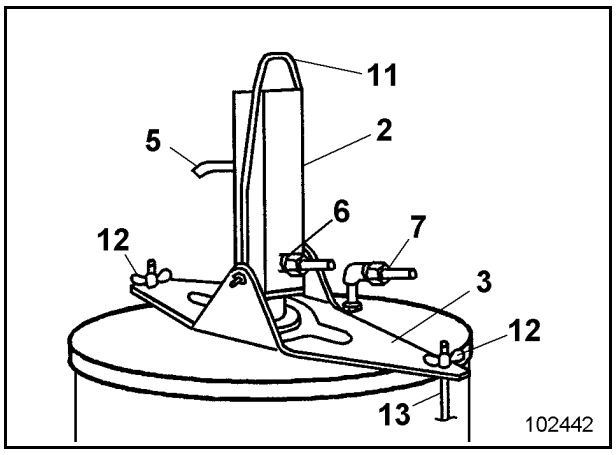


Fig. 3-116:

- Remove cover together with grease pump (2, Fig. 3-116:) from grease container 1, Fig. 3-117:).
- Replace the empty container by a full one.
- Fasten cover with grease pump (2, Fig. 3-116:) on grease container.
- Reconnect lines (5, 6 and 7).

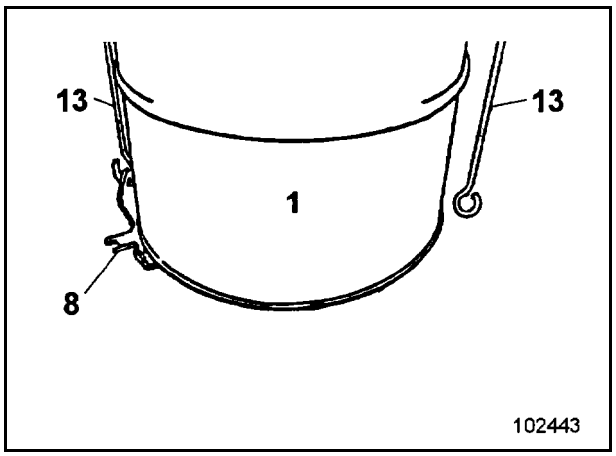


Fig. 3-117:

Filling up the grease container

(Optional)

Fill up the grease container through the service station (Fig. 3-118:).

The use of the hose is described in the chapter "Flexible hose for the change of oil and cooling water"

- Switch on the indicator system with toggle switch (33, Fig. 3-118:).
- Unscrew the cap of the express coupling (11).
- Connect the filling hose of the service vehicle.
- When the grease container is full, the indicator lamp (34) lights up.
- Remove the flexible hose.
  The express coupling closes automatically.
- Refit the protective cap.

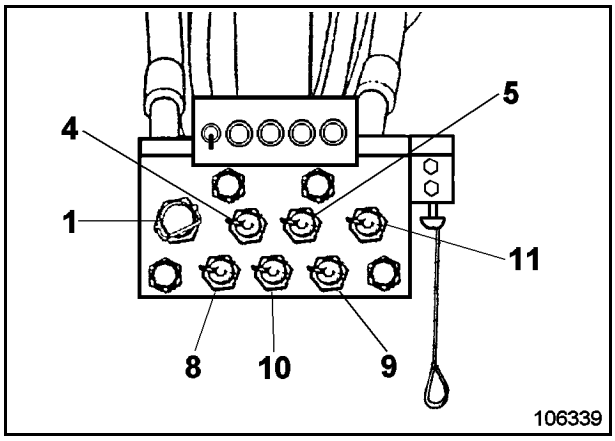


Fig. 3-118:

4 REPAIR WORK

	Operating instructions	Target group
Part 1	**INTRODUCTION** **FUNDAMENTAL** **SAFETY INSTRUCTIONS**	**Operating personnel** **+** **Inspection and servicing personnel** **+** **Repair personnel**
Part 2	**OPERATION**	**Operating personnel** The operating personnel must have know-how relevant to the operation and the application of this or comparable machines.
Part 3	**INSPECTION AND SERVICING**	**Inspection and servicing personnel** The inspection and servicing personnel must have know-how relevant to the inspection and servicing of this or comparable machines.
Part 4	**REPAIR WORK**	**Repair personnel** The repair personnel must have know-how and experience relevant to the repair of this or comparable machines.
Part 5	**ANNEX**	**Operating personnel** **+** **Inspection and servicing personnel** **+** **Repair personnel**
Part 6	**INDEX**	**Operating personnel** **+** **Inspection and servicing personnel** **+** **Repair personnel**

WELDING OPERATIONS - SAFETY INSTRUCTIONS

Never perform welding operations unless you are qualified to do so.

Observe the accident prevention regulations.

Wear protective clothing

- protective suit
- protective gloves
- face protection

Any work on receptacles that contain or have contained substances

- which are combustible or which encourage combustion,
- which are susceptible to explosion,
- or which may develop health-hazardous gases, vapours, mist or dust

during welding operations must be carried out only under expert supervision and only by experienced persons authorized to do such work.

Detailed information on the correct execution of welding operations is given in the technical manual "Welding for maintenance and repair".

Should you have any problems or queries, apply to the Terex|O&K after-sales service department.

If parts of the machine have to be dimantled, read and take note of the following sections:

Assembling attachments - safety instructions",

"Inspection and servicing - safety instructions",

"Repair - safety instructions".

Protect the disconnected terminals and plugs from short-circuiting and soiling by covering them with foil or adhesive tape.

Attach the welding-current pincers close to the welding zone (max. 2 - 3 m).

The welding current must not flow via the ball resp. the roller bearing swing ring, via pin couplings, articulated joints or hydraulic cylinders.

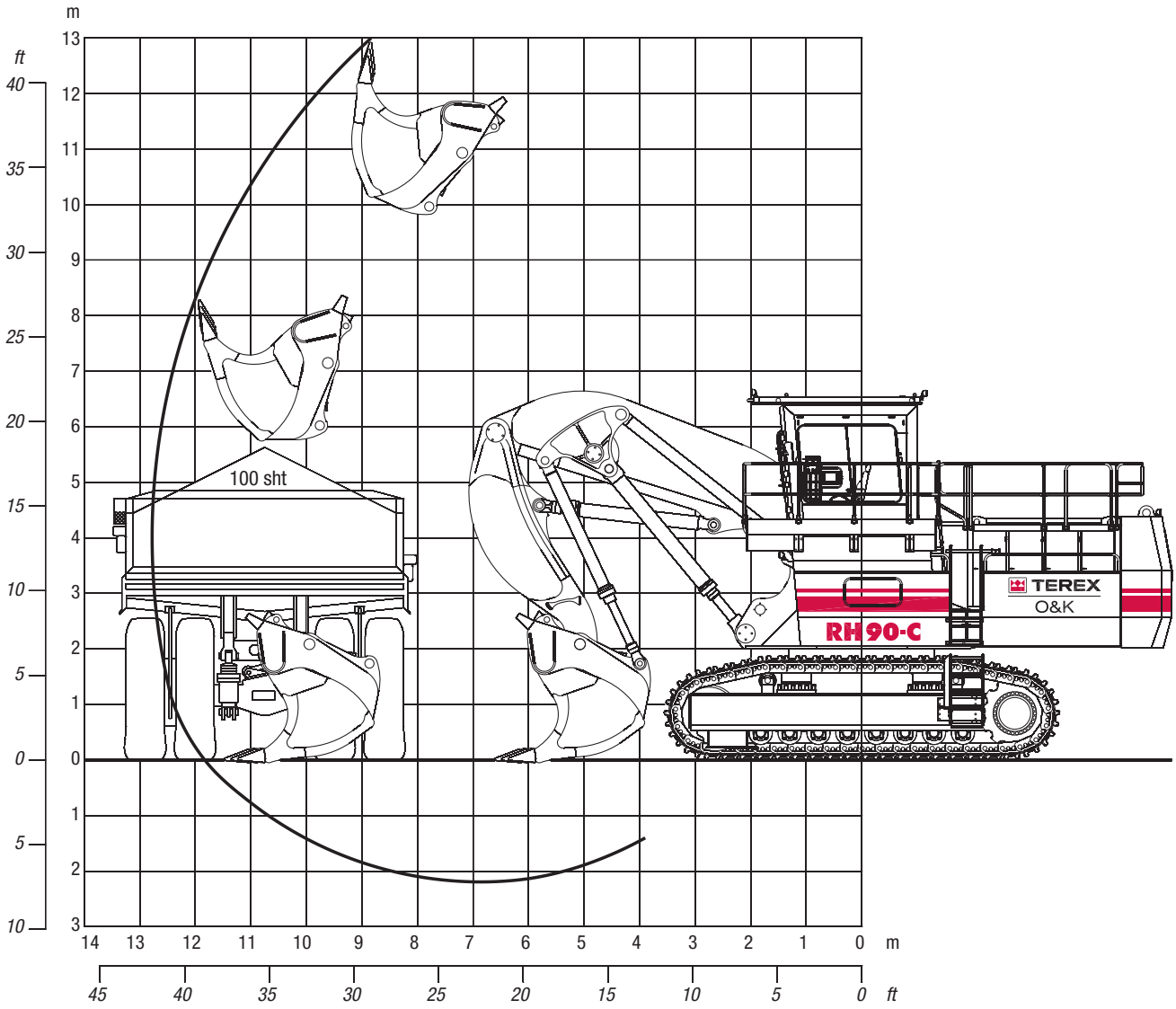
An electric current flowing over an air gap (in an articulated joint, for instance) generates sparks that damage metallic surfaces.

On completion of the welding operation, restore all electrical connections.

Swing mechnism – Fault table

Fault					Remedial action	
No swing possible					Check	**P**
	No righthand or lefthand swing				Adjust	**E**
					Replace	**W**
		Swing performance insufficient			Top up	**A**
					Reduce	**S**
			Uncontrolled swing movement		Clean	**R**
					1) Contact the Terex|O&K Service	
				Cause	**Chapter ref.**	
•				Servo control not activated / defective	Working	**P**
•				Endschalter Aufstiegleiter (Option) defekt, nicht vollständig eingefahren	Operation	**P**
•				Superstructure holding brake applied		**P**
•		•		Pressure-relief valve adjusted too low level / defective		**1)**
•				Servo system pump defective		**1)**
•		•		Malfunction in feed-pressure circuit of swing pump		**1)**
		•		Malfunction in high-pressure circuit of swing system		**1)**
	•	•		Malfuction of moment-regulating valve		**1)**
	•		•	Malfunction in swing pump displacement cylinder		**1)**
		•		Excessive leakage in swing motor		**1)**

Working Diagram - Face Shovel (FS) - Boom 6.4 m (23') - Stick



Digging Forces

Max. crowd force	870 kN	*195,520 lbs*
Max. crowd force at ground level	750 kN	*168,550 lbs*
Max. breakout force	750 kN	*168,550 lbs*

Working Range

Max. digging height	13.0 m	*42'8"*
Max. digging reach	12.8 m	*42'*
Max. digging depth	2.2 m	*7'3"*
Max. dumping height	10.1 m	*33'2"*
Crowd distance on level	4.9 m	*16'1"*

Face Shovels

Type			Heavy rock shovel		Standard rock shovel	
Tooth system			ESCO V 81		ESCO V 81	
Capacity SAE / PCSA 1:1	m^3	*cuyd*	9.2	*12.0*	12.0	*15.7*
Capacity SAE / CECE 2:1	**m^3**	***cuyd***	**8.0**	***10.5***	**10.0**	***13.1***
Total width	mm	*ft:in*	3,100	*10'2"*	3,450	*11'4"*
Opening width	mm	*ft:in*	1,900	*6'3"*	1,900	6'3"
No. of teeth			5		6	
Weight incl. universal wear kit	kg	*lbs*	15,000*	*33,070**	17,000	*37,480*
Max. material density (loose)	t/m^3	*lbs/cuyd*	2.2	*3,710*	1.8	*3,030*

* incl. special wear package for highly abrasive materials