EM029999-0 (en-us)

Operation and Maintenance Manual

6060 AC, 6060 AC FS
Hydraulic Shovel

Machines with converted Board Control System from BCSIV-eCAMP to BCS3e:
DH360155, -169, -175, -176, -178, -181, -182, -185, -186, -187

Language: Original Instructions

Restricted Visibility

The size and the configuration of this machine may result in areas that cannot be seen when the operator is seated. For restricted visibility areas, an appropriate job site organization must be utilized to minimize hazards of this restricted visibility. For more information regarding job site organization refer to this Operation and Maintenance Manual, “Visibility Information”.

Fig. 1 and Fig. 2 provide an approximate visual indication of the areas at ground level inside a radius of 24 m (79 ft) from the operator of significant restricted visibility for machines with faceshovel and backhoe attachments. Refer to the correct illustration for your machine configuration.

All restricted visibility areas less than 300 mm wide may not be shown. These illustrations do not indicate areas of restricted visibility for distances outside of the shown radius.

The areas of restricted visibility shown in the illustrations are with the track and work tool of the machine in the “travel position”.

This machine may be equipped with optional visibility aids that may provide visibility to some of the restricted visibility areas. Refer to this Operation and Maintenance Manual, “Mirror – Clean/Adjust” for more information on additional visibility.

If your machine is equipped with cameras, refer to this Operation and Maintenance Manual, “Monitoring Cameras” for more information on additional visibility.

For areas that are not covered by the optional visual aids, an appropriate job site organization must be utilized to minimize hazards of this restricted visibility. For more information regarding job site organization refer to Operation and Maintenance Manual, “Visibility Information”.

When equipped with optional visual aids, the machine visibility will meet the technical requirements found in ISO5006:2006.

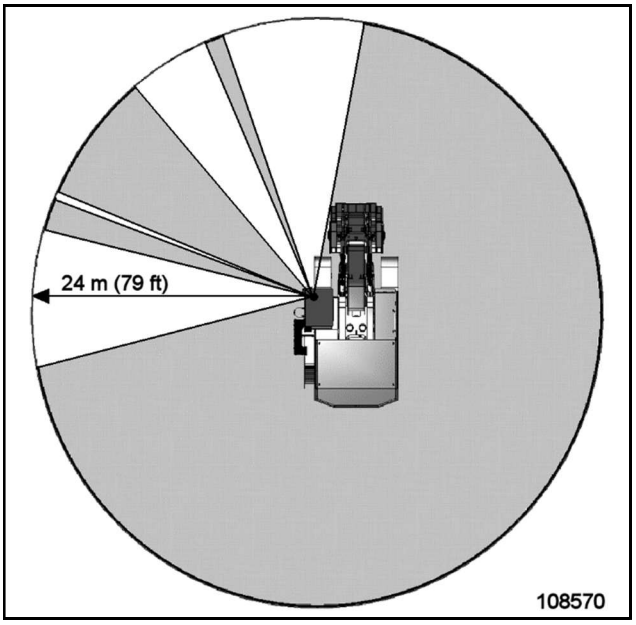


Fig. 1-1:

Fig. 1-1: shows the machine with faceshovel attachment. Top view of machine, ground level visibility without use of visual aids that are not standard in all markets.

Note: The shaded areas indicate the approximate location of areas with significant restricted visibility.

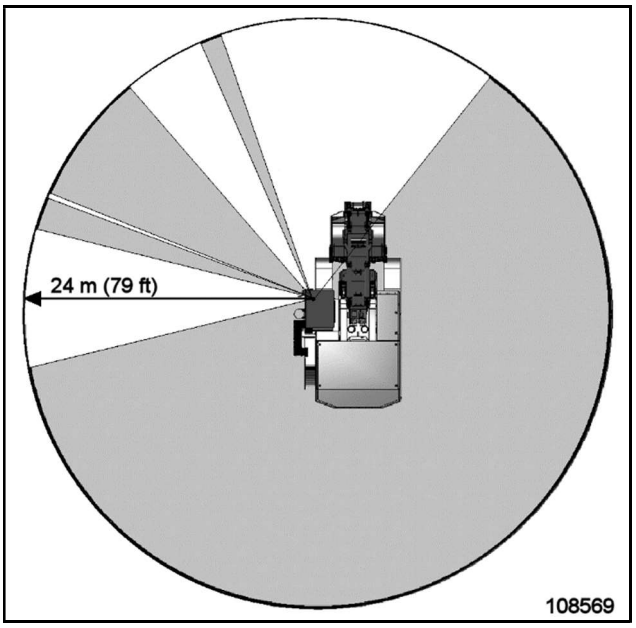


Fig. 1-2:

Fig. 1-2: shows the machine with backhoe attachment. Top view of machine, ground level visibility without use of visual aids that are not standard in all markets.

Note: The shaded areas indicate the approximate location of areas with significant restricted visibility.

NOTES

Demand control / Zero-flow regulation

In the fine-control range, swivelling of the hydraulic pumps, and thus the variation of oil flow, are proportional to control lever and pedal valve travel. This means that during the work, the pumps supply only as much hydraulic oil as required to perform the working movement. In the neutral position of the control levers, the pumps are automatically swivelled to zeroflow.

These special features offer the following advantages:

- minimum power losses,
- reduced temperature of the hydraulic oil,
- greater service life of hydraulic pumps and electric motor.

Board-Control-System (BCS)

The BCS is a micro-processor-controlled system for the acquisition and processing of measuring data. It's function consists in collecting data of the hydraulic shovel operating conditions and to evaluate, store and display these data to the hydraulic shovel operator. For this purpose, the BCS is connected via a bus system to the Control and Monitoring Platform (CAMP). An interface with the outside world ensures the drive of stored data and software updating.

The measured values (actual values) from the sensors and transducers installed in the hydraulic shovel are compared to the predefined reference values. Inadmissible deviations are indicated as fault messages on a display screen. Sensor or transducer defects or defective connecting cables are detected and indicated by plain-text messages.

The data from other electronic units are acquired, processed and displayed in the same way.

Critical states of operation are brought to the operator's attention by means of optical and acoustic warning signals.

The display screen of the BCS is a touch-screen with a surface sensitive to the touch. This feature supports the hydraulic shovel operator or the service technician in navigating through the menus of the BCS sorftware.

For further information in this respect, please refer to section 5 in this Operation and Maintenance Manual or to the brochure "Board-Control-System – Operation and Maintenance Manual"

Electrical system

Supply voltage ✱ (medium voltage)	6000 V - 7200 V
Control voltage (low voltage)	400 / 230 V
Lighting voltage	24 V
Emergency voltage	24 V
Control voltage	24 V

✱ Supply voltage depends on the individual configuration of the shovel. Please refer to the data plate of the electric motor.

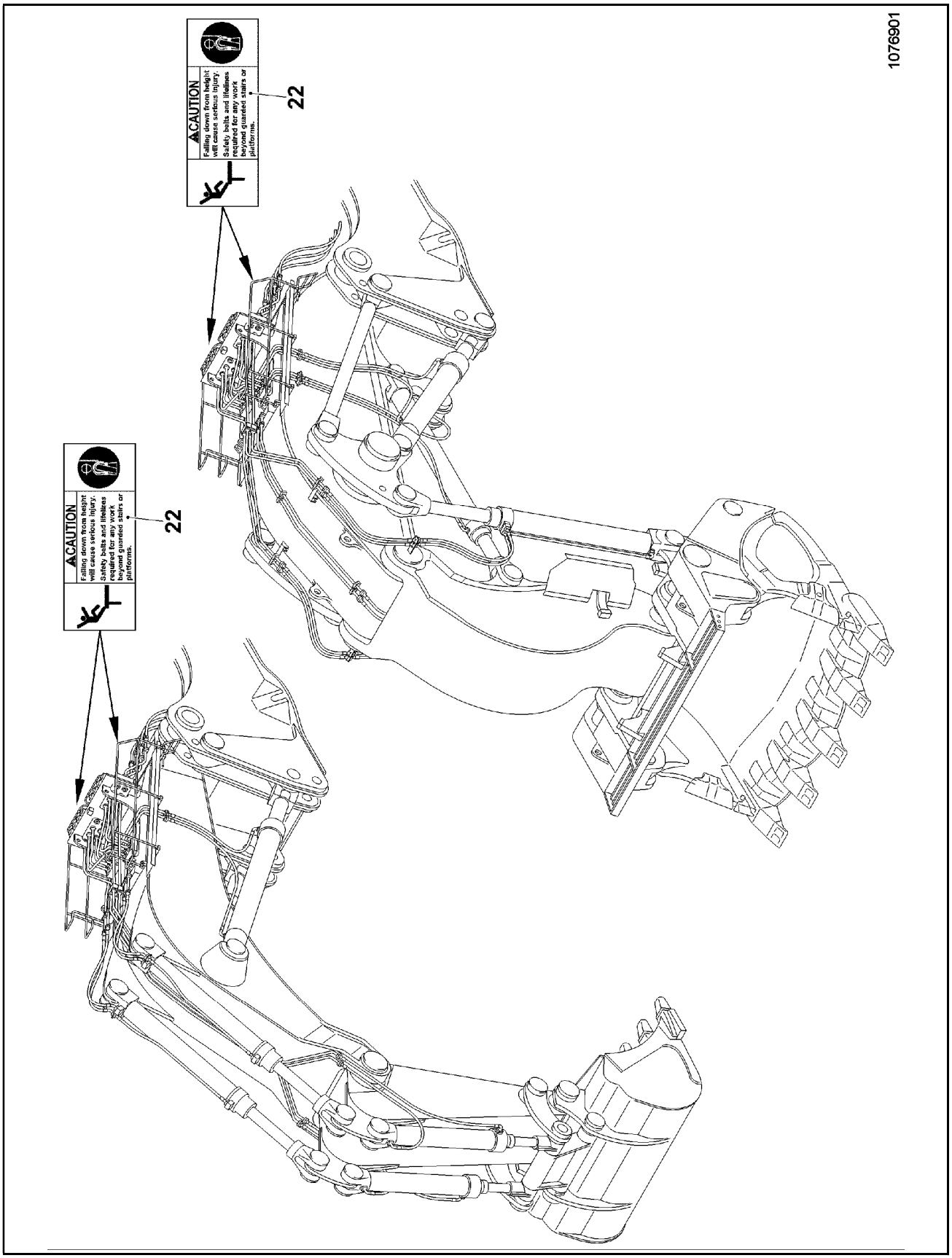

1076901
CAUTION
Falling down from height will cause serious injury.
Safety belts and lifelines required for any work beyond guarded stairs or platforms.
22
CAUTION
Falling down from height will cause serious injury.
Safety belts and lifelines required for any work beyond guarded stairs or platforms.
22

Fig. 2-14:

Entering and leaving the machine - Safety instructions

Risk of injury due to slipping.

Clean off oil, grease, soil, mud, snow, ice and other substances from footwear, grab handles, ladders and steps.

Keep ladders, steps, platforms and grab handles in a non-slippery condition.

For entering and leaving use only the ladders, steps, platforms and grab handles provided (see illustration in Fig. 2-45:).

Always face the machine when entering or leaving it.

Always maintain a three point contact with the steps and the grab handles.

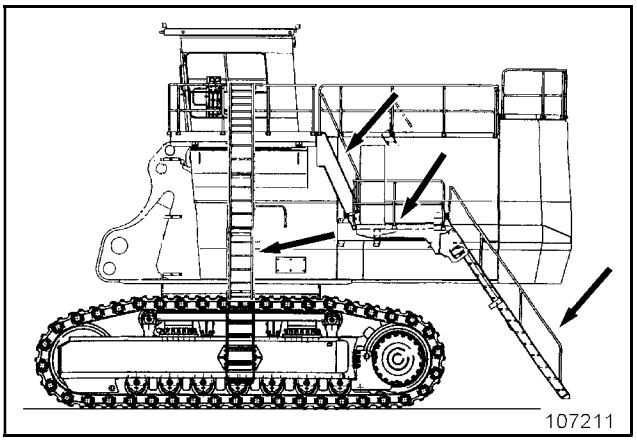


Fig. 2-45:

Access ladder - Lighting

The access ladder of the machine can be illuminated.

From outside:

The pull-switch (2, Fig. 2-46:) of the lighting system is located beneath the superstructure. The lights are switched on from the ground by means of the pull-rope.

From the cab:

The switch is located besides the door (arrow, Fig. 2-47:).

The lighting remains on during a presettable ON time. The ON time of the lighting is factory-adjusted to three minutes.

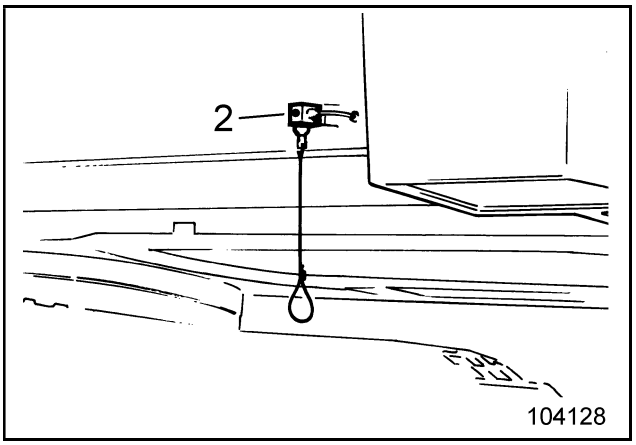


Fig. 2-46:

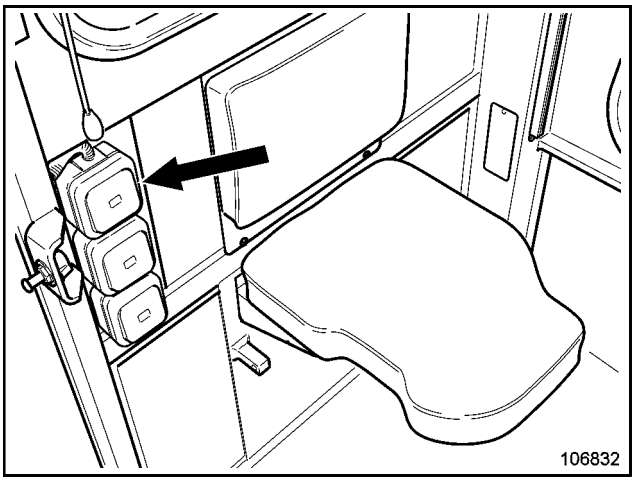


Fig. 2-47:

(Fig. 2-74:)
All switches and pushbuttons have an illuminated symbol face.
The opposite side is equipped with an LED. The LED lights up when the switch / pushbutton is actuated.

No.	Element		Function	Symbol
61	**Push-button**	**Superstructure holding brake**	Blocks the superstructure. **Press this button when the superstructure is stationary. Do not use this button while the superstructure is still in motion. Risk of damage to the brake and the swing gearboxes.**	
63	**Push-button**	**Hydraulic shovel parking brake, for Service and Maintenance purposes only**	Press the switch face with the symbol: The parking brake is applied permanently. The hydraulic shovel cannot be moved. For more information refer to chapter “Track parking brake”. **Actuate this switch only when the hydraulic shovel is stationary.** **Do not use this switch while the hydraulic shovel is still in motion. Risk of damage to the brakes and the travel gearboxes.**	
64	**Push-button**	**Central greasing system reset**	Reset function of the central greasing system control (Press for at least 3 sec.). Press switch face without symbol: Resets the control of the superstructure. Press the switch face with the symbol: Resets the control of the undercarriage.	
65	**Push-button**	**Emergency lowering**	Lowering of the working equipment in an emergency situation. For instance, if the electric motor has failed. For more information refer to chapter “Emergency lowering of the working equipment”.	

Assemblies resp. reservoirs	Measuring device	Remarks
Pump drive gear-box	Dipstick (1, Fig. 2-80:)	Stop filling when the oil reaches the "max" mark on the dipstick (see Part 3, chapter "Pump drive gearbox - Checking the gearbox oil level/Filling in oil").
Hydraulic oil tank	BCS monitor (Fig. 2-83:), Inspection glass (1, Fig. 2-81:), sign (2. Fig. 2-81: and Fig. 2-82:)	Checking the oil level: Extend the piston rods of stick and bucket cylinders halfway and stand working equipment on the ground (as shown on sign 2, Fig. 2-82:). Check oil level at an oil temperature of ca. 50 °C (122°F), with the electric motor shut off. Fill in oil when the oil level in the inspection glass has-dropped below the "min" mark. Stop filling if the oil reaches the "max" mark on the inspection glass or the acoustic warning signal "Travel alarm" sounds (see chapter "Hydraulic system - Checking the hydraulic oil level / Refilling hydraulic oil").

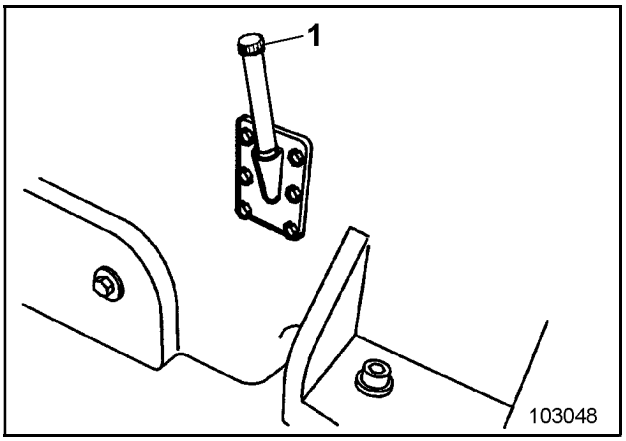


Fig. 2-80:

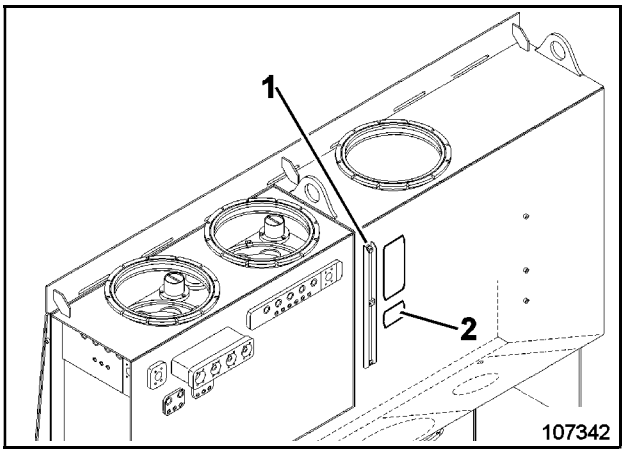


Fig. 2-81:

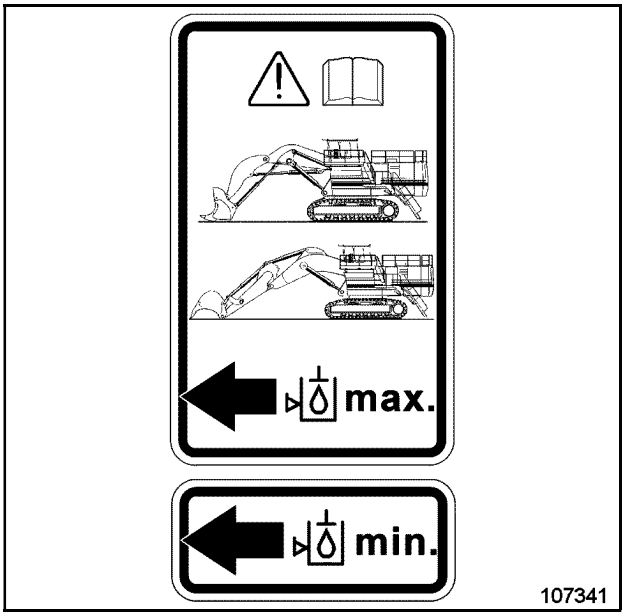


Fig. 2-82:

Preheating system for hydraulic oil reservoir and pump gearbox, switching on and off (if equipped)

Preheating systems are build in at the hydraulic oil reservoir as well as in the pump gearbox.

On low outside temperatures they warm up the hydraulic oil as well as the gear oil so that the operating temperature is reached faster.

Integrated thermostats prevent the heating elements from overheating and damage at continious operation.

The heating elements are connected electrically to a centralized switchbox. The switchbox is fixed at the hydraulic oil reservoir and can be accessed from the pump- or motor compartment (Fig. 2-98:).

After the power supply for the shovel is switched on the preheating system is functional.

(The circuit breaker must be switched on, the indicator lamps **"7.2kV* OK"** and **"PHASE SEQUENCE OK"** are on at the control cabinet 400V).

➲ Switch on the preheating system before starting work using switches at the switchbox (Fig. 2-98:).
The monitoring lamps near the switches lit up then.

Fig. 2-98:

* Supply voltage depends on the individual configuration of the shovel. Please refer to the data plate of the electric motor.

Filling and emptying the backhoe bucket

When released, all joysticks for working operation return automatically to position "**0**".

- To fill / tip back the backhoe bucket:
  shift joystick (116, Fig. 2-112:) to the left.
- To empty the backhoe bucket by dumping / tipping:
  shift joystick (116) to the right.

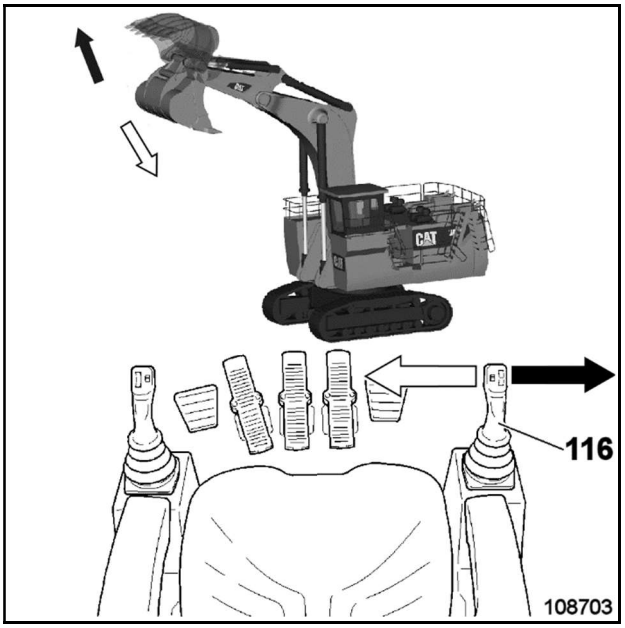


Fig. 2-112:

Filling the face shovel, curl close / curl open

When released, all joysticks for working operation return automatically to position "**0**".

- To fill / curl close the face shovel:
  shift joystick (116, Fig. 2-113:) to the left.
- To curl open the face shovel:
  shift joystick (116) to the right.

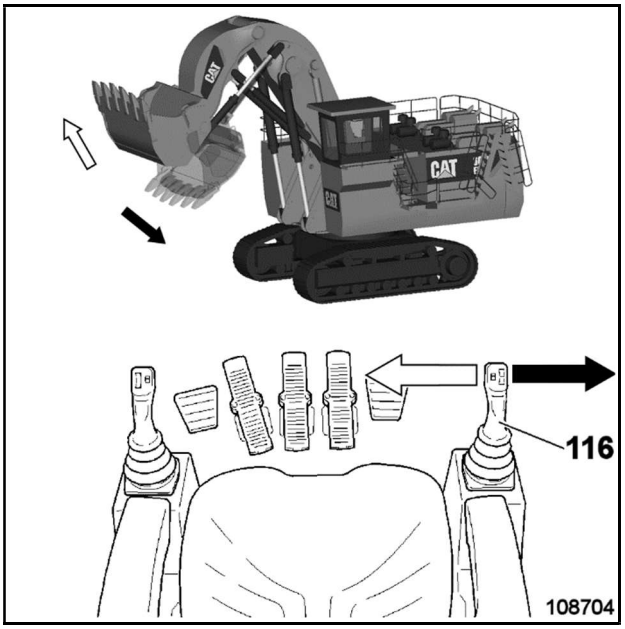


Fig. 2-113:

Double Benching

Double Benching is an operation method which could be productive but also be very harmful to component life. This method should be used only by well trained and experienced operators in accordance with the following rules.

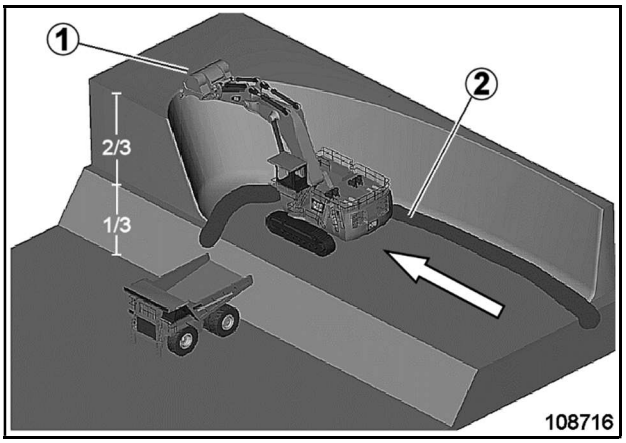


Fig. 2-130:

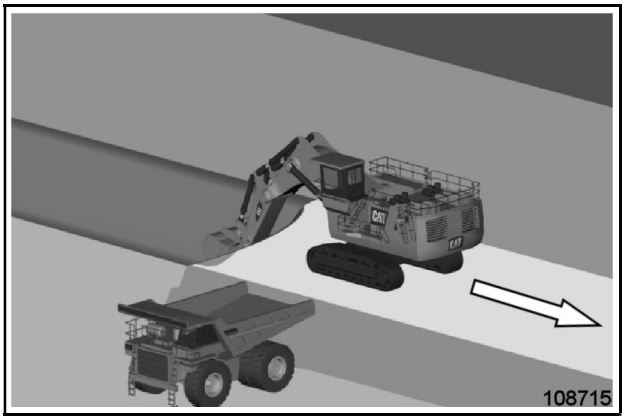


Fig. 2-131:

Rules for “Double Benching”

Material:

Loose, well blasted and easy to dig material is absolutely essential for Double Benching.

Boom down function should be used in float position only to pull down material from the wall.

Note: Digging poorly blasted material with great boulders or too tough material is a great stress for the steel structure and could result in serious damages.

Do not use the “Power boom down” - function.

Always maintain a proper distance to the highwall to avoid operating at the limits of the cylinders.

Bench height:

A high bench is split up into two segments, 1/3 of the bench is below the excavator and 2/3 is above the excavator (Fig. 2-130:).

The ideal upper bench height is when the bucket could lay flat on the top of the bench (1, Fig. 2-130:).

The ideal lower bench height is equal to the length of the stick or equal to the truck body side wall edge.

Note: Too low lower benches can cause collisions of the counterweight and the truck body.

Working direction:

While digging the upper bench, the cab must be on the opposite side of the high wall, swing direction is to the truck / cabin side (Fig. 2-130:). Dig forward (arrow, Fig. 2-130:).

While digging the lower bench, the cab must be on the opposite side of the high wall, swing direction is to the truck / cabin side (Fig. 2-131:). Dig backwards (arrow, Fig. 2-131:).

Working method:

Dig the upper bench first, progressing from right to left, by digging down material from the face (Fig. 2-130:).

Dig the lower bench on the way back in standard setup from left to right (Fig. 2-131:).

Dig a trench in front of the machine and along the high wall (2, Fig. 2-130:).

Leave this trench along the dig face (approx. 1.5 meters / 5 ft. deep) while digging forward.

If any spillage falls out it is collected in the trench and won’t damage the excavator.

The hole in front of the machine also eases bucket fill.

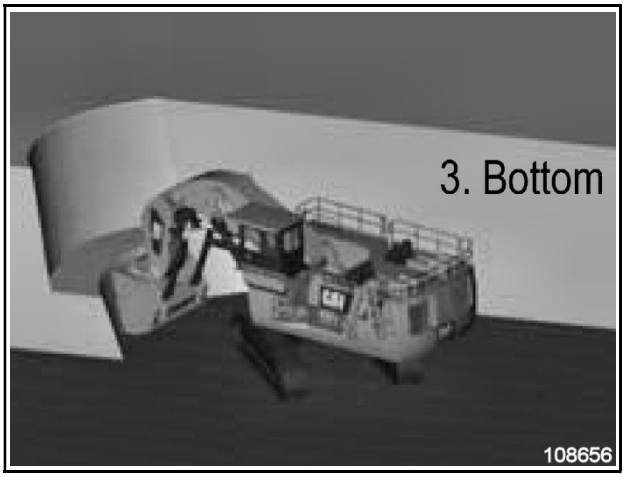


Fig. 2-154:

Loading Trucks

- ➲ Position the truck as closely as possible to the hydraulic shovel (Fig. 2-156:).
- ➲ Swing the attachment at a sufficient height over the loading platform.
  Do not swing the attachment over unprotected driver cabs.
- ➲ Distribute material evenly on loading platform.
- ➲ Do not overload the truck.
- ➲ Remove sticky material from the bucket.

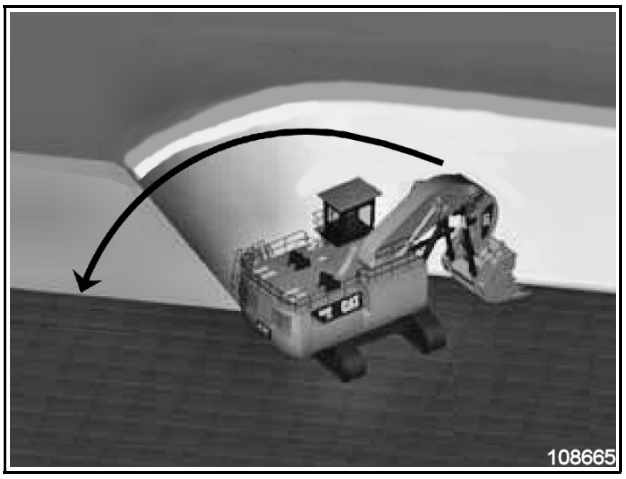


Fig. 2-155:

- ➲ Utilize the time between trucks (during truck spotting) to prepare the 1st pass for the next truck load (Fig. 2-155:).
- ➲ Use low penetration height to clean up the ground and fill the shovel. There is enough time for a large swing angle until the next truck arrives.
- ➲ Take the opportunity to check the face for potential rock fall and large and oversize material.

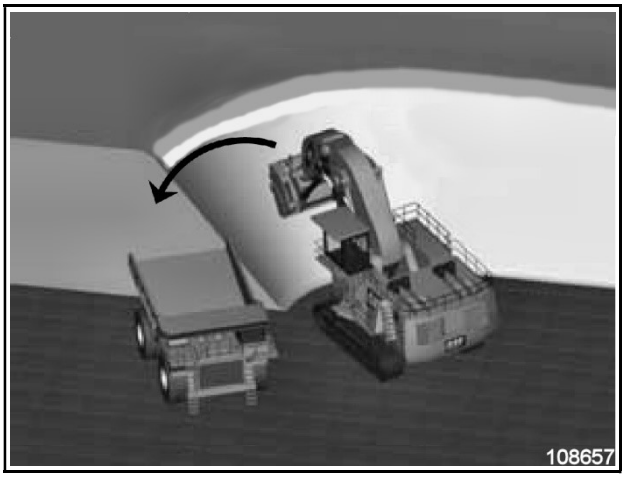


Fig. 2-156:

- ➲ For the 2nd and the subsequent passes (the truck is in position) dig again from top to bottom maintain smaller swing angles.
  This minimizes truck loading time.

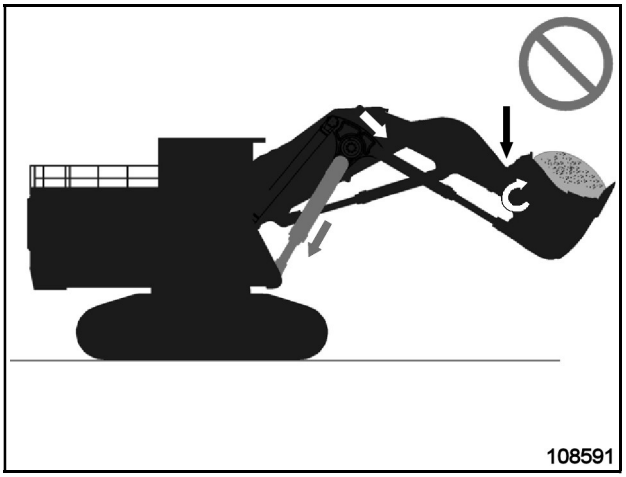


Fig. 2-181:

The bucket may contact the end of travel stops located on the top of the stick when the boom is lowered (Fig. 2-181:).

Curl out the bucket when lowering the boom to avoid contact.

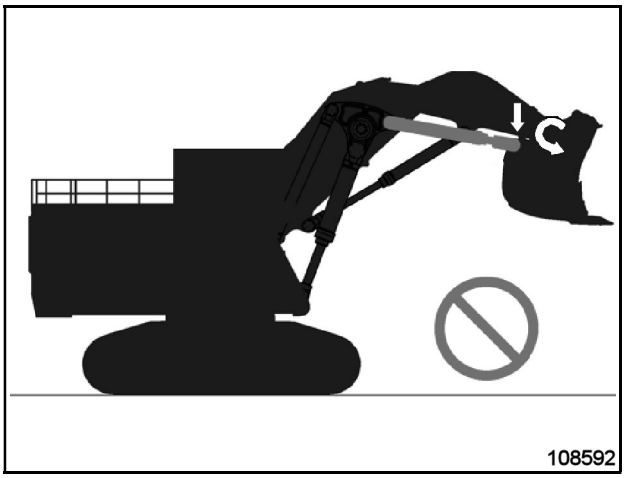


Fig. 2-182:

Do not retract the bucket cylinder to cause contact between the travel stops between the stick and bucket (located on bottom of the stick) (Fig. 2-182:).

Curl in the bucket to avoid contact.

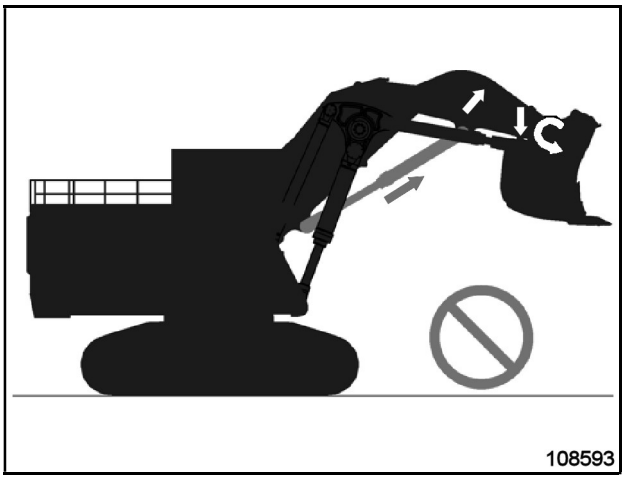


Fig. 2-183:

The bucket may contact the end of the travel stops located on the bottom of the stick when the stick is extended (Fig. 2-183:).

Curl in the bucket when extending the stick to avoid contact.

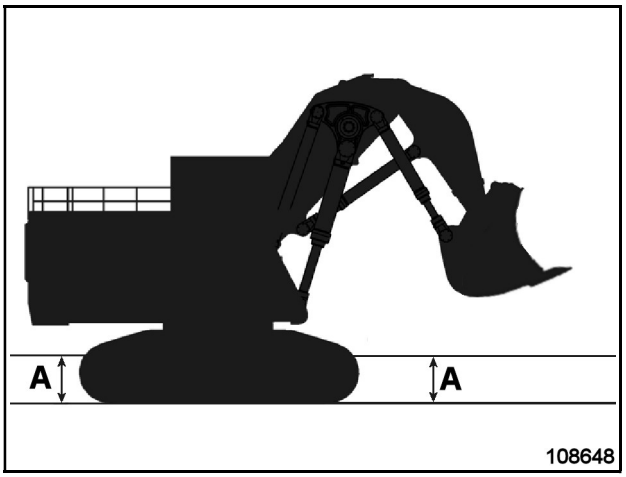


Fig. 2-211:

When working in any body of water or mud be careful that the level of water or mud is not higher than the breather valves on top of the final drives (Dimension A, Fig. 2-211:).

Water or mud could enter the gearboxes and cause serious damages.

While you cross any body of water or mud, carefully confirm the depth of the water or mud with the bucket. Do not move the machine into an area that has a water or mud depth that is higher than the breather valves of the final drives (Dimension A, Fig. 2-211:).

Traveling uphill and downhill on ramps and steep slopes

Note:

When traveling uphill or downhill on ramps and steep slopes, the travel drives must always face downhill (1, Fig. 2-228: to Fig. 2-231:).

Otherwise track tension loss may occur.

Do not exceed the maximum machine inclination when traveling uphill or downhill (refer to section “Maximum machine inclinations”).

Read and observe section "Traveling – Safety instructions".

Traveling uphill:

- ➲ Select slow speed level. To do so, switch speed level switch (72, Fig. 2-232:) to the left. **Note:** Change speed level only when the hydraulic shovel is stationary.
- ➲ Bring shovel in a position shown in Fig. 2-228: and Fig. 2-229:. The final drives (1) and the counterweight are facing downhill.
- ➲ Depress travel pedals (112 and 113, Fig. 2-232:).

Traveling downhill:

- ➲ Select slow speed level. To do so, switch speed level switch (72, Fig. 2-232:) to the left. **Note:** Change speed level only when the hydraulic shovel is stationary.
- ➲ Bring shovel in a position shown in Fig. 2-230: and Fig. 2-231:. The final drives (1) are facing downhill. The counterweight is facing uphill.
- ➲ Depress travel pedals (112 and 113, Fig. 2-232:).

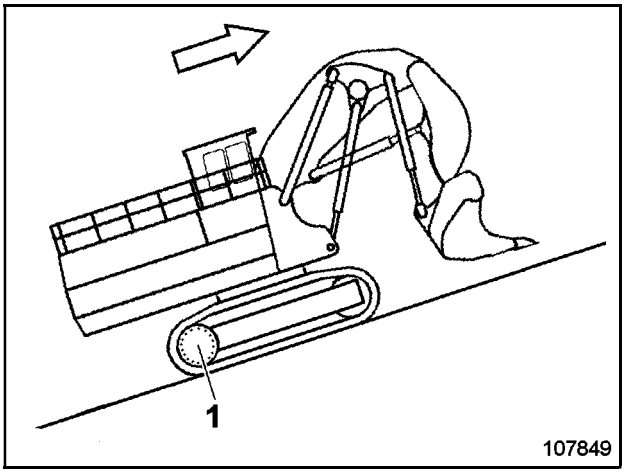


Fig. 2-228:

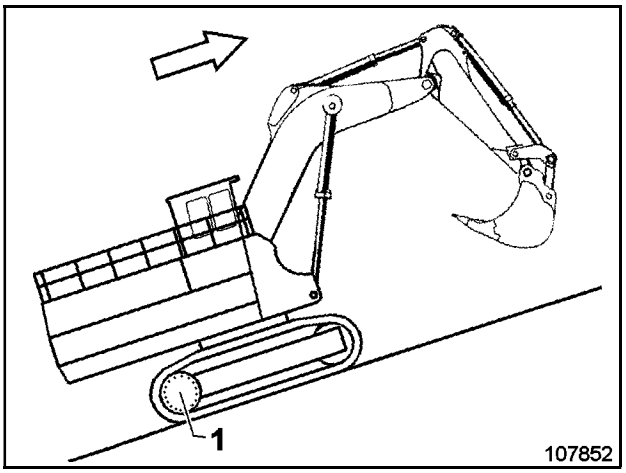


Fig. 2-229:

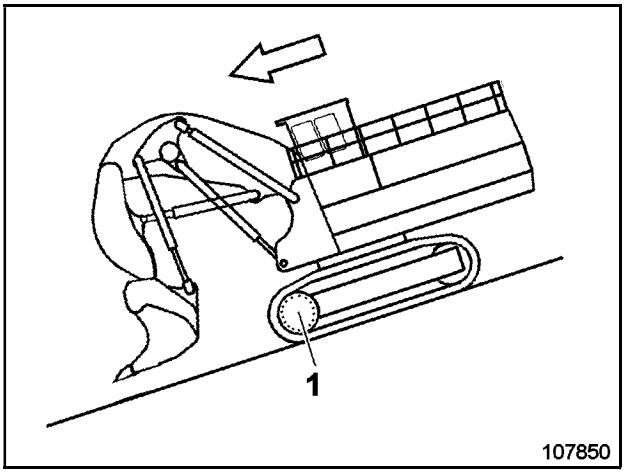


Fig. 2-230:

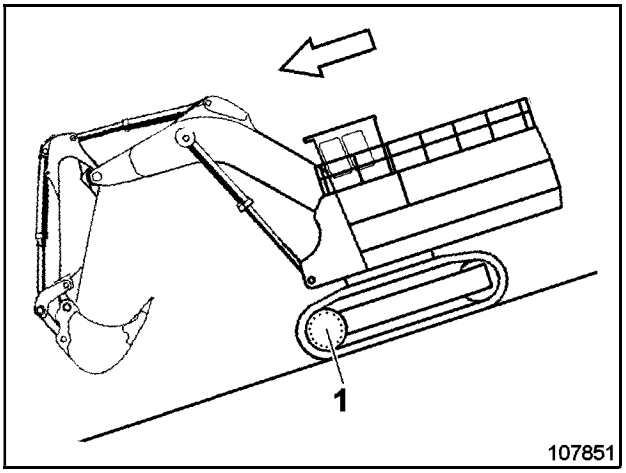


Fig. 2-231:

RUNNING-IN INSTRUCTIONS FOR HYDRAULIC CYLINDERS

Compression of an oil/air compound in a hydraulic cylinder may result in detonations which might damage pistons and sealing rings.

Prior to initial commissioning and/or after repairs, run in the hydraulic cylinders as follows:

- Switch on the electric motor.
  The pressure-limiting valve in the hydraulic system must not respond
- In the first two working cycles, retract and extend the pistons of the hydraulic cylinders to max. ½ to ¾ (not to the limit stop).
  Never change direction suddenly. The waiting time between changes of direction must be at least 4 seconds.
- In the next eight working cycles, retract and extend the pistons of the hydraulic cylinders to the limit stop. The waiting time between changes of direction must be at least 4 seconds.
- When all hydraulic cylinders have been run in, the hydraulic shovel can operate at a higher speed.

NOTES

INSPECTION AND SERVICING PLANS – INSTRUCTIONS

Servicing Intervals

The inspection and servicing plan lists all jobs which have to be done on the machine at regular intervals.

The individual inspection and servicing plans are marked with letters providing a link between the operating hours (OH) recorded by the hours-run meter of the machine and the inspection and servicing plans.

Plan	Do all jobs ….
V	…once prior to initial commissioning.
N	…after initial commissioning and during the running-in period (after 100 OH).
T	…every 10 OH or every working shift [1)]
W	…every 60 OH or weekly .[2]
B	…after every 500 OH.
C	…after every 1000 OH.
D	…after every 5000 OH.
E	…after every 10000 OH.
OH = Bh = Operating hours	

Oils / Lubricants

For the specification of oils and lubricants to be used refer to the “LUBRICANTS / CONSUMABLES” section.

The numerals mentioned in the “Oil / Lubricant” column in the inspection and servicing plans have the following meaning:

I	Oils for combustion engines and compressors
II	Oils for hydraulic systems
IIIa, b	Oils for gearboxes
V	Lubricants for bearings and swing rings

Cleaning jobs

Cleaning jobs, especially on cooling systems, must be done at shorter intervals if the machine is exposed to severe dust build-up.

Components

The maintenance intervals for components, e.g. electric motor and gearboxes, are listed in the following CGM-HMS GmbH maintenance schedules.

It is possible that the manufacturer’s documentation for these components states intervals deviating from the above-mentioned intervals.

In such case, only the maintenance intervals specified by CGM-HMS GmbH shall apply.

[2] Whichever comes first.

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
Hydraulic system	Check pressure (see Service Manual)				●	●	●
Oil cooler							
- Bearing							
- Fastening bolts	Check for tightness				●	●	●
- Rubber bearing	Check condition				●	●	●
Return-flow filter	Replace	2 x 7			●	●	●
- Magnetic rod	Check / clean	2		●	●	●	●
- Bypass valve	Check / clean filter sieve	2 x 3			●	●	●
- O-Ring of filter chamber cover	Replace	2 x 1			●	●	●
High-pressure filter (working hydraulics)	Replace	4				●	●
Filter (servo circuit)	Replace	1				●	●
Filter (swing charge pump)	Replace	3				●	●
Hydraulic oil reservoir	Carry out oil analysis	1		●	●	●	●
	Change oil	1 [7] [8]					●
- Breather filter	Replace	2			●	●	●
Pressure accumulator	Check pressure (see Service Manual)	5			●	●	●
Cylinder (seals and guide rings)	Replace						●

[7] see “Refilling quantities – Oil“ table

[8] Unless it is regulary analyzed, the hydraulic oil must be changed every 5000 OH or after 3 years at the latest

LUBRICANTS
Notes on the selection of oils and lubricants

Original CGM-HMS GmbH oils and lubricants

Besides regular and careful maintenance, the quality of the oils and lubricants used in the machine has a decisive influence on high performance, reliability and long service life of a machine and of its units and assemblies.

The lubricants tables in the CGM-HMS GmbH Operation and Maintenance Manual contain specifications for the oils and lubricants that are approved for use in CGM-HMS GmbH machines. These oils and lubricants are especially adapted to CGM-HMS GmbH machines and their units and assemblies.

Other oils and lubricants which do not fulfil the requirements of the specifications can be the cause of premature wear or of damage to and failures of machine units and assemblies.

For this reason, CGM-HMS GmbH only approves the use of the specified oils and lubricants.

All other qualities are not approved.

CGM-HMS Hydraulic Fluid

Caterpillar is not in a position to evaluate the many types of fluids promoted by other manufactures and their effect on Caterpillar products. The use of these products is at the discretion of the customer who assumes all risks for the effects that result from this usage.

The CGM-HMS Hydraulic fluid that is provided as a factory fill for the HMS has been evaluated for fluid compatibility when adding or topping off with the Caterpillar HYDO Advanced product. The 2 fluids are compatible and can be used. Follow the maintenance interval schedule and for fluid sampling that is stated in the Operation and Maintenance Manual for your machine. To have the full benefit of the properties of either fluid the cross contamination should be kept to 10% or less. With a greater cross contamination the full benefit of either of the fluids may not be realized so it is important to monitor the fluid properties regularly. For additional details about Cat HYDO Advanced and Caterpillar's fluids recommendations, please refer to Special Publication SEBU6250, "Caterpillar Machine Fluids Recommendations" and publication EM027744, "Fluid Specifications HMS" which may be found on the Web at SIS.Cat.com.

Although the lab testing has shown compatibility between the BM Hydraulic fluid and the Cat Hydo Advance, we are not able to test every situation and condition with the fluid mixtures and would recommend that the fluid be changed out to eliminate any fluid incompatibility issues.

Alternative oils and lubricants

The oils and lubricants filled into the machine must meet at least the specifications mentioned in the lubricants tables of the CGM-HMS GmbH Operation and Maintenance Manual.

In the event of damage to the machine or to its units and assemblies caused by the use of alternative oils and lubricants that are not compatible with CGM-HMS GmbH specifications, CGM-HMS GmbH does not assume any responsibility and does not accept any warranty claims.

Electric motor (ABB) - Initial Lubrication of Motor Bearings

Risk of serious injury or death.

During lubricating the bearings the electric motor must be switched on. Be extremely careful to all rotating parts.

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

Wear protective gloves and close-fitting, firm work clothes.

Read and observe: "Inspection and Servicing – Safety Instructions" and the electric motor Operation and Maintenance Manual.

- Remove the sump plugs from beneath the bearing cavities on the non drive end (NDE; 2, Fig. 3-14:) and from the drive end (DE; 2, Fig. 3-15:).
- Clean the grease nipples before lubricating.
- Start machine and have motor idling.
- Pump recommended grease into drive end bearing (1, Fig. 3-14:), 20-25 pumps with a hand pump. Pump very slowly to allow grease to move around the bearing while pumping.
- Lubricate the motor bearing at the non drive end (NDE) the same way (1, Fig. 3-15:).
- Leave machine running for ten minutes, then repeat lubrication as described above.
- Refit plugs (2) and send machine back to work.
- Every two working hours repeat lubrication procedure described above until grease is seen pushing out from the bearing and down into the sump through the sump plug hole (May take up to 24 hours to complete).
- Once this initial lubrication procedure has been performed, lubrication will only be necessary every 1000 OH as per the maintenance procedures.

Additional information on servicing the electrical motor is given in the electric motor operating instructions from the motor manufacturer.

Up to 30 minutes after greasing the temperature of the bearings might heavily increase. Thereafter the temperature decreases to normal. This is normal, the procedure is monitored on the BCS display.

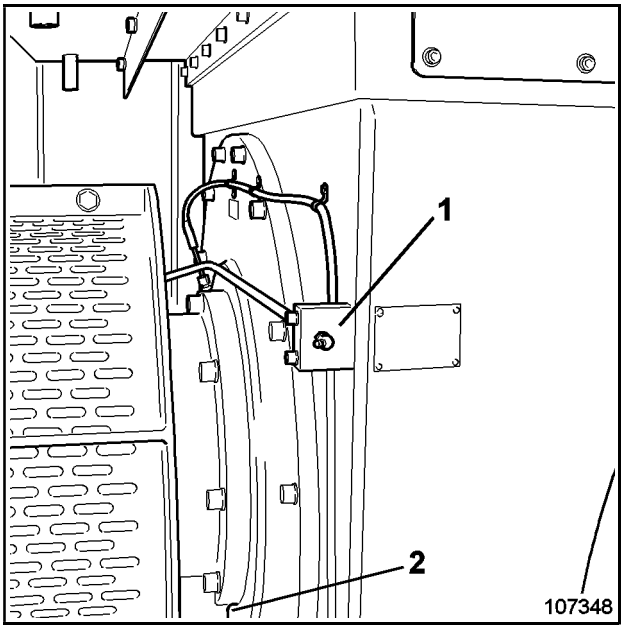


Fig. 3-14:

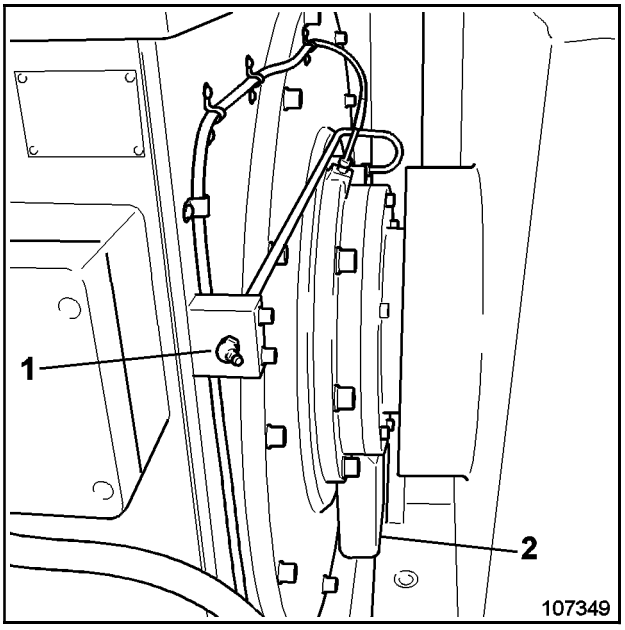


Fig. 3-15:

Lighting systems in LED technonogy, instructions

The lights of the maintenance lighting system (Fig. 3-29) as well as the working floodlights (Fig. 3-30) are equipped with lamps in LED technology (light-emitting diodes).

High-performance LEDs ensure the emission of light with high luminance. If the light is allowed to shine directly into the eyes from a short distance and over prolonged periods, there is a risk of injury to the retina.

Do not look for a prolonged period into the light cones of the LEDs.

Adjust the lights in such way that they do not shine directly into the eyes and that you are not blinded by the glare.

The lights become hot in operation. The heat is dispersed via the ribbed metal housing.

For this reason, the housings must not be covered up and cleaning rags or similar things placed over them.

The high-performance LEDs in these lights have a very long service life and can therefore not be replaced. If one or more of these LEDs fail, the light can remain in service if the remaining luminance is still sufficient.

Fig. 3-29

Fig. 3-30

Filter (servo control circuit), replace

Risk of scalding caused by hot hydraulic oil.

The filter housings themselves may also be hot.

Wear protective gloves and firm working clothing.

Skin contact with hydraulic oil may cause skin injury. Avoid skin contact.

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

- ➲ Shut off the electric motor.
- ➲ Depressurize the hydraulic system.
- ➲ Clean the filter housings as well as the immediate vicinity carefully.
- ➲ Dispose of waste oil, used filters and oil-stained cleaning rags properly and separated from other waste.

Fig. 3-53:

Replacing the filter element

To filter the hydraulic oil in the control circuit, the machine is equipped with a high-pressure filter (arrow, Fig. 3-53:).

Change filter element regulary and when the BCS indicates a contamination.

- ➲ Place a suitable collecting recipient under the filter housing (Fig. 3-53:).
- ➲ Collect escaping hydraulic oil and used filter elements. Discard without polluting the environment.
- ➲ Unscrew filter housing (5, Fig. 3-54:) by counterclockwise rotation. Pour out the oil.
- ➲ Withdraw filter element (6) from filter housing (5).
- ➲ Check filter housing (5) as well as used filter surface for debris.
- ➲ Clean filter housing (5) and the sealing face at the filter head with white spirit or paraffin oil.
- ➲ Check seals (8) and replace, if required.
- ➲ Screw in the filter housing (5) to stop. Then turn out the filter housing by an 1/8 turn so that the filter housing is not stuck due to pressure pulsation and can be easily loosened in case of maintenance works.
- ➲ Check high-pressure filters for leaks after putting the hydraulic system back into operation.

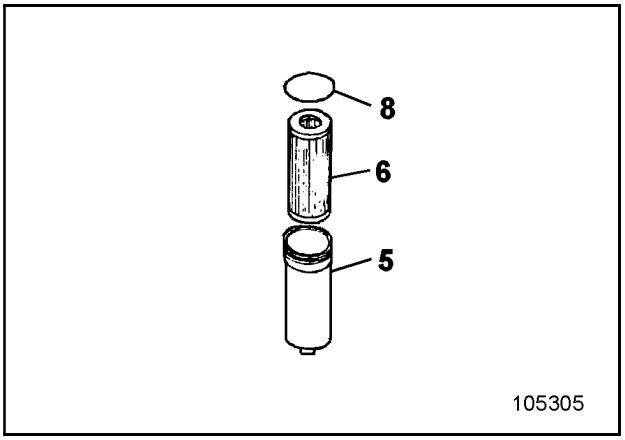


Fig. 3-54:

Pressure accumulator - Emergency lowering

To permit the attachment to be lowered in an emergency, the machine is equipped with a pressure accumulator (1, Fig. 3-71:).

The pressure accumulator (1) is located in the upper structure and is accessible from the ground.

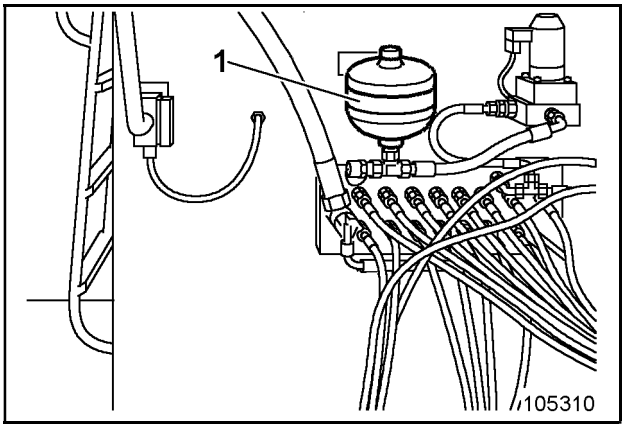


Fig. 3-71:

Pressure-accumulator inspection regulations

The following regulations are applicable only in Germany. Please observe the relevant regulations in force in your own country.

Extract from the German regulations

The accumulator vessel must not be subjected to welding, soldering or any other mechanical work. Work on systems containing accumulators (repairs, connection of pressure gauges or similar work) may be carried out only when the fluid pressure has been released

Extract from the German acceptance regulations

Hydraulic accumulators are pressure vessels and are therefore subject to the "Druckbehälterverordnung (DruckbehV)" [Pressure Vessel Regulations]. Their installation, equipment and operation are governed by the "Technische Regeln Druckbehälter (TRB)" [Technical Rules for Pressure Vessels]. The pressure vessels of hydraulic accumulators are classified by the admissible operating pressure p in bars, the capacity l in liters and the product of pressure and capacity p x l. Depending on the class to which the accumulator belongs, the following inspections are mandatory:

Checking the gas charging pressure in the pressure accumulator

After commissioning (new installation or repair), the gas charging pressure in the pressure vessel must be checked at least once during the first week. If no pressure loss is detected, the second pressure test must be performed after ca. 3 months. If no pressure loss is detected in this test either, the testing interval can be fixed at once pressure test each year.

Group	Inspections prior to commissioning		Regular inspections
	at the factory	at the place of use	
II $p \geq 1$ bar and $p \cdot x\ l \leq 200$	Pressure testing Prototype and pressure test certified by the manufacturer	Inspection certificate (Check of correctness and correct installation) issued by an expert	Inspection schedule to be drawn up by end user, based on experience with type of operation and fluid.

Travel gearbox - Changing oil

Carry out oil change when oil is nearly at operating temperature. All suspended particles and contaminations will be rinsed out with the old oil.

Draining off oil

- ➲ Move the hydraulic shovel into such a position that the screw plugs (1, 2 and 3, Fig. 3-89:) are in the displayed position.
- ➲ Place a collecting recipient for used oil under the travel gearbox.
  Choose the required capacity in accordance with the "Refilling quantities - Oil" table.
- ➲ Unscrew drain plug (2) and drain off the oil completely.
  Slackening plug (3) allows the oil to run out more readily.
- ➲ Clean screw plugs (2 and 3)
- ➲ Screw screw plug (2) back in place.

Filling in oil

- ➲ Unscrew screw plug (1 and 3).
- ➲ Fill in oil through opening in plug (3) until it flows out of opening in plug (1).
  Oil grade see: „LUBRICANTS / CONSUMABLES“.
- ➲ Screw plugs (1 and 3) back in place.

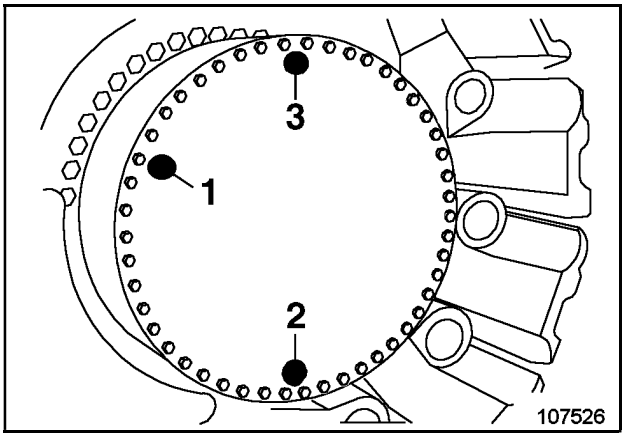


Fig. 3-89:

Spur gear section - Changing the oil / Draining off oil

- ➲ Place a collecting recipient for used oil under the pre-chamber.
  Choose the required capacity in accordance with the "Refilling quantities - Oil" table.
- ➲ Unscrew drain plug (3, Fig. 3-90:) and drain off the oil completely.
  Slackening plug (4) allows the oil to run out more readily.
- ➲ Clean screw plugs (3 and 4)
- ➲ Screw screw plug (3) back in place.

Filling in oil

- ➲ Unscrew screw plug (4).
- ➲ Fill in oil through opening of plug (4) until it reaches the center of the inspection glass (2).
  Oil grade see: „LUBRICANTS / CONSUMABLES“.
- ➲ Screw plug (4) back in place.

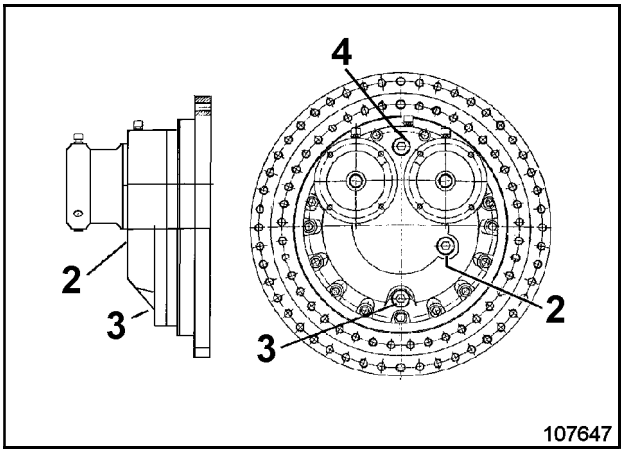


Fig. 3-90:

CRAWLER TRACKS

Cleaning

Clean tracks, track and upper rollers, sprockets and idlers regularly and whenever required. Cleaning is especially important in winter to prevent

- the tracks from being thrown off
- oil from leaking out of track and upper rollers, sprockets and idlers
- excessive wear
- the track from breaking.

To clean the tracks:

➲ Raise one side of the hydraulic shovel with the attachment and allow track to turn.

➲ Clean the side member supporting the track.

➲ Clean upper rollers and track rollers (1 and 2 ,*Fig. 3-109:*) thoroughly.

➲ Clean the sliding planes on the idler guides.

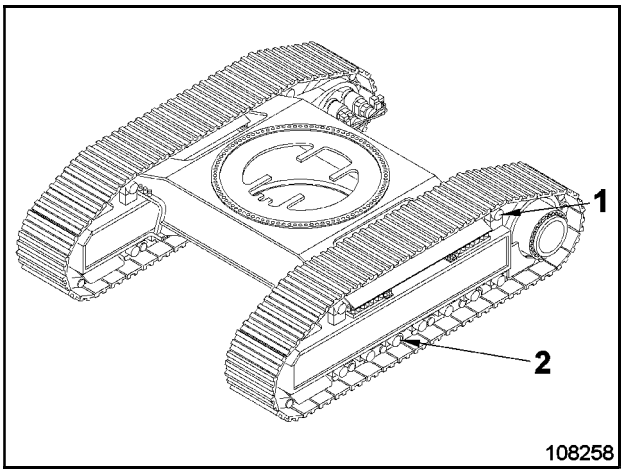


Fig. 3-109:

Checking the greasing pressure

(for machines with automatic greasing of the track rollers, optional)

Check every week, whether the oil pressure indicated by pressure gauge (4, Fig. 3-128:) is 60 bars / 870psi (the pressure is depending on temperature and viscosity of the oil and may vary).

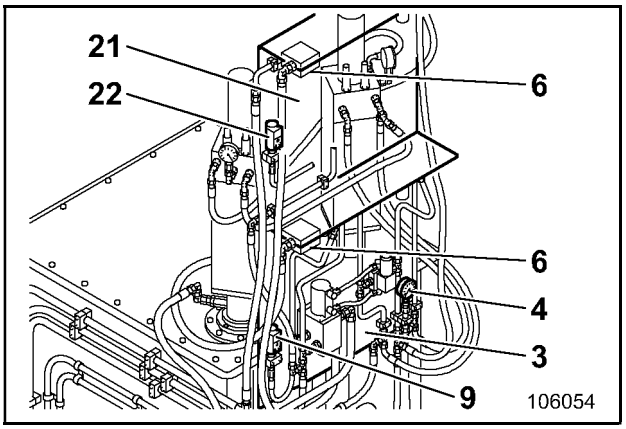


Fig. 3-128:

This oil pressure is reduced so that the pressure indicated by pressure gauge (2, Fig. 3-129:) is 35 – 40 bars (507-580psi) and by pressure gauge (4) is 49 – 51 bar (710-739psi).

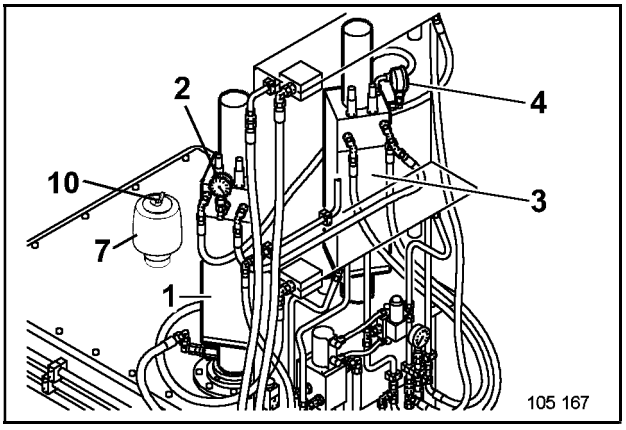


Fig. 3-129:

The necessary greasing pressure of 320 bar / 4641psi for the upper structure and 180 bar / 2610psi for the undercarriage is generated by means of a pressure translator.

The greasing pressure for the upper structure is indicated by pressure gauge (9, Fig. 3-128:) and for the undercarriage by pressure gauge (22).

In the event of deviating pressure values, switch off the electric motor and check the central greasing system.

Lower oil pressure means that not all of the greasing points are supplied with lubricant.

Higher oil pressure may cause bursting of a lubricanting line.

Always refill the lubricant container in time to avoid air from penetrating into the greasing system. Air in the greasing may cause malfunctions.

PUTTING THE HYDRAULIC SHOVEL OUT OF OPERATION AND RECOMMISSIONING

Putting the hydraulic shovel out of operation

- ➲ Park the hydraulic shovel on firm and level ground.
- ➲ Set the attachment down on the ground, retracting the piston rods of the hydraulic cylinders as far as possible.
- ➲ Set all control element to **"0"**.
- ➲ Clean the machine.
- ➲ Carry out a visual inspection of the hydraulic shovel.
- ➲ Remove coarse dirt, snow and ice from the fins and fan wheel of the hydraulic oil cooler.
- ➲ Protect all bright metal parts (e.g. piston rods) from rust and dirt.
- ➲ Remove the batteries; see "Battery storage".
- ➲ Secure the machine against unauthorized starting by:
  withdrawing the key from the key-switch
  setting the battery main switch to OFF
  setting the main circuit breaker to OFF
  locking the cab door
  securing all lockable hatches.
- ➲ Cover up all openings

Battery storage

During prolonged machine downtimes, remove the batteries and store in a dry room at an ambient temperature of ca. 20°C / 68°F. Observe the following points with regard to maintenance:

- ➲ Clean the batteries.
- ➲ Check the acid density and the electrolyte level of the battery every two weeks.
- ➲ Recharge the batteries at the latest, when the acid density has dropped to 1.23 kg/dm³.
- ➲ Keep the batteries clean and dry on the outside.

Recommissioning

- ➲ Remove the covers.
- ➲ Degrease / clean all protected components.
- ➲ Check track tension (visual inspection)
- ➲ Check lubricant filling in lubricant container.
- ➲ Oil level
  - swing gearboxes
  - pump drive gearboxes
  - travel gearboxes
- ➲ Check oil level in hydraulic oil reservoir.
- ➲ Check battery acid density and level.
- ➲ Install batteries and reconnect.
- ➲ Set battery main switch to ON
- ➲ Set the main circuit breaker to ON
- ➲ Function checks:
  - upper structure holding brake
  - track brake
  - lighting system
  - signalling equipment
- ➲ Vent the hydraulic system.

Tanks, pressure vessels and pressure accumulators

Any work on vessels containing or having contained

- combustible or combustion-accelerating substances,
- potentially explosive substances or
- substances susceptible to develop harmful gases, fumes, mists or dusts during welding

may only be carried out under expert supervision and only by experienced personnel especially assigned to such work.

This prescription applies, for instance, to all tanks and reservoirs for hydraulic fluid, engine oil, diesel fuel or lubricating grease.

Welding work on pressure vessels and pressure accumulators is forbidden.

Pressure vessels containing cold-starting fluid (ether) may be installed in or near the engine compartment.

Ether is toxic and highly flammable; the vessels are under pressure. These pressure vessels can explode if exposed to high temperatures (above 49°C / 120°F) or in the event of damage.

Protect the vessels against damage and high temperatures.

Do not perform welding work in the vicinity of these pressure vessels before they have been covered up safely against accidental contact or flying sparks. Have the pressure vessels removed from the machine, if safe protection cannot be ensured.

Inform yourself about the locations in the machine where the pressure accumulators of the hydraulic system are installed. Do not perform welding work in the vicinity of these pressure accumulators before they have been covered up safely against accidental contact or flying sparks. Have the pressure accumulators removed from the machine, if safe protection cannot be ensured.

Slewing rings and articulated joints

The welding current must not flow through ball-bearing or roller-bearing slewings rings, through bolted connections or articulated joints or through hydraulic cylinders.

An electric current flowing through an air gap (e.g. in the bearing or in the articulation) produces a spark which damages the metallic surface.

The welding clamps must therefore always be connected very close to the weld area (max. 2 - 3 m away (6.6-9.8 ft)).

Information relating to the electrical system and to electronic modules

Electric arc welding produces electromagnetic fields, electrostatic charges and voltage spikes which can cause damage to electronic modules. Although the electronic modules of the machine are carefully protected against these influences, it is nevertheless necessary to take additional precautions in order to prevent such damage to the greatest possible extent.

Switch off the electrical system ("ignition OFF").

Open the battery main switch (or disconnect the starter batteries from the machine).

Lay the welding cables as far away from electric lines as possible.

If it is not possible to implement all of the above-mentioned precautions, all connectors must be removed from the electronic modules before beginning any welding work.

Protect withdrawn terminals and connectors from short circuits and soiling. Cover up terminals and connectors with foils or adhesive tape.

Never touch the enclosures of electrical and electronic modules with the welding electrode.

Protect electric lines against the heat emanating from the weld area.

Restore all electrical connections when the welding operations are terminated.

Never connect the ground clamp of the welding cable to the enclosures of electric or electronic modules.

BCS3e, the Start Screen

The screen displays the graphical user interface of the Board Control System. The basic screen (Fig. 3) appears when all electronic units of the CAMP system have started and when their self-tests have been completed.

Note:

At low outside temperatures it is possible that the basic screen appears a few minutes after switching on the electrical system (warming up phase).

Starting from this basic screen, the user can access a number of other screens. This does not require an input device such as a keyboard, mouse or similar.

The BCS screen is designed as a touch-screen. By slightly touching the active areas, the user can perform activities such as changing to another screen page.

Active areas are shown on the screen as three-dimensional graphics. In the basic configuration – not activated - they seem to project out of the user interface. When touched, they appear to be lowered.

Note:

Never use pointed objects such as a ball pen, screwdriver, nail or similar to touch the screen.

This could damage the active surface of the touch-screen.

Do not press on the sensitive areas, just slightly touch them with your fingertips!

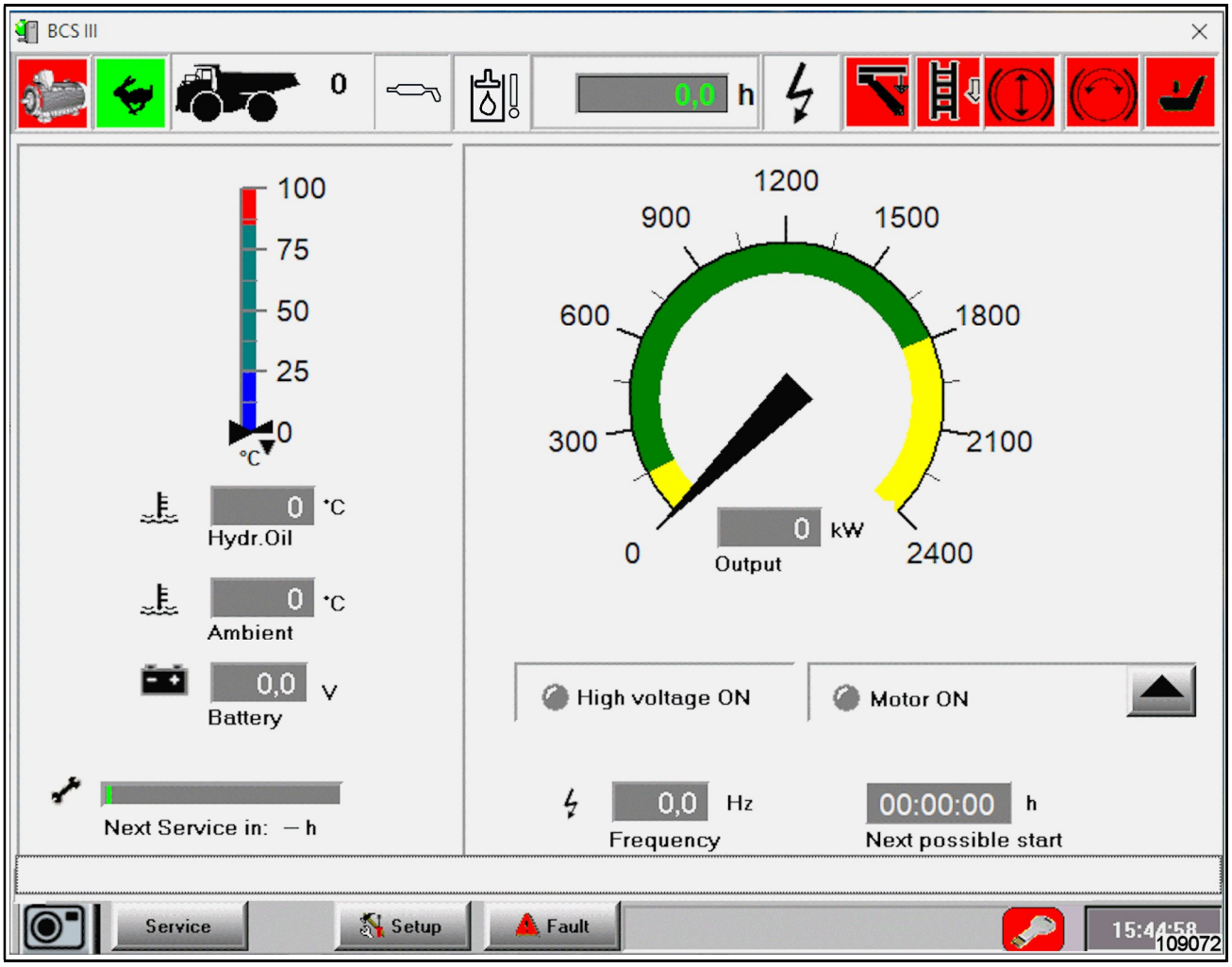


Fig. 3

Hydraulic Data Screen

1	This screen displays data related to the hydraulic system.
2	Tapping the button with the door icon “Exit” leaves the current screen and opens the previous screen.
3	All data displayed can be saved to an USB-stick after tapping the camera button (see: “Store Screenshot Screen”).

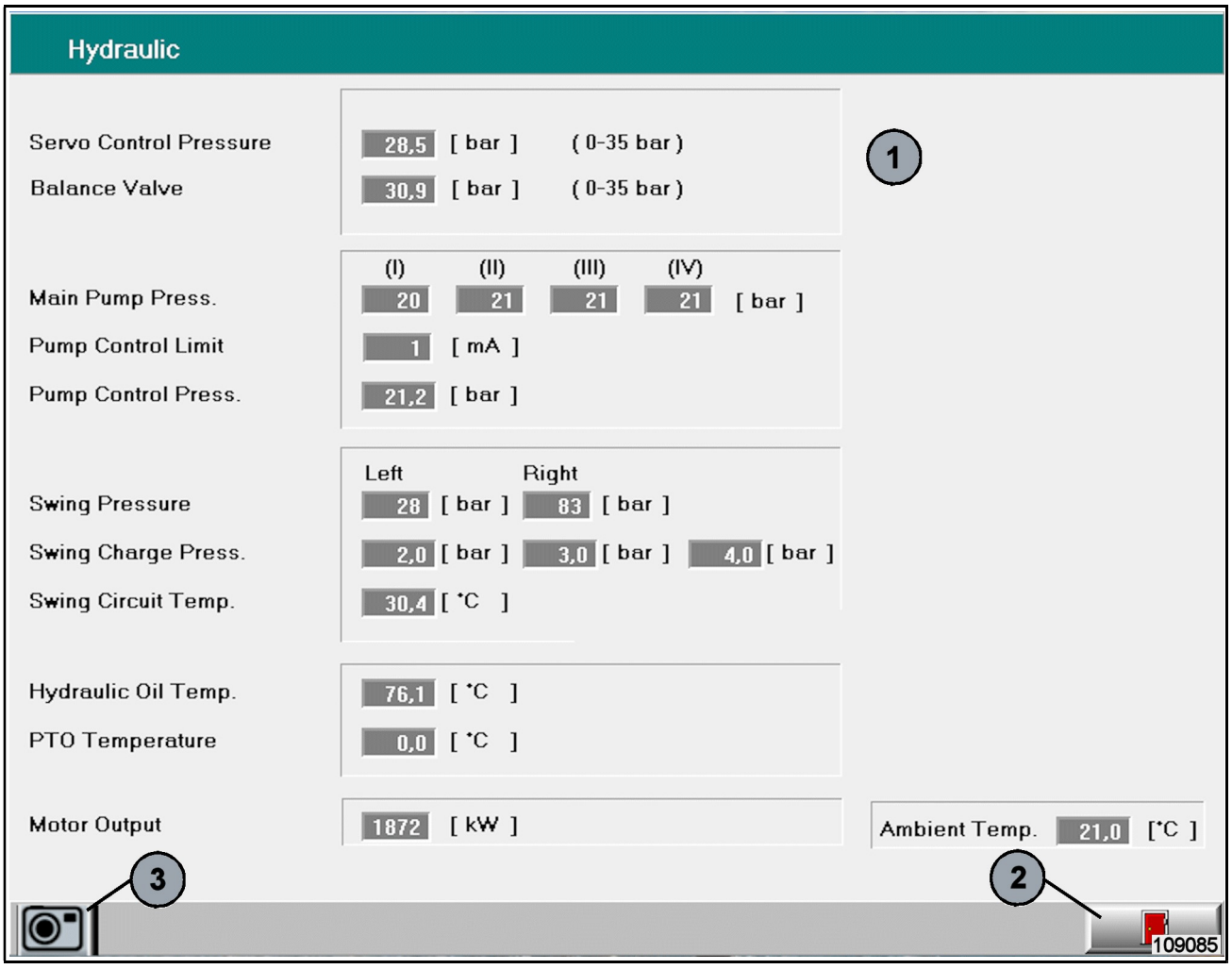


Fig. 13

BCS files – Copy to USB-Stick

Coming from the “Fault Storage – Fault Detail” screen, on this screen you can copy files from the BCS system to a USB-Stick or vice versa.

Plug in your USB-stick (see “BCS3e – Interfaces”).

1	Select the files to be displayed in the selection window: Database = Fault storage files Datalogging = Log files
2	Selection windows. Select the file(s) you want to copy. Tapping on button “Select all” (4) selects all files in the window. Tapping on the red arrow symbols starts the copy process.
3	Tapping the button with the door icon “Exit” leaves the current screen and opens the previous screen.
4	Tapping this button selects all files in the selection window to be copied.
5	Tapping the button will delete the fault storage inside the BCS system. You will be asked to proceed.
6	Tapping the button will refresh the display.

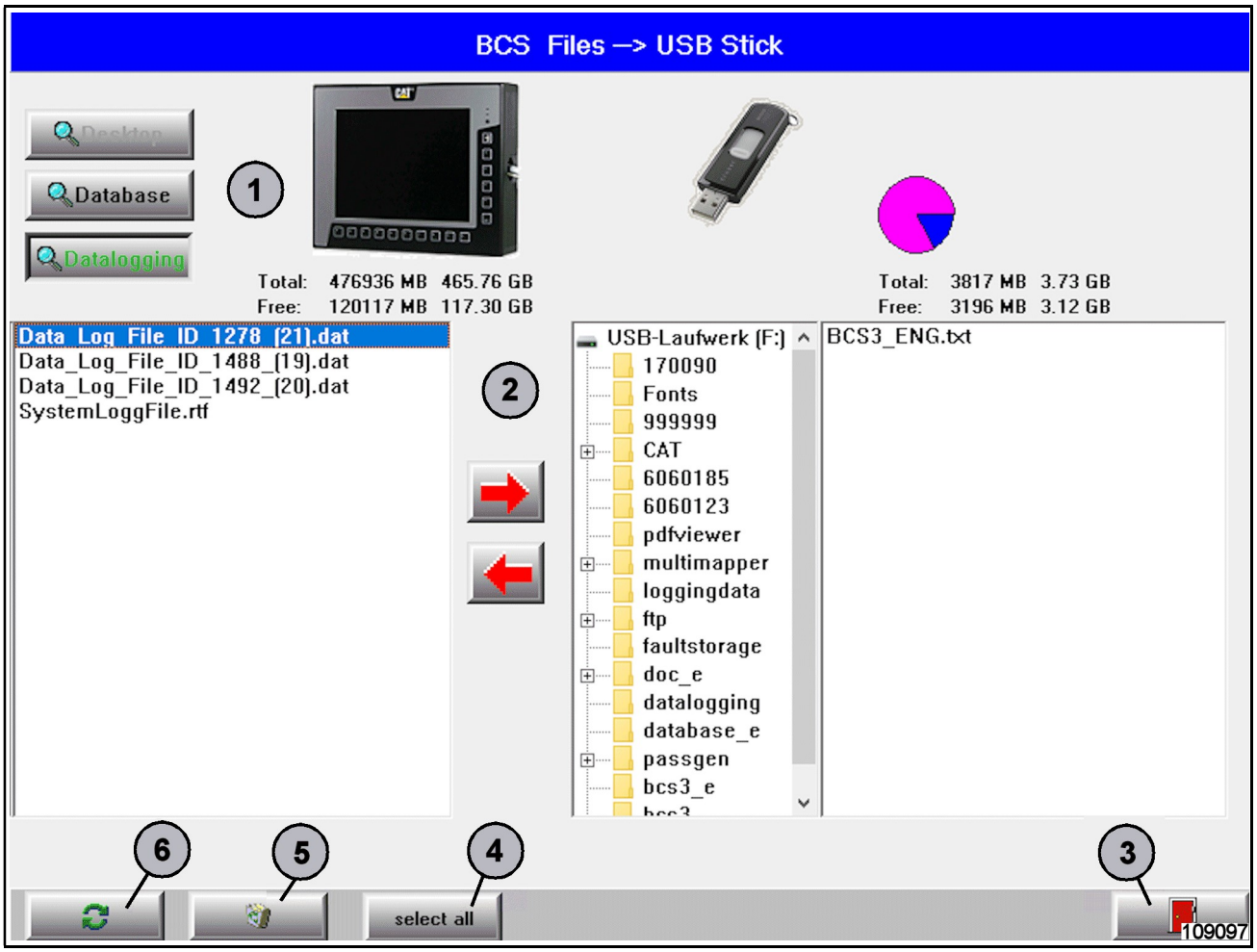


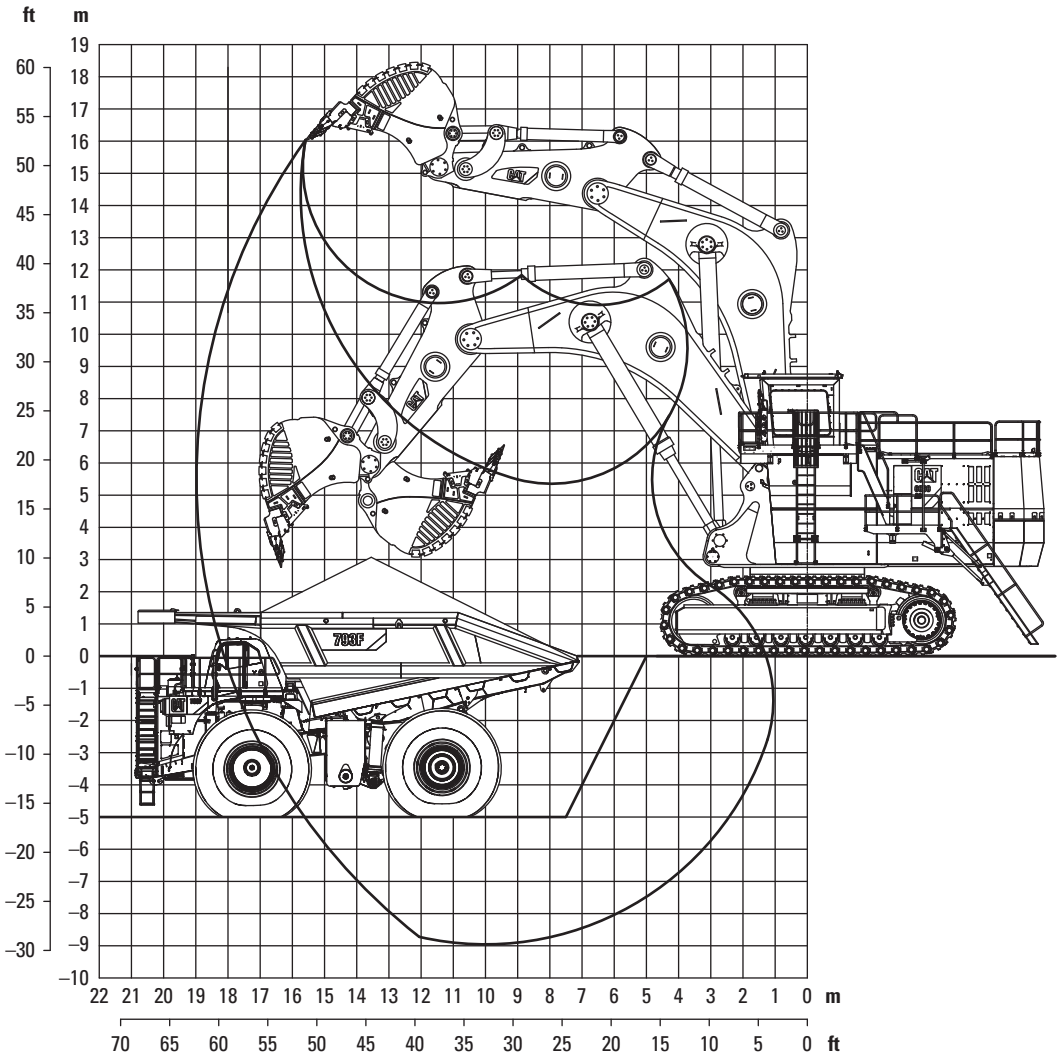
Fig. 23

ABBREVIATIONS

A	Ampere (SI base unit of electric current)
abt.	about
acc.	according to
Ah	Ampere hours (SI base unit of quantity of electricity)
API	American Petroleum Institute
approx.	approximately
BA	= OMM = Operation and Maintenance Manual
bar	unit of pressure, 1 bar = 14.5 psi
Bh	= OH = Operating hour
CE	Communauté Européenne = European community
CECE	Committee for european Construction Equipment (Defines a measure for bucket, grab or scoop filling)
CEN	European Standardization Committee
cm	centimeter (= $^1/_{100}$ m)
cm^3/rev	Cubic centimeters per revolution
CCW	counterclockwise
CW	clockwise
dB(A)	Decibel (sound intensity according to measuring method A)
dia.	Diameter
DIN	German Industrial Standard
EDS	Electronic diagnostic system
eff.	effective
e.g.	for example
etc.	etcetera
Fig.	Figure, serial number of illustration
FOPS	Falling objects protective structures
FS	Rock shovel (working equipment)
ft	foot (unit of distance), 1 ft = 0.30 meter
gal	gallon (unit of volume), 1 gal = 3.78 liters
GLR	Full-load controller (electronic module for PMS)
HD	Heavy duty
Hydr.	Hydraulic, Hydraulics
i	Transmission ratio
i.e.	id est = that is
IFN	ISO service rating, blocked
Incl.	including, inclusive of
ISO	International Standardization Organization
kg	Kilogram (unit of weight), 1 kg = 2.2 lb
kg/dm^3	Kilograms per cubic decimeter (= unit of specific density)
km/h	Kilometers per hour
kNm	KiloNewtons per meter (1 kNm = 1000 Nm) = unit of torque
kW	Kilowatt (1 kW = 1.36 hp)
l	Liter (unit of volume), 1 liter = 0.26 gal
lb	pound (unit of mass), 1 lb = 0.45 kg
Lb/in^2	Pounds per square inch (= psi)
LC	Long crawler
LDA	Charge pressure-dependent full-load limiter
LED	Light-emitting diode
l/min	Liters per minute
LpA	Sound pressure at workplace
LS	Limited slip
LwA	Sound power level of the machine in stationary operation
m	Meter (unit of distance), 1 m = 3.28 ft
M_A	Tightening torque
mA	Milliampere (=$^1/_{1000}$ **A**)
max.	maximal, maximum
min.	minimal, minimum
min^{-1}	Revolutions per minute
mm	Millimeter (=1/1000 m)
N	Normal, standard version
N, kN	Newton, kiloNewton (unit of force)
NLGI	National Lubricating Grease Institute (USA)
NLGI--Klasse	Consistency - lubricant classification acc. to DIN 51 818
Nm	Newtonmeter (unit of torque)
No.	Number
OH	Operating hour
op.inst.	Operating instructions
OW	Superstructure
oz	ounce (unit of volume) 1 oz = 0.03 liter

Working Range – Backhoe Attachment (BH)

All dimensions are approximate.



Boom	10.5 m	34 ft 5 in
Stick	**5.0 m**	**16 ft 5 in**
Digging Forces		
Maximum tearout force	1276 kN	286,760 lbf
Maximum breakout force	1233 kN	277,090 lbf

Working Range		
Maximum digging height	16.0 m	52 ft 2 in
Maximum digging reach	19.0 m	62 ft 0 in
Maximum digging depth	8.9 m	29 ft 2 in

Backhoes					
Type	Heavy Rock Bucket	Heavy Rock Bucket	Heavy Rock Bucket	Standard Rock Bucket	Light Duty Bucket
G.E.T. system	CL1-W950	CL1-W900	CL1-W900	CL1-W900	CL1-W900
Capacity heaped 1:1 (ISO 7451)	25.0 m³ (32.7 yd³)	28.0 m³ (36.6 yd³)	31.0 m³ (40.5 yd³)	34.0 m³ (44.5 yd³)	36.0 m³ (47.1 yd³)
Total width	4765 mm (15 ft 8 in)	4765 mm (15 ft 8 in)	4765 mm (15 ft 8 in)	4765 mm (15 ft 8 in)	4765 mm (15 ft 8 in)
Inner width	4300 mm (14 ft 1 in)	4300 mm (14 ft 1 in)	4300 mm (14 ft 1 in)	4300 mm (14 ft 1 in)	4300 mm (14 ft 1 in)
Number of teeth	6	6	6	6	6
Weight including standard wear package	33 100 kg (72,970 lb)	32 500 kg (71,650 lb)	33 600 kg (74,070 lb)	34 300 kg (75,620 lb)	34 600 kg (76,280 lb)
Maximum material density (loose)	2.4 t/m³ (4,050 lb/yd³)	2.2 t/m³ (3,710 lb/yd³)	2.0 t/m³ (3,370 lb/yd³)	1.8 t/m³ (3,030 lb/yd³)	1.65 t/m³ (2,780 lb/yd³)