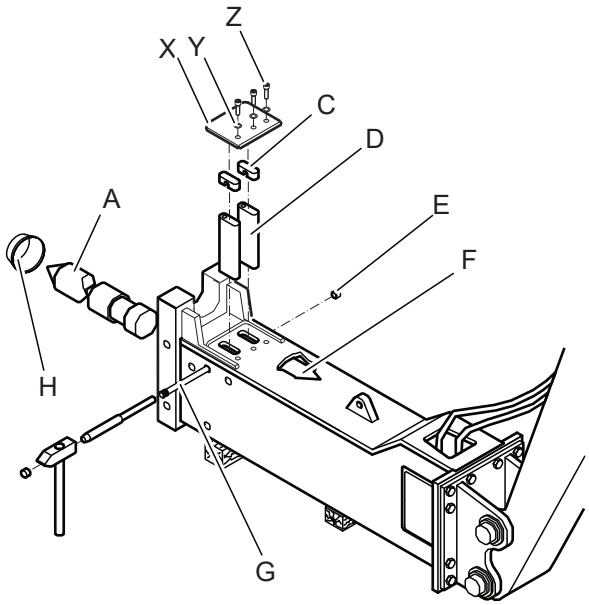
5.8.2 Installation

- Place the hydraulic breaker on timber support blocks.

NOTICE The working tool may break

There is an increased risk of the working tool breaking if it has not been stored in frostfree conditions.

- ▶ Store the working tool in a frostfree environment for one day before installing it. or
- ▶ Heat up the working tool for several hours, e.g. with a heating blanket, until it has warmed up thoroughly.



Wiper installed (only hydraulic breakers with DustProtector):

When installing the working tool for the first time after it has been delivered, you first have to remove the wiper (H) from the DustProtector.

- Remove the wiper (H) from the DustProtector (see chapter **DustProtector/Removal**).

NOTICE Damage to the wiper

If the wiper is not removed it will bend back when installing the working tool. The wiper can then no longer be used.

- ▶ Remove the wiper before installing the working tool.

Retainer bar installed:

When installing the working tool for the first time after it has been delivered, you must remove the protective cap and the retainer bars.

- Remove the protective cap from the aperture for the working tool.
- Store the protective cap for future use.
- Remove the screws (Z), washers (Y), plate (X), and plugs (E).
- Use a pin punch and a hammer to drive the bolt (G) for the retainer bars (D) out of the lower breaker part (F) from the side.
- Remove the two plugs (C) from the slotted holes for the retainer bars (D).
- Screw one screw (M 12) into the bore on the front side of the retainer bars.
- Pull out the retainer bars by the screw.

Retainer bar and wiper removed:

If the retainer bars and the wiper (only on hydraulic breakers with DustProtector) have been removed, proceed as follows:

- Clean the insertion area of the working tool (A).
- Grease the insertion area of the working tool (A) with chisel paste.
- Grease both retainer bars (D) with chisel paste.
- Install the working tool (A).
- Put the retainer bars (D) in place.
- Turn the working tool (A) until the retainer bars (D) slide into place in the slotted holes of the lower breaker part (F).
- Remove the screw from the retainer bars (D).
- Install the sealing plugs (C).
- Drive the bolt (G) into place using a pin punch and a hammer.
- Install the plate (X), washers (Y), screws (Z), and the plugs (E).
- If the hydraulic breaker is a DustProtector type, install the wiper (H) (see chapter **DustProtector/Installing**).

5.8.3 Removal

- Place the hydraulic breaker on timber support blocks.

⚠ WARNING The working tool suddenly comes loose

A clamped working tool is still under the pressure of the piston accumulator. When the working tool is loosened, it will partly jump out of the hydraulic breaker; this may lead to serious injury.

▶ Never position yourself directly in front of the installed working tool.

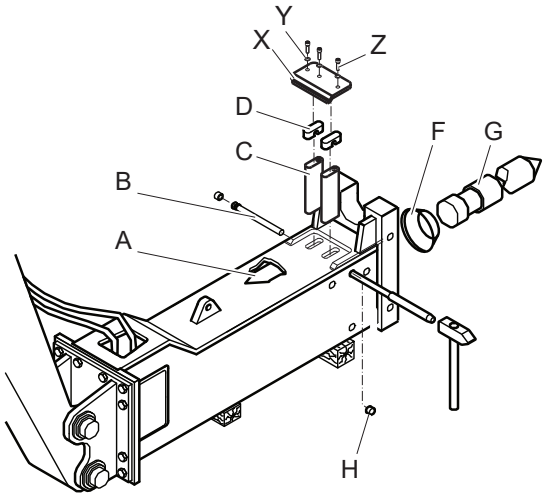
⚠ WARNING Hot working tool

The tip of the working tool gets very hot during operation. Touching it may lead to burns.

▶ Never touch the hot working tool.

▶ If you have to carry out any activities, wait for the working tool to cool down first.

- Remove the screws (Z), washers (Y), plate (X), and plugs (H).



- Use a pin punch and a hammer to drive the bolt (B) for the retainer bars (C) out of the lower breaker part (A) from the side.
- Remove the two plugs (D) from the slotted holes for the retainer bars.
- Screw one screw (M 12) into the bore on the front side of the retainer bars.
- Pull out the retainer bars by the screw.
- Pull the working tool (G) out of the lower breaker part.
- If the hydraulic breaker is a DustProtector type, remove the wiper (F) (see chapter **DustProtector/Removal**).

6 Operation

⚠ WARNING Components bursting

Components of the swivel joint may burst. Metal parts may become projectiles and cause serious injuries and damage property.

- ▶ Never operate the hydraulic breaker without attached swivel joint covers.

⚠ WARNING Hot hydraulic oil squirting out

The hydraulic system is under high pressure. If hydraulic connections come loose, hydraulic oil will squirt out under high pressure. Hydraulic oil squirting out can lead to serious injury.

- ▶ Immediately switch off the hydraulic attachment and the carrier if you detect any leaks in the hydraulic circuits.
- ▶ Depressurise the hydraulic system (see chapter **Depressurising the hydraulic system**).
- ▶ Repair any leaks before operating the hydraulic attachment again.

⚠ WARNING Hot parts

The percussion unit, the working tool, hoses, pipes and fittings become very hot during operation. Touching them may lead to burns.

- ▶ Never touch hot parts.
- ▶ If you have to carry out activities where you have to touch the parts, wait for them to cool down first.

NOTICE Environmental damage due to hydraulic oil

Hydraulic oil is environmentally harmful and must not penetrate the ground or enter the water table or water supplies.

- ▶ Collect any hydraulic oil which escapes.
- ▶ Dispose of it in accordance with the applicable environmental regulations.

NOTICE Hydraulic oil too hot

The temperature of the hydraulic oil must not exceed 80 °C (176 °F). Higher temperatures will damage the seals of the hydraulic breaker and the diaphragm of the HP-accumulator.

- ▶ The temperature of the hydraulic oil must be monitored.
- ▶ Shut off the carrier and the hydraulic breaker if you measure an increased temperature in the tank.
- ▶ Check the hydraulic installation and the pressure relief valve.

NOTICE Damage due to idling strokes

If the percussion piston carries out a hammer action without hitting the working tool, it is carrying out an idling stroke. If this happens it will lead to hydraulic peak pressures which may damage the seals of the hydraulic breaker and the carrier.

- ▶ Do not allow the percussion piston to carry out idling strokes for a prolonged period of time.

6.1 Initial operation and operation after long storage

Prior to first use and after more than eight weeks storage of the hydraulic breaker, the pressure in the piston accumulator must be checked.

- ■ Remove the protective cap from the aperture for the working tool.
- ■ Remove the retainer bars.
- ■ Check the pressure in the piston accumulator without exerting pressure (see chapter **Piston accumulator**).
- ■ Fill up the piston accumulator or release the pressure from the piston accumulator until the piston accumulator has reached the minimum gas pressure (see chapter **Piston accumulator**). Use the tabular value at ambient temperature, not at operating temperature in this case.
- ■ Install the hydraulic breaker (see chapter **Installation**).
- ■ Operate the hydraulic breaker until the operating temperature 60 – 70 °C (140 – 158 °F) has been reached.
- ■ Follow all instructions as described in the chapter **Operation**.
- ■ Check the pressure in the piston accumulator without exerting pressure of the working tool (see chapter **Piston accumulator**).
- ■ Fill up the piston accumulator to the required gas pressure (see chapter **Piston accumulator**).

6.2 Preparations before starting

⚠ WARNING Falling carrier

A carrier falling or tipping over due to the surface not being level may cause serious injury and material damage.

- ▶ Always observe great care when moving the carrier.
- ▶ Do not use the hydraulic attachment until the carrier is positioned stably.

⚠ WARNING Fragments flying around

Fragments of material which come loose while operating the hydraulic attachment may be flung away and can cause serious injury if people are hit by them. Small objects falling from a great height can also cause serious damage.

During hydraulic attachment operation the danger zone is considerably greater than during the excavation operation due to fragments of stone and pieces of steel flying around, and for this reason the danger zone must, depending on the type of material to be worked on, be enlarged correspondingly, or secured in a suitable manner through corresponding measures.

- ▶ Secure the danger zone.
- ▶ Stop the hydraulic attachment immediately if anyone enters the danger zone.
- ▶ Close the windscreen and the side windows of the driver's cab.

The preparations required prior to starting the hydraulic attachment depend on the ambient temperature:

- Ambient temperature below 0 °C (32 °F) (see chapter **Low ambient temperature**).
- Ambient temperature above 30 °C (86 °F) (see chapter **High ambient temperature**).

The oil temperature in the hydraulic attachment must be between 0 °C (32 °F) and +80 °C (176 °F) when operating the breaker.

The full capacity of the hydraulic attachment can be achieved when the oil temperature is approx. 60 °C (140 °F).

- ■ Make sure that there are no people in the danger zone.
- ■ Start the carrier as instructed by the carrier manufacturer.
- ■ Let the carrier heat up until the operating temperature prescribed by the carrier manufacturer has been reached.
- ■ Put the carrier in its working position.
- ■ Put the working tool on the material to be broken.

6.3 Switching the hydraulic breaker on and off

After properly attaching the hydraulic attachment to the carrier, the hydraulic attachment can be operated using the carrier‘s hydraulic system. All functions for normal carrier operation remain intact.

The hydraulic attachment is switched on and off using electrical and hydraulic signals.

If you have any questions about electric / hydraulic commands, consult the carrier manufacturer and / or the Epiroc Customer Center / Dealer in your area.

- ■ Switch the hydraulic attachment on and off, as described in the carrier‘s operating instructions.
- ■ When leaving the driver’s cab, set the safety switch/ lever for the electrical / hydraulic attachment installation to the „OFF“ position.

Carry out the above actions to prevent any unintended start-up of the hydraulic attachment.

6.4 Functional test

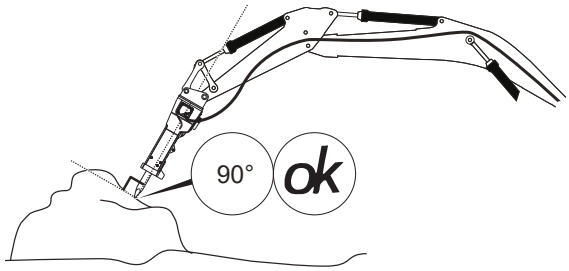
Always carry out a functional test before putting the hydraulic attachment into use to check that all hydraulic lines and connections are tight and that the hydraulic attachment works without any problems.

- ■ Prepare the hydraulic attachment so that you can start using it.
- ■ Carry out a couple of test impacts on the material to be broken.
- ■ Check the hydraulic lines and make sure that the hydraulic attachment works without any problems.
- ■ Immediately switch off the hydraulic attachment if oil escapes from the hydraulic lines or if other defects in functioning occur.
- ■ Depressurise the hydraulic system (see chapter **Depressurising the hydraulic system**).
- ■ Only use the hydraulic attachment again after having repaired all leaks and operating defects.

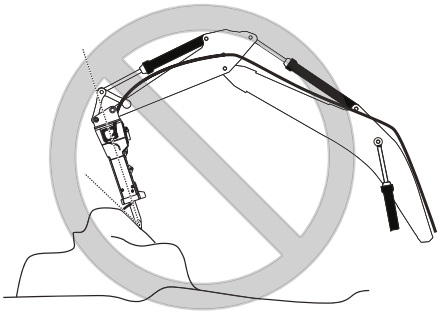
6.5 Correct operation

6.5.1 Working angle

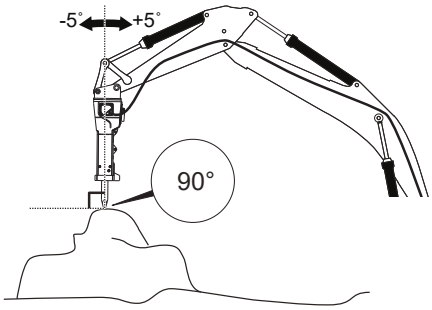
- Always position the tool so that it hits the material to be broken at a right angle.



If you do not do this, the hydraulic breaker will wear faster and damage will occur after a while.



- Slightly swing the hydraulic breaker to and fro when carrying out the hammer impacts, but never swing it through more than approx. 5°.



This swing action enables any dust under the tip or the cutter of the working tool to escape. Otherwise a layer of dust is created which would prevent the full percussion energy being transferred to the material to be broken. The tip of the working tool then becomes hot and loses its hardness.

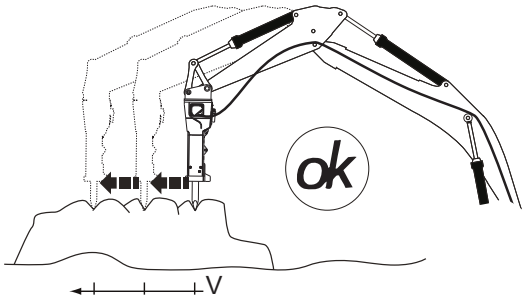
Larger swing angles would lead to bending loads and damage to the working tool and the hydraulic breaker.

6.5.2 Advance

Select the distance marked with "V“ such that the fragment is released within 30 seconds. If this is not the case decrease the advance or apply the tool again to another location.

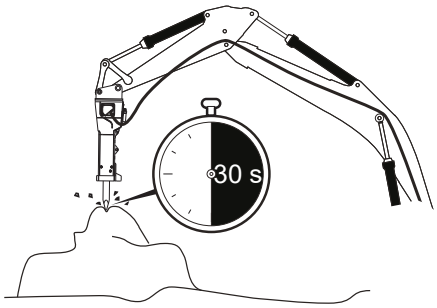
Excessive advances do not improve the working result. The working tool will then penetrate the material without a satisfactory breaking result. The tip of the working tool then becomes hot and loses its hardness. Work step by step to achieve the optimum work result.

- Start near the edge of the material to be broken and work your way back to its centre.



6.5.3 Impact time

- Never apply the hydraulic breaker to the same point for more than 30 seconds.



- If the material fails to break, apply the tool to a new location.

6.5.4 High ambient temperature

- Only use hydraulic oils of sufficient viscosity.

  In summer and in tropical climates, the minimum requirement is a hydraulic oil of type HLP 68.

6.5.5 Low ambient temperature

Ambient temperature below 0 °C (32 °F):

NOTICE The working tool may break

There is an increased risk of the working tool breaking if it has not been stored in frostfree conditions.

▶ Store the working tool in a frostfree environment for one day before installing it. or

▶ Heat up the working tool for several hours, e.g. with a heating blanket, until it has warmed up thoroughly.

Additional instructions when working at an ambient temperature of below -20 °C (-4 °F):

You must heat up the hydraulic attachment and the carrier when working at ambient temperatures of below -20 °C (-4 °F). Preferably park the carrier and the hydraulic attachment in a heated, sheltered space while not in use.

NOTICE Hydraulic oil too cold

Operating the hydraulic breaker while the hydraulic oil is still cold will damage the seals of the hydraulic breaker and the diaphragm in the HP-accumulator.

▶ Do not operate the hydraulic breaker until the temperature of the hydraulic oil is at least 0 °C (32 °F).

- Start the carrier as instructed by the carrier manufacturer.
- Let the carrier heat up until the operating temperature prescribed by the carrier manufacturer has been reached.

NOTICE Damage to hydraulic parts

If a hydraulic breaker which has not reached operating temperature is operated with hot hydraulic oil this will lead to tensions and the hydraulic breaker will stop working.

▶ Do not fill the hydraulic system with hot hydraulic oil.

NOTICE Damage due to idling strokes

If the percussion piston carries out a hammer action without hitting the working tool, it is carrying out an idling stroke. If this happens it will lead to hydraulic peak pressures which may damage the seals of the hydraulic breaker and the carrier.

▶ Do not allow the percussion piston to carry out idling strokes for a prolonged period of time.

The temperature of the hydraulic oil of the carrier must be at least 0 °C (32 °F).

- Start the hydraulic attachment when the temperature has risen to 0 °C (32 °F).
- During operations, leave the carrier engine and pumps running even during breaks.

6.6 Prohibited operation

6.6.1 Lifting/Transporting

⚠ WARNING Falling load

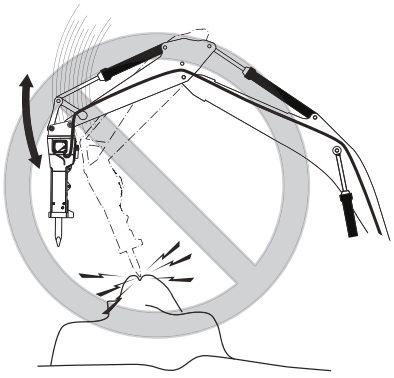
The lifted object can fall and cause serious injuries or death.

▶ Never lift or transport loads with the hydraulic attachment.

The hydraulic attachment was not constructed to lift or transport loads. The hydraulic attachment will be damaged by such use.

6.6.2 Impacting

- Do not use the hydraulic breaker as a sledge hammer to demolish the material.

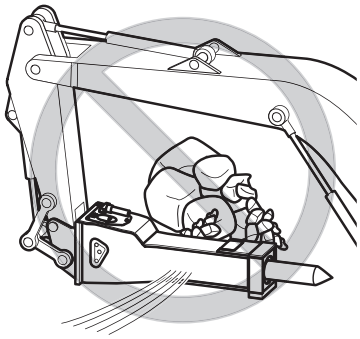


This will damage the hydraulic breaker, the working tool and the carrier.

6.6.3 Moving objects

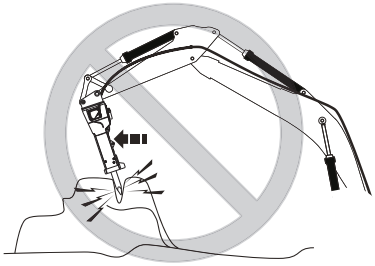
- Never use the hydraulic attachment to move debris.

  This would damage the hydraulic attachment.



6.6.4 Levering

- Never use the working tool for crowbar-type applications.

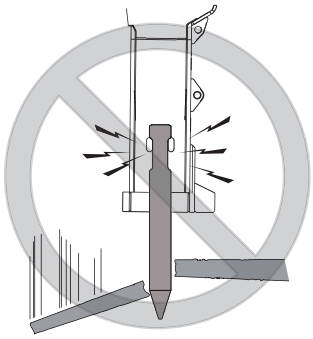


This might cause the working tool to break. Listen to the sound of the hydraulic breaker – it changes when stresses occur between the working tool and the wear bush.

6.6.5 Blank firing of the working tool

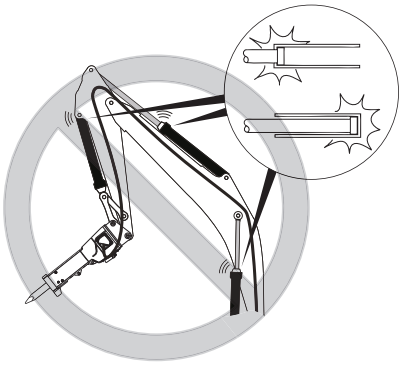
The working tool "blank fires" if the percussion energy is transferred to the retainer bars instead of to the material to be broken. This happens when the working tool breaks through the material or slips off it, e.g.: when working on thin concrete slabs or layers of loose rocks. Blank firing of the working tool subjects the hydraulic breaker and the carrier to increased loads. Blank firing of the working tool generates a typical metallic sound.

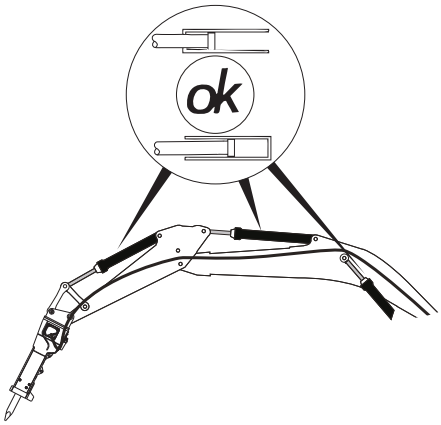
- Try to avoid blank firing of the working tool by:
  - observing the material to be broken to identify whether there is any risk of the working tool breaking through the material or slipping off it.
  - listening to the sound of the hydraulic breaker. You can hear a metallic twang when the working tool is blank firing.
- Stop the hydraulic breaker when blank firing occurs.



6.6.6 Cylinder end positions

- Avoid operating the hydraulic attachment when the carrier stick and bucket cylinder is in one of its end positions.





These end positions have damping facilities; the hydraulic cylinder may be damaged by prolonged use while in its end positions.

- Reposition the carrier so that you do not have to work with the cylinder in its end positions.

6.7 Working with safety equipment

6.7.1 Underwater applications

Using the hydraulic breaker in and under water is possible if it has been fitted out with special safety equipment. A special connection kit for underwater use was developed to avoid damage to the hydraulic breaker. It contains all the necessary components including the safety facilities to keep the interior of the lower breaker part free from water by using external compressed air. Specific documentation, has been drawn up, including operating instructions and a spare parts list, for underwater usage.

- Before using the hydraulic breaker in or under water, consult the Epiroc Customer Center / Dealer in your area.

6.7.2 Usage in tunnels

Using the hydraulic breaker for tunnelling with overhead operations and horizontal applications or for river bed excavation/slope construction is possible if it has been fitted out with special safety equipment. Dust and stone particles and/or water penetrating the hydraulic breaker can lead to operating failures and can even cause the hydraulic breaker to malfunction completely. Preventative measures to protect the hydraulic breaker have been collected in separate documentation.

- Before using the hydraulic breaker for tunnelling work, consult the Epiroc Customer Center / Dealer in your area.

6.7.3 Hot applications

Using the hydraulic breaker in a hot environment is possible if it has been fitted out with special safety equipment.

- Before using the hydraulic in a hot environment, consult the Epiroc Customer Center / Dealer in your area.

6.8 AutoControl System

The AutoControl System is a combination of a pressure-maintaining and reversing valve. The AutoControl System protects the breaker from damage if blank firing occurs. The pressure-maintaining valve makes sure that the hydraulic breaker switches correctly in all operating situations. It enables up to 30 % energy to be recovered when working on hard rock. The reversing valve automatically switches over the hydraulic breaker to a shorter stroke to reduce the single-impact energy.

6.8.1 AutoControl in daily use

The system works automatically without any manual intervention by the carrier operator and automatically adjusts to the conditions of use. If the situation requires a high single blow energy, the system produces a full stroke and a high single blow energy.

6.8.2 AutoControl in special applications

For special applications, e.g. work with very little percussion, the AutoControl System can be blocked mechanically at a high impact rate with a reduced single-impact energy.

For further information, please contact the Epiroc Customer Center / Dealer in your area.

6.9 Intelligent Protection System (IPS)

The “Intelligent Protection System (IPS)” automatically controls the start-up and shut-off behaviour of the hydraulic breaker. The hydraulic breaker always starts in the “AutoStart” mode, i. e. the breaker starts operating without exerting pressure on the working tool. If “AutoControl” triggers a long piston stroke, “IPS” will automatically switch over to the “AutoStop” mode and shuts off the hydraulic breaker. If the hydraulic breaker continues to work in the short piston stroke mode after having been started, “IPS” will stay in the “AutoStart” mode.

6.10 PowerAdapt

PowerAdapt protects the hydraulic breaker against hydraulic overloads and switches it off if the hydraulic input energy is too high.

An overload occurs when the hydraulic breaker is operated while the delivery rate and the pressure from the carrier are too high. The carrier driver can correct this by reducing the engine speed or setting a lower mode stage on the carrier.

Adjusting the delivery rate:

- Start the carrier.
- Set the maximum speed and the highest mode stage.
- Switch on breaker operation.

If the hydraulic breaker fails to work:

- Lower the speed or the mode stage and restart the hydraulic breaker.
- Repeat this until the hydraulic breaker works continuously without failures.

The oil volume can be increased after the heat-up phase.

The advantage of PowerAdapt is that manual adjustment puts the maximum percussion energy at your disposal, without overloading the hydraulic breaker.

Hydraulic adjustment of the carrier to enable working with the hydraulic breaker is still necessary, in spite of using PowerAdapt. PowerAdapt is not a pressure-relief valve.

7 Maintenance

The maintenance activities are carried out by the carrier driver.

⚠ WARNING Hot hydraulic oil squirting out

The hydraulic system is under high pressure. If hydraulic connections come loose, hydraulic oil will squirt out under high pressure. Hydraulic oil squirting out can lead to serious injury.

- ▶ Immediately switch off the hydraulic attachment and the carrier if you detect any leaks in the hydraulic circuits.
- ▶ Depressurise the hydraulic system (see chapter **Depressurising the hydraulic system**).
- ▶ Repair any leaks before operating the hydraulic attachment again.

⚠ WARNING Hot hydraulic oil squirting out

The hydraulic system is under high pressure. Hydraulic oil escaping out can lead to serious injury.

- ▶ Immediately switch off the hydraulic attachment and the carrier if you detect any leaks in the hydraulic circuits.
- ▶ Do not inspect for possible leaks with your fingers or other parts of the body, but use a piece of cardboard instead, holding it up to the suspected leakage site.
- ▶ Examine the cardboard for traces of liquid.
- ▶ Depressurise the hydraulic system (see chapter **Depressurising the hydraulic system**).
- ▶ Repair any leaks before operating the hydraulic attachment again.

⚠ WARNING Hot parts

The percussion unit, the working tool, hoses, pipes and fittings become very hot during operation. Touching them may lead to burns.

- ▶ Never touch hot parts.
- ▶ If you have to carry out activities where you have to touch the parts, wait for them to cool down first.

⚠ WARNING Accidental start

If the hydraulic attachment is started by accident this may lead to serious injury.

- ▶ Follow the instructions in the Operating Instructions of the carrier to prevent the hydraulic attachment starting by accident.

⚠ WARNING Unexpected movement

Sudden movements of the carrier may cause serious injury.

- ▶ Secure the carrier such that it cannot move unexpectedly.
- ▶ Observe the carrier manufacturer’s instructions.

NOTICE Environmental damage due to hydraulic oil

Hydraulic oil is environmentally harmful and must not penetrate the ground or enter the water table or water supplies.

- ▶ Collect any hydraulic oil which escapes.
- ▶ Dispose of it in accordance with the applicable environmental regulations.

7.1 Maintenance schedule

during a shift	Monitor the filling level of the grease cartridge of the ContiLube® II lubrication system and immediately replace an empty cartridge. Monitor the lubricant film on the shaft of the working tool. Manual lubrication of the working tool approx. every 2 hours.
daily	Check the bolted connections at the adapter plate and tighten as required. Check the hydraulic lines for leaks. Check that the pipe clamps on the carrier are tight. Check the screw connections of the swivel joint covers and tighten as required. Replace damaged swivel joint covers.
during and after the first 50 operating hours	Tighten the screw connections daily during the first 50 operating hours. Replace the oil filter cartridges after the first 50 operating hours. Check the fill pressure of the HP-accumulator during the first operating week.
weekly	Visual check of the tensioning bolts through the service openings placed at the top of the breaker box's rear side. Check the screw connections and tighten as required. Check the pins in the retainer bars. Check that the plugs of the retainer bars are in place and are not damaged. Replace any damaged plugs. Check the adapter plate and the breaker box for cracks. In normal use: Clean and grease the DustProtector system. Check the connecting fittings of the ContiLube® II system for leaks. Visual check of the HP-accumulator.
monthly	Check the pressure in the piston accumulator.
after the first three operating month	Check the fill pressure of the HP-accumulator.
every 500 operating hours	Check the oil filter and replace as required.
when replacing the working tool, and at least every 100 operating hours	Check the working tool for wear. Check the lower and upper wear bush for wear. Check that the piston impact surface is not chipped. Check that the working tool impact surface is not chipped. Check the working tool for burrs. Check the retainer bar for burrs.
annual	Check the fill pressure of the HP-accumulator.
if necessary	Replace bent and damaged pipes. Replace damaged hoses. Check the pressure in the piston accumulator. In case of dusty conditions: Clean and grease the DustProtector system. Check the adapter plate bolts for wear.

7.2 Depressurising the hydraulic system

Even when you have switched off the carrier, a considerable residual pressure can still be present in the hydraulic system.

A residual pressure can still be present in the hydraulic breaker even after you have disconnected the quick-release couplings or closed the shut-off valves.

The hydraulic breaker can only be depressurised using the hydraulic system of the carrier, by allowing hydraulic oil to drain to the tank via the return connection.

If the hydraulic breaker is fitted with a high-pressure accumulator, it can take longer to relieve the pressure in the hydraulic system to the tank, since a larger volume of oil has to be drained away.

Depending on the type of hydraulic breaker, the internal leaks, the oil temperature, the type of hydraulic oil and the design of the hydraulic installation of the carrier, the time required to relieve the pressure can vary.

Depending on the hydraulic system of the carrier you will have to consider using various measures in order to depressurise the hydraulic system.

Case 1: If measurement connections are present in the supply pipe to the hydraulic breaker, with which the depressurised state can be checked using a suitable gage. In order to depressurise the hydraulic breaker you must observe the following steps:

1. The hydraulic breaker must be connected to the hydraulic system of the carrier device, i.e. the hydraulic hoses must be connected up and the respective shut-off valves in the supply pipe and in the connection to the tank must be opened.
2. Depressurise the hydraulic system according to the manufacturer's safety and operating instructions for the carrier.
3. Measure the pressure with a suitable gage at a measurement connection in the supply pipe to the hydraulic breaker.
4. If residual pressure is still present, wait until the pressure has been completely relieved.
5. When you have made sure that no more pressure is present in the hydraulic system, you must disconnect the hydraulic connection to the carrier. Close the shut-off valves or disconnect the quick-release couplings, so that no hydraulic oil can flow back from the carrier.

Case 2: If no facility for measuring the pressure is present in the supply pipe to the hydraulic breaker and the return pipe is connected to the tank without an intermediate valve connection, you must observe the following steps in order to depressurise the hydraulic breaker:

1. Ensure that the hydraulic oil in the hydraulic breaker and in the carrier has a temperature of at least 0 °C. If necessary, pre-heat it to at least 0 °C.
2. The hydraulic breaker must be connected to the hydraulic system of the carrier, i.e. the hydraulic hoses must be connected up and the respective shut-off valves in the supply pipe and in the connection to the tank must be opened.
3. Depressurise the hydraulic system according to the manufacturer's safety and operating instructions for the carrier.
4. You must wait at least another 30 minutes until the pressure has been relieved through leakages.

   Only after this period of time will there be no more residual pressure present in the hydraulic system of the hydraulic breaker.
5. When you have made sure that no more pressure is present in the hydraulic system, you must disconnect the hydraulic connection to the carrier. Close the shut-off valves or disconnect the quick-release couplings, so that no hydraulic oil can flow back from the carrier.

Case 3: If no facility for measuring the pressure is present in the supply pipe to the hydraulic breaker and the return pipe is connected to the tank via intermediate valves, which for example close off or pressurise the return pipe, you must observe the following steps in order to depressurise the hydraulic breaker:

1. The hydraulic breaker must be connected to the hydraulic system of the carrier, i.e. the hydraulic hoses must be connected up and the respective shut-off valves in the supply pipe and in the connection to the tank must be opened.
2. Depressurise the hydraulic system according to the safety and operating instructions from the carrier manufacturer, and where appropriate, those of the manufacturer of the hydraulic installation for the attachment.
3. When you have made sure that no more pressure is present in the hydraulic system, you must disconnect the hydraulic connection to the carrier device. Close

the shut-off valves or disconnect the quick-release couplings, so that no hydraulic oil can flow back from the carrier.

7.3 Cleaning

NOTICE Environmental damage due to polluted water

Hydraulic oil and chisel paste are environmentally harmful and must not penetrate the ground or enter the water table or water supplies.

▶ Collect the water used for cleaning if it has been contaminated by hydraulic oil and chisel paste.

▶ Dispose of the water in accordance with the applicable regulations to avoid environmental hazards.

7.3.1 Preparations

Hydraulic breaker installed:

- Place the breaker on the working tool and exert a slight pressure.

  This prevents water penetrating the percussion piston.

Hydraulic breaker not installed, working tool removed:

- Plug up all hydraulic ports.
- Seal the aperture for the working tool with the protective cap.

7.3.2 Procedure

NOTICE Damage to the hydraulic breaker

Water can penetrate the percussion chamber via the percussion chamber ventilation non-return valve. This may cause the percussion piston to rust which may result in damage to the seals and the cylinder.

▶ Never direct the pressure cleaner jet onto the percussion chamber non-return valve.

- Use a pressure cleaner to remove dirt from the hydraulic breaker.

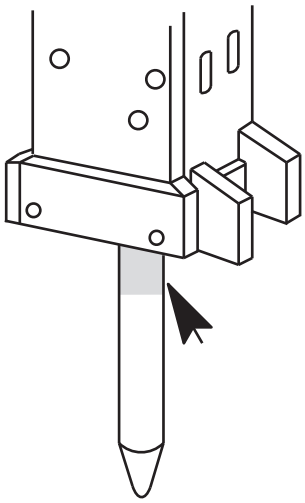
7.4 Lubrication

7.4.1 Checking the lubricant film

The lubricant film on the shaft of the working tool must be checked during the work shift.

- Let the hydraulic breaker hang freely from the carrier boom.

When the working tool is hanging from the retainer bars, the lubricant film on the shaft of the working tool becomes visible. There must be an even film of lubricant on the entire shaft.



- Increase the lubricant supply if the film of lubricant comes away or dry spots can be seen:
  - Automatic lubrication: increase the lubricant supply via the metering screw of the ContiLube® II.
  - Manual lubrication: increase the lubrication interval and the number of strokes from the manual grease gun.

NOTICE Damage due to excessive lubrication

Excessive lubrication may damage the hydraulic breaker and the carrier. The impact surface of the working tool must be free of grease.

▶ Do not over-lubricate the working tool.

If the ContiLube® II automatic lubrication system has been installed, a lubrication pulse is triggered whenever the hydraulic breaker is switched on.

- Adjust the lubricant supply to your work method.

7.4.2 Automatic lubrication

The hydraulic breaker is lubricated automatically by the ContiLube® II.

The ContiLube® II has been installed near the service opening in the upper section of the breaker box.

Instructions on how to operate and maintain the ContiLube® II is described in a seperate documentation.

- If you have questions how to use the ContiLube® II, contact the Epiroc Customer Center / dealer in your area.

7.4.3 Replacing the lubricant cartridge

- Unscrew and remove the empty lubricant cartridge and the old seal by turning counter clockwise.
- Remove the cover from the new cartridge. Make sure not to damage the sealing cone (A).
- Place the seal (B) on the cartridge.

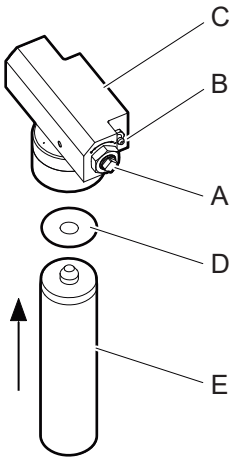
- Use your thumb to push the cartridge piston down until lubricant escapes from the screw thread.
- Screw the cartridge until the stop into the guide hole of the grease pump.

  The ContiLube® II is ready for use.

7.4.4 ContiLube® II operation

Please remember the following:

- The ContiLube® II (C) is self-venting, i.e. the system does not require you to vent it.
- The lubricant level in the transparent cartridge (E) of recyclable PE plastic can always be checked from the cab by looking at the position of the red piston.
- The piston side of the cartridge (E) must never be sealed, otherwise no grease supply will be possible.
- You can change the supply volume by adjusting the metering screw (A), depending on the actual use.
- Tighten the screw clockwise = less grease
- Loosen the screw counter-clockwise = more grease



The pump unit (C) must always be sealed to prevent the ingestion of water and dust.

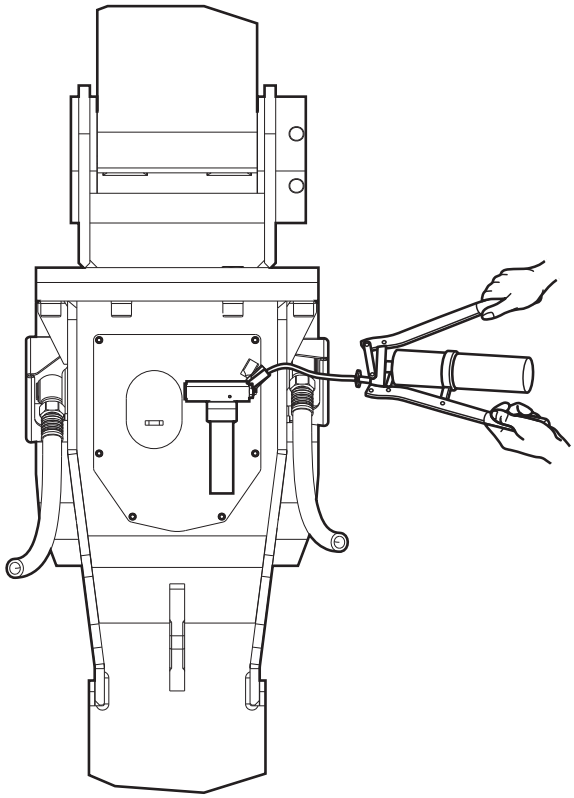
- Use a dust cover or leave the empty cartridge in the pump until a new cartridge is available.
- Check the tightness of the connections of all hoses for the ContiLube® II operation once a week.

Emergency lubrication is possible via the grease nipple (B) on the side of the ContiLube® II.

7.4.5 Manual lubrication

Manual lubrication is required if the automatic lubrication system fails to work.

- Place the hydraulic breaker at a right angle on the working tool and exert pressure.
- Only use chisel paste for lubrication.
- Put the manual grease gun on the grease nipple of the emergency lubrication system and inject chisel paste.



- Lubrication interval: approx. every 2 hours
- Hydraulic breaker without DustProtector: 5 to 15 strokes from the manual grease gun
- Hydraulic breaker with DustProtector: 5 to 10 strokes from the manual grease gun

7.4.6 Chisel paste filling device

Construction Tools GmbH offers a device for refilling empty cartridges. This can be mounted on a 15-kg or 45-kg hobbock to fill empty cartridges as required.

Bio chisel paste

550-g Bio chisel paste cartridges packed per 12 cartridges:

part number 3363 1223 56 for ContiLube® II

15-kg Bio chisel paste container,

part number 3363 1223 57

45-kg Bio chisel paste container,

part number 3363 1223 58

Chisel paste

500-g chisel paste cartridges packed per 12 cartridges:

part number 3363 0912 00 for ContiLube® II

15-kg chisel paste container,

part number 3362 2639 00

45-kg chisel paste container,

part number 3362 2632 75

Manual grease gun for ContiLube® II cartridges:

part number 3363 0345 67

Filling device for use with 15-kg containers:

part number 3363 0946 69

Filling device for use with 45-kg containers:

part number 3363 0664 11

For further information, please contact the Epiroc Customer Center / Dealer in your area.

7.5 Checking the tensioning bolts

⚠ WARNING Rupturing washers become projectiles

Washers can rupture and cause serious injuries, if you hit the heads of the tensioning bolts or the washers.

▶ Never check the tensioning bolts by acoustic test, but by visual test.

The visual check is only an indication. You can only check doubtless in a repair shop after removing the adapter plate and the elastic pad.

- Remove the covers of the service openings which are placed at the top of the breaker box's rear side.
- Check the seat of the paint marks which are placed on the heads of the tensioning bolts and washers.

The paint marks have to be in your visual field. In other cases, the respective tensioning bolt can be loose or broken. In this case act as follows:

- Dismount the adapter plate and the elastic pad (see chapter **Removing the adapter plate**).
- Check the tensioning bolt for tight fit.
- Tighten the loose tensioning bolt with the torque required. (see chapter **Bolt connections/Tightening torques**).
- Strip the old paint mark.
- Mark new the tighten tensioning bolt, the washer and the cylinder cover with a colour cast of 10 mm width vertically over all three parts. The paint mark shall be seen in the centre of the service openings.
- Have broken tensioning bolts immediately replaced.
- If you have any questions about replacement of broken tensioning bolts, consult the Epiroc Customer Center / Dealer in your area.

You can only check the front tensioning bolts, if you dismount the adapter plate and the elastic pad (see chapter **Removing the adapter plate**).

- Check the tensioning bolts weekly for tight fit.

7.6 Checking the working tool

⚠ WARNING Hot working tool

The tip of the working tool gets very hot during operation. Touching it may lead to burns.

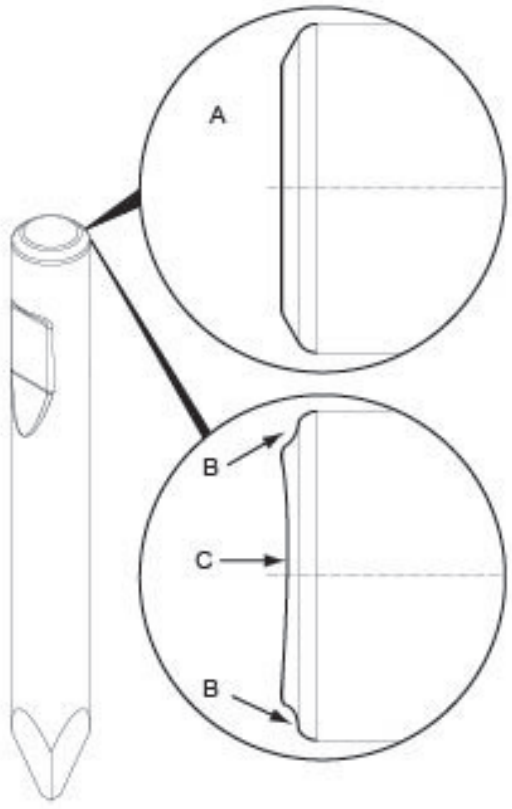
▶ Never touch the hot working tool.

▶ If you have to carry out any activities, wait for the working tool to cool down first.

- Remove the working tool (see the chapter **Dismantling the working tool**).
- Check the impact surface of the working tool for chips and cracks.
- Check the impact surface of the working tool for deformation:

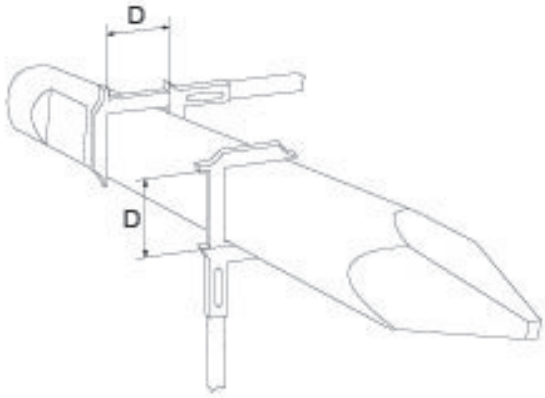
  A = new working tool

  B, C = worn working tool



- Replace the working tool if you detect chips, cracks or deformations (B and C).
- Check the wear condition of the impact ring if you detect deformations (B). Replace impact ring if necessary.

- Check the shaft of the working tool for wear whenever replacing it, but at least once every 100 operating hours.



- Replace the working tool if the shaft has worn to the minimum diameter D_{min} stated below.

Type	D_{min}
HB 2000, HB 2000 DP	140 mm (5.51 in.)
HB 2500, HB 2500 DP	150 mm (5.91 in.)

7.7 Checking the retainer bars

- Check both retainer bars whenever replacing working tools.
- Rework or replace the retainer bars if you find any signs of wear, such as sharp edges, notches or severe erosion.
- Deburr the retainer bars by careful grinding.
- Install the retainer bars in their reversed orientation if they cannot be reworked anymore.
- Replace the retainer bars if both sides cannot be reworked anymore.
- Check both plugs for the retainer bars.

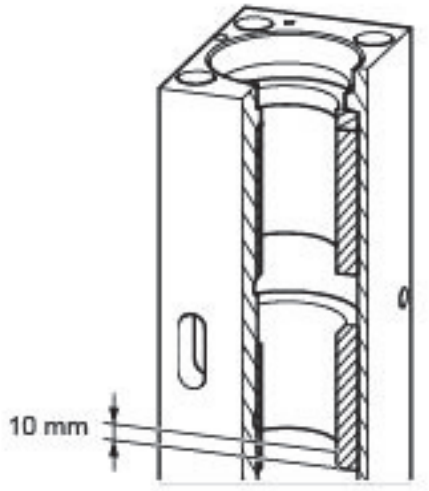
  The plugs must not be damaged.

7.8 Checking the percussion piston impact surface

- Check the percussion piston impact surface whenever replacing the working tool, but at least once every 100 operating hours to make sure it is not chipped and has no visible cracks.
- Use an electric torch to illuminate the surface of the dismantled working tool.
- Do not use the hydraulic breaker again if you have found the surface to be chipped or cracked.
- Consult the Epiroc Customer Center / Dealer in your area.

7.9 Checking the wear bushes and impact ring

The wear bushes can be checked after removing the working tool. You can check the diameter using the enclosed test gauge. The diameter measured must not exceed the maximum permissible diameter D_{max} (measuring point see below).

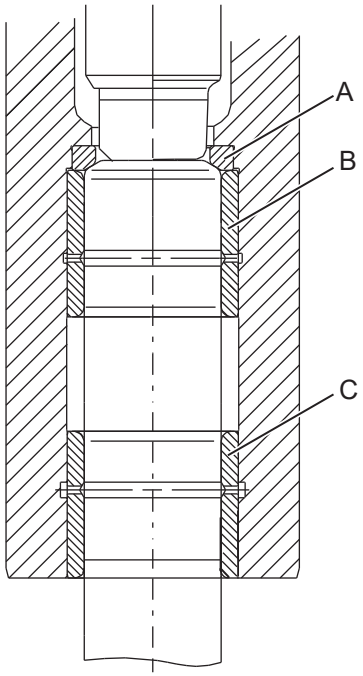


Type	Size information on test gauge	D_{max}
HB 2000 HB 2000 DP	Ø 145	150 mm (5.91 in.)
HB 2500 HB 2500 DP	Ø 155	160 mm (6.30 in.)

- Check the inside diameter of the lower and upper wear bush whenever replacing the working tool, but at least once every 100 operating hours.
- Clean the area around the impact ring to enable a visual check.

The lower wear bush can be replaced on site. Consult the Epiroc Customer Center / Dealer in your area.

- Remove all remnants of lubricant from the inside of the lower breaker part before installing new parts.



A. impact ring
B. upper wear bush
C. lower wear bush

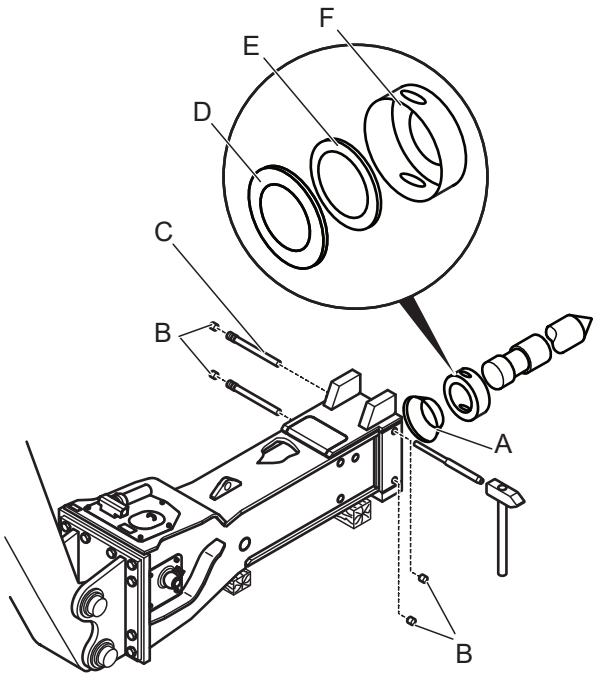
The upper wear bush and the impact ring must be replaced in a workshop fitted out for this purpose.

- Replace the lower wear bush when its inside diameter is greater than the maximum permissible diameter.
- When replacing the lower wear bush check the inside diameter of the upper wear bush using inside callipers (part number 3363 0949 52).
- Replace the upper wear bush and the impact ring when the inside diameter is greater than the maximum permissible diameter.
- Replace the impact ring if you find chips and cracks.

7.10 Checking and cleaning the DustProtector system

An important factor for the DustProtector operation is that the floating ring which moves in a radial direction can follow the movements of the breaker and the working tool.

If dust penetrates it, it may block up the available installation space and interfere with the DustProtector system operation.



- Regularly check that the floating ring (E) can move freely.

NOTICE Environmental damage due to chisel paste

Chisel paste is environmentally harmful and must not penetrate the ground or enter the water table or water supplies.

▶ Dispose of chisel paste polluted by dust and of cloths with chisel paste in accordance with the applicable regulations to avoid environmental hazards.

Regular cleaning and greasing of the installed parts and their holders safeguards their operation and improves the availability of the hydraulic breaker.

The inspection frequency depends on how much dust is generated:

Normal dust generation: once a week (assuming 40–50 hours of operation).

- Check more frequently if the floating ring (E) is stuck.
- Remove the floating ring (E), counter ring (D) and guide ring (F) (see chapter **DustProtector/Removal**).
- Clean the space in front of the flexible wiper (A) of all loose dust.
- Check the wiper (A) for damage.
- Replace the wiper (A) if it is damaged.
- Check the inside diameter of the floating ring (E) with a suitable test gauge or with a inside calliper.

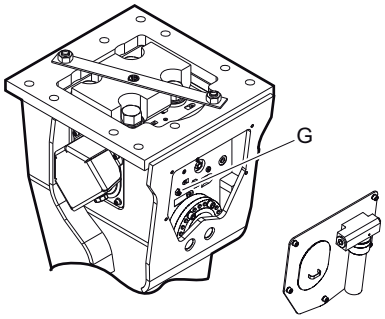
Type	**Size information on test gauge**	D_{max}
HB 2000 DP	Ø 145	150 mm (5.91 in.)
HB 2500 DP	Ø 155	160 mm (6.30 in.)

The diameter measured must not exceed the maximum permissible diameter D_{max}.

- If it has eroded so much that its inside diameter has become too great, replace the floating ring (E).
- Clean and grease the floating ring (E), counter ring (D) and guide ring (F) and install them again (see chapter **DustProtector / Installation**).

7.11 Piston accumulator

The pressure in the piston accumulator is measured at the filling valve (G). The piston accumulator is also filled through this valve.



The following accessories can be supplied:

1 nitrogen filling device

1 test pressure gauge ¼", 0-25 bar, test category 1.6

1 nitrogen bottle

1 adapter, country-specific

To enable the following inspection and maintenance activities to be carried out, the equipment referred to above has to be directly available at the location of use at all times.

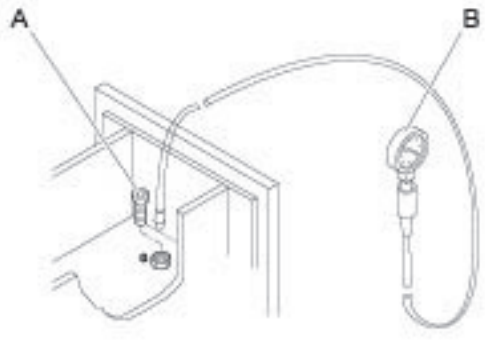
7.11.1 Checking the pressure in the piston accumulator

Check the gas pressure in the piston accumulator monthly, and in cases of decreasing power or failure of the hydraulic breaker. Do not top up the piston accumulator unless the gas pressure is equal to or less than the minimum gas pressure.

Check the pressure in the piston accumulator when the hydraulic breaker is at operating temperature 60 – 70 °C (140 – 158 °F).

- Lay down the hydraulic breaker.

  Do not apply pressure to the working tool.



- Remove the threaded plug (A) from the filling valve »**G**«.
- Push the hose end of the test pressure gauge (B) into the filling valve and note the pressure.
- If the value measured is below the required gas pressure add nitrogen into the piston accumulator.

The required pressure in the piston accumulator is:

if operating temperature 60-70 °C and without exerting pressure!

Type	Minimum gas pressure	Required gas pressure
HB 2000, HB 2000 DP	12.3 bar (178 psi)	14.8 bar (215 psi)
HB 2500, HB 2500 DP	11.6 bar (168 psi)	15.1 bar (219 psi)

7.11.2 Release the pressure from the piston accumulator

- Release gas from the piston accumulator to depressurise the piston accumulator or if the value measured is above the required gas pressure.

NOTICE Damage to the filling valve

Nails, screwdrivers or similar objects can damage the filling valve.

▶ Never use nails, a screwdriver or similar objects to release nitrogen gas from the piston accumulator.

- Push the hose end of the test pressure gauge into the filling valve again.

  This will cause gas to escape from the piston accumulator.

- Repeat this until the required gas pressure has been reached or until the piston accumulator is depressurized.

- Install the threaded plug (A) in the filling valve (G).

7.11.3 Filling / topping up the piston accumulator

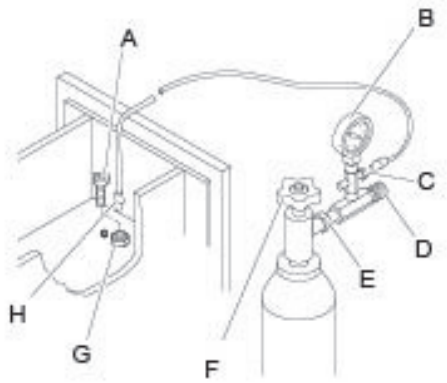
⚠ WARNING Unexpected movement

If the working tool has got stuck, it might come loose unexpectedly if the pressure in the piston accumulator is increased. The unexpected impact may lead to serious injury.

▶ When filling the piston accumulator make sure that there is nobody within the direct vicinity of the working tool.

If a country-specific adapter (E) is required, it has to be installed between the nitrogen bottle and the pressure relief valve (D).

- Connect the pressure relief valve (D) to the nitrogen bottle.



- Close the pressure relief valve (D).
- Connect the filling hose end (H) to the minimess connection (C) of the pressure relief valve (D).
- Open the valve of the nitrogen bottle (F).
- Remove the threaded plug (A) from the filling valve (G).
- Push the free filling hose end (H) into the filling valve (G).
- Slowly open the pressure relief valve (D) to let the nitrogen flow into the piston accumulator.
- Read out the pressure increase from the pressure gauge (B).
- Close the pressure relief valve (D) when the piston accumulator has reached the required pressure +10 %.
- Pull the filling hose out of the filling valve (G).
- Check the pressure in the piston accumulator and let gas escape until the required gas pressure has been reached.
- Install the threaded plug (A) in the filling valve (G) and tighten it to the required tightening torque (see chapter **Bolt connections / Tightening torques**).
- Close the nitrogen bottle valve (F).

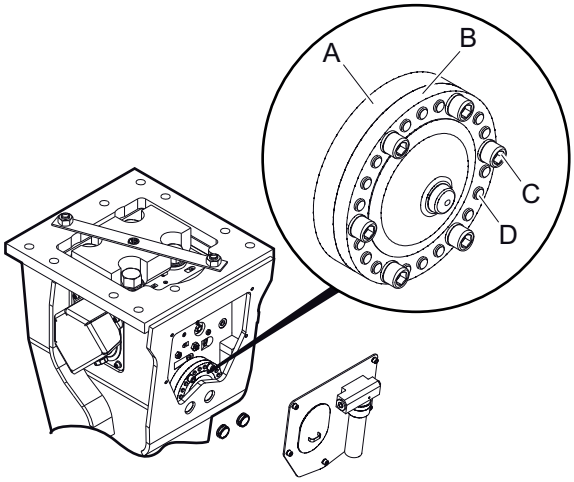
7.12 HP-accumulator

Accumulators are pressure containers in the context of the European Pressure Equipment Directive 2014/68/EU.

As safety−related components, high pressure accumulators are subject to special safety regulations.

Overhauling high pressure accumulators is only permitted if carried out by professionals. Professionals are people who are authorised to overhaul high pressure accumulators according to national regulations.

Contact the Epiroc Customer Center / Dealer in your area for a professional.



A. Lower shell
B. Upper shell
C. Fastening screws
D. Connecting screws

⚠ WARNING Component coming loose abruptly

The HP-accumulator is under pressure, even when the hydraulic system has been depressurised. Screw connections and parts of the HP-accumulator might come loose abruptly and cause injuries.

- ▶ Never unscrew the cover or the upper shell from a pressurised HP-accumulator.
- ▶ Have the HP-accumulator checked in accordance with the national / regional safety provisions.

7.12.1 Visual check

Once a week carry out a visual check of the HP-accumulator.

In case of damages, safe, trouble-free operation is ensured only if the complete HP-accumulator is replaced.

- Immediately replace the complete HP-accumulator if you detect:
  - −cracks/fissures,
  - −distortion/deformation,
  - −corrosion,
  - −thread damage to the threaded bores.
- If broken or missing connecting screws are detected the HP-accumulator shells needs to be checked for cracks, deformations and damage to the threaded bores by a professional. All connecting screws must be replaced.
- Never operate the hydraulic breaker if you detect any damage to the HP-accumulator.

The HP-accumulator can be replaced on site. Contact the Epiroc Customer Center / Dealer in your area.

7.12.2 Checking the fastening screws

Once a week, check that the HP-accumulator fastening screws are tight.

- Check that the fastening screws (C) are tight.
- Tighten any loose fastening screws to the right tightening torques (see chapter **Bolt connections / Tightening torques**).
- If any of the HP-accumulator fastening screws are broken, replace all fastening screws.

7.12.3 Checking the gas pressure

Note:

For checking the gas pressure you need a pressure gauge with a 5 m (16 ft) minimess hose. It's also recommended to use a union tee EVT-8 PLR ED fitting.

After the first installation of the hydraulic breaker, the gas pressure of the HP-accumulator must be checked at least once during the first week.

If no loss of gas is found, the second check is to be carried out after three months.

If no change in gas pressure is found at that stage, then testing can be performed annually.

Further checks, e.g. prior to installation and regular checks, are to be carried out in accordance with national regulations.

The gas pressure changes with the gas temperature. Before checking the gas pressure it is necessary to wait until the temperature of the HP-accumulator has levelled

to about 20 °C (68 °F). If you cannot reach this temperature please contact the Epiroc Customer Center / Dealer in your area.

The gas pressure can be checked by measuring the velocity of the pressure drop in the hydraulic system. Use a pressure gauge (measuring range ≥ 250 bar (3625 psi)).

1. Place the hydraulic breaker on timber support blocks. The breaker box service opening must be facing upwards.
2. Depressurise the hydraulic system before disconnecting a hydraulic hose (see chapter **Depressurising the hydraulic system**).
3. Remove the cover of the service opening.
4. Fit the EVT-8 PLR ED fitting between the angled screw coupling at connection port **»PCL«** connection and the ContiLube.
5. Lead the minimess hose of the pressure gauge through the opening in the cover.
6. Connect the minimess hose to the EVT-8 PLR ED fitting.
7. Fix the cover of the service opening to ensure a save checking procedure.
8. Close the tank line **»T«**.

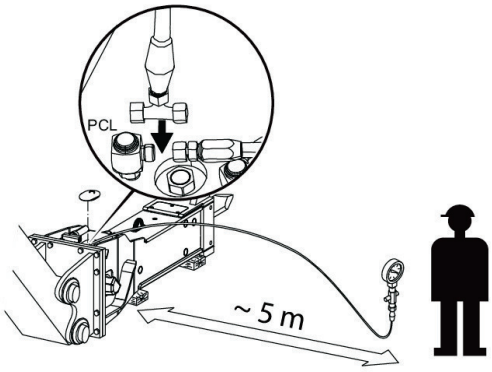
   You need an assistant to monitor the pressure gauge.

   ⚠ WARNING Injury by impacts

   A sudden movement of the carrier may cause your assistant to be hit and injured by the boom or the hydraulic attachment.

   ▶ Only move the boom very slowly and in a controlled manner while an assistant is within the danger zone.
   ▶ Always keep sight of your assistant.

   For safety reasons the assistant has to keep a distance of about 5 m (16 ft) to the breaker during the checking procedure.



9. Switch on the hydraulic breaker at the lowest possible engine rpm in hydraulic breaker mode.
10. Switch off the hydraulic breaker as soon as your assistant indicates that the pressure of 180 bar (2610 psi) is reached.
11. Open the tank line **»T«** a little and slowly release pressure.
12. Watch the pressure gauge during the release procedure. As soon as the gas pressure in the HP-accumulator is reached, the indicator stops shortly and then drops sharply to zero.
13. Refilling is required if the gas pressure is lower than 50 bar (725 psi). Releasing gas is required if the gas pressure is above 60 bar (870 psi). Refilling and releasing gas must be performed by an authorized person. Contact the Epiroc Customer Center / dealer in your area.
14. After checking the gas pressure depressurise the hydraulic system before disconnecting a hydraulic hose (see chapter **Depressurising the hydraulic system**).
15. Remove the minimess hose and the EVT-8 PLR ED fitting, fit the ContiLube to the angled screw coupling and fix the cover of the service opening.

7.13 Checking the hydraulic lines

- Before starting your work shift, always carry out a visual check of all lines (pipes and hoses) from the pump to the hydraulic attachment and from there to the tank.
- Tighten any loose screw connections or hose clamps.
- Replace damaged pipes and/or hoses.

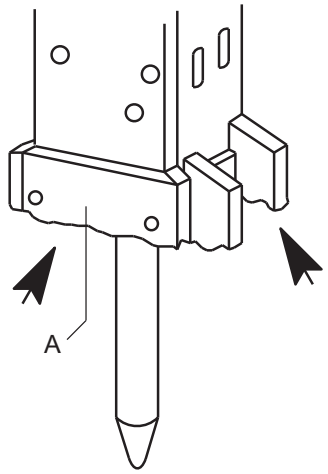
7.14 Checking and cleaning the hydraulic oil filter

An oil filter must be integrated in the tank line of the hydraulic system. The maximum mesh width allowed for the oil filter is 50 microns; it must have a magnetic separator.

- Replace the oil filter cartridges after the first 50 operating hours.
- Check the oil filter every 500 operating hours and replace as required.

7.15 Checking the adapter plate and the breaker box for cracks and/or wear

- Check the adapter plate and the breaker box for cracks every week.
- Have rework activities or repairs carried out in time to avoid major damage.
- The wear rails (A) in the lower section of the breaker box can be replaced as required. Please consult the Epiroc Customer Center / dealer in your area.



If the wear rails have worn severely, this may cause damage to the basic body of the breaker box.

7.16 Checking the adapter plate bolts for wear

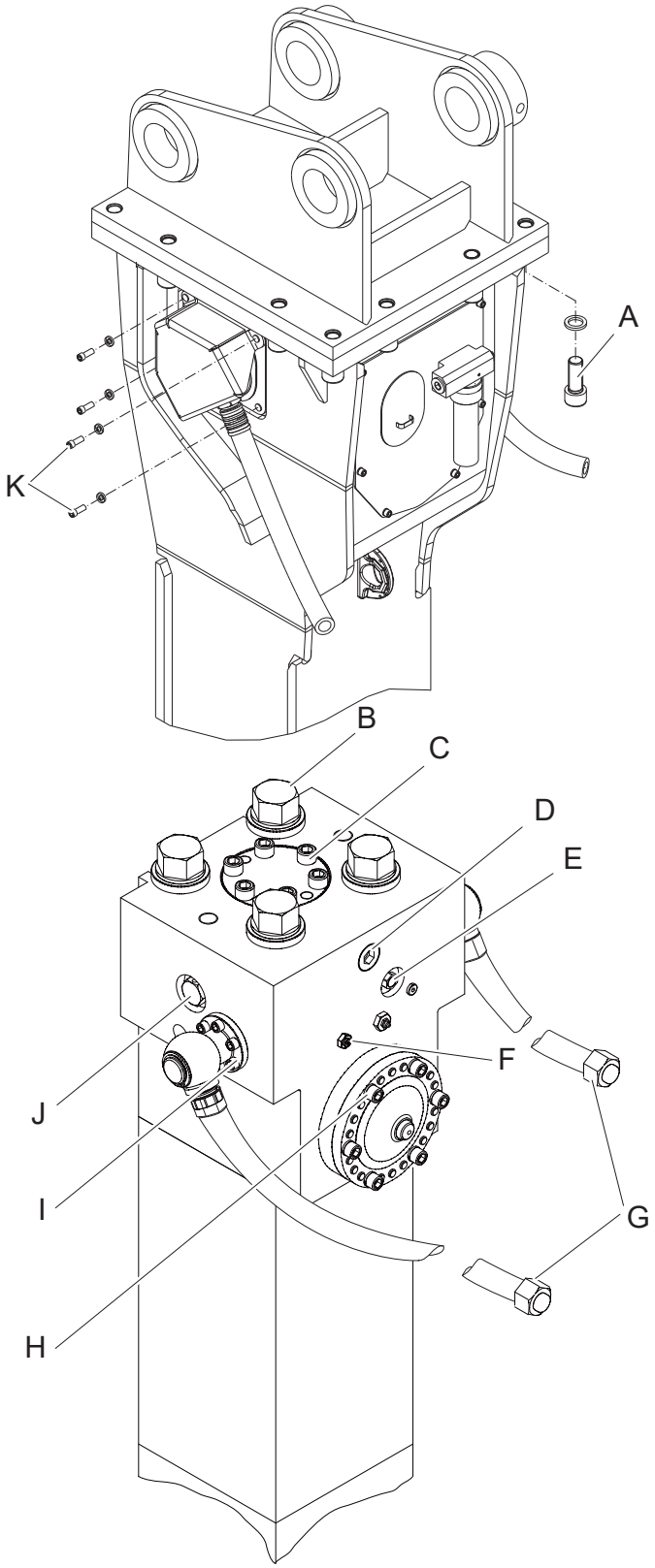
- Carry out this visual check whenever the hydraulic attachment has been removed from the carrier.
- Check the adapter plate bolts for excessive wear such as cracks, pitting or severe erosion.
- Rework or replace worn bolts.

7.17 Bolt connections / Tightening torques

The bolt connections of hydraulic breakers are subjected to very high loads.

- Tighten any loose connections without exceeding the recommended tightening torques.

Connection point		Interval	Type of spanner	HB 2000 HB 2000 DP	HB 2500 HB 2500 DP
				Size / Torque	
Adapter plate* (fastening screws)	A	daily	Allen key	22 mm (0.87 in.) 1500 Nm (1106 ft lbs)	
Tensioning bolts**	B	weekly visual check	torque spanner / power wrench	55 mm (2.17 in.)	65 mm (2.56 in.)
Cover for control mechanism / control mechanism (Allen screws / hexagon head screws)	C	in case of a repair	Allen key	17 mm (0.67 in.) 380 Nm (280 ft lbs)	
AutoControl System	D	in case of a repair	Allen key	22 mm (0.87 in.) 300 Nm (221 ft lbs)	
PowerAdapt	E	in case of a repair	socket spanner	24 mm (0.95 in.) 300 Nm (221 ft lbs)	
Filling valve »**G**« (threaded plug)	F	in case of a repair	socket spanner Allen key	22 mm (0.87 in.) 130 Nm (96 ft lbs) 5 mm (0.20 in.) 20 Nm (15 ft lbs)	
Ports »**P**« and »**T**«	G	weekly	open-ended wrench	55 mm (2.17 in.) 285 Nm (210 ft lbs)	
HP-accumulator (Fastening screws)	H	weekly	Allen key	14 mm (0.55 in.) 350 Nm (258 ft lbs)	
Flanges (Allen screws)	I	weekly	Allen key	10 mm (0.39 in.) 80 Nm (59 ft lbs)	
percussion chamber ventilation	J	in case of a repair	open-ended wrench	41 mm (1.31 in.) 200 Nm (148 ft lbs)	
Swivel joint covers (Allen screws)	K	daily	Allen key	10 mm (0.39 in.) 80 Nm (59 ft lbs)	
Hose connections ContiLube® II	-	weekly	Various open-ended spanners with different spanner sizes		
*	Apply anti-seize compound to the allen screw threads before inserting them. The contact faces of the screw head and the lock washers must not be lubricated.				
**HB 2000 **HB 2500	The tensioning bolt heads can be seen through the openings in the breaker box. 1. Pre-tighten the tensioning bolts to 500 Nm (367 ft lbs) crosswise, 2. retighten 120° (2 hexagons) crosswise, 3. retighten 150° (2.5 hexagons) crosswise				


A
K
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8 Troubleshooting

8.1 The hydraulic breaker does not start

Cause	Remedy	By
Pressure and tank lines swapped	Check the laying of the pressure and tank lines and connect correctly (see chapter **Making the hydraulic connections**)	Carrier driver
Shut-off valve in pressure and/or tank line closed	Check the shut-off valve and open	Carrier driver
Gas pressure in piston accumulator too high	Check the gas pressure in the piston accumulator and adjust it to the correct value (see chapter **Checking the pressure in the piston accumulator** and **Release the pressure from the piston accumulator**)	Carrier driver
Oil level in tank too low	Check the oil level and top up oil	Carrier driver
Defective couplings blocking pressure and tank lines	Check coupling and replace defective coupling halves	Workshop
Faults in the electrical system of the hydraulic breaker installation	Check the electrical system of the hydraulic breaker installation and clear faults	Workshop
Magnet on switch-on valve damaged	Replace the magnet	Workshop
Operating pressure too low	Check the carrier engine speed, the pump delivery and the pressure relief valve; check the operating pressure Adjust settings and replace defective parts if required	Carrier driver or Epiroc Customer Center / Dealer in your area
PowerAdapt active	Check the engine speed and/or mode stage of the carrier and lower as required (see chapter **PowerAdapt**)	Carrier driver

8.2 Hydraulic breaker operates too slowly

Cause	Remedy	By
Insufficient hydraulic oil delivery volume	Check the engine speed and/or mode stage of the carrier and the operation pressure and adjust	Carrier driver
The connecting fitting in the pressure and tank line has come loose	Check the connecting fitting and tighten	Carrier driver
Shut-off valve in pressure and/or tank line partly closed	Check the shut-off valve and open	Carrier driver
Flow resistance on oil filter or oil cooler too high	Check the oil filter and oil cooler, clean or renew them	Carrier driver
Gas pressure in piston accumulator too high	Check the gas pressure in the piston accumulator and release some gas if required (see chapter **Checking the pressure in the piston accumulator** and **Release the pressure from the piston accumulator**)	Carrier driver
Working tool jams in the lower breaker part	Correct the direction of the carrier boom. The pressing force must act in the axial direction of the hydraulic breaker. Check the shaft of the working tool and deburr if required.	Carrier driver

Cause	Remedy	By
	Check the working tool and the wear bush for wear and replace if required (see chapter **Checking the working tool** and **Checking the wear bushes and impact ring**)	
Inside diameter of tank line too small	Check the inside diameter and change if required Observe the minimum inside diameter! (see chapter **Technical specifications**)	Workshop
Return pressure too high	Check and lower the return pressure	Epiroc Customer Center / Dealer in your area
Hydraulic oil return to the tank via a valve section	Connect the hydraulic oil return circuit directly to the tank or filter	Carrier driver or Epiroc Customer Center / Dealer in your area
Diaphragm in high-pressure accumulator defective (Hose at port »**P**« is flailing about wildly)	Replace the high-pressure accumulator Observe the national safety regulations!	Workshop
Hydraulic oil temperature in the tank higher than 80 °C (176 °F)	Check the oil level in the hydraulic tank and top up if required	Carrier driver
Hydraulic oil pressure too low	Check the pressure; adjust as required; Fit new type-tested pressure relief cartridges where necessary	Workshop

8.3 Impact force too low

Cause	Remedy	By
Gas pressure too low	Check the gas pressure and fill the piston accumulator (see chapter **Filling / topping up the piston accumulator**)	Carrier driver
The pump of the hydraulic installation does not deliver sufficient oil	Check the pump characteristic with a measuring device and compare it to the original details; renew the pump if required	Checking: Epiroc Customer Center / Dealer in your area Replacing: by carrier manufacturer's customer service

8.4 Impact rate too high and impact force too low

Cause	Remedy	By
No gas in piston accumulator	Check the gas pressure and fill the piston accumulator (see chapter **Filling / topping up the piston accumulator**)	Carrier driver
O-rings defective	Replace O-rings	Workshop

8.5 Oil leaks from ports »P« und »T«

Cause	Remedy	By
Cap nuts loose	Check the cap nuts and tighten (see chapter **Bolt connections / Tightening torques**)	Carrier driver

Cause	Remedy	By
Hose connection CL to port »**P**« for ContiLube® II or the plug is loose and ContiLube® II has not been installed	Check the cap nuts and tighten Check the plugs and tighten (see chapter **Bolt connections / Tightening torques**)	Carrier driver

8.6 Oil escapes between the cylinder cover and the cylinder

Cause	Remedy	By
Tensioning bolts are loose	Check the tensioning bolts and tighten (see chapter **Bolt connections / Tightening torques)**	Workshop
Seals damaged	Replace the seals	Workshop

8.7 Oil escapes from parts of the hydraulic breaker installation (connecting fittings, hoses etc.)

Cause	Remedy	By
Connecting fittings are loose; flange connections to the valve are loose	Check the connecting fittings and tighten; replace any defective parts if required (see chapter **Bolt connections / Tightening torques**) Check the hydraulic breaker installation and replace any damaged parts Only use original parts!	Carrier driver or workshop

8.8 Oil escapes from the working tool

Cause	Remedy	By
Lower piston seal defective	Dismantle the hydraulic breaker Replace the seals	Workshop

8.9 Oil escapes from the high pressure accumulator

Cause	Remedy	By
The fastening screws of the high pressure accumulator are loose	Replace O-ring and back-up ring Tighten the fastening screws (see chapter **Bolt connections / Tightening torques**)	Workshop
Connecting screws of lower and upper shell are loose or broken	Replace the HP- accumulator Observe the national safety regulations	Workshop

8.10 Oil or grease escapes from the ContiLube® II

Cause	Remedy	By
Connecting fittings are loose	Check the connecting fittings and tighten (see chapter **Bolt connections / Tightening torques**)	Workshop

8.11 Operating temperature too high

Cause	Remedy	By
Oil level in tank too low	Check the oil level and top up oil	Carrier driver or workshop
Carrier pump delivery too high; a constant volume of oil is squirted out of the pressure relief valve	Check carrier engine speed and lower	Carrier driver
	Check carrier settings and adjust	Epiroc Customer Center / Dealer in your area
Operation in high outside temperature without oil cooler	Check oil temperature and install an oil cooler if required	Workshop or Epiroc Customer Center / Dealer in your area
Pressure relief valve defective or valve with poor characteristic	Fit new type-tested pressure relief cartridges or a more precise pressure-limiting valve	Workshop

8.12 Pressure line »P« flails violently

Cause	Remedy	By
There is a problem with the HP-accumulator operation	Immediately stop the hydraulic breaker. The HP-accumulator needs to be checked by a professional	Workshop

9 Repair

⚠ WARNING Risk of injury

Nonprofessional disassembly and assembly of the hydraulic breaker may lead to serious injury and property damage.

- ▶ Never pull the percussion unit out of the breaker box. Dismounting the percussion unit is only permitted if carried out by professionals trained by Construction Tools GmbH. These professionals must follow all safety instructions and guidelines for repair.
- ■ For technical support contact the Epiroc Customer Center / Dealer in your area.

9.1 Sending in the hydraulic attachment for repairs

NOTICE Mixed hydraulic oil

Never mix mineral and non-mineral hydraulic oils! Even small traces of mineral oil mixed in with non-mineral oil can result in damage to both the hydraulic attachment and the carrier. Non-mineral oil loses its biodegradability.

- ▶ Only use one type of hydraulic oil.
- ■ Always specify which hydraulic oil has been used when sending in the hydraulic attachment to have it repaired.

10 Storage

⚠ WARNING Hydraulic breaker / working tool fall

The hydraulic breaker and the working tool are heavy. If they topple over or fall down from where they are stored, injury may be the result.

▶ Store the hydraulic breaker and the tool so that they cannot topple over or fall down.

10.1 Hydraulic breaker

The hydraulic breaker must be stored in an upright position to avoid its seals being damaged.

10.1.1 Short storage

Proceed as follows in the case of storage for less than eight weeks:

- Remove the hydraulic breaker from the carrier (see chapter **Removing the hydraulic attachment from the carrier**).
- Store the hydraulic breaker in a dry, properly ventilated room.
- If you can only store the hydraulic breaker in the open air, cover it with plastic sheeting or tarpaulins to protect it against the weather.
- Store the hydraulic breaker in an upright position and so that it cannot topple over.

10.1.2 Long storage

Proceed as follows if storage is expected to be for more than eight weeks:

- Remove the hydraulic breaker from the carrier (see chapter **Removing the hydraulic attachment from the carrier**).
- Remove the working tool (see chapter **Working tool/ Removal**).
- Grease the working tool with chisel paste to prevent it corroding.
- Grease the wear bushes.
- Depressurise the piston accumulator (see chapter **Release the pressure from the piston accumulator**).
- Leave the filling hose in the filling valve to let the gas escape.

NOTICE Environmental damage due to hydraulic oil

Hydraulic oil is environmentally harmful and must not penetrate the ground or enter the water table or water supplies.

▶ Collect any hydraulic oil which escapes.
▶ Dispose of it in accordance with the applicable environmental regulations.

Oil may escape when pushing the percussion piston up.

- Remove the covers from the connection hoses.
- Slide the percussion piston into its upper stroke position.
- Slide the percussion piston retainer into the aperture for the working tool.
- Install the retainer bar.

The percussion piston has now been locked in its upper stroke position.

- Remove the filling hose from the filling valve.
- Seal the connection hoses with the covers.
- Seal the aperture for the working tool with the protective cap.
- Pull the filling hose out of the filling valve.
- Store the hydraulic breaker in a dry, properly ventilated room.
- Store the hydraulic breaker in an upright position and so that it cannot topple over.
- Prior to reuse the hydraulic breaker follow the instructions as described in the chapter **Initial operation and operation after long storage**.

10.1.3 How to proceed after more than twelve months‘ storage

⚠ WARNING Risk of injury

Nonprofessional disassembly and assembly of the hydraulic breaker may lead to serious injury and property damage.

▶ Never pull the percussion unit out of the breaker box. Dismounting the percussion unit is only permitted if carried out by professionals trained by Construction Tools GmbH. These professionals must follow all safety instructions and guidelines for repair.

The following measures are required to prevent premature hydraulic breaker failure, after it has been stored for over twelve months:

- Contact the Epiroc Customer Center / Dealer in your area.
- Professionals trained by Construction Tools GmbH will disassemble the hydraulic breaker properly and:
  - check any parts liable to corrosion (percussion piston, cylinder, control) for corrosion damage.
  - rework or replace corroded parts.
  - replace all sealing elements.

10.2 Working tool

- Grease the working tool with chisel paste to prevent it from corroding.
- Store the working tool in a dry, properly ventilated room.
- Store the working tool so that it cannot topple over or roll down.

10.3 Grease cartridges

⚠ WARNING Fire and harmful vapors

Chisel paste can burn and cause serious fire. Harmful vapors are generated when chisel paste is burnt.

- ▶ Never store grease cartridges near fire-propagating or self-igniting substances.
- ▶ Do not expose the grease cartridges to direct sunlight.
- Store the grease cartridges in a cool, properly ventilated room.

11 Disposal

NOTICE Environmental damage due to consumables

Hydraulic oil and chisel paste are environmentally harmful and must not penetrate the ground or enter the water table or water supplies.

▶ Collect any such consumables which may escape.
▶ Dispose of them in accordance with the applicable environmental regulations.

11.1 Hydraulic breaker

- Remove the hydraulic breaker from the carrier (see chapter **Removing the hydraulic attachment from the carrier**).
- Release the gas from the piston accumulator (see chapter **Release the pressure from the piston accumulator**).
- Remove the working tool (see chapter **Working tool/ Removal**).
- Remove the adapter plate (see chapter **Removing the adapter plate**).
- Remove the hydraulic hoses from the hydraulic breaker.
- Clean the hydraulic breaker (see chapter **Cleaning**).
- Before disposal the HP-accumulator must be depressurised. This must be done by an authorized person. Contact the Epiroc Customer Center / dealer in your area.
- Dispose of the hydraulic breaker in line with all applicable regulations or consult an authorised and specialised recycling company.

11.2 Hydraulic hoses

- Drain the hydraulic oil from the hydraulic hoses and collect it.
- Dispose of the hydraulic hoses in accordance with the applicable regulations to avoid environmental hazards.

11.3 Hydraulic oil

- Collect any hydraulic oil that escapes.
- Dispose of it in accordance with the applicable environmental regulations.

11.4 Chisel paste and grease cartridges

- Dispose of chisel paste and not completely emptied grease cartridges in accordance with the applicable regulations.
- Completely emptied grease cartridges can be recycled.

12 Technical specifications

	HB 2000, HB 2000 DP	HB 2500, HB 2500 DP
Carrier weight class[1)]	22 - 38 t (48500 - 84000 lbs)	27 - 46 t (59500 - 101000 lbs)
Service weight[2)]	2000 kg (4400 lbs)	2500 kg (5500 lbs)
Delivery weight (Standard version)[4)]	1638 kg (3610 lbs)	2050 kg (4520 lbs)
Delivery weight (DustProtector version)[4)]	1714 kg (3780 lbs)	2112 kg (4660 lbs)
Oil flow rate	150 - 190 l/min (39.6 - 50.2 gal/min)	170 - 220 l/min (44.9 - 58.1 gal/min)
Operating pressure	160 - 180 bar (2320 - 2610 psi)	
Impact rate	AutoControl 300 - 625 blows/min	AutoControl 280 - 580 blows/min
Working tool diameter	145 mm (5.71 in.)	155 mm (6.10 in.)
Working length of working tool (Standard version)	635 mm (25 in.)	640 mm (25 in.)
Working length of working tool (DustProtector version)	570 mm (22 in.)	600 mm (24 in.)
Max. hydraulic input power	57 kW (76.4 hp)	66 kW (88.5 hp)
Back pressure acceptance[8)]	30 bar (435 psi)	
Gas pressure HP- accumulator (20 °C)	60 bar (870 psi)	
Air pressure (min. gauge pressure in percussion chamber)[5)]	1.5 bar (22 psi)	
Air flow (up to depth of 10 meters (33 ft))[6)]	4 m^3/min (141 cfm)	
Max static pressure (pressure relief valve on carrier)	200 bar (2900 psi)	
Piston accumulator gas pressure (min, at operating temperature 60-70 °C)[7)]	12.3 bar (178 psi)	11.6 bar (168 psi)
Piston accumulator gas pressure (max (optimum), at operating temperature 60-70 °C)[7)]	14.8 bar (215 psi)	15.1 bar (219 psi)
Hose inside diameter **»P«**	25 mm (1 in.)	
Hose inside diameter **»T«**	25 mm (1 in.)	
Start up mode	IPS	

[1)] Weights apply to standard carriers only. Any variances must be agreed with Epiroc and / or the carrier manufacturer prior to attachment

[2)] Hydraulic breaker incl. breaker box, working tool and adapter plate of medium size. Please note that the service weight can be considerably higher, depending on the adapter plate.

[4)] Hydraulic breaker, breaker box and ContiLube® II without working tool and adapter plate

[5)] Air pressure at pressure regulator has to be adjusted to 1.5 bar (22 psi) plus 0.1 bar per meter depth (0.5 psi per ft depth)

[6)] Air flow for depth of more than 10 meters (33 ft): Flow = 0.1 x depth [m] x flow up to 10 meters [m^3/min] (0.0305 x depth [ft] x flow up to 33 ft [cfm])

[7)] Hydraulic breaker in horizontal position, no pressure applied to working tool

[8)] Back pressure acceptance when breaker still runs regular but at significant reduced performance (oil flow)

12.1 Noise declaration statement

	HB 2000, HB 2000 DP	HB 2500, HB 2500 DP
Sound pressure [1] dB(A)	91	92
Sound power [2] dB(A)	120	121

[1] Sound pressure level according to EN ISO 3744 in accordance with directive 2000/14/EC at 10 metres distance. [2] Guaranteed sound power according to EN ISO 3744 in accordance with directive 2000/14/EC inclusive spread in production.

These declared values were obtained by laboratory type testing in accordance with the stated directive or standards and are suitable for comparison with the declared values of other tools tested in accordance with the same directive or standards. These declared values are not adequate for use in risk assessments and values measured in individual work places may be higher. The actual exposure values and risk of harm experienced by an individual user are unique and depend upon the way the user works, in what material the breaker is used, as well as upon the exposure time and the physical condition of the user, and the condition of the breaker.

We, Construction Tools GmbH, cannot be held liable for the consequences of using the declared values, instead of values reflecting the actual exposure, in an individual risk assessment in a work place situation over which we have no control.

13 EC Declaration of Conformity (EC Directive 2006/42/EC)

We, Construction Tools GmbH, hereby declare that the machines listed below conform to the provisions of EC Directive 2006/42/EC (Machinery Directive) and 2000/14/EC, ANNEX V (Noise Directive) and 2014/68/EU (Pressure Equipment Directive), and the harmonised standards mentioned below.

Hydraulic Breaker	Guaranteed sound power level [dB(A)]	Measured sound power level [dB(A)]
HB 2000	120	119
HB 2000 DP	120	119
HB 2500	121	120
HB 2500 DP	121	120

Following harmonised standards were applied:

- EN ISO 12100
- EN ISO 3744

Technical Documentation authorised representative:

Stephan Schröer

Construction Tools GmbH

45143 Essen

Germany

Authorised Representative:

see respective separate original EC declaration of conformity

Manufacturer:

Construction Tools GmbH

45143 Essen

Germany

Epiroc

epiroc.com

APPENDIX D2: LUBRICATION PUMP

Pump unit

P 653 M

Description

The compact P 653 M automatic lubrication pump consists of a housing with integrated motor, reservoir with stirring paddle, pump element with pressure-relief valve, filling nipple and electrical connection parts. It can drive up to three pump elements and operates according to a customer-supplied, external control unit (pause and lubrication times). Versatile and economical, this pump can be enhanced with low-level control that enables control of lubrication cycles. The P 653 M can supply up to 100 lubrication points, depending on line length.

Features and benefits

- Reservoir size up to 100 l *(26.4 gal)* available
- Powerful and robust pump
- Drives up to three pump elements
- C5M corrosion protection available
- CE, UL/CSA certified
- Pump elements could be internally combined to one outlet

Applications

- Wind energy systems
- Construction
- Renewable energies
- Etc.

Technical data

Function principle	electrically operated piston pump
Operating temperature	-40 to +70 °C; *-40 to +158 °F*
Operating pressure	350 bar; *5 075 psi*
Lubricant	grease: up to NLGI 2
Outlets	up to 3 pump elements
Metering quantity	depending on pump element; 8 cm^3/min; *0.48 in^3/min*
Lubricant output [1]	max. 24 cm^3/min; *1.44 in^3/min*
Reservoir	4, 8, 10, 15, 20, 30 [2], 40 [2] and 100 [2] l; *1.05, 2.11, 2.64, 3.96, 5.28, 7.92 [2], 10.56 [2] and 26.4 [2] gal*
Connection main line	G $^1/_4$
Operating voltage	90-264 V AC, 50/60 Hz; 24 V DC
Protection class	IP 6K 9K
Approvals	UL/CSA, CE
Dimensions	min. 240 × 235 × 415 mm max. 500 × 500 × 1 064 mm *min. 9.45 × 9.25 × 16.94 in* *max. 19.69 × 19.69 × 41.89 in*
Mounting positions:	
with stirring paddle	reservoir upside
with follower plate	any

1) with internally combined three pump elements to one outlet
2) reservoir made from steel without follower plate

NOTE
Further technical information, technical drawings, accessories, spare parts or product function descriptions are available on SKF.com/lubrication:
16797 EN

Pump unit

P 653 M

Identification code P653M [ ] [ ] [ ] [ ] [ ] – [ ] – [ ] – [ ] [ ] . [ ]

Product design

Corrosion protection class
_ = C3
X = C5-M

Approval
_ = CE
U = UL/CSA

Reservoir capacities
4 = plastic, transparent, 4 l; *1.05 gal*
8 = plastic, transparent, 8 l; *2.11 gal*
10 = plastic, transparent, 10 l; *2.64 gal*
15 = plastic, transparent, 15 l; *3.96 gal*
20 = plastic, transparent, 20 l; *5.28 gal*
30 = metal, 30 l; *7.92 gal*
40 = metal, 40 l; *10.56 gal*
100 = metal, 100 l; *26.4 gal*

Reservoir type
XN = grease reservoir without low-level indication (for metal reservoirs only)
XL = grease reservoir with low-level indication [2] (for metal reservoirs only)
XNBO = grease reservoir without low-level indication and refilling from top (for plastic reservoirs only)
XLBO = grease reservoir, with low-level indication and refilling from top (for plastic reservoirs only)
XLF = plastic, grease reservoir with empty message and follower plate [1] (for plastic reservoirs only)

Pump elements
... = without pump elements
1K7 = 8,0 cm³/min; *0.48 in³/min* (single pump element)
2K7 = 2 × 8,0 cm³/min; *0.48 in³/min* (2 outlets)
3K7 = 3 × 8,0 cm³/min; *0.48 in³/min* (3 outlets)
2Z7 = 16 cm³/min; *0.96 in³/min* (2 pump elements combined in one outlet)
3Z7 = 24 cm³/min; *1.44 in³/min* (3 pump elements combined in one outlet)

Power supply
24 = 24 V DC
AC = 90-264 V AC; 50/60; Motor 24 V DC

Electric connections
1A = DC Bayonet plug, 7-pole for power supply DC and low-level control (XLBO)
1A = AC Square-type plug for power control (XLF) [1]
2A = AC Square-type plug for power supply, Bayonet plug 4-pole for low-level control (XLBO)

Type of connection
1 = square-type plug
7 = bayonet plug 7/7-pole [2]

Connection outside of the pump
01 = with junction box, without cable
16 = bayonet socket with 10 m cable, 7-wire

1) With follower plate pumps, the empty signal can be picked up at the top of the cube plug (container lid). 30 and 100 l reservoirs without follower plate.
2) Only with connection 1A7

Pump element

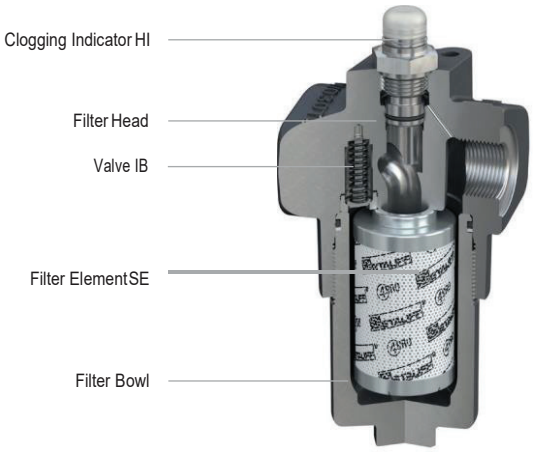
Order number	Description	Metering quantity	
		cm³/stroke	*in³/stroke*
645-29873-1	pump element K7, corrosion class C3 incl. sealing ring	0,246	*0.015*
645-77196-1	outlet combinable pump element Z7, corrosion class C3 incl. sealing ring	0,246	*0.015*
645-77734-1	pump element K7, corrosion class C5M incl. sealing ring	0,246	*0.015*
645-77625-1	outlet combinable pump element Z7, corrosion class C5M incl. sealing ring	0,246	*0.015*

Pressure relief valve

Order number	Designation	Opening pressure		Connection
		bar	*psi*	∅ mm
624-29056-1	SVET-350-G1/4A-D6	350	*5 075*	6
624-29054-1	SVET-350-G1/4A-D8	350	*5 075*	8

APPENDIX D3: PRESSURE FILTER

High Pressure Filters ▪ Type SF



Product Description

STAUFF SF series High Pressure Filters are designed for in-line hydraulic applications, with a maximum operating pressure of 420 bar / 6000 PSI. Used together with STAUFF SE series Filter Elements, a high efficiency of contaminant removal is assured. The high dirt-hold capacity of the elements ensures long service life and, as a result, reduced maintenance costs.

Technical Data

Construction
- Designed for in-line assembly, with threaded mounting holes on top of the head.

Materials
- Filter head: Spheroidal Graphite Cast Iron
- Filter bowl: Cold Drawn Steel
- O-rings: NBR (Buna-N®)
  FKM (Viton®)
  EPDM (Ethylene-Propylene-Diene-Monomer-Rubber)
- Support ring: PTFE (Polytetrafluoroethylene)

Port Connections
- BSP
- NPT
- SAE O-ring thread
- SAE 3000 PSI (Code 61) flange
- SAE 6000 PSI (Code 62) flange

Other port connections available on request.

Operating Pressure
- Max. 420 bar / 6000 PSI

Burst Pressure
- Min. 1260 bar / 18275 PSI

Temperature Range
- -10 °C ... +100 °C / +14 °F ... +212 °F

Filter Elements
- Specifications see page 40

Media Compatibility
- Mineral oils, other fluids on request

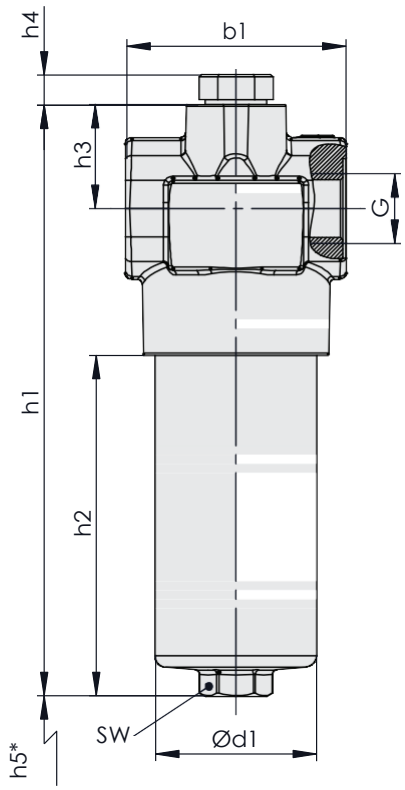
Options and Accessories

Valves
- Bypass valve: Allows unfiltered oil to bypass the contaminated element once the opening pressure has been reached, a differential pressure of $6^{+0,5}$ bar / $87^{+7.25}$ PSI Δp is the standard setting. Other settings available upon request.
- Reverse flow valve: Allows reverse flow through the filter head without backflushing the element.
- Non-return valve: Prevents draining of the delivery line during element change.
- Multi-function valve: Opening pressure $6^{+0,5}$ bar / $87^{+7.25}$ PSI
  Bypass, reverse flow capability and non-return valve combined in one valve.

Clogging Indicators
- Standard actuating pressure: $5_{-0,5}$ bar / $72.5_{-7.25}$ PSI Δp
  Other actuating pressure settings are available upon request.
- Available indicators: Visual
  Electrical
  Visual-electrical (24 V DC, 110 V AC, 230 V AC versions)
  Double Visual-electrical (24 V DC)

High Pressure Filters ▪ Type SF

C



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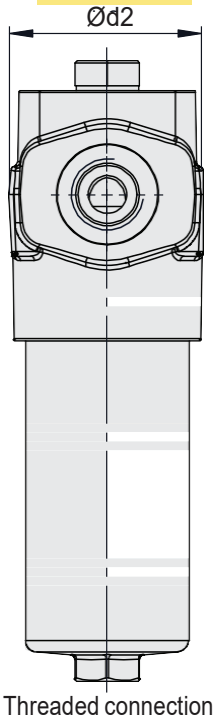
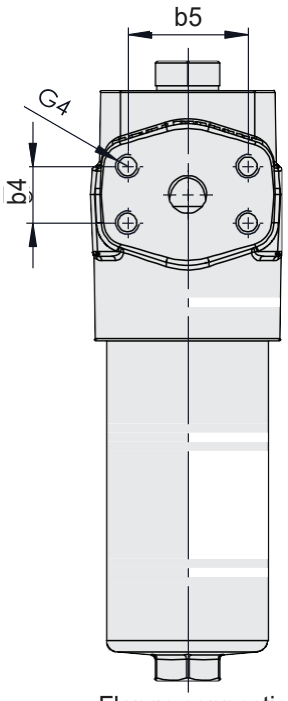
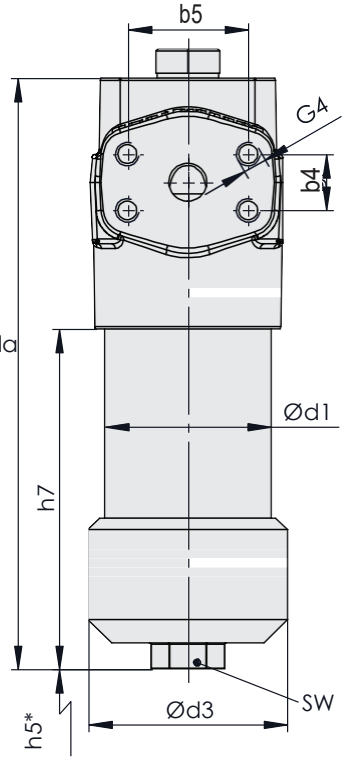


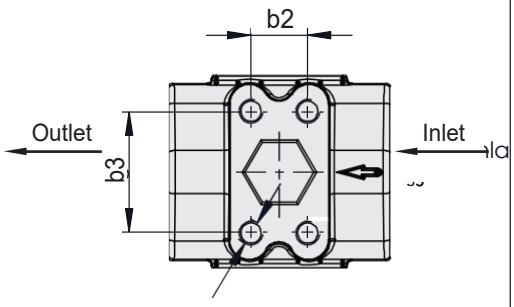
Threaded connection



Flange connection

SF-250...300

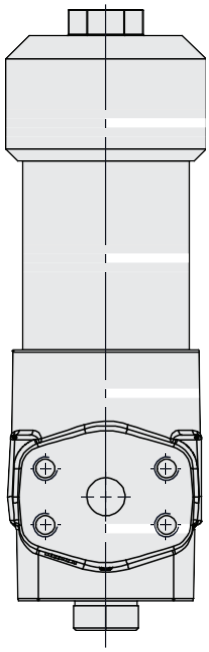




G2: for BSP threads and metric flanges

G3: for NPT- and SAE-threads and for UNC-flanges

~~**Toploader**~~
~~**SF-014...300..TL**~~



Filter with filterbowl in two-part style for element change from the top

* recommended space for element change

High Pressure Filters ▪ Type SF

Thread Connection G	Filter Size SF 014	030	045	070	125	090	130	160	250	300
BSP	3/4	3/4	1-1/4	1-1/4	1-1/4	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2
NPT	3/4	3/4	1-1/4	1-1/4	1-1/4	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2
SAE O-ring Thread	1-1/16–12	1-1/16–12	1-5/8–12	1-5/8–12	1-5/8–12	1-7/8–12	1-7/8–12	1-7/8–12	1-7/8–12	1-7/8–12
SAE Flange 3000 PSI	3/4	3/4	1-1/4	1-1/4	1-1/4	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2
SAE Flange 6000 PSI	3/4	3/4	1-1/4	1-1/4	1-1/4	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2
Weight (kg/lbs) incl. Elements with Filter Bowl in One-Part Style	5	5,9	10,3	12	-	27	30,2	35,5	-	-
	11	13	22.7	26.5	-	59.9	66.6	78.3	-	-
Weight (kg/lbs) incl. Elements with Filter Bowl in Two-Part Style	5,6	6,6	12,2	13,7	20	32	-	39,3	49	57,3
	12.3	14.6	26.9	30.2	44.1	70.5	-	86.5	108	126.3

Dimensions (mm/in)		Filter Size SF 014	030	045	070	125	090	130	160	250	300
b1		93	93	126	126	126	178	178	178	178	178
		3.66	3.66	4.96	4.96	4.96	7.01	7.01	7.01	7.01	7.01
d2		81	81	120	120	120	159	159	159	159	159
		3.19	3.19	4.72	4.72	4.72	6.26	6.26	6.26	6.26	6.26
h3		44	44	44,5	44,5	44,5	72	72	72	72	72
		1.73	1.73	1.75	1.75	1.75	2.84	2.84	2.84	2.84	2.84
h4		12,5	12,5	12,5	12,5	12,5	12,5	12,5	12,5	12,5	12,5
		.49	.49	.49	.49	.49	.49	.49	.49	.49	.49
with Filter Bowl in One-Part Style Type SF	d1	68	68	95	95	-	130	130	130	130	130
		2.68	2.68	3.74	3.74	-	5.12	5.12	5.12	5.12	5.12
	h1	184	250	233,5	292	-	323	416	494	-	-
		7.24	9.84	9.19	11.51	-	12.72	16.38	19.45	-	-
	h2	78	144	102,5	161,5	-	148	241	319	-	-
		3.07	5.67	4.03	6.35	-	5.83	9.5	12.56	-	-
	h5 rec.*	100	170	140	200	-	190	290	360	-	-
		3.94	6.69	5.51	7.87	-	7.48	11.42	14.17	-	-
	h5 min.*	85	85	120	120	-	150	150	150	-	-
		3.35	3.35	4.72	4.72	-	5.91	5.91	5.91	-	-
	Hex	27	27	32	32	-	36	36	36	36	36
		1.06	1.06	1.26	1.26	-	1.42	1.42	1.42	1.42	1.42
with Filter Bowl in Two-Part Style Type SF...TL	d1	70	70	101,6	101,6	101,6	133	-	133	133	133
		2.76	2.76	4	4	4	5.24	-	5.24	5.24	5.24
	d3	84	84	115	115	115	155	-	155	155	155
		3.31	3.31	4.53	4.53	4.53	6.10	-	6.10	6.10	6.10
	h5	65	130	100	160	340	120	-	290	425	590
		2.56	5.12	3.94	6.30	13.39	4.72	-	11.42	16.73	23.23
	h6	184	250	234	294	475	329,5	-	500,5	656,5	821,5
		7.27	9.84	9.21	11.57	18.7	12.97	-	19.71	25.85	32.34
	h7	78	144	103	163	344	154,5	-	325,5	481,5	646,5
		3.07	5.67	4.06	6.42	13.54	6.08	-	12.82	18.96	25.45
	Hex	27	27	32	32	32	36	-	36	36	36
		1.06	1.06	1.26	1.26	1.26	1.42	-	1.42	1.42	1.42
Dimensions SAE Flange 3000 PSI	b4	22,3	22,3	30,2	30,2	30,2	35,7	35,7	35,7	35,7	35,7
		.88	.88	1.87	1.87	1.87	1.41	1.41	1.41	1.41	1.41
	b5	47,6	47,6	58,7	58,7	58,7	69,9	69,9	69,9	69,9	69,9
		1.19	1.19	2.32	2.32	2.32	2.75	2.75	2.75	2.75	2.75
	G4	M10 x 15	M10 x 15	M10 x 18			M12 x 20				
		3/8–16 UNC	3/8–16 UNC	7/16–14 UNC			1/2–13 UNC				
Dimensions SAE Flange 6000 PSI	b4	23,8	23,8	31,8	31,8	31,8	36,5	36,7	36,7	36,7	36,7
		.94	.94	1.25	1.25	1.25	1.44	1.45	1.45	1.45	1.45
	b5	50,8	50,8	66,6	66,6	66,6	79,3	79,4	79,4	79,4	79,4
		2.00	2.00	2.62	2.62	2.62	3.12	3.13	3.13	3.13	3.13
	G4	M10 x 15		M14 x 17			M16 x 20				
		3/8–16 UNC		1/2–13 UNC			5/8–11 UNC				

Reference: rec.*: Recommended | min.*: Minimum

Dimensions (mm/in)		Filter Size SF 014	030	045	070	125	090	130	160	250	300
T	b2	23,8	23,8	31,6	31,6	31,6	36,7	36,7	36,7	36,7	36,7
		.94	.94	1.24	1.24	1.24	1.45	1.45	1.45	1.45	1.45
	b3	50,8	50,8	66,7	66,7	66,7	79,4	79,4	79,4	79,4	79,4
		2.00	2.00	2.63	2.63	2.63	3.13	3.13	3.13	3.13	3.13
	G2	M10 x 15		M14 x 17			M16 x 20				
	G3	3/8–16 UNC x .59		1/2–13 UNC x .79			5/8–11 UNC x .79				
TH (optional)	b2	32	32	35	35	35	60	60	60	60	60
		1.26	1.26	1.38	1.38	1.38	2.36	2.36	2.36	2.36	2.36
	b3	56	56	85	85	85	115	115	115	115	115
		2.20	2.20	3.35	3.35	3.35	4.53	4.53	4.53	4.53	4.53
	G2	M6 x 9		M10 x 15			M12 x 20				
	G3	1/2–28 UNF x .35		3/8–24 UNF x .59			1/2–20 UNF x .79				

C

High Pressure Filter Housings / Complete Filters ▪ Type SF

SF - 014 - G - 10 - B - T - ☐ G12 - IB - P T 230 - TL / X☐

a b c d e f g h i j k l m

a Type

High Pressure Filter	SF

b Group

Flow	Size
60 l/min / 14 US GPM	014
110 l/min / 30 US GPM	030
160 l/min / 45 US GPM	045
240 l/min / 70 US GPM	070
330 l/min / 90 US GPM	090
475 l/min / 125 US GPM	125
500 l/min / 132 US GPM	130
660 l/min / 160 US GPM	160
990 l/min / 250 US GPM	250
1135 l/min / 300 US GPM	300

Note: Exact flow will depend on the selected filter element.
For technical data please see pages 57 / 58.

c Filter Material

Material	max. Δp*collapse	Micron ratings available	Code
Without filter element	-	-	0
Inorg. glass fibre	25 bar / 363 PSI	3, 5, 10, 20	G
Inorg. glass fibre	210 bar / 3045 PSI		H
			A
Stainless mesh	30 bar / 435 PSI	25, 50, 100, 200	S

Note: * Collapse/burst resistance as per ISO 2941.

d Micron Rating

3 µm	03
5 µm	05
10 µm	10
20 µm	20
25 µm	25
50 µm	50
100 µm	100
200 µm	200

Note: Other micron ratings on request.

e Sealing Material

NBR (Buna-N®)	B
FKM (Viton®)	V
EPDM	E

Note: Other sealing materials on request.

f Connecting Flange

Type T	T
Type TH (optional)	TH

g Connection Style

Connection Style	Thread Style	Group 014 030	Code	Group 045 070 125	Code	Group 090 130 160 250 300	Code
BSP	-	3/4	G12	1-1/4	G20	1-1/2	G24
BSP	-	1	G16	1-1/2	G24	-	-
NPT	-	3/4	N12	1-1/4	N20	1-1/2	N24
SAE O-ring Thread	-	1-1/16–12	U12	1-5/8–12	U20	1-7/8–12	U24
SAE Flange 6000 PSI	metric	3/4	C612M	1-1/4	C620M	1-1/2	C624M
SAE Flange 6000 PSI	UNC	3/4	C612U	1-1/4	C620U	1-1/2	C624U
SAE Flange 3000 PSI	metric	3/4	C312M	1-1/4	C320M	1-1/2	C324M
SAE Flange 3000 PSI	UNC	3/4	C312U	1-1/4	C320U	1-1/2	C324U
SAE Flange 3000 PSI	metric	1	C316M	-	-	2	C332M
SAE Flange 3000 PSI	UNC	1	C316U	-	-	2	C332U

Note: Other port connections on request. Bold types identify preferred connection styles.

h Valve

Without integrated Bypass valve*	I0
Without valve	0
Integrated Bypass valve*	IB
Bypass valve	B
Reverse flow valve	R
Non-return valve	N
Multi-function valve	M

Note: * Valve Type IO and IB only available for Group size SF-014, SF-030, SF-045, SF-070 and SF-125

i Clogging Indicator

Without clogging indicator	0
Visual, with automatic reset	A
Visual, with manual reset	V
Electrical	E
Electrical, Deutsch plug	ED
Visual-electrical	P
Double Visual-electrical	D024

j Thermostop

Without thermostop	none
With thermostop	T

k Voltage (only for Code P)

24 V DC	024
110 V AC	110
230 V AC	230

l Style Filter Bowl

With bowl in one-part style	none
Toploader, with bowl in two-part style	TL

Note: Group size SF-250 and SF-300 only available in TL-version.
With drain plug available on request.
Group size SF-130 only available in one-part style.
Group size SF-125 only available in two-part style.

m Design Code

Only for information	X

Filter Elements ▪ Type SE

SE - 014 - G - 10 - B / X ☐

a b c d e f

a Type

Filter Element Series	SE

b Group

According to filter housing

c Filter Material

Material	max. Δp*collapse	Micron ratings available	Code
Inorganic glass fibre	25 bar / 363 PSI	3, 5, 10, 20	G
Inorganic glass fibre	210 bar / 3045 PSI		H
Stainless fibre	210 bar / 3045 PSI		A
Stainless mesh	30 bar / 435 PSI	25, 50, 100, 200	S

Note: * Collapse/burst resistance as per ISO 2941.

d Micron Rating

3 µm	03
5 µm	05
10 µm	10
20 µm	20
25 µm	25
50 µm	50
100 µm	100
200 µm	200

Note: Other micron ratings on request.

e Sealing Material

NBR (Buna-N®)	B
FKM (Viton®)	V
EPDM	E

Note: Other sealing materials on request.

f Design Code

Only for information	X

APPENDIX D4: RETURN FILTER

D

D

Description

STAUFF Return-Line Filters were designed as filters for tank-top mounting, tank-inside mounting or inline mounting. They filter the hydraulic oil before it flows back into the reservoir. This ensures that contamination arising in the components does not get into the tank. Return-Line filters maintain the targeted purity class like Pressure Filters. However, because of their arrangement, they do not fulfil the additional function of a protection filter. In contrast to a Pressure Filter, it only has to withstand low pressure levels.

The practical design of STAUFF Return-Line Filters enables quick assembly as well as easy exchange of the filter elements.

Media Compatibility

- Mineral oils, others on request

Options and Accessories

Valves

- Bypass valve integrated in the filter element (except STAUFF Return-Line Filter RTF)

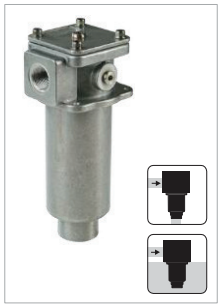
Clogging Indicators

- On request with visual clogging indicator or electrical clogging switch
- Others on request

Type RF

- Filter bowl with option of thread connection (e.g. STAUFF Diffuser SRV) or leakage oil connection

- Operating pressure: max. 16 bar / 232 PSI
- Nominal flow rate: max. 500 l/min / 130 US GPM
- Materials: Filter head: Aluminium, Filter bowl: PA
- Connections: BSP, NPT, SAE thread or SAE flange (ISO 6162-1)



Type RFA

- Filter bowl with option of thread connection (e.g. STAUFF Diffuser SRV) or leakage oil connection

- Operating pressure: max. 25 bar / 365 PSI
- Nominal flow rate: max. 110 l/min / 30 US GPM
- Materials: Filter housing: Aluminium
- Connection: SAE thread

Type RFB

- Low weight and compact design
- Filter bowl with option of thread connection
- Filter head with option of integrated air filter

- Operating pressure: max. 10 bar / 145 PSI
- Nominal flow rate: max. 185 l/min / 52 US GPM
- Materials: Filter head: Aluminium, Filter bowl: PA
- Connections: BSP, NPT, SAE thread

Type RFS and RFS-D

- Robust design, suitable for high flow rates
- Filter bowl with option of BSP or SAE flange

- Operating pressure: max. 25 bar / 365 PSI
- Nominal flow rate: max. 1135 l/min / 300 US GPM
- Materials: Filter head and bowl: Steel
- Connections: BSP or SAE flange (ISO 6162-1)

Type RTF

- Filter bowl is designed to return the oil beneath the surface thus preventing entrainment of air
- Filter head with option of integrated air filter

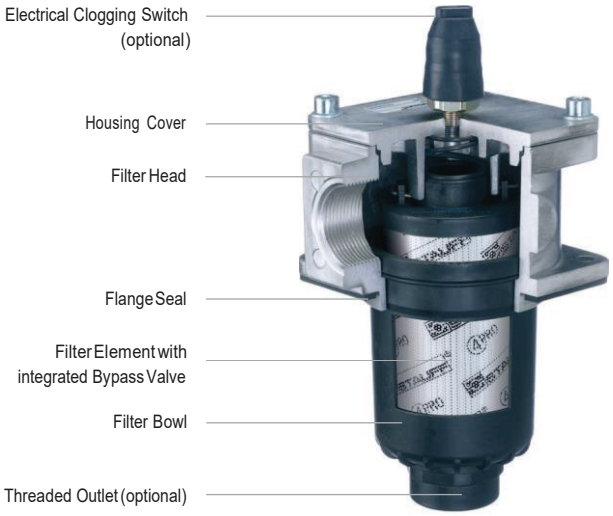
- Operating pressure: max. 10 bar / 49 PSI
- Nominal flow rate: max. 380 l/min / 100 US GPM
- Materials: Filter head: Aluminium, Filter bowl: PA or Steel
- Connection: BSP or NPT, others on request

Type RTF-N

- Return-Line insert filter
- Custom reservoir design with an in-tank filtering system
- Magnetic pre-filtration

- Operating pressure: max. 10 bar / 145 PSI
- Nominal flow rate: max. 500 l/min / 132 US GPM
- Materials: Flange plate: Aluminium, Magnet rod / Bypass / Diffuser: Steel

Return-Line Filters ▪ Type RF



D

Product Description

STAUFF RF Return-Line Filters are designed as tank top filters. They are mounted directly on the tank top and when 100% of the system's oil is filtered they provide the optimum removal of contaminant from the system. This provides the pump with clean oil thus reducing contaminant generated wear. The filter bowl is designed to return the oil beneath the surface thus preventing the entrainment of air by the returning oil. A high efficiency of contaminant removal is assured by using STAUFF RE Replacement Filter Elements. The high dirt-hold capacity of STAUFF Elements ensures a long service life and as a result reduced maintenance costs.

Technical Data

Construction
- Tank Top flange mounting

Materials
- Filter head: Aluminium
- Filter bowl: Glass Fibre reinforced Polyamide
- Sealings: NBR (Buna-N®)
  FKM (Viton®)
  EPDM (Ethylene-Propylene-Diene-Monomer-Rubber)
  Other sealing materials on request

Port Connections
- BSP
- NPT
- SAE O-ring thread
- SAE flange 3000 PSI

Operating Pressure
- Max. 16 bar / 232 PSI

Temperature Range
- -10 °C ... +100 °C / +14 °F ... +212 °F

Filter Elements
- Specifications see page 72

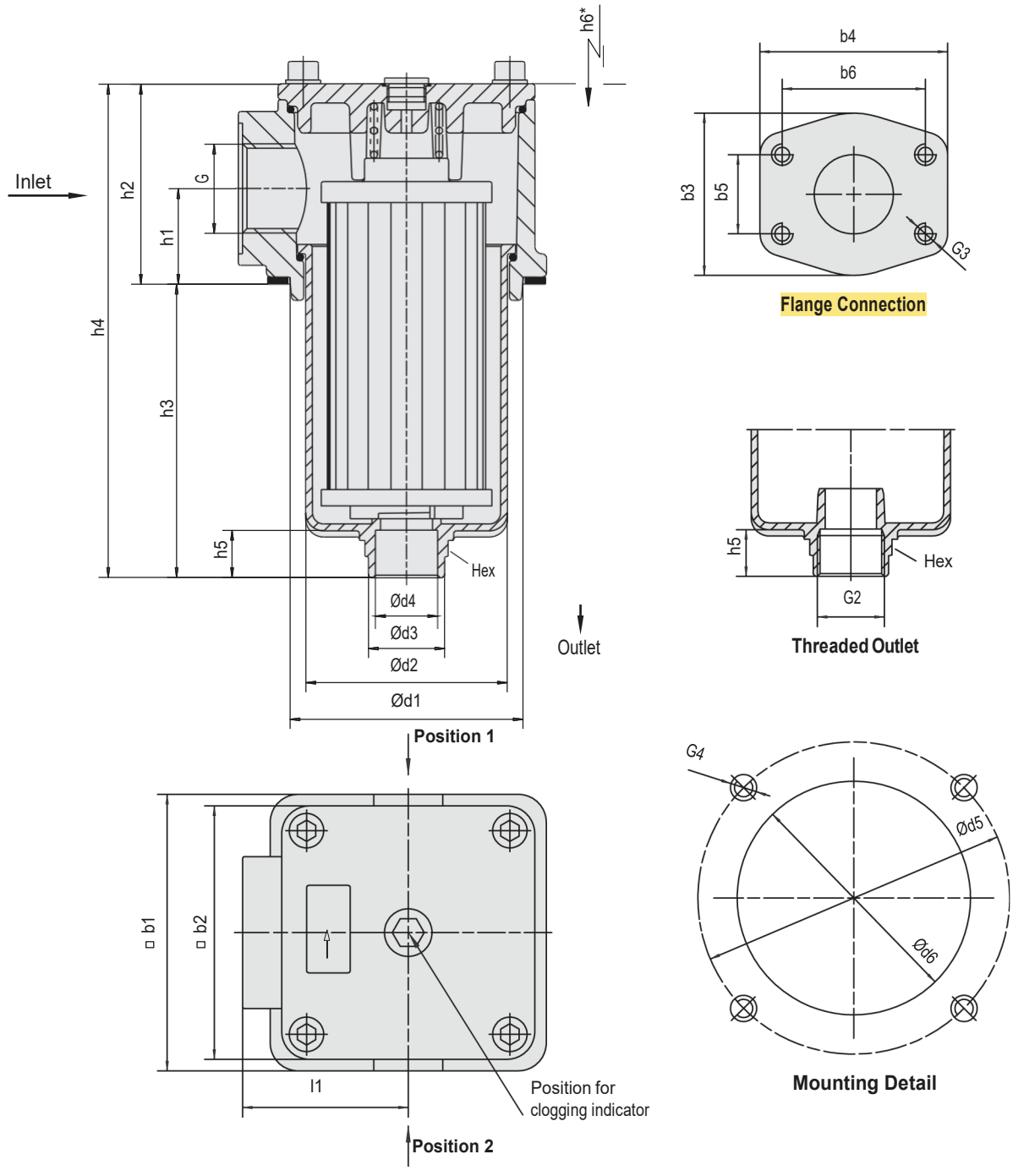
Media Compatibility
- Mineral oils, other fluids on request

Options and Accessories

Valve
- Bypass valve (integrated in the filter element): Opening pressure 3 bar ± 0,3 bar / 43.5 PSI ± 4.35 PSI
  Other settings available on request

Clogging Indicators
- For clogging indicator types please see page 73

Return-Line Filters ▪ Type RF



* recommended space for element change

Thread Connection G	Filter Size RF					
	014	030	045	070	090	130
BSP	3/4	1	1-1/4	1-1/2	2	2
NPT	3/4	1	1-1/4	1-1/2	2	2
SAE O-ring Thread	1-1/16–12	1-5/16–12	1-5/8–12	1-7/8–12	1-7/8–12	1-7/8–12
SAE Flange 3000 PSI	-	-	-	-	2	2

Dimensions (mm/in)	Filter Size RF					
	014	030	045	070	090	130
b1	89	89	120	120	150	150
	3.50	3.50	4.72	4.72	5.91	5.91
b2	80	80	110	110	135	135
	3.15	3.15	4.33	4.33	5.31	5.31
b3	-	-	-	-	88	88
					3.47	3.47
b4	-	-	-	-	102	102
					4.02	4.02
b5	-	-	-	-	42,9	42,9
					1.69	1.69
b6	-	-	-	-	77,8	77,8
					3.06	3.06
d1	73	73	100	100	126	126
	2.87	2.87	3.94	3.94	4.96	4.96
d2	57,5	57,5	84	84	112,5	112,5
	2.26	2.26	3.31	3.31	4.43	4.43
d3	36	36	48	48	54,5	54,5
	1.42	1.42	1.89	1.89	2.15	2.15
d4	17	17	28	28	37,5	37,5
	.67	.67	1.1	1.1	1.48	1.48
d5	100	100	135	135	170	170
	3.94	3.94	5.31	5.31	6.69	6.69
d6	78	78	105	105	131	131
	3.07	3.07	4.13	4.13	5.16	5.16
h1	33	33	41	41	47	47
	1.30	1.30	1.61	1.61	1.85	1.85
h2	66	66	86	86	98	98
	2.60	2.60	3.39	3.39	3.86	3.86
h3	91,5	159,5	119	180	172,5	252,5
	3.60	6.28	4.69	7.09	6.79	9.94
h4	157,5	225,5	206	267	273,5	353,5
	6.20	8.88	8.11	10.51	10.77	13.91
h5	23,5	23,5	24	24	27	27
	.93	.93	.95	.95	1.06	1.06
h6	140	210	180	240	235	315
	5.51	8.27	7.09	9.45	9.25	12.40
l1	48	48	66	66	85	85
	1.89	1.89	2.60	2.60	3.35	3.35
G2	G1 or 1 NPT	G1 or 1 NPT	G1-1/4 or 1-1/4 NPT	G1-1/4 or 1-1/4 NPT	G1-1/2 or 1-1/2 NPT	G1-1/2 or 1-1/2 NPT
G3	-	-	-	-	M12x15	M12x15
G4	M6 or 1/4–20 UNC	M6 or 1/4–20 UNC	M8 or 5/16–18 UNC	M8 or 5/16–18 UNC	M10 or 3/8–16 UNC	M10 or 3/8–16 UNC
Hex	36	36	50	50	55	55
	1.42	1.42	1.97	1.97	2.16	2.16

Return-Line Filter Housings / Complete Filters ▪ Type RF

RF - 070 - G - 10 - B - G24 - G42NO - D - O - L1 / X

a b c d e f g h i j k

a Type

Return-Line Filter	RF

b Group

Flow	Size
60 l/min / 14 US GPM	014
110 l/min / 30 US GPM	030
160 l/min / 45 US GPM	045
240 l/min / 70 US GPM	070
330 l/min / 90 US GPM	090
500 l/min / 130 US GPM	130

Note: Exact flow will depend on the selected filter element. For technical data please see pages 75 / 76.

c Filter Material

Material	max. Δp*collapse	Micron ratings available	Code
Without filter element	-	-	0
		3, 5, 10, 20	G
Stainless fibre	30 bar / 435 PSI		A
Filter paper	10 bar / 145 PSI	10, 20	N
Stainless mesh	30 bar / 435 PSI	25, 50, 100, 200	S

Note: *Collapse/burst resistance as per ISO 2941. Other materials on request.

d Micron Rating

3 µm	03
5 µm	05
10 µm	10
20 µm	20
25 µm	25
50 µm	50
100 µm	100
200 µm	200

Note: Other micron ratings on request.

e Sealing Materials

NBR (Buna®)	B
FKM (Viton®)	V
EPDM	E

Note: Other sealing materials on request

i Outlet Style

Size	Connection thread	Code
all	Without thread (Standard outlet)	0
014 / 030	1" BSP / 1" NPT	G16 / N16
045 / 070	1 1/4 BSP / 1 1/4 NPT	G20 / N20
90 / 130	1 1/2 BSP / 1 1/2 NPT	G24 / N24

f Connection Style

Connection Style	Thread Style	Group 014	Code	Group 030	Code	Group 045	Code	Group 070	Code	Group 090	Code	Group 130	Code
BSP	-	3/4	G12	1	G16	1-1/4	G20	1-1/2	G24	2	G32	2	G32
BSP	-	1/2	G08	1/2	G08	1-1/2	G24	1-1/4	G20	1-1/4	G20	1-1/4	G20
BSP	-	1	G16	3/4	G12	-	-	-	-	1-1/2	G24	1-1/2	G24
NPT	-	3/4	N12	1	N16	1-1/4	N20	1-1/2	N24	2	N32	2	N32
NPT	-	1	N16	3/4	N12	1-1/2	N24	1-1/4	N20	1-1/2	N24	1-1/2	N24
SAE O-ring Thread	-	1-1/16	U12	1-5/16	U16	1-5/8	U20	1-7/8	U24	1-7/8	U24	1-7/8	U24
SAE O-ring Thread	-	1-5/16	U16	1-1/16	U12	1-7/8	U24	1-5/8	U20	1-5/8	U20	1-5/8	U20
SAE Flange 3000 PSI	metric	-	-	-	-	-	-	-	-	2	C332M	2	C332M
SAE Flange 3000 PSI	UNC	-	-	-	-	-	-	-	-	2	C332U	2	C332U

Note: Bold types identify preferred connection styles.

g Clogging Indicator

Without Clogging Indicator	0
Visual Clogging Indicator	V
Electrical Clogging Switch 42 V, NO	G42NO
Electrical Clogging Switch 42 V, NC	G42NC
Electrical Clogging Switch 110 V ... 230 V, two-way contact (only for Code W)	G230

h Option Clogging Indicator G42NO, G42NC and G230

Plug connector	0
M12 x 1,5	M12
AMP plug	A
Deutsch plug	D
Rubber boot	S
90 degree Polyamide cap (only for Code G230)	W

j Additional Features

	Position*		
Without leakage oil connection	-		none
Leakage oil connection	1	2	L

Note: *Position of the leakage oil connection see page 70.
Without any code: assembly in the middle of the filter cover.

k Design Code

Only for information	X

Filter Elements ▪ Type RE

RE - 014 - G - 10 - B / X

a b c d e f

a Type

Filter Element Series	RE

b Group

According to filter housing

c Filter Material

Material	Max. Δp*collapse	Micron ratings available	Code
Inorg. glass fibre	25 bar / 363 PSI	3, 5, 10, 20	G
Stainless fibre	30 bar / 435 PSI		A
Filter paper	10 bar / 145 PSI	10, 20	N
Stainless mesh	30 bar / 435 PSI	25, 50, 100, 200	S

Note: *Collapse/burst resistance as per ISO 2941. Other materials on request.

d Micron Rating

3 µm	03
5 µm	05
10 µm	10
20 µm	20
25 µm	25
50 µm	50
100 µm	100
200 µm	200

Note: Other micron ratings on request.

e Sealing Materials

NBR (Buna®)	B
FKM (Viton®)	V
EPDM	E

Note: Other sealing materials on request.

f Design Code

Only for information	X

Electrical Clogging Switch

The switch is used where an electrical signal is needed to indicate when the element needs to be changed. The switch can turn on a light, or shut the machine down, or any further function controlled by an electric signal. The switching pressure is 2,5 bar / 36.25 PSI and this allows the element to be changed before the bypass setting of 3 bar / 43.5 PSI is reached.

Standard type with plug connector and rubber cap. Available with DEUTSCH DT04-2P plug (industrial standard), AMP Junior Timer plug (industrial standard) and five-pin circular connector M12, A-coded, according to IEC 61076-2-101.

Technical Data

	Limit-Switch G42NO+NC	Limit-Switch G230
Switching Capacity	100 VA	1000 VA
Voltage	10…42 VAC	10…250 VAC
Current	10mA…4A	
Switching Accuracy	± 0,5 bar at room temp. and new state	
Switching Frequency	200/min	
max. Pressure Ramp Rate	≤ 1 bar/ms	
Degree of Protection	IP65 (plug type S and W), IP67 (plug type M12, A, D)	
Temperature Range	-30°C … +100°C	-40°C … +100°C

Order Code

Limit-Switch - G42NO - S - M10 - B2.5

a b c d e

a Type

Limit-Switch	

b Connector Type

Electrical Clogging Switch 42 V, NO	**G42NO**
Electrical Clogging Switch 42 V, NC	**G42NC**
Electrical Clogging Switch 110 V ... 230 V, two-way contact (only for Plug Type W)	**G230**

c Plug Type

M12 Five-Pin Connector according to IEC 61076-2-101	**M12**
AMP-Junior-Timer Plug	**A**
DEUTSCH Plug DT04-2P	**D**
Rubber boot	**S**
90 degree Polyamide cap (only for Connector Type G230)	**W**

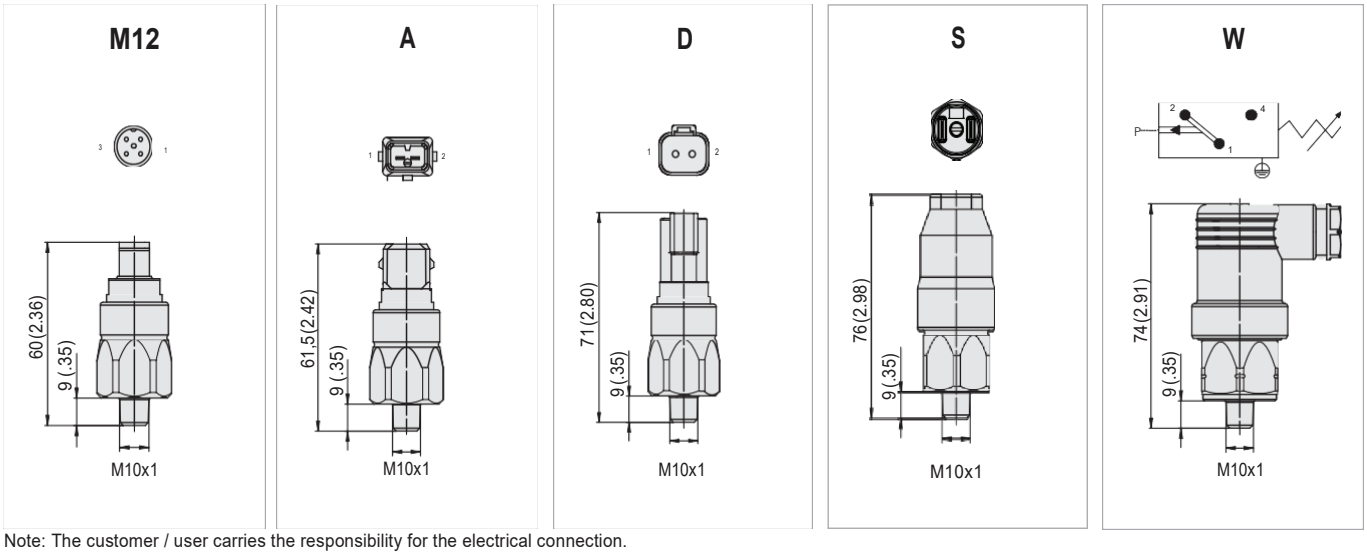
d Thread Type

M10 x 1	**M10**

e Pressure Setting

2,5 bar / 36.3 PSI	**B2.5**

Dimensions Plug Type



Note: The customer / user carries the responsibility for the electrical connection.

Dimensional drawings: All dimensions in mm/in.

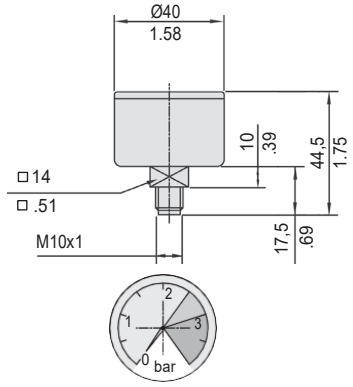
Return-Line Filters ▪ Type RF

Visual Clogging Indicator

The gauge visually displays the degree of contamination of the element.
The colored segments allow quick visual checking.

green	0 ... 2,5 bar / 0 ... 36.25 PSI	Element has service life left
yellow	2,5 ... 3,0 bar / 36.25 .....PSI	Element is contaminated and should be changed
red	> 3,0 bar / >43.5 PSI	Bypass valve open, unfiltered oil passing to tank

Visual Clogging Indicator



Order Codes

SPG-C-040-00004-02-P-M10-402922

①

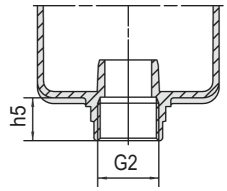
ⓐ Type

Visual Clogging Indicator	**SPG-C-040-00004-02-P-M10-402922**

Filter Bowl with Threaded Connection

Under some circumstances such as a tall reservoir or one with oil levels which vary greatly during operation, it is necessary to extend the filter bowl so that the returning oil returns beneath the surface and does not entrain air in the process.
The optional bowl with a female thread allows an extension to be fitted quite simply.

Threaded Outlet

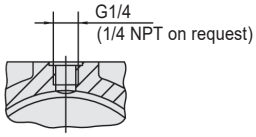


Dimensions see table page 71

Leakage Oil Connection

Seal or case drain lines can be connected to the filter through either of the clogging indicator ports providing that the leakage oil can accept a pressure of 3 bar / 43.5 PSI. It ensures that no unfiltered oil can return to the reservoir.

Leakage Oil Connection

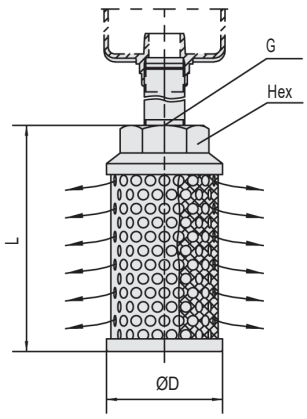


Filter Bowl with Threaded Connection and Diffuser

Diffusers mounted to the filter bowl minimise foaming and reduce noise of high Return-Line flows. For further details on STAUFF Diffusers please refer to the Calatogue No. 10 - Hydraulic Accessories.
Attention: Connection pipe not included in scope of delivery!

Size SRV	for Return-Line Filter Size	Dimensions (mm/in)			
		øD	L	Thread G	Hex
SRV-114-G16	RF-014/030	60	139	G1	46
SRV-114-N16		2.36	5.47	1 NPT	1.81
SRV-200-G20	RF-045/070	82	139	G1-1/4	60
SRV-200-N20		3.23	5.47	1-1/4 NPT	2.36
SRV-227-G24	RF-090/130	82	200	G1-1/2	60
SRV-227-N24		3.23	7.87	1-1/2 NPT	2.36

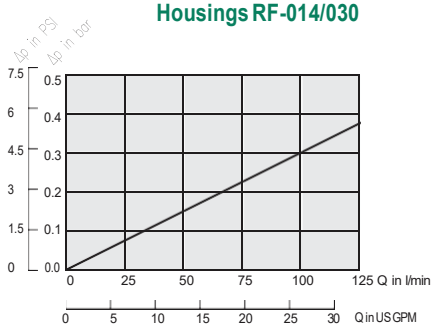
Threaded Outlet with SRV



Return-Line Filters ▪ Type RF Flow Characteristics

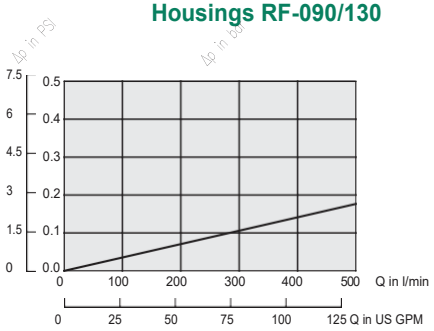
The following characteristics are valid for mineral oils with a density of 0,85 kg/dm³ and the kinematic viscosity of 30 mm²/s (30cSt). The characteristics have been determined in accordance to ISO 3968. Multipass filter ratings have been obtained in accordance to ISO 16889. The housing pressure drop is directly proportional to the oil density. Contact STAUFF for details.

Housings RF-014/030

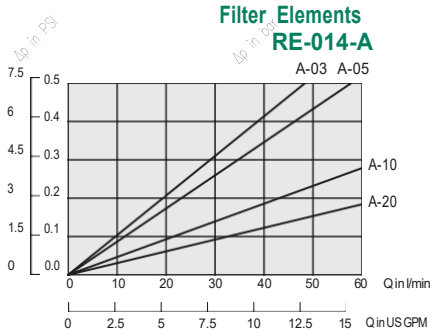


Housings RF-045/070

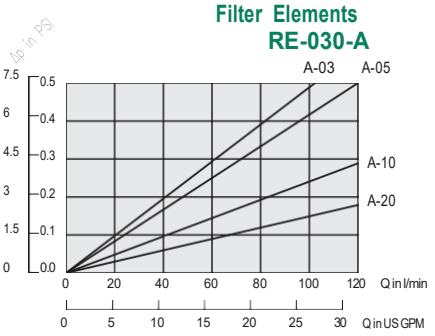
Housings RF-090/130



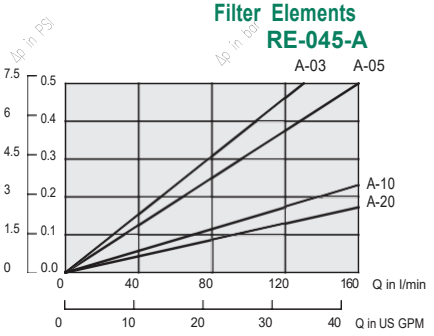
Filter Elements RE-014-A



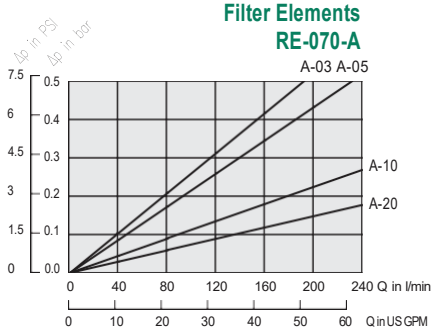
Filter Elements RE-030-A



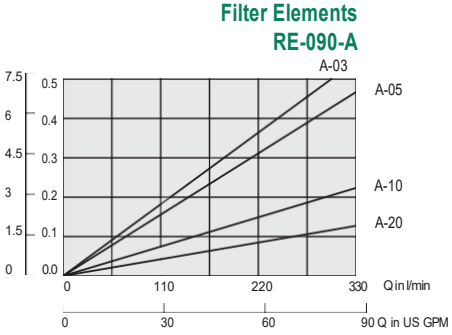
Filter Elements RE-045-A



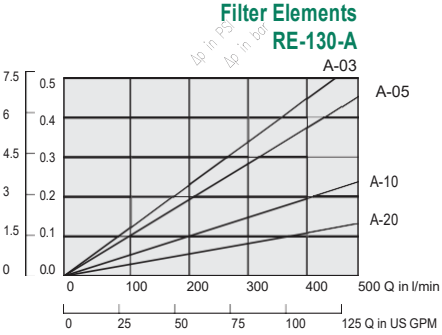
Filter Elements RE-070-A



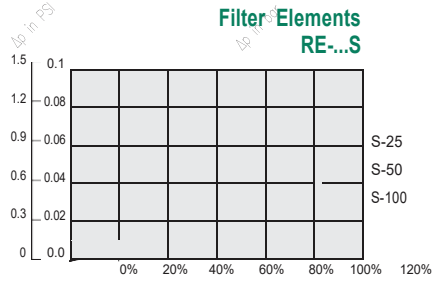
Filter Elements RE-090-A



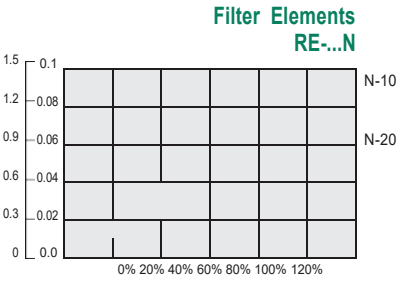
Filter Elements RE-130-A



Filter Elements RE-...S



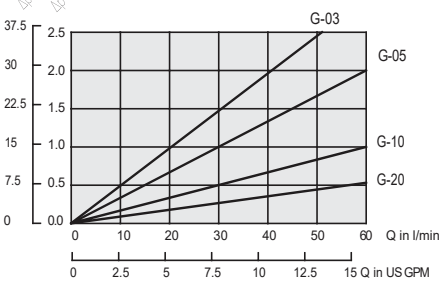
Filter Elements RE-...N



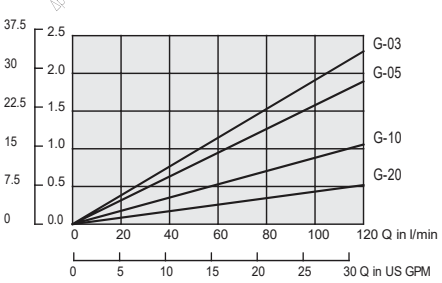
Return-Line Filters ▪ Type RF Flow Characteristics

The following characteristics are valid for mineral oils with a density of 0,85 kg/dm³ and the kinematic viscosity of 30 mm²/s (30cSt). The characteristics have been determined in accordance to ISO 3968. Multipass filter ratings have been obtained in accordance to ISO 16889. The housing pressure drop is directly proportional to the oil density. Contact STAUFF for details.

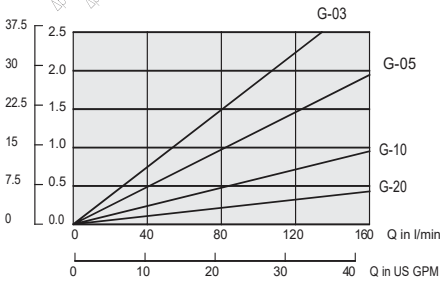
Filter Elements RE-014-G



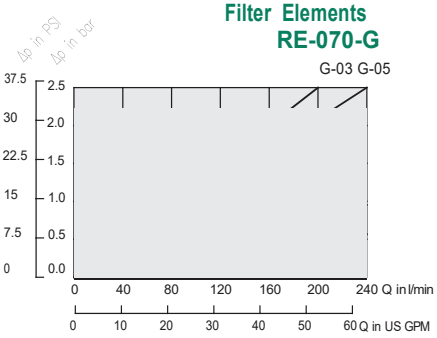
Filter Elements RE-030-G



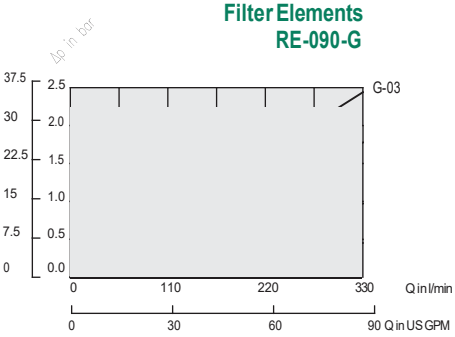
Filter Elements RE-045-G



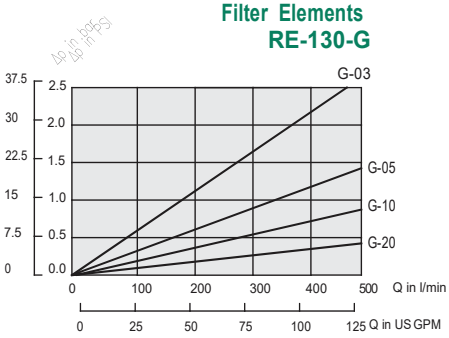
Filter Elements RE-070-G



Filter Elements RE-090-G



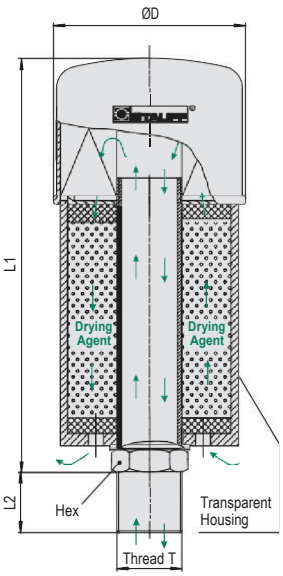
Filter Elements RE-130-G



APPENDIX D5: RESERVOIR BREATHER

C

Desiccant Air Breather incl. Air Filter Element Type SDB



Drying Agent

Capable in changing colours with increasing moisture

ACTIVE

REPLACE

This product does not contain any dangerous substances according to EC Council directives 99/45/EC and 2001/60/EC.

Dimensions and Technical Data

Type	Thread T	Dimensions (mm/in)				Weight (g/lbs)		Volume (cm³/in³)	Max. Water Absorption (g/lbs)	Air Filter Elements				
		ØD*	L1*	L2*	Hex	Complete Unit	Drying Agent	Drying Agent		Type	Filter Material	Micron Rating	Filter Surface	Max. Air Flow Rate
SDB-093/2	Male G3/4 BSP (ISO 228)	98	160	18	32	1200	225	300	86	SGB-090-03-B	Synthetic Fibre	3µm	752 cm²	0,70 m³/min
		3.86	6.30	.71	1.26	2.65	.50	18.3	.19				115 in²	24.71 cfm
SDB-096/2	Male G3/4 BSP (ISO 228)	98	220	18	32	1500	450	600	172	SGB-090-03-B	Synthetic Fibre	3µm	752 cm²	0,70 m³/min
		3.86	8.66	.71	1.26	3.31	.99	36.6	.38				115 in²	24.71 cfm
SDB-121/2	Male G1-1/4 BSP (ISO 228)	130	258	25	50	2700	750	1000	288	SGB-120-03-B	Synthetic Fibre	3µm	2095 cm²	1,50 m³/min
		5.12	10.16	.98	1.98	5.92	1.65	61.0	.63				320 in²	52.97 cfm
SDB-122/2	Male G1-1/4 BSP (ISO 228)	130	355	25	50	4000	1500	2000	576	SGB-120-03-B	Synthetic Fibre	3µm	2095 cm²	1,50 m³/min
		5.12	13.98	.98	1.98	8.82	3.31	122.0	1.27				320 in²	52.97 cfm

* ± 2 mm / .08 in

Characteristics

Combination of air breather and water removal filter

When a reservoir or gearbox breathes, air containing water vapor is ingested into the system. Temperature fluctuations will cause this water vapor to condense which can speed up the oxidation of the fluid and lead to damage in the system.

While inhaling, Desiccant Air Breathers SDB first dry the air as it passes through the drying agent. The air then passes through a 3µm air filter element to remove any solid contamination particles.

As moisture is absorbed, the drying agent will gradually change from red to orange. When it is orange, replace the drying agent. If required, an optional visual indicator gives an indication of the status of the air breather. With the moisture absorbed, the oxidation process can be decreased and the lifetime of the oil and the entire machinery will be extended.

Desiccant Air Breathers SDB can also be re-fitted with a layer of active carbon (1/3) and a layer of regular drying agent (2/3) for vapor filtration.

Features

- Available in 4 different sizes
- Diameter of Ø100 mm / Ø3.94 in or Ø130 mm / Ø5.12 in
- Refillable with drying agent (non-toxic ZR gel grain) or a mix of drying agent and active carbon
- Replaceable air filter element SGB
- Connection: Male BSP thread (ISO 228) on Stainless Steel tube
- Available with adaptor plate to simplify installation and to enable the use of a visual contamination indicator
- Operating temperature range: -40 °C ... +90 °C / -40 °F ... +194 °F*

Accessories / Spare Parts

Adaptor plate
- for SDB-093/2 and SDB-096/2: **AP-1**
- for SDB-121/2 and SDB-122/2: **AP-2**

Visual contamination indicator
- for all sizes (in conjunction with adaptor plate only): **FM**

Drying agent refilling material (supplied in air tight container)
- for SDB-093/2 (300 cm³ / 18.3 in³): **RD-093**
- for SDB-096/2 (600 cm³ / 26.6 in³): **RD-096**
- for SDB-121/2 (1000 cm³ / 61.0 in³): **RD-121**
- for SDB-122/2 (2000 cm³ / 122.0 in³): **RD-122**

Active carbon refilling material (supplied in air tight container)
- for SDB-093/2, SDB-096/2 and SDB-121/2 (300 cm³ / 18.3 in³): **RC-093/096/121**
- for SDB-122/2 (600 cm³ / 18.3 in³): **RC-122**

Please note: Use one layer of active carbon (1/3) and one layer of regular drying agent (2/3).

Replacement air filter element (sealing included)
- for SDB-093/2 and SDB-096/2: **SGB-090-03-B**
- for SDB-121/2 and SDB-122/2: **SGB-120-03-B**

Order Codes

SDB - 122 - RC - AP - FM / X

① ② ③ ④ ⑤ ⑥

Type
Desiccant Air Breather **SDB**

Max. Water Absorption and Size
s at Ø100 mm / Ø3.94 in **093**
172 g / .38 lbs at Ø100 mm / Ø3.94 in **096**
288 g / .63 lbs at Ø130 mm / Ø5.12 in **121**
576 g / 1.27 lbs at Ø130 mm / Ø5.12 in **122**

Please see table above for further technical details.

Drying Agent Material
ng agen
One layer of active carbon (1/3) and one layer of regular drying agent (2/3) for vapor filtrati **RC**

d Adaptor
Without ada
With adapto

e Contami
Without cor
With visual
(in conjunct

Please see

f Design

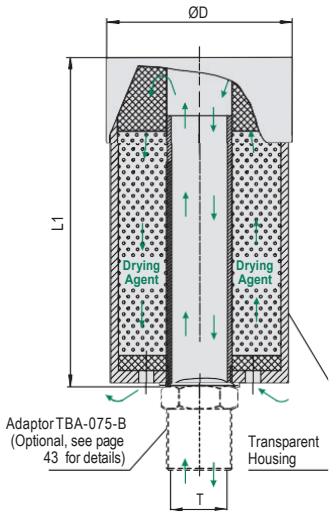
* Note: The operation of the Desiccant Air Breather may vary at temperatures below 0°C / 32°F due to very low humidity %.

Desiccant Air Breather (Disposable Version) Type SVDB

Drying Agent

Capable in changing colours with increasing moisture

This product does not contain any dangerous substances according to EC Council directives 99/45/EC and 2001/60/EC.



Dimensions and Technical Data

Type	Thread T	Dimensions (mm/in) ØD*	L1*	L2*	Weight (g/lbs) Complete Unit	Drying Agent	Volume (cm³/in³) Drying Agent	Max. Water Absorption (g/lbs)	Max. Air Flow Rate
SVDB-093	Female G3/4 BSP (ISO 228)	94	109	18	400	225	300	86	0,70 m³/min
		3.70	4.68	.71	.88	.50	18.3	.19	24.71 cfm
SVDB-096	Female G3/4 BSP (ISO 228)	94	179	18	700	450	600	172	0,70 m³/min
		3.70	7.05	.71	1.54	.99	36.9	.38	24.71 cfm

* ± 2 mm / .08 in

Features

- Light-weight alternative to the SDB series
- Available in 2 different sizes
- Diameter of Ø94 mm / Ø3.70 in
- Filled with drying agent (non-toxic ZR gel grain)
- Connection: Female BSP thread (ISO 228) in Plastic housing
- Operating temperature range: -40 °C ... +90 °C / -40 °F ... +194 °F*

Please note that neither the air filter element nor the drying agent can be replaced when saturated.

Order Codes

SVDB - 096 - A - AP - FM

① ② ③ ④ ⑤

a Type

Desiccant Air Breather (Economy Version)	**SVDB**

b Max. Water Absorption and Size

86 g / .19 lbs at Ø94 mm / Ø3.70	**093**
172 g / .38 lbs at Ø94 mm / Ø3.70	**096**

Please see table above for further technical details.

c Connection Adaptor

Without connection adaptor	**-**
With connection adaptor TBA-075-B	**A**

Please see page 43 for details.
Contact STAUFF for alternative adaptors.

d Adaptor Plate

Without adaptor plate	**-**
With adaptor plate (in conjunction with connection adaptor A only)	**AP**

e Contamination Indicator

Without contamination indicator	**-**
With visual contamination indicator FM (in conjunction with adaptor plate AP only)	**FM**

Please see page 47 for details.

Characteristics

Combination of air breather and water removal filter

When a reservoir or gearbox breathes, air containing water vapor is ingested into the system. Temperature fluctuations will cause this water vapor to condense which can speed up the oxidation of the fluid and lead to damage in the system.

Desiccant Air Breathers SVDB are the light-weight alternative to the proven SDB series, offering an almost identical filtration and absorption performance.
While inhaling, Desiccant Air Breathers SVDB also first dry the air as it passes through the drying agent. The air then passes through a 10 µm coarse filter to remove any solid contamination particles.

As moisture is absorbed, the drying agent will gradually change from red to orange. When it is orange, replace the entire unit. If required, an optional visual indicator gives an indication of the status of the air breather. With the moisture absorbed, the oxidation process can be decreased and the lifetime of the oil and the entire machinery will be extended.

Accessories / Spare Parts

Connection adaptor (see page 43 for details)
- for all sizes: **TBA-075-B**

Adaptor plate
- for all sizes (in conjunction with adaptor plate only): **AP-1**

Visual contamination indicator
- for all sizes (in conjunction with adaptor plate only): **FM**

* Note: The operation of the Desiccant Air Breather may vary at temperatures below 0°C / 32°F due to very low humidity %.

APPENDIX D6: HPU MOTOR

TECO Instruction Manual

Squirrel Cage Induction Motors

NOTE

Whilst Motors are installed awaiting commissioning they must be adequately protected against the elements, all external components in particular the shaft extension and external labyrinth seals at the drive end must be fully covered to avoid water ingress entering the motor body whilst stationery.

Please ensure that both the non drive end and drive end antifriction bearings are fully purged with sufficient grease at first start up/commissioning with the recommended grade and quantity of grease.

TECO Electric & Machinery Co. Ltd.

Table of Contents

Chapter 1: MOTOR DESCRIPTION

This manual applies to Teco model series types as follows:

AEEB, AEVB, AEHB, AEMB, AEUB, AEHD, AEJE, AFJE, AEJU, AEJH and AFJH.

The motors are of Cast Iron Construction, Totally Enclosed Fan Cooled, Squirrel Cage Induction type designed for operation on a 415/1000/3,300/6,600V/ 3 Phase 50Hz supply system equipped with grease lubricated anti friction type bearings.

SAFETY WARNING

The following instruction address the more common situations encountered in motor installation, operation and maintenance. For the TECO warranty to remain valid, the motor must be installed and operated in strict accordance with the outline drawing, motor nameplate and these instructions and must not be altered or modified in any unauthorized manner.
During the installation & operation of motors in heavy industrial applications there is a danger of live electrical parts and rotating parts. Therefore to prevent injury and/or damage the basic planning work for transport, assembly, installation & operation needs to be carried out by authorized and competent personnel. Points in this manual that are boxed and headed "DANGER", "CAUTION" or "NOTE"(see below) should be observed as they indicate possible danger to personnel and/or the potential of equipment damage.

DANGER

This prompt is used when there is an immediate hazard that WILL result in severe personal injury or death if correct procedures are not followed.

CAUTION

This prompt is used to warn against potentially unsafe practices that COULD result in personal injury and/or property damage if correct procedures are not followed.

NOTE

This prompt is used when an operation, condition, or information is of sufficient importance to warrant highlighting

Chapter 2: TECHNICAL DATA

This manual covers a power outputs ranging through to 1500kW with varying frame sizes and speeds etc.
For motor technical data refer to appropriate motor data sheet.

Chapter 3: INSTALLATION AND COMMISSIONING

3.1. INSPECTION UPON RECEIPT.

Check the following points upon receipt:

a. Is the nameplate rating identical to your order?
b. Do dimensions and colour comply with your specification?
c. Are the nameplate ratings for the heater, temperature detector etc. identical with what you ordered?
d. Is there any damage due to transportation?
e. Is the original transportation shaft lock fitted to the drive end shaft?
f. Are all accessories in good order?
g. If there are any specific requirements, please check if they conform with your specification.

3.2. STORAGE

When storing motor, the following procedures should be undertaken.

3.2.1. Place.

a. It should be dry, well-ventilated and not subject to direct sunlight, dust or corrosive gas.
b. It should not be located close to a boiler or freezer.
c. It should be entirely free from vibration and have easy access.
d. Motor should be stored on pallets to prevent moisture ingress.

3.2.2. During storage, the insulation resistance should be kept above the specified values as follows:-

a. Stator: Above 50MΩ measured with 1000VDC megger.
b. If the motor has absorbed moisture as evidenced by low insulation resistance, it must be dried with external heat until it is thoroughly dry and the value of insulation resistance exceeds the minimum requirements.
c. Measurement of insulation resistance should be performed once every month.
d. Anti-condensation heaters should always be connected where fitted.

3.2.3 Insulation resistance test should be performed before making high voltage test.

a. Use 500VDC megger to measure insulation resistance.

i. Stator: Over 50MΩ between windings.

ii. Stator: Over 50MΩ between windings and earth.

b. High Voltage Test

i. This test can be undertaken only after the values of insulation resistance in item 3.2.3 (a) are assured.

ii. The value of testing voltage is (1000 + 2E) X 0.8 where E: rated voltage.

3.2.4. Care should be taken to keep parts such as the fitting surface, key, shaft extension and axial centre hole free of any foreign matter. Grease should also be generously applied to stop rust.

3.2.5. The shaft should also be rotated by hand a few revolutions once per month.

3.2.6. If practical, a test run should be performed once every three months.

3.2.7. Clean the motor thoroughly, and replenish grease before the machine is put back to operation.

3.2.8. The ventilation system should be covered to avoid the entry of foreign matter or insects. It should be thoroughly cleaned before use.

3.2.9. Make sure the hoisting hook is correctly connected to eye bolts or lugs of motors before hoisting.

NOTE

Parts such as fan cowl, terminal boxes, etc. which have their own lifting facilities can only carry their own weight. They should not be used for lifting the entire motor.

DANGER

An accident could occur if the motor eyebolt/lifting hook is overloaded.

They are suitable for the motor weights only.

Do not lift motor and load combined with motor lifting hook.

3.2.10. Points to note when hoisting:

a. Do not twist steel wires.

b. Make sure eye bolts have been firmly screwed in.

c. Keep the sling vertical when moving/lifting motor.

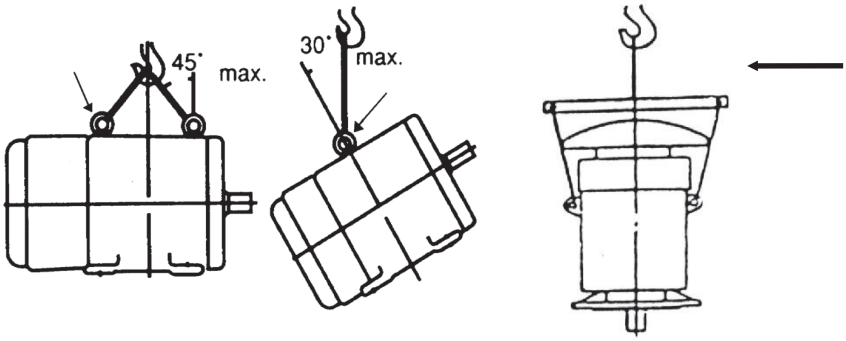
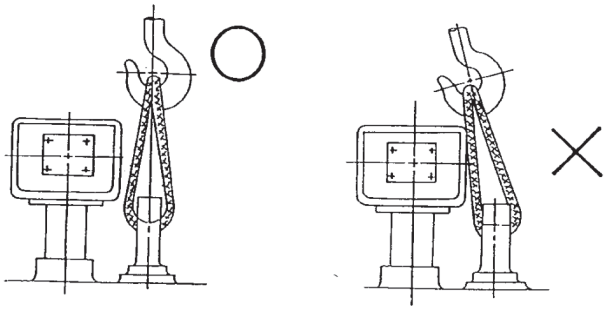


Fig. 1



Please keep the sling vertical when lifting / moving the motor.

Fig. 2

CAUTION

Motor is fitted with lifting points (arrowed). These points are designed to lift motor weight only.
Do not use other hooks or handles to lift motor.

3.3. TRANSPORTATION

To keep the rotating parts of motor from moving, thus causing damage during Transportation, they should be held securely as follows:

3.3.1. Motors fitted with a retaining plate/bracket to secure the shaft must have it fitted during transportation. Please retain this device for future transportation of the motor.

3.3.2. After receiving motor, remove all securing studs, nuts, etc. before putting motor into operation. (Fig.3)

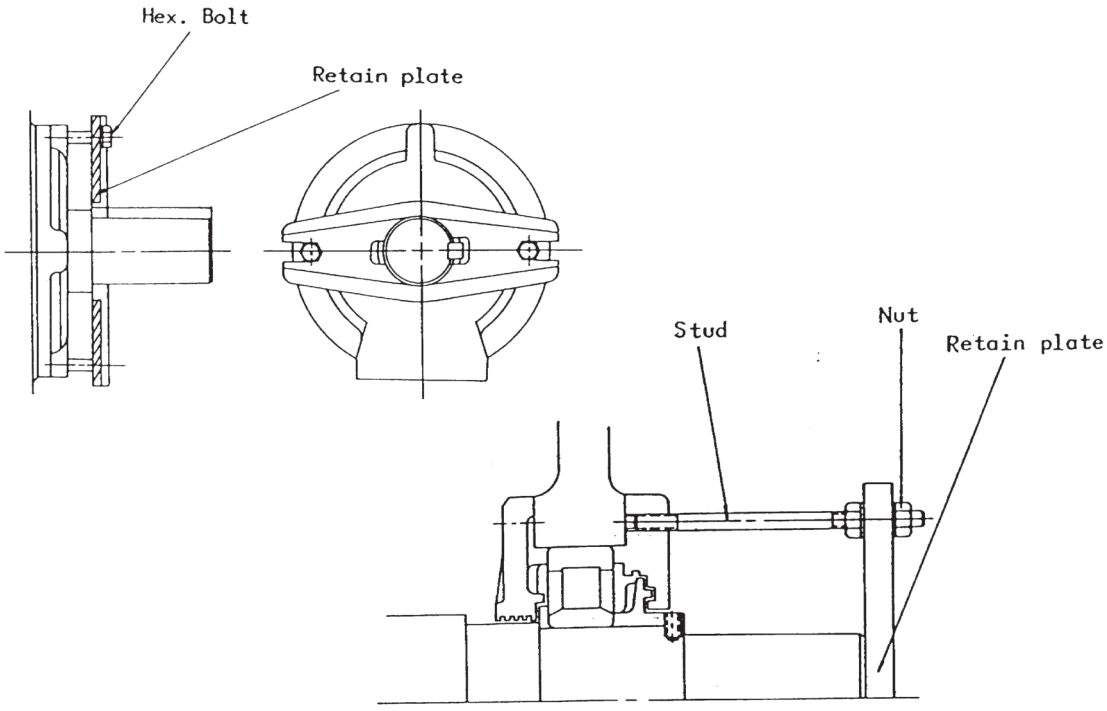


Fig 3

CAUTION

Shaft Locks are fitted as standard and these should be fitted during installation and should only be removed once the pulleys and guards are ready to be fitted. The motor must not be transported without the shaft lock fitted, damage to bearings caused by shaft locks being removed or moisture ingress whilst awaiting commissioning is not covered under motor warranty.

3.4. INSTALLATION.

3.4.1. Site conditions for motor installation:

Standard site conditions for installation of motors are as follows:

a. Ambient temperature: -20^0C~40^0C.

b. Humidity: Relative humidity below 90% RH for totally enclosed type.

c. Elevation: Below 1000 metres.

d. Should the installation be in an industrial zone, it should be free of explosive gases and liquids.

e. Foundation should be strong so as not to induce vibration.

3.4.2. Ventilation and Space.

a. Installation should be well ventilated.

b. The area should be large enough to facilitate heat dissipation and maintenance.

3.4.3. Foundation.

Use rigid and solid sole plate or common bed as the foundation.

3.5. MOUNTING.

3.5.1. An adequate motor support (which is the responsibility of others) is very important. It must have sufficient rigidity to maintain alignment between the motor and its driven load. Inadequate or improperly designed motor supporting structures can lead to serious vibration and alignment problems.

3.6. COUPLING & ALIGNMENT.

CAUTION

Two pole motors and motors larger than Frame 315M must not be coupled to the driven equipment by means other than direct connection.

Please refer to TECO if belt connection is to be used.

3.6.1. Installation.

Field application of a coupling to the motor shaft should follow the procedures recommended by the coupling manufacturer. Under no circumstances may the motor shaft be modified as to configuration or diameter without the approval of Teco Australia. The motor shaft extension must not be subjected to either extreme heat or cold during coupling installation. If it is necessary to exert axial force on the shaft, either continuously or intermittently, during coupling application, it must be properly restrained axially to prevent bearing damage.

3.6.2. After the motor has been properly aligned with the driven equipment and the hold down bolts have been installed and tightened, at least two dowel pins should be installed diagonally opposite motor feet.

The exposed rotating parts should be covered to prevent accidents.

3.6.3 Alignment.

Motors must always be accurately aligned. Incorrect alignment can lead to bearing failure, vibration and even shaft fracture. As soon as bearing failure or vibration is detected, the alignment should be checked.

In aligning the motor (and rotor) axially with the driven equipment, consideration should be given to the axial shaft expansion and increase in shaft centre line height due to thermal effects.
Shaft height growth (change in shaft centre line elevation) for TEFC machines can be calculated as follows,
Growth =(0.0005) x (motor foot to shaft centre line dimension [in mm]).

3.6.4 It is desirable, in normal operation that the motor operates, so that no axial force is exerted on the coupling.

The motor shaft and the driven shaft should be aligned within the following tolerances in both angular and parallel alignment (refer Table 1).

Units in mm

TIR Total Runout Indicated		Solid Coupling	Flexible coupling
Dimension C	Medium, Low speed up to 2500 RPM	0.04	0.05
	High speed over 2500 RPM	0.03	0.03
Dimension A	Medium, Low speed up to 2500 RPM	0.03	0.04
	High speed over 2500 RPM	0.03	0.03

Table 1

3.6.5 Angular misalignment is the amount by which the centre lines of the driver and driven shaft are skewed. It can be measured using a dial indicator set up as shown in fig 4. The couplings are rotated together through 360 degrees so that the indicator does not measure runout of the coupling hub face. The shaft should be forced against either the in or out extreme of their end float while being rotated.

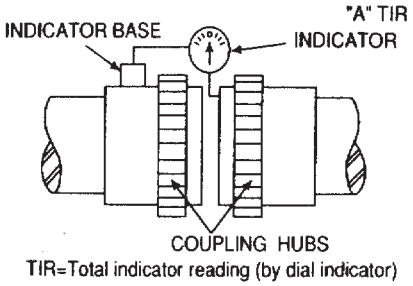


Fig. 4

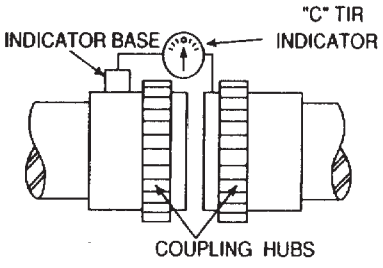


Fig. 5

3.6.6 Parallel misalignment is the amount by which the centre lines of the driver and the driven shafts are out of parallel. It can be measured using the dial indicator as shown in fig. 5. Again the couplings are rotated together through 360 degrees so that the indicator does not measure runout of the coupling hub outside diameter.

3.6.7 After the motor has been properly aligned with the driven equipment and the hold down bolts have been installed and tightened, at least two dowel pins should be installed diagonally opposite motor feet.

3.7. INSTALLATION FOR BELT DRIVE

CAUTION

Do not hammer the conveyance devices such as coupling, belt sheaves, chain wheels, gears, pulleys etc. onto the motor shaft. Those shaft fitments should be fitted and removed only by means of suitable devices. Heat shrinking may be a better alternative to avoid damaging bearings and other components.

3.7.1. Small, medium and large motors within frame sizes up to and including 315 frame are designed for use with belt transmission or direct coupling.

3.7.2. The diameter ratio between conveyance sheaves should not be greater 5 to 1 for flat belts, and 8 to 1 for V-belts. It is also advisable to limit the belt velocity to under 35m/sec to limit belt abrasion and vibration. The smaller the outer diameter of the V-belt sheave, the greater the shaft bending stress will be. If bending stress is in excess of the shaft fatigue stress, the shaft may break. If concerned please inform TECO of the size of the sheaves and belt details for checking.

NOTE

Place the sheave and belt as close as possible to the motor body and shaft shoulder to reduce the bending moment and improve shaft life.

3.8. ELECTRICAL CONNECTIONS

3.8.1. The rated conditions of operation for the motors are as shown by the nameplate. Within the limits given below, of voltage and frequency variation from the nameplate values, the motor will continue to operate but with

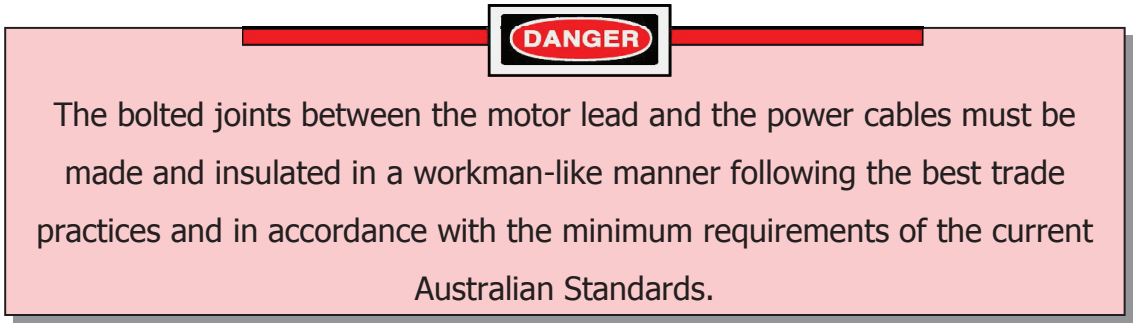
performance characteristics that may differ from those at the rated conditions:

- +/- 10% of rated voltage
- +/- 5% of rated frequency
- +/- 10% combined voltage and frequency variation so long as frequency variation is no more than +/- 5% of rated value.

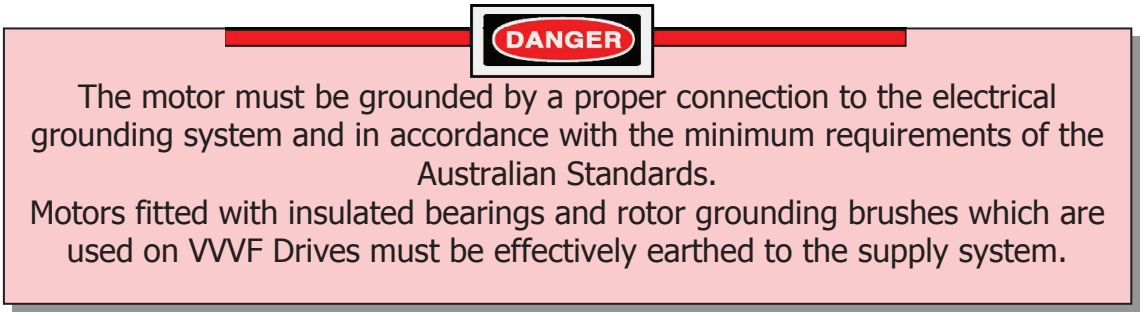
Operating the motor at voltage and frequencies outside of the above limits can result in both unsatisfactory motor performance and damage to/or failure of the motor.

3.8.2. Motor connections should be carried out in accordance with the details applicable to the appropriate supply voltage as shown on the motor nameplate and should be undertaken by suitably qualified personnel.

3.8.3. The main lead box furnished with the motor has been sized to provide adequate space for the make up of the connections between the motor lead cables and the incoming power cables.



3.8.4. The motors are provided with grounding pads and/or bolts for the connection of earthing.



3.9. AUXILIARY DEVICES

3.9.1. Please refer to your specification and the motor nameplate to determine if the motor is fitted with thermal winding protection devices.
The following are the most common:

One set (one per phase – total 3 off) of PTC winding thermistors.

Two sets (two per phase – total 6 off) of PTC winding thermistors.

One set (one per phase – total 3 off) of PT100 winding Resistance Temperature Detectors (RTD's).

Two sets (two per phase – total 6 off) of PT100 winding Resistance Temperature Detectors (RTD's).

3.9.2. Where specified motors may also be equipped with PT100 bearing Resistance Temperature Detectors (RTD's).

3.9.3. Thermistors are positive temperature coefficient type (1000 ohm @ tripping temperature) refer to specification table for tripping temperature.
They are a tripping device only and not a temperature detector.
Thermistor leads should be connected to an appropriate thermistor control relay from a reputable supplier.

3.9.4. RTD's where fitted are of the platinum type (PT100) with a reference temperature of 0°C at 100Ω.
RTD leads should be connected to an appropriate motor protection system from a reputable supplier.
Recommended temperature settings for RTD's are as per table 2 below.

DEVICE	TYPE	LOCATION	ALARM	TRIP
RTD	PLATINIUM 100Ω @ 0^{O}C	WINDING	140^{0}C	150^{0}C
RTD	PLATINIUM 100Ω @ 0^{O}C	DE & NDE BEARING	90^{0}C	95^{0}C

Table 2

CAUTION

Thermistors and/or RTD's should not be meggered or tested at a voltage above 2.5Volts.

CAUTION

Should the motor thermal protection circuit trip indicating over temperature the cause/s should be thoroughly investigated before a restart is attempted.
Failure to do so may lead to permanent damage or failure of the motor.

3.9.5. Where specified motors may be equipped with internal space heaters (check for nameplate), to prevent the ingress of moisture into the motor insulation system whilst motor is idle.
The incoming supply to the heaters should be in accordance with the details contained on the heater nameplate.
The heater circuit should be inter-locked with the motor starter so as to de-energise heaters when the motor is running.

DANGER

Anti Condensation Heaters may be LIVE when the motor is switched off. Isolate supply at all times before working on the motor.

Chapter 4: OPERATING INSTRUCTIONS

4.1. EXAMINATION BEFORE START.

4.1.1. After motor is installed the following points should be noted:-

a. Check all wiring is correct and in accordance with connections appropriate to the supply voltage as shown on motor nameplate.

b. Is the incoming cable size adequate?

c. Are all connections tight and properly insulated?

d. Check the rating of fuses, starter/contactor are correct & operating normally.

e. Check motor is correctly earthed especially if supplied via a VVVF drive.

f. Make sure starter/switches are set in correct position.

g. Check heater circuit if fitted is de-energised when motor is in operation.

h. Check bearings are filled with the correct quantity and grade of grease.

4.1.2. Measurement of insulation resistance.

a. Rated voltage below 1000V, measure with 500VDC megger.

b. In accordance with IEEE-43 clause 9.3 standards, refer to following formula:

$$R\ (M\Omega) = > \frac{(\text{Rated Voltage} + 1)}{1000} \times 10$$

c. If a new winding has a low insulation resistance reading moisture ingress is generally the problem. Drying the winding through the proper application of heat will normally increase the insulation resistance to an acceptable level. Following are several accepted methods for applying heat to a winding:

i. If the motor is equipped with anti condensation heaters these can be can be energised to heat the winding.

ii. Direct current (as from a DC welder) can be passed through the winding. The total current should not exceed approximately 50% of rated full load current. Delta wound motors have six leads and the three phases should be connected into one series circuit.

iii. Heated air can be either blown directly into the motor or into a temporary enclosure surrounding the motor. The source of heated air should preferably

be electrical as opposed to fuelled (such as kerosene) where a malfunction of the fuel burner could result in carbon deposits entering the motor.

NOTE

Caution must be exercised, when heating the motor with any source of heat other than self-contained space heaters, to raise the winding temperature at a gradual rate to allow any entrapped moisture to vaporise and escape without rupturing the insulation. The entire heating cycle should extend over 15-20 hours.

DANGER

Ensure adequate guarding is provided so live parts cannot be touched.

iv. Insulation resistance measurements can be made while the winding is being heated. However, they must be corrected to 40^0C for evaluation since the actual insulation resistance will decrease with increasing temperature. As an approximation for a new winding, the insulation resistance will approximately halve for each 10^0C increase in insulation temperature above the dew point temperature.

d. Should the resistance fail to attain the specified value even after drying, careful examination should be undertaken to eliminate all other possible causes, if any.

4.1.3. Power Supply

a. Is the capacity of the power supply adequate?

b. Do voltage and frequency of supply match with those on the nameplate?

c. Voltage variation should be confined to within +/-10% of the rated value and the phase to phase voltages should be balanced.

4.1.4. Bearing Lubrication

Grease Lubricated Type.

NOTE

The bearings are initially lubricated with the correct grade of grease at the factory. After installation, long storage and at initial start up/commissioning the bearings must be fully purged with new grease. Please refer to section 7.

a. Refer to the section "Maintenance of Bearing" for maintenance procedures and grease type.

4.1.5. Other Points to note

a. Make sure the transmission system, including belts, screws, bolts, nuts and set pins are in good condition.

b. Dismantle all locks which fasten the moveable parts of the motor during transportation, and turn the shaft by hand (if practical) to check if it moves freely.

c. Check if there is any evidence of foreign matter inside the motor before starting.

d. Make sure the items above are examined. Test the motor with or without load. Record and check according to "Maintenance" at 15 minute intervals during the first three hours of operation. Then conduct regular examinations after longer intervals. If problems are experienced test without load to ascertain whether it is a load, structure, alignment or motor issue.

4.2. STARTING OPERATION.

4.2.1. Starting Load.

The initial test involves running the motor without load. Unless specified, a motor is designed to start with light load, which is then gradually increased to full load, as the motor accelerates to full speed.

4.2.2. Starting.

a. Motor can be restarted if the initial start fails. Three attempts are permissible when the motor is at ambient (cold) temperature. Two starts in succession are permitted when motor is at normal running temperature. Smaller motors have a more frequent starting cycle.

b. Should an additional start be necessary beyond the conditions stated above, the following restrictions should be noted:

i. Let the motor cool down for 60 minutes before a full load restart.

ii. Let the motor cool down for 30 minutes before a no load restart.

iii. Two inching starts can be regarded as one normal start.

c. If the motor rotor fails to start turning after two seconds, shut off power supply immediately. This can result from:

i. Too low a voltage at the motor terminals.

ii. The load is too large for motor rating.

iii. The load has seized mechanically.

iv. Electrical connections incorrect.

v. Single phase power has been applied.

vi. Any combination of the above.

Note – Investigate thoroughly and take corrective action before attempting a restart.

4.2.3. Direction of Rotation.

a. Motors are generally bi-directional. Some 2 pole and low noise motors are uni directional only. If motor is uni-directional the fan cowl will be fitted with a direction of rotation arrow.

b. If direction of rotation must be changed on a bi-directional motor, cut power and wait until the motor stops, then interchange any two of the three incoming phase leads.

4.2.4. Power Supply. Voltage/Current.

a. Check if the voltage and frequency of the power supply are identical to that shown on the nameplate.

b. Voltage variation should be confined to within +/-10% of nameplate voltage, and the three phase voltages should be balanced.

c. Check if the phase currents of the motor, without load, are within +/-5% of the average values.

4.2.5. Frequency.

Frequency variation should be confined to within +/-5% of the nameplate frequency. The aggregate variation of voltage and frequency should be confined to within +/-10% of the absolute value of the rating.

4.2.6. Run Up Time.

NOTE

The Run Up time is longer for motors connected to a load with a large inertia. However, if the run up time exceeds what is deemed normal or there is abnormal noise, the motor and load should be examined to establish the cause before attempting a restart.

4.3. CAUTIONARY POINTS TO NOTE:

4.3.1. Bearings:

a. The motor is fitted with grease lubricated bearings. Following initial start up the bearing temperatures should be closely monitored. A rapid rate of rise in bearing temperature is more indicative of impending trouble, however, when greasing an expected higher temperature is normal and should equalize after a period of time.

b. When the rate of bearing temperature rise is less than 1°C per half hour, the bearing temperature is considered to be stabilised.

c. If the total bearing temperature exceeds 100°C, the motor should be shut down immediately and subsequent checks be undertaken.

4.3.2. Vibration:

a. The ideal values generally for motors are figures below 2.8mm/sec. If vibration exceeds this level, an examination of the motor, load, structure etc, should be made to determine the cause, the first check to undertake would be to run the motor un-coupled and check if the vibration is still evident, see section 5.4 Vibration.

4.3.3. Starting:

a. If the motor acceleration time exceeds the typical ramp time for this application, shut off the power immediately.
Investigate thoroughly and take corrective action before attempting to restart.

b. It should be recognised that each start of an induction motor subjects the motor to current greater than full load current with resulting heating of the stator and rotor windings. Each start can produce more heat than is produced and dissipated by the motor under a full load condition.

c. The starting duty for which the motor is designed must not be exceeded if long motor life is expected. Abnormally low terminal voltage and/or excessive load torque during motor start up can cause lengthened acceleration times during which the rotor ventilation is reduced. This can cause rotor damage or lead to shortened rotor life.

Chapter 5: ROUTINE MAINTENANCE

5.1. IMPORTANCE OF DAILY INSPECTION.

5.1.1. Normally electric motors do not fail suddenly. It happens over time, and regular inspection will detect a problem before a serious situation develops. If operators in the plant are alert, faults can be detected early and action taken to eliminate trouble.

Daily inspection, can be performed without interrupting the end user's normal operation.

5.1.2. Do not overlook any minor irregularities. If necessary, stop the machine immediately to check and repair. Essentially, inspections should be performed by the operator daily. But a maintenance technician should also check the machine once a week together with the operator.

5.2. POINTS TO NOTE WHEN STARTING.

a. Check power supply to see if voltage and frequency are normal.
b. Is starter set at starting position?
c. Are there sparks during start?
d. Is the motor accelerating normally?

5.3. TEMPERATURE RISE.

5.3.1. The temperature of a motor is often determined by measuring the temperature of the frame. This is not indicative of actual internal winding operating temperature, however, this method can often be referred to and compared with previous readings. If the temperature is found to be higher than usual please check the following possibilities.

DO NOT MAKE TEMPERATURE READINGS WITH THE SENSE OF TOUCH. Often the temperature of a motor is determined by touch. Human hands can only tolerate temperatures below 60^0C. Most motors safely operate at temperatures greater than this, therefore, the sense of touch should not be used. Temperature readings by hand are also inaccurate. Readings should be made using a thermometer probe or non-contact infra red thermometer.

5.3.2. Main causes of high temperature:

a. Motor Conditions

i. Voltage and frequency variation of power source is in excess of tolerance.

ii. Unbalanced three phase voltage, open circuit or poor contact.

iii. Insufficient or excessive lubrication.

iv. Abnormal frequency of starts.

v. Single-phasing due to open circuit or short circuit.

vi. Damaged starter or improper operation.

vii. Blocked ventilation ducts.

viii. Motors cooling vents blocked.

b. Due to load or mechanical conditions:

i. Overload.

ii. Defective transmission coupling.

iii. Poor installation causing overload.

iv. High ambient temperature or radiant heat emitted from driven load or surroundings.

5.4. VIBRATION.

5.4.1. Main causes inducing vibration:

i. Unbalanced load.

i. Misalignment of couplings.

ii. Unbalanced belt-sheaves.

iii. Improper couplings with belts or chains.

iv. Unsuitable foundation or poor installation.

v. Unbalanced motor rotor.

vi. Serious abrasion to motor or load machine drive bearing.

vii. Defective bearing or subsequent bearing damage.

5.4.2. No matter what causes the vibration, if it is not eliminated, the following faults may develop:

i. Bearing damage.

ii. Deformation of shaft.

iii. Loose parts or couplings.

5.5. NOISE.

5.5.1. Points to Note.

Not all noise is the result of a fault or abnormality. For instance, wind and slight electromagnetic sounds are perfectly normal. They will remain at the same level no matter how long the motor is in operation. Generally the louder the noise, the larger the vibration amplitude will be.

5.5.2. Bearing Sound.

i. Bearing noise is a guide to the condition of the motor bearings without dismantling the motor.

ii. Normal bearing sound in general is continuous, not intermittent. The sound may tend to increase with the age of the bearings, but its increase is gradual and hardly noticeable by the ear.

iii. Abnormal bearing sound is intermittent, rarely continuous.

iv. Some motors will emit noise when unloaded or after greasing due to skating. This is normal and temporary.

5.5.3. Abnormal bearing sound generally develops from the following causes:

i. Foreign matter in grease.

ii. Scratches on the contact surface of the bearing.

iii. Rust on the contact surfaces of the bearing due to moisture ingress.

iv. Poor quality of grease or wrong type of grease.

v. Insufficient grease (the sound could be continuous).

5.5.4. Causes of abnormal electromagnetic sound:

i. Single phasing.

ii. Short circuit in windings.

iii. Unbalanced air gap resulted from serious bearing wear.

5.6. ODOUR.

5.6.1. Causes of motor odours:

i. Short circuit or over current causing overheating of varnish.

ii. Poor lubrication due to insufficient or contaminated grease.

5.7. MEASUREMENT OF THREE PHASE CURRENT.

5.7.1. Causes & effects

When load current is above the rating on the nameplate, it means the motor may be overloaded. However, the cause of over current is not confined to overloading, but may be caused by poor coupling installation, transmission structure, excessive high or low voltage, etc.

a. Causes of unbalanced three phase current.

i. Unbalanced three phase voltage.

ii. Open circuit in power distribution lines.

iii. Poor switch contact.

iv. Open or short circuit in winding.

v. Open circuit at power transformer.

b. Effects:

i. Overheating of the windings causing fire or short circuit.

ii. Vibration of motor.

iii. Reduction of motor output torque.

c. Causes of wavering of ammeter indicator:

The characteristics of devices such as compressor or press are apt to cause wavering of the indicator. Other causes are,

i. Poor contact of switches.

ii. Uneven mechanism.

iii. Unbalanced air gap due to serious bearing aberration.

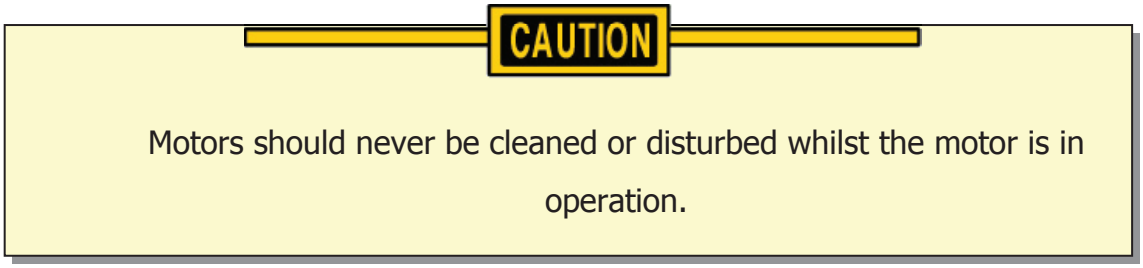
iv. Broken conductors of squirrel cage rotor.

5.8. MOTOR APPEARANCE.

5.8.1. Reasons for Cleaning

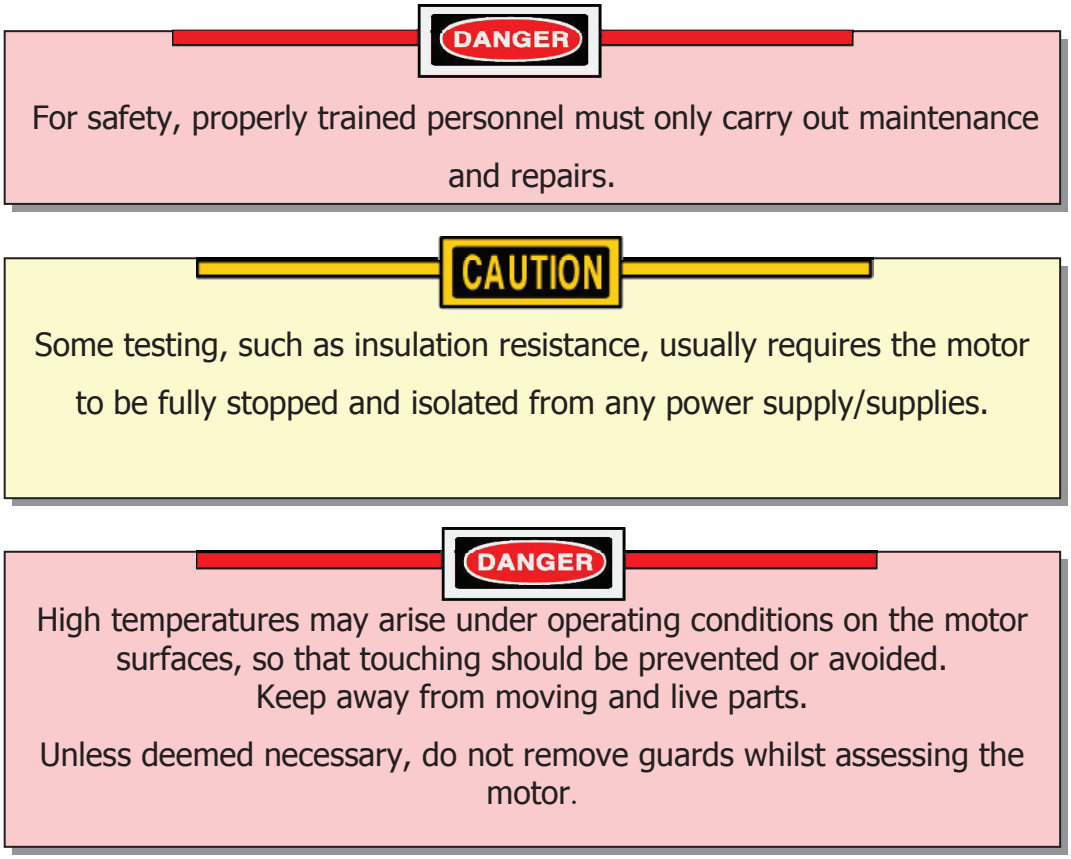
a. Excessive dust or oil accumulation on the motor surface leading to the clogging of ventilation channels between cooling ribs will reduce the motors cooling efficiency.

b. Keeping the motor and equipment clean will improve appearance and longevity.



Chapter 6: PERIODIC MAINTENANCE

6.1. REGULAR INSPECTION & MAINTENANCE.



6.1.1. Major points in regular inspection and maintenance:

a. Routine inspection and maintenance are usually performed by operators with the sense of touch, sight, smell and simple meters. But it is difficult to detect trouble such as insulation deterioration etc. unless the motor is stopped and checked.

b. Replacement of worn-out parts will increase longevity and prevent breakdown.

c. Regular inspection and maintenance is important in preventing breakdown and lengthening service life.

c. Owing to the varied uses and environments motors are placed in, it is difficult to set periods for regular inspection and maintenance. However, it has to be performed at least once every 6 months. Generally, the inspection time is determined by the following factors:

i. Ambient conditions.
ii. Start and stop frequency.
iii. Trouble with components affecting motor functions.
iv. Parts which wear (eg. bearings).
v. The important position of a motor in operation of a factory, mine etc. should be fully recognised. Therefore, its condition should be monitored, especially when it is operating in severe conditions.

6.1.2. Motor Windings.

a. For measurement of insulation resistance and tests to determine quality of insulation resistance, please refer to measures stated in Section 4.1.2.

b. Inspection of coil end:
   i. Grease and dust accumulated on coil may cause insulation deterioration and a reduction in cooling efficiency.
   ii. Moisture.
   iii. Discolouring from original colour. Overheating mainly causes this.

c. Stator wedges, is there any change from their original position?

d. Is the tie wire at the coil ends in correct position with no movement?

6.1.3. Bearings.

a. Please refer to section 7 for bearing maintenance.

6.1.4. Cleaning the interior of the motor.

a. After a motor has been in operation for some time, accumulation of dust, carbon powder and grease etc., on the inside is unavoidable, and may cause damage. The inside should therefore, be regularly cleaned and examined to assure reliable performance.

b. Points to note during cleaning:

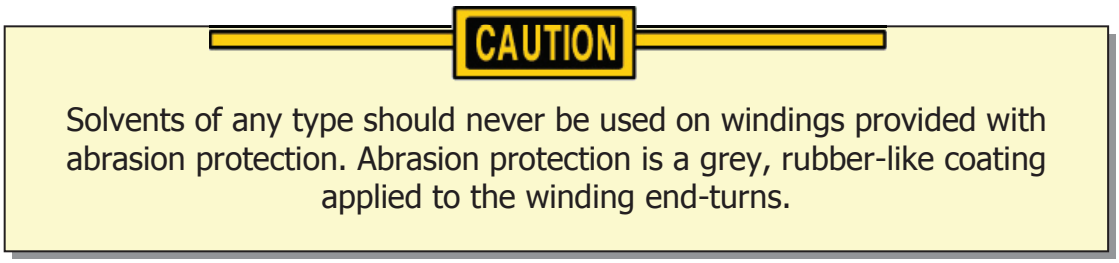
i. If using compressed air or a blower (Typically for squirrel cage only).
   - Compressed air should be free of moisture.
   - Maintain air pressure at 4kg/cm^2, since high pressure can cause damage to coils.

ii. Vacuum – Recommended for wound rotor/slip ring type.

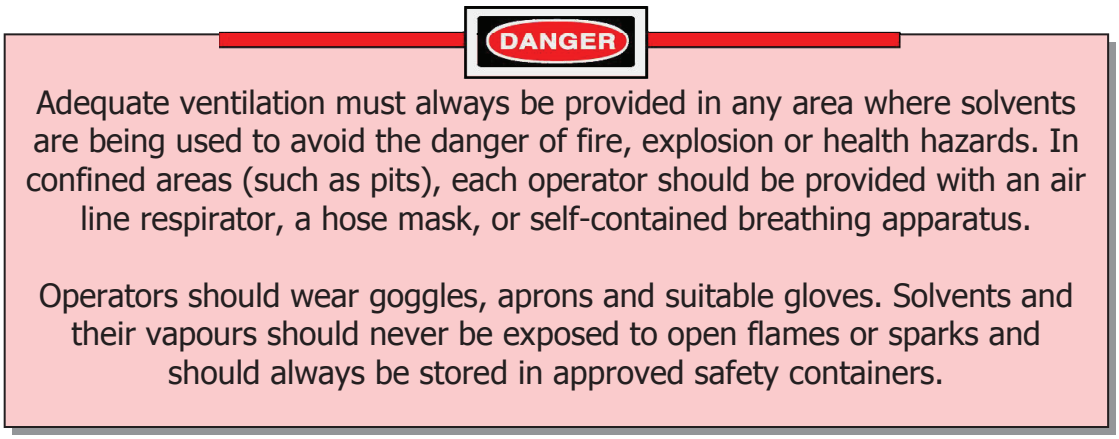
Vacuum cleaning can be used, both before and after other methods of cleaning, to remove loose dirt and debris. It is a very effective way to remove loose surface contamination from the winding. Vacuum cleaning tools should be non-metallic to avoid any damage to the winding insulation.

iii. Wiping.

Surface contamination on the winding can be removed using a soft, lint-free cloth. If the contamination is oily, the cloth can moistened (not dripping wet) with a safety type petroleum solvent. In hazardous locations, a solvent such as inhibited methyl chloroform may be used, but must be used sparingly and immediately removed. While this solvent is non-flammable under ordinary conditions, it is toxic and proper health and safety precautions should be followed while using it.



Solvents of any type should never be used on windings provided with abrasion protection. Abrasion protection is a grey, rubber-like coating applied to the winding end-turns.



Adequate ventilation must always be provided in any area where solvents are being used to avoid the danger of fire, explosion or health hazards. In confined areas (such as pits), each operator should be provided with an air line respirator, a hose mask, or self-contained breathing apparatus.

Operators should wear goggles, aprons and suitable gloves. Solvents and their vapours should never be exposed to open flames or sparks and should always be stored in approved safety containers.

6.1.5. Clean the exterior of the motor.

a. The inlet air openings should not be allowed to accumulate any dirt, dust, slurry, lint, etc. that could restrict free air movement.
b. Totally enclosed fan cooled motors require special cleaning consideration. The external fan must be cleaned thoroughly since any dirt build up not removed can lead to balance issues and vibration.

CAUTION

Motors should never be cleaned or disturbed whilst the motor is in operation.

6.1.6. Checking motor installation and coupling.

a. Installation:

i. Is foundation solid?

ii. Are all bolts and/or nuts tight and in good order?

b. Coupling:

i. Is coupling in good order?

ii. Are fasteners tight and in good order?

6.2. CLEANING OF COILS, DRYING & VARNISHING TREATMENT.

Age, constant heating and cooling and other factors may cause insulation deterioration. Also, salt deposits or grease may lower insulation resistance. Steam cleaning, drying and re-varnishing may be necessary if the motor has been flooded or showing deterioration from age.

6.2.1. Cleaning:

a. If the coils are slightly contaminated, compressed air, cloth or a nylon brush can be used to do the cleaning. However, when contamination is serious, thorough washing has to be performed. The cleaning methods are as follows:

b. Cleaning with water:

i. This method is applicable to motors having been immersed in water or insulated with no cotton yarn and paper materials.

ii. After washing, dry immediately.

iii. Cleaning with steam.

- If the motor has been immersed in sea-water or a chemical solution, clean with steam after washing thoroughly.
- Steam pressure must be kept between 2 – 4 kg/cm^2. High pressure may cause insulation damage.

c. Steam temperature should be maintained between 50^0C – 80^0C.

d. After cleaning, dry immediately.

6.2.3. Drying Method.

a. Application:

i. Drying after cleaning.

ii. Motor has absorbed moisture.

b. Hot air method (using heater and blower).

i. Parts to be dried are surrounded inside a steel plate leaving an inlet and an outlet for hot air. Hot air will enter the inlet to dry parts (stator, rotor, etc.), and will leave via the outlet carrying away moisture.

ii. The temperature within the area surrounded by the steel plate should be maintained at 90^0C – 100^0C.

c. Drying with infrared ray lamp:

i. Install the infrared ray lamp in a baking area surrounded with steel plate with openings at the bottom.

ii. This method can cause partial overheating. So attention must be paid to the parts heated and the temperature must be kept below 100^0C.

d. Drying method with electric current:

i. The winding must have a minimum insulation resistance above 0.5MΩ measured with 500VDC megger before using this method so as to avoid a short circuit.

ii. Lock the rotor (short the secondary winding of the wound rotor motor), apply rated voltage of approximately 5% - 10% to the winding.

iii. Temperature control settings:
Squirrel cage rotor induction motor: 70^0C – 80^0C for the stator.

e. Measurement of insulation resistance.

i. Measure the insulation resistance periodically during drying.

ii. At the initial stage of drying, insulation resistance may decline slightly. When it returns to normal, the drying process is complete.

iii. When the current method is applied, be sure to turn off the power to measure insulation resistance.

6.3. VARNISH.

Kind of Varnish

JIS-W-25 or W-28 are highly recommended.

a. Method of Varnish Treatment

i. Dipping method: Immerse windings completely into varnish until no air bubbles appear.

ii. Pouring Method: Pour varnish completely over windings

Note: Let varnish drip to dry after dipping or pouring. Changing position of the motor will obtain an even coverage.

b. Curing of Varnish

i. Set oven temperature at 110°C.

ii. Curing time should be 12 – 16 hours

iii. Ensure ventilation is adequate during curing. Combustible gases are present.

To ensure adequate insulation the above procedure should be repeated.

6.4. KEY POINTS FOR MAINTENANCE & INITIAL OPERATION INSPECTION AFTER LONG STORAGE.

6.4.1. If the motor has been out of service in excess of three months, careful inspection should be made before putting the motor into operation again.

6.4.2. When the motor is not in operation, the following precautionary measures should be undertaken:

The place for storage should be dry and well-ventilated. If the motor has to be placed at work site for some time, it should be completely covered and stored on pallets to prevent dust and moisture contamination.

Inspection and maintenance prior to storage.

Please refer to "Regular Inspection and Maintenance" (Section 6.1).

6.4.3. Items to be examined prior to initial operation.

a. Cleaning:

- Outside of motor.
- Motor interior.

b. Measurement of insulation resistance:

Measurement of insulation resistance and standards to determine quality if Insulation resistance, please refer to measures stated in Section 4.1.2. Measurement of insulation resistance.

6.4.4. Drying: If the motor has absorbed moisture, it must be dried.

6.4.5. Examination of bearings.

Turn the motor shaft by hand (if practical) to see if it rotates smoothly and if there is any unusual noise.

6.4.6. Replenishment of grease. (Refer to bearing maintenance Section 7).

6.4.7. Switches and starters.

Clean off dust and any foreign matter etc.
Check if the operation is normal.
Are the moving parts functioning smoothly?
Check if all bolts and nuts are tight and in good order.

6.4.8. Examination and maintenance of standby motor.

Important: The purpose of a standby motor is to substitute as an emergency motor if the motor in operation breaks down, this motor should not be exposed to induced vibration whilst stationery.
It is important to always maintain the standby motor in top condition.
Maintenance should be performed strictly according to items and notes stated previously.

6.5. RECORDS OF OPERATION AND MAINTENANCE.

6.5.1. Objective:

a. Fully understand the site conditions of the motor in operation and discover any abnormalities in advance.

b. Prevent the neglect and act of maintenance.

c. Map pertinent maintenance plans after fully understanding the operation of motor.

d. Assess the life of parts to determine the quantity of spare parts to be kept.

e. To plan the number of spare motors and replace or repair the motors in operation according to a schedule.

6.5.2. Records of operation.

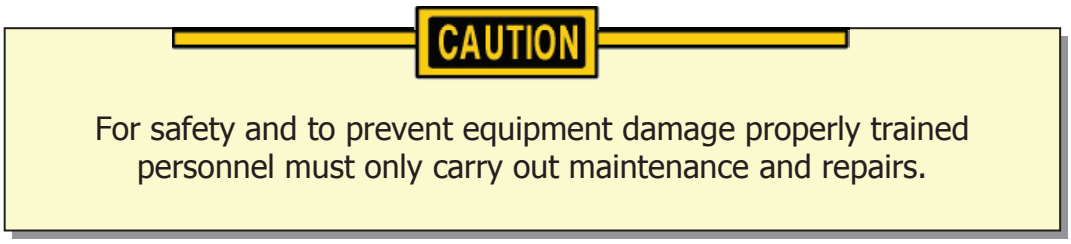
a. A maintenance card in table form is acceptable.

b. Principle contents:

   i. Serial number of machine
   ii. Model
   iii. Three phase voltage
   iv. Three phase current
   v. Temperature of a motor in operation
   vi. Ambient temperature, humidity, weather, date and time
   vii. Time of start and stop
   viii. Special remarks
   ix. Operator's name

6.6. POINTS TO NOTE ON DISASSEMBLY.

a. Disassemble according to the pre-set steps.
b. Necessary tools should be ready before disassembly.
c. Mark the disassembled parts so as to facilitate re-assembly.
d. Place parts, bolts and nuts etc, in a box to avoid misplacing.
e. Avoid damage to heavy parts during transportation.
f. Dust accumulation on coil-end, ducts etc., should be cleaned during disassembly.
g. Coat parts with light oil.
h. Note if there is any shaft deflection or bearing damage when re-assembling.
i. Disassemble and assemble bearing according to the bearing maintenance manual.



Chapter 7: BEARINGS

7.1. MAINTENANCE OF ROLLING BEARING.

NOTE

Whilst Motors are installed awaiting commissioning they must be adequately protected against the elements, all external components in particular the shaft extension and external labyrinth seals at the drive end must be fully covered to avoid water ingress entering the motor body whilst stationery.

Please ensure that both the non drive end and drive end antifriction bearings are fully purged with sufficient grease at first start up/commissioning with the recommended grade and quantity of grease.

7.1.1. General.

Bearings play a very important role in motor performance. It is essential to keep bearings in good order for the motor to operate at optimum performance. For this reason, please maintain bearings according to this manual.

7.1.2. Motors within frame sizes D180 and below are complete with sealed for life Bearings. (Unless the specification dictates these need to be re-greasible) This type of bearing is a non maintainable item and has been pre packed with grease and fitted with containment shields at point of manufacture. These bearings do not require greasing for the life of the bearing.

7.1.3. Motors within frame sizes D200 and larger are equipped with through flush greasing facilities.

Grease replenishment is required, if the motor has been out of service for 3 months or more and should also be carried out on initial start and at regular intervals thereafter.

a. Replenishment of grease is recommended when the motor is running.
b. Clean the grease nipple and open the grease drain (if applicable) prior to greasing. Restore after greasing.
c. A slight leakage of grease between the flinger and bearing cover is normal and assists in totally sealing the bearing from ingress of dust and foreign matter.