Index

1. Description of Breaker Hydraulic Systems.

1.1 - Breaker Technologies.

The breakers currently in the market can be classified into two main groups:

- **Hydraulic thrust.**
- **Gas thrust.**

The disadvantages of gas-thrust breakers are as follows:

- Loss of nitrogen which gradually reduces the impact energy;
- High susceptibility to ageing and early wear;
- Efficiency greatly affected by temperature changes;
- Low second-hand residual value;
- Excavator pumps wear out quickly;
- Hydraulically stiff: they stress excavator arms and sleeves and they overstress the outlet and inlet pipes.

Therefore, the advantages of oil-thrust breakers (such as INDECO) over gas-thrust (old style) breakers can be summarised as follows:

- The gas charge and energy per blow can remain constant;
- Reduced wear and tear, and high resell value;
- Efficiency less affected by temperature changes. Internally or Externally
- Hydraulic shock absorption system leads to less stress is placed on carrier pins, bushings and auxiliary plumbing components.
- Less needed maintenance, results in lower costs and improved ROI.
- Leading manufacturers in breaker technology are adopting hydraulic thrust.
- Industry recognition for longer life between service intervals.
- Simple design and fewer seals in breaker, resulting in lower cost to renew.
- Simple design also aids in troubleshoot problems with ease.

1.2 - Indeco Hydraulic Breakers.

The Indeco Hydraulic System is very simple to use and has several advantages over its rivals:

- First, the Automatic Variable blows which recognise the type of material to be broken and adapt the power of the blow and the frequency to the type of rock. This optimises the hydraulic power supplied by the excavator and cuts fuel costs;
- Indeco breakers also have a dual shock-absorption system - a hydraulic one and a mechanical one. The first is a system made up of hydraulic cushions, which dampen the outward vibrations. Together with the external shock absorption system, consisting of upper and side shock absorbers, this system greatly reduces the vibrations and stress transmitted to the excavator;
- The simplicity of the hydraulic system and in particular the distribution require few O-rings and seals, with a large reduction of the cost of replacements;
- The automatic centralised greasing system considerably improves the greasing of all of the parts, even those not in vertical positions;
- The quick-change field replaceable lower bushing insert which enables maintenance to be carried out in the workplace without prolonged machine down times. Does not require disassembly of breaker. This insert bushing can be made either of steel or of a future alloy material and incorporated into older models for quick upgrading. Correct choice of insert will lengthen the service life of the tool. Currently available are Bronze, Steel, and Composite.
- The lightweight of Indeco breakers, which is due to their simple design, reduces stress on the excavator arm. Their slim lower end structure makes them ideal for specific uses like work in tunnels or in cuttings;
- Indeco breakers are available in the soundproofed HD model, and in supersoundproofed Whisper model. Both models ensure that noise levels are considerably reduced, especially in the Whisper version, which uses sound isolating material inside the casing.

2. Breaker Use.

2.1 - Foreword

In order to use Indeco breakers correctly:

- Make sure to match the breaker & carrier size with the right tool for the material to be broken.
- Review & read operators manual.
- Check pre-installation setup by experienced technician, by checking the oil flow rate and pressure supplied to the breaker are within specifications.
- Check to see if the hydraulic plumbing is set to breaker mode and restriction free and the shut off valves are open.
- Make sure the breaker and the tool are pre-greased;
- Adhere to all breaker safety precautions & job site safety.

2.2 - Rules for correct use.

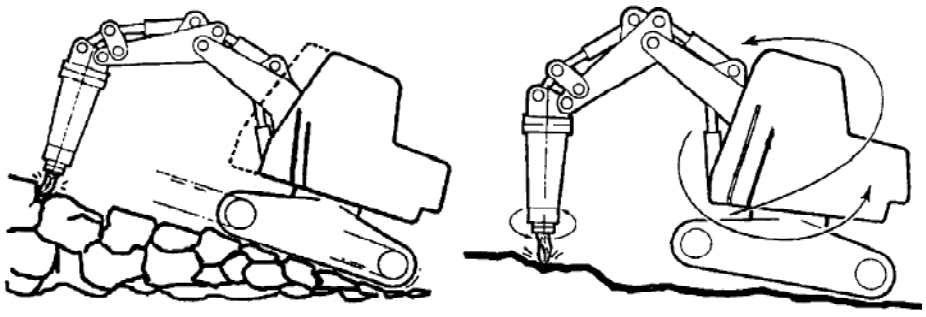


Fig. 1 – NO – rotate or move the excavator using the tool as a lever

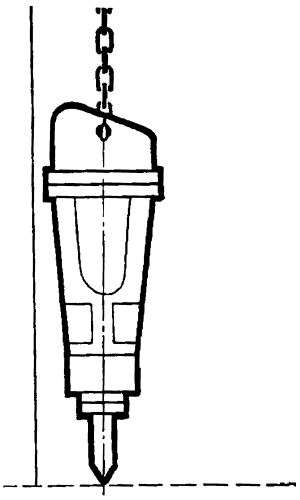


Fig. 2 - YES - always keep the breaker perpendicular to the rock or to any surfaces

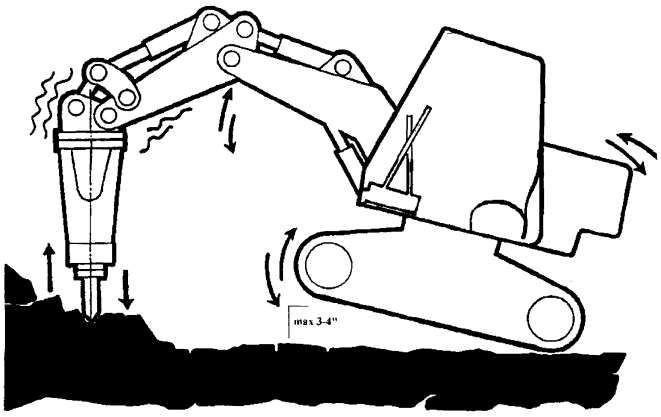


Fig. 3 - NO - rest the excavator on an unstable base

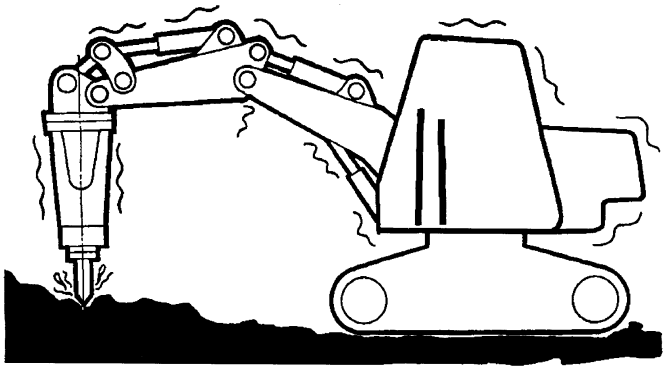


Fig. 4 - NO - press the breaker tool lightly against the rock

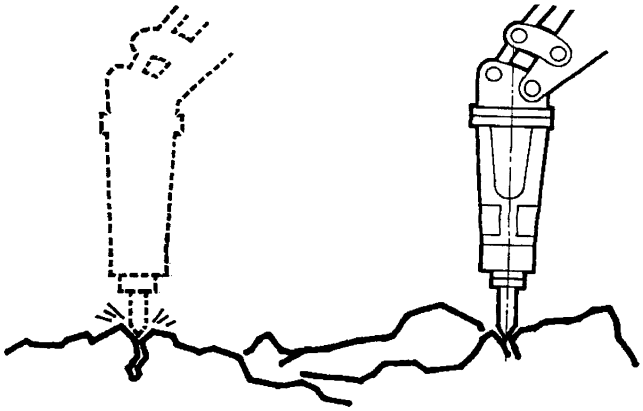


Fig. 5 - YES - reposition the breaker every 30-40 seconds

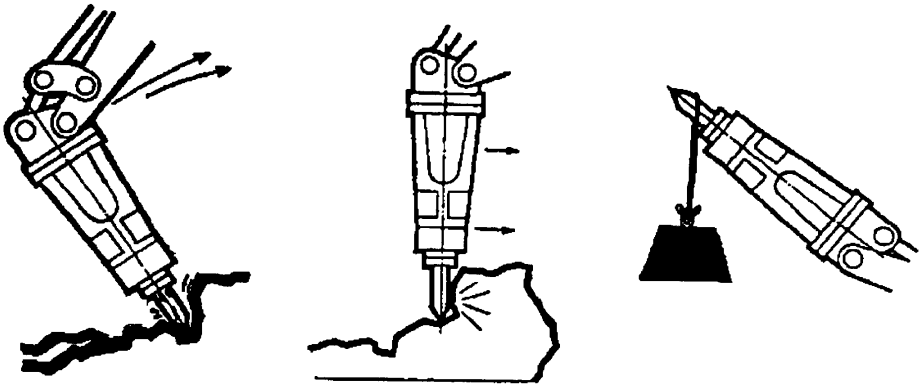


Fig. 6 - NO - lever with the tool, lift weights or wrongly position the breaker

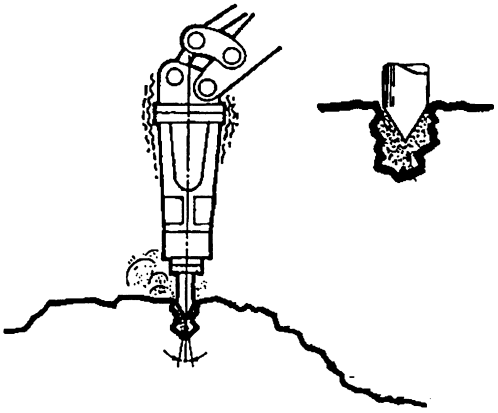


Fig. 7 - NO - allow an overheated cushion of air to form under the tool

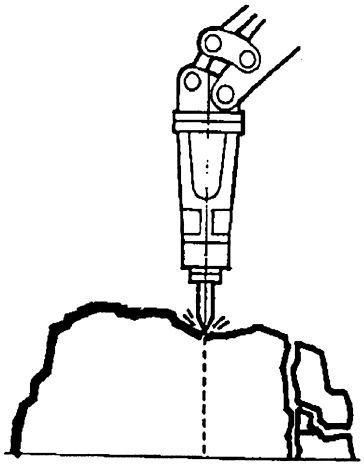


Fig. 8 - YES - make sure that the energy of the tool is released on a hard stable surface

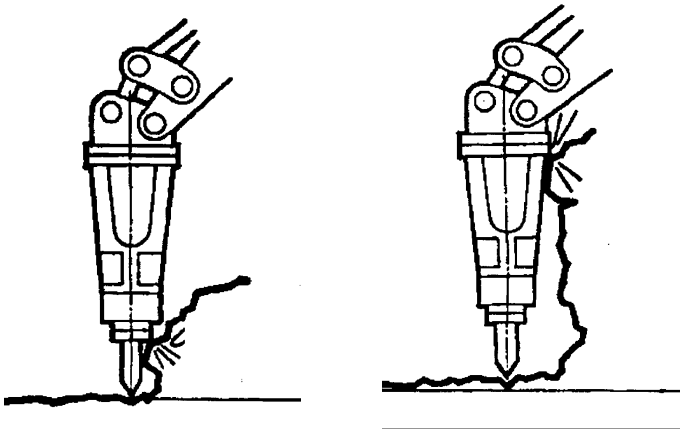


Fig. 9 - NO - do not work if there are any obstacles contact the breaker

Indeco recommends:

- Pushing the breaker firmly against the rock.
- Following through with the breaker as it penetrates (correcting the inclination as it does so).
- Do not dry fire. (not enough down pressure on tool or blank firing).
- Keep an optimal thrust. (excavator position over work area)
- Ensure that the breaker is in the right position. (tool at 90 degrees to material)
- Always ensure, that there is a coating of grease on the tool & inside the bushings at all times.
- Do not pry and or overstress the working tool.
- Maintain or install a sharp working tool as needed.
- Inspect the tool. Inspect upper part of tool, spacer, bushing & axles.

2.3 - Choosing the right tool.

Choosing the right tool can give the following advantages:

- Increases productivity.
- Reduction in tool breakage.
- Less bushing wear.
- Damage breaker wear items.

To make the right choice, identify the most common type of work that the breaker has to perform. We recommend that you follow the indications on the next page.

NOTES:

2.3.1 - Tools and recommended use:

TOOLS

Chisel tool 	Suitable for all earthworking or narrow-section excavation jobs on medium to hard stratified rock.
Moil point tool 	Suitable for breaking up concrete, or medium-hard non-stratified rock. Secondary demolitions: average, hard or extremely hard blocks.
Asphalt cutter 	Suitable for breaking up concrete, or medium-hard non-stratified rock. Secondary demolitions: average, hard or extremely hard blocks.
Wood cutting chisel 	Suitable for felling trees and cutting large tree stumps.
Pile driver 	Suitable for pilework or press-moulded supports for guardrails, etc.
Shovel-shaped tool 	Suitable for cutting asphalt, breaking up flooring, as well as brick or sandstone walls, where the working direction of the tool is perpendicular to the direction of the machine.
Pyramidal point 	Suitable for demolishing hard reinforced concrete flooring, as well as sedimentation material.
Cobra chisel tool 	Suitable for all types of excavation work on medium-hard to hard rock, non-stratified rock or rock which tends to pulverise when being broken up, "puddingstones".
Blunt tool 	Suitable for breaking up blocks of any hardness, or to reduce the size of rubble.

3. Breaker Installation.

3.1 Machine & Breaker Combination.

The breaker & machine combination is very important. In particular, any comparison with competitors' breakers should take into account tool diameter. Making the right choice of breaker for a particular excavator eliminates any breaker reliability problems, excessive or wasteful stress and poor work yield. We recommend checking with your local dealer or Indeco's web-site at www.indeco-breakers.com. Your dealer has sales brochures with detailed carrier and breaker combination listings.

NOTES:

It is also very important, to choose the right breaker for the hydraulic characteristics of the excavator. For small breakers, make sure that the backpressure in the aux. circuit is no higher than that shown on the breaker specifications. For all circuits on medium and large breakers, it is important to ensure that the backpressure is as low as possible (6-8 bars max) (75 to 100 PSI). To eliminate high backpressure, you can modify the return line (changing hose diameters and curves and altering any taps and/or valves). For further information, please contact the Indeco technical department.

Below is a table with the technical specifications needed to install a breaker on a carrier. **It is not recommended to calibrate the carrier with the maximum oil delivery and maximum pressure. Instead, choose:**

- Maximum delivery and minimum pressure, for a high working frequency.
- By contrast, minimum delivery and maximum pressure, for increased penetration.

Finally, always make sure that the return line backpressure is lower than the maximum value shown in the specifications.

BREAKER	OIL FLOW RATE MIN GPM	OIL FLOW RATE MAX GPM	INLET PRESSURE PSI	INLET PRESSURE MAX PSI	BACK PRESSURE MAX **PSI**	OPERATING WEIGHT lb	EXCAVATOR WEIGHT (OPTIMAL MIN-MAX) tons
HP200	4	7	1650	1800	190	230	.75 to 3.3
HP350	7	12	1650	1800	210	360	1.6 to 5.5
HP500	8	16	1650	1800	200	510	1.8 to 7
HP750	14	22	1650	1800	270	710	3.4 to 8.8
HP1000	14	24	1700	1850	220	860	4--12
HP1100	14	27	1700	1850	220	980	4--14
HP1250	19	28	1700	1850	160	1170	5.5--16
HP1500	19	29	1700	1850	120	1380	8--18
HP1800	22	34	1850	1900	140	1880	12--22
HP2000	23	35	1850	1900	120	2250	14-25
HP3000	30	40	1850	1900	120	2650	19-32
HP4000	34	43	1850	1900	100	3320	23-42
HP5000	39	48	1925	2025	120	4350	24-35
HP5500	43	53	2100	2250	100	4900	25-40
HP7500	48	61	2100	2250	120	5780	32-62
HP8000	51	71	2100	2250	100	6650	40-70
HP10000	67	81	2200	2350	120	8900	45-80
HP12000	77	94	2200	2350	120	11100	50- 90
HP16000	86	111	2200	2350	130	17200	60-100

fig. 11

3.2 - Checking Auxiliary Hydraulics on the carrier.

Before the breaker is mounted on the excavator, the following points must be checked:

- The aux. hydraulic flow on the excavator must match with the indications set out in the technical specifications for the breaker;
- **In particular, the return line must be directly connected to the tank;**
- If, however, the return pipe goes to the control valve spool, ensure that the backpressure is lower than the value shown in the breaker specifications, or contact Indeco for help with the choice of breaker. **In most cases, the backpressure will be too high.**
- Also, the size of the outlet and inlet pipes going to the breaker must conform to the indications set out in the technical specifications for the breaker. In most cases, the return is one size larger than the pressure.
- Check both whip hoses for restrictions such as 90degree turns, quick couplers, small shutoff valves or any other restrictions that could cause a loss of flow back to tank.

3.3 - Regulating the flow rate and the inlet pressure to the breaker.

Before installing the breaker on the excavator, the flow rate and the inlet pressure have to be tested. A flow meter shown here in figs. 12 and 13 is adapted and connected to the excavator plumbing.
All of the calibration operations need to be carried out when the oil at working temperatures.

Fig. 12

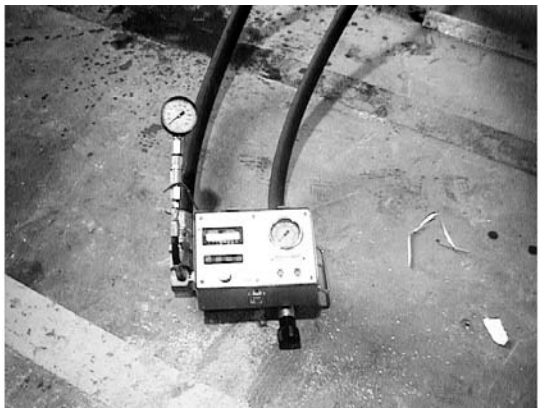


Fig. 13

3.4 - Flow testing & adjusting the excavator relief valve.

After adjusting the flow rate on the carrier to the breaker, the relief valve on the carrier must be adjusted. Again, a flow meter is used for this and is connected as shown above.
Choke the flow meter until the flow rate drops. The pressure value corresponding to the reduction in the flow rate is the set-up value for the valve. This value has to correspond to that indicated in the breaker specifications, about 25% higher than the operating pressure.

3.5 Checking the breaker operating pressure & backpressure.

Connect the breaker to the excavator and check that the oil is hot (simply touch the pipes). Then connect the pressure gauges to the breaker at the attachments.
This operation is carried out by adjusting the central valve on the breaker head using a large wrench (see fig.15) and pressure gauges consisting of: a glycerine filled pressure gauge (see fig.14) (range up to 5000 PSI) with 1/4" or 1/8" test high pressure flexible hydraulic hose. Indeco has a testing kits available for purchase if needed.

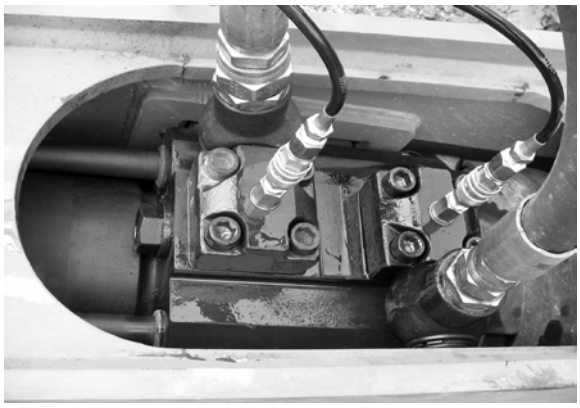


Fig. 14

Check both oil pressures ports with the breaker working (caution test ports are metric BSPP) The pressure and return ports must show the values indicated in the specifications. To regulate the pressure to the breaker, adjust the central pressure valve in the breaker head by add or removing shims under spring wear disc.

Fig. 15

The number of shims can be changed to increase or decrease pressure. To increase pressure, add shims under wear spacing disc under the spring, where as to decrease pressure remove the number of shims under spacing disc. The medium size breakers will have two special shims that measure 2mm each, instead of the 1mm. If there are no more spacers to remove when decreasing pressure a reduction of GPM will be needed, Contact Indeco service for guidance & suggestions. No more than eight spacers should be used. Each 1 mm spacer increases the pressure by about 5 bars. (75 to 100PSI) depending on backpressure.

If the operating pressure is still too high, this may be due to:

a) High back pressure; (too small of a return line, quick couplers, too many 90's or 45's fittings, return line not going straight to hydraulic tank)
b) High oil flow rate (GPM to high, use a external flow control valve to reduce flow) optional OEM or from Indeco.
c) Central valve defects. (Trash in orifice bleed hole)

If the pressure is too high, this will stress the breaker components, reducing their service life. If the backpressure is too high, the circuit needs to be rerouted by connecting the outlet directly to the tank or by asking the excavator manufacturer for advice. For pressurized breakers (closed circuits), you must ensure that the backpressure is sufficient to provide adequate inlet pressure (about 10 to 20 bars, according to the type of breaker). In some models, you need to follow specific indications, such as for the HP 200 and HP 500. For further information, please contact the Indeco technical department.

3.6 - Calibrating the breaker. (speed and pressure valve regulation)

Breaker calibration involves regulating the blow frequency and thus the energy of each blow. Make sure that the oil is hot. This regulation can be carried out manually on medium and large breakers, while it is automatic on small ones.
The calibration involves adjusting the variable valve, which lies next to the central one in the head. This is done after first calibrating the central valve.
In order to increase the working frequency, either the number of spacers or the stiffness of the spring must be increased. Similarly, removing some spacers can reduce the frequency.

NOTES:

4. Breaker disassembly and assembly.

4.1 - Removing the tool.

In order to remove the tool, the tool retainers (pos. 108) must be taken out of their housing in the sliding block.
Push the stop nut, located beside the hammer (pos. 109), firmly into place with a screwdriver or similar tool, turn 180° until it returns to its resting position.

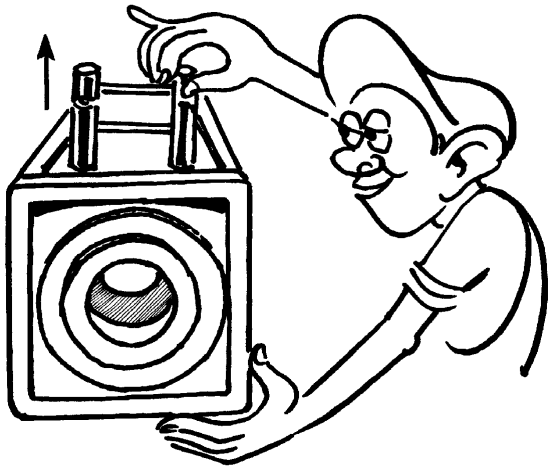


Fig. 16

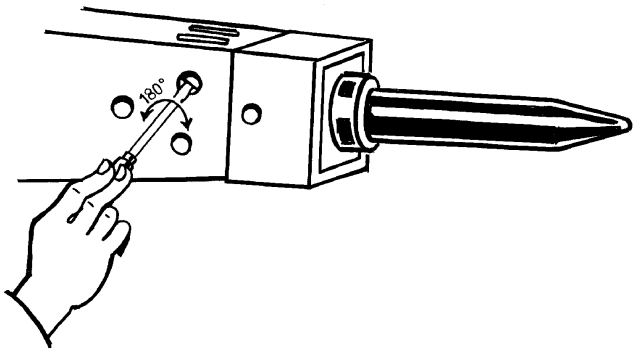


Fig. 17

Then, using the same screwdriver or rod, push the tool retainer out from the opposite side.

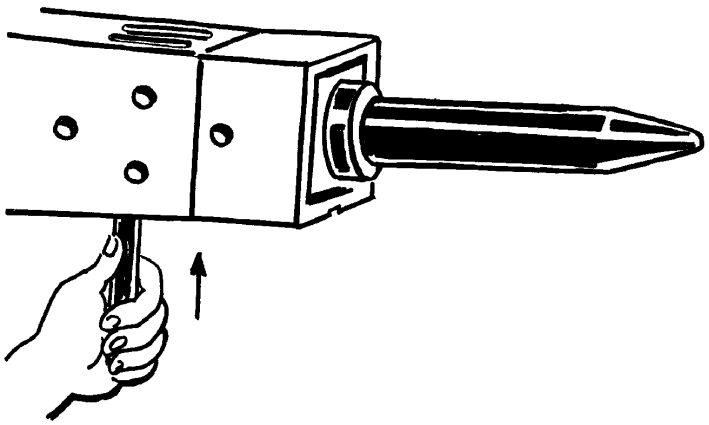


Fig. 18

Repeat the above for the second tool retainer. During re-assembly, insert the WELL GREASED tool so that the hollows on the sides of the tool are aligned with the tool retainer compartments and push firmly into place.

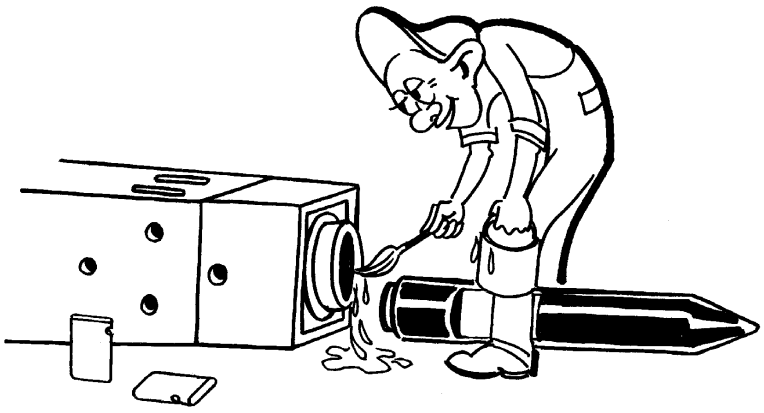


Fig. 19

Insert the tool retainer with the slots facing the front of the breaker and push firmly into place, then push the stop nut down and twist 180° to block the tool retainers.

4.2 - Disassembling the accumulator and recharging it.

The nitrogen charge in the accumulator is essential for the correct operation of the breaker, both for blow energy and for hydraulic efficiency. If the accumulator needs recharging, then there will be strong vibrations on the breaker pipes, especially on the inlet one. Every 600 hours or every 12 months, it is advisable to recharge the breaker with nitrogen. The diaphragm should be replaced after each gun reseal or removal of accumulator gas. **The sealing ring under the charging plug must be replaced each use.**

a) Break free the eight accumulator screws (pos. 507) with an Allen Wrench. (See Appendix A). Once the screws have been broke free, speed up the operation with an impact driver.

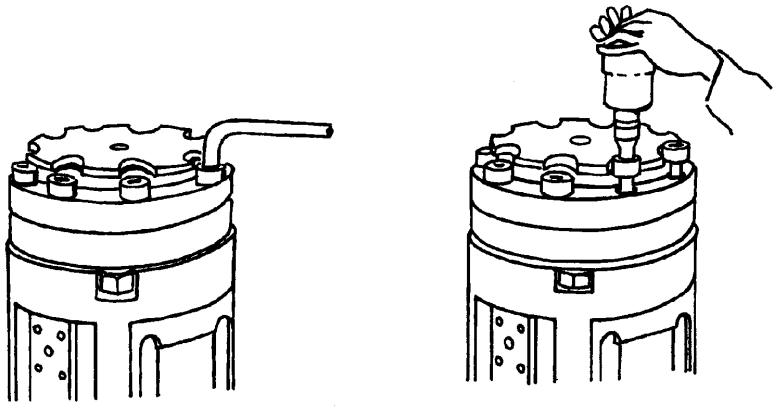


Fig. 20

b) Remove the accumulator from the head using the same screws (pos. 507) assembled in the side holes, and check the state of the O-ring (pos. 508).

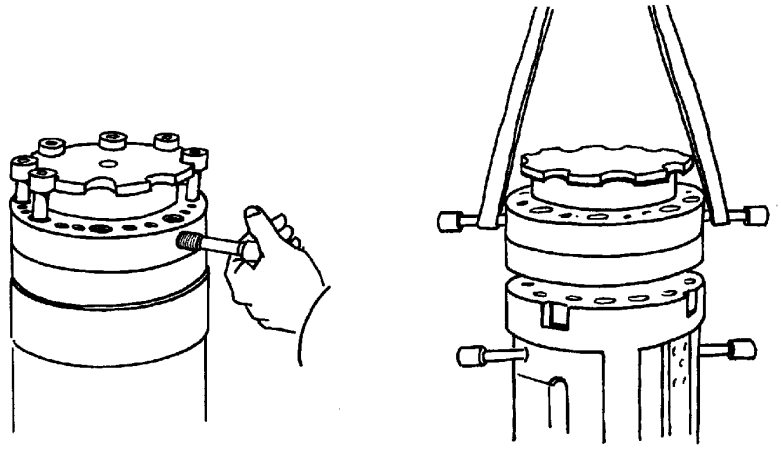


Fig. 21

Some accessories are needed for the recharging operations:

a) A high pressure nitrogen regulator gauge with a connection for a nitrogen bottle that is adjustable outlet up to 1000 PSI.
b) Clean hydraulic hose for connecting to charging valve. (no oily hoses)
c) Indeco Charging Kit.
d) Torque Wrench.
e) Soap water or hydraulic oil for leak testing

The recharge must be carried out at 450-500 psi if the oil temperature is usually above 160°F; otherwise if the cooling system is better and the temperature is around 140°F the recharge must be carried out around 500-575 psi.

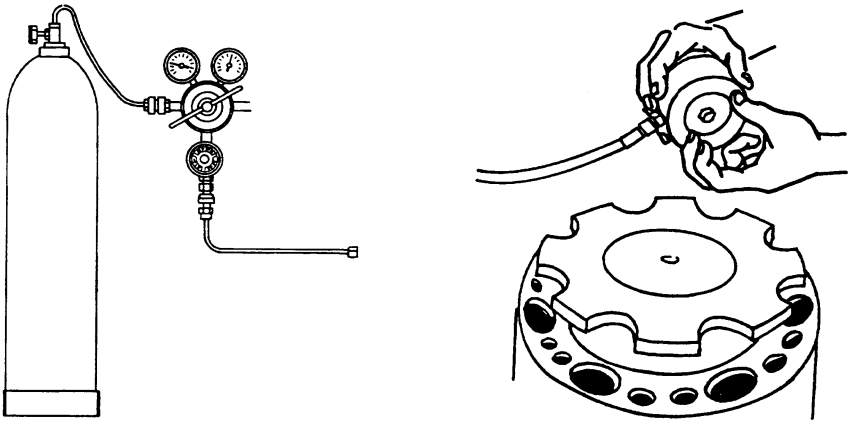


Fig. 22

a) WARNING: Before recharging, undo the screw (pos. 504) and release the nitrogen. Wear gloves and use a protective screen to protect yourself against any oil that might be forced out;
b) Open the accumulator by undoing the screws (pos. 506) with an Allen key;
c) Replace the diaphragm (pos. 503);
d) Close the accumulator and cross-tighten the screws (pos. 506) using a torque wrench to the torque settings indicated in the table below (Appendix A);
e) Use a new sealing ring (pos. 505) and check the resting surface. Tighten the screw (pos. 504), after coating it with Teflon Tape. Recharge the accumulator to 0.5 Kgm and then proceed with charging. Feed in the nitrogen through the reducer valve. Finally, tighten the screw on the accumulator.

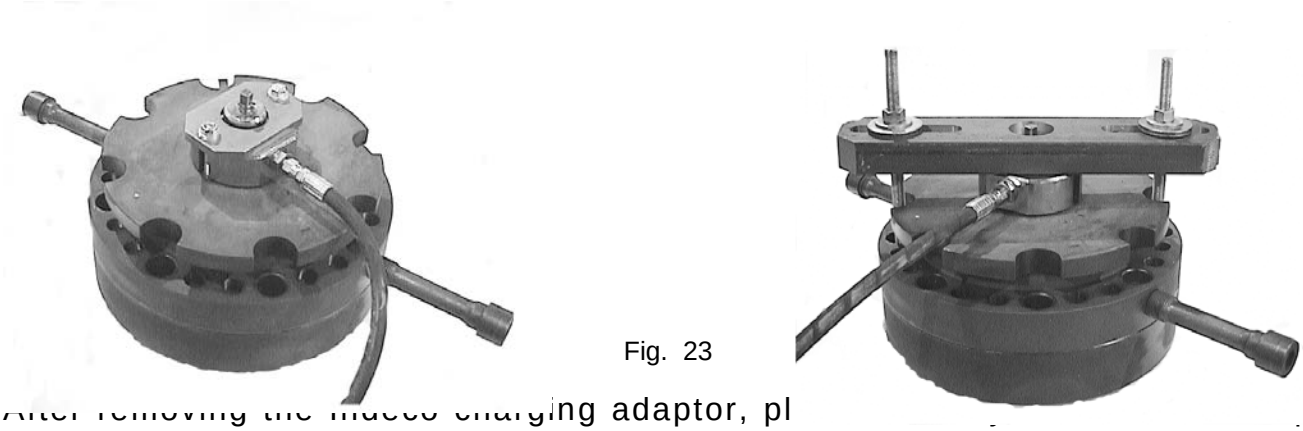


Fig. 23

After removing the Indeco charging adaptor, pl water on the charge plug to check for gas leaks. Leave the oil for a few hours (fig. 24).

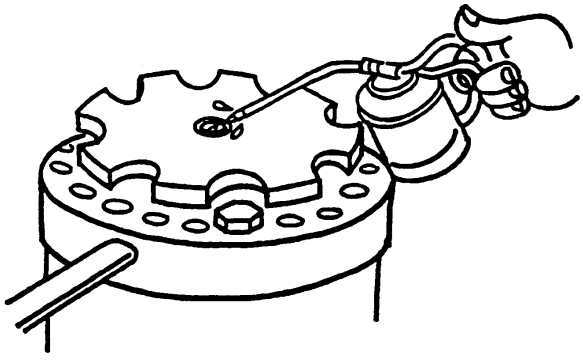


Fig. 24

4.3 - Disassembling the breaker.

4.3.1 – Top Mount Cap, Hose Swivel Links and Side Shocks.

a) Place the breaker in a horizontal position, pull out the tool retainers and remove the tool (par. 4.1);
b) Loosen the bolts and the corresponding nuts (pos. 618 and 619) that hold the Top Cap to the breaker casing (fig. 25).

Fig. 25

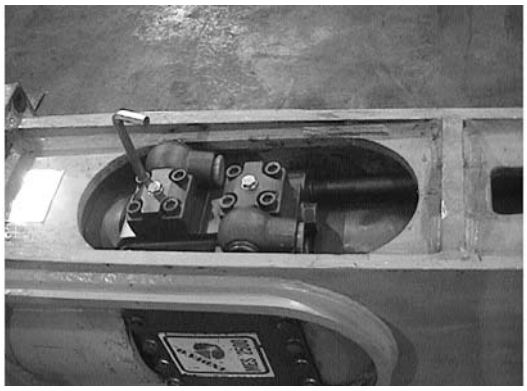


Fig. 26

Using an Allen key, remove the four bolts (pos. 409) that attach the H.P. connection (pos. 401). (Fig. 26). When dismantling, check the state of the O-rings (pos. 410). Repeat the same operation for the L.P. link right below it.

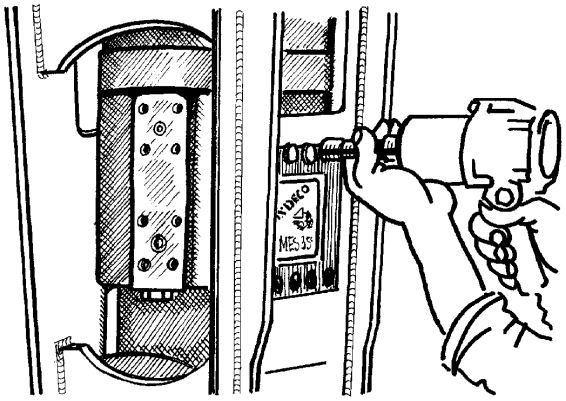


Fig. 27

Then remove the side shock-absorbers (side shocks) (pos. 602) by removing all the connection bolts with a spanner (fig. 27). Do not damage the threads. Preheat bolts to soften red (loc-tight) and if the breaker is horizontal, support the breaker about 50% with a strap to unload the side shocks. Clean thread with tap to remove remaining thread-locker

Fig. 28 – Unloading & Removing Side Shocks

Fig. 29 – Extraction

Once the breaker has been removed from its casing, see figs 28 and 29 for small breakers and fig. 30 for large breakers, place it in a pit or on a jig to keep it vertical during the subsequent disassembly and re-assembly phases. This becomes important when re-torque the bolts. (fig. 31 and 32)

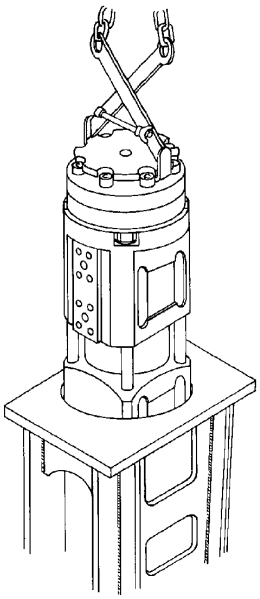


Fig. 30 - Lifting

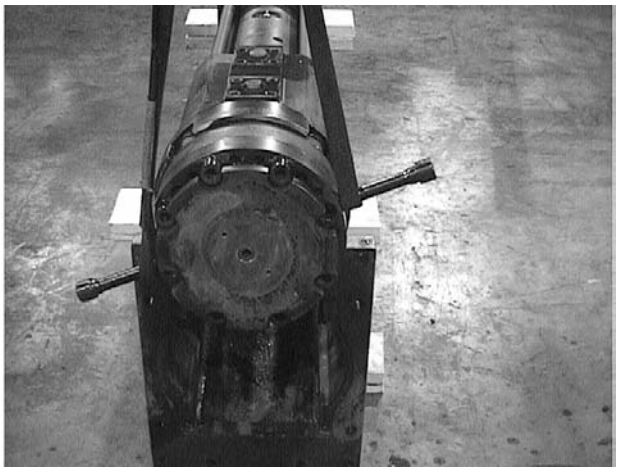


Fig. 31 - Slinging the breaker

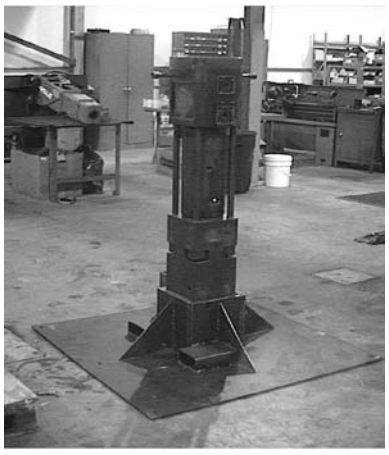


Fig. 32 – Holding

Note: The Accumulator bolts are used as lifting aids for the Accumulator, Head & Cylinder.

4.3.2 - Head disassembly.

Remove the steel diaphragm (pos. 306) from the head (pos. 301) and check for damage. If it is slightly worn, you should grind the coupling surfaces. After these controls, carefully wash the steel diaphragm (pos. 306) and keep it carefully covered in a clean place.

a) Remove the four rubber stoppers. (pos. 313) and the metal stops on the side bolts;
b) Loosen the four side bolts. (pos. 307) (fig. 33);
c) Slide the side bolts out one at a time, to ensure that you remount the same polygonal nut (pos. 308) back onto each one (fig. 34). Clean and visually, check the thread. Check the resting surfaces for the side bolts, nuts and head. If necessary repair them;

Fig. 33 - loosening the side bolts.

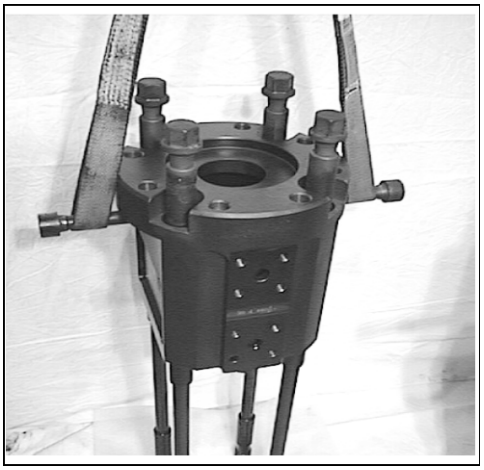


Fig. 34 - lifting the head and side bolts.

d) Check the state of the O-rings (pos. 303) on the head.
e) Check the state of the O-Ring. (pos. 410) on the central valve of the head, then regulate the breaker pressure, after first extracting the barrel (pos. 411).
f) Carefully wash the head and the valves, make sure they work, replace the O-Rings (pos. 303 & 410), reassemble the valves and put them aside in a clean place.
g) If the distributor (pos. 304) did not come out at the same time as the barrel, remove it now from the distributor box body.
h) Using the specific extractor tool for Indeco breakers, extract the box body (pos. 302) from the head (pos. 301) and the shock absorber cover (pos. 305) making sure not to lose the pin (pos. 310). Check the state of the O-Ring (pos. 311) and put it aside in a clean place.

Fig. 35

Fig. 36

i) Remove the distributor and make sure that the external faces and the insides are uniform and clean;

j) Remove any oil left inside the cylinder with a syringe so that it does not spill onto the ground;

k) Make sure that the pin (pos. 211) stays in its place in the guide adapter (figs. 35 and 36);

l) Remove the piston (pos. 209) using the corresponding screw (pos. 507). The guide adapter (pos. 210) will come out of the cylinder (pos. 201) at the same time. Make sure that there is no anomalous wear on either component. Particular attention must be paid to the two resting surfaces and if necessary, they should be taken away and polished until smooth.

4.3.3 - Cylinder disassembly.

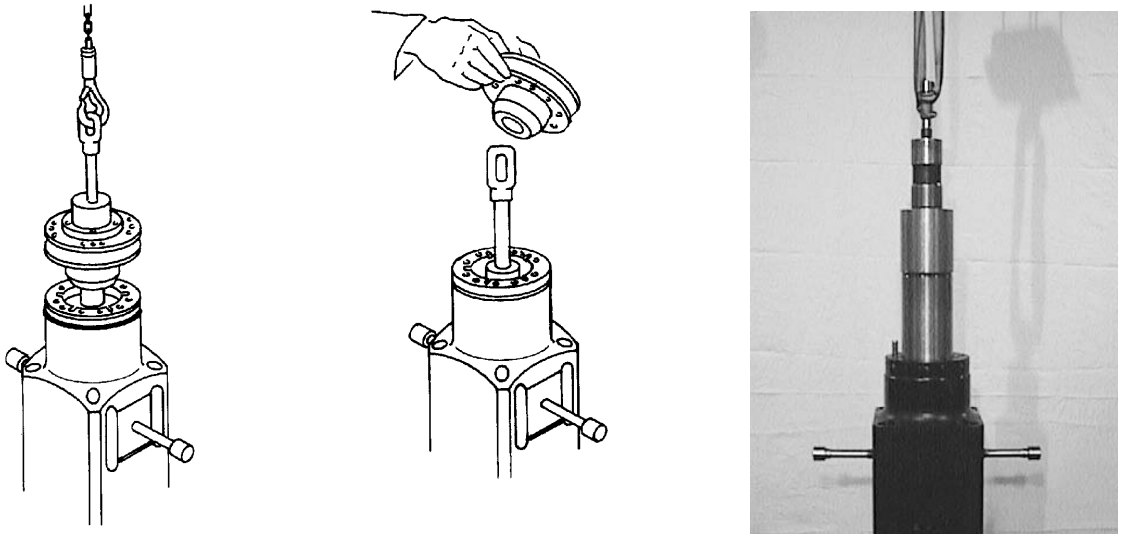


Fig. 37 - removing the piston and the guide adapter

a) Remove the check valves (pos. 205) from the cylinder and check the blow area. Clean and if necessary replace the check valves and check the cylinder seal area.

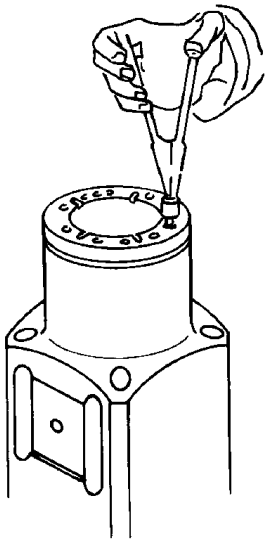


Fig. 38 - removing the valves

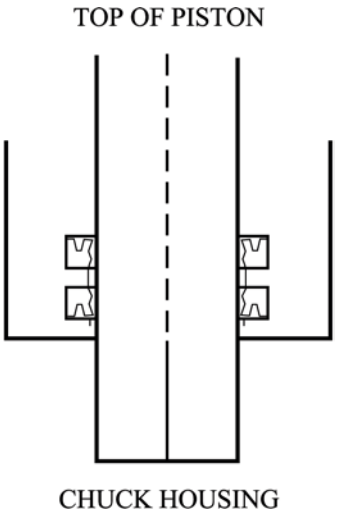


Fig. 39 - cylinder seals

b) Check the coupling areas of the cylinder in the head area;

c) Remove the cylinder (pos. 201) from the chuck housing (pos. 101) using the screws (pos. 507), which should then be attached to the existing holes on the chuck housing. Check the inside of the cylinder and if there are any seizures lap with an appropriate lapping tool cooled with petrol;

d) Check the lower coupling and how it sits on the spacer, replace the 'O' ring (pos. 303) and the lip seals (pos. 204). Carefully clean the inner seal (its lips turn inwards) and the outer one, which acts as a dust guard (its lips turn outwards). Keep in a clean place.

4.3.4 - Dismantling the chuck housing.

a) Manually remove the spacer (pos. 105). If necessary, put the tool back into its place to help remove the spacer;

b) Manually remove the upper bushing (pos. 104). If necessary weld a disk inside it and extract it using a press;

c) Using an M10 pin, remove the nylon plugs (pos. 112) and remove the pin (pos. 103), if necessary using a pin remover;

Note: some units have one a piece spacer

Fig. 40 - bushings

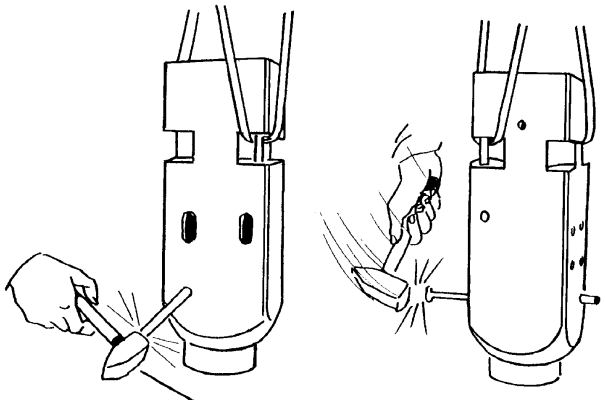


Fig. 41 - elastic pin (metric)

d) Remove the elastic pin (pos. 110) by driving down using a metric pin remover, into until it falls inside the housing. (fig. 41). The tool retaining plug (pos. 109) will now be free - check the wear on the retaining plug, the replace O-ring(s) (pos. 113) and the reaction spring (pos. 111) (fig. 42);

Note: a solid lock is available for hard rock conditions and under water applications to prevent premature axle unlocking.

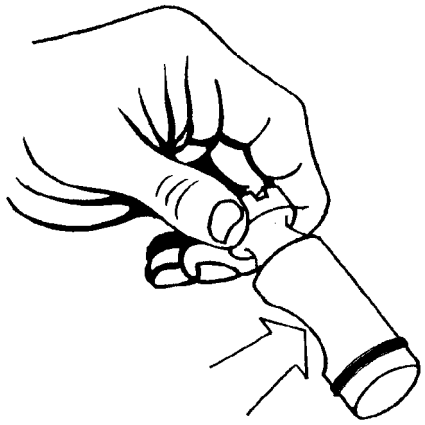
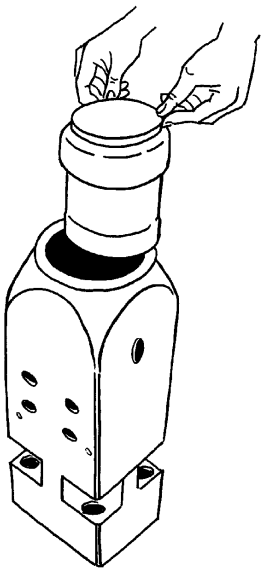


Fig. 42

e) Weld a plug (slice of an old tool) inside the insert holder (pos. 102);



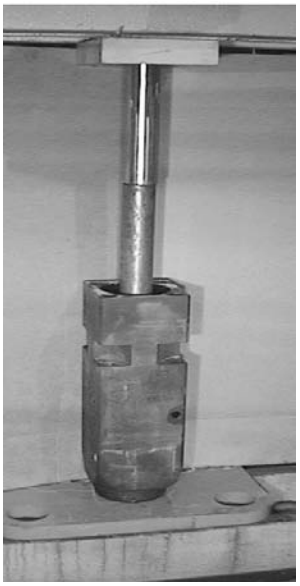


Fig. 43

f) With a plug welded onto the insert holder (pos. 102), remove it using a hydraulic press.

4.3.5 - Disassembling the hydraulic links.

If needed, the HP and LP connection units can be checked as follows:

a) Remove the snap rings (pos. 408) using a pair of special pliers;

b) Remove the tab washer (pos. 407) and pull out the connection. Check the state of the O Rings (pos. 406) and the keying areas. If necessary, replace the O-Rings. Clean carefully and put aside in a clean place.

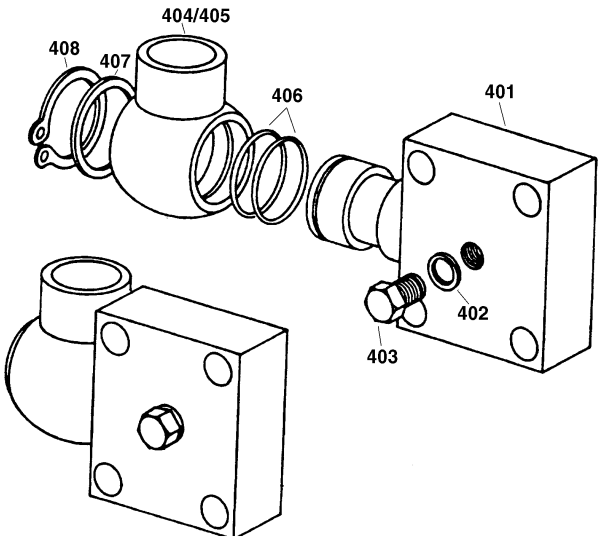


Fig. 44 - supply unit

Note: Non-swivel links are available for special applications were the swivels are not needed.

4.4 - Assembling the breaker

4.4.1 - Assembling the chuck housing.

a) Fix the lower insert holder (pos. 102) by aligning the pin seat with the outer face of the sliding block using the same pin lodged in the bushing gap and measuring the distances at the ends as shown in the picture. After coupling, activate the press and push. Indeco recommends cooling insert holder overnight in freezer, dry ice or liquid nitrogen for immediate installations.

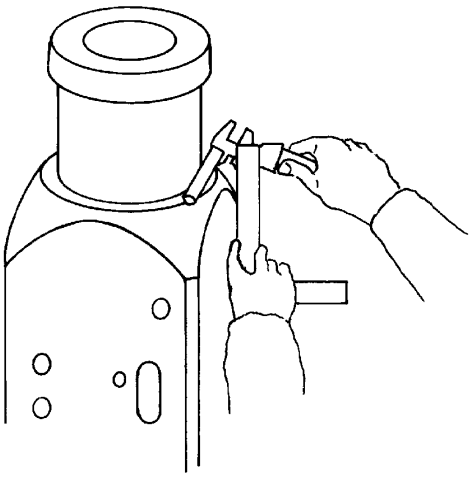


Fig. 45- positioning the bushing insert holder

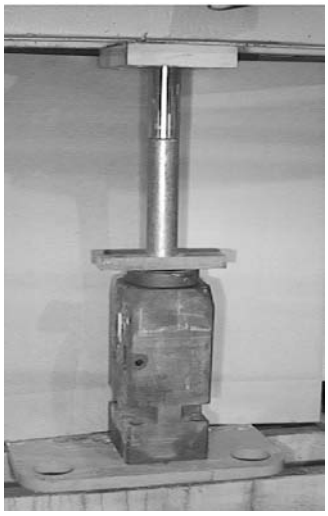


Fig. 46 - mounting the bushing holder

b) Mount the pin (pos. 103) using a hammer, if necessary.

Fig. 47

4.4.2 - Cylinder and Piston assembly.

a) Mount 2 screws (accumulator bolts) into the threaded holes (pos. 507) to enable the cylinder to move better and attach one O-Ring to the cylinder;

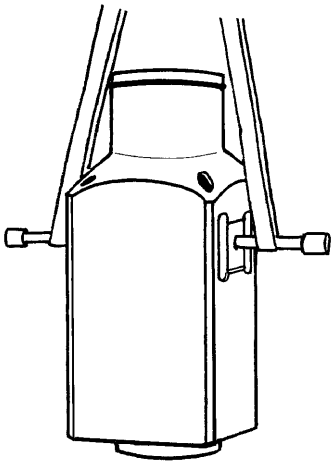


Fig. 48 - lifting the cylinder

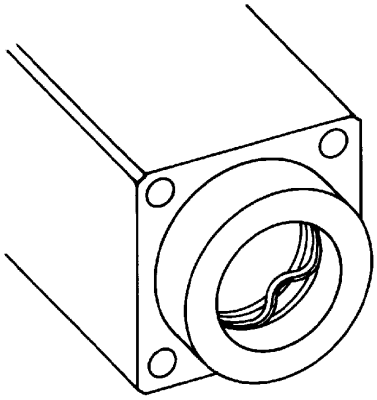


Fig. 49 - Fitting the lip seals

b) Assemble two lip seals (pos. 204) into the internal seats of the cylinder (pos. 203), making sure that they are assembled with the lips facing away from one another. The lip seals (pos. 204) must be mounted on the internal seats of the cylinder (fig. 49);
c) Place the cylinder (pos. 203) complete with seals on the chuck housing (pos. 101);
d) Slide the piston into the cylinder using the anchoring screw (pos. 507) (fig. 50);

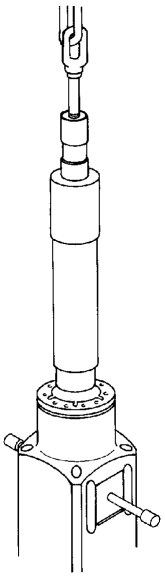


Fig. 50- Piston assembly

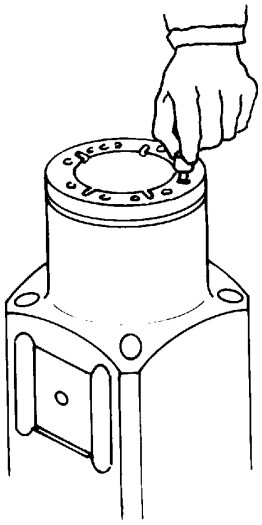


Fig. 51 – Check valve assembly

e) Insert the check valves (pos. 205), (fig. 51);

f) Mount the pin (pos. 211) in the circular guide (pos. 210) and insert them both into the cylinder (pos. 201);

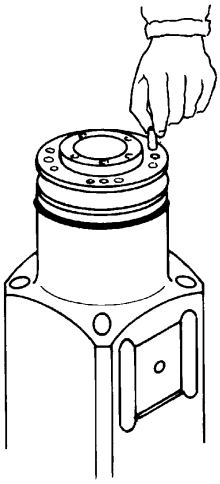


Fig. 52 - Fitting the guide adapter and pin

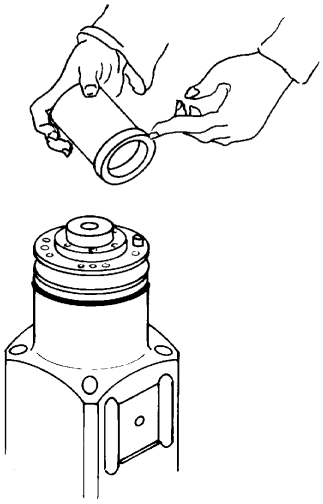


Fig. 53 - Distributor assembly (complete)

g) Insert the distributor inside the box body and check free movement (pos. 304);

h) Set the distributor box body & distributor together on guide adaptor (pos. 302) ensuring that the alignment hole lines up with the pin. Then spread lubricant using a brush, such as STP Oil Treatment or Vaseline.

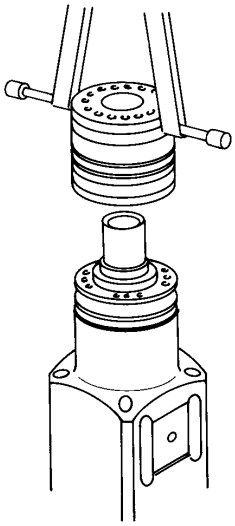


Fig. 54 - Assembling the distributor box body

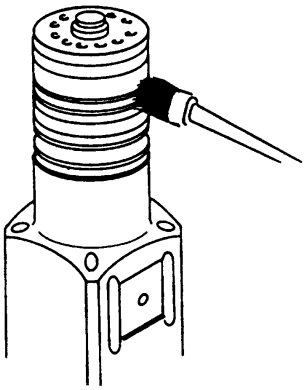


Fig. 55 – STP oil treat the O-rings

4.4.3 - Head assembly

a) Insert the O-ring (pos. 410) onto the barrel (pos. 411) and mount on the central hole in the head. Again spread lubricant liberally inside the head around the o-ring for smooth assembly.

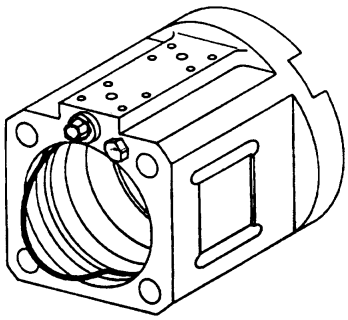


Fig. 56 - O-ring in the head

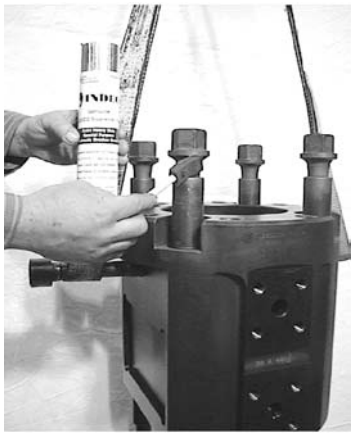


Fig. 57 Assembling and lubricating the side bolts & rubber

b) Use 2 accumulator screws (pos. 507) for lifting the head, and then place the head perpendicularly on the cover and distributor box body and mount it onto the cylinder. Use 2 side bolts opposite the inlet ports to balance the head during installation. Install remaining 2 after head installation is complete.

c) Strike the head with a dead blow hammer until it fits tightly over the distributor box body and cylinder. Larger breakers require larger dead blows. (Fig. 59)

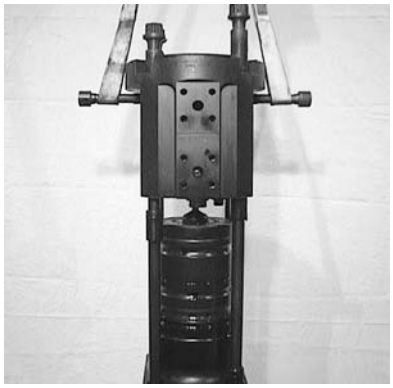


Fig. 58 – Setting head assembly

Fig. 59 – Driving down the head

d) Spread Indeco HD grease generously all over the surface of the side bolts, rubber on bolts, nuts and threads. Then assemble the four side bolts (pos. 307) and the corresponding nuts (pos. 308) to a light torque up to the value shown in the specifications.

e) After preloading, mark the heads of the side bolts with chalk and cross tighten them until the side bolt has performed 1/2 a turn + 15° and then loosen it slightly (anticlockwise), so that it is tightened to exactly 1/2 turn + the initial pre-load torque.

NOTES:

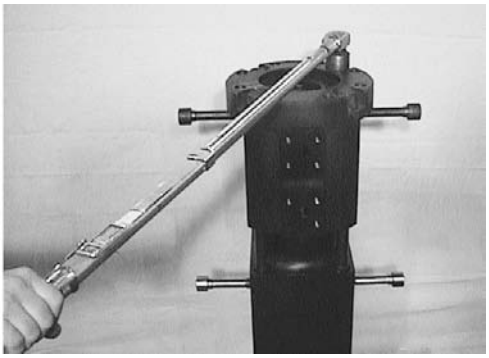


Fig. 60 - tightening side bolts

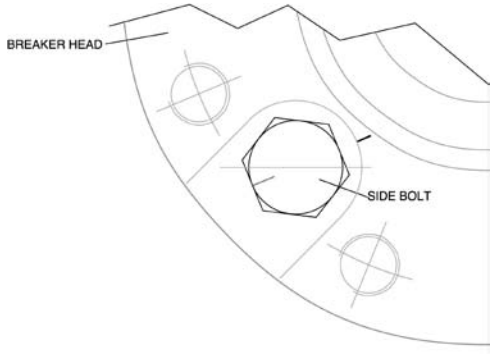


Fig. 61 - marking with chalk before the half-turn

f) Insert 4 side bolt locks and 4 rubber stoppers (pos. 314 & 313) onto the heads of the side bolts.

g) Insert the steel shock-absorbing diaphragm into the shock-absorber cover (fig. 63 next page).

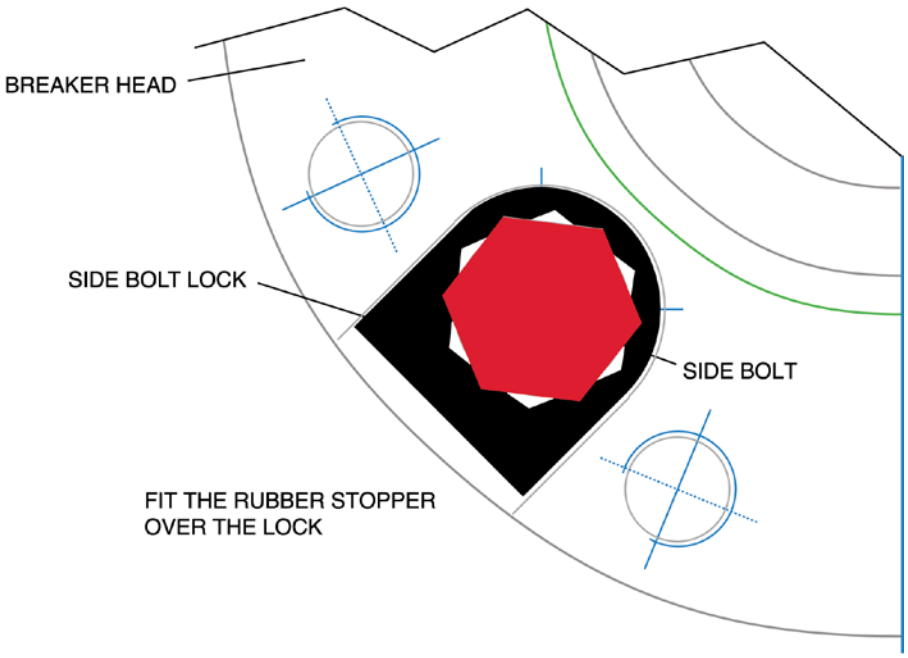


Fig. 62 - side bolt lock

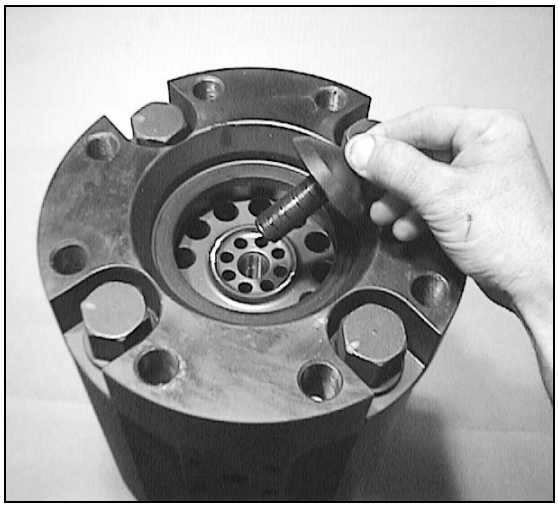


Fig. 63 - steel shock-absorbing diaphragm

4.4.4 - Accumulator assembly.

a) Using the special Indeco tool, check that the accumulator is charged. Insert the O Ring seal into the lower shell (pos. 508);
b) Insert the accumulator into the breaker head, tighten the eight screws (pos. 507) and cross-tighten them to a final torque, as set out in the specifications.

5. Breaker maintenance.

5.1 - General rules

Breaker maintenance is essential for maintaining breaker efficiency and productivity over the course of time. Indeed, as it is used for breaking, it is very important that components subject to wear which control how the breaker works, should be kept under constant control, maintaining the tolerances and the coupling parameters within acceptable values.
A distinction must be made between Large, Medium and Small breakers. For maintenance purposes, it is important to understand that the stress on materials varies enormously from small to large breakers and therefore wear increases exponentially.

5.2 - Routine maintenance

Routine maintenance involves replacing components subject to wear, according to the Indeco specifications shown in the table below (table 1). These values are the mean wear values during normal operations, as reported in the manual supplied with the breaker.
This type of maintenance reduces the cost of replacing components subject to wear, therefore preventing the problems arising from worse damage or long machine downtimes.

As Needed: Min. 1 Hour

- Greasing the tool, if breaker does not have an power greasing system, make sure that in the meantime the tool is always greased;
- In very dusty environments, grease more often (every hour) and if necessary use a dust guard on the lower bushing.

Every 8-16 hours of work

- Make a visual inspection to ensure the side bolts and all of the external screws are tightened (side shock absorbers, front side bolts, screws on oil connections, etc.). Especially during break in periods.

Every 80-100 hours of work

- Remove the tool and turn 180 it so that it is in a new operating position.
- Remove & check the condition of the tool retainers.
- Inspect the clearance between bushing and tool during tool. (see 3.4.5);
- Check the wear on the inserts (see 3.4.4 for alloy).
- Check the wear on the impact bushing (see 3.4.1).
- Grease the wear plates.
- Check the condition of the rubber shock absorbers on the sides and top of the breaker.
- Check underwater plug for tightness.
- Inspect for loose or missing bolts.

Every 600-800 hours of work

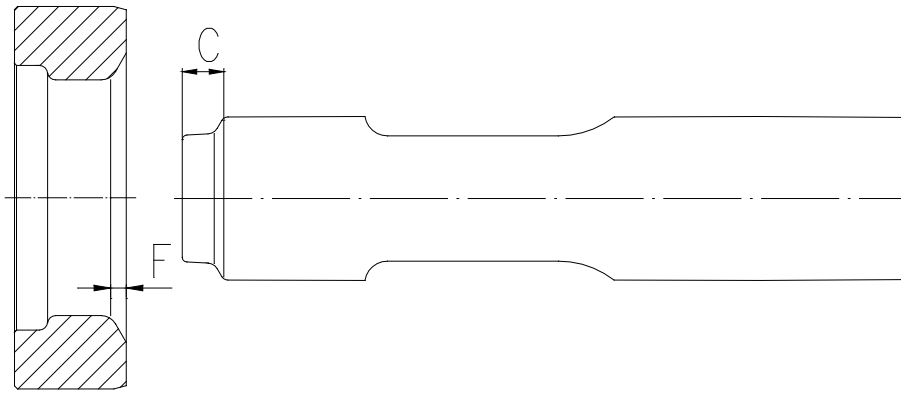
- Check and flow the excavator in order to ensure the right flow rate and oil pressure to the breaker.
- Check the nitrogen charge and replace the seal if necessary.
- Check upper bushing & upper spacer.

5.3 - Programmed Maintenance

Programmed maintenance consists of a maintenance contract offered by Indeco that ensures low cost maintenance with short machine downtime at a fixed cost.
It involves planning service dates with the user so that machine downtime is kept down to a minimum. All the servicing work, the components and breakages are included in the price without further charges. Each job is under warranty and very reliable. Programmed maintenance also keeps second-hand values high.
It is also possible to have a replacement breaker during repair periods.

5.4 - Diagram showing service life of main components.

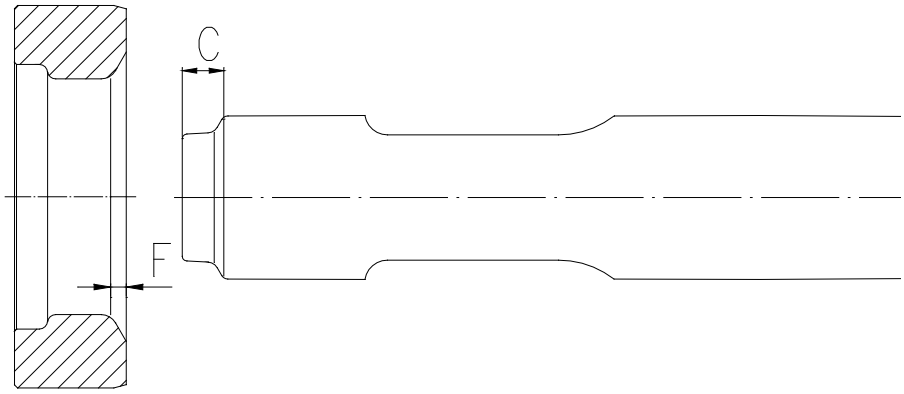
5.4.1 - spacer



BREAKER	C inches	F inches	MAXIMUM WEAR inches	$(C+F)_{max}$ inches
HP 16000	2.205	0.866	0.787	3.583
HP 12000	1.575	0.787	0.827	2.874
HP 10000	2.008	0.748	0.630	3.386
HP 8000	1.417	0.354	0.591	2.362
HP 7500	0.394	0.315	0.433	1.142
HP 5500	1.437	0.315	0.394	2.126
HP 5000	0.295	0.315	0.394	0.945
HP 4000	0.236	0.236	0.472	0.945
HP 3000	0.276	0.236	0.433	0.906
HP 2000	0.276	0.276	0.354	0.906
HP 1800	0.256	0.197	0.354	0.787

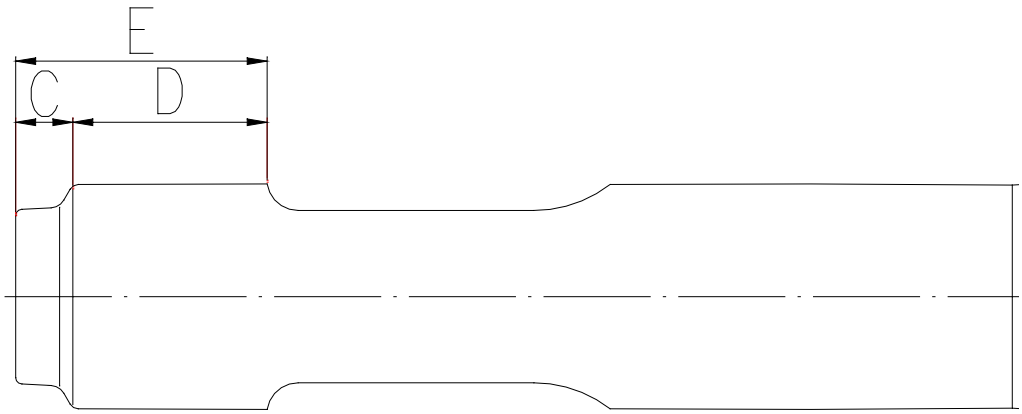
5.5 - Diagram showing service life of main components.

5.4.1 - spacer



BREAKER	C mm	F mm	MAXIMUM WEAR mm	(C+F) max mm
HP 16000	56	22	20	91
HP 12000	40	20	21	73
HP 10000	51	19	16	86
HP 8000	36	9	15	60
HP 7500	10	8	11	29
HP 5500	36.5	8	10	54
HP 5000	7.5	8	10	24
HP 4000	6	6	12	24
HP 3000	7	6	11	23
HP 2000	7	7	9	23
HP 1800	6.5	5	9	20

5.4.2 - Tool Impact Area

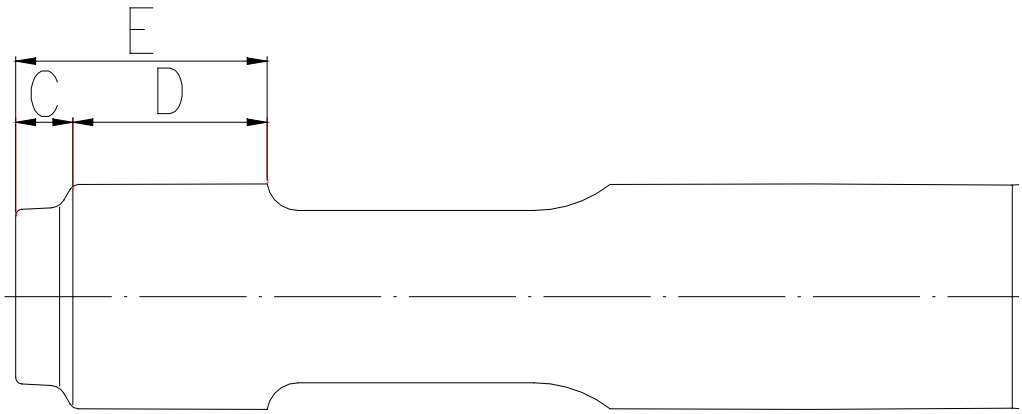


BREAKER	C inches	D inches	E inches	E_{min} inches
HP 16000	2.205	4.882	7.087	6.614
HP 12000	1.575	5.039	6.614	6.299
HP 10000	2.008	5.158	7.165	6.693
HP 8000	1.417	4.882	6.299	5.709
HP 7500	0.394	4.921	5.315	4.724
HP 5500	1.437	5.059	6.496	5.906
HP 5000	0.295	3.839	4.134	3.740
HP 4000	0.236	3.937	4.173	3.780
HP 3000	0.276	3.071	3.347	2.874
HP 2000	0.276	2.795	3.071	2.480
HP 1800	0.256	3.110	3.347	2.874

5.4.3 - wear plates on the casing

Check the wear on the casing plates, to ensure that there is a max clearance of 0.118 inches between the chuck housing and the casing.

5.4.2 - Tool Impact Area

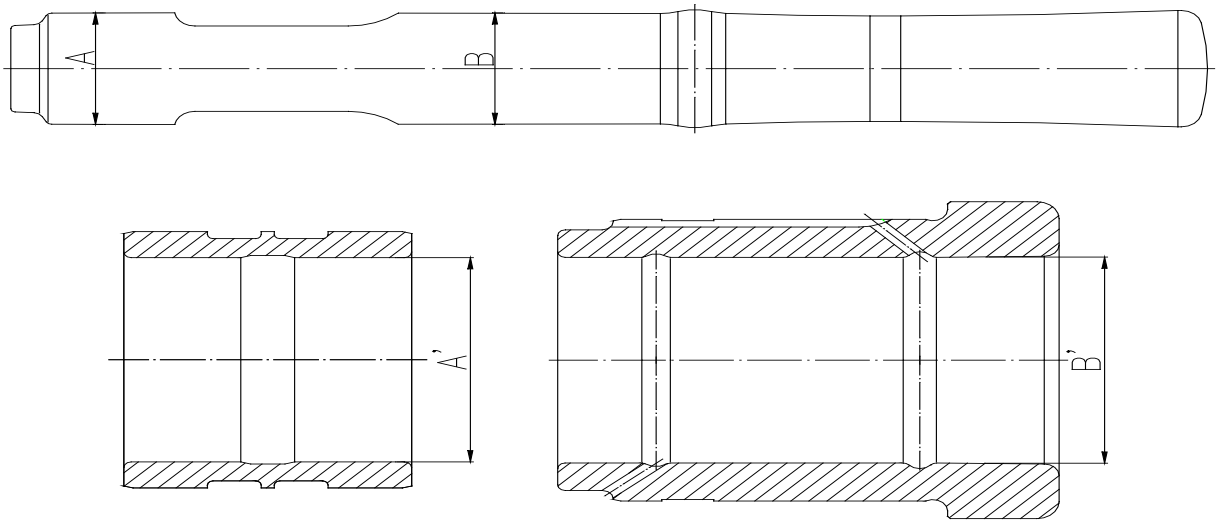


BREAKER	C mm	D mm	E mm	E_{min} mm
HP 16000	56	124	180	168
HP 12000	40	128	168	160
HP 10000	51	131	182	170
HP 8000	36	124	160	145
HP 7500	10	125	135	120
HP 5500	36.5	128.5	165	150
HP 5000	7.5	97.5	105	95
HP 4000	6	100	106	96
HP 3000	7	78	85	73
HP 2000	7	71	78	63
HP 1800	6.5	79	85	73

5.4.3 - wear plates on the casing

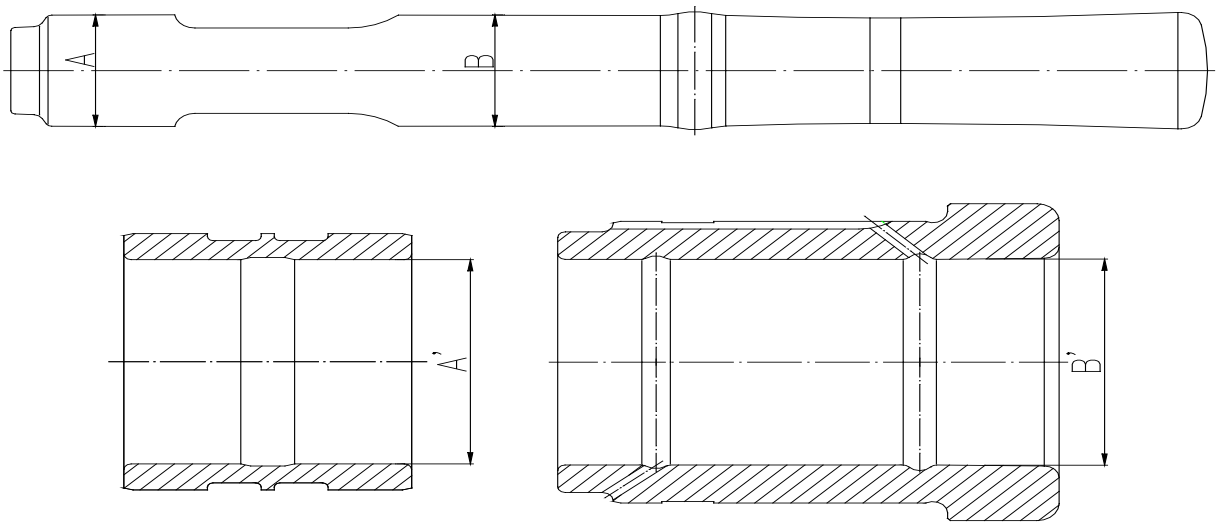
Check the wear on the casing plates, to ensure that there is a max clearance of 3 mm between the chuck housing and the casing.

5.4.5 – Bushings & Tools



BREAKER	NOMINAL DIMENSION ØA, ΦA', ΦB, ΦB'	MAX DIAMETER CLEARANCE A-A'	MAX DIAMETER CLEARANCE B-B'
HP 16000	8.465"	0.512"	0.669"
HP 12000	7.677"	0.512"	0.650"
HP 10000	7.087"	0.492"	0.630"
HP 8000	6.299"	0.453"	0.591"
HP 7500	5.906"	0.394"	0.512"
HP 5500	5.709"	0.413"	0.532"
HP 5000	5.512"	0.354"	0.472"
HP 4000	5.118"	0.374"	0.492"
HP 3000	4.724"	0.335"	0.433"
HP 2000	4.528"	0.315"	0.413"
HP 1800	4.331"	0.276"	0.354"

5.4.5 – Bushings & Tools



BREAKER	NOMINAL DIMENSION ØA, ΦA', ΦB, ΦB'	MAX DIAMETER CLEARANCE A-A'	GIOCO MAX DIAMETRALE B-B'
HP 16000	215 mm	13 mm	17 mm
HP 12000	195 mm	13 mm	16,5 mm
HP 10000	180 mm	12,5 mm	16 mm
HP 8000	160 mm	11,5 mm	15 mm
HP 7500	150 mm	10 mm	13 mm
HP 5500	145 mm	10,5 mm	13,5 mm
HP 5000	140 mm	9 mm	12 mm
HP 4000	130 mm	9,5 mm	12,5 mm
HP 3000	120 mm	8,5 mm	11 mm
HP 2000	115 mm	8 mm	10,5 mm
HP 1800	110 mm	7 mm	9 mm

6. Breaker troubleshooting.

6.1 - The breaker does not strike or strikes weakly.

If the breaker does not strike, there are two possible types of reason:

- A problem with the excavator;
- A problem with the breaker;

To check the excavator, make sure that the correct oil flow rate reaches the breaker, then check all the possible reasons why the flow might be interrupted, such as closed shut off valves, defective or broken solenoid valves, bad quick couplers, circuit relief set too low, leakages in the hydraulic flow system, low outlet pressure, high oil temperature.

After checking the excavator, turn your attention to the breaker. Check the following:

- The accumulator and, in particular, excessive pipe vibration;
- That the side bolts are tight;
- That the central valve is working and is not blocked;
- That the tool impact area and impact bushing are not excessively worn;
- Remove the tool and make sure that the piston moves freely.

If there are no faults, the breaker must be disassembled to check the state of the internal parts. We recommend contacting an authorized dealer.

6.2 - The breaker strikes slowly and powerfully

(without any variation in speed.)

If the breaker strikes slowly and without any variations, you should check:

- The back-pressure on the outlet;
- The central valve;
- The oil flow rate to the breaker;
- The speed valve;
- The spring and O-ring on the central valve. In this case, the operating pressure falls as the tool penetrates the rock.

6.3 - The breaker is very irregular - it stops and starts

When the breaker strikes irregularly, stopping and starting again, the following areas must be checked:

- The excavator solenoid valve;
- The breaker central valve;
- Oil leakages in the hydraulic flow system;
- That the side bolts are tight;
- The excavator relief valve;
- That the piston can move freely;
- That the temperature is not too high, i.e. above 180°F;
- Wear on the bushings and tool impact area.

6.4 -The oil overheats.

In this case, check:

- That the excavator cooling system is working properly;
- That the excavator solenoid valve is working properly;
- The excavator relief valve;
- Oil leakages in the hydraulic flow system;
- The breaker central valve;
- That the side bolts are tight;
- That the piston can move freely;
- That there are no leaks in the breaker head - if necessary replace the o-rings.

6.5 - Oil leaks.

If there are any oil leaks, the problem may be caused by one of the following:

- Temperature too high, i.e. above 180°F;
- Overheated seals on the piston due to lack of grease.
- Scored at seal area or damaged piston.
- Breaker use underwater.
- Worn out seals.
- Excessive back-pressure.
- High operating pressure.

6.6 - Residual blows.

The presence of residual blows on the breaker can create problems in particular situations and cause excessive stress to some breaker components, such as tool retainers and stop nuts. The following remedies can completely prevent residual blows:

a) Replace the central valve on the breaker with a valve specifically designed for eliminating residual blows (contact the Indeco technical department);

b) Fit a two-way electric valve on the line between the inlet and outlet on the breaker, as shown in fig. 64. This valve is usually open and closes only when the breaker requires oil.

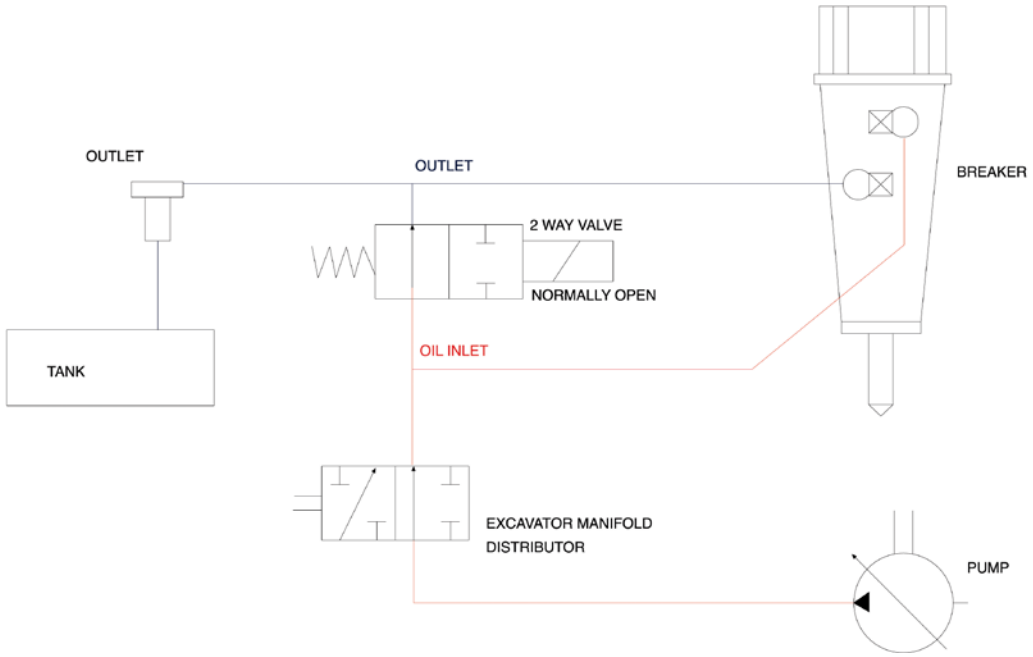


Fig. 64 – circuit diagram for valve eliminating blank firing

6.7 - Premature tool breakage.

Early tool breakage can be caused for different reasons, each of which must be analysed separately. First, remember that the choice of tool for specific jobs is vital in order to ensure:

- High productivity;
- Less tool breakage.

See paragraph 2.3 for a guide to choosing the right tool.

The most common forms of breakage and their causes are as follows:

- Misalignment or leverage. The section appears to have suffered fatigue failure due to flexure, with a small section subject to shear breakage. The breakage area is just outside the breaker, below the lower bushing. Caused by working the tool at an incorrect angle to the rock, or by excessive tool leverage;

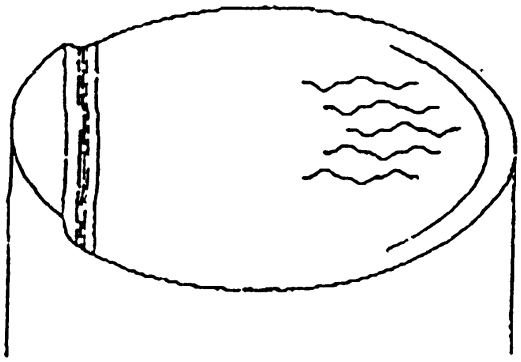


Fig. 65

- Micro welding inside the bushing due to friction. The section appears to have suffered fatigue failure due to flexure with clear signs of seizure on the outside. In this case, the cause is poor lubrication or a wrong insert in the lower bushing. Seizure is responsible for triggering the crack.

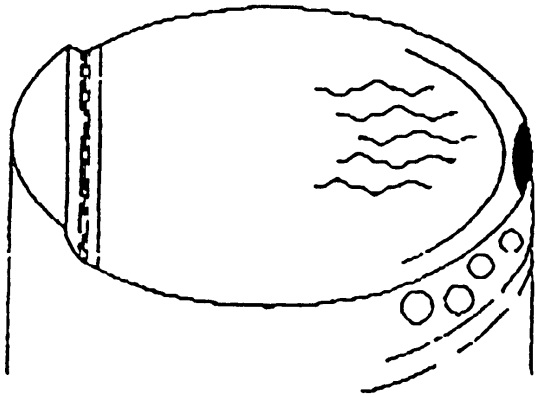


Fig. 66

- Blank firing. This happens especially when breaking up blocks, when the type of job causes the tool to bounce on the surface of the material. These blows have a violent impact on the tool retainers on the breaker causing "heading" in the area indicated.

Note: Excessive blank firing can destroy side shocks, top shock and lower end parts.

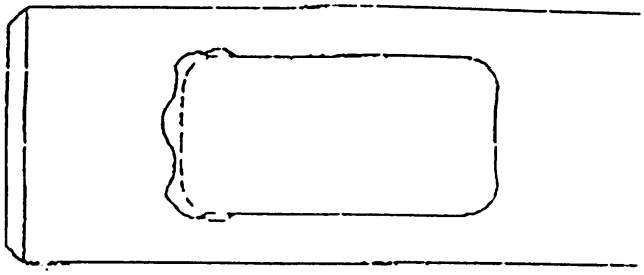


Fig. 67

- Mechanical damage to the tool surface. A strong blow on the outside of the tool triggers this type of fatigue breakage.

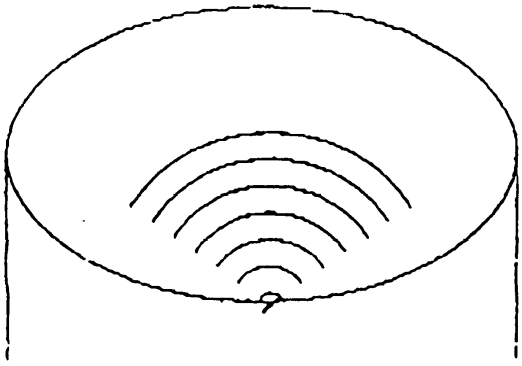


Fig. 68

- Cold break. Using the tool in excessively low temperatures, which make the tool more fragile, causes this.

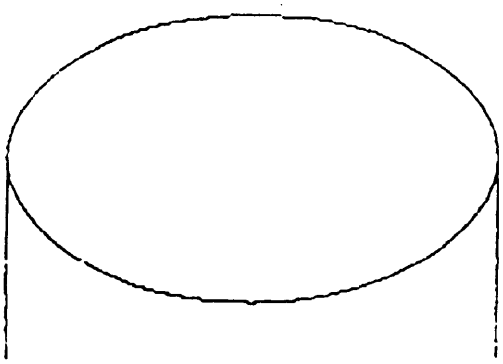


Fig. 69

- Breakage in the tool retainer area. Using worn and poorly greased tool retainers causes this type of breakage. Micro-cracks are produced in the sliding part of the tool retainer, triggering the breakage.

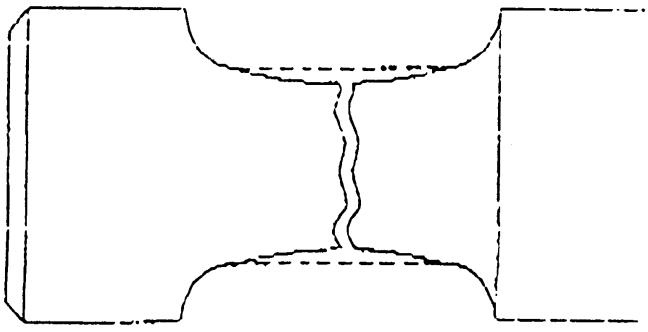


Fig. 70

- Breakage of the chisel tool tip. This breakage is caused by contact between tool and rock, at an incorrect angle.

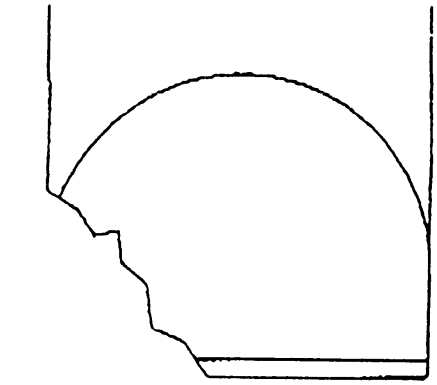


Fig.71

- Heading at the end of the tool. This happens when the same point is hit for a long time, without allowing the tool to cool. In such cases there is a temperature change inside the material of the tool.

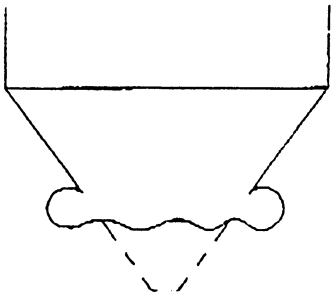


Fig. 72

If a material or manufacturing defect is found after analysing both the break and the tool material, Indeco will replace the tool with a new one.

NOTES:

7. Innovations

7.1 – “HP” system

The "HP" system is the result of a whole series of updates and innovations, which have been brought in over the last few years.
The evolution from the original system to HP, via the UP (Upgrading) series, involved the following modifications:

- Looks - a new color scheme and new stickers;
- Function - hydraulic modifications;
- Reliability - updates and improvements to the quality of various components;
- Structural and environmental - the new closed soundproofed casings.

There have been design changes, with a new color scheme and new labels.
The functional changes were brought in to optimise performance under various different operating conditions. On top of the UP series modifications, the hydraulic and power settings for some models have also been updated, increasing the cylinder capacity and redesigning the regulation valves.
Reliability has been improved by optimising the following components, with improvements to materials, shape and design:

- Steel diaphragm and cover (UP);
- Piston (HP);
- Housing (HP);
- Bushes (HP);
- Side bolts (UP);
- Casings (HP);
- Lower shock absorber in casing (HP);
- Greasing system (UP);
- Anti-dust kit (optional UP);
- Side bolt locks (UP);
- Fixing screws (UP);
- Tools (HP);
- Regulation valves (HP).

The Piston and Cylinder have both been redesigned, in order to increase the energy per blow; the centralised greasing system has been redesigned in order to optimise the distribution of lubrication to the bushings; all of the torque settings have been reviewed and corrected, and locks have been added to the side bolts, which thus can no longer work loose. An optional anti-dust kit has been designed for special applications. Years of experience in various different markets have enabled us to develop new tools, with improved penetration, using innovative materials and manufacturing methods.
The housings and bushes have new materials and innovative manufacturing methods to increase their service life and reduce breakages to a minimum.
Casings have been redesigned in order to improve their durability, toughness and soundproofing. On the mini range, the first closed casings have been introduced, with polyurethane lining, which reduces noise levels and increases reliability.

The HP series valves are far more versatile and provide better functionality and improved penetration - the frequency can be regulated at will.

7.2 - Research and development projects.

Various research and development projects are under way. The most important are as follows:

- Variable valve (variability);
- Central valve (introduction of a flow control system);
- Inserts for lower bushing (new materials in bronze);
- Super soundproofed casing to reduce noise levels even further;
- Anti-dust kit improved.

Appendix A (1)

SCREW TORQUE SETTINGS AND NITROGEN INFLATING PRESSURE 1 MKG = 7.233 Ft-Lbs

Item		HP 200			HP 350			HP 500			HP 750			HP 1000			HP 1100		
		POS.	Wrench	Lb ft	POS.	Wrench	Lb ft	POS.	Wrench	Lb ft	POS.	Wrench	Lb ft	POS.	Wrench	Lb ft	POS.	Wrench	Lb ft
Side bolt		314	27	** 145	308	27	** 203	308	27	** 203	307	30	* 101	308	32	** 347	307	30	* 101
Guiding Plug		413	19	181	413	24	217	413	24	217				418	30	362	418	30	362
Pressure Testing Screw		403	B 6	36										403	19	29	403	19	29
Side Shock Absorbers Screw																	615	17	58
Link Fixing Screw		409	B 6	22										409	B 10	51	409	B 10	51
Inflating Screw		504	B 8	65	504	B 8	65	504	B 8	65	504	B 14	36	504	B 14	36	504	B 14	36
Accumulator Fixing Screw / or Shell					502	INDECO	579	506	B 12	80	507	B 14	116	507	B 14	116	507	B 17	232
Shell Screw		506	27	232				505	B 10	51	506	B 12	80	506	B 12	80	506	B 14	116
Plug																	107	B 12	181
Cradle Bolt		618	22	145	618	22	145	618	22	145	618	30	289	618	30	289	618	30	289
Casing Bolt		607	22	87	607	27	217	607	27	217	607	41	470	607	30	311			
Casing Spacer Nut					608	27	145	608	27	145	608	27	145	608	30	217			
Nitrogen Inflating Pressure	Oil 140°F	508 psi			508 psi			508 psi			508 psi			508 psi			508 psi		
	Oil 158°F	435 psi			435 psi			435 psi			435 psi			435 psi			435 psi		

* Recharge as indicated by cross tightening the bolts in several phases.
Using the same technique, tighten by 180° + 15°~. When this is complete, loosen each side rod by 15°~.

** The torque setting shown must be reached gradually by cross tightening the bolts in several phases.

Appendix A (1)

SCREW TORQUE SETTINGS AND NITROGEN INFLATING PRESSURE 1 MKG = 7.233 Ft-Lbs

Item		HP 200			HP 350			HP 500			HP 750			HP 1000			HP 1100		
		POS.	Wrench	MKG	POS.	Wrench	MKG	POS.	Wrench	MKG	POS.	Wrench	MKG	POS.	Wrench	MKG	POS.	Wrench	MKG
Side bolt		314	27	** 20	308	27	** 28	308	27	** 28	307	30	* 14	308	32	** 48	307	30	* 14
Guiding Plug		413	19	25	413	24	30	413	24	30				418	30	50	418	30	50
Pressure Testing Screw		403	B 6	5										403	19	4	403	19	4
Side Shock Absorbers Screw																	615	17	8
Link Fixing Screw		409	B 6	3										409	B 10	7	409	B 10	7
Inflating Screw		504	B 8	9	504	B 8	9	504	B 8	9	504	B 14	5	504	B 14	5	504	B 14	5
Accumulator Fixing Screw / or Shell					502	INDECO	80	506	B 12	11	507	B 14	16	507	B 14	16	507	B 17	32
Shell Screw		506	27	32				505	B 10	7	506	B 12	11	506	B 12	11	506	B 14	16
Plug																	107	B 12	25
Cradle Bolt		618	22	20	618	22	20	618	22	20	618	30	40	618	30	40	618	30	40
Casing Bolt		607	22	12	607	27	30	607	27	30	607	41	65	607	30	43			
Casing Spacer Nut					608	27	20	608	27	20	608	27	20	608	30	30			
Nitrogen Inflating Pressure	Oil 60°C	35 Bars			35 Bars			35 Bars			35 Bars			35 Bars			35 Bars		
	Oil 70°C	30 Bars			30 Bars			30 Bars			30 Bars			30 Bars			30 Bars		

* Recharge as indicated by cross tightening the bolts in several phases.
Using the same technique, tighten by 180° + 15°~. When this is complete, loosen each side rod by 15°~.

** The torque setting shown must be reached gradually by cross tightening the bolts in several phases.

Appendix A (2)

Item		HP 1250			HP 1500			HP 1800			HP 2000			HP 3000			HP 4000		
		POS.	Wrench	Ft lb	POS.	Wrench	Ft lb	POS.	Wrench	Ft lb	POS.	Wrench	Ft lb	POS.	Wrench	Ft lb	POS.	Wrench	Ft lb
Side bolt		307	30	* 101	307	30	* 145	307	38	* 159	307	38	* 195	307	38	* 304	307	38	* 362
Guiding Plug		418	30	362	418	30	362	418	30	361	418	30	362	418	38	506	418	38	506
Variable Valve Plug																	438	24	181
Pressure Testing Screw		403	19	29	403	19	29	403	19	29	403	19	29	403	19	29	403	19	29
Side Shock Absorbers Screw		615	19	72	615	19	72	615	22	109	615	22	109	615	22	109	615	22	109
Link Fixing Screw		409	B 10	51	409	B 10	51	409	B 10	51	409	B 10	51	409	B 14	130	409	B 14	130
Inflating Screw		504	B 14	36	504	B 14	36	504	B 14	36	504	B 14	36	504	B 14	36	504	B 14	36
Accumulator Fixing Screw		507	B 17	232	507	B 17	232	507	B 19	389	507	B 19	398	507	B 5/8	434	507	B 5/8	434
Shell Screw		506	B 14	145	506	B 14	116	506	B 14	116	506	B 14	116	506	B 9/16	188	506	B 9/16	188
Plug / Bush		107	B 12	181	107	B 12	181	107	B 12	181	107	B 12	181	123	B 12	181	123	B 12	181
Cradle Bolt		618	30	289	618	30	289	618	30	289	618	30	289	618	30	289	618	30	289
Nitrogen Inflating Pressure	Oil 140°F	580 psi			580 psi			580 psi			580 psi			580 psi			580 psi		
	Oil 158°F	508 psi			508 psi			508 psi			508 psi			508 psi			508 psi		

* Recharge as indicated by cross tightening the bolts in several phases.
Using the same technique, tighten by 180° + 15°~. When this is complete, loosen each side rod by 15°~.
** The torque setting shown must be reached gradually by cross tightening the bolts in several phases.

Appendix A (2)

Item		HP 1250			HP 1500			HP 1800			HP 2000			HP 3000			HP 4000		
		POS.	Wrench	MKG	POS.	Wrench	MKG	POS.	Wrench	MKG	POS.	Wrench	MKG	POS.	Wrench	MKG	POS.	Wrench	MKG
Side bolt		307	30	* 14	307	30	* 20	307	38	* 22	307	38	* 27	307	38	* 42	307	38	* 50
Guiding Plug		418	30	50	418	30	50	418	30	50	418	30	50	418	38	70	418	38	70
Variable Valve Plug																	438	24	25
Pressure Testing Screw		403	19	4	403	19	4	403	19	4	403	19	4	403	19	4	403	19	4
Side Shock Absorbers Screw		615	19	10	615	19	10	615	22	15	615	22	15	615	22	15	615	22	15
Link Fixing Screw		409	B 10	7	409	B 10	7	409	B 10	7	409	B 10	7	409	B 14	18	409	B 14	18
Inflating Screw		504	B 14	5	504	B 14	5	504	B 14	5	504	B 14	5	504	B 14	5	504	B 14	5
Accumulator Fixing Screw		507	B 17	32	507	B 17	32	507	B 19	55	507	B 19	55	507	B 5/8	60	507	B 5/8	60
Shell Screw		506	B 14	20	506	B 14	16	506	B 14	16	506	B 14	16	506	B 9/16	26	506	B 9/16	26
Plug / Bush		107	B 12	25	107	B 12	25	107	B 12	25	107	B 12	25	123	B 12	25	123	B 12	25
Cradle Bolt		618	30	40	618	30	40	618	30	40	618	30	40	618	30	40	618	30	40
Nitrogen Inflating Pressure	Oil 60°C	40 Bars			40 Bars			40 Bars			40 Bars			40 Bars			40 Bars		
	Oil 70°C	35 Bars			35 Bars			35 Bars			35 Bars			35 Bars			35 Bars		

* Recharge as indicated by cross tightening the bolts in several phases.
Using the same technique, tighten by 180° + 15°~. When this is complete, loosen each side rod by 15°~.
** The torque setting shown must be reached gradually by cross tightening the bolts in several phases.

Appendix A (3) SCREW TORQUE SETTINGS AND NITROGEN INFLATING PRESSURE

Item		HP 5000			HP 5500			HP 7500			HP 8000			HP 10000			HP 12000			HP 16000		
		POS.	Wrench	Ft lb	POS.	Wrench	Ft lb	POS.	Wrench	Ft lb	POS.	Wrench	Ft lb	POS.	Wrench	Ft lb	POS.	Wrench	Ft lb	POS.	Wrench	Ft lb
Side bolt		307	41	* 434	307	41	* 470	307	41	* 506	307	46	* 543	307	46	* 651	307	55	* 723	307	55	* 904
Guiding Plug		418	41	723	418	41	723	418	41	723	418	41	723	418	41	723	418	41	723	418	41	723
Variable Valve Plug		438	24	181	438	24	181	438	24	181	438	24	181	438	24	181	438	24	181	438	24	181
Pressure Testing Screw		403	19	29	403	19	29	403	19	29	403	19	29	403	19	29	403	19	29	403	19	29
Side Shock Absorbers Screw		615	22	109	615	22	109	615	22	109	615	24	145	615	30	232	615	30	232	615	30	232
Link Fixing Screw		409	B 14	130	409	B 14	130	409	B 14	130	409	B 14	130	409	B 14	130	409	B 14	130	409	B 14	130
Inflating Screw		504	B 14	36	504	B 14	36	504	B 14	36	504	B 14	36	504	B 14	36	504	B 14	36	504	B 14	36
Accumulator Fixing Screw		507	B 22	796	507	B 22	796	507	B 22	796	507	B 22	796	507	B 27	1085	507	B 27	1085	507	41	1085
Shell Screw		506	B 17	326	506	B 17	326	506	B 17	326	506	B 17	326	506	B 19	362	506	B 19	362	506	B 19	579
Bush		123	B 12	181	123	B 12	181	123	B 12	181	123	B 12	181	123	B 12	181	123	B 12	181	123	B 12	181
Cradle Bolt		618	36	506	618	36	506	618	36	506	618	41	723	618	55	1374	618	55	1374	618	55	1374
Nitrogen Inflating Pressure	Oil 140°F	580 psi			580 psi			580 psi			580 psi			580 psi			580 psi			580 psi		
	Oil 158°F	508 psi			508 psi			508 psi			508 psi			508 psi			508 psi			508 psi		

* Recharge as indicated by cross tightening the bolts in several phases.
Using the same technique, tighten by 180° + 15°~. When this is complete, loosen each side rod by 15°~.
** The torque setting shown must be reached gradually by cross tightening the bolts in several phases.

Appendix A (3) SCREW TORQUE SETTINGS AND NITROGEN INFLATING PRESSURE

Item		HP 5000			HP 5500			HP 7500			HP 8000			HP 10000			HP 12000			HP 16000		
		POS.	Wrench	MKG	POS.	Wrench	MKG	POS.	Wrench	MKG	POS.	Wrench	MKG	POS.	Wrench	MKG	POS.	Wrench	MKG	POS.	Wrench	MKG
Side bolt		307	41	* 60	307	41	* 65	307	41	* 70	307	46	* 75	307	46	* 90	307	55	* 100	307	55	* 125
Guiding Plug		418	41	100	418	41	100	418	41	100	418	41	100	418	41	100	418	41	100	418	41	100
Variable Valve Plug		438	24	25	438	24	25	438	24	25	438	24	25	438	24	25	438	24	25	438	24	25
Pressure Testing Screw		403	19	4	403	19	4	403	19	4	403	19	4	403	19	4	403	19	4	403	19	4
Side Shock Absorbers Screw		615	22	15	615	22	15	615	22	15	615	24	20	615	30	32	615	30	32	615	30	32
Link Fixing Screw		409	B 14	18	409	B 14	18	409	B 14	18	409	B 14	18	409	B 14	18	409	B 14	18	409	B 14	18
Inflating Screw		504	B 14	5	504	B 14	5	504	B 14	5	504	B 14	5	504	B 14	5	504	B 14	5	504	B 14	5
Accumulator Fixing Screw		507	B 22	110	507	B 22	110	507	B 22	110	507	B 22	110	507	B 27	150	507	B 27	150	507	41	150
Shell Screw		506	B 17	45	506	B 17	45	506	B 17	45	506	B 17	45	506	B 19	50	506	B 19	50	506	B 19	80
Bush		123	B 12	25	123	B 12	25	123	B 12	25	123	B 12	25	123	B 12	25	123	B 12	25	123	B 12	25
Cradle Bolt		618	36	70	618	36	70	618	36	70	618	41	100	618	55	190	618	55	190	618	55	190
Nitrogen Inflating Pressure	Oil 60°C	40 Bars			40 Bars			40 Bars			40 Bars			40 Bars			40 Bars			40 Bars		
	Oil 70°C	35 Bars			35 Bars			35 Bars			35 Bars			35 Bars			35 Bars			35 Bars		

* Recharge as indicated by cross tightening the bolts in several phases.
Using the same technique, tighten by 180° + 15°~. When this is complete, loosen each side rod by 15°~.
** The torque setting shown must be reached gradually by cross tightening the bolts in several phases.