USER'S MANUAL

FOR

HYDROHAMMER® S-70

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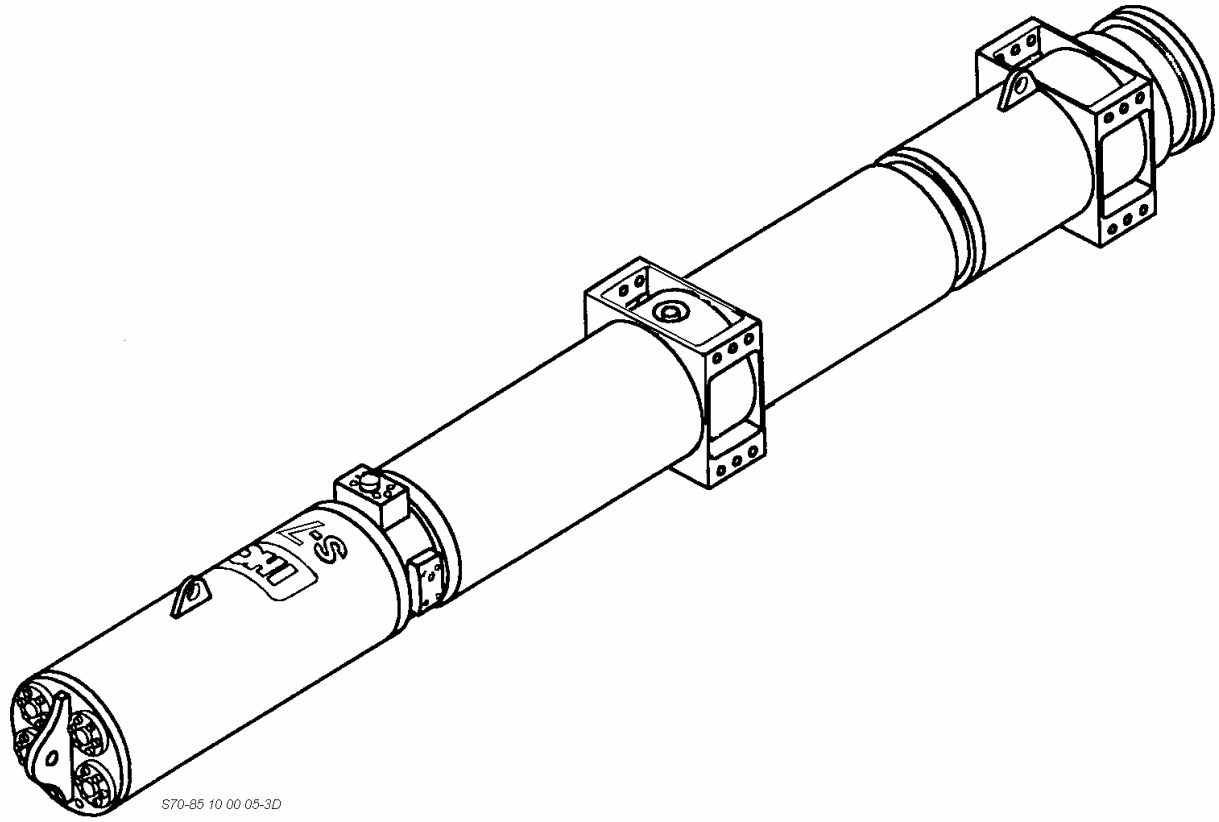


PREFACE

This manual gives the necessary information for the safe operation of the ***Hydrohammer® S-70***. It also includes guidelines for preventive maintenance. Operation and maintenance shall be done by approved persons only. References to other documentation, figures etc. are shown in *italics*

Intended use

The *Hydrohammer® S-70* is only intended for use as a hydraulic piling hammer for driving steel piles, in combination with its corresponding control system in non hazardous areas.
Only approved persons may operate or maintain the machine. An approved person is one who is familiar with this equipment and with possible dangers involved. During first commissioning, the user(s) will be instructed as per agreement by IHC HYDROHAMMER. This manual must be used in combination with the user's manual of the selected *Hydraulic power pack* and *Control equipment*.
For any repair, please contact IHC HYDROHAMMER B.V.

Read this manual carefully before actually working with the unit.

GUARANTEE/LIABILITY

The terms for guarantee and liability as specified in the general conditions of IHC (October 1991) shall apply, unless mentioned otherwise in this manual or agreed between IHC HYDROHAMMER B.V. and the customer in writing.

SAFETY PRECAUTIONS

IHC HYDROHAMMER B.V. points out that the execution of the safety precautions as specified below and abidance with the safety rules can only be the full responsibility of the user.
IHC HYDROHAMMER B.V. therefore, denies any claim which should arise from failure to execute the necessary safety precautions or negligence of the rules as laid down by user's management or safety officer.
Safety stickers have been used as shown on fig. 9 of this manual. Replace stickers as soon as they can not be read.

The header **WARNING** is used where failure to obey the instruction can result in injury to the operator or exposed persons.
The header **CAUTION** is used where failure to obey the instruction can result in damage to the equipment.

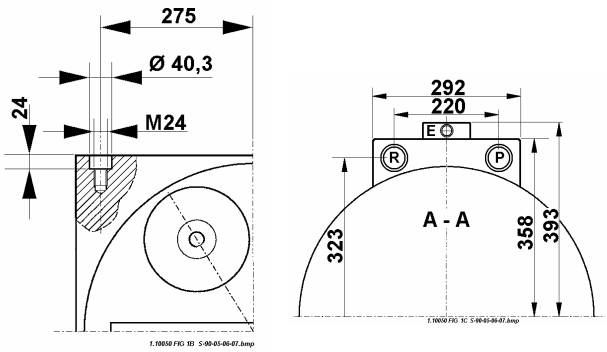
- Use only approved lifting equipment when moving the Hydrohammer®.
- Pile driving should be stopped immediately to prevent possible (further) damage:
  - after trouble or something unusual has been observed,
  - when the refusal criteria are reached *(see par. 3.4),*
  - in case of fire near the hammer.

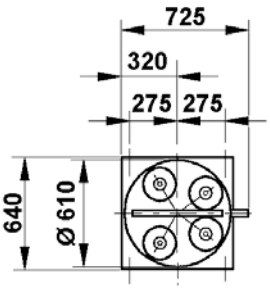
  Problems for which no solution can be found in this manual, please contact IHC HYDROHAMMER B.V.
- Use personal protection items such as safety goggles, gloves and shoes to prevent injury.
- Never insert hands, fingers or tools in inspection holes.
- The cross-sectional area of the steel pile shall not be less than 200 cm^2.
- The eccentricity of the hammer relative to the pile shall be less than 2.5 cm.
- The angle between hammer and pile shall not exceed 1:50. Check regularly the amount of wear on the inserts of sleeves in use.
- Do not (dis)connect the hoses while the *Hydraulic power pack* is in operation.
- Make sure that the cap is under pressure before lifting the hammer from horizontal to vertical position, to prevent uncontrolled movement of the ram. In case charging is necessary, the ram weight will move and may hit the bottom of the housing with a "bang" which is normal.
- **Dirt and sand are enemy no. 1 to hydraulic systems.**
  Do not grind or weld near disassembled or open hydraulic components *(during maintenance)*. Clean the components if necessary with engine fuel.

Page

1. GENERAL INFORMATION

1.1 Technical data Hydrohammer® type S-70





Operating data

Max. net energy/blow	70	kNm
Min. net energy/blow	2	kNm
Blow rate @ max. energy	50	Blows/min

Weights

Ram	3,5	tons
Hammer (incl. ram, in air)	8,3	tons
Hammer (incl. ram, in water)	x,x	tons

Hydraulic data

Average operating press.	230	bar
Max. operating pressure	350	bar
Max. oil flow	220	l/min

Nitrogen filling pressures

Vertical pile driving only! Values will vary for pile driving under different angles with the vertical

Supply accumulator	120-140	bar
Return accumulator	4-5	bar
Cap	10-13	bar

Safety setting

Cap (rupture disc)	40	bar

Connections

Oil supply 1 ¼ " hose (P)	38S/M52	male
Oil return 1 ¼ " hose (R)	38S/M52	male
Nitrogen/ air to cap (CA)	R 3/4"	male

See fig. 9 (page 13) for other connections

Lifting eyes	**WLL Working Load Limit**	**hole diam.**	**thick ness**
L1	25 tons	Ø 52 mm	70 mm
L2	9 tons	Ø 40 mm	40 mm
L3	9 tons	Ø 40 mm	40 mm

Noise emitting data

Since the noise level highly depends on the applied energy levels, pile caps etc., a range is given for the equivalent A-weighted noise pressure level at a distance of 1 m and at 1.6 m above the ground level (average over 10 consecutive blows at 70% of max. energy):
L A eq 90-98 dB(A)
With an optional sound enclosure, this level can be reduced to 85 dB(A)

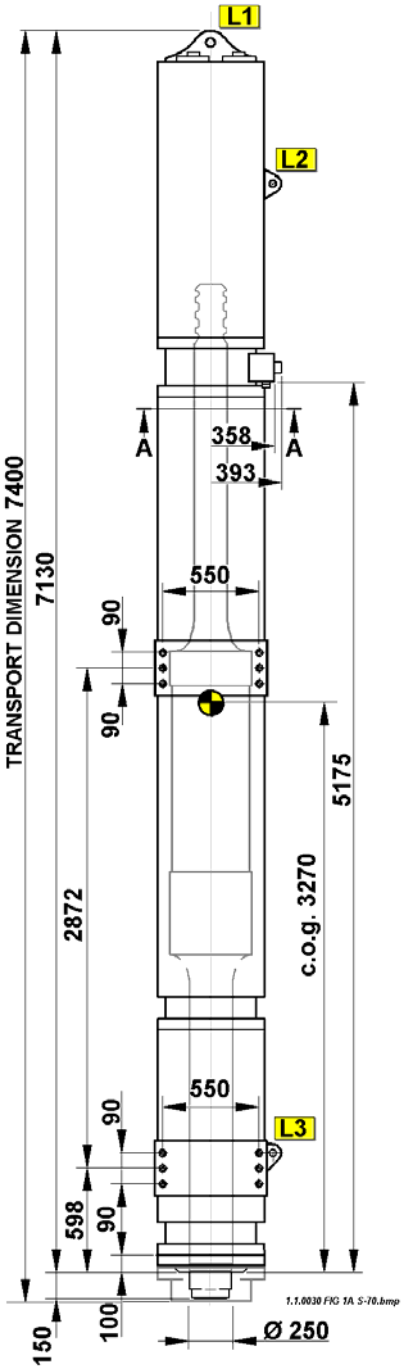


Fig. 1: Main dimensions

1.2 The Hydrohammer® S-70 and its features

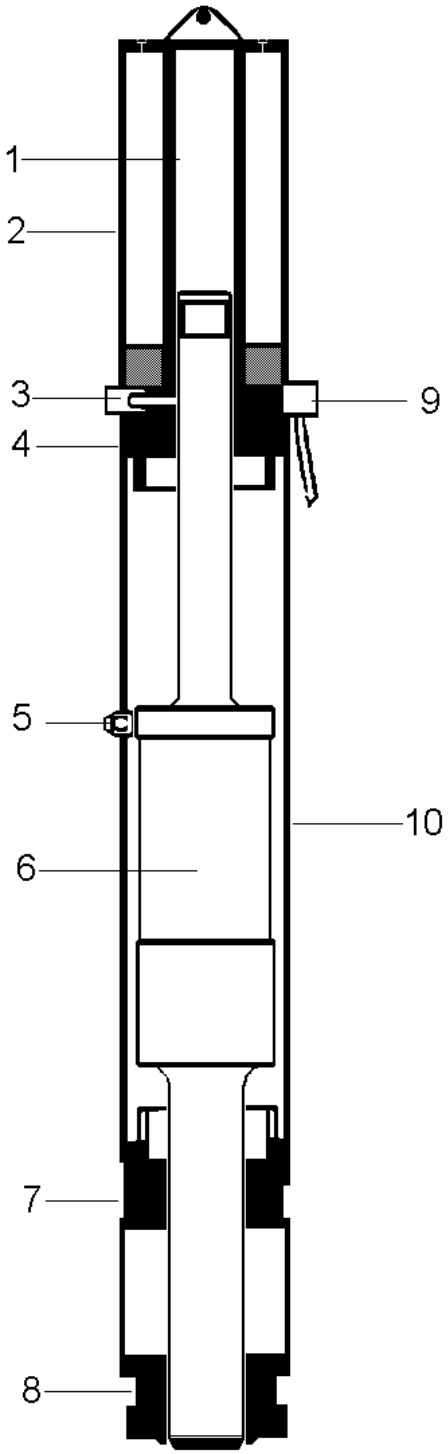
The **Hydrohammer®** S-70 is a universal, electronically controlled, hydraulic impact type of hammer for steel piles. It is also suitable for underwater operation with minor preparation (contact IHC for further details).

The **Hydrohammer®** complies with the very strict requirements of modern pile driving.

It provides:
- Possibility for underwater pile driving without loss of energy.
- Control and read-out of the energy per blow, permitting control of the entire piling operation.
- Automatic protection for overload.
- Simple construction for easy operation and maintenance.
- High reliability.
- Relatively high blow energy / net weight ratio.
- No loss of performance after prolonged operation.
- No requirement for hard wooden or synthetic cap filling for hammer protection.
- Suitability for leader guiding or free riding operation.
- No need of a guide cage. With a fixed pile guide sleeve, the hammer can be placed free on the pile.
- Possibility to drive batter piles up to 45° to the vertical, with only a minor reduction of the blow energy.

1.3 Main components *(see fig. 2)*

The **Hydrohammer®** basically consists of a hydraulically driven ram weight (6), guided by oil lubricated bushings in the upper ring (4) and the lower housing (7). The piston at the upper part of the ram weight (6) moves inside the cylinder (1). The two supply- and two return accumulators, located in the cap (2), are filled with Nitrogen at one side of their internal floating piston (not shown). The return and supply valves (3) are externally mounted to the upper ring.
The two hose connections are located on the connecting block (9) which is also mounted on the upper ring.
The supply and return valves are identical and therefore interchangeable, the same applies to the accumulators.
Sensors (5), activated by the ram weight, are installed in the housing (10) and supply the signals to the electronic control system to regulate the stroke and to measure the blow energy.
Shock absorbers (8) are installed in the lower housing to absorb the rebound of the pile.



1 Cylinder
2 Cap
3 Valves
4 Upper ring
5 Sensors
6 Ram weight
7 Lower housing
8 Shock absorbers
9 Connecting block with air connection
10 Housing

Fig. 2: Main components

1.4 Operating principle *(see fig. 3)*

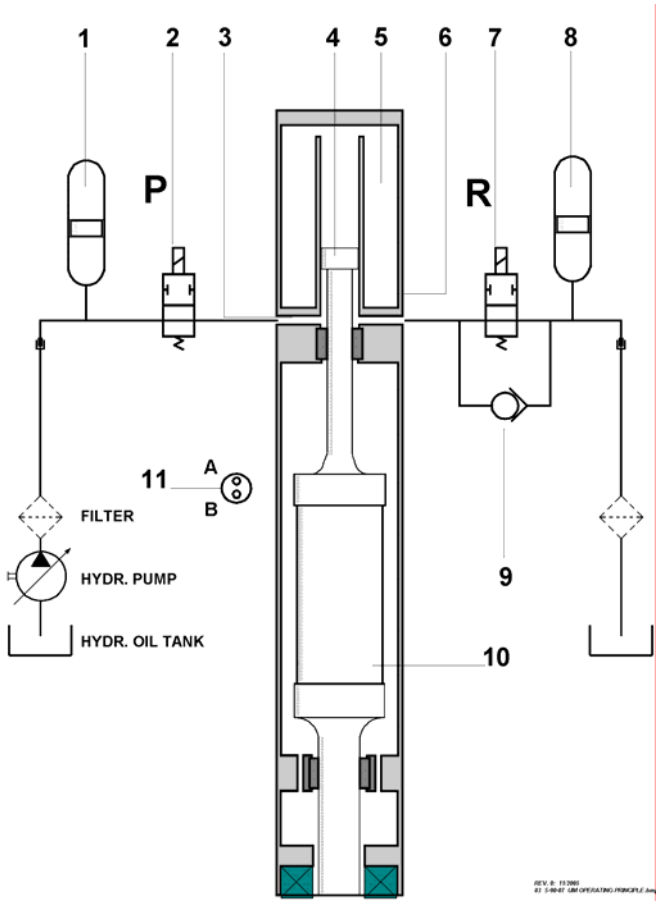
Fig. 3 shows schematically the hammer operation. For the sake of clarity, the valves (2 and 7) and the accumulators (1 and 8) are drawn outside the hammer.
At rest (not energized), both the return and supply valves are open, allowing a continuous oil circulation through the **Hydrohammer®** and the hydraulic hoses with filtered oil from the power pack.

Hammer cycle
When starting the **Hydrohammer®**, the return valve (7) closes and the oil in the space (3) under the piston (4) lifts the ram. At the end of the lifting stroke, the supply valve (2) closes and the return valve opens. The ram (10) is now pushed downwards by its own weight and the gas pressure on top of the piston.
At the end of the downward stroke (sensor B "sees" ram weight), the return valve closes, followed by the opening of the supply valve, completing the cycle and a new cycle will start. The suppletion valve (9) acts as a check valve, enabling backflow of hydraulic oil to the piston of the ram weight during the very short periods that both supply and return valve are closed (after the blow and ram in top position).

Cap pressure
A cap pressure below the value as specified in par. 1.1 reduces the operating pressure and maximum blow energy. On the other hand, a higher cap pressure increases the operating pressure and maximum blow energy.

Accumulators
The accumulators (1 and 8) reduce the pressure and flow fluctuations between the continuous oil flow from the power pack and the intermittent flow in the hammer.

Blow energy
Blow energy is controlled by varying the time that the return valve (7) remains closed during the lifting stroke of the ram.
The energy, delivered to the pile, is measured for every blow via sensors *(see fig.2/5)* and can be selected for display on the control box, as well as the blow rate and velocity.



2 Supply valve
1 Supply accumulators
3 Space under piston
4 Piston
5 Cap space
6 Cap fill connection
7 return valve
8 return accumulators
9 Suppletion valve
10 Ram weight
11 Sensor block AB

Fig. 3: Operating principle

2. COMMISSIONING

2.1 Checking of Hydrohammer®
(see fig. 4).

The **Hydrohammer®** S-70 is shipped:
- o with the cap and accumulators pressurized at the (max.) levels as specified in par. 1.1.
- o with the hydraulic hose connections closed by a "bleeding hose set".
  This is done for **safe depressurizing** of the possible pressure built-up in the internal hydraulic oil circuit, due to gas leakage from cap and accumulators.
  This set-up also provides environmental protection against oil spillage.

Perform the following checks with the **Hydrohammer®** in *horizontal* position:

1 Drain the cap as described in par. 4.2.3.
2 Drain any hydraulic oil leaked from the housing at connection D2 *(see fig. 7).*
3 Check the oil level of the lower bearing at connection F4 *(see fig. 7)* and top up if necessary.
4 Depressurize hydraulic circuit of the hammer with the bleeding hose set:
- Ensure both ball valves are in closed position.
- Disconnect the small hose (3) at the arrow from the ball valve at the press. connection (P).

CAUTION
- **Slowly** open the ball valve at the return connection (R) to depressurize the internal hydraulic oil circuit. Collect the escaping hydraulic oil.
- Reconnect the hose to the valve at connection (P) and disconnect the small hose from the ball valve at connection (R).

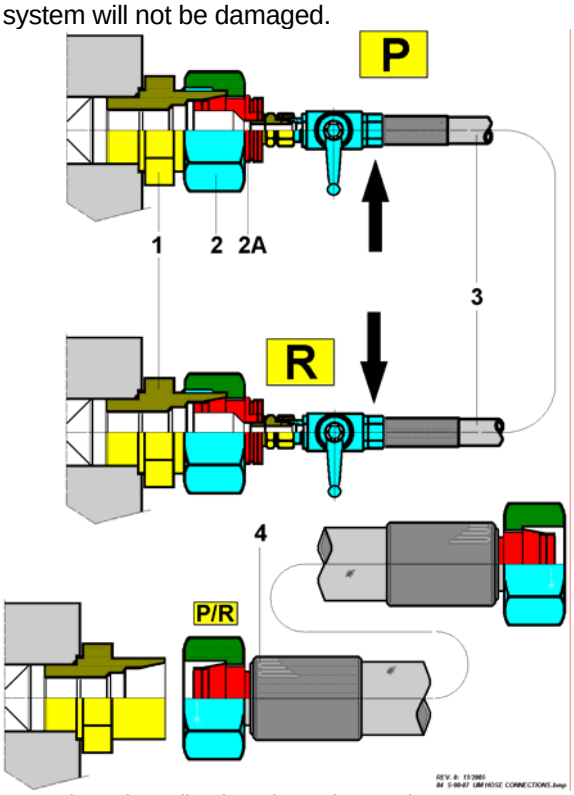
5 Open the ball valve at the pressure connection (P) to drain and to collect any remaining oil.
6 Reconnect the hose to the ball valve at (R), disconnect both coupling nuts with blanking plugs (2) and store it together with the valved hose for later reuse in case of storage and transport.
7 Check the pressure of the cap and the accumulators using the nitrogen charge tool *(see par. 4.2.1 and 4.2.2).*

2.2 Connection of hydraulic hoses
(see fig. 4)

USE ONLY HOSES, supplied by IHC.

Before connecting the hoses make sure that:
- the engine of the power pack is not in operation,
- nobody is standing right in front of the hose connections of the power pack,
- there are no traces of sand or dirt left in the coupling nuts and connecting nipples. If necessary clean the connections with engine fuel.

Connect the hydraulic hoses (4) at the connections (P) and (R) of the hammer and at the power pack.
If, accidentally, the supply and return line have been crosslinked, the **Hydrohammer®** will not function properly. A pressure of 90 bar will be indicated when the oil is circulated. As long as the operating pressure is less than 200 bar, the system will not be damaged.



1 Male stud coupling (remains on hammer)
2 Hose coupling nut with plug (remains on bleeder hose set
3 Bleeder hose set, including ¼" ball valves, nipples and Interconnecting hose (L= 1500 mm)
4 Hydraulic hose 1 ¼" M52 (P & R)

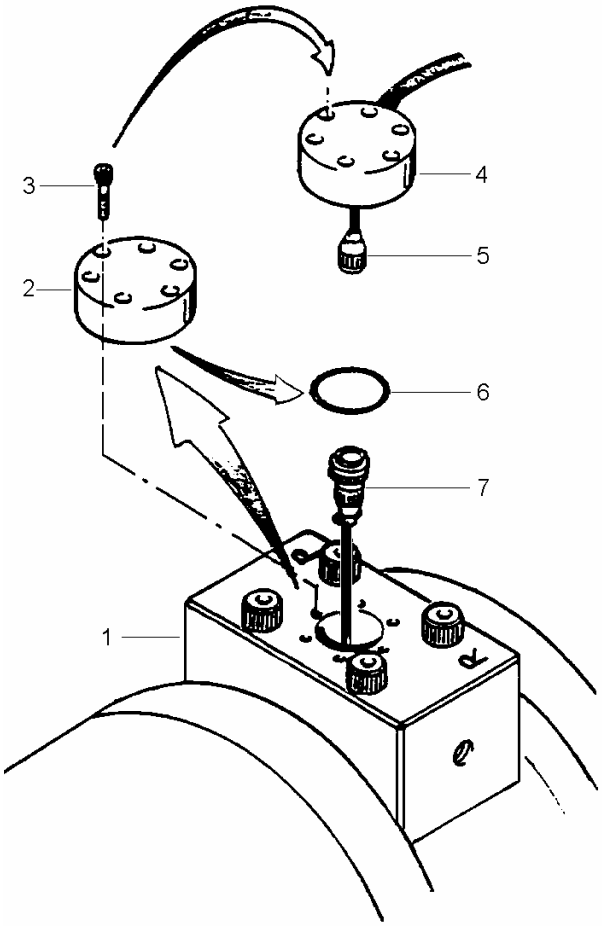
Fig. 4: Hose connections

2.3 Connection of control cable *(see fig. 5)*

The **Hydrohammer®** S-70 is shipped with the control cable disconnected from the connecting block (1) and with a transport cover (2) installed at cable entry.

The procedure for connecting the control cable is as follows:

1 Remove the transport cover (2) and put the six socket head screws (3) aside for later use *(see step 6)*
2 Remove the O-ring (6) from the cover and place it on the special cable cover (4).
3 Pull the 14 pins connector (7) out of the connecting block over approx. 20 cm.
4 Ensure that both connector parts are clean and free of oil or water.
5 Connect the female connector (5) of the cable cover to the corresponding male connector (7). Tighten coupling nut until the nut lock engages.
6 Slide the connector into the connecting block and mount the cable cover to the connecting block with the same six screws.
7 Store the transport cover conveniently for later reuse (storage or transport).



1 Connecting block
2 Transport cover
3 Socket head screw
4 Cable end block
5 Female connector (14p)
6 O-ring
7 Male connector (14p)

Fig. 5: Connection of control cable

2.4 Hammer positioning

Assumed is that all other associated equipment, necessary for the intended piling operation (leader-guided or free riding mode for vertical or batter piling), is already installed.

Lift the **Hydrohammer®**, using the lifting eyes L1, L2 and L3 *(see fig. 9)* as necessary, to place the hammer in the required position.

WARNING:

- The eccentricity of the hammer relative to the pile shall be less than 2.5 cm.

- The angle between hammer and pile shall not exceed 1:50.

3. OPERATION

3.1 Initial start of pile driving

The actual start and piling operation is controlled from the portable control box C-32 or C-34.
See further the user's manual of control equipment as purchased by the client.

Having properly started up the power pack (engine speed approx. 1500 rpm, see power pack manual) and with the **Hydrohammer®** correctly placed in piling position, pile driving is started by switching the START/STOP switch on the control block in START position.

Check for any irregularities, such as jumping of hoses, oil leakage etc.

3.2 Blow energy and blow rate

Because the setting of the energy level is time based, the energy level at a certain cap pressure, is determined by:
- oil flow (dictated by engine speed and number of connected pump heads)
- position of the energy knob on the remote control block (a higher value of lifting time increases the lifting height of the ram weight, at the same time reducing the blow rate).

It often appears that a lower blow energy at higher blow rate is more productive than a higher blow energy at a lower blow rate.

The user will soon get the feeling for the optimal settings of energy and engine speed (minimum 1500 rpm) for a particular soil resistance and type of pile.

CAUTION
The cross-sectional area of the steel pile shall not be less than 200 cm^2 when applying full energy.

3.3 Penetration per blow

The **Hydrohammer®** will not stop when driving piles through soft soil layers, unless the pile drops dramatically
(trip 04: ram below sensor A).
In such situations it is recommended to keep the blow energy low. When passing through thick layers of very soft soil ("thick water"), where the pile and hammer "sink", it is recommended to stop the operation for a while.

When driving piles in hard soil, the blow energy must be increased.

3.4 Refusal criteria

3.4.1 Pile driving refusal

The refusal criteria at which pile driving operations have to be stopped immediately and beyond which the IHC warranty conditions do not apply anymore are:

1 pile driving refusal is defined as the point where the pile driving resistance exceeds:
either:
an **average** of 250 blows/25 cm (equivalent to 300 blows/ft) pile penetration over six (five) consecutive distances of 25 cm (1 foot).
This equivalent to a maximum of 1500 blows for a distance of 1,5 meter (5 feet) or less,
or:
exceeds 650 blows per single distance of 0,25 m penetration (equivalent to 800 blows/ft)

2 This shall not apply if there has been a delay in pile driving operations for one hour or longer.
For the first next 25 cm (1 foot), the blow count may be 1000 as a maximum. Thereafter the refusal criteria of point 1 shall apply again.

Above blow count criteria represent very hard driving conditions and have the purpose to protect the hammer for mechanical breakdowns or failures. In general one can consider a blow count of approximately **80-100 bl/0,25 m (100-125 bl/ft)** at maximum pile driving energy as a practical maximum.
A small increase in the Resistance to Driving (SRD) will result in a large increase in blow count, i.e. consequently also a large increase in driving time.

3.4.2 Extraction refusal for upwards and downwards blows

See the separate documentation about the refusal criteria for use of the IHC extraction cap and extraction cat.

3.4.3 Rock breaking operation

See the separate documentation about the refusal criteria for use of the IHC chisel set.

3.5 Stop / start of pile driving

Pile driving should be stopped immediately after trouble or an irregularity has been observed, so as to prevent more damage.

Use the emergency stop on the control equipment for emergency cases ONLY (both engine of the power pack and piling operation will stop immediately).
See the user's manual of the control equipment how to RESET after an emergency stop.

If problems occur for which no solution can be found in this manual, please contact IHC Hydrohammer.

Pile driving should also be stopped when the refusal criteria (as stated in 3.4 above) are reached, in order to prevent damage to the pile and hammer.

The piling operation can be stopped and restarted with the STOP/START switch on the remote control block at any time as long as no automatic stops occur.

3.6 Automatic stops

The **Hydrohammer®** is stopped automatically when a trip function is activated as indicated by the trip code on the control box.
See the user's manual of the control equipment how to RESET after an automatic stop.

3.7 Day's end of pile driving

At the day's end of pile driving, the Hydrohammer system is stopped as follows:
- put stop/start switch S4 on control equipment C-32 in STOP position (S5 on C-34),
- stop the engine as described in the power pack manual.
- turn the power supply switch S1 on the engine panel A-32 of the power pack in position OFF

In case of prolonged idle operation (three days or more); preservation of the hammer is required as described in paragraph 6.3 Procedure for preservation.

3.8 Shutting down the Hydrohammer®

At the end of the job, the **Hydrohammer®** will be shut down and eventually prepared for storage or transport.

o **Depressurise the hydraulic oil system** by opening the bypass ball valves on the hydraulic manifold *(see user's manual of the power pack)*

o **Disconnect the hoses**

NOTE:
The hydraulic hose as supplied are equipped with quick connectors (with integral check valves) at the power pack side which makes emptying of the hoses unnecessary (assuming the hoses can be left connected to the hammer).

at hammer

In case the hoses need to be disconnected **from the hammer**, the hydraulic hoses must be emptied to the hydraulic reservoir for environmental reasons:
- by making use of gravity flow (with hammer in vertical position) and by opening the R 1/4" aeration plugs on the connecting block *(see fig. 6/V1 and V2),*
- screw and tighten the plugs back in place, having completed emptying,
- disconnect the hoses from the hammer and install the bleeder hose set, *(see fig. 4)* to the P and R connections of the connecting block
- place the dust caps on open hose ends to prevent entrance of dirt and moisture.

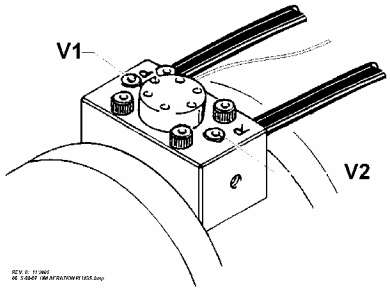


Fig. 6: Aeration plugs

at power pack
- Disconnect the quick connectors of the hydraulic oil hoses (P and R) at power pack and place the dust caps to prevent entrance of dirt and moisture.

Check for possible damage to the hoses.
Store the hoses at a proper place

o **Disconnect the control cable**
- Disconnect the cable end block of the control cable *(see fig. 5 Pos 4/5)* and store at a proper place to prevent possible damage.
- Install the transport cover (fig. 5/2) on the cable entry opening.

Put the hammer in horizontal position on wooden blocks.

4. MAINTENANCE

4.1 Preventive maintenance

The valves and sensors can all be replaced from the outside. The **Hydrohammer®** does not require internal inspections for preventive maintenance.

4.1.1 Daily

Make an overall visual inspection of the hammer for any sign of oil leakage, loose components and the like. In case of loose screwed connections, use the following torque values:

4.1.2 Weekly

- Drain the cap *(as described in par. 4.2.3)* and the housing *(see par. 4.2.4),* before starting piling operation.
- Check the oil level of the lower bearing at connection fig. 9/F4 and top up if necessary with **TOTAL FINA ELF DROSERA MS 68.**

4.1.3 Every 3 months

- Check shock absorbers (visual inspection of the shock absorbers is recommended when exchanging the pile cap).
- Check the leakage rate of hydraulic oil, drained from the cap and the housing, measured over a full week of piling operation.
- Check the pressure of the cap and the accumulators as described in par. 4.2.1.
  It is strongly recommended to do this also at the beginning of a new piling job.

4.1.4 Yearly

It is recommended to change the bearing oil at least once a year. *(See fig. 9 F4 en D3).*

4.1.5 Major maintenance

The best indicator for internal wear of the hammer is the leakage rate of the hydraulic oil.
Drain, collect and measure the **total** amount of leakage oil from the cap and housing after **a full week of piling operation**. If the amount exceeds 50 l/week, closer attention is required. From that moment on, **logging of leakage rates is recommended**, and major maintenance must be planned.

A cross check with the changes of the hydraulic oil level in the powerpack is recommended.
All major maintenance work, which include replacement of all seals, shall be done by personnel, qualified to IHC standards.

4.2 Maintenance procedures

4.2.1 Checking pressure of accumulators and cap

Too high or too low pressures in the accumulators may cause the hydraulic hoses to jump. The nitrogen charge tool is supplied to check and correct these pressure levels.
See par. 1.1 Technical data, for pressure levels of accumulators and cap.

Checking procedure is as follows, see fig. 7:

1 Stop piling operation.
2 Stop the engine as described in the power pack manual.
3 Put power switch on control box in OFF position.
3a **Only** for checking the **return accumulator** (to eliminate pressurizing by possible gas leakage from the cap): Open the two ball valves on the hydraulic manifold of the powerpack to depressurize the system.
4 Install Nitrogen charge tool *(see par. 4.2.2)* and ensure valves (1, 2 and 3) are closed.
5 Open slightly bolt (7) by turning spindle (5) and read pressure on gauge (H), use gauge (L) only for accurate reading of pressures below 40 bar.
6 When pressure is too high, bleed off by opening valve (2).
7 When pressure is too low: ensure valve 2 is closed, **close the spindle** and proceed:
  - Open the Nitrogen supply to the charge tool, open valve (3) **only half a turn** and read pressure on gauge (H); must be higher than the required pressure.
  - Charge by opening the spindle (5) until pressure on gauge (H) indicates required pressure and close the spindle.
8 Close valve (3) and the Nitrogen supply.
  Open and close bleed valve (2)
9 Disconnect the Nitrogen supply.

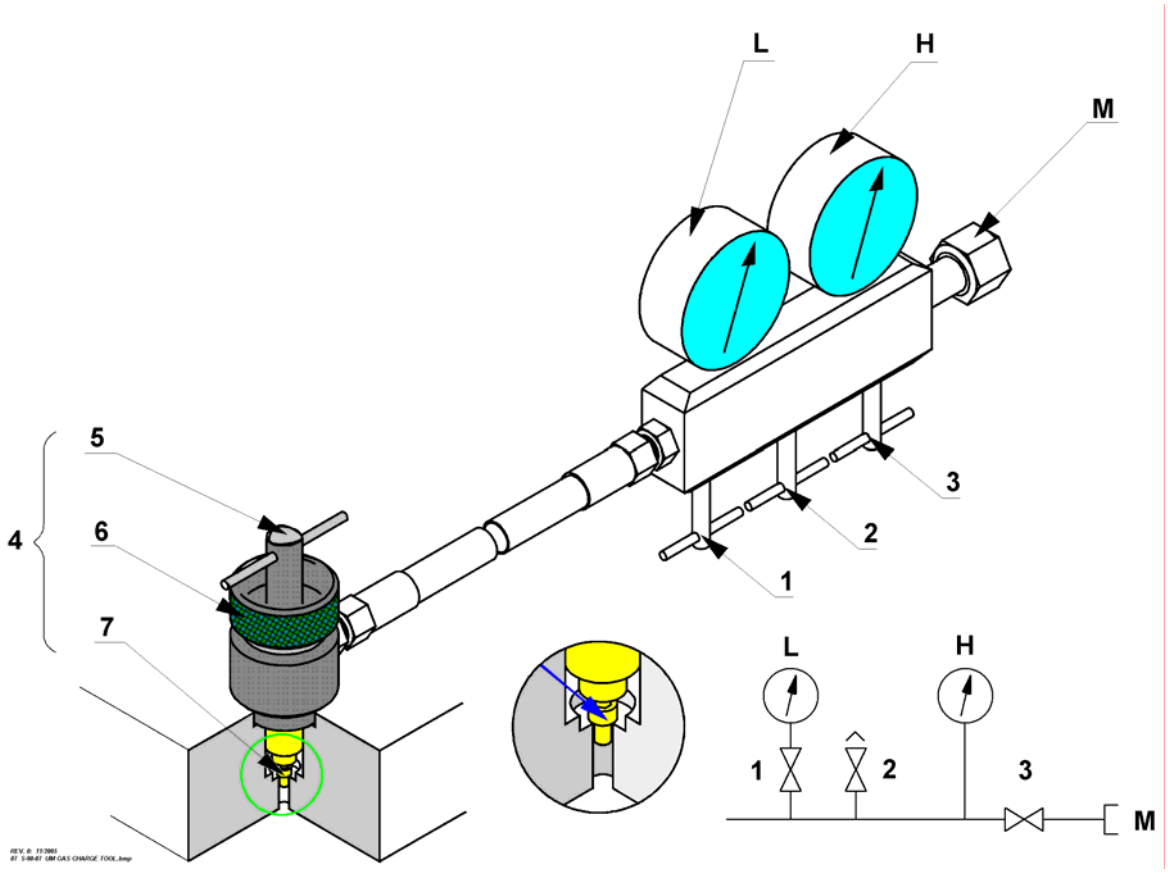
4.2.2 Installation of Nitrogen charge tool

See fig. 7.
At one side of the Nitrogen charge tool a coupling nut (M) has been fitted for the Nitrogen. Make sure that the correct connecting nipple has been mounted with regard to the different Nitrogen connections in the various countries *(see for details document 86 70 01 00).* Furthermore the Nitrogen charge tool is fitted with a filling hose and gas connecting assembly (4).

CAUTION
Keep valve (1) closed at all times when the charge tool is connected to the hammer or gas supply, to protect pressure gauge (L).

Proceed as follows to mount the Nitrogen charge tool to an accumulator or cap:
- close the valves (1), (2) and (3) for safety reasons
- remove the plug from the accumulator (connection F2 or F3) or the cap (connection F1), using Allen key 12
- loosen bolt (7) by means of a 5 mm Allen key
- mount the gas connector assembly (4) by turning the knurled ring (6) and make sure the hexagon bottom of the spindle (5) falls into the head of bolt (7).
- connect valve block with coupling nut (M) to the Nitrogen supply.

Removal of the Nitrogen charge tool is in reversed order.



M	Coupling nut	4	Connector assembly
H	Pressure gauge (250 bar)	5	Spindle
L	Pressure gauge (40 bar)	6	Knurled ring
1	Isolation valve for (L)	7	Sealing bolt
2	Bleed valve		
3	Block valve		

Fig. 7: Nitrogen charge tool

4.2.3 Draining oil from the cap

The procedure to drain the cap is as follows *(see fig. 8):*

WARNING: The cap is normally pressurized!

- remove the R 1/4" drain plug, marked D1B on the upper ring,
- connect the cap drain hose (3) (supplied as special tool) to the drain opening and place the end of the hose in a bucket,
- remove the R 1/8" plug, marked D1A on the upper ring (next to D1B),
- screw the R 1/8" insert (2) (supplied as special tool) in the drain opening, thus opening the spring loaded ball (4),
- collect the hydraulic oil, leaked into the cap,
- after completion of drainage, remove the hose and insert tool and install both plugs.

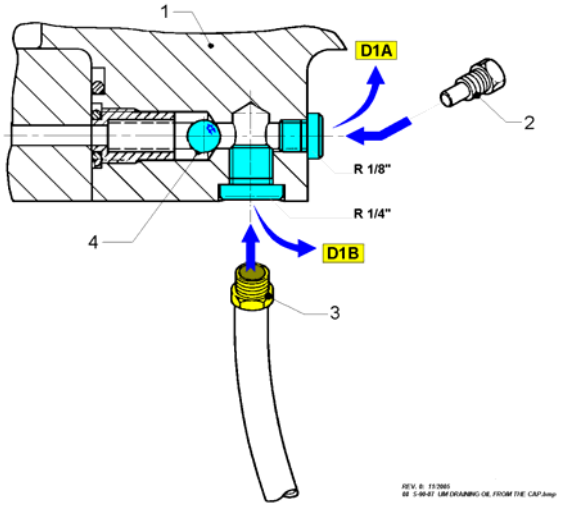


Fig. 8: Draining oil from the cap

4.2.4 Draining oil from the housing

The procedure to drain the housing is as follows *(see fig. 9 for connecting points):*

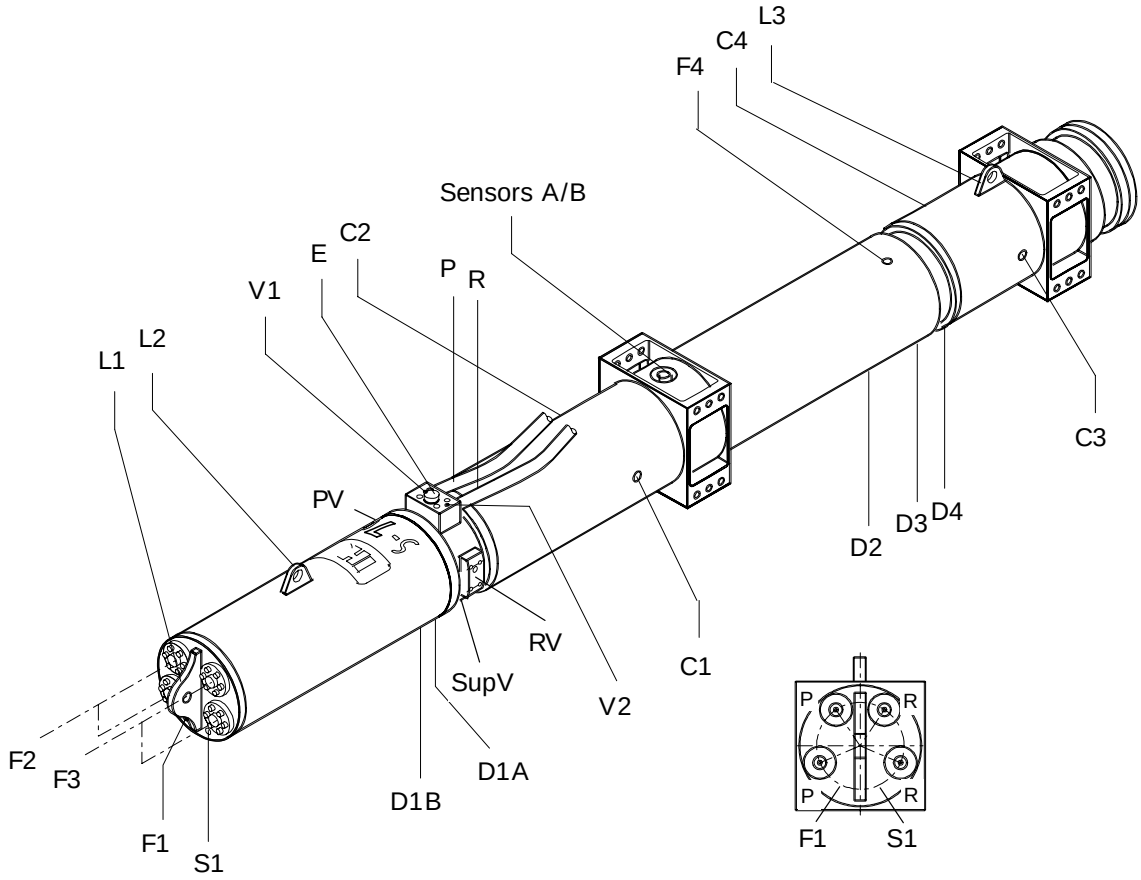
- remove the R 1/2" drain plug, marked D4 on the lower housing, when hammer is in vertical position on the pile.

  ATTENTION
  Hammer must be on the pile, otherwise ram weight may be resting on lower stop in the housing, preventing full drainage of leakage oil.

- remove the R 1" drain plug, marked D2 on the housing, when hammer is in horizontal position.

1 Upper ring
2 Special tool 86 70 02 01 (insert for cap drain)
3 Cap drain hose, special tool 86 70 03 01
4 Ball

Replace stickers as soon as they are damaged or have become illegible.
Thoroughly clean the surface with a grease solvent, before applying the new sticker.
New stickers can be ordered from IHC Hydrohammer.



Indication	Connection	Function	Remarks
F1	R 3/4"	Cap filling	p = 10 - 13 bar, Allen key 12 mm WARNING: Use Nitrogen only!
F2	R 3/4" (2x)	Filling P-Accumulators	p = 120-140 bar, Allen key 12 mm WARNING: Use Nitrogen only!
F3	R 3/4" (2x)	Filling R-Accumulators	p = 4 - 5 bar WARNING: Use Nitrogen only!
	R 3/4"	Oil fill lower bearing	10 l, **TOTAL FINA ELF DROSERA 68**, Allen key 12 mm. For batter piling at angles less than 45 º to the horizontal, use TOTALFINAELF CARTER EP 230
D1A	R 1/8"	Cap drain	Allen key 5 mm See WARNING below.
D1B	R 1/4"	Cap drain	Allen key 6 mm See WARNING below.
D2	R 1"	Drain, housing (horizontal)	Allen key 17 mm
D3	R 1/4"	Oil drain lower bearing	Allen key 6 mm
D4	R 1/2"	Drain, housing (vertical)	Allen key 10 mm
P	M 52	Hose connection oil supply	Wrench 60 mm
PV	4 x M24	Pressure valve	Allen key 19 mm
R	M 52	Hose connection oil return	Wrench 60 mm
RV	4 x M24	Return valve	Allen key 19 mm
SupV	4 x M16	Suppletion valve	Allen key 14 mm
C1-C4	R 1"	Preservation	Allen key 17 mm
L1	ø 52 mm	Lifting eye	WLL = 25 tons
L2/L3	ø 40 mm	Lifting eye	WLL = 9 tons
Sensors A/B	6 x M12	Cover for sensors A/B	Allen key 10 mm
S1	R 1 1/4"	Rupture disc	40 bar
V1	R 1/4"	Aeration of P-hose	Allen key 6 mm
V2	R 1/4"	Aeration of R-hose	Allen key 6 mm
E	6 x M10	Control cable	Allen key 8 mm

WARNING:
Always connect cap drain hose (special tool *86 70 03 01*) **first** at D1B,
then depressurize with insert (special tool *86 70 02 01*) at D1A.

Fig. 9: Location of various connections on the hammer S-70.

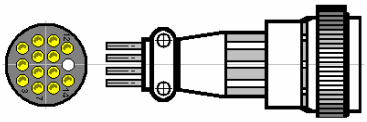
5. TROUBLE SHOOTING

In this chapter, only the specific **Hydrohammer**® malfunctions will be discussed.
For malfunctions of the hammer which are normally related to incorrect situations in the powerpack or control box, reference is made to the user's manual of the powerpack and control box.

Possible cause	Remedy
1. Ram weight of Hydrohammer® not moving	
a Hammer not correct on pile (trip 11).	a Lamp A and or B on control box is not lit, see user's manual of control box.
b Control cable not properly connected.	b Check connection at control box and connecting block on hammer.
c Valve P or R malfunctioning.	c Pilot valve sticking or solenoid defective: replace or return for repair.
d Incorrect situation at control box or powerpack.	d See user's manual of control box and powerpack.
2. Jumping of hydraulic hoses	
at initial start: a Hydraulic hoses P and R are crossed	a Read working pressure on gauge panel, while circulating the hydraulic oil (hammer not in operation). If reading is 90 bar, correct hose connections.
during operation: b Incorrect pressure in accumulators	b Check and correct as necessary, see par. 1.1 for pressure levels.
3. Jumping of hammer on pile	
a Cap pressure too high	a Check and correct cap pressure, see par. 1.1 for pressure level.
4. Hydrohammer® strikes irregularly	
a Hydraulic oil supply to hammer too low.	a1 Increase engine speed or pump capacity. a2 Ball valves on hydraulic manifold in open position, close valves
b Pressure valve malfunctioning (strong pressure fluctuations noticeable)	b Check pilot valve and solenoid.
c Return valve malfunctioning	c Check pilot valve and solenoid.

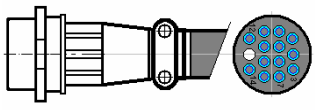
Table 1: Trouble shooting S-70

Standard Internal wiring 85 10 70 10
14 Pin AMP male connector

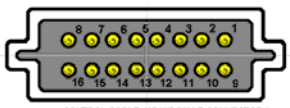


INTERNAL WIRING 14P AMP MALE CONNECTOR.bmp

Control cable 86 60 01 02 (L=50m)
14 Pin AMP female connector — 16 p Walther Procon male connector



CONTROL CABLE 14P AMP FEMALE CONNECTOR.bmp



CONTROL CABLE 16P WP MALE CONNECTOR.bmp

wire colour		**Function**		pin number
blue	1	Sensor	A -	3
green/yellow	2	Sensor	B -	5
black	3	Sensor	A +	2
brown	4	Sensor	B +	4
blue	5	Pressure valve	P -	12
brown	6	Pressure valve	P +	13
blue	7	Return valve	R -	14
brown	8	Return valve	R +	15
blue	9	Reference		7
	10 thru 14	Not connected		

Table 2: Connection internal wiring to control cable

6. STORAGE AND TRANSPORT

After completion of the shutting down activities as described in par. 3.9, the hammer can be prepared for storage or transport.

6.1 Support of hammer

For storage and transport, the **Hydrohammer®** must be placed in horizontal position with the connecting block facing upwards.
The hammer can be supported by its own leader boxes.

For transport, proper fixation of the hammer to prevent movement during transport, is required.

WARNING:
In case of transport after any period of storage, the cap pressure must be checked. The cap pressure must be at least 5 bar, to prevent movement of the ram during normal transport.

6.2 Conditions for preservation

Provisions must be taken to preserve the **Hydrohammer®** in the following cases:

- In case of **storage**, or in case of transport which takes 3 days or more and for sea-transport.
- In case of prolonged idle operation (three days or more).

6.3 Procedure for preservation

The procedure for preservation is as follows:
- Put the hammer in horizontal position.
- Remove the R1" plugs of the connections C1-C4 *(see fig. 9)* and spray a liberal amount of preservation fluid **TOTALFINAELF OSYRIS DWX 9000** (formerly known as **ELF PROTERA DR 07X**) (use an atomiser) through each opening. Reinstall the plugs.
- Spray also a liberal amount of the preservation fluid in the circumferential space between the lower end of the ram and the buffer locking plate.