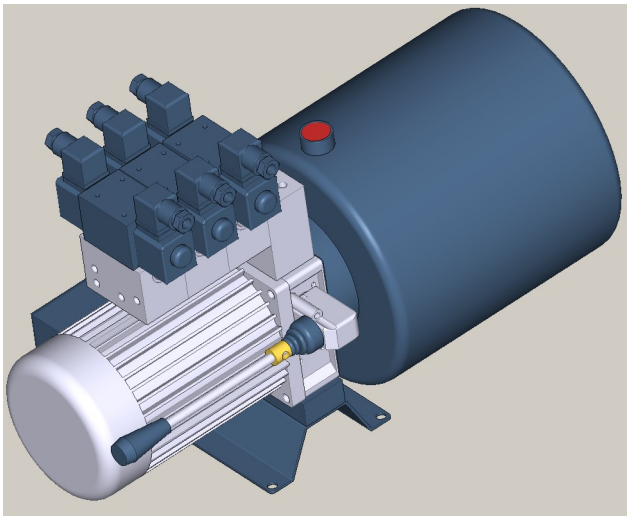
Hydronit



Power Packs Compact series

Use and maintenance handbook

Power Packs Compact series Use and Maintenance Handbook

We thank you for your choice of Hydronit advanced range and invite you to carefully follow the instructions and the advices stated in this handbook for a proper use of our products.

This handbook is addressed to trained and qualified staff that however cannot replace a professional and competent installer. The qualified staff have got a sufficient knowledge of Hydronit range of products thanks to technical train and experience. The qualified staff is liable for the application, security and directions requested by the rules in force.

The user is liable for the product and accessories choice. Therefore it is important for the user to analyse its own application and the problems involved, making adequate analyses and tests.

The manufacturer is not liable for damages to persons and things due to a bad or incorrect installation of PPC hydraulic power units.

Hydronit Srl is making a continuous research and development of its products with the consequent right to modify all necessary technical specifications at any time without notice.

The Hydronit management team

Chapter 1: identification

Logo: PPC power units are identified by the logos "MADE IN ITALY" and "EOS TECHNOLOGIES" on the body casting.

Label: PPC power units are identified with a sticker (normally on the tank) showing "HYDRONIT" logo, the production code, the month and the year of manufacturing. When the product is supplied without tank or in loose parts, normally there is no label.

Chapter 2: normal use and applications

PPC power units are meant for hydraulic machines and tooling manufacturers. If requested, PPC power units are supplied to the Customer with a "Declaration of conformity" (according to UNI CEI EN 45014 standards) and a "Declaration of manufacturer" (according to 8973927CEE machines standards, enclosure "IIB").

As the application fields of the power unit is wide and the final destination of the products is not always known, this handbook has been made according and limited to the general well known applications. Some examples are:

- car lifts
- dock levellers
- lifting platforms
- tail-gates for trucks
- tipping platforms for small trucks
- truck lifts
- snowplough blades
- industrial applications (machines tools, food field, textile field)
- garbage compactors

Use limits: Warning! Hydronit Srl does not authorize users, customers or manufacturers to employ the power units in following applications :

- wherever there is explosion and fire danger,
- aeronautical and space vehicles,
- steering installations and systems on vehicles and on means of transport for people, things and animals,
- braking, locking and stalling systems in general,
- tooling and installations for military, nuclear, medical and hospital applications.

However, on user's request, the technical managers of Hydronit Srl reserve the right to evaluate case by case the above stated applications and to give their authorization when they believe it is opportune.

Warning! The power packs cannot be used to solve security situations.

Chapter 3: general safety rules

Mechanical specifications:

- Do not unduly operate on any type of valve, fitting, accessory or component of the power unit; a simple valve loosening could cause the free drop of loads or a yielding of the structures.
- All the operations involved in installation, assembly, maintenance and disassembly of the power unit and assembled components must be carried out carefully following the safety rules. During these operations there must be no pressure (null pressure) inside the hydraulic circuit and no kind of load on the installation structure or on the machine on which the power unit has to be installed (null load).

Electric specifications:

- All electric connections and disconnections must be made by qualified and trained people.
- Unplug the motor and any other electric component, before proceeding with any operation on the power unit.
- All motorization or devices different from the electric ones (pneumatics, hydraulic, mechanicals, etc.) must be

previously disconnected to avoid any casual energy production .

Security rules:
- Use accident prevention protections;
- Work in very good cleaning conditions;
- Work in maximum security conditions;
- Use suitable and clean instruments, tools and benches;
- Warning: during operations of starting-up, normal service, maintenance, installation breathing setting , set on of the valves and the various control devices, there could be hydraulic fluid outlet and sudden splashes at such high temperature that could cause skin burns.

The hydraulic fluid can be dangerous for health as its contact with eyes and skin can cause serious damages. Carefully follow the security rules stated by the fluid manufacturers on the technical and toxicity specifications card of the product.
The hydraulic fluid is a polluting product. Therefore it is better to avoid fluid leakages using gathering tanks and accidental fluid leakages using absorbent products.

Chapter 4: hydraulic fluid choice
The fluid transmits the power and in the same time lubricates all the installation components in the hydraulic circuits.

Hydraulic fluid: use ISO 6743/4 (DIN 51519) mineral base fluid only. Other fluids can damage and jeopardize the good service of the installation.

Viscosity: the advised viscosity must follow the ISO3448 standards:
- min. viscosity: 22 mm^2/s
- max. viscosity: 100 mm^2/s
- advised viscosity: 46 mm^2/s

Chapter 5: installation and commissioning
Assembly: proper assembly and installation are very important for a good long time service for an hydraulic system. Dust and dirt are the worst enemies for hydraulic systems. During the installation take care of cleaning, making the principal connecting operations in clean and dust free rooms.

The power unit must be assembled in such a way to allow an easy accessibility to devices, inspections, maintenance and repairing; assembly must be made in an area protected from accidental impacts and casual physical contacts, as the temperature reached during working may cause burns.
The power unit must be firmly fixed to the machine in the points of major resistance (for example: load bearing frame, side members, etc.), far from any possibility of vibration source or components that may transmit or amplify noises or vibrations.

All installation and commissioning operations must be carried out by trained and qualified people.
Motors, particularly DC motors, and reservoirs can reach high temperatures, often exceeding the "threshold of burn" (as defined in UNI EN 563 standards).
As the "reduction of the surface temperature" cannot be treated as a technical solution (UNI EN 563 appendix C), the operator must use protections such as screens or barriers, warning signals and personal protections (gloves).

Attemperation:
- Environment temperature: –15°C ÷ +50°C
- Fluid temperature: –15°C ÷ +70°C

Sudden temperature variation can jeopardize either the performance or the life of the product, therefore it is necessary to protect it from these situation.

General rules for a correct installation:
- Look at the hydraulic circuit and eventual electric one (our technical/sales departments are at your disposal for any relevant information).
- Do not take off the protection plastic caps before you start with hoses connection.
- Use hoses and pipes having the same or bigger diameter of the power unit connecting ports, with reference to the following speed parameters inside the pipelines:

  delivery : 4 ÷ 6 m/sec return line : 1,5 ÷ 3 m/sec
- Please find here below a table stating the advised hoses dimensions to obtain above mentioned speeds:

Flow: l/min.	Delivery hose	Return line hose
Up to 5	1/4"	1/4"
From 5 a 10	1/4"	3/8"
From 10 a 20	3/8"	1/2"
From 20 a 40	1/2"	3/4"

Note: for single acting cylinders it is necessary to use the hoses advised in the "return-line" column; for long hoses (over 3m length) the advised values must be increased accordingly.

- For power units driven by an electric intervention, the coils must be powered by the voltage stated on them. Input

voltage does not have to exceed the following limit: nominal voltage ± 10%. Exceeding this limit may jeopardize the good service of the valve and the coil life.
- The coil connection must be made by DIN 43650 / ISO 4400 connectors; the choice of connectors depends on the type of used solenoid valve.
- Some solenoid valves have got a manual emergency, this emergency must always be disconnected before re-starting the installation.
- For power units with manual device valve, apply a maximum voltage of 24V DC/AC to the micro switch.
- For power units with external modular manifolds, use cylindrical fittings for the connecting ports, according to DIN 3852 standards and threading according to UNI-ISO 228 standards.

Advised tightening torques:
Warning! Screwing steel fittings with dents on the male thread may cause chips removal in the aluminium female seat, with consequent improper valves and power unit operation.
Depending on the bolt/fitting type here below recommended screwing torques:
M5: 4÷5,5 Nm, M6: 8÷10 Nm, M8: 16÷25 Nm, M10: 35÷40 Nm, 1/4"BSP: 35÷40 Nm. For more detailed information see appendix D at the end of this manual.

Reservoir filling: if the power unit has the plastic reservoir, fill-in with hydraulic fluid filtered at 25µ or better grade and check the level through the tank transparent wall; if the power unit has a steel reservoir check the fluid level through the filling/breathing cap or through the optical level, if present.

If the power unit comes without the reservoir, mount the power unit kit inside the seat previously realized by the user, checking that the o-ring on the central manifold is granting a proper sealing, then fill-in the reservoir as above stated.

Commissioning: the sense of rotation of the pump can be clockwise or counter-clockwise (the sense of rotation is given looking the pump or the motors having the shaft in front of you). Generally speaking, on our power units the most widely used pumps have clockwise rotation. Check the presence of a direction sticker or mark on the pump or motor body.
Electrically connect the motor. This operation is to be carried out only by qualified people.

Check list of controls: check the proper working of all controls.
- Relief valve: the relief valve is a security component, therefore it must not be unduly operated, for example: replacement of the adjustment screw. The security standards state that the relief valve of the power unit has to be leaded to avoid any unduly operation.
- Air breathing: during the first commissioning, it is necessary to make an air breathing of the system to avoid foam in the reservoir and eventual uncontrolled movements of cylinders.
  At the same time, check again the fluid level and, if necessary, fill-up to the proper level.
  After some working hours, check the eventual presence of leakages in all the system, check again the fluid level and eventual presence of foam.

Chapter 6: handling and stocking
Handling: the power units must be handled with care.
- They are equipped with protuberances such as the filling/breathing caps on the reservoir, all valves screwed on the body, the electrical box for the AC motors which can be subject to breakages.
- When equipped with DC motors there are connecting electric cables that can get tangled in, with consequent fall of the power unit.
- When the power unit is equipped with manifolds and eventually with electric distributors, it is necessary to protect them against impacts and flexure that could bring to irreversible damages.

Stocking:
- Since the motor is normally the heavier component of the power unit, it is necessary to stock it in horizontal, never in vertical position!
- The power units must be stocked in a place possibly closed, protected from dust, dirt, dump and atmospheric agents, at a temperature not lower than –15°C and not higher than +50°C.
- The reservoir must by empty.
- Protect the unit with nylon bags, paying more attention for units supplied without reservoir, as in this case it is absolutely necessary to protect the exposed parts, particularly hoses, pump, filters, etc. The protection must avoid hydraulic fluid leakages and not allow external particulars to come in; these could be very dangerous for the good service and life of the power unit.

Chapter 7: disposal of the power unit and hydraulic fluid
Power unit waste: the power units are mainly built of aluminium, steel alloys and plastic material. Depending on waste regulations of each country, they can be scrapped as normal material sent to recycling or not. Check local waste policy. In any case take care of empting the power units from the hydraulic fluid first: the hydraulic fluid must follow specific waste rules.

Please respect the information and instructions of the products and follow the relative laws in force in the Country where the products have been used. DO NOT SCATTER THE REPLACED FLUID IN THE ENVIRONMENT!

Chapter 8: maintenance
An hydraulic system where the operation of installation, assembly and commissioning have been duly done will have a long life without troubles and will not need particular maintenance.

It is necessary to often check the quality and the state of the fluid transmitting the power and to be sure there are no impurities inside the circuit. The reliability of any hydraulic machine is tied to this: it is now scientifically stated that the principal cause of troubles in hydraulic systems is due to the wear and ageing of the hydraulic fluid with consequent loss of its chemical-physic performances and to the presence of particles and micro-particles continuously running inside the fluid, causing wear and damage. These particles, free to run inside the circuit, act as an abrasive mixture scratching the surfaces they contact and dragging further contamination in circulation; of course the more sophisticated are the installations the worst incidence have these damages.

Since the installation starting-up, the maintenance is made by small operations that must be done regularly to be really effective.
It is extremely important to program the maintenance operations and report them on machines or installation cards; these cards must always follow each power units or each part of the installation.

The following periodical operations are advised:
1 – External cleaning: it allows an easy localization of eventual leakages and immediate intervention. The excessive dirt storage can pass through the filling/breathing plug.
2 – Fluid topping up: it has to be done every time the level goes down to the minimum.
3 – Continuous check of the hydraulic fluid temperature: the fluid deterioration due to the temperature is a reason of pollution and degradation of the installation. The heat is particularly increasing the hydrocarbons degradation; the oxidation speed is average constant up to 60°C, starting from this value it doubles each increase of 10°C. The presence of sludge and sediment gives to the fluid a turbid look and it is a signal of its degradation.
4 – Replacement of the hydraulic fluid: a frequent check and the periodical replacement of the fluid assures the best working conditions for a long time. Generally replacement has to be done after the first 100 working hours, then every 2000 hours or in any case once a year. Every time you change the fluid, replace also filters and clean the reservoir. Before changing the fluid, completely empty the system.

Chapter 9: spare parts.
The components of the power unit with normal wear are really few if the instructions and the suggestions of this handbook have been followed during the installation and final check operations.

Brushes for DC electric motors: generally, we can state that the average brushes life is 1/3 of the power unit one. This indication can greatly change depending on the conditions of use (stability of the supply voltage, temperatures, duty charge,...).

Filters: as advised in the maintenance chapter at "FLUID CHANGE", replace the filters every time you change the fluid: it is opportune to keep some spare filters in your store.

Seals: the seals are normally removed during an ordinary maintenance and can be damaged: it is opportune to keep some complete kits of seals of the power unit in your store.

Plugs: the plugs are made of plastic and it is easy to damage them: it is opportune to keep some spare plugs in your store.

Chapter 10: general conditions for warranty and technical after-sales service for out-of-warranty products.
General conditions for warranty: the warranty for the products we manufacture covers manufacturing defects and failures due to employed materials.
The warranty period is of 12 months from the date of despatch to the user.
Eventual warranty operations must be made by our authorized technical centres or at our plant where the products have to arrive free of any transport charge and adequately packed.
Warranty will be considered over if the products have been incorrectly used, unduly opened, modified and/or repaired without our authorization.

Technical after-sales service for out of warranty products: Hydronit Srl and its authorized after-sales centres are at customer's disposal for its products repair even after the warranty period and may make repairs after several years too (if economically convenient).
Marketed components are guaranteed up to the stock out, or rather until they are available on the worldwide market.
The repair of our out of warranty products is generally a job card cost.
The estimate has to be requested when the product is returned for repair. If the estimate is not accepted, the cost involved for its formulation will be however debited.

Below stated documents have to follow every product returned for repair:
- Regularly filled return material note.
- Letter stating the defects, in which conditions they appeared and with intervention has been done prior to shipping back the product. Also it should include the reference name and contact numbers of the responsible technician for eventual additional information.

Chapter 11: troubleshooting

Trouble	***Probable causes***	***What to do***
Insufficient pressure or pressure drop compared with the circuit scheduled situation	- half-opened relief valve	- reset the original calibration according to the setting field allowed by the spring
	- worn pump	- replace
	- insufficient pump power	- replace by a motor with more power
	- too many load losses	- check the oil viscosity (too high); - check the fluid lines dimensions; - partially clogged fluid lines
The pump does not supply the requested flow	- wrong pump rotation	-check the rotation sense
	- clogged filter	- take it off and replace
	- clogged suction hose	- take it off and clean
	- small suction hose or the same is having a winding run	- check the hose size and bending angle
	- air is coming in	- check the suction kit; - check the tightening of hoses-filter-fittings; - check the breather and filter plug
	- the motor/pump connecting coupling has broken	- take if off and replace
	- the frontal seal of the pump has worn out	- take off the pump from the body and replace the seal
	- the pump is excessively worn	- take it off and replace
	- too high fluid viscosity	- check the specifications on the use and maintenance handbook
	- too slow rotation speed	- check the pump specifications
The pump is noisy	- cavitation	- check the suction hose dimensions - too high fluid viscosity, check the specifications on the use and maintenance handbook
	- air is coming in	- check the air inlet (see above)
	- vibration of the installation	- check the installation
Valves leakage or locking	- the check valve is leaking	- take it off and clean (eventually replace)
	- the electric valves are leaking	- check the voltage
	- the electric valves are energized	- check that the coil is powered with the minimum needed voltage (90% of nominal voltage)
Overheating (max. fluid temperature over 70°C)	- the reservoir capacity is not enough	- check the reservoir capacity
	- the cooling is not enough	- mount an heat exchanger
	- too many load losses	- check the fluid viscosity (too high); - check the fluid lines dimensions; - partially clogged fluid lines

Appendix A: general conditions of use

- ISO6743/4 (DIN 51519) mineral base hydraulic fluid
- Hydraulic fluids viscosity must be according to ISO 3448 standards:
    - min. viscosity: 22 mm^2/s; max. viscosity: 100 mm^2/s
    - advised viscosity: 46 mm^2/s
- The contamination degree must not be higher than 18/14 ISO 4406 class
- Minimum temperature of the hydraulic fluid: –15°C
- Maximum temperature of the hydraulic fluid: +70°C
- Optimal temperature of the hydraulic fluid: +30°C ÷ +50°C
- Minimum environment temperature: –15°C
- Maximum environment temperature: +50°C
- Use new and filtered hydraulic fluid (25µ or better)
- Never mix hydraulic fluids of different manufacturers as they can cause dangerous mud and sediments.

Appendix B: pumps working pressures and rotational speeds

Standard gear pumps K series:

Cm^3/rev	Continuous pressure bar	Intermittent pressure bar	Peak pressure bar	rev/min (max)
0,2	160	180	200	4000
0,4	160	180	200	4000
0,6	160	180	200	4000
0,9	200	230	260	6000
1,2	200	230	260	6000
1,6	200	230	260	6000
2,1	200	230	260	6000
2,7	200	230	260	6000
3,2	200	230	260	5000
3,7	180	210	240	4500
4,2	180	210	240	4000
5	140	170	210	3500
6	140	170	210	3000
7,9	140	150	160	2100

High performance gear pumps G series:

Cm^3/rev	Continuous pressure bar	Intermittent pressure bar	Peak pressure bar	rev/min (max)
0,2	190	210	230	7200
0,4	190	210	230	7200
0,6	190	210	230	7200
0,9	210	240	260	6000
1,1	210	240	260	6000
1,3	210	240	260	6000
1,6	210	240	260	6000
2,1	210	240	260	6000
2,6	210	240	260	6000
3,2	210	230	260	5000
3,7	210	230	250	4500
4,2	210	230	250	4000
4,9	210	230	250	3500
6	190	210	230	3000
7,9	160	180	200	2100
9,8	150	170	190	2000

Helical rotor pumps for high pressure, high flow and low noise applications **S series**:

Cm^3/rev	Continuous pressure bar	Intermittent pressure bar	Peak pressure bar	rev/min (max)
6,4	250	230	200	3600
8,3	215	195	153	3600
10,2	190	170	126	3600
12,9	160	140	99	3600

Above stated pressure and rotational speed limits are according to tests made at our plant and have been assumed as internal testing specifications. Intermittent pressure is intended for a period of maximum twenty seconds, peak pressure is intended for a period of maximum two seconds, both measured with testing rotational speed 50% lower of the maximum allowed. Higher pressures can be allowed if previously agreed with our technical/sales departments, however these conditions reduce the average life of the pump, in a manner directly proportional to the working pressure increase.

Appendix C: reservoirs capacity

Reservoir identification: to quickly identify the reservoir a reference number and letters have been assigned to each one of them (example: 5BV). The number in the code (in the example "5") is referring to a rough average capacity in liters of the reservoir. The letter refers to the tank type (in the example "B") and to the mounting style (V=vertical, none=horizontal).

Filling capacity: it states the necessary quantity of fluid to fill the reservoir correctly.

Suction capacity: it states the real suction quantity of hydraulic fluid.
Both the filling and the suction capacities are stated in average values, as the pump size room inside the tank changes from 0,2 cc/rev to 10 cc/rev.
An exact value of the effective filling capacity can be obtained with tests on the specific power unit only.

Identification of ***plastic reservoirs***	Filling capacity horiz. mounting dm^3	Filling capacity vert. mounting dm^3	Suction capacity horiz. mounting dm^3	Suction capacity vert. mounting dm^3
Lt. 1,5 - square	2,46	1,43	2,1	1,2
Lt. 3 - square	4,55	4,17	4,0	3,5
Lt. 5 – square	5,97	5,64	5,5	5,1
Lt. 6 – square	6,37	6,55	5,9	6,1
Lt. 8 – square	8,29	8,67	7,7	7,9

Identification of ***steel reservoirs***	Filling capacity horiz. mounting dm^3	Filling capacity vert. mounting dm^3	Suction capacity horiz. mounting dm^3	Suction capacity vert. mounting dm^3
Lt. 1,5 - cylindrical Ø130	1,6	1,5	1,4	1,4
Lt. 2,5 - cylindrical Ø130	2,8	2,4	1,7	1,8
Lt. 5 - cylindrical Ø180	5,3	5,3	4,8	4,9
Lt. 10 - cylindrical Ø220	10,4	10,3	10	9,8
Lt. 10 - square	10,2	8,24	8,5	6,8
Lt. 12 - cylindrical Ø240	13,5	13,5	12	11,7
Lt. 8 - square vertical		10,5		8,5
Lt. 15 - square vertical		18		16,5
Lt. 20 - square vertical		21		19,5
Lt. 22 - square	23,3	19,5	21	18
Lt. 30 - square vertical		33,5		31

Appendix D: hydraulic connections

The pressure port is identified by the letter "P", which can be marked or not on the power unit body, while the return port, if marked, is identified by the letter "T".

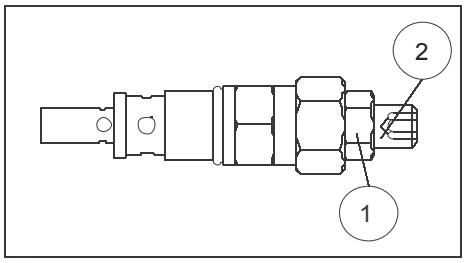
Cylindrical fittings and copper seals must be used for connections according to DIN3852 standards and the threads must follow the UNI-ISO228 standards.

Please follow below advised tightening torques:

Threads	***Nm***
M5	4/5,5
M6	8/10
M8	16/20
M8 pump	20/25
M20x1,5	35/50
BSPP ¼"	38/42
BSPP 3/8"	45/55
¾-16 UNF cavity	38/42
Check valve cavity	25/30
Relief valve cavity	50/60

Appendix E: relief valve setting:
The adjustment of the relief valve must be done by a qualified person with the help of a gauge (pressure reader):

- Loosen the nut (1)
- Unscrew the screw (2) almost completely
- Start the power unit
- Tighten the screw (2) up to the wished adjustment, checking the pressure on the gauge
- Lock the nut (1) keeping the screw still (2)
- Check again the obtained value on the gauge and eventually repeat the operation
- Lead the valve



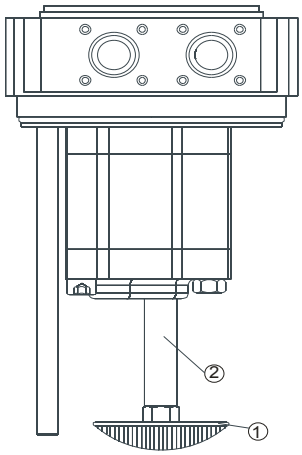
The security standards state that the relief valve of the power unit has to be leaded to avoid any unduly operation.
The maximum working pressures are stated in appendix B.

Appendix F: reservoirs assembling / disassembling:
Assembly of the reservoir: to assemble the reservoir it is necessary to put the power unit in such a way to facilitate the operator's work. The assembling must be done by qualified people:

- Check the reservoir cleaning
- Check the clamp to be smooth, without burrs, welding slags, scoring, etc.
- Check the o-ring and its seat cleaning
- Grease the clamp and the o-ring
- Insert the reservoir with a firm hand pressure
- With steel reservoir, put the screws in their seats and tighten them by hand
- Tighten the screws uniformly with a tightening torque of 8-19 Nm (both the clamp and all the other screws).

Disassembly of the reservoir: no particular attention has to be paid in the reservoir disassembly operation, just empty it from the hydraulic fluid; the disjunction from the power unit (and vice-versa) must be done by hand with a light undulation of one of the two components.
This operation must be done with great care as disjunction may occur suddenly, with exit of hot fluid residuals.
Using levers or screwdrivers may cause dents or scoring that could jeopardize the power unit.

Appendix G: filter replacement
Unscrew the filter (1) keeping the suction pipe still (2).
Screw the new filter by hand completely, at end stroke lightly force the threading making the polyethylene hose penetrate the filter, granting the mechanical and hydraulic sealing.



Before any of the above stated operation, please carefully read following chapters of the power unit use and maintenance handbook:
- Chapter 3 – GENERAL SAFETY RULES
- Chapter 7 – DISPOSE OF THE POWER UNIT AND HYDRAULIC FLUID
- Chapter 8 - MAINTENANCE

All the operations must be carried out by qualified and trained people.

Appendix H: manufacturer declaration

MANUFACTURER DECLARATION DRAFT

Machine directive 98/37/CE (attachment II B)

Hydronit Srl, registered office via Pastrengo 62 – 20039 Varedo (MI) Italy, declares under its responsibility that the power pack:
Code: _____
Descriptive code: _____
Batch no.: _____
Document no.: _____

- is built to take part in a machine or to be assembled within other machinery in order to build up a machine considered by the directive 98/37/CE;
- therefore it is not fully conform to all points of a.m. directive.

Hydronit Srl declares that it is not allowed to switch on the product until the machine that contains it has not been identified and declared conform to the directive 98/37/CE; that is to say until the product is not incorporated in the final machine.

CE CONFORMITY DECLARATION

Hydronit Srl declares that the specified product is conform to the directive 73/23/CE low voltage and/or to the directive 89/336/CEE electromagnetic compatibility as follows:

- with A.C. electric motor: 73/23/CEE, 89/336/CEE according to CEI EN 50081-1;
- with D.C. electric motor with winded magnet: 73/23/CEE, 89/336/CEE according to CEI EN 50081-2;
- with D.C. electric motor with permanent magnet: 73/23/CEE.

ADDITIONAL MOTOR SPECIFICATIONS

- A.C. electric motor: protection class IP54, insulation class F
- D.C. electric motor 800W (M46C*S008): protection class IP54, insulation class F
- D.C. motor 1600-2200W (M46C1S016 and M46C2S022): protection class IP54, insulation class F
- D.C. motor 2500-3000W (MB14C1S025 and MB14C2S030): protection class IP20, insulation class F

Technical Manager

Varedo,

_____