



Operation and Maintenance Manual

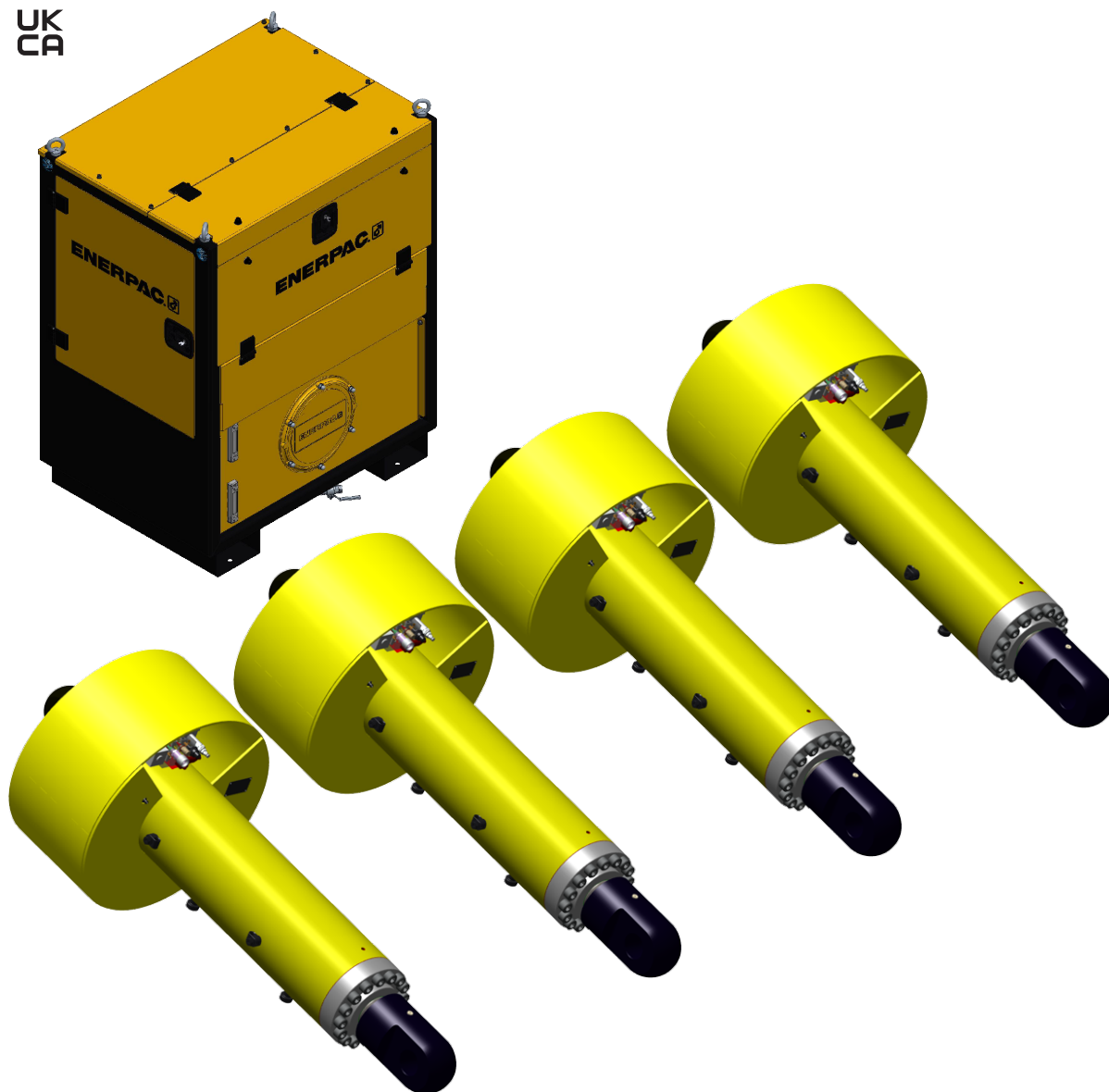
Enerpac SHS Manual Synchoist System

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To reduce the risk of injury, user must read and understand this document before use.

ABOUT US



Enerpac is a global market leader in high pressure hydraulic tools, controlled force products, portable machining, on-site services and solutions for precise positioning of heavy loads. As a leading innovator with a 110-year legacy, Enerpac has helped move and maintain some of the largest structures on earth. When safety and precision matters, elite professionals in industries such as aerospace, infrastructure, manufacturing, mining, oil & gas and power generation rely on Enerpac for quality tools, services and solutions. For additional information, visit www.enerpac.com.

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WARRANTY

Refer to the Enerpac Global Warranty document for terms and conditions of the product warranty. Such warranty information can be found at www.enerpac.com.

PUMP NAMEPLATE

 	
Zuidelijke Havenweg 7554RR Hengelo The Netherlands Tel. +31(0)742 422045	
MODEL:	CODE: XX XX X
SERIAL:	DATE: day/month/year
FLOW PUMP:	MAX. PRESSURE:
MOTOR VOLTAGE:	CONTROL VOLTAGE:
PHASES:	FREQUENCY:
POWER:	ROTATION:
SIZE:	WEIGHT:
RESERVOIR CAPACITY:	OIL TYPE:

CYLINDER NAMEPLATE

 	
Zuidelijke Havenweg 7554RR Hengelo The Netherlands Tel. +31(0)742 422045	
MODEL:	SERIAL:
WEIGHT:	STROKE:
MAXIMUM RATED PRESSURE - PULL / PUSH :	
MAXIMUM RATED LOAD - PULL / PUSH :	
ASME BTH-1	ASME BTH-1
DESIGN CATEGORY:	SERVICE CLASS:
	THIS LIFTING DEVICE MEETS REQUIREMENTS OF ASME BTH-1-2017 WITH THE EXCEPTION OF SECTIONS 4-11.2a AND 4-11.2b. CONTACT MANUFACTURER FOR ADDITIONAL DETAILS

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1. Safety

Read all instructions carefully. Follow all recommended safety precautions to avoid personal injury as well as damage to the product and / or damage to other property. Enerpac cannot be responsible for any damage or injury from unsafe use, lack of maintenance, or incorrect operation. Do not remove warning labels, tags, or decals. In the event that any questions or concerns arise, contact Enerpac or a local Enerpac distributor for clarification.

Save these instructions for future use.

If you have never been trained on high-pressure hydraulic safety, consult your distributor or service center for information about Enerpac Hydraulic Safety Courses.

This manual follows a system of safety alert symbols, signals, words, and safety messages to warn the user of specific hazards. Failure to comply with these warnings could result in death or serious personal injury, as well as damage to the equipment or other property.



The Safety Alert Symbol appears throughout this manual. It is used to alert you to potential physical injury hazards. Pay close attention to Safety Alert Symbols and obey all safety messages that follow this symbol to avoid the possibility of death or serious injury.

Safety Alert Symbols are used in conjunction with certain Signal Words that call attention to safety messages or property damage messages and designate a degree or level of hazard seriousness. The Signal Words used in this manual are DANGER, WARNING, CAUTION, and NOTICE.

DANGER Indicates a hazardous situation that, if not avoided, will result in death or serious personal injury.

WARNING Indicates a hazardous situation that, if not avoided, could result in death or serious personal injury.

CAUTION Indicates a hazardous situation that, if not avoided, could result in minor or moderate personal injury.

NOTICE Indicates information considered important, but not hazard related (e.g. messages related to property damage). Please note that the Safety Alert Symbol will not be used with the signal word.

1.1 Safety Precautions



Failure to observe and comply with the following precautions could result in death or serious personal injury. Property damage could also occur.

- Read and completely understand the safety precautions and instructions in this manual before operating the SHS or preparing it for use. Always follow all safety precautions and instructions, including those that are contained within the procedures of this manual.
- Always wear protective head-wear, ear protectors, footwear and gloves (at a minimum rigger type gloves) suitable for safe operation of the tool. The protective clothing must not interfere with safe operation of the tool or restrict the ability to communicate with co-workers.
- Be sure your workplace is safe. Follow the instructions in your workplace's standard operating procedures and be sure to observe all communicated safety precautions.
- Ensure all hydraulic components are rated to a safe working pressure of 700 bar (10150 psi).
- Do not remove or disable the pump relief valve.
- The system operating pressure must not exceed the pressure rating of the lowest rated component in the system.
- Never set a relief valve to a higher pressure than the maximum rated pressure of the SHS. If ratings are different, relief valve setting should not exceed the setting of the lowest rated component (pump or cylinder).
- Do not overload equipment. Never attempt to move a load with higher weight than the maximum load value of the SHS. Overloading causes equipment failure and possible personal injury.
- Always perform a visual inspection of the SHS before placing it into operation. If any problems are found, do not use the cylinder. Have the cylinder repaired and tested before it is returned to service.
- Never use a cylinder that is leaking oil. Do not use the SHS if it is damaged, altered or in need of repair.
- Always lift the cylinder using a crane or other suitable lifting device of sufficient rated capacity. Use only the 4 hoisting eyes on the SHS frame to attach the cylinder to the lifting device.
- Allow only trained and experienced personnel to supervise and perform lifting and lowering procedures.
- Be sure the operator has completed safety induction training, specific to the work surroundings. The operator should be thoroughly familiar with the controls and the proper use of the tool.
- Be certain that no persons are working on or near the SHS before moving of the load begins. Alert all personnel in advance that the procedure is about to occur.

- Lift only dead weight loads. Avoid lifting live weight loads.
- Be especially careful when lifting loads such as partially filled storage tanks, in which the center of gravity could move or shift during lifting. Be aware that the distribution of some loads can change quickly and without warning.
- Keep all personnel clear of the work area while lifting or lowering is in progress. To avoid personal injury, keep hands and feet away from cylinder and load during operation.
- Maintain communication with the operator at all times during lifting or lowering to avoid accidents. Use hand signals, two-way radios or other appropriate forms of communication (as required by applicable laws and regulations) if the load is not visible to the operator.
- Operate SHS as required to ensure that the load is moved evenly and at a controlled rate.
- Closely watch the load at all times during the moving process. Stop immediately if the load becomes unstable or appears to be moving unevenly.
- Always be certain that hydraulic pressure is fully relieved and that the load is fully removed from the SHS before disconnecting hydraulic hoses, loosening hydraulic fittings, or performing any cylinder disassembly or repair procedures.
- Any components that are blocked or stuck in any way (and any parts connected to these components) will be under mechanical tension. If you release these parts, they could change position suddenly and serious injury could result.
- Brake valves of pressurized functions (cylinders, motors and accumulators) must never be removed before depressurizing the respective function.
- Immediately replace worn or damaged parts with genuine Enerpac parts. Enerpac parts are designed to fit properly and to withstand high loads. Non-Enerpac parts may break or cause the product to malfunction.
- To prevent damage to pump electric motor, check specifications. Use of incorrect power source will damage the motor.
- Any modifications to the SHS could cause a dangerous situation and void the warranty.
- Keep the hydraulic and moving components of the SHS clean to prevent the SHS from jamming or causing damage to itself or other equipment.
- Switch the power off before inspection, maintenance or repair of the SHS. Make sure that relevant parts are no longer receiving power. If possible, make a ground connection. Insulate any adjacent components that are still receiving power.
- If work does need to be performed on components receiving power, then a second person must be present in the area to switch off the main power switch in the event of an emergency. Cordon off the work zone and only use certified and properly insulated tools.
- Lubricate tools as directed in this manual prior to operation. Use only approved lubricants of high quality, following the lubricant manufacturers instructions

NOTICE

Failure to observe and comply with the following precautions could result in property damage and/or void the product warranty.

- Always use Enerpac pumps and hoses.
- Always use Enerpac replacement parts.
- Check and inspect the electrical system of the SHS at regular intervals. Problems, such as loose connections and damaged or stuck wiring, must be resolved immediately. Only use original fuses and circuit breakers with the correct current value.
- Always follow the inspection and maintenance instructions contained in this manual. Perform maintenance and inspection activities at the specified time intervals.

CAUTION

Failure to observe and comply with the following precautions could result in minor or moderate personal injury. Property damage could also occur.

- Be careful to avoid damaging hydraulic hoses. Avoid sharp bends and kinks when routing hydraulic hoses. Do not exceed the minimum bend radius specified by the hose manufacturer. Using a bent or kinked hose will cause severe back-pressure. Sharp bends and kinks will internally damage the hose, leading to premature hose failure.
- Ensure components are protected from external sources of damage, such as moving machine parts, sharp edges, weld spatter, corrosive chemicals and excessive heat or flame.
- Do not drop heavy objects on hoses. A sharp impact may cause internal damage to hose wire strands. Applying pressure to a damaged hose may cause it to rupture.
- Keep hydraulic equipment away from flames and heat. Excessive heat will soften packings and seals, resulting in fluid leaks. Heat also weakens hose materials and packings.
- For optimum performance, do not expose hydraulic equipment to temperatures of 150°F [65°C] or higher.

2. Compliance Statement

2.1 Conformance to National and International Standards

- SHS45520MW •SHS45540MW • SHS45560MW
- SHS48520MW •SHS48540MW •SHS48560MW
- SHS411040MW •SHS411060MW
- SHS45520MJ •SHS45540MJ • SHS45560MJ
- SHS48520MJ •SHS48540MJ •SHS48560MJ
- SHS411040MJ •SHS411060MJ



These tools conform with the requirements for CE and UKCA.

Energac declares that the product(s) have been tested and conforms to applicable standards and the product(s) are compatible to all EU and UK Requirements.

Copies of the EU Declaration as well as the UK Self-Declaration are enclosed with each shipment.

3. Transport

Lifting and hoisting work must be performed by trained operators with certified lifting and hoisting equipment. Before use, check the validity of these certificates and qualifications.

For loading and unloading, only use lifting and hoisting equipment capable for holding the loads in question. The lifting and hoisting equipment must be stable enough and have suitable lifting and hoisting capacity.

Loading and offloading should always be performed by properly trained personnel.

Lift loads as described in the user manual (connection points for lifting hooks) and observe the professional standards.

Only use suitable containers with adequate load bearing capacity for transport purposes. Secure the load properly using suitable connection points and twist locks (for the containers). When using twist locks, secure them properly and check the locking mechanism is working correctly.

Disconnect any power connections in advance, even if the SHS only needs to be moved a short distance.

The equipment must be transported in a frame designed for this purpose. This frame can be placed in a container to provide good protection against weather influences and give a good rigid protection. Make sure that all parts are secured against sliding around. Refer to Figure 1 for frame details.

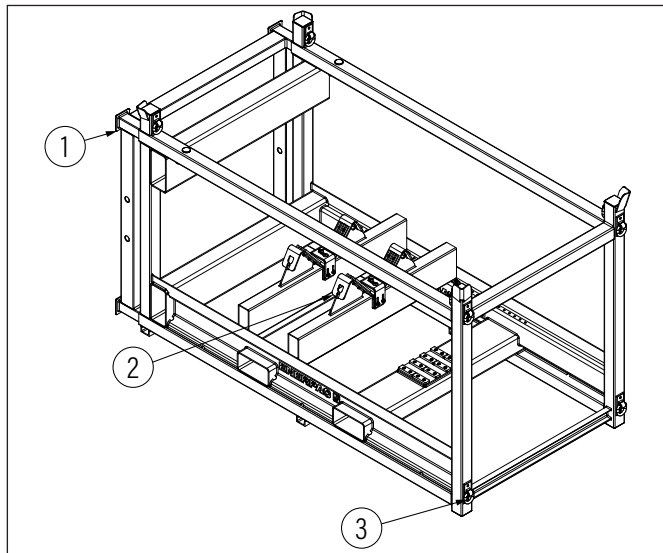


Figure 1: SHS transport frame parts

1. Frame Support
2. Synchoists Support
3. Eyebolt

Place the synchoist into the transport frame as showed in Figure 2.

1. Place the transport frame in the vertical position using the eyebolts.
2. Lift the synchoist from the rear clevis eye and insert it into the frame in the vertical position.

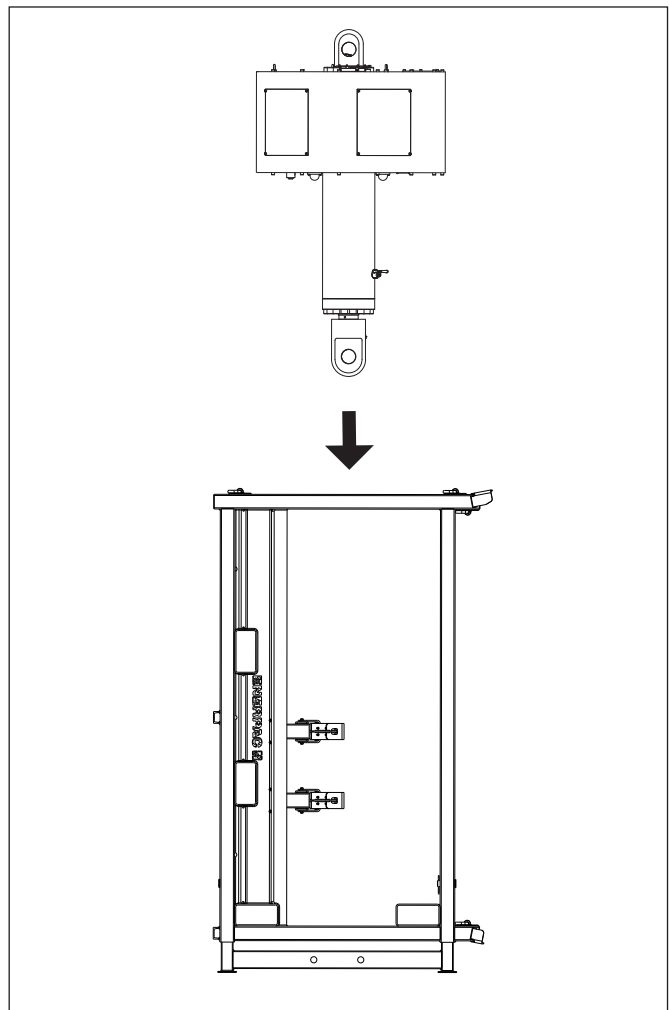
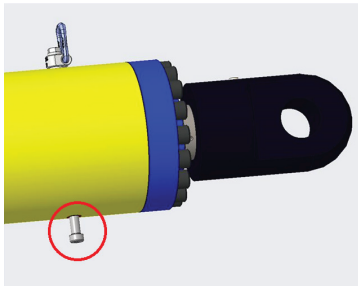


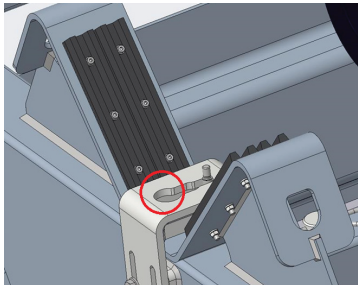
Figure 2: SHAS Frame Insertion

Refer to the following sequence of assembly to fix the synchoist into the structure (see Figure 3):

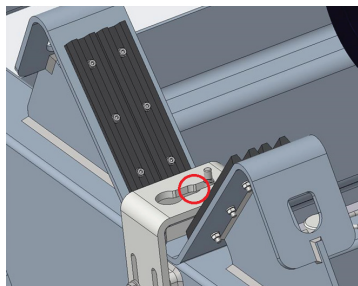
1. Insert the connection bolt into the synchoist support through the hole.
2. Move the synchoist forward until the connection bolt fits into the narrowing of the support to prevent it from moving during transport.
3. Repeat the same procedure with the other synchoist support.
4. Once the synchoist is completely attached, place the structure horizontally for transport.



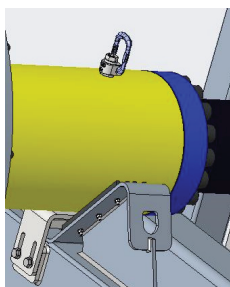
CONNECTION BOLT



SUPPORT HOLE



SUPPORT NARROWING



SYNCHOIST ATTACHMENT

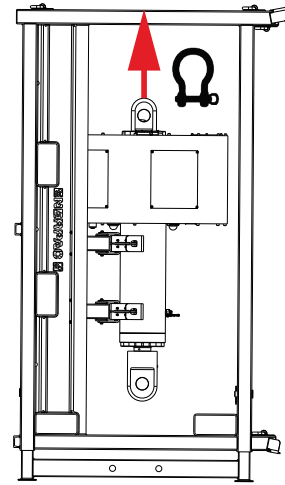
Figure 3: SHAS Attachment

The synchoist must be removed from the transport frame prior to work operation.

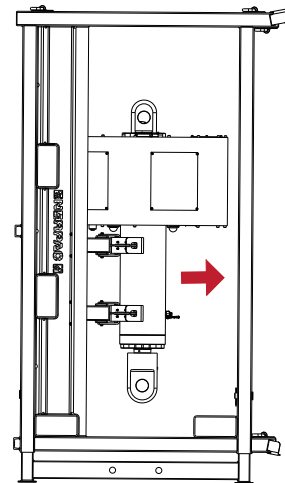
Refer to the following sequence to disconnect the synchoist from the transport frame:

1. Place the synchoist and transport frame assembly in the vertical position.

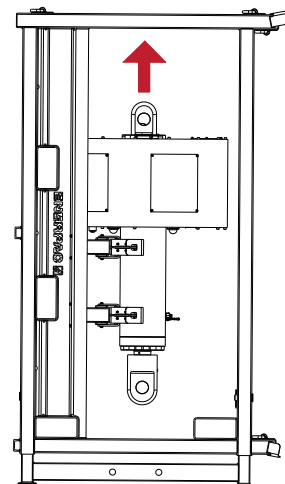
2. Connect the rear clevis eye with a shackle to hold the synchoist.
3. Lower and displace the synchoist to release the connection bolts from the synchoist support.
4. Lift the synchoist and remove it from the transport frame to start working operation.



SHACKLE CONNECTION



FRAME DISASSEMBLE



SYNCHOIST LIFT

Figure 4: Synchoist Disassembly

4. Features & Components

4.1 Manual SHS HPU

- 1. Electric Motor
- 2. Return Filter
- 3. Control Lever
- 4. Electric Plug
- 5. Motor Starter
- 6. Pressure Reading Device
- 7. Gauges
- 8. Visual Level
- 9. Breather Filter
- 10. Manifold Assembly

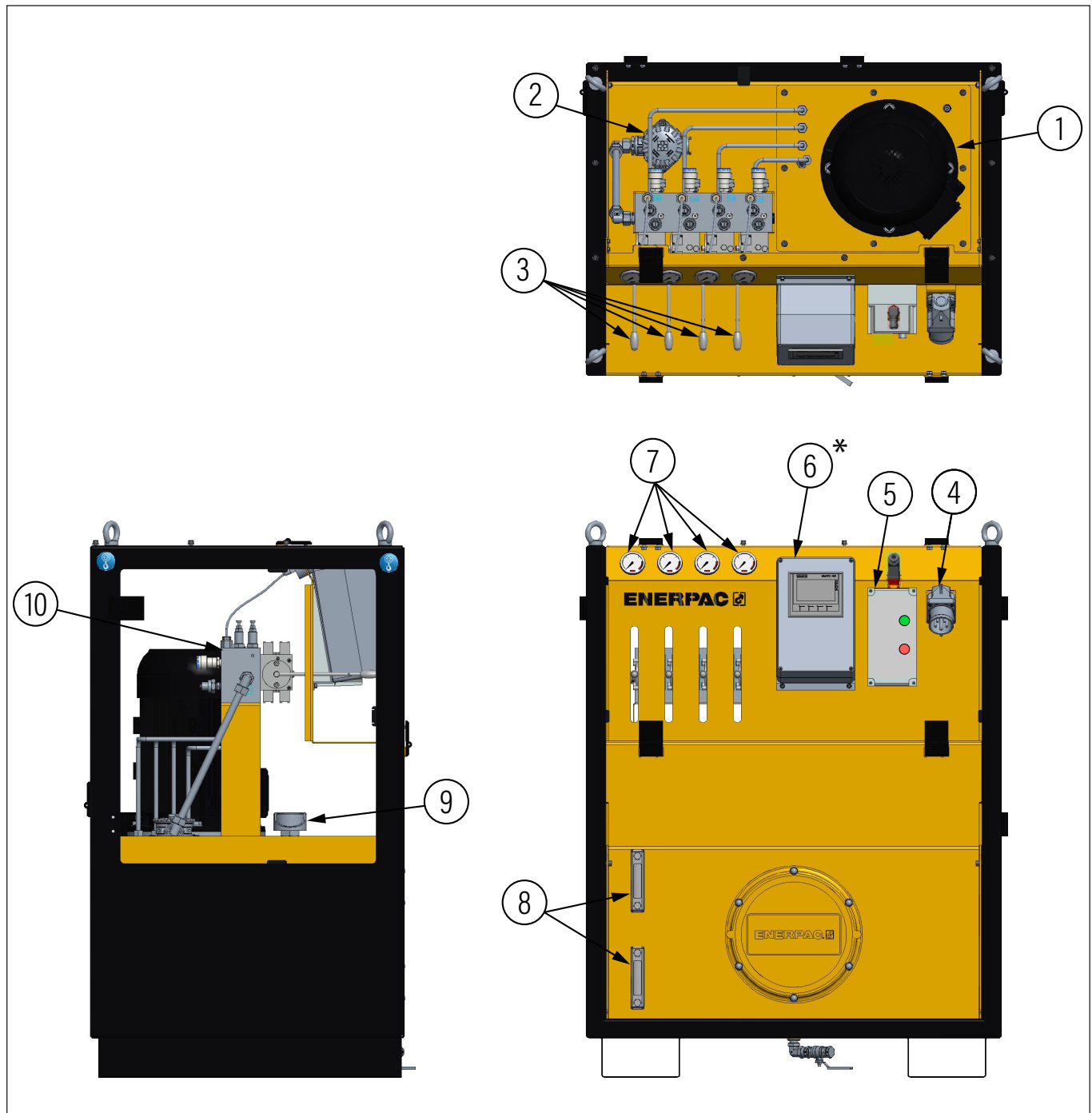


Figure 5: Features and components of Manual SHS HPU

* In W models, Pressure Reading Device (PRD) is optional and it is not included on the package, while in J models, PRD is factory mounted.

4.2 Synchoist Cylinders

- | | |
|-----------------------|---------------------------|
| 1. Protector Assembly | 6. Connection Bolt |
| 2. Manifold Assembly | 7. Plunger |
| 3. Lifting Eyes | 8. Sensor Connection Port |
| 4. Cylinder Body | |
| 5. Clevis Eye | |

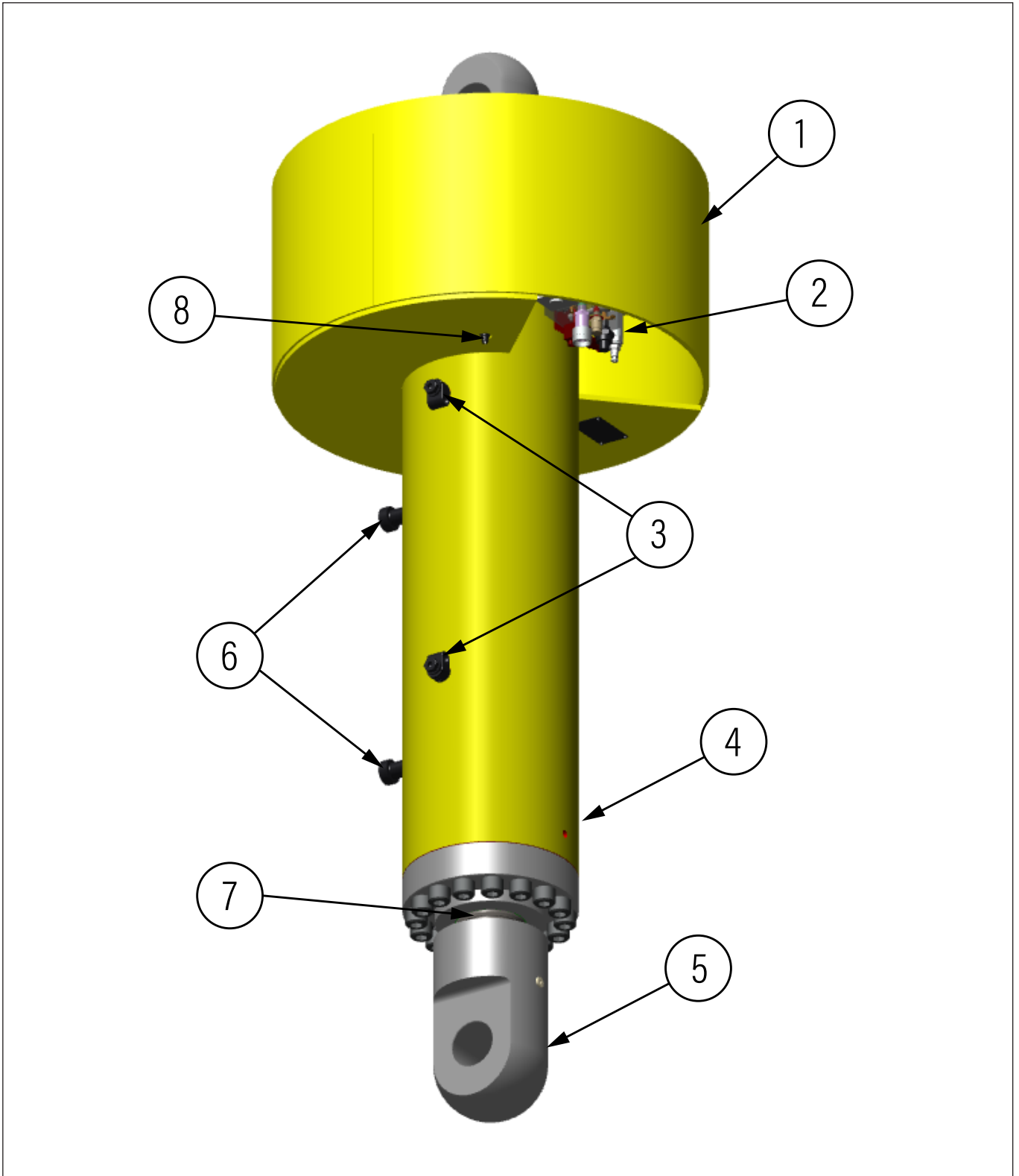


Figure 6: Features and components of SHS Cylinders

5. Product Technical Data

5.1 Manual SHS Pumps Dimensional Callout Art

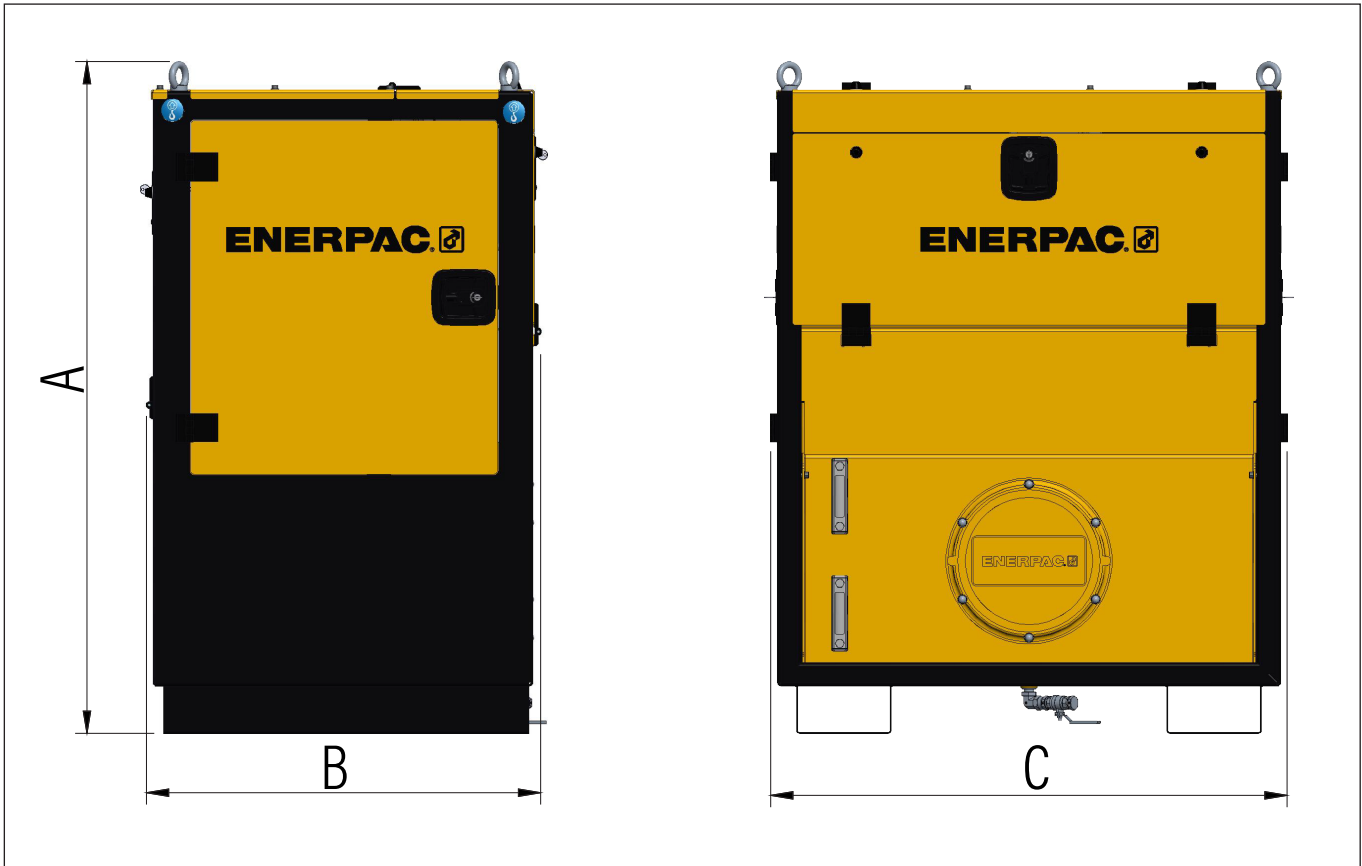


Figure 7: Manual SHS pump dimensions

5.2 Manual SHS Pumps Dimensional Table

Measurement	SHP414MW / SHP414MJ SHP421MW / SHP421MJ	
	mm	in
A	1418	55.82
B	832	32.75
C	1090	42.91

5.3 Manual SHS Pump Capabilities

	SHP414MW		SHP414MJ		SHS421MW		SHP421MJ	
Flow	4 x 1.4 l/min	4 x 0.36 gal/min	4 x 1.68 l/min	4 x 0.44 gal/min	4 x 2.1 l/min	4 x 0.55 gal/min	4 x 2.52 l/min	4 x 0.66 gal/min
Max. Pressure	700 bar	10150 psi	700 bar	10150 psi	700 bar	10150 psi	700 bar	10150 psi
Reservoir	250 l	66.04 gal	250 l	66.04 gal	250 l	66.04 gal	250 l	66.04 gal
Wet Weight	695 kg	1532.21 lbs	695 kg	1532.21 lbs	725 kg	1598.35 lbs	725 kg	1598.35 lbs
Motor Power	7.5 kW		9 kW		11kW		13.2 kW	
Motor Speed	1500 RPM		1800 RPM		1500 RPM		1800 RPM	
Frequency	50 Hz		60 Hz		50 Hz		60 Hz	
Power Supply	400 V		480 V		400 V		480 V	
Oil Grade	HF95 (Enerpac)							

5.4 SHS Cylinders Dimensional Callout Art

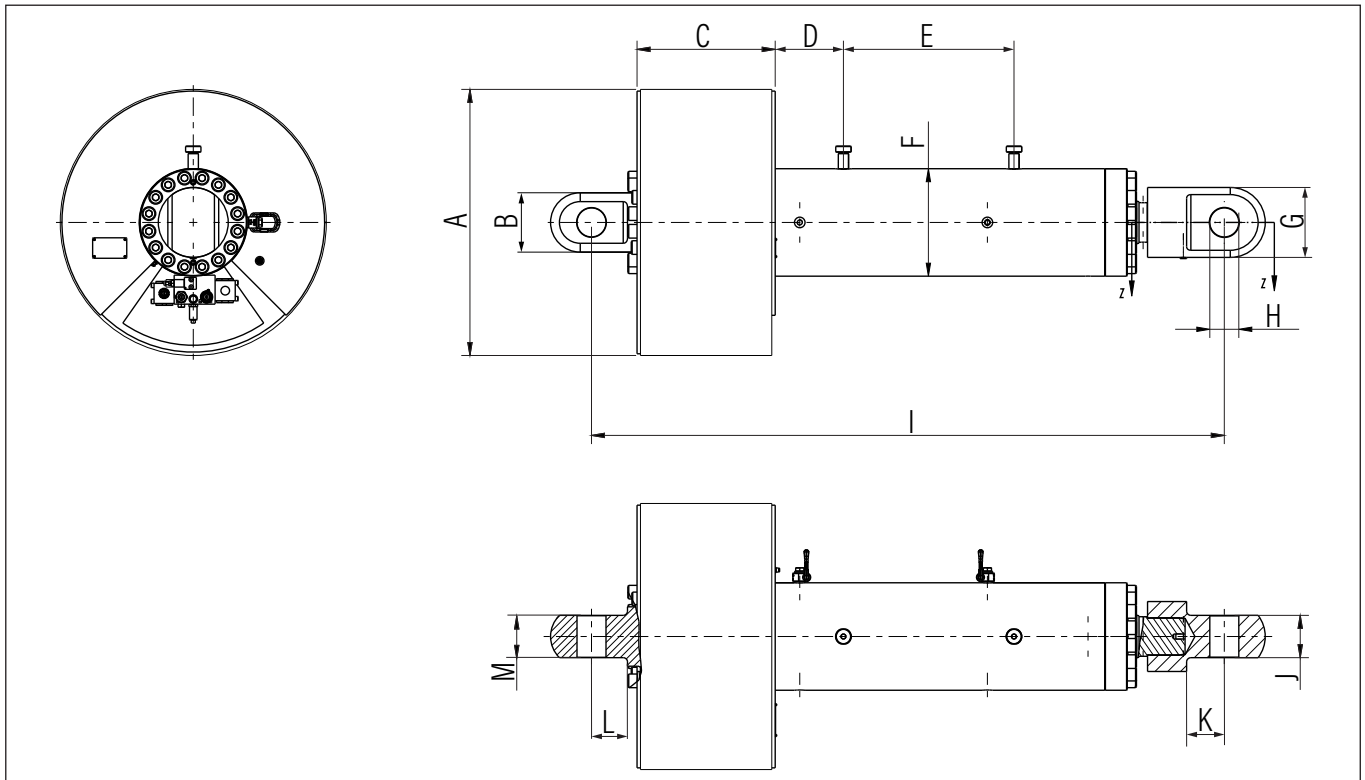


Figure 8: SHS cylinder dimensions

5.5 SHS Cylinders Dimensional Table

Model	A		B		C		D		E		F		G	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
SHC5520	690	27.16	160	6.29	395	6.45	165	6.49	200	7.87	245	9.64	160	6.29
SHC5540	690	27.16	160	6.29	395	6.45	200	7.87	500	19.68	245	9.64	160	6.29
SHC5560	690	27.16	160	6.29	395	6.45	200	7.87	500	19.68	245	9.64	160	6.29
SHC8520	690	27.16	164	6.45	385	15.15	165	6.49	200	7.87	265	10.43	164	6.45
SHC8540	680	26.77	164	6.45	385	15.15	200	7.87	500	19.68	265	10.43	164	6.45
SHC8560	690	27.16	164	6.45	385	15.15	200	7.87	500	19.68	265	10.43	164	6.45
SHC11020	780	30.70	174	6.85	405	15.94	160	6.29	200	7.87	315	12.40	174	6.85
SHC11040	780	30.70	174	6.85	405	15.94	200	7.87	500	19.68	315	12.40	205	8.07
SHC11060	780	30.70	174	6.85	405	15.94	200	7.87	500	19.68	315	12.40	205	8.07

Model	H		I		J		K		L		M	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
SHC5520	59	2.32	1300	51.18	80	3.14	91.5	36.02	91.5	36.02	80	3.14
SHC5540	59	2.32	1800	70.86	80	3.14	91.5	36.02	91.5	36.02	80	3.14
SHC5560	59	2.32	2300	90.55	80	3.14	91.5	36.02	91.5	36.02	80	3.14
SHC8520	72	2.83	1330	52.36	100	3.93	105.5	41.53	105	4.13	100	3.93
SHC8540	72	2.83	1830	72.04	100	3.93	105.5	41.53	105	4.13	100	3.93
SHC8560	72	2.83	2330	91.73	100	3.93	105.5	41.53	105	4.13	100	3.93
SHC11020	85	3.34	1355	53.34	124	4.88	110.5	43.50	105.5	4.15	124	4.88
SHC11040	85	3.34	1855	73.03	124	4.88	110.5	43.50	105.5	4.15	124	4.88
SHC11060	85	3.34	2355	92.71	124	4.88	110.5	43.50	105.5	4.15	124	4.88

* Cylinders which include pressure transducers have suffix P (ex. SHC5520P).

** Cylinders which include internal stroke sensor and pressure transducers have suffix S (ex. SHC5520S).

5.6 SHS Cylinders Capabilities

Technical specifications of these cylinders in the following tables:

- For 55 Ton Cylinders: SHC5520, SHC5540, and SHC5560.

55 Ton Cylinder Characteristics		
Pushing Pressure	125 bar	1812 psi
Pushing Capacity	18.2 Ton	178.48 kN
Pulling Pressure	700 Bar	10150 psi
Pulling Capacity	56.78 Ton	556.82 kN
External Diameter	245 mm	9.64 in
Internal Diameter	135 mm	5.31 in
Plunger Diameter	90 mm	3.54 in
Effec. Area (Pushing)	143.1 cm ²	22.18 in ²
Effec. Area (Pulling)	79.5 cm ²	12.32 in ²
Area Ratio	1.80	

Model	SHC5520	SHC5540	SHC5560
Oil Capacity (Pushing)	7.16 L	14.3 L	21.5 L
	1.89 gal	3.77 gal	5.67 gal
Oil Capacity (Pulling)	3.98 L	7.9 L	11.9 L
	1.05 gal	2.08 gal	3.14
Stroke	500 mm	1000 mm	1500 mm
	19.68 in	39.37 in	59.05 in
Weight	476 kg	624 kg	800 kg
	1049.4 lbs	1375.68 lbs	1763.7 lbs

- For 85 Ton Cylinders: SHC8520, SHC8540 and SHC8560.

85 Ton Cylinder Characteristics		
Pushing Pressure	125 bar	1,812 psi
Pushing Capacity	25.6 Ton	251.05
Pulling Pressure	700 bar	10150 psi
Pulling Capacity	87.5 Ton	858.08 kN
External Diameter	265 mm	10.43 in
Internal Diameter	160 mm	6.29 in
Plunger Diameter	100 mm	3.93 in
Effec. Area (Pushing)	201.1 cm ²	31.17 in ²
Effec. Area (Pulling)	122.5 cm ²	18.98 in ²
Area Ratio	1.64	

Model	SHC8520	SHC8540	SHC8560
Oil Capacity (Pushing)	10.05 L	20.11 L	30.16 L
	2.65 gal	5.31 gal	7.96 gal
Oil Capacity (Pulling)	6.13 L	12.25 L	18.38 L
	1.61 gal	3.23 gal	4.85 gal
Stroke	500 mm	1000 mm	1500 mm
	19.68 in	39.37 in	59.05 in
Weight	531 kg	700 kg	900 kg
	1170.65 lbs	1543.24 lbs	1984.16 lbs

- For 110 Ton Cylinders: SHC11020, SHC11040 and SHC11060.

110 Ton Cylinder Characteristics		
Pushing Pressure	125 bar	1812 psi
Pushing Capacity	36.1 Ton	354.02 kN
Pulling Pressure	700 bar	10150 psi
Pulling Capacity	114.8 Ton	1125.8 kN
External Diameter	315 mm	12.40 in
Internal Diameter	190 mm	7.48 in
Plunger Diameter	125 mm	4.92 in
Effec Area (Pushing)	283.5 cm ²	439.42 in ²
Effec Area (Pulling)	160.8 cm ²	249.24 in ²
Area Ratio	1.76	

Model	SHC11020	SHC11040	SHC11060
Oil Capacity (Pushing)	14.18 L	28.35 L	42.53 L
	3.74 gal	7.48 gal	11.23 gal
Oil Capacity (Pulling)	8.04 L	16.08 L	24.12 L
	2.12 gal	4.24 gal	6.37 gal
Stroke	500 mm	1000 mm	1500 mm
	19.68 in	39.37 in	59.05 in
Weight	750 kg	970 kg	1235 kg
	1653.47 lbs	2138.48 lbs	2722.70 lbs

5.7 SHS Description

Enerpac SyncHoist System is a unique crane product for below-the-hook heavy load positioning that require precision placement.

Manual SHS is composed of 4 specialized hydraulic cylinders which have an internally mounted distribution block. These cylinders are connected to an included powerpack or HPU which provides the operator freedom to precisely monitor and adjust each lifting point independently.

Manual HPU has 4 levers to control cylinder movements with an optional pressure reading screen to easy monitor the pressure going on each line.

The system is designed for 10150 psi [700 bar] maximum working pressure.

5.8 Product Table

There can be several configurations of this system depending on the HPU and cylinder model used. HPUs can be W model, with a 400 V, 3ph, 50Hz powerpack, and J model, with a 480V, 3ph, 60Hz powerpack. Cylinders have 3 different models, which are normal ones with no sensors, P models with pressure transducers, and S models, which incorporates pressure transducers and stroke sensor. All different combinations can be checked on the following table.

SHS Model	SHC Model	HPU Model
SHS45520MW/MJ	SHC5520	SHP414MW/MJ
	SHC5520P	
	SHC5520S	
SHS45540MW/MJ	SHC5540	
	SHC5540P	
	SHC5540S	
SHS45560MW/MJ	SHC5560	
	SHC5560P	
	SHC5560S	
SHS48520MW/MJ	SHC8520	SHP421MW/MJ
	SHC8520P	
	SHC8520S	
SHS48540MW/MJ	SHC8540	
	SHC8540P	
	SHC8540S	
SHS48560MW/MJ	SHC8560	
	SHC8560P	
	SHC8560S	
SHS411020MW/MJ	SHC11020	SHS421MW/MJ
	SHC11020P	
	SHC11020S	
SHS411040MW/MJ	SHC11040	
	SHC11040P	
	SHC11040S	
SHS411060MW/MJ	SHC11060	
	SHC11060P	
	SHC11060S	

6. Installation

6.1 Handling

The frame can be lifted with a crane, holding it by the lifting points previously explained. Refer to paragraph 1 for further information.

6.2 Hydraulic Oil Requirements

Use of Enerpac HF Series ISO 32 hydraulic oil is recommended. Enerpac HF oil is available at your local Enerpac Distributor or Authorized Service Center.

NOTICE

- Failure to use the correct oil type (high-quality ISO 32 hydraulic oil) may result in damage to cylinder hydraulic components and will void the product warranty.
- Be sure that the oil is clean. The oil cleanliness should be maintained to a maximum level of 18/16/13 per the ISO4406 standard. If the oil develops a milky, cloudy or dark appearance, it should be changed immediately.
- To avoid overfilling and possible equipment damage, add oil to the pump reservoir only after all Synchoists are completely retracted and system pressure is released.
- When using a hand-operated pump to power the

cylinder(s), it is permissible to use a high-quality brand of ISO 15 hydraulic oil. The lower oil viscosity will result in reduced pumping effort, especially in cold weather conditions.

6.3 Hydraulic Connections

CAUTION

On double-acting cylinders be certain that hoses are connected to BOTH couplers. Never attempt to pressurize a double-acting cylinder if only one hose is connected.

For installation of Synchoist cylinders, it is not necessary to start-up the power pack.

It is advisable to connect the hoses with retracted and horizontal positioned cylinders. If hoses are connected with cylinders in the vertical position it may be impossible to connect the hose in the small chamber due to the pressure created by plunger weight.

Connect hydraulic hoses as follows:

- A Port is connected to the retract outlet of the HPU.
- B Port is connected to the advance outlet of the HPU.

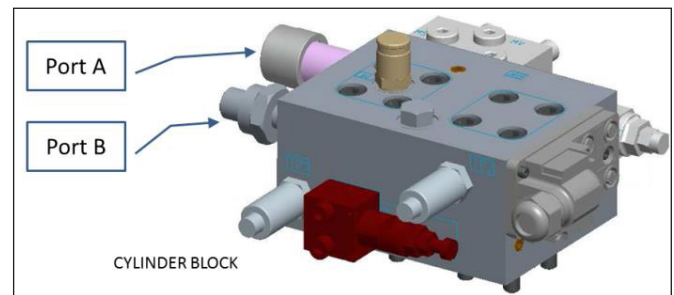


Figure 9: Distribution manifold ports

Perform the following steps to correctly connect the hoses:

1. Keep cylinders connected to a hydraulic system with a fluid cleanliness level minimum of NAS 1638 Class 6.
2. Remove dust covers/rubber plugs from oil ports
3. Inspect all threads and fittings in search of wear or damage signs and replace as needed.
4. Clean all threads and fittings.
5. Make hydraulic connections for double-acting cylinders using two hoses.
6. Fully hand-tighten all couplers. Loose coupler connections will block the flow of oil between the pump and the cylinder.

Check for leaks in system and have repaired by qualified personnel.

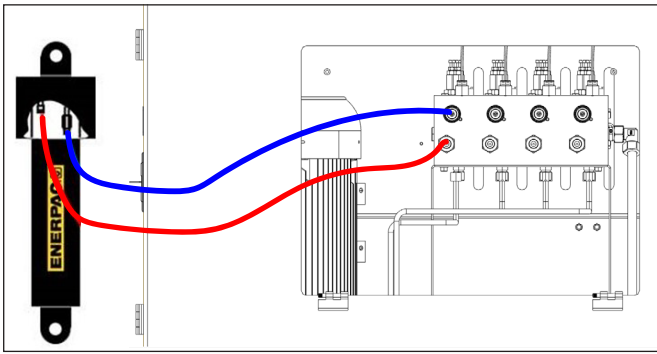


Figure 10: Hoses connection layout



Extend and retract the piston rods a few centimeters before installing the cylinders under the hook. Enerpac recommends this to be done while cylinders are located in the transport structure. Check all cylinders for leakage.

6.4 Electrical Connections

The pump is factory equipped with a 3 phase electrical plug for the given voltage, altering the plug type should only be done by a qualified electrician, adhering to all applicable local and national codes.

The plug supplied will vary, depending on voltage and motor size:

Motor Size		Electric Plug
7.5 kW	10 hp	3Ph + PE 400V 16A
11 kW	14.75 hp	3Ph + PE 400V 32A

The disconnection and line circuit protection will be provided by the customer. Line circuit protection will be 115% of motor full load current at maximum pressure of application.

If the cylinder includes pressure transducers or stroke sensors, in order to connect them to the HPU, the user must connect a cable from the sensor connection port, which is connected to the electrical distribution box of the cylinders safety block, to the connectors on top of the Pressure Reading device.

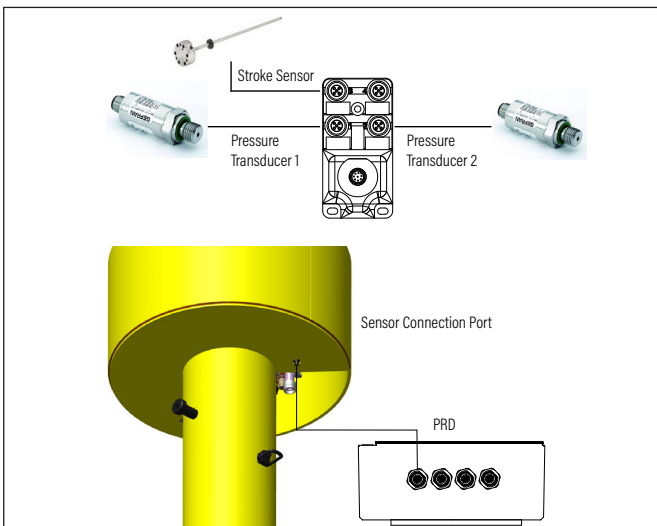


Figure 11: Sensors connection layout



The pump requires correct motor rotation. After connecting the plug to the main power supply, start the motor and check rotation against the arrow label on the motor and correct phase if required.

6.4.1 Manual SHS HPU Controls

The controls of the Manual SHS HPU are indicated on the following picture:

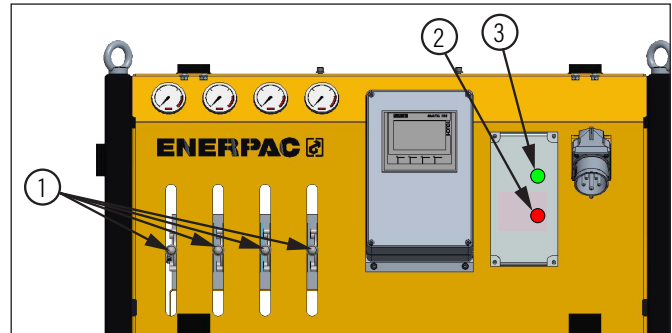


Figure 12: Manual SHS HPU Controls

1. Control levers: The user controls the cylinder movements manually with these levers. Pulling up the levers will make cylinders pull or retract and pulling down will make cylinders to extend or advance. There can be more than one lever pulled up or down at the same time.
2. Stop Motor Button: The HPU motor and pump will power off if this button is pushed.
3. Start Motor Button: The HPU motor and pump will power on if this button is pushed.

7. Screens

7.1 Main Screen

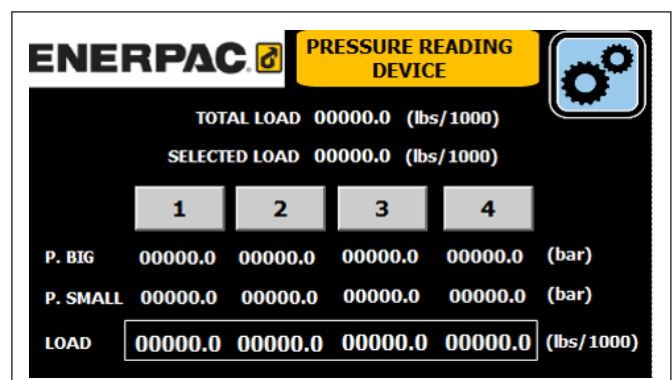


Figure 13: Main Screen

This is the main screen showed by the PRD when the system is powered on. In this screen the system shows the pressure and load values of all cylinders during the movements. If the top right corner button is pushed, the user will enter the Parameters screen.

7.2 Parameters Screen

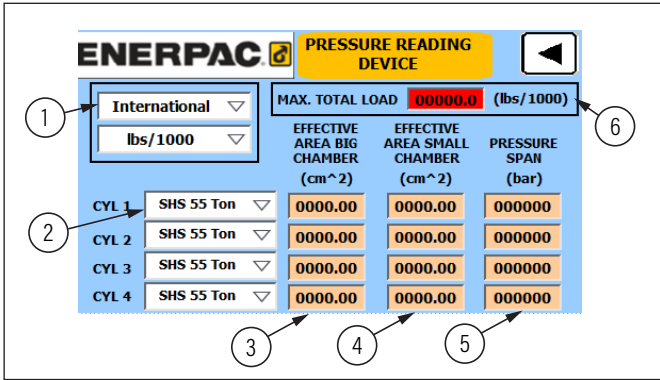


Figure 14: Parameters screen

In this screen the user must define some movements and security values of the system. In this screen, the following elements are found:

1. Units Selection: The user can select the units whereby the system will show the values. This values can be:
 - Load units: lbs/1000, Ton (1000 kg), s Ton (907,18 kg) and kN.
 - Dimensional units: mm or inches.
2. SHS Drop Down Menu: Here the user must choose the type of SHS which is being used. These can be standard or custom ones. If the user select an standard type, all values will be loaded automatically by the system. If custom is selected, the system will let the user type the specifications of the SHS. Point 3 to 5 gets affected by this fact.
3. Effective Area Big Chamber: The system will show the effective area of the piston face.
4. Effective Area Small Chamber: The system will show the effective area of the rear piston face.
5. Pressure span: The system will show the maximum capacity of the pressure transducer.
6. Maximum Total Load: The user must type the maximum load expected of all cylinders which are involved in the current application. When this value is exceeded, the control will show a warning alarm and the movement will be stopped.

8. Operation

8.1 Preparing the Synchoist

Synchoist cylinders must be positioned vertically, hanging on the crane by the hoisting eye located near the safety block protector, and the load on the hoisting eye installed on the plunger of the cylinder.

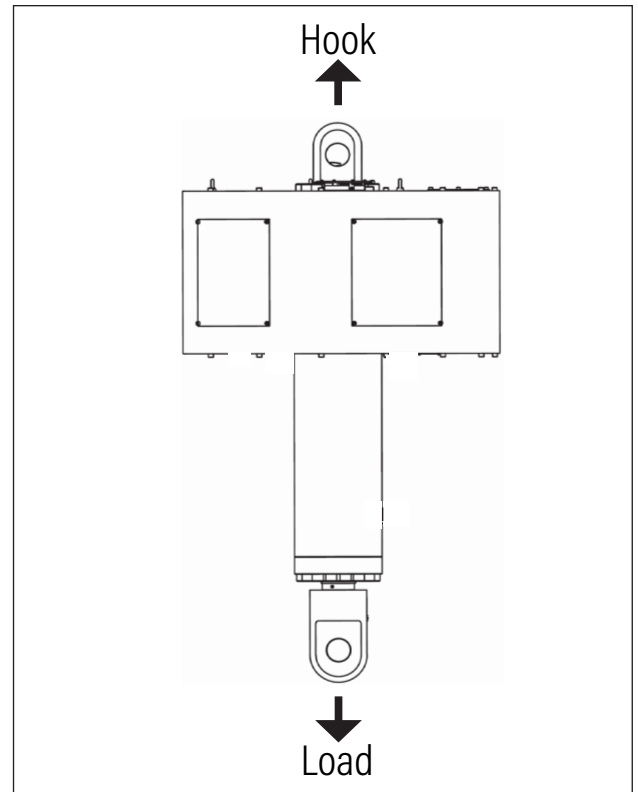


Figure 15: Position of the cylinder

The Synchoist must be attached and secured to the hook using the following pins:

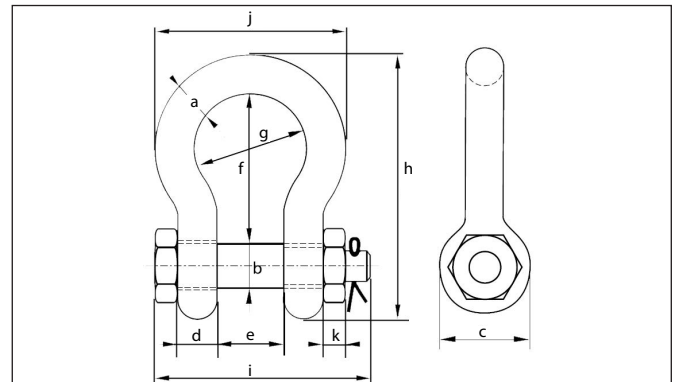


Figure 16: Hook pins

Depending on the tonnage of the load, the dimensions of the hook pin will change.

Measure	Tons mm [in]		
	55	85	120
A	57 [2.24]	70 [2.75]	83 [3.26]
B	57 [2.24]	70 [2.75]	83 [3.26]
C	117 [4.60]	143 [5.62]	162 [6.37]
D	57 [2.24]	70 [2.75]	83 [3.26]
E	83 [3.26]	105 [4.13]	127 [5]
F	197 [7.75]	260 [10.23]	329 [12.95]
G	138 [5.43]	180 [7.08]	190 [7.48]
H	341 [13.42]	437 [17.20]	535 [21.06]
I	286 [11.25]	344 [13.54]	403 [15.83]
J	252 [9.92]	320 [12.59]	356 [14.01]
K	26 [1.02]	32 [1.25]	40 [1.57]

NOTICE

Remind that to connect hydraulic hoses, cylinders must be retracted and in horizontal position. If hoses are connected with cylinders in the vertical position it may be impossible to connect the hose in the small chamber due to the pressure created by plunger weight.

8.2 Manual SHS HPU Operation

WARNING

Be sure the operator has completed safety induction training, specific to the work surroundings. The operator should be thoroughly familiar with the controls and the proper use of the tool.

1. Electrical power must be given to the HPU connecting the main power source to the electrical plug located on right side of the HPU controls.
2. To power on the HPU, the Start Motor Button must be pushed.

CAUTION

Assure that the setup is stable and check all hydraulic connections before making movements with Synchoists.

3. To retract the cylinders plunger and pull the load, pull up the control levers.
4. To extend the cylinders plunger and lower the load, pull down the control levers.

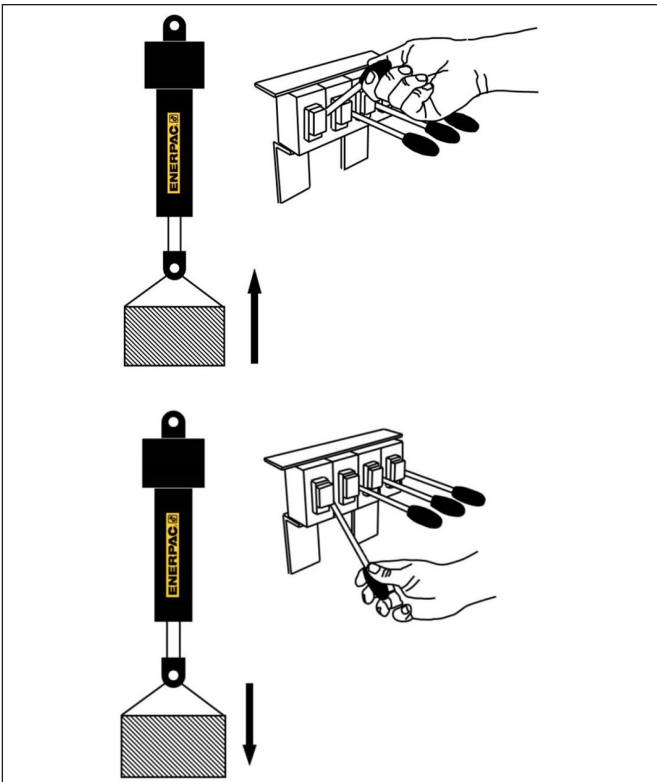


Figure 17: Control Levers

NOTICE

It is possible to move more than one cylinder at the same time.

WARNING

Be certain that no persons are working on or near the SHS before moving of the load begins. Alert all personnel in advance that the procedure is about to occur.

9. Maintenance & Inspection

In order to keep the SHS in a good working condition, good quality maintenance is required. Periodic preventive inspection and maintenance are necessary to keep SHS in good operating condition at all times. The early recognition and elimination of minor irregularities and immediate replacement of worn and damaged parts will help prevent downtime, associated costs and safety issues.

9.1 Modifications

- Perform the prescribed maintenance tasks at the prescribed times and observe the details regarding the replacement of components.
- If modifications to the machine are performed without the manufacturer's permission, the warranty becomes invalid.

WARNING

Any Modifications to the SHS could cause a dangerous situation.

NOTICE

Only use OEM parts. Failure to use OEM replacement parts may void the warranty. Enerpac cannot assume responsibility for damage or injury resulting from use of non-OEM replacement parts.

9.2 Safety During Maintenance

The following instructions are general safety rules for maintenance personnel:

1. The operator must familiarize with the system and its operating procedures.
2. Do not perform maintenance work unless you are authorized to do so. Unauthorized personnel must not work on the SHS.
3. Observe all safety and warning signs on the SHS.
4. Observe all safety instructions contained in this manual.
5. Observe the applicable safety regulations when working with inflammable fluids.
6. Perform maintenance work only after the motor has been switched off. Always ensure that the SHS is protected from unauthorized operation before beginning maintenance work.
7. Be sure the hydraulic system is despressurized, before starting maintenance operations at the hydraulic system.
8. In some cases, maintenance needs to be carried out on motors, and other components during

operation. This task must only be carried out by trained personnel. Specialized personnel must always supervise the work on the system in these cases.

9. Do not spill lubricants / oil, etc. Be aware of the environment and the cost of cleaning up.
10. Ensure that all PPE's and other safety equipment are used when operating conditions demand it.
11. Be aware of fire alarms. Know the location and operation of fire extinguishers.
12. Only use appropriate workshop equipment. Prevent damage to parts using unsuitable equipment.
13. No modifications, additions or conversion work that could affect the safety of the equipment must be carried out. This applies also to the fitting and adjustment of safety devices, covers, valves and welding supporting parts.
14. Spare parts must conform the specified technical requirements of the manufacturer.
15. Return the system to proper working conditions once maintenance work is completed. Inform the operator accordingly.

9.3 Responsibilities

Maintenance work and inspections must only be performed by trained and qualified personnel. In most cases, maintenance can be performed by the operator.

For the following maintenance work, however, the manufacturer must be contacted:

- Hydraulic equipment pressure settings adjustment.
- Hydraulic pumps adjustment and repair.
- Control valves of all main functions adjustment and repair.
- Electrical system adjustment and control system repairs.
- Welding, cutting, grinding or any other structural adjustment work.
- Main parts replacement.
- Additional maintenance work not written in this manual.



It is the customer responsibility to maintain the system regularly for durability and to keep it in good working conditions.

9.4 General Maintenance Procedure

Before, during and after maintenance, the following procedures are applicable:

1. Procedures prior to maintenance work.
 - Let powerpacks cool down. When working on the electrical system or welding on the work site, shut down the powerpack and remove all electric connectors.
 - Maintain the work area and equipment clean. Use the appropriate cleaning materials for the items to be cleaned.
2. Procedures during maintenance.

- Perform inspection / maintenance work according to the table and fill in the maintenance form.
 - Use all required PPE's.
 - Use technical competence and tools suitable for the job.
3. Procedures after maintenance.
 - Return system to proper working condition.
 - Check all components for leaks.
 - Fit safety devices and carry out operational checks on the system.

9.5 Hoses maintenance

In order to maintain hoses in a good condition, follow the next steps:

1. Keep below the maximum permitted pressure. Ensure that peak pressures do not exceed the maximum allowed pressure.
2. Do not drop heavy objects or stand on pressurized hoses.
3. Do not pull on connected hoses. If pulling forces are exerted on a hose, hydraulic couplings could weaken, which may result in bursting of the hose out of the coupler.
4. Do not bend hoses too tightly. Do not exceed the bending radius permitted by the manufacturer.
5. Change worn or damaged hoses immediately. Do not use dirty or corroded couplers.
6. Do not expose hoses to temperatures higher than 150°F [65°C].

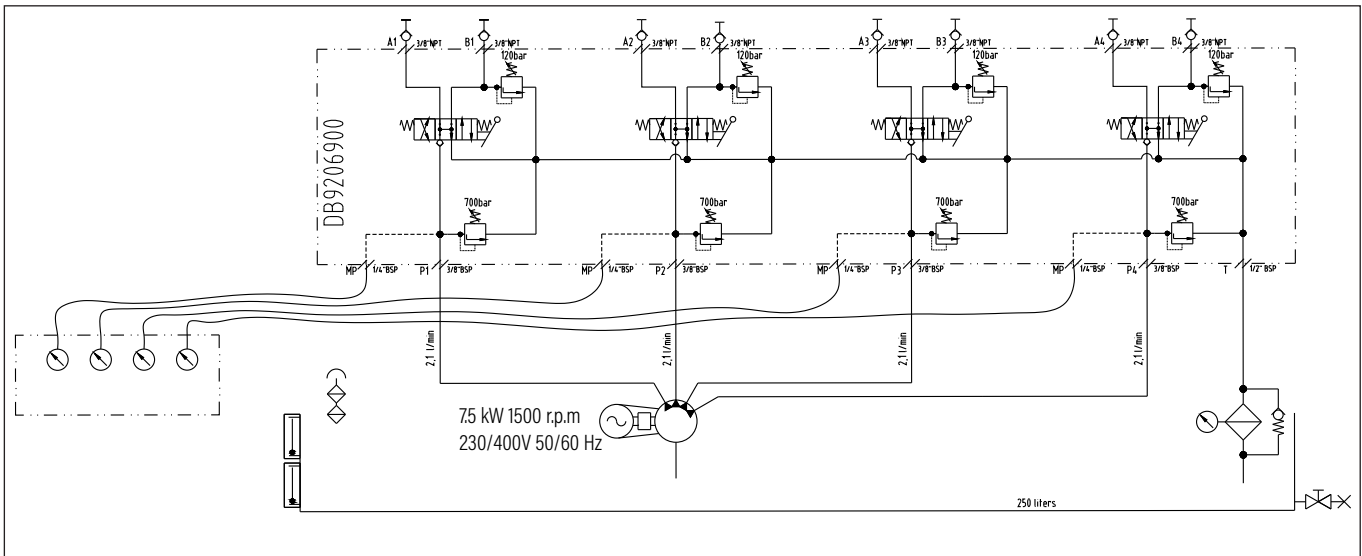
7. Electric Scheme Table

The electric scheme references of these pump models are found on the following table.

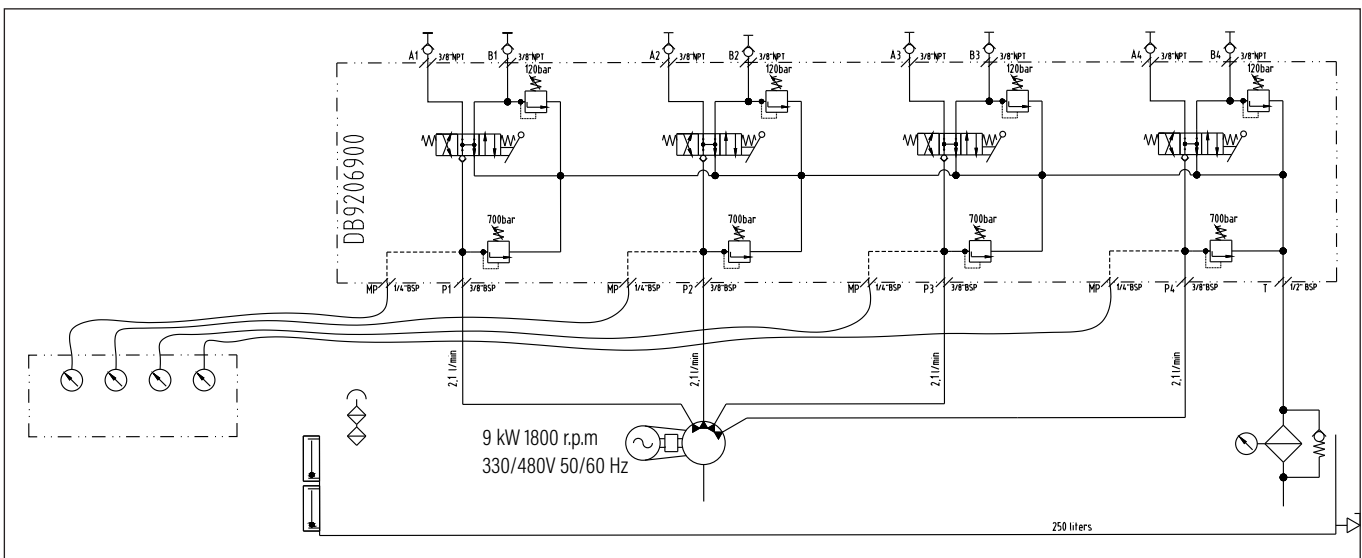
SHS Model	Electric Scheme Reference
SHP414MW	SHSEC414MW
SHP414MJ	SHSEC414MJ
SHP421MW	SHSEC421MW
SHP421MJ	SHSEC421MJ

10. Hydraulic Schemes

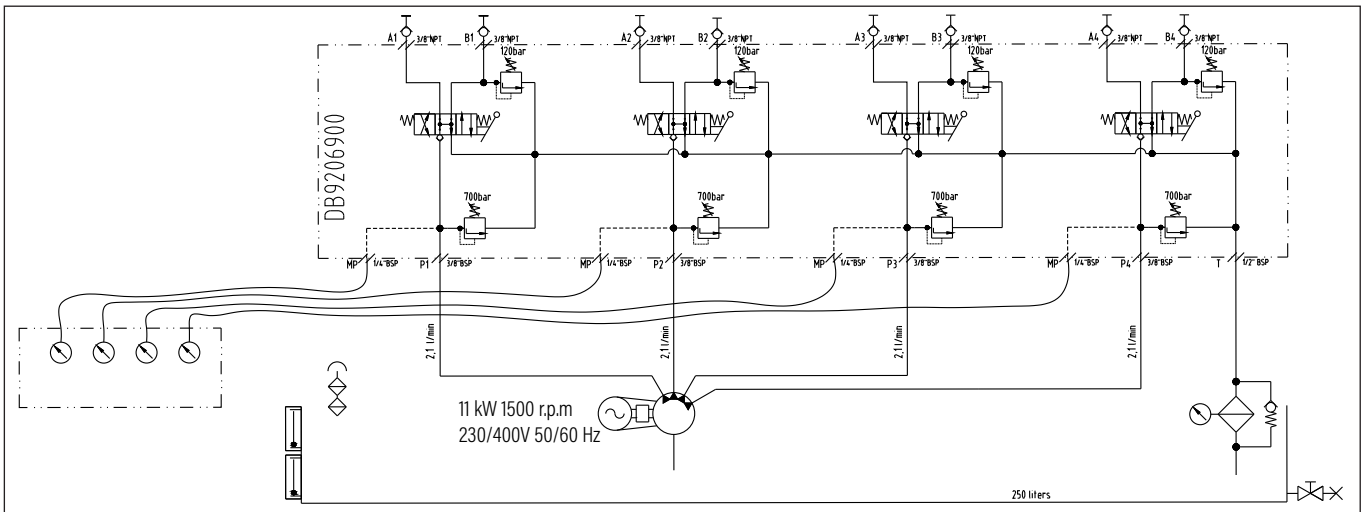
10.1 SHP414MW



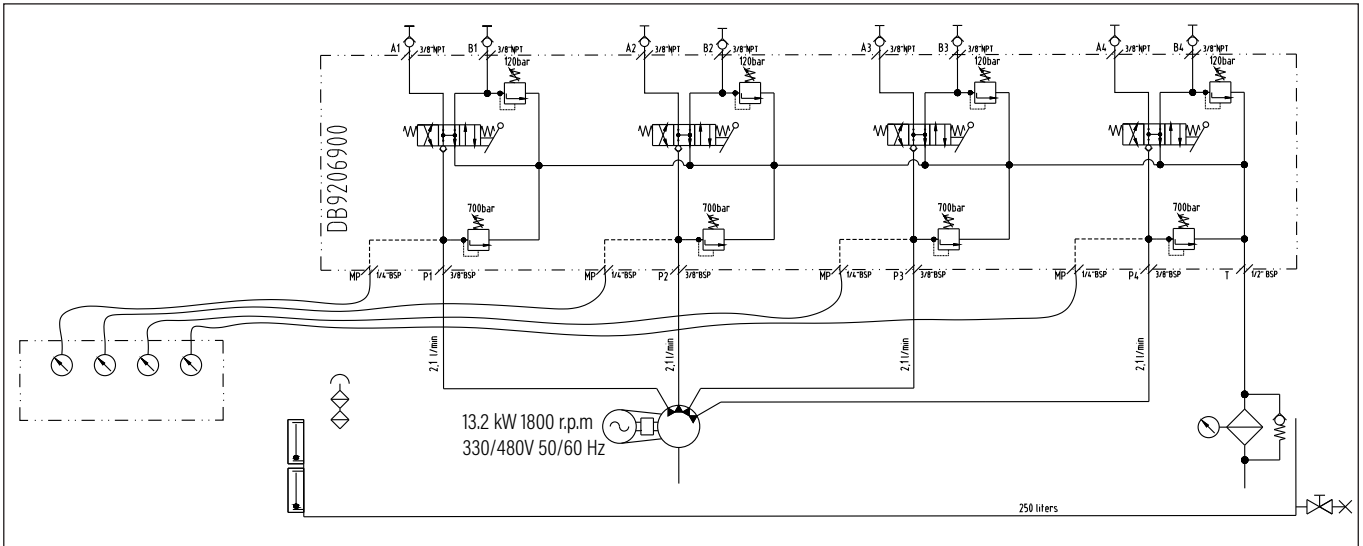
10.2 SHP414MJ



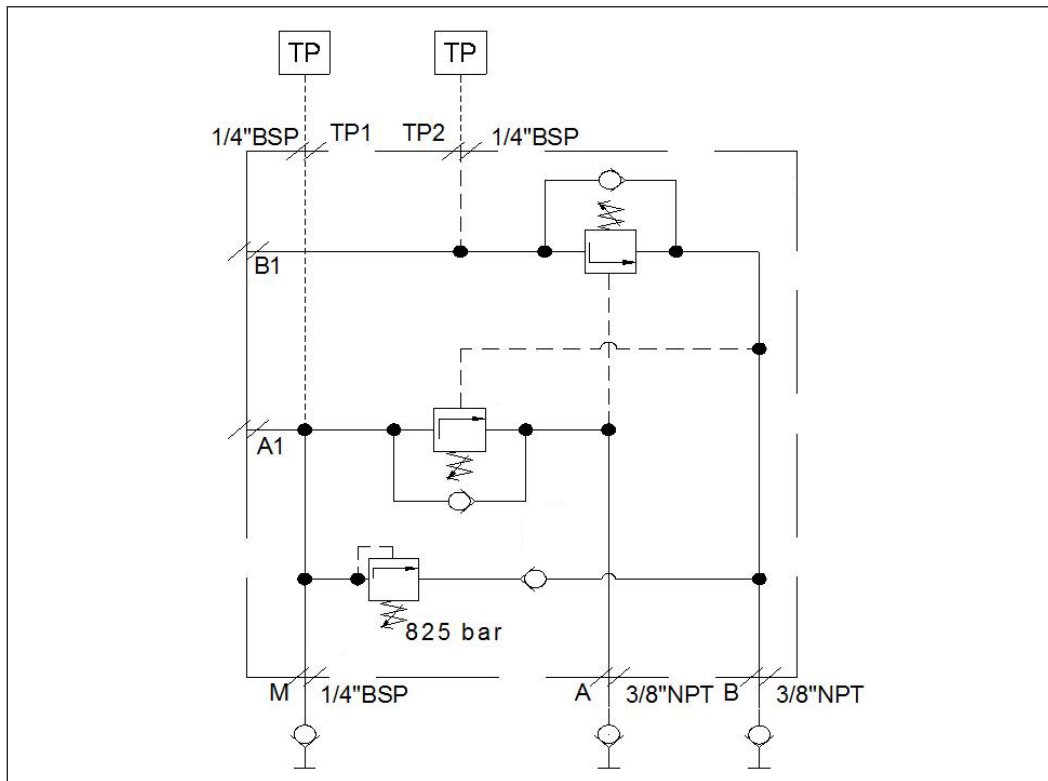
10.3 SHP421MW



10.4 SHP421MJ



10.5 SHC Distribution Block with Pressure Transducers



11. Parts List

11.1 Manual SHS HPU Frame Assembly

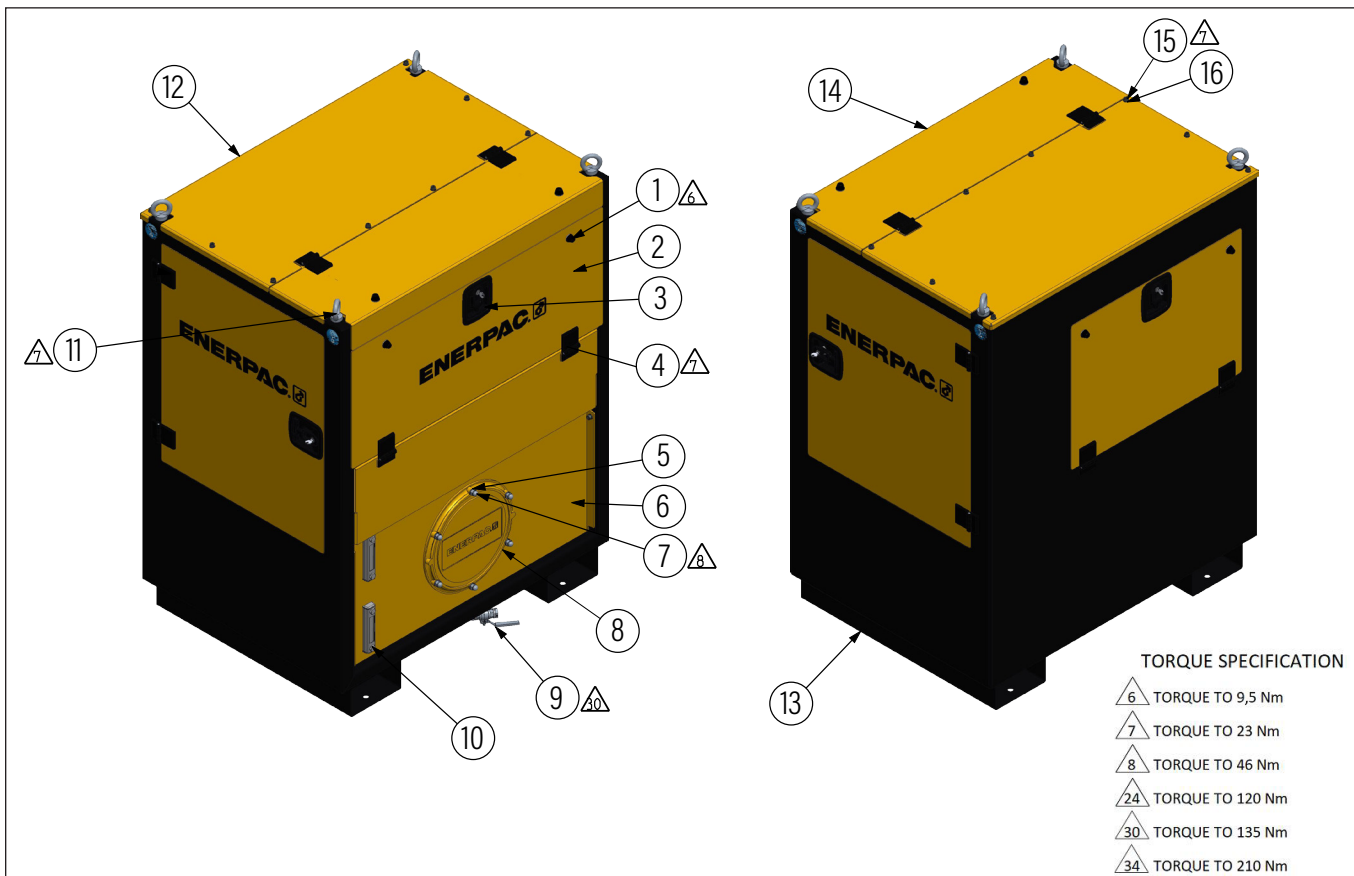


Figure 18: Manual SHS Frame detailed view

11.1.1 Manual SHS HPU Frame Table of Parts

Item N.º	Description	Qty.	Part Number
1	Pin with Rubber	6	DB0132202
2	SHP Frame Frontal Door	1	DB0125201-13
3	Folding Lock RVS	4	DB131202
4	Hinge Bolt M8	10	DB130202
5	Flat Washer 10.50 x 20 x 2	6	CAE1100108-1A
6	SHP Reservoir	1	DDB0127025
7	Acorn Nut M10	6	CAE1100055-1A
8	Reservoir Register Plate	1	DB9091900
9	Ball Valve Assembly	1	DB9359900-12
10	Visual Level FSA	2	DB4405022
11	Lifting Eyes M8	4	CBB1080120-1D
12	Manual SHS Top Cover Plate	1	DB0125201-9
13	SHS Frame	1	DB0125201
14	Manual SHS Top Cover Door	1	DB0125201-10-99
15	SHCS Screw M8 x 12	8	CBA817028-1A
16	Flat Washer 8.40 x 16 x 1.60	64	CAE1080108-1A

11.2 Manual SHS HPU

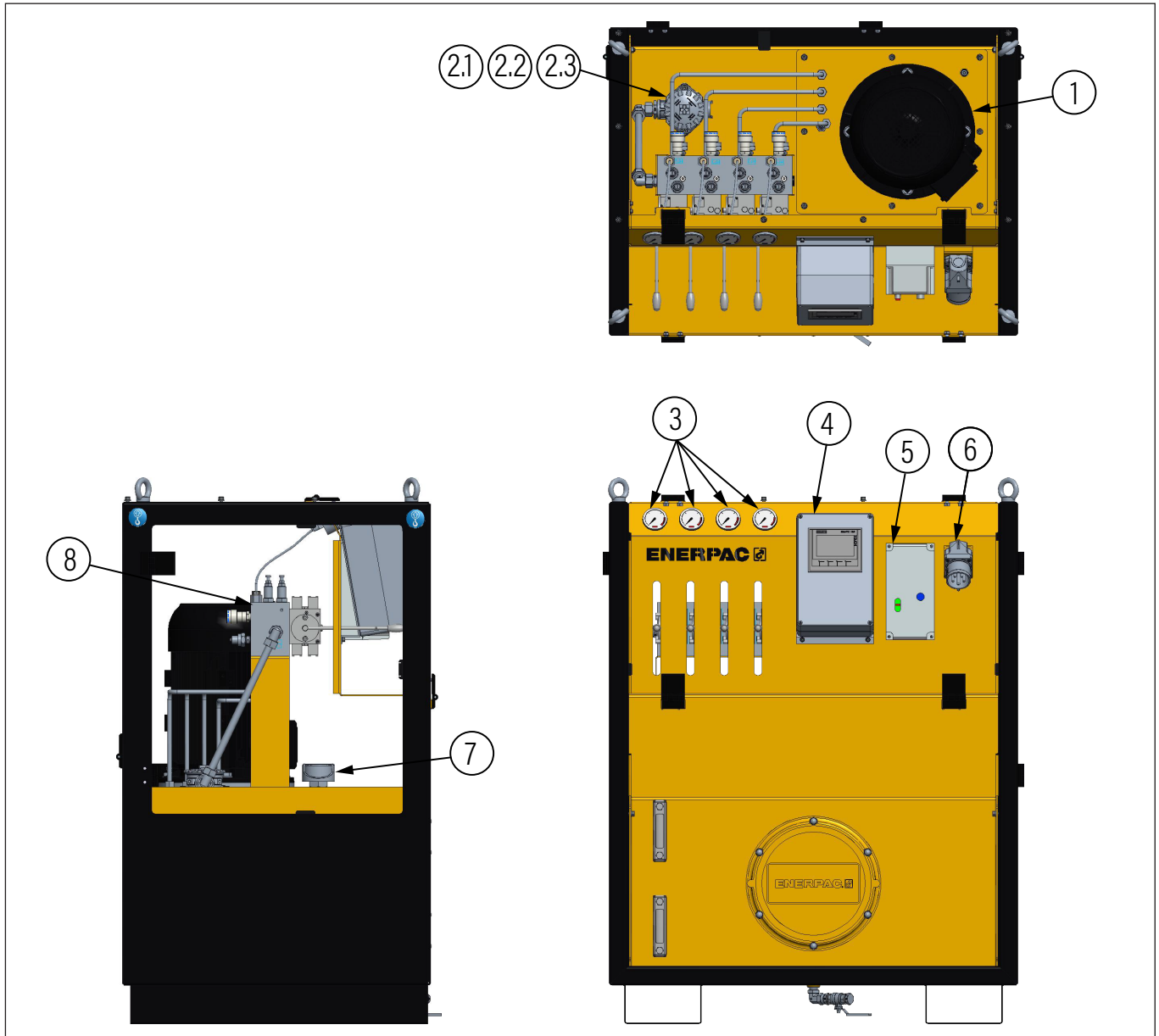


Figure 19: Manual SHS HPU detailed interior view

11.2.1 Manual SHS HPU Table of Parts

Item N.º	Description	Qty.	Part Number			
			SHP414MW	SHP414MJ	SHP421MW	SHP421MJ
1	Electric Motor	1	DB4348259	DB4431259	DB4621259	DB4432259
2.1	Return Filter Housing	1	DB4603118			
2.2	Return Filter Element	1	DB4604175			
2.3	Clogging Filter Indicator	1	DB4605118			
3	Gauge 700 bar	4	G2538R			
4	Pressure Reading Device	1	---	SHS-PRD	---	SHS-PRD
5	Motor Starter	1	DB06914380			
6	Electric Plug	1	DB06447606			
7	Breather Filter	1	DB4368118			
8	Manual SHS Manifold Assembly	1	DB9206900			

11.3 Manual HPU Manifold Assembly

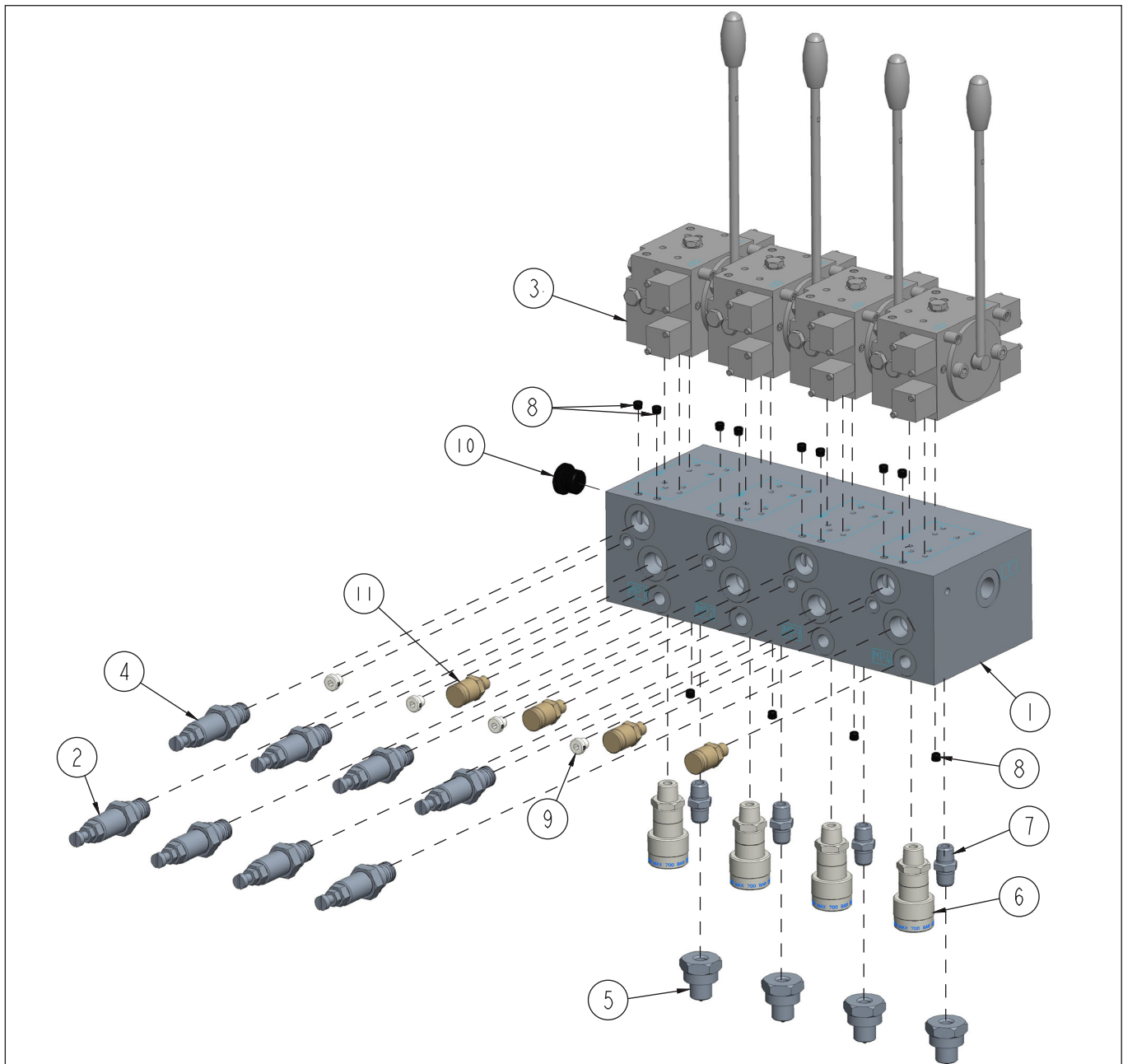


Figure 20: Manual SHS manifold assembly exploded view

11.3.1 Manual HPU Manifold Assembly Table of Parts

Item N.º	Description	Qty.	Part Number
1	Manifold	1	DB5086840A
2	Relief Valve	4	DB1062663
3	Hand Directional Valve 4/3 700 bar	4	DB1154661
4	Relief Valve	4	DB1062663-1
5	Male Coupler	4	CH604
6	Female Coupler	4	CR400
7	Fitting	4	FZ1617
8	1/16" NPT Plug	12	A1006245
9	1/8" BSP Plug	4	DB2142006
10	1/2" BSP Plug	1	DB2141006
11	Test Point Minimes, 1/4" BSP 680 bar	4	DB2421034

11.4 Synchoist Cylinder

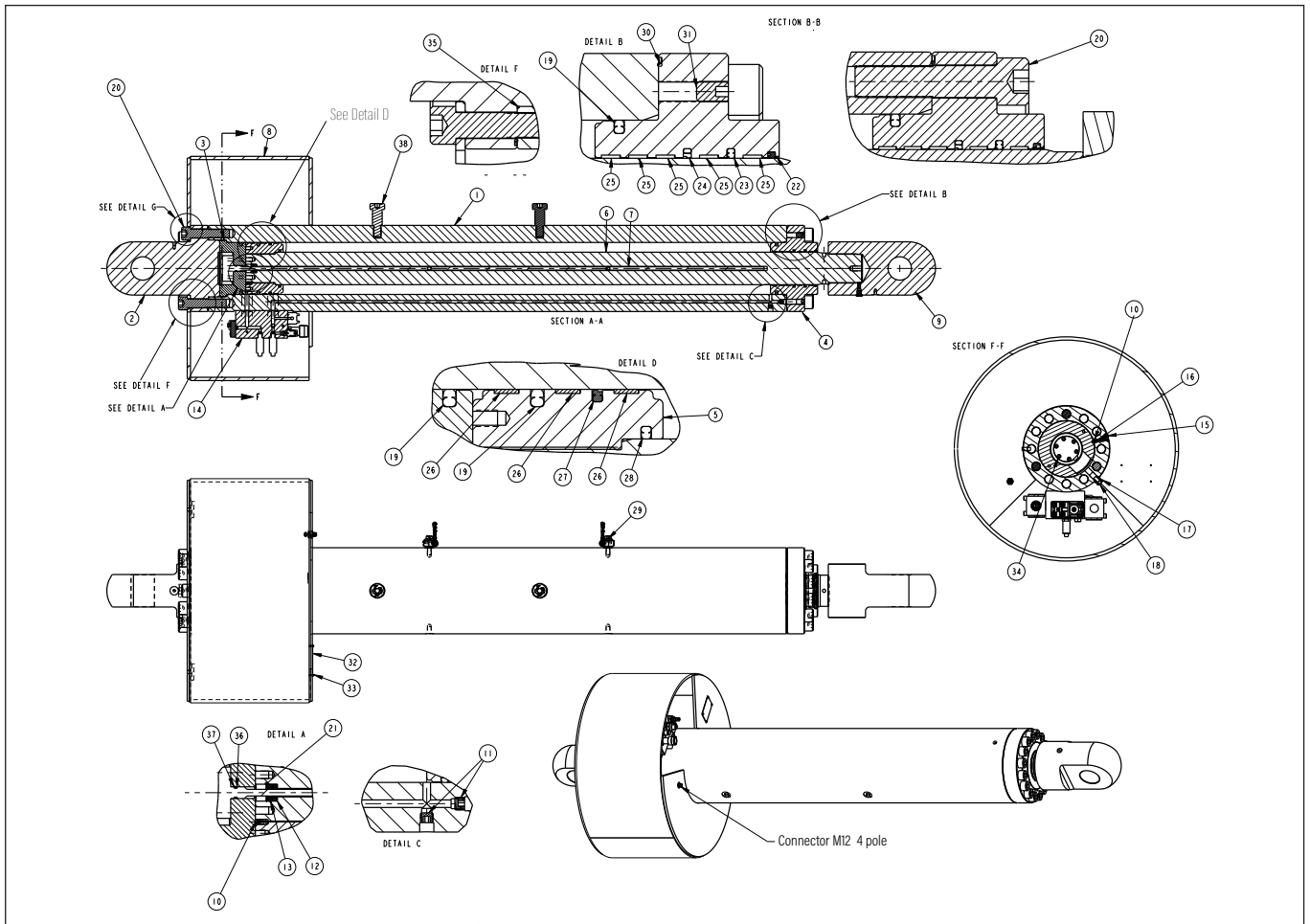


Figure 21: SHC cylinder detailed view

11.4.1 Synchoist Cylinder Table of Parts

Item N.º	Description	Qty.	Part Number
1	Cylinder base	1	Not Available as Service Part
2	Bottom Plate	1	Not Available as Service Part
3	Sensor Plug	1	Not Available as Service Part
4	Stop Ring	1	Not Available as Service Part
5	Piston	1	Not Available as Service Part
6	Rod	1	Not Available as Service Part
7	Stroke Sensor ■	1	Not Available as Service Part
8	Protector Assembly	1	Not Available as Service Part
9	Clevis Eye	1	Not Available as Service Part
10	Screw Din 913 M8 x 20	3	CCA821028-5A
11	Flush Plug 1/4	2	A1008245
12	Separator ■	1	DB80006101
13	Magnet ■	1	DB8009384
14	Synchoist Cylinder Safety Block w/sensor ■▲	1	DB9346900
	Synchoist Cylinder Safety Block no sensor ●	1	DB9353900
15	Plug	2	CS235006
16	Screw 913 M8 x 12	1	CCA817028-5A
17	Cable Gland VK	1	B122013386-20-1
18	Insert Gland ■	1	B122013386-20-2
	Sealing Plug ●▲	1	B122013386-20-4

19	Glyd Ring T	3	Not Available as Service Part
20	Bolt Din 912 M27 x 3	24	CBA2751028-1A-GE
21	Ring Ret Din 472 ■	1	CCA1026044-1C
22	Scraper	1	Not Available as Service Part
23	Rimseal	1	Not Available as Service Part
24	Stepseal	1	Not Available as Service Part
25	Wear Ring	5	Not Available as Service Part
26	Slydring	3	Not Available as Service Part
27	Stepseal	1	Not Available as Service Part
28	Glyd Ring T	1	Not Available as Service Part
29	Lifting Eyes M12	2	Not Available as Service Part
30	O-Ring	2	Not Available as Service Part
31	Screw Din 913	2	Not Available as Service Part
32	Identification Plate	1	B140090026-20
33	Allen Bolt Din 912 M3x9	4	CBA311028-1A
34	Allen Bolt M6 x 16	6	DB016028-1A
35	O-Ring	1	Not Available as Service Part
36	O-Ring ■	1	Not Available as Service Part
37	Back-Up Ring ■	1	Not Available as Service Part
38	Screw SHC M20 x 50	2	DB9482242

Notes:

- : Parts pointed with this mark are only available on -S model synchoist cylinders.
- ▲ : Parts pointed with this mark are only available on -P model synchoist cylinders.
- : Parts pointed with this mark are only available normal synchoist cylinders.

All other parts are available in all cylinders.

11.5 Synchoist Cylinder Distribution Block

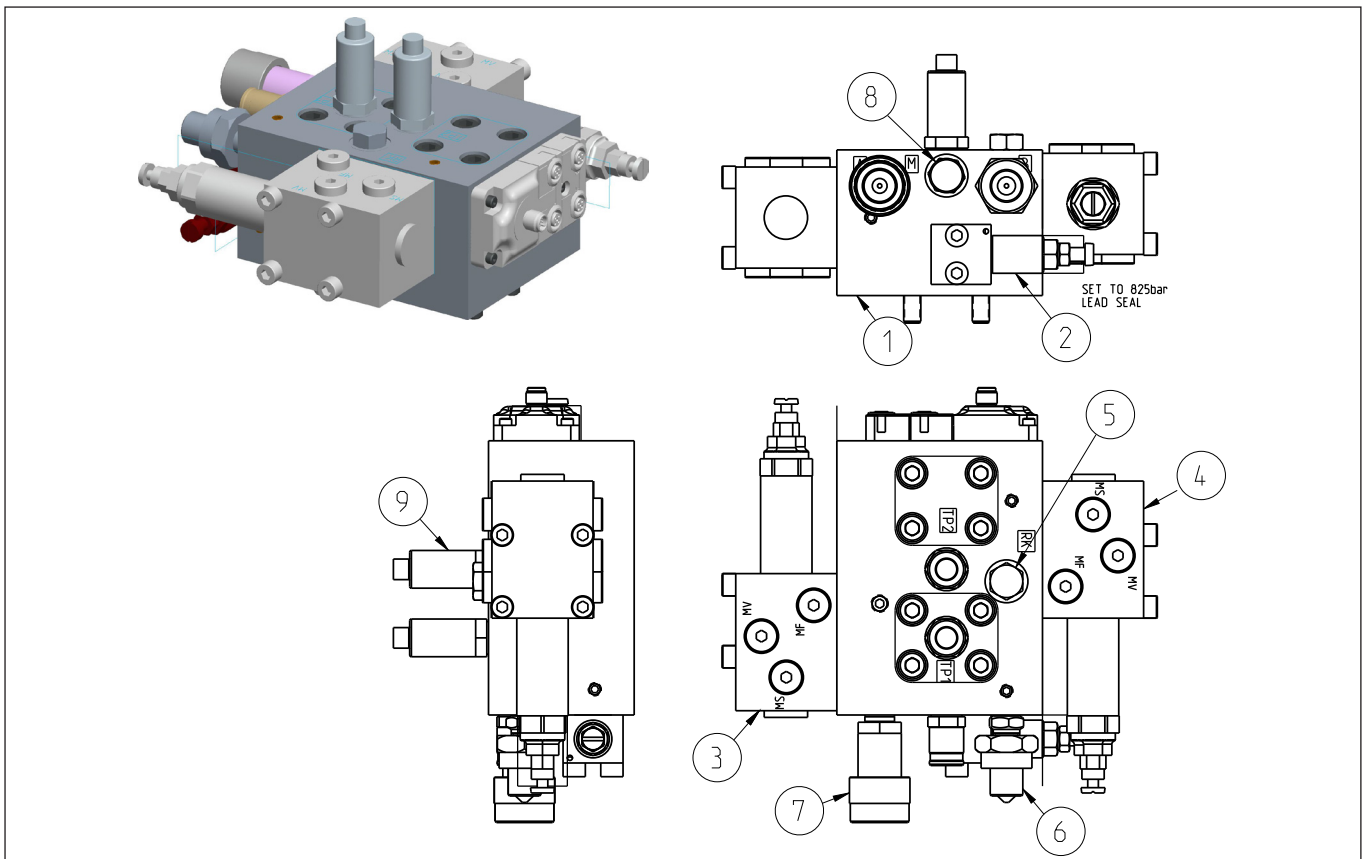


Figure 22: Synchoist cylinder distribution block parts

11.5.1 Synchoist Cylinder Distribution Block Table of Parts

Item N.º	Description	Qty.	Part Number
1	Manifold	1	DB5122840
2	Relief Valve	1	DB1187663
3	Over Center Valve	1	DB1199663-1
4	Over Center Valve	1	DB1199663-4
5	Check Valve	1	RK1
6	Male Coupler	1	CH604
7	Female Coupler	1	CR400
8	Test Point	1	DB2421034
9	Pressure Transducer	2	KSEEZB08CMV

12. Alarms List

Only qualified hydraulic technicians should service pump or system components. System failure may or may not be the result of a pump malfunction. To determine the cause of the problem, the complete system must be included in any diagnostic procedure.

Refer to the alarm chart for a list of alarms and possible causes. The alarm chart is not all-inclusive, and should be only considered as an aid to help diagnose the most common problems. For repair service, contact Authorized Enerpac Service Center.

ALARMS CHART		
ALARM	POSSIBLE CAUSE	SOLUTION
Cylinder (#) Pressure Signal Failure.	<ul style="list-style-type: none"> The pressure transducer signal of indicated (#) cylinder is not reaching the PLC. 	<ul style="list-style-type: none"> Visually check the pressure transducer and the cable. Reset alarm.
Maximum Total Load.	<ul style="list-style-type: none"> The total sum of cylinder loads has exceeded the value entered in the "Maximum Total Load" parameter. 	<ul style="list-style-type: none"> Check the parameter, considering the load weight and the cylinder characteristics. If it is incorrect, change it. Check the cylinder model in spans screen. If "Maximum Total Load" parameter is correct, the load weight is bigger than the theoretical value expected in the application. Reset alarm. The alarm only can be reset by entering a parameter bigger than the Maximum Total Load.

