



Operation and Maintenance Manual

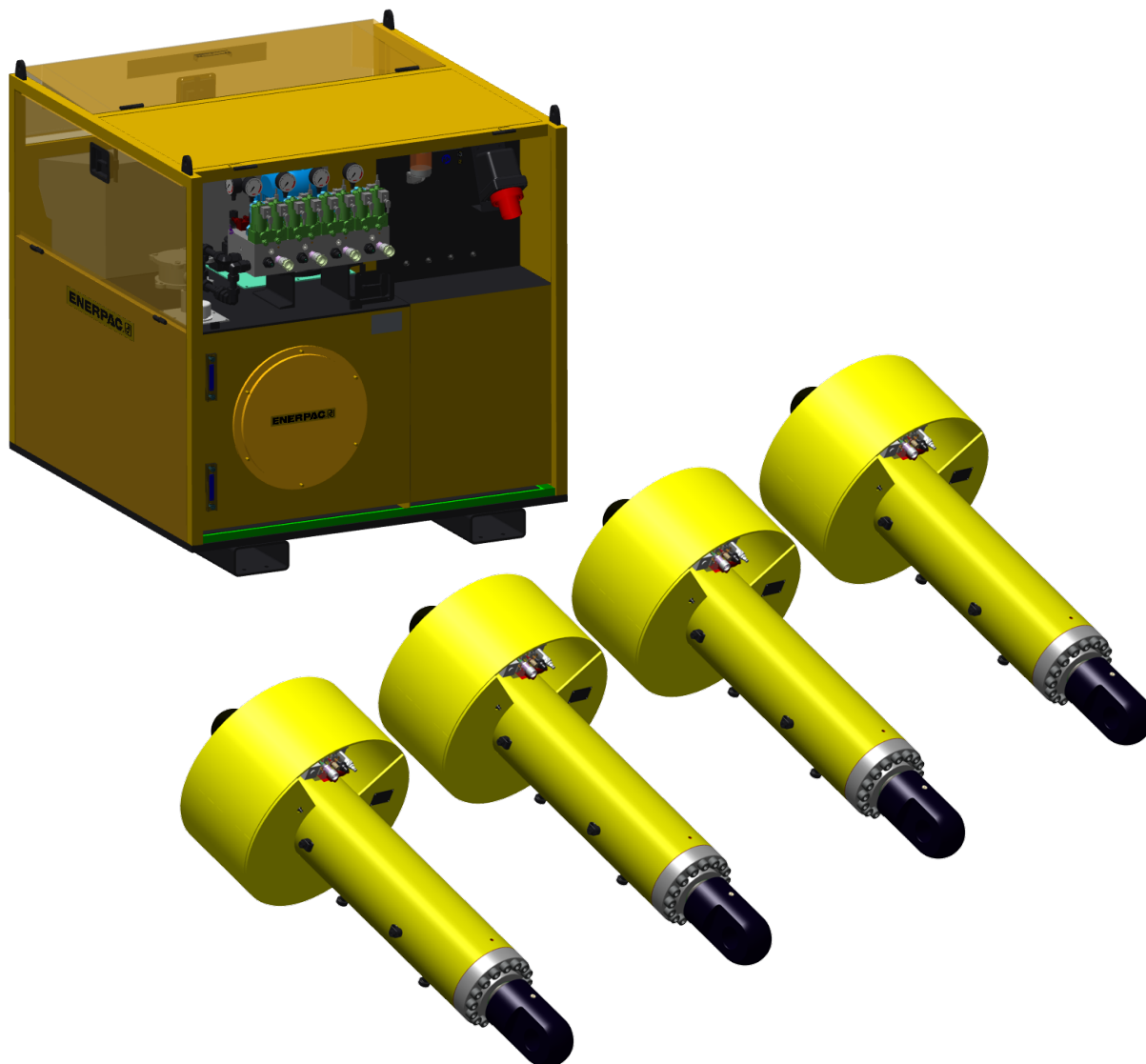
Enerpac SHS Automatic Synchoist System

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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

ENERPAC  	
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

ENERPAC  	
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 DESIGN CATEGORY:	ASME BTH-1 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

⚠ WARNING

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 (10,150 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 weighing more than the capacity 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.
- 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 cause serious injury could result.

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 break.
- 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. Protect all hydraulic equipment from weld spatter.
- 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 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 the relevant parts are no longer receiving power. If possible, make a connection to earth. 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.
- Always follow the inspection and maintenance instructions contained in this manual. Perform maintenance and inspection activities at the specified time intervals.

2. Compliance Statement

2.1 Conformance to National and International Standards

•SHS45520AW •SHS45540AW •SHS45560AW
•SHS48520AW •SHS48540AW •SHS48560AW
•SHS411020AW •SHS411040AW •SHS411060AW
•SHS45520AJ •SHS45540AJ •SHS45560AJ
•SHS48520AJ •SHS48540AJ •SHS48560AJ
•SHS411020AJ •SHS411040AJ •SHS411060AJ



These tools conform with the requirements for CE and UKCA.

Enerpac declares that these 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 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.

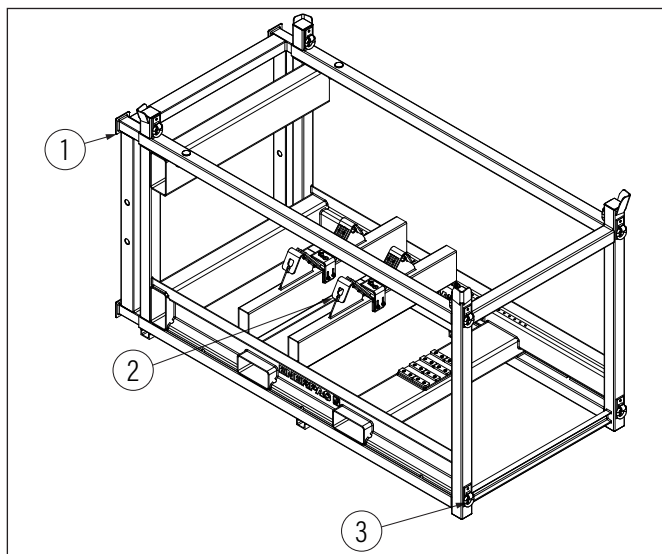


Figure 1: SHS transport frame parts

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.

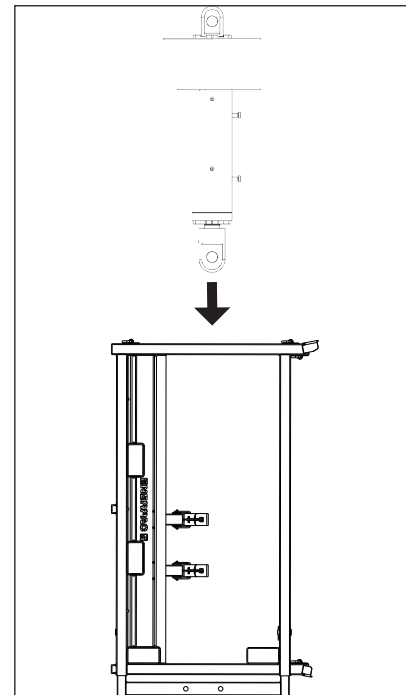


Figure 2: SHS Frame Insertion

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

1. Screw the connection bolts to the bottom eyebolt holes of the synchoist.
2. Insert the connection bolt into the synchoist support through the hole.
3. Move the synchoist forward until the connection bolt fits into the narrowing of the support to prevent it from moving during transport.
4. To fix the cylinder to the structure for safer transport, install fastening straps through the holes of the cylinder support.
5. Repeat the same procedure with the other synchoist support.
6. Once the synchoist is completely attached, place the structure horizontally for transport.

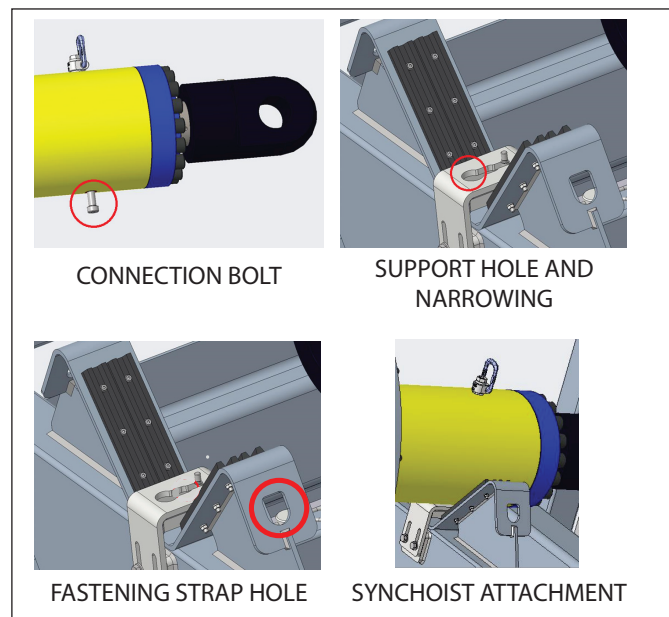


Figure 3: SHS Attachment

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. Loosen the fastening straps that fix the cylinder to the structure
4. Lower and displace the synchoist to release the connection bolts from the synchoist support.
5. Lift the synchoist and remove it from the transport frame to start working operation.

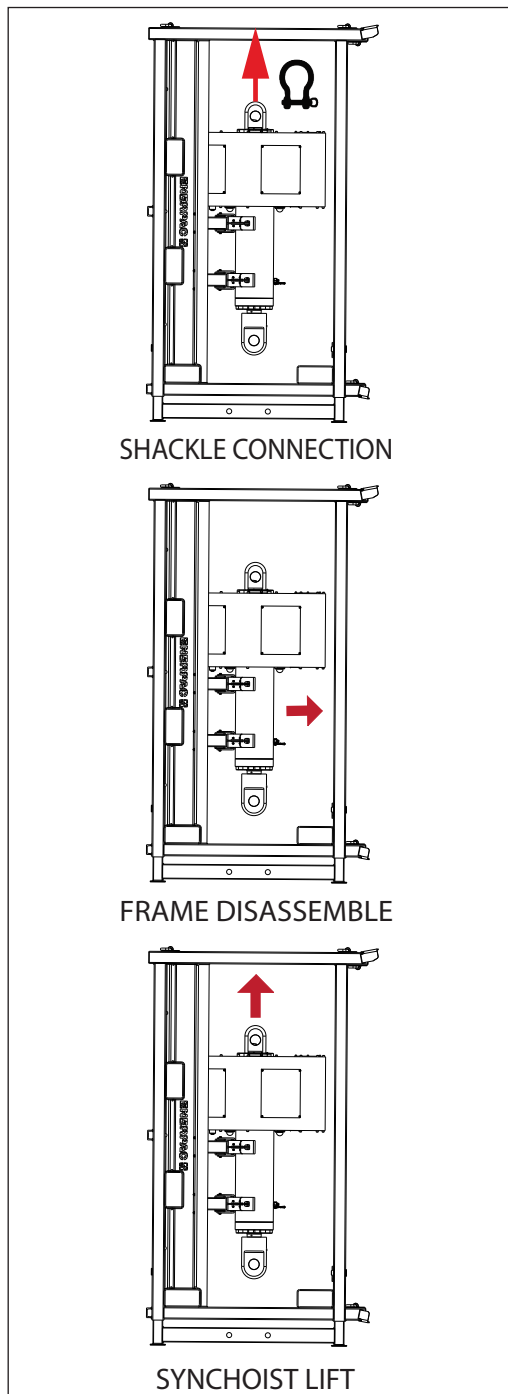


Figure 4: Synchoist Disassembly

4. Features & Components

4.1 Automatic SHS HPU

- | | | |
|---------------------|----------------------|--------------------|
| 1. HPU Frame | 6. Main Motor | 11. Pressure Gauge |
| 2. Control Manifold | 7. Auxiliary Motor | |
| 3. Return Filter | 8. Sensor Connectors | |
| 4. Visual Level | 9. Power Plug | |
| 5. Electric Cabinet | 10. Siren Beacon | |

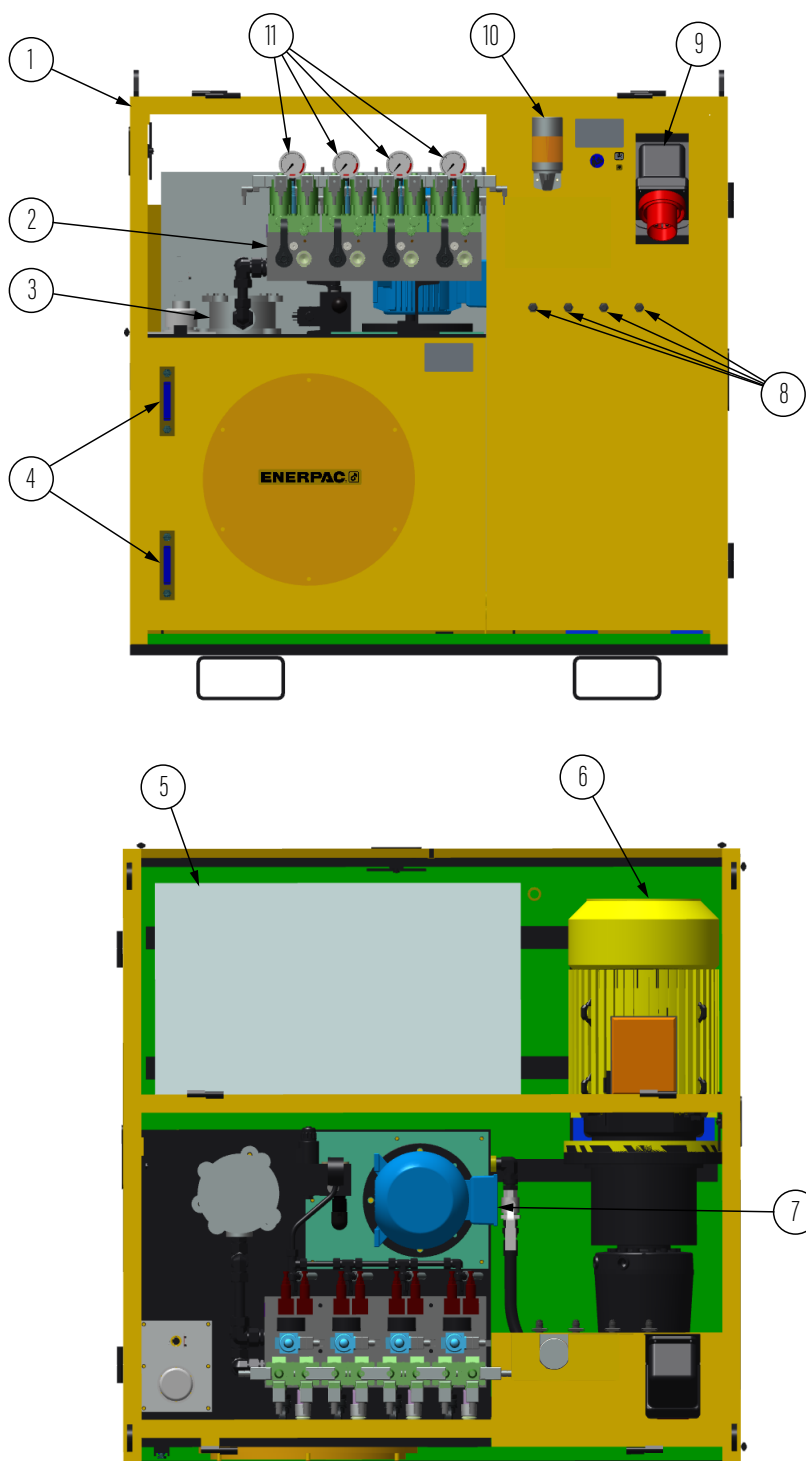


Figure 5: Features and components of Automatic SHS HPU

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 | |

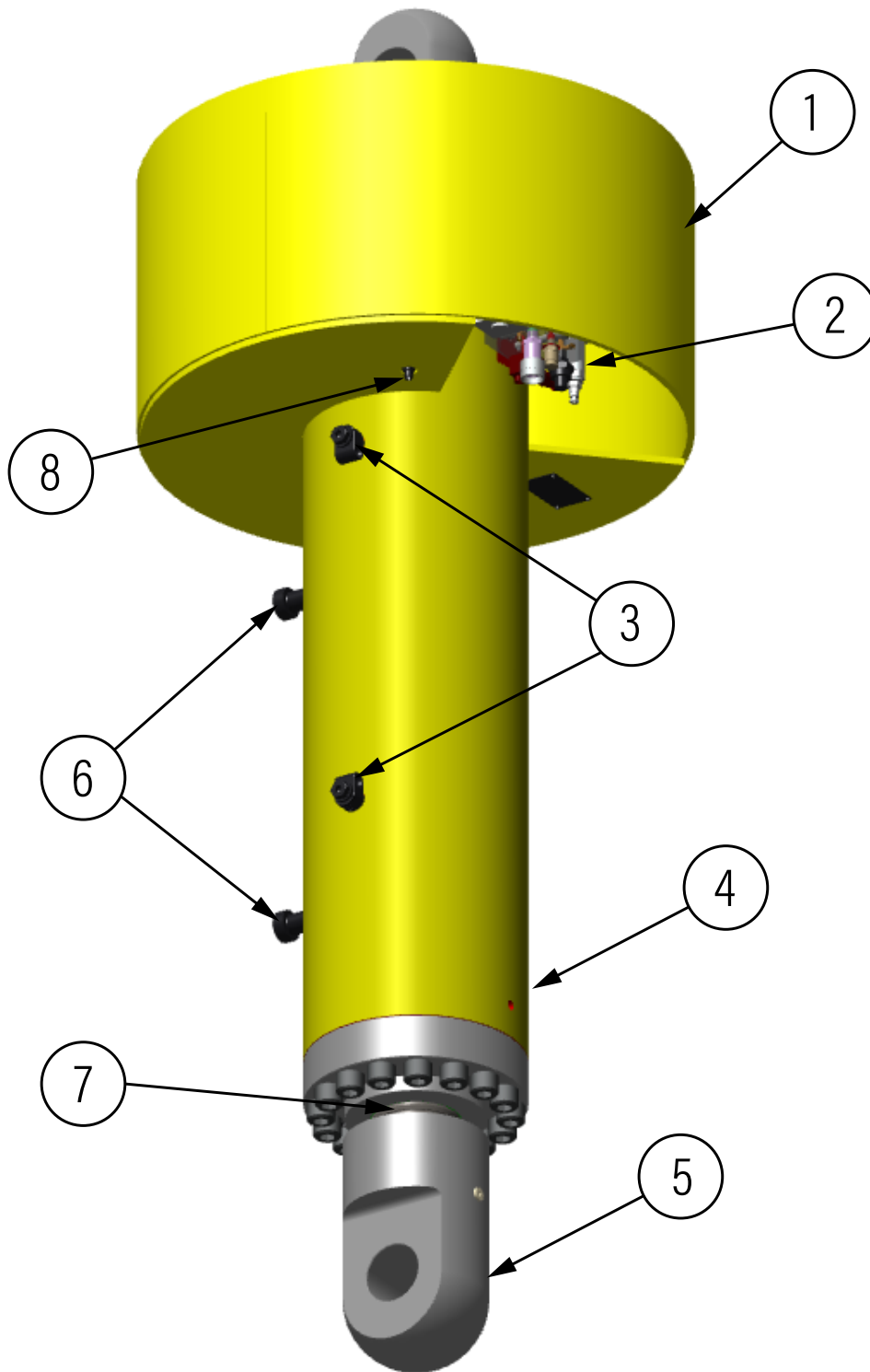


Figure 6: Features and components of SHS Cylinders

5. Product Technical Data

5.1 Automatic SHS Pumps Dimensional Callout Art

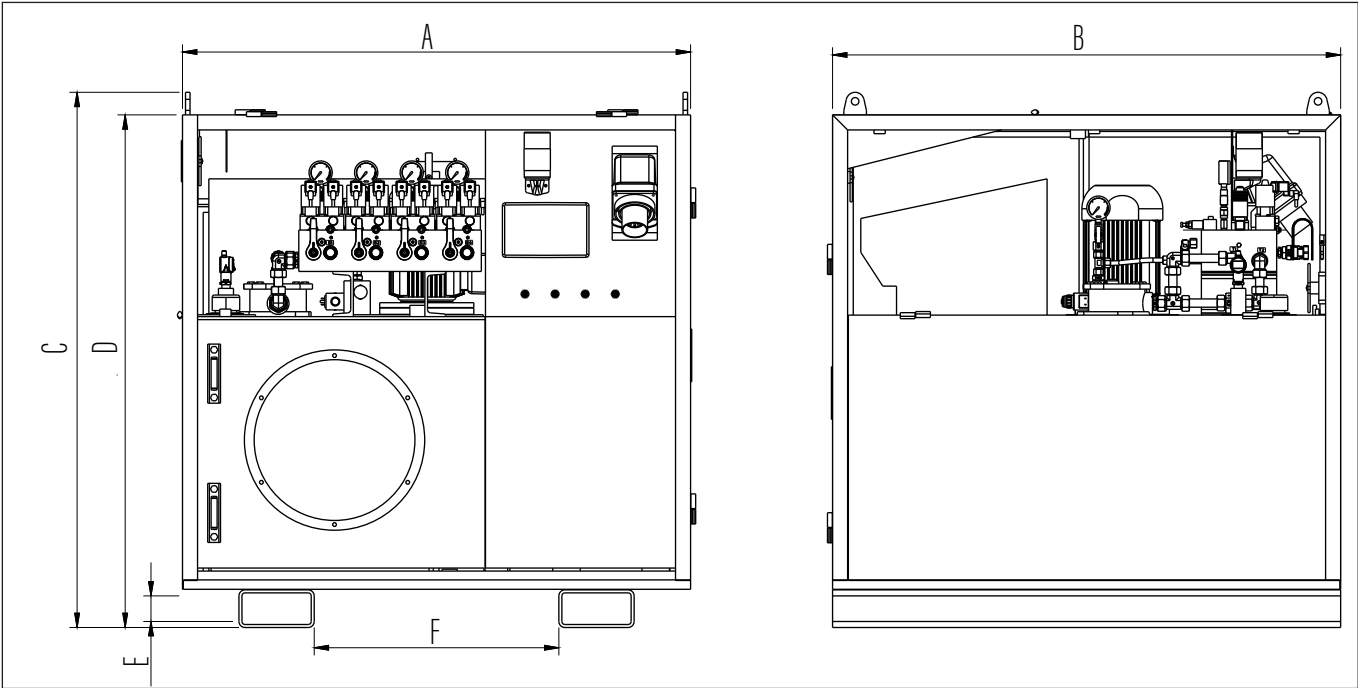


Figure 7: Automatic SHS pump dimensions

5.2 Automatic SHS Pumps Dimensional Table

Measurement	SHP421AW/AJ	
	mm	in
A	1350	53.14
B	1350	53.14
C	1422	55.98
D	1362	53.62
E	68	2.67
F	650	25.59

5.3 Automatic SHS Pump Capabilities

Features	SHP421AW	SHP421AJ
Flow	2.1 L/min	
Motor Power	15 kW	13 kW
Power Supply	3 ph/400 V/50-60 Hz	3 ph/480 V/60 Hz
Max. Pressure	700 bar	
Reservoir	250 L	
Oil Grade	ISO VG 32	

5.4 SHS Cylinders Dimensional Callout Art

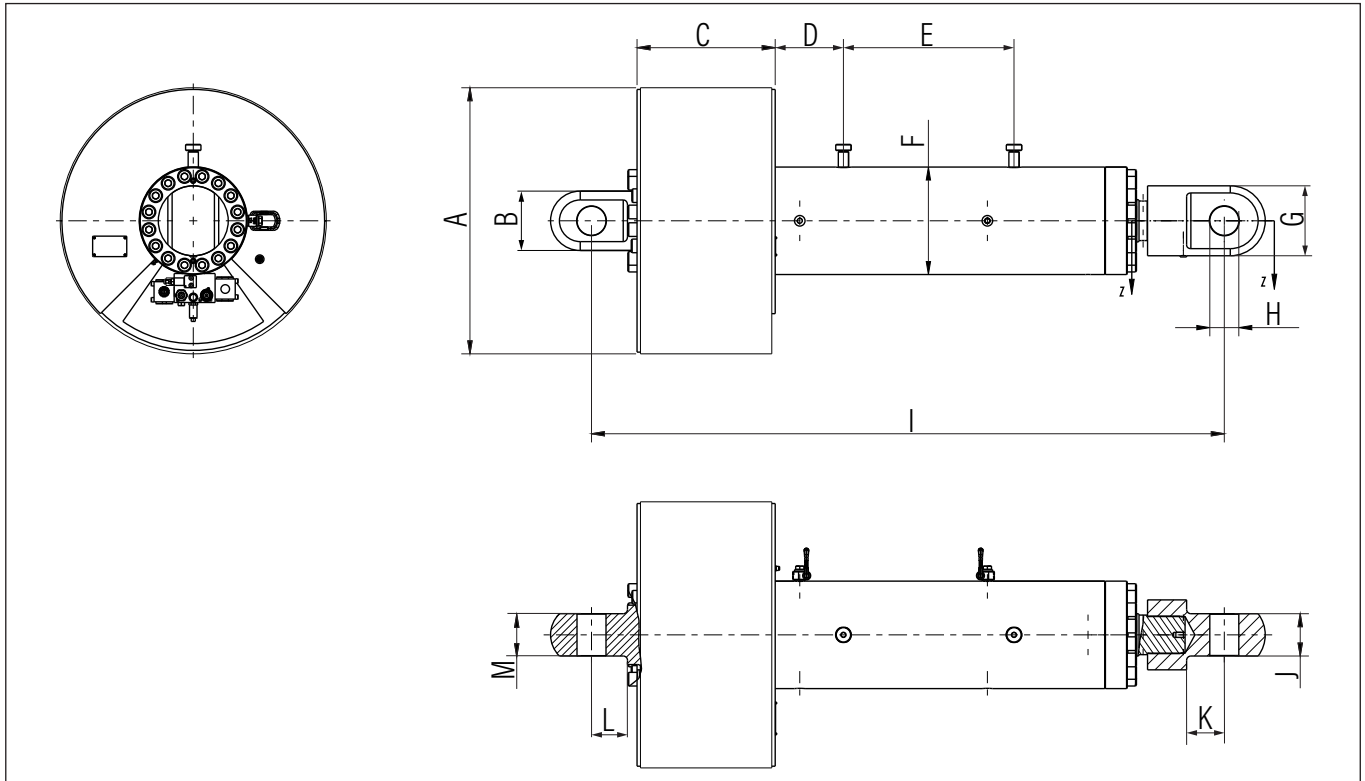


Figure 8: SHS cylinder dimensions

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 positioning of heavy loads that require precision placement.

Automatic 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.

Automatic HPU controls the cylinder movements from a control panel with buttons to start, pause or stop work cycles. This work cycles are previously set with an integrated touch screen (HMI) which has different screens to configure parameters and movement values.

The system is designed for 10,150 psi [700 bar] maximum working pressure.

5.8 Product Table

There can be several system configurations 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.

HPU Model	SHS Model	SHC Model
SHP421AW/AJ	SHS45520AW/AJ	SHC5520
		SHC5520P
		SHC5520S
	SHS45540AW/AJ	SHC5540
		SHC5540P
		SHC5540S
	SHS45560AW/AJ	SHC5560
		SHC5560P
		SHC5560S
	SHS48520AW/AJ	SHC8520
		SHC8520P
		SHC8520S
	SHS48540AW/AJ	SHC8540
		SHC8540P
		SHC8540S
	SHS48560AW/AJ	SHC8560
		SHC8560P
		SHC8560S
	SHS411020AW/AJ	SHC11020
		SHC11020P
		SHC11020S
	SHS411040AW/AJ	SHC11040
		SHC11040P
		SHC11040S
	SHS411060AW/AJ	SHC11060
		SHC11060P
		SHC11060S

6. Installation

6.1 Handling

The HPU can be lifted with a crane, holding it by the lifting points on top of the frame.

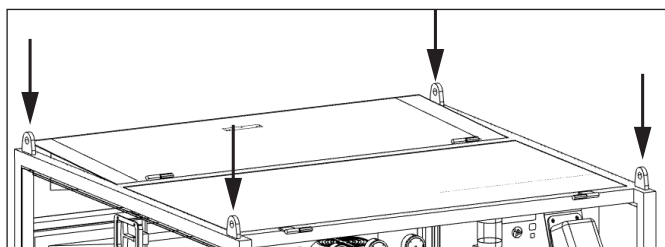


Figure 9: Lifting points

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

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 female coupler is connected to the retract male coupler of the HPU.
- B Port male coupler is connected to the advance female coupler of the HPU.

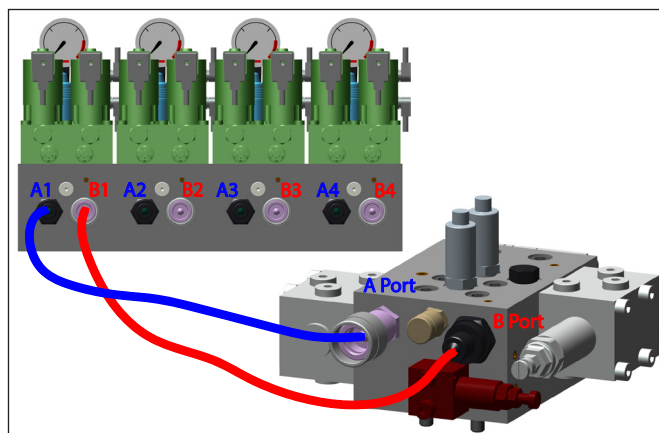


Figure 10: Distribution manifold ports

Perform the following steps to correctly connect the hoses:

1. Remove dust covers/rubber plugs from oil ports.
2. Inspect all threads and fittings in search of wear or damage signs and replace as needed.
3. Clean all threads and fittings.
4. Make hydraulic connections for double-acting cylinders using two hoses.
5. 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.

CAUTION

Extend and retract the piston rods a few centimetres 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, to connect them to the HPU, the user must connect a cable from the cylinder sensor connection port to the sensor connectors on the HPU panel.

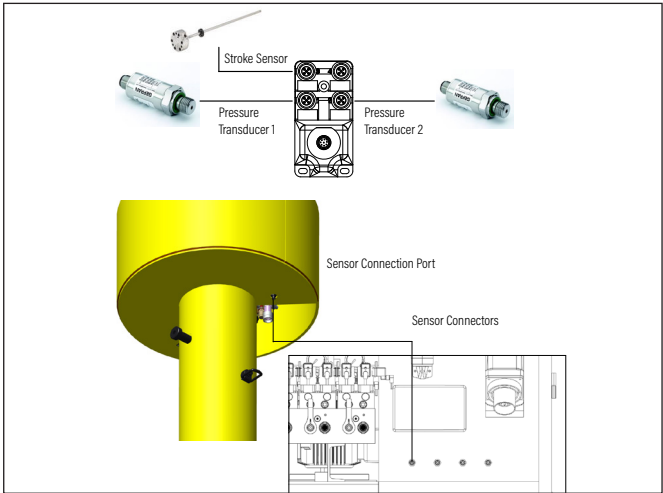


Figure 11: Sensors connection layout



WARNING

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 Automatic SHS HPU Controls

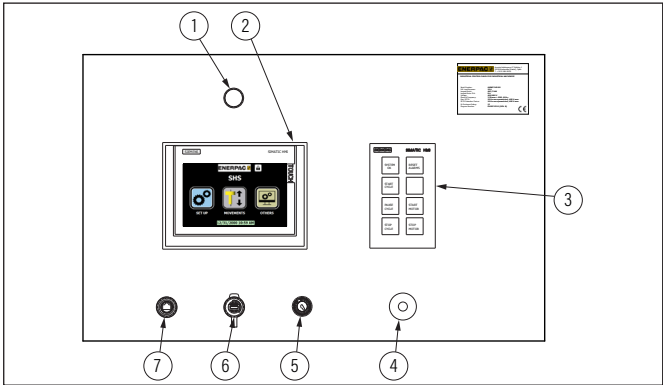


Figure 12: Automatic SHS HPU Controls

1. Power light: This light shows the cabinet is correctly connected to a power source.
2. Touch screen: In this screen the user can type, visualize and select the type of movement of the SHS.
3. Keypad: In this button panel are included all the work cycle control buttons, Start and Stop Motor buttons and Reset Alarms button.
4. Emergency button: Push this button in emergency case. The system will be stopped immediately.
5. Local / Pendant Key Switch: The user must introduce the key to be able to change the SHS control mode. In local mode, the user commands the SHS using the control panel above the electrical cabinet. In pendant mode, the SHS is commanded with a pendant controller.

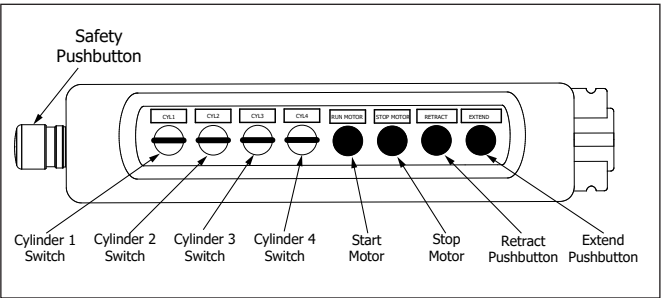


Figure 13: Pendant Controller

6. Ethernet connection: For service connection only. (Used by Enerpac Service Centre for troubleshooting or software update).
7. USB connection: A USB drive can be connected in this plug to save the position values, load readings of every cylinder during the movements, and screenshots.

7. Screens

7.1 Initial Screen

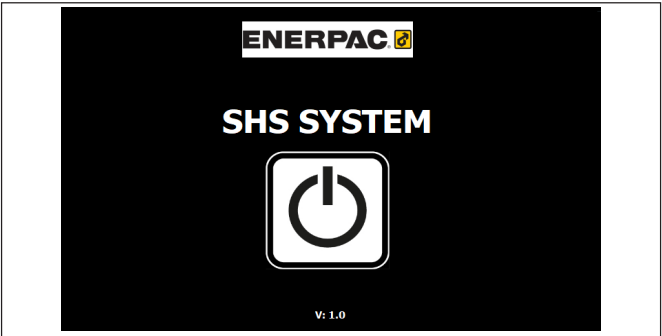


Figure 14: Main Screen

This is the first screen shown by the system. From this screen the operator can access to the other screens of the system and set the movement values.

When the start button is pushed, the system will inquire the ID and Password to log into the user profile.

NOTICE

The system is submitted with the standard user profile

which is recorded with the ID: enerpac and password: 100.

7.2 Main Screen

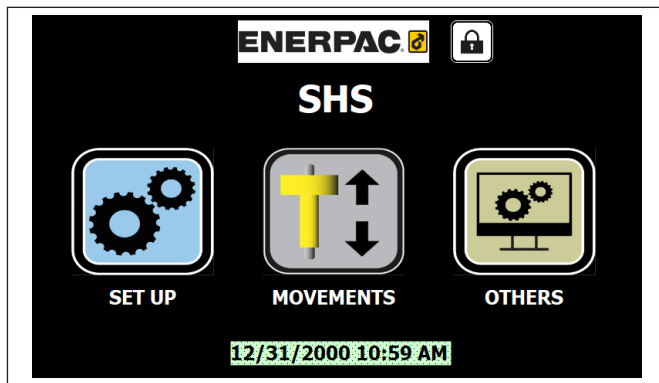


Figure 15: Details of the General Screen

This is the general screen of the software. From this screen the user can access to the Set Up screens in order to configure Synchoist parameters, to the Movements screen to select the type of movements that cylinders will perform and to the Others screen where the operator can adjust other features of the software not related with the movements.

The screen shows 3 buttons: Set Up button, Movements button and Others button.

When the user tap on each button a pop up come up with shortcuts to the screens belonging to each section.

Movements pop up

In Movements pop up, the user can access to the following screens: Manual, Preload, Despressurize and Tilting. The user can access to all screens of Movements section tapping in each button. The background colour of this section and screens is gray.

Set Up pop up

In Set Up pop up the user can access to the following screens: Work Parameters, Spans, Calibration, Offset, Connection Diagnostic and Tare. The user can access to all screens of Set Up section tapping in each button. The background colour of this section and screens is blue.

Others pop up

In Others pop up the user can access to the following screens: Data Recording, Language, Users, Inverter Speed, Instruction Manual and Maintenance. If Maintenance is tapped, another pop-up will appear with Hour Counter, Diagnostic, Pressure Diagnostic and Control Panel options. The user can access to all screens of Others section tapping in each button. The background colour of this section and screens is yellow.

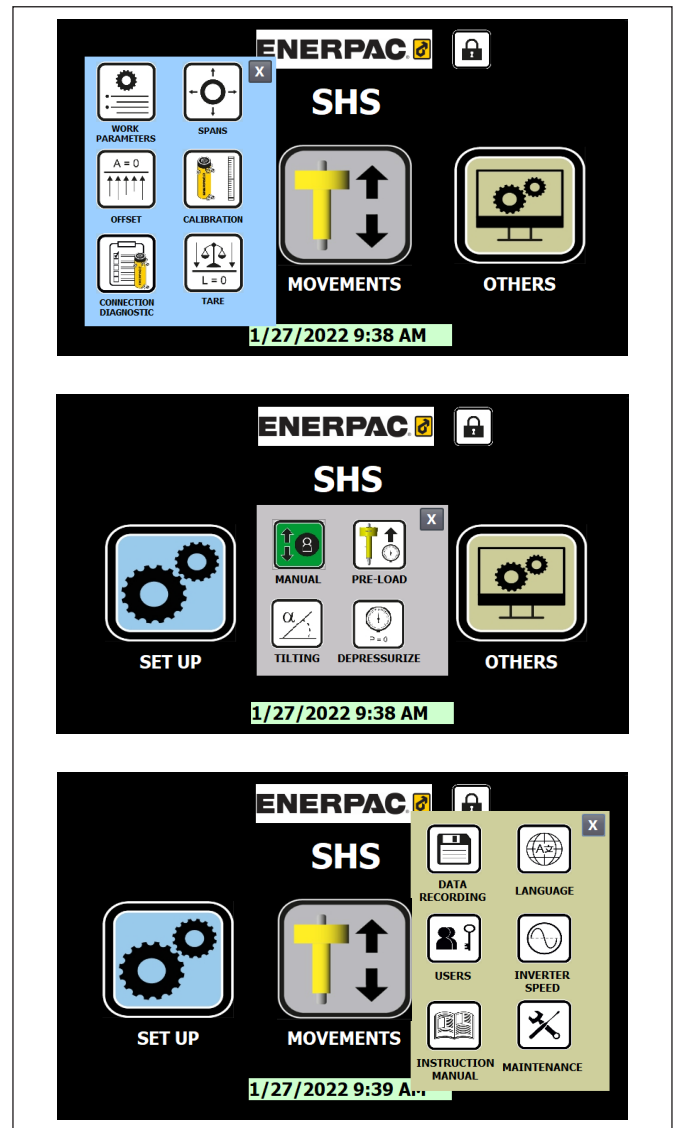


Figure 16: Pop Up Screens

In each section screens there is an arrow which allows to merge a slide with the shortcuts to the screens of the selected section. Through these slides, the user can easily navigate between screens.

In order to see the section slides, the user must tap an arrow placed in the screen. In Set Up section the arrow is placed on the left of the screen, for the Movements section the arrow is placed on the lower right corner of the screen and for the Others section the arrow is on the right of the screen.

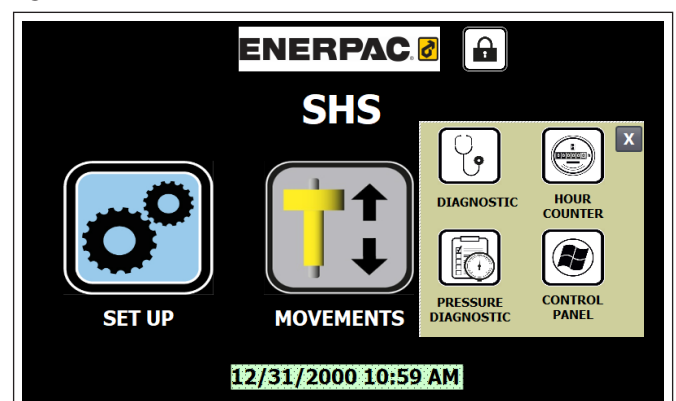


Figure 17: Maintenance pop up

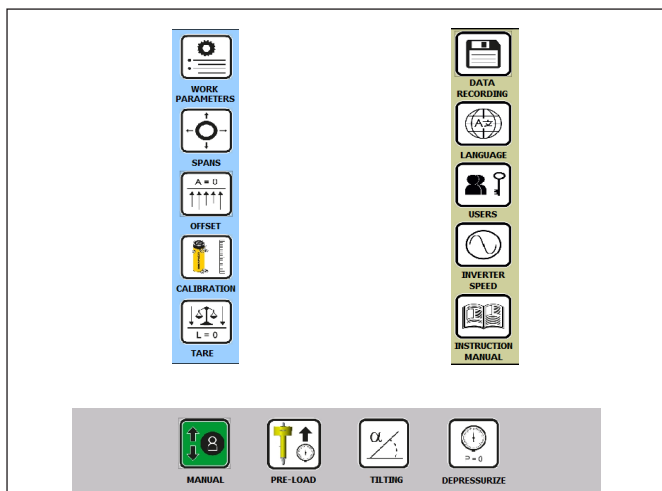


Figure 18: Slides

The software has a common header for all screens. This header shows the following information:

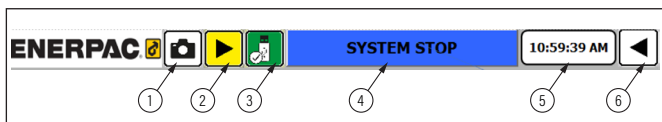


Figure 19: Screens Common Header Details

1. Snapshot: This button makes a snapshot of the current screen and save it in the USB memory.
2. Recording buttons: Pushing this button, the user can start and stop the data recording of the current movement. This values will be saved in the USB memory.
3. USB Connection status: This section will remain white while there is no USB connected to the port. The background colour turns green when there is successful connection to a USB memory, and red if the user starts data recording without any USB plugged in.
4. System status indicator: In this section the software informs about the status of the system.
5. Time section: This section shows the current time. The local time can be adjusted in the control panel screen.
6. Back button: The user can go back to the Main Screen pushing this button.

7.3 Work parameters Screen

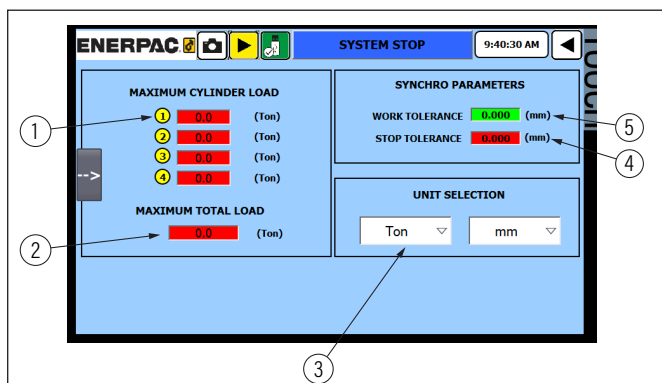


Figure 20: Work Parameters Screen Details

In this screen the user must define some movements

and security parameters of the system. In this screen the following components are found:

1. Maximum Cylinder Load: The user must type the maximum load expected of each cylinder. When this value is exceeded a warning alarm will be shown by the system.

WARNING

Bear in mind that these values can not be higher than cylinders capacity.

2. Maximum Total Load: The user must type the maximum load expected of the cylinders involved in the current application. When this value is exceeded the movement will be stopped by the system.
3. 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.
4. Stop Tolerance: During a synchronized movement, there is a range of desynchronization between the most extended and the most retracted cylinder. The user must type in this box which is the maximum admissible value between the most extended and the most retracted cylinder. If this value is exceed the system will stop the movement through a stop alarm.
5. Work Tolerance: The user must type in this box which is the synchronization value between the most extended and the most retracted cylinder. If this value is exceed the system will stop the most extended cylinder until the most retracted cylinder reaches into the typed range.

NOTICE

Bear in mind that when units are changed, all values are updated to new units. There is no need to type new values in that case.

7.4 Spans Screen

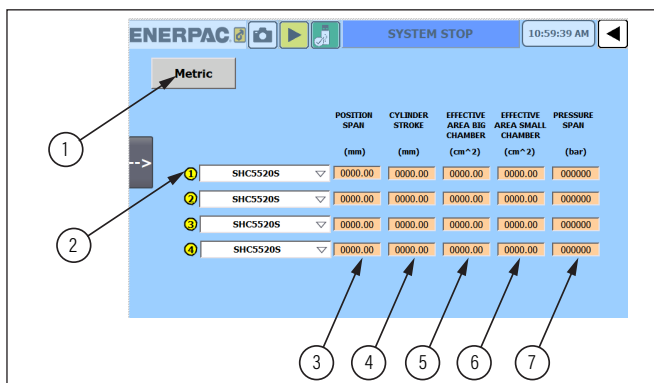


Figure 21: Spans Screen Details

In this screen the operator can select the appropriate SHS type through the drop down menu. This data can be read in the characteristics label of the device.

If a custom cylinder is being used, selecting custom in the drop menu will permit the user to type manually the SHS specifications.

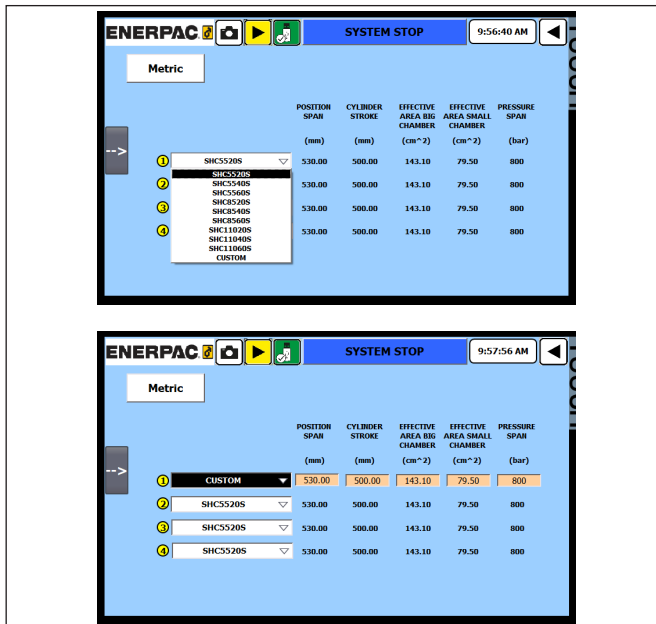


Figure 22: Custom SHS Cylinder Layout

In this screen, the following elements are found:

1. Units button: The user can switch between two unit systems pushing this button. These are the International System of Units (Metric) and the Imperial System of Units (Imperial).
2. SHS Drop Down Menu: The user must choose the SHS model being used. These can be standard or custom ones. If the user selects an standard model, 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 7 are affected by this fact.
3. Position Span: This value is the maximum length of the stroke sensor installed on the selected SHS.
4. Cylinder Stroke: This value indicates the maximum stroke of the selected SHS.
5. Effective Area Big Chamber: The system will show the effective area of the piston chamber.
6. Effective Area Small Chamber: The system will show the effective area of the rod chamber.
7. Pressure span: This value shows the maximum capacity of the pressure transducer.

7.5 Calibration Screen

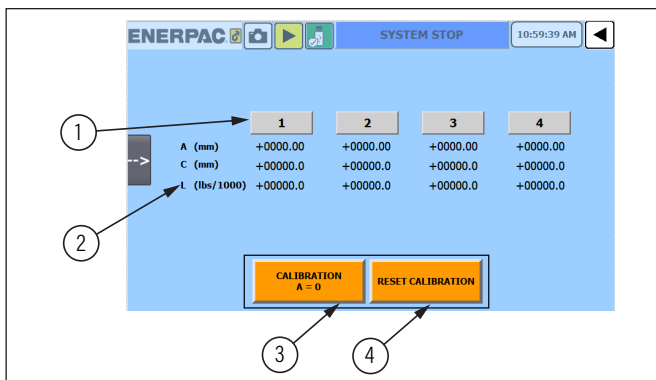


Figure 23: Calibration Screen Details

Through calibration and spans parameters, the system

can make security calculations to prevent mistakes.

To set the stroke sensor position and the plunger position to 0, the user must perform a cylinder calibration. When the calibration is done, all cylinders will have value A = 0 when fully extended.

In this screen, the following elements are found:

1. Cylinder Selection button: The user must select the cylinder which will be involved in the movement or operation. When a cylinder is selected, the button will become green.
2. Movement Values: There are several values that the system shows during the movement. These are:
 - A (Absolute position): The absolute position is the position of the cylinder plunger taken from the initial zero. This initial zero is the zero set in the calibration screen if applied.
 - L (Load withstood by cylinder): This value shows the load being withstood by each cylinder in the current moment.
3. Calibration: Based on the place of the stroke sensor, this button allows to calibrate and set absolute position of the cylinder (A = 0). The user must push and hold during 3 seconds this button to make the value effective.

NOTICE

The calibration must be done when the cylinder plunger is totally extended.

4. Reset Calibration button: If during the calibration process something was wrong, this button allows to back to the previous value of the absolute position and reset the calibration process.

7.6 Offset Screen

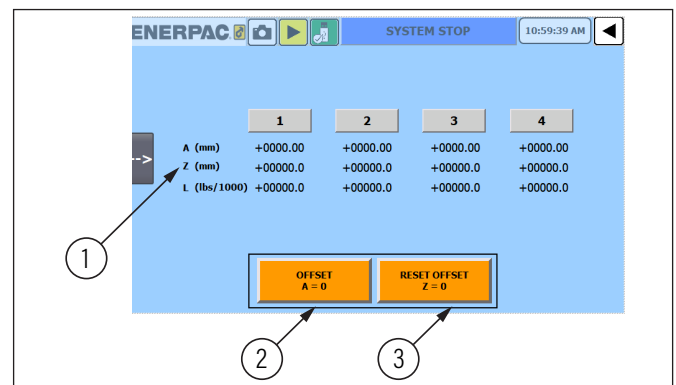


Figure 24: Offset Screen Details

Offset is generally used to have a dimensional reference when a load is going to be lifted to an unknown dimension and it is subsequently lowered at the same position. Making an offset before lifting the load is useful to have a reference of the initial position where it started after making the movement.

The offset variable (Z) is used as a memory variable. When Offset is done, the value that currently has the variable A (absolute position) is stored in Z.

At this time variable A acquires the value zero (0) and variable Z houses the value that A previously had.

In this screen the following elements are found:

1. Movement Values: Absolute position and Load values are detailed in paragraph 7.5 and will be omitted in this point.
 - Z (Offset Variable): Memory variable for a movement reference.
2. Offset Button: This button has to be pushed and hold during 3 seconds to convert the current value A into 0 and Z in the current value of A.

NOTICE

The offset value does not disappear when the equipment is turned off or there is a power failure. This value is maintained until the operator performs a reset of the Offset value.

3. Reset Offset button: Push and hold this button during 3 seconds to convert the value Z into 0 and A will take the current value of Z and will add it to the current value.

$$A_f = A_i + Z$$

7.7 Tare Screen

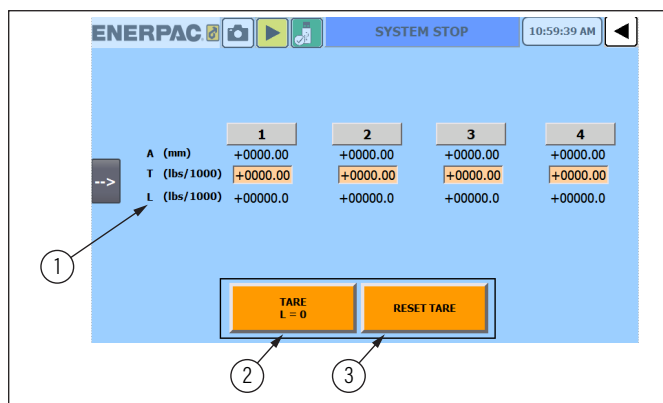


Figure 25: Tare Screen Details

1. Movement values: Absolute position and Load values are detailed in paragraph 7.5 and will be omitted in this point. Only changes Tare Value:
 - T (Tare Value): This value indicates the load value of the structure between load and cylinders.
2. Tare Button: This button set all cylinders weight to zero. Hold pressed 3 seconds to make the change effective.
3. Reset Tare Button: This button reset the weight of each cylinder to its own real reading.

7.8 Connection Diagnostic

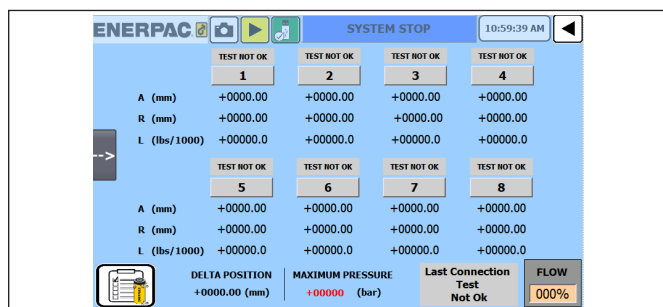


Figure 26: Connection Diagnostic Screen

This screen is used to assure that hoses and stroke sensors are correctly connected to the cylinders.

Pressing the test button, the system will revise the connections of all cylinders one by one. If the test is successful, the square above every cylinder selection button will turn green.

7.9 Manual Mode Screen

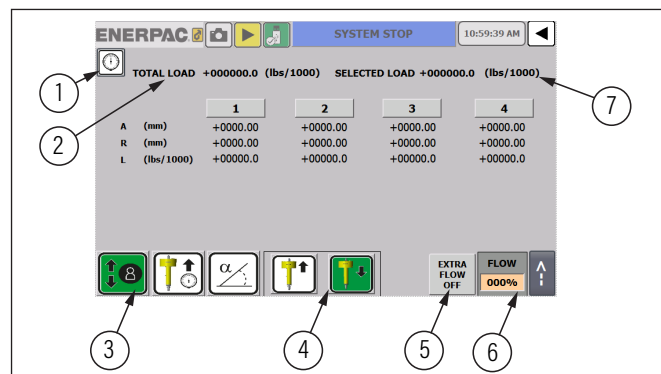


Figure 27: Manual Mode Screen Details

This screen belongs to the Movements section. In this section the user must select the type of movements being executed.

In the case of the manual movements, the user can move cylinders with a total control of the movement. The user can move the cylinder plunger outward or inward pushing and holding the start cycle button, and stop the movement just releasing the button. This work mode is used to make small positioning movements in the application.

In this screen, the following elements are found:

1. Pressure Data Button: Shows the pressure of all system cylinders. It is shown in the screen as PB, which is the pressure inside the big chamber, and PS which is the pressure inside the small chamber of the cylinder.
2. Total Load value: This value shows the load being withstood by all cylinders. This value results from the sum of all system loads.
3. Manual Button: Select this button to activate the manual mode in the movement. When this button is selected, the background colour of the button will become green.
4. Lift / Lower buttons: The user can push Lift button to retract the plunger inside the cylinder base and lift the load, and Lower button to extend the plunger out of the cylinder and lower the load.
5. Extra Flow button: This functionality is only available on this mode. Pressing this button will power up an auxiliary motor that provides extra oil flow.
6. Flow: The system allows selecting the cylinder movement speed. This value is a percentage between 30 and 100% of the total flow.
7. Selected Load value: This value shows the load being withstood by all selected cylinders.

7.10 Preload Screen

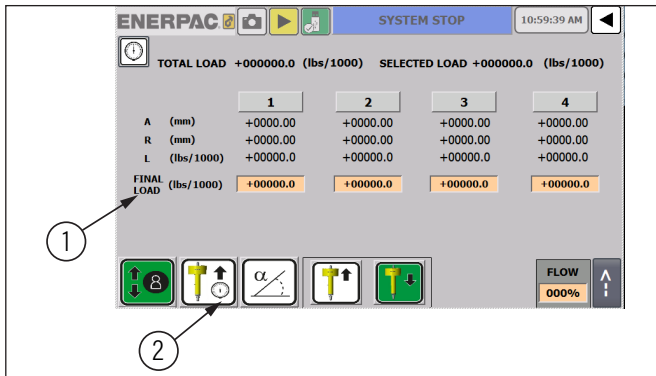


Figure 28: Preload Screen Details

This mode is used to tighten the slings that are in contact with the load which is going to be lifted. This work mode allows the operator to set a load limit for the cylinders. When each cylinder reaches this load value the system stops the movement.

In this screen, the following elements are found:

1. Final Load: The user must type the load value that cylinders must reach. When all cylinders get this load value the movement will stop and the cycle will finish.
2. Preload button: Select this button to set the preload movement in the system. When this button is selected, the background colour of the button will become green.

7.11 Tilting Screen

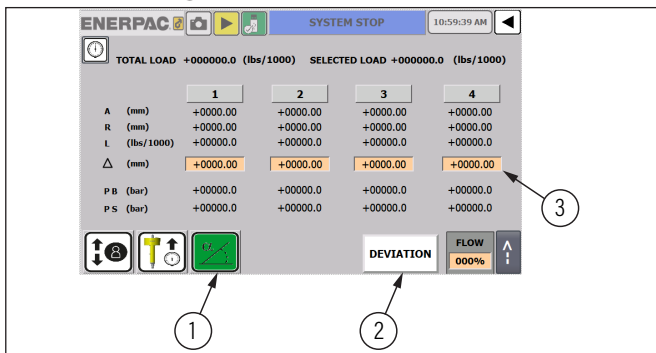


Figure 29: Tilting Screen Details

This work mode allows setting a different Delta value for each cylinder and make synchronous movements of every cylinder in such a way that all cylinders finish at the same time.

The Tilting screen contains the same elements as the Manual screen (Figure 26). Only the elements shown in Figure 27 change.

In this screen the following elements are found:

1. Tilting mode button: Select this button to set the tilting movement in the system. When this button is selected, the background colour of the button will become green.
2. Deviation button: This button shows the Deviation screen. In this screen the user can check the current tilting movement details.
3. Delta Final Position: The user must type in this box

the increment of the current position which the cylinders must reach in the next cycle. This target can be positive (if retracting cylinders) or negative (if extending cylinders). This value can be set individually for each cylinder.



At the end of each cycle, all cylinders will finish at the same time. Bigger stroke cylinders will have more stops and waiting time than less stroke ones. Consider this behaviour to avoid uncontrolled movements.

7.11.1 Deviation Screen

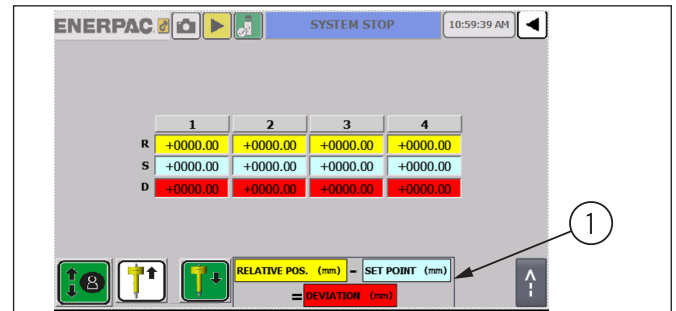


Figure 30: Deviation Screen Details

In this screen the user can check the current tilting movement details.

In this screen the following elements are shown:

1. Key formula: This area shows the formula used to make tilting movement calculations.
 - Relative Position — Set Point = Deviation
2. Tilting movement values of each cylinder:
 - R (Relative Position): This value shows the current position of the cylinder rod.
 - S (Set Point): This value is the theoretical position which should have the plunger in the current moment, according to the internal calculations done by the system in order to all cylinders reach the final delta target at the same time.
 - D (Deviation): This value is the difference between the plunger theoretical position, according to the internal calculations of the software (Set Point), and the rod real position in the current movement (Relative Position).

This screen is only for information proposal. The user cannot type or select any value.

7.12 Despressurize Screen

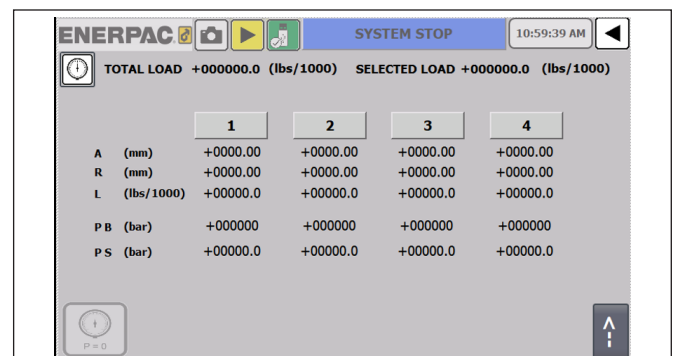


Figure 31: Despressurize screen

The Despressurize screen contains the same elements as the Manual screen (Figure 25). The only difference is the Despressurize Button P=0.

After working with the system, the equipment can keep residual pressure. Using this work mode, the system will release the total pressure of the equipment.

NOTICE

This mode release the pressure from the pump and hoses but not from the cylinders, due to they have counter-balance valves installed that mantain the pressure inside the cylinder.

Select this button to activate Despressurize mode. When this button is selected, the background colour of the button will become green.

When this working mode is used, a warning screen will remember the risk taken using this working mode with cylinders withstanding a load.

7.13 Data Recording

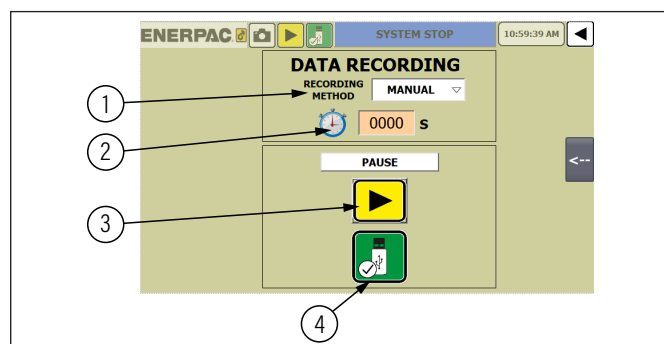


Figure 32: Data Recording Screen

With this screen, the operator can record movement data into an external storage device.

In this screen the following elements are found:

1. Recording mode: Select the recording mode (manual or automatic), for recording movement data purpose. When the manual option is selected, the system will record only when the user pushes the record button. When automatic mode is selected, the system will automatically record the data when the system is moving.
2. Time period: The user must type the frequency of data recording. The units used are seconds.
3. Start recording button: Push this button to start recording the data of the movements in the selected device. Push it again to stop recording data.
4. Storage: The storage icons indicates the storage drive in which the recording is saved. These can be USB drive or SD card. When the recording starts, the icon of the storage device in which the data is saved turns green.

7.14 Language Screen

The user can choose the alarms language in this screen. Select the language desired and tap the back button to go to the main screen.



Figure 33: Language Screen

7.15 Users Screen

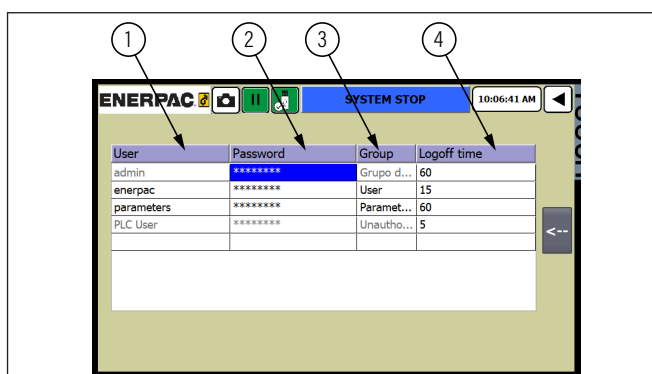


Figure 34: Users Screen Details

In this screen, the user can create and set several users to manage the system. In this screen the following sections are found:

1. User: The user must tap a cell of this column and type a new user.
2. Password: in the next column, the operator must tap and type the password corresponding to the user.
3. Group: The user has to tap and choose a group name for the typed user.
4. Log off time: Tap and type the number of minutes to log off the system with that user.

NOTICE

To this screen is only reachable by the user logged with parameters profile. Id: parameters, password: 200.

7.16 Inverter Speed Screen

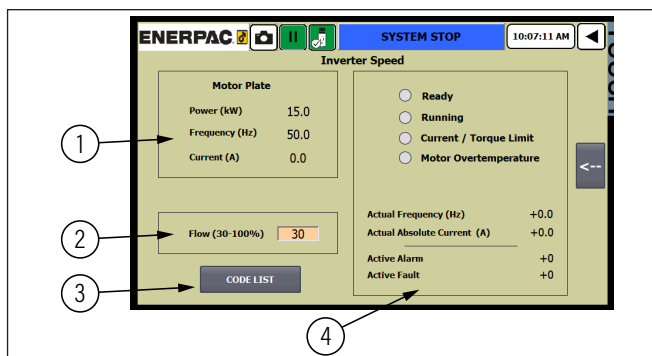


Figure 35: Inverter Speed Screen Details

This screen shows the frequency inverter status in the current moment. This screen notifies important

information for experimented operators. The user must type the oil flow required between 30% and 100%.

In this screen there are the following elements:

1. Motor features plate: In this square appears the electric motor values.
2. Flow: The system allows selecting the movement speed of the cylinders. This value is a percentage and can be typed between 30 and 100% of the total flow. It correspond to the speed of the motor.
3. Code List: This button gives access to the list of faults and alarms of the system.
4. Status Section: In this section the operator can check the status of the motor. There are the following features:
 - Ready: The Inverter speed is already switched on with a good communication with PLC. It is indicated by a green light. When this light is green the motor is ready to be switched on with no fault or alarm in the inverter speed.
 - Running: When this light is green indicates that an operation is going on.
 - Current / Torque Limit: The light becomes red when the motor has been operating at the torque limit or at the current limit.
 - Motor over temperature: The light becomes red when the motor has reached the limit of the working temperature.
 - Actual Frequency: This parameter shows the real frequency of the motor.
 - Actual Absolute Current: This parameter shows the real current of the motor.

7.17 Instruction Manual Screen



Figure 36: Instruction Manual Screen

In this screen, the operator can access to the Instruction Manual of the Automatic SHS.

7.18 Diagnostic Screen

The PLC status can be reviewed by the operator with this screen.

It is important when a problem occurs, verifying the information of this screen before contacting with the service center.

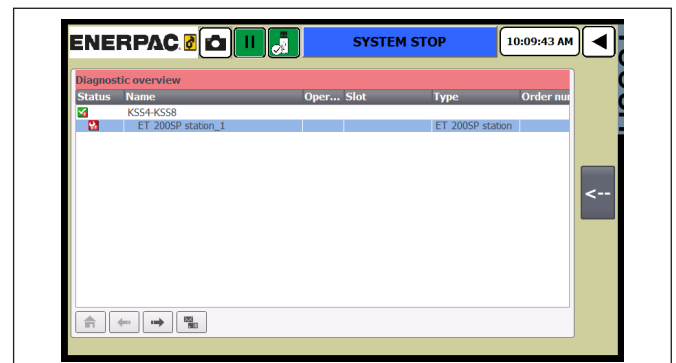


Figure 37: Diagnostic Screen

7.19 Hours Counter Screen

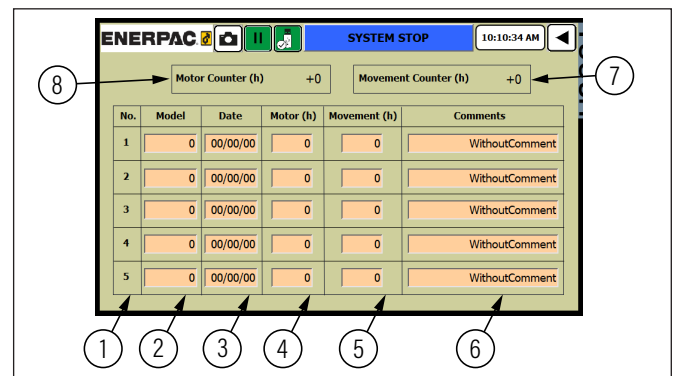


Figure 38: Hours Counter Screen

In this screen the user can have a record of the services done to the pump.

In this screen, the following elements are found:

1. Row number: The operator can have up to 5 records
2. Model number: The user can type the model number of the pump.
3. Date: The user can type the date when the service was done.
4. Number of working hours of the motor: The user can type the number of working hours of the motor when the service is done.
5. Number of movement hours: The user can type the number of hours in which movements have been done.
6. Comments column: The user can enter some brief descriptive comment.
7. Movement counter: This parameter is given to have a reference of how many hours the pump has been working making movements.
8. Motor counter: This parameter is given to have a reference of how many hours the motor has been switched on.

NOTICE

Motor counter and movement counter are different, because the pump can be switched on with the motor working but with no movement in the valves or cylinders.

7.20 Control Panel Screen

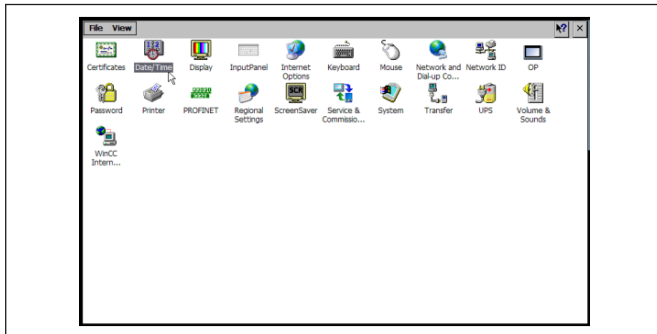


Figure 39: Control Panel Screen

In this screen the user can set date and time of the system. In order to do it, the user must access to the panel control of the system.



In the control panel there are many other icons and options that can be changed. Enerpac dissuades touching other icon except the date and time. Malfunctioning and unset risk exist when other parameters in this screen are changed.

7.21 Pressure Diagnostic

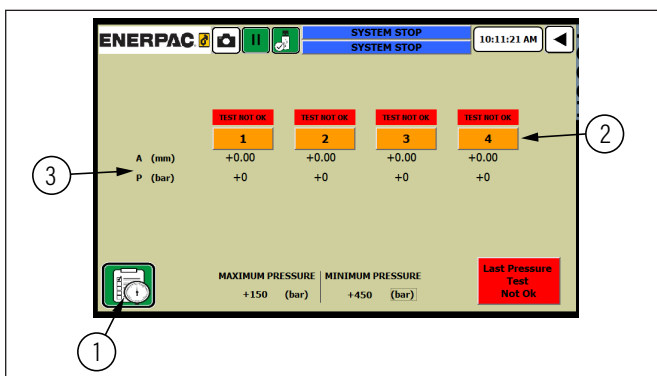


Figure 40: Pressure Diagnostic Screen Details

With this test, the user can check the isolation of the hydraulic system and detect any leakage.



This test must be done without cylinders or hoses connected and with the hinged lids of the frame in the outlets side closed. When the hydraulic connectors are pressurized with no hoses connected, a projection risk can be merged.

In this screen the user can find the following parts:

1. Pressure inspection: Pressing this button the system is ready to make the pressure test. Through this mode the system is pressurized firstly in A outlets and secondly in B outlets. If the pressure does not drop in 1 minute, the system will show the advise green. Otherwise it will turn red if the test was not passed.
2. Outlets selection: For the position and flow inspection, the user must select the outlet to be tested.
3. Parameters: The user can check some parameters

during the test. These parameters are:

- A: Absolute position of the cylinder during the test.
- P: Pressure build in each line.

8. Operation

8.1 Preparing the Synchoist

Synchoist cylinders must be positioned vertically, hanging on the crane the hoisting eye located near the safety block protector, and the load on the hoisting eye installed on the plunger of the cylinder, as it is shown on the Figure 39

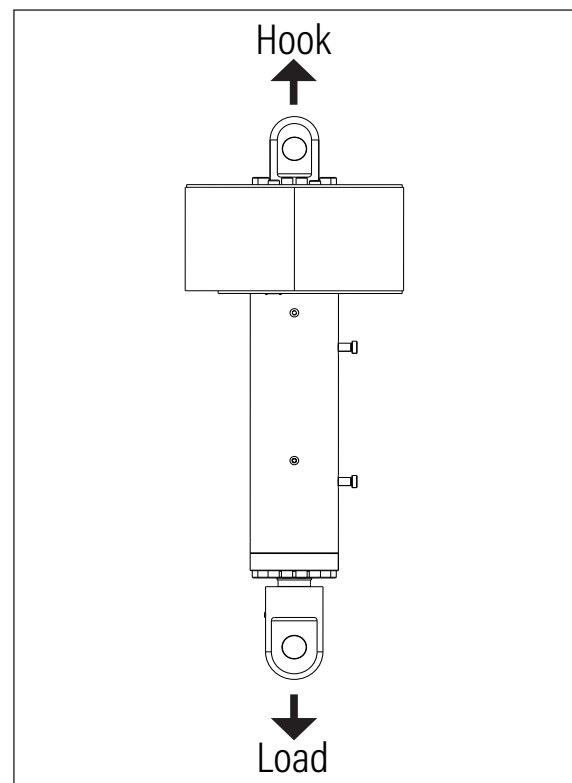


Figure 41: Position of the cylinder

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

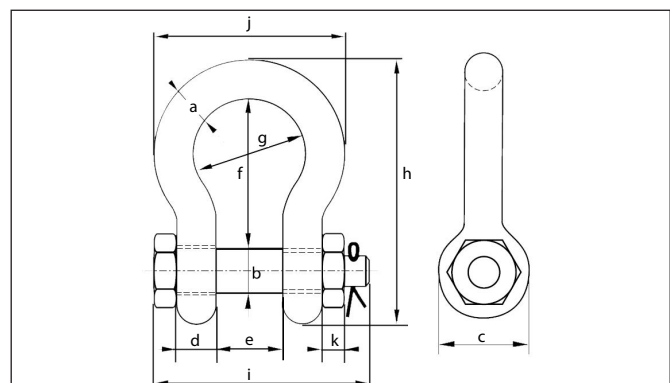


Figure 42: Hook pins

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]

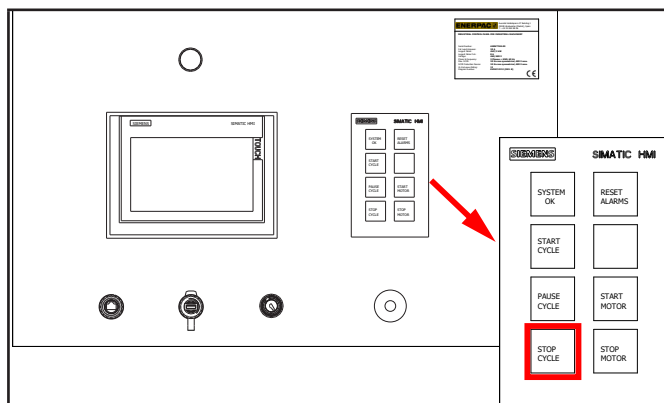
NOTICE

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.

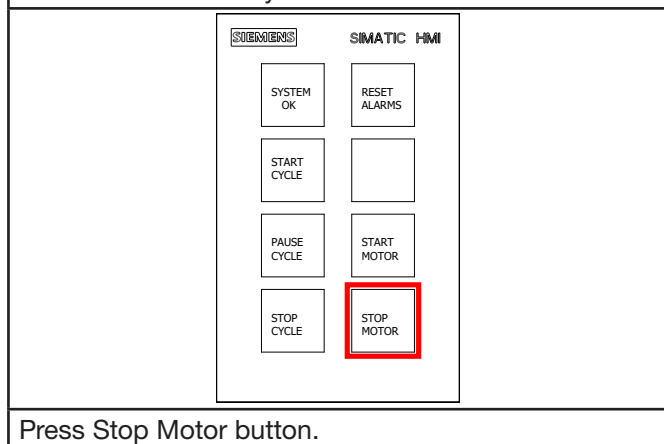
8.2 Automatic SHS HPU Operation

8.2.1 Turning the System Off

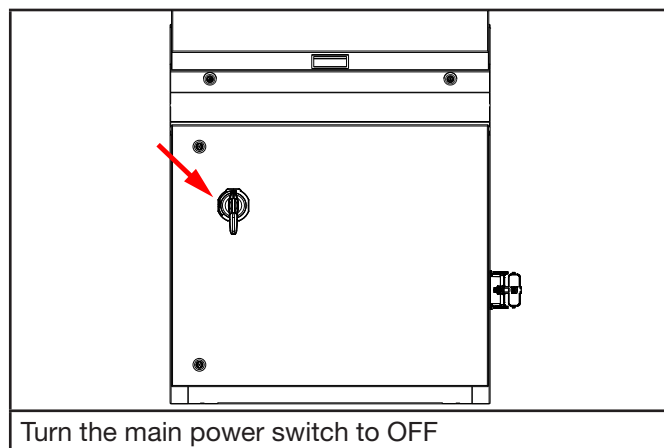
To turn the machine off we recommend following these steps to avoid faults:



Press the Stop Cycle button in the keypad to stop any movement or work cycle.

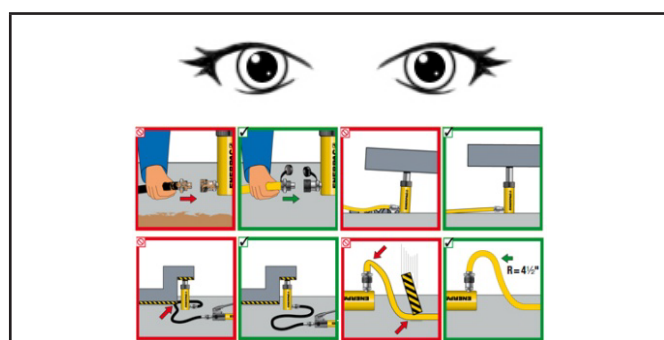


Press Stop Motor button.

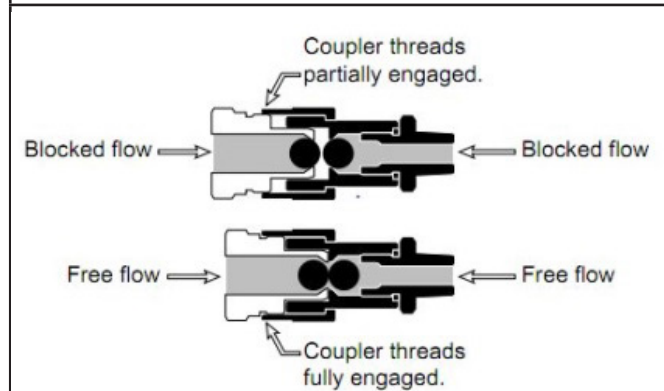


8.2.2 Turning the System On

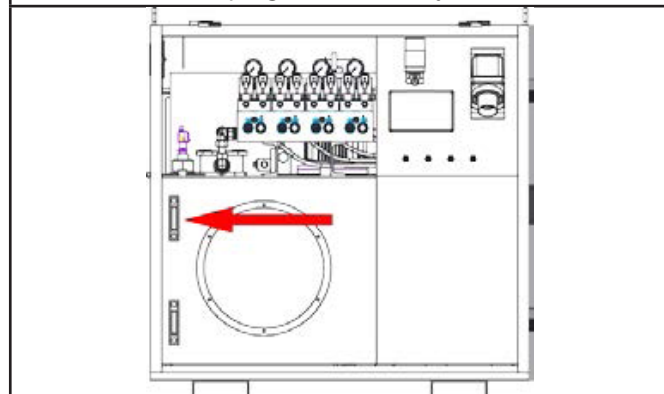
To turn the system on, follow the next steps:



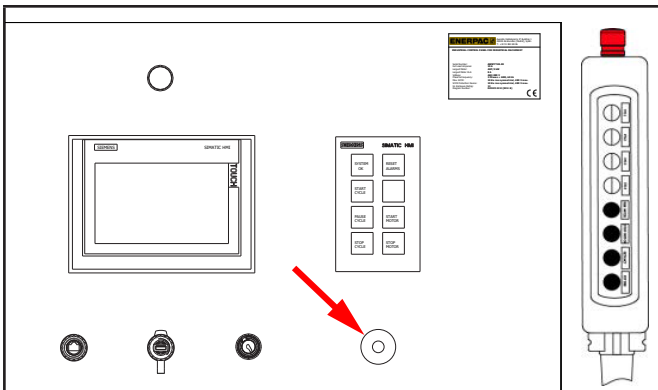
The user must perform a visual check of hoses and cylinders, ensuring they are not bent and they are in the correct position.



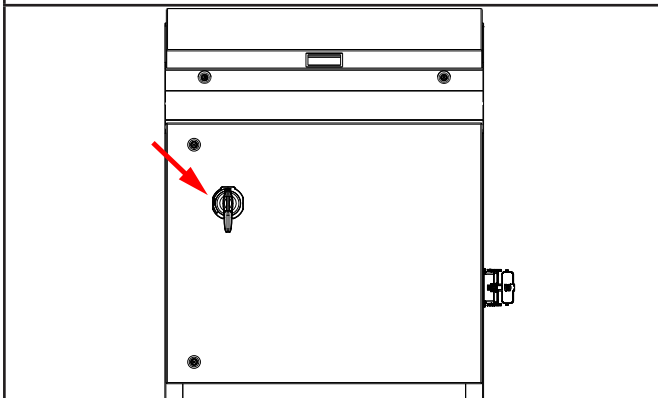
Assure that hose plugs are correctly inserted in.



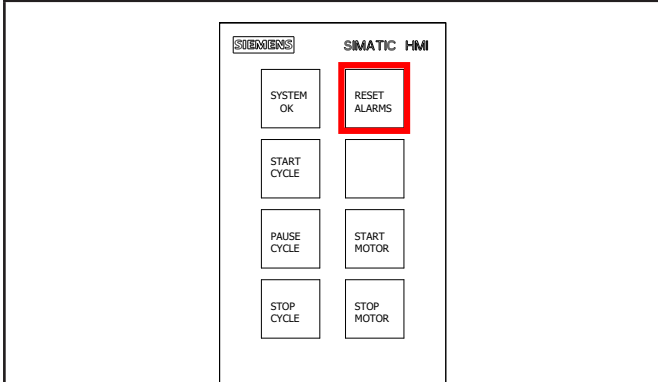
Check the oil level. Bear in mind that if cylinders are extended, the reservoir level should be low.



Emergency stop buttons on the pendant and on the control panel must be released. Turn the safety knob clockwise.



Turn on the main switch. Check the voltage light in the control panel.



Check for alarms in the control. If any alarm has came up, check and solve the root cause and push Reset Alarm button in the control.

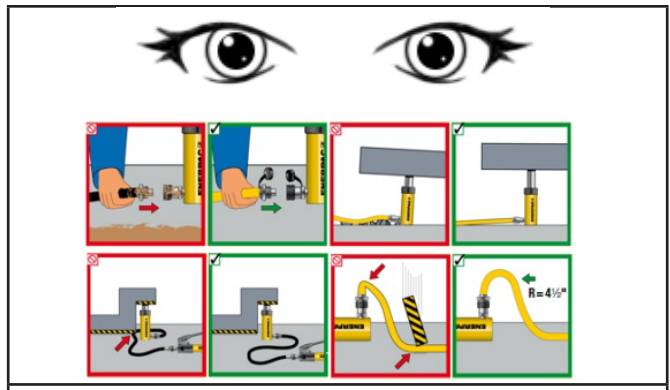
8.2.3 Calibration Works

Calibration process allows to have the reference between plunger position and internal sensor stroke, and set zero position in the system.

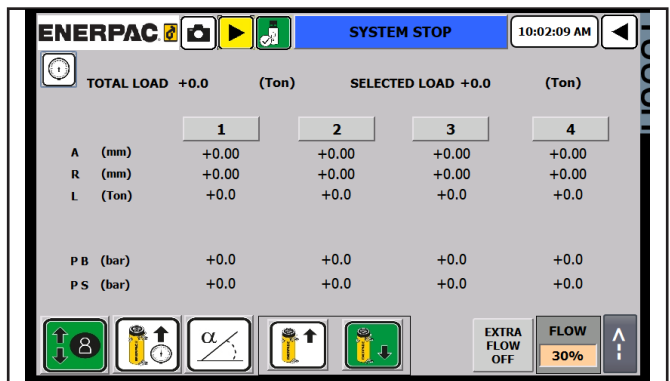
Through calibration and spans parameters, the system can do security calculations to prevent mistakes when introducing movement values.

If a Delta value bigger than the cylinders stroke is typed, the system will automatically change it to the maximum stroke value introduced on Spans screen.

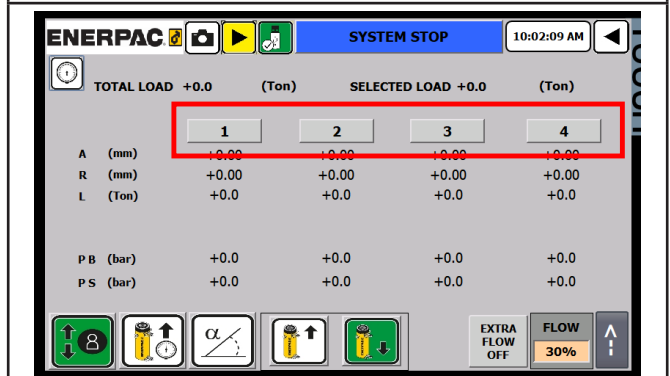
To correctly perform the Calibration process, follow the next steps:



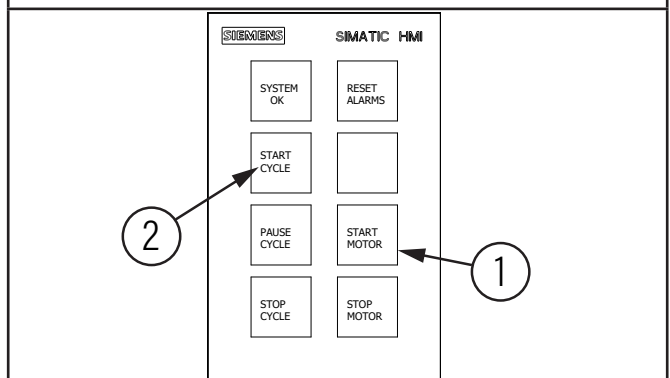
Perform a visual check of the cylinders, ensuring they are in good condition.



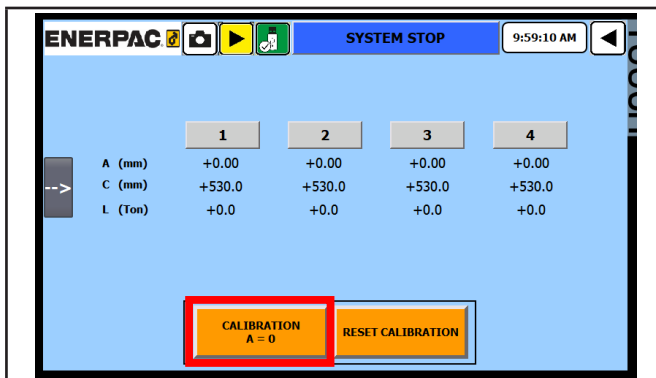
Go to Manual screen and press extend button.



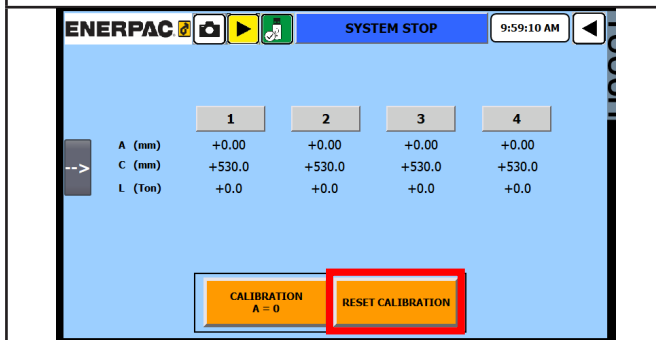
Select the cylinders required to move (usually all of them should be selected).



Press the Start Motor button to power up the HPU. Then, press Start Cycle button in the keypad and hold it until all cylinder plungers are extended.



Go to Calibration screen and hold down calibration button for 3 seconds. The real position will change to zero.

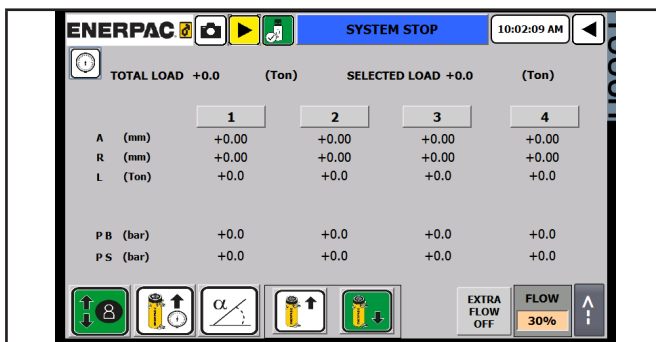


If the previous position value is required, press Reset Calibration button.

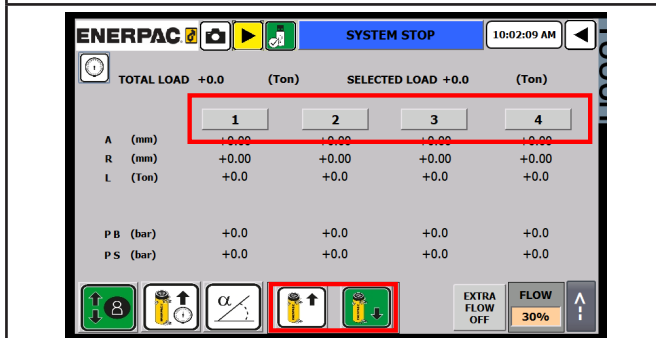
8.2.4 Manual Mode

Manual mode is used to move cylinders in a free way. This mode is used to check and set the cylinders before a work and also for maintenance purposes.

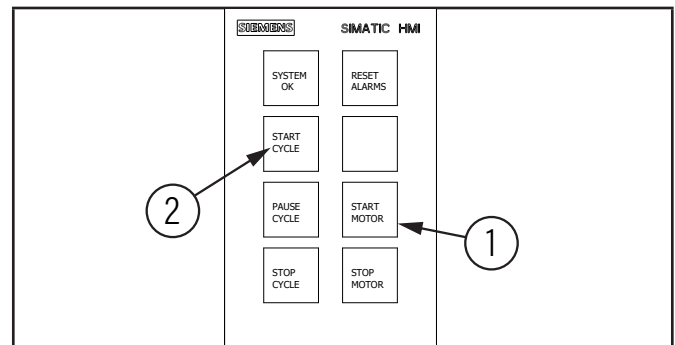
In order to work with this mode, follow the steps below:



Go to Manual screen and press Manual Button



Select cylinders to move and the type of movement which cylinders will follow.



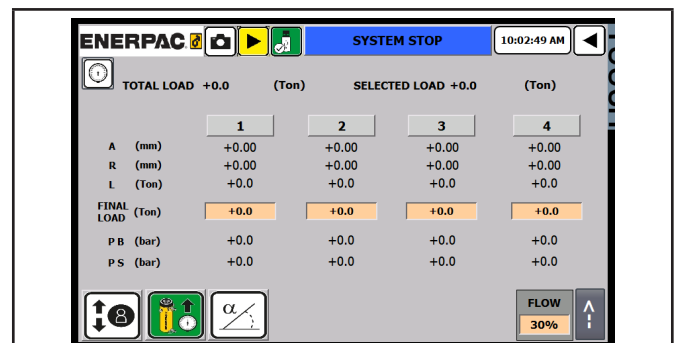
Press the Start Motor button to power up the HPU. Then, press and hold down the Start Cycle button. Cylinders will move until this button is released. The movements are not synchronized.

8.2.5 Preload Mode

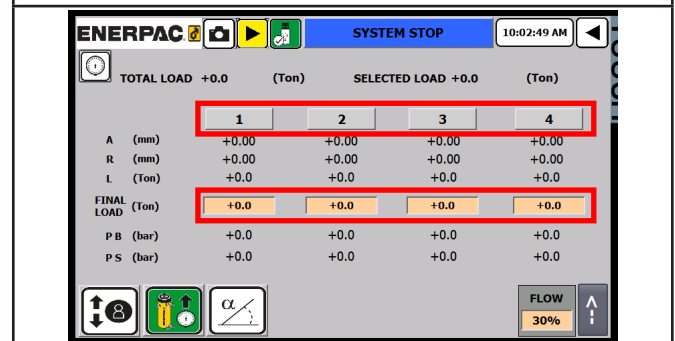
This mode is used to have the first contact with the load by tightening the slings which are fixed to the object being lifted.

Preload mode allows the operator to set a load limit for each cylinder. When every cylinder reaches this limit, the system stops.

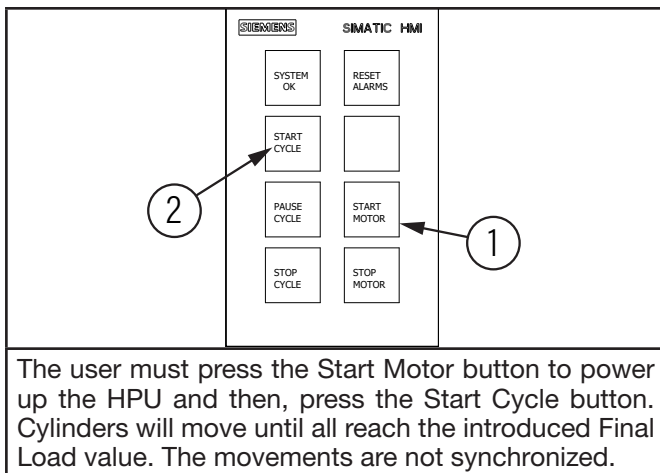
To work correctly with this mode, follow the next steps:



Go to Preload screen



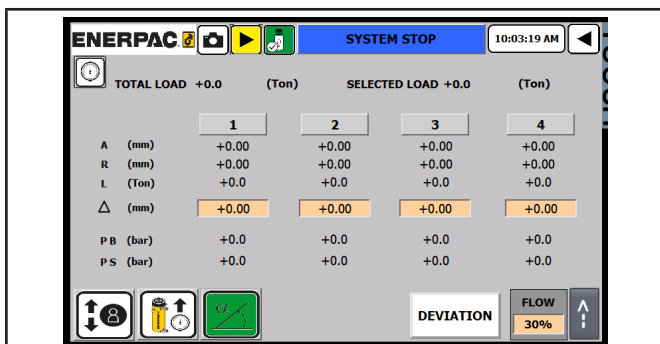
The user must type the Final Load value that cylinders must reach and select the cylinders to move. When the selected cylinders reach this value, the cycle will stop.



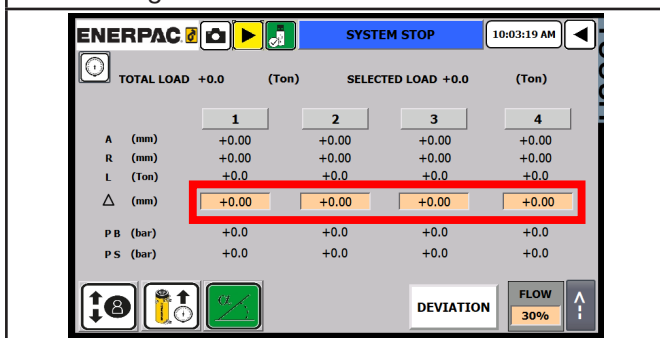
8.2.6 Tilting Mode

This movement allows the user to do load inclination movements. This movement allows the user to set different targets for each cylinder and make a synchronous movement in such a way that all cylinders finish at the same time.

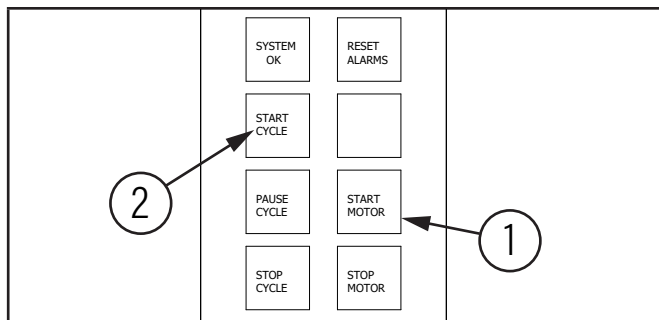
In order to work with this mode, follow the next steps:



Go to Tilting screen

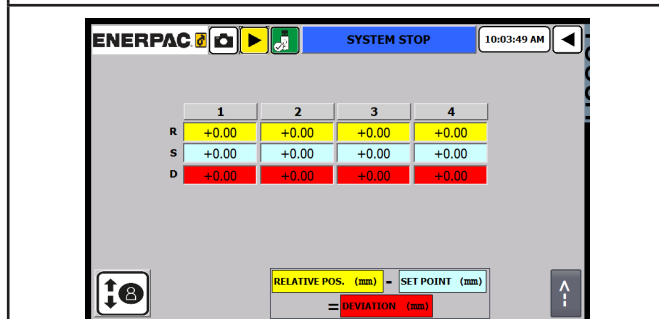


The system can perform synchronous movements with different Delta value in each cylinder. Select the cylinders to be moved, and introduce Delta values for every selected cylinder.



The user must press the Start Motor button to power up the HPU and then, press the Start Cycle button. Cylinders will move in a synchronized way until they reach the Delta Position introduced.

While the movement is being executed, the system continuously calculates the position of each cylinder. This position is also called “set point” (SP). The system activates and deactivates the distribution valves to have an accurate control of the movement.



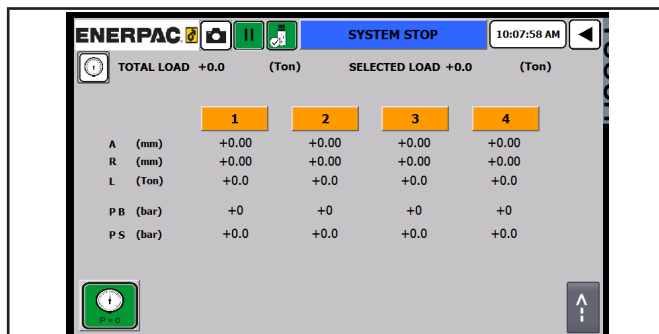
The deviation screen shows the tilting synchronization values.

The deviation box shows the difference between the current position of each cylinder (relative position) and its own set point.

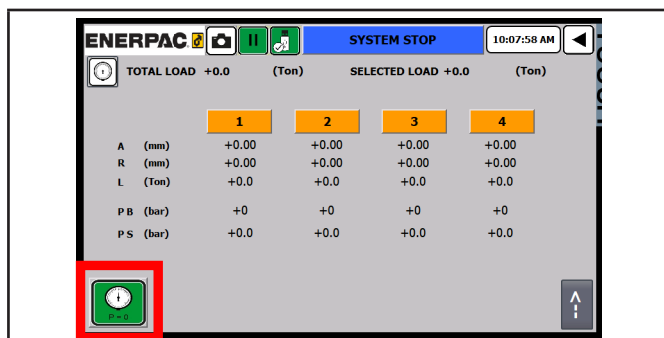
8.2.7 Despressurize Mode

After working with the system, the equipment can keep residual pressure. With work mode, the system will release the total pressure of the equipment except from the cylinders due to it's counterbalance valve which keeps the pressure inside the cylinder.

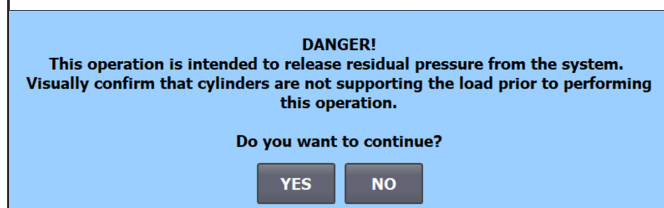
In order to work with this mode, follow the steps below:



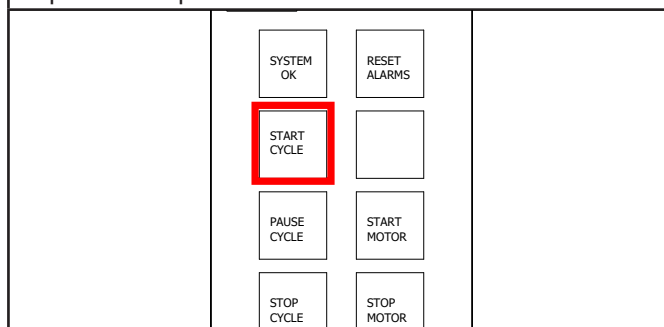
Go to Despressurize screen



All cylinders will be selected automatically when the Depressurize Mode button is selected.



The system will require a second check to start the depressurize process.



Push the Start Cycle button. The system will be depressurized in seconds.

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.



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:

- The operator must familiarize with the system and its operating procedures.
- Do not perform maintenance work unless you are authorized to do so. Unauthorized personnel must not work on the SHS.
- Observe all safety and warning signs on the SHS.
- Observe all safety instructions contained in this manual.
- Observe the applicable safety regulations when working with inflammable fluids.
- Perform maintenance work only after the motors have been switched off. Always ensure that the SHS is protected from unauthorized operation before beginning maintenance work.
- Be sure the hydraulic system is depressurized, before starting maintenance operations at the hydraulic system.
- 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.
- Do not spill lubricants / oil, etc. Be aware of the environment and the cost of cleaning up.
- Ensure that all PPE's and other safety equipment are used when operating conditions demand it.
- Be aware of fire alarms. Know the location and operation of fire extinguishers.
- Only use appropriate workshop equipment. Prevent damage to parts using unsuitable equipment.
- 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.
- Spare parts must conform the specified technical requirements of the manufacturer.
- 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].

10. Hydraulic Schemes

10.1 SHP421AW

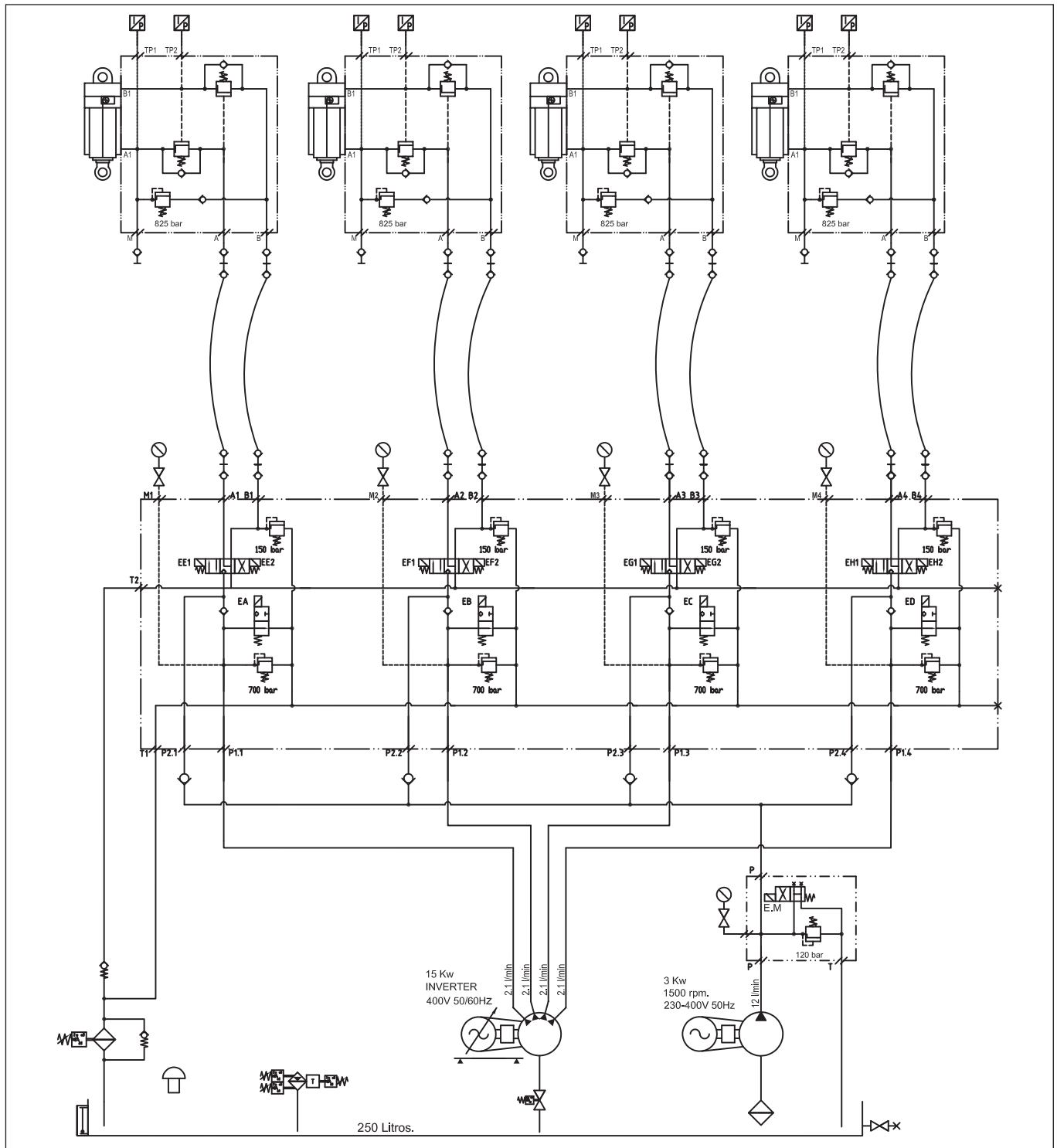


Figure 43: SHP421AW Hydraulic Scheme

11. Parts List

11.1 Automatic SHS HPU

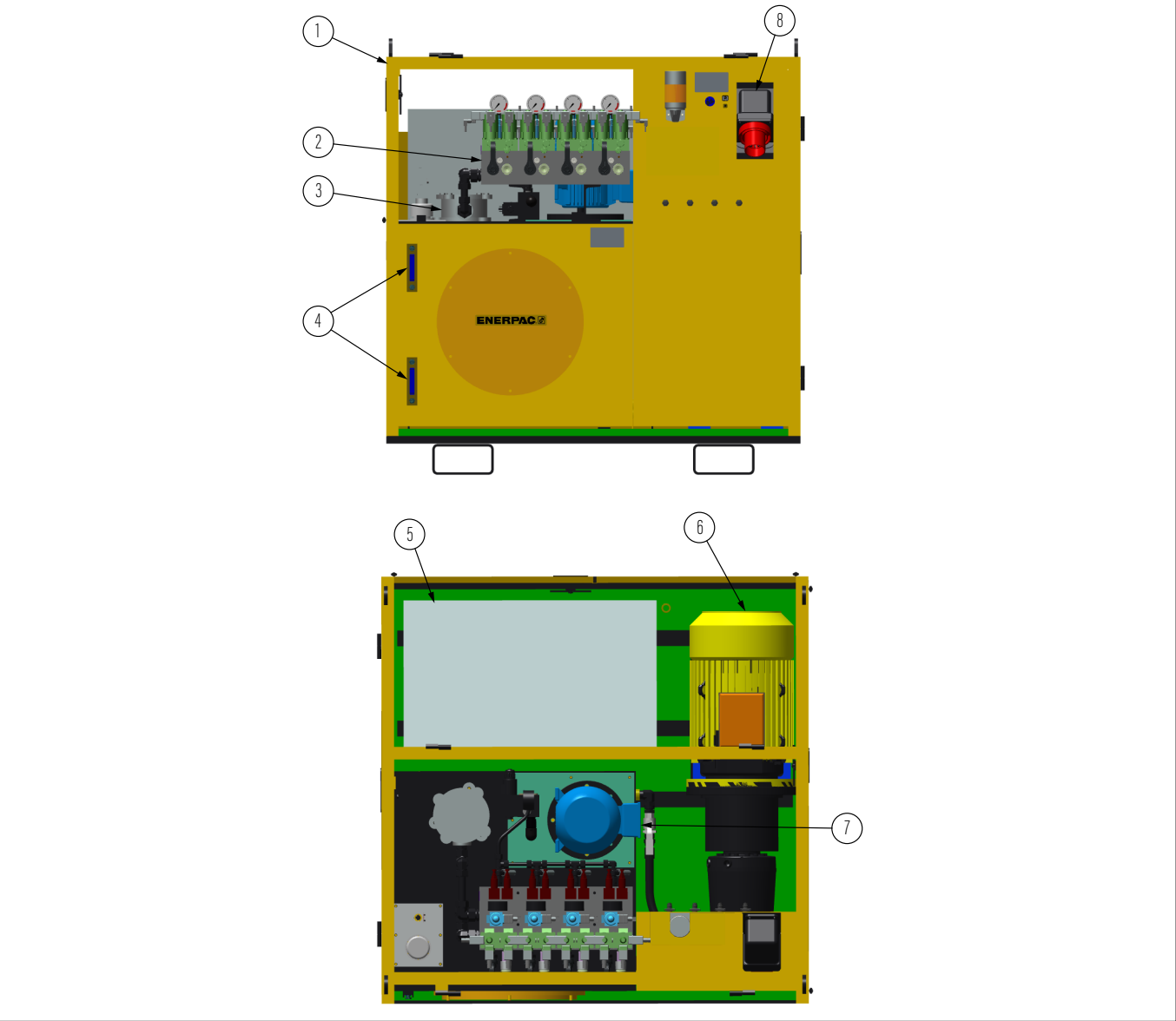


Figure 44: Automatic SHS HPU detailed interior view

11.1.1 Automatic SHS HPU Table of Parts

Item N.º	Description	Qty.	Part Number	
			SHP421AW	SHP421AJ
1	HPU Frame	1	DB0076201-99	DB0076201-99
2	Control Manifold	1	DB9205900	DB9205900
3	Return Filter	1	023-RFM050CD1BB681S	023-RFM050CD1BB681S
4	Visual Level	2	024-FSA127-1X/T/12	024-FSA127-1X/T/12
5	Electric Cabinet	1	SHP421AEC	SHS-EC-421E-A-UL
6	Main Electric Motor	1	DB4383259	DB4383259
7	Auxiliary Electric Motor	1	DB4380259	DB4380259
8	Power Supply Connector	1	SHP421APS	DB06576480

11.2 Automatic HPU Manifold Assembly

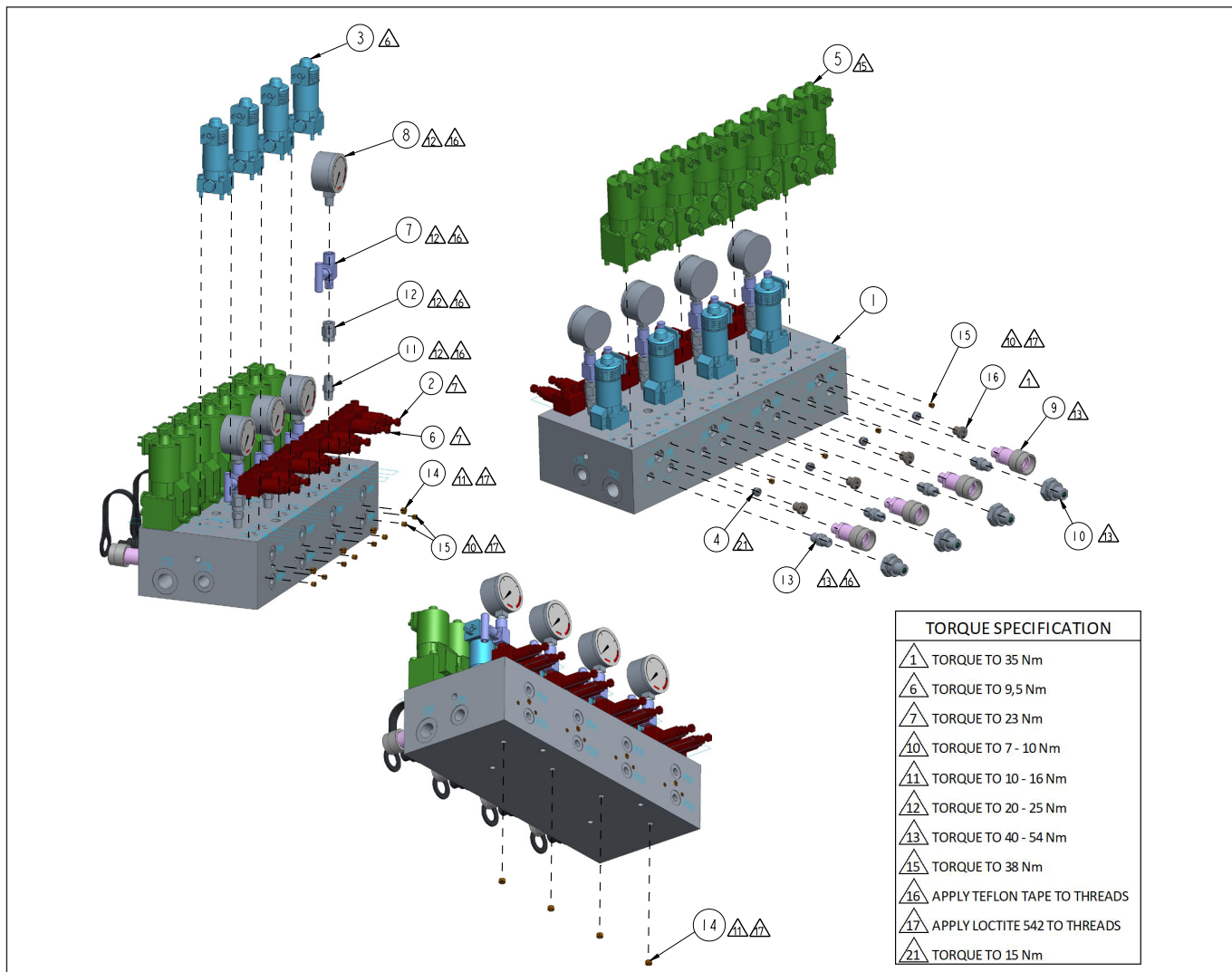


Figure 45: Automatic SHS manifold assembly exploded view

11.2.1 Automatic HPU Manifold Assembly Table of Parts

Item N.º	Description	Qty.	Part Number
1	Manifold	1	B092320840-2
2	Relief Valve	4	MVP4A
3	By-Pass Valve	4	GS2-1-A24
4	Check Valve	4	RK1
5	Distribution Valve	4	G48-22 X24
6	Relief Valve	4	MVP4C
7	Needle Valve	4	NV251
8	Gauge	4	G2536L
9	Female Coupler	4	CR400
10	Male Coupler	4	CH604
11	1/4" Hex Coupler	4	FZ1608
12	Bushing 1/4" NPT	4	FZ1605
13	Nipple 3/8" NPT	4	FZ1617
14	Plug 1/8" NPT	8	A1007245
15	Plug 1/16" NPT	12	A1007245
16	Plug 1/4" BSP	4	0189342100

11.3 Synchoist Cylinder

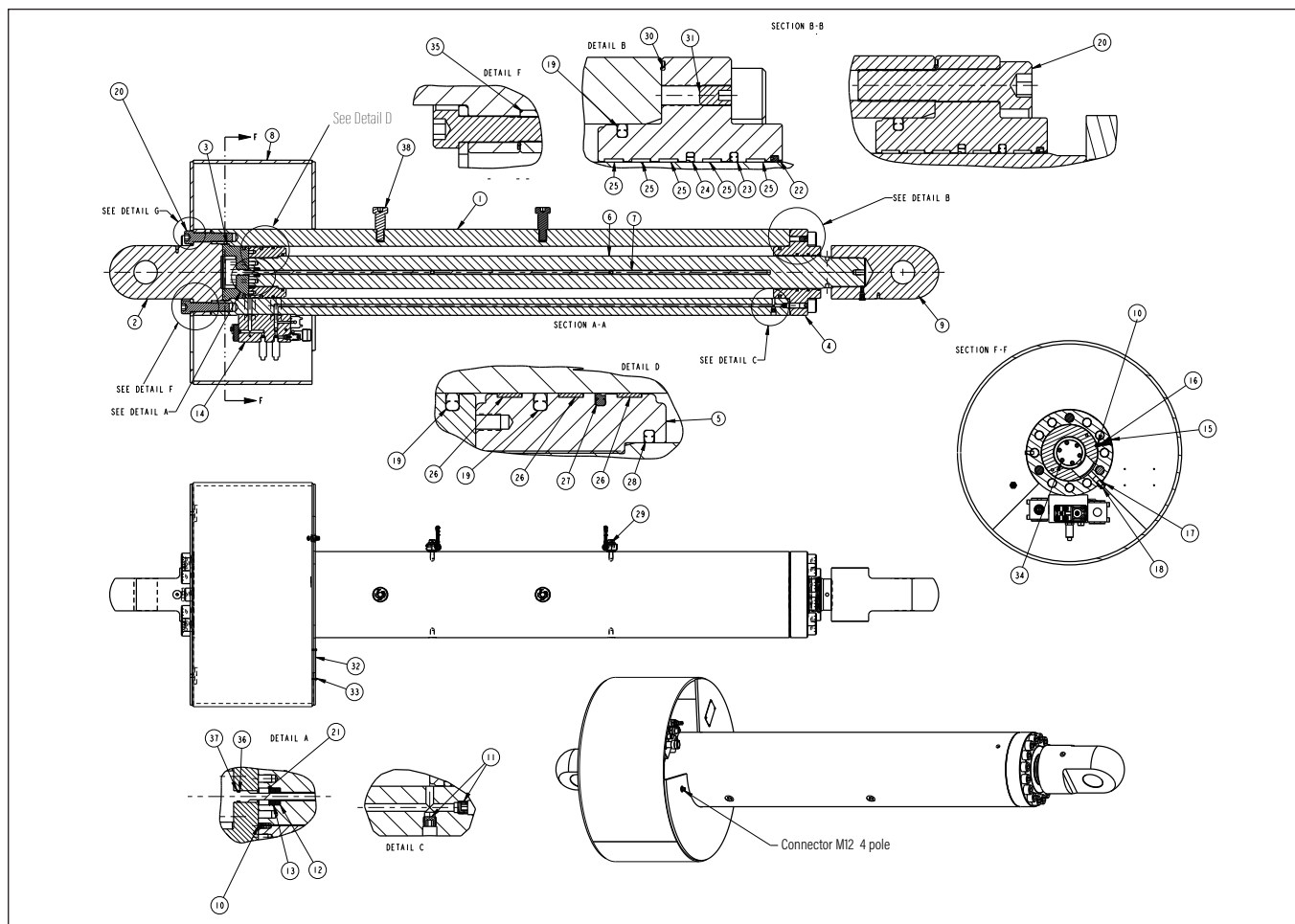


Figure 46: SHC cylinder detailed view

11.3.1 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 M24 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.

11.4 Synchoist Cylinder Distribution Block

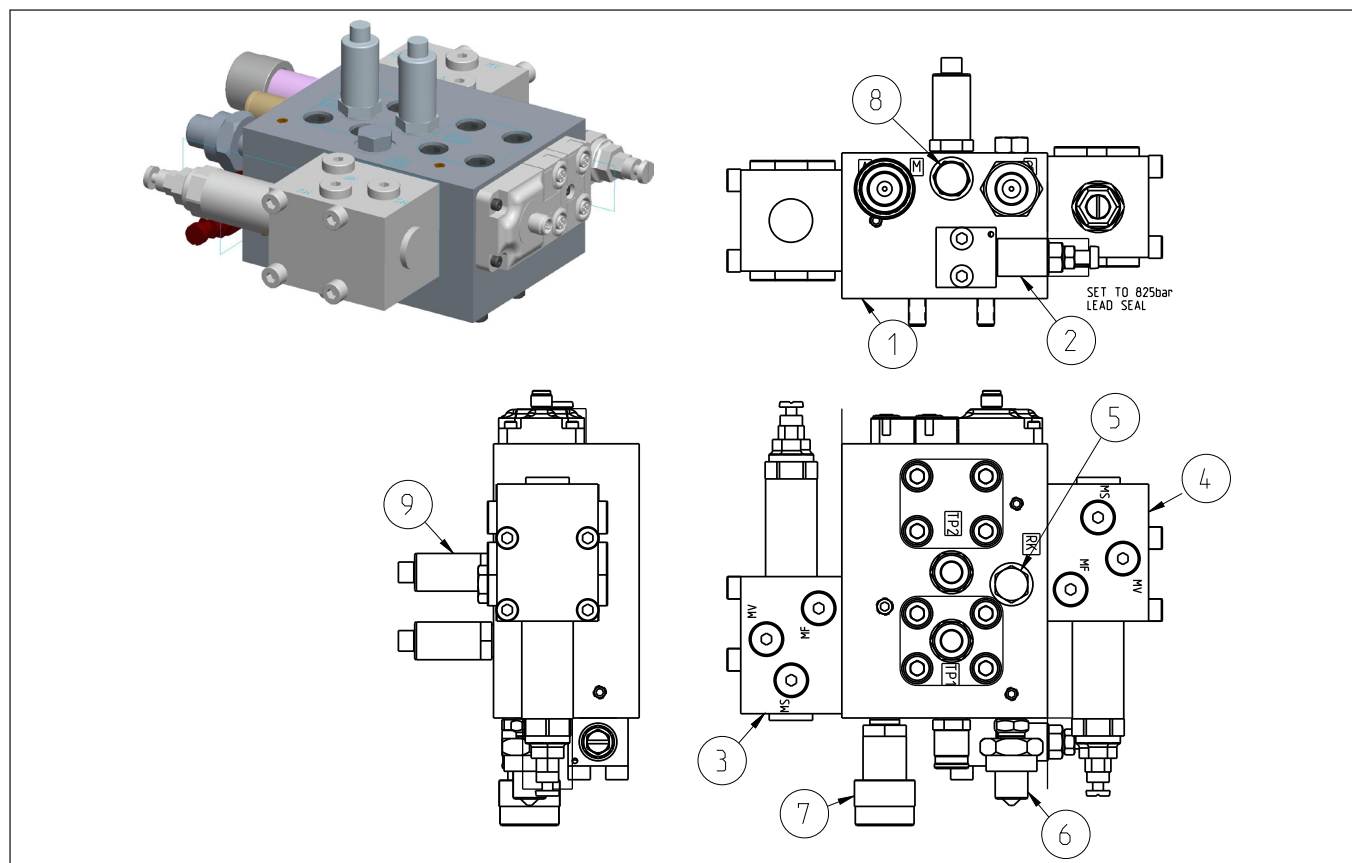


Figure 47: Synchoist cylinder distribution block parts

11.4.1 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	TYPE	POSSIBLE CAUSE	SOLUTION
Motor OFF.	S	A movement has been attempted with the motor powered off.	- Reset the alarm. - Start the motor.
Maximum Cylinder (#) Load.	W	The load withstand by the cylinder (#) has exceeded the entered value in Maximum Cylinder Load parameter.	- Check the parameter, considering the load weight and the cylinder characteristics. If it is incorrect, change it. - Check the cylinder model in spans screen. - Reset the alarm. It only can be reset by entering a parameter bigger than the previous cylinder load.
Cylinder (#) Pressure Signal Failure.	W	The pressure transducer signal of indicated (#) cylinder is not reaching the PLC.	- Visually check the pressure transducer and the cable. - Reset alarm.
Cylinder (#) Stroke Signal Failure.	W	The stroke sensor signal of indicated (#) cylinder is not reaching the PLC.	- Visually check the stroke sensor cable. - Reset alarm.
Inverter Cyl (#) Failure.	S	Inverter Speed error.	- Push Reset Alarms button in the console. - Check inverter.
Synchronization Alarm.	S	In Tilting mode, the Deviation value is bigger than the Stop Tolerance parameter in a single cylinder.	- Check the Stop Tolerance parameter. If it is incorrect, change it. - If it is correct, reset the alarm and continue the cycle. - If the alarm is occurs again, visually check the cylinder. - Check delta values to be sure they are not too exaggerated (e.g. Delta 1: 2 mm / Delta 2: 1000 mm)
Maximum Total Load.	S	The total sum of cylinder loads (selected and non-selected) has exceeded the value entered in the "Maximum Total Load" parameter.	- 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. Ask to the engineer about it. - Reset alarm. The alarm only can be reset by entering a parameter bigger than the Maximum Total Load.
Pump Inlet Valve Closed		This alarm indicate that the Inlet valve is close and the oil does not flow	Open the inlet valve and reset the alarm
Safety stop pendant (pendant mode) Safety Stop cabinet (Local mode)	S	Each alarm shows depending on de mode we are working	Rearm the Stop button and reset the alarm

[illegible]

NOTES

[illegible]

