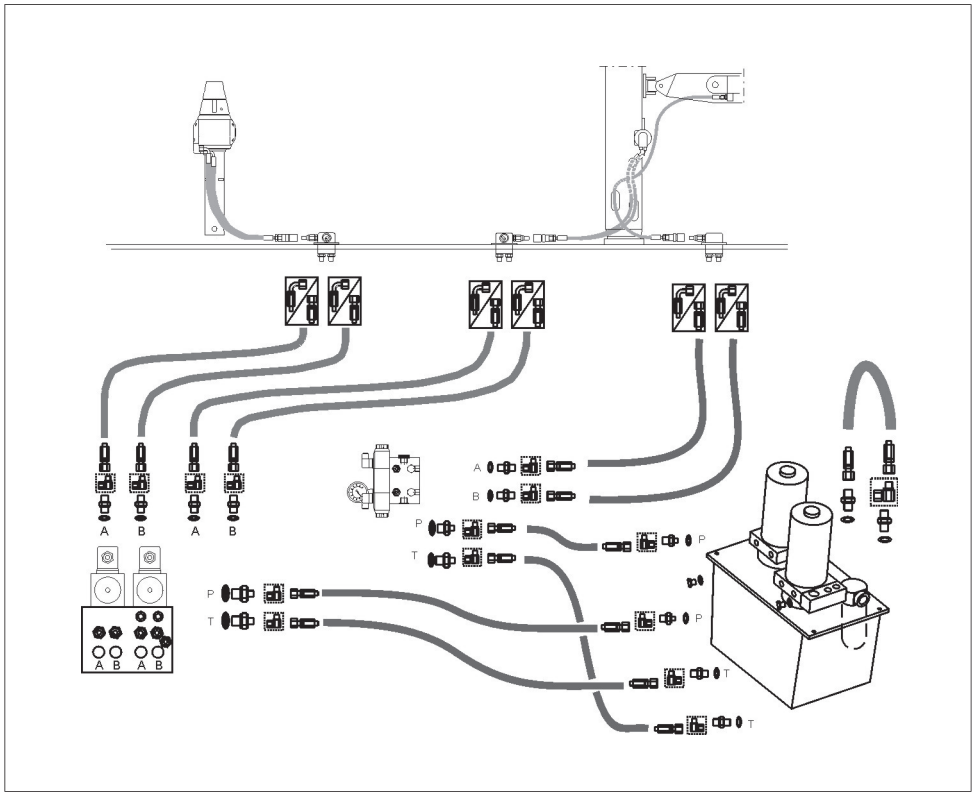
595-922-E
2007-02-15

Manual for
HYDRAULIC ASSEMBLY
(Power pac)



SELDÉN

Contents

INTRODUCTION

The manual

This manual is a guide to Seldén's series of power pacs. It shows how to install and operate the hydraulic pump and motor with reference to both the electrical and hydraulic systems.

Section 1 contains a general description of the hydraulic system.
Section 2 shows how to install the system. Each component is described with advice on positioning, cable dimensions etc.
Section 3 describes how the system components work and includes installation settings for valves plus pressure and flow data for pumps etc.
Section 4 contains the circuit diagrams and hydraulic schematics along with dimensioned drawings for the valve pack and hydraulic assembly.
In Section 5 you will find the drawings of different installation options, showing hoses and couplings in detail. Also included are blank order forms to be completed. The drawings and forms are used to order hoses below deck. Note that these hose sets are optional equipment.

Please see also the respective manuals for the functions that are to be operated using a power pac (e.g. hydraulic Furlex, or hydraulic boom outhaul).

This symbol denotes safety-related information.

1 HYDRAULIC SYSTEM – DESCRIPTION

1.1 General

Seldén's hydraulic assemblies (power pacs) and valve packs have been developed with a view to providing the optimum power supply for Seldén's range of hydraulic products, although they can of course be used to operate motors or cylinders of a different make. In Chapter 3 the capacity of the different assemblies is shown in diagram form. Here you can see which assembly is suitable for operating a winch, for example.

When you purchase a Seldén hydraulic assembly, you purchase a complete system. This comprises a pump complete with motor and reservoir, a valve block with directional valves enabling you to select the function you wish to operate, and a control box for electrical control of the system. Both 12 and 24 volt versions of Seldén's hydraulic assembly and valve block are available: see the summary in Chapter 1.3.

The hydraulic assembly comes in the form of a single or double power pac.
The single power pac is mounted in a cylindrical tank and is designed to supply one function at a time. Often a hydraulic boom outhaul is used at the same time as the furling motor in the mast: in this case two single units will be required. Each unit comes complete with an oil filter, which is fitted on the return line.

The double power pac has two pumps and a motor mounted in a rectangular tank, with a common return filter built into the tank. This assembly takes up considerably less space and can be used for two different operating modes. It can either replace the two single units for operating two functions simultaneously, or the two pumps can be connected for operation in parallel. They then supply one function with a large power requirement at a time (greater oil flow). In this case another single unit will be required if a boom outhaul is also being used.

The valve block for motors has a directional valve for each motor function and comes in the form of a double or a triple block. If more than three functions are required, two blocks can be combined to provide the right number of valves.

Apart from a directional valve, the valve block for the boom outhaul cylinder also has an overcentre valve, which maintains the pressure in the outhaul cylinder even after the powered hydraulic operation has stopped.

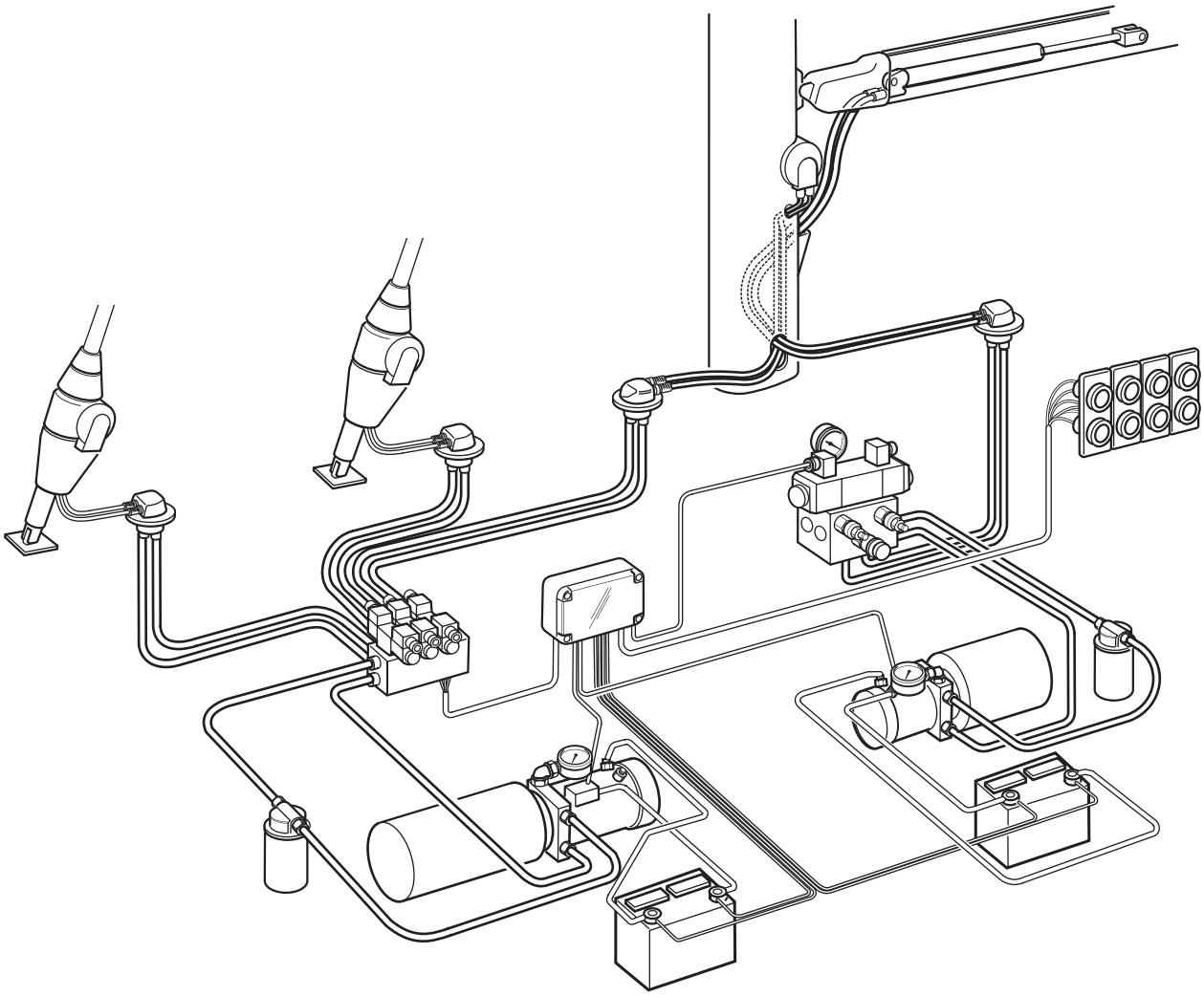
The cables from the control buttons, directional valves and pump motor relays are connected to the control box.

As an optional extra, Seldén offers hydraulic hoses for installing the system below deck. This does not include hoses from the respective application (e.g. furling mast motor) to the deck gland. These are included in the purchase of the mast motor.

Please note that these power pacs are designed for intermittent use, not continuous operation. For more information, see Chapter 3.1.

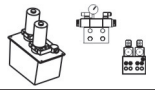
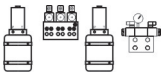
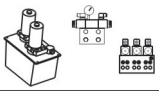
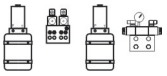
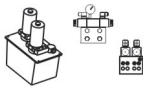
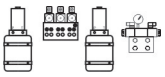
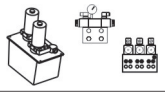
1.2 Hydraulic system on board

The picture shows the basic layout of a hydraulic system on board the boat.
Both single power pacs are fitted horizontally here, but they can also be fitted vertically.

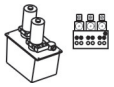


1.3 Hydraulic assembly, valve block and applications – summary

The table below shows the available combinations of Seldén's hydraulic functions and hydraulic assemblies. Please note that there are more variants of the 24V system than of the 12V system.
The HOSE SET column refers to the different hydraulic installation options. See Chapter 5 for the various alternatives. The CIRCUIT DIAGRAM column shows which diagram applies to the installation option in question (see Chapter 4.2).
OML 12.5, OMM20 etc. describe the size of the hydraulic motor.

Mast-system/ Furlex	Hydraulic boom outhaul	Seldén assy nummer and power		Assembly/ Valve Block	Hose set below deck		Circuit diagram
		12v	24v		Keel stepped mast	Deck stepped mast	
No Mastmotor or Furlex	Outhaul only	550-139-41 1.6 kW	550-141-41 2 kW		X	Y	1
Furl. Mast RB/RC (OML12.5) Flx 300 or 400 (OML12.5)	No outhaul	550-140-01 3 kW	550-141-01 2 kW		A	B	2
	With outhaul	550-140-11 3+1.6 kw	550-141-11 2+2 kW		A+X	B+Y	1+2
	With outhaul	XXX	550-143-11 (2+2) kW		C	D	3
Furl. Mast RB/RC (OML12.5) Flx 300 and 400 (OML12.5)	No outhaul	550-140-21 3 kW	550-141-21 2 kW		A	B	2
	With outhaul	550-140-31 3+1.6 kW	550-141-31 2+2 kW		A+X	B+Y	1+2
	With outhaul	XXX	550-143-31 (2+2) kW		C	D	3
Furl. Mast RD (OML12.5) Flx 300 or 400 (OML12.5)	No outhaul	XXX	550-142-01 3 kW		A	B	2
	With outhaul	XXX	550-142-11 3+2 kW		A+X	B+Y	1+2
	With outhaul	XXX	550-149-11 (3+2) kW		C	D	3
Furl. Mast RD (OML12.5) Flx 300 and 400 (OML12.5)	No outhaul	XXX	550-142-21 3 kW		A	B	2
	With outhaul	XXX	550-142-31 3+2 kW		A+X	B+Y	1+2
	With outhaul	XXX	550-149-31 (3+2) kW		C	D	3

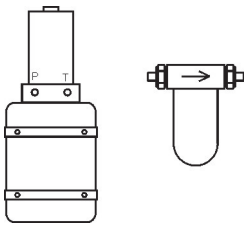
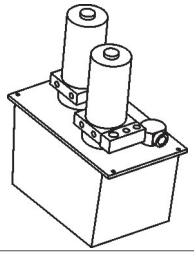
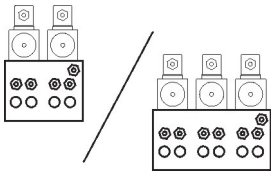
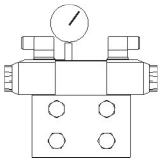
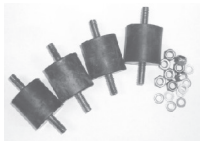
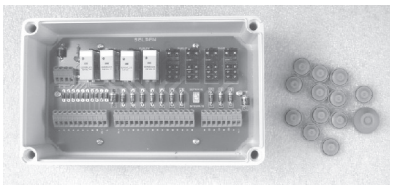
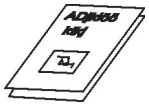
Continued on next page

Mast-system/ Furlex	Hydraulic boom outhaul	Seldén assy nummer and power		Pumps/ Valve block	Hose set below deck		Circuit diagram
		12v	24v		Keel stepped mast	Deck stepped mast	
Furl. Mast RD (OML20)	No outhaul	XXX	550-143-01 (2+2) kW		E	F	4
Flx500 (OMM20)	With outhaul	XXX	550-143-41 (2+2)+2 kW		E+X	F+Y	1+4
Furl. Mast RD (OML20)	No outhaul	XXX	550-143-21 (2+2) kW		E	F	4
Flx 400 and 500 (OMM20) (OMM20)	With outhaul	XXX	550-143-51 (2+2)+2 kW		E+X	F+Y	1+4

1.4 12 volts or 24 volts?

The battery charging generator on the boat's engine determines whether a 12V or 24V assembly is required. In general, 24V assemblies require lower currents, allowing longer cables can be fitted or a smaller cable area installed.

1.5 Checklist

Illustration	Qty	Notes
		Single powerpac Check voltage, 12/24V 1 filter unit for each single power pac
		Double powerpac Check voltage, 12/24V The tank has a built-in filter
	1	Valve unit for hydraulic motors Check voltage, 12/24V
	1	Valve unit for hydraulic boom outhaul Check voltage, 12/24V
	4	Four dampers for each power pac (single or double), including. 8 M8 nuts & washers
	1	Controlbox including 2 relays for each function) Check voltage of relays, 12/24V
	1 1	Manual for Hydraulic Assembly 595-922-E 595-922-S

2. INSTALLATION

2.1 General

Both the electrical and hydraulic systems should be professionally installed.

Find the table in Chapter 1.3. Start by identifying the complete hydraulic installation that applies to the vessel. Then identify the relevant circuit diagram(s) and hose set(s).

Prior to installation, determine where the various components are to be fitted in the boat. A general rule of thumb is to position all units where they will be protected against the effects of moisture and physical damage.
The following is a guide to positioning etc of the system components during installation.

2.1.1 Control buttons

It goes without saying that the control buttons should be easily accessible in the cockpit. One solution is to mount the buttons on the wheel pedestal, with the **OUT** buttons on the starboard side and the **IN** buttons on the port side. The buttons are then within reach of both the helmsman and crew and the risk of confusion is reduced. **NB:** The hydraulic boom outhaul and the furling mast hydraulics are two separate systems that are operated simultaneously when furling and unfurling. To be able to operate these with **one hand**, the two **OUT** buttons must be mounted close to one another. The same applies to the two **IN** buttons.
The control buttons have integral illumination so that they can be seen more easily in the dark. They are completely water-tight from the outside.
See fig. 2.1.b below for mounting dimensions and location of the mounting holes.
See the circuit diagram in Chapter 4.1 and 4.2 for connection of the electrical system.

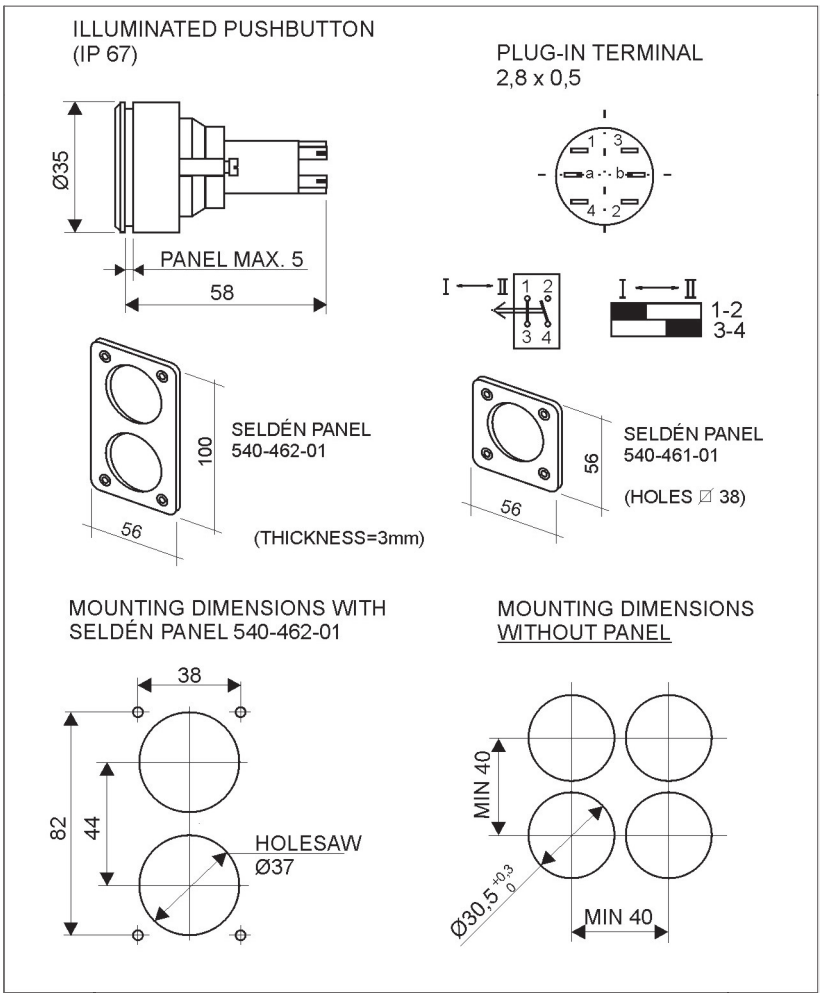


Fig. 2.1.a

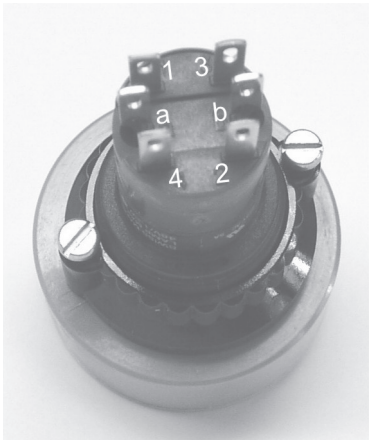


Fig. 2.1.b

2.1.2 Control box

To make control of the functions easier, the control box should be fitted close to the hydraulic valve unit.
The power supply to the box is normally taken from the boat's electrical panel via a standard switch and fuses. The picture shows the control box fitted with relays for the furling mast motor and Furlex1 functions. The relay positions for the boom outhaul and Furlex2 are empty. Fit the box aligned as in the fig 2.1.2.a.
Height including lid = 100 mm.

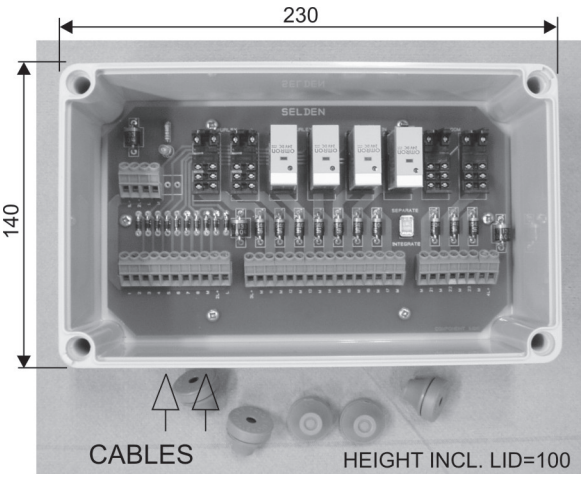


Fig. 2.1.2.a

On installation the changeover switch in the control box is set to the **separate** position. See the manual for the hydraulic boom outhaul (595-091) for more information.

The complete electrical drawings can be found in Chapter 4.1.
A simplified circuit diagram is shown in Chapter 4.2.
The summary table in Chapter 3.1 indicates which simplified diagram(s) applies/apply (E1, E2 etc).

2.1.3 Hydraulic assembly

The hydraulic assemblies come either as single or double power pacs.

The single power pac is mounted on a cylindrical steel tank, which has frames with attachment holes. The unit can be mounted horizontally or vertically. If mounted horizontally, the tank is aligned fore and aft. The assembly comes in different sizes and as a 12 or 24 V assembly. All single power pacs have an identical tank with a maximum recommended filling volume of 9 litres (9.5 litres when mounted horizontally). A drain plug is located at the bottom, diagonally opposite the filling hole.

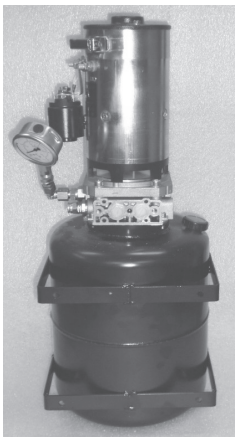


Fig. 2.1.3.a

The double power pac is mounted on a rectangular aluminium tank with a lid of steel plate that projects longitudinally. Here four fastening holes have been provided. These are fitted with rubber pads with M8 screws and locking nuts, see adjacent picture. Double power pacs are available in various sizes, but only as 24 V units. The tank is identical for all double power pacs and has a maximum recommended filling volume of 14 litres.

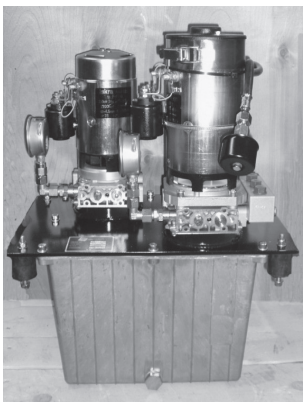


Fig. 2.1.3.b

The two pumps and their motors are either operated individually or connected in parallel to produce double the flow.
If the pumps are operated individually, the left-hand pump (1) is used for the boom outhaul and the right-hand pump (2) for the Furlex etc.
The fig: 2.1.3.c shows the double power pac from above. The filter (3), oil filler (4), oil dipstick (5) and connection for the venting hose (6) can also be seen here.
In the photo a drain plug for the oil is also visible at the bottom of the tank.

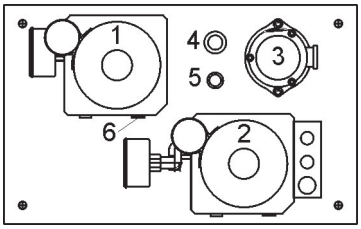


Fig. 2.1.3.c

Single and double power pac

The hydraulic assembly can be positioned anywhere on board the boat. When operating, the motor generates heat. Ensure that the chosen location will have adequate ventilation . Installing it close to the mast means that only short hydraulic hoses are required and so there will only be a slight pressure drop in the hoses. Placing it close to the batteries means short electrical cables and thus a small cable area. Short cables also reduce the risk of short-circuit in the event of physical damage.

When installing the hydraulic assembly, bear in mind that it needs to be easily accessible for draining and refilling the oil, changing the filter, adjusting the working pressure valve etc.

To reduce the propagation of noise within the boat to a minimum, use the enclosed rubber pads when installing the unit.

A venting hose roughly 0.6 m long is fitted to each tank. This must be connected and positioned so as to discharge as high above the tank as possible. It must **not** be positioned such that a "water trap" is formed.

See Chapter 4 for drawings containing the installation dimensions for both single and double pumps.
See Chapter 4.1 for installation of the electrical and hydraulic systems.

Warning: Never operate the hydraulic assembly without oil in the tank.

Connecting the motor cable

To connect the power supply to the pump motor, fit crimp terminals with holes for M8 screws.

Deciding on the cable area/cable length

The tables below show Seldén's recommended cable dimensions for each pump motor and operating mode.
The following formula is used to calculate the maximum cable length:
Lmax = (cable area x voltage drop) / (0.017 x current)

-Lmax: 2 x cable length between battery and pump motor in m (thus combined length of positive and negative cable).
-cable area: expressed in mm2
-the voltage drop is set to 0.6V for a 12V system and 1.2V for a 24V system (equivalent to 5%).
-0.017: factor dependent on the conductor material. 0.017 applies to copper conductors
-current value: from diagram for pump characteristic in Chapter 3.2, expressed in A

Minimum cable area for 12V is set at 50 mm2 and for 24V at 35 mm^2.

1,6 kW 12V

Maximum working pressure (bar)	Max current (A)	Cable area (mm$^{2)}$)	L max (m) 2x (battery – pump)
100	250	50	7
		70	10
		90	12,5
130	300	50	6
		70	8
		90	10,5
		120	14
160	350	50	5
		70	7
		90	10
		120	12

3 kW 12V

Maximum working pressure (bar)	Max current (A)	Cable area ($mm^{2)}$)	L max (m) 2x (battery – pump)
140	320	50	5,5
		70	7,5
		90	10
		120	13

2 kW 24V

Maximum working pressure (bar)	Max current (A)	Cable area ($mm^{2)}$)	L max (m) 2x (battery – pump)
100	120	35	20,5
130	150	35	16,5
140	160	35	15
		50	22
160	175	35	14
		50	20
		70	28

3 kW 24V

Maximum working pressure (bar)	Max current (A)	Cable area ($mm^{2)}$)	L max (m) 2x (battery – pump)
140	150	35	16,5
		50	23,5

2.1.4 Valve block for motors (Furlex etc)

The valve block has been specially designed and is manufactured from aluminium. The block contains cartridge-type valves. The blocks come in two versions, designed to operate two or three hydraulic functions on board depending on the number of sections. Several valve blocks can be connected in parallel if you wish to operate other hydraulic applications in addition to the furling mast motor and two Furlex units.

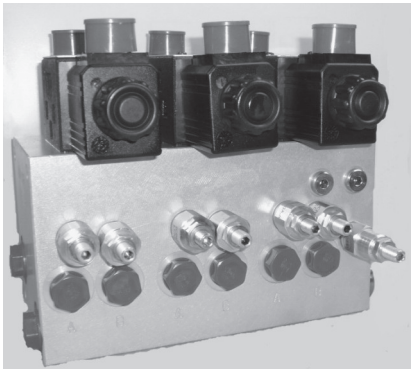


Fig. 2.1.4.a

On the front of the valve block are valves for regulating the pressure and flow. When installing the block, ensure that these valves remain accessible for adjustment. The valves are preset on delivery.

To make control of the functions easier, it is best to fit the valve block and control box close to one another.

The fig. 2.1.4.a on the right shows a 3-function valve block.

The valve block functions are described in greater detail in Chapter 3.3.
Chapter 4 contains drawings showing the installation dimensions.
See Chapters 4 for electrical circuit diagram and hydraulic schematics.

2.1.5 Valve block for boom outhaul cylinder

This valve block has been specially designed to operate the hydraulic boom outhaul. It is manufactured from aluminium and features cartridge-type valves.
Located on the front of the valve block are the overcentre valves (preset on delivery) and one emergency valve. There is also space for two flow control valves (optional). When installing the block ensure that these valves remain accessible for adjustment.

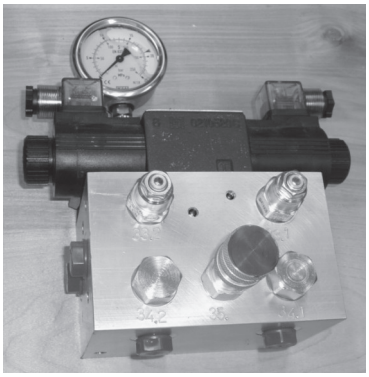


Fig. 2.1.5.a

To make control of the functions easier, it is best to fit the valve block and control box close to one another.

The valve block functions are described in greater detail in Chapter 3.4.
Chapter 4 contains drawings showing the installation dimensions.
See Chapters 4 for electrical circuit diagram and hydraulic schematics.

2.1.6 Oil filter

The double power pac has an **oil filter built into** the lid. This is a common filter for both pumps.

A spin-on type filter is supplied for the single power pac, see adjacent picture. This is designed to be fitted on the return line. Two holes (cc40mm) with internal M8 threads are provided for this purpose. Note that the flow direction is indicated by arrows on the filter casing.

See Chapter 3.5 for further information on the oil filter.
See Chapter 4 for hydraulic schematics.

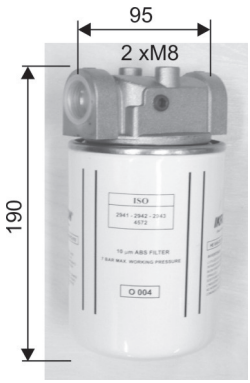


Fig. 2.1.6.a

2.1.7 Hydraulic hoses below deck (optional)

(Every hydraulic application from Seldén (Furlex, boom outhaul etc) comes complete with hydraulic hoses, quick couplings and a deck gland. If the mast is keel stepped, the hoses emerge at the foot of the mast and are terminated by quick couplings. The quick couplings and other fittings on these hoses are made from stainless steel.)

Other hydraulic hoses (hoses below deck) and couplings can be ordered from Seldén as an optional extra. These hoses have couplings of yellow chromated or zinc-plated carbon steel. However, where the hoses connect to a deck gland or to the mast foot, acid-resistant fittings are used.
See the table in Chapter 1.3 to find the correct HOSE SET (A, B, X, Y etc). The relevant drawings can be found in Chapter 5. The adjacent illustration shows an example. Each drawing also includes a form for noting the hose length and choice of couplings (see below).

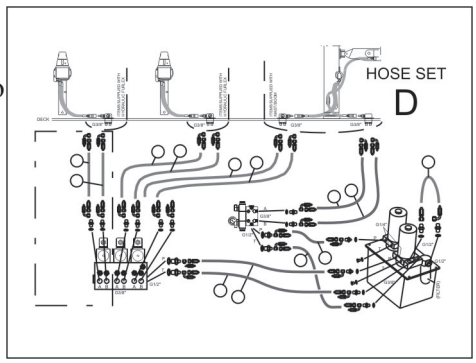


Fig. 2.1.7.a

To calculate the dimensions of hydraulic hoses below deck (optional):
Fit all components in their final positions before working out the length of each hose and noting this on the form in Chapter 5. Note that a minimum bending radius of 125 mm is permitted for 3/8” hose. For ½” hose the corresponding value is 175 mm.
All hoses are provided with crimped straight couplings with swivel nuts. A 90o adapter can be ordered as an optional extra (the adapter has a nipple at one end and swivel nut at the other). Where the hoses connect to deck glands a choice is made between straight or angular crimped couplings.

When installing the hoses it is very important to not twist the hose. A twist of the hose will create internal tensions and shorten the working life of the hose. If the hose is twisted 25°, the working life will be reduced by 90%. Bear this in mind and plan carefully for installation of each hose, and each choice of couplings.

All hydraulic hoses on board must be firmly attached and must not under any circumstances come into contact with any sharp edges that could damage them. Bear in mind that the hose vibrates and moves around to some extent when pressure is applied. Seldén recommends fastening the hoses with rubber clips spaced 400-500 mm apart.

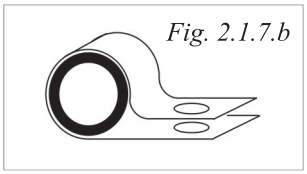


Fig. 2.1.7.b
Rubber clip

WARNING: A hydraulic hose with crimped couplings is **not particularly flexible**, so it is very important to specify the correct length. The form in Chapter 5 explains *how* the hose length is measured out when the hose is manufactured later. You should use this method of measurement. **If measurement is difficult, it is best to order slightly longer hoses with one end open. Then cut the hose to the correct length on board and have the loose coupling crimped on at a local workshop.**

It is very important not to allow any impurities to enter the hydraulic system during fitting. Clean all hoses carefully and use protective plugs on all open ends during installation. Use the enclosed protective plugs for the quick couplings as soon as the couplings are removed.
If hoses are purchased from another supplier, make sure that you use good-quality hydraulic hose that conforms to SAE 100R7/DIN 24951. See pump curves in Chapter 3.2 for maximum working pressure.

2.1.8 Hydraulic oil

A high-quality mineral hydraulic oil is used in the system. Please note that the cylinder of the hydraulic boom outhaul is filled with this type of oil on delivery. See the manual for the hydraulic boom outhaul (Seldén manual no. 595-091, Chapter 7) for the make and type of oil used in the cylinder. Also note that different types of oil must not be mixed. For example, mixing mineral oil with bio-oil.

If the assembly operates a cylinder (boom outhaul) the oil level is checked when the cylinder is in the compressed position, BOOM OUT. (When the cylinder is in its outer position the volume of the piston rod is replaced by oil and the tank oil level will be a little lower. The volume of the piston rod varies between 0.8 and 1.3 litres depending on the stroke of the cylinder, 1800-2600 mm)

The double power pacs are fitted with an oil dipstick with a mark for 14 litres. The single power pac comes with a separate oil dipstick, with a mark for 9 litres. To fill oil or to check the oil level, the venting hose must first be removed. The correct measurement for the oil level is when the dipstick is inserted as shown in the illustrations. Note that the oil dipstick should not be screwed down.

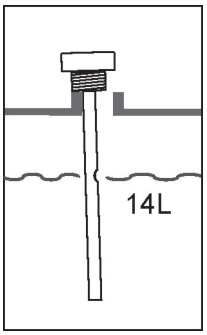


Fig. 2.1.8.a
Double power pacs

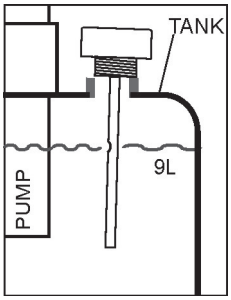


Fig. 2.1.8.b
Single power pac vertical installed

When a single power pac is horizontally installed the oil level should reach the top of the pump housing. If a drop of oil is visible on the tip of the dipstick, the level is correct. As an alternative you can check that the oil is at pump housing top level by using a torch. At this level reference the tank contains 9.5 litres of oil.

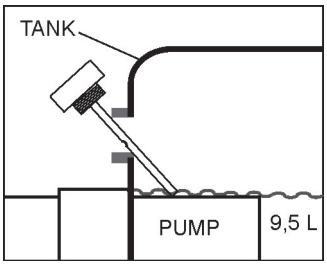


Fig. 2.1.8.c
Single power pac horizontally installed

Warning: Be careful not to allow any impurities to get into the hydraulic system. When the quick couplings are removed, protect these using the plugs or caps provided.

3. HYDRAULIC ASSEMBLY – OPERATION

The basic mode of operation of the assembly is shown in the hydraulic schematic in Chapter 4.3.
The hydraulic assembly consists of three separate units, a pump unit, a valve unit and a filter. The assembly is rated to drive one function at a time. Several functions can each be driven individually if the pressure and flow produced by the pump unit are sufficient for the respective function.

3.1 Hydraulic assembly

The electric motor of the assembly is rated for intermittent use. If used continuously, the motor temperature will rise until the integral temperature sensor interrupts the control circuit to the starter solenoid and the motor stops. The temperature sensor closes the circuit again automatically when the motor temperature has dropped. When operating at 140 bar, it is possible to run the power pac for 3-5 minutes before the temperature rises and the circuit is cut. When operating the unit at a lower pressure, the running time will be extended.
In heavy weather conditions the pressure can rise to 130-140 bar when furling the sail. In normal use the operating pressure is lower. In all circumstances we recommend the motor is allowed cool between furling operations.

The electric motor drives a hydraulic oil pump located inside the oil reservoir.
Motor, pump and reservoir are connected via a manifold.
The pump line is connected to the P-port of the manifold and the return line to the T-port. On the double unit, the T-port of the manifold is plugged and the return lines are routed together to the tank via an aluminium block and the built-in filter.

A manometer and a pressure relief valve are fitted on each manifold. This pressure relief valve is set on delivery and the setting must not be changed.
If the load on the motor or cylinder should increase excessively (for example, when furling the genoa without slackening the sheet), the pressure in the system increases. When it has reached the set value, the pressure relief valve opens and the oil is pumped directly back to the tank. The valve is also called the system pressure valve or the working pressure valve. The adjacent picture shows the adjusting screw (2) with the cap nut (1) removed. Also shown in the fig. 3.1.a are the sealing washer (3) and locking nut (4).

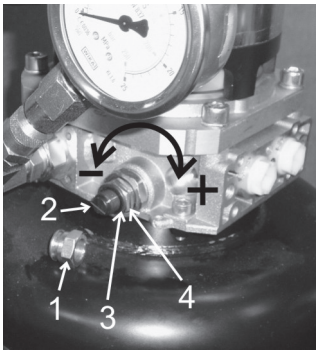


Fig. 3.1.a

3.1.1 Weight table, hydraulic assembly

	Motor/tank	Weight excl. oil (kg)
12V	1,6 kW/9l	16
	3 kW/9l	20
24V	2 kW/9l	16
	3 kW/9l	21
	2+2 kW/16l	37
	2+3 kW/16l	43

3.1.2 Pressure relief valve on assembly for boom outhaul cylinder

On the unit that operates the boom outhaul cylinder, the pressure relief valve is set to between 100 and 160 bar on delivery depending on the size of the boom. See “Hydraulic Schematic Boom Outhaul”, Chapter 4.3.2. The pressure relief valve is designated 2.4 in the schematic. Seldén’s manual for the hydraulic boom outhaul (595-091) explains in detail how to change the value set on the pressure relief valve if necessary.

3.1.3 Pressure relief valve on assembly for hydraulic motors (Furlex etc)

The pressure relief valve on the hydraulic assembly that operates Seldén's hydraulic motors (Furlex etc) must always be set to 140 bar (set on delivery). If the value needs adjusting, this is done as follows:

1. Disconnect the quick couplings on the hydraulic hoses from Furlex1 at the deck gland. Place protective plugs/ caps on the couplings.

2. Press the FURLEX IN button briefly for 2 to 3 seconds. The electric motor and hydraulic pump are now put under maximum load. All the oil is pumped through the pressure relief valve back to the reservoir.

3. The manometer on the assembly shows the current pressure. One person reads off the manometer at the same time as another person presses the control button.

4. The illustration in Chapter 3.1 shows the pressure relief valve of the hydraulic assembly. Unscrew the cap nut (1) for the pressure relief valve adjusting screw (2). Be prepared for a little oil leaking out of the adjusting screw, as the cap nut and accompanying sealing washer (3) act as a seal for the adjusting screw. Loosen the locking nut (4) of the adjusting screw.
   Set the desired pressure using the relief valve adjusting screw.
   Clockwise rotation (+) = pressure increases
   Anti-clockwise rotation (-) = pressure decreases.

5. If the pressure is too high from the start: Unscrew the adjusting screw in an anti-clockwise direction (-) a few turns. Start the assembly (see 2) and read off the manometer, which should now show a value that is too low. Then increase the pressure (+) to the desired value.

6. Tighten the locking nut (4), fit the sealing washer (3) and cap nut (1). Tighten this so that the valve is sealed.

7. Check the maximum pump pressure set once more on the manometer by starting the assembly once as indicated in 2

8. Reconnect the quick couplings from Furlex1 to the deck gland.

The higher the value for the pressure relief valve, the higher also the maximum current consumption, which determines the dimensions of the electrical cables. Chapter 3.2 includes pump curves showing the relationship between the pressure, flow and current value for the various assemblies.

3.2 Pump curves

In the diagrams you find the points where the pressure relief valve opens. This indicates the maximum current value that will be achieved in the system. This pressure value is set at delivery to fit the actual hydraulic application/s in your boat. Note that the power pacs are designed for intermittent operation, for more information see Chapter 3.1.

3.2.1 Unit 12V, 1.6 kW

This pump is always fitted in a 9-litre tank and is only used for the boom outhaul.

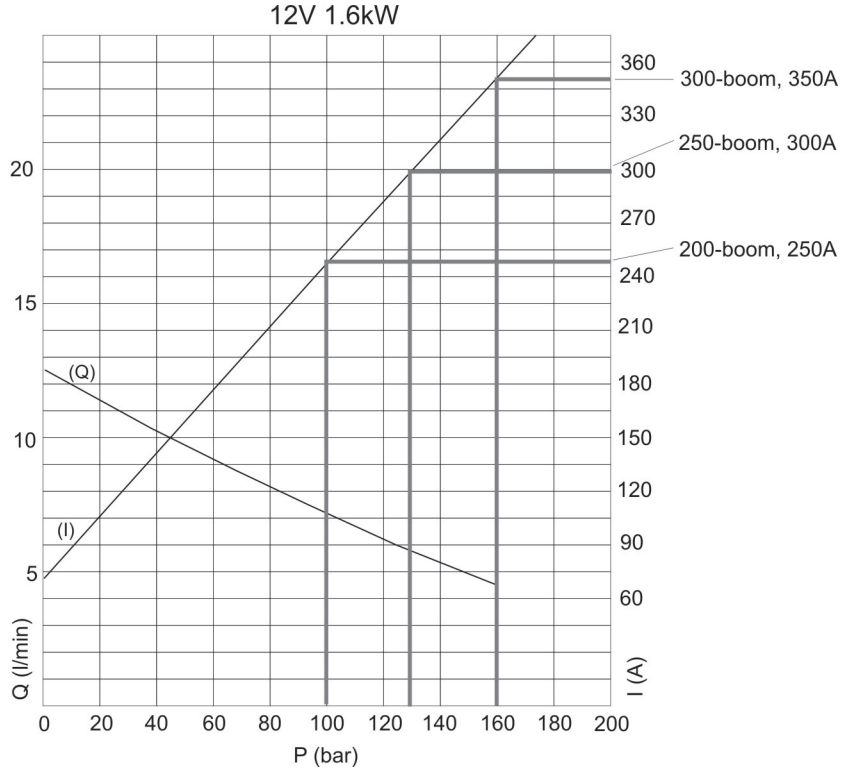


Fig. 3.2.1.a

3.2.2 Unit 12V, 3 kW

This pump is always fitted in a 9-litre tank and is used for functions with hydraulic motors such as the furling mast motor and Furlex.

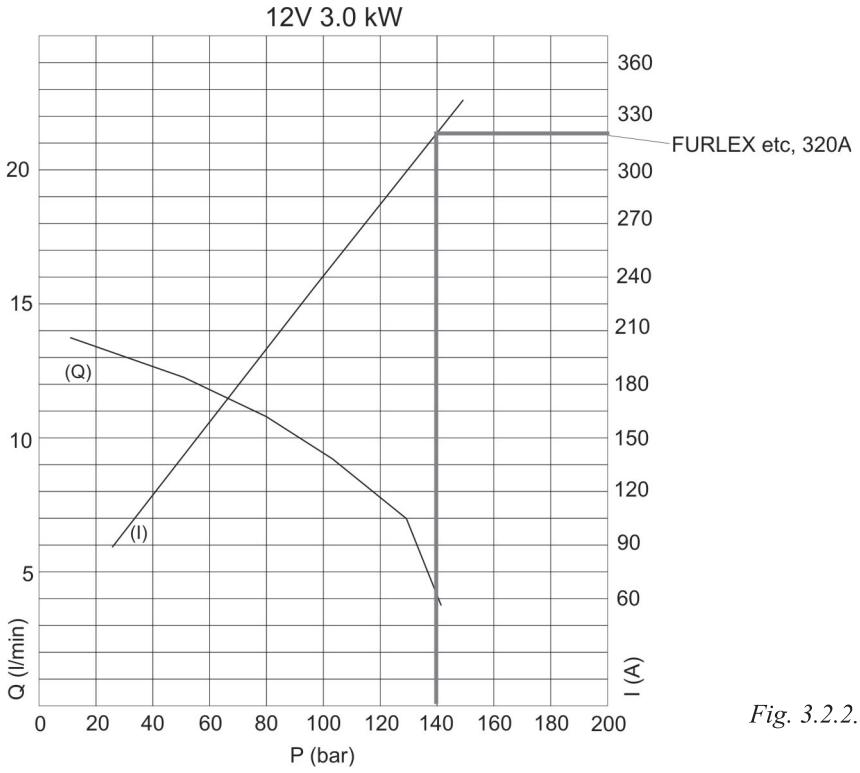


Fig. 3.2.2.a

3.2.3 Unit 24V, 2 kW

This pump comes both as a single unit fitted in a 9-litre tank and as a double unit fitted in a 14-litre tank. It operates either motor applications or the boom outhaul cylinder.

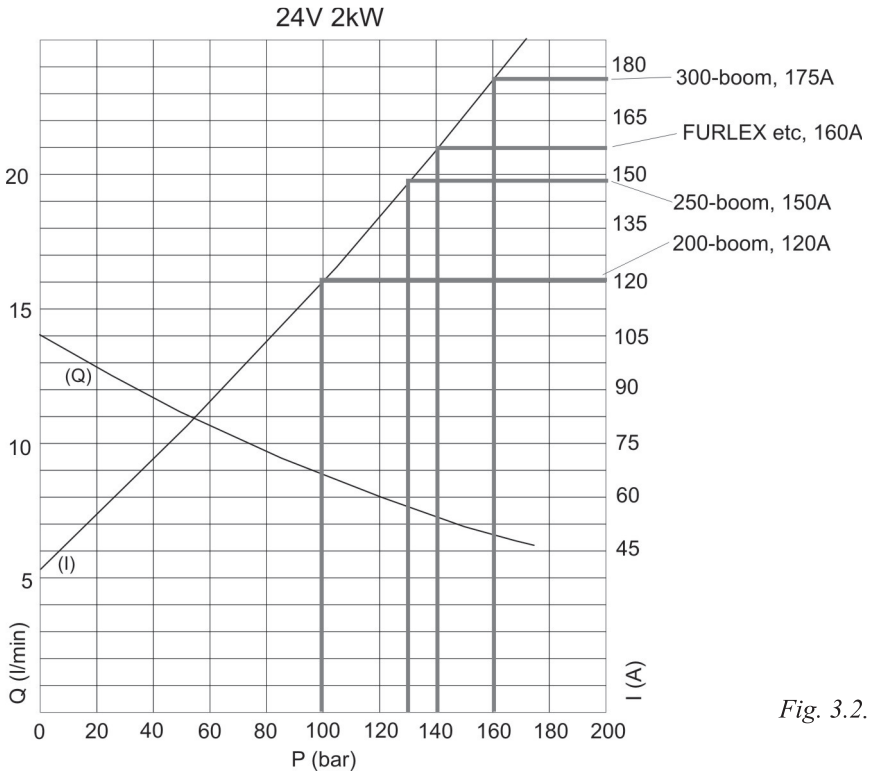


Fig. 3.2.3.a

3.2.4 Unit 24V, 3 kW

This pump comes both as a single unit fitted in a 9-litre tank and as a double unit fitted in a 14-litre tank. It only operates motor applications.

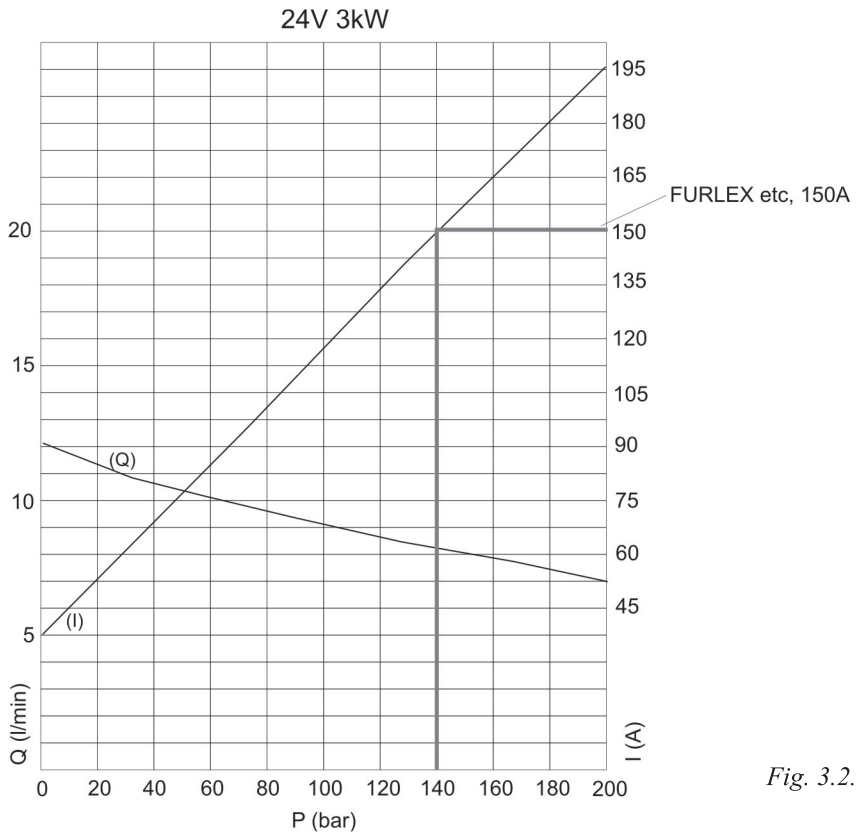


Fig. 3.2.4.a

3.3 Valve unit for hydraulic motors

The fig 3.3.a on the right shows a 2-function valve unit for hydraulic motors. This has a flow control valve for each A- and B-port (1-4 in the picture).
Adjusting these influences the flow of oil and thus the speed for each function.
The B-port of the furling mast motor also has a pressure relief valve (5).

A directional valve is located on the top of the valve unit for each function.

The functions of the valves are described in the following Chapters (3.3.1 – 3.3.3).

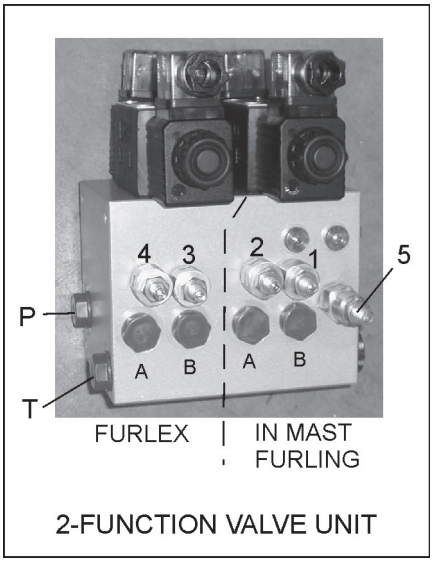


Fig. 3.3.a

3.3.1 Directional valve

The valve changes the direction of the oil flow to the motor, causing it to rotate in one direction or the other. The valve is controlled by the MAIN OUT and MAIN IN buttons and has an electromagnetic actuator on each side. The electrical contacts for the respective actuator are fitted with LEDs, which illuminate when the control button is pressed in. The valve can also be opened manually to release residual pressure by pressing the button that lies at the respective end of the valve (see arrows in fig. 3.3.1.a below).

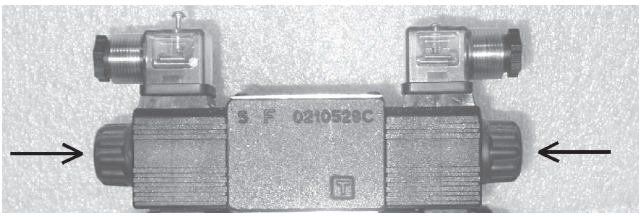


Fig. 3.3.1.a

3.3.2 Flow control valve

This valve can be used to adjust (reduce) the speed of the motors individually for each function. The valve is set to the maximum speed/flow on delivery. It also has an integral check valve that permits oil to flow freely back into the tank, even if the valve is heavily restricted in the other direction.
NOTE: Heavy restriction will cause high power losses.

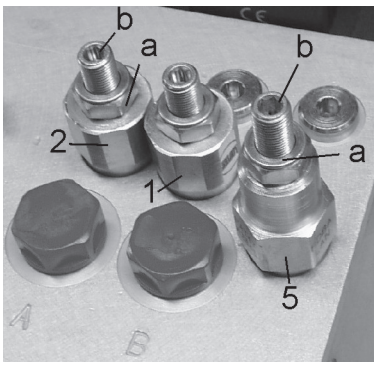


Fig. 3.3.2.a

The fig. 3.3.2.a shows two flow control valves designated 1 and 2. The setting is changed as follows:
Hold the adjusting screw (b) in place using an Allen key and loosen the locking nut (a).
To **reduce** the flow, turn the adjusting screw (b) **clockwise**.
To **increase** the flow, turn the adjusting screw (b) **counter-clockwise**.

3.3.3 Pressure relief valve

The picture shows the pressure relief valve (5). This valve can be used to reduce the maximum pressure to the furling mast motor. The valve is set to the correct value on delivery.
(On the RC and RD furling system, the valve is set to max. The pressure is the same hydraulic assembly, i.e. 140 bar. For an RB system the valve is set to 120 bar.)

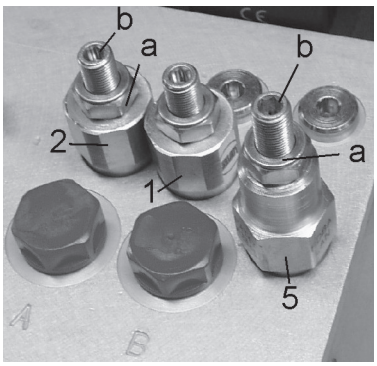


Fig. 3.3.3.a

If the setting should need to be changed for any reason, this is done as follows:
Hold the adjusting screw (b) in place using an Allen key and loosen the locking nut (a).
To **reduce** the pressure, turn the adjusting screw (b) **counter-clockwise.**
To **increase** the pressure, turn the adjusting screw (b) **clockwise**.

Then hold the adjusting screw (b) in place once more and tighten the locking nut (a).

Note: This unit is not equipped with a manometer. If the pressure is adjusted, the new value has to be checked at the associated A- or B-port. One way to do this is to release the hoses from the mast motor at the quick-couplings and then attach a manometer in this point.

3.4 Valve unit for hydraulic boom outhaul

All the adjustable hydraulic valves in this unit have been set on delivery to suit your boat. You should not normally need to make any adjustments. The only valve that you should have any reason to move is the emergency valve. For more detailed information on how the system operates, the valves and their functions are described below. Pos. 33.1 etc refer to the "Hydraulic Schematic for Boom Outhaul", Chapter 4.3.2, and to the adjacent fig. 3.4.a. For a more detailed description of how the valve unit works, see the manual for the hydraulic boom outhaul (595-091).

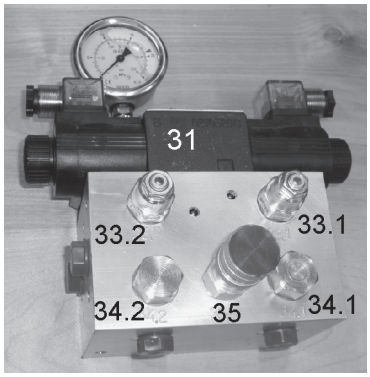


Fig. 3.4.a

3.4.1 Directional valve, pos. 31

The valve changes the direction of the oil flow to the hydraulic cylinder, causing it to move out or in. The valve is controlled by the BOOM OUT and BOOM IN buttons and has an electromagnetic actuator on each side. The electrical contacts for the respective actuator are fitted with LEDs, which illuminate when the control button is pressed in. The directional valve can also be operated manually to release residual pressure by pressing the button at the respective end of the valve (see arrows in fig. 3.3.1.a below).

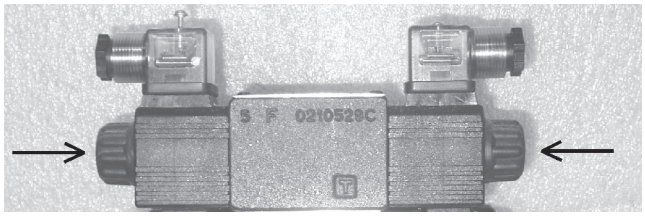


Fig. 3.3.1.a

3.4.2 Overcentre valve, pos. 33.2

The overcentre valve holds the hydraulic cylinder in position during sailing. It also safeguards against overloading the mainsail. On delivery the valve is set to a certain pressure depending on the boom size – see "Hydraulic Schematic for Boom Outhaul", Chapter 4.3.2. If this pressure is exceeded, for example if a very strong squall hits the sail, the valve opens automatically and slackens off the outhaul line so that the load on the sail does not exceed the set value. This is a signal that the mainsail should be reefed.

3.4.3 Flow control valve, pos. 34.1 & 34.2 (optional)

The speed of the hydraulic cylinder for BOOM IN and BOOM OUT can be set individually very easily using the adjusting knobs on this valve. The valve is set to the maximum speed/flow on delivery. **NOTE:** Excessive restriction will cause high power losses.

3.4.4 Emergency valve, pos. 35

This valve is normally closed, and only opened if you wish to furl the mainsail manually. The valve has a red control knob and a locking knob. Do not overtighten the knobs, or the valve will be difficult to open.
Clockwise rotation = closed
Anti-clockwise rotation = open

3.4.5 Non return valve, pos. 33.1

This valve keeps the oil from draining back to the tank from the cylinder. The valve is set on delivery and should not be adjusted.

3.5 Oil filter

3.5.1 Oil filter for single power pac, return line mounted

The filter element is made from micro-fibre glass, and it has a filtering grade of 10 µm absolute. Maximum working pressure for the filter is 7 bar.
The filter housing is equipped with a bypass valve which opens when the pressure drop across the filter (due to captured particles) exceeds 1.7 bar. The oil by-pass the filter and return directly to the tank.

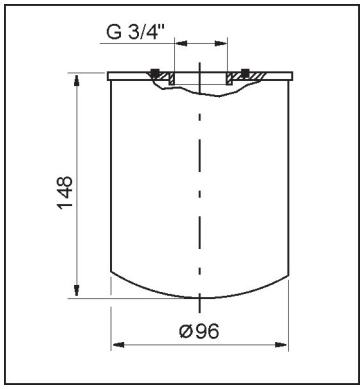


Fig. 3.5.1.a

The filter should be replaced every fourth year.

Seldén's part number for the replacement filter is 550-135.
Please refer to this number when you order a filter element.

The original filter element is
IKRON, HE K45-20.135-AS-FG 010.

3.5.2 Oil filter for double power pac, tank mounted

The filter element is made from micro-fibre glass, and it has a filtering grade of 10 µm absolute. Maximum working pressure for the filter is 8 bar.
The filter housing is equipped with a bypass valve (2) which opens when the pressure drop across the filter (due to captured particles) exceeds 1.7 bar. The oil will by-pass the filter and return directly to the tank.

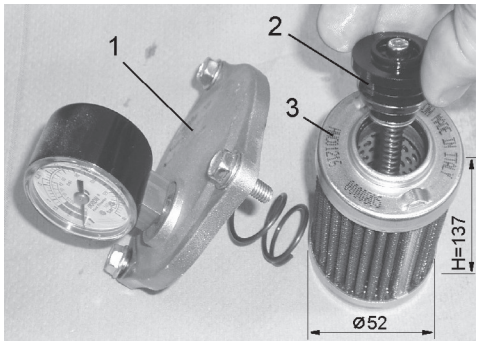


Fig. 3.5.2.a

The filter should be replaced every fourth year or when the manometer reads more than 1.5 bar.

When the filter element is to be replaced; undo the three allen key screws and remove the spring loaded lid (1).The bypass valve (2) is removed, ready to be reused with the new filter element (3).

Seldén's part number for the replacement filter is 550-152.
Please refer to this number when you order a filter element.

The original filter element is
IKRON, HE K02-10.129-AS-FG 010.

4. DRAWINGS AND LAYOUT

4.1 Complete circuit diagram (5 pages)

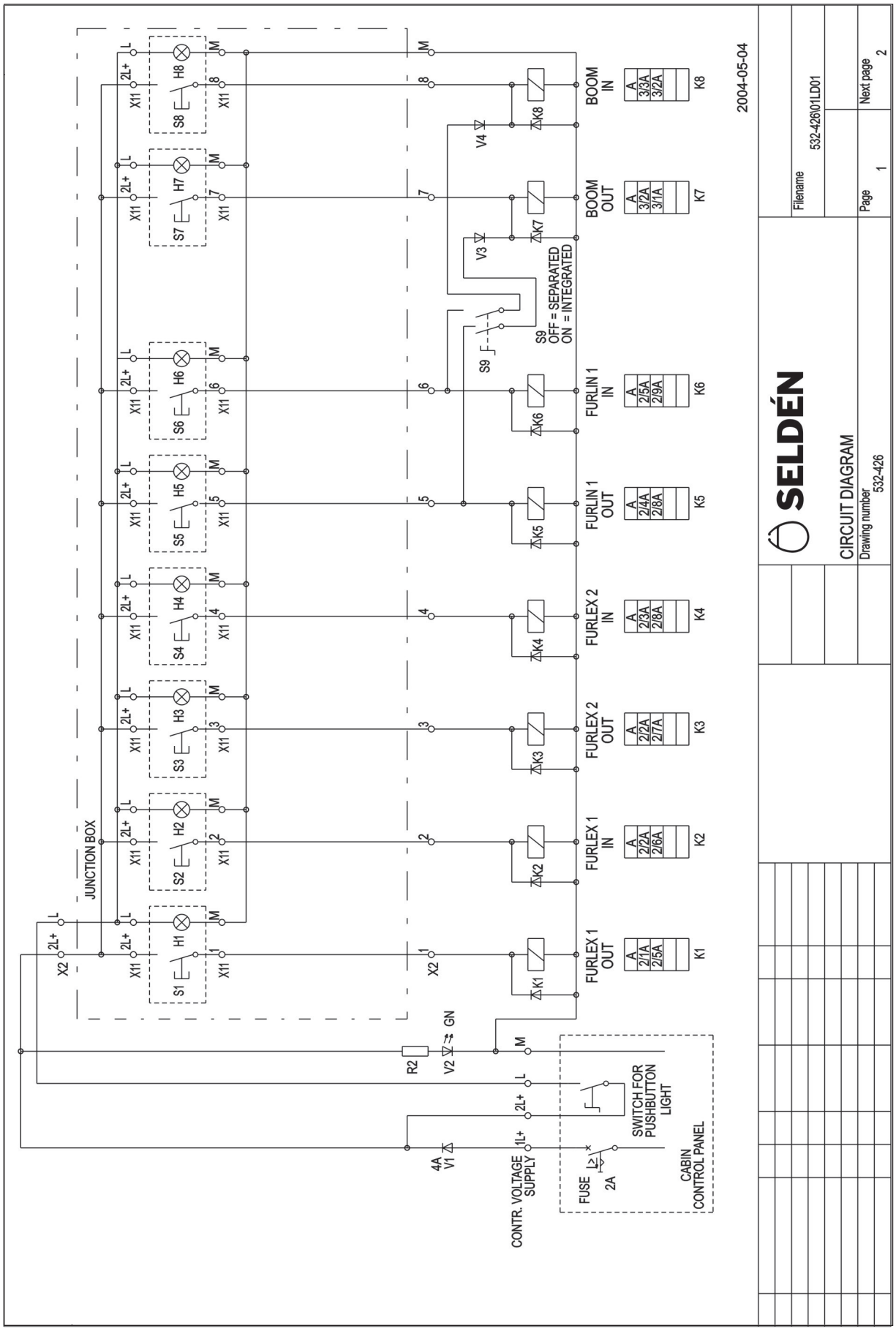


Fig. 4.1.a

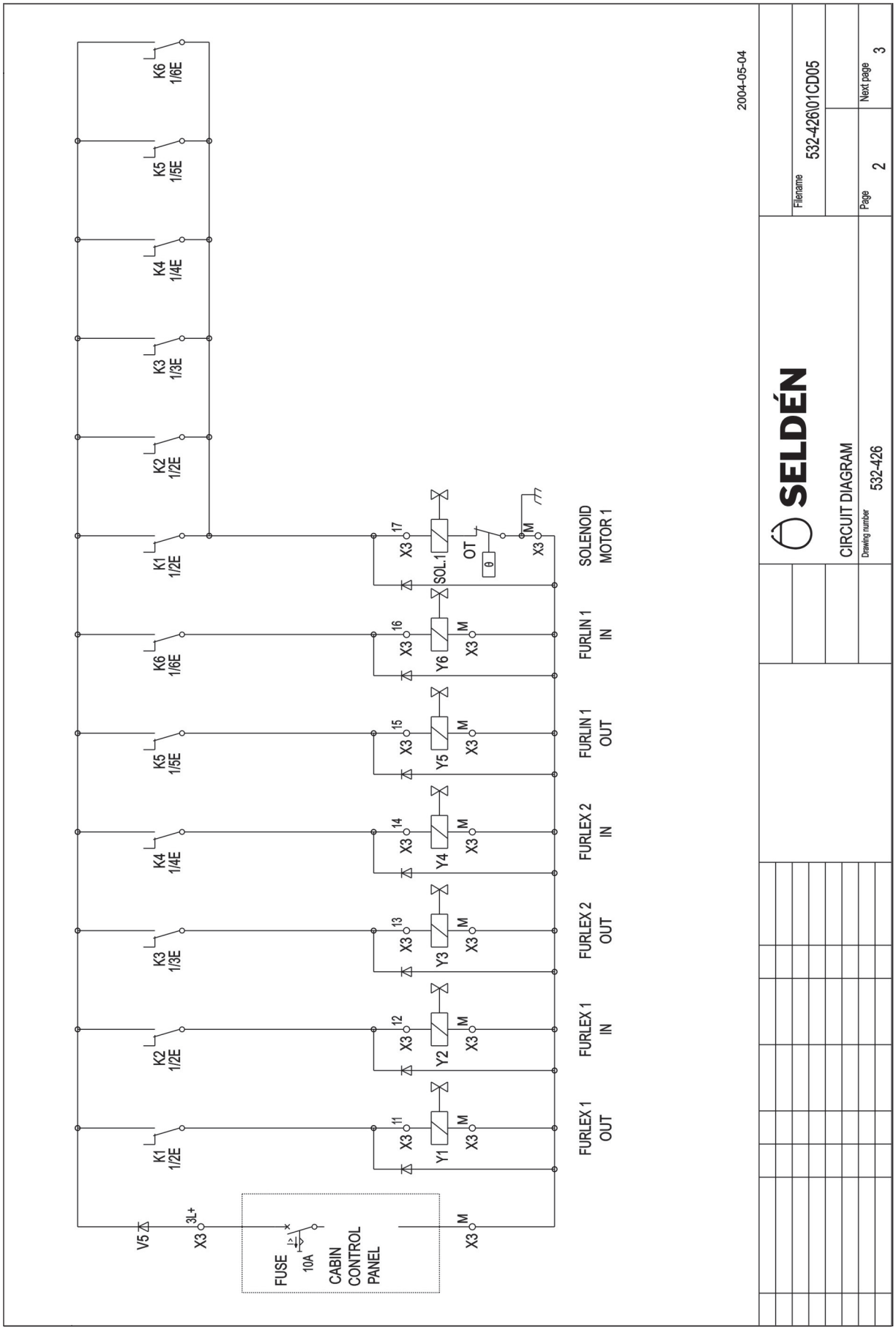

2004-05-04
SELDÉN
CIRCUIT DIAGRAM
Drawing number 532-426
Filename 532-426\01CD05
Page 2
Next page 3
V5
3L+
X3
FUSE 10A
CABIN CONTROL PANEL
K1 1/2E
K2 1/2E
K3 1/3E
K4 1/4E
K5 1/5E
K6 1/6E
FURLEX 1 OUT
FURLEX 1 IN
FURLEX 2 OUT
FURLEX 2 IN
FURLIN 1 OUT
FURLIN 1 IN
SOLENOID MOTOR 1
Y1
Y2
Y3
Y4
Y5
Y6
SOL.1
OT
θ
M

Fig. 4.1.b

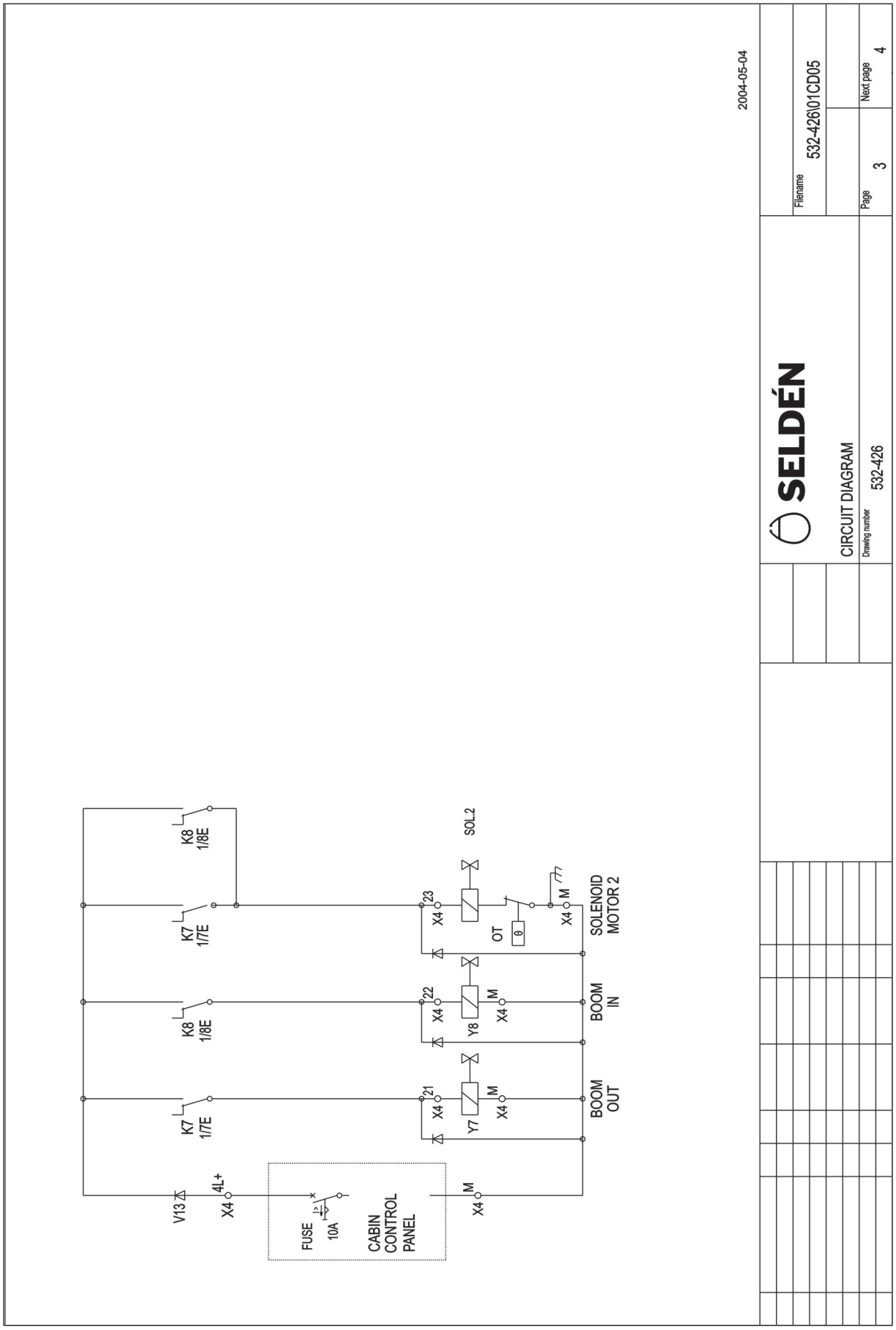

2004-05-04
SELDÉN
CIRCUIT DIAGRAM
Drawing number 532-426
Filename 532-426\01CD05
Page 3
Next page 4
V13
4L+
X4
FUSE
10A
CABIN
CONTROL
PANEL
M
X4
K7
1/7E
K8
1/8E
K7
1/7E
K8
1/8E
21
X4
Y7
M
X4
BOOM
OUT
22
X4
Y8
M
X4
BOOM
IN
23
X4
OT
θ
SOL.2
M
X4
SOLENOID
MOTOR 2

Fig. 4.1.c

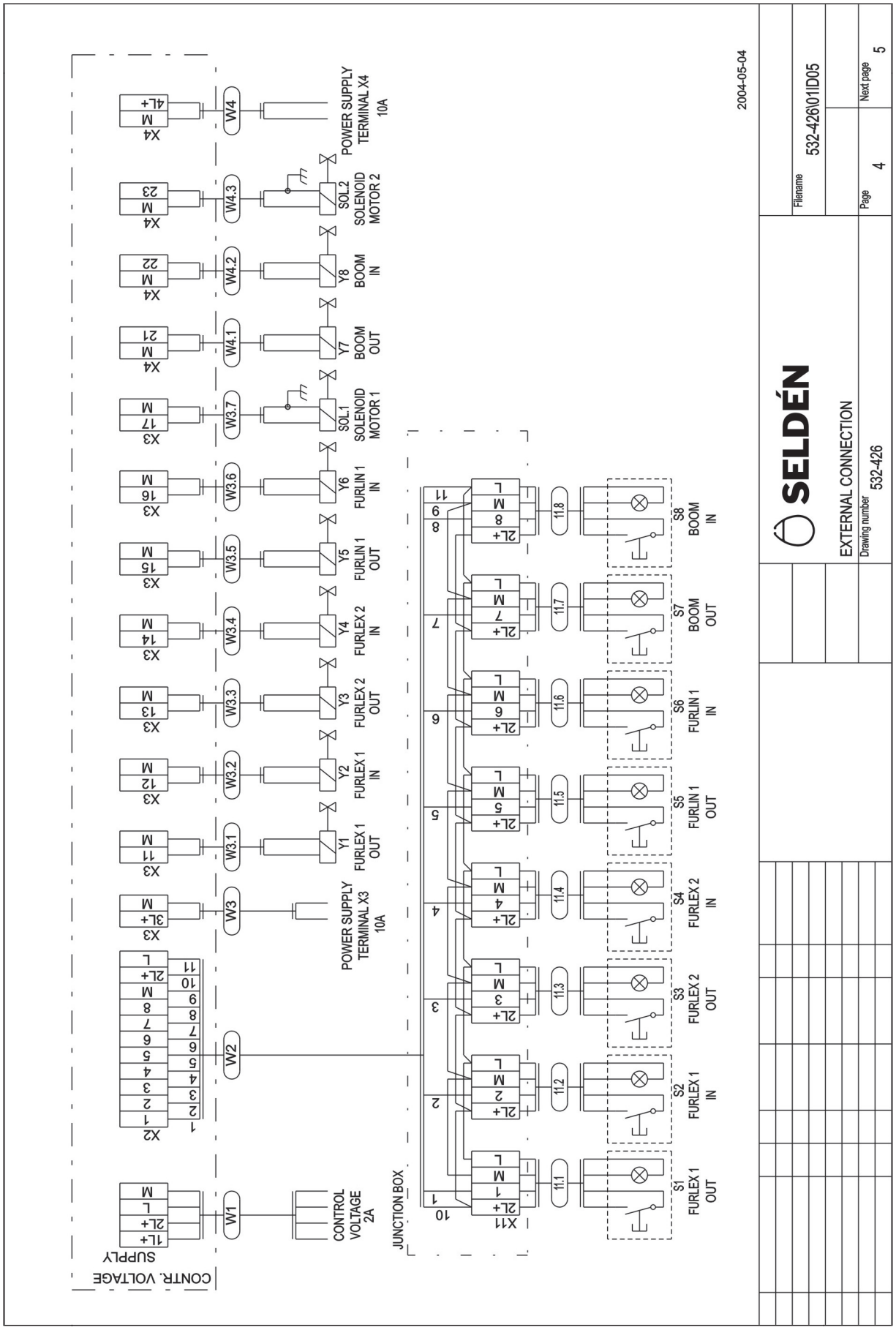

SELDÉN
EXTERNAL CONNECTION
Drawing number 532-426
Filename 532-426101D05
Page 4
Next page 5
2004-05-04
CONTR. VOLTAGE SUPPLY
1L+
2L+
M
L
W1
CONTROL VOLTAGE 2A
JUNCTION BOX
X2
W2
X3
3L+
M
W3
POWER SUPPLY TERMINAL X3 10A
X4
4L+
M
W4
POWER SUPPLY TERMINAL X4 10A
S1 FURLEX 1 OUT
S2 FURLEX 1 IN
S3 FURLEX 2 OUT
S4 FURLEX 2 IN
S5 FURLIN 1 OUT
S6 FURLIN 1 IN
S7 BOOM OUT
S8 BOOM IN
X11
Y1 FURLEX 1 OUT
Y2 FURLEX 1 IN
Y3 FURLEX 2 OUT
Y4 FURLEX 2 IN
Y5 FURLIN 1 OUT
Y6 FURLIN 1 IN
Y7 BOOM OUT
Y8 BOOM IN
SOL.1 SOLENOID MOTOR 1
SOL.2 SOLENOID MOTOR 2

Fig. 4.1.d

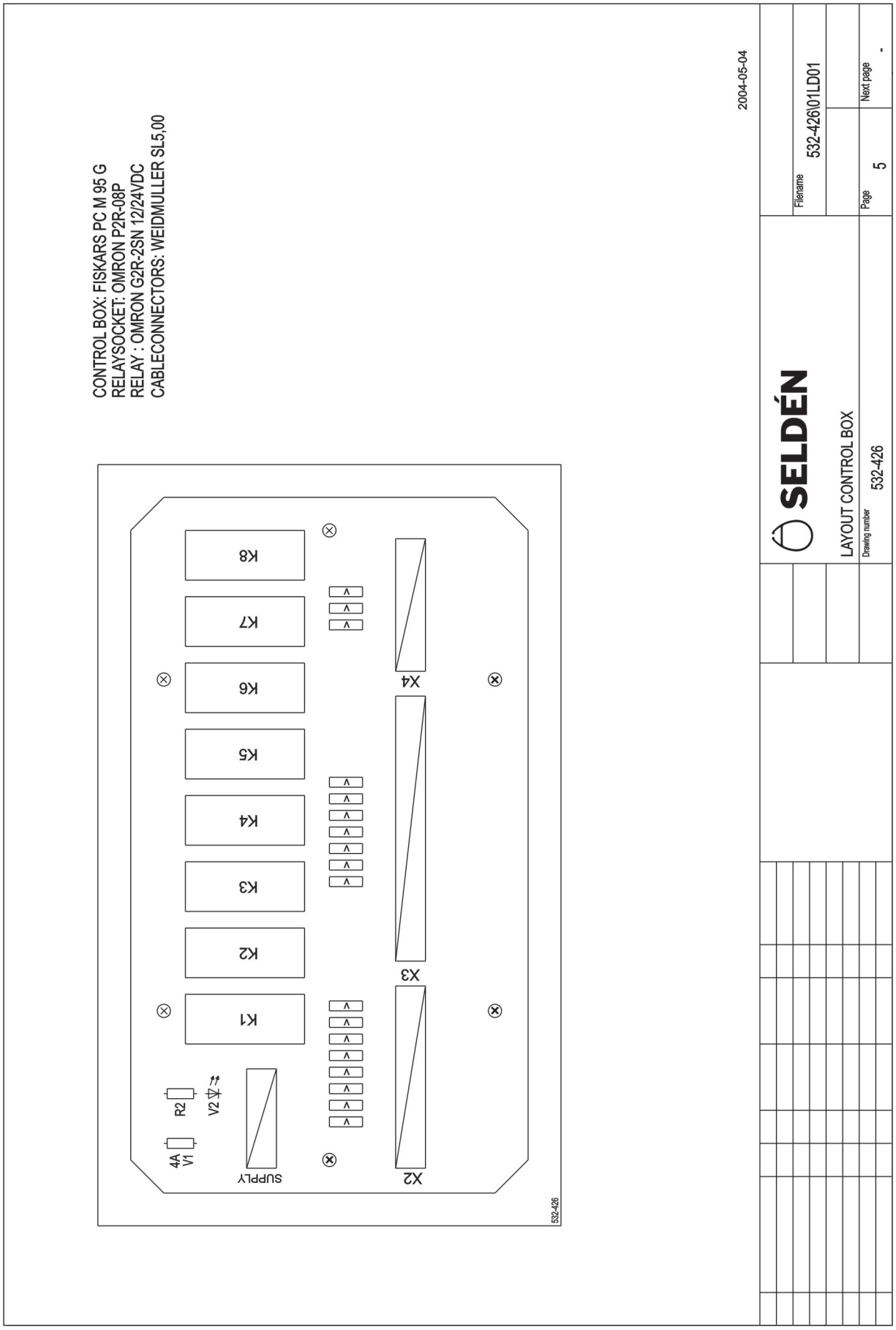

CONTROL BOX: FISKARS PC M 95 G
RELAYSOCKET: OMRON P2R-08P
RELAY : OMRON G2R-2SN 12/24VDC
CABLECONNECTORS: WEIDMULLER SL5,00
2004-05-04
SELDÉN
LAYOUT CONTROL BOX
Drawing number 532-426
Filename 532-426\01LD01
Page 5
Next page -
K8
K7
K6
K5
K4
K3
K2
K1
X4
X3
X2
SUPPLY
4A
V1
R2
V2
532-426

Fig. 4.1.e

4.2 Simplified circuit diagram

4.2.1 Circuit diagram E1: single power pac, boom outhaul only

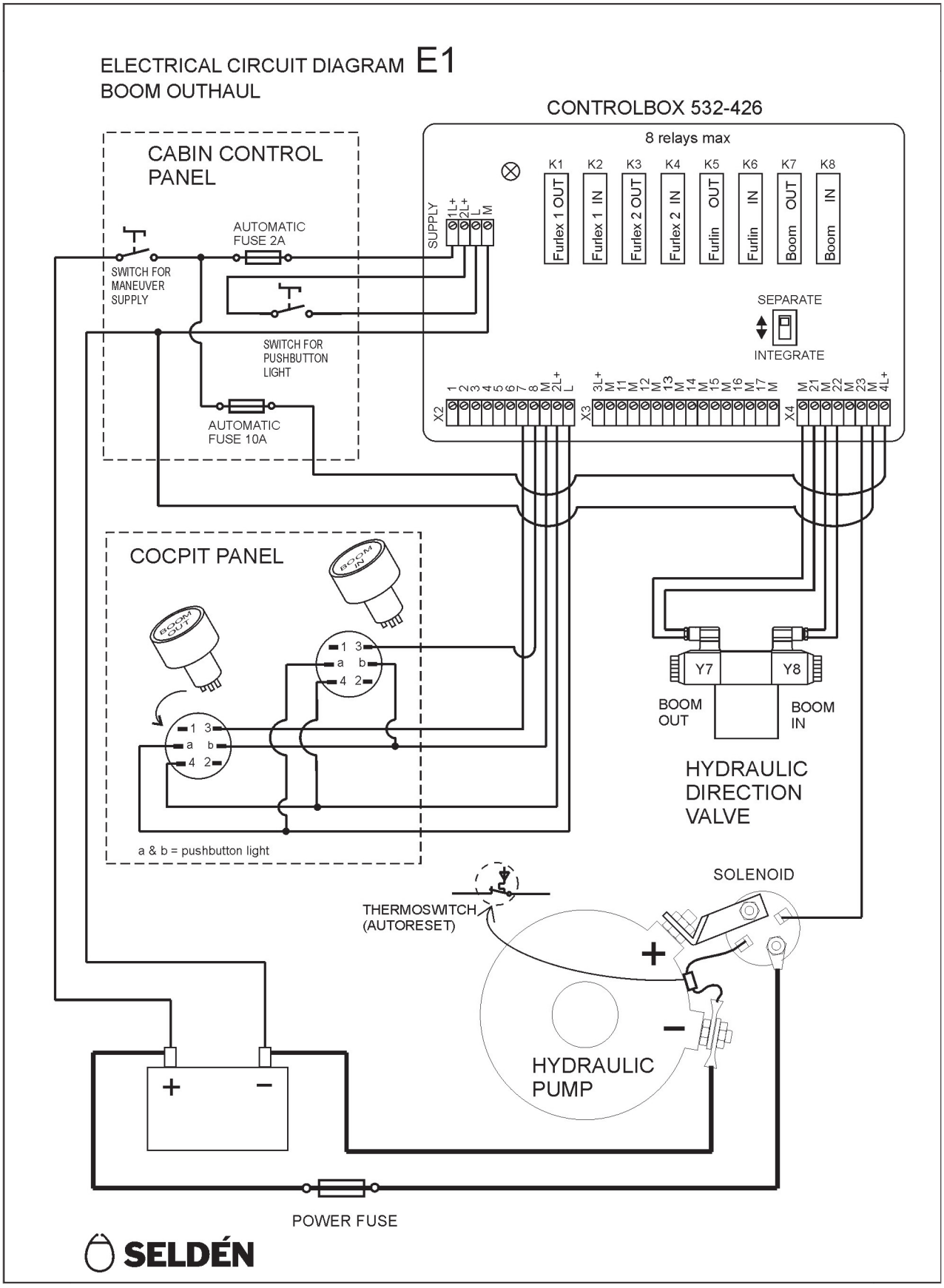


Fig. 4.2.1.a

4.2.2 Circuit diagram E2: single power pac, Furlex etc

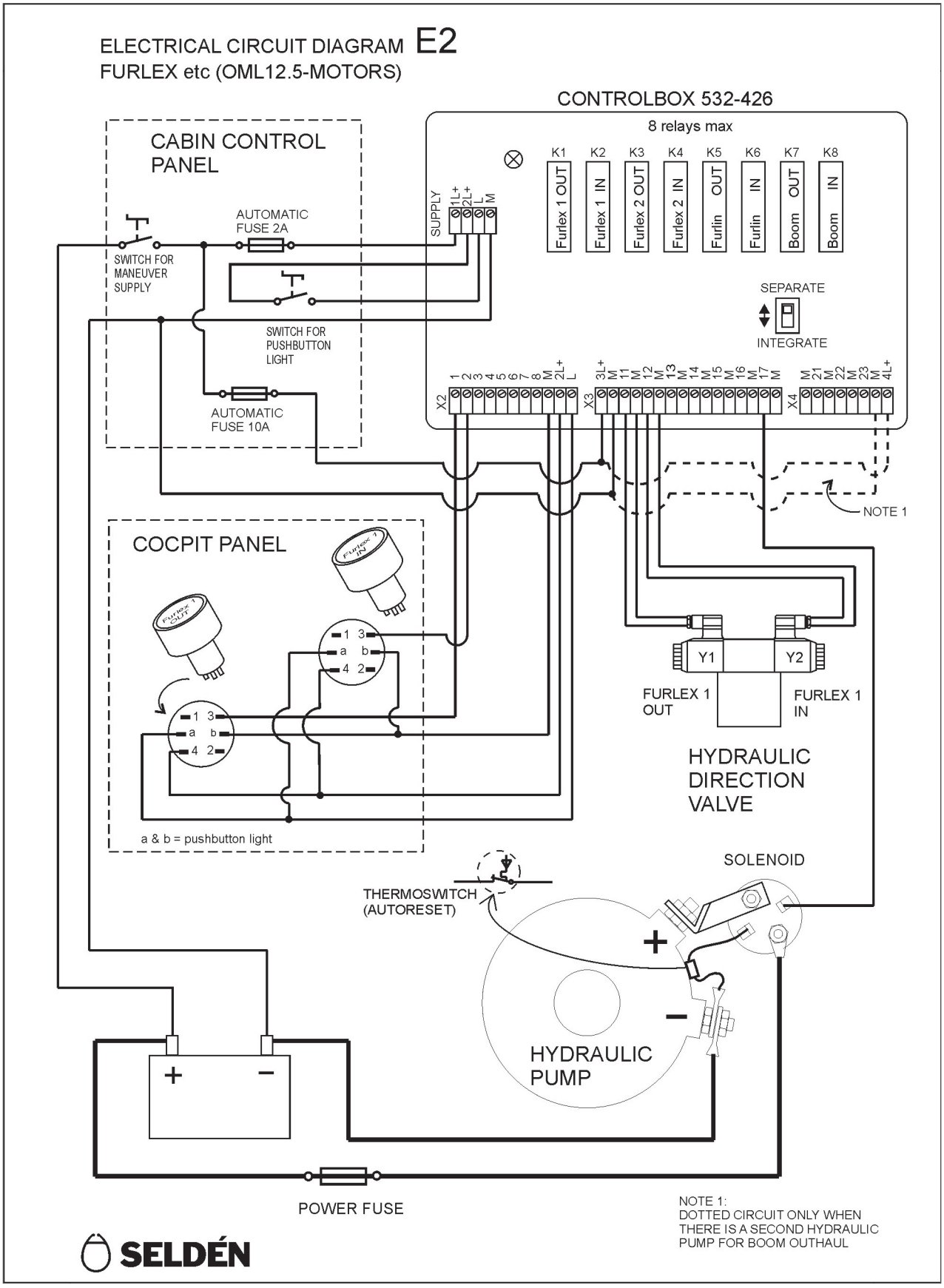


Fig. 4.2.2.a

4.2.3 Circuit diagram E3: double power pac, boom outhaul & Furlex etc

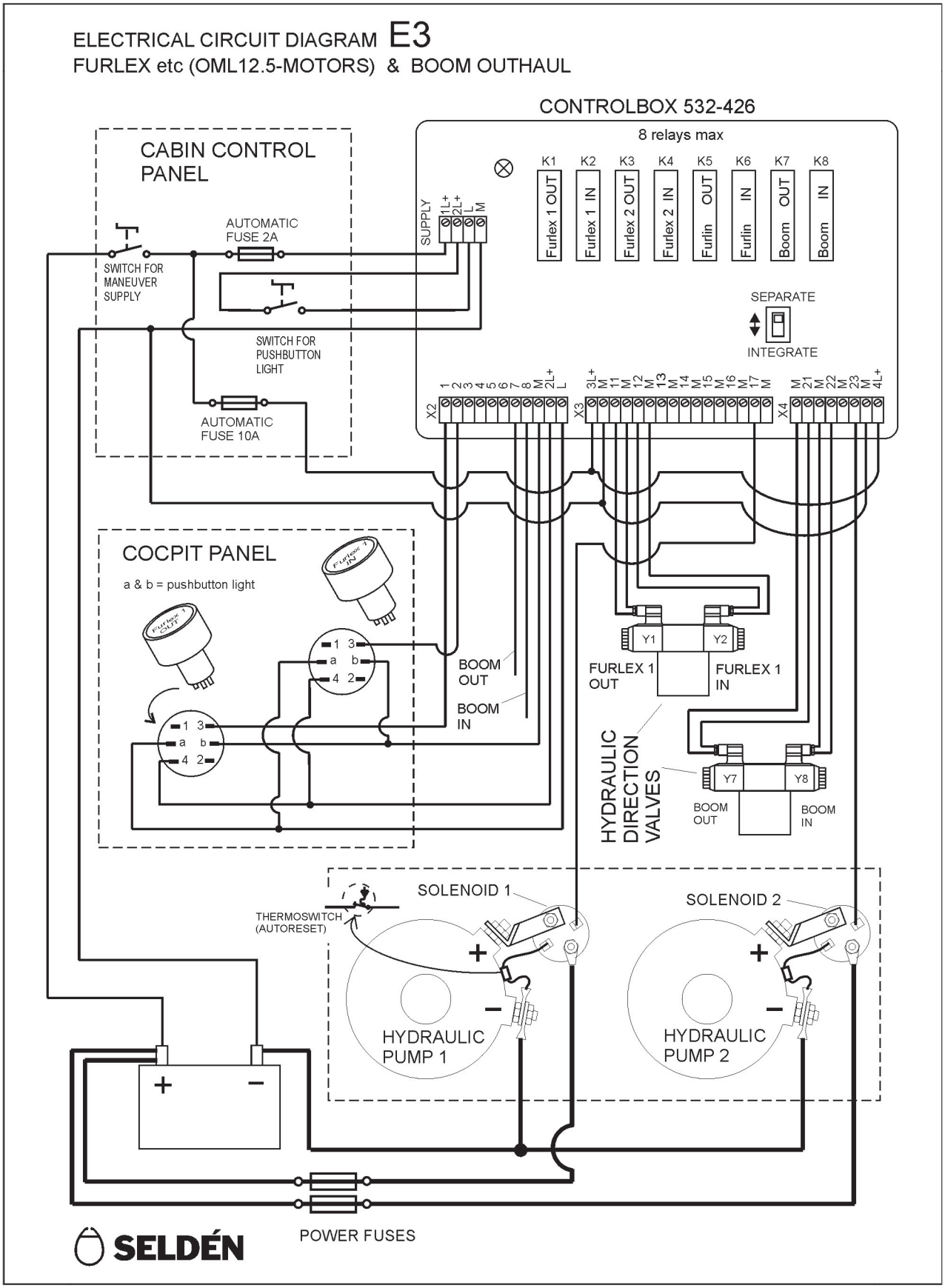


Fig. 4.2.3.a

4.2.4 Circuit diagram E4: double power pac connected in parallel (double flow), Furlex etc

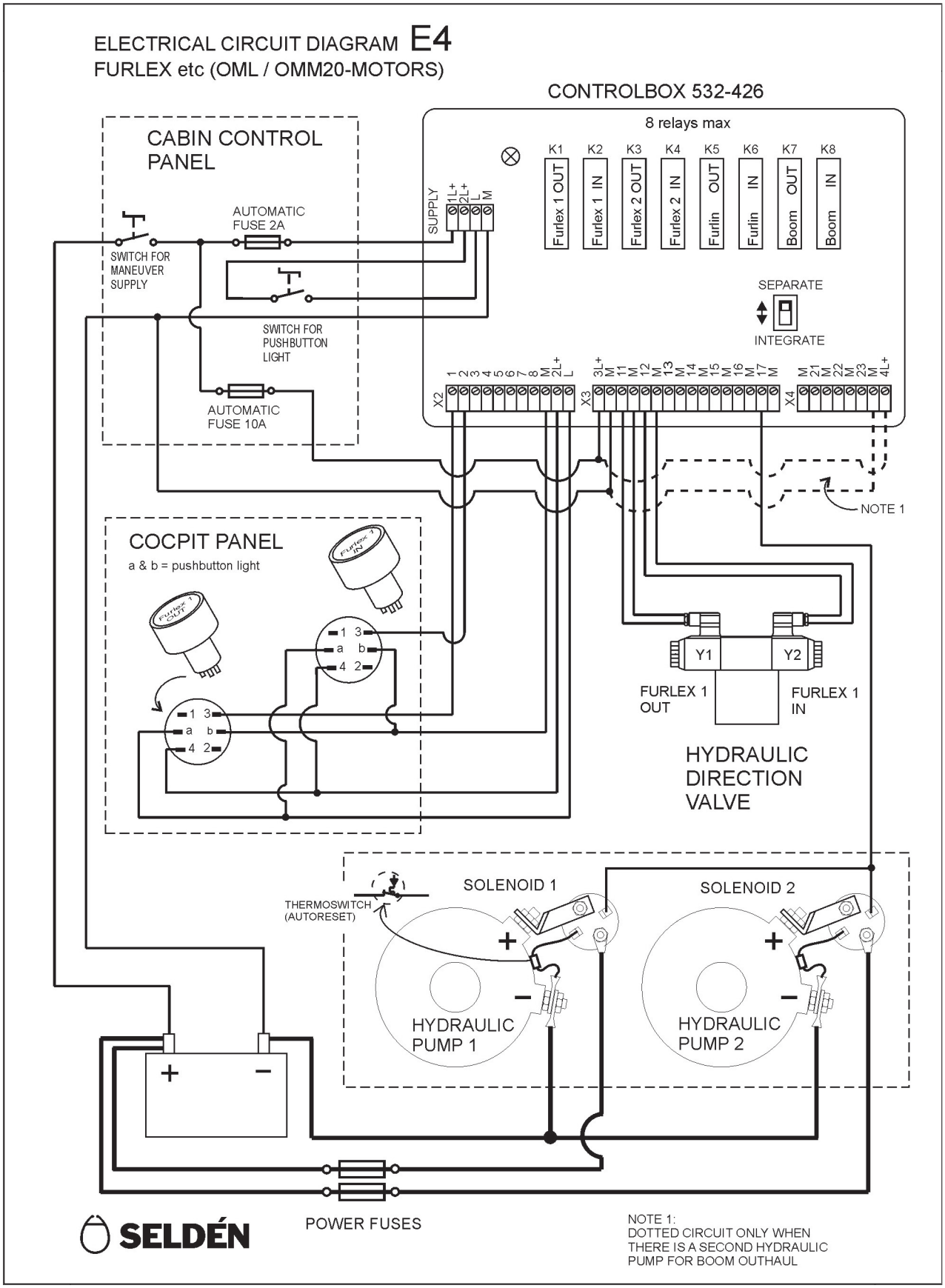


Fig. 4.2.4.a

4.3 Hydraulic schematic

4.3.1 Hydraulic schematic for Furlex etc, OML 12.5 motors (single assembly)

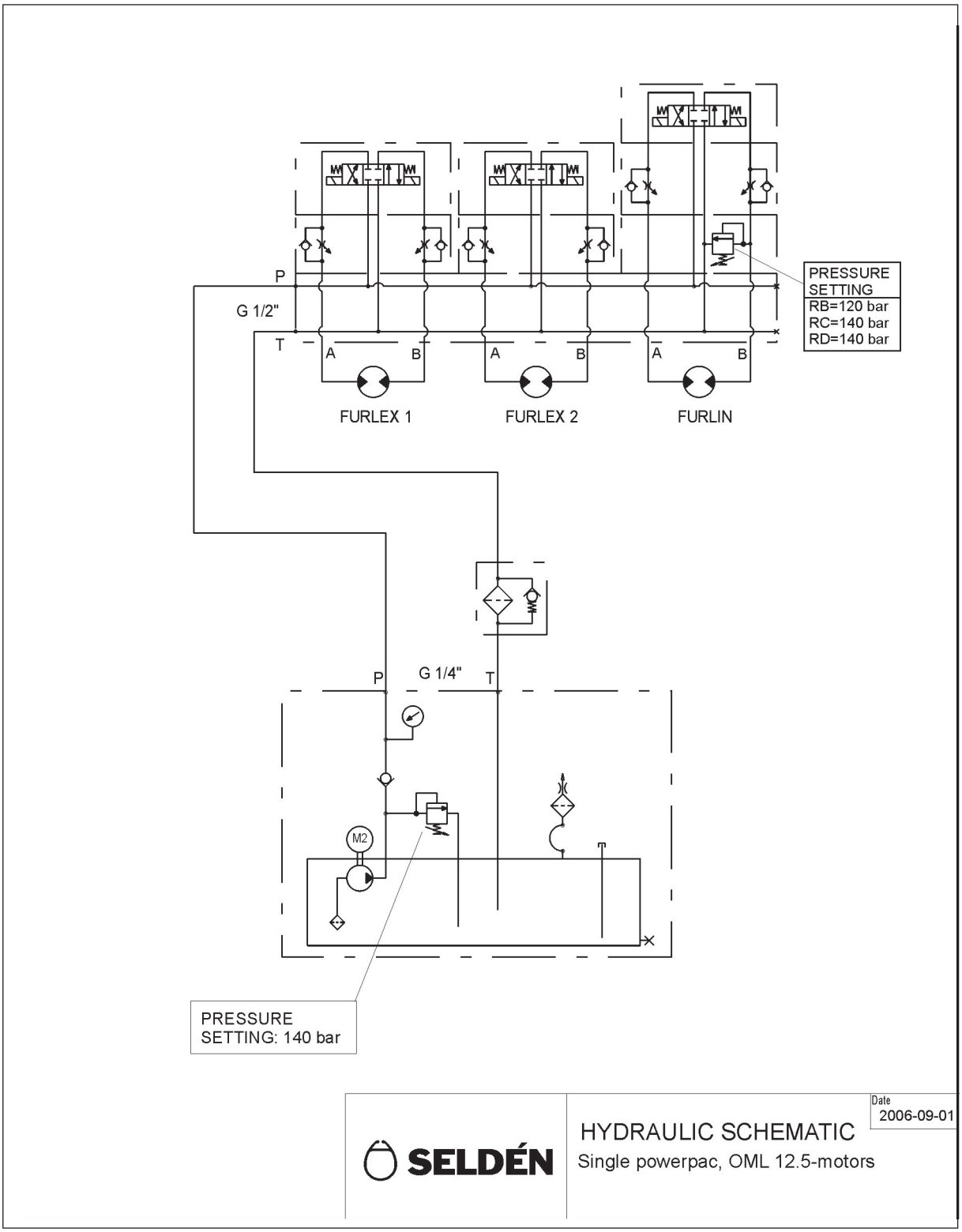


Fig. 4.3.1.a

4.3.2 Hydraulic schematic for boom outhaul (single assembly)

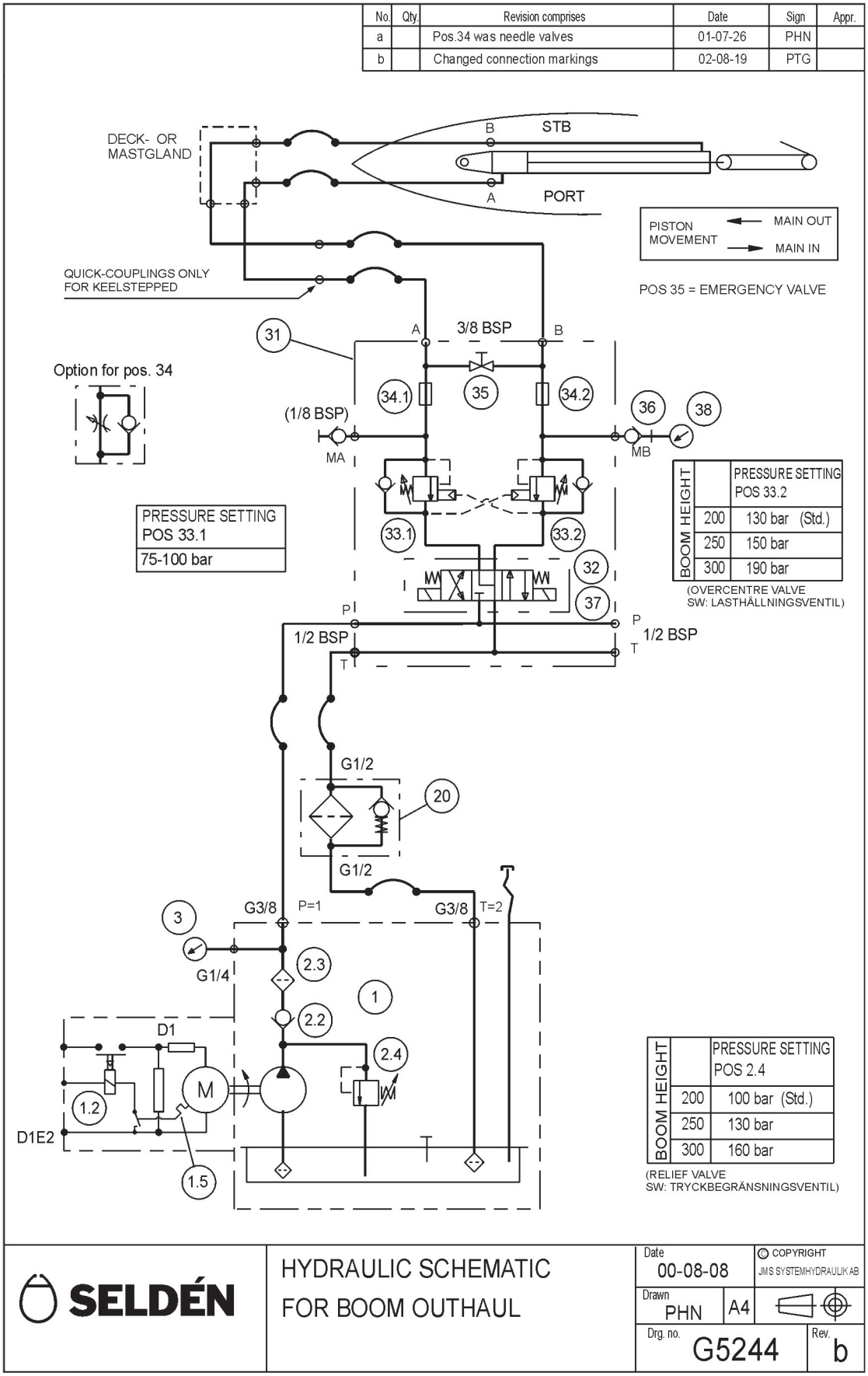


Fig. 4.3.2.a

4.3.3 Hydraulic schematic for Furlex etc, OML 12.5 motors and boom outhaul (double assembly)

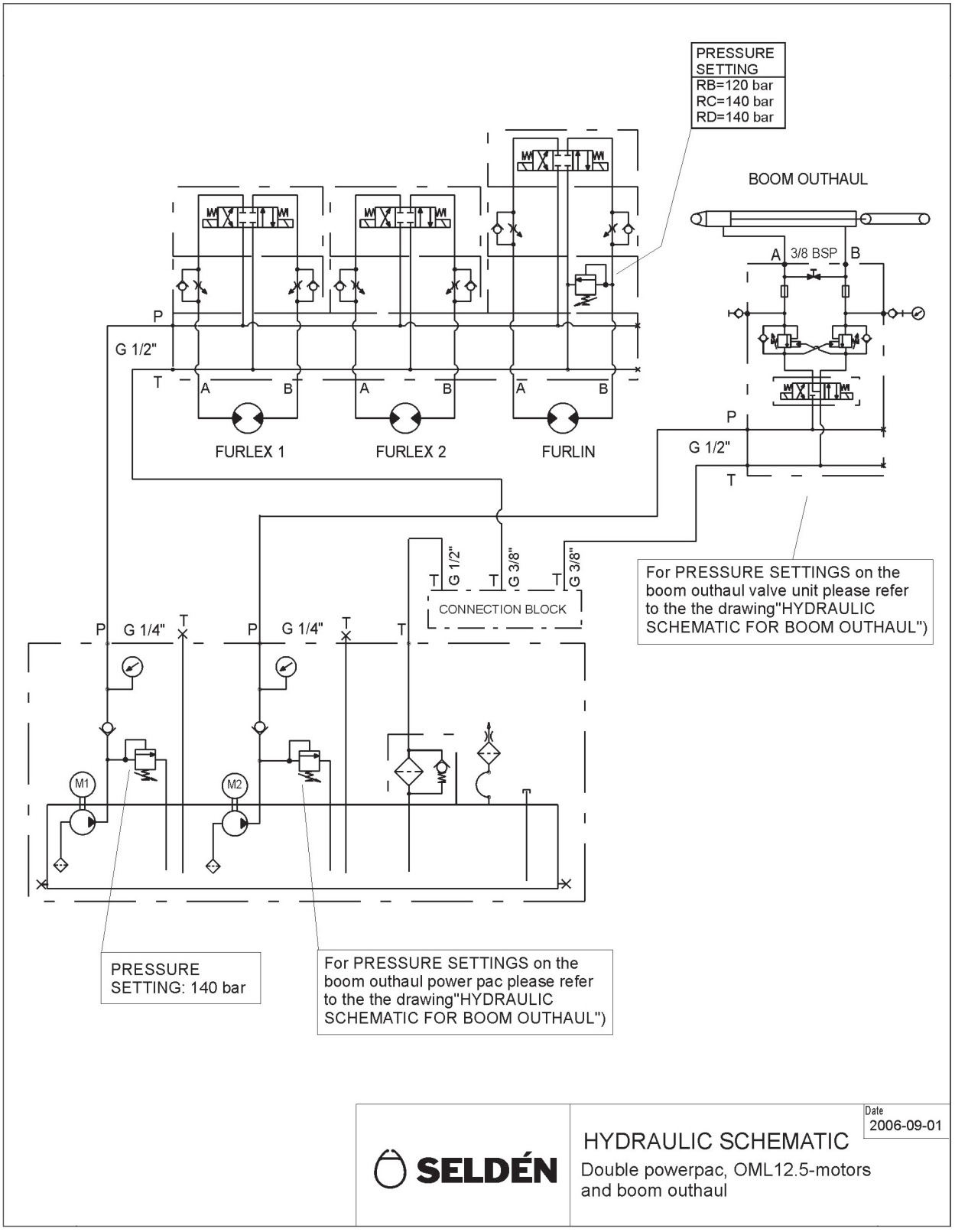


Fig. 4.3.3.a

4.3.4 Hydraulic schematic for Furlex etc, OML/OMM20 motors (double assembly)

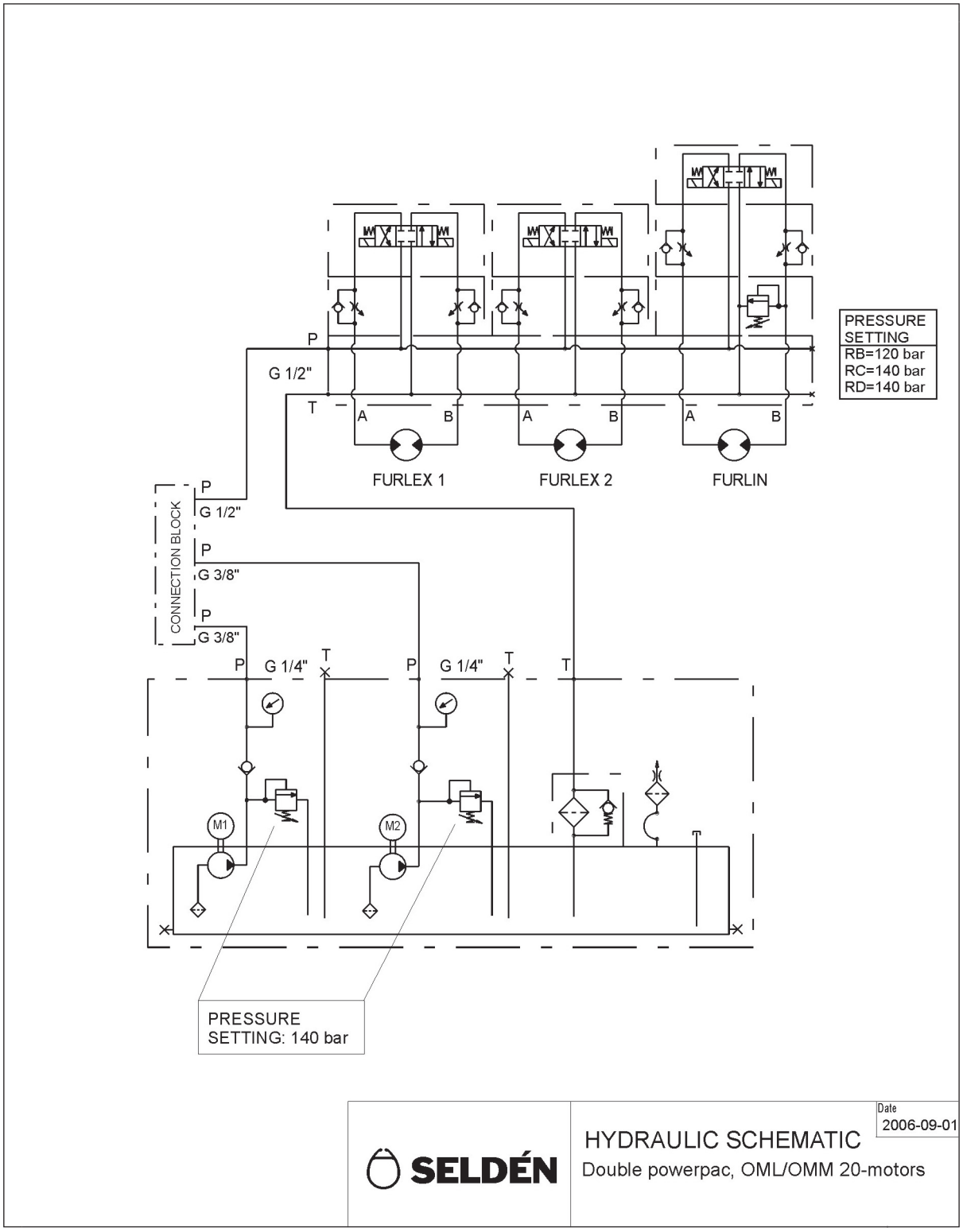


Fig. 4.3.4.a

4.4 Dimensioned drawings

4.4.1 Double assembly, 24V 2+2kW

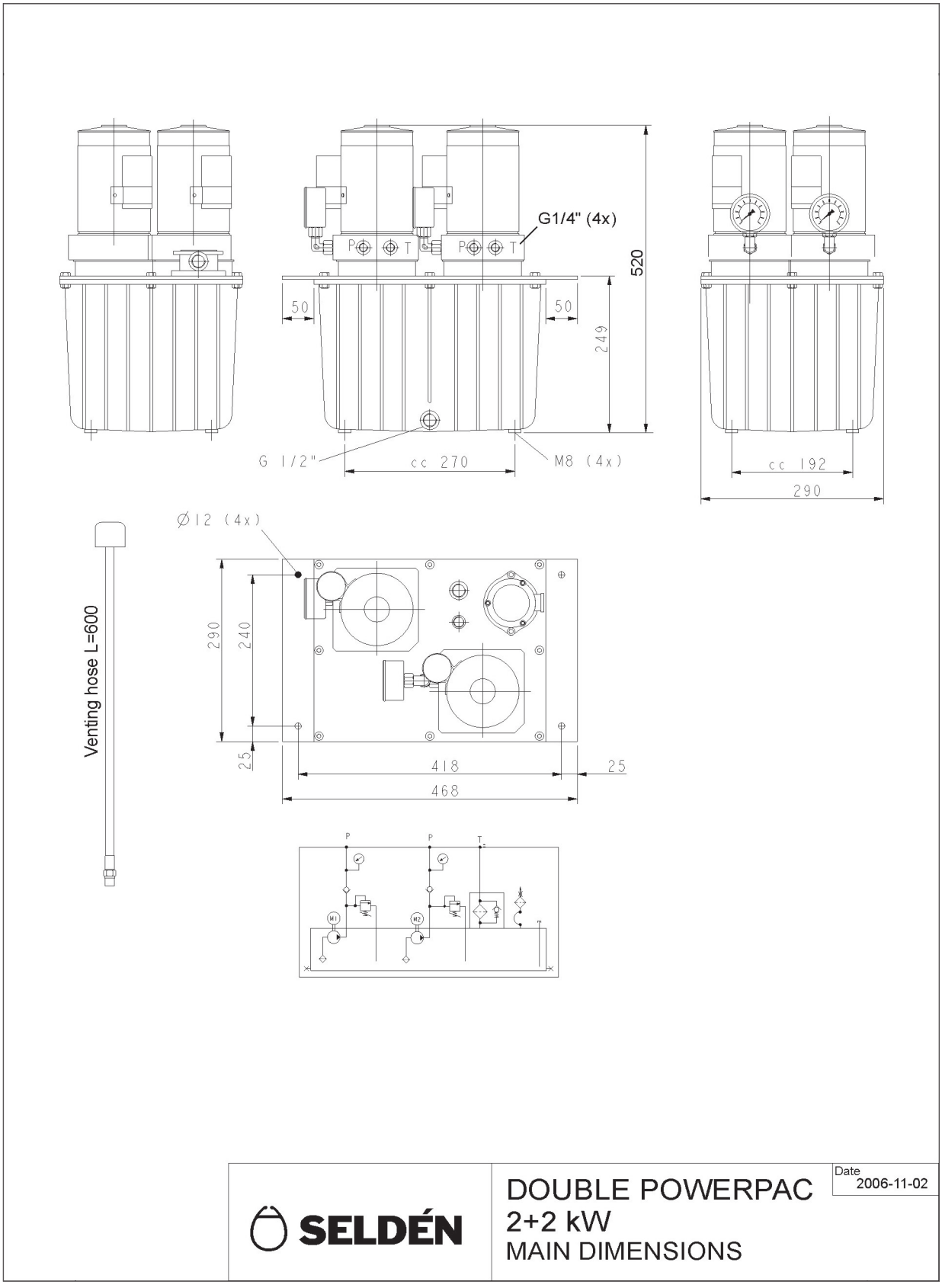


Fig. 4.4.1.a

4.4.2 Double assembly, 24V 2+3kW

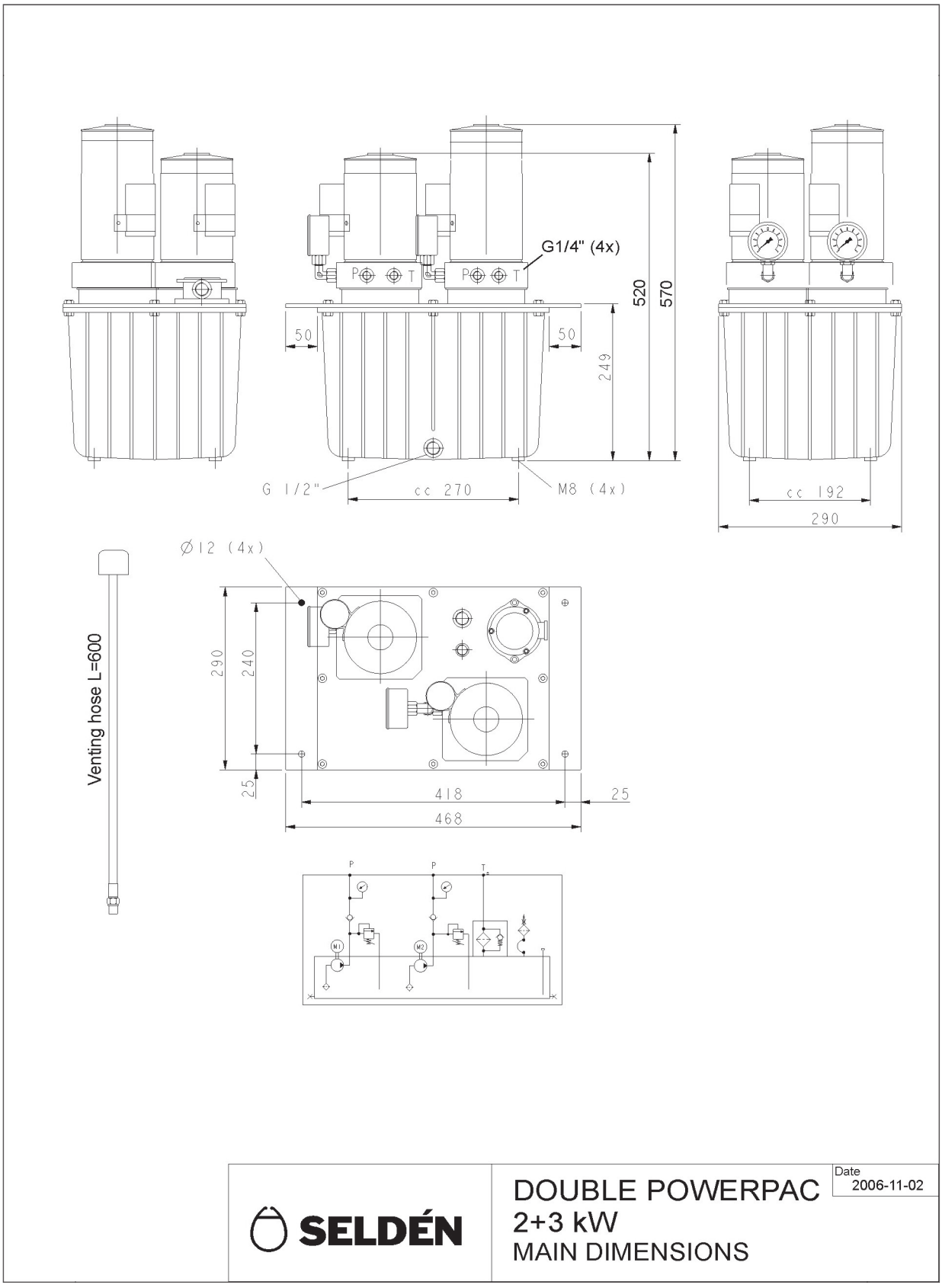


Fig. 4.4.2.a

4.4.3 Single assembly

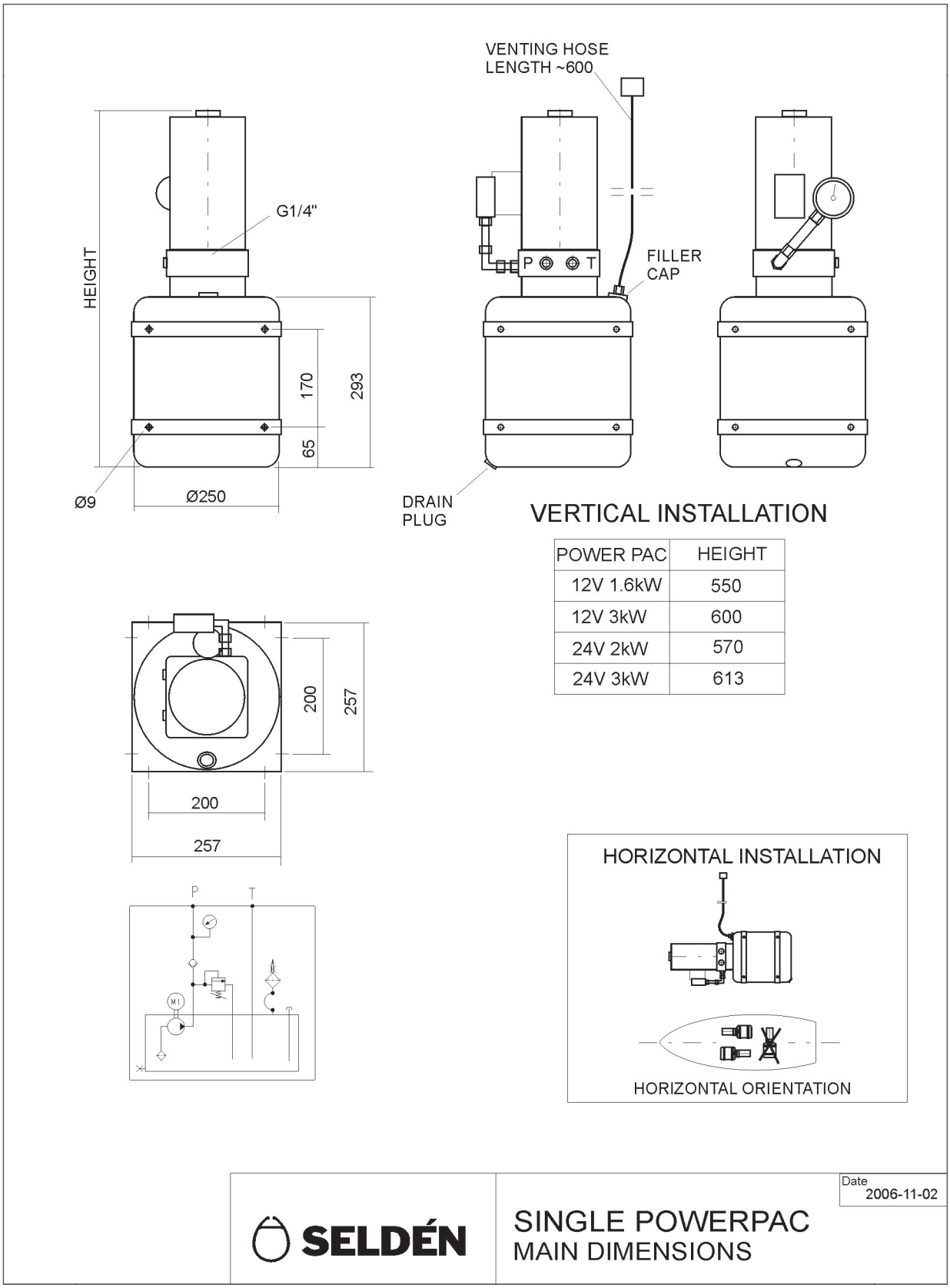


Fig. 4.4.3.a

4.4.4 Valve pack for boom outhaul

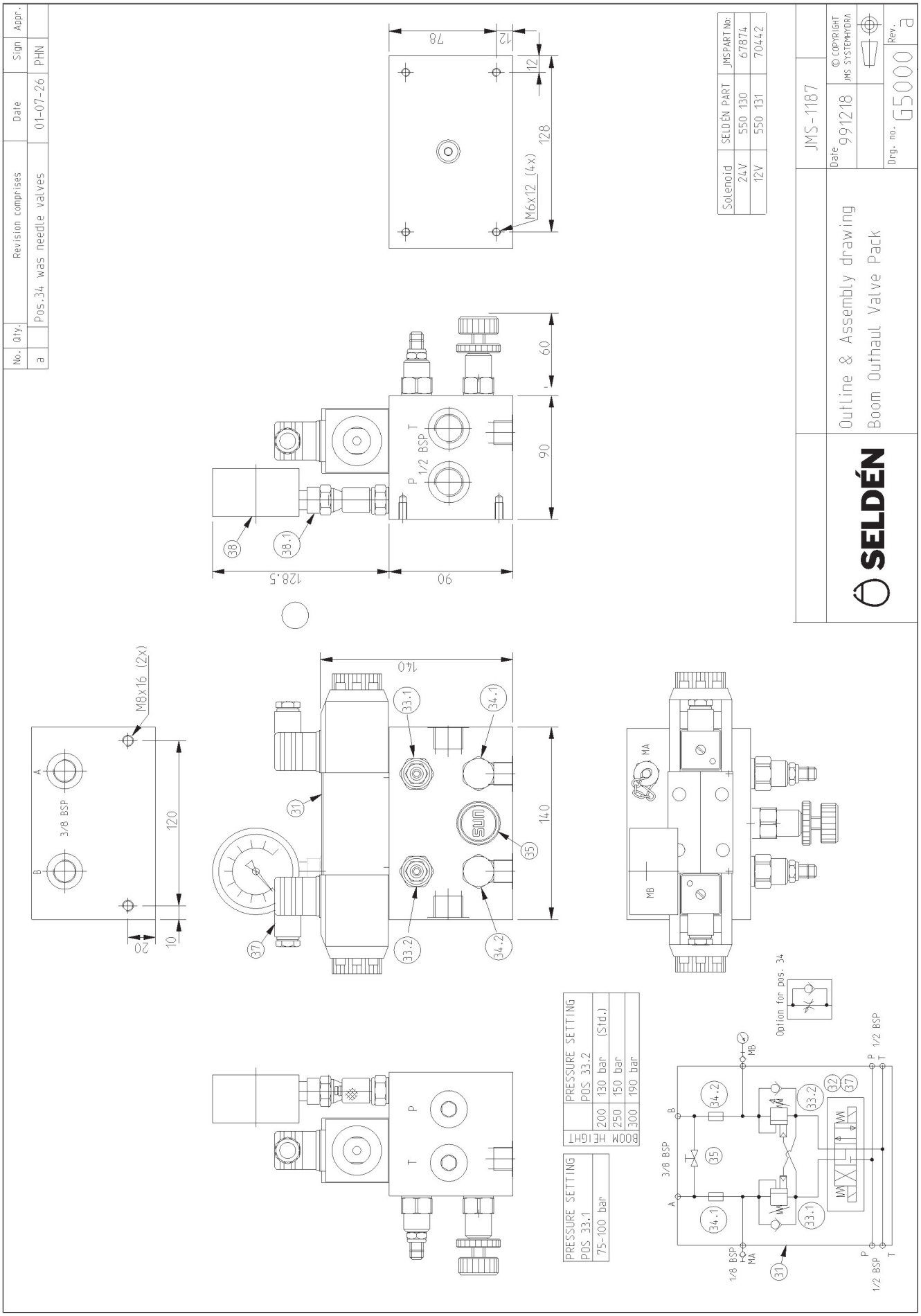


Fig. 4.4.4.a

4.4.5 2-function valve pack for motor applications (Furlex etc)

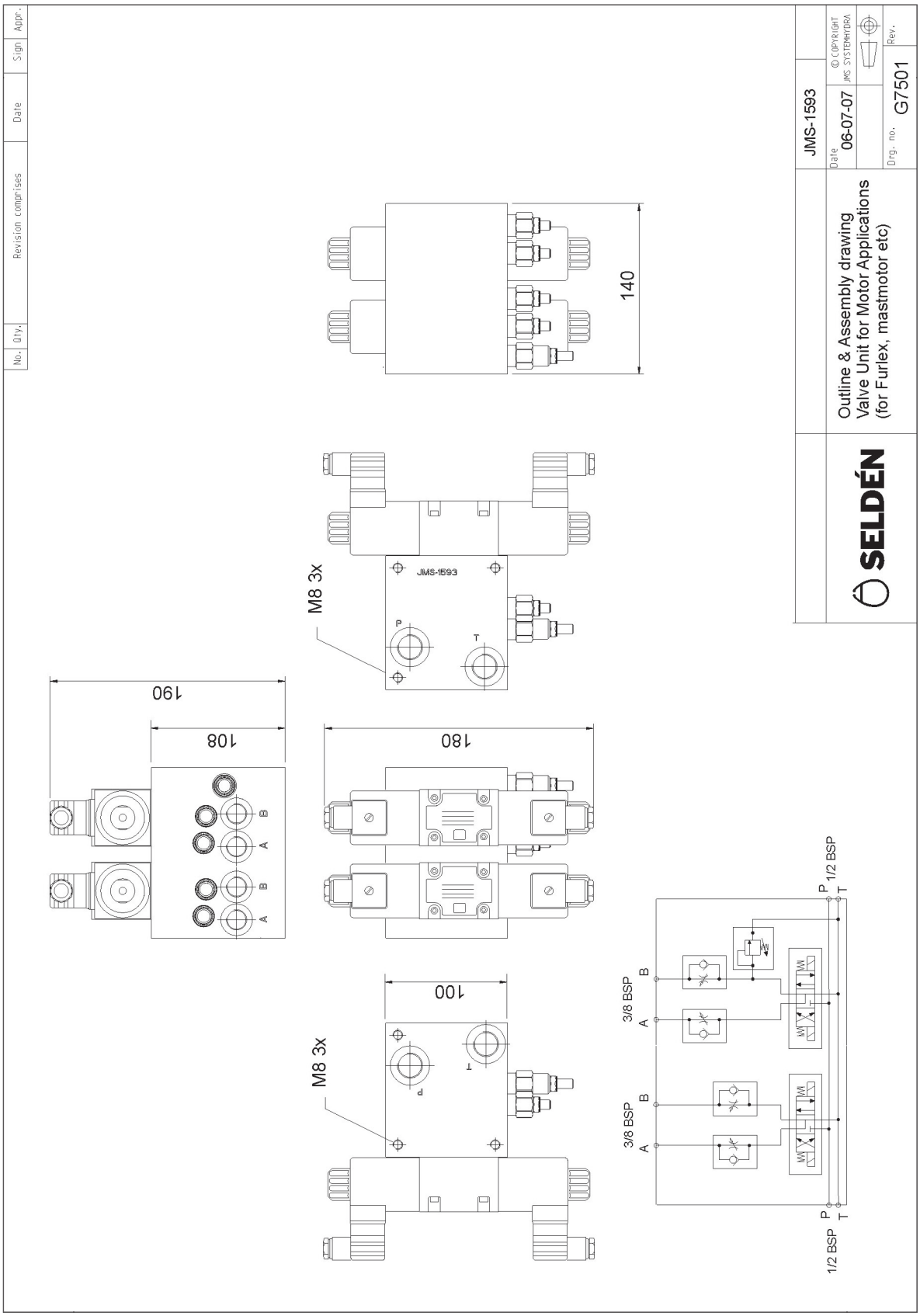


Fig. 4.4.5.a

4.4.6 3-function valve pack for motor applications (Furlex etc)

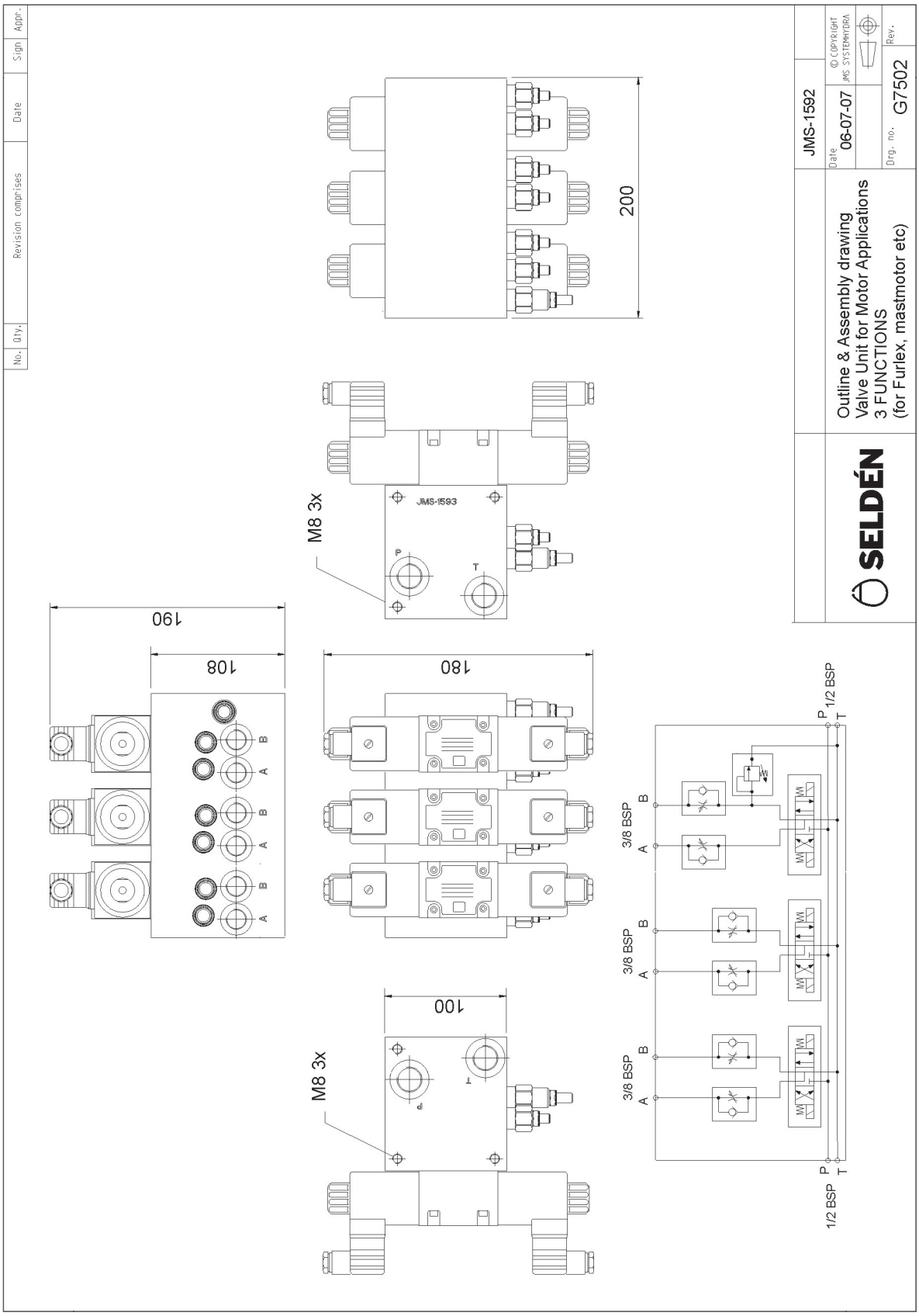


Fig. 4.4.6.a

5 HOSES AND COUPLINGS BELOW DECK (OPTIONAL)

5.1 Hose set A-F, X-Y

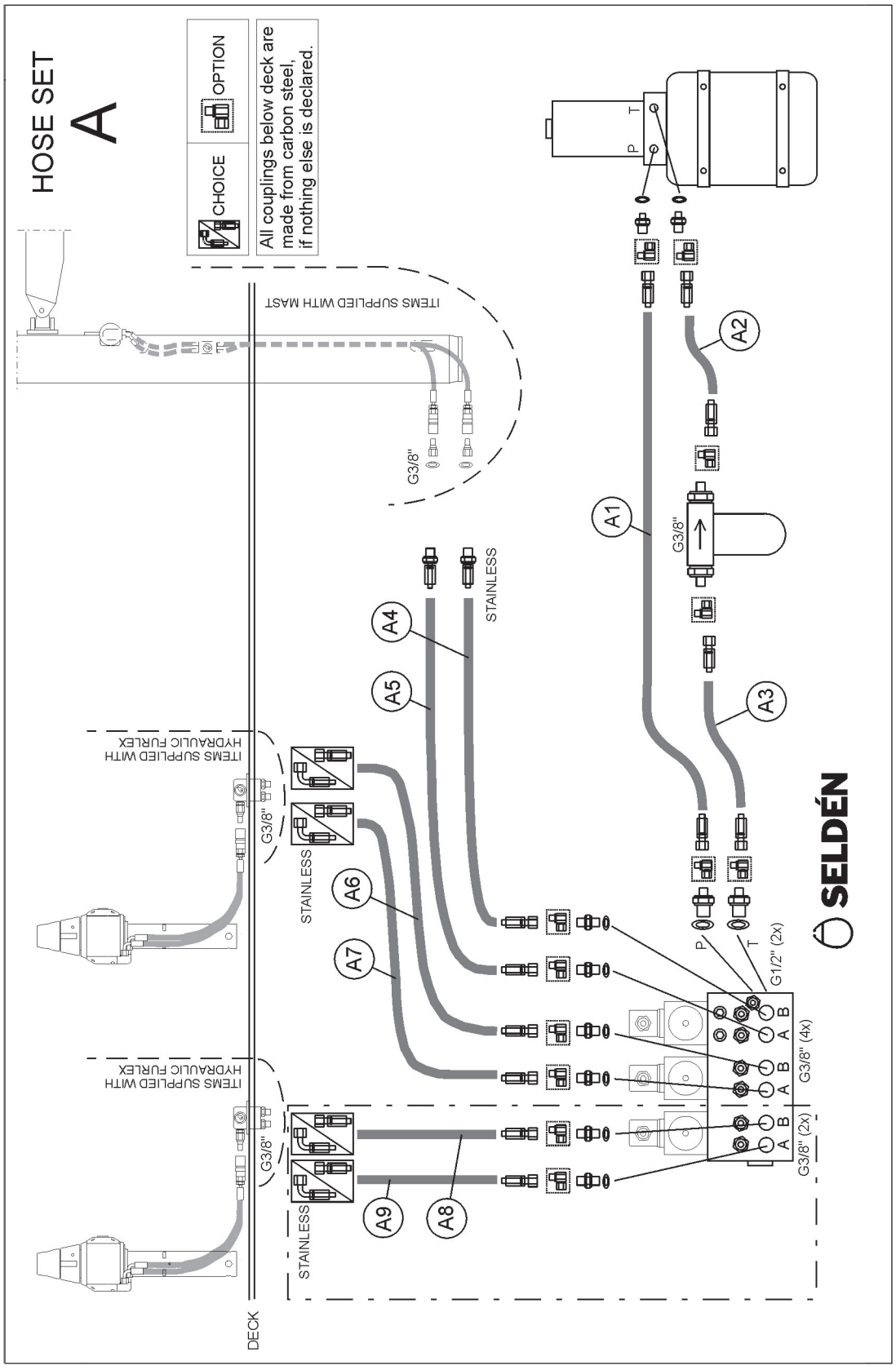


Fig. 5.1.a

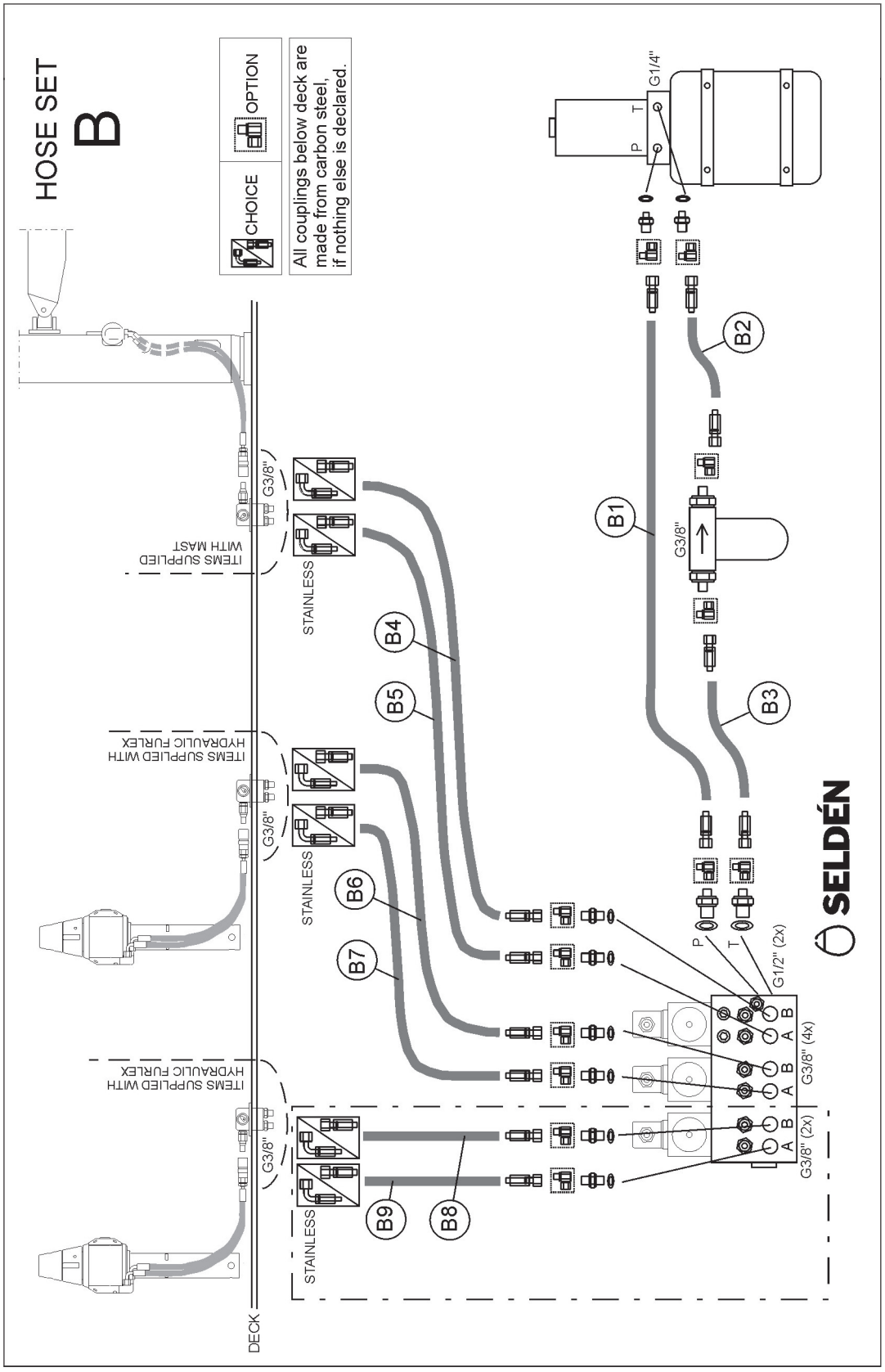

HOSE SET
B
CHOICE
OPTION
All couplings below deck are made from carbon steel, if nothing else is declared.
G1/4"
P
T
B1
B2
B3
B4
B5
B6
B7
B8
B9
G3/8"
STAINLESS
ITEMS SUPPLIED WITH MAST
ITEMS SUPPLIED WITH HYDRAULIC FURLEX
G1/2" (2x)
G3/8" (4x)
G3/8" (2x)
A B
SELDÉN
DECK

Fig. 5.1.b

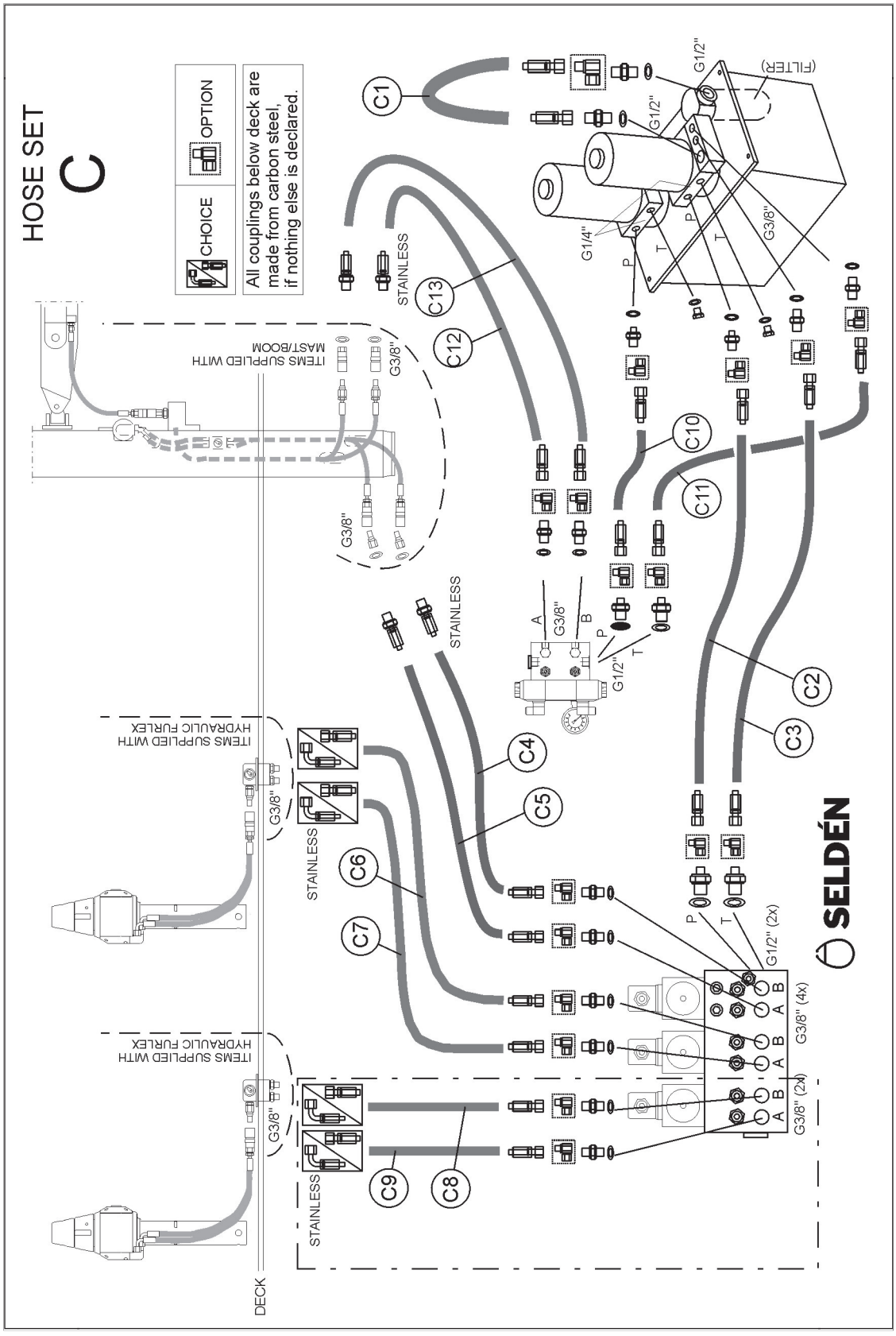

HOSE SET
C
CHOICE
OPTION
All couplings below deck are made from carbon steel, if nothing else is declared.
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
STAINLESS
G3/8"
G1/2"
G1/4"
(FILTER)
P
T
A
B
ITEMS SUPPLIED WITH MAST/BOOM
ITEMS SUPPLIED WITH HYDRAULIC FURLEX
G1/2" (2x)
G3/8" (4x)
G3/8" (2x)
DECK
SELDÉN

Fig. 5.1.c

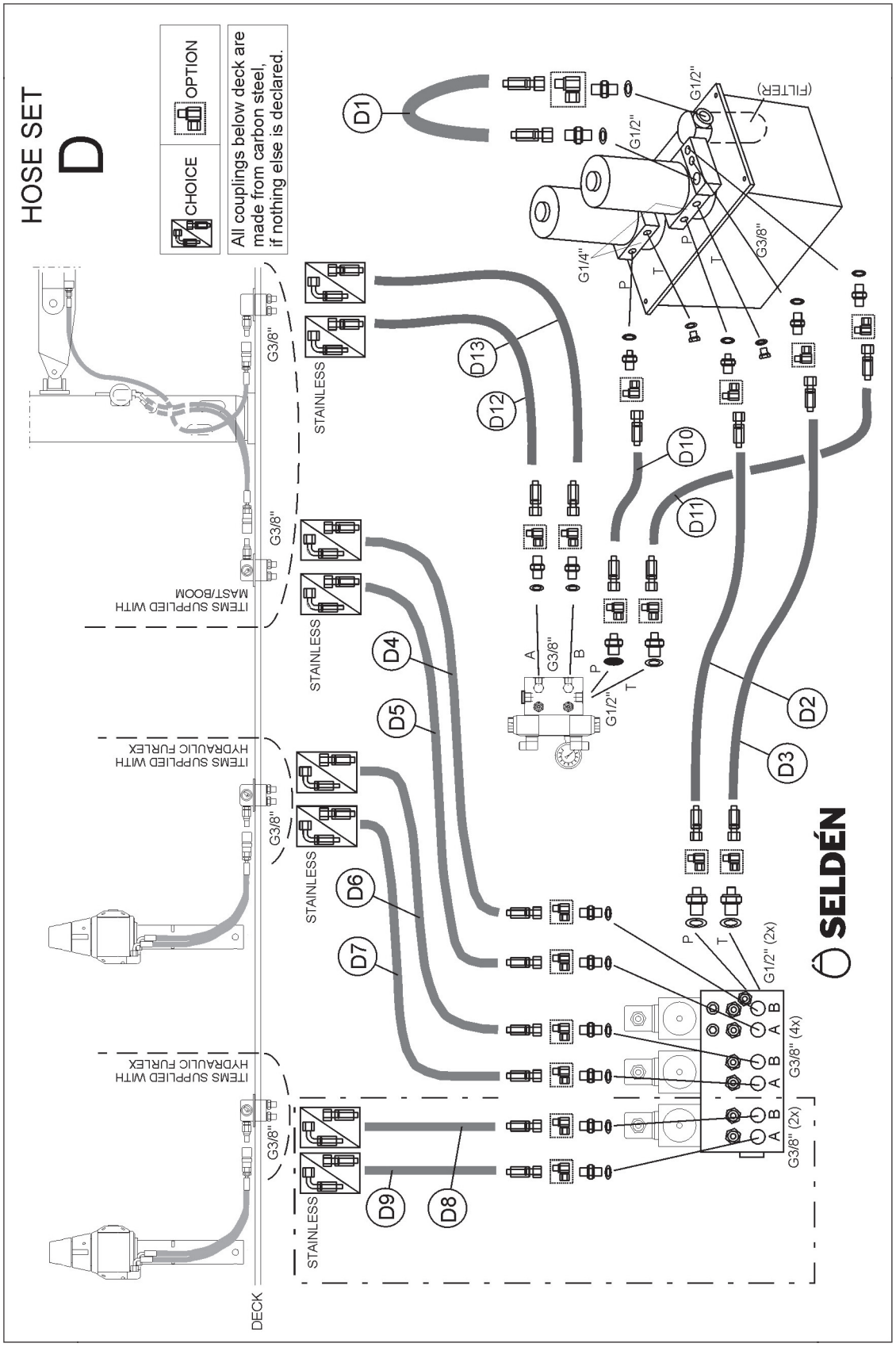

HOSE SET
D
CHOICE
OPTION
All couplings below deck are made from carbon steel, if nothing else is declared.
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
G1/2"
(FILTER)
G1/4"
G3/8"
P
T
A
B
G1/2" (2x)
G3/8" (4x)
G3/8" (2x)
STAINLESS
ITEMS SUPPLIED WITH MAST/BOOM
ITEMS SUPPLIED WITH HYDRAULIC FURLEX
DECK
SELDÉN

Fig. 5.1.d

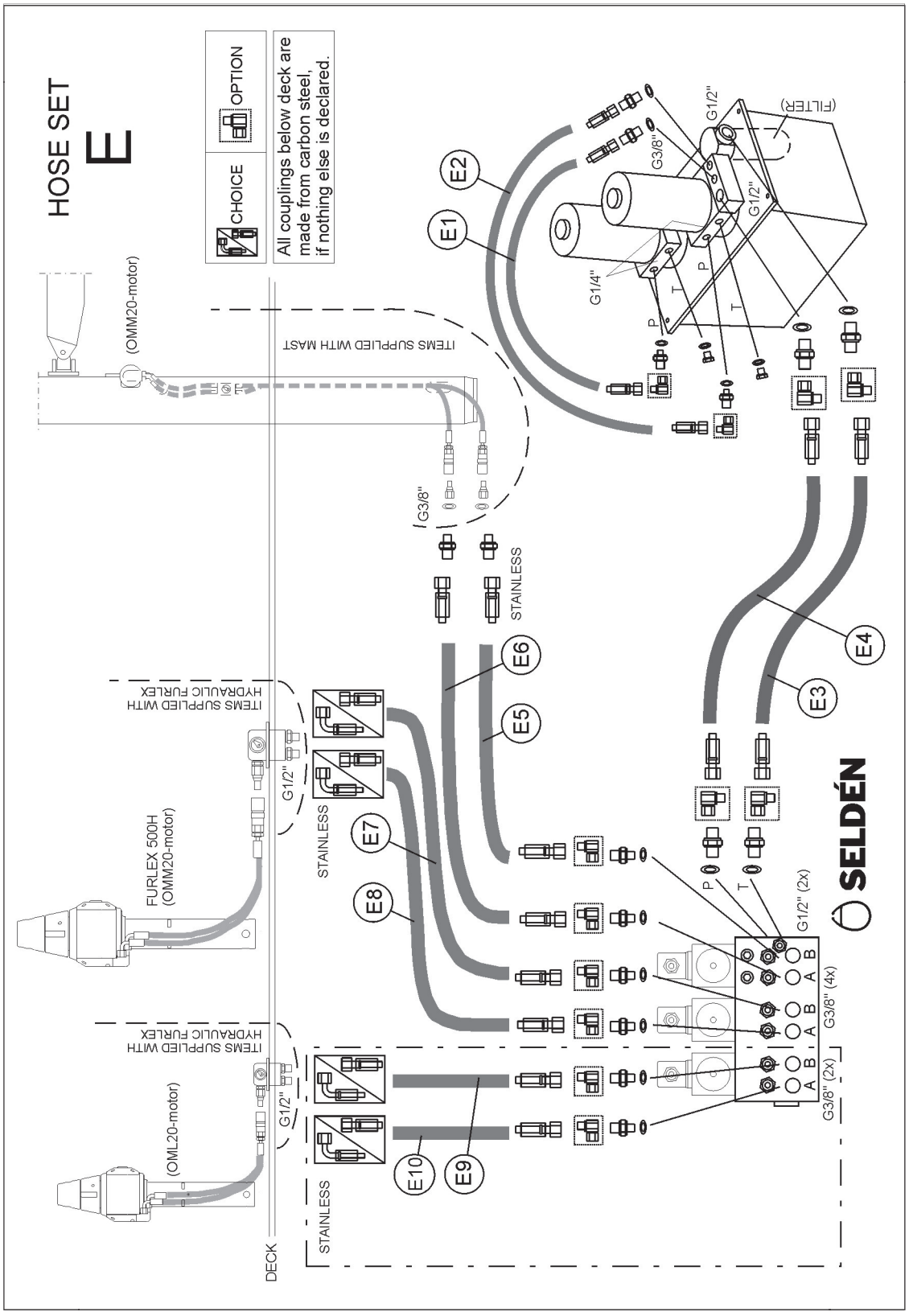

HOSE SET
E
CHOICE
OPTION
All couplings below deck are made from carbon steel, if nothing else is declared.
(OMM20-motor)
ITEMS SUPPLIED WITH MAST
G3/8"
STAINLESS
E1
E2
E3
E4
E5
E6
E7
E8
E9
E10
G1/4"
G3/8"
G1/2"
(FILTER)
P
T
ITEMS SUPPLIED WITH HYDRAULIC FURLEX
FURLEX 500H (OMM20-motor)
(OML20-motor)
DECK
G1/2" (2x)
G3/8" (4x)
G3/8" (2x)
A B
SELDÉN

Fig. 5.1.e

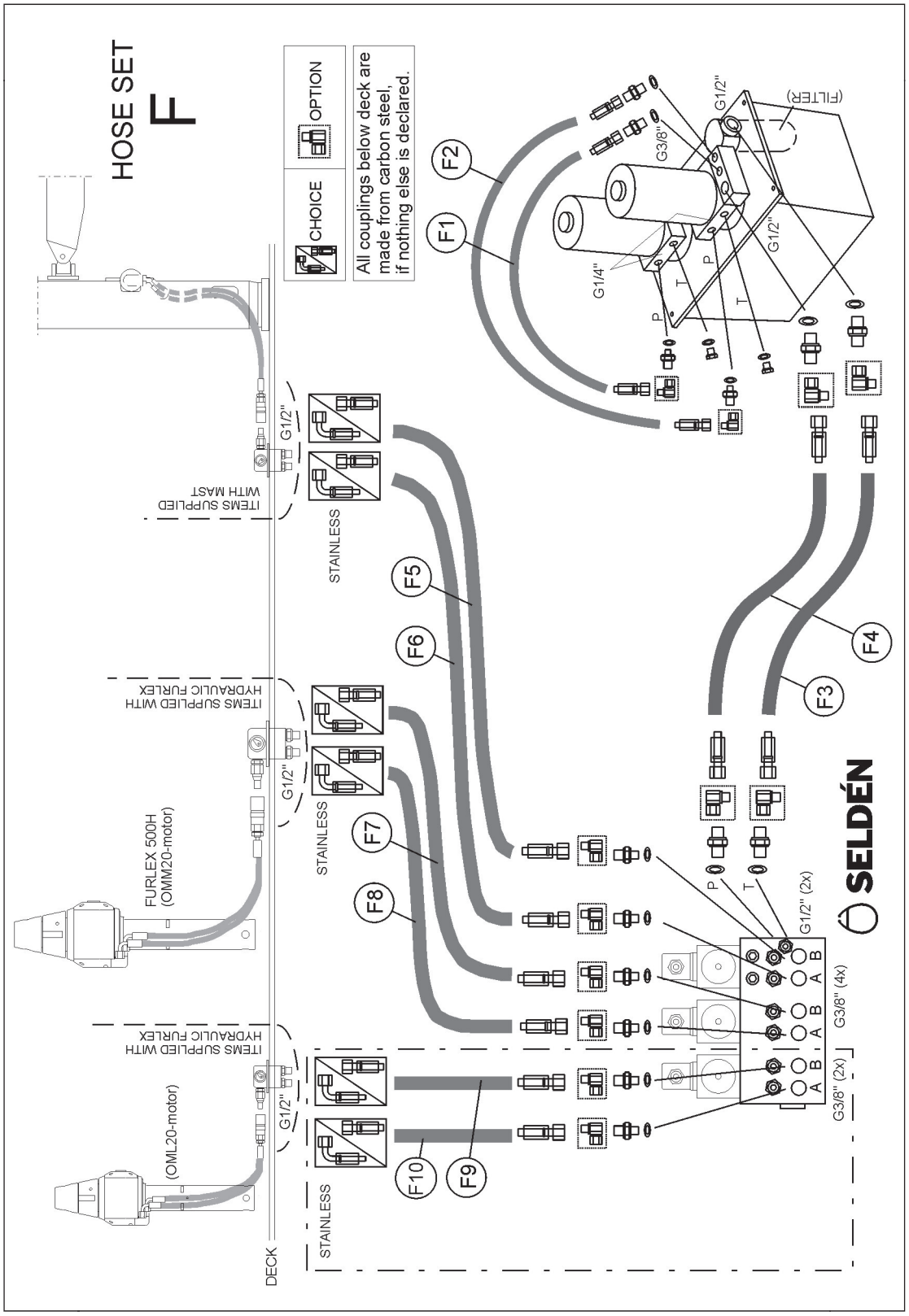

HOSE SET
F
OPTION
CHOICE
All couplings below deck are made from carbon steel, if nothing else is declared.
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
G1/2"
G3/8"
G1/4"
(FILTER)
P
T
ITEMS SUPPLIED WITH MAST
ITEMS SUPPLIED WITH HYDRAULIC FURLEX
FURLEX 500H (OMM20-motor)
(OML20-motor)
STAINLESS
G1/2" (2x)
G3/8" (4x)
G3/8" (2x)
A B
SELDÉN
DECK

Fig. 5.1.f

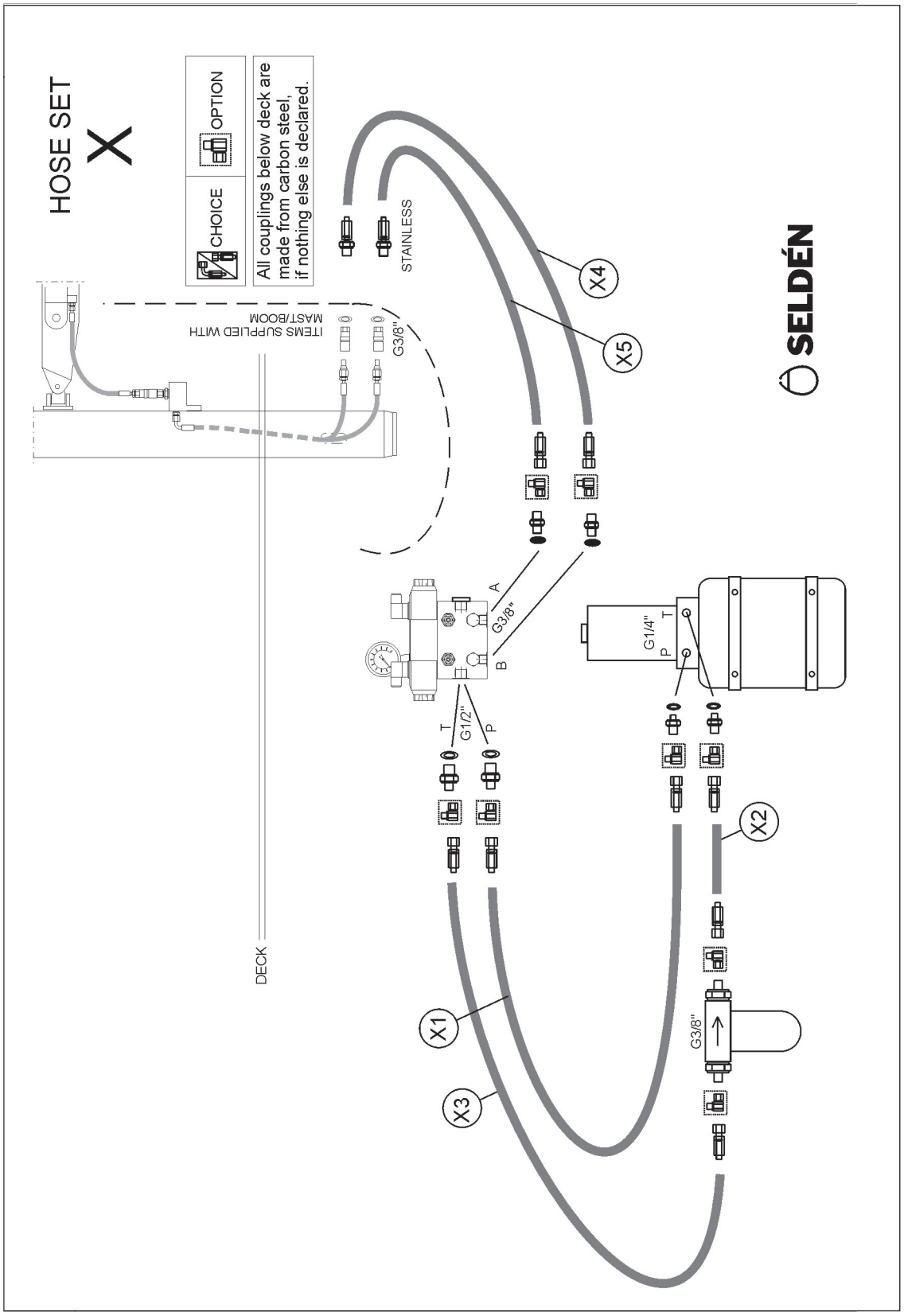

HOSE SET
X
OPTION
CHOICE
All couplings below deck are made from carbon steel, if nothing else is declared.
STAINLESS
ITEMS SUPPLIED WITH MAST/BOOM
G3/8"
DECK
X4
X5
SELDÉN
A
B
G3/8"
T
G1/2"
P
G1/4"
T
P
X1
X2
X3
G3/8"

Fig. 5.1.g

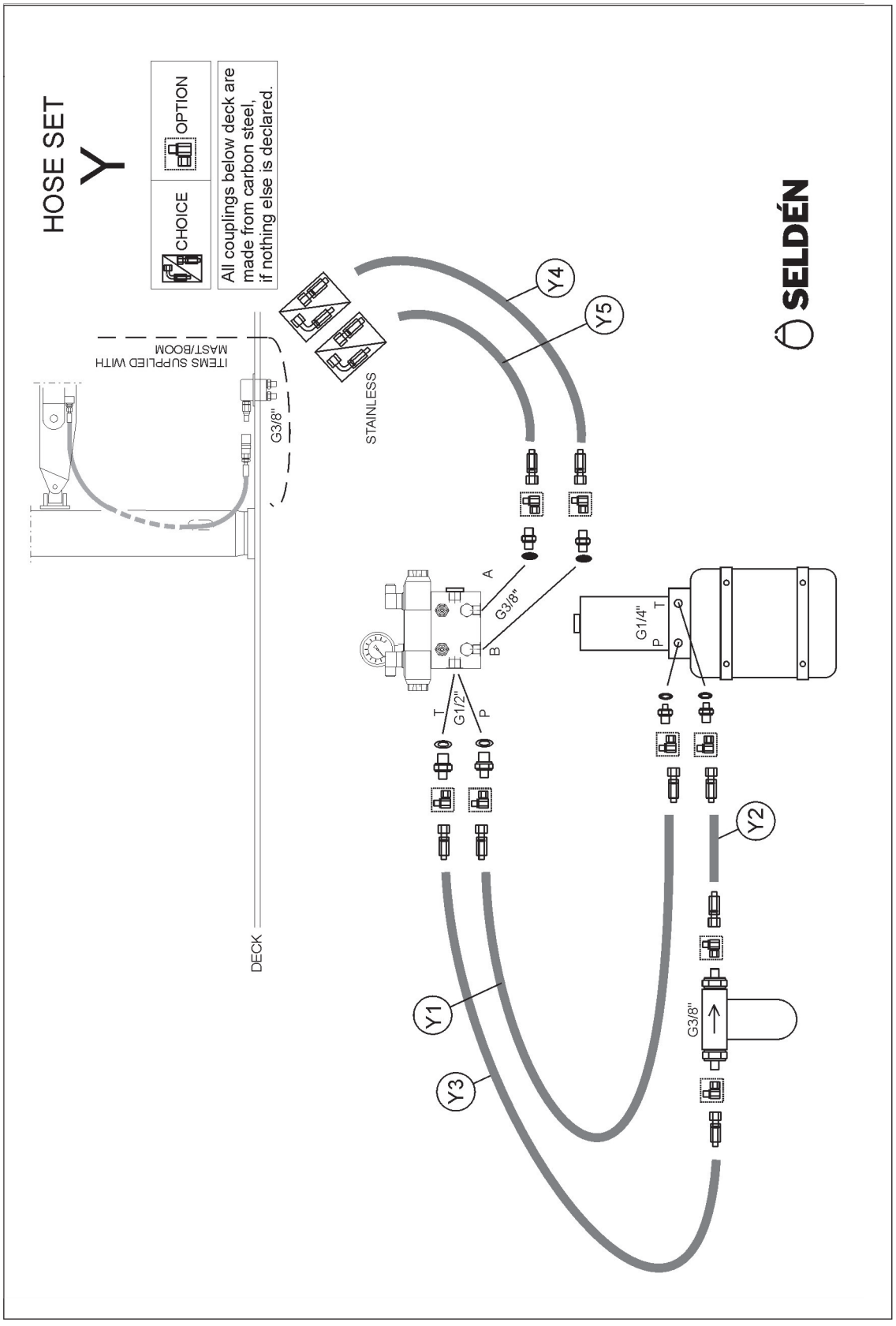

HOSE SET
Y
OPTION
CHOICE
All couplings below deck are made from carbon steel, if nothing else is declared.
SELDÉN
ITEMS SUPPLIED WITH MAST/BOOM
DECK
G3/8"
STAINLESS
Y4
Y5
A
B
G3/8"
T
G1/2"
P
G1/4"
T
P
Y2
Y1
Y3
G3/8"

Fig. 5.1.h

5.2. Fill-in forms for hose-length and couplings (A-F, X-Y)

			STAINLESS			CARBON STEEL						STAINLESS				
HOSE SET		540-870	540-885	540-900	540-902	540-976	540-977	540-978	540-972	540-979	540-973	540-914	540-963	540-915	540-920	591-690-01
A		HYDR. HOSE 3/8	Washer 1/4" ST	Washer 3/8" ST	Washer 1/2" ST	Nipple G3/8"-1/4" C.ST.	Nipple G3/8"-3/8" C.ST.	Nipple G1/2"-3/8" C.ST.	Hydr.coupling 3/8" NUT 0° C.ST.	Adaptor 3/8" 90° (MLE-NUT) C.ST.	Clamp hydr. hose 3/8" C.ST.	Hydr.coupling 3/8" MALE 0° ST	Hydr.coupling 3/8" NUT 0° ST	Hydr.coupling 3/8" NUT 90° ST	Clamp hydr. hose 3/8" ST	LABEL KIT (HOSE SET A)
										Option			Choice			
Hose assy number	Hose dim.	Hose length (mm)	Quantity of details													
SUM			2	6	2	2	6	2	12		12	2			6	1
A1	3/8"		1		1	1		1	2		2					
A2	3/8"		1			1			2		2					
A3	3/8"				1			1	2		2					
A4	3/8"			1			1		1		1	1			1	
A5	3/8"			1			1		1		1	1			1	
A6	3/8"			1			1		1		1				1	
A7	3/8"			1			1		1		1				1	
A8	3/8"			1			1		1		1				1	
A9	3/8"			1			1		1		1				1	

BOAT	
DATE	
SIGN	

SELDÉN

Please measure the hoses, using the definition of length below.

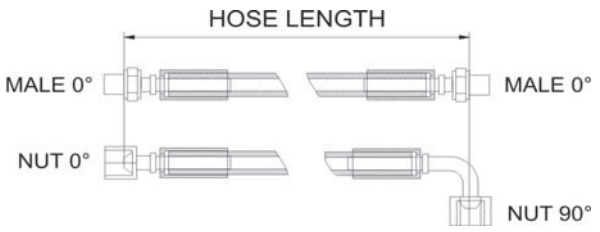


Fig. 5.2.a

HOSE SET B		540-870	STAINLESS			CARBON STEEL						STAINLESS				
			540-885	540-900	540-902	540-976	540-977	540-978	540-972	540-979	540-973	540-914	540-963	540-915	540-920	591-690-02
		HYDR. HOSE 3/8	Washer 1/4" ST	Washer 3/8" ST	Washer 1/2" ST	Nipple G3/8"-1/4" C.ST.	Nipple G3/8"-3/8" C.ST.	Nipple G1/2"-3/8" C.ST.	Hydr.coupling 3/8" NUT 0° C.ST.	Adaptor 3/8" 90° (MLE-NUT) C.ST.	Clamp hydr. hose 3/8" C.ST.	Hydr.coupling 3/8" MALE 0° ST	Hydr.coupling 3/8" NUT 0° ST	Hydr.coupling 3/8" NUT 90° ST	Clamp hydr. hose 3/8" ST	LABEL KIT (HOSE SET B)
										Option			Choice			
Hose assy number	Hose dim.	Hose length (mm)	Quantity of details													
SUM			2	6	2	2	6	2	12		12				6	1
B1	3/8"		1		1	1		1	2		2					
B2	3/8"		1			1			2		2					
B3	3/8"				1			1	2		2					
B4	3/8"			1			1		1		1				1	
B5	3/8"			1			1		1		1				1	
B6	3/8"			1			1		1		1				1	
B7	3/8"			1			1		1		1				1	
B8	3/8"			1			1		1		1				1	
B9	3/8"			1			1		1		1				1	

BOAT	
DATE	
SIGN	

SELDÉN

Please measure the hoses, using the definition of length below.

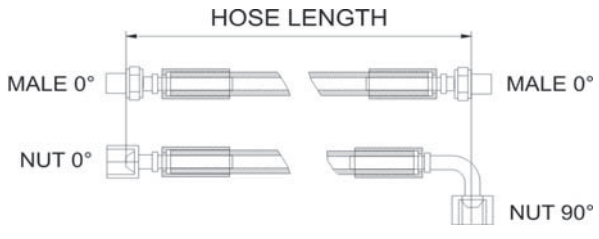
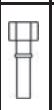
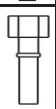
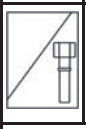


Fig. 5.2.b

			STAINLESS			CARBON STEEL										STAINLESS				
HOSE SET C			540-885	540-900	540-902	540-976	540-977	540-978	540-982	540-972	540-974	540-979	540-980	540-973	540-975	540-914	540-963	540-915	540-920	591-690-03
		HYDR. HOSE 3/8", 540-870 HYDR. HOSE 1/2", 540-981	Washer 1/4" ST	Washer 3/8" ST	Washer 1/2" ST	Nipple G3/8"-1/4" C.ST.	Nipple G3/8"-3/8" C.ST.	Nipple G1/2"-3/8" C.ST.	Nipple G1/2"-1/2" C.ST.	Hydr.coupling 3/8" NUT 0° C.ST.	Hydr.coupling 1/2" NUT 0° C.ST.	Adaptor 3/8" 90° (MLE-NUT) C.ST.	Adaptor 1/2" 90° (MLE-NUT) C.ST.	Clamp hydr. hose 3/8" C.ST.	Clamp hydr. hose 1/2" C.ST.	Hydr.coupling 3/8" MLE 0° ST	Hydr.coupling 3/8" NUT 0° ST	Hydr.coupling 3/8" NUT 90° ST	Clamp hydr. hose 3/8" ST	LABEL KIT (HOSE SET C)
																				
												Option					Choice			
Hose assy number	Hose dim.	Hose length (mm)	Quantity of details																	
SUM			2	10	6	2	10	4	2	16	2		1	16	2	4			8	1
C1	**1/2"**				2				2		2		1		2					
C2	3/8"		1		1	1		1		2				2						
C3	3/8"			1	1		1	1		2				2						
C4	3/8"			1			1			1				1		1			1	
C5	3/8"			1			1			1				1		1			1	
C6	3/8"			1			1			1				1					1	
C7	3/8"			1			1			1				1					1	
C8	3/8"			1			1			1				1					1	
C9	3/8"			1			1			1				1					1	
C10	3/8"		1		1	1		1		2				2						
C11	3/8"			1	1		1	1		2				2						
C12	3/8"			1			1			1				1		1			1	
C13	3/8"			1			1			1				1		1			1	

BOAT	
DATE	
SIGN	

SELDÉN

Please measure the hoses, using the definition of length below.

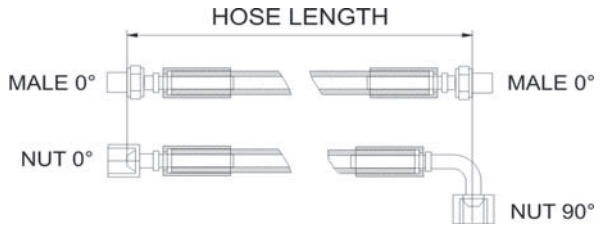


Fig. 5.2.c

HOSE SET			STAINLESS			CARBON STEEL										STAINLESS				
			540-885	540-900	540-902	540-976	540-977	540-978	540-982	540-972	540-974	540-979	540-980	540-973	540-975	540-914	540-963	540-915	540-920	591-690-04
D		HYDR. HOSE 3/8", 540-870 HYDR. HOSE 1/2", 540-981	Washer 1/4" ST	Washer 3/8" ST	Washer 1/2" ST	Nipple G3/8"-1/4" C.ST.	Nipple G3/8"-3/8" C.ST.	Nipple G1/2"-3/8" C.ST.	Nipple G1/2"-1/2" C.ST.	Hydr.coupling 3/8" NUT 0° C.ST.	Hydr.coupling 1/2" NUT 0° C.ST.	Adaptor 3/8" 90° (MLE-NUT) C.ST.	Adaptor 1/2" 90° (MLE-NUT) C.ST.	Clamp hydr. hose 3/8" C.ST.	Clamp hydr. hose 1/2" C.ST.	Hydr.coupling 3/8" MLE 0° ST	Hydr.coupling 3/8" NUT 0° ST	Hydr.coupling 3/8" NUT 90° ST	Clamp hydr. hose 3/8" ST	LABEL KIT (HOSE SET D)
												Option					Choice			
Hose assy number	Hose dim.	Hose length (mm)	Quantity of details																	
SUM			2	10	6	2	10	4	2	16	2		1	16	2	2			8	1
D1	**1/2"**				2				2		2		1		2					
D2	3/8"		1		1	1		1		2				2						
D3	3/8"			1	1		1	1		2				2						
D4	3/8"			1			1			1				1					1	
D5	3/8"			1			1			1				1					1	
D6	3/8"			1			1			1				1					1	
D7	3/8"			1			1			1				1					1	
D8	3/8"			1			1			1				1					1	
D9	3/8"			1			1			1				1					1	
D10	3/8"		1		1	1		1		2				2						
D11	3/8"			1	1		1	1		2				2						
D12	3/8"			1			1			1				1		1			1	
D13	3/8"			1			1			1				1		1			1	

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Please measure the hoses, using the definition of length below.

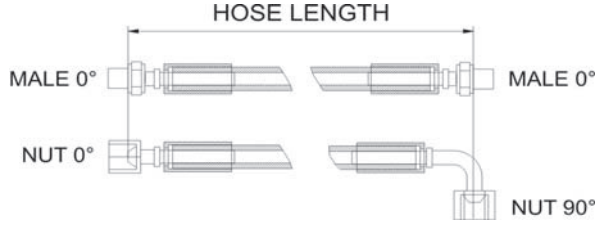

Fig. 5.2.d

HOSE SET E			STAINLESS			CARBON STEEL									STAINLESS				
			540-885	540-900	540-902	540-976	540-977	540-978	540-982	540-972	540-974	540-979	540-980	540-973	540-975	540-931	540-983	540-984	540-985	591-690-05
		HYDR. HOSE 3/8", 540-870 HYDR. HOSE 1/2", 540-981	Washer 1/4" ST	Washer 3/8" ST	Washer 1/2" ST	Nipple G3/8"-1/4" C.ST.	Nipple G3/8"-3/8" C.ST.	Nipple G1/2"-3/8" C.ST.	Nipple G1/2"-1/2" C.ST.	Hydr.coupling 3/8" NUT 0° C.ST.	Hydr.coupling 1/2" NUT 0° C.ST.	Adaptor 3/8" 90° (MLE-NUT) C.ST.	Adaptor 1/2" 90° (MLE-NUT) C.ST.	Clamp hydr. hose 3/8" C.ST.	Clamp hydr. hose 1/2" C.ST.	Nipple G1/2"-3/8" ST	Hydr.coupling 1/2" NUT 0° ST	Hydr.coupling 1/2" NUT 90° ST	Clamp hydr. hose 1/2" ST	LABEL KIT (HOSE SET E)
												Option					Choice			
Hose assy number	Hose dim.	Hose length (mm)	Quantity of details																	
SUM			2	8	4	2	2	6	4	4	16			4	16	2			6	1
E1	**3/8"**		1	1		1	1			2				2						
E2	**3/8"**		1	1		1	1			2				2						
E3	1/2"				2				2		2				2					
E4	1/2"				2				2		2				2					
E5	1/2"			1				1			2				2	1	1		1	
E6	1/2"			1				1			2				2	1	1		1	
E7	1/2"			1				1			2				2				1	
E8	1/2"			1				1			2				2				1	
E9	1/2"			1				1			2				2				1	
E10	1/2"			1				1			2				2				1	

BOAT	
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Please measure the hoses, using the definition of length below.

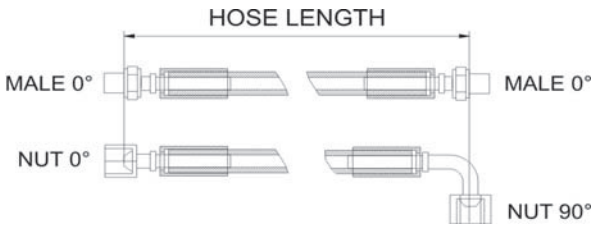

Fig. 5.2.e

HOSE SET F

HYDR. HOSE 3/8", 540-870 HYDR. HOSE 1/2", 540-981

			STAINLESS			CARBON STEEL									STAINLESS				
			540-885	540-900	540-902	540-976	540-977	540-978	540-982	540-972	540-974	540-979	540-980	540-973	540-975	540-931	540-983	540-984	540-985	591-690-06
			Washer 1/4" ST	Washer 3/8" ST	Washer 1/2" ST	Nipple G3/8"-1/4" C.ST.	Nipple G3/8"-3/8" C.ST.	Nipple G1/2"-3/8" C.ST.	Nipple G1/2"-1/2" C.ST.	Hydr.coupling 3/8" NUT 0° C.ST.	Hydr.coupling 1/2" NUT 0° C.ST.	Adaptor 3/8" 90° (MLE-NUT) C.ST.	Adaptor 1/2" 90° (MLE-NUT) C.ST.	Clamp hydr. hose 3/8" C.ST.	Clamp hydr. hose 1/2" C.ST.	Nipple G1/2"-3/8" ST	Hydr.coupling 1/2" NUT 0° ST	Hydr.coupling 1/2" NUT 90° ST	Clamp hydr. hose 1/2" ST	LABEL KIT (HOSE SET F)
												Option					Choice			
Hose assy number	Hose dim.	Hose length (mm)	Quantity of details																	
SUM			2	8	4	2	2	6	4	4	16			4	16				6	1
F1	**3/8"**		1	1		1	1			2				2						
F2	**3/8"**		1	1		1	1			2				2						
F3	1/2"				2				2		2				2					
F4	1/2"				2				2		2				2					
F5	1/2"			1				1			2				2				1	
F6	1/2"			1				1			2				2				1	
F7	1/2"			1				1			2				2				1	
F8	1/2"			1				1			2				2				1	
F9	1/2"			1				1			2				2				1	
F10	1/2"			1				1			2				2				1	

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Please measure the hoses, using the definition of length below.

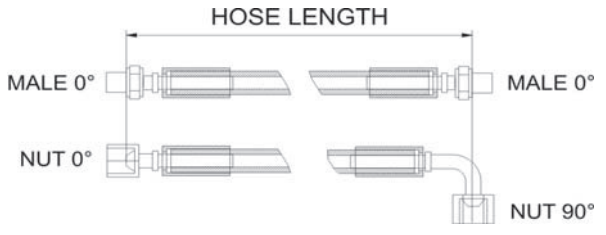

Fig. 5.2.f

			STAINLESS			CARBON STEEL						STAINLESS				
HOSE SET X		540-870	540-885	540-900	540-902	540-976	540-977	540-978	540-972	540-979	540-973	540-914	540-963	540-915	540-920	591-690-07
		HYDR. HOSE 3/8	Washer 1/4" ST	Washer 3/8" ST	Washer 1/2" ST	Nipple G3/8"-1/4" C.ST.	Nipple G3/8"-3/8" C.ST.	Nipple G1/2"-3/8" C.ST.	Hydr.coupling 3/8" NUT 0° C.ST.	Adaptor 3/8" 90° (MLE-NUT) C.ST.	Clamp hydr. hose 3/8" C.ST.	Hydr.coupling 3/8" MALE 0° ST	Hydr.coupling 3/8" NUT 0° ST	Hydr.coupling 3/8" NUT 90° ST	Clamp hydr. hose 3/8" ST	LABEL KIT (HOSE SET X)
										Option			Choice			
Hose assy number	Hose dim.	Hose length (mm)	Quantity of details													
SUM			2	2	2	2	2	2	8		8	2			2	1
X1	3/8"		1		1	1		1	2		2					
X2	3/8"		1			1			2		2					
X3	3/8"				1			1	2		2					
X4	3/8"			1			1		1		1	1			1	
X5	3/8"			1			1		1		1	1			1	

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Please measure the hoses, using the definition of length below.

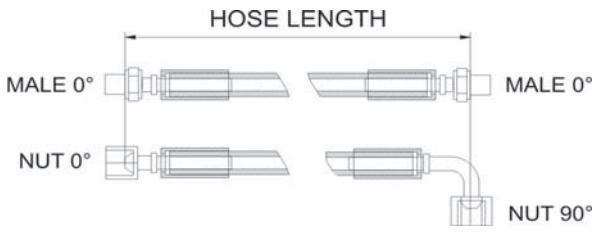
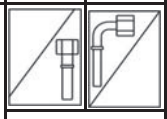


Fig. 5.2.e

HOSE SET Y			STAINLESS			CARBON STEEL						STAINLESS				
		540-870	540-885	540-900	540-902	540-976	540-977	540-978	540-972	540-979	540-973	540-914	540-963	540-915	540-920	591-690-08
		HYDR. HOSE 3/8	Washer 1/4" ST	Washer 3/8" ST	Washer 1/2" ST	Nipple G3/8"-1/4" C.ST.	Nipple G3/8"-3/8" C.ST.	Nipple G1/2"-3/8" C.ST.	Hydr.coupling 3/8" NUT 0° C.ST.	Adaptor 3/8" 90° (MLE-NUT) C.ST.	Clamp hydr. hose 3/8" C.ST.	Hydr.coupling 3/8" MALE 0° ST	Hydr.coupling 3/8" NUT 0° ST	Hydr.coupling 3/8" NUT 90° ST	Clamp hydr. hose 3/8" ST	LABEL KIT (HOSE SET Y)
										 Option			 Choice			
Hose assy number	Hose dim.	Hose length (mm)	Quantity of details													
SUM			2	2	2	2	2	2	8		8				2	1
Y1	3/8"		1		1	1		1	2		2					
Y2	3/8"		1			1			2		2					
Y3	3/8"				1			1	2		2					
Y4	3/8"			1			1		1		1				1	
Y5	3/8"			1			1		1		1				1	

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Please measure the hoses, using the definition of length below.

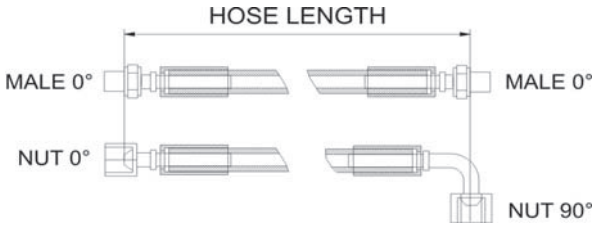

Fig. 5.2.e

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