



CURVETECH

**12 STATION INTELLIGENT
HYDRAULIC CONTROL UNIT
(iHCU)**

TECHNICAL MANUAL

SMD Reference: 12 Station Valve

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1 INTRODUCTION

This document is a technical manual for SMD's Curvtech 12 Station Valve Pack.

This document describes the specification, installation, operation and maintenance of this Valve Pack. The Valve Pack can be configured in 6 variants with a combination of proportional and directional valves.

The use of valve packs minimises the need for extensive hydraulic plumbing and consolidates the valve wiring onto a single cable. The valve packs group together valves of similar function. Spare functions are provided in various valve packs. The oil filled housing for each valve pack is fitted with a clear perspex cover for visual inspection of valves, oil quality, and LED indicators where fitted. The manifolds are manufactured from hard anodised 6082-T6 Aluminium for corrosion protection. The main housing is manufactured from Nylatron.

All valve packs and hydraulic components are easily accessible for maintenance. Test points are provided for the attachment of pressure gauges for maintenance, testing and set up.

Where possible, the hydraulic hoses are routed as a loom, together with electrical cables, for tidiness and protection. Each hose and pipe is identified with the SMD part number and has a circuit identification label attached.

One or two twelve function valve packs are located at the front of the vehicle and mounted vertically. They are used to control various tooling options mounted on the vehicle.



Figure 1 - 12F iHCU



2 SAFETY

2.1 SMD Statement on Product Safety

SMD view system safety as a critical property of all equipment that they manufacture.

SMD strive to:

- Remove or minimise hazards inherent in a system to the greatest practical extent.
- Provide control measures for residual hazards.
- Provide the users with the required information and warnings to avoid, or take precautions against, residual hazards.

Client Responsibilities

- Ensure that all personnel have read the required documentation to ensure they are operating safely.
- Equipment supplied by SMD is as safe as practicality permits regarding standard operation, maintenance and direct access to equipment, however due to the variations in installation SMD cannot foresee all hazards once installed on the clients vessel, therefore SMD shall not be liable for safety in the area where the equipment is installed, or for any deviations from standard operations or installation.
- During standard operations, it is unnecessary for personnel to be in close proximity to the machinery apart from when routine operational maintenance is carried out.
- It is the client's responsibility to provide adequate safety measures and procedures for the protection of personnel, including guards or other means to prevent unauthorised access to equipment.
- As the equipment is normally operated in a marine environment, safety measures pertaining to this must be taken into account and incorporated in the client's safety procedures.
- Training on the equipment and compliance with safety procedures are the responsibility of the client.
- All personnel must observe established safety procedures

2.2 Recommended Safety Precautions

Safety guidelines for handling, installing, operating and maintaining SMD equipment are given below. Specific precautions for protection of personnel and equipment are also provided.

The client is urged to incorporate these safety guidelines into their own safety procedures and make sure that all personnel are fully aware of these.



2.3 General Precautions

Safety devices provided by SMD are primarily intended for the protection of personnel and secondarily for the protection of the equipment.

Only suitably qualified and competent personnel should install, operate or maintain this equipment.

Personnel must fully understand and follow safe operating procedures at all times during the operation and maintenance of the equipment covered by these manuals.

The person in charge of operations must always have a clear view of the deck equipment.

When operations are conducted at night or in poor visibility, ensure that the equipment and immediate area around it are adequately illuminated.

Ensure that the work area is easily accessible without obstruction.

Route cables and hoses through separate protection channels or conduits wherever possible.

Ensure that all guard, guardrails and other protective devices are in position before commencing any operation.

Never wear loose clothing when working with moving machinery.

When there is uncertainty that a circuit is de-energised, it must be considered “live” at all times. This may be taken to mean electric or hydraulic circuits.

Isolate, lock-off and tag all electrical power sources before making any connections or disconnections or working on circuits.

Many critical components of the equipment may be subject to wear or damage and other deterioration, which reduces their normal useful life.

The equipment design provides safety margins taking into account normal wear and tear, however, in the case of extreme wear duty or known overload; the appropriate steps should be taken to rectify any problem and return the system to within its original specification.

If replacement is neglected, components can reach a point where they constitute a safety hazard; similarly, failure to maintain mechanisms necessary to assure correct and proper operation may also constitute a safety hazard.

Safety guidance may also be found in the relevant proprietary information manuals.



2.4 Specific Precautions

The equipment is manufactured from various grades of steel and aluminium.

On no account should welding be undertaken on any of the equipment without implementing approved weld procedures appropriate to the materials involved; failure to do this could endanger life and invalidate the certification of manufacture.

Hydraulic relief valves are one of the most important safety features and must never exceed manufacturer's recommended settings.

Only suitably qualified and competent personnel may perform any testing and re-adjustment of pressure relief devices.

Written records of inspection and maintenance activities should be maintained and regularly updated.

2.5 Warnings and Cautions



WARNING

- Statements outline minimum safety requirements to be observed when operating the equipment and during maintenance procedures.

Ignoring these warnings could result in serious injury or death of personnel.



CAUTION

- Statements call particular attention to a step in a procedure that, if not followed, could result in damage to, or destruction of, equipment.



3 SPECIFICATION

System pressures			
Maximum Pressure			300 bar
Working pressure			210 bar
Pressure Compensation			1 bar (max.)
Materials of Construction			
Housing			Nylatron
Manifold			Anodised Aluminium grade 6082-T6
Lid			Perspex
Measurements			
Weight	In Air		26kg
	In Sea Water		15kg
Length	Housing		524
	Housing including connectors		583
Depth	Housing		186
	Housing including connectors		234
Height	Housing		196
	Housing including connectors		247
Valve Specifications			
Proportional	Type		Wandfluh NG3-Mini 3-proportional solenoid spool
	Flow		Up to 8lpm bi-directional
Directional	Type		Wandfluh NG3-Mini 3-solenoid spool valve
	Flow		Up to 15lpm bi-directional
PO Check with Thermal Relief	Type		Wandfluh NG3-Mini 3-Check valve
	Flow		Up to 8lpm bi-directional
	Pressure Setting		Up to 315bar
Reducing Valve	Type		Sun Pilot operated reducing valve
	Flow		Up to 20lpm
	Pressure setting		210bar
Connections			
Hydraulic	Inlet		2 x 9/16" UNF SAEJ475 (ISO725)
	Return		2 x 9/16" UNF SAEJ475 (ISO725)
	Valve Control (A+B)		7/16" UNF SAEJ475 (ISO725)
	Compensator Ports	Fill	2 x 9/16" UNF SAE (1 blanked)
		Bleed	3 x 7/8" UNF SAE
Mechanical	Mounting Holes		4 x M8 (See Drawings for Footprint)
Electrical	Input Voltage		24V dc
	Serial Interface		RS 485 (Isolated)
	Connection		Impulse BH-8-MP (c/w Locking Collar)
	Power Consumption		14W per Valve, 30W electronics

Table 1 - 12 Station Valve Pack Specification



Miscellaneous	
Leak Detectors	2 Fitted and One Sensed
Oil Type	Mineral Oil Shell Tellus, Esso Nuto or Equivalent
Maximum Oil Temperature	50°C
Oil Viscosity Range	15-30 cSt at operating temperature (nominal 30°C)
Oil Cleanliness	NAS1638 class 7 or better
Pressure sensor	0 – 400 bar (4 – 20 mA)

Table 2 - 12 Station Valve Pack Specification (Continued)

3.1 Specific Options

Proportional Valves	Directional Valves	Pressure Regulating valve	Directional & PO Check Valves	Electrical Sensor Connections	SMD Part Reference	SMD Wiring Reference
4	6		2	Yes	AC2157	AA9070
4	8			No	AC2596	AB2918
6	6			No	AC3063	AB2918
2	9	1	1	Yes	AC3054	AC4346
4	8	1		Yes	AC3056	AC4346
6	6	1		No	AC3061	AB2918

Table 3 - Valve Configuration Options

Note:

The electrical sensor connections are available for bespoke wiring (consult SMD for details)



4 INSTALLATION

4.1 Mechanical / Hydraulic

The Valve Pack can be installed vertically or horizontally using the 4 M8 holes provided on the manifold block. The orientation of the Valve Pack is dependant on the layout of the mounting frame. See [9. GENERAL ARRANGEMENT DRAWINGS](#) for mounting hole dimensions

The Valve Pack is supplied with plastic plugs in all female pressure, return and valve control ports. It is operator choice as to the fittings used in the female thread interface.

During installation ensure the following:-

- Relief valve is fitted on the top of the unit
- Pressure and Return lines are piped correctly to the ports on the manifold body.
- All Valve Ports (A&B) are correctly piped to their appropriate tool.
- The appropriate compensator (1 Bar Max.) is attached to one of connections on the housing.
- All fittings are tightened with the correct size of spanner and there are no plastic covers or plastic plugs left on any of the threaded ports.
- All threaded connections to have an 'Anti-Seizing' compound applied prior to making up threaded connections.
- Should O-Rings be removed ensure that prior to re-installing the O-Ring groove is clean, free from damage and the O-Ring is lightly smeared with silicon grease.
- Prior to start up ensure that both the manifold body and main housing have all the air bled from them.

For hydraulic circuits see [9. GENERAL ARRANGEMENT DRAWINGS](#)

4.2 Electrical

The power and signals for the valve pack are connected through the Impulse Connector and Pin-out details are as follows:-

1. RS485 +
2. RS485 –
3. Comms Screen
4. 24V (PCB)
5. N/C
6. 24V (Valve Drive)
7. 0V.
8. N/C

Pin out details and optional sensor details are shown in wiring diagrams.

4.3 Control Protocol

If this is required, contact SMD for "SMD MVP Communication Protocol" document. For SMD contact details see page [19](#).



5 MAINTENANCE PROCEDURES

WARNING

- There is a risk of injury to personnel's skin and eyes from hydraulic fluid.
- Even when the Hydraulic Power Source is isolated residual pressure may be present unless the system is de-pressurised.
- Never attempt to remove any hydraulic hose or component while the HPU is in operation or when the system is known to be under pressure.
- Never disconnect hydraulic hoses unless it is KNOWN that the system is depressurised.
- Hydraulic fluid under pressure may have sufficient force to penetrate the skin causing serious injury.
- Serious tissue damage can develop if proper medical treatment is not administered immediately. The fluid may also be hot enough to cause burns.
- The release of hydraulic fluid under pressure presents a risk of eye injury to personnel. Always wear adequate eye protection; goggles are the best protective equipment for this.
- A competent first aider must treat any eye injury immediately as particles of debris may be contained in oil and some oil additives are irritants to the eye. The eye must be flushed with copious amounts of clean, fresh water or sterile saline; this must be immediately available.

CAUTION

- Equipment damage may occur if the following precautions are not taken.
- Prior to all maintenance activities ensure that the system is de-pressurised.
- Maintenance activities involving breaking into the hydraulic system must be planned in such a manner that they are conducted in a clean environment to prevent ingress of dirt, rust or other extraneous particles.
- The system proportional hydraulic directional control valves require hydraulic oil of cleanliness superior to NAS1638 class 8. Only use oil of this quality or superior.



5.1 General Maintenance

Inspection of the condition of the Valve Pack should be performed between each deployment of the system. The following should be considered in association with the customers standard inspection procedures.

- Mounting fixtures.
- Damage to hoses/piping.
- Leaks/damage to hydraulic fittings (including cover).
- Compensator oil level.
- Physical damage to Valve Pack (Housing, Lid and Manifold Block)
- Damage to Anodised protective coatings.
- Oil cleanliness.

5.2 Pre / Post Operational Checks

5.2.1 Electrical Connectors

Check that all shell connectors are tightened properly. Check that all pluggable connectors are fully inserted.



- **Lubricate electrical connectors with Silicone Spray Only.**
- **Use of grease based lubricant will cause premature failure of connectors.**

(Use PE6812 - Silicone Spray Aerosol {RS691-892} or equivalent)

Check that all other connectors are properly mated. Refer to the wiring diagram for connector types and locations. Check that all harnesses are securely fastened using the appropriate clamps or cable ties.

5.2.2 Hydraulic Fittings & Hoses

Check that all pipe and hose fittings are secure and that there is no evidence of leaks. Ensure that all pipes and hoses are securely fastened using the appropriate clamps or ties. Ensure that none of the hoses are subjected to undue tension or are kinked.

5.3 Hydraulics System Maintenance

See Figure 2 HCU - 12f Valve Pack on page 14.



5.3.1 Draining the Valve Pack Housing

The Valve Pack must be drained before accessing any internals for maintenance so it will be necessary to isolate the compensation system before draining. Follow the procedure below

Tools required
26 A/F spanner
28 A/F spanner

- 1) Disconnect the valve pack compensation connection.
- 2) Remove the lowest drain plug in the housing by removing 7/8 drainage blank, using a 26 A/F spanner. At the same time, counter hold the sealing adaptor with a 28mm A/F spanner. Do not loosen the retaining nut (38mm A/F). Drain the oil into a suitable container.
- 3) If necessary lift the relief valve on top of the valve pack to let air bleed in and thereby allow oil to drain faster.
- 4) Clean the drain plug, check the seal and refit the plug.

5.3.2 Filling the Valve Pack Housing

If the Valve Pack is connected to a compensation system then re-connecting it to the compensation hose will begin the fill process. In this instance follow procedures for filling a compensator to fill the valve pack housing. In addition to this check the following

- 1) Lift the relief valve to bleed air from the valve pack as it is filled with oil.
- 2) Visually check the oil level in the in the housing through the transparent cover.
- 3) Inspect the valve pack and compensation system for leaks.



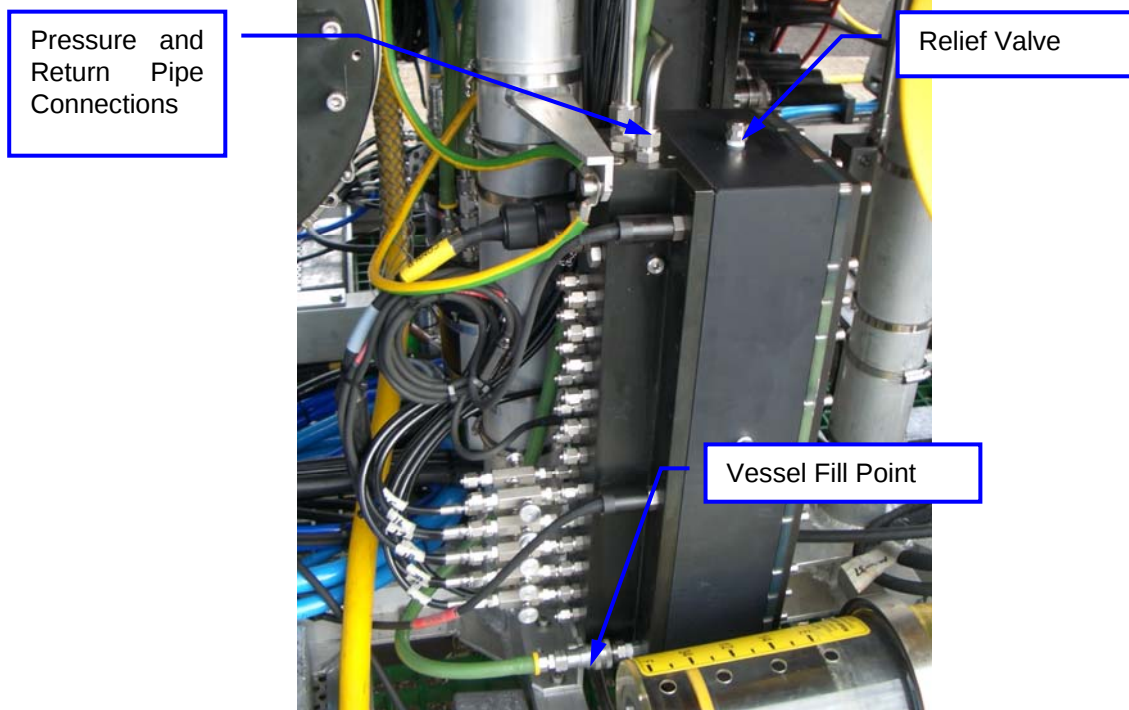


Figure 2 - HCU - 12f Valve Pack

5.3.3 Hydraulic Valve Replacement

There are three valve types fitted

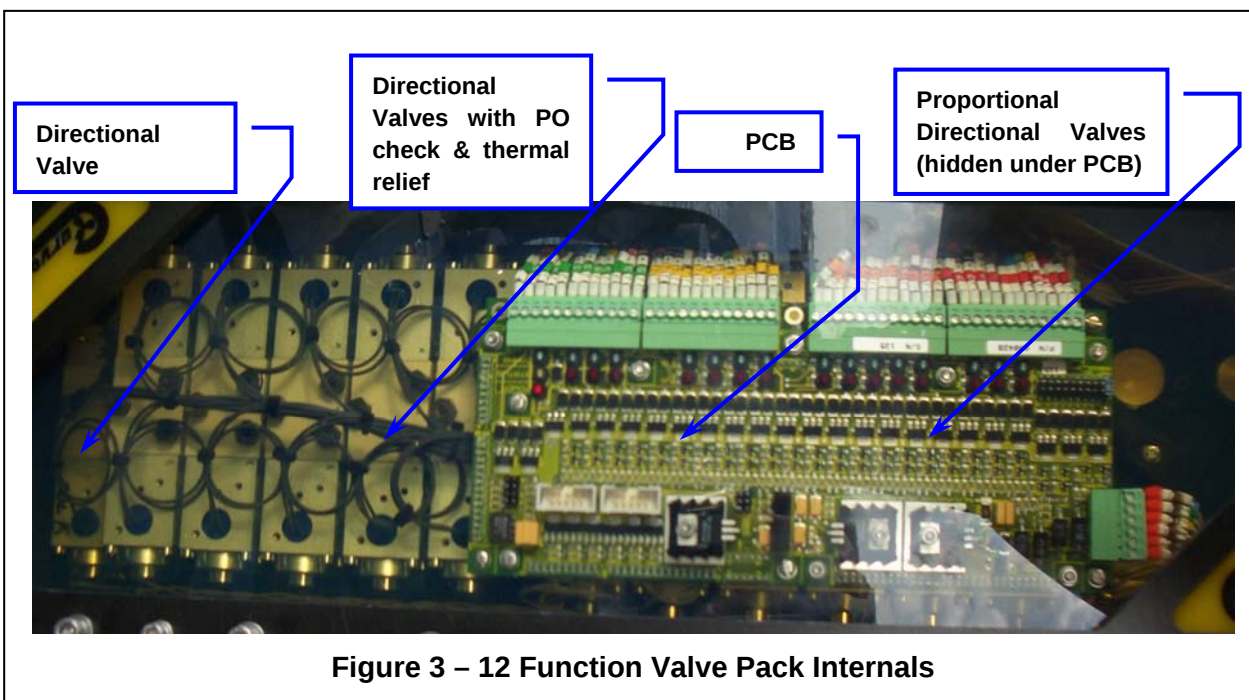
1. Proportional Directional Valves
2. Directional Valves
3. Check Valves c/w pilot operated check valve and integral thermal relief.

Tools required	Where used
M5 hexagon key	Cover Screws
Cross drive screw driver	PCB mounts
M3 hexagon key	Valve bolts

The following procedure applies to the replacement of any faulty hydraulic valve:

- 1) Isolate vehicle and hydraulics.
- 2) Drain the oil from the valve pack housing (see section [5.3.1](#))
- 3) Loosen all 22 M6 socket head cap screws from valve pack cover flange (leaving the four M5 bolts in place). The housing is then removed in one piece.
- 4) Note the identification and location of electrical connections on the valve driver Printed Circuit Board (PCB). Disconnect the electrical connectors on the PCB.
- 5) If the valve is located under the PCB, remove the PCB and the PCB mounting plate to clear access by loosening 4 x M3 cross head screws.





- 6) Remove 3 valve retaining bolts as appropriate and withdraw the valve or valve stack as appropriate.
- 7) Trace the wires on the valve being replaced back to the connector. Note cable identities and unscrew the terminals. Remove wires from the loom.
- 8) Check seals are in place on replacement valve and fit the valve quickly to minimise oil loss.
- 9) Refit valve retaining fasteners by tightening the first retaining fastener so the seal is just under compression then move to the opposite corner and tighten the retaining fastener till the seal is just under compression, repeat this for the other two bolts. Go round and tighten the four retaining fasteners, to the torque shown below.

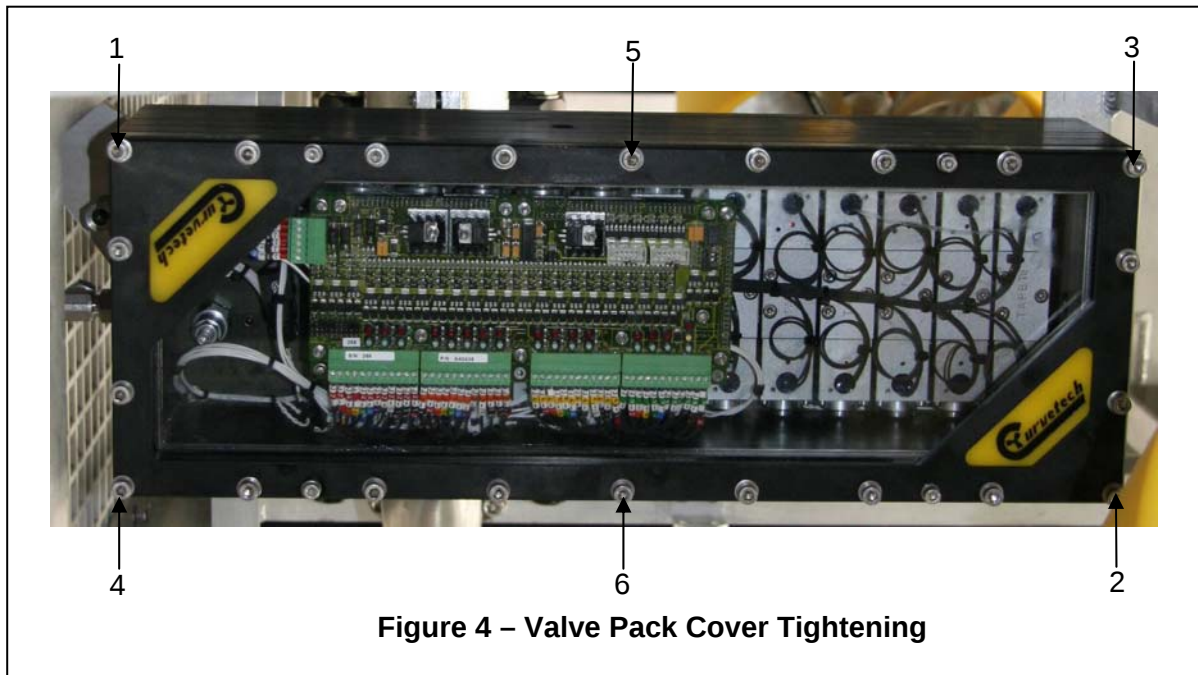
RECOMMENDED TORQUE

3Nm (2.2 ft/lb)

- 10) Connect the wires on the replacement valve to the connector terminals and replace the identity tags. Tighten the terminals screws and tidy the loom if required with tie wraps.
- 11) Re-fit the PCB and reconnect the electrical connectors.
- 12) Un-Isolate the hydraulic system from the valve packs.
- 13) Operate the valve in both directions and check for leaks.



- 14) Clean out the valve pack cover taking particular care to clean the flange and seal groove thoroughly.
- 15) Inspect the valve pack cover seal for damage. Replace if necessary.
- 16) Refit the valve pack cover by tightening socket head cap screw in the corner (1) till seal is only just under compression, then go onto the screw in the opposite corner (2) and tighten till seal is only just under compression. Repeat this procedure for socket head cap screws 3,4,5,6. Once complete go round and tighten up all socket head cap screws in the same order as above and insert the rest of the socket head cap screws.



- 17) Fill valve pack as per Section [5.3.2 above](#).

5.3.4 Setting Function Relief Valves

Thermal relief valves are fitted to protect the directional valves.

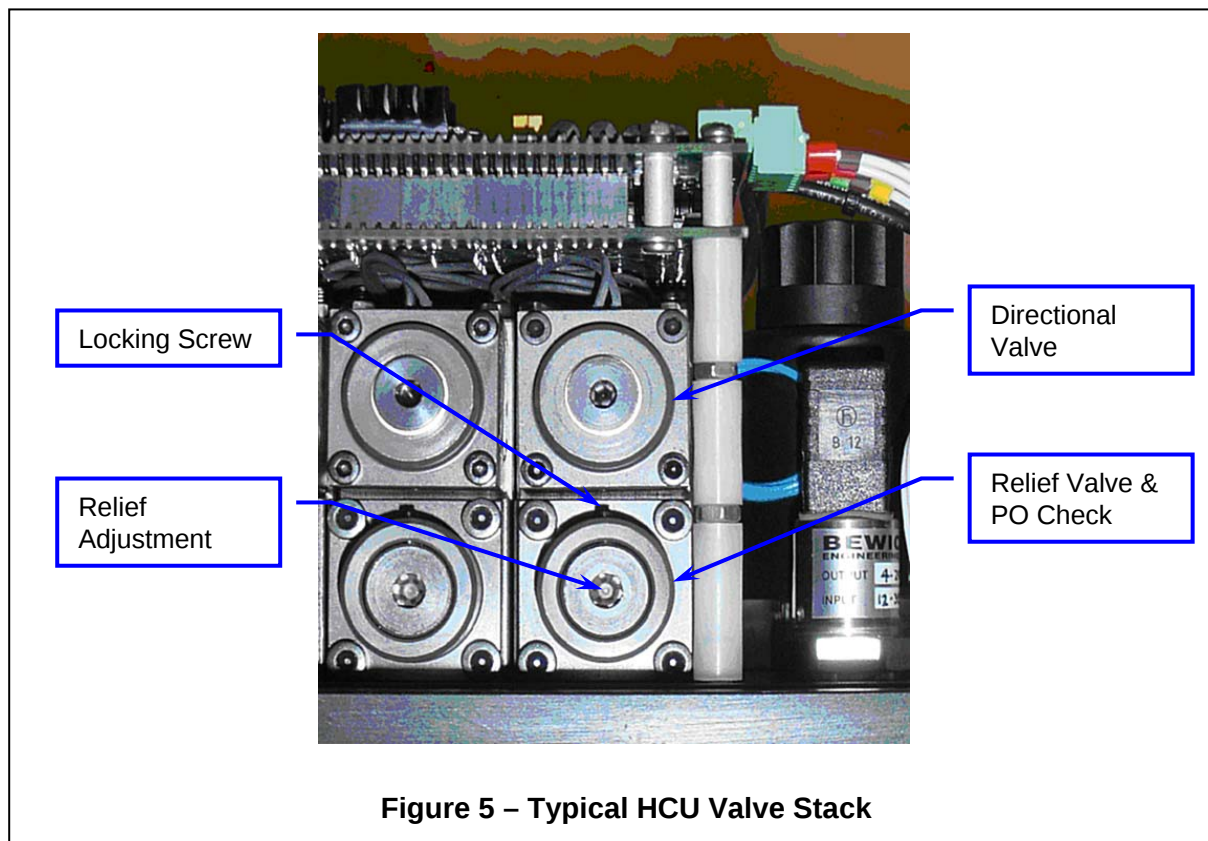
CAUTION

- Relief valves are low flow, and are only fitted to protect the functions from over pressurisation due to change in ambient pressure (water depth) or thermal expansion due to temperature change

The hydraulic circuit diagram shows the location of these valves. The method of setting the relief valve on a typical hydraulic function is as per the following procedure.



- 1) Isolate valve pack and hydraulics.
- 2) Drain the valve pack housing as per section [5.3.1 above](#) and remove the cover.
- 3) Remove the relevant function hose or pipe from the manifold. Blank the free end of the hose to prevent dirt & moisture ingress.
- 4) Attach a low flow hand pump pressure source (e.g.: Enerpac) to the function port, via an adaptor.
- 5) Operate the pump slowly to increase the pressure - the valve will relieve at the set pressure (210bar as factory set).



- 6) To adjust the setting, first slacken the lock screw.
- 7) Turn the relief adjusting with Allen key to gain the correct pressure, pumping as necessary:

Adjusting screw turned clockwise will increase pressure
Adjusting knob turned anticlockwise will decrease pressure

CAUTION

- Turning the setting down too far will result in the complete valve & components being forced out of the end of the valve body.



- 8) Release the pressure and tighten the lock screw on the relief valve adjusting screw.
- 9) Refit the hose or pipe removed.
- 10) Replace the cover and fill the valve pack housing as per Section [5.3.2 above](#)

5.4 Bolt Tightening

Stainless steel bolts throughout the valve system should be lubricated with 'AquaLube' grease and tightened to the torque values given in the table below. Valves are secured with M4 grade 8.8 bolts. These should be tightened to 3Nm.

Size	Torque Nm
M4	3
M6	10
M8	22
M10	44

Figure 6 – Torque values for Lubricated Grade A4-80 Stainless Steel Bolts

5.5 Storage

Valve Packs are shipped assuming they will be fitted to a system within 12 weeks. This assumes no extraordinary storage conditions, as no special precautions are taken for long term storage.

5.6 Yearly Maintenance

To ensure long service life, the following checks are to be done at least once a year:

- Check that valve bolts are not loose.
- Check that all valve bolts are still at the recommended tightening torque according to the torque table.
- Check the oil purity.



6 SERVICE AND SPARE PARTS

6.1 Service Returns Procedure

- The valve pack should be suitably packaged and returned to SMD freight paid after advising SMD of the required service work.
- A maintenance/failure report by the customer is required.
- A quotation for service/repair will be provided by SMD.
- An order to service/repair the unit is required before work can commence.

6.2 Spare Parts

Refer to the spare parts table below. Ordering by SMD part number reduces the risk of wrong parts being provided.

Part Number	Part Description
OF8017-1	Flow Control/Free flow check valve
PD8370	Relief Valve 15psi
AA5059	Directional valve mini – 3 24V flying leads
AA5061	Proportional Directional valve
AA5063	Check and thermal relief valve
PF2119	Connector
AA0439	PCB multi function valve controller

7 DISTRIBUTORS

Contact SMD Limited for a current list of distributors:-

- Telephone :- ++44 (0) 191 234 2222.
- Fax :- ++44 (0) 191 234 8599.
- E-mail :- info@smd.co.uk
- Web Site :- <http://www.smd.co.uk>
- Address :- Soil Machine Dynamics Limited.
Turbinia Works
Davy Bank
Wallsend,
Tyne and Wear,
United Kingdom.
NE28 6UZ.

SMD has a network of distributors that can provide in-field support for Curvetech Products in their relative areas.



8 PROPRIETARY INFORMATION

Part No.	Description	Link
PK4444	Senstronic pressure sensor – 0-4 bar	PK4444
AA5059	Valve directional mini 3	Mini 3-D
AA5061	Valve proportional mini 3	Mini 3-P



9 GENERAL ARRANGEMENT DRAWINGS INCLUDING PARTS LIST

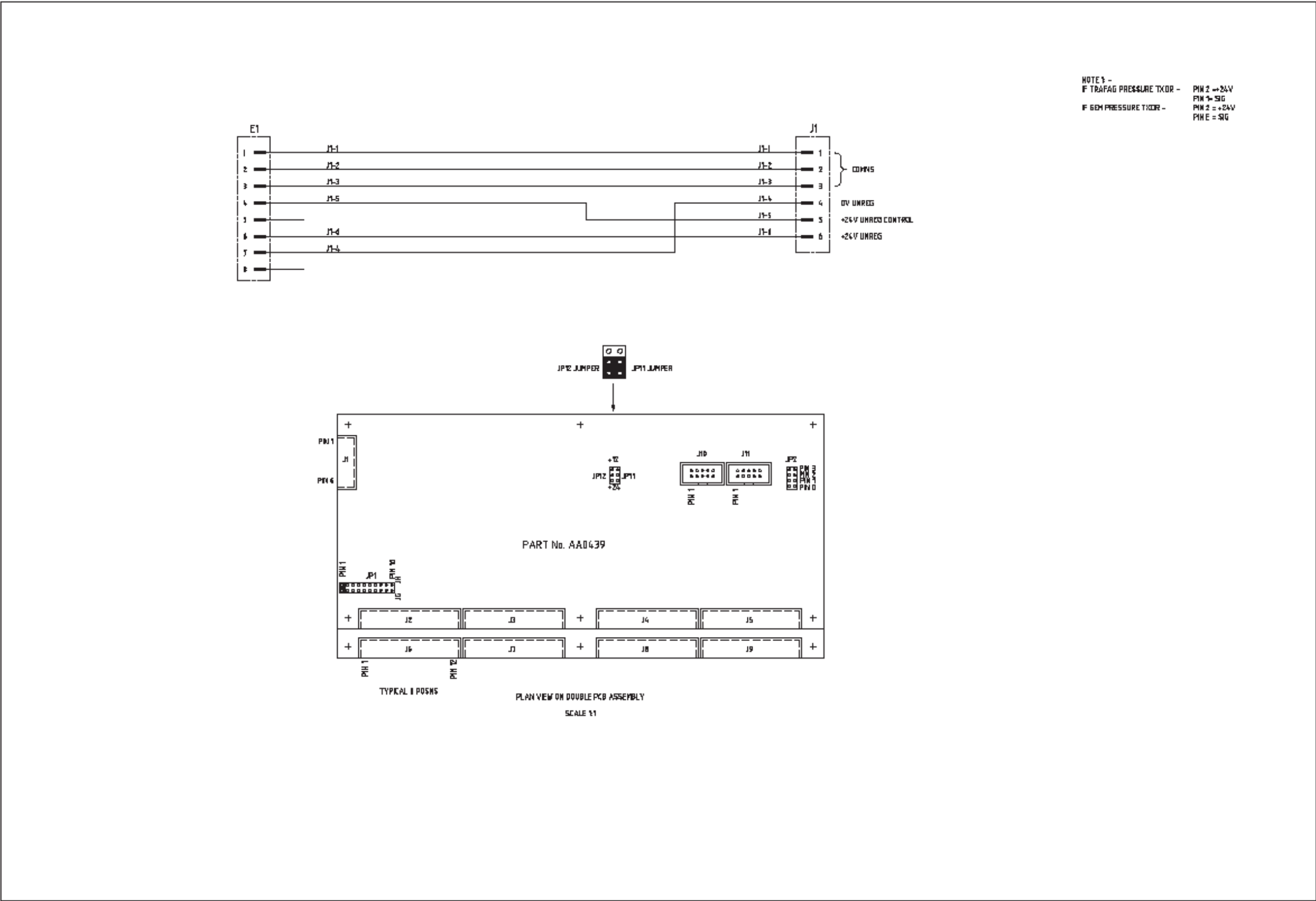


Figure 7 – AC1527 1/2



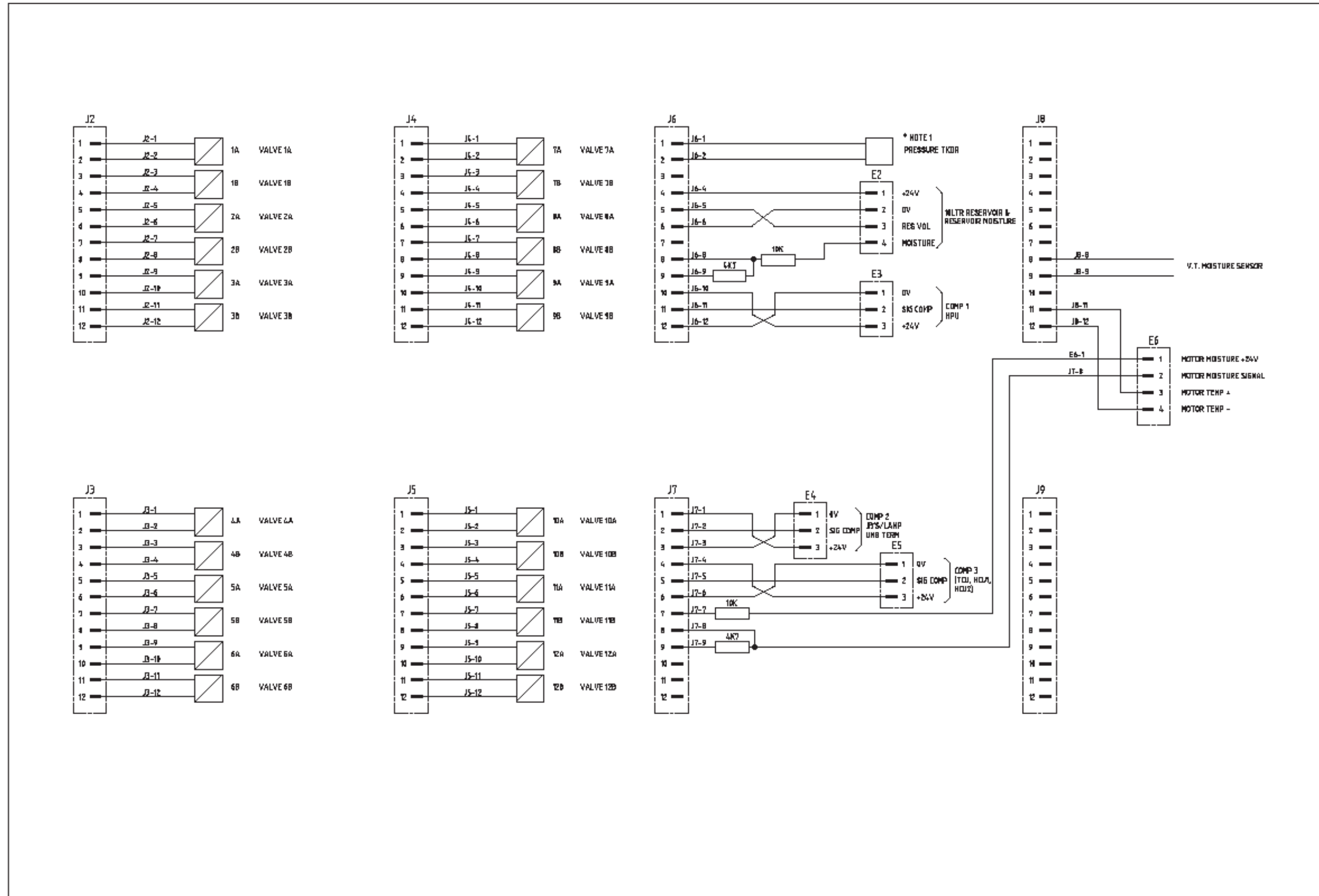


Figure 8 – AC1527 2/2



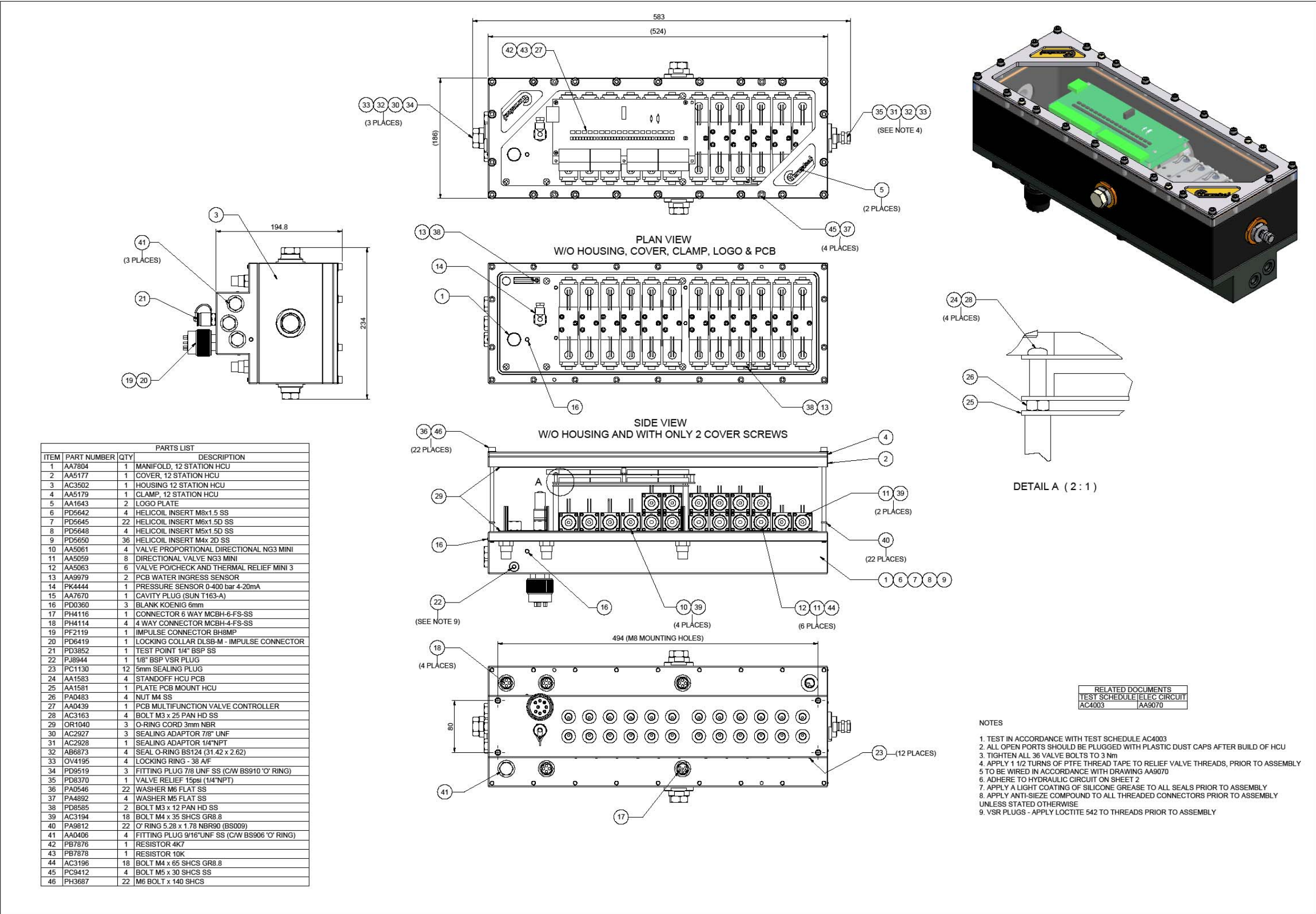


Figure 9 - AC2157 - 1/2



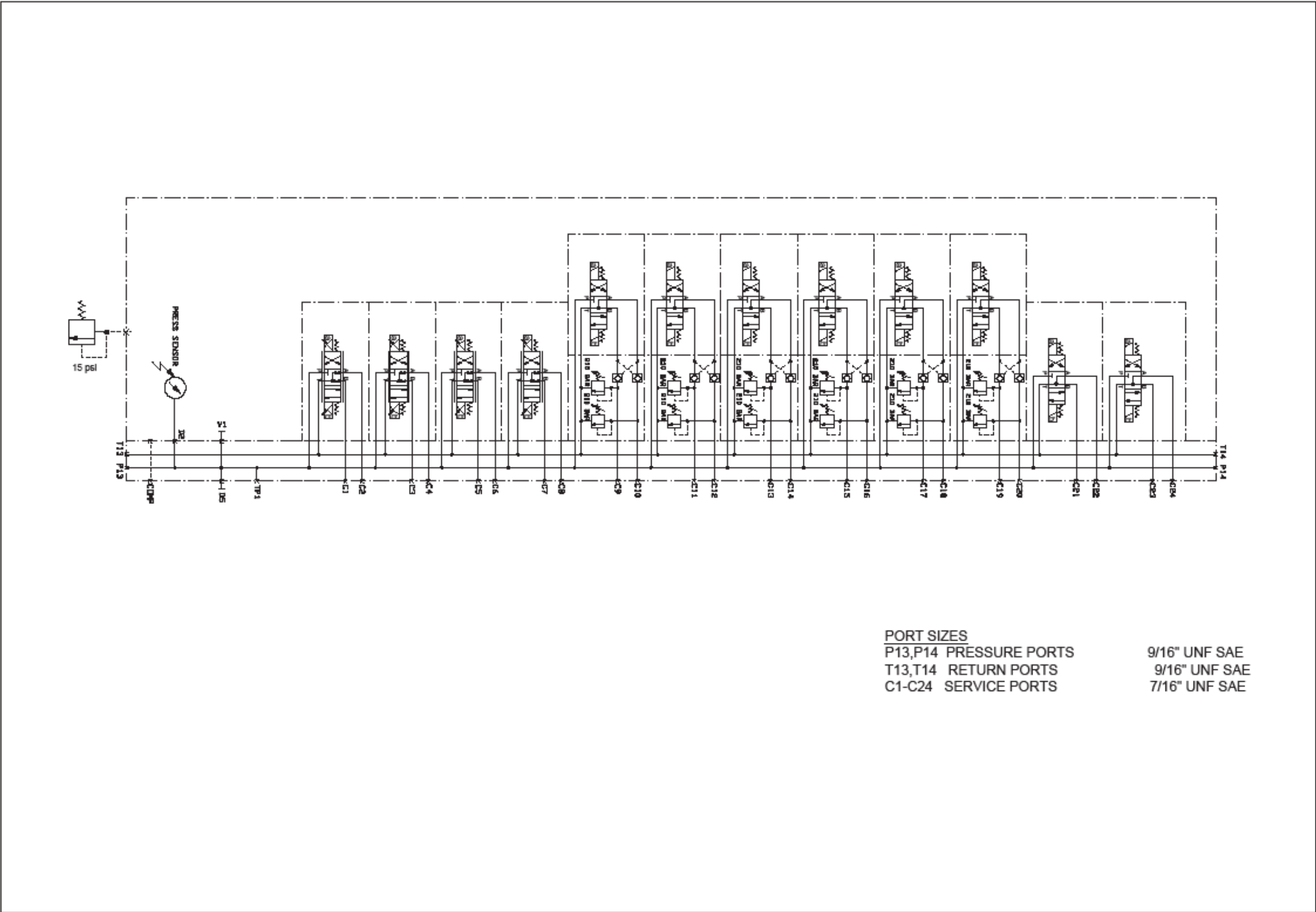


Figure 10 – AC2157 2/2



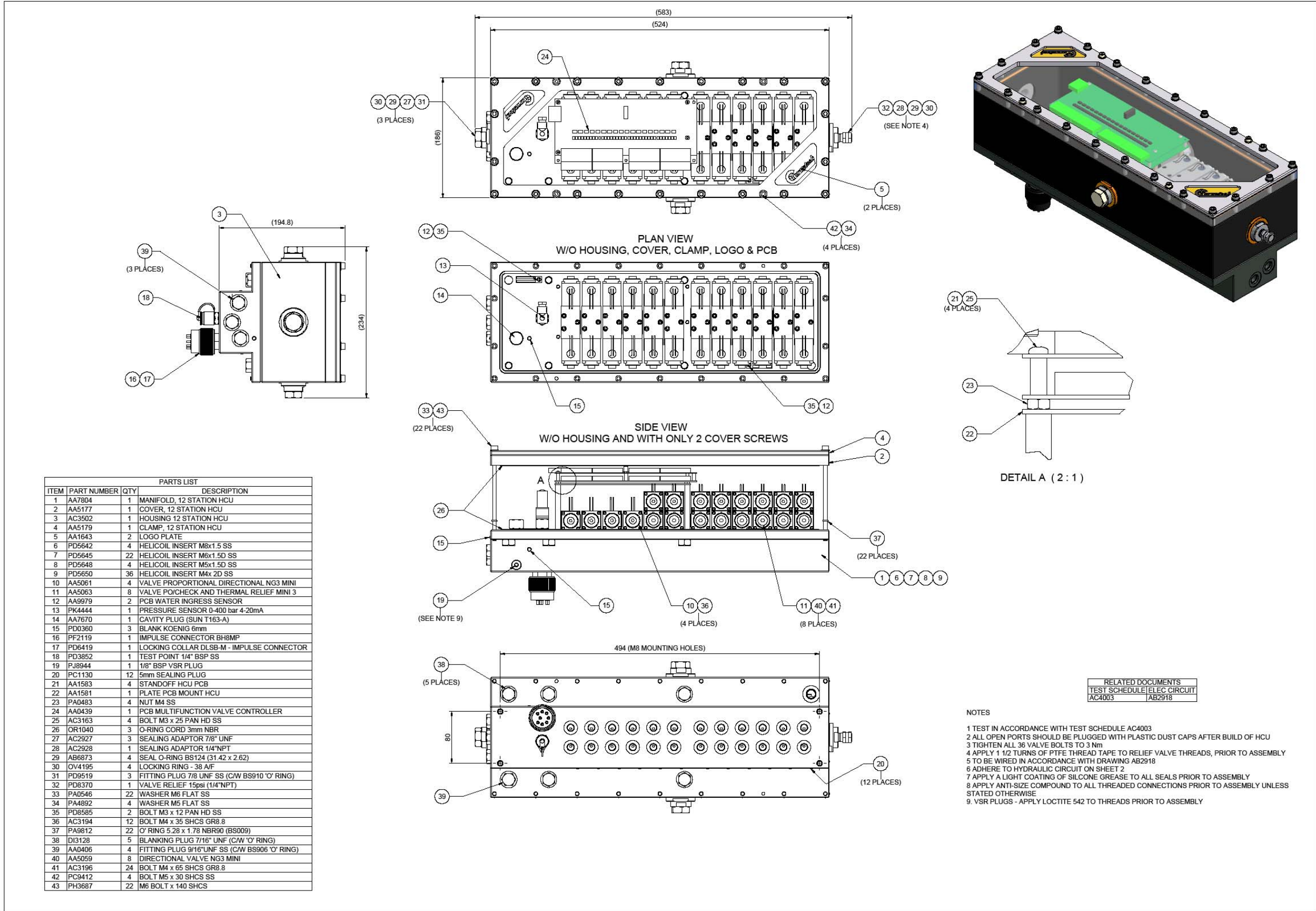


Figure 11 – AC2596 1/2



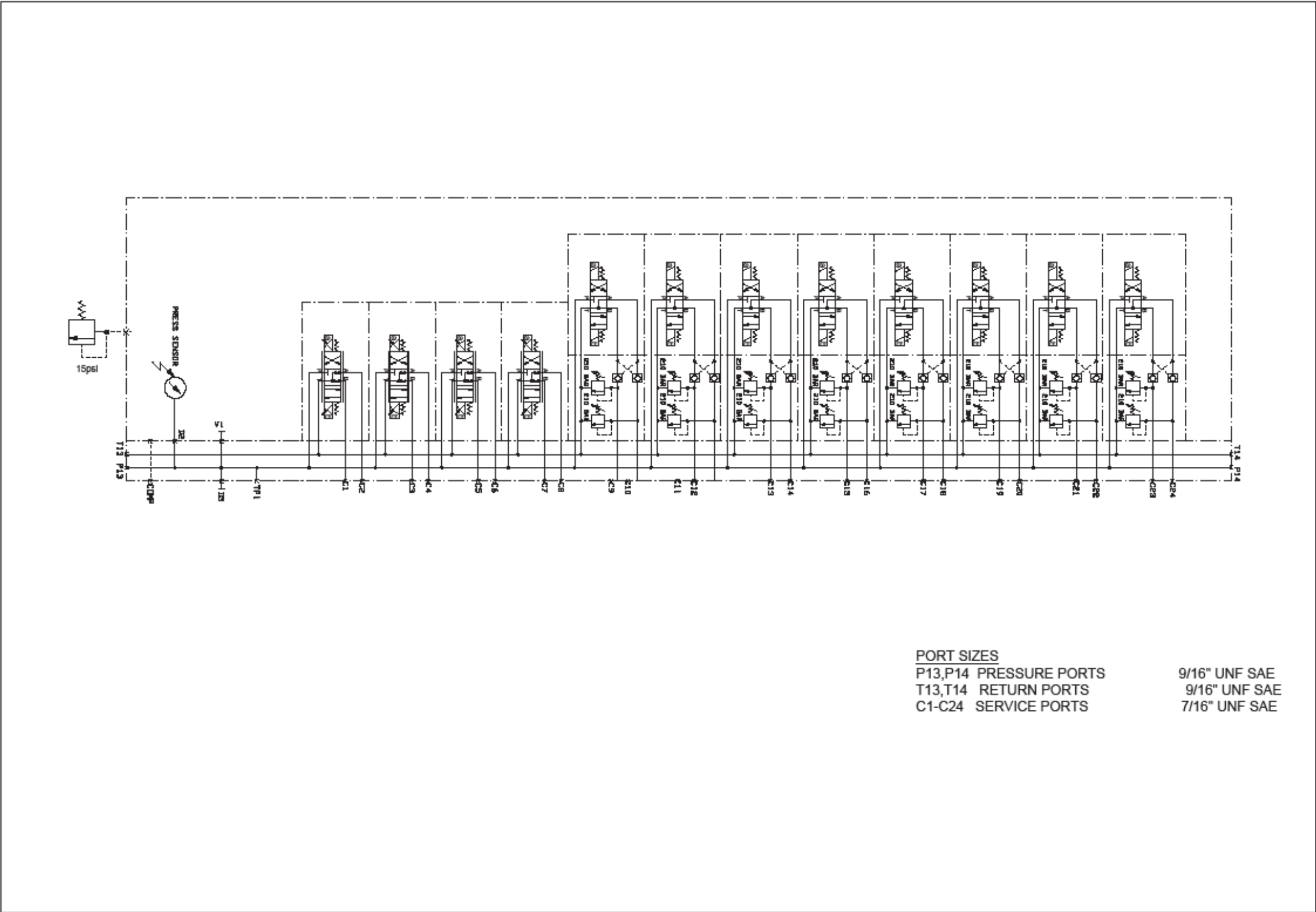


Figure 12 – AC2596 2/2



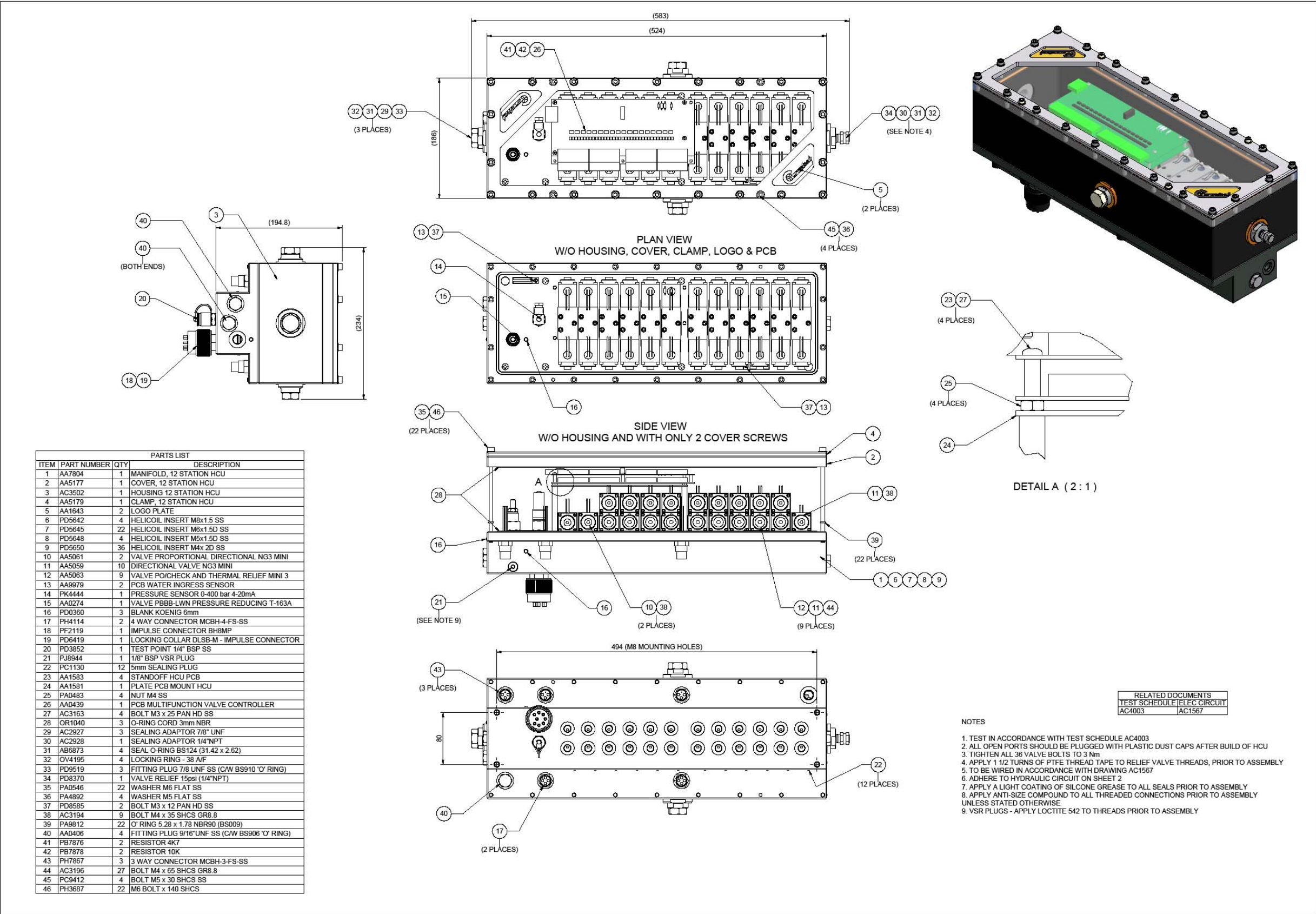


Figure 13 – AC3054 1/2



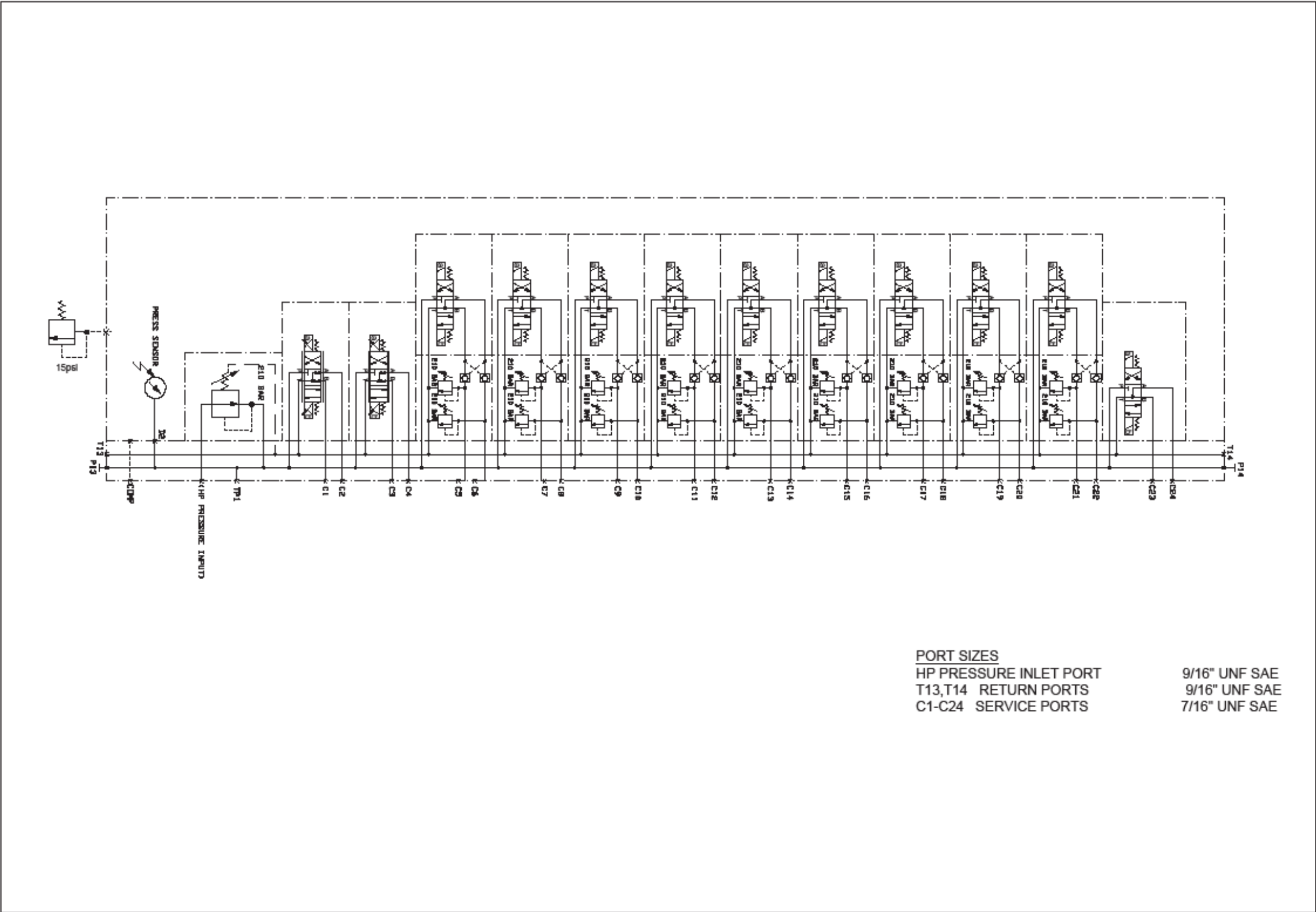


Figure 14 – AC3054 2/2



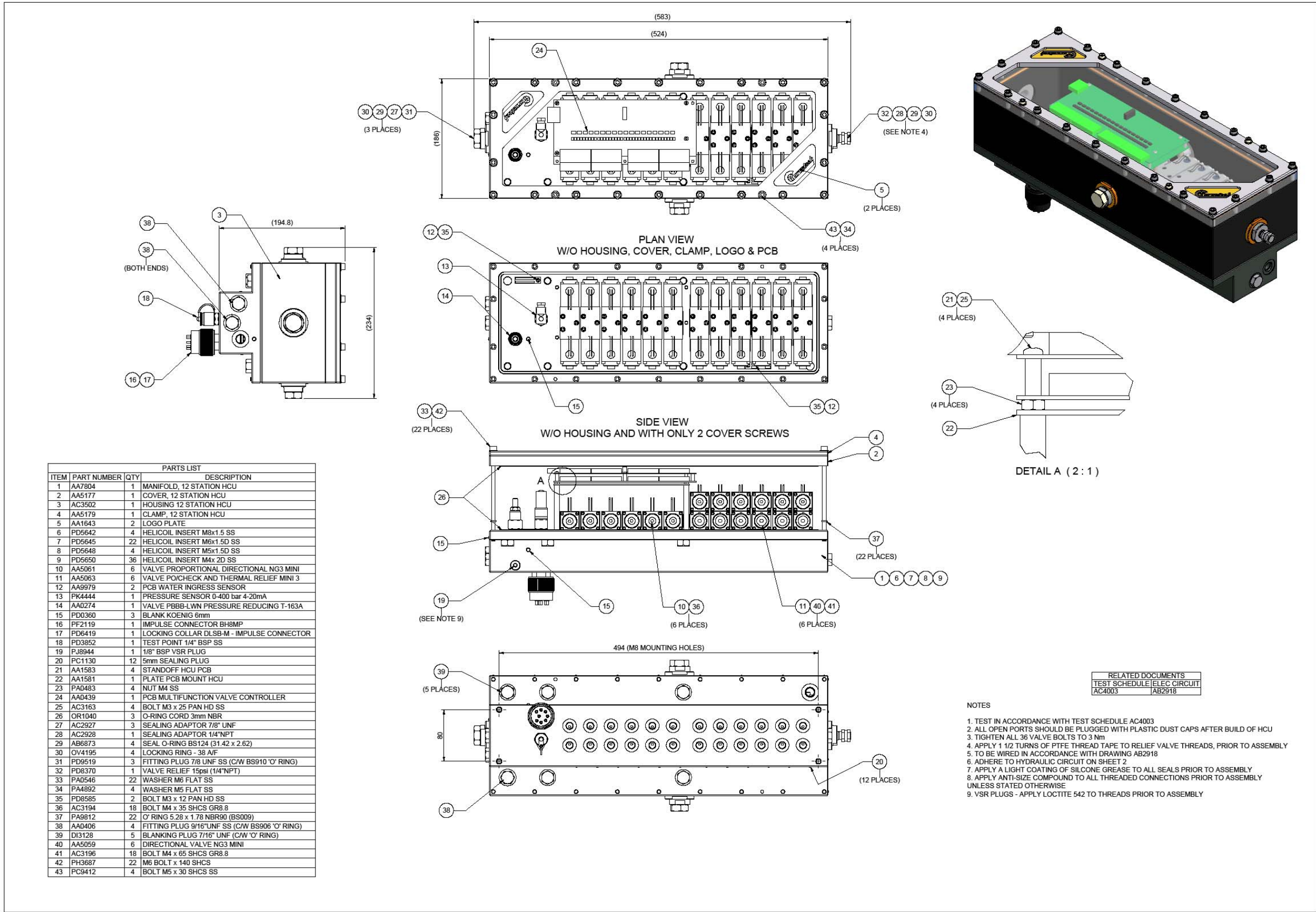


Figure 15 – AC3061 1/2



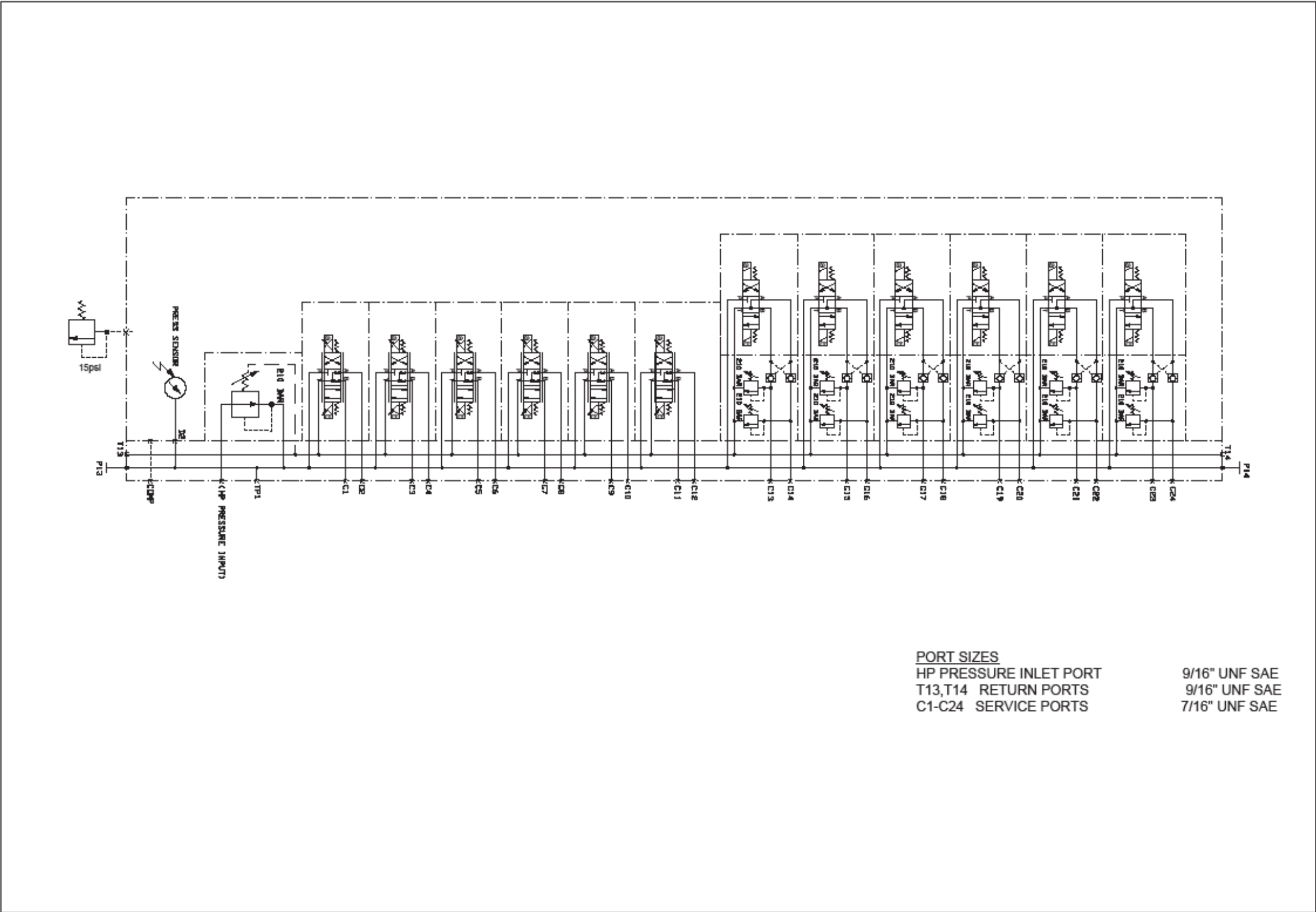


Figure 16 – AC3061 2/2



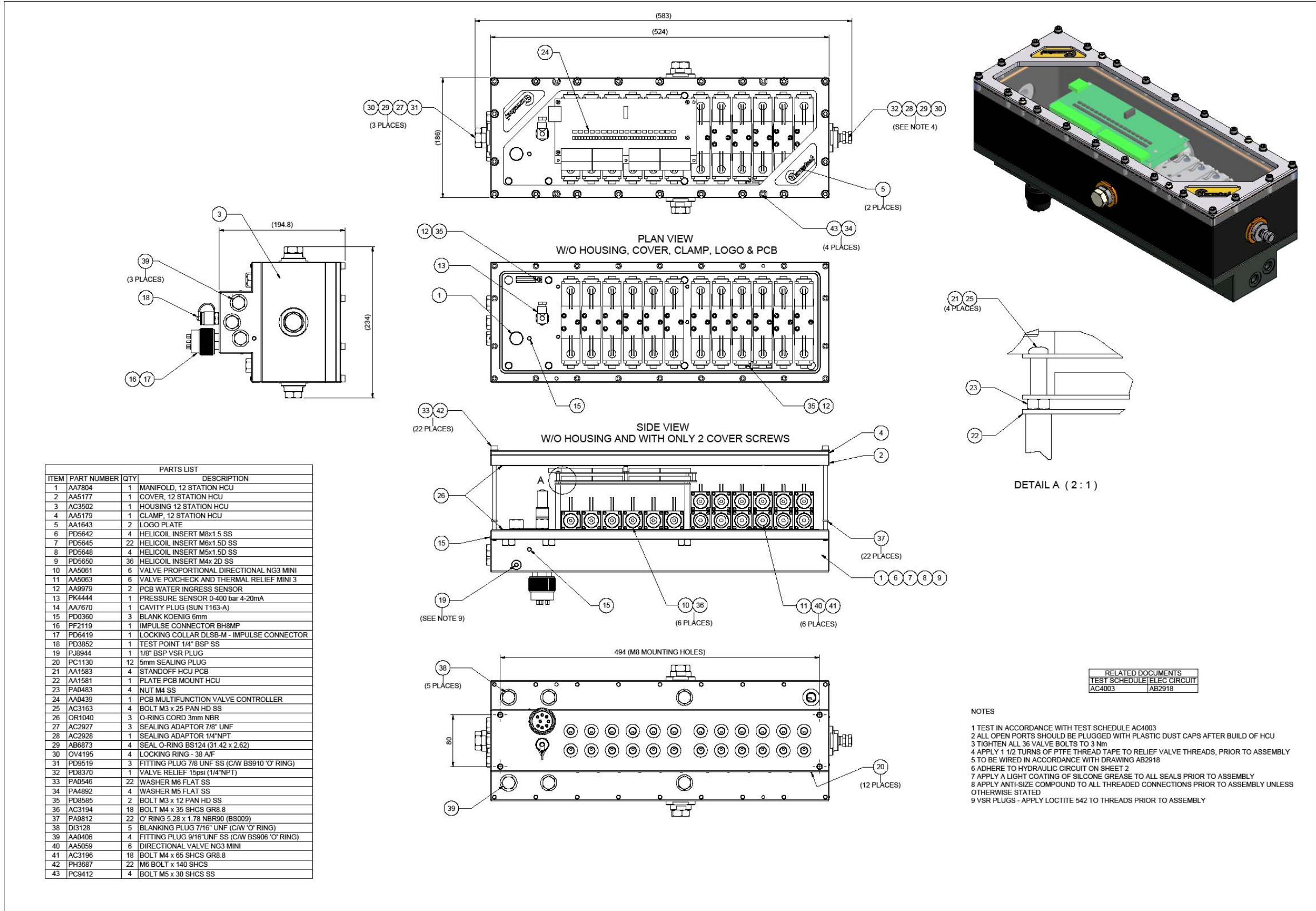


Figure 17 – AC3063 1/2



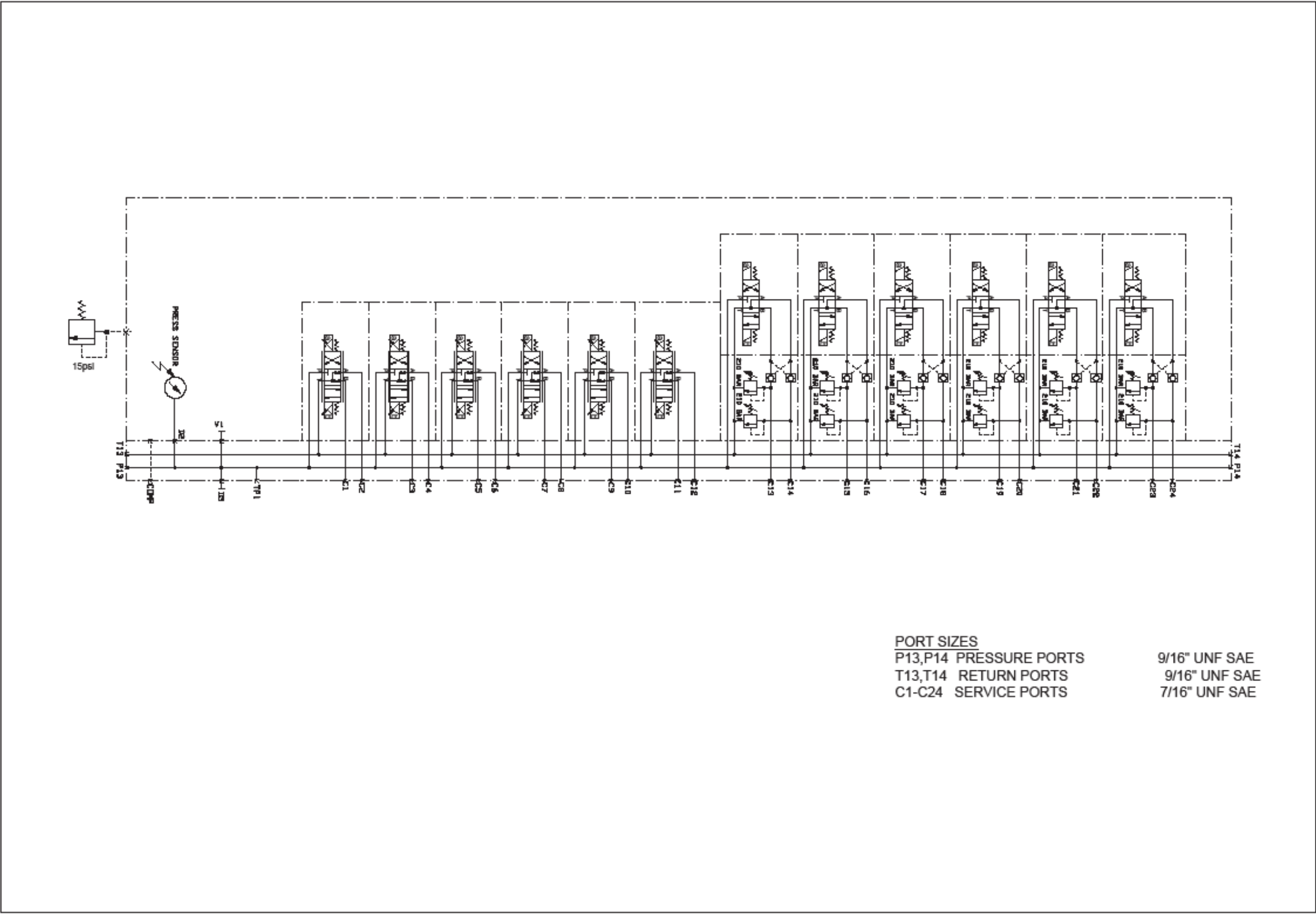


Figure 18 – AC3063 2/2



10 ELECTRICAL DRAWINGS

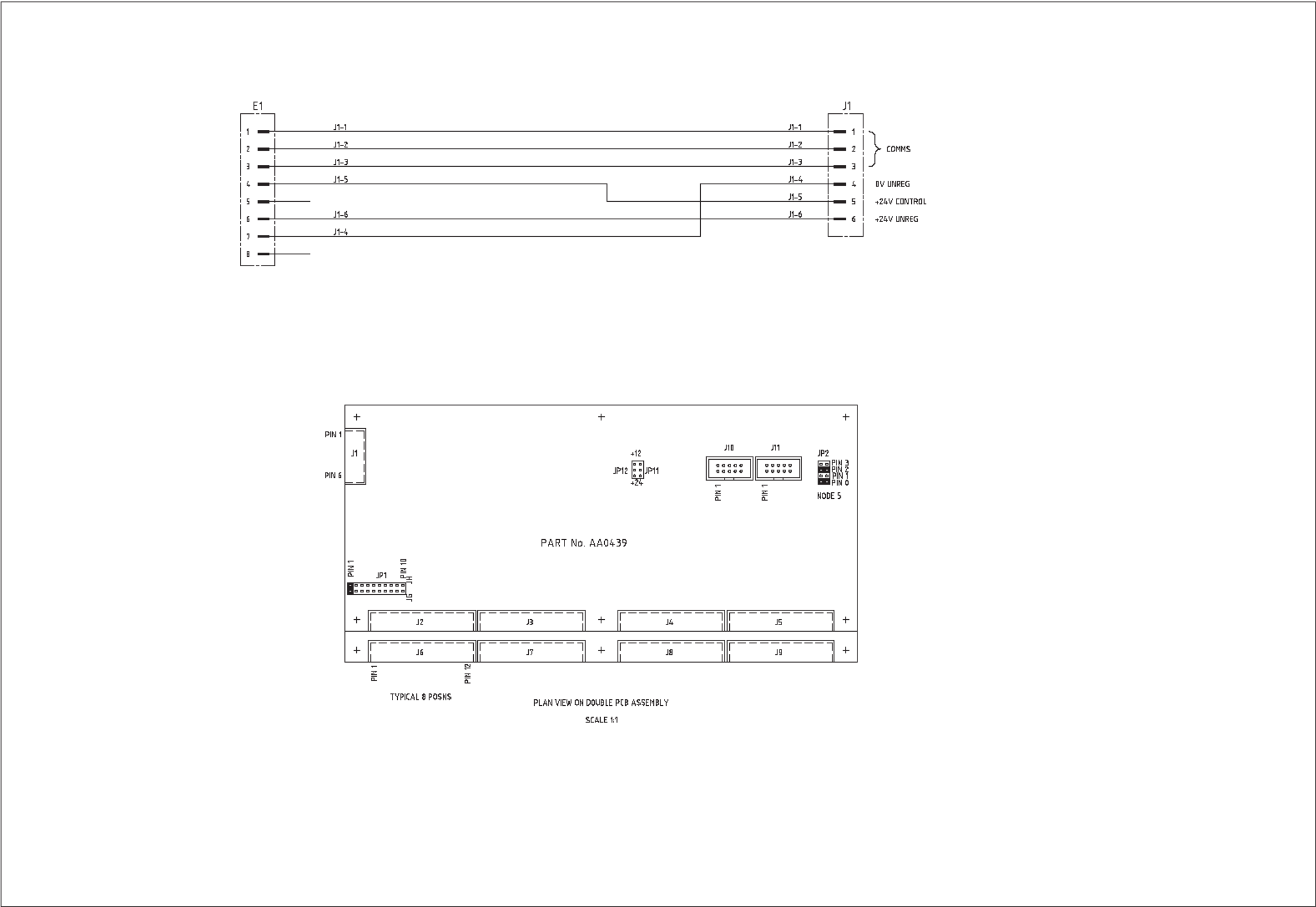


Figure 19 – AA9070 1/2



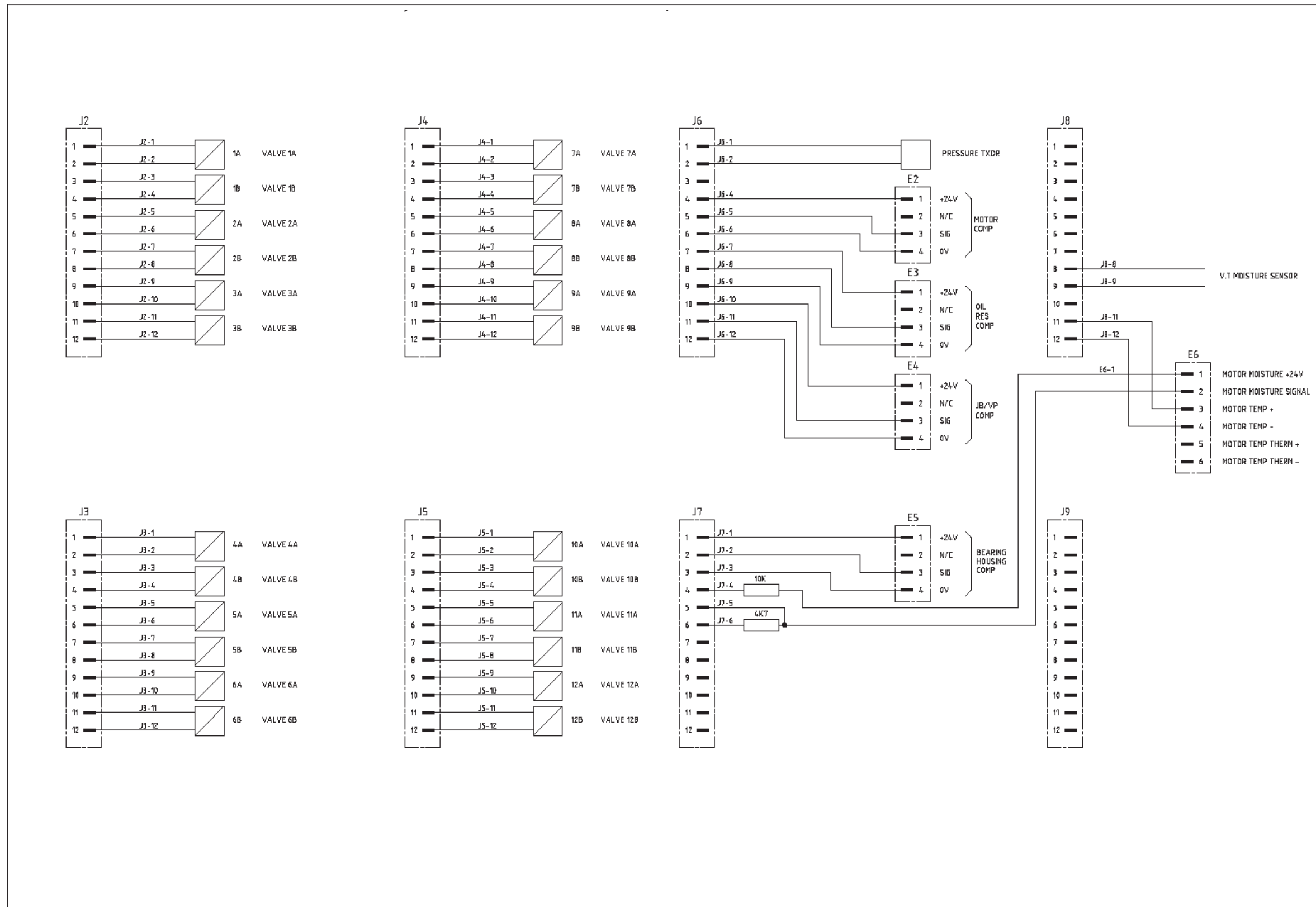


Figure 20 – AA9070 2/2



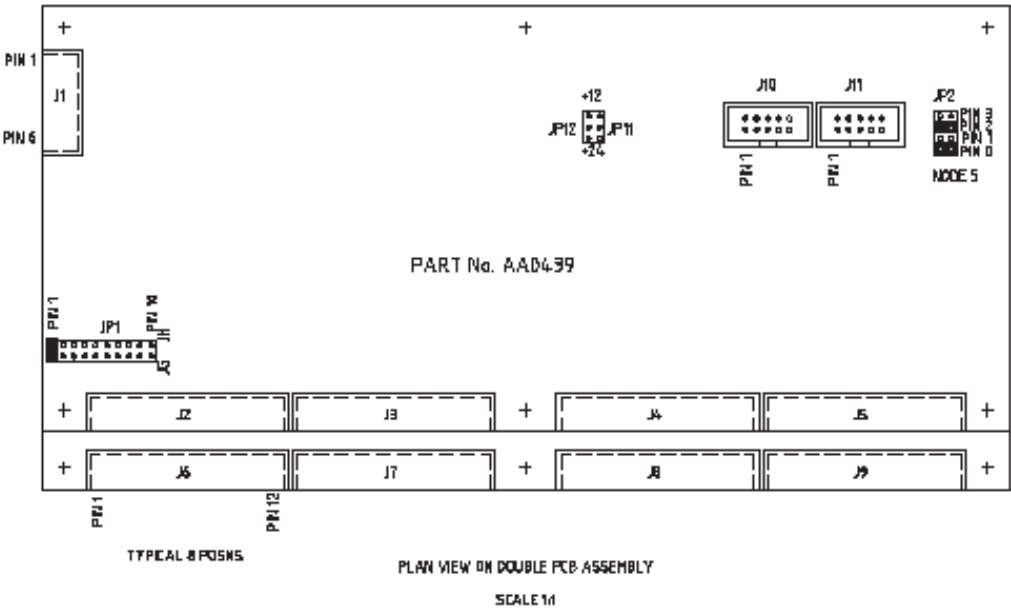
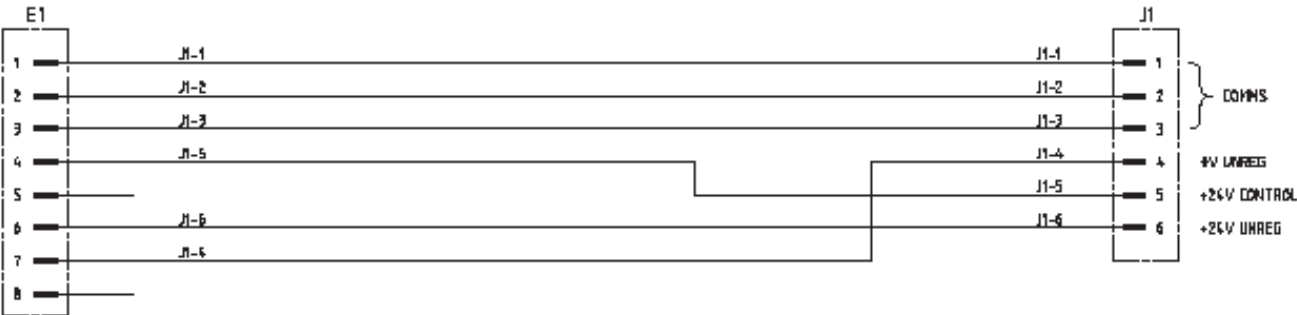


Figure 21 – AB2918 1/2



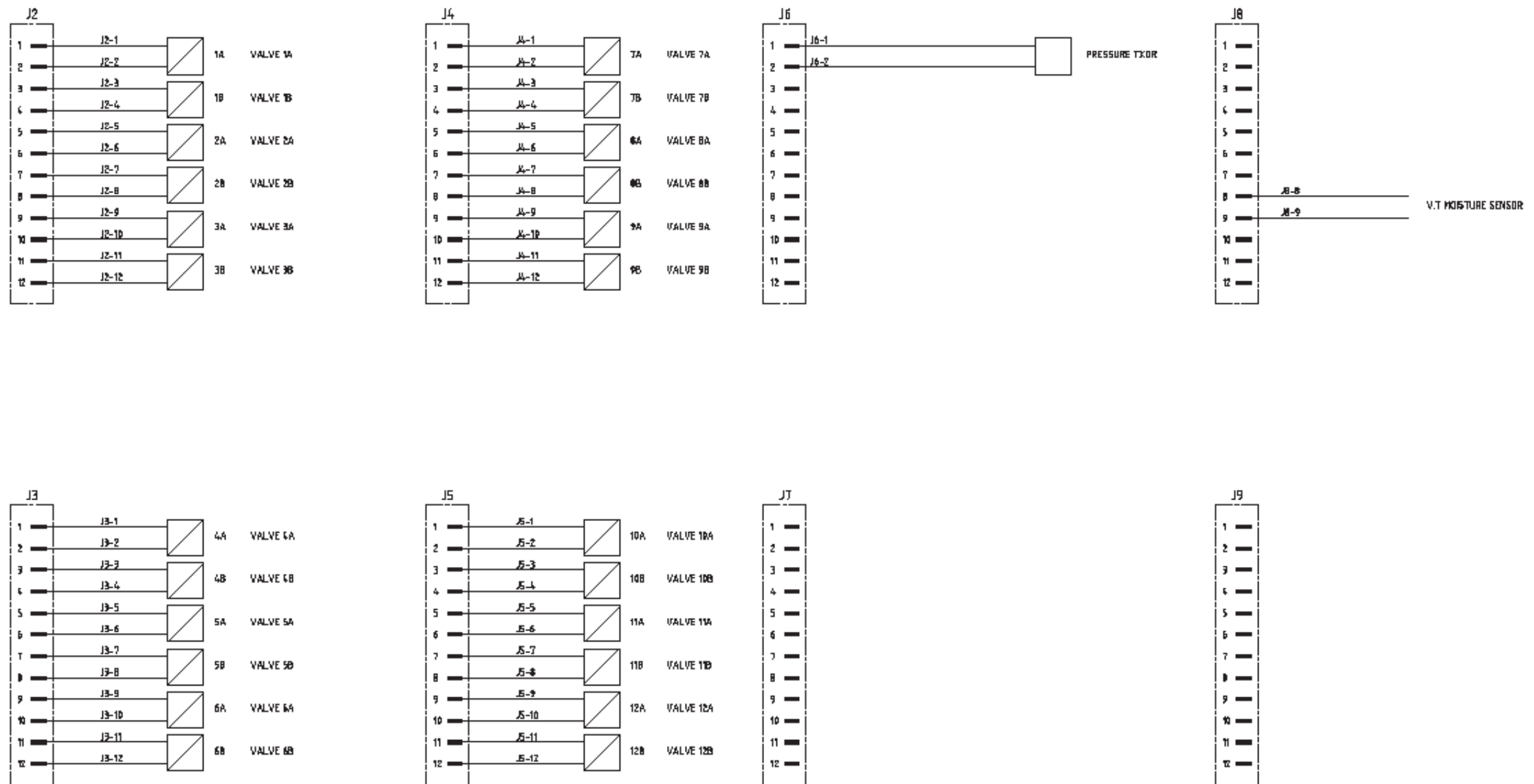


Figure 22 – AB2918 2/2



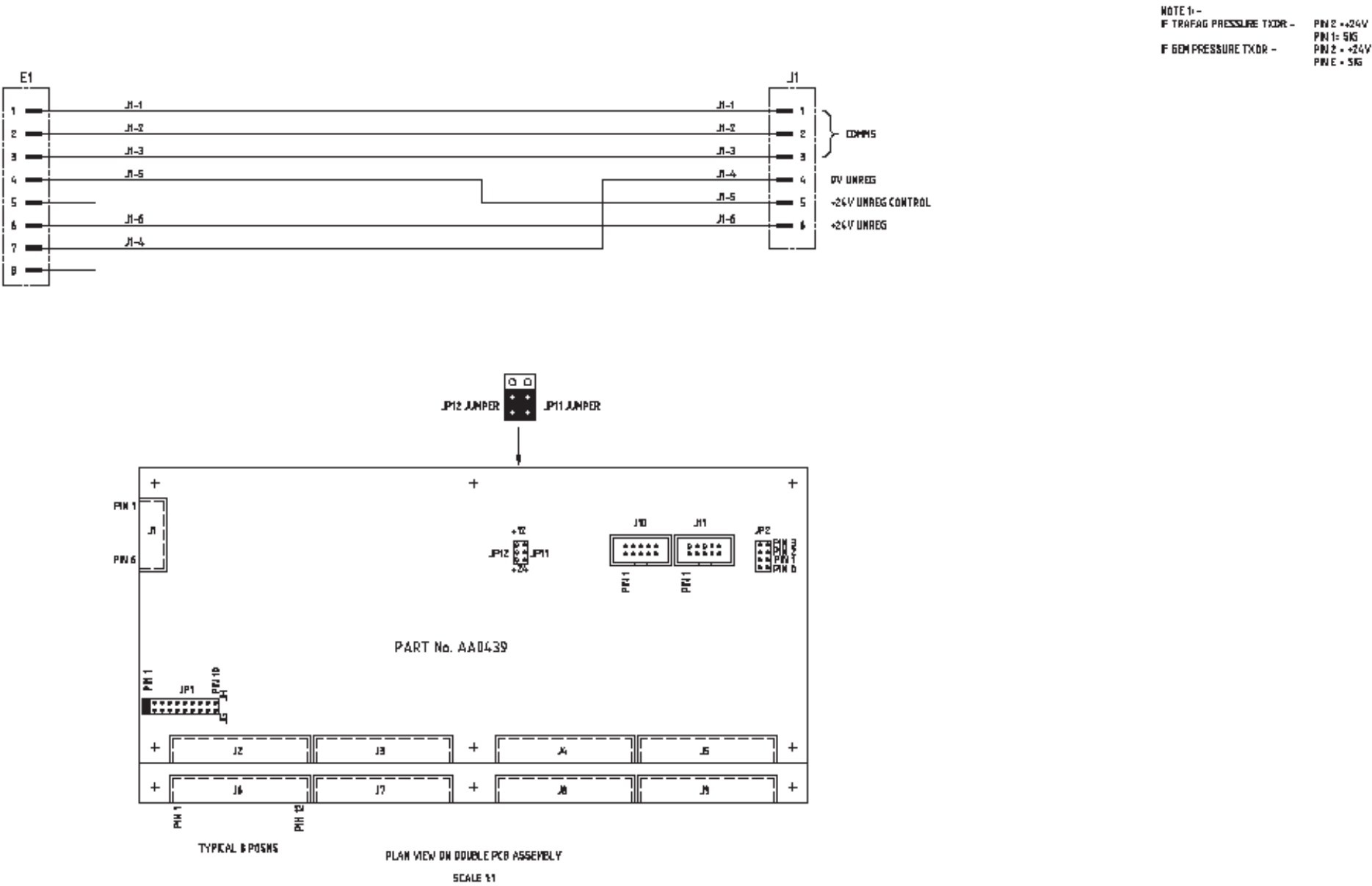


Figure 23 – AC4346 1/2



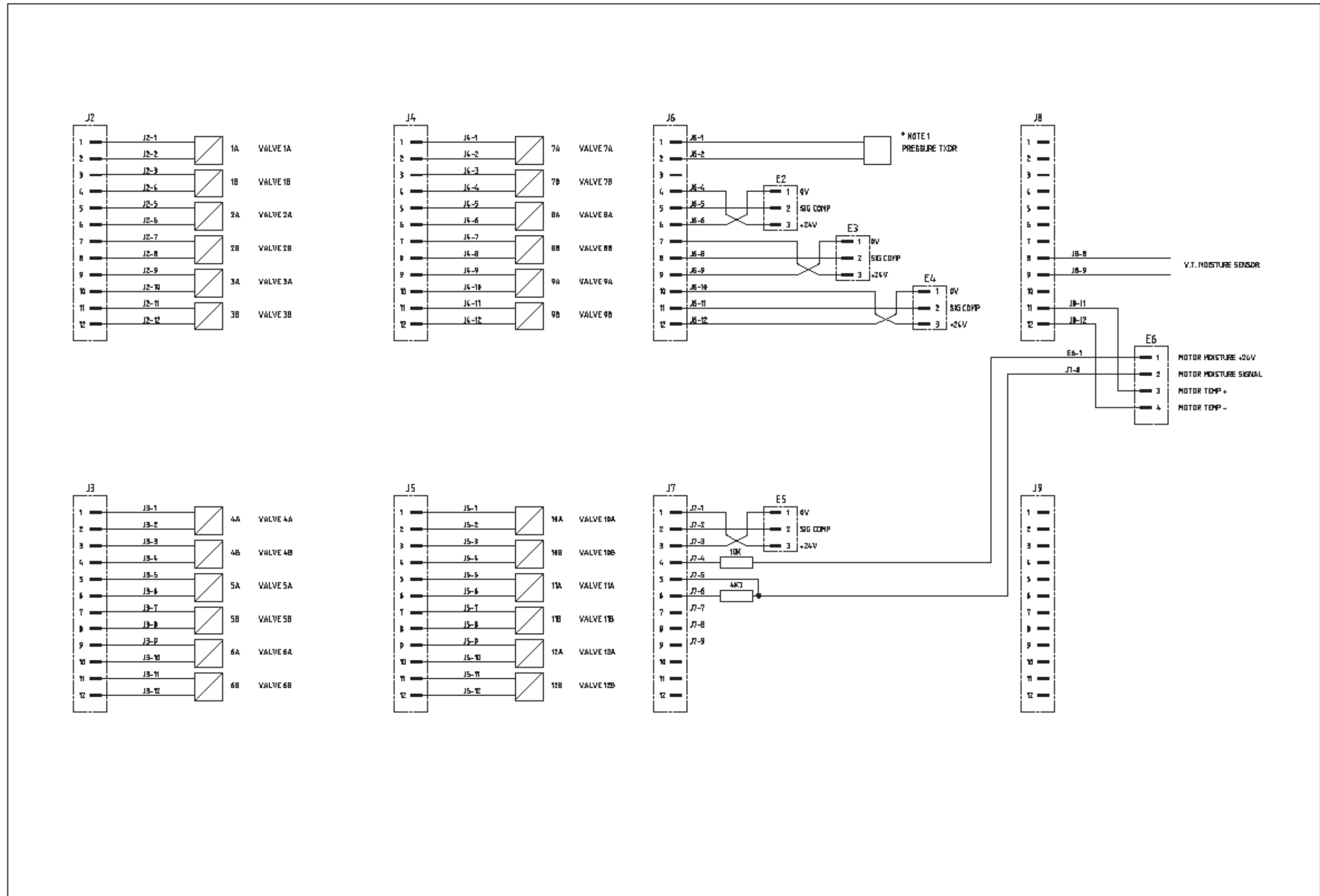


Figure 24 – AC4346 2/2

