VP500-TFP16F

ORIGINAL INSTRUCTIONS

Installation and Maintenance Manual

Monitored dump valve for use in safety related systems

Product Names:

(25A-)VP542(R)-X536, VP544(R)-X538

(25A-)VP742(R)-X536, VP744(R)-X538

Safety component as defined by the Machinery Directive 2006/42/EC article 2c

The intended use of this valve is to vent a protected system to atmosphere when it is de-energised. When properly integrated into a suitable safety system the duplex VP#44 valve is compatible for use in systems up to Category 4, and the single VP#42 valves is compatible for use in systems up to Category 2 as defined by EN ISO 13849-1:2008.

1 Safety Instructions

This manual contains essential information for the protection of users and others from possible injury and/or equipment damage.

- Read this manual before using the product, to ensure correct handling, and read the manuals of related apparatus before use.
- Keep this manual in a safe place for future reference.
- These instructions indicate the level of potential hazard by label of “Caution”, “Warning” or “Danger”, followed by important safety information which must be carefully followed.
- To ensure safety of personnel and equipment the safety instructions in this manual and the product catalogue must be observed, along with other relevant safety practices.

⚠ **Caution**	Indicates a hazard with a low level of risk, which if not avoided, could result in minor or moderate injury.
⚠ **Warning**	Indicates a hazard with a medium level of risk, which if not avoided, could result in death or serious injury.
⚠ **Danger**	Indicates a hazard with a high level of risk, which if not avoided, will result in death or serious injury.

1 Safety Instructions (Continued)

⚠ Warning

- The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.
  Since the products specified here can be used in various operating conditions, their compatibility with the specific pneumatic system must be based on specifications or after analysis and/or tests to meet specific requirements.
- **Only trained personnel should operate pneumatically operated machinery and equipment.**
  Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced personnel.
- **Do not service machinery/equipment or attempt to remove components until safety is confirmed.**
  1) Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
  2) When equipment is to be removed, confirm the safety process as mentioned above. Switch off air and electrical supplies and exhaust all residual compressed air in the system.
  3) Before machinery/equipment is re-started, ensure all safety measures to prevent sudden movement of cylinders etc. (Supply air into the system gradually to create back pressure, i.e. incorporate a soft-start valve).
- **Do not use this product outside of the specifications. Contact SMC if it is to be used in any of the following conditions:**
  1) Conditions and environments beyond the given specifications, or if the product is to be used outdoors.
  2) Installations in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications, or safety equipment.
  3) An application which has the possibility of having negative effects on people, property, or animals.
- The end user is expected to analyse and ensure the safe use of the product in all circumstances, including operation & maintenance.
- This product is intended for use in a safety related part of a control system and is capable of providing the stated safety function to the category stated in the Declaration of Conformity, when correctly used. Any system using this product must be designed and validated by a properly qualified and responsible person, to meet the requirements of the relevant standards, laws and regulations applicable to the equipment in which it is installed.
- **Extended periods of continuous energisation**
  For applications such as mounting a valve on a control panel, incorporate measures to limit the heat radiation so that it is within the operating temperature range.
- **Do not disassemble the product or make any modifications, including additional machining. It may cause human injury and/or an accident.**

⚠ Caution

- Ensure that the air supply system is filtered as specified in 2.1.

2 Specifications

2.1 Valve specifications

	VP500	VP700
Type of Actuation	Normally closed	
Return method	Spring return	
Fluid	Air	
Proof pressure	1.05 MPa	
Operating pressure range	0.25 to 0.7 MPa	
External pilot pressure	0.25 to 0.7 MPa (where applicable) (5)	
Ambient & operating fluid temp.	-10~+50℃ (no freezing / no condensation)	
Lubrication	Not required (1)	
Operating frequency: Max	30 cycles per minute	
Operating frequency: Min	1 cycle per week (2)	
Response time	See 2.10.2.1	See 2.10.2.2
Vibration / Impact resistance	150 / 30 m/s² (3,4)	
Ambient humidity	20% to 90%	
Air quality	5 µm filtration or better	
Environment	Indoor use only	
Enclosure	IP65	
$B10_d$	1,000,000 cycles	1,000,000 cycles
Mission time	1,000,000 cycles	1,000,000 cycles
Mass (g)	350 (930 for X538 assembly)	590 (1510 for X538 assembly)

Note:
1) If lubrication is used in the system, use class 1 turbine oil (no additive), ISO VG32.
2) The valve must be energised/de-energised at least once per week.
3) Shock resistance:
- No malfunction resulted from the impact test using a drop impact tester.
- The test was performed on the axis and right angle direction of the main valve and armature, for both energised and de-energised states.

4) Vibration resistance:
- No malfunction occurred in a one-sweep test between 8.3 and 2000 Hz.
- Test was performed at both energised and de-energised state to the axis and right angles direction of the main valve and armature (valve in the initial stage).

5) Same as operating pressure or higher.

2.2 Flow specifications

Flow specifications \ Passage:	VP542-X536		VP544-X538		VP742-X536		VP744-X538	
	1→2 (P→A)	2→3 (A→R)	1→2 (P→A)	2→3 (A→R)	1→2 (P→A)	2→3 (A→R)	1→2 (P→A)	2→3 (A→R)
C[liter/(s.bar)]	8.9	8.9	6.5	6.7	15.1	15.3	10.3	9.7
b	0.16	0.20	0.08	0.10	0.21	0.22	0.08	0.08
Cv	2.2	2.1	1.3	1.3	3.6	3.7	2.3	2.1

2.3 Pilot valve specifications

Electrical entry	D or Y type DIN terminal (See 3.7.1)
Coil rated voltage	24 VDC
Allowable voltage fluctuation	-7% to +10%
Power consumption	0.45 W
Surge voltage suppressor	Varistor

2.4 Limit switch specifications

Electrical entry	G1/2 connector, M12 connector
Contact resistance	25 mΩ max
Minimum permissible load	5 VDC 1mA (resistive load)
Rated voltage	24 VDC + 10% max
Maximum permitted load current	50 mA(1)
Maximum permitted load inductance	0.5 H (1)
Rated insulation voltage	300 V
Electric shock protection class	Class II (double insulation)
Pollution degree	Level 3 (EN60947-5-1)
Vibration / Impact resistance	See note(2)

2.4.1 Notes

1) For the purposes of EN ISO 13849-2:2008 table D.2 the switch is de-rated from the figures specified by the switch manufacturer. The switch load must be limited in the application in order to maintain the specified safety performance, including the B10d and mission time.

2 Specifications (Continued)

2) The switch is subject to the following vibration and shock limitations specified by the manufacturer:
- ‘*Contact opening time should be less than a 1 ms pulse under vibration of 0.75 single amplitude, 10 to 55 Hz, 10 cycles in each direction for 45 minutes*.’
- Shock: 300 m/s^2 (Contact open time: 1 ms maximum pulse)

2.5 Safety specification

Safety function: When the valve is de-energised the protected circuit is vented to atmosphere. The valve can be continuously energised to provide this function, subject to the specified minimum operating frequency.

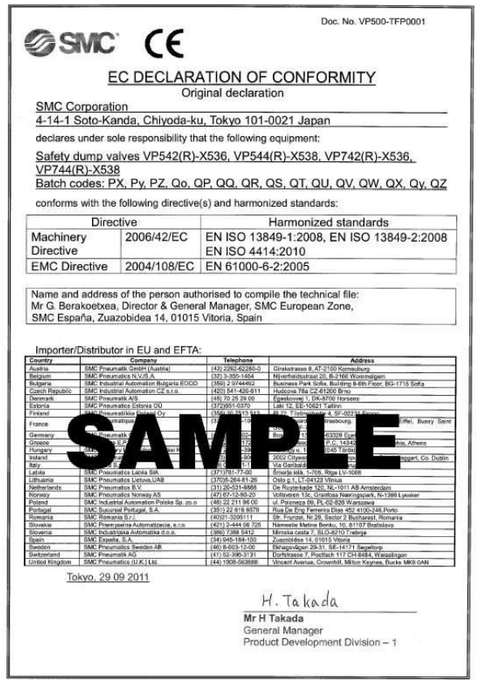
- The VP#42 single valve is capable up to Category 2 according to the Safety Standard when integrated into a suitable safety system.
- The VP#44 duplex valve assembly is capable up to Category 4 according to the Safety Standard when integrated into a suitable safety system.

In this section, ‘the Safety Standard’ refers to EN ISO 13849-1 and ‘the Validation Safety Standard’ refers to EN ISO 13849-2 as referenced in the Declaration of Conformity.

Information about compatibility with the Safety Standard is given in section 2.10

2.6 Declaration of Conformity

Below is a sample Declaration of Conformity (DoC) used for this product. An actual DoC will be supplied with each product.



Doc. No. VP500-TFP0001

SMC CE

EC DECLARATION OF CONFORMITY
Original declaration

SMC Corporation
4-14-1 Soto-Kanda, Chiyoda-ku, Tokyo 101-0021 Japan

declares under sole responsibility that the following equipment:

Safety dump valves VP542(R)-X536, VP544(R)-X538, VP742(R)-X536, VP744(R)-X538
Batch codes: PX, Py, PZ, Qo, QP, QQ, QR, QS, QT, QU, QV, QW, QX, Qy, QZ

conforms with the following directive(s) and harmonized standards:

Directive		Harmonized standards
Machinery Directive	2006/42/EC	EN ISO 13849-1:2008, EN ISO 13849-2:2008 EN ISO 4414:2010
EMC Directive	2004/108/EC	EN 61000-6-2:2005

Name and address of the person authorised to compile the technical file:
Mr G. Berakoetxea, Director & General Manager, SMC European Zone,
SMC España, Zuazobidea 14, 01015 Vitoria, Spain

Importer/Distributor in EU and EFTA:

Country	Company	Telephone	Address
Austria	SMC Pneumatik GmbH (Austria)	(43) 2262-62280-0	Girakstrasse 8, AT-2100 Korneuburg
Belgium	SMC Pneumatics N.V./S.A.	(32) 3-355-1464	Nijverheidsstraat 20, B-2160 Wommelgem
Bulgaria	SMC Industrial Automation Bulgaria EOOD	(359) 2 9744492	Business Park Sofia, Building 8-6th Floor, BG-1715 Sofia
Czech Republic	SMC Industrial Automation CZ s.r.o.	(420) 541-426-611	Hudcova 78a CZ-47200 Brno
Denmark	SMC Pneumatik A/S	(45) 70 25 29 00	Egeskovvej 1, DK-8700 Horsens
Estonia	SMC Pneumatics Estonia OÜ	(372)651-0370	Laki 12, EE-10621 Tallinn
Finland	SMC Pneumatiikka Oy	(358) 09-513 [illegible]	Tel. Tietäjäntie 4, SF-02130 [illegible]
France	SMC Pneumatique S.A.	(33) 1 [illegible]	1 Bld. Robert Schuman, Z.A. [illegible], Bussy Saint
Germany	SMC Pneumatik GmbH	(49) [illegible]	[illegible]
Greece	SMC Hellas E.P.E.	(30) [illegible]	[illegible], Athens
Hungary	SMC Hungary Ipari Automatizálási Kft.	(36) 1 [illegible]	[illegible]
Ireland	SMC Pneumatics (Ireland) Ltd.	(353) [illegible]	2002 Citywest Business Campus, Naas Road, Saggart, Co. Dublin
Italy	SMC Italia S.p.A.	(39) [illegible]	Via Garibaldi 62, I-20061 Carugate (Milano)
Latvia	SMC Pneumatics Latvia SIA	(371)781-77-00	Smerļa iela 1-705, Rīga LV-1006
Lithuania	SMC Pneumatics Lietuva,UAB	(370)5-264 81 26	Oslo g.1, LT-04123 Vilnius
Netherlands	SMC Pneumatics B.V.	(31) 20-531-8888	De Ruyterkade 120, NL-1011 AB Amsterdam
Norway	SMC Pneumatics Norway AS	(47) 67-12-90-20	Vollsveien 13c, Granfoss Næringspark, N-1366 Lysaker
Poland	SMC Industrial Automation Polska Sp. z o.o.	(48) 22 211 96 00	ul. Poloneza 89, PL-02-826 Warszawa
Portugal	SMC Sucursal Portugal, S.A.	(351) 22 610 8570	Rua De Eng Ferreira Dias 452 4100-246 Porto
Romania	SMC Romania S.r.l.	(40)21-3208111	Str. Frunzei, Nr.29, Sector 2 Bucharest, Romania
Slovakia	SMC Priemyselna Automatizacia, s.r.o.	(421) 2-444 56 725	Námestie Matina Benku, 10, 81107 Bratislava
Slovenia	SMC Industrijska Avtomatika d.o.o.	(386) 7388 5412	Mirnska cesta 7, SLO-8210 Trebnje
Spain	SMC España, S.A.	(34) 945-184-100	Zuazobidea 14, 01015 Vitoria
Sweden	SMC Pneumatics Sweden AB	(46) 8-603-12-00	Ekhagsvägen 29-31, SE-14171 Segeltorp
Switzerland	SMC Pneumatik AG	(41) 52-396-3131	Dorfstrasse 7, Postfach 117 CH-8484, Wasslingen
United Kingdom	SMC Pneumatics (U.K.) Ltd.	(44) 1908-563888	Vincent Avenue, Crownhill, Milton Keynes, Bucks MK8 0AN

SAMPLE

Tokyo, 29 09 2011

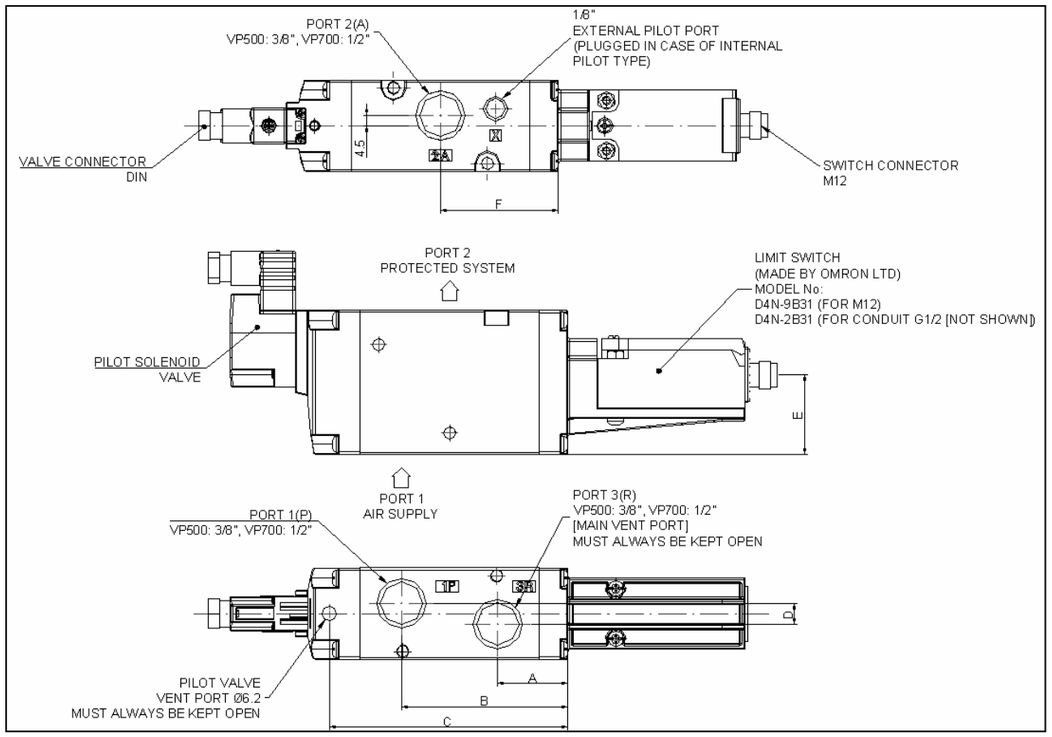
H. Takada

Mr H Takada
General Manager
Product Development Division – 1

2 Specifications (Continued)

2.7 Interfaces (Dimensions are in mm)

2.7.1 VP#42 single valve

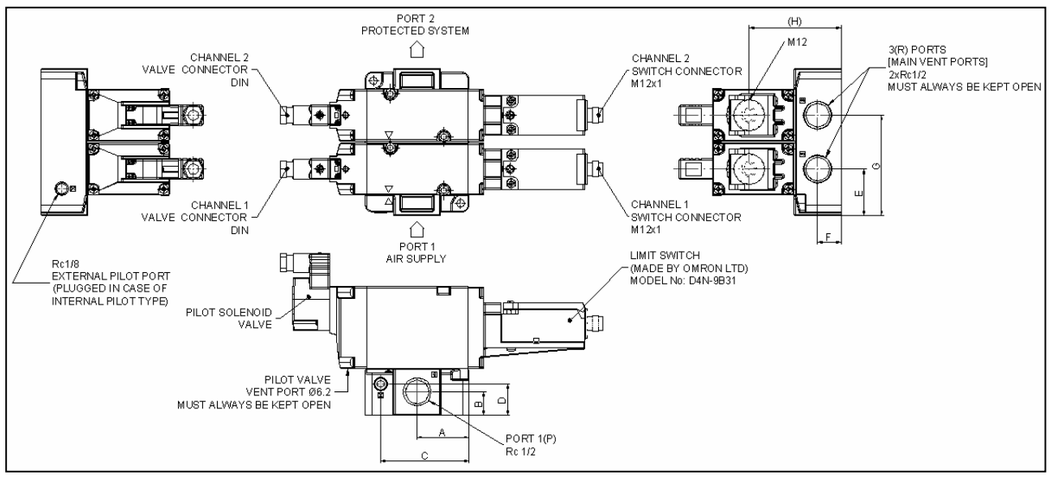


	A	B	C	D	E	F
VP542	25.60	56.30	80.50	7.00	25.70	41.10
VP742	30.50	72.50	104.00	9.00	34.70	51.50

Thread Variable (#)	(Nil)	F	N
Port Threads	Rc	G	NPT

Note: The above drawing shows the VP742R-5DZ1-04-M-X536 valve. Other variations are available; the port threads on the VP542 are 3/8" instead of 1/2", and all ports are available in a range of different thread types:

2.7.2 VP#44 duplex valve assembly

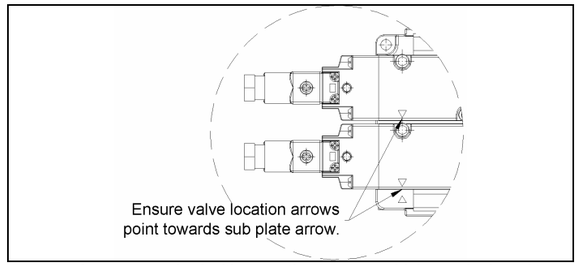


	A	B	C	D	E	F	G	(H)
VP544	28.50	17.50	49.50	22.30	29.00	17.50	62.50	59.70
VP744	40.00	18.00	68.00	24.00	36.00	18.00	77.50	70.70

Note: The above drawing shows the VP744R-5DZ1-04-M-X538 valve.

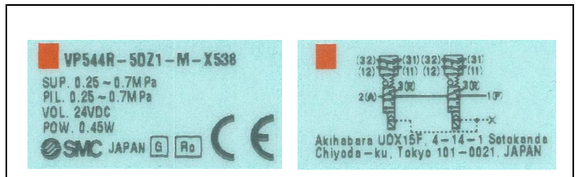
Other variations are available; the port threads on the VP544 are 3/8" instead of 1/2", and all ports are available in a range of different thread types as shown in the table in section 2.7.1.

2.8 Duplex valve identification



VP#44 valves are marked with mounting arrows, which are designed to point towards a mating arrow on the sub plate.

2.9 Product label (example)



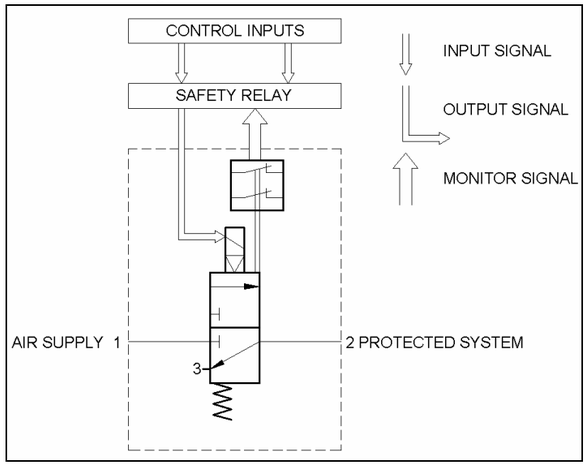
Batch code in the above label translates to construction year / month according to the following table (eg. "RQ = Mar 2013):

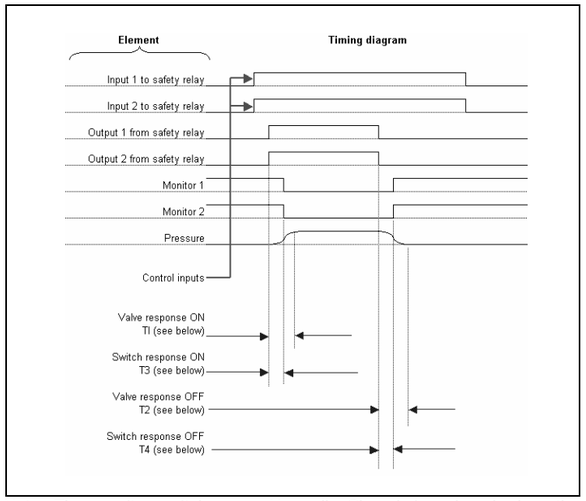
Construction Year/ Month	Production Batch Codes											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013	Ro	RP	RQ	RR	RS	RT	RU	RV	RW	RX	Ry	RZ
2014	So	SP	SQ	SR	SS	ST	SU	SV	SW	SX	Sy	SZ
...	...	...	...	...	...	...	...	...	...	...	...	...
2018	Wo	WP	WQ	WR	WS	WT	WU	WV	WW	WX	Wy	WZ

2.10 Safety System

2.10.1 The System Interface

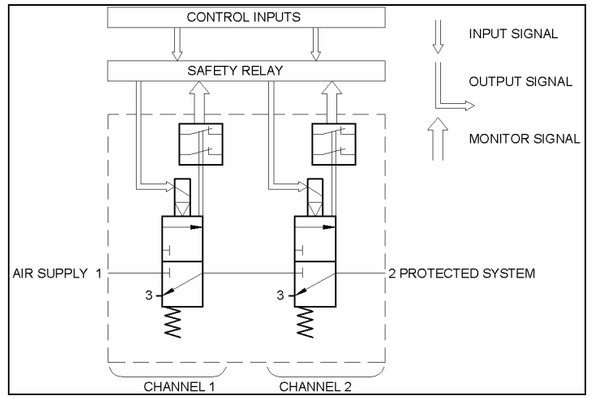
2.10.1.1 VP#42 single valve





Note: The monitor switches are Normally Closed, i.e. closed when the valve solenoids are de-energised. The monitor signals are therefore shown 'High' when the valve is de-energised.

2.10.1.2 VP#44 duplex valve assembly



The diagram shows the valve in the dotted line box connected to a safety relay in dual channel mode following the principles of the Safety Standard.

2.10.2 Timing Diagram

2 Specifications (Continued)

2.10.2.1 VP544 Valve & switch Response

- The valve response time ON (T1) depends on the supply pressure and the volume of the protected system. T1 times are not related to the safety function.
- The valve response time OFF (T2) depends on the volume (V) and the flow capacity of the protected system. It is defined as the time interval in which the pressure in a test volume connected to an outlet port of the valve reduces from 0.63 MPa to 0.05 MPa in response to a change in the control signal to that valve. Refer to table below for indicative values under SMC conditions:
- The ON response time of the limit switch (T3) is shown in the table below.
- The OFF response time of the limit switch (T4) is shown in the table below.

Volume / liter	Valve OFF response / T2, ms	Switch Response	
		T3, ms	T4, ms
3	1110	30	155
10	3560		
20	7060		

2.10.2.2 VP744 Valve & Switch Response

- The valve response time ON (T1) depends on the supply pressure and the volume of the protected system. T1 times are not related to the safety function.
- The valve response time OFF (T2) depends on the volume (V) and the flow capacity of the protected system. It is defined as the time interval in which the pressure in a test volume connected to an outlet port of the valve reduces from 0.63 MPa to 0.05 MPa in response to a change in the control signal to that valve. Refer to table below for indicative values under SMC conditions:
- The ON response time of the limit switch (T3) is shown in the table below.
- The OFF response time of the limit switch (T4) is shown in the table below.

Volume / liter	Valve OFF response / T2, ms	Switch Response	
		T3, ms	T4, ms
3	930	40	280
10	2750		
20	5350		

⚠ Caution

Response times are based on tests under SMC conditions and are not guaranteed. Always observe the terms of 2.10.3.

- Exhaust times will be increase on the VP#44 duplex valves when only one channel is functioning in a fault condition.
- Exhaust times are based on tests under SMC conditions and are not guaranteed. Always observe the terms of 2.10.3.

2.10.3 Relationship of flow and response performance to safety function

The safety function is to vent the compressed air in the protected system so that the protected system does not present a hazard when the application operates under the control of a suitable safety system. The time taken for the air to vent and remove the hazard is a function of:

- The flow capacity of the valve
- The flow restriction of silencers fitted to the valve
- The volume of the protected system
- The pressure of the air in the protected system
- The flow restrictions in the protected system

The end user is expected to establish the time taken to vent the application system and ensure that this time is consistent with the requirement of the overall safety system. This includes the selection of suitable silencers.

The performance of the system should be validated by test after each installation to ensure that the actual performance of the valve is consistent with the safety function. Validate the performance of the system under all foreseeable operating conditions of pressure, flow and volume.

2 Specifications (Continued)

2.10.4 Mission time according to the Safety Standard

The operational life of the product should be limited to the mission time stated in section 2.1. The mission time is given in cycles, the user is expected to calculate an equivalent figure in time units based on the operating frequency of the application. After the mission time has expired for the component it should be replaced with a new unit.

2.10.5 MTTFd according to the Safety Standard

The B10d for the component given in section 2.1 is derived from product knowledge and based on specific life tests. The system integrator should use this data to determine MTTFd and the Performance Level (PL) of the system using the methods described in the Safety Standard.

2.10.6 Diagnostic Coverage according to the Safety Standard

These valves are fitted with ‘direct monitoring’ according to Table E1 of the Safety Standard. When properly integrated these valve assemblies contribute to a DC value of 99% for the safety function.

2.10.7 Common Cause Failures according to the Safety Standard

CCF analysis is the responsibility of the system integrator.
The VP#42-X536 valve is a single channel system so CCF does not apply.
The VP#44-X538 has 2 channels made of identical valves. The use of this valve might not allow the system calculation to include CCF points for diversity.

3 Installation

3.1 Installation

⚠ Warning

- Do not install the product unless the safety instructions have been read and understood.
- Do not install the product if it appears to have been damaged during transport.
- The valve must be protected from contamination from the downstream system when air is vented through the valve.
- Do not paint the product.
- Do not remove or cover up warnings or specifications printed or affixed to the product.
- Ensure sufficient space for maintenance activities. When installing the products, allow access for maintenance.
- Ensure that the connections of pipework and cables to the unit do not result in a residual trip hazard to system operators or maintainers.
- If air leakage increases or equipment does not operate to specification, stop operation.
- Check mounting conditions when air and power supplies are connected. Initial function and leakage tests should be performed after installation.

3.2 Environment

⚠ Warning

- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact. Check the product specifications.
- Do not mount in a location exposed to radiant heat.
- Do not install in a location subject to strong magnetic fields.

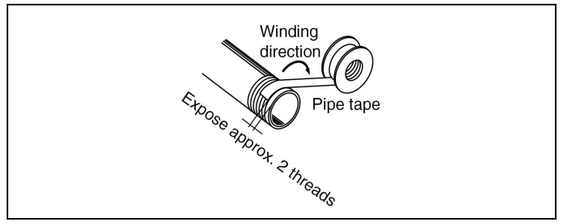
3 Installation (Continued)

- Do not install in an EMC environment other than ‘industrial’ according to the scope of standard listed on the Declaration of Conformity.
- If it is used in an environment where there is possible contact with oil, weld spatter, etc., exercise preventive measures.
- When the solenoid valve is mounted in a control panel or is energised for a long time, make sure ambient temperature is within the specification of the valve.

3.3 Piping

⚠ Caution

- Before piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fittings, ensure sealant material does not enter inside the port. When using seal tape, leave 1.5 to 2 threads exposed on the end of the pipe/fitting.



- Tighten fittings to the specified tightening torque.

Thread	Tightening Torque / N·m
Rc/G/NPT 1/8	7 to 9
Rc/G/NPT 3/8	22 to 24
Rc/G/NPT 1/2	28 to 30

- The valve must be protected from contamination from the downstream system when air is vented through the valve.

3.4 Lubrication

⚠ Caution

- SMC products have been lubricated for life at manufacture, and do not require lubrication in service.
- If a lubricant is used in the system, use turbine oil Class 1 (no additive), ISO VG32. Once lubricant is used in the system, lubrication must be continued because the original lubricant applied during manufacturing will be washed away.

3.5 Air Supply

⚠ Caution

- Type of fluids

Please consult with SMC when using the product in applications other than compressed air

- When there is a large amount of drainage.

Compressed air containing a large amount of drainage can cause malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.

- Drain flushing

If condensation in the drain bowl is not emptied on a regular basis, the bowl will overflow and allow the condensation to enter the compressed air lines. It causes malfunction of pneumatic equipment.
If the drain bowl is difficult to check and remove, installation of a drain bowl with an auto drain option is recommended.

- Use clean air

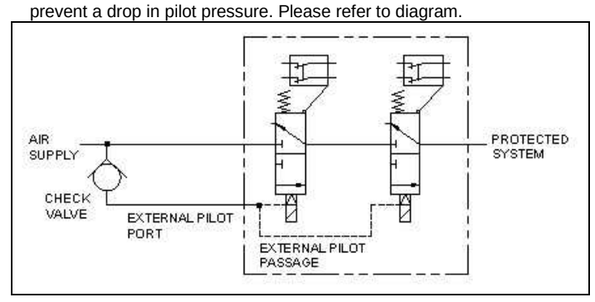
Do not use compressed air that contains chemicals, synthetic oils including organic solvents, salt or corrosive gases, etc., as it can cause damage or malfunction.

⚠ Caution

- When extremely dry air is used as the fluid, degradation of the lubrication properties inside the equipment may occur, resulting in reduced reliability (or reduced service life) of the equipment. Please consult with SMC.
- Install an air filter upstream near the valve. Select an air filter with a filtration size of 5 μm or smaller.

3 Installation (Continued)

- Take measures to ensure air quality, such as by installing an aftercooler, air dryer, or water separator.
  Compressed air that contains a large amount of drainage can cause malfunction of pneumatic equipment such as valves.
- If excessive carbon powder is seen, install a mist separator on the upstream side of the valve.
  If excessive carbon dust is generated by the compressor it may adhere to the inside of a valve and cause it to malfunction.
- The air supply to the valve must be large enough to operate the valve and to deal with possible transient pressures. The supply should be a minimum of DN10 for the VP500 and DN13 for the VP700.
- When using the external pilot type valve it is recommended that the main supply pressure and the pilot pressure are taken from separate lines. It is also suggested that a check valve is installed in the pilot line to prevent a drop in pilot pressure. Please refer to diagram.



- Minimise the distance between the valve and the air supply and between the valve and the protected system. Do not place any devices between the valve and the protected system that might interfere with the safety function. The exhaust ports of the valve should not be left unconnected. The exhaust ports of the valves should never be blocked and must be protected from ingress of contamination by a suitable silencer or device which does not affect the valve function.

3.6 Noise

⚠ Caution

It is recommended that silencers or noise reduction devices are fitted to protect personnel from transient noise when the valves are de-energised. The pressure drop of silencers or devices must be taken into account during the design and testing of the application system to ensure that the safety function is maintained.

3.7 Electrical Connection

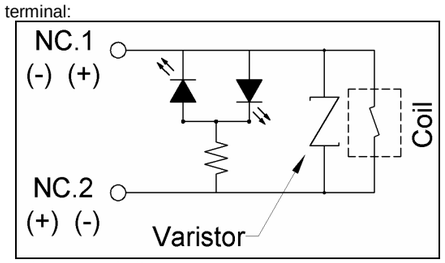
⚠ Caution

- When electric power is connected to a solenoid valve, be careful to apply the proper voltage. Improper voltage may cause malfunction or coil damage.
- Check if the connections are correct after completing all wiring.

3.7.1 Pilot Valve

3.7.1.1 Surge voltage suppression

For DIN terminal:



DIN terminal has no polarity.

3 Installation (Continued)

3.7.1.2 Pilot valve connections

- DIN interchangeablilty

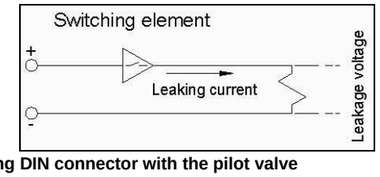
The 'Y' type DIN terminal corresponds to the DIN connector with a terminal pitch of 8 mm, which complies with EN175301-803C. The pitch is different from the 'D' type DIN connector (which has a pitch of 9.4 mm): the two types are therefore not interchangeable.

Terminal No.	1	2
Polarity	+	-

Applicable cable dia: Ø3.5 ~ Ø7 mm

3.7.1.3 Leakage voltage

Ensure that any leakage current when the switching element is OFF causes < 3% of the rated voltage across the valve:



3.7.1.4 Using DIN connector with the pilot valve

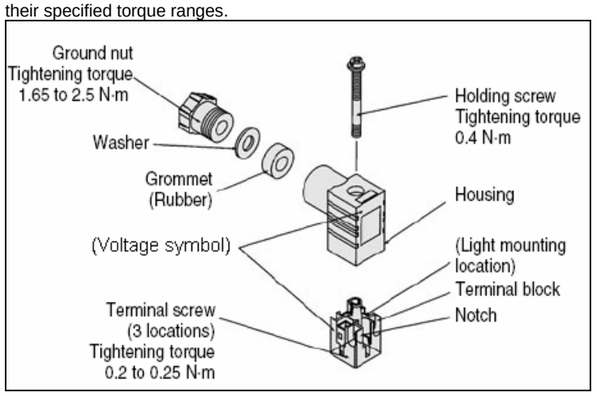
⚠ Caution

Connection

1) Loosen the holding screw and pull the connector out of the solenoid valve terminal block.
2) After removing the holding screw, insert a flat head screwdriver, etc. into the notch on the bottom of the terminal block and pry it open, separating the terminal block and the housing.
3) Loosen the terminal screws (slotted screws) on the terminal block, insert the cores of the lead wires into the terminals according to the connection method, and fasten them securely with the terminal screws.
4) Secure the cord by fastening the ground nut.

⚠ Caution

When making connections, take note that using other than the supported size (ø3.5 to ø7) heavy duty cord will not satisfy IP65 (enclosure) standards. Also, be sure to tighten the ground nut and holding screw within their specified torque ranges.



Changing the entry direction

After separating the terminal block and housing, the cord entry can be changed by attaching the housing in the desired direction (4 directions at 90° intervals).

* When equipped with a light, be careful not to damage the light with the cord's lead wires.

Precautions

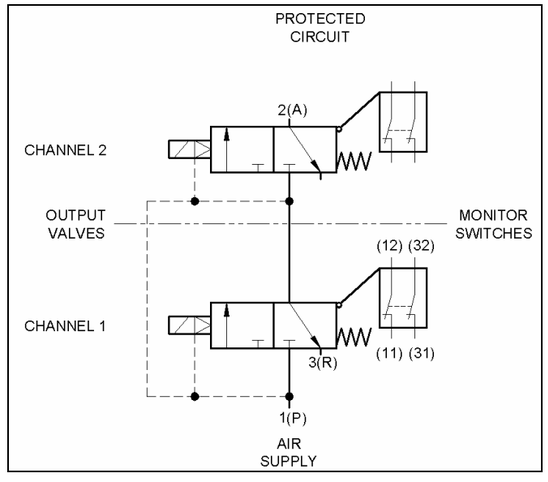
Plug in and pull out the connector vertically without tilting to one side.

Compatible cable

Cord O.D.: Ø3.5 to Ø7
(Reference) 0.5 mm², 2-core or 3-core, equivalent to JIS C 3306

3 Installation (Continued)

3.7.2 Omron Limit Switch



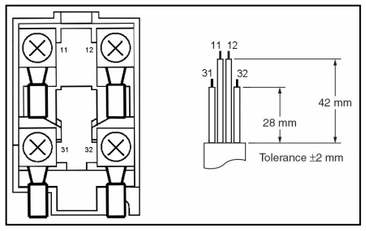
3.7.3 Limit Switch: Omron conduit type

3.7.3.1 Limit switch screw tightening torque

Screw position	Tightening torque / N·m
Terminal screw	0.6 to 0.8
Cover clamping screw	0.5 to 0.7
Conduit mounting connection	1.8 to 2.2

3.7.3.2 Wiring (conduit type)

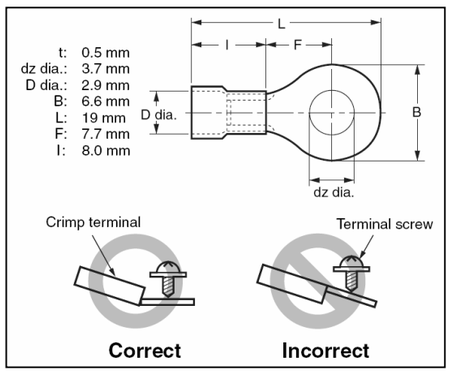
- When connecting to the terminals via insulating tube and M3.5 crimp terminals, arrange the crimp terminals as shown below so that they do not rise up onto the case or the cover. Application lead wire size: AWG20 to AWG18 (0.5 to 0.75 mm²)



- Do not push crimp terminals into gaps in the case interior. Doing so may cause damage or deformation of the case.
- Use crimp terminals not more than 0.5 mm in thickness. Otherwise, they will interfere with other components inside the case. The crimp terminal shown below are not more than 0.5 mm thick.

Manufacture	Type	Wire size
J.S.T.	FV0.5-3.7 (F type) V0.5-3.7 (straight type)	AWG20 (0.5 mm²)

J.S.T. is a Japanese manufacturer.



3 Installation (Continued)

3.7.3.3 Conduit Opening

- Connect a recommended connector to the opening of the conduit and tighten the connector to the specified torque. The case may be damaged if an excessive tightening torque is applied.
- Use a cable with a suitable diameter for the connector.

3.7.3.4 Recommended Connectors

Use connectors with screws not exceeding 9 mm, otherwise the screws will protrude into the case interior, interfering with other components in the case. The connectors listed in the following table have connectors with thread sections not exceeding 9 mm. Use the recommended connectors to ensure conformance to the stated IP level.

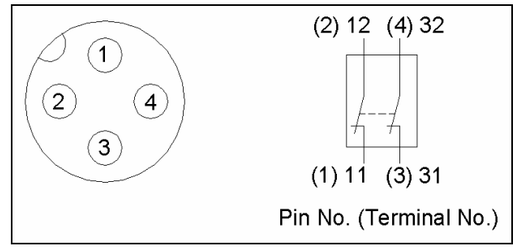
Size	Manufacturer	Model	Applicable cable diameter
G 1/2	LAPP	ST-PF1/2 5380-1002	6.0 to 12.0 mm
	Ohm Denki	OA-W1609	7.0 to 9.0 mm
		OA-W1611	9.0 to 11.0 mm

Use LAPP connectors together with seal packing (JPK-16, GP-13.5, GPM20, or GPM12), and tighten to the specified tightening torque.
Seal packing is sold separately.

LAPP is a German manufacturer, Ohm Denki is a Japanese manufacturer.

3 Installation (Continued)

3.7.4 Limit Switch: Omron M12 connector type

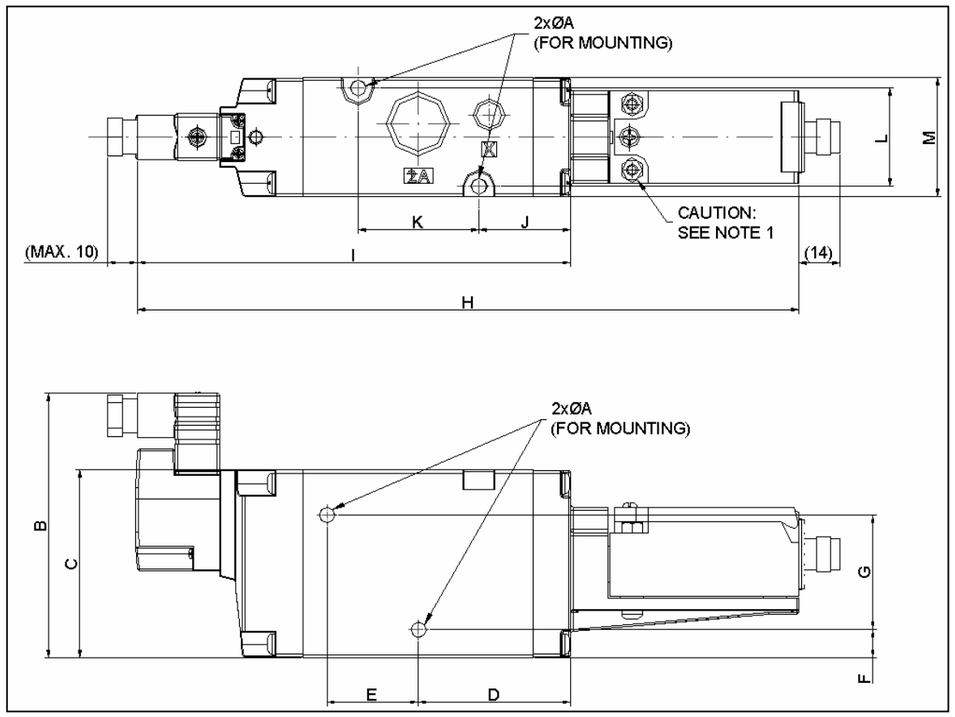


3.7.4.1 Socket tightening (Connector type)

- Turn the socket connector screws by hand and tighten until no space remains between the socket and the plug.
- Make sure that the socket connector is tightened securely. Otherwise, the rated degree of protection may not be maintained and vibration may loosen the socket connector.

4 Outline Dimensions

4.1.1 VP#42 single valve outline dimensions (mm)



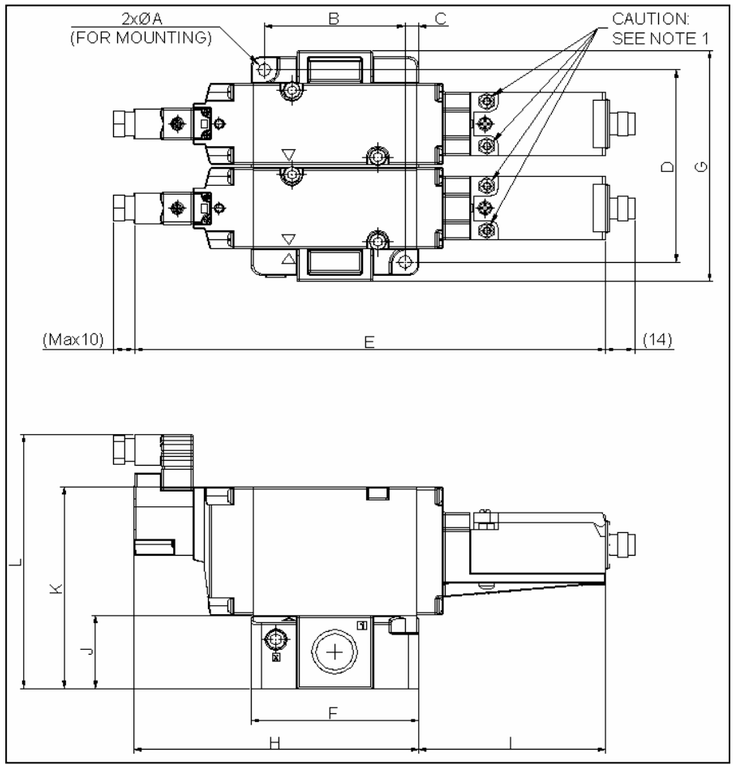
4 Outline Dimensions (Continued)

	VP500	VP700
A	4.20	5.20
B	70.80	88.80
C	45.00	63.00
D	39.60	61.50
E	23.50	31.00
F	4.00	9.40
G	31.50	38.50
H	201.80	224.20
I	124.00	146.80
J	25.60	31.00
K	31.00	41.00
L	26.00	33.00
M	31.00	40.00

Note 1: M4 limit switch retaining screws secured into position with adhesive. Do not remove.

4 Outline Dimensions (Continued)

4.1.2 VP#44 duplex valve assembly outline dimensions (mm)



	VP500	VP700
A	5.20	6.20
B	47.00	67.00
C	5.00	6.50
D	75.50	94.50
E	201.80	224.20
F	57.00	80.00
G	91.50	113.50
H	112.00	135.90
I	90.40	88.90
J	34.00	36.00
K	79.00	99.00
L	104.80	124.80

Note 1: M4 limit switch retaining screws secured into position with adhesive. Do not remove.

4.2 Mounting

- Mounting orientation: Unrestricted.
- The valve assembly can be mounted using two M6 bolts
- The sub plate is compatible with the AC series FRL unit by the use of 'Y' spacers.
  Spacer Y300 can be used with the VP500 sub plate, and the Y400 with the VP700 sub plate.

5 Maintenance

5.1 General Maintenance

Caution

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
- If handled improperly, compressed air can be dangerous. Maintenance of pneumatic systems should be performed only by qualified personnel.
- Before performing maintenance, turn off the power supply and be sure to cut off the supply pressure. Confirm that the air is released to atmosphere.
- After installation and maintenance, apply operating pressure and power to the equipment and perform appropriate functional and leakage tests to make sure the equipment is installed correctly.
- Do not make any modification to the product.
- Do not disassemble the product, unless required by installation or maintenance instructions.

5.2 Maintainable parts

Warning

- Under no circumstances attempt to change the solenoid of the pilot valve as this is an integral part of the valve and doing so will negate any such SMC warranty.
- There are no replaceable parts on these safety products.

5.3 Periodic testing

The product should be tested for proper operation of the safety function once per month or whenever considered necessary for the purposes of the end user. The test should consist of operation of the safety system and observation of the following:

When the connected control system is energising the solenoids:

- Check that the solenoid indicator lamps are illuminated.
- Check that the connected downstream system is properly pressurised.
- Check that the switch contacts are open.

5 Maintenance (Continued)

- For VP#44 duplex valve assembly check that when only one channel of the system (one of the solenoids) is energised that the protected system does not become pressurised. Check this for both channels.

When the connected control system is not energising the solenoids:

- Check that the solenoid indicator lamps are not illuminated.
- Check that the connected downstream system is properly vented to atmosphere and ensure that the condition of the silencers is not causing an extension of the vent time.
- Check that the switch contacts are closed.
- For the VP#44 duplex valve assembly check that when only one channel of the system (one of the solenoids) is de-energised that the protected system is vented to atmosphere. Check this for both channels.

Warning

The specification of the valve requires the valve to be cycled (energised and de-energised) at least once per week.

5.4 Silencers

Warning

Ensure that any silencers fitted to the valve remain clean and uncontaminated in operation because blockage will affect the safety function.
Examine any silencers at least once per month and more frequently if necessary due to the nature of the application environment.

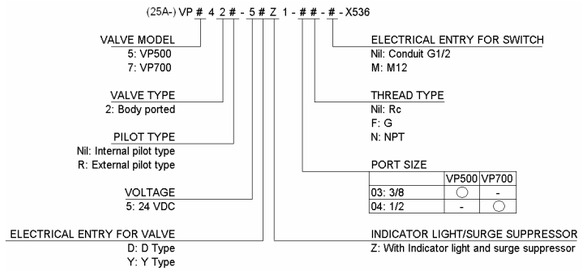
5 Maintenance

5.5 Troubleshooting guide

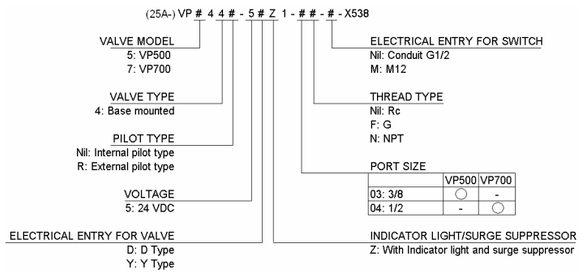
Symptom	Possible fault	Action
Valve does not open	Pilot valve is not energised	Check pilot solenoid indicator (light)
	Supply pressure is too low	Check supply pressure
	Pilot valve has failed	Replace whole valve
Valve does not close	Pilot valve remains energised	Check pilot solenoid indicator (light)
	Pilot valve is jammed	Replace whole valve
	Main valve is jammed	Replace whole valve
	Supply pressure is to high	Check supply pressure
Switch contacts do not open	Switch has failed	Replace whole valve
Switch contacts do not close	Switch has failed	Replace whole valve
Valve operation is noisy or erratic	Supply flow is inadequate	Increase supply pressure and/or flow
Valve is slow to pressurise protected system	Supply flow is inadequate	Increase supply pressure and/or flow.
	Once channel of valve is not functioning	Check 'Valve does not open' symptoms above
Valve is slow to vent protected system	Inadequate flow are in protected system	Revise flow in protected system
	One channel of valve is not functioning	Check 'Valve does not close' symptoms above

6 How to order

6.1 VP#42 single valve – how to order



6.2 VP#44 duplex valve assembly – how to order

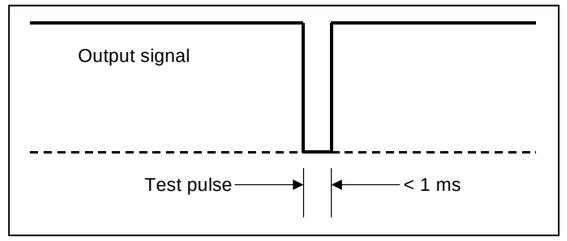


7 Limitations of Use

7.1 Safety relays

Warning

If a safe output from a safety relay or PLC is used to operate this valve, ensure that any output test pulse duration is shorter than 1 ms to avoid the valve solenoid responding.



7.2 Limitations

Caution

This product is CE marked as a safety component as defined under the Machinery Directive 2006/42/EC. For details please refer to the Declaration of Conformity supplied with the product.
The valve may only be used to provide the stated safety function for the supply and removal of pressure from all or part of a pneumatic system, under the total control of a supervisory device. The valve can only perform as a safety component when properly installed in a system conforming to the appropriate safety standards.
Any such use must be within the specified limits and application conditions for the product.
In order to meet a required performance level as defined by the appropriate safety standard, the user must provide all the other necessary components to complete function of the safety system.
The user is responsible for the specification, design, implementation, validation and maintenance of the safety system.

8 Contacts

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