HSV Cetop 3&5 - Monitored Hydraulic Valve Systems

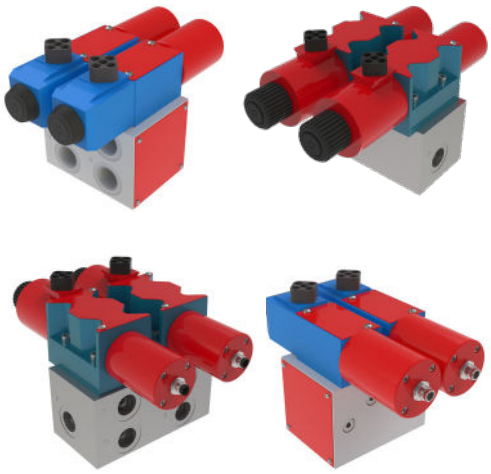
Description

The valve monitoring system is primarily designed as an interface between the fluid power operation of a machine and the electrical safety circuits monitoring gates, guard and emergency stop circuits.

The monitoring function can provide for detection of a single valve fault including change of switching times, sticking valve or spontaneous change of state as per the requirements of ISO 13849-1 and other national and international machinery safety standards.

The systems are additionally suited to the monitoring requirements of machine specific standards such as ISO 16092-2 Presses, Safety requirements for hydraulic presses.

Dual directional control valves mounted on a specially manufactured manifold for hydraulic safety applications in Cetop 3 or Cetop 5 sizes supplied in a four port two position single solenoid format. The valves incorporate two pole precision positive driven plunger type limit switches pre approved to category 4 safety applications.



Options & Ordering Information

Description	Part NO.
Spare Cetop 3 Hydraulic Valve 40LPM	HSV-03AD-S
Single Cetop 3 Hydraulic Valve 40LPM	HSV-03AD-1-G075-MP0
Dual Cetop 3 Hydraulic Valve 40LPM	HSV-03AD-2-G075-MP0
Spare Cetop 5 Hydraulic Valve 110LPM	HSV-05AD-S
Single Cetop 5 Hydraulic Valve 110LPM	HSV-05AD-1-G075-MP0
Dual Cetop 5 Hydraulic Valve 110LPM	HSV-05AD-2-G075-MP0

Safety Functions

Safety Function 1: To block hydraulic pressure from process and drain to tank when electrical signal not applied

Safety Function 2: Turns mechanical movement of spool into operation of safety contacts

Safe State

Hydraulic pressure removed from process

Important:

The products must be used in accordance with the installation instructions and operating conditions in this data sheet, which has been produced to support the requirements of the harmonized standard ISO 13849-1.
Additionally, for products intended to be sold in European Economic Area:
“Safety devices” or other safety functions mentioned in any product literature are not necessarily “safety components” as defined by the Machinery Directive 2006/42/EC, unless otherwise stated together with the CE Mark and specific reference to said directive.

This product is designed for use according to the installation and operating instructions enclosed. It must be installed by competent and qualified personnel who have read and understood the whole of this document prior to commencing installation. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. Any modification to or deviation from these instructions invalidates all warranties. Fortress Interlocks Ltd accepts no liability whatsoever for any situation arising from misuse or misapplication of this product.

DUAL VALVES ARE SUITABLE FOR APPLICATIONS UP TO AND INCLUDING PERFORMANCE LEVEL E, CATEGORY 4 AS PER ISO 13489-1 AND SIL3 AS PER IEC 61508
BEWARE OF INTENTIONAL MISUSE CAUSED BY OPERATORS WANTING TO BYPASS SAFETY SYSTEMS. THE INSTALLER SHOULD ASSESS THE RISKS AND MITIGATE AGAINST THEM.
SINGLE VALVES ARE SUITABLE FOR APPLICATIONS UP TO AND INCLUDING PERFORMANCE LEVEL D, CATEGORY 2.
IF YOU HAVE ANY QUESTIONS OR QUERIES OF ANY NATURE WHATSOEVER PLEASE CONTACT THE SUPPLIER WHO WILL BE PLEASED TO ADVISE AND ASSIST.

Operating Instructions: Specifications

For Safety Components in accordance with Annex IIC (Machinery Directive)	
Valves manufactured by **Fortress Interlocks Ltd** conform to the requirements of the following Directives and European Standards.	
Low Voltage Directive	73/23/EEC – EN 60204, IEC 1010, IEC 950.
EMC Directive	89/336/EEC – EN 55014, EN 50081-2, EN 50082-1, EN 50082-2
Machinery Directive	98/37/EC – EN 292-1, EN 292-2, EN 983, EN 954-1, EN 1050, EN60204.

System Overview

Hydraulic System

The Hydraulic system comprises two Cetop 3 or Cetop 5 Eaton valves with a spool configuration selected as determined by a hazard identification / risk assessment for each and every application. The operation of the monitoring will now permit hydraulic power pack motors and pumps to remain online during operator access in to machinery areas which would have previously required full current isolation. The following installation guidelines would require the pump to be pressure compensated type or a relief / unloading valve fitted directly on pump outlet.

Installation

The dual valve system has been designed to interface with new or existing hydraulic applications and can be fully interlocked in to any existing safety systems to a category 4 level of integrity.

Figure 1: Existing Hydraulic Control

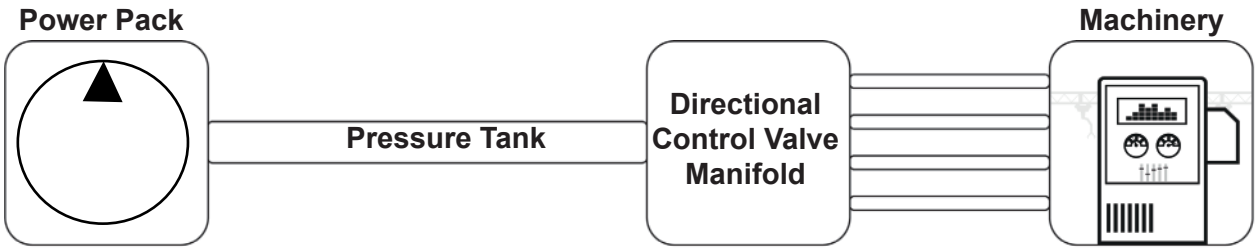
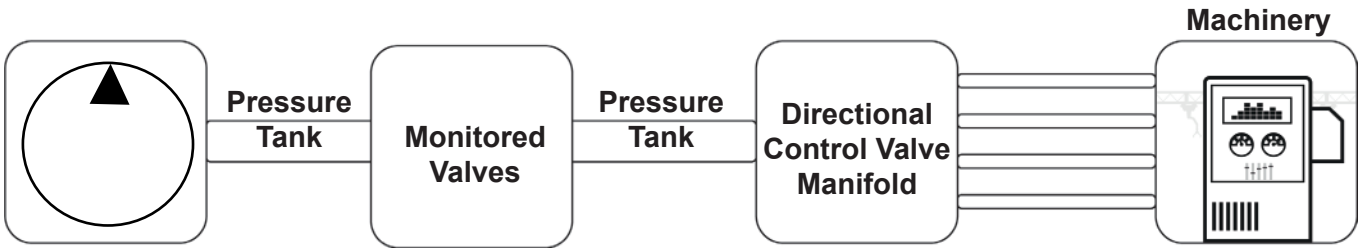


Figure 2: Interfaced Monitored Valves



Valve Specifications	
Materials	
Main body, extension housing	Steel and Aluminium
Spool	Induction hardened steel
Pushrod return spring	Steel
Spool return spring	Steel
Screws	Steel
Lubricant	Diamond Grease
Torque	
M5x30 mounting screws grade 12.9 (Cetop 3)	6Nm
M6x40 mounting screws grade 12.9 (Cetop 5)	16Nm
Solenoid	
Voltage(s) Available	24VDC
Current/Watts	Cetop 3 1.25 Amp/30Watts
	Cetop 5 1.625 Amp/39 Watts

Valve Specifications	
Performance	
Valve working pressure range	0 – 350 Bar – Cetop 3
	0 – 315 Bar – Cetop 5
Solenoid	Direct Acting
Port connection - P, T, T1, A, B	¾" BSP Parallel
Medium	Hydraulic oil ISO 32 to 68
Environment and oil operating temperature range	-20 C to +70 C (Mineral Oil)
Flow Rate	HSV-03AD... : 40LPM HSV-05AD... : 110LPM
Activation Time	Cetop 3 - 32 Milliseconds
	Cetop 5 - 50 Milliseconds
Deactivation Time	Cetop 3 - 50 Milliseconds
	Cetop 5 - 130 Milliseconds
Rating	
Ingress Protection	IP 65
Weight	
Cetop 3 dual valve on manifold	6.94 kg
Cetop 5 dual valve on manifold	13.04 kg
Manual	
Manual Override	Removed
Cleanliness	
ISO 4406 Code	19/16/13
Valve Specifications	
ISO 13849-1	
B10d	1,000,000 cycles
Vibration	Vibration in line with spool axis < 5g
Silting	Silting occurs when hydraulic valves are left in the actuated position for long periods of time. It is recommended that the user considers periodically cycling the valve to limit these effects.

Figure 3: Hydraulic Circuit Diagram

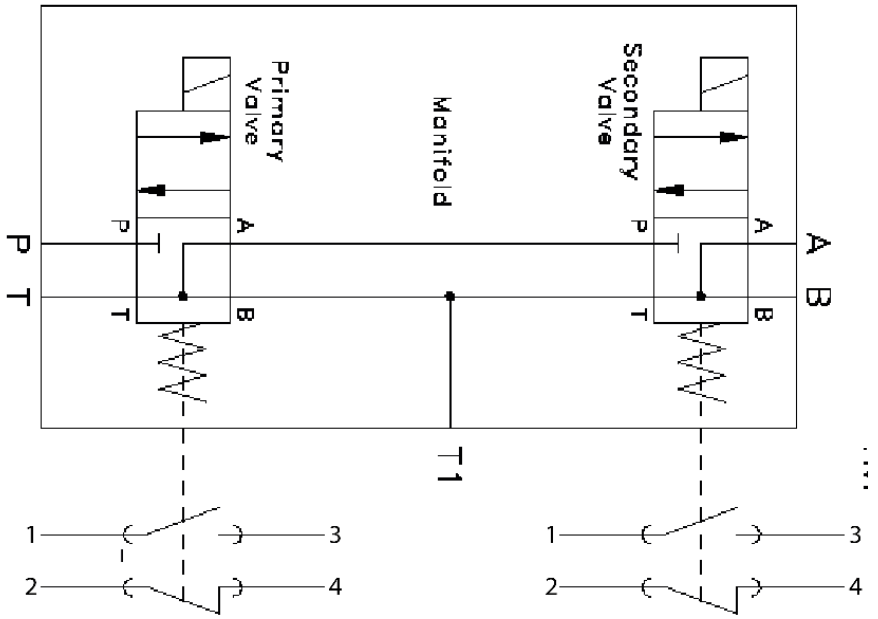


Figure 4: Wiring Diagram - Electrical Interlocking / Interfacing

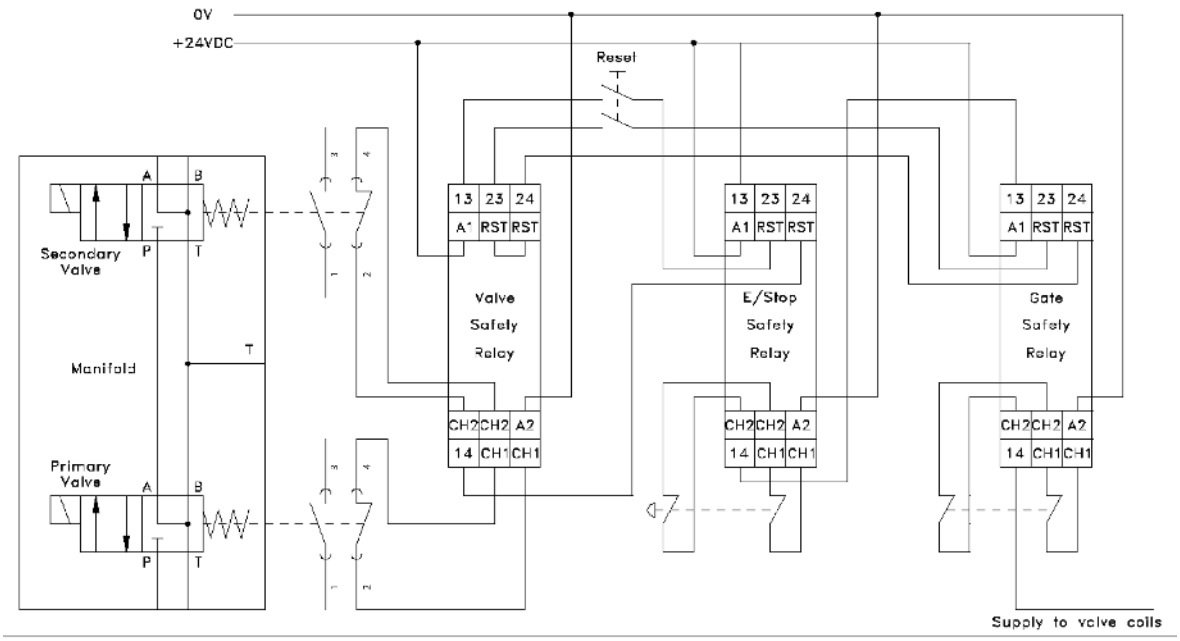


Figure 5: Delta "P" Curve - HSV-03AD-1-G075-MP0

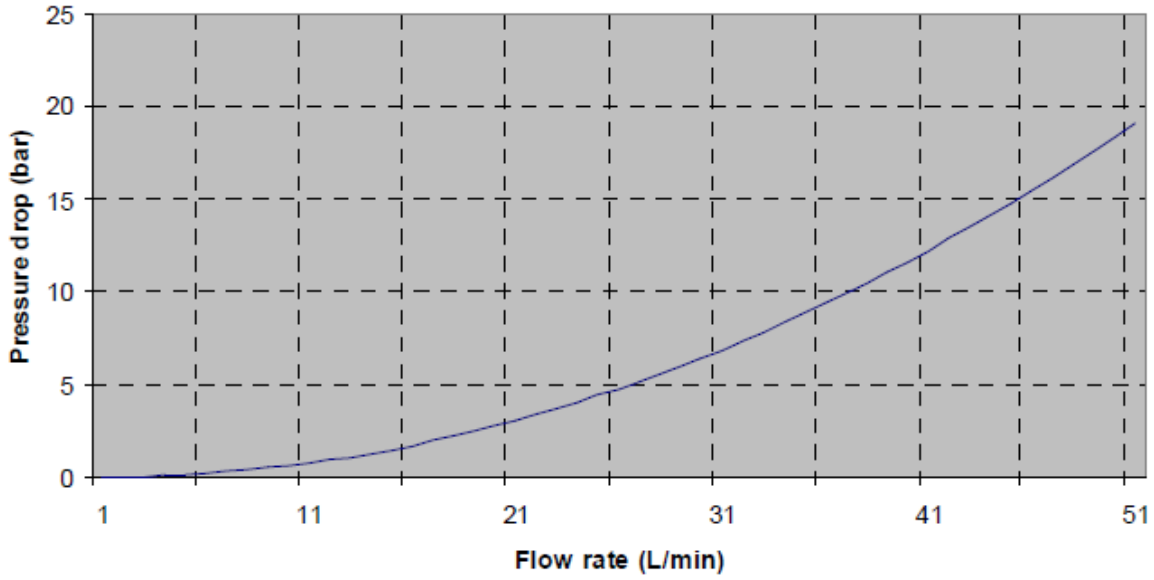


Figure 6: Delta "P" Curve - HSV-03AD-2-G075-MP0

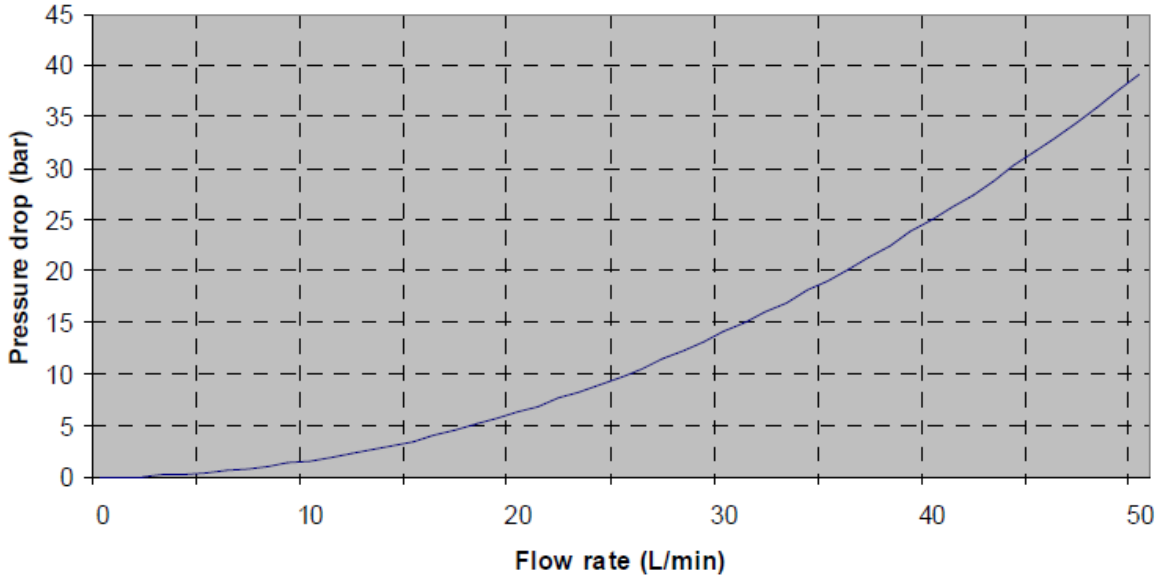


Figure 7: Delta "P" Curve - HSV-05AD-1-G075-MP0

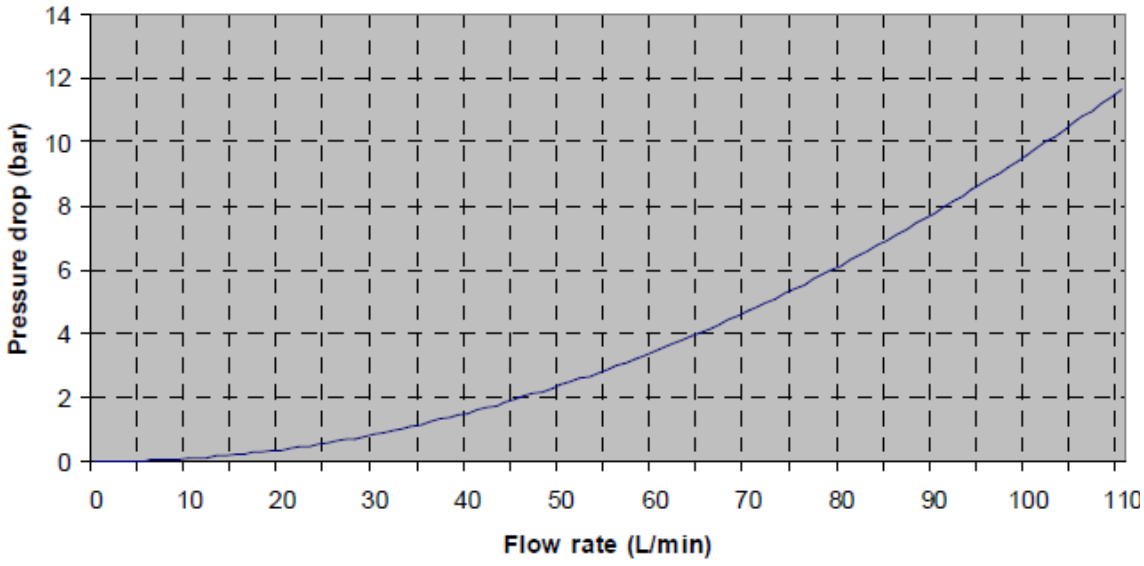


Figure 8: Delta "P" Curve - HSV-05AD-2-G075-MP0

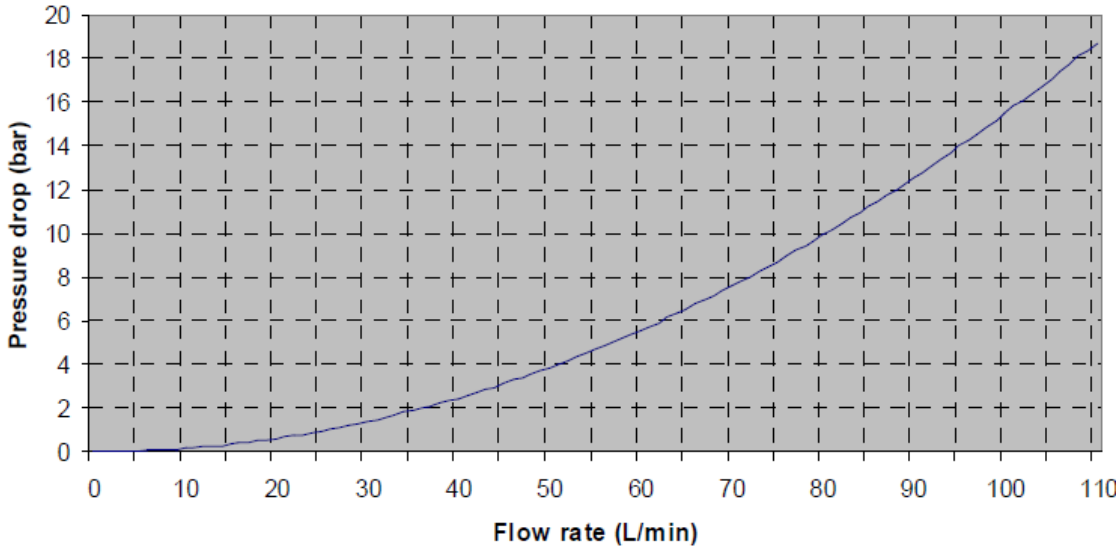


Figure 9: Dimensional Drawing - HSV-03AD-2-G075-MP0 - 40LPM - 3/4" Port Connection BSP - M12

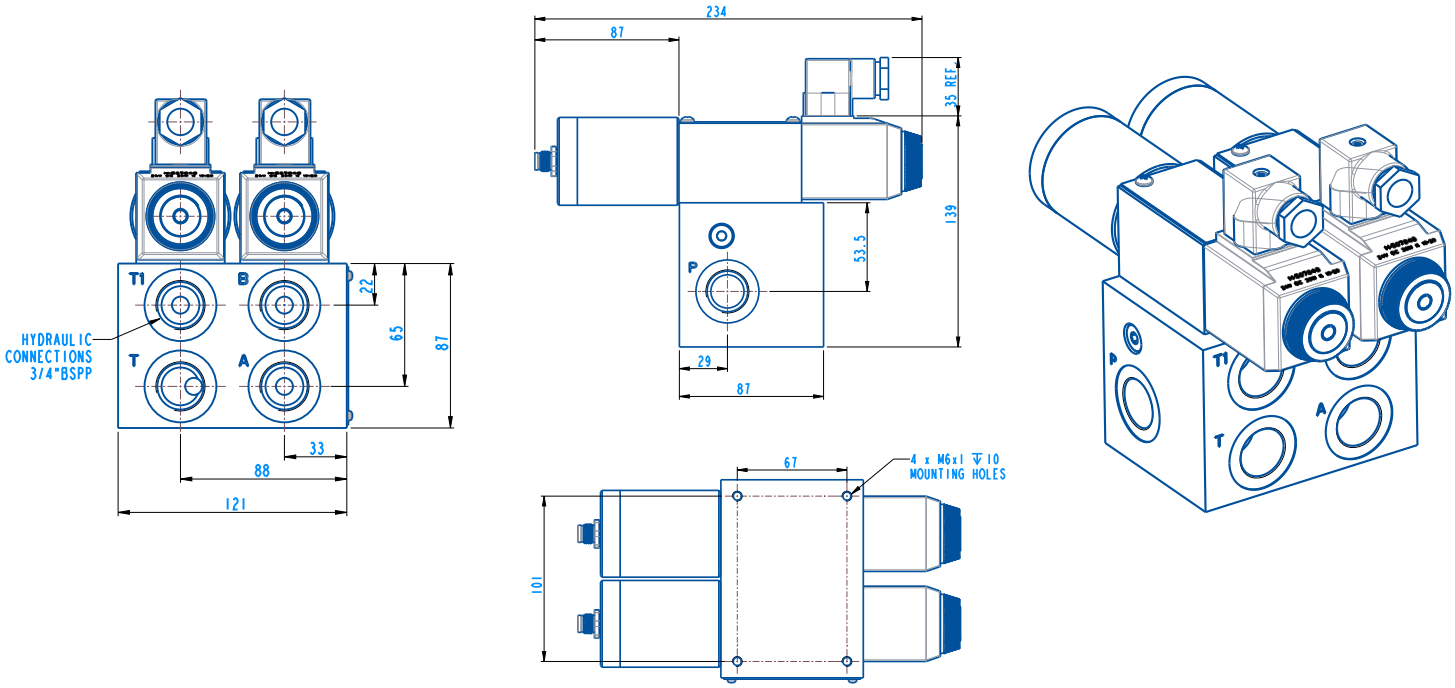
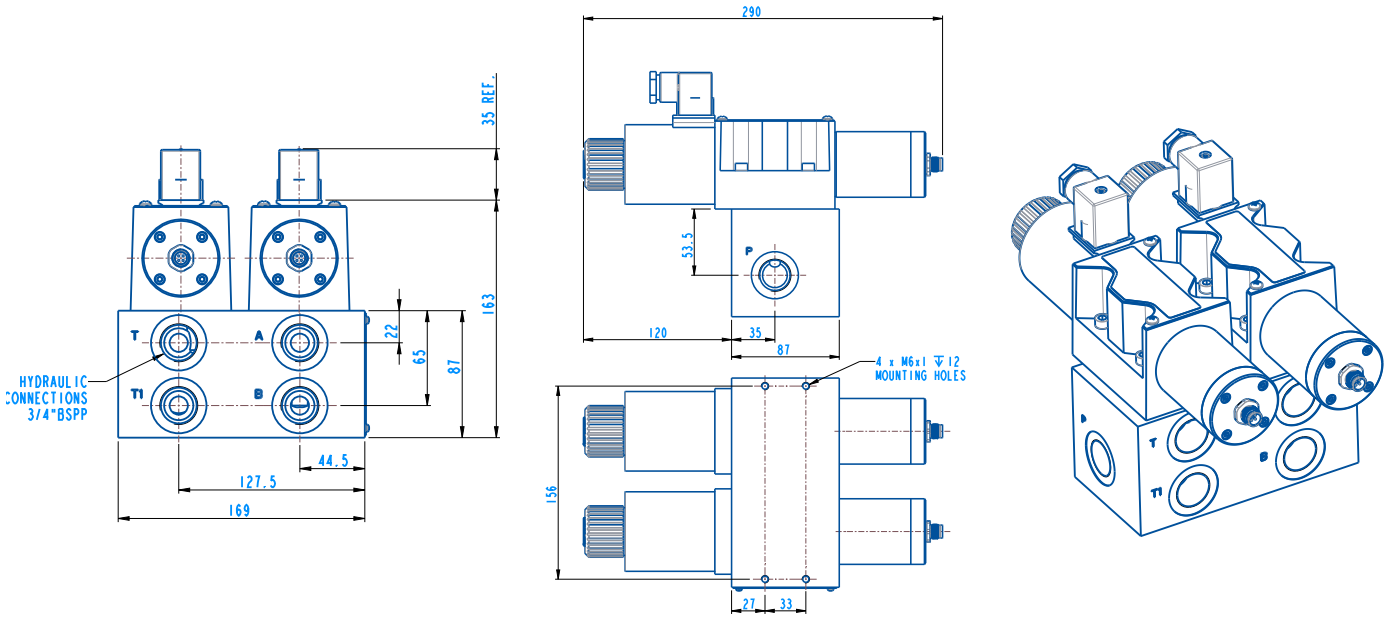


Figure 10: Dimensional Drawing - HSV-05AD-2-G075-MP0 - 110LPM - 3/4" Port Connection BSP - M12



Safety Instructions - Cautions & Warnings

Circuit Placement and Connection

Careful consideration must be given to suitable circuit placement and care must be taken not to pressurise the tank port of the monitored valve. Pressurisation of the tank ports can cause damage to the valve. Outlet ports of control valving must not be connected the 'T' port of the monitored valves. For example where a monitored block and bleed function is to be performed in conjunction with a directional control valve (DCV), the monitored valve would be typically placed in circuit prior to the DCV (**See Figure 2**). The 'T' or tank ports must be plumbed directly to tank without any other interconnection or restriction.

Cleanliness

Fortress Safety recommends 10 micron absolute filtering for the hydraulic supply to monitored valving.

Connection of Tank Lines

Return line filtering must not be used on 'T' or 'T1' tank lines.

Silting

Silting occurs when hydraulic valves are left in the actuated position for long periods of time and in conjunction with dirty or contaminated oil this can cause valves to seize in a dangerous state. The only remedy for such a situation is maintained oil filtering systems and periodic operation of valves. Valves should be cycled a minimum once every 8 hours of continual operation. Silting may also be overcome by cycling each valve at some idle time when there is no requirement for access by operators and there is no operation of the hydraulics.

Power Supply

A power supply providing the total current consumption of each coil energised at any one time is required. If an inadequate power supply exists, valves may fail to energise and solenoid coils could be subject to damage.

Cooling

The solenoid coils of the HSV series monitored valves are cooled via recirculation of the hydraulic oil. Solenoid coils should not be energised for an extended period without an active hydraulic oil flow.

Gravity Loads

Due to spool seepage and or drainage orifices where applied, monitored spool valves are not recommended for gravity loads.

Monitoring

Each monitored valve provides a normally closed mechanically linked positive opening high precision switch for the safety function (de-energised state). To prevent undetected faults the monitoring contacts should not be series connected in a feedback circuit. For safety applications the normally closed contacts must be connected to individual electrical safety monitoring system inputs. Each valve has an additional normally open contact for process control signaling purposes.

The external safety evaluation device must:
- Monitor both signals are high before it can leave its safe state
- Monitor that both signals are synchronous
- Have diagnostic coverage of at least 99%

Safety Instructions - Cautions & Warnings

Warning

Selection

Confirm specifications
Products represented in this data sheet are designed for use in hydraulic applications only, unless otherwise indicated. Do not use the products outside their design parameters.

Installation

1. **Do not install unless the safety instructions have been read and understood.**
   Keep this data sheet on file for future reference.
2. **Access**
   When installing the products, please allow access for replacement of spare single valves. (maintenance is not required. Individual valves can be replaced)
3. **Tightening Torque**
   When installing the products, please follow torque specifications.

Caution

Piping

1. **Before Piping**
   Make sure that all debris, cutting oil, dust, etc. are removed from the piping.
2. **Sealant Tape**
   When installing piping or fitting into a port, ensure that sealant material does not clog up the pressure port. When using sealant tape leave the first 1.5 to 2 thread turns exposed at the end of the pipe/fitting.

Warning

Environment

1. **Do not use in an environment where the product is directly exposed to corrosive gases, chemicals, salt water, water or steam.**
2. **Do not expose the product to direct sunlight for an extended period of time. If the product has to be mounted in an area where exposure to direct sunlight cannot be avoided, the use of a protective cover is recommended.**
3. **Do not mount the product in a location where it is subject to strong vibrations and/or shock.**
4. **Do not mount the product in a location where it is exposed to radiant heat.**

Maintenance (maintenance is not required. Individual valves can be replaced)

1. **Replacement of spare single valves**
   If handled improperly, pressurized fluids can be dangerous. Assembly, handling and repair of hydraulic systems should be performed by qualified personnel only.
2. **Shut down before replacement of single valves**
   Before attempting any kind of maintenance make sure the supply pressure is shut off and all residual air pressure is released from the system to be worked on.
3. **Start up after replacement of single valves**
   Apply operating pressure and power to the equipment and check for proper operation and possible air leaks. If operation is abnormal, please verify product set-up parameters.
4. **Do not make any modification to the product**
   Do not take the product apart.

Regular Testing

The product should be examined to ensure that the safety function is operating properly.
This should be performed whenever deemed necessary by the end user, or once per month.
The test should focus on the safety system's functionality and should check the following observation:
When the solenoids are powered on by the control system:
• Verify the pressurisation of the connected downstream system.
• Verify that the contacts on the switch are open.
When using a Dual valve assembly, make sure that when only one channel of the device is actuated, no downstream systems become pressurised. Perform this for each channel.

When the solenoids are not energised by the control system:
• Verify that the associated downstream system is appropriately drained to the tank.

• Verify that the contacts on the switch are closed.
For dual valve assembly, ensure that the protected system is drained to the tank when just one channel of the device (one of the solenoids) is de-energized. Check both channels.

Trouble Shooting

Trouble	Possible Cause		Remedy
Faulty Operation	Valve does not operate	Low signal voltage	Increase voltage
		Incorrect or damaged wiring	Re-wire correctly
		Blown fuse	Check for cause (e.g. damaged wires) etc. and replace
		Poor contact in plug	Replace plug or reconnect wires correctly
		Broken internal wire	Replace faulty valve on manifold
		Foreign matter caught in valve	Replace faulty valve on manifold
	Valve operates but is sluggish	Low pressure	Adjust pressure
	Burnt-out coil	Voltage too high or wrong coil	Check voltage. Relace faulty valve.
		Water ingress	Protect valve to keep water away. Replace faulty valve.
Leakage	Excessive amount of oil leaks through valve from exhaust ports	Worn spool	Replace faulty valve on manifold
		Foreign matter caught in valve	Replace faulty valve on manifold
		Foreign matter caught in core	Replace faulty valve on manifold
	Oil leaks from base gasket	Bolt tightening insufficient	Tighten to specified mounting torque.
Buzzing	A buzzing sound is heard when power is applied	Foreign matter caught in core	Replace faulty valve on manifold
		Worn coil	Replace faulty valve on manifold
		Low signal voltage	Increase voltage