



RC-HBH-OI EN

HBH Series

Redundant Valve Systems

Hydraulic Block & Stop

Safety Valves

Operating Instructions



PRODUCT CREDENTIALS

Performance Level
Per ISO 13849-1:2015



Pending

Safety Integrity Level
Per IEC 2061:2001

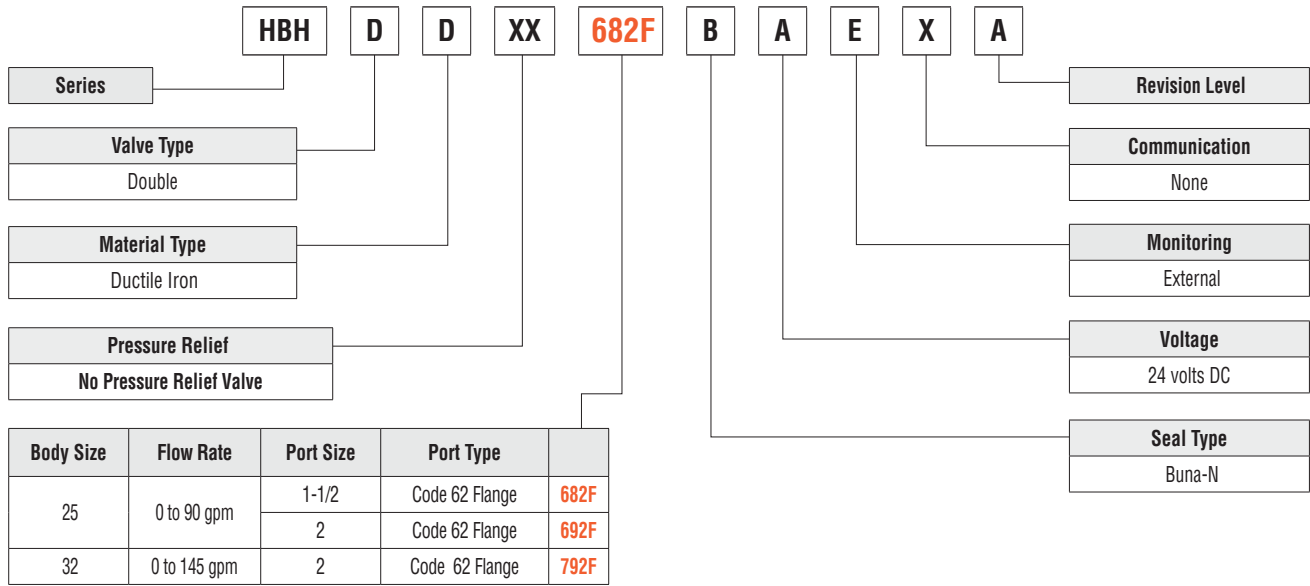


Pending

Declaration of Conformity



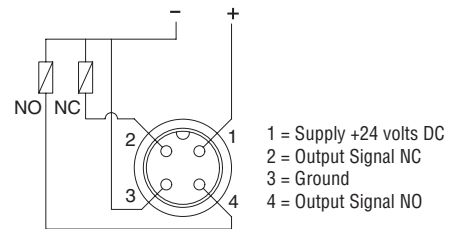
PRODUCT KEY IDENTIFICATION



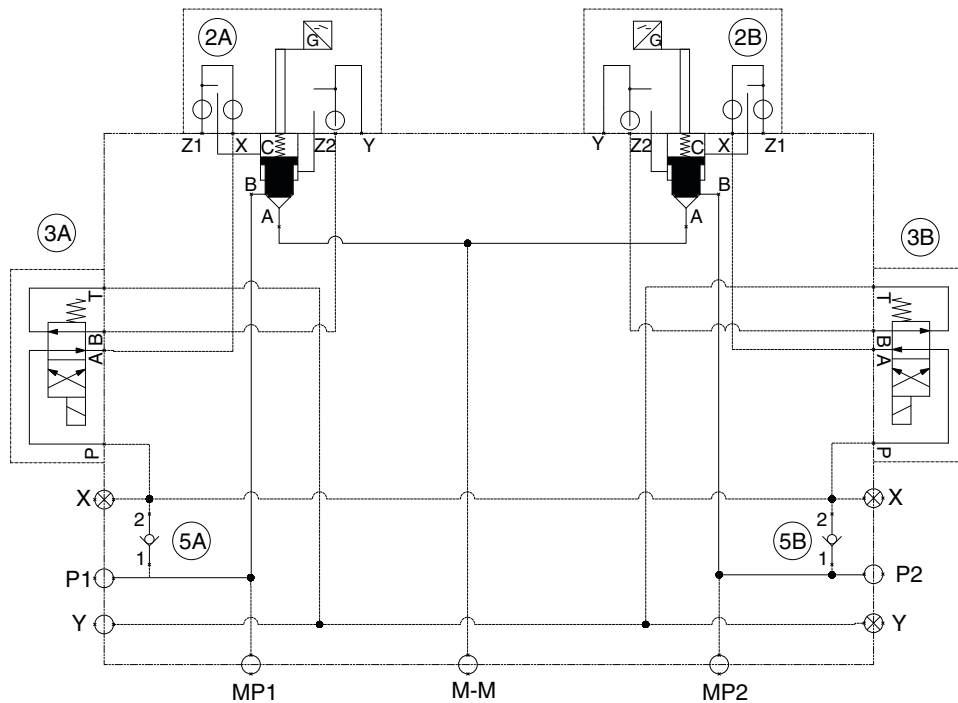
PRODUCT LABEL IDENTIFICATION



WIRING DIAGRAM Inductive Position Switch Connector



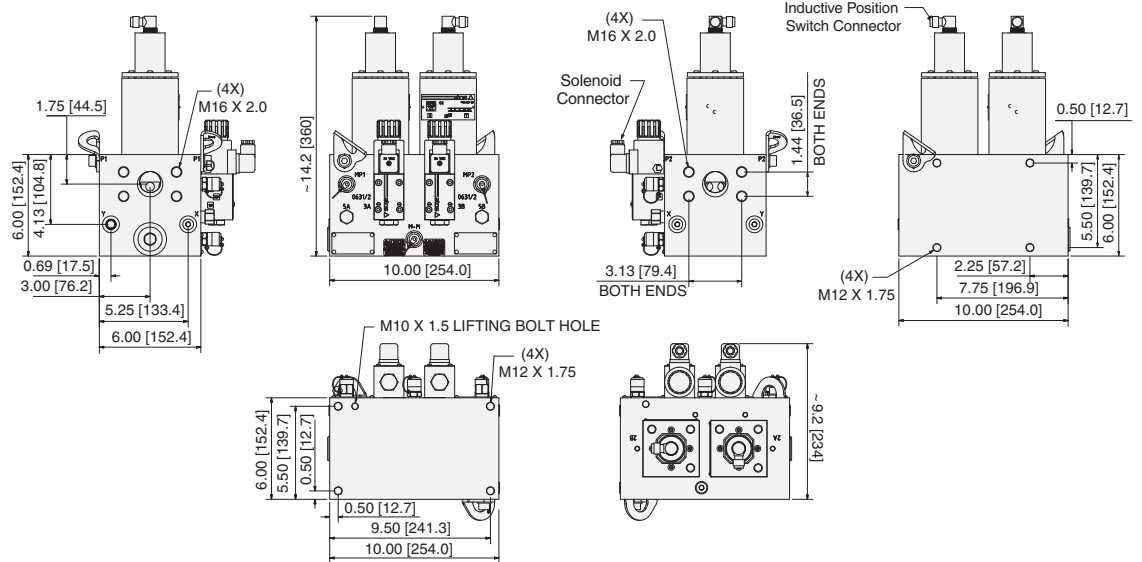
SCHEMATIC



MOUNTING INFORMATION AND OVERALL DIMENSIONS (inches/mm)

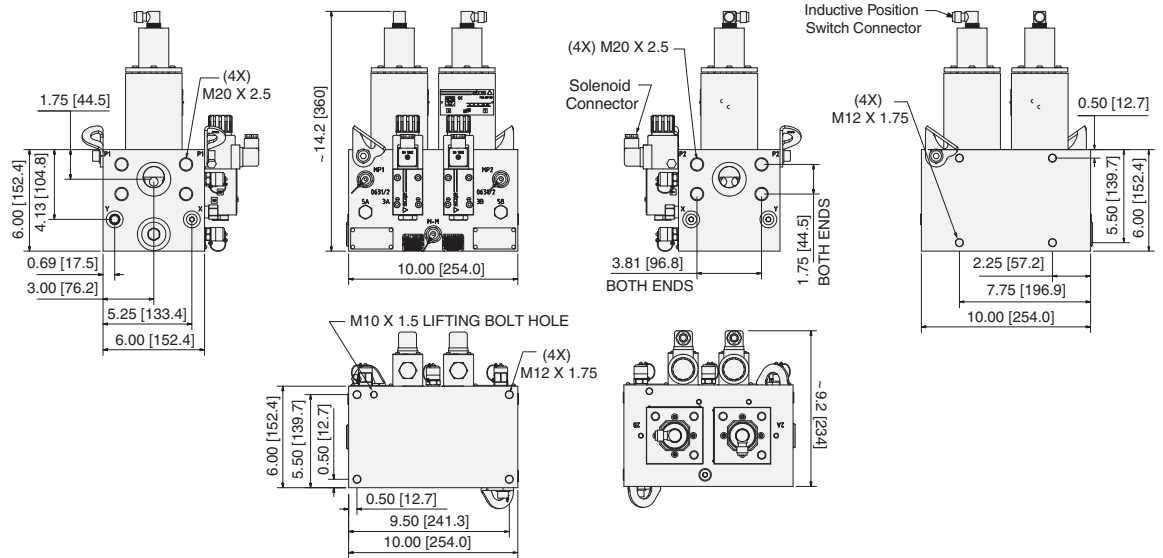
Body Size 25 Port Size 1-1/2

Ports List	
ID	Name
P1	1.500 MT 62
P2	1.500 MT 62
X	SAE # 6
Y	SAE # 6
MP1	SAE # 6
M-M	SAE # 6
MP2	SAE # 6



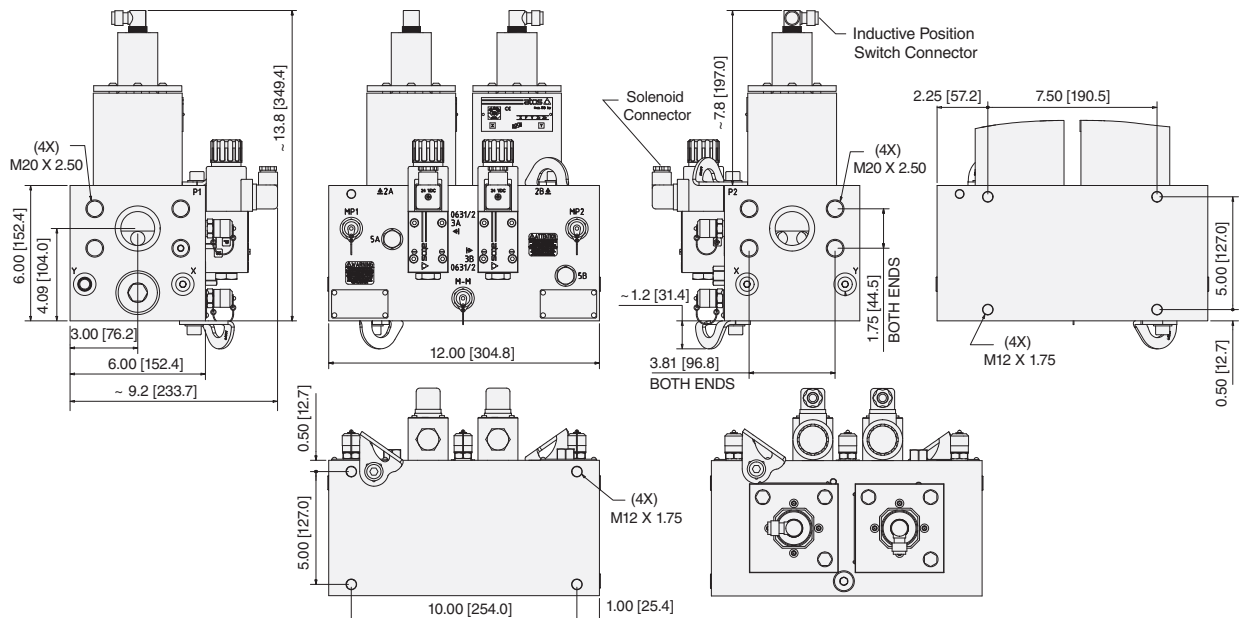
Body Size 25 Port Size 2

Ports List	
ID	Name
P1	2.000 MT 62
P2	2.000 MT 62
X	SAE # 6
Y	SAE # 6
MP1	SAE # 6
M-M	SAE # 6
MP2	SAE # 6



Body Size 32

Ports List	
ID	Name
P1	2.000 MT 62
P2	2.000 MT 62
X	SAE # 6
Y	SAE # 6
MP1	SAE # 6
M-M	SAE # 6
MP2	SAE # 6



1. About this Documentation

These instructions contain important information for the safe and appropriate assembly and commissioning of the product.

- Read these instructions all the way through, particularly section 6 "Notes on Safety," before working with the product.

For more information see last page for contact information, or visit www.rosscontrols.com.

- In addition, observe all applicable local and national regulations on accident prevention and on environmental protection.

1.1. Warning Notices in these Operating Instructions

In these operating instructions, warning notices precede sections with handling requirements which incur risks of personal injury or material damage.

Warnings are structured as follows:

SIGNAL WORD	
Type or source of hazard!	Consequences
► Measures to avert danger	

- **Warning triangle:** Indicates a risk of fatal or severe injuries.
- **Signal word:** Indicates the severity of the danger.
- **Type or source of hazard:** States the type of danger or the source of the hazard.
- **Consequences:** Describes possible consequences of ignoring the warning.
- **Measures to avert danger:** Indicates how to avoid the danger. It is essential that the measures to avert danger are complied with.

DANGER	Indicates an imminent and serious danger that will result in severe or even fatal injury if you fail to avoid it.
WARNING	Indicates a possible danger that could result in severe or even fatal injury if you fail to avoid it.
CAUTION	Indicates a danger that may result in minor to moderate injuries if you fail to avoid it.
ATTENTION	Indicates potential property damage that may be incurred by the product or its surroundings if you fail to avoid it.

2. Product Identification

The valve assembly is marked with Model Number, Revision level, and a serial number which can be used to identify date of manufacture and location. Please contact ROSS Controls for further information.

Product label identification & product key identification example, see page 2.

3. Prerequisites for Use of the Product

- Make these operating instructions available to the engineer and assembly technician of the machine/system in which the product will be used.
- Keep these operating instructions for the entire product life cycle.

3.1. Qualified Personnel

Assembly, installation, commissioning, maintenance, and decommissioning should only be carried out by qualified personnel that have the required knowledge of and experience in dealing with electrical and hydraulic control technology.

All work may be performed only by properly trained and qualified individuals who have been specifically instructed for the tasks assigned to them. The levels of responsibility of personnel are to be clearly delineated by the owner/operator. Protective clothing and gear is to be worn when performing all work. The relevant safety and accident prevention regulations are to be adhered to. Any special safety requirements specified in the documentation for the unit/system are to be complied with.

4. Package Contents

Items included:

- Block & Stop control valve system
- Operating instructions

5. Service, Repair, and Maintenance

- In case of technical problems or a required repair, please contact your local ROSS® representative.
- Checks should be conducted once a month to ensure valves are in functioning order.

5.1. Maintenance

WARNING
- All activities of maintenance must be conducted by competent and qualified staff - Always depressurize the relevant part of the system before any maintenance operation on the hydraulic system.

When/if a valve is replaced; a basic functional test should be performed (see 8.1 Test Procedure).

It is important that all the check-up operations, even if simple, are programmed and reported on specific maintenance program schedules.

Before the inspection, cleaning should be undertaken if necessary.

WARNING
- Always ensure cleanliness when working on the HBH Valve. - Do not perform maintenance with the equipment functioning! - Penetrating dirt and liquids will cause faults! - Safe function of the HBH valve is not ensured when operated with contaminated fluid. - Certain solvents and aggressive cleaning agents or detergents may damage the seals on the HBH valve and make them age faster. - Never use solvents or aggressive detergents as these can cause damage to the hydraulic system and seals! - The water pressure of a high-pressure cleaner can damage the seals of the HBH valve. - Do not use a high-pressure cleaner. - Pay attention to prevent detergent penetration into the HBH valve. - Check that all seals and electrical plug connections are firmly fitted to prevent the penetration of detergents.

6. Notes on Safety

The product has been manufactured according to the accepted rules of current technology. There is risk of injury or damage if the following safety instructions and warnings given in this instruction manual are not observed.

6.1. Intended Use

The HBH Series Block & Stop Control systems are safety components designed and manufactured in accordance with Machinery Directive 2006/42/EC.

The HBH system is comprised of two single valves which make it a redundant design for meeting the needs and requirements of safe hydraulic Block & Stop applications. Typically, these systems are designed to meet Category 3, PL d, SIL 2 applications if properly implemented into the safety control & monitoring system.

The HBH Series Block & Stop system is designed to allow the flow of hydraulic fluid into or out of a cylinder or to block the flow in order to stop cylinder motion (Block & Stop) when needed.

NOTE: Block and Stop functions are intended to momentarily stop an actuator (linear or rotary), but not to hold the actuator in place for an extended period. The HBH valve is a spool type valve, and normal spool leakage will occur. The valve is intended to be used as a "permissive" safety device. Applications where long-term holding is necessary should also incorporate other components such as PO check, counterbalance, or mechanical locking devices.

NOTE: HBH valves are intended to be used only for tasks that are routine, repetitive, and integral to production. Maintenance tasks require following full lock-out/tag-out procedures to relieve hazardous energy and prevent unexpected startup.

During normal operation, the HBH system is held actuated, allowing the flow of hydraulic fluid through the HBH unit from inlet to outlet. In a situation when immediate pressure and flow shut-off is needed, the HBH Series Block & Stop system can be turned off to provide an immediate flow and pressure blocking action.

The HBH Series Block & Stop systems are designed to be externally monitored by a safety control & monitoring system for safe, redundant operation of the valves. Each single valve is equipped with a PNP inductive position switch. Monitoring both of these switches on each actuation and de-actuation of the HBH Block & Stop system provides a diagnostic coverage of up to 90%. Monitoring of these switches must be done by an external monitoring system.

The unit cannot be used by itself. It is designed for installation in a machine. ROSS and its suppliers will assume no liability in the event that the system or parts thereof are not used in accordance with their designated use or if modifications are made in a non-authorized manner.

Any drawings, hydraulic or electric circuit diagrams, parts lists and acceptance certificates (inspection reports) supplied do not form a part of these operating instructions. They are supplied for the purpose of illustrating the unit or procuring parts.

6.1.1. Safety Function According to ISO 13849 and EN 692

The Machinery Directive has a dual objective: to permit the free movement of machinery within the internal market while ensuring a high level of protection of health and safety. A hydraulic valve system designed and specified as being capable of performing a safety function as well as normal production use is a "safety component" where other parts of the definition are met. However, a similar valve where the manufacturer markets it only for normal production use would not be considered a safety component.

HBH Block & Stop systems are designed in accordance with the requirements listed in ISO 13849-1 and -2. Their "fail-to-safe" safety function is ensured even in case of a fault within the valve (e.g., caused by power loss, wear, contamination, or similar situations).

The safety function of the HBH Series Block & Stop system is to only supply flow into a cylinder or designated portion of the hydraulic machine/system when the two valve elements are actuated simultaneously, but to block the flow in both directions when both valves are shut-off or if only one of the two valves is de-actuated. A fault in the system where only one valve actuates when switching on or only one de-actuates when switching off prevents flow of hydraulic fluid from moving downstream or upstream. Monitoring of the two inductive position switches by the user's external safety control & monitoring system makes it possible to detect these fault situations and to shut off and prevent further electrical energization of the solenoids.

Port identification on the manifold according to ISO 16874

The HBH Series Block & Stop system is designed and manufactured in accordance with the identification requirements laid out in the ISO 16874:2004 standard.

6.1.2. Common Cause Failure – CCF

The product has been engineered and manufactured according to the fundamental and proven safety principles of ISO 13849-1:2015 and -2:2012.

Common Cause Failures (CCF) are failures of different components, resulting from a single event. CCF are not to be confused with cascading faults or common mode faults. Common cause failures can cause loss of the safety function, especially in dual channel circuits where both channels could fail simultaneously due to a single event.

6.1.3. Critical failure modes and causes:

- Failure of the safety function - caused by simultaneous incomplete return of both solenoid pilot valves (3A and 3B) or main cartridge valves (2A and 2B).
- Maintain hydraulic fluid quality, i.e., proper filtration.
- Operate within prescribed temperature limits.
- Install the valve such that the normal stroke travel of the valve elements is perpendicular to the main direction of machine vibration and/or mechanical shock.
- Avoid external magnetic fields.

6.1.4. Diagnostic Coverage

A diagnostic coverage of 90% is achievable through appropriate integration of the HBH Series Block & Stop system into the safety control system. The monitoring system must check for the proper change of state of each valve's inductive position switch (Switch 2A & Switch 2B) with each change of state of the safety control system outputs to the valve solenoids (Sol 3A & Sol 3B). Detection of a fault by the safety control & monitoring system must trigger a shut-off of the safety controller's outputs to the valve solenoids (Sol 3A & Sol 3B).

6.1.5. Fault Modes

Note that normal operation requires that Sol 3A & Sol 3B be energized simultaneously for switching the HBH Series Block & Stop system on, and de-energizing both Sol 3A and Sol 3B simultaneously for switching the HBH Series Block & Stop system off.

NOTE: The switches are supplied with both NC and NO contacts. The statements below only refer to whether or not the switches are actuated.

Faults that could occur during normal operation are:

Sol 3A & Sol 3B energized simultaneously

- Switch 2A ON, Switch 3A OFF
- Switch 2A OFF, Switch 3A ON
- Switch 2A OFF, Switch 3A OFF

Sol 3A & Sol 3B de-energized simultaneously

- Switch 2A ON, Switch 3A OFF
- Switch 2A OFF, Switch 3A ON
- Switch 2A ON, Switch 3A ON

6.1.6. Foreseeable Misuse



Risk of Injury!

Misuse may result in injury or damage.

- The product must be used exclusively as intended.

Foreseeable misuse includes:

- Bypassing the safety function or diagnostics.
- Replacing the safety valves with unauthorized valves.
- Tampering with the position switches.
- Failing to utilize the position switches to verify valve operation on every cycle - when energizing and de-energizing.
- Allowing continued operation of the valve when one or both valve shifted signals (from position switches) are not confirmed.
- Operating at pressures above maximum operating pressure.

6.2. Responsibilities of the System Owner

Observation of general requirements pertaining to hazards:

- Unusual noises, vibration, defects or damage is to be remedied immediately as it may point to potential hazards.
- Generally speaking, no maintenance work may be done on the hydraulic system and power units as long as they are under hydraulic pressure or the power supply has not been switched off.
- Prior to performing any maintenance work, pressure accumulators are to be depressurized.
- The hydraulic system has to be depressurized at any time work is done on the gas side of an accumulator.
- Note the load pressures present. Also note any loads applied. If necessary, make sure that the loads are secured or properly supported.
- Hydraulic systems may only be operated by properly trained and instructed personnel.
- All safety devices and equipment are to be checked to see that they function properly.
- The setting of pressure relief valves featuring a tamper-resistant seal may not be changed.
- Safety devices and equipment may not be removed, deactivated or circumvented owing to the accident hazard posed by this action.
- General safety and accident prevention regulations pertaining to operating the unit/system are to be adhered to.
- Comply with the further requirements of ISO 13849 (e. g., MTTFD, CCF, DC, PLr,) if you intend to use the product in higher categories (2 or 3).
- Check the valve at least once a month to ensure its proper operation.
- Make sure that the fundamental and proven safety principles in accordance with ISO 13849 for implementation and operation of the component are complied with.
- Selection and installation of replacement valves must take place in accordance with the manufacturer's specifications.

6.3. Safety Instructions

The HBH Block & Stop System features a state-of-the-art design. Reliable and safe operation cannot be ensured unless all the instructions, settings and output limits applicable to the unit supplied are adhered to.

The systems involved are pressure-generating systems whose components feature pressurized liquid; consequently, the systems may pose a hazard if not dealt with properly.

6.3.1. Additional Safety Considerations

- When implementing surge suppression measures, be sure to check whether or not this extends the valve system shut off response time which could extend the machine stopping time.
- In case of high levels of machine vibration, use appropriate vibration-reducing elements when installing the valve system.
- Supply the proper voltage as overvoltage situations can result in solenoid burnout.

7. Assembly and Installation



CAUTIONS

Risk of injury due to installation while pressurized or with live parts!

Installation while pressurized or with electrical power switched on can result in injuries due to sudden pressure build-up or electric shock.

- Installation while pressurized or with electrical power switched on can result in injuries due to sudden pressure build-up or electric shock.
- De-energize and de-pressurize the relevant system parts before installing the valves.
- Secure the system to prevent it from being switched back on again.

ATTENTION

Destruction of components!

Chemical substances can damage the surface, the markings and the seals of the device.

- Install the valve such that it is protected against the effects of chemicals.

Damage to the device through storage at incorrect temperatures!

The storage temperature represents the permissible ambient temperature and depends on the type of valve in question.

- Observe the temperature information in chapter 10 "Technical Data."

7.1. Installation Instructions

Secure the system using the through holes in the manifold. Refer to pattern for the required dimensions, - see dimensional drawings on page 3.

7.1.1. Component Inspection: Prior to use, a careful examination of the HBH valve system must be performed. The HBH valve system must be checked for correct style, size, catalog number and external condition, and must be examined for cleanliness, absence of external defects or gouges or otherwise deformed parts or other imperfections. DO NOT use any item that displays any signs of nonconformance. Any accessory including, but not limited to, fittings, bolt kits, hoses, sub-bases, manifolds and electrical connectors must be subjected to the same examination.

7.1.2. Filtration: Fluid cleanliness is a necessity in any hydraulic system. Fluid filters need to be installed and maintained in the system to provide the required level of cleanliness. Filters can be placed in the inlets.

7.1.3. Accessory Ratings: All accessories used in combination with the selected or intended HBH valve system must be used in accordance with the HBH specifications.

7.2. Electrical Connections

Install the electrical connectors (EN 175301-803 Form A type, pre-wired or non-prewired) for both the valve solenoids.

Install the inductive position switch connectors (M12, 5-pin, A-coded) on each valve and follow the electrical wiring schematic of the switch on page 2.

8. Commissioning and Operation



CAUTIONS

Damage to health due to loud noise!

Levels above 70 dB(A) may lead to damage to health!

- Always wear ear protectors when working on the product.

Before commissioning, the installation must be carefully inspected by a qualified, trained professional.

Make sure that the technical specifications match the operating criteria of the machine and/or the hydraulic system.

8.1. HBH Test Procedure for Valve Operation

NOTE 1: This valve test procedure only checks for proper function of the HBH valve system. Please refer to the HBH Integration Guide for the External Monitoring Validation Procedure.

NOTE 2: The valve test procedure requires fault simulation. It will be necessary to induce faults electrically by disabling a different solenoid at different times. This will be most easily done by disconnecting solenoid cables at the valve.

NOTE 3: The PNP position switches are supplied with both NC and NO contacts.

NOTE 4: "-" indicates no change from the previous step.

Step	Action	Sol 3A	Sol 3B	Flow P1 to P2	Switch Conditions				Pass/Fail
					Switch 2A		Switch 2B		
				YES/NO?	(NC)	(NO)	(NC)	(NO)	(P/F)
1	Energize solenoid 3A	ON	OFF	NO	OPEN	CLOSED	CLOSED	OPEN	
2	De-energize both solenoids	OFF	OFF	NO	CLOSED	OPEN	-	-	
3	Energize solenoid 3B	OFF	ON	NO	-	-	OPEN	CLOSED	
4	De-energize both solenoids	OFF	OFF	NO	-	-	CLOSED	OPEN	
5	Energize both solenoids 3A & 3B	ON	ON	YES	OPEN	CLOSED	OPEN	CLOSED	
6	De-energize both solenoids	OFF	OFF	NO	CLOSED	OPEN	CLOSED	OPEN	

8.2. Limitations Due to System Leakage

Even though the HBH is designed to redundantly block flow, it is important to periodically test for leakage within the HBH and the system it controls, as any leak within the HBH itself, interconnecting hoses, connectors, cylinders or other actuators, or even other valves in the circuit may cause unexpected movement.

In order to test for leakage within the HBH itself, it is necessary to check for actuator (cylinder) movement when the HBH is in each of the following conditions:

- A) fully de-energized (both solenoids 3A & 3B de-energized)
- B) solenoid 3A energized with solenoid 3B de-energized
- C) solenoid 3A de-energized with solenoid 3B energized.



WARNING

Performing this test could cause injury or damage to equipment due to unexpected or uncontrolled movement. Take all necessary precautions to ensure worker safety prior to initiating this test.

Depending on the application, it may be necessary to preposition actuators and/or other valves such that energizing the HBH would allow motion to occur. This sets up the circuit so that the HBH valve is the sole motion-controlling device during testing. For example, if a cylinder is fully retracted, a leak that normally allows retract motion to occur could be masked because the cylinder is already fully retracted.

This test helps to troubleshoot leaks within the HBH system. Other leaks within the associated system can affect the outcome of this test.



WARNING

If any leakage is discovered within the system, measures should be taken to eliminate the leak(s) as failing to do so could limit the ability of the safety system to safely stop motion when required.



WARNING

Continued operation of the system without periodic leakage inspections can lead to unexpected movement.



WARNING

Unexpected movement could occur if one of the check valves in the pilot system, including any check valve installed in the external pilot supply line, were to fail open. A failure of one of these check valves could allow as much as 10 gpm flow from P1 to P2, P2 to P1 or P2 to X (external pilot port). The amount of flow could be higher from P2 to X when using external pilot supply depending on the flow capability of the check valve that the user installs in that line or, especially, if no check is installed in the external pilot line.

9. Disconnecting and Removal

⚠ CAUTIONS

Risk of injury due to installation while pressurized or with live parts!

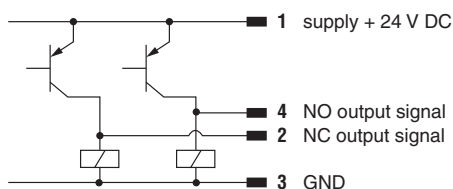
- ▶ Disconnecting a hydraulic component while the system is pressurized or while electrical power is supplied can result in injury or death due to sudden pressure release, unexpected movement, or electric shock.
- ▶ Isolate and lock out the electrical and hydraulic systems before disconnecting the unit.

10. Technical Specifications

Construction Design	Poppet type with spool type pilot valves
Actuation	One solenoid per valve element Solenoids must be operated synchronously
	Solenoid pilot operated, spring return
Mounting	Type: In-line
	Orientation: Any, preferably horizontal
Solenoids	Version as per VDE 0580. Rated for continuous duty. Electrical connection according to EN 175301-803 Form A. Enclosure rating according to DIN 400 50 IP 65.
Standard Voltages	24 volts DC
Power Consumption (each solenoid)	30 watts
Inductive Position Switch (2 per system)	PNP (M12, 4-pin, A-coded, male) Works with both 4-pin & 5-pin female cord sets
Maximum Current (each switch)	400mA maximum
Temperature Range (recommended)	Ambient: -4° to 160°F (-20° to 71°C)
	Media: -4° to 140°F (-20° to 60°C)
Flow Media	Hydraulic Fluids: Mineral Oil HLP, HL-DIN 51524 Vegetable Oil HETG - VDMA 24568
Max Fluid Contamination Level	ISO 4406 class 20/18/15 NAS 1638 class 9
Flow	Size 25: 90 gpm
	Size 32: 145 gpm
Inlet Pressure	5000 psi (344 bar)
Construction Material	Valve Body: Cast Steel
	Manifold: Ductile Iron
	Spool: Steel
	Seals: Buna-N

Technical Characteristics Of PNP Inductive Position Switch

Type Of Switch	Contactless inductive position switch with integrated amplifier
Supply Voltage [V]	20-32 V DC
Ripple Max [%]	≤ 10
Max Current [mA]	400
Reaction Time [ms]	15
Max Peak Pressure [bar]	400
Mechanical Life	Virtually Infinite
Switch Logic	PNP



OUTPUT SIGNAL STATUS FOR EACH VALVE IN THE HBH SYSTEM

Hydraulic configuration	
Spool position	
Pin 2	ON
Pin 2	OFF
Pin 4	ON
Pin 4	OFF

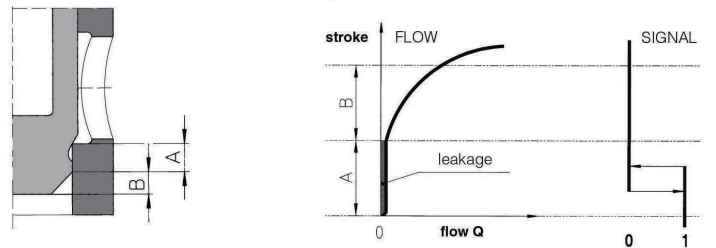
Note: PNP Position Switch can be electrically wired by the consumer as NO or NC and then the status of the output signal will be in accordance to the selected configuration.

■ = Intermediate spool position corresponding to the hydraulic configuration change.

STATUS OF OUTPUT SIGNAL

A: overlapping stroke
B: damping stroke

According to the criteria of safety specifications, the poppet position signal must change state during the overlapping stroke (before the effective valve opening.)



⚠ WARNING

Risk of Injury!

Misuse may result in injury or damage.

- ▶ The product must be used exclusively as intended.

- Failure to observe the prescribed procedures and cautions may represent a risk for personal injury.
- Safety valves must only be installed by qualified personnel.
- Safety valves must not be disassembled.
- The inductive position switches can only be adjusted by the valve manufacturer.
- Valve components cannot be interchanged.
- The valves must operate without switching shocks or spool vibration.
- There is a small portion of the main cartridge overlap stroke that may be undetectable and may allow flow if the other main cartridge is in the open position. This could be as much as 15 gpm on size DIN 25 and 18 gpm on size DIN 32.
- Check valves are used in the pilot supply system to ensure that the highest available pressure within the HBH system is supplied to the pilot valves. A failure of one of these check valves to close could allow as much as 10 gpm flow from P1 to P2, P2 to P1, or P2 to X (external pilot port).
- It is recommended that a check valve be installed in the X (external pilot supply port) to help prevent flow from P2 to X when pressure in P2 is higher than the pressure in X. Check valve shall be in accordance with Table C.4 of ISO 13849-2 for fault exclusion.
- Pilot pressure must be equal to or higher than the highest pressure at A and B.
- Do not downsize plumbing or connection to Y Ports. Connections (fittings and tubing/piping) must be equal to or larger the stated connection size at Port Y.

11. Disposal

Dispose of the valve in accordance with the applicable statutory regulations in your country.

GLOBAL LOCATIONS

	AMERICAS	USA	ROSS CONTROLS	Tel: +1-248-764-1800	www.rosscontrols.com
		Canada	ROSS CANADA	Tel: +1-416-251-7677	www.rosscanada.com
		Brazil	ROSS BRASIL	Tel: +55-11-4335-2200	www.rosscontrols.com.br
	EUROPE	Germany	ROSS EUROPA	Tel: +49 (0)6103-7597-100	www.rosseuropa.com
		France	ROSS FRANCE	Tel: +33(0)1-49-45-65-65	www.rossfrance.com
		United Kingdom	ROSS UK	Tel: +44 (0)1254 872277	www.rossuk.co.uk
	ASIA & PACIFIC	India	ROSS CONTROLS INDIA	Tel: +91-44-2624-9040	www.rosscontrolsindia.com
		China	ROSS CONTROLS CHINA	Tel: +86-21-6915-7961	www.rosscontrolschina.com
		Japan	ROSS ASIA	Tel: +81-42-778-7251	www.rossasia.co.jp



www.automaticvalve.com



www.rossdecco.com



www.manufactis.net



www.masterpneumatic.com



www.pneumatrol.com



www.ubsafe.com