



Pneumatic Division  
Richland, Michigan 49083

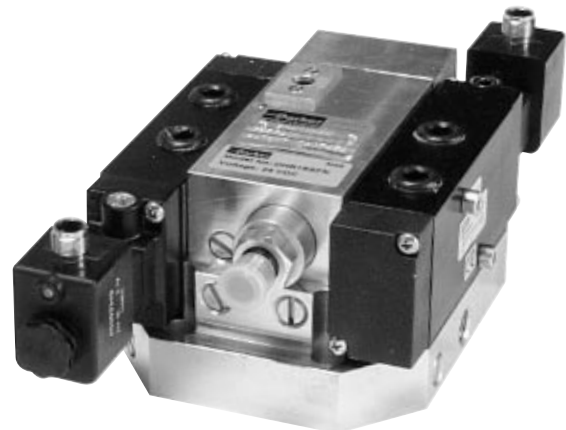
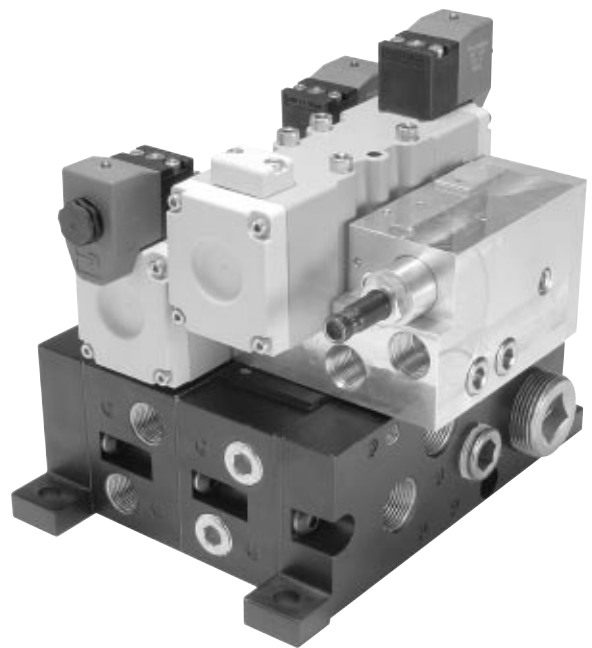
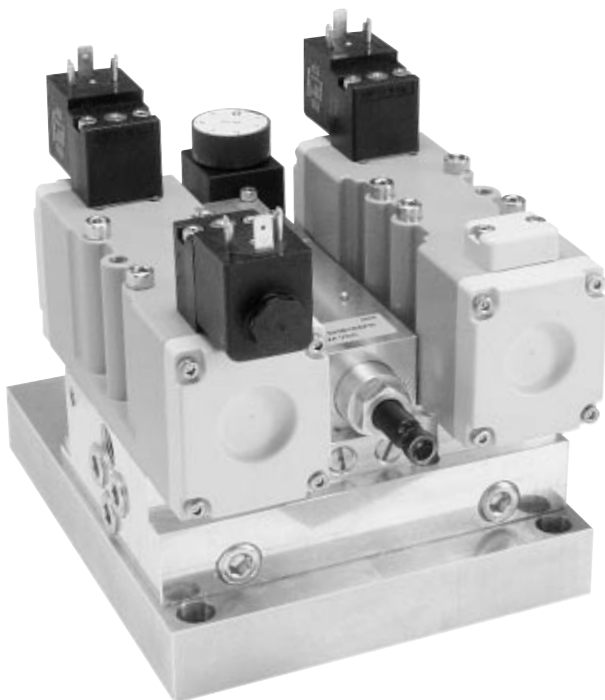
WCS-SIF-01

Training & Maintenance Manual

ISSUED: November, 2006

Supersedes: June, 2006

# Pneumatic Spotwelding Control Systems Training & Maintenance Manual



## Description & Operation

### General Description of Spotwelding Units

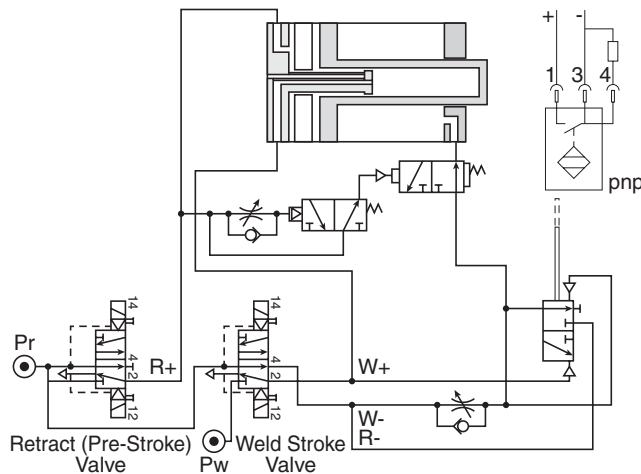
The spotwelding system is an integrated pneumatic controlled circuit that is specifically designed to increase production throughput, while improving weld quality and reducing decibel noise level.

Each unit consists of 2 independent, 2 position, directional control valves for retract (pre-stroke) and weld stroke. Each valve is dual pressure, with single solenoid / spring assist return or double solenoid available. Also included with each unit is a proportional / quick dump valve, a feedback sensor for initiating the welding process, and a flow control for metering the impact speed of the weld tips.

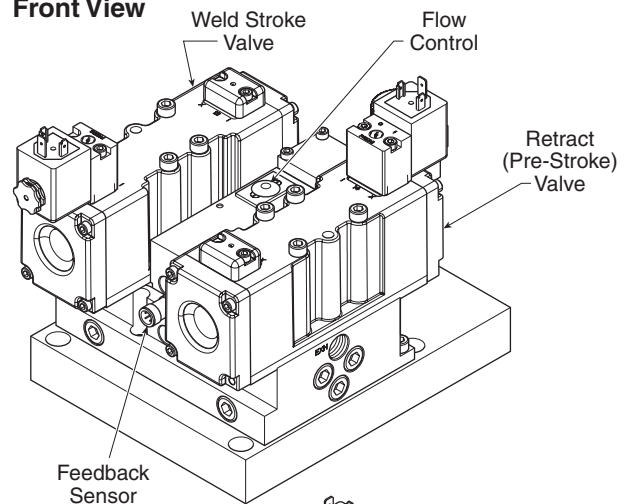
### ANSI (3 Ported Cylinder Option)

#### Inductive Sensor / Connection: Turck Connection Diagram Inductive Sensor

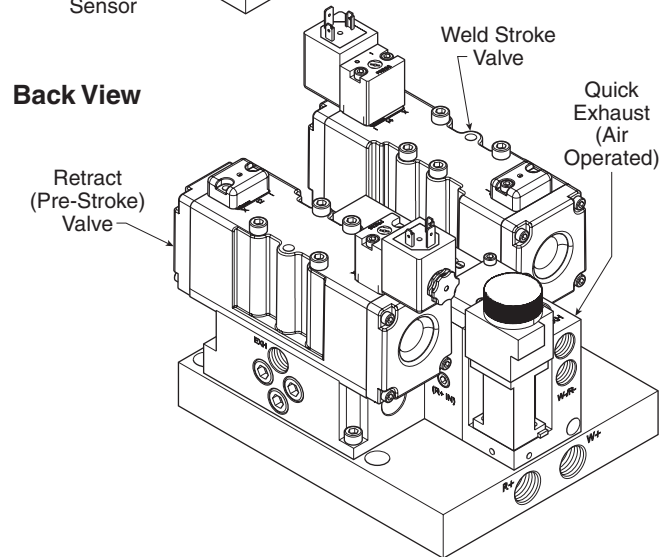
- |   |       |                      |
|---|-------|----------------------|
| 1 | Brown | +24 VDC Power Supply |
| 3 | Blue  | 0 V Power Supply     |
| 4 | Black | Switch Wire          |



#### Front View



#### Back View



### General Operation of Spotwelding Units – 3 ported guns

Spotwelding systems control both retract (pre-stroke) and weld stroke motions. When a 3 ported cylinder is used, the control block functions as follows:

1. The pre-stroke (retract) valve is energized, allowing the weld cylinder to extend under full line pressure by actuating the quick exhaust valve and moving to its predetermined position prior to welding.
2. The quick exhaust valve time is adjusted by the knob on top of the unit. To start, the white line on the dial is set at top dead center. Turn knob clockwise to set quick exhaust valve open time. Continuing to turn knob clockwise will lengthen time until it reaches a full 360° rotation, which covers the complete timing range.
3. The weld stroke valve is then energized using a selected weld schedule pressure. The closure speed of the weld tips is controlled by the use of an adjustable flow control, thus creating "low impact".
4. Immediately following weld tip contact with the sheet metal, two actions take place.

- a. The proportional / quick dump valve that senses pressure allows the front end of the cylinder to exhaust (by-passing the flow control), providing weld schedule pressure instantly.
- b. The proportional / quick dump valve also actuates a feedback sensor to start the weld cycle.
5. Once the weld cycle is complete, the weld stroke valve is de-energized, allowing the weld tips to open under full pressure.
6. The retract (pre-stroke) valve is then de-energized, allowing the weld cylinder to open completely under full line pressure.

**Note:** Dual pressure is provided to the control block. Line (high) pressure is used for both retract stroke and weld stroke open. Weld schedule pressure is used for weld stroke close. Dual pressure provides for weld tips to be closed for tip dressing using any pressures available, from as low as 5 PSIG to maximum line pressure.

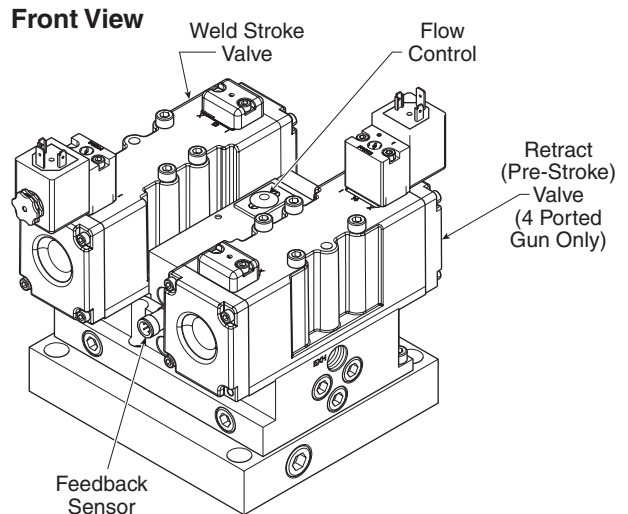
## Description & Operation

### General Operation of Spotwelding Units – 2 and 4 ported guns

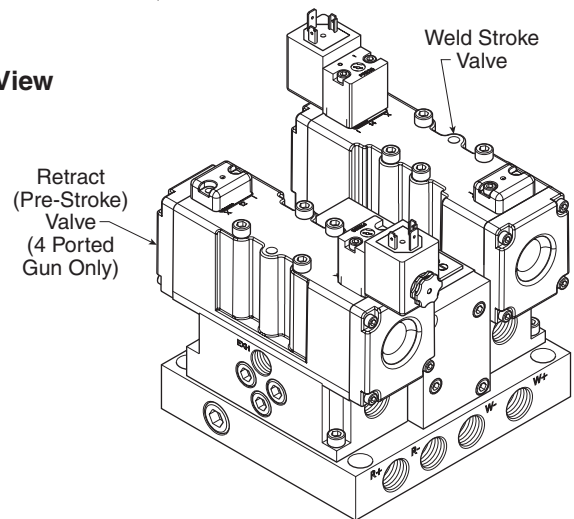
Spotwelding systems control both retract (pre-stroke) and weld stroke motions. When a 4 ported cylinder is used, the control block functions as follows:

1. The retract (pre-stroke) valve is energized, allowing the weld cylinder to extend under full line pressure and moving to its predetermined position prior to welding.
2. The weld stroke valve is then energized using a selected weld schedule pressure. The closure speed of the weld tips is controlled by the use of an adjustable flow control, thus creating "low impact".
3. Immediately following weld tip contact with the sheet metal, two actions take place.
  - a. The proportional / quick dump valve that senses pressure allows the front end of the cylinder to exhaust (by-passing the flow control), providing weld schedule pressure instantly.
  - b. The proportional / quick dump valve also actuates a feedback sensor to start the weld cycle.
4. Once the weld cycle is complete, the weld stroke valve is de-energized, allowing the weld tips to open under full pressure.
5. The retract (pre-stroke) valve is then de-energized, allowing the weld cylinder to open completely under full line pressure.

**Note:** Dual pressure is provided to the control block. Line (high) pressure is used for both retract stroke and weld stroke open. Weld schedule pressure is used for weld stroke close. Dual pressure provides for weld tips to be closed for tip dressing using any pressures available, from as low as 5 PSIG to maximum line pressure. 2 ported guns perform the same steps as above, except that the retract (pre-stroke) portion of the cylinder does not exist. Steps 2–4 only apply.



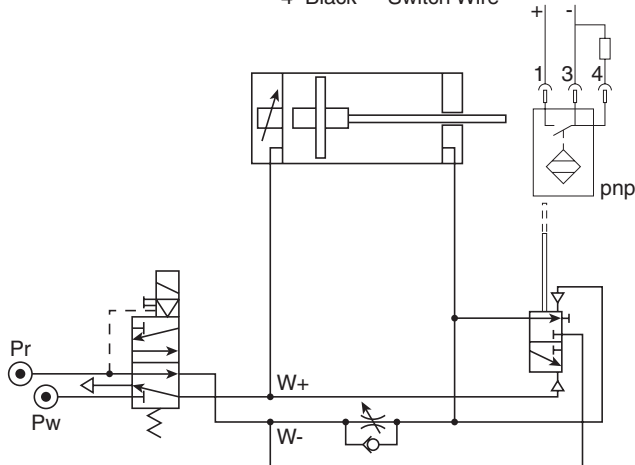
Back View



### ANSI (2 Ported Cylinder Option)

**Inductive Sensor / Connection: Turck Connection Diagram Inductive Sensor**

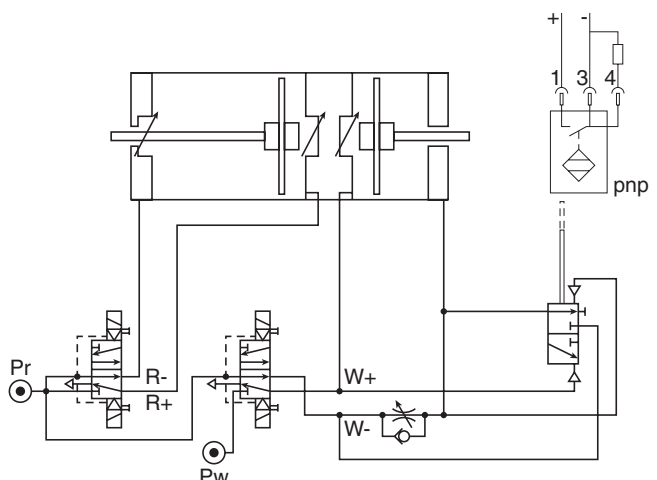
- 1 Brown +24 VDC Power Supply
- 3 Blue 0 V Power Supply
- 4 Black Switch Wire



### ANSI (4 Ported Cylinder Option)

**Inductive Sensor / Connection: Turck Connection Diagram Inductive Sensor**

- 1 Brown +24 VDC Power Supply
- 3 Blue 0 V Power Supply
- 4 Black Switch Wire



**Installation – Air and Electrical**

**A. Installing Weld Block with Existing Equipment**

1. Shut off air supply to weld gun and turn power off to cell.
2. Disconnect air hoses from existing weld block ports. This will vary depending on weld gun type, and whether the existing weld block is single or dual pressure.  
 Note: If the current weld block is mounted directly to the cylinder, then only the inlet port hoses will be disconnected.
3. Disconnect solenoid connectors from valves. Be sure to note which connectors are being used for pre-stroke (retract) valves and weld stroke valves.
4. Remove current weld block from gun.

**B. Installing Weld Block on New Equipment**

5. Mount weld block spotwelding system to robot using (4) M8 screws and torque to 130 to 145 in. lbs (14.7 to 16.4 Nm).
6. Connect all air hoses to weld block (see schematic on pages 2 or 3).  
 Note: An additional air hose may be necessary for the inlet, since this unit is dual pressure. If so, connect the already existing hose to the Pw port (pressure weld). This hose should be supplying scheduled pressures from a proportional regulator. Connect the additional hose before the proportional regulator using a T-fitting so that full line pressure is being used. This hose should be connected to the Pr port (pressure retract).
7. Connect the solenoid cables to the proper valves. Connect an M12 sensor cable to the feedback sensor on the unit. The other end of this cable should be wired to the PLC controller.

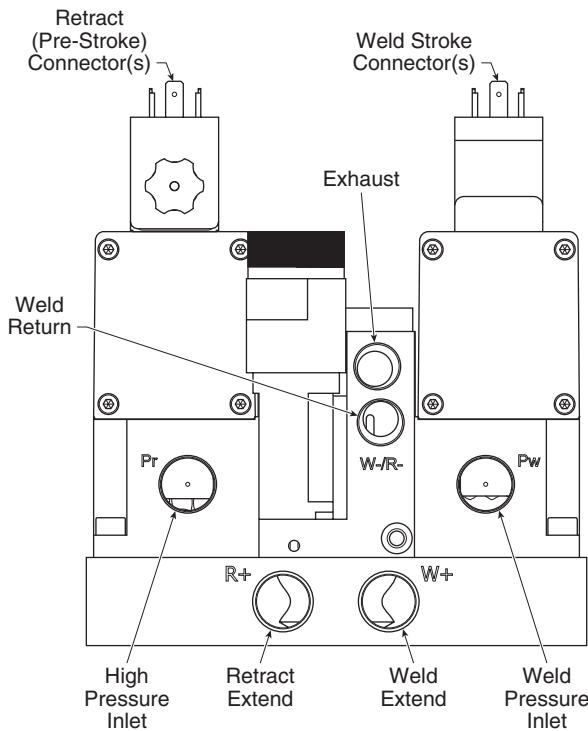
8. Turn air supply and power on.
9. Check for air leaks. The weld cylinder should be in the home position (completely open). If not, check that all air hoses are connected to the correct ports. Verify that all solenoids are de-energized, and valve overrides are unactuated. Once this is done, verify the function of the weld block, by actuating the weld block valves using the manual overrides. Press and hold the retract (pre-stroke) valve manual override. The weld cylinder should move to the weld stroke position. Press and hold the weld stroke valve manual override [still holding the retract (pre-stroke) override]. The weld cylinder should now close. Release the weld stroke override and the retract (pre-stroke) override. The weld cylinder will return to home position.

**Note:** The weld stroke portion of the cylinder will move slower than the pre-stroke. This is due to the regulated pressure being used, as well as the flow control. Adjusting the speed of the cylinder will be covered in the Setup Instructions. Repeat this process, now energizing the solenoids. The cylinder should perform the same. If not, verify that the solenoid connectors are located on the proper valves. Once the unit has been properly installed, the following setup procedure can be used to ensure that the Parker weld system is used to its fullest potential.

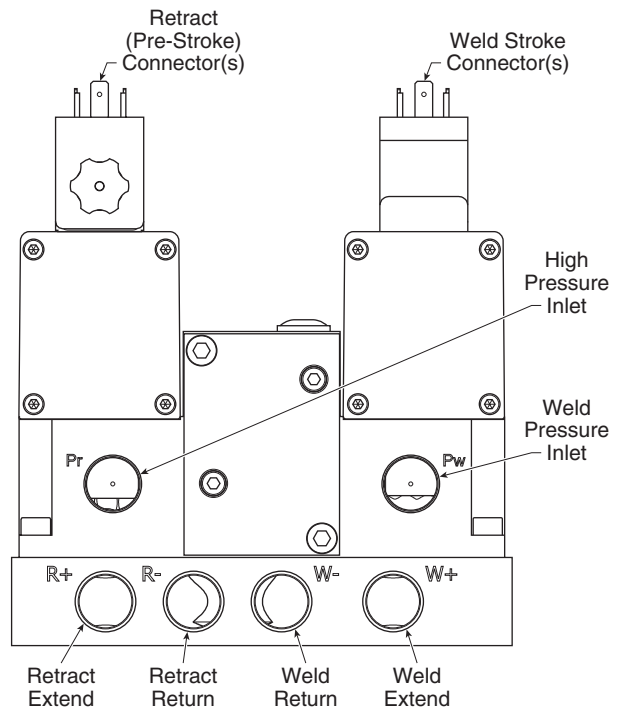
**Wiring**

Refer to valve Instruction Sheet for proper wiring connections. Available at: [www.parker.com/pneumatic](http://www.parker.com/pneumatic) (see B6 and ISO size 2 valves Installation and Service Instructions).

**3 Ported Installation**



**4 Ported Installation**



# Installation & Setup Instructions

## Setup

Below are the step by step setup procedures for properly setting the flow control and feedback sensor.

### How to Set the Flow Control Properly

Begin by turning the flow control clockwise until it stops. If this is done properly, then the weld stroke should move extremely slow or not at all.

**Note:** As stated in the Installation procedure, the pre-stroke valve must be actuated prior to the weld stroke valve in order for the weld cylinder to move correctly.

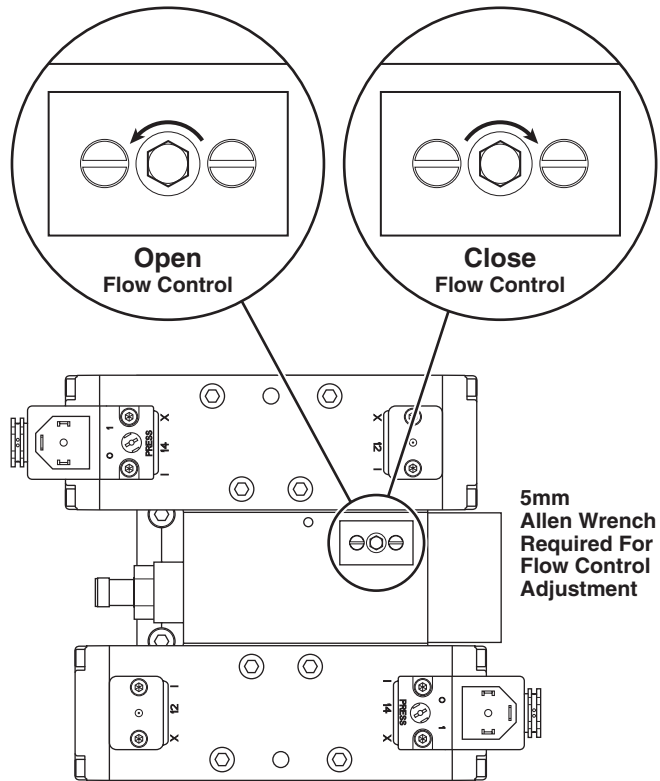
Slowly (1/4 to 1/2 turn at a time) begin to open the flow control by turning counterclockwise. The weld tips should now close upon actuation of the valves. At this point, you should begin to hear a second exhaust coming from the weld unit once the weld tips have made contact. This second exhaust is the air from the front side of the cylinder bypassing the flow control. As you continue to speed up the weld stroke by turning the flow control, the delay between the tips closing and the second exhaust will get shorter. Also, check the feedback sensor while this is occurring. The indicator light from the sensor should illuminate when you hear the second exhaust. This is the key to determining the proper setting of the flow control. The optimum setting for each weld block will be different for each gun, based on the bore size and weld stroke used. Continue to open the flow control, allowing the weld tips to close faster until:

1. You have reached an impact speed you are happy with.
2. You have reached an acceptable decibel noise level.
3. You see that the second exhaust and feedback sensor illumination occur “just” as the weld tips contact.

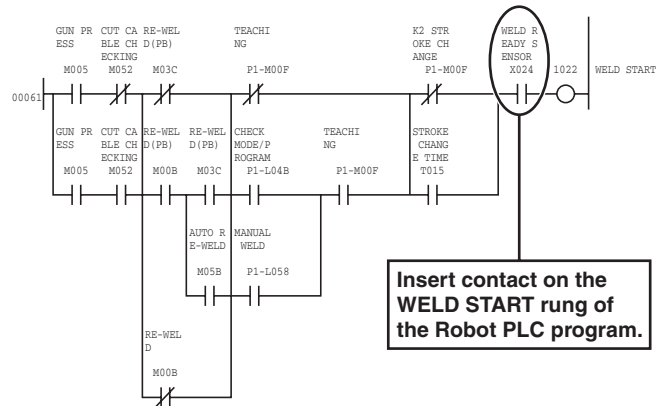
**Note:** This is a judgement call. If the flow control is set too far open, then the weld block could result in welding misfire causing the gun to fire before the weld tips close fully. The reason this would occur is because the flow control has been opened so much that all the air on the front side of the cylinder has exhausted before the tips fully close, thus negating the “low impact” benefit of the system. To guarantee proper performance, find the setting where the exhaust / illumination occurs “just” as the tips close, and then adjust the flow control 1/2 turn clockwise.

### How to Set the Feedback Sensor Properly

The purpose of the feedback sensor is to provide an input signal at the exact moment that full weld pressure has been obtained at the weld tips. Traditionally this is achieved using squeeze time. An experienced weld / electrical engineer is needed to place the feedback sensor input into the PLC program. The location of this input will vary depending on the PLC manufacturer. Consult the robot manufacturer for the proper input location.



### Electrical Changes (Sample):



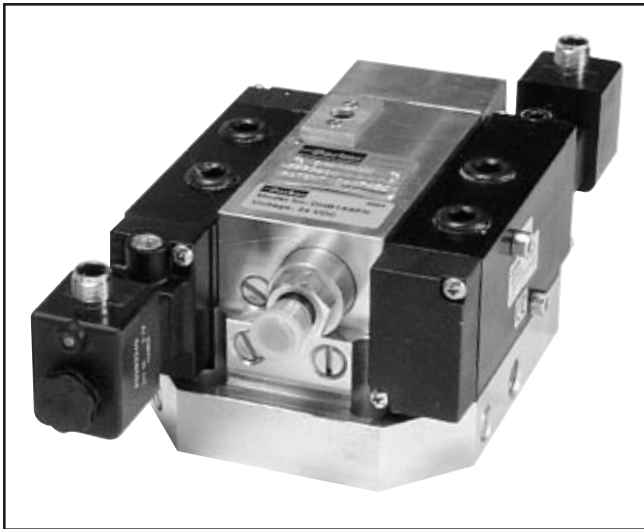
Above is a sample PLC program where the feedback sensor was placed during a typical install. The location of the input should be right before the weld start command. Once the input has been placed into the program, disconnect the sensor cable from the feedback sensor. This will allow you to determine whether or not the input was placed in the correct spot.

Perform a trial run. If on the first weld, the weld tips close and the robot stops, then the sensor input has been located correctly in the program. If the robot continues to run, despite the cable being disconnected, then the sensor input is not correct. Review the location and then try the trial run again.

**Note:** The weld block should perform the same whether the robot is in manual or automatic mode.



## Pneumatic System with Low Impact and Rapid Approach Control



### Description

Pneumatic valve block for use with pneumatic weld gun cylinders. The block has an integrated low impact system and is provided with two solenoid operated “Namur” or ISO size 2 valves. One valve for the retract (pre-stroke) and one for the weld stroke. The valves can be of the single solenoid type or the double solenoid type. The block is available for different constructions of cylinders:

- DH / WH = 3 Ported Cylinders
- DP / WP = 2 and 4 Ported Cylinders

**Ordering Code:** See pages 7 – 13.

**Dimensions:** See pages 15 – 18.

### Applications

The Spotwelding System can be used with any Pneumatic Spot Weld Cylinder.

### Mounting

The weld block can either be mounted on the side of the robot or directly to the cylinder. See pages 10 – 12 for bolt hole patterns for robot mount. Consult Parker for cylinder mount application.

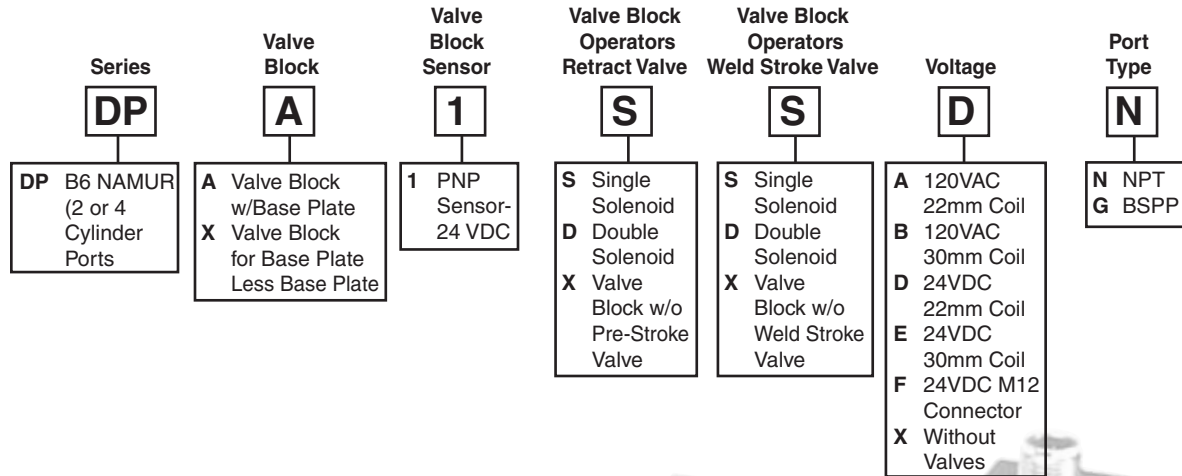
### Technical Data

- Medium..... Compressed air, filtered to 40µ and dried to a dewpoint of 37°F (3°C), lubricated or non-lubricated. Once lubricated air is applied, this must be maintained.
- Working Pressure .....37 to 145 PSIG (2.5 to 10 bar)
  - WH Series Air Operated
  - Quick Exhaust .....40 to 115 PSIG (2.7 to 7.9 bar)
- Ambient Temperature ..... 41°F to 120°F (5°C to 49°C)
- Weight –
  - DP ..... 12.0 lbs (5.4 kgs)
  - DH ..... 7.0 lbs (3.2 kgs)
  - WP (with Baseplate) ..... 14.0 lbs (6.4 kgs)
  - WH (with Baseplate) ..... 18.0 lbs (8.2 kgs)
- Pneumatic Valve
  - 24 VDC
    - Operating Voltage Solenoids .... 24 VDC +10/-15%
    - Power Consumption.....4.8W
    - Class of Protection..... IP65 (with plug mounted)
    - Connector ..... M12, 22mm, 30mm, Auto (ISO 2 only)
  - 120 VAC
    - Operating Voltage Solenoids ... 120 VAC +10/-15%
    - Frequency .....50 / 60 Hz
    - Power Consumption..... 7.8 VA / 6.3 VA
    - Class of Protection..... IP65 (with plug mounted)
    - Connector ..... M12, 22mm, 30mm, Auto (WP / WH only)
- Proximity Sensor
  - 24 VDC
    - Supply Voltage .....10 to 30 VDC
    - Rated Operational Current.....200mA
    - Degree of Protection .....IP67
    - Ambient Temperature Range ..... -13°F to 158°F (-25°C to 70°C)
    - Switching Indication ..... By LED (Yellow)
    - Output ..... PNP or NPN
  - 120 VDC (Consult factory for availability)
    - Supply Voltage ..... 20 to 140 VAC
    - Frequency ..... 50 or 60 Hz
    - Supply Voltage Indication..... By LED (Green)
    - Rated Operational Current.....400 mA
    - Degree of Protection .....IP67
    - Ambient Temperature Range ..... -13°F to 158°F (-25°C - +70°C)
    - Switching Indication ..... By LED (Orange)

**Service Kits:** See page 9.

**Ordering Information**

**Model Number Index – B6 Namur Valves (2 and 4 Ported Guns)**

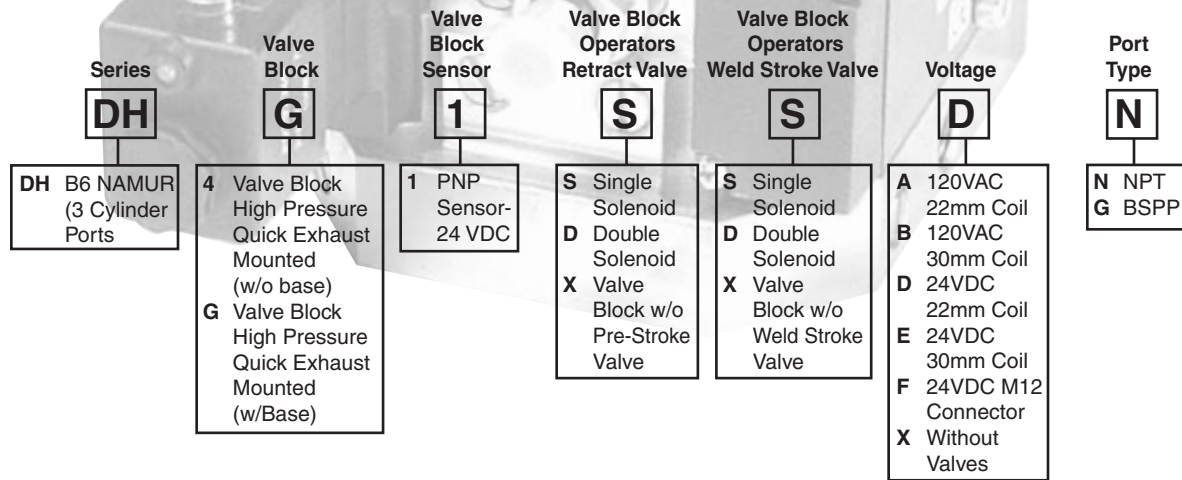


**Note:** NAMUR valves mounted on valve block have BSPP porting.

**Model Selection Examples**

Valve Block Only.....DPX1SSDN  
Valve Block with Base..... DPA1SSDN

**Model Number Index – B6 Namur Valves (3 Ported Guns)**



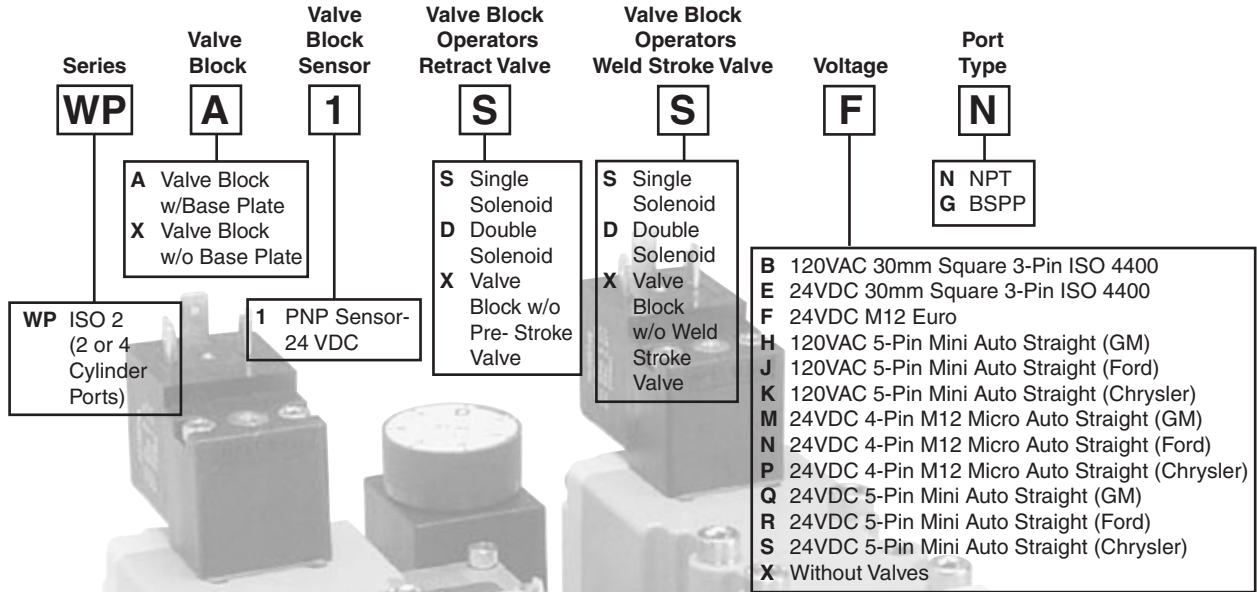
**Note:** NAMUR valves mounted on valve block have BSPP porting.

**Model Selection Examples**

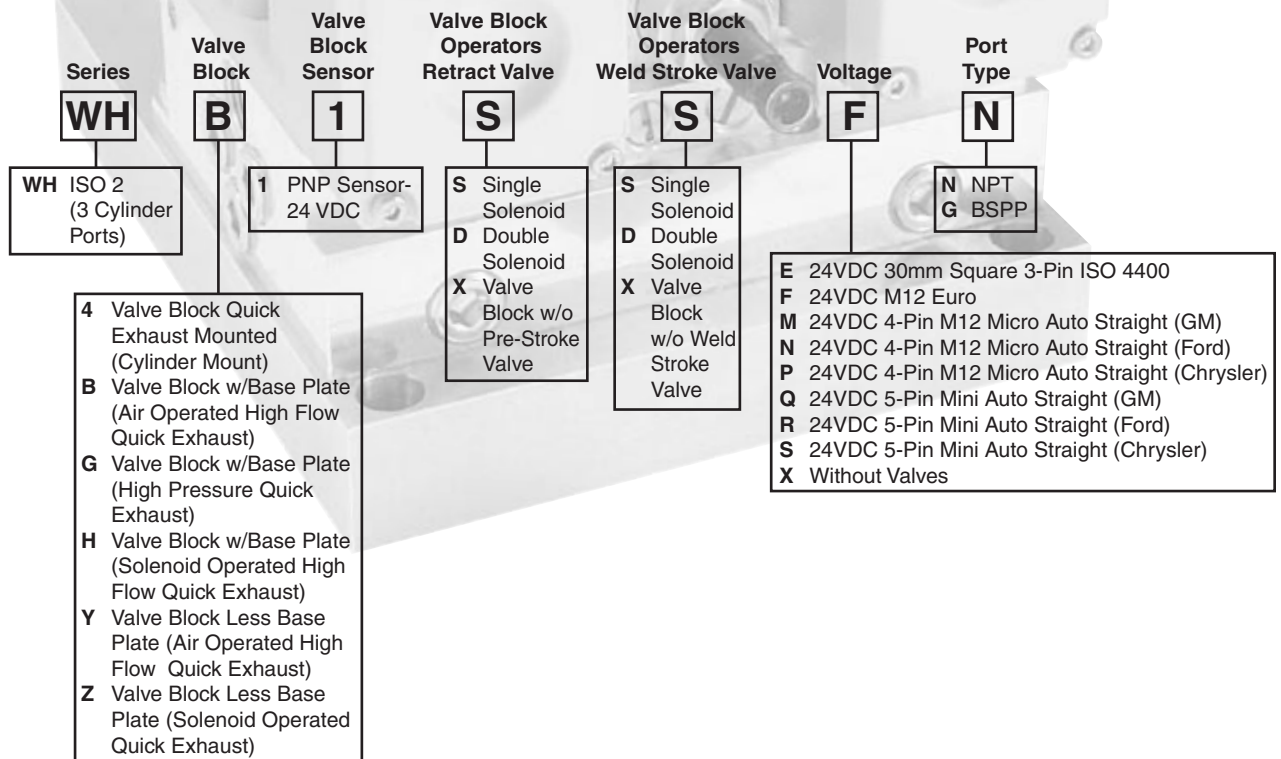
Valve Block with Quick Exhaust (w/o Base) ..... DH41SSDN  
Valve Block with Quick Exhaust (w/ Base) ..... DHG1SSDN

**Ordering Information**

**Model Number Index – ISO Size 2 Cylinder & Base Plate Mountable (2 and 4 Ported Guns)**



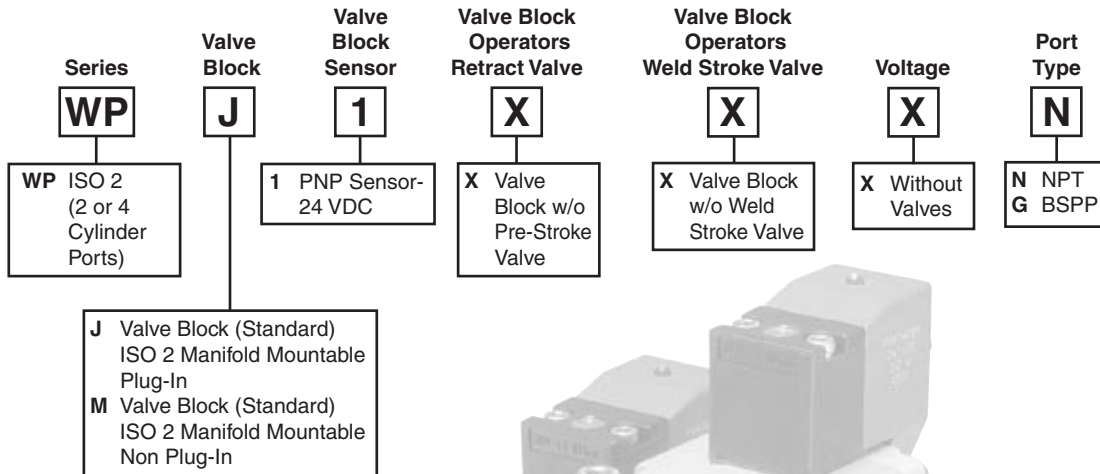
**Model Number Index – ISO Size 2 Cylinder & Base Plate Mountable (3 Ported Guns)**



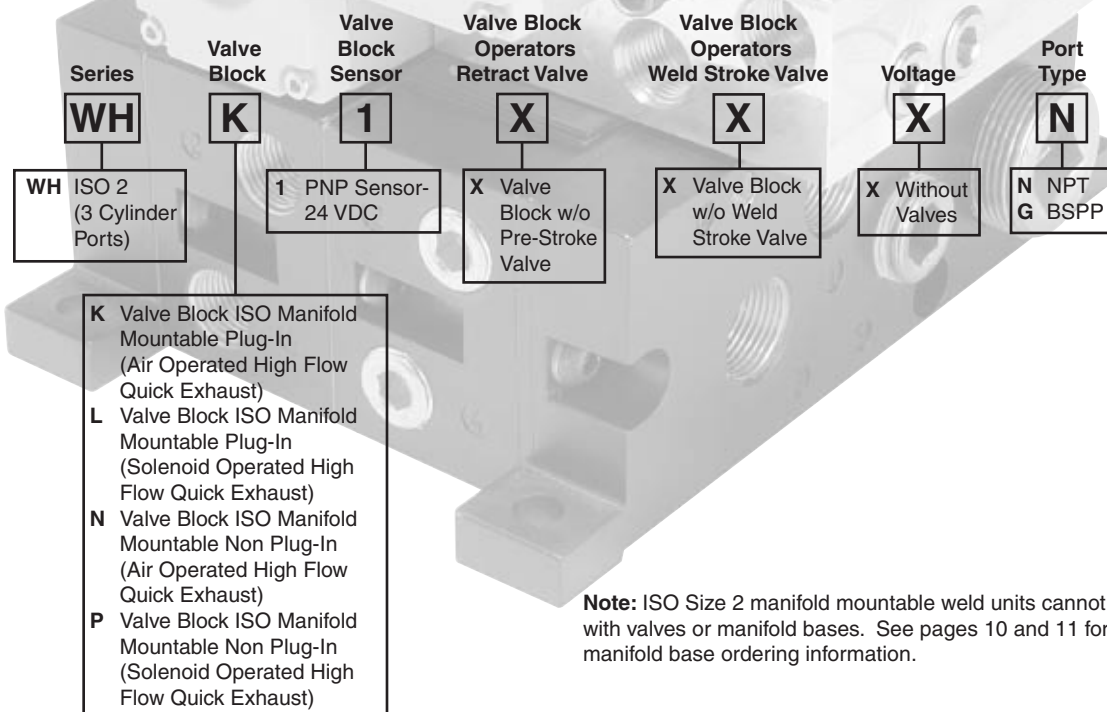


**Ordering Information**

**Model Number Index – ISO Size 2 Manifold Mountable (2 and 4 Ported Guns)**

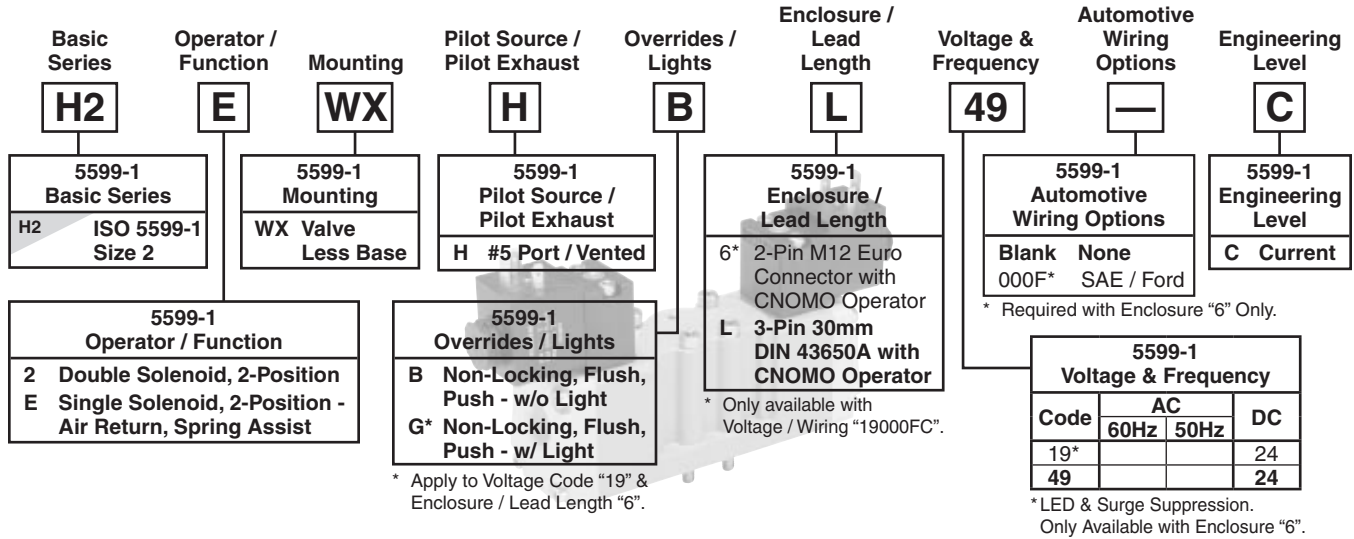


**Model Number Index – ISO Size 2 Manifold Mountable (3 Ported Guns)**

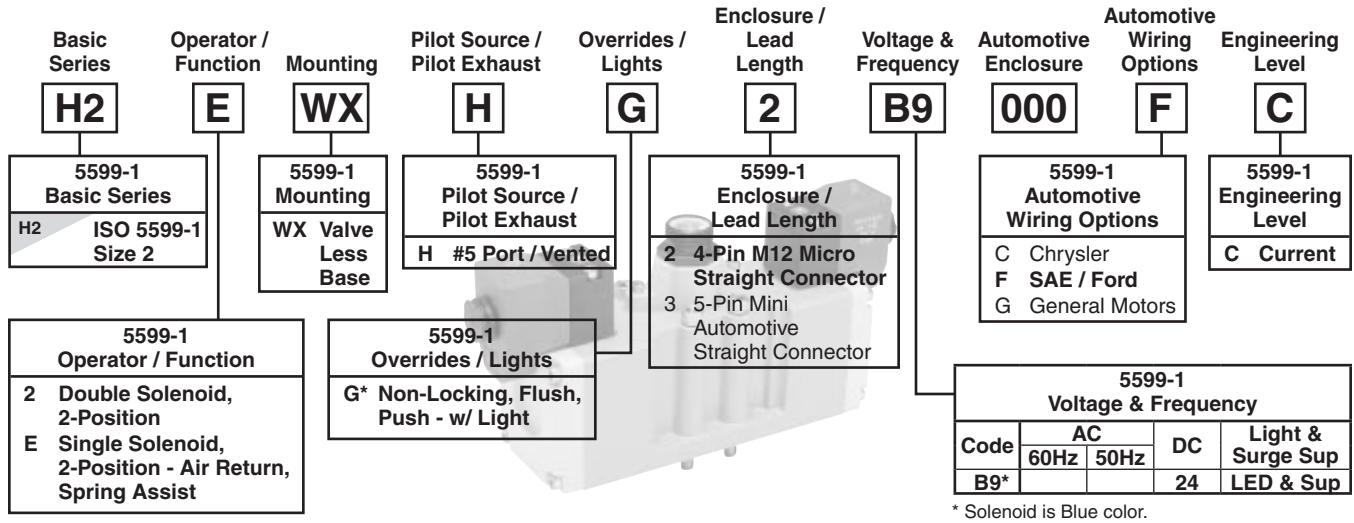


**Ordering Information**

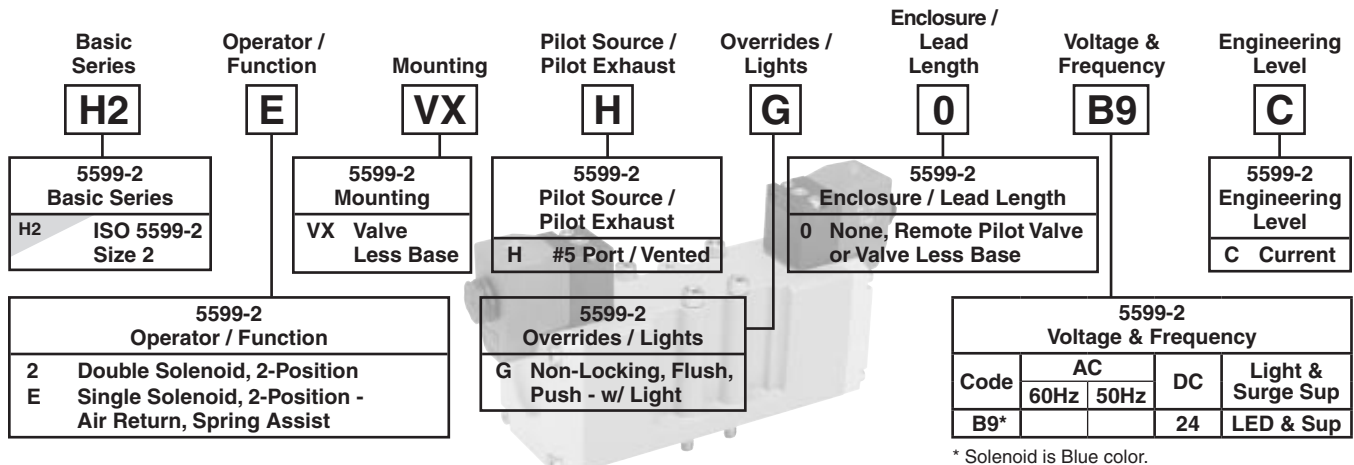
**Model Number Index – 5599-1 CNOMO - Size 2**



**Model Number Index – 5599-1 AUTO - Size 2**



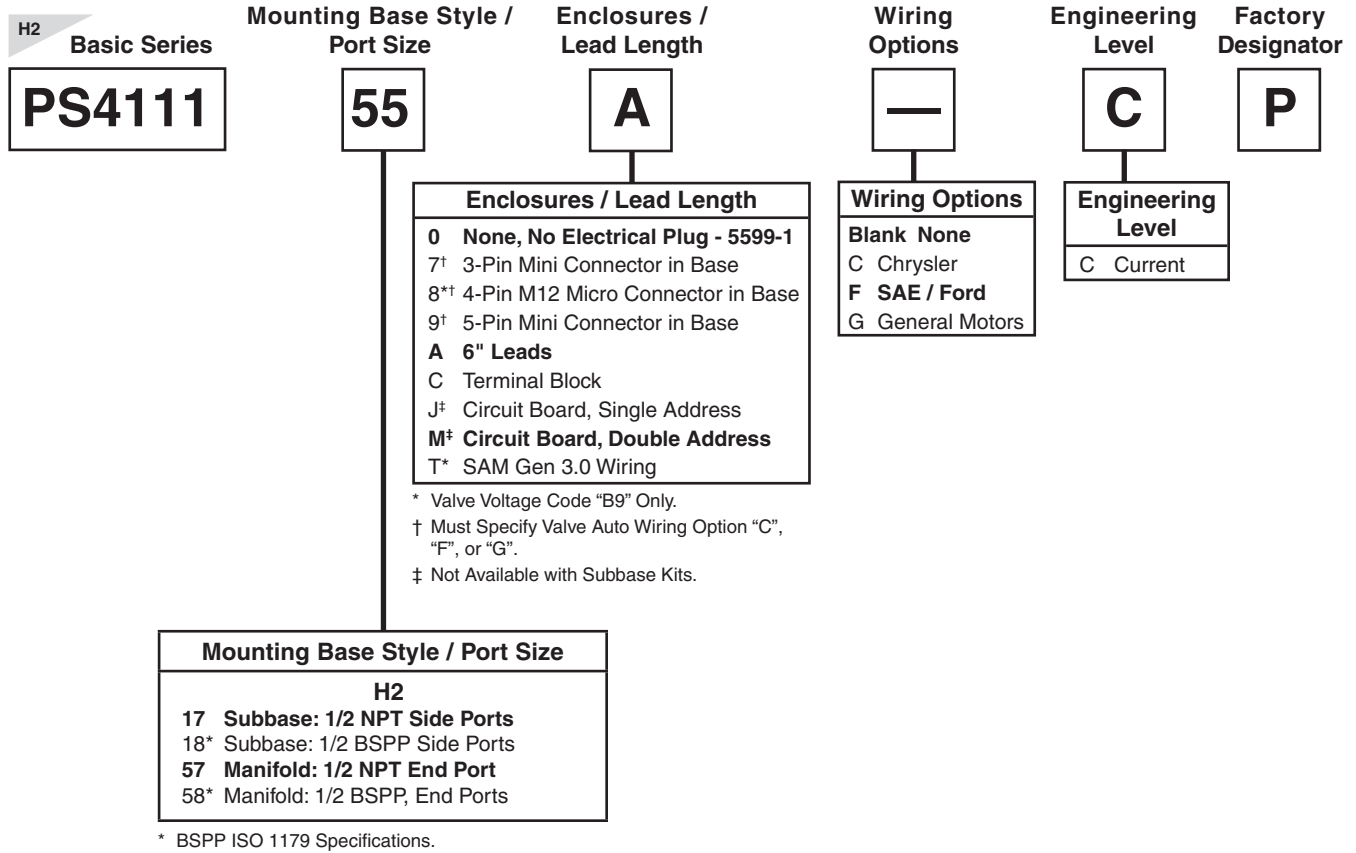
**Model Number Index – 5599-2 Size 2**



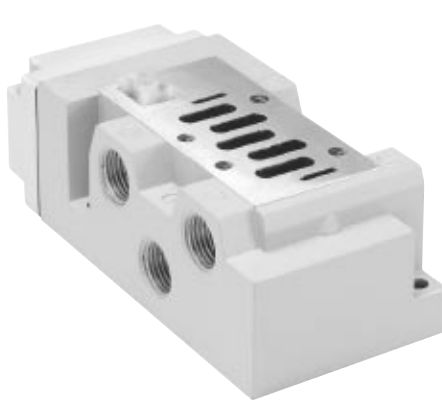
**BOLD OPTIONS ARE MOST POPULAR**

**Ordering Information**

**Manifold and Subbase Kit Ordering Code**



**Subbase Kits**




**H2**

**Automotive Connectors**

*Mounted in 1/2" Conduit Port*

- 3-Pin - Wired for Single Solenoid
- 4-Pin / 5-Pin - Wired for Double Solenoid

**Manifold Kits**



**H2**

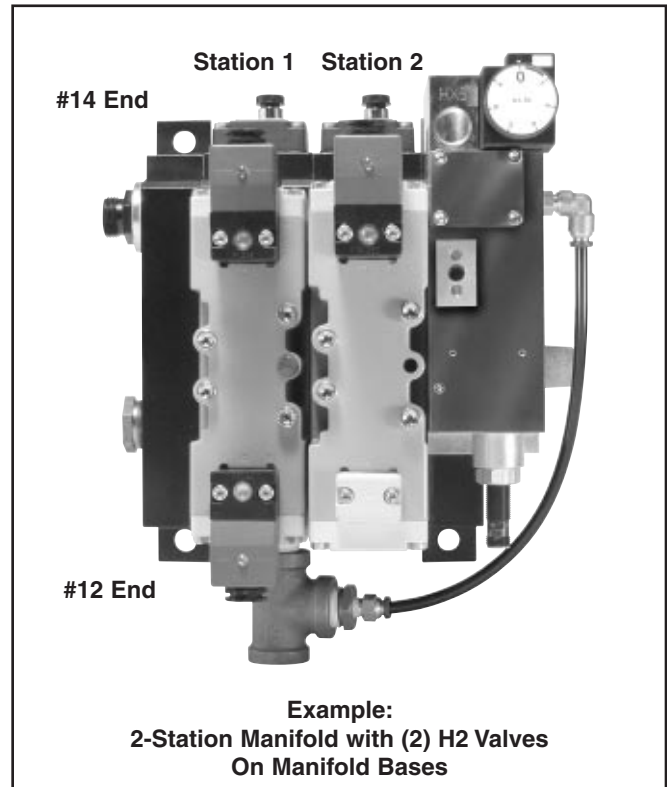
**Automotive Connectors**

*Mounted in Individual Manifold Conduit Cover*

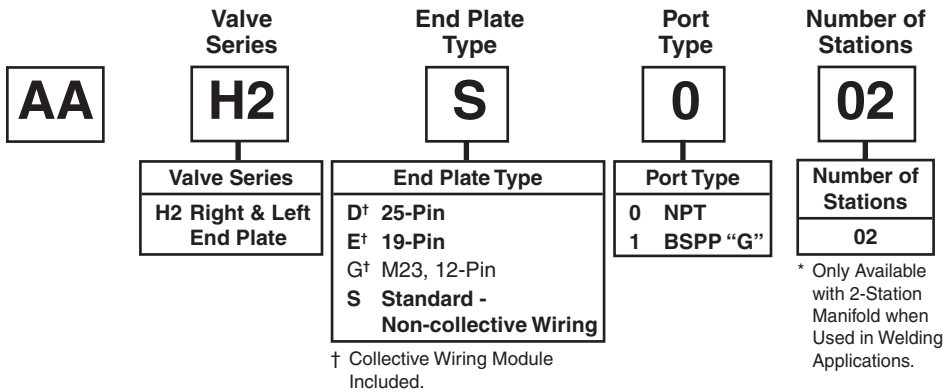
- 3-Pin - Wired for Single Solenoid
- 4-Pin / 5-Pin - Wired for Double Solenoid

## How To Order Add-A-Fold Assemblies

1. List Add-A-Fold Assembly call out. This automatically includes the end plate kit assembly.
2. List complete Valve and Base model number. List left to right, **LOOKING AT THE CYLINDER PORTS** on the #12 end of the manifold. The left most station is station 1.



## Add-A-Fold Assembly Model Number



## Example

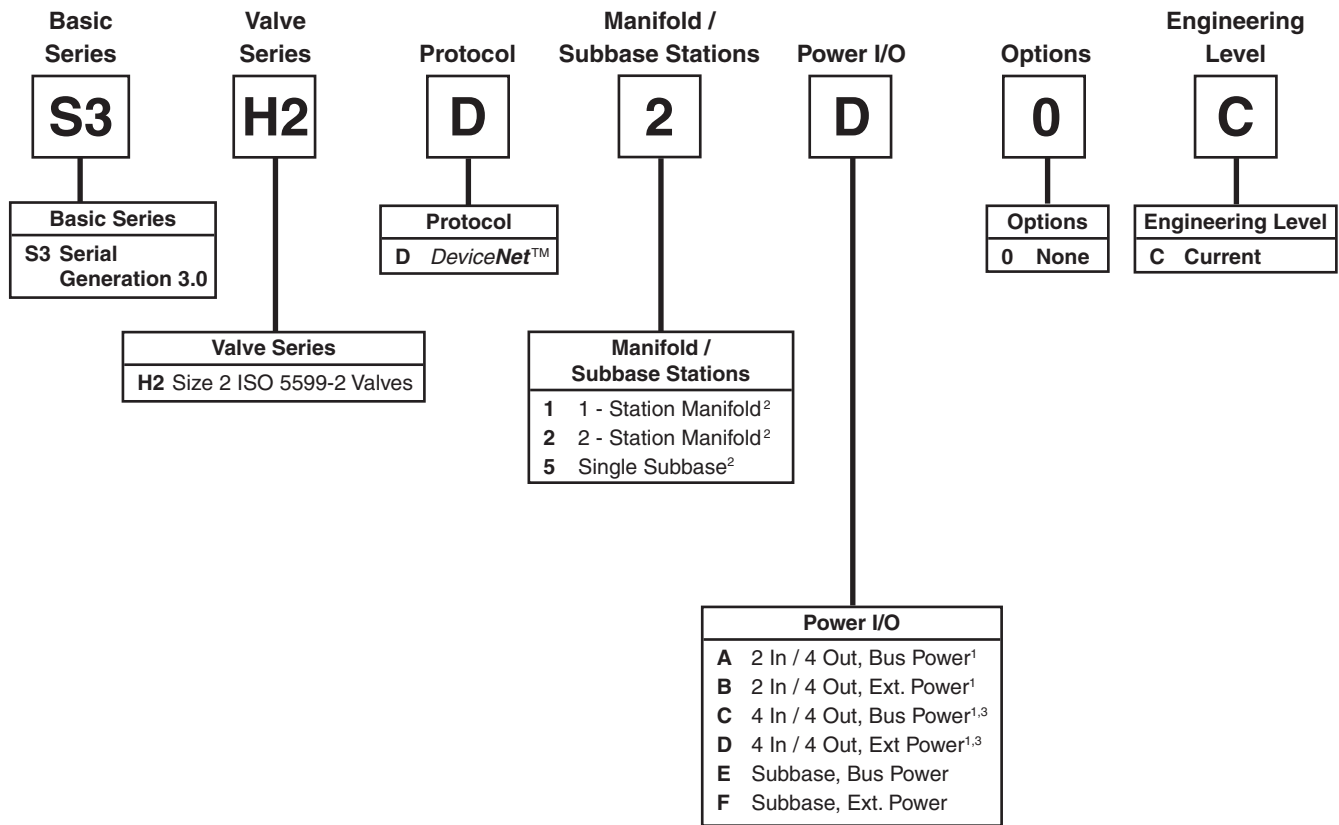
Application requires a 2-Station manifold with weld block and valves, and requires isolation between station 1 and 2 for port #3 galley only.

**NOTE:** Construct manifold assemblies from left to right while looking at the cylinder ports.

Item	Qty.	Part No.
01	1	AAH2E002
02	1	H22VXHG0B9C ..... Station 1 & 2
03	2	PS411157MCP ..... Station 1 & 2
04	1	WPJ1XXXN ..... Station 2
05	1	H2EVXHG0B9C ..... Station 2
06	1	PS3632P ..... Galley 3 Isolation Between Station 1 & 2

**Ordering Information**

**Model Number Index – Generation 3.0**



**Notes:**

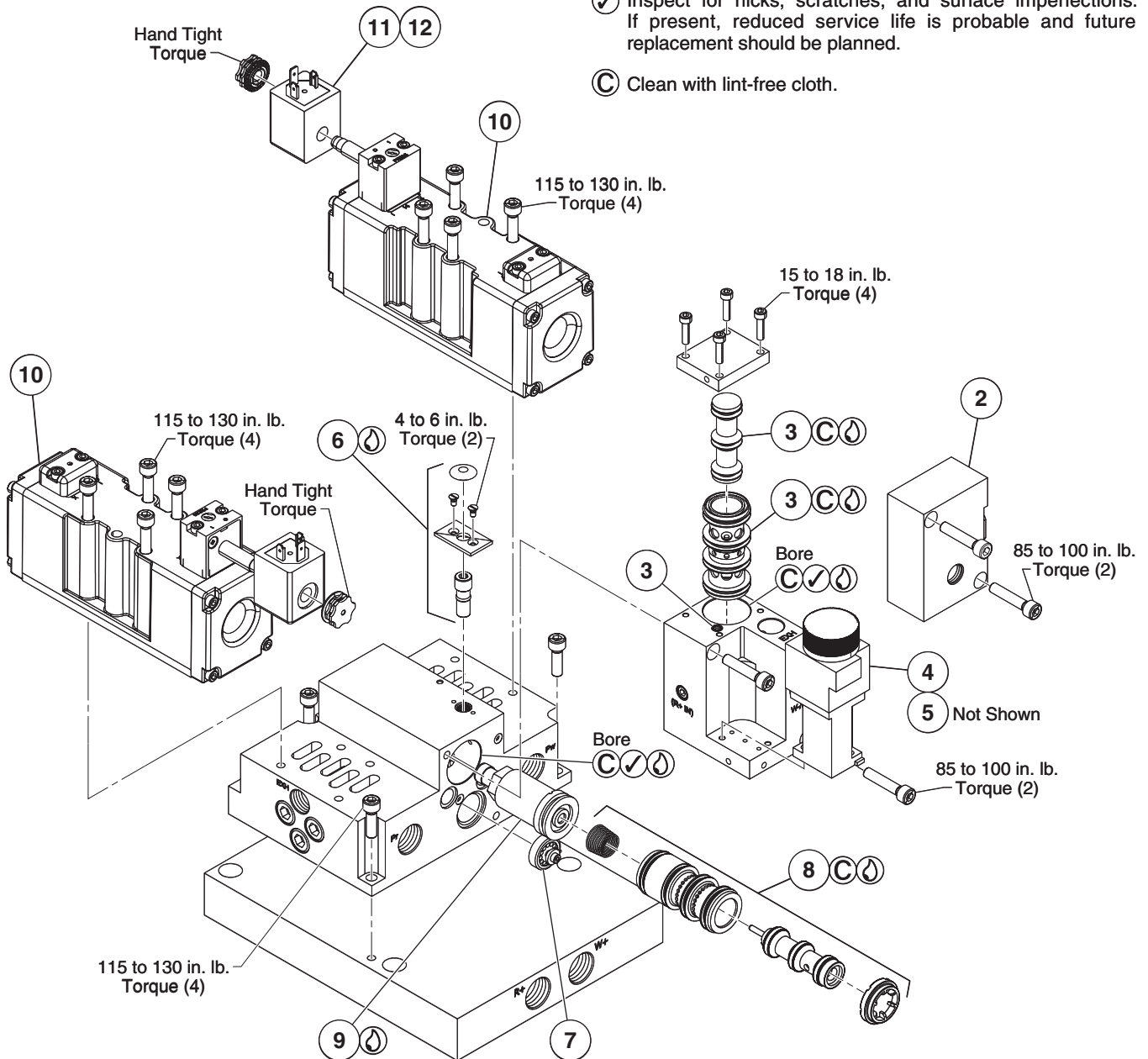
1. Not available with single subbase option.
2. 2 inputs come standard with subbase or manifold options.
3. 2 additional auxiliary inputs can be ordered by selecting this option.



**Replacement Components**

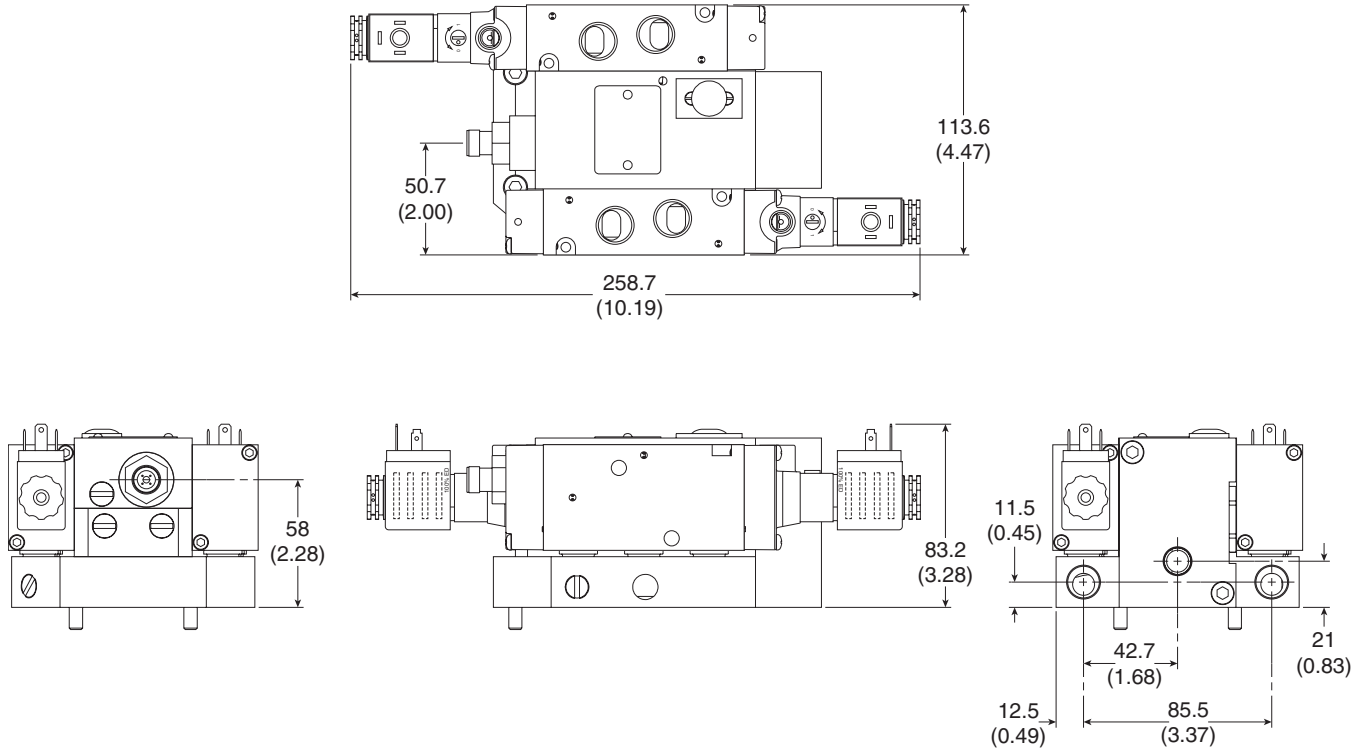
Item	Kit Number	Description	Item	Kit Number	Description
1	6505953	DP/DH Weld Block Sleeve Kit (1 pc.) (Not Shown)	8	3087900	Sensor Valve Kit
2	3534400	Quick Exhaust Kit - High Pressure	9	3087800	PNP 24 VDC Sensor Kit
3	3538600	High Flow Quick Exhaust Kit	10	See page 10	ISO 2 Replacement Valve for WP/WH Weld Blocks
4	PRTF10	Air Operated Timer for High Flow Quick Exh.	11	PS2828A49P	24 VAC 30mm Coil Kit
5	WHQE49	Sol. Oper. Kit for High Flow Quick Exh. 24VDC	12	PS2828619P	24 VDC M12 Euro Coil Kit
6	3059500	Flow Control Kit	13	Contact Parker	B6 Replacement Valve for DP/DH Weld Blocks
7	3059900	Check Valve Kit	—	—	—

- Ⓐ Lightly grease with provided lubricant.
- ✓ Inspect for nicks, scratches, and surface imperfections. If present, reduced service life is probable and future replacement should be planned.
- Ⓒ Clean with lint-free cloth.

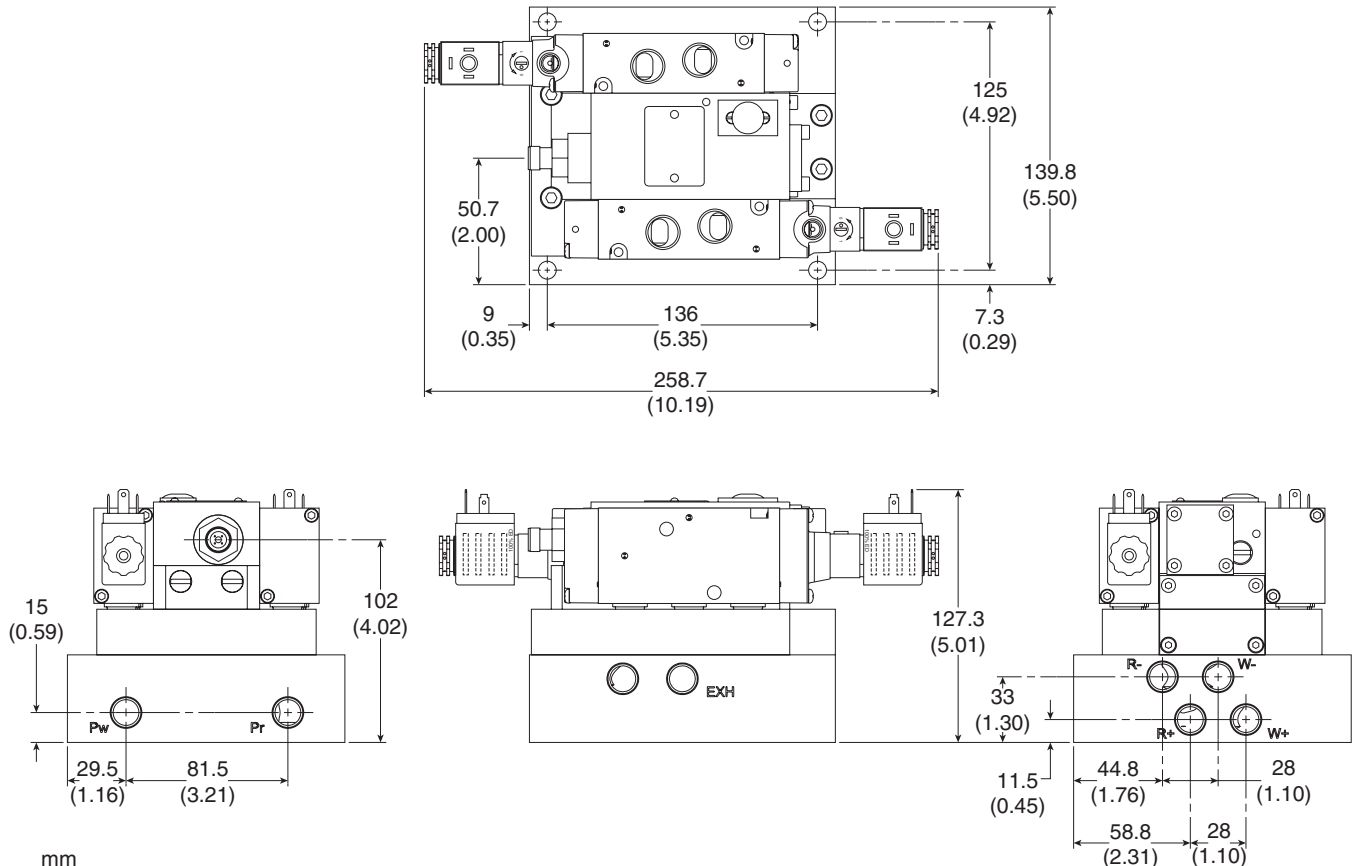


**ISO 2 Weld Block - Exploded View**

**DH Series – 3 Ported Guns Dimensions**



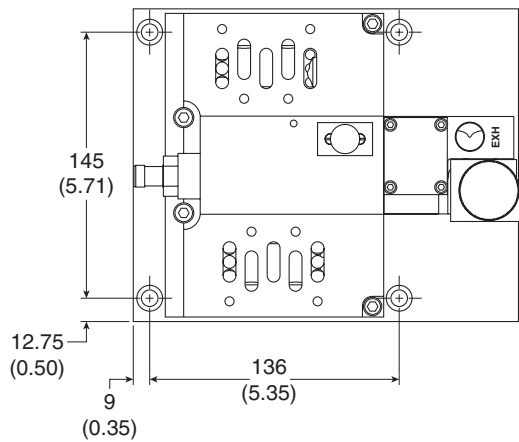
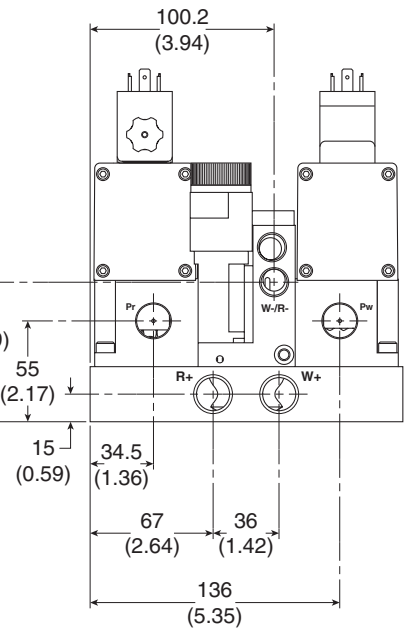
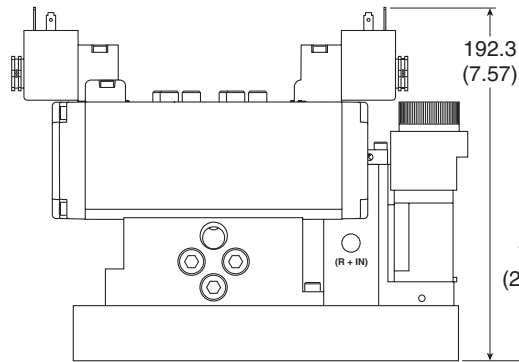
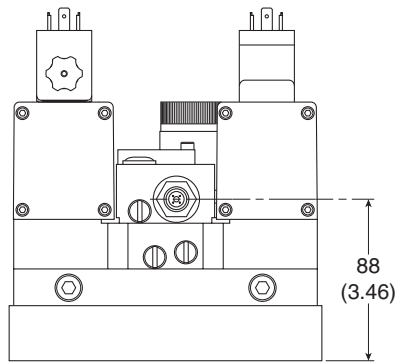
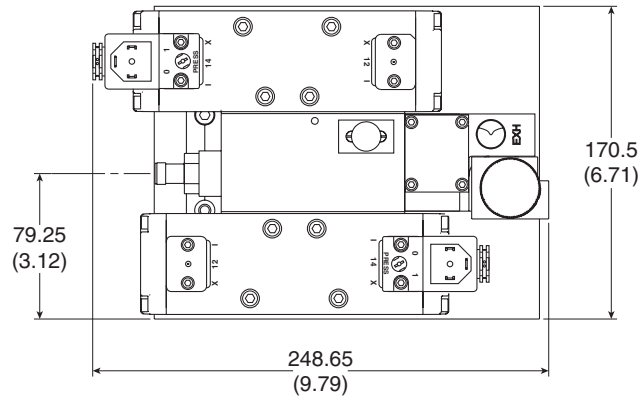
**DP Series – 2 and 4 Ported Guns Dimensions**



mm  
(inches)

### WH Series – For 3 Ported Gun Dimensions

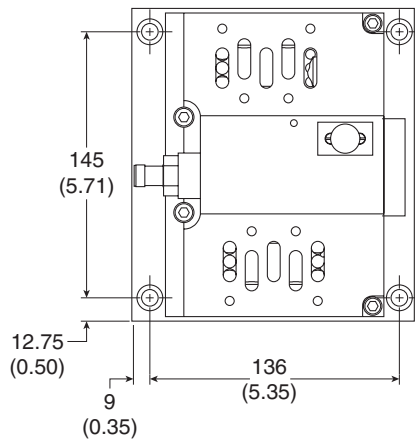
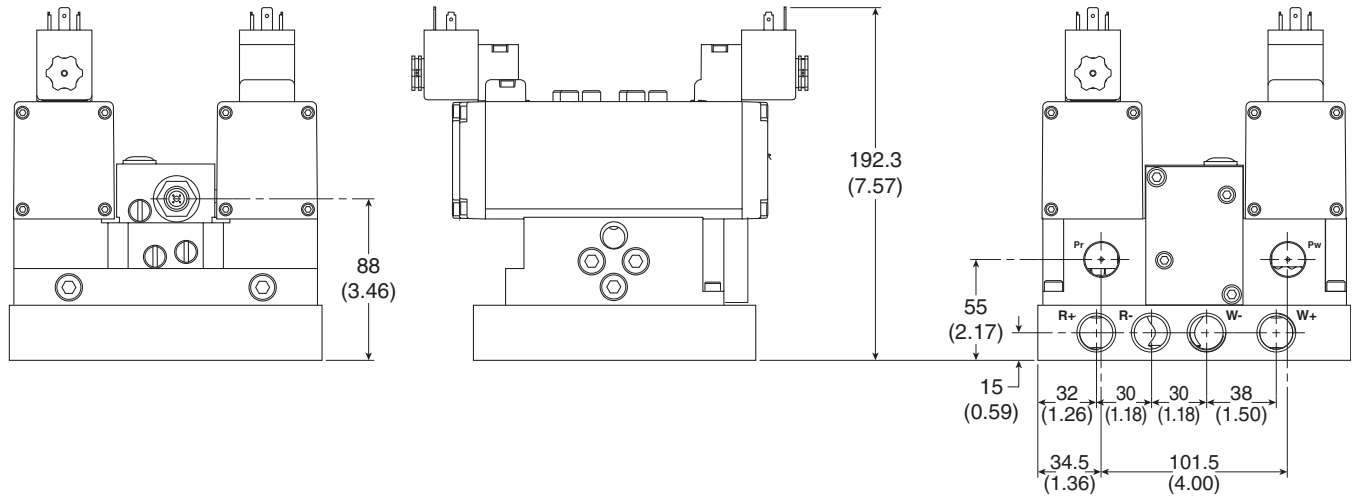
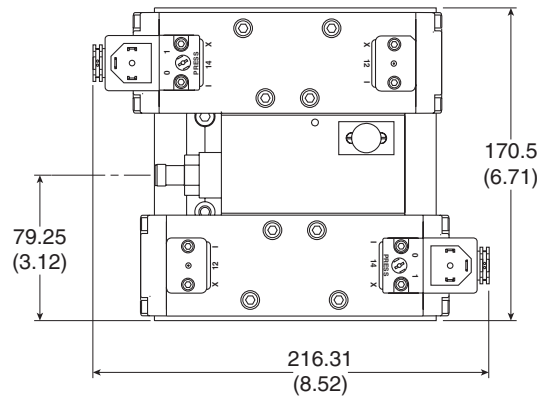
### WH ISO Size 2 Cylinder & Base Plate Mountable



mm  
(inches)

**WH Series – For 3 Ported Gun Dimensions**

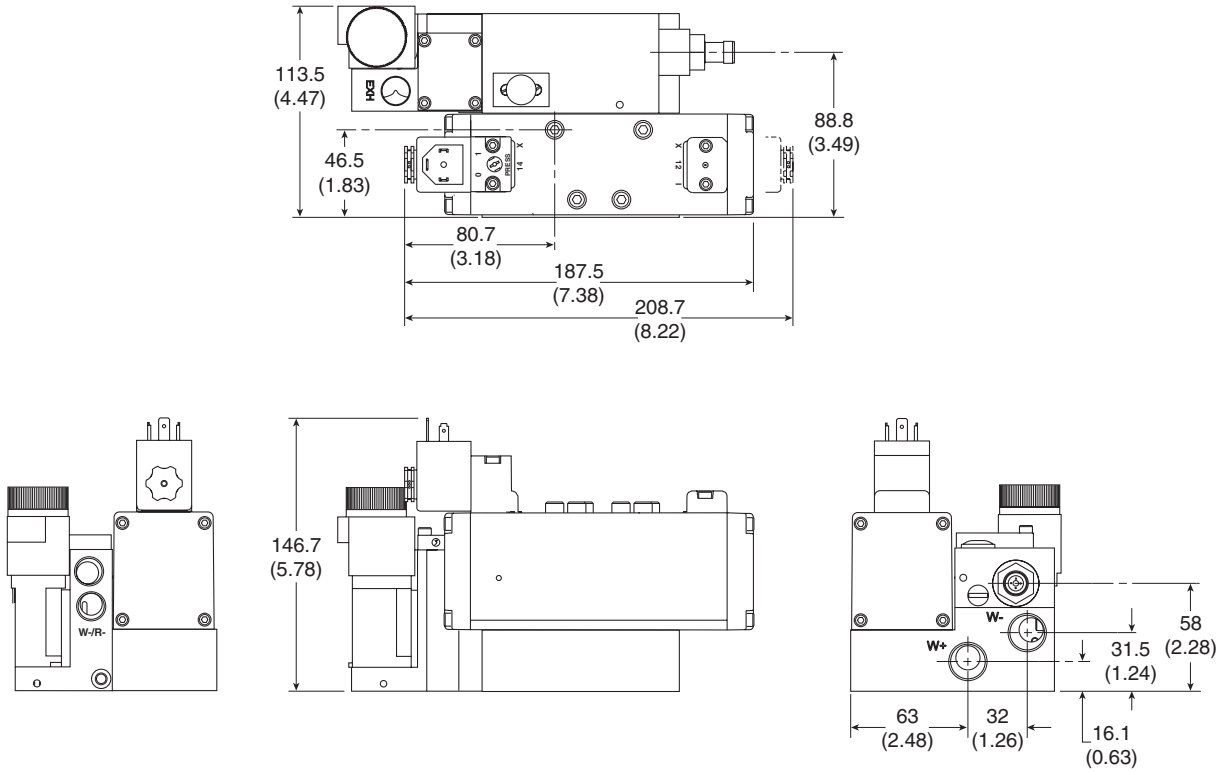
**WP ISO Size 2 Cylinder & Base Plate  
Mountable**



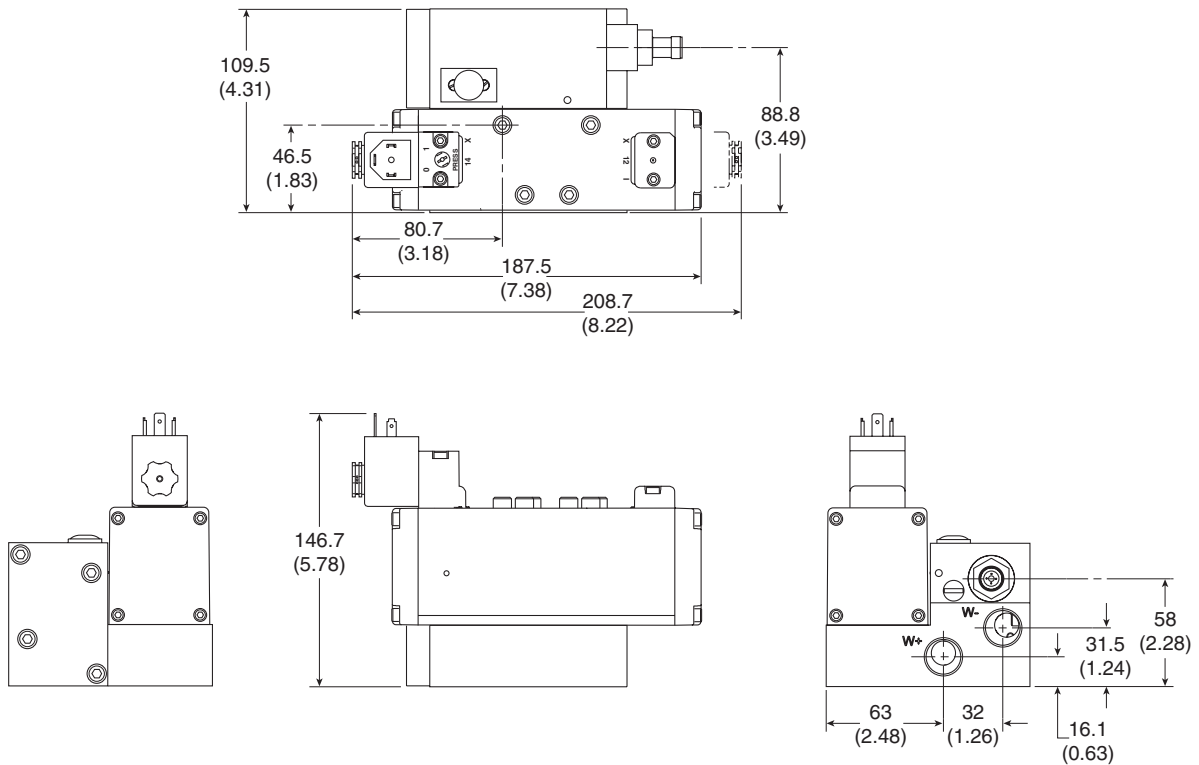
mm  
(inches)

WP Series – For 2 & 4 Ported Gun Dimensions

WH ISO Size 2 Manifold Mountable



WP ISO Size 2 Manifold Mountable



mm  
(inches)



## Scheduled Maintenance

**Silencer** – Periodic maintenance of the exhaust mufflers may be required. The frequency of maintenance depends on the environment and condition of the air supply.

### Cautions

- Filtrate the inlet air to protect the weld block against contaminating matter typically found in compressed air systems (i.e. rust, water, compressor oil, or other foreign particles). A standard 40 micron filter is recommended.

If liquid aerosols, both water and oil, and submicron particulate matter need to be removed from your air system, then a coalescing filter is required.

- The inlet compressed air must be filtered, regulated, and periodically maintained to ensure maximum operating performance and warranty.

## Weld Block Troubleshooting

Always verify that air and electrical are connected properly per Installation Instructions on page 4. At startup, cylinder should be open fully with no electrical signal to solenoids. All air lines, filters, regulators, tubing, hoses, fittings and electrical cables should be in good working condition as specified in automotive plant maintenance schedule.

### 1. Cylinder does not extend / retract.

- Does the cylinder move using manual overrides?
  - If yes, then check electrical conditions. Check the following:
    - Solenoid connections
    - Coils – replace if necessary
    - PLC program

- If no, does the cylinder move freely with air turned off?
  - If no, then cylinder should be repaired / replaced.
  - If yes, is the flow control open?
    - If no, open flow control. See Setup Instructions on page 5.
    - If yes, verify with gauges that there is pressure on back side of cylinder when valve shifts. There is a possibility that the metering of exhaust air on the front side of the cylinder, due to the flow control, is creating a “Joe Block” effect occurring between the piston face and cylinder. Contact Parker Representative for assistance.
    - If yes, replace valves on System

### 2. Cylinder tips close too fast / slow.

- Adjust flow control. See Setup Instructions on page 5.
- Quick Exhaust only – Adjust air timer on quick exhaust.
- Check muffler for proper operation. If covered with weld slag, then replace muffler.

### 3. Weld gun does not fire weld.

- Is cable connected to sensor?
  - If no, connect to sensor
  - If yes, is cable connected to PLC?
    - If no, wire to controller
    - If yes, check PLC program on location of weld signal to start weld. Also verify feedback sensor is operating properly.

### 4. Weld gun fires before tips are closed

- Adjust flow control so that weld tips close slower. See Setup Instructions on page 5.
- Is sensor input in the PLC correct? See Setup Instructions on page 5.

## Warnings

### WARNING

To avoid unpredictable system behavior that can cause personal injury and property damage:

- Disconnect electrical supply (when necessary) before installation, servicing, or conversion.
- Disconnect air supply and depressurize all air lines connected to this product before installation, servicing, or conversion.
- Operate within the manufacturer’s specified pressure, temperature, and other conditions listed in these instructions.
- Medium must be moisture-free if ambient temperature is below freezing.
- Service according to procedures listed in these instructions.
- Installation, service, and conversion of these products must be performed by knowledgeable personnel who understand how pneumatic products are to be applied.
- After installation, servicing, or conversion, air and electrical supplies (when necessary) should be connected and the product tested for proper function and leakage. If audible leakage is present, or the product does not operate properly, do not put into use.
- Warnings and specifications on the product should not be covered by paint, etc. If masking is not possible, contact your local representative for replacement labels.

### WARNING

**FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.**

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**2. Payment:** Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that the Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

**3. Delivery:** Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

**4. Warranty:** Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 18 months from date of shipment from Parker Hannifin Corporation. THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO ITEMS PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED.

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**6. Changes, Reschedules and Cancellations:** Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require.

**7. Special Tooling:** A tooling charge may be imposed for any special tooling, including without limitations, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right

to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

**8. Buyer's Property:** Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer, or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

**9. Taxes:** Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

**10. Indemnity For Infringement of Intellectual Property Rights:** Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets (hereinafter "Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgements resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

**11. Force Majeure:** Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.

**12. Entire Agreement/Governing Law:** The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.



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