

molstic-S™
Engineered Mounting Systems
for molbloc-S® Mass Flow Elements
Operation and Maintenance Manual



Do not exceed the maximum operating pressure of the molbox: 600 kPaa (87 psia) for molbox A700K; 250 kPaa (36 psia) for molbox A350K.



High pressure gases are potentially hazardous. Energy stored in these gases can be released unexpectedly and with extreme force. High pressure systems should be assembled and operated only by personnel who have been instructed in proper safety practices.

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NOTES



1. INTRODUCTION

1.1 PRODUCT OVERVIEW

The molstic-S™ provides an engineered solution to the practical issues of mounting the molbloc-S® mass flow elements, connecting a gas supply, regulating the pressure and connecting the device to be tested. Highest quality components are integrated into a modular, convenient, compact assembly.

Depending on the variation, the molstic-S provides mounting locations and the necessary hardware for up to two molbloc-S elements with 48 mm square bodies. It can be used for testing DUT's in either the upstream or downstream position. By utilizing the available accessories, the molstic-S allows for the simultaneous use of two molbloc-S elements (plumbed in parallel with downstream tee assembly P/N 401884) in order to obtain additional flow range capacity. The optional pressure-reducing regulator kits (P/Ns 401880 and 401881) are available for mounting and use directly on the molstic-S in order to provide pressure control capability to the user.



Calibration test devices that are capable of controlling flow must be installed upstream of the molbloc-S if they are to be tested in "control mode". Use the molstic-S in conjunction with the appropriate molstic-S Supply Assembly (P/N 401876 or 401877) when calibrating this type of device.

In order to provide flexibility, the molstic-S is supplied with 50 cm of PFA tubing (either 1/4 in. or 1/2 in. OD) for use in making connections to the gas supply or to the DUT. Ensure that the safe operating pressure of 1 MPa (150 psig) is not exceeded when using this tubing.

1.2 SPECIFICATIONS

1.2.1 GENERAL SPECIFICATIONS

	<u>1/4 in. molstic-S</u>	<u>1/2 in. molstic-S</u>
Electrical Power Requirements	None required.	None required.
Maximum Supply Pressure (applied to molstic-S plumbing)	0.7 MPa (100 psig)	0.7 MPa (100 psig)
Operating Temperature Range	15 to 35 °C	15 to 35 °C
Storage Temperature Range	- 20 to 70 °C	-20 to 70 °C
Platform Dimensions (L x W x H) (without molblocs)	585 mm x 176 mm x 70 mm (23.0 in. x 7.0 in. x 2.75 in.)	585 mm x 176 mm x 70 mm (23.0 in. x 7.0 in. x 2.75 in.)
Weight (without molblocs)	2.5 to 6 kg (5.5 to 13.2 lb.) depending upon configuration	3 to 6 kg (6.6 to 13.2 lb.) depending upon configuration

1.2.2 COMPONENT IDENTIFICATION OF THE AVAILABLE MOLSTIC-S CONFIGURATIONS

1.2.2.1 MOLSTIC-S, SINGLE 1/4 IN., STANDARD CONFIGURATION

ORDERING INFO		DESCRIPTION
P/N	FAM0009	molstic-S, molstic for molbloc-S
Option	-01-1	Single Channel, 1/4 in. Plumbing

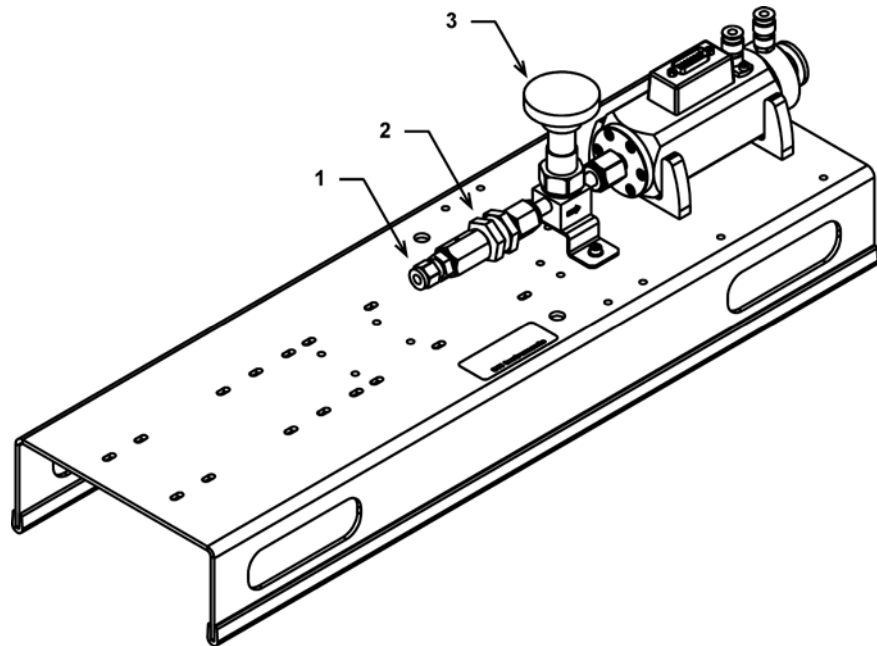


Figure 1. molstic-S, Single 1/4 in., Standard Configuration

1. Inlet adaptor – 1/4 in. tube x 1/4 in. male VCR
2. Particulate filter, 2 micron
3. Flow shut-off/metering valve



50 cm of clear PFA tubing is included with the molstic-S in order to provide versatility in the connection of DUT's and inlet supply plumbing.

1.2.2.2 MOLSTIC-S, SINGLE 1/2 IN., STANDARD CONFIGURATION

ORDERING INFO		DESCRIPTION
P/N	FAM0009	molstic-S, molstic for molbloc-S
Option	-01-2	Single Channel, 1/2 in. Plumbing

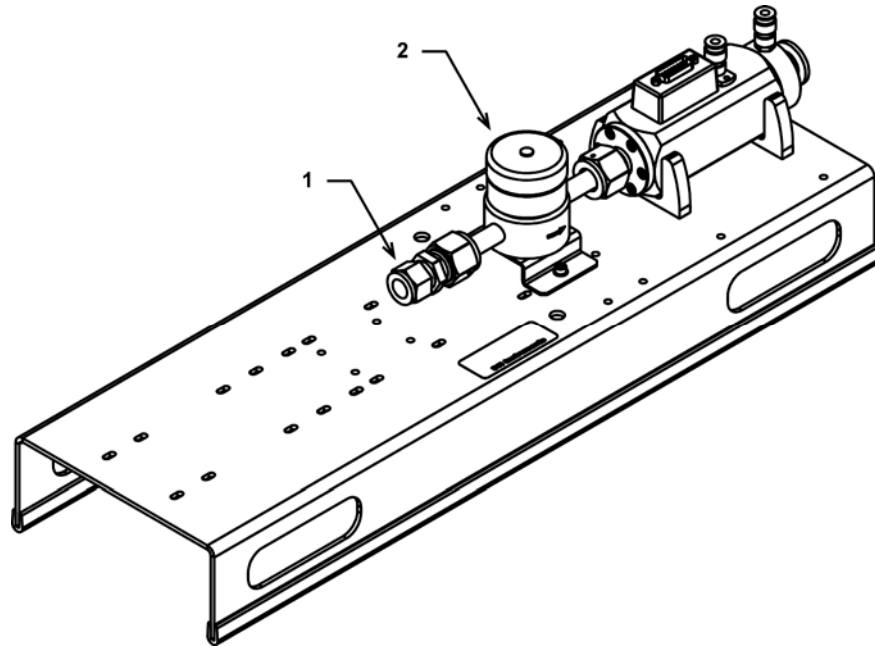


Figure 2. molstic-S, Single 1/2 in., Standard Configuration

1. Inlet adaptor – 1/2 in. tube x 1/2 in. male VCR
2. Flow shut-off/metering valve



50 cm of clear PFA tubing is included with the molstic-S in order to provide versatility in the connection of DUT's and inlet supply plumbing.

1.2.2.3 MOLSTIC-S, DUAL 1/4 IN., STANDARD CONFIGURATION

ORDERING INFO		DESCRIPTION
P/N	FAM0009	molstic-S, molstic for molbloc-S
Option	-01-3	Dual Channel, 1/4 in. Plumbing

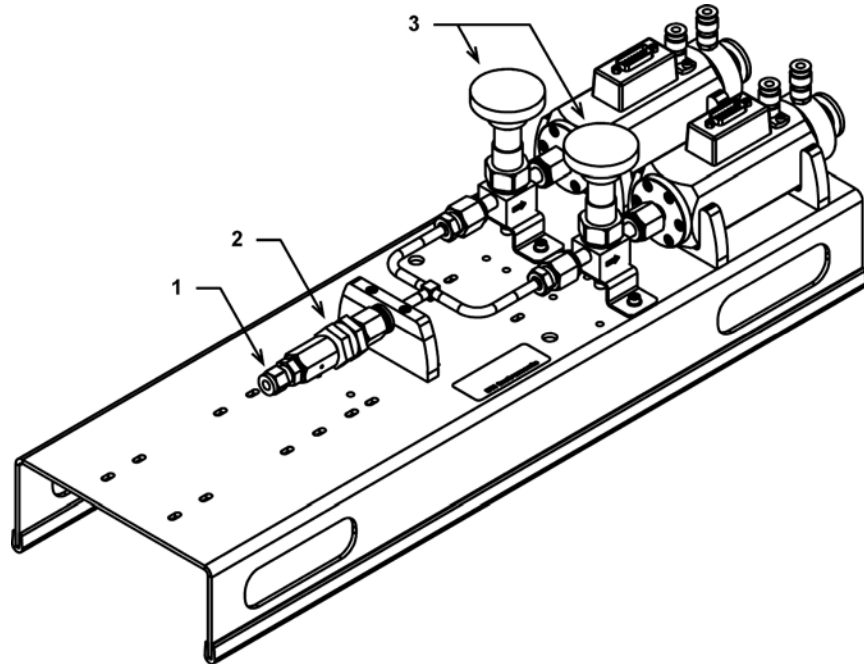


Figure 3. molstic-S, Dual 1/4 in., Standard Configuration

1. Inlet adaptor – 1/4 in. tube x 1/4 in. male VCR
2. Particulate filter, 2 micron
3. Flow shut-off/metering valve, 2 ea.



50 cm of clear PFA tubing is included with the molstic-S in order to provide versatility in the connection of DUT's and inlet supply plumbing.

1.2.2.4 MOLSTIC-S, DUAL 1/2 IN., STANDARD CONFIGURATION

ORDERING INFO		DESCRIPTION
P/N	FAM0009	molstic-S, molstic for molbloc-S
Option	-01-4	Dual Channel, 1/2 in. Plumbing

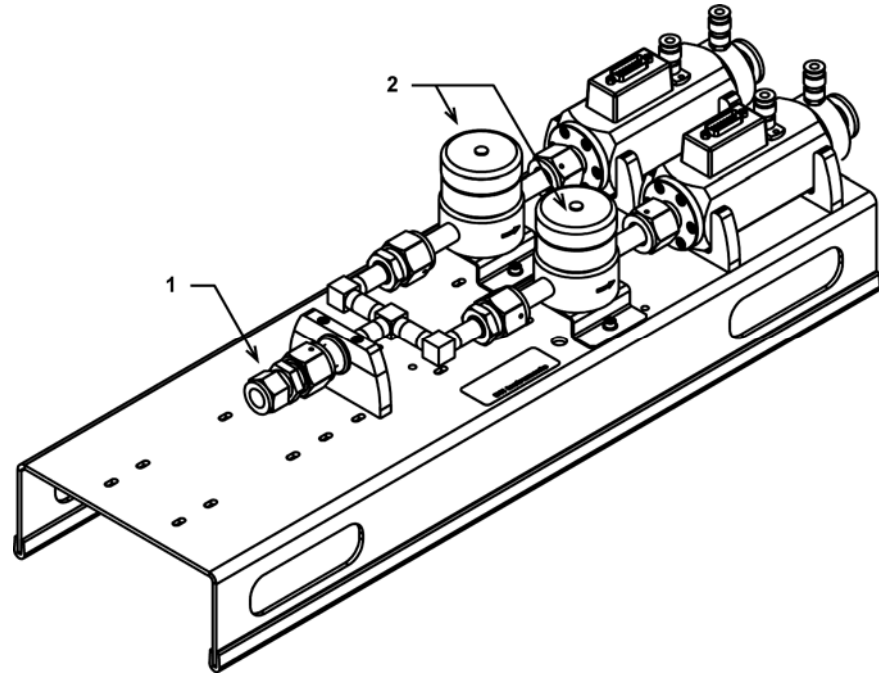


Figure 4. molstic-S, Dual 1/2 in., Standard Configuration

1. Inlet adaptor – 1/2 in. tube x 1/2 in. male VCR
2. Flow shut-off/flow metering valve, 2 ea.



50 cm of clear PFA tubing is included with the molstic-S in order to provide versatility in the connection of DUT's and inlet supply plumbing.

1.2.2.5 MOLSTIC-S, SINGLE 1/4 IN., WITH REGULATION

ORDERING INFO		DESCRIPTION
P/N	FAM0009	molstic-S, molstic for molbloc-S
Option	-01-1	Single Channel, 1/4 in. Plumbing
	-03-2	With 1/4 in. Pressure Reducing Regulator
	-03-4	With 1/4 in. Back Pressure Regulator

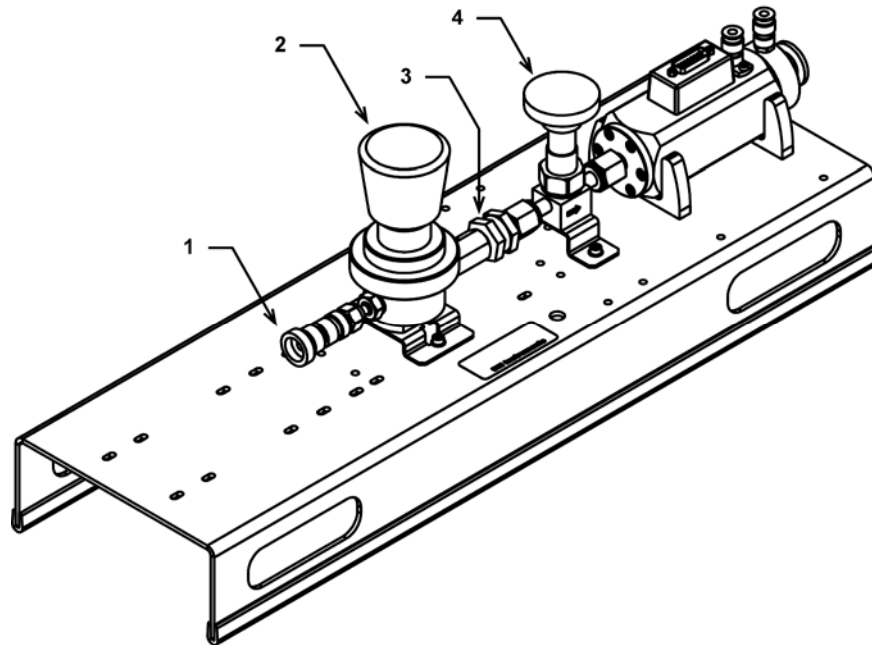


Figure 5. molstic-S, Single 1/4 in., with Regulation

1. Inlet quick connect (includes stem with 1/4 in. SWG, not shown)
2. Pressure reducing regulator/back pressure regulator
3. Particulate filter, 2 micron
4. Flow shut-off/metering valve



50 cm of clear PFA tubing is included with the molstic-S in order to provide versatility in the connection of DUT's and inlet supply plumbing.

1.2.2.6 MOLSTIC-S, SINGLE 1/2 IN., WITH REGULATION

ORDERING INFO		DESCRIPTION
P/N	FAM0009	molstic-S, molstic for molbloc-S
Option	-01-2	Single Channel, 1/2 in. Plumbing
	-03-3	With 1/2 in. Pressure Reducing Regulator
	-03-5	With 1/2 in. Back Pressure Regulator

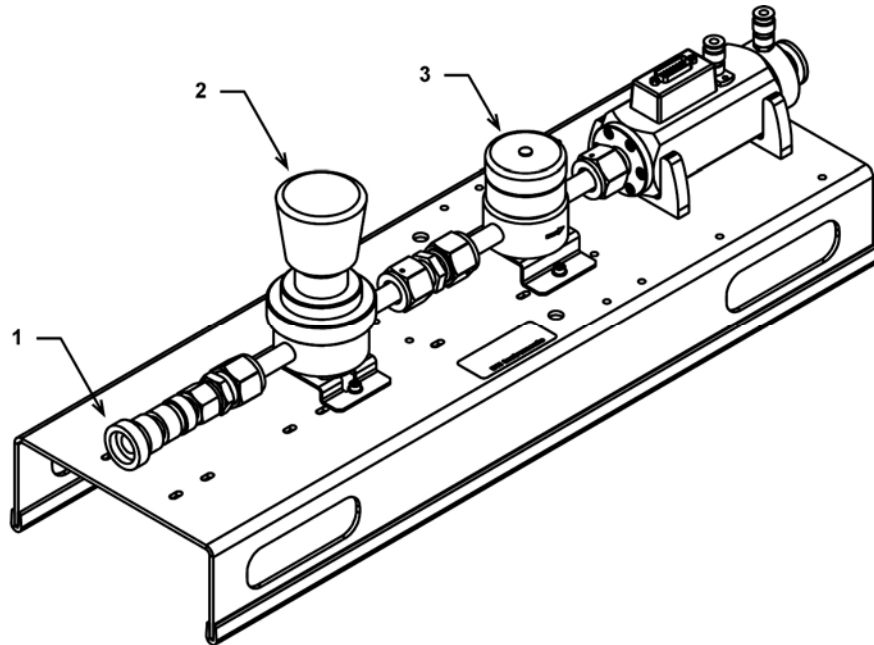


Figure 6. molstic-S, Single 1/2 in.,
with Regulation

1. Inlet quick connect
(includes stem with 1/2 in. SWG, not shown)
2. Pressure reducing regulator/back pressure regulator
3. Flow shut-off/metering valve



50 cm of clear PFA tubing is included with the molstic-S in order to provide versatility in the connection of DUT's and inlet supply plumbing.

1.2.2.7 MOLSTIC-S, DUAL 1/4 IN., WITH REGULATION

ORDERING INFO		DESCRIPTION
P/N	FAM0009	molstic-S, molstic for molbloc-S
Option	-01-3	Dual Channel, 1/4 in. Plumbing
	-03-2	With 1/4 in. Pressure Reducing Regulator
	-03-4	With 1/4 in. Back Pressure Regulator

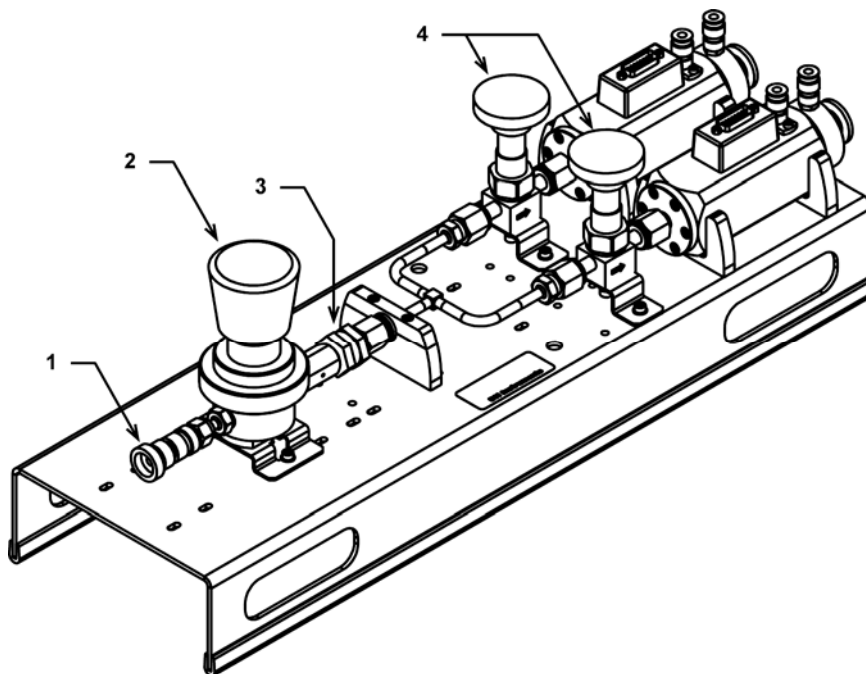


Figure 7. molstic-S, Dual 1/4 in., with Regulation

1. Inlet quick connect
(includes stem with 1/4 in. SWG, not shown)
2. Pressure reducing regulator/back pressure regulator
3. Particulate filter, 2 micron
4. Flow shut-off/metering valve, 2 ea.



50 cm of clear PFA tubing is included with the molstic-S in order to provide versatility in the connection of DUT's and inlet supply plumbing.

1.2.2.8 MOLSTIC-S, DUAL 1/2 IN., WITH REGULATION

ORDERING INFO		DESCRIPTION
P/N	FAM0009	molstic-S, molstic for molbloc-S
Option	-01-4	Dual Channel, 1/2 in. Plumbing
	-03-3	With 1/2 in. Pressure Reducing Regulator
	-03-5	With 1/2 in. Back Pressure Regulator

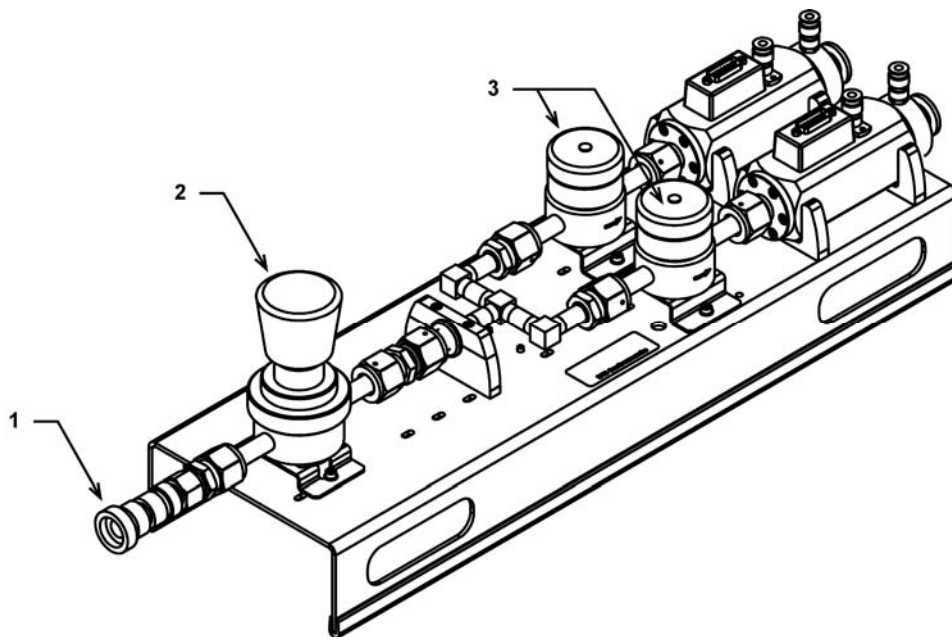


Figure 8. molstic-S, Dual 1/2 in.,
with Regulation

1. Inlet quick connect
(includes stem with 1/2 in. SWG, not shown)
2. Pressure reducing regulator/back pressure regulator
3. Flow shut-off/metering valve, 2 ea.



50 cm of clear PFA tubing is included with the molstic-S in order to provide versatility in the connection of DUT's and inlet supply plumbing.

1.2.2.9 MOLSTIC-S, SINGLE 1/4 IN., WITH LOW- OR MID-FLOW METERING VALVE

ORDERING INFO		DESCRIPTION
P/N	FAM0009	molstic-S, molstic for molbloc-S
	-01-1	Single Channel, 1/4 in. Plumbing
Option	-04-2	With 1/4 in. Low Flow Metering Valve
	-04-3	With 1/4 in. Mid Flow Metering Valve

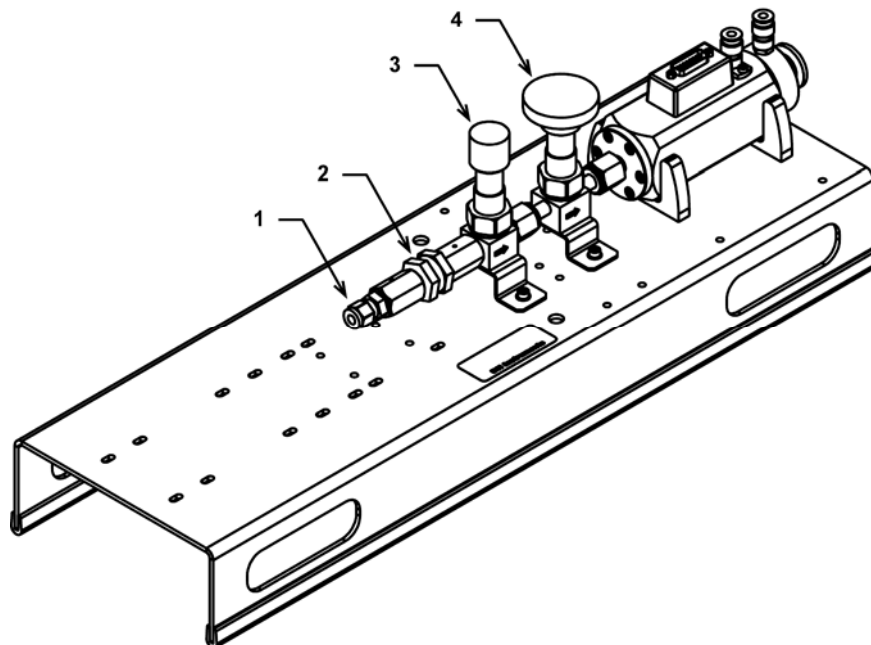


Figure 9. molstic-S, Single 1/4 in., with Low- or Mid-Flow Metering Valve

1. Inlet adaptor – 1/4 in. tube x 1/4 in. male VCR
2. Particulate filter, 2 micron
3. Precision flow metering valve
4. Flow shut-off/metering valve



50 cm of clear PFA tubing is included with the molstic-S in order to provide versatility in the connection of DUT's and inlet supply plumbing.

1.2.2.10 MOLSTIC-S, DUAL 1/4 IN., WITH LOW- OR MID- FLOW METERING VALVE

ORDERING INFO		DESCRIPTION
P/N	FAM0009	molstic-S, molstic for molbloc-S
	-01-3	Dual Channel, 1/4 in. Plumbing
Option	-04-2	With 1/4 in. Low Flow Metering Valve
	-04-3	With 1/4 in. Mid Flow Metering Valve

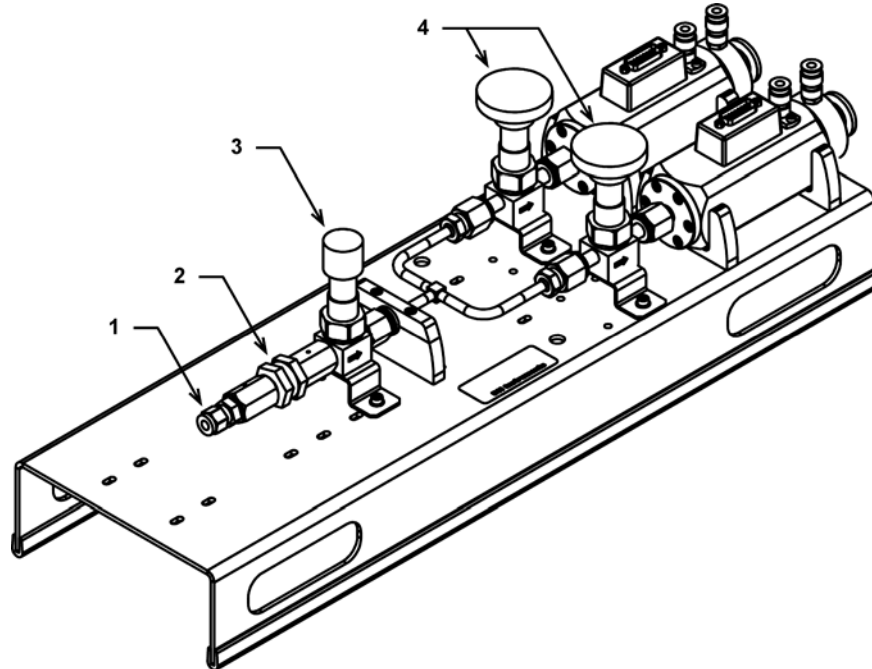


Figure 10. molstic-S, Dual 1/4 in., with Low- or Mid-Flow Metering Valve

1. Inlet adaptor – 1/4 in. tube x 1/4 in. male VCR
2. Particulate filter, 2 micron
3. Precision flow metering valve
4. Flow shut-off/metering valve, 2 ea.



50 cm of clear PFA tubing is included with the molstic-S in order to provide versatility in the connection of DUT's and inlet supply plumbing.

1.2.2.11 MOLSTIC-S, SINGLE 1/4 IN., WITH LOW- OR MID-FLOW METERING VALVE AND REGULATION

ORDERING INFO		DESCRIPTION
P/N	FAM0009	molstic-S, molstic for molbloc-S
	-01-1	Single Channel, 1/4 in. Plumbing
	-03-2	With 1/4 in. Pressure Reducing Regulator
Option	-03-4	With 1/4 in. Back Pressure Regulator
	-04-2	With 1/4 in. Low Flow Metering Valve
	-04-3	With 1/4 in. Mid Flow Metering Valve

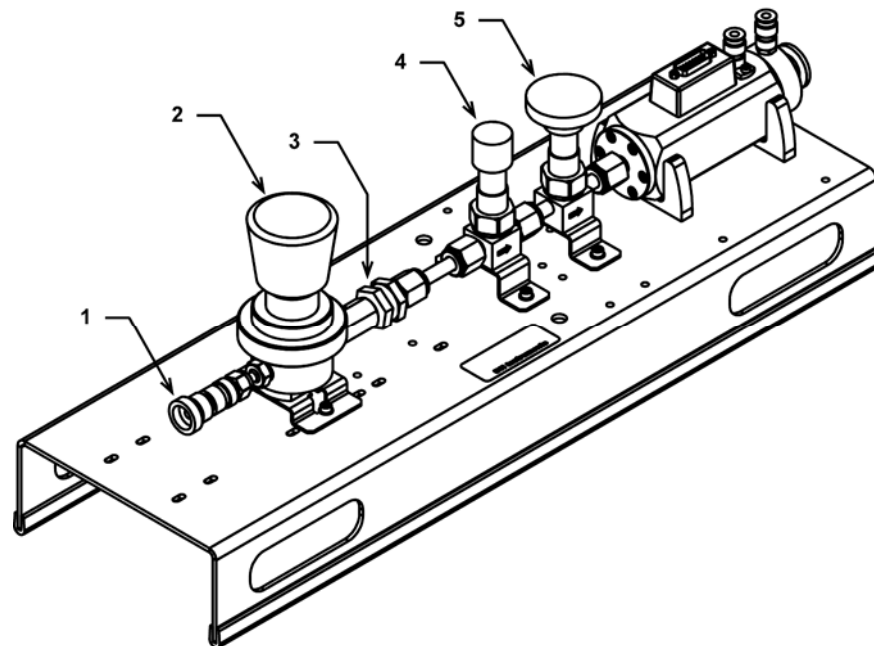


Figure 11. molstic-S, Single 1/4 in., with Low- or Mid-Flow Metering Valve and Regulation

1. Inlet quick connect
(includes stem with 1/4 in. SWG, not shown)
2. Pressure reducing regulator/back pressure regulator
3. Particulate filter, 2 micron
4. Precision flow metering valve
5. Flow shut-off/flow metering valve



50 cm of clear PFA tubing is included with the molstic-S in order to provide versatility in the connection of DUT's and inlet supply plumbing.

1.2.2.12 MOLSTIC-S, DUAL 1/4 IN., WITH LOW- OR MID- FLOW METERING VALVE AND REGULATION

ORDERING INFO		DESCRIPTION
P/N	FAM0009	molstic-S, molstic for molbloc-S
	-01-3	Dual Channel, 1/4 in. Plumbing
	-03-2	With 1/4 in. Pressure Reducing Regulator
Option	-03-4	With 1/4 in. Back Pressure Regulator
	-04-2	With 1/4 in. Low Flow Metering Valve
	-04-3	With 1/4 in. Mid Flow Metering Valve

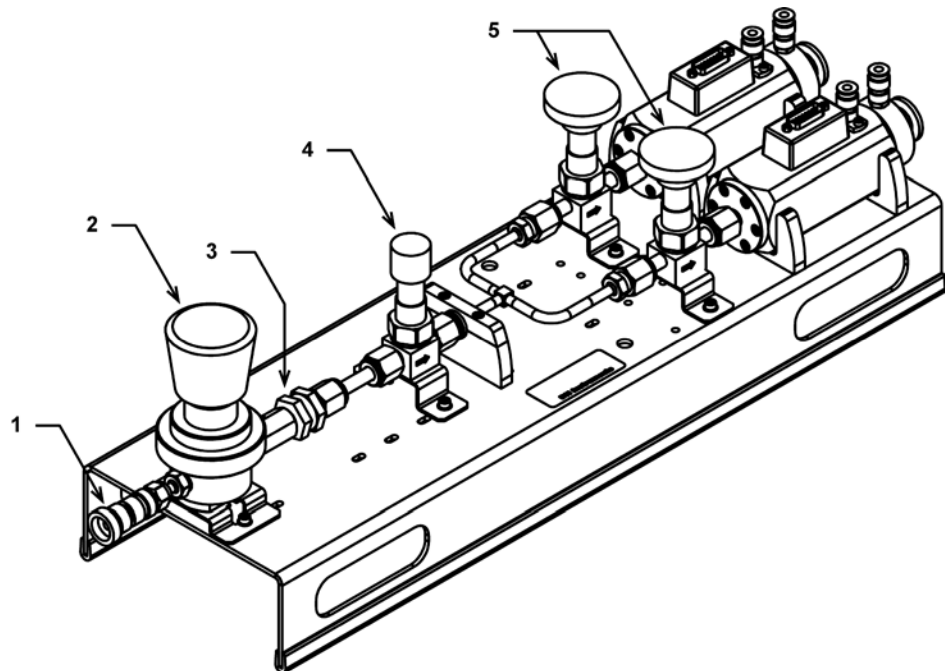


Figure 12. molstic-S, Dual 1/4 in., with Low- or Mid-Flow Metering Valve and Regulation

1. Inlet quick connect
(includes stem with 1/4 in. SWG, not shown)
2. Pressure reducing regulator/back pressure regulator
3. Particulate filter, 2 micron
4. Precision flow metering valve
5. Flow shut-off/flow metering valve, 2 ea.



50 cm of clear PFA tubing is included with the molstic-S in order to provide versatility in the connection of DUT's and inlet supply plumbing.

NOTES



2. INSTALLATION

2.1 UNPACKING AND INSPECTION

2.1.1 REMOVING FROM PACKAGING

The molstic-S is delivered, along with its standard accessories, in a corrugated container with foam-in-place inserts.

Remove the molstic-S and its accessories from the shipping container and remove each item from its protective plastic bag.

2.1.2 INSPECTING CONTENTS

Check that all items are present and that there are no visual indications of damage.

Each variation of the molstic-S mounting system is delivered with one of the following accessory kits:

2.1.2.1 ACCESSORIES INCLUDED WITH MOLSTIC-S SHIPMENTS

Table 1. Accessory Kit, 1/4 in. molstic-S versions, P/N 401938

DESCRIPTION		PART #
1	molstic-S™ Operation and Maintenance Manual	550130
1	16 mm ISO-KF Blanking Flange	103238
1	16 mm ISO-KF Centering Ring	101544
1	16 mm ISO-KF Overpressure Ring	103240
1	16 mm ISO-KF Clamp	102975
4	1/4 in. VCR Face Seal O-ring	102070
2	1/4 in. VCR Face Seal Gasket	102183
1	1/4 in. OD PFA Tubing, 50 cm	101450-Z

Table 2. Accessory Kit, 1/2 in. molstic-S versions, P/N 401939

DESCRIPTION		PART #
1	molstic-S™ Operation and Maintenance Manual	550130
1	16 mm ISO-KF Blanking Flange	103238
1	16 mm ISO-KF Centering Ring	101544
1	16 mm ISO-KF Overpressure Ring	103240
1	16 mm ISO-KF Clamp	102975
4	1/2 in. VCR Face Seal O-ring	102912
2	1/2 in. VCR Face Seal Gasket	102923
1	1/2 in. OD PFA Tubing, 50 cm	103227-Z

2.2 SITE REQUIREMENTS

The molstic-S should be installed on a stable work surface at a convenient height. The bottom edge of the molstic-S platform has a rubberized material that will protect the work surface from marring and scratching. This will also prevent the molstic-S from slipping on smooth surfaces.

When installing the molstic-S, consideration should be given to where the gas supply to molbloc-S will be located. Minimize the length of supply plumbing and keep it organized so that it does not cross the area in which the operator will be working.

2.3 INITIAL SETUP

2.3.1 PREPARATION FOR OPERATION

- ❶ Remove the plastic protective caps from the supply and outlet ports of the molstic-S.
- ❷ Determine whether the DUT will be installed upstream or downstream of the molstic-S.
- ❸ Make the inlet gas supply and DUT connections per the instructions below.



DUTs that have built in flow control capability, such as MFCs, (and are to be tested in flow control mode) must be tested in the upstream location. Install this type of DUT upstream of the molbloc-S only.

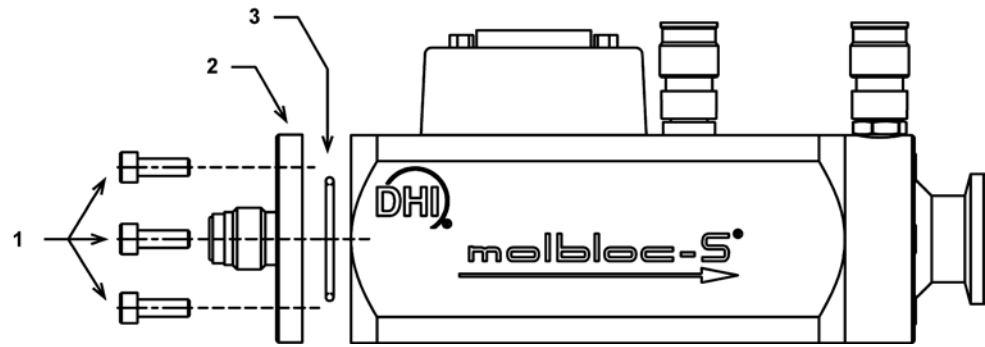
2.3.2 INSTALLATION AND SWAPPING OF MOLBLOC-S

Typically the molstic-S mounting system configured with 1/4 in. plumbing is used to accommodate the molbloc-S elements with 48 mm square bodies and 1/4 in. male VCR® inlet fittings, designated 1E2-S and smaller. In some cases, when running “low” flows in sub-atmospheric mode, it might be desirable to use molbloc-S elements that have 1/2 in. VCR inlet fittings on the 1/4 in. molstic-S mounting system. Use the inlet flange conversion kit, P/N 401935.

The molstic-S mounting system configured with 1/2 in. plumbing can accommodate any molbloc-S elements with 48 mm square bodies, up to 2E3-S. In order to be used on this molstic, any molbloc-S element designated 1E2-S and smaller must have its 1/4 in. VCR inlet fitting replaced with the 1/2 in. VCR end flange through the use of conversion kit P/N 401936.

2.3.2.1 REPLACING VCR INLET FLANGES ON MOLBLOC-S (AS REQUIRED)

Use the following procedure to replace the VCR inlet flange on the molbloc-S elements, using conversion kit P/N 401935 or 401936.



1. Body screw, 6 ea.
2. Inlet flange
3. O-ring, P/N 2-022

Figure 13. Replacing molbloc-S Flanges

- ❶ Using a 3 mm hex wrench, remove and preserve the socket head caps screws that retain the existing VCR inlet end flange. DO NOT remove the downstream end flange.
- ❷ Preserve the end flange face seal, Viton[®] O-ring (DHI P/N 102221) Parker P/N 2-022, for use with the new flange. Be careful not to damage this seal in any way, as a leak can result which will cause errors during flow measurement.
- ❸ Position the replacement VCR inlet flange on the end of molbloc-S, making sure that the flange seal is in its proper location, and be sure not to “pinch” the seal between the flange and body.
- ❹ Thread each of the socket head caps screws into the body, but leave loose enough to allow adjustment in the flange’s final position.
- ❺ Tighten each of the screws in a “star” pattern a little at a time. Finish by tightening to a torque value of 3 Nm on each screw.

2.3.2.2 INSTALLATION OF MOLBLOC-S ONTO MOLSTIC-S

Place the molbloc-S into the cradles on the molstic-S, making sure that its orientation matches the flow direction of the molstic-S.

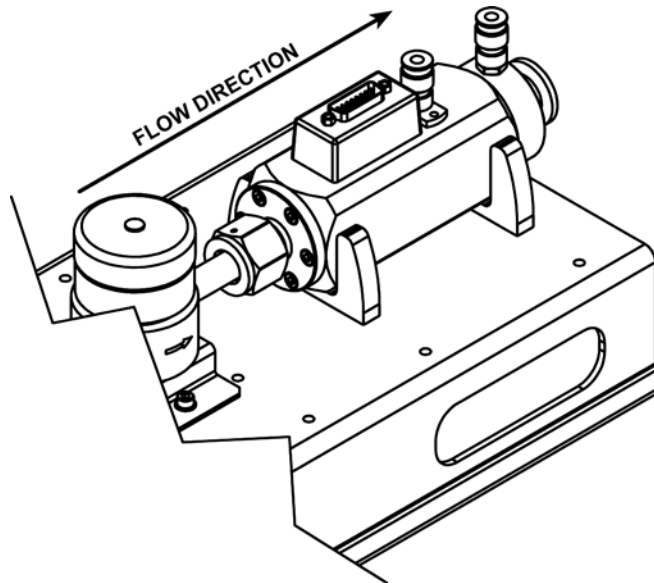


Figure 14. Installation of molbloc-S onto molstic-S

2.3.2.2.1 molbloc-S Inlet Fitting Connection

The inlet fitting to the molbloc-S utilizes the VCR face seal type connection. Use the following procedure for connecting and disconnecting molbloc-S elements with VCR connections.

Connecting, Disconnecting and Mounting molbloc-S with VCR Face Seal Fittings (molbloc-S Inlet Fitting)

In making the molbloc-S inlet flow connection, always use soft O-rings. They allow a leak free connection to be accomplished with minimal torque, and they provide a source of flexibility between the molbloc-S and elements to which it is connected, protecting the molbloc-S from mounting stresses.

Use the following O-ring seal for making molbloc-S VCR connections:

VCR FACE SEAL SIZE	DHI PART NO.	PART NO. PARKER SEAL GROUP, O-RING DIVISION	COMPOSITION
1/4 in.	102070	2-202	Fluorocarbon rubber (FKM), Viton
1/2 in.	102912	2-207	Fluorocarbon rubber (FKM), Viton

Making and Breaking Procedure for molbloc-S VCR Face Seal Connection

- ❶ Install the recommended soft O-ring securely against the sealing surface in the nut of the mating fitting.
- ❷ Align the mating nut with the molbloc's male VCR fitting and thread the nut onto the fitting. Hold the molbloc-S with your hand, rotate the nut until resistance is felt when the O-ring begins to compress.
- ❸ Holding the molbloc-S with your hand, tighten the nut an additional 1/2 turn. A wrench may be used on the nut if desired, but do not tighten beyond one half turn. If more than one half turn is needed to make a leak free connection, the O-ring may be damaged and should be replaced.
- ❹ To break the fitting, hold the molbloc-S with your hand and loosen the nut until it is completely backed off.

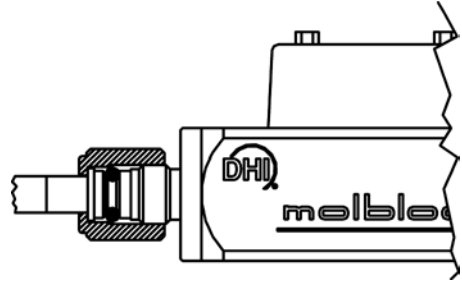


Figure 15. molbloc-S VCR Face Seal Connection



Never use wrenches to hold the molbloc-S body.

2.3.2.2.2 molbloc-S Connections to molbox

For the pressure connections, use the molbox[®] to molbloc-S pressure tubes (P/N 401125) supplied with the molbox. Following the color coding on the pressure lines, connect the upstream (HI) molbox rear panel quick connector to the upstream port of the molbloc-S and the downstream (LO) quick connector to the downstream port. Push firmly on the quick connect until it clicks into place to assure that the connection is completed.

For the electrical/data connection, use the molbox to molbloc-S connection cable (P/N 102096, or 102096-CE) supplied with the molbox. Connect the cable to the 15-pin electrical/data connector on the molbloc-S and then to the molbox rear panel connector labeled "molbloc".

2.3.2.2.3 Swapping molbloc-S Elements onto molstic-S

To change the molbloc-S element, break the VCR face seal inlet connection. The O-ring seal is reusable but should be examined for damage that could cause a leak. Place the new molbloc-S into the cradles, and make the VCR face seal connection.

2.4 MOLSTIC-S INTERCONNECTIONS

2.4.1 GAS SUPPLY CONNECTIONS TO MOLSTIC-S

Determine the maximum operating pressure range of your molbox RPTs prior to connecting a gas source to your molstic-S.



See the molbox calibration report to determine the pressure range of the Reference Pressure Transducers (RPTs) in the molbox you are using. molbox1-A700K has a maximum operating pressure of 600 kPaa (87 psia), and molbox1-A350K has a maximum operating pressure of 250 kPaa (36 psia).



If a contaminated device under test is located upstream of the molbloc, contaminants may flow from the device under test to the molbloc-S and alter its calibration. If the device under test must be connected upstream of the molbloc-S, be sure it is clean before flowing and consider installing a filter between the DUT and the molbloc.

The gas supply to the molstic-S has the following requirements:

- The gas supply must be clean and free of particulate contamination in order to avoid damage to the molbloc.
- For correct measurements, the gas must be of the same species as that selected by the molbox **[GAS]** function. Use of ambient air (moist air) is supported by the molbox. Gas purity will affect the measurement uncertainty of the flow measurements as molbox uses the thermodynamic properties of the flowing gas in its calculations. Use gases with purity of 99.9 % or better for molbloc measurements.
- The pressure must be regulated and stable within the limits of the molbloc-S calibration pressure range, and low enough to avoid over-pressurization of the molbox.
- The pressure must not exceed the maximum operating pressure rating of the RPTs in the molbox. **See the back panel label of the molbox to determine the maximum operating pressure allowed. Verification of the pressure rating should be obtained by examination of the calibration range on the molbox certification of calibration.**

2.4.1.1 MOLSTIC-S USE WITH DHI SUPPLIED REGULATORS

The inlet gas supply to the molstic-S must be suitably regulated prior to connection to the inlet of the molbloc-S plumbing. The molstic-S is available with the proper pressure reducing regulator integrated, or it can be added in the field using the optional regulator upgrade kits that are available in 1/4 in. or 1/2 in., P/N 401880 and 401881, respectively.

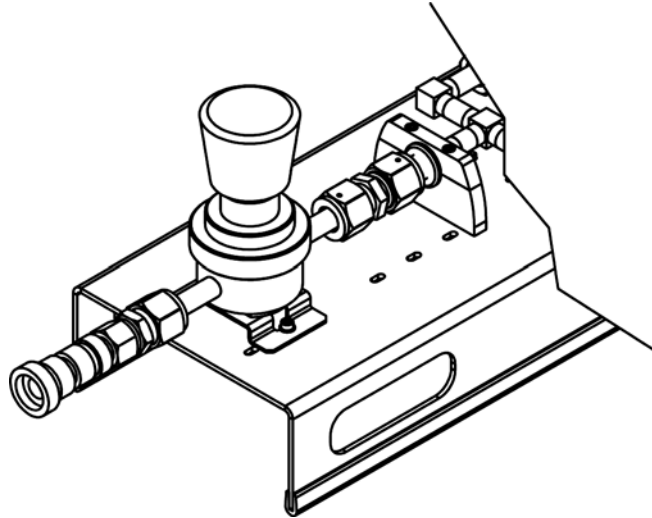


Figure 16. molstic-S with Supplied Regulator

DHI also offers the **supply only** platform that includes the regulator with a quick connect inlet, and a shut-off/metering valve on the outlet. P/Ns 401876 and 401877 are compatible with the 1/4 in. and 1/2 in. molstic-S, and allow additional flexibility in the plumbing location of the DUT. The regulators supplied by **DHI** were chosen for their superior performance and compatibility with the molbloc-S operation methods.

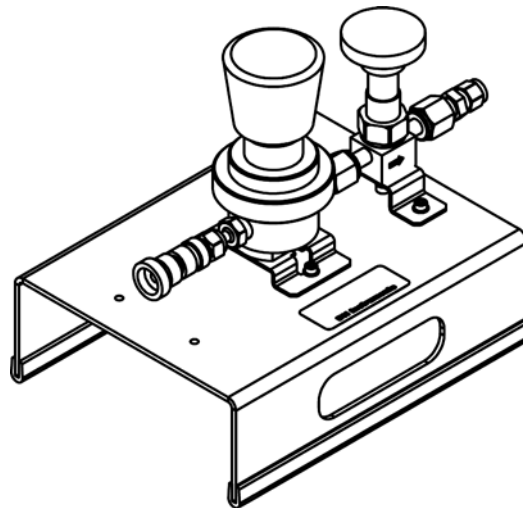


Figure 17. molstic-S with Supply Only Platform

- ❶ **Set regulator outlet pressure to minimum:** Rotate the knob of the pressure reducing regulator in the counterclockwise direction until the spring force of the diaphragm is relieved. Insure that the shut-off valve(s) is in the closed position.



Be sure that the molstic-S Supply Assembly or molstic-S shut-off valve(s) is closed before connecting the quick connector stem to the quick connector body (located on the regulator's inlet).

- ❷ **Connect the gas supply:** Connect the gas supply to the quick connector stem (1/4 in. or 1/2 in. tube). The gas supply pressure should not exceed 1.7 MPa (250 psig). Insert the stem into the quick connect body.

2.4.1.2 MOLSTIC-S USE WITH REGULATORS NOT SUPPLIED BY DHI

The inlet gas supply to the molstic-S must be suitably regulated prior to connection to the inlet of the molbloc-S plumbing. In addition, a shut-off valve should be used downstream of the regulator in order to allow for system leak testing. The pressure reducing regulators supplied by **DHI** are selected for the following characteristics:

- High quality
 - High sensitivity and stability
 - Outlet (control) pressure range: 0 to 100 psig
 - Non-venting – does not relieve control pressure outside of plumbing
 - Low droop (change in control pressure with change in flow rate)
 - Low inlet pressure effect (change in control for a given change in supply pressure)
 - Flow capacity – capability to flow to maximum required flow rate
- ❶ **Set regulator outlet pressure to minimum:** Rotate the knob of the user supplied pressure reducing regulator in the counterclockwise direction until the spring force of the diaphragm is relieved. Insure that the shut-off valve(s) is in the closed position.
 - ❷ **Connect the gas supply:** Connect the gas supply to the pressure regulator's inlet port using suitable means and compatible fittings. The gas supply pressure should not exceed the regulator's maximum operating pressure.

2.4.2 INLET CONNECTION - MOLSTIC-S USE WITH DUT UPSTREAM



DUTs that have built in flow control capability, such as MFCs, (and are to be tested in flow control mode) must be tested in the upstream location. Install this type of DUT upstream of the molbloc-S only.

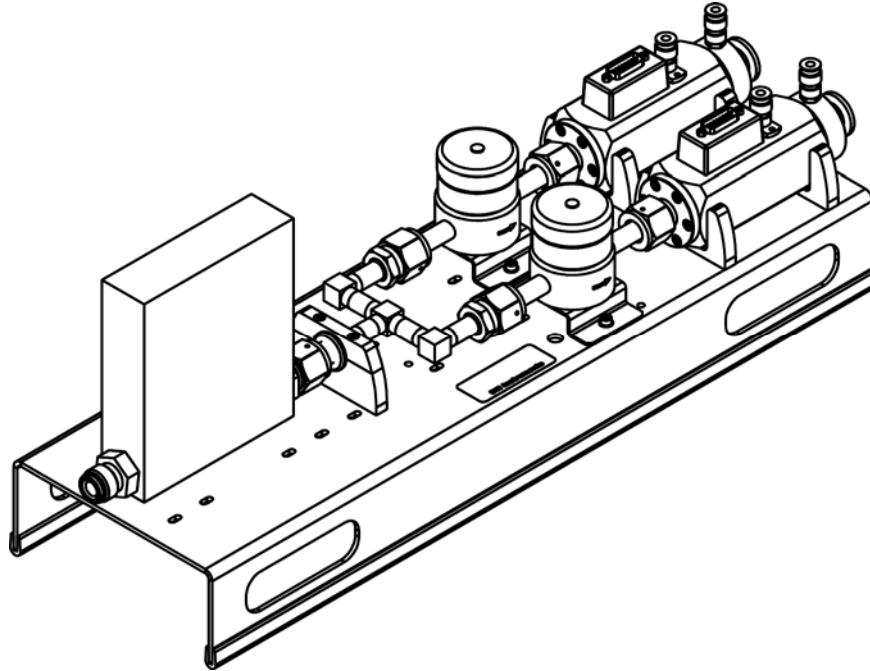


Figure 18. molstic-S with DUT Upstream

Follow these guidelines when connecting the DUT to the upstream of the molstic-S:

- **Inspect the DUT for contamination:** When using the molstic-S with the DUT installed upstream, as is required when calibrating flow devices that control flow, it is recommended practice to inspect the DUT for any material that might contaminate either the molstic plumbing or the molbloc-S elements installed on the molstic.
- **Use inline particulate filters:** Since the smaller molbloc-S elements that are compatible with the 1/4 in. molstic-S have quite small passages, the 1/4 in. molstic-S comes with a 2 micron particulate filter. There is a filter kit available from **DHI** for use between the DUT and the inlet of the 1/2 in. molstic-S, to protect the molbloc-S elements from particulate contamination. (Consult factory for availability of 1/2 in. inline filter kit).
- **Connect DUT to molstic-S inlet:** Since there are so many types and sizes DUTs that can be calibrated by the molbloc-S, and since there is no standardized dimension for the DUT's plumbing centerline to its base, the molstic-S was not designed to accommodate the DUT directly on its platform. For the sake of flexibility, the molstic-S is supplied with 50 cm of PFA tubing to help make the inlet and outlet connections. Use of the adjustable DUT stand (P/N 401934) will also facilitate the alignment of the centerline of the DUT's inlet plumbing connection with that of the molstic-S plumbing.
- **Connect Gas Supply to DUT Inlet:** Connect the gas supply to the DUT inlet per Section 2.4.1.
- **Leak Check System Plumbing:** Refer to Section 3 for leak check recommendations.



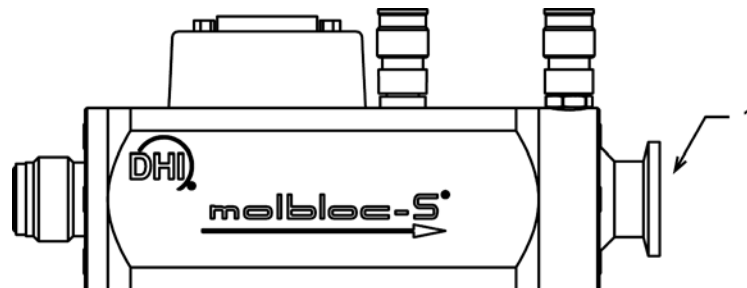
During system leak testing, be extremely careful not to apply pressure in excess of the maximum operating pressure of the molbox: 600 kPaa (87 psia) for molbox1-A700K, 250 kPaa (36 psia) for molbox1-A350K models!

2.4.3 INLET CONNECTION - MOLSTIC-S USE WITH DUT DOWNSTREAM

- ❶ **Connect the Gas Supply:** Connect the gas supply to the inlet fitting of the molstic-S using suitable means and compatible fittings. Following instructions in Section 2.4.1.

2.4.4 OUTLET CONNECTION - MOLBLOC-S OUTLET CONNECTION

The outlet fitting of the molbloc-S utilizes the ISO-KF Style vacuum flange. Use the following procedure for connecting and disconnecting molbloc-S elements with ISO-KF Style connections.



1. Flange, ISO-KF style, 16 mm

Figure 19. molbloc-S with ISO-KF Style Flange

2.5 CONNECTING, DISCONNECTING AND MOUNTING MOLBLOC-S™ WITH ISO-KF STYLE VACUUM FLANGE (MOLBLOC-S OUTLET FITTING)

2.5.1 ISO-KF STYLE VACUUM FLANGE FITTINGS

The outlet connection system on the molbloc-S body is the ISO-KF style vacuum flange. It utilizes an internal centering ring, an external overpressure ring and clamp. The seal is effected by the uniform application of pressure by the clamp on the 15° surface of the mating stainless steel flanges. These mating flange surfaces compress a Viton O-ring that is held in place by the centering ring. The overpressure ring keeps the O-ring in place, and maintains a leak free connection when the system is subjected to internal pressures above vacuum level. This connection is reusable, rotatable, and can operate leak free in vacuum applications up to 10^{-8} Torr, and in positive pressures of 700 kPa (100 psig).



When performing a leak test of a plumbing system that contains the ISO-KF Style Vacuum Flanges, do not exceed the maximum operating pressure of the molbox: 600 kPaa (87 psia) for molbox1-A700K, 250 kPaa (36 psia) for molbox1-A350K models.

2.5.2 MAKING AND BREAKING PROCEDURE FOR MOLBLOC-S ISO-KF VACUUM FLANGE CONNECTION

- ❶ Place the over-pressure ring past one of the ISO-KF flanges to be mated.
- ❷ Place the centering ring into the groove of the ISO-KF flange on the outlet of the molbloc-S.
- ❸ Align the mating flange against molbloc's ISO-KF flange, and close the gap by hand.
- ❹ Hold the flanges together and move the overpressure ring directly over the mated flanges.

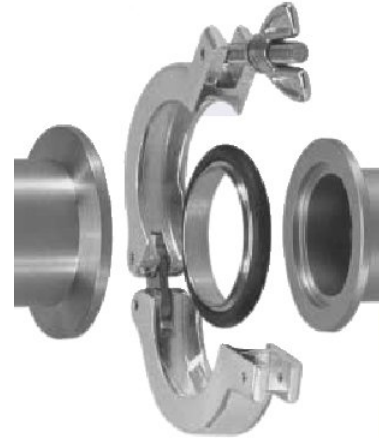


Figure 20. ISO-KF Style Flange

- ❺ Place the clamp around the mated flanges. Swing the clamp closed. If necessary loosen the thumbscrew to allow the thrust washer and wing nut to fall into position on top of the clamp. Fully tighten the wing nut by hand.
- ❻ To break the fitting, hold the molbloc-S with your hand and loosen the wing nut until the clamp can be separated. Remove the clamp, centering ring, and overpressure ring.



Never use wrenches to hold the molbloc-S body or tighten the wing nut.

2.5.2.1 MOLSTIC-S USE WITH DUT UPSTREAM

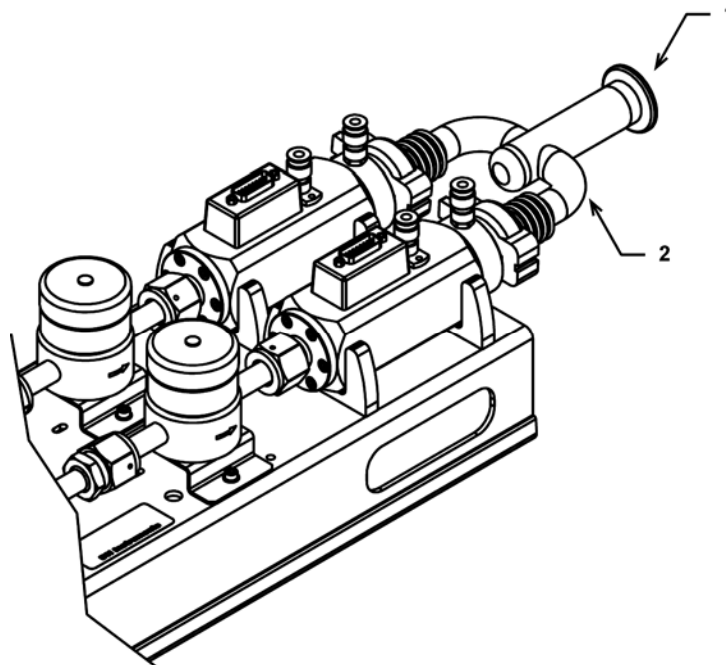
During operation the molbloc-S exhaust sound pressure can become quite high. If desired, the outlet of the molbloc-S can be connected to exhaust plumbing in order to dampen this noise. In this case care should be exercised to minimize the amount of back pressure that is applied to the molbloc-S. Utilize plumbing that is as short as practical, and with a diameter as large as practical.

In order to maximize each molbloc-S element's usable range, the application of a vacuum source on the downstream connection of the molbloc-S may be utilized. Use of the Downstream Tee Assembly, P/N 401884, will facilitate this connection.

2.5.2.2 MOLSTIC-S USE WITH DUT DOWNSTREAM



DUTs that have built in flow control capability, such as MFCs, (and are to be tested in flow control mode) must be tested in the upstream location. Install this type of DUT upstream of the molbloc-S only.



1. Flange, ISO-KF style, 25 mm
2. Tee assembly, downstream

Figure 21. molstic-S with DUT Upstream

The outlet flange of the molbloc-S or the Downstream Tee Assembly can be adapted to other types of connections.

- ❶ **Adapt to molbloc-S Outlet Fitting:** When testing a DUT downstream of the molbloc-S, connect the DUT's inlet plumbing to the outlet of the molbloc-S. The molbloc-S elements with the 48 mm square bodies have 16 mm ISO-KF style vacuum flange outlet fittings. The Downstream Tee Assembly end fitting type is the 25 mm ISO-KF style vacuum flange. These fittings can be converted to either Swagelok tube fitting or VCR Face Seal fittings using one of the following adaptor kits:

Table 3. molbloc-S Adaptor Kits

DESIGNATOR	DESCRIPTION	PART NO.
PK-MOL-KF16-1/4 in. SWG	16 mm ISO-KF x 1/4 in. tube	401890
PK-MOL-KF16-3/8 in. SWG	16 mm ISO-KF x 3/8 in. tube	401891
PK-MOL-KF16-1/4 in. VCR	16 mm ISO-KF x 1/4 in. male VCR	401892
PK-MOL-KF16-1/2 in. VCR	16 mm ISO-KF x 1/2 in. male VCR	401893
PK-MOL-KF25-1/4 in. SWG	25 mm ISO-KF x 1/4 in. tube	401894
PK-MOL-KF25-3/8 in. SWG	25 mm ISO-KF x 3/8 in. tube	401895
PK-MOL-KF25-1/4 in. VCR	25 mm ISO-KF x 1/4 in. male VCR	401896
PK-MOL-KF25-1/2 in. VCR	25 mm ISO-KF x 1/2 in. male VCR	401897

- ② **Connect DUT to molbloc-S Outlet:** Since there are so many types and sizes of DUTs that can be calibrated by the molbloc-S, and since there is no standardized dimension for the DUT's plumbing centerline to its base, the molstic-S was not designed to accommodate the DUT directly on its platform. For the sake of flexibility, the molstic-S is supplied with 50 cm of PFA tubing to help make the inlet and outlet connections. Use of the adjustable DUT stand (P/N 401934) will also facilitate the alignment of the centerline of the DUT's inlet plumbing connection with that of the molstic-S plumbing.



For best results, follow the DUT manufacturer's recommendation for the length and size of upstream and downstream straight plumbing.

NOTES



3. MOLSTIC-S OPERATION

3.1 SYSTEM PRESSURIZATION AND REGULATOR ADJUSTMENT – PRESSURE REDUCING REGULATOR



During system operation, be extremely careful not to apply pressure in excess of the maximum operating pressure of the molbox: 600 kPaa (87 psia) for molbox1-A700K; 250 kPaa (36 psia) for molbox1-A350K.

Once the test system with molbloc-S and molstic-S has been completely interconnected, the following procedure should be used for its safe pressurization and operation.

The outlet pressure of a pressure reducing regulator is controlled by adjusting the position of the control knob. Rotating the knob in the clockwise direction raises the outlet (control) pressure. Counterclockwise rotation, coupled with venting of the downstream side of the regulator plumbing, lowers the outlet pressure. molstic-S regulators are NOT self-venting so the outlet pressure will not decrease with counterclockwise rotation of the control knob unless the downstream gas is allowed to escape.

Make final adjustments of control pressure in the direction of increasing pressure in order to obtain the most accurate and stable set point.

3.1.1 SYSTEM PRESSURIZATION

- ❶ **Begin with system pressure vented:** Make sure that the system pressure is vented.
- ❷ **Set inlet pressure to minimum:** Turn the regulator's adjustment knob counterclockwise until the spring force has been relieved.
- ❸ **Turn on gas supply:** Apply the supply pressure to the pressure control regulator.
- ❹ **Open molstic-S flow control/shut off valve(s):** Valves must be open to allow test gas to fill the test system.
- ❺ **Isolate from vacuum system:** If the outlet plumbing of the molstic-S flows into a vacuum pump, disconnect or otherwise isolate from the vacuum system. When capping off ISO-KF style flanges use overpressure rings to insure a leak free connection at positive line pressure.
- ❻ **Plug-off/cap-off system:** Place a plug or cap (as applicable) on the outlet fitting of the test system.
- ❼ **Open DUT's flow control valve:** If the test system contains a DUT that has flow control capability, it must be opened slightly in order to allow pressure to pass through. All that is necessary is a small flow to allow the system to fully pressurize.
- ❽ **Display system pressure:** Monitor the system pressure as measured by molbox by pressing the [P&T] function until the pressure is displayed. Refer to molbox Operation and Maintenance Manual for details.
- ❾ **Turn on gas supply:** Apply the supply pressure to the pressure control regulator.

- ⑩ **Slowly raise system pressure to desired test pressure:** Rotating the regulator's control knob clockwise raises the outlet pressure. Rotate counterclockwise to lower the outlet pressure. Increase the system pressure to the desired DUT operating pressure. Make final adjustments of control pressure in the direction of increasing pressure in order to obtain the most accurate and stable set point. Provide additional margin in the control pressure only if the final pressure will be within the safe operating range of the molbox.

3.1.2 REGULATOR MAXIMUM PRESSURE ADJUSTMENT

Once the regulator has been adjusted to the desired pressure its adjusting stem should be locked down to prevent further adjustments. This will help protect the molbox RPTs from over-pressurization.

- ① **Remove regulator knob cover:** Use a small flat screwdriver to remove the plastic cap on the top of the regulator adjustment knob.
- ② **Loosen jamb nut:** Using the properly sized socket wrench, loosen the jamb nut located on top of the adjustment knob.
- ③ **Adjust knob position:** Rotate the regulator adjustment knob clockwise until it gently bottoms out against the regulator body.
- ④ **Tighten jamb nut:** Hold the adjustment knob in position while using the socket wrench to tighten the jamb nut against the top of the adjustment knob.
- ⑤ **Retest system pressure:** Vent the system pressure. Use the procedure in Section 3.1 to re-pressurize and verify the regulator pressure setting. Readjust if necessary.
- ⑥ **Replace regulator knob cover:** Place the regulator adjustment knob cover back on top of the knob and gently snap back in place.

3.1.3 PRESSURE REDUCING REGULATOR ADJUSTMENT

During operation, the pressure reducing regulator can be finely adjusted to control or limit molbloc-S flow and operating pressure by rotating the regulator adjustment knob. (See Section 3.4)

3.2 SYSTEM PRESSURIZATION AND REGULATOR ADJUSTMENT – BACK PRESSURE REGULATOR



During system operation, be extremely careful not to apply pressure in excess of the maximum operating pressure of the molbox: 600 kPaa (87 psia) for molbox1-A700K; 250 kPaa (36 psia) for molbox1-A350K.

Once the test system with molbloc-S and molstic-S has been completely interconnected, the following procedure should be used for its safe pressurization and operation.

The pressure directly upstream of a back pressure regulator is controlled by adjusting the position of the control knob. Rotating the knob in the clockwise direction raises the upstream (control) pressure. Counterclockwise rotation, coupled with venting of the downstream side of the regulator plumbing, lowers the upstream pressure. molstic-S regulators are NOT self-venting therefore the upstream pressure will not be adjusted with rotation of the control knob unless the downstream gas is allowed to escape.

Make final adjustments of control pressure in the direction of increasing pressure in order to obtain the most accurate and stable set point.

3.2.1 SYSTEM PRESSURIZATION

- ❶ **Begin with system pressure vented:** Make sure that the system pressure is vented.
- ❷ **Set the system pressure to minimum:** Rotate the system supply regulator's adjustment knob counterclockwise until the spring force has been relieved.
- ❸ **Turn on gas supply:** Apply the supply pressure to the pressure control regulator.
- ❹ **Open molstic-S flow control/shut-off valve(s):** Valves must be open to allow test gas to flow through the system.
- ❺ **Slowly raise system supply pressure:** Using the pressure reducing regulator upstream of the DUT, slowly raise the system pressure (by rotating the knob clockwise) to the desired operating pressure. Provide additional margin only if the final pressure will be within the safe operating range of the molbox. **Do not exceed the maximum operating pressure of the molbox.**

3.2.2 BACK PRESSURE REGULATOR ADJUSTMENT

- ❶ **Begin with pressure at minimum:** Rotate the back pressure regulator's adjustment knob counterclockwise until the spring force has been relieved.
- ❷ **Open the DUT's flow control valve:** If the test system contains a DUT that has flow control capability, it must be opened slightly in order to allow pressure to pass through. All that is necessary is a small flow to allow the regulator to be adjusted.
- ❸ **Adjusting back pressure:** Rotate the back pressure regulator adjustment knob clockwise in order to raise the pressure level upstream of the regulator. Rotate the back pressure regulator adjustment knob counterclockwise in order to lower the pressure level upstream of the regulator.

3.2.3 LOCKING THE BACK PRESSURE REGULATOR ADJUSTMENT (OPTIONAL)

Once the Back Pressure Regulator has been adjusted to the desired level of upstream pressure, the adjustment knob can be locked down in order to prevent future adjustment if desired.

- ❶ **Remove regulator knob cover:** Use a small flat screwdriver to remove the plastic cap on the top of the regulator adjustment knob.
- ❷ **Remove the top jamb nut:** Using the properly sized socket wrench, loosen and remove the jamb nut located on top of the adjustment knob. Retain for later reinstallation.
- ❸ **Remove the adjustment knob:** Rotate the regulator adjustment knob counterclockwise to remove it from the regulator. Retain it for future use.
- ❹ **Tighten bottom jamb nut:** Rotate the bottom jamb nut clockwise until it gently bottoms out against the regulator body.
- ❺ **Tighten top jamb nut:** Using a properly sized wrench, hold the bottom jamb nut in position while using the socket wrench to tighten the top jamb nut.
- ❻ **Retest system pressure:** Vent the system pressure. Repeat system pressurization procedure to verify the regulator back pressure setting. Readjust if necessary.

3.2.4 BACK PRESSURE REGULATOR OPERATION

During operation the back pressure can be more finely adjusted by rotating the back pressure regulator adjustment knob to obtain the desired pressure.

3.3 LEAK CHECK RECOMMENDATIONS



During system leak check, be extremely careful not to apply pressure in excess of the maximum operating pressure of the molbox: 600 kPaa (87 psia) for molbox1-A700K, 250 kPaa (36 psia) for molbox1-A350K models.

Once the test system with molbloc-S and molstic-S has been completely interconnected, and pressurized to the desired leak check pressure use the following procedure.

- ❶ **Complete Leak Check of System Plumbing:** Refer to the molbox Operation and Maintenance Manual for the details of the molbox system leak check procedure.

3.4 MOLSTIC-S FLOW CONTROL

The mass flow rate through the molbloc-S is primarily a function of the absolute pressure on its inlet. This pressure can be controlled by various means. If the device under test (DUT) has its own flow control capability it must be installed upstream of the molbloc-S and will provide the control of inlet pressure to the molbloc-S.

If the DUT does not have its own flow control capability, the inlet pressure to the molbloc-S must be controlled by either an upstream pressure regulator or an upstream flow control valve.

3.4.1 DUT WITH FLOW CONTROL CAPABILITY



If the DUT's supply pressure requirement is in excess of the maximum operating pressure of the molbox, a pressure reducing regulator that has a maximum outlet pressure within the molbox pressure range should be installed upstream of the molbloc-S in order to protect the molbox from over-pressurization.

- ❶ **Make sure the molstic-S pressure reducing regulator, if installed, is set to a pressure that allows the molbloc-S to reach the desired flow rate, but protects the molbox from overpressure.** Use instructions in Section 3.1 for regulator adjustment.
- ❷ **Using a separate pressure reducing regulator connected upstream of the DUT, such as the one on a supply-only molstic, set the inlet pressure supplied to the DUT.**
- ❸ **Open molstic-S flow control/shut off valve(s):** All valves must be open to allow test gas to fill the test system.
- ❹ **Set flow rate using DUT.**

3.4.2 DUT WITHOUT FLOW CONTROL CAPABILITY

3.4.2.1 FLOW CONTROL USING METERING VALVES

- ❶ **Slowly raise system pressure to desired test pressure:** Rotating the regulator's control knob clockwise raises the outlet pressure. Rotate counterclockwise to lower the outlet pressure. Increase the system pressure to the desired DUT operating pressure. Make final adjustments in control pressure in the direction of increasing pressure in order to obtain the most accurate and stable set point.
- ❷ **Open molstic-S shut off valve(s):** All shut off valves must be open to allow test gas to fill the test system.
- ❸ **Adjust system flow rate:** Rotate the flow control valve adjustment knob to set the desired flow rate on the molbloc-S. Fine adjustments in flow rate can be achieved by combining adjustments in the supply pressure with adjustments in the flow control valve.

3.4.2.2 FLOW CONTROL USING THE PRESSURE REGULATOR

- ❶ **Set inlet pressure to minimum:** Turn the regulator's adjustment knob counterclockwise until the spring force has been relieved.
- ❷ **Open molstic-S shut off valve(s):** All shut off valves must be open to allow test gas to fill the test system.
- ❸ **Adjust system flow rate:** Rotate the regulator control knob in the clockwise direction in order to raise the outlet pressure, and thus the flow rate through the system. Rotate the regulator control knob in the counterclockwise direction to lower the outlet pressure, and thus the flow rate.

NOTES



4. OPTIONS AND UPGRADES

4.1 REGULATOR UPGRADE TO MOLSTIC-S

The molstic-S variations that do not include the integrated Pressure Reducing Regulator or Back Pressure Regulator can be upgraded using the following kits from DH Instruments:

KIT PN	DESCRIPTION	INSTRUCTION SHEET
401880	1/4 in. molstic-S Pressure Reducing Regulator kit	560051
401881	1/2 in. molstic-S Pressure Reducing Regulator kit	560065
402075	1/4 in. molstic-S Back Pressure Regulator kit	560068
402103	1/2 in. molstic-S Back Pressure Regulator kit	560069

Detailed information on the installation and use of these regulator kits can be found in the referenced instruction sheets. These instruction sheets are available on the DHI website, www.dhstruments.com.

4.2 UPGRADE OF MOLSTIC-S WITH 1/4 IN. METERING VALVE

The 1/4 in. molstic-S is delivered with integrated shut-off/metering valves. These valves provide a measure of flow control when calibrating devices that do not have their own flow control capability; however, their primary use on the molstic-S is to provide a means of positive flow shut-off to allow for system leak testing. The 1/4 in. low-flow and 1/4 in. mid-flow metering valve kits provide higher precision flow control capability.

Use the 1/4 in. metering valve kits with the following molbloc-S ranges and molboxes:

Table 4. Metering Valve Use with molbloc-S

	MOLBOX1-A700K	MOLBOX1-A350K
Low-Flow, P/N 401885	5E1-S	5E1-S
Mid-Flow, P/N 401666	1E2-S, 2E2-S	1E2-S, 2E2-S

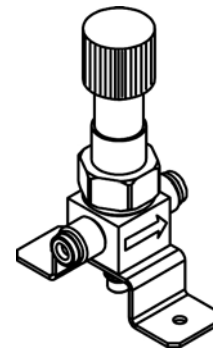


Figure 22. Metering Valve

See the installation and operation instructions included with the metering valve kit for more details.

4.3 UPGRADE OF SINGLE MOLSTIC-S TO DUAL CHANNEL

The single channel molstic-S mounting systems can be upgraded to dual channel. Contact the factory for information on this upgrade.

NOTES



5. MOLSTIC-S MAINTENANCE AND RECOMMENDATIONS

5.1 FILTER CLEANING

The 1/4 in. molstic-S filter is a sealed 2 micron pleated mesh filter (Swagelok SS-4FW-VCR-2). It can be cleaned by backflushing with clean gas, but must be removed from the molstic-S. When removing, cleaning and re-installing the filter the metallic VCR gaskets (P/N102183) must be replaced and all manufacturers' recommendations followed.

5.2 HANDLING

The molstic-S platforms should not be picked up or carried by their components. Always handle the molstic-S by its base.

NOTES