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High Pressure Access Systems

System Overview

High Pressure Access Systems are specialized piping arrangements which permit internal access to production plant vessels and pipework operating under full process conditions. The corrosion monitoring industry standard for such access systems is based on a 2-inch nominal bore design.

When operated with a Retrieval Tool and Service Valve, high pressure access systems allow the installation and retrieval of corrosion monitoring coupon holders, probes, chemical injection equipment, and other devices to be carried out safely and without plant shutdown, at working pressures up to 3,600 psi.

High pressure access systems are used most frequently (although not exclusively) in oil and gas production operations. This is typical of high pressure operations in which users are not prepared to shut down and depressurize process systems in order to remove or install corrosion monitoring devices.

The Access Fitting Assembly consists of three main components:

1. **Protective Cover** – designed to protect the external threads of the access fitting body.

2. **Plug** – the carrier for the installed device. Depending on the type of device being used, a solid plug or a hollow plug is selected. The plug assembly screws into the access fitting body and seal the bore of the fitting to contain line pressure.

3. **Access Fitting Body** – the specialized pipe fitting which is permanently attached to the process plant vessel or pipework.
**Safety Precautions**

1. Good engineering and operational practices should be adhered to at all times.

2. Do not use the retrieval tool unless you have familiarized yourself with its operation.

3. If this is the first time you have used the equipment or you are an infrequent user, you should review the manual and, if possible, perform a trial operation on a mock fitting / trainer (see Metal Samples Pressure Test Stand below).

4. In addition to the requirements of this manual, all plant safety requirements and environmental regulations must be followed.

*Metal Samples Pressure Test Stand – Part # HA106001*
Access Fitting Body

Access Fitting Body Types

High Pressure Access Fitting Bodies are available in styles that may be welded (Flareweld, Socketweld, and Buttweld), threaded (NPT), or flanged (API, ANSI RF, ANSI RJ) to the pipe or vessel wall.

1. **Flareweld** – HP1000/HP1100 Flareweld bodies are the most widely used. These bodies incorporate a reinforced welding neck and also have a radius machined into the base to accommodate the curvature of the pipe or vessel to which the body is welded.

2. **Buttweld** – HP2000/HP2100 Buttweld access fittings are designed to be buttwelded directly to a 2” pipe end.

3. **Socketweld** – HP3000/HP3100 Socketweld fittings are designed to be welded directly to a 2” socket end.

4. **NPT** – HP4000/HP4100 NPT fittings can be threaded into a 2” female NPT fitting.

5. **Flanged** – Flanged fittings are available in three standard configurations:
   a. ANSI Ring Joint (RJ) – HP5000/HP5100
   b. ANSI Raised Face (RF) – HP6000/HP6100
   c. API – HP7000/HP7100
Access fittings are manufactured from materials which conform to NACE MR-0175 specifications for sour service. Choice of material for the access fitting body is based on minimum operating temperature as well as process stream corrosivity. "Standard" temperature materials are suitable for use above a minimum operating temperature of -20°F (-29°C). "Low Temperature" materials should be selected for minimum operating temperatures below this value.

The Metal Samples standard material specification for Flareweld Socketweld, Buttweld, and NPT bodies is AISI 1018 for standard temperature and ASTM A350LF2 for low temperature. For flanged fittings, ASTM A105 is used for standard temperature and ASTM A350LF2 for low temperature. However, all access fitting components can be made to order in any customer-specified material; carbon or stainless steel, duplex materials, or other more exotic alloys.

All access fitting bodies have an external 3-inch ACME thread, which is used to attach the service valve during retrieval operations. Access fitting bodies should always be fitted with a cover which is designed to protect both external thread and also the service valve sealing surfaces.
**Tee Type & Non-Tee Types**

Access Fitting Bodies are available as either **non-tee types** or **tee types**.

Non-tee access fitting bodies are used in applications such as coupon holders and monitoring probes.

Tee type access fitting bodies are used in applications where inlet or outlet access to the process stream is required.

A side-tee port is drilled and tapped in the access fitting’s extra thick body to provide an integral connection point for a nipple and shut-off valve arrangement. Fittings with 1/4", 1/2", 3/4", or 1" FNPT side-tee ports are available as standard items.

Tee type access fitting bodies are used with Chemical Injection Systems, Sampling, and Sand Monitoring Systems. If required, the side-tee port may be sealed off with a pipe plug. This would allow devices normally used with the non-tee type access fittings to be used with the tee type access fittings. **NOTE:** The installation and removal of the pipe plug requires the process stream to be shut down and depressurized.

The materials of construction of tee type access fitting bodies are the same as the non-tee type access fitting bodies.

*Injection System using a Tee Type Access Fitting Body*
Non-Tee Types

<table>
<thead>
<tr>
<th>Model</th>
<th>Height (in)</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP1000 Flareweld</td>
<td>5.25</td>
<td>5.5</td>
</tr>
<tr>
<td>HP2000 Butt weld</td>
<td>5.25</td>
<td>4.5</td>
</tr>
<tr>
<td>HP3000 Socket weld</td>
<td>6.25</td>
<td>4.5</td>
</tr>
<tr>
<td>HP4000 NPT</td>
<td>6.25</td>
<td>4.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flange Size</th>
<th>Height (in)</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150#</td>
<td>5.25</td>
<td>10.50</td>
</tr>
<tr>
<td>300#</td>
<td>5.25</td>
<td>11.50</td>
</tr>
<tr>
<td>4/600#</td>
<td>6.25</td>
<td>15.25</td>
</tr>
<tr>
<td>9/1500#</td>
<td>6.25</td>
<td>30.75</td>
</tr>
<tr>
<td>2500#</td>
<td>6.25</td>
<td>40.00</td>
</tr>
</tbody>
</table>

Temperature Rating: -20°F (−28.9°C) to +350°F (176.6°C)
Pressure Rating: 6000 PSI or as Flange Size
## Tee Types

<table>
<thead>
<tr>
<th>Model</th>
<th>Flange Size</th>
<th>1/4&quot; T</th>
<th>1/2&quot; T</th>
<th>3/4&quot; T</th>
<th>1&quot; T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model HP1100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flareweld</td>
<td></td>
<td>5.25</td>
<td>4.5</td>
<td>6.25</td>
<td>5.75</td>
</tr>
<tr>
<td>Model HP2100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buttweld</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model HP3100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socketweld</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model HP4100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Temperature Rating:
-20° F (28.9° C) to +350° F (176.6° C)

### Pressure Rating:
6000 PSI or as Flange Size
### Attaching the Access Fitting Body

Access Fitting Bodies which have a welded end connection (flareweld, buttweld, or socketweld), must be welded according to local and plant codes.

NPT type access fittings are manufactured in accordance with ANSI/ASME B1.20.1 -Specification for Taper Pipe Threads. This fitting should be installed by a qualified technician using standard protocol for taper pipe threads.

ANSI flange fittings are manufactured in accordance with ANSI B16.5 – Specification for Flanges and Flanged Fittings. Flange gaskets and stud-and-nut sets are not provided with the access fitting body. This fitting should be installed by a qualified technician using standard protocol for flange installation.

### General Welding Instructions

1. Determine if the system in which the access fitting is to be placed will permit welding.

2. Remove the plug assembly from access fitting prior to welding.

3. Protect the internal and external threads from weld splatter with a temperature resistant cloth wrapped around the body and dampened on the outside only.

4. Place the access fitting on the line and align.

5. Establish proper weld gap by placing 1/16" spacer rods under the access fitting.

6. Most steels should be preheated prior to welding when the fluid or metal temperature is less than 50°F.

7. Arc welding should be used to minimize warping.

8. Preheat access fitting body to 400°F and tack weld, using AWS 1/8" welding rod of the proper grade.


10. Tie the root pass into the tack weld to make complete fusion. Apply a stringer bead around the base of the fitting, removing slag at each pass.

11. Tempil sticks should be used to insure that the access fitting body temperature does not exceed 1000°F.
12. Apply continuous cover beads to fill the bevel.

13. Apply a post heat of 600°F for fifteen (15) minutes. Wrap with insulating cloth and allow to cool.

14. Hot tapping will be necessary for lines in service.

    **Note:** *Weld time approximately one (1) hour with welder and helper.*

The procedure described above is for general access fitting installation reference. Metal Samples **shall not** be held responsible or liable in any way for loss or damage resulting therefrom, or any regulations which they may conflict.
**Plug Assemblies**

The Plug Assembly is the retrievable carrier which holds corrosion monitoring, chemical injection, or various other devices which may be installed through the access fitting. There are two distinct types of plug assemblies - the Solid Plug and the Hollow Plug.

The plug assembly screws into the bore of the access fitting body and is designed to seal the fitting against line pressure. When tee type access fittings are being used, a pipe plug or nipple and shut-off valve is additionally required to seal the fitting.

The standard material of construction for the plug assembly is 316 Stainless Steel. It should be noted that when stainless steel or duplex materials are specified for the access fitting body, the plug assembly should be specified to be Nitronic 60 to prevent thread galling.

All plug assemblies are individually pressure tested at the factory and are rated for operation at 3600 psi. The operating temperature range for standard plug assemblies is -50°F (-45°C) to 350°F (176°C), but this range can be extended by use of alternative sealing materials.
Solid Plugs

Solid plugs carry coupon holders, injection/sampling systems, sand probes, and bioprobes.

The solid plug nut is unscrewed from the base of the plug and replaced by the device being installed. A left-hand thread is used to ensure that installed devices do not become loose during the retrieval procedure.

Pipe Plug – Protects internal threads and provides secondary backup seal. Must be removed during retrieval operations.

Solid Plug Body

O-Ring Seal

Primary Packing Seal

Solid Plug Nut – Only used when no other device is attached.

<table>
<thead>
<tr>
<th>Description</th>
<th>Part No.</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Plug</td>
<td>HA700697158</td>
<td>316SS</td>
</tr>
<tr>
<td>Solid Plug Body</td>
<td>HA700006158</td>
<td>316 SS</td>
</tr>
<tr>
<td>O-Ring</td>
<td>HA700600834</td>
<td>Viton®</td>
</tr>
<tr>
<td>Primary Packing</td>
<td>HA700266785</td>
<td>PTFE (25% G)</td>
</tr>
<tr>
<td>Solid Plug Nut</td>
<td>HA7002101 58</td>
<td>316 SS</td>
</tr>
<tr>
<td>SetScrew</td>
<td>09158E1032ST0187</td>
<td>316SS</td>
</tr>
</tbody>
</table>
Hollow Plugs

Hollow plugs are used with electrical resistance probes, linear polarization resistance probes, and hydrogen probes.

To connect these devices, the hollow plug seal nut is removed and the monitoring device is screwed into the female thread in the base of the hollow plug. A left-hand thread is used. Access is allowed through the top of the hollow plug for electrical connections to be made directly to probes for the purpose of taking readings.

<table>
<thead>
<tr>
<th>Description</th>
<th>Part No.</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Plug</td>
<td>HA700167</td>
<td>Plastic</td>
</tr>
<tr>
<td>Hollow Plug Body Anti-Gall Coating</td>
<td>HA700300158</td>
<td>316 SS</td>
</tr>
<tr>
<td>Primary Packing</td>
<td>HA700266785</td>
<td>PTFE (25% G)</td>
</tr>
<tr>
<td>Hollow Plug Nut</td>
<td>HA700302158</td>
<td>316 SS</td>
</tr>
<tr>
<td>Set Screws (2)</td>
<td>09158E1032ST0187</td>
<td>316 SS</td>
</tr>
<tr>
<td>Probe Packing</td>
<td>HA700277785</td>
<td>PTFE (25% G)</td>
</tr>
<tr>
<td>Hollow Plug Bore Sealing Nut</td>
<td>HA700311158</td>
<td>316 SS</td>
</tr>
</tbody>
</table>

Thread Protector – Must be removed during retrieval operations.

Hollow Plug Body.

Primary Packing Seal.

Hollow Plug Nut.

Device Seal.

Bore Seal Nut – Only used when no other device is attached.
Installing & Orienting the Plug

If the corrosion monitoring device requires radial orientation with the product flow (coupon holder, LP probe, injection quill, etc.), you will need to “reference” or “index” the plug assembly by filing a notch across the top of the hex (see left). The notch should be filed so that the device can be aligned with the product flow. Apply an appropriate grease to the full length of the plug.

If inserting the plug under pressure, use the Retriever Tool and Service Valve.

If inserting the plug manually, thread the plug assembly into the access fitting body. Do not use excessive force and be sure that the threads engage properly to prevent cross-threading.

The reference mark as previously mentioned must now be aligned to product flow direction. Turn the plug assembly hex clockwise until the mark aligns to the flow direction.

Make sure the fitting is clean and dry, and install the thread protecting pipe plug into the top of the plug.
Protective Covers

Protective covers are designed with internal threads which mate with the access fitting body and are recommended to prevent damage to the fitting’s exterior thread. In addition, they protect the surfaces against which the service valve seals during retrieval operations.

Heavy Duty Pressure Rated Covers

Heavy duty pressure rated covers are manufactured as standard in AISI 1018 and are supplied with a paint coat finish suitable for the most aggressive environments. Covers are individually pressure tested for a pressure rating of 4000 psi and are available with an optional bleed valve and/or pressure gauge.

Covers are available with or without a center hole. Center holes are required when an external sensor connection is required to be permanently installed. Covers with an unthreaded 1 3/8” (3.5 cm) diameter center hole are required for installations where mechanical Hydrogen Probes are installed. Covers with a 1/2” NPT center hole are required where continuous monitoring of electrical probes is required. Connection of an electrical probe to a permanent monitoring instrument requires the use of a probe adapter that extends through the 1/2” hole in the cover. The probe adaptor must be ordered separately.

Non-Pressure Rated Covers

More economical than heavy duty pressure rated covers, non-pressure rated covers are internally threaded to protect against mechanical damage to the external access fitting threads. Non-pressure rated covers are available in plastic or metal, with the plastic version having the added advantage of being lightweight and non-sparking. They can be ordered with or without a center hole.
## Protective Covers – Part Numbers

<table>
<thead>
<tr>
<th>Description</th>
<th>Application</th>
<th>Part No.</th>
<th>Material</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Pressure Rated Cover without Hole</td>
<td>Intermittent Monitoring - Chemical Injection</td>
<td>HA700734C25</td>
<td>A350 LF2 Carbon Steel</td>
<td>2.5 lbs.</td>
</tr>
<tr>
<td>Non-Pressure Rated Cover w/ 1/2&quot; NPT Hole</td>
<td>Continuous Monitoring</td>
<td>HA700732C25</td>
<td>A350 LF2 Carbon Steel</td>
<td>2.0 lbs.</td>
</tr>
<tr>
<td>Non-Pressure Rated Cover without Hole</td>
<td>Intermittent Monitoring</td>
<td>HA700436709</td>
<td>Nylon</td>
<td>0.5 lbs.</td>
</tr>
<tr>
<td>Non-Pressure Rated Cover w/ 1/2&quot; NPT Hole</td>
<td>Continuous Monitoring</td>
<td>HA700435709</td>
<td>Nylon</td>
<td>0.5 lbs.</td>
</tr>
<tr>
<td>Heavy Duty Pressure Rated Cover w/o Hole</td>
<td>Intermittent Monitoring (rated for 6,000 PSI)</td>
<td>HA700735C25</td>
<td>A350 LF2 Carbon Steel</td>
<td>9 lbs.</td>
</tr>
<tr>
<td>Heavy Duty Pressure Rated Cover with 1/2&quot; NPT Hole</td>
<td>Continuous Monitoring - provides a secondary seal and allows for probe adapter (rated for 6,000 PSI)</td>
<td>HA700731C25</td>
<td>A350 LF2 Carbon Steel</td>
<td>9 lbs.</td>
</tr>
<tr>
<td>Heavy Duty Pressure Rated Cover and Bleed Valve</td>
<td>Continuous Monitoring - provides a secondary seal (rated for 6,000 PSI)</td>
<td>HA700480C25</td>
<td>A350 LF2 Carbon Steel (cover), 316 SS (bleed val.)</td>
<td>9 lbs.</td>
</tr>
<tr>
<td>Heavy Duty Pressure Rated Cover, Bleed Valve &amp; Pressure Gauge</td>
<td>Continuous Monitoring - provides a secondary seal (rated for 6,000 PSI)</td>
<td>HA700481C25</td>
<td>A350 LF2 Carbon Steel (cover), 316 SS (bleed val. &amp; gauge)</td>
<td>10 lbs.</td>
</tr>
<tr>
<td>Heavy Duty Pressure Rated Cover, Bleed Valve, Pressure Gauge and 1/2&quot; NPT Hole</td>
<td>Continuous Monitoring - provides a secondary seal (rated for 6,000 PSI)</td>
<td>HA700482C25</td>
<td>A350 LF2 Carbon Steel (cover), 316 SS (bleed val. &amp; gauge)</td>
<td>9 lbs.</td>
</tr>
<tr>
<td>Heavy Duty Pressure Rated Cover w/ Bleed Valve &amp; 1/2&quot; NPT Hole</td>
<td>Continuous Monitoring - provides a secondary seal (rated for 6,000 PSI)</td>
<td>HA700483C25</td>
<td>A350 LF2 Carbon Steel (cover), 316 SS (bleed val.)</td>
<td>9 lbs.</td>
</tr>
<tr>
<td>Heavy Duty Pressure Rated Cover w/ Pressure Gauge &amp; 1/2&quot; NPT Hole</td>
<td>Continuous Monitoring - provides a secondary seal (rated for 6,000 PSI)</td>
<td>HA700484C25</td>
<td>A350 LF2 Carbon Steel (cover), 316 SS (gauge)</td>
<td>9 lbs.</td>
</tr>
</tbody>
</table>
**Cover Installation & Removal**

All pressure retaining covers are supplied with an internal o-ring. Ensure that the o-ring is installed into the internal groove. Ensure the external threads on the access fitting body are clean and dry. Lubricate the threads with an appropriate grease, and thread the cover onto the fitting. Non-pressure retaining covers can be installed hand-tight. Pressure retaining covers should be tightened with a spanner wrench. To remove the cover, unscrew the cover from the fitting, using a spanner wrench to loosen the cover, if required. If pressure retaining covers are used, be sure all pressure is bled from the cover before removal. If it is not possible to bleed pressure, the cover should not be removed until the line is depressurized.
Maintenance Procedure for High Pressure Access Systems

1. High Pressure Plugs – Leak Maintenance

   If the high pressure solid/hollow plugs are leaking: remove the plug, replace the primary and secondary seals to prevent further leaks. If this does not solve the issue, please contact Metal Samples for support.

2. External Corrosion of Access Fittings (Mainly Applies to Carbon Steels)

   If the coating of an installed access fitting is damaged or not sufficiently covering the fitting, re-apply coating to ensure that external corrosion does not occur. If coating is removed and external corrosion has occurred, grit blast the fitting and re-apply coating.

3. Access Fitting Cover – Thread Maintenance

   If the cover is difficult to remove from the access fitting, remove the cover and re-apply lubricant/grease to ensure smooth threading of the cover back onto the access fitting. If this does not solve the problem, please contact Metal Samples for support.