

Maxum II

PD PA AP Maxum II Valves and Oven Components

Service Manual

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(TCM)

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Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

DANGER

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WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

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Oven Types

Chromatographic separations of samples are carried out inside the oven zone of the Maxum II analyzer. For most separations to be performed, the oven must be kept at an elevated temperature. This means that the oven zone must have a heat source, while simultaneously preventing that heat source from being capable of igniting flammable vapors which might be present within the oven. This is accomplished by the oven heater system.

A variety of oven configurations are available for the Maxum II. For isothermal analyses which use a single set temperature, airbath, airless, and modular ovens are available. Since the Maxum II is capable of performing analyses simultaneously on multiple trains (parallel chromatography), the airbath oven is available as either a single oven or as a split oven configuration that offers two independent temperature zones. The airbath oven heats by convection. The airless oven heats by conduction and is available in the dual or single configuration. For configurations requiring only one airless oven, the second oven compartment is left unequipped. The modular oven functions in a manner similar to the airless oven, heating by conduction. Either one or two independent modular ovens may be equipped in a Maxum II Modular Oven analyzer.

It should be noted that there may be desired operating conditions which are mutually incompatible. It may be desirable to operate an application which requires a very hot oven temperature (for example, the separation of very high molecular weight hydrocarbons or the analysis of some heavy liquid chemicals). It is also possible that there may be flammable gases and vapors present in the area of installation which can ignite at relatively low temperatures (for example, some hydrocarbons). Because of these opposing constraints, it is possible that this example application requires an oven temperature so high that the analysis zone itself becomes a source of ignition. This situation is not permitted. It is the responsibility of the user to ensure that the analyzer is never installed in an area that is not rated appropriately for the oven temperatures required for the application. The temperature rating for the analyzer is specified in the custom documentation package shipped with the analyzer.

Oven temperature is monitored by a resistance temperature device (RTD) sensor and controlled by associated circuitry. This circuitry maintains oven temperature at the software controlled set point along with monitoring actual surface temperatures. Within the oven the highest temperature is found on or near the heater surface and this temperature is limited in different ways depending on configuration.

In the airbath/airless oven configuration, the heater temperature is limited by two set point resistors on a single set point board. These set point resistors are generally located on the Power Entry Control Module (PECM) or on a Detector Personality Module (DPM). Instructions pertaining to this appear in other documentation. However, for reference, a table of highest surface temperatures and area temperature ratings is included at the beginning of this manual.

In a modular oven configuration, the heater block temperatures are limited by the Power Entry Control Module - Direct Current (PECM-DC). Fixed set point resistors are used on the PECM-DC board. The oven temperature never exceeds the surface temperature limit for the T4 temperature rating as identified by the table at the beginning of this manual.

Thus, regardless of configuration, the oven heater system is designed to ensure that the temperatures of the oven heaters are controlled in a safe manner and do not create a fire hazard.

1.1 Isothermal Air Bath Oven Heater System (Single and Split)

The isothermal airbath oven is the most common oven used in the Maxum II. It is available in single and split configurations to accommodate a wide range of chromatographic applications. Because high temperatures are often necessary in order to carry out chromatographic separations, the isothermal airbath oven heater system is equipped with various safety features to prevent ignition.

The approximate internal dimensions of this oven are 580mm ($22\frac{13}{16}$ ") wide, 378mm ($14\frac{7}{8}$ ") high, and 267mm ($10\frac{1}{2}$ ") deep.

1.1.1 Heater Assembly Purge

The airbath oven heater is a purged system. This means that the heater element is located inside an air purged tubular assembly. Clean instrument air continuously flows over the heating element and into the oven. This air flow distributes heat to the oven. An air pressure sense switch mounted on the PCM determines whether air pressure exists in the tubing that supplies air to the heater. If pressure exists, then air is flowing, and the switch is activated allowing the oven heater to be energized. If the switch does not detect pressure, then the heater remains off (power is not supplied to the oven heater). See the photo below. The air supply to the airbath oven heater system must be free of particulates, clean of any hydrocarbon vapors or other flammable materials, and dry.

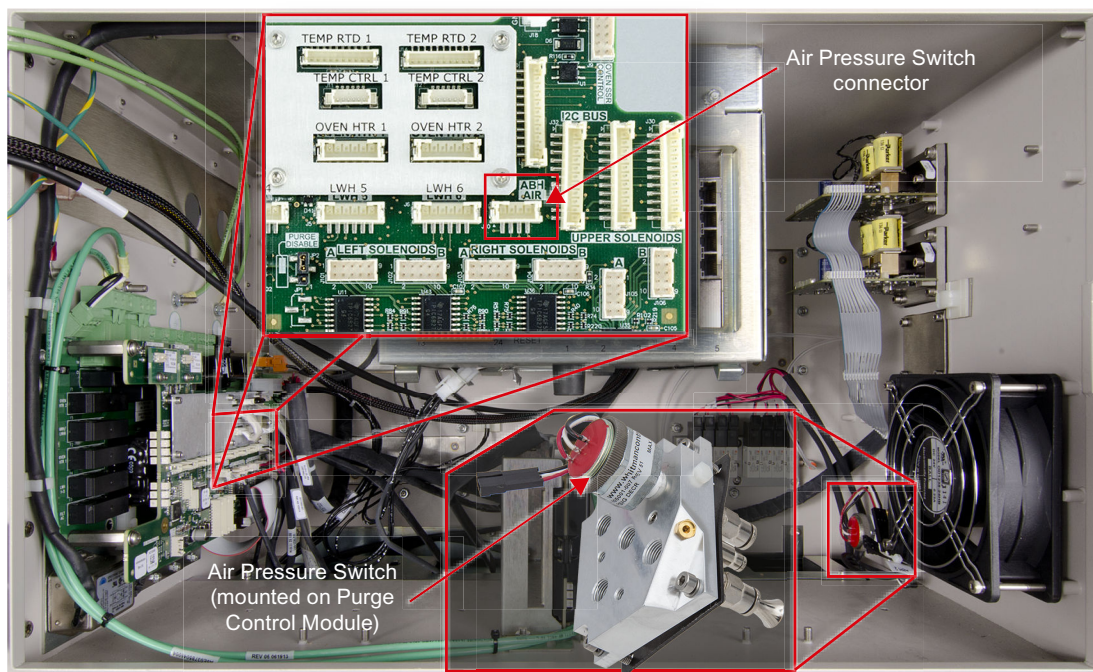


Figure 1-1 Pressure Switch and Purge Control Module

1.1 Isothermal Air Bath Oven Heater System (Single and Split)

The air pressure switch is connected to the oven air flow using an extension that runs parallel to the oven air flow line. This extension line is equipped with a restrictor coil. The coil is necessary in order to create a short delay between the start of air flow and the activation of the pressure switch. This delay forces the oven heater to purge for a short time before the heater is powered up. See the photo below.

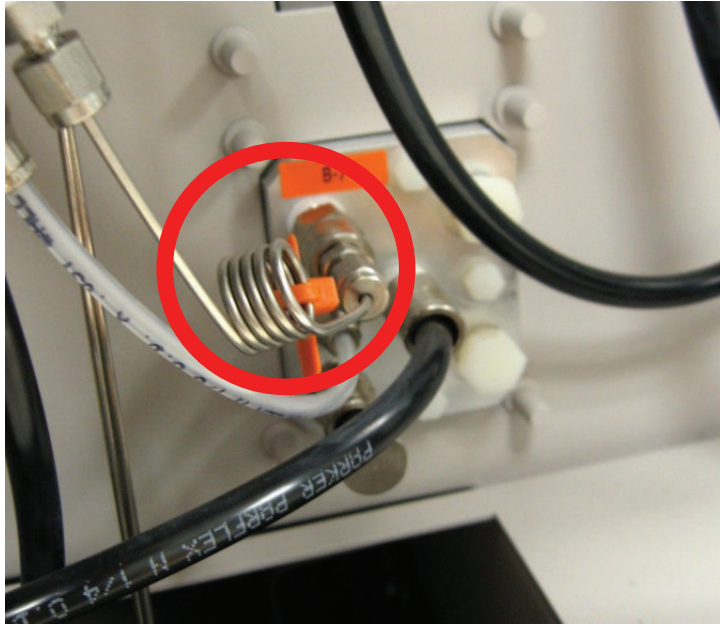


Figure 1-2 Timing Coil for Pressure Switch

1.1.2 Temperature Limiting

The temperature-control path of the oven is controlled via an RTD sensor, set-point resistor, associated circuitry and a solid-state relay. The temperature of the air itself is monitored via two independent control paths which ensure that all temperatures remain below possible ignition limits.

The limits set by the set point resistors determine the "T-rating" of the entire analyzer in any given situation. The sensors are located inside the heater assembly near where the air exits the heater.

The two control paths operate two relays that control the power to the heater. One relay maintains the set point temperature and temperature limit of the heater. The second relay is connected in series with the first relay and is used for overtemperature shutdown.

The first control path has a "temperature limit" (TL) sensor that detects whether the air has reached a certain limit based on the applicable T-rating. If this temperature limit is reached as indicated by this sensor, then the power to the heater is cut until the temperature falls below the limit point.

If a component the TL control path should fail, the overtemperature shutdown (OTS) feature is activated. The "Overtemperature" (OT) sensor, with its separate control circuit and relay, activates at a slightly higher temperature than the TL sensor. If this happens, the power to the oven heater is interrupted. Because this sensor should not activate unless there is a mechanical failure of the TL control path, the power to the heater cannot be reactivated without powering down and restarting the analyzer.

Because the solid-state relays controlled by these two circuits are in series, power is removed from the heater if either one opens.

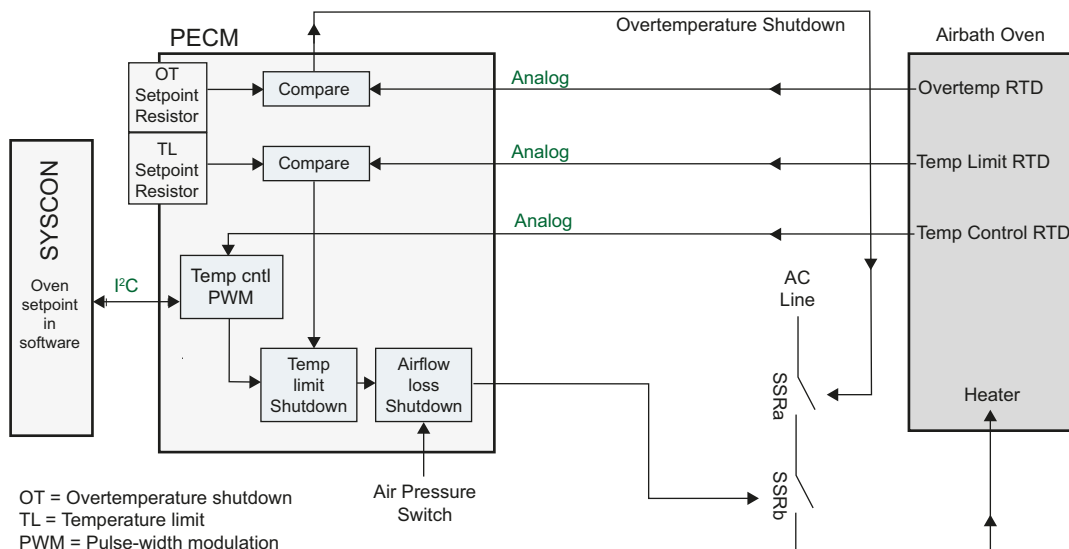


Figure 1-3 Airbath Oven Heater Control Loop

1.2 Programmed Temperature Air Bath Oven Heater System

In chromatographic applications "temperature programming" is used in special situations where incremental increases in column temperature are needed in order to reduce retention time (the time required for separation). In the Maxum II, the programmed temperature airbath oven is a modified version of the isothermal airbath oven. The primary modification is the addition of a "deflector assembly" in the center of the oven. This deflector assembly is a partially enclosed chamber that acts as a much smaller oven compartment which can be heated and cooled quickly.

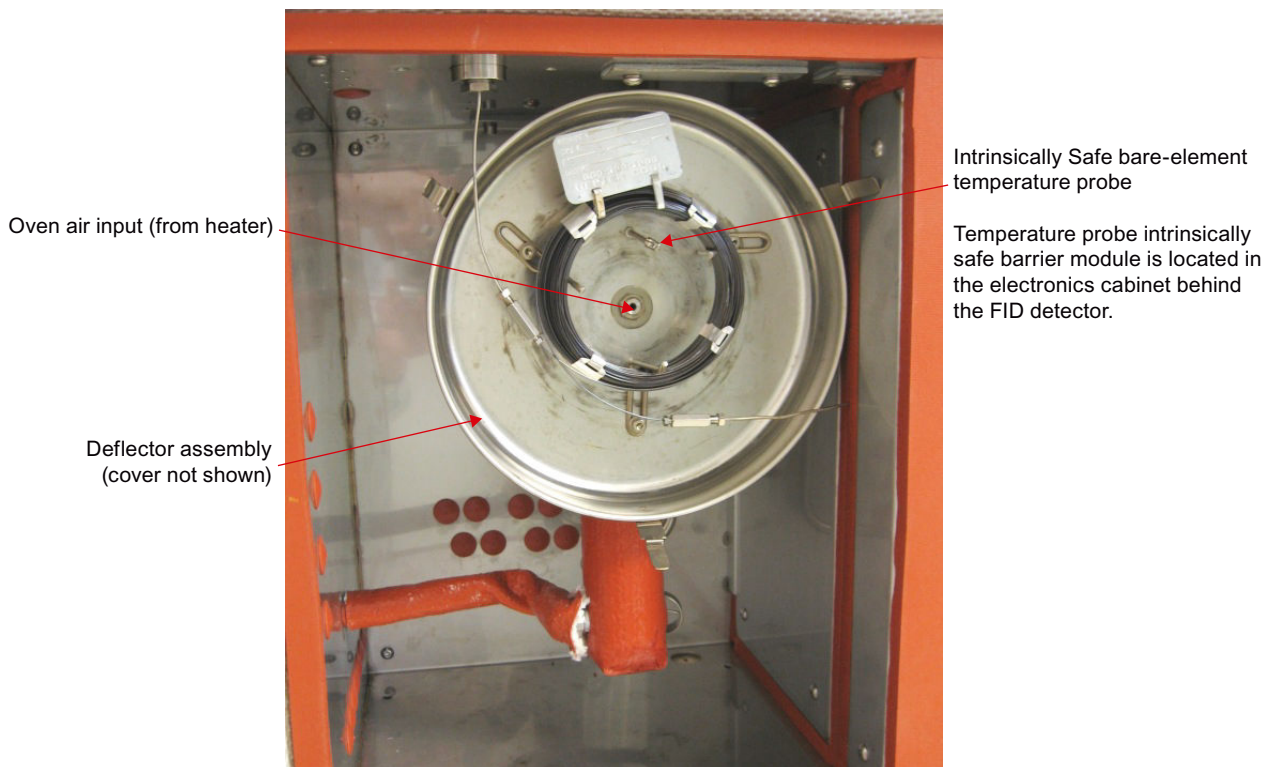


Figure 1-4 Programmed Temperature Airbath Oven (with Deflector)

The chromatographic column is mounted in the center of the deflector assembly along with a temperature sensor. The heated oven air from an airbath heater assembly flows into a hole in the center of the deflector. The interior shape of the deflector allows the temperature of the air around the column to be carefully controlled. The interior shape and small size of the deflector compartment allow the temperature surrounding the column to be modified very quickly such that temperature programming can be used.

Within the Maxum II, temperature control and air purging of the airbath heater is the same for the programmed temperature oven as for the isothermal airbath oven.

1.2.1 IS Probe and Barrier

To maintain a fast measurement response, a bare-element RTD sensor is used for the temperature probe. However, this type of probe must be intrinsically safe. The probe is connected to an IS barrier mounted behind the detector cabinet as shown below. This circuit is thus intrinsically safe.

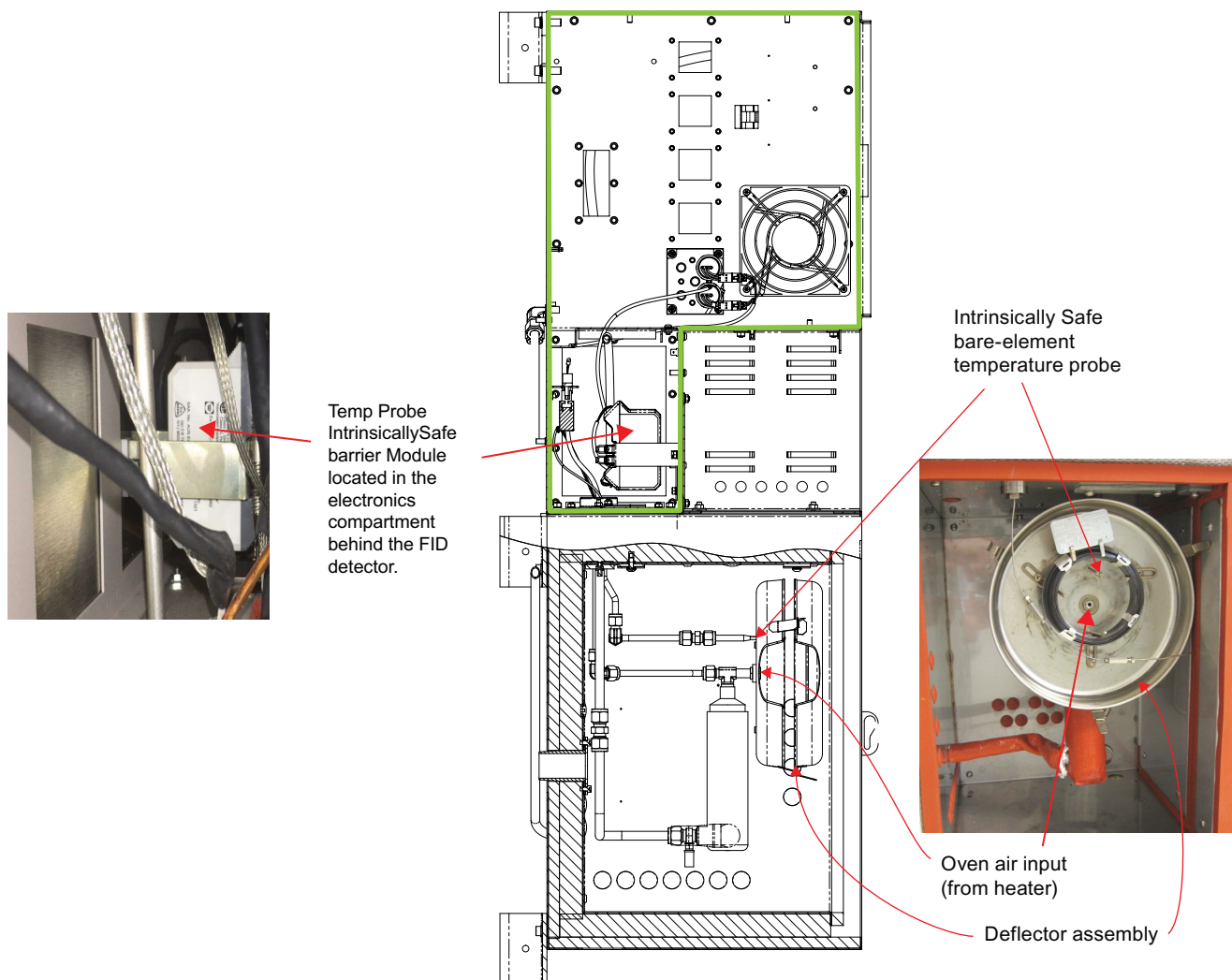


Figure 1-5 Programmed Temperature Air Bath Oven Component Locations

1.3 Isothermal Airless Oven Heater System

The Maxum II airless oven is used to provide a very stable isothermal oven temperature without the need to supply air to control the oven temperature. This allows for excellent chromatographic results while reducing utility costs. The interior of the airless oven is surrounded with heavy aluminum walls that have channels for two cartridge heating elements and temperature sensors. The walls conduct heat to all sides of the oven. The airless oven comes configured as two fully independent ovens with separate oven doors. If only one airless oven compartment is required, then the second compartment is left empty without the aluminum walls and heating elements.

The approximate internal dimensions of this oven are 226mm (8⁷/₈") wide, 346mm (13⁵/₈") high, and 257mm (10¹/₈") deep.



Figure 1-6 Airless Oven

The primary explosion safety system within the Isothermal Airless Oven is the heating and temperature control system. As mentioned above, the oven is heated using two heating elements inserted into explosion-proof channels within the aluminum walls. The temperature of each heating element is detected by a dual-RTD sensor probe that is also inserted into the aluminum wall adjacent to the heating element. The temperature-limit probe and associated circuits are not used with the cartridge heaters. The heaters are controlled by temperature control circuitry on the Power Entry Control Module (or Detector Personality Module) and are set below the applicable T-rating such that exposed surfaces will not exceed the maximum allowable temperature. The locations of the temperature probes and heating elements are shown below.

1.3 Isothermal Airless Oven Heater System

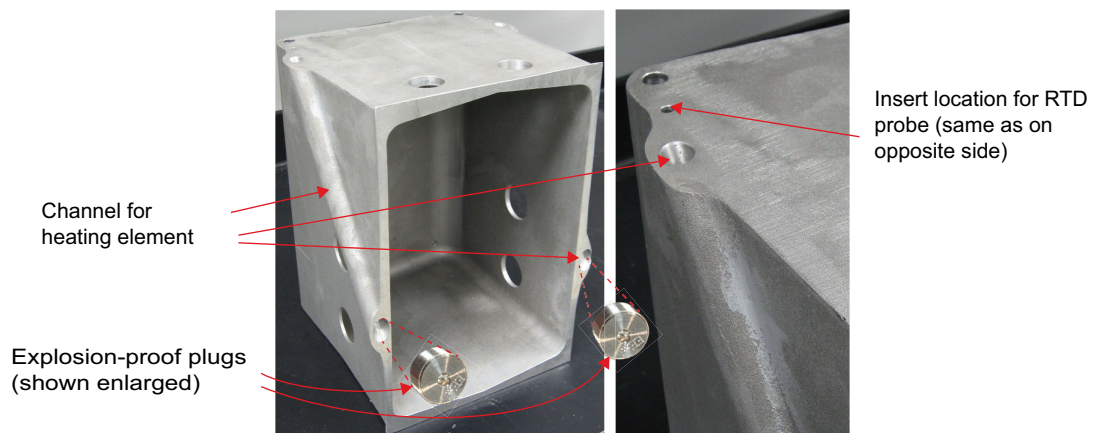


Figure 1-7 Location of Temperature Probes and Heaters in Airless Oven

The heating elements are enclosed in hollow channels running diagonally down the side of the aluminum casing. The heating elements are inserted in the channels from the lower front, and the wires protrude out the top. The probes are inserted from the top as shown in the photo above. During operation, the open ends of the heating element channels are equipped with screw-in, explosion-proof plugs. These plugs must be fully screwed in so that the threads are fully engaged.

The temperature control path of the airless oven is shown below.

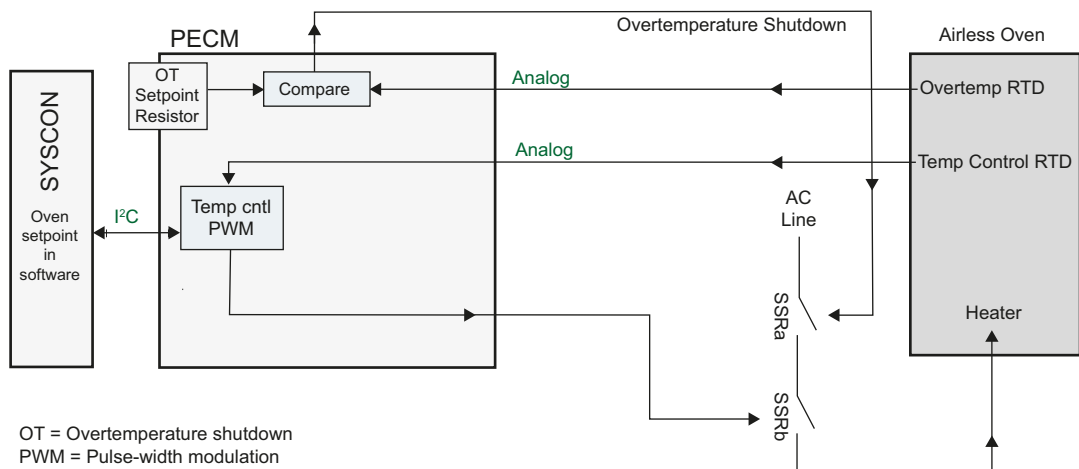


Figure 1-8 Airless Oven Heater Control Loop

Two relays are used to control the power to the heater. One relay powers the heater to maintain the set point temperature of the heater (oven temperature) in the software. The second relay is connected in series with the first relay and is used for overtemperature shutdown. Because the overtemperature shutdown sensor should not activate unless there is a mechanical failure of the set point temperature, its related control circuit or its relay, the power to the heater cannot be reactivated without powering down and restarting the analyzer. Note that the overtemperature shutdown can be triggered by incorrectly entering a setpoint temperature that is too high, such as 250°C when the OT setpoint is 200°C.

1.4 Maintenance Considerations for Airbath and Airless Ovens

The following practices must be observed in order to operate, maintain and prevent compromise of the airbath oven (including programmed temperature oven) and airless ovens of Maxum II. Modular ovens are described in the next section.

- The user must ensure that the analyzer T-rating is suitable for the area in which the analyzer is to be installed. If a particular application requires oven temperatures that are very hot, it may be necessary to locate the analyzer in a different area of the plant that has a better T-rating. It is the responsibility of the user to ensure that the actual, final analyzer T-rating is suitable for the area of installation.
- Instrument air supplied to the airbath oven of the analyzer must be clean and dry as described above. Unsuitable air may cause smoke or other damage to the analyzer and can result in a hazardous condition.
- The set point resistors used to control the T-rating must have the correct value for the desired T-rating. These resistors are installed at the factory and should be changed only by properly trained service personnel. If these resistors are the wrong value, it could be possible for temperatures within the oven to become too hot for the stated T-rating of the analyzer.

Note

Always replace the set point resistor board with the same part number and resistance values. Multiple heated devices in the same analyzer with the same T rating can have different set point resistor values based on the size of the heater and design of the heater housing.

- For the airbath oven, the heater apparatus should be inspected for physical damage. If there are any cracks, bends or other damage, the assembly must be switched off immediately and replaced. All fittings and conduit attachments must be tight and installed according to local codes.
- It is possible for heater elements to burn out. In either oven type, the new heater must be installed using proper techniques.
 - For the airbath oven, if the heater is to be replaced, the factory spare part is a complete sealed system. It cannot be disassembled for repair in the field. If the heater element or any attached components fail, the entire heater assembly must be replaced with a new replacement part from the factory.
 - For the airless oven, it is possible to replace only the heating element.

1.5 Airbath Heater Assembly Replacement

1. Verify work area is safe
2. Disconnect power from analyzer
3. Turn off air supply to analyzer
4. Unplug probe from converter cable at PECM
5. Remove center or left of center Mezzanine Cover
6. Unplug heater power plug in Mezzanine Electronics area
7. Disconnect air inlet and air outlet
8. Remove mounting screws and remove heater assembly
9. Replace in reverse order.

1.6 Airless Heater Replacement

1. Verify work area is safe
2. Disconnect power from analyzer
3. Remove left side mezzanine cover and the center mezzanine cover.
4. Unplug heater power connector in Mezzanine Electronics area
5. Disconnect wires to heater on the connector pins 1 and 2
6. Remove the wires from the wire sleeve.
7. Loosen the 7mm nuts on the mounting plate in mezzanine electronics area to allow the heater to move.
8. Remove mounting plug with a 4mm hex key.
9. Remove heater by sliding it out the front of the analyzer. A M6 bolt may be screwed in the bottom end of the heater and used to wiggle the heater back and forth and pull it out.
10. Replace in reverse order.
11. Slipping a plastic tube in the heater shaft makes it easier to slide the heater wires up the shaft.
12. The plug must be screwed in 5 threads and apply a non-hardening, corrosion proof anti seize containing no evaporates to the heater plug before installing it into the heater housing. (Loctite, silver grade anti-seize 76732)

13. The gasket needs to be set to cover the hole to get the purge in the EC to work properly.

14. Verify the temperature controller and heaters are working properly.

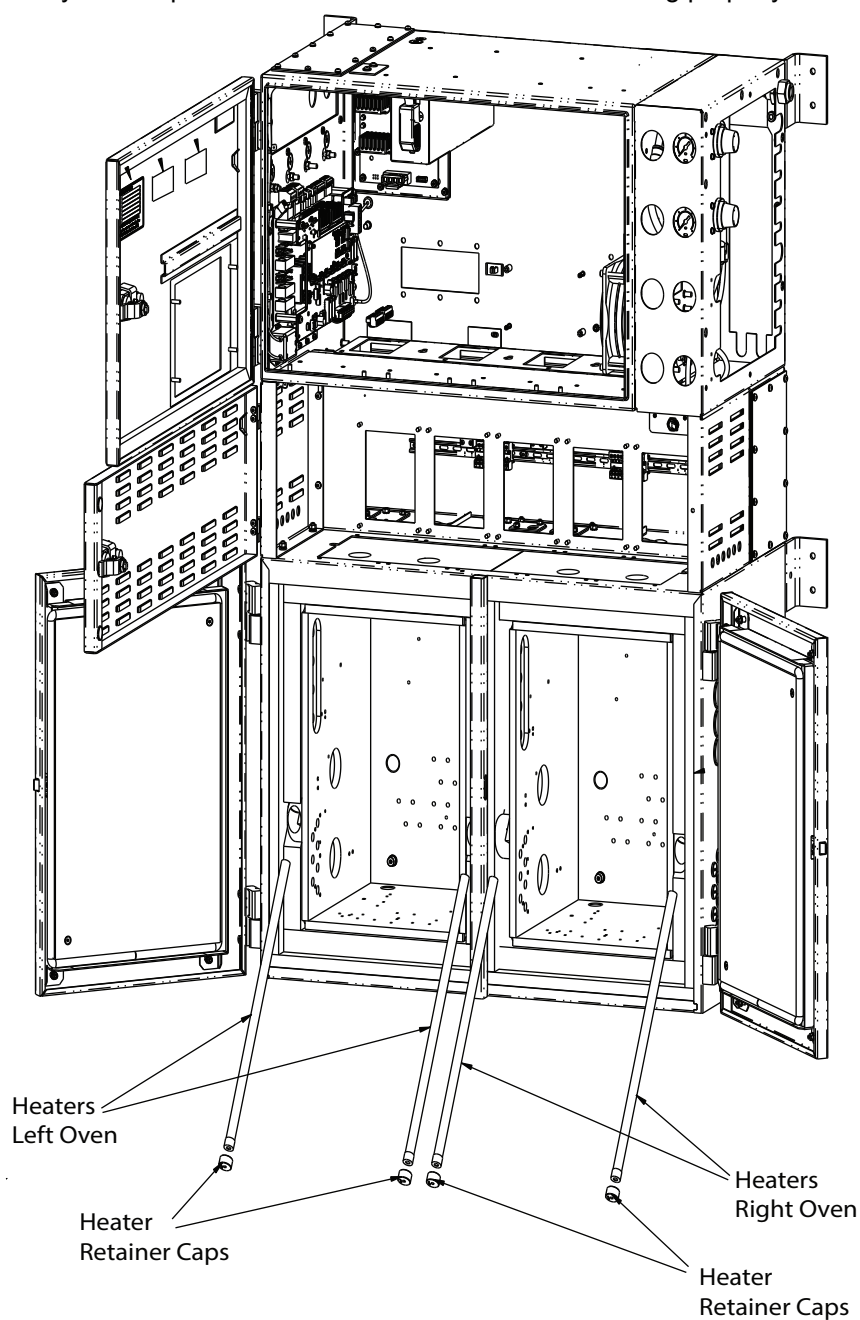


Figure 1-9 Airless Oven Heater Locations

1.7 Modular Oven Heater System

The Maxum II Modular Oven provides a stable isothermal oven temperature for certain lower temperature applications. The hardware of the Maxum II Modular Oven analyzer configuration is simplified and fully modular. Two independent ovens may be installed in the Maxum II Modular Oven analyzer. Each of these may be a smaller or larger oven as shown below. The ovens are designed such that pre-configured application modules may be easily installed and removed. The image below shows a double application module in the right (large) oven and no module installed in the left (small) oven. Visible in the left oven below is the manifold upon which the application module mounts. The large oven has a double manifold and may alternatively have two single sized application modules installed instead of the double size module shown. In normal operation, the modular ovens are covered with face plates (not shown) that are attached using thumb screws.

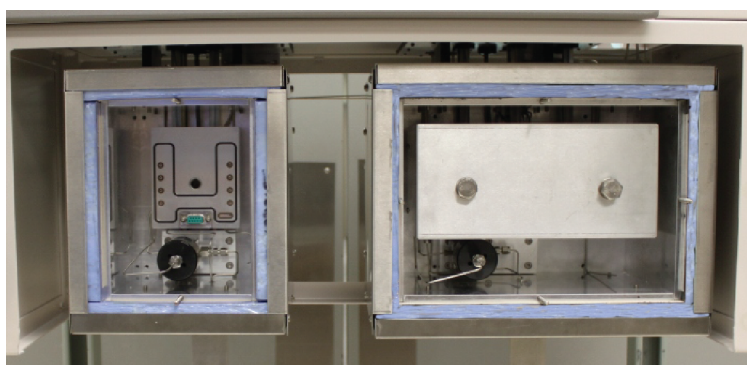


Figure 1-10 Typical Modular Oven Configuration

The oven heater system of the modular oven consists of two heated areas. The first is an ambient control heater element mounted in a small manifold in the bottom rear of the oven. This heater element maintains the temperature inside the oven near the desired temperature for measurement, regardless of the ambient temperature outside the oven within the limits of the analyzer specs. The second heated area is in the application-module manifold and the mounted application module. The heater elements in the application-module manifold maintain the temperature inside the application module at the desired temperature for measurement. A small modular oven has one analytical heater element and a large oven has two analytical heater elements (one for each side of the manifold).

Although they are mounted within manifolds inside of the modular oven, the heater elements are installed in tubes that extend down from the electronics cabinet (EC) as shown in the figure below. These tubes are separated from the oven by the aluminum walls of the manifolds. In this way, the heaters are part of the purged space in the EC. As such, they are prevented from being an ignition source.

Temperature for the modular oven heater system is detected and limited by RTD sensor probes that are also embedded in tubes that extend down from the EC. These tubes run adjacent to the tubes for the heater elements. These probes are connected to temperature control circuitry on the Power Entry Control Module - Direct Current (PECM-DC).

The oven heater system of the Maxum II Modular Oven never exceeds the surface temperature limit applicable to a T4 temperature rating.

Two relays control the power to the heater. One relay maintains the set point temperature of the heater (oven temperature) in the software. The second relay is connected in series with the first relay and is used for overtemperature shutdown. Because the overtemperature shutdown sensor should not activate unless there is a mechanical failure of the set point

temperature, its related control circuit or its relay, the power to the heater cannot be reactivated without powering down and restarting the analyzer.



Figure 1-11 Heater and RTD Tubes for the Modular Oven

1.8 Maintenance Considerations for Modular Ovens

The following practices must be observed in order to operate, maintain and prevent compromise of the Maxum II Modular Oven heater system.

- The installation of the heater elements and RTDs should be inspected to verify that they are fully inserted into the tubes as shown in the previous section. Heater wiring should be inspected for any damage and proper connection to the PECM-DC.
- Application modules should be properly installed with their cover plates, and the face plate of the modular oven should be installed and secured with the provided thumb screws.
- Because of the relatively low operating temperature, low power, and stable temperature applications, the expected life of the heater elements is expected to be many years. However, if a heater element burns out, replacement is possible.

Using Small Tubing Fittings

Two main types of fittings are used in Maxum II analyzers for the small $1/16$ " tubing used for the detectors. The first, (Valco or Swagelok) use a metal-to-metal seal that results from compressing a ferrule. The second, (Siemens) uses a PTFE seal and a compression ring to create a seal.

Assembling Valco and Swagelok Fittings

The ports are machined for a $1/16$ " Valco internal nut. The Valco ferrule or the 2-piece Swagelok ferrule can be used. It is important to follow the manufacturer's procedures when cutting tubing and seating ferrules to ensure that the fitting does not leak.

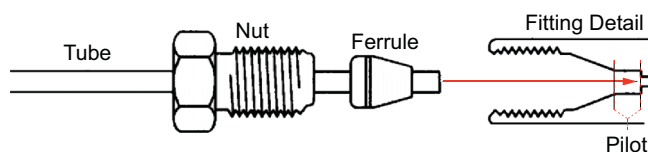


Figure 2-1 Valco Fitting

Use a wheel-cutting tool (such as Supelco 58692-U) to score the tubing, and then with a pair of straightening pliers (such as Supelco 58646) and a pair of needle nose pliers, snap the tubing at the score line. Make certain that all tubing ends are cut square with the tube axis, and that both the inside and the outside of the tube are thoroughly deburred; use a deburring tool (such as Supelco 58804). Inspect the end of the tubing where the ferrule will seat for scratches along its length. Visible scratches along the tubing where the ferrule will seat are not acceptable, but those behind the front edge of the ferrule will not interfere with the integrity of the fitting.

1. Slide the nut and ferrule onto the tubing.
2. Insert this assembly in the fitting detail (valve body), screwing the nut 2 or 3 turns by hand.
3. Push the tubing all the way forward into the fitting pilot so that it seats firmly.
4. Manually turn the nut until it is finger tight.
5. Turn the nut $1/4$ turn (90 degrees) past the point where the ferrule first starts to grab the tubing.
6. Remove the fitting and inspect it. The ferrule may be free to spin axially on the tubing but should have no lateral movement along the tubing. If it does, reinstall the fitting and tighten it another $1/8$ turn past finger tight. Remove, re-inspect and repeat if necessary.

Comparing Fitting Types

The Valco fitting seals the connection by 'biting' into the tubing to form a secure metal-to-metal seal. As noted above, scratches on the tubing can compromise the sealing action and cause leaks. To replace a Valco fitting, the tubing must be cut to remove the old ferrule. This creates a problem when the tubing is part of a flameproof enclosure such as found on the Ex TCD block. These tubes may not be shortened.

The Siemens fitting compresses the PTFE seal material so that it deforms and fills the space around the tubing and inside the compression ring and port. The PTFE seal fills in small scratches in the tubing, and can be replaced without cutting the tubing. The Siemens fitting can withstand more connect-disconnect cycles than the Valco fitting.

The type of fitting used is application dependent.

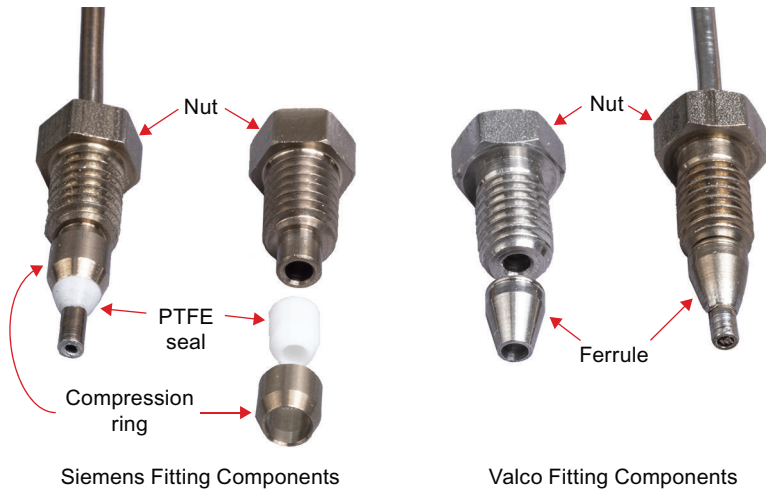


Figure 2-2 Siemens and Valco Fittings Compared

Assembling Siemens Fittings

The Siemens fitting has a PTFE seal insert that fits over the tube, and is held inside a compression ring.

1. Slide the nut over the tubing.
2. Slide the PTFE seal over the tubing and towards the tip of the nut.
3. Place the compression collar over the seal so that the tip of the seal protrudes through the compression collar. The illustration below shows how the parts fit together, along with a cutaway view of how the compression ring works to create a secure seal.

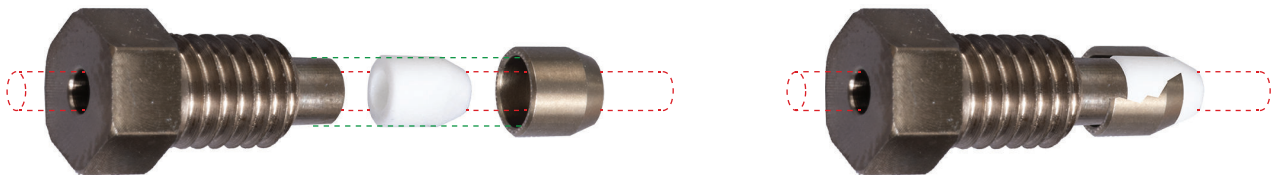


Figure 2-3 Siemens Fittings Assembly

4. Insert the fitting into the port, making sure that the tubing is seated firmly into the pilot hole.
5. Tighten the nut to finger tight.
6. Then use a small 6 mm wrench to tighten to 1.695 to 1.921 Nm (15 to 17 in-lbs) of torque. (If the installation is too crowded to use a torque wrench, use a torque wrench on an external object to get a feeling for the exertion required to produce 15-17 inch-pounds of torque.)

Temperature Control Module (TCM)

Overview

The Temperature Control Module (TCM) is identical to the Base3 DPM except that it includes only the temperature-control components. This is useful when extra temperature-control functions are needed.

A Location ID Switch is also included, and functions as described in *Location ID Switch* in the *Base3 DPM* section.

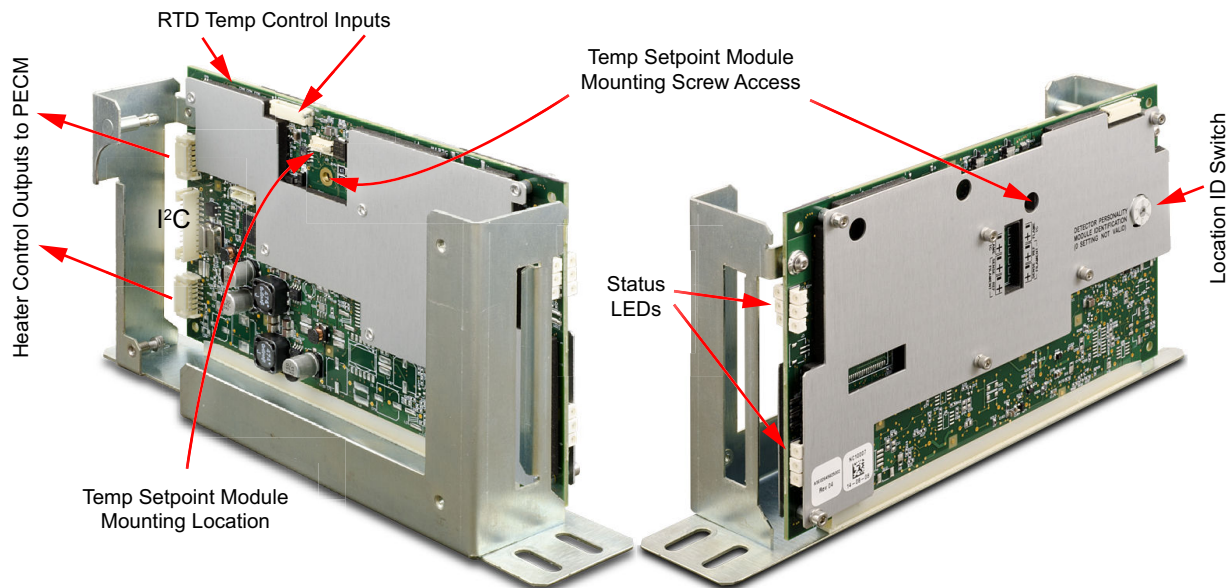


Figure 3-1 Temperature Control Module Connections

The Temperature Control Module (Part Number A5E02645925002) can be used as a replacement part for the temperature-control functions of earlier DPMs in Maxum I analyzers using an adapter, part number A5E34938458001.

3.1 Replacing a TCM

Removing the TC-DPM

See the illustration *Temperature Control Personality Module Connections* for connector and module locations.

1. Back up and shut down the unit using the *General Analyzer Shutdown Procedure* in the Maxum Edition II Analyzer General Maintenance Manual (A5E42019842001) from the Siemens web site (<http://support.industry.siemens.com/cs/products?dtp=Manual&pnid=17741>).
2. Open the electronics enclosure door.
3. Disconnect the RTD temperature input cables (top rear of unit, if present).
4. Remove the nut on the bottom-front of DPM bracket.
5. Slide the unit forward to disengage the rear mounting lug.
6. Lift the unit up and part way out of the enclosure.
7. Disconnect the I²C/power cable and temperature control output cables from the rear edge of the board.
8. Remove the unit from the analyzer and place on ESD-safe work surface.
9. Unscrew the mounting screw for the temperature setpoint module stack using the access hole near the center of the metal plate.
10. Unplug the temperature setpoint module stack from the left side of the board.
11. Remove the two mounting screws near the upper corners and remove the old unit from the cage.

Configuring the New TC-DPM

Set the location ID switch on the replacement unit to match the unit being removed.

Installing the Replacement TC-DPM

1. Install the new unit into the DPM cage. Insert the bottom edge into the slot in the plastic DPM mounting rail on the DPM cage, and secure with the two screws removed from the old unit.
2. Plug the temperature setpoint module stack onto its mount on the left side of the unit.
3. Reinstall the screw to secure the temperature setpoint module stack through the access hole on the right side of the unit.
4. Insert the rear lug into the slot at the rear of the DPM mounting position with the mounting stud at the front inserted through the slot in the DPM bracket.
5. Slide backward to lock the rear mounting lug into the slot.
6. Reinstall the nut on the threaded stud to secure the DPM.
7. Reconnect the I²C/power cable and temperature control output cables from the rear edge of the board.

8. Reconnect the RTD temperature input cables (top rear of unit, if present).
9. Follow the steps in the *General Analyzer Startup Procedure* in the Maxum Edition II Analyzer General Maintenance Manual (A5E42019842001) from the Siemens web site (<http://support.industry.siemens.com/cs/products?dtp=Manual&pnid=17741>).

3.1 Replacing a TCM

Valves

4.1 Solenoid Valves

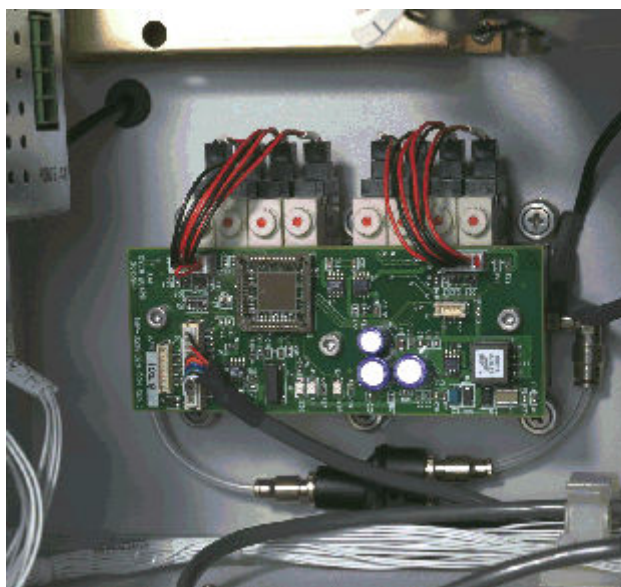
4.1.1 Solenoid Valve Control Module (SVCM)

The Solenoid Valve Control Module (SVCM) provides pneumatic interface to control flow to the oven sampling and column valves. Solenoid valves are suitable for air, nitrogen and helium on the pressure side and vacuum on the vent side. The electronic enclosure has space for up to three modules.

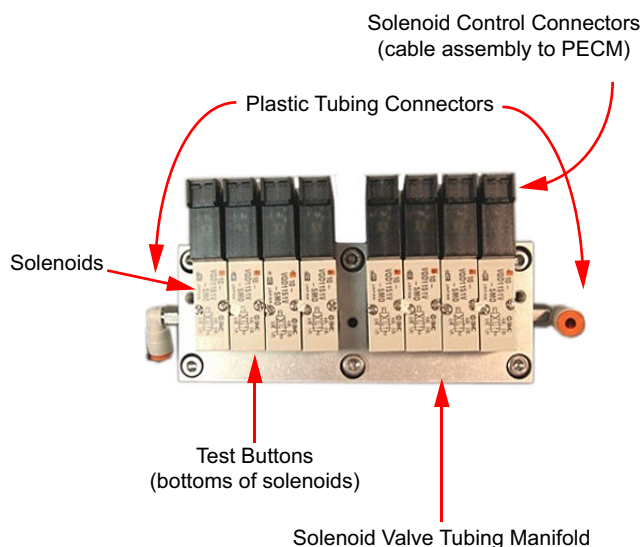
SVCM Versions

There are two configurations of SVCM. The old version, which is still supported as a spare part, is equipped with a valve driver circuit board. For the newer version of the SVCM, this valve drive circuitry has been moved to the PECM module (PECM-DC in the Modular Oven model). The newer version is more reliable and robust.

The SVCM electronics, whether onboard for the old version or on the PECM for the new version, receives commands from the SYSCON module via the I²C bus. Pulse timing is controlled from the SVCM electronics.



Legacy SVCM



Present SVCM

Figure 4-1 Solenoid Valve Control Module (SVCM)

Mechanical

Each SVCM incorporates 8 solenoid valve circuits for driving 3-way and 4-way solenoid valves. The SVCM is mounted in the Controller Enclosure on the manifold block. It can also be mounted in a Division 2 purged enclosure. Up to 3 SVCM assemblies can be mounted in the Maxum II. This allows up to twelve 3-way solenoids and twelve 4-way solenoids. SVCM-1 is mounted in the lower right portion of the back wall. SVCM-2 is mounted in the lower left portion of the back wall. SVCM-3 is mounted (vertically) in the upper right portion of the back wall. The original SVCM is equipped with Parker solenoids. The newer SVCM is equipped with SMC solenoids. Manifold in/out SST tubing connections incorporate one-touch push-type tubing connectors.

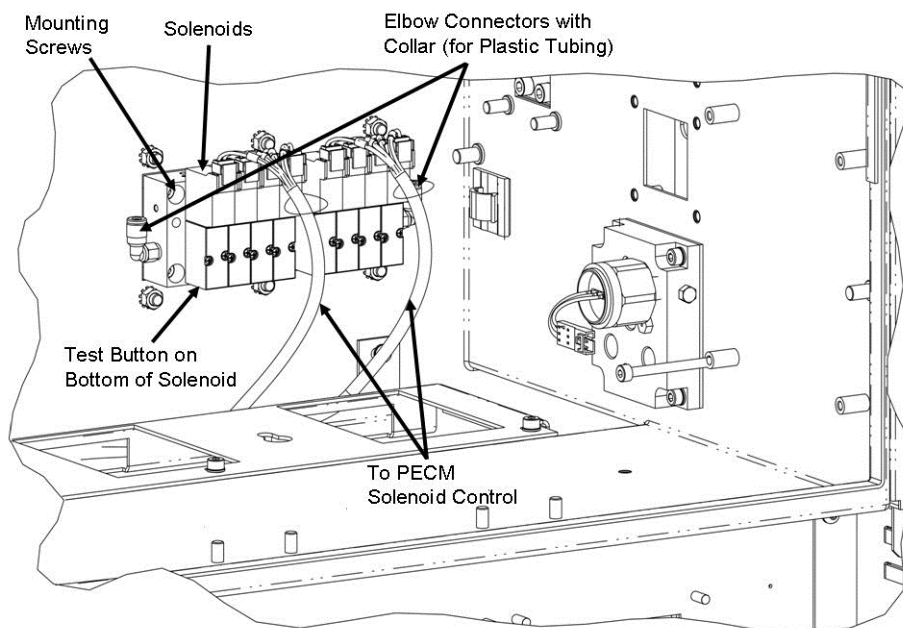


Figure 4-2 Solenoid Control Module

Digital Control Channels

On present Maxum II analyzers, the solenoid control circuitry is on the PECM. Digital outputs assigned to each solenoid valve are shown in the table below. If a digital output is 0 the valve is OFF; if the output is a 1, the valve is ON. Each group of four valves is identified as being left or right. There are no digital inputs. See the table below for the numbering pattern of solenoid valves (same for original and newer versions). Each solenoid valve can be manually set to the ON or OFF conditions by manually depressing the red button on each solenoid. This button is on the top-front of each Parker (original) solenoid and on the bottom of each SMC (new) solenoid.

Table 4-1 Digital Output Solenoid Valve Groups

Group	Solenoid Valve
Left	Valve 1
	Valve 2
	Valve 3
	Valve 4
Right	Valve 1
	Valve 2
	Valve 3
	Valve 4

Table 4-2 SVCM I/O Assignments

SYSCON Channel Number	I/O Name	Group	Channel
DO 1	LEFT_GROUP_VALVE_1	1	80h
DO 2	LEFT_GROUP_VALVE_2		40h
DO 3	LEFT_GROUP_VALVE_3		20h
DO 4	LEFT_GROUP_VALVE_4		10h
DO 5	RIGHT_GROUP_VALVE_1		08h
DO 6	RIGHT_GROUP_VALVE_2		04h
DO 7	RIGHT_GROUP_VALVE_3		02h
DO 8	RIGHT_GROUP_VALVE_4		01h

Table 4-3 SVCM Fault Indicators

Fault Indicator	Fault Condition
VALVE_SWITCH_ERROR	Valve status read back is incorrect
J10_DISCONNECTED (left bank connector)	J10 connector not connected
J11_DISCONNECTED (right bank connector)	J11 connector not connected

4.1 Solenoid Valves

Operation Test

1. Using a fine-pointed object, press Solenoid Valve red button.
2. When pressed, pressure is applied to the piston that moves to either the open or closed position. Resulting pressure is then applied to the column or sample valve.
3. If piston does not operate when the button is pressed, check for correct gas pressure.
4. If piston does not operate and pressure is 75 psig, Solenoid Valve is defective and must be replaced.
5. Repeat for each valve operating on and off. Allow at least 1 second between button presses.

Table 4-4 SVCM Specifications

Function	Specification
Switching Speed (Maximum response time on/off ms)	
4-way	15 ms
3-way non-latching	15 ms
Operating Voltage	24 VDC
Pressure Range, 3-way	172 to 690 kPa (25 to 100 psig)
Pressure Range, 4-way	172 to 690 kPa (25 to 100 psi)
Vacuum Range	0 to -91.4 kPa (0 to 27" of Hg)
Ambient Temperature Range	-18°C to 65°C (-0.4°F to 149°F) (dry air)
Leakage	≤ 50 µl/min, air @ 70°F (21°C) with 345 kPa (50 psig) on the common port.

4.1.2 Replacing a Solenoid Valve

The solenoid valves are mounted on either the floor or back of the electronic enclosure, depending on configuration. Valves are replaced individually. The Solenoid Valve Replacement Kit is available as part number 2020149-001.

**WARNING**

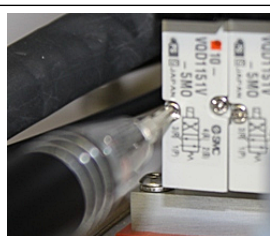
Voltage dangerous to life exists. Failure to follow proper procedures may result in equipment damage, personal injury or death.

Before performing the removal and installation procedures, turn off primary AC power to the Maxum II from the main circuit breaker. Observe all site safety requirements before performing any repair or maintenance on the Maxum II.

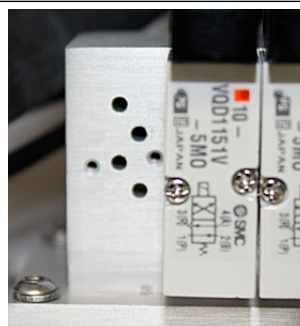
Procedure

1. Back up and shut down the unit using the *General Analyzer Shutdown Procedure* in the Maxum Edition II Analyzer General Maintenance Manual (A5E42019842001) from the Siemens web site (<http://support.industry.siemens.com/cs/products?dtp=Manual&pnid=17741>).
2. Open electronic enclosure door (using a 4mm (5/32") Allen wrench if necessary).

3. Unplug the cable to the solenoid to be replaced.
4. As show below, use a small screwdriver to remove the two screws that fasten the solenoid to the manifold. If the black gasket adheres to the manifold after removing the solenoid, then remove the gasket manually.



Solenoid Valve Retaining Screws

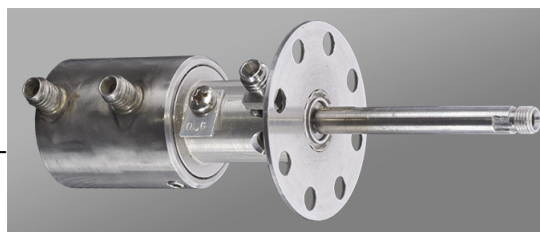


Solenoid Valve Mounting Position

5. Install the new solenoid, using a new gasket from the kit.
6. Reattach the cable to the solenoid.
7. Follow the steps in the *General Analyzer Startup Procedure* in the Maxum Edition II Analyzer General Maintenance Manual (A5E42019842001) from the Siemens web site (<http://support.industry.siemens.com/cs/products?dtp=Manual&pnid=17741>).

4.2 Liquid Injection Valve

The Siemens Liquid Injection Valve (SLIV) is used to automatically inject a fixed quantity of liquid sample followed by fast, complete vaporization. Small gas quantities can also be injected using the valve. Common sample injection sizes include; 0.6 microliters, 1.2 microliters and 2.4 microliters.



Liquid Injection Valve

Components

The Siemens Liquid Injection Valve (SLIV) consists of three components:

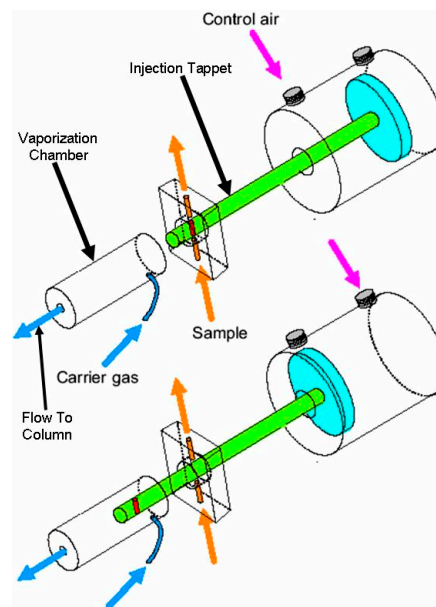
- Temperature-controlled vaporization system
- Sample flow unit with seals
- Pneumatic drive (actuator)

Functional Description

The SLIV uses a moving injection tappet attached to a piston actuator. Sample is injected via a groove or cross hole in the tappet. In the filling position, the sample flows continuously through the cross hole or the ring groove of the injection tappet. When injecting, the tappet is pushed pneumatically into the heated vaporization area. The liquid in the cross hole or ring groove is vaporized and flushed by the carrier gas into the column. The tappet is then shifted pneumatically, via the piston actuator, back into its original position. Sample then passes through the injection hole again.

The Sample flow unit and control cylinder are located outside the chromatograph oven. The vaporizer is located in the chromatograph oven. A heater assembly controls the temperature of the vaporizer. The vaporizer temperature can be raised to vaporize high boiling point samples.

Samples that contain salts that would cake on a diaphragm valve during injection are washed off when the valve stem is moved back to the flowing sample. Samples that contain a lot of solids, which would clog a diaphragm valve, can be measured using a Siemens Liquid Injection Valve. With the use of a temperature control circuit, the vaporizer temperature can be changed for different boiling point samples to insure complete vaporization.



Sample Injection

Vaporization System

The vaporization tube is inserted with an aluminum sleeve and into the heater assembly. The carrier gas is preheated by routing it along the outside of the heated vaporizer and then into the vaporizer. The vaporization temperature can be set independently of the oven temperature, and is set based on the sample composition.

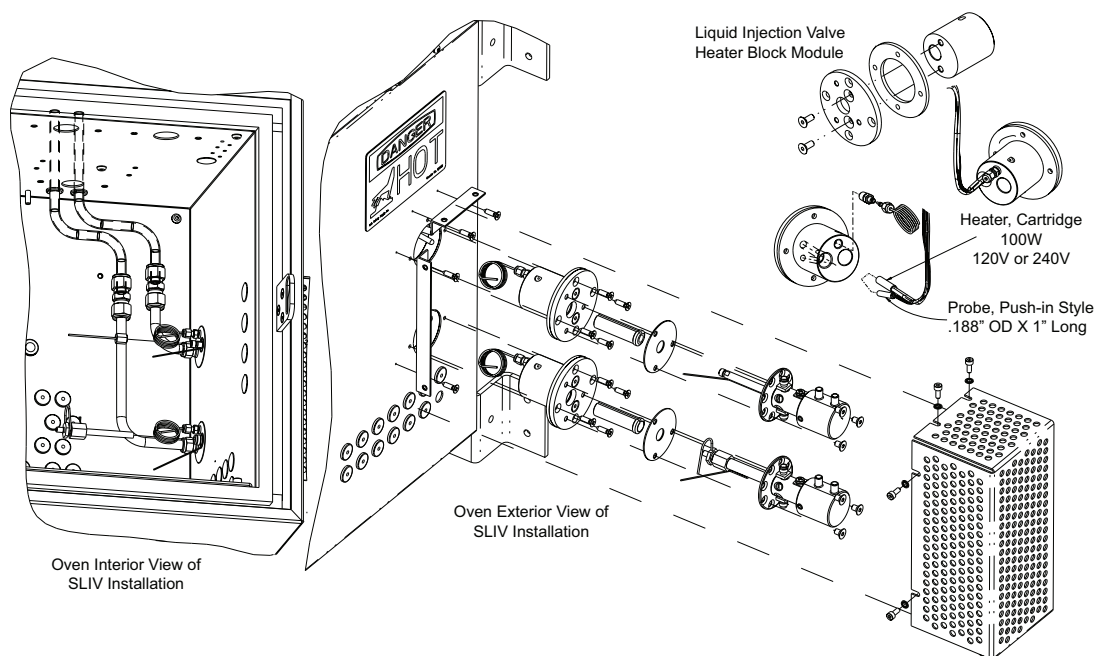


Figure 4-3 SLIV Installation Details

Temperature Control

The Siemens Liquid Injection Valve Heater Module probe is connected to a Base Detector Personality Module (DPM) Temperature Controller. Most Base DPM boards have two temperature control circuits so there is normally an extra one for the SLIV. If not, then a Temperature Control Module (TCM), part number A5E02645925002, is added to the analyzer. One of the Low Wattage relay pairs on the PECM is used to control the SLIV heater. A cable from the DPM to the PECM is used to control the low wattage relay on the PECM. This cable is not shown in this diagram.

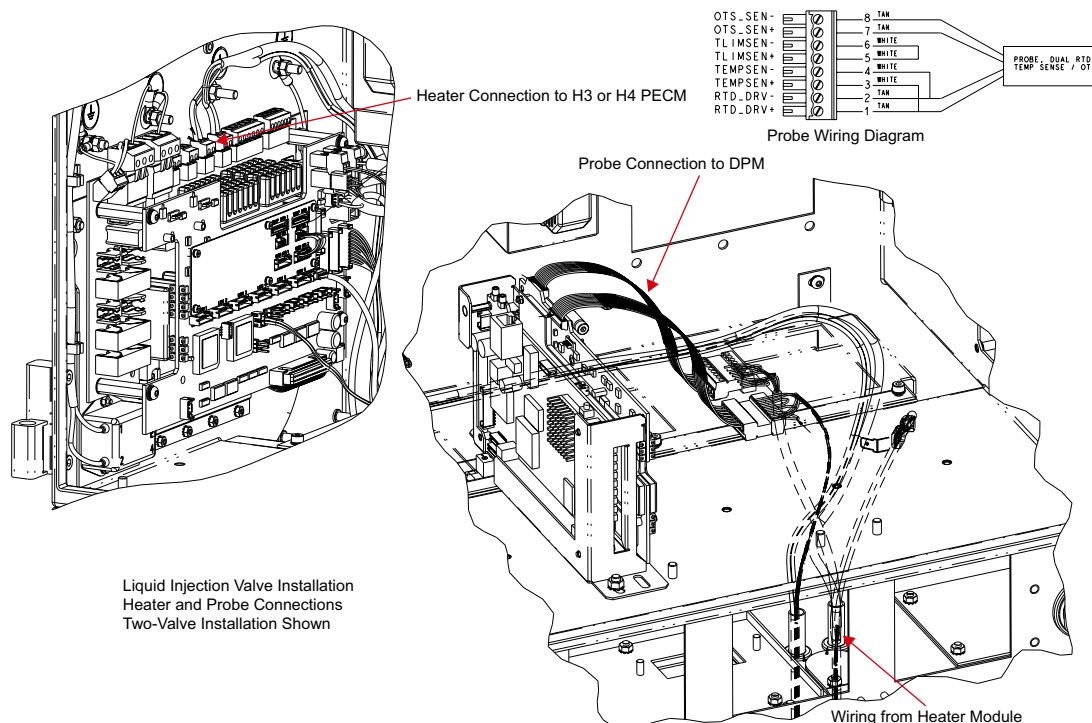
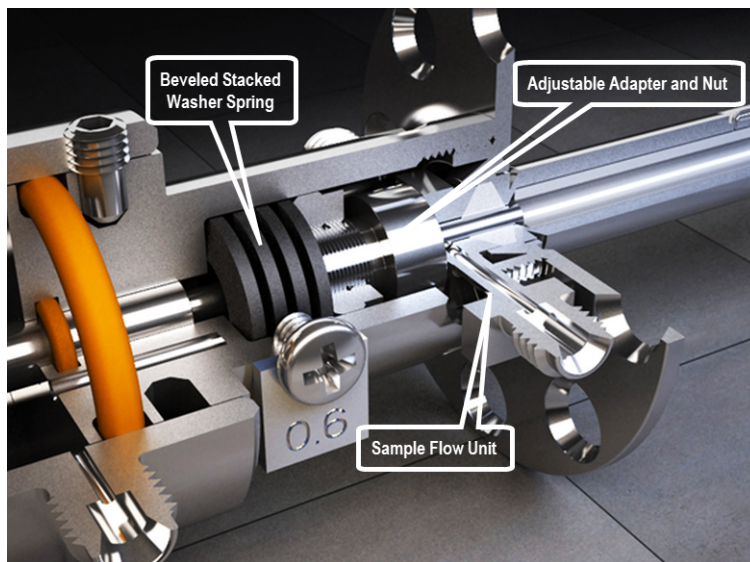


Figure 4-4 SLIV Heater and Probe Connections in the Electronics Cabinet

Sample Flow Unit

The sample flow unit is located in the middle section (body) of the valve between the vaporizer and the actuator piston. It is isolated from the vaporizer and actuator by lens-shaped Teflon gaskets. An adjustable adapter and Belleville washers position the Teflon gaskets with a constant pressure to align the sample hole or groove with the sample connections, and to compensate for temperature expansion and gasket wear.



SLIV Cutaway View, Main Components



Sample Flow Unit

Vaporization Temperature

The vaporization temperature can be set independently of the oven temperature. It is selected according to the sample and the boiling point of the sample. The optimum vaporization temperature must be determined experimentally. The amount by which the vaporization temperature should be above the sample's boiling point depends on the heat of vaporization of the sample. Samples with a high heat of vaporization, such as aqueous samples, only vaporize sufficiently fast for chromatographic purposes at high temperatures (above 200°C), as shown below.

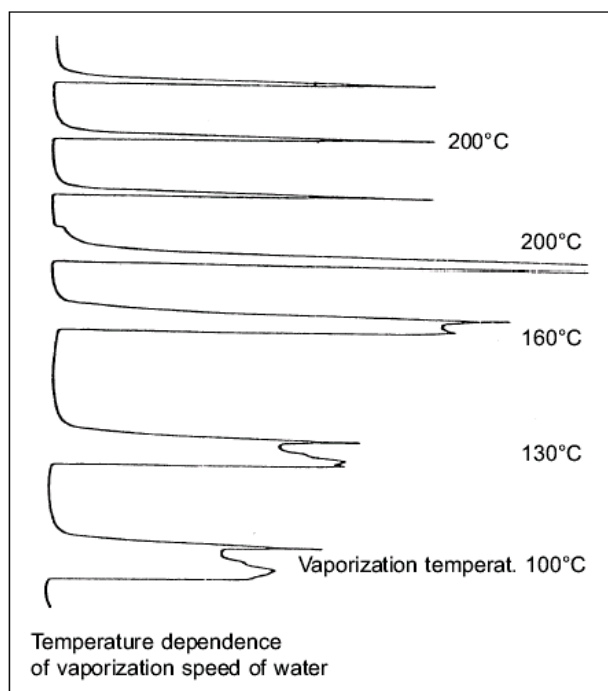


Figure 4-5 Vaporization Temperature

Note

Ex units: To comply with electrical hazardous area requirements ensure that:

- The sensor of the temperature sensor is fully inserted into the heating plate.
- The purge tube vent is not being obstructed.

Filter Requirements

The tappet and gaskets will wear faster if the sample contains solid particles. In these cases, a filter is required upstream of the injection. Siemens recommends a filter with the following characteristics:

- 98% for 0.3- μm particles with liquid samples
- 99.99% for 0.1- μm particles with gaseous samples

4.2.1 SLIV Maintenance Overview

Schedule

This section provides routine maintenance and repair procedures for the liquid injection valve. A 6-week preventive maintenance schedule is recommended for servicing the valve; however, the schedule you choose will depend upon the:

- Sample properties
- Vaporization temperature
- Ambient temperature
- Sample pressure
- Analysis Duty Cycle

Valve Service Life

You can expect a 1 year service life for the valve. However, the service life of the valve is also dependent upon the properties of the sample as well as the preventive maintenance schedule. The service life of the valve is adversely effected if the sample is injected at a high sample pressure >20 bar (290 psi.).

- If the sample has a corrosive effect on the surface of the injection stem (also called a tappet), the stem must be replaced with a different material type (e.g. Hastelloy).
- Over time, particles from the sample build up on the gaskets and will eventually obstruct the sample flow. Teflon and Rulon made gaskets are less subject to build up, but are not suitable for all applications. In addition, if the gaskets are subjected to temperatures outside of their rating they will lose their shape and reduce the service life of the valve.
- A sample that contains non-volatile or easily polymerized components (salts, proteins, monomers etc.) can deposit residues in the vaporizer (16), in the injection hole, on the sample flow unit (15), and on the injection stem (6). Therefore, these parts should be cleaned regularly if the sample contains materials which are not vaporized. See Exploded View (Page 38).
- The sample flow unit (15) should be oriented vertically when the valve is installed. This is so that the sample will flow vertically through the valve to prevent air bubbles from forming in the valve. Make note of this when reinstalling the valve after service.

Part Locations

Throughout this section, the numbers located next to part names, such as “Flange (17)”, refer to callouts listed in the Liquid Injection Valve Exploded View (Page 38).

Operational Notes

- If the sample has a corrosive effect on the surface of the injection stem (also called a tappet), the stem must be replaced with a different material type (e.g. Hastelloy).
- Over time, particles from the sample build up on the gaskets and will eventually obstruct the sample flow. Gaskets made of Teflon and Rulon are less subject to build up, but are not suitable for all applications. In addition, if the gaskets are subjected to temperatures outside of their rating they will lose their shape and reduce the service life of the valve.

4.2 Liquid Injection Valve

- A sample that contains non-volatile or easily polymerized components (salts, proteins, monomers etc.) can deposit residues in the vaporizer (16), in the injection hole, on the sample flow unit (15), and on the injection stem (6). Therefore, these parts should be cleaned regularly if the sample contains materials which are not vaporized.
- The sample flow unit (15) should be oriented vertically when the valve is installed. This is so that the sample will flow vertically through the valve to prevent air bubbles from forming in the valve. Make note of this when reinstalling the valve after service.

4.2.2 Liquid Injection Valve Component Locations

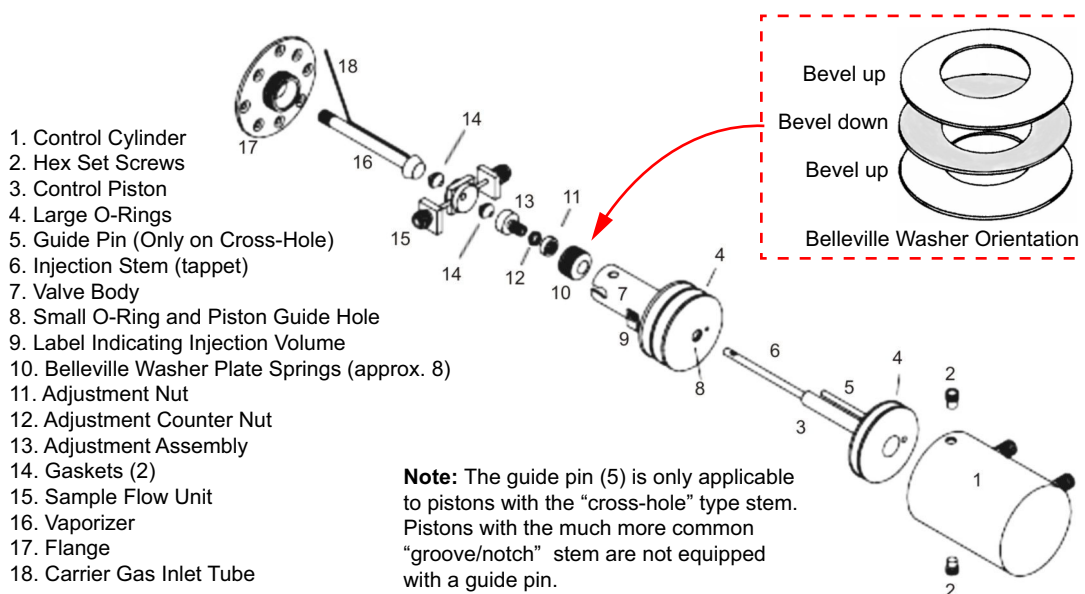


Figure 4-6 Liquid Injection Valve Exploded View

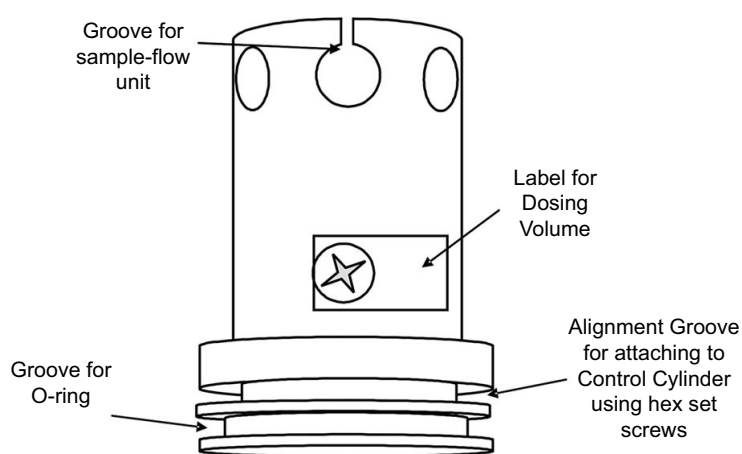


Figure 4-7 Liquid Injection Valve Body

4.2.3 Troubleshooting

Faults, Causes, Remedies

Fault	Causes	Remedy
All peaks appear smaller	Sample flow unit (15) or injection blocked. Buildup of material on injection stem.	Clean injection hole, stem (6), vaporizer (16) and sample flow unit (15).
Peaks are becoming wide and shifted to longer times. Baseline becomes negative before injection of sample.	Vaporizer (16) is contaminated.	Replace gaskets (14) if necessary.
Baseline becomes positive before injection of sample.	Gasket (14) between sample flow and vaporizer is leaking.	
Interruption in chromatogram: sample is not getting injected.	Leaky pneumatic actuator, grease used up, O-rings (4) damaged, control pressure too low.	Clean pneumatic actuator, replace O-rings, and grease sliding surfaces and O-rings.
Peaks too small and too wide, especially those with higher boiling points.	Heating plate is faulty. Vaporization temperature too low.	Replace heating plate. Set higher equalization temperature.
Injection quantity slowly rises until a double peak results (with calibration medium). Poor peak form, platform following peak. Increase in baseline. Visible discharge of sample.	Worn gaskets (14) and/or stem (6).	Replace gaskets (14) or stem (6).
The section of the injection stem that is normally in the sample flow stream (near the notch) is rough. Material wear on this section of the stem is visible using a magnifier. The effect is significantly less on the rest of the stem.	Corrosive sample	Possibly replace injection stem (6) by version made of another material more compatible with the sample chemical, such as Hastelloy.
Thin scratches are visible (with a magnifying glass) on the stem near the sample groove. These scratches run along the stem for several millimeters.	Sample is contaminated by particles (most frequent case). The particles get lodged in the gasket and scratch the stem during injection.	Check filter from sample system and replace if necessary. Replace stem (6) and gasket (14).

4.2 Liquid Injection Valve

Fault	Causes	Remedy
The space between the stem (6) and the inside wall of the vaporizer (16) is filled by deposits. This can block the supply of carrier gas. In extreme cases deposits may result on the stem (6).	The sample contains dissolved salts and other nonvolatile materials.	The deposits in the vaporizer (16) may be removed mechanically (drill/ream with 3.3 mm diameter), or the part may be replaced.
Brown deposits are present on the vaporizer gasket (14) at the outlet to the vaporization area.		

4.2.4 Service Procedures

Overview

These procedures refer to the Liquid Injection Valve Component Locations (Page 38) illustrations.

**CAUTION****Temperature and Heating Components in Explosion Proof analyzers**

If the heating assembly is removed, exchanged or retrofitted, the assembly must be tested and certified in accordance with appropriate regulations before the analyzer can be placed back in service.

Removing the Valve

Perform the following procedure to remove the valve from the oven. Removing the vaporizer (16) and flange (17) is optional when removing the valve.

**CAUTION****Potential burn hazard. Handling hot components may result in personal injury.**

To prevent injury from burns always switch off the oven and valve heaters and allow the oven and liquid injection valve to cool down before touching the valve.

Procedure

1. Switch off oven and valve heaters and allow oven and valve to cool down.
2. Switch off sample flow at the sample conditioning system and allow sample line to empty.
3. Shut off power to the chromatograph.
4. Shut off carrier gas and control air supplies.

Note

Before doing the next step, purge the sample line including the valve with Nitrogen to avoid exposure to hazardous substances.

5. Unscrew the sample line and pneumatic actuation control lines from the liquid injection valve.
6. (If removing entire valve) Disconnect the carrier gas inlet line from the carrier inlet tube (18), and disconnect the column from the vaporizer (16) outlet inside the oven and then remove the valve.
7. (If not removing vaporizer and flange) Do not disconnect carrier gas or column. Unscrew the valve body (7) from the flange (17) and pull out.

Disassembling the Valve

NOTICE
Clean Work Area Required
Perform all work on a clean dry surface to avoid contamination. Parts should be placed on a clean lint free cloth and hands should be clean.

1. If vaporizer (7) and flange (8) were not removed from the analyzer, then skip this step.
2. Unscrew the valve body (7) from the flange (17) and vaporizer (16) and separate the components.
3. Remove the 2 hex set screws (2) and remove the control cylinder (1).
4. Lift off the sample flow unit (15) and adjustment assembly (13) from the injection stem (6).
5. Remove the sample flow unit and the lens shaped gasket (if the gasket is not present it is stuck in the vaporizer) to allow the Belleville washer plate springs (10) to drop out.
6. Pull the control piston (3) with stem (6) out of the valve body (7). Do NOT use any tools such as a screwdriver as a wedge between the piston and the valve body. This would damage the valve body and control piston.

Replacing the Teflon Gasket

Replace the Teflon gaskets if they show any signs of wear or contamination.

Procedure

1. Remove the gaskets (14) from the adjustment assembly (13) and vaporizer (16). To do this, gently insert the tip of the stem (6) approx. 5 mm into the gasket and then tip to the side until the gasket is loose and can be pulled out with the stem.
2. Insert new gaskets (14) into the adjustment assembly (13) and vaporizer (16). Use the correct type gasket according to the application and temperature class.
3. There should be no play between the new gasket and the injection stem. It should be extremely difficult to move the gasket.

O-Ring Replacement

The silicone O-rings of the pneumatic drive should be regularly greased with a high-quality lubricant such as DuPont Krytox EG2000 or equivalent (Siemens part number G87004).

Procedure

1. Carefully remove the two large O-rings (4) and the small O-ring (8) out of the valve body (7) and control piston (3) using a small screwdriver or a needle. Only use silicone O-rings, temperature class -40°C to 200°C.
2. Insert new O-rings in all three locations (4 & 8).
3. Apply a thin film of grease to the new O-rings and the sliding surfaces of the control cylinder (1) and the piston guide (2 & 8).

Valve Assembly

Read the following notes before performing the assembly procedure. See the Exploded View (Page 38) for the following procedures.

Notes

- The screw threads on the flange plate (17) must move freely. Grease if necessary.
- The diameter of the piston guide hole (8) should be 5.7 mm and be smooth. Replace the part if there are traces of wear on the piston shaft.
- The adjustment assembly (13) must slide smoothly down inside the valve body (7).

Procedure

1. Before assembling the valve, apply a thin coat of grease (discussed in *O-Ring Replacement* above) to the following parts.
 - Internal wall of control cylinder (1)
 - Shaft of Control Piston (3)
 - Piston Guide hole/small O-ring (8)
 - Outside of Large O-rings (4) following reassembly of valve body (7) and piston (3)
2. Insert the piston (3) with stem (6) into the valve body (7) such that the stem does not become greasy.
3. Drop the Belleville washer plate springs next to one another over the stem into the valve body. Washers must be positioned in an alternating bevel up/bevel down manner (to form a spring). See *Liquid Injector Valve Exploded View* for washer orientation.
4. Slide the adjustment assembly (13) with nut (11), counternut (12) and Teflon gasket (14) onto the stem.

5. Insert the sample flow unit (15) into the valve body (7) over the stem (6). See the Liquid Injection Valve Body (Page 39) illustration.
Note that the stem hole through the sample flow unit is tapered. This tapering is not readily apparent when looking at the uninstalled sample flow unit, but it will be visible when it is installed on the stem. The narrowest side of the hole in the valve body should face outward (toward the vaporizer). The narrowest side of the hole will be apparent because it will have the least spacing between the stem and the side of the hole. Newer sample flow units have this orientation marked with an arrow.
6. Move stem (6) into filling position. This means that the stem should be “pushed in” towards the control cylinder (1)
7. If you have completely removed the liquid injection valve, fit the flange (17) over the vaporizer (16), and screw the valve body (7) and the flange together.
8. If the the flange plate (17) and vaporizer (16) were not removed from the analyzer, screw the partially reassembled valve onto the already installed flange plate.

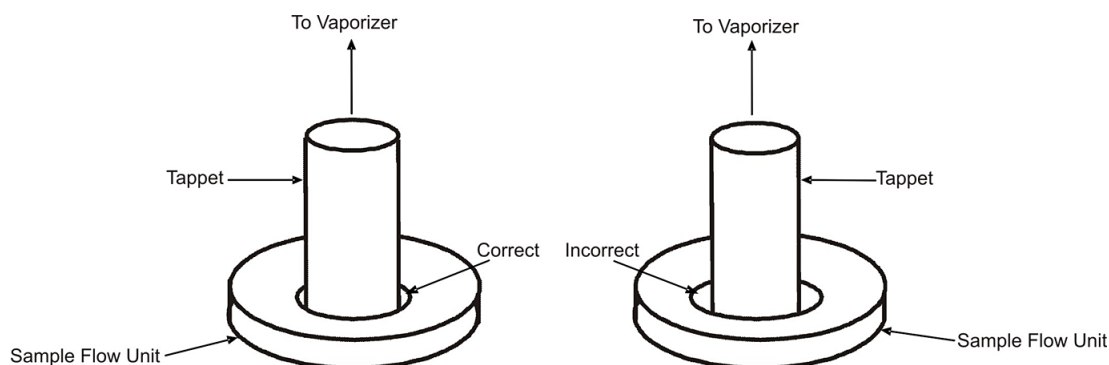


Figure 4-8 Orientation of Sample Flow Unit Hole

Belleville Washer Spring Adjustment

It may be necessary to adjust the amount that the Belleville washer springs are being compressed. These washers should compress about 2 mm when adjusted appropriately. This compression distance is called “spring travel” and it is adjusted using the following procedure.

- Standard setting with 7 Belleville Washers: smooth round nut (11) extending about 0.5 mm past end of the threads on the adjustment assembly (13).
- Standard setting with 8 Belleville Washers; about 0.5 mm of threads showing below the round nut on the adjustment assembly (13).

The spring travel is not critical, but more compression distance should be used for higher pressures (greater than 20 bars) and less should be used for low pressures (less than 2 bars). Adjust accordingly.

Procedure

1. Check the spring travel and correct using the adjustment assembly (13) if necessary. The spring travel is correctly set if the flange (17) can be rotated a further 2.5 rotations starting with the first pressing of the Belleville washer plate springs until the flange rests on the valve body. The plate springs can be viewed through a hole when pressing together. If the flange is tightened firmly, there should be a gap of 0.3 to 0.5 mm between the plate springs.
2. If the adjustment is necessary, loosen the flange from the valve body again, and screw the nut and counternut in or out as necessary. Then repeat the preceding step.
3. This step is only necessary if using the less common cross-hole stem and should only be executed if the entire valve including the vaporizer is removed from the analyzer. Rotate the vaporizer (16) using a 6mm wrench until the carrier gas inlet (18) is parallel to the sample flow unit (15). The carrier gas should flow through the hole in the stem when injecting.

Installing the SLIV in the Analyzer

1. If the entire valve was completely removed from the analyzer (including the flange and vaporizer), reinstall it at this time, but do not connect control lines, sample lines, or carrier gas. When installing the valve, adjust the valve body (7) so that sample will flow vertically through the valve. This is necessary to prevent bubbles from forming in the valve.
2. Position the control cylinder (1), and tighten the two hex set screws (2) on the side. The screws must firmly grip the groove in the valve body (5) wall. See the *Liquid Injection Valve Body* illustration.
3. Connect the control lines.
4. Activate the actuator pneumatically. Check that you can hear the switching and movement noises.
5. Connect the sample lines. After connecting the sample lines inspect that they are not subjected to any strain and that sample will flow through the valve vertically (to prevent bubbles from collecting in the valve).
6. Complete re-installation of valve into analyzer including reconnection of carrier gas and column tubing (if these were disconnected during removal).

Replacing the Dosing Stem

Although it is possible to replace the control piston (3) and stem (6) without disassembling the valve body (7), Siemens recommends that the valve body be disassembled and serviced whenever the stem is replaced.

4.2.5 Siemens Liquid Injection Valve Specifications

Table 4-5 Configuration

Valve Type	Pneumatically operated piston actuating a moving liquid-injection tappet
Vaporization System	Temperature-controlled vaporization system

Table 4-6 Siemens Liquid Injection Valve

Vaporization temperature	60 to 350°C (140 to 662°F) depending on application and temperature class
Injection volume	0.1 to 9.5 µl
Sample temperature	-20 to +150°C (-4 to 302°F)
Material in Contact with Sample	Stainless steel, mat. no. 1.4571, Hastelloy, Monel, Rulon, Teflon or special materials
Control pressure	400 to 600 kPa (58 to 87 psig)
Sample pressure	Max. 6000 kPa (870 psig), recommended 50 to 100 kPa (7.25 to 14.5 psig)
Connections for pipe	3.14 mm (1/8") outer diameter

Table 4-7 Liquid sample inlet conditions

Sample Flow	5-20 cc/min (application dependent)
Sample Filtration	0.3-5 micron (sample valve dependent)
Minimum Sample Pressure	35 kPa (5 psig), lower pressure optional
Maximum Sample Pressure	2070 kPa (300 psig) standard; higher pressure optional
Maximum Sample Temperature	121°C (250°F) standard; higher temperature optional

4.3 Model 50 Valve

The Model 50 valve is a pneumatically operated diaphragm valve that is equipped with 10 ports. It can perform the function of two Model 11 valves, although it is less than half the size of a Model 11 valve.

The valve is turned On or Off using air pressure applied to diaphragms. This air pressure activation eliminates the need for pistons, plungers, or any other moving parts. The valve can both inject vapor samples and switch columns simultaneously. The Model 50 is capable of switching gasses up to 75 psig (515 kPa). Actuation air for the Model 50 can be either carrier gas or other bottled inert gas. Consumption of gas for actuation is negligible.

One primary distinction that separates the Model 50 from the Model 20 and Model 11 valves is the port switching. When the valve is On, flows between the following ports are open: ports 1 & 10, ports 2 & 3, ports 4 & 5, and ports 8 & 9. When the valve is Off, flows between the following ports are open: ports 1 & 2, ports 3 & 4, ports 5 & 6, ports 7 & 8, and ports 9 & 10. Note that when the valve is On, flow between ports 6 & 7 is not active as might be expected (see figure below). This patented feature is unique to the Model 50 and allows elimination of external hardware that would be required otherwise.

The Model 50 is designed such that the pressure is required to turn the valve either On or Off. Actuation ports are located on the side of the valve between ports 1 and 10. The Off actuation port is labeled "0" and the On actuation port is labeled "1". When pressure is applied to the Off actuation port, the valve is set to Off. When pressure is applied to the On actuation port, the valve is set to On. When no pressure is applied to either actuation port, ALL ten valve ports are interconnected.

4.3.1 Basic Maintenance: Model 50 Valve

The following equipment is required to repair the Model 50 valve:

- Model 50 Repair Kit: Siemens PN 2020164-001 (includes 10 diaphragms, 10 screws with washers, and 12 Valco fittings).
- Valve Assembly Fixture: Siemens PN 2020281-001
- Torque screwdriver with Allen head bit: Siemens PN 1631005-003

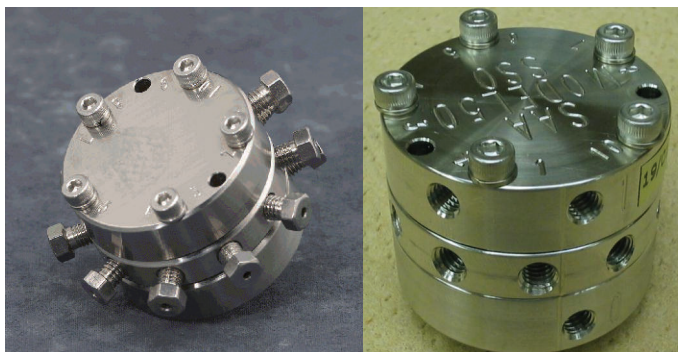


Figure 4-9 Model 50 Valve

4.3.2 Preventing Port to Port Leaks

Particulates introduced to the valve either from the sample or from the columns can prevent the diaphragms from sealing against the center plate of the valve. Also, to insure proper sealing of the diaphragms, the actuation pressure should be 25 psig higher than the carrier gas or sample gas pressure.

To help prevent leaks, always turn the sample and carrier gas off before the actuation gas is turned off. Without actuation gas, the Model 50 valve is in an undefined state where ALL ports are interconnected, and the flow path of the carrier or sample cannot be controlled. Leaks in the actuation gas lines could result in a lower actuation gas pressure which could result in port to port leaks. The symptoms can include small peaks, repeatability problems, contaminated columns and noise on the detector.

4.3.3 Maintenance Considerations

If customer maintenance personnel are not technically trained to repair the Model 50 valve on site, it is recommended that the valve be returned to Siemens for service, repair, or direct replacement.

To repair the Model 50 valve on site, the customer must have the necessary maintenance tools and replacement parts. Recommended valve spare parts can be obtained from Siemens.

When cleaning the Model 50 valve and associated components, it is imperative that the maintenance be performed in a clean and contaminant free facility. Components should be placed on a lint free cloth to prevent impurities from contaminating the valve and its components. Hands should be clean and free of contaminants. Presence of any foreign contamination can cause additional valve problems after reinstallation.

All foreign contamination adhering to valve must be removed using cleaning solvent, such as hexane, acetone, or methanol and a dust/lint free cloth. After cleaning Model 50 valve components, shake or blow with clean air the excess cleaning fluid from the individual components. Ensure that the components are air dry before reassembling.

Note

Do not allow Model 50 valve polished surfaces to rest on any surface other than a lint free cloth. Clean sample flow openings in top plate, center plate, bottom plate and Valco fitting nuts using a syringe filled with cleaning solvent such as hexane, acetone, or methanol.



CAUTION

Potential burn hazard. Handling hot components may result in personal injury.

Before servicing the Model 50 valve, it is important that primary AC power to the Maxum II be turned off from the main circuit breaker, and the oven be allowed to cool. Only maintenance personnel with proper authorization should open the electronic enclosure. Failure to observe safety precautions can result in personal injury.

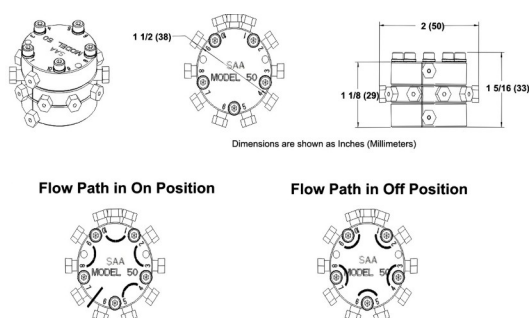


Figure 4-10 Dimensions and Flow Paths of Model 50 Valve

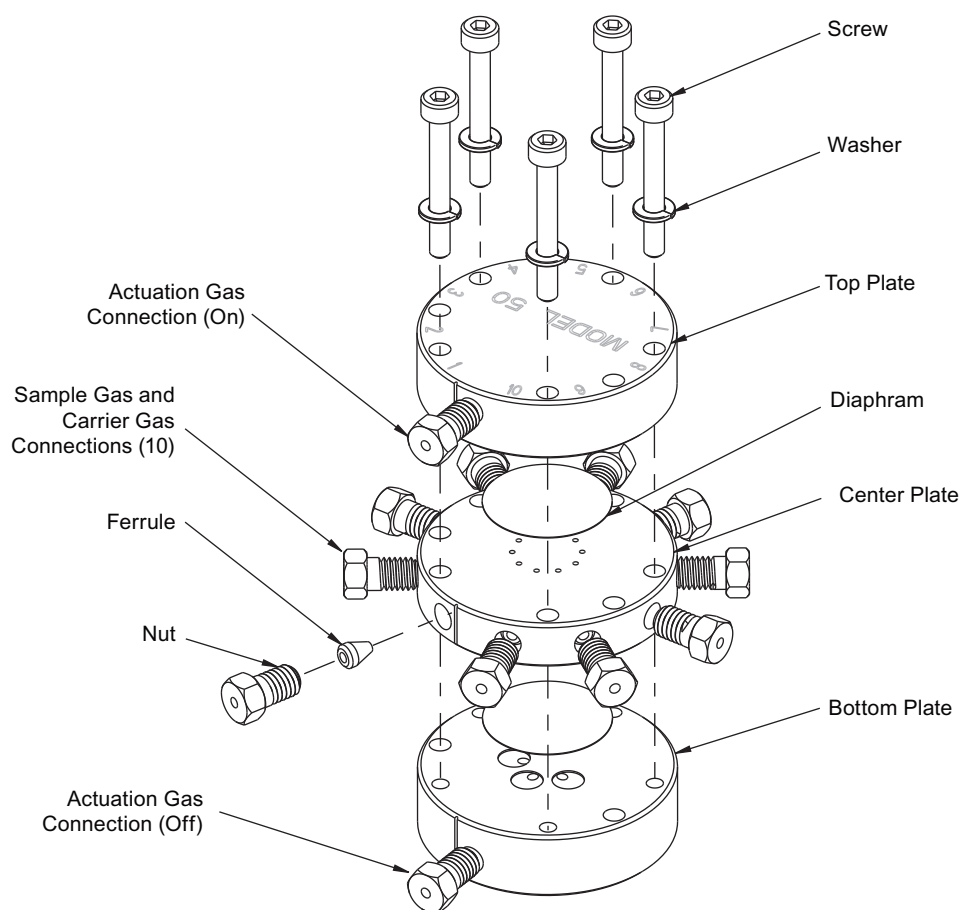


Figure 4-11 Model 50 Valve Exploded View

4.3.4 Model 50 Valve Maintenance Procedure

If customer maintenance personnel are not technically trained to repair the Model 50 valve on site, it is recommended that the valve be returned to Siemens for service, repair, or direct replacement.

Valve Removal

1. Turn off the oven heater and allow time for the oven to cool to a safe temperature.
2. Turn off all gases going to the valve. Start by turning off the sample gas by blocking it in at the sample system. Flush any hazardous gases in the sample loop with an inert gas. Block the carrier gas by closing the block valve supplying carrier to the analyzer. Block in the valve gas by closing block valve supplying valve gas to the analyzer.
3. Shut off the air to the oven heater.
4. Open door to the Maxum II oven using a 4mm (5/32") Allen wrench.
5. Tag each tubing connection to the Model 50 valve with the valve port number or actuation line position.

6. Make note of the valve orientation in the oven.
7. To remove Model 50 valve from the oven, first disconnect all tubing to the valve.

Note

When disconnecting Valco fastening nuts from Model 50 valve, exercise caution not to bend or crimp the stainless steel tubing.

Note

Before removing Model 50 valve from oven, make note of its orientation within the oven.

8. Remove the valve from the oven by unscrewing the two M3 x 35 socket head cap screws securing the Model 50 valve. These mounting screws are located between ports 2 and 3 and ports 8 and 9. Refer to Figure 6-2 for port locations.

Note

If the valve is to be sent back to Siemens for service, then skip to the "Valve Reinstallation" portion of this procedure to install the replacement valve.

Valve Disassembly, Cleaning, and Reassembly

1. Place the valve on a clean dust lint free cloth within a clean work environment.

Note

Do not place polished top plate, center plate or bottom plate against any abrasive surface. Place components on a lint free cloth free of foreign contaminants.

2. Place the valve bottom plate on a lint free cloth. Using a 2.5 mm Allen wrench, remove the five socket head fastening cap screws.
3. Separate Top, Center and Bottom plates of the valve, placing them on a lint free cloth. Both diaphragms are visible.
4. Remove the old diaphragms from the plates. DO NOT attempt to reuse the old diaphragms.
5. Clean the valve parts by wiping with a dust/lint free cloth and a cleaning solvent (or clean using an ultrasonic cleaner) as described at the beginning of this chapter. After cleaning, shake excess cleaning fluid from all parts and allow to air dry before reassembling.
6. With the pins installed in the base of the assembly fixture, place the bottom plate of the valve on the center of the base. The pins should fit in the mounting holes on the bottom plate and hold it in place.

Note

Use the Valve Assembly Fixture, Siemens Part Number 2020281-001, to properly align the diaphragms when rebuilding the Model 50 valve. The fixture consists of a base, two guide pins, and a diaphragm placement disc. This fixture will allow the user to place the diaphragm in the center of the valve. If the diaphragm is not in the center, it may leak.

7. Position the placement disc on the bottom plate and set the diaphragm in place.

4.3 Model 50 Valve

8. Carefully remove the placement disc without moving the diaphragm. Inspect the diaphragm for proper alignment. If the diaphragm is not in the center of the plate, repeat the placement procedure using the placement disc.
9. Place the middle plate on the valve taking care to use the correct holes. Check the alignment mark on the side of the plate. It should align with the mark on the bottom plate. If not, the middle plate is upside down and must be removed, turned over, and reinstalled correctly.
10. Repeat steps 7 and 8 with the middle plate.
11. Place the top plate on the valve, verifying alignment using the alignment marks.
12. Install the 5 screws and washers finger tight.
13. Tighten the screws down evenly (2.5mm Allen wrench) to 6 to 8 inch-pounds of torque. (It is recommended to use the torque wrench available from Siemens, PN 1631005-001, which is calibrated at 7.2 inch pounds). Remove the assembled valve from the valve fixture.

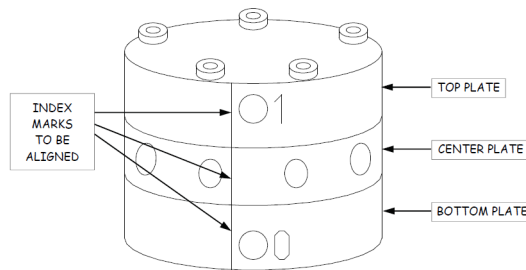
Valve Cleaning

To clean the three valve plates use an Ultrasonic cleaner with clean acetone. If cleaning solvent becomes contaminated during performance of the following steps, replace it with a clean supply of cleaning solvent. Do not place polished valve plates against any surface in ultrasonic cleaner or against any abrasive surface. Place parts on a lint free cloth, free of foreign contaminants.

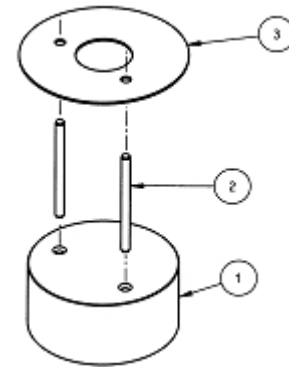
1. Fill Ultrasonic cleaner with cleaning solvent.
2. Before placing valve plates in Ultrasonic cleaner, wipe off all grease and foreign contaminants from valve parts.
3. Place valve body parts on a lint free cloth in ultrasonic cleaner.
4. Turn Ultrasonic cleaner ON and allow to run for 10 minutes.
5. Remove parts and blow dry.
6. Inspect each port on all three plates carefully for material blocking ports. Check both vertical and horizontal holes on center plate. (If needed use a 0.031" gage pin.)
7. Before reassembling valve, clean hands, tools and perform reassembling procedures in a clean dust-free area.

Valve Reassembly

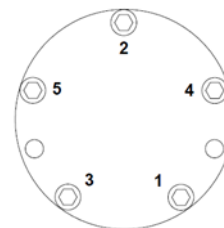
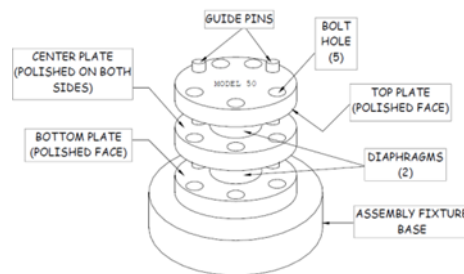
Use the Valve Assembly Fixture, Siemens PN 2020281-001, properly align the Diaphragms when rebuilding the Model 50 Valve. The fixture consists of a base (1), 2 guide pins (2) and a diaphragm placement disc (3). This fixture will allow the user to place the diaphragm in the center of the valve. If the diaphragm is not in the center it may leak.



Model 50 Index Marks



Valve Assembly Fixture 2020281-001



TORQUE SEQUENCE
(1,2,3,4,5,1)

Figure 4-12 Model 50 Valve Assembly Details

1. Remove the old diaphragms from the plates. DO NOT attempt to reuse the old diaphragms.
2. With the pins installed in the fixture base, place the bottom plate of the valve on the base. The pins should fit in the mounting holes on the bottom plate and hold it in place.
3. Position the placement disc on the bottom plate and set the diaphragm in place.
4. Carefully remove the placement disc without moving the diaphragm. Inspect the diaphragm for proper alignment. If the diaphragm is not in the center of the plate, repeat the placement procedure using the placement disc.
5. Place the middle plate on the valve taking care to use the correct holes. Check the alignment mark on the side of the plate. It should align with the mark on the bottom plate. If not, the middle plate is upside down and must be removed, turned over, and reinstalled correctly.
6. Remove the old diaphragms from the plates. DO NOT attempt to reuse the old diaphragms.
7. With the pins installed in the fixture base, place the bottom plate of the valve on the base. The pins should fit in the mounting holes on the bottom plate and hold it in place.
8. Position the placement disc on the bottom plate and set the diaphragm in place.

4.3 Model 50 Valve

9. Carefully remove the placement disc without moving the diaphragm. Inspect the diaphragm for proper alignment. If the diaphragm is not in the center of the plate, repeat the placement procedure using the placement disc.
10. Place the middle plate on the valve taking care to use the correct holes. Check the alignment mark on the side of the plate. It should align with the mark on the bottom plate. If not, the middle plate is upside down and must be removed, turned over, and reinstalled correctly.
11. Position the placement disc on the center plate and set the diaphragm in place.
12. Carefully remove the placement disc without moving the diaphragm. Inspect the diaphragm for proper alignment. If the diaphragm is not in the center of the plate, repeat the placement procedure using the placement disc.
13. Place the top plate on the valve, verifying alignment using the alignment marks.
14. Install the 5 screws and washers finger tight.
Tighten the screws down evenly following the 'Torque Sequence' in the above drawing. Use a torque wrench with a 2.5mm hex bit to 6 to 8 inch-pounds of torque. (It is recommended to use the torque wrench available from Siemens, PN 1631005-003, which is calibrated at 7.2 inch pounds). Remove the assembled valve from the valve fixture.
15. Reinstall the valve in the oven. Use the same torque wrench with a 2.5mm hex bit to 6 to 8 inch-pounds of torque to tighten the mounting screws. Connect all tubing following the fitting manufacture's recommendations as noted below.
16. Connect all tubing following the fitting manufacture's recommendations as noted below.

Note

Over tightening the fittings can cause the center plate to bulge at the fitting site. This bulge will cause the valve to leak.

17. Turn the valve gas on at the block valve. Then turn on the carrier gas.
18. Power up the analyzer and enable the heaters.
19. Check for leaks at the fittings and between the plates in both the off and on valve states.
20. Verify valve operation by running chromatograms. Understand how the chromatogram will change if the valve is not working properly by knowing what the chromatogram looks like when the valve is working and what changes when the valve fails in different conditions.

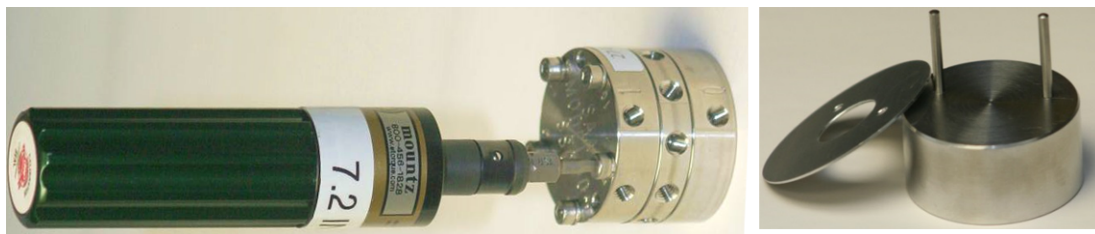


Figure 4-13 Tools for Model 50 Valve Assembly

Valve Reinstallation

1. Reinstall the valve in the oven and connect all tubing.

Note

Best practice is to seat the fittings in a Valco fitting and not in the Model 50 Valve ports. This will help increase the life of the valve and reduce the chances of causing the center plate to bulge from over tightening the fittings. See the AUTOHOTSPOT section for instructions.

2. Power up and check for leaks. Verify valve operation by running chromatograms.

4.3.5 Model 50 Valve Specifications

Table 4-8 Configuration

Valve Type	Double-acting, pneumatically operated
Number of Ports	10
Flow Paths	On state: flow between ports 1 & 10, 2 & 3, 4 & 5, 8 & 9 Off state: flow between ports 1 & 2, 3 & 4, 5 & 6, 7 & 8, 9 & 10 Note: flow between ports 6 & 7 is always blocked

Table 4-9 Performance and Requirements

Sample Types	Vapor samples only, free of particulates
Actuation Gas	Inert gas, particulate free
Switching Time	20 ms (Typical in Maxum gas chromatographs.) In other uses, actual switching time is dependent on the type of solenoids used to deliver the pneumatic signal to the valve and the size of the pneumatic tubing to the valve.
Sample Filtration	5 micron
Maximum Actuation Pressure	690 kPa (100 psig)
Minimum Actuation Pressure	140-175 kPa (20-25 psig) higher than maximum carrier gas or sample gas pressure
Maximum Port Pressure (Carrier or Sample)	515 kPa (75 psig); contact factory for higher pressure options
Minimum Port Pressure (Carrier or Sample)	35 kPa (5 psi)
Pressure Drop	< 35 kPa (5 psi) for 200 scc/min (air) Pressure drop was measured in air at room temperature with flow from port to port. Actual pressure drop will vary with temperature and gas type. Pressure drop through the sample loop is dependent on the inside diameter and length of the sample loop.
Maximum Temperature	120°C (248°F); contact factory for higher temperature options
Carrier Gas Flow	0.3 ml/min to 40 ml/min; contact factory for higher flow options
Mean Time Between Failures	>10 ⁷ cycles at 60°C (140°F); >4×10 ⁶ cycles at 150°C (300°F). Valve failure is typically caused by particulates preventing the diaphragms from sealing against the center plate or long term wear resulting in deformation of the diaphragms.

4.4 Model 20 Valve

Table 4-10 Dimensions

Mounting	2 clearance holes for mounting screws (mounting brackets available as separate spare part if desired)
Actuation & Sample Connections	1.6 mm ($1/16$ ") OD tubing with Valco® or Swagelok® fittings
Dimensions	Height: 33 mm ($1\frac{5}{16}$ ") Body Diameter: 38 mm ($1\frac{1}{2}$ ") Outside Diameter: 50 mm (2")
Weight	0.25 kg (0.5 lb)
Materials of Construction	Body: 316 stainless steel Diaphragms: Teflon® coated stainless steel

4.4 Model 20 Valve

4.4.1 Basic Maintenance

This section presents information to perform fault diagnostic testing, maintenance and repair and installation of Model 20 valve. To assure optimum valve operation, a clean contaminant free operating environment is required at all times.

Maintenance procedures for the Model 20 valve are divided into three types. These are: diagnostic, mini-maintenance, and maxi-maintenance. Diagnostic procedures can determine problems by a visual examination of valve. Mini-maintenance involves removal and cleaning of the valve cap, which can be performed while the valve is installed in the analyzer. Maxi-maintenance procedures are more involved and include complete disassembly of the valve. In this manual, only diagnostic and mini-maintenance procedures are discussed. More detailed maintenance procedures are discussed in other manuals; however, it is recommended that the valve be returned to Siemens for service when more detailed maintenance is needed.

4.4.1.1 Maintenance Considerations

If customer maintenance personnel are not technically trained to repair the Model 20 valve on site, it is recommended that the valve be returned to Siemens for service, repair, or direct replacement.

To repair the valve on site, the customer must have the necessary maintenance tools and replacement parts. Recommended valve spare parts, including the Model 20 repair kit (PN K21000), can be obtained from Siemens.

When cleaning the Model 20 valve components, it is imperative that the maintenance be performed in a clean and contaminant free facility. Components should be placed on a lint free cloth to prevent impurities from contaminating the valve and its components. Hands should be clean and free of contaminants. Presence of any foreign contamination can cause additional valve problems after reinstallation.

All foreign contamination adhering to valve components must be removed using cleaning solvent, such as hexane, acetone, or methanol and a dust/lint free cloth. After cleaning valve cap and tubing, shake or blow with clean air the excess cleaning fluid from the individual components. Ensure that the components are air dry before reassembling.

It is possible to remove the valve cap of the Model 20 valve while the valve is installed in the Maxum oven. However, there may be situations where the user wishes to remove the valve from the oven. While this is not described in this manual, it is a straightforward process to detach air connections, loosen the mounting clamp, and remove the valve.

Note

Do not allow polished face of valve cap to rest on any surface other than a lint free cloth. Clean metal parts using only a syringe and a cleaning solvent such as hexane, acetone, or methanol.

** CAUTION**

Potential burn hazard. Handling hot components may result in personal injury.

Before servicing the Model 20 valve, it is important that primary AC power to the Maxum II be turned off from the main circuit breaker, and the oven be allowed to cool. Only maintenance personnel with proper authorization should open the electronic enclosure. Failure to observe safety precautions can result in personal injury.

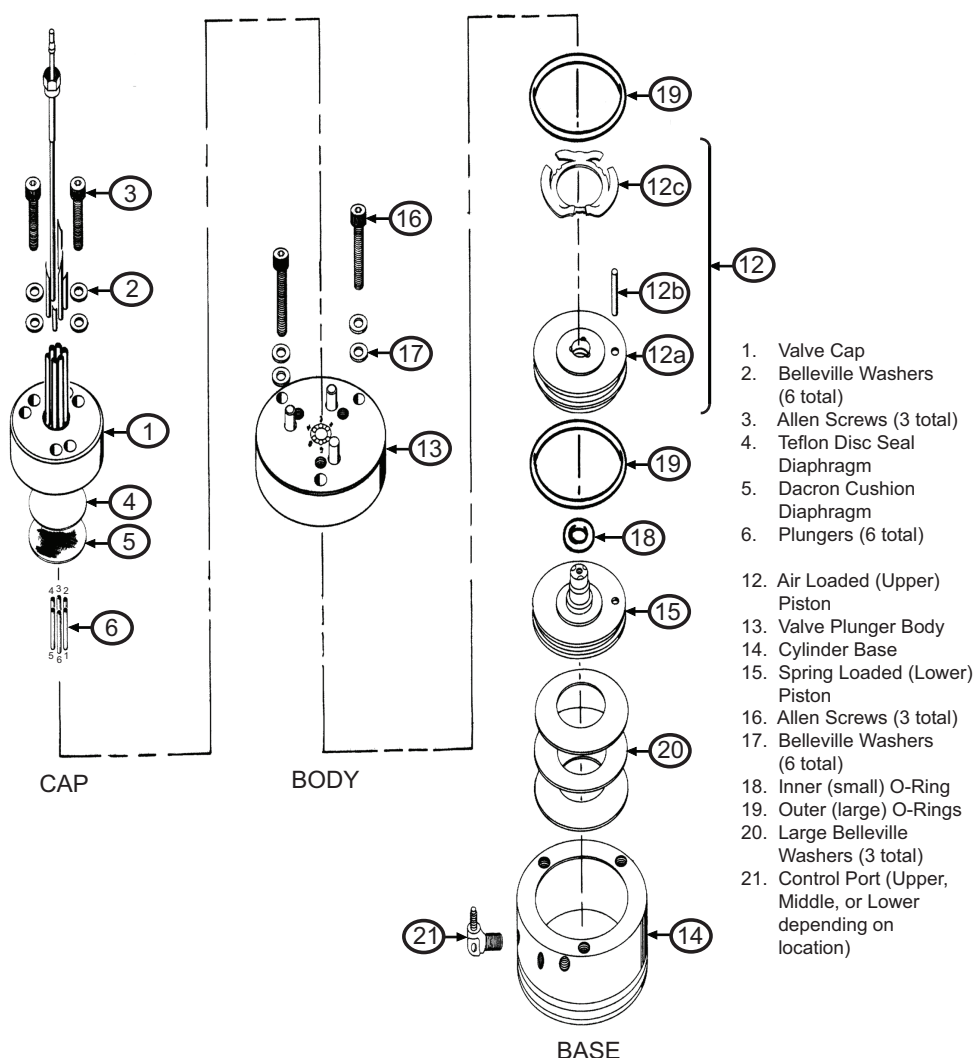


Figure 4-14 Model 20 Valve Exploded View

4.4.1.2 Diagnostic Procedures

Depending on the installation, the following tests can be performed with the valve mounted in the analyzer. Other tests require the analyzer to be shut down and valve ports disconnected. These diagnostic tests indicate specific areas of the fault or trouble.

Valve Leakage

Sample Pressures Lower Than Carrier Gas Pressure: Leakage may be from a carrier-gas port to a sample port within the valve regardless of whether valve is actuated or deactivated. With sample inlet flow turned off, sample outlet should be zero. Check carrier and sample gas for leakage.

Carrier and Sample Gas Leakage: Bubbles indicate internal leakage. For a liquid carrier, check for liquid dripping from sample outlet tube.

Sample Pressure Higher Than Carrier Gas: Leakage between ports is visually displayed on analyzer recorder as a baseline shift when sample pressure is removed from valve.

Plugged Valve

If the valve is plugged, plungers are pressed upward by air pressure or spring action and will not release to their open position when sample pressure drops.

Ruptured Diaphragm

Escaping air from valve vent hole indicates a ruptured diaphragm (4), which must be replaced. Check for liquid substances escaping from the vent hole.

Slow Erratic Piston Switching

Improper lubrication and/or contamination of O-rings will increase friction on valve-actuating piston. This causes valve switching to be erratic, slow or inoperative.

This condition requires disassembly of the entire valve (maxi-maintenance). It is recommended that the valve be returned to Siemens for service.

4.4.1.3 Model 20 Valve Cap Maintenance Procedure

If customer maintenance personnel are not technically trained to repair the Model 20 valve on site, it is recommended that the valve be returned to Siemens for service, repair, or direct replacement.

Within the following procedures, the numbers in parenthesis are callouts. They denote parts referenced in the lists contained in the figure in section 6.5.2; refer back to the figure for locations.

Valve Cap Disassembly, Cleaning, and Reassembly

1. Loosen the three Allen screws (16), holding the plunger valve body (13) to the valve cylinder base (14). The screws should be loosened to the point that most of the spring pressure is relieved (approximately 1/8 inch or 3.2 mm).
DO NOT remove these three screws.
2. To remove valve cap (1), remove the three Allen screws (3) and six Belleville washers (2) holding the valve cap (1) to the valve plunger body (13).
3. Remove the valve cap (1) from the plunger valve body (17).

NOTICE

Do not place polished valve cap (1) against any abrasive surface. Place it on an uncontaminated lint free cloth.

4.4 Model 20 Valve

1. Inspect the valve cap Teflon® base seal disc diaphragm (4) and the Dacron® disc cushion diaphragm (5) for dirt, contamination or breaks.
Regardless of whether damage or contamination is evident, discard old seal and cushion, and replace them with new component(s).

Note

If Teflon® sealing disc and Dacron® cushion disc are brittle or dirty, but not ruptured, or they are ruptured but clean, visually inspect the rest of the valve. If it is clean and in good order, it is possible to continue with this procedure.

If ruptured discs appear to have caused contamination of the valve, it will need to be disassembled in order to be cleaned. It is recommended that the valve be returned to Siemens for service.

Note

All valve fittings and tubing must be clean and valve diaphragms inspected for cleanliness, catalyst or polymer buildup. Valve cap or plunger valve body faces should be wiped clean using hexane, acetone or methanol and a lint free cloth.

2. Prepare a large syringe with a Tygon® tubing adapter installed. Fill syringe with a recommended cleaning solvent.
3. An ultrasonic cleaner filled with a recommended cleaning solvent is recommended for cleaning all components. Solvent must not leave any residue on evaporation.
Clean valve cap while it is disassembled.
After cleaning of cap, using syringe, flush solvent through each port in the valve cap.

NOTICE

When reassembling the valve cap, always install a new Teflon® Seal Disc diaphragm (4) and Dacron® Cushion Disc (5). **DO NOT** install the previously used Seal and/or Cushion Disc.

4. Position the Dacron® cushion disc diaphragm (5) between the three alignment pins on the plunger valve body (13).
5. Using tweezers, hold Teflon® seal disc diaphragm (4) by its edges. Before installing disc, remove lint, dust and oils by sliding disk between your index and middle fingers.
6. Install Teflon® seal disc diaphragm (4) over the Dacron® diaphragm disc cushion (5).
7. Align valve cap (1) over the valve body three-plunger guide pins (13). Port 1 must be placed toward the upper control port.
8. Lower valve cap (1) over plunger valve body plunger guide pins (13) then install valve cap (1) onto the plunger valve body.
9. Install, but **DO NOT** securely tighten, the three Allen screws (3) each with two Belleville lock washers (2).

Note

To assure proper tightness in the following two steps, it is recommended to use the torque wrench available from Siemens, PN 1631005-002, which can be adjusted over the range of torque measurements listed below.

10. Referring to the following screw tightening rotation sequence, securely tighten the three Allen screws (3) that connect the valve cap (1) to the valve plunger body (13). One at a time, tighten each screw to first torque. Then continue with the next torque value until the final value is reached.
 - Finger tighten
 - 20 inch pounds (2.3 Nm)
 - 40 inch pounds (4.5 Nm)
 - 60 inch pounds (6.8 Nm)
11. Tighten the three Allen screws (16) that secure the plunger valve body (13) to the cylinder base (14) to approximately 30 to 40 inch-pounds (3.4 to 4.5 Nm).

NOTICE

Be certain all Allen screws are securely tightened. DO NOT overtighten.

4.4.2 Disassembly and Cleaning

4.4.2.1 M20 Description

This section presents information to disassemble, clean, and rebuild the Model 20 Valve.

Maintenance procedures for the Model 20 valve are grouped into two types, Mini-Maintenance procedures and Maxi-Maintenance procedures. Mini-Maintenance procedures involve working on the valve while it is still installed in the analyzer. Maxi-Maintenance procedures may be used when Mini-Maintenance does not correct a valve fault. However, it is often cheaper and easier to replace the valve or return it to Siemens for service. This manual covers the Maxi-Maintenance procedures in the following order.

- Valve Cap Disassembly
- Actuator Disassembly
- Cleaning Actuator, Fittings, Tubing, etc.
- Actuator Assembly
- Valve Cap Cleaning and Assembly

To assure optimum valve operation, a clean contaminant free work environment is required for this procedure. To repair the valve on site, the customer must have the necessary maintenance tools and replacement parts. Recommended valve spare parts can be obtained from Siemens. Recommended tools will include an ultrasonic cleaner and a clean workstation with lint-free cloth.

It may be easier and less expensive to replace a valve or return it to Siemens for service rather than perform Maxi-Maintenance.

4.4.2.2 M20 Intended Users

This procedure is intended for qualified users with sufficient training to safely repair a valve in the field. If customer maintenance personnel are not technically trained to repair the valve on site, it is recommended that the valve be returned to Siemens for repair or direct replacement.

In addition to training, the customer must have a clean work environment available for rebuilding and cleaning the valve. Performing the work in a contaminated environment, or performing the work incorrectly may damage the valve.

4.4.2.3 M20 Safety and Certification Information

This procedure is not likely to directly impact the safety systems of the analyzer. However, care must be exercised at all times when working with the analyzer. Since the valve is located in the oven of the Maxum II, appropriate care must be taken to ensure that the environment is safe to perform the work.

Maintenance work on the Maxum II analyzer should only be performed when the area is known to be safe for the work to be done.

Note

This procedure must only be executed with the consent and approval of all applicable local safety personnel and/or the local authority having jurisdiction.

4.4.2.4 M20 Procedure - Overview

Throughout this procedure there are steps that instruct the user to inspect the valve to determine whether additional disassembly is necessary. This is to prevent unnecessary effort and to prevent the possibility of damaging the valve through further disassembly.

4.4.2.5 M20 Procedure - Maintenance Facility

When cleaning the valve and associated components, it is imperative that the maintenance be performed in a clean and contaminant free facility. Components should be placed on a lint free cloth to prevent impurities from contaminating the valve and/or components. Hands should be clean and free of contaminants.

Presence of any foreign contamination can cause additional valve problems after reinstallation.

All foreign contamination adhering to valve must be removed quickly using a dust/lint free cloth and a cleaning solvent such as hexane. After cleaning valve cap and tubing, shake excess cleaning fluid from tubes and let valve cap air dry before reassembling.

NOTICE
Do not allow polished face of valve cap to rest on any surface other than a lint free cloth. Clean metal parts using a syringe or ultrasonic cleaner and an appropriate cleaning solution as described in this procedure.

4.4.2.6 M20 Procedure - Figures

The following figures are intended for use as a reference throughout the procedure. The numbers in the diagrams relating to individual components are referenced in parentheses in the procedure steps.

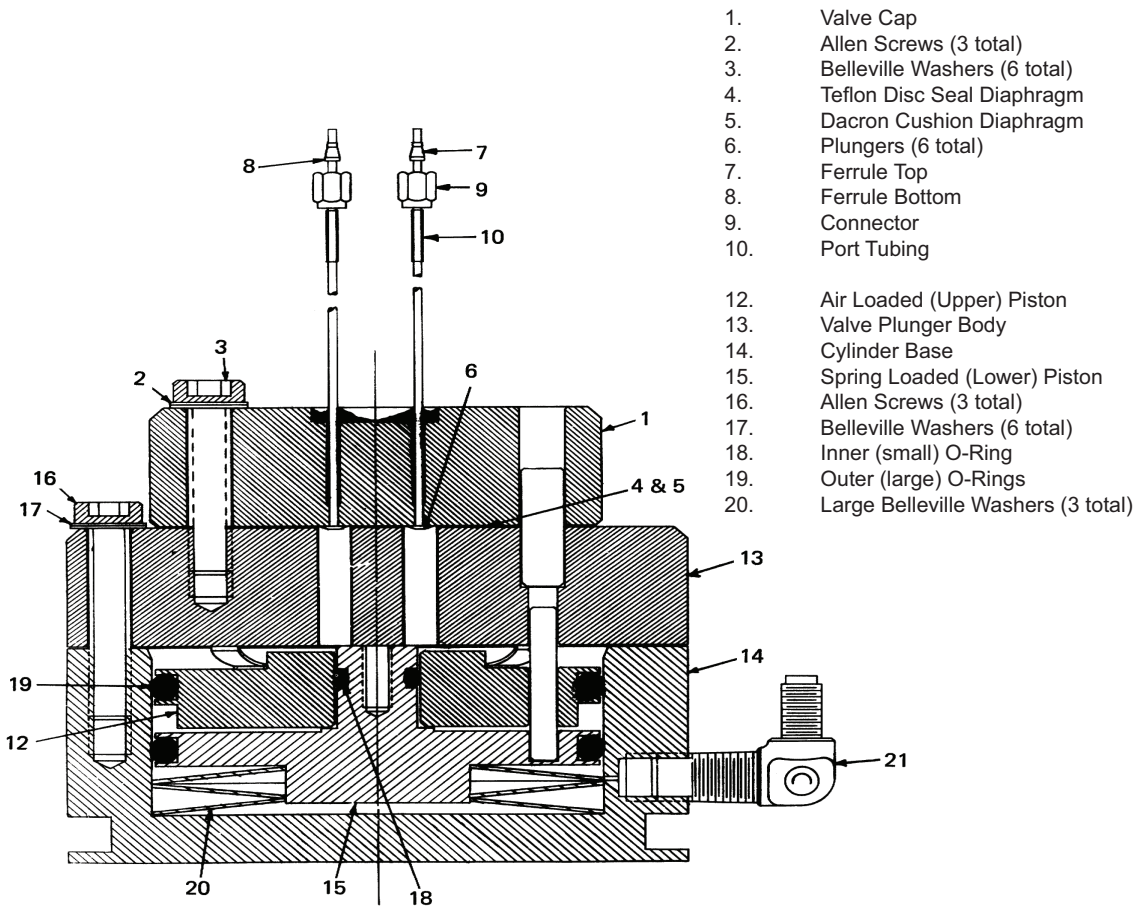


Figure 4-15 Section View of Model 20 Valve

4.4 Model 20 Valve

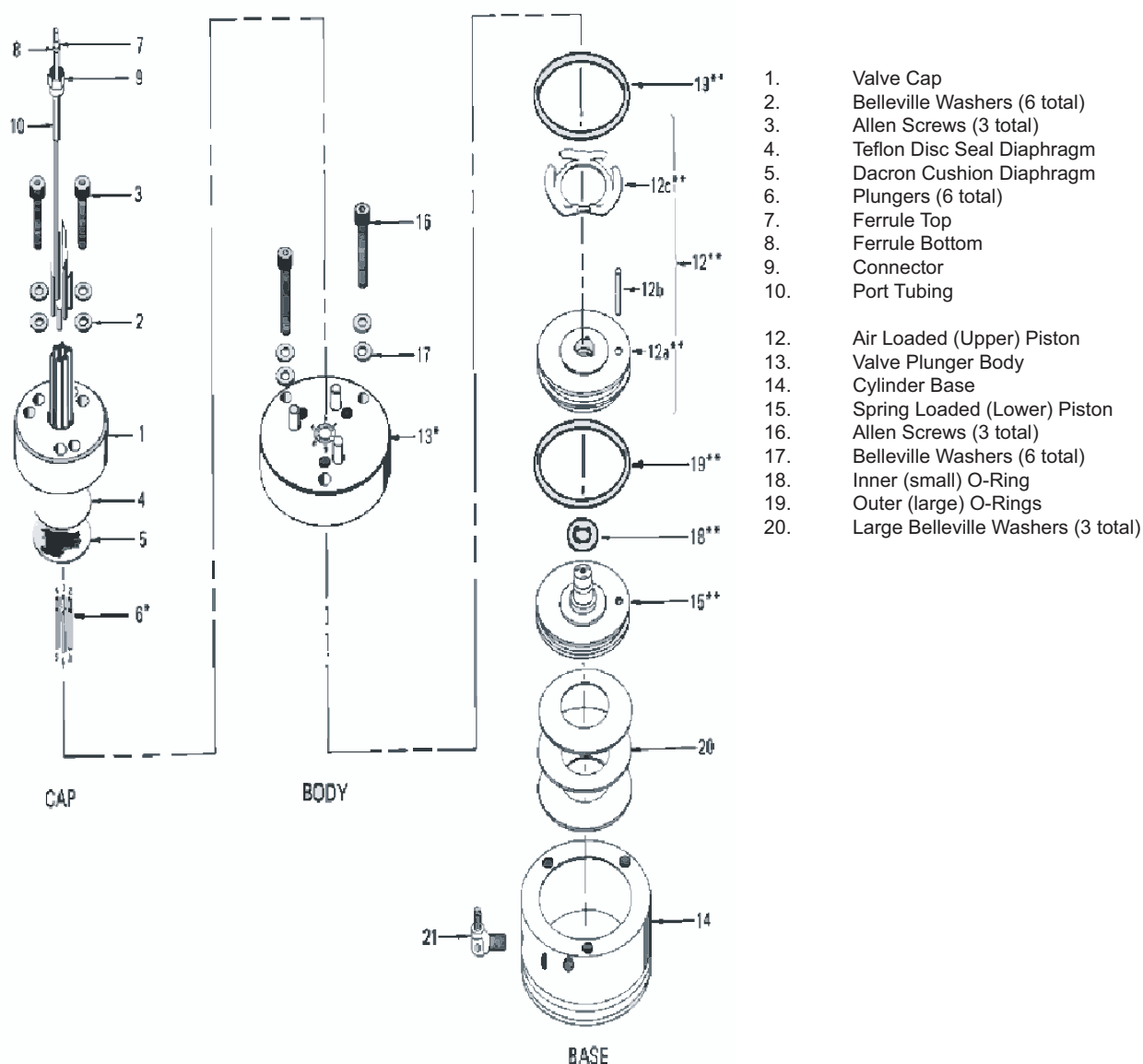


Figure 4-16 Exploded View of Model 20 Valve

4.4.2.7 M20 Procedure - Cleaning of Parts

All parts must be inspected for cleanliness, including catalyst or polymer buildup on the valve cap. Before re-assembly, faces of the plunger valve body (13) should be wiped clean using hexane, acetone, or methanol and a lint free cloth.

An ultrasonic cleaner filled with a recommended cleaning solvent or detergent is recommended for cleaning all components. However, after cleaning, there must not be any remaining residue. If cleaning solution becomes contaminated during cleaning, it must be replaced with an uncontaminated supply.

A syringe and appropriate solvent can be used to flush the ports of the valve cap. This is described in the procedure.

It is important for proper procedures to be used when cleaning valve and detector parts. All foreign contamination adhering to the part should be removed using an appropriate cleaning solvent, such as hexane, acetone, or methanol and a dust/lint free cloth. Use of an ultrasonic cleaner is often helpful. After cleaning, it is necessary remove excess cleaning fluid from the components by blowing with clean air or shaking. Components must be air dry before reassembling.

It is possible and often better to use an appropriate detergent, such as Alconox® for cleaning instead of solvent. However, after cleaning with a detergent, it is necessary to rinse the part thoroughly with deionized water (distilled water is also acceptable) in order to remove detergent residue. All water must then be removed by blowing with clean air or shaking. Components must be completely dry before reassembling.

4.4.2.8 M20 Procedure - Valve Cap Disassembly

1. Loosen the three Allen screws (16), holding the plunger valve body (13) to the valve cylinder base (14). The screws should be loosened to the point that most of the spring pressure is relieved (approximately 1/8" or 3.2 mm).
Do not remove the three Allen mounting screws at this time.
2. To remove valve cap (1), remove the three Allen screws (3) and six Belleville washers (2) holding the valve cap (1) to the valve plunger body (13).
3. Remove the valve cap (1) from the plunger valve body (13).

NOTICE

To prevent damage to the valve cap (1), do not place polished surface of the valve cap against any abrasive surface. Place it on a lint free cloth free of foreign contaminants.
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4. Inspect the valve cap Teflon base seal disc diaphragm (4) and the Dacron disc cushion diaphragm (5) for dirt, contamination or breaks.
Regardless of whether damage or contamination is evident, discard old seal and cushion, and replace them with new component(s).
5. Visually inspect the rest of valve. If it is clean and in good condition, install a new disc seal diaphragm (4) and cushion diaphragm (5).
To reassemble the valve cap, refer to the applicable steps later in this chapter.

Note

The valve cap and fittings will be cleaned before reassembly. This step will be executed later in this chapter.

4.4.2.9 M20 Procedure - Actuator Disassembly

Note

In the next three steps, valve plungers (6) are checked for sticking.

4.4 Model 20 Valve

1. Using even finger pressure around edges of plunger valve body (13), push valve plunger body against cylinder valve base (14). All six plungers should rise.
2. Release plunger valve body (13). The six plungers should drop. If plungers do not drop, check for oil film on plungers. This can prevent plungers from dropping.
3. Apply gentle pressure to the top of each of the six plungers. If plungers drop, without excessive pressure, the valve is operating normally and does not require additional disassembly. If plungers stick or are sluggish in their operation, they must either be thoroughly cleaned with a recommended cleaning solution, repaired, or the entire actuator must be replaced.
4. Remove all connections from the valve and remove the entire valve from the oven. While removing the valve, hold it upright to prevent plungers from falling out. Additional work should be on a clean workspace.
5. Turn actuator on its side. Remove the three screws (16) which secure the plunger valve body (13) to the cylinder valve base (14).

Note

When performing the following step, DO NOT allow actuator plungers to fall from plunger valve body (13).

6. With plunger valve body (13) in the horizontal position, remove it from the cylinder base (14). Carefully remove all six plungers (6).

Note

Perform EITHER step 7 or step 8 to remove the actuator piston from the cylinder base.

7. Place cylinder valve base (14) in upright position. Insert a 6-32 hex threaded standoff screw into the center-threaded hole and pull to remove air loaded piston (12) and spring-loaded piston (15).

Note

In the following step, DO NOT use more than 30 psig (210 kPa) of air pressure when using this method.

8. *Alternate method for removing actuator piston.*
Carefully apply 10 psig (70 kPa) air pressure on bottom port of cylinder valve base (14). This extends the pistons allowing them to be pulled out of cylinder valve base by hand.
9. Inspect actuator cylinder walls and the three Belleville washers (20). These components must be clean and show no evidence of damage. If necessary, clean parts or replace them.
10. Separate the upper air loaded piston (12) and lower spring loaded piston (15). Inspect pistons (12 and 15), silicone O-rings (18 and 19) and finger loaded valve spring (12c). These components must be clean and show no evidence of damage. If necessary, clean parts or replace them.

4.4.2.10 M20 Procedure - Actuator Reassembly

Note

It is extremely important that, when reassembling the actuator, that the assembly area be clean and dust free. Hands of maintenance personnel must be clean and not oily and tools must also be clean.

Note

Be certain valve cap (1) does not rest on abrasive surface and valve cap has completely air dried before reassembly. Rest valve cap on a clean lint free cloth.

1. Install the three large Belleville washers (20) in cylinder valve base (14). Washers must be positioned in an alternating bevel up, bevel down manner (to form a spring). Refer to Figures 5-1 and 5-2.
2. Apply a bead of Krytox 240 AC lubricant, or equivalent; in "O" ring grooves of spring-loaded piston (15).
3. Install new silicon O-rings (18 and 19) in spring loaded piston (15) and apply a coating of lubricant over each "O" ring.
4. Apply bead of lubricant in upper groove of air loaded piston (12a).
5. Install a new silicon "O" ring (19) in the upper groove of air loaded piston (12a) and apply a coating of lubricant over the "O" ring.
6. Place upper piston (12a) over the small diameter of lower piston (15). Position pistons using guide pin (12b) for proper orientation.
7. Apply Krytox 240C lubricant to each of the six finger spring (12c) pressure points. This is the point where the spring fingers contact the plunger body (13).
8. Position the valve upright with its three ports on the left. Install a #6-32 screw in the center-threaded hole of air loaded piston assembly (12) and bottom spring-loaded piston (15).
9. Lift the combined assembly (12 and 15), and orient it with the upper piston guide pin (12b) facing toward maintenance person.
10. Press the piston assembly into the cylinder base (14). After installation, remove the #6-32 screw.
11. Align plunger valve body (13) and insert the piston guide pin (12b) into one of the three bottom holes of plunger valve body (13).
12. Rotate plunger valve body (13) to align body screw holes with cylinder base (14) threaded holes.
13. Install three #10-32 7/8" socket head screws (16) and Belleville washers (17).
14. Hand tighten screws. DO NOT compress the Belleville washers (20) into the cylinder base (14).
15. Install six plungers (6) into the plunger valve body (13). Plunger recess must face up.
A clean plunger will fall with its own weight, and, when dropped into the valve body (13), it will bounce.

16. Place a small drop of Krytox 143 AY or equivalent oil between each plunger.
17. Using a pair of tweezers, lift each plunger up and down to allow the oil to flow around a plunger.

4.4.2.11 M20 Procedure - Valve Cap Reassembly

Note

Before reassembling the valve cap, clean it as described below.

1. Prepare a large syringe with a Tygon tubing adapter installed. Fill syringe with a recommended cleaning solvent.
 2. Using syringe, flush solvent through each port in the valve cap.
-

Note

When reassembling the valve cap, always install a new Teflon Seal Disc diaphragm (4) and Dacron Cushion Disc (5) on plunger valve body (13). Do not install the previously used Teflon Seal (4) and/or Dacron Cushion Disc (5). Before reinstalling seal and cushion on plunger valve body, remove lint and any dust particles.

3. Place the actuator assembly upright on a clean lint free cloth surface. Refer to Figures 5-1 and 5-2.
 4. Position the Dacron cushion disc diaphragm (5) between the three alignment pins on the plunger valve body (13).
 5. Using tweezers hold the Teflon seal disc diaphragm (4) by its edges. Before reinstalling disc, remove lint, dust and oils by sliding disk between your index and middle fingers.
 6. Install Teflon seal disc diaphragm (4) over the Dacron diaphragm disc cushion (5).
 7. Align and lower valve cap (1) over the three guide pins of the valve plunger body (13). Then install valve cap (1) onto the plunger valve body.
 8. Install, but do not securely tighten, the three Allen screws (3) each with two Belleville lock washers (2).
-

Note

To assure proper tightness in the following two steps, it is recommended to use the torque wrench available from Siemens, part number 1631005-002, which can be adjusted over the range of torque measurements listed below.

9. Referring to the following screw tightening rotation sequence, securely tighten the three Allen screws (3) that connect the valve cap (1) to the valve plunger body (13). One at a time, tighten each screw to first torque. Then continue with the next torque value until the final value is reached.
 - a. Finger tighten
 - b. 20 inch-pounds (2.3 Nm)
 - c. 40 inch-pounds (4.5 Nm)
 - d. 60 inch-pounds (6.8 Nm)
10. Tighten the three Allen screws (16) that secure the plunger valve body (13) to the cylinder base (14) to approximately 30 to 40 inch-pounds (3.4 to 4.5 Nm).
BE CERTAIN ALL ALLEN SCREWS ARE SECURELY TIGHTENED. DO NOT OVERTIGHTEN.

4.4.3 Model 20 Valve Specifications

Internal loop sample size:	2 µl standard. (Other sizes are available on special request.)
External loop sample size:	170 µl standard. (Other sizes are available on special request.)
Sample filter:	5 µm recommended (not furnished with valve).
Maximum operating temperature:	122°C (250°F) standard
Maximum sample pressure:	1380 kPa (200 psi) gage instrument air standard. 10350 kPa (1500 psi) gage with 2 80 550 kPa (80psi) gage air signals. Higher operating pressure available on special request.
Minimum sample pressure:	34.5 kPa (5 psig)
Maximum leak rate between ports:	Less than 1 µl per minute between ports.
Material in contact with sample:	316 stainless steel and Teflon, standard. Other materials are available on special request.
Connection size and type:	1.6 mm ($1/16$ ") O. D. tubing, with Swagelok® fittings
Actuating air:	345 kPa to 550 kPa (50 to 80 psig) instrument air standard. 550 kPa (80 psig) maximum. Helium or nitrogen may be substituted for air.
Total switching time:	150 ms (total time from initiation of command signal to completion of change in valve state)
Body size:	70 mm ($2\frac{3}{4}$ ") diameter by 70 mm ($2\frac{3}{4}$ ") height
Mounting:	Clamp type
Other:	A carrier purge (helium, hydrogen, or nitrogen) may be used (an external low-pressure gas supply is required).

4.5 Model 20 HT Valve

4.5.1 M20HT Description

This section presents information to disassemble, clean, and rebuild the Model 20 High Temperature (Model 20 HT) Valve. The Model 20 HT Valve is similar to the standard Model 20 with a few distinct differences. Procedures to disassemble and clean the Model 20 HT are very similar to the Model 20. However, procedures to re-assemble the Model 20 HT valve are different from the standard Model 20.

Like the standard Model 20 valve, maintenance procedures for the Model 20 HT valve are grouped into two types, Mini-Maintenance procedures and Maxi-Maintenance procedures. Mini-Maintenance procedures involve working on the valve while it is still installed in the analyzer. Maxi-Maintenance procedures may be used when Mini-Maintenance does not correct a valve fault. This manual covers the Maxi-Maintenance procedures in the following order.

- Valve Cap Disassembly
- Actuator Disassembly
- Cleaning Actuator, Fittings, Tubing, etc.
- Actuator Assembly
- Valve Cap Cleaning and Assembly

To assure optimum valve operation, a clean contaminant free work environment is required for this procedure. To repair the valve on site, the customer must have the necessary maintenance tools and replacement parts. Recommended valve spare parts can be obtained from Siemens. Recommended tools will include an ultrasonic cleaner and a clean workstation with lint-free cloth.

Mini-Maintenance procedures can be found in the Maxum II Maintenance Manual. This manual can be found on the Maxum II Documentation CD (part number 2000597-001). Additional procedures related to the Model 20 High Temperature Valve can be found in the Model 20 High Temperature Valve Repair Manual, which can also be found on the Maxum II Documentation CD.

It may be easier and less expensive to replace a valve or return it to Siemens for service rather than perform Maxi-Maintenance.

4.5.2 M20HT Intended Users

This procedure is intended for qualified users with sufficient training to safely repair a valve in the field. If customer maintenance personnel are not technically trained to repair the valve on site, it is recommended that the valve be returned to Siemens for repair or direct replacement.

In addition to training, the customer must have a clean work environment available for rebuilding and cleaning the valve. Performing the work in a contaminated environment, or performing the work incorrectly may damage the valve.

4.5.3 M20HT Safety and Certification Information

This procedure is not likely to directly impact the safety systems of the analyzer. However, care must be exercised at all times when working with the analyzer. Since the valve is located in the oven of the Maxum II, appropriate care must be taken to ensure that the environment is safe to perform the work.

Maintenance work on the Maxum II analyzer should only be performed when the area is known to be safe for the work to be done.

NOTICE
Obtain appropriate permits.
This procedure must only be executed with the consent and approval of all applicable local safety personnel and/or the local authority having jurisdiction.

4.5.4 M20HT Procedure - Overview

Throughout this procedure there are steps that instruct the user to inspect the valve to determine whether additional disassembly is necessary. This is to prevent unnecessary effort and to prevent the possibility of damaging the valve through further disassembly.

4.5.5 M20HT Procedure - Maintenance Facility

When cleaning the valve and associated components, it is imperative that the maintenance be performed in a clean and contaminant free facility. Components should be placed on a lint free cloth to prevent impurities from contaminating the valve and/or components. Hands should be clean and free of contaminants.

Presence of any foreign contamination can cause additional valve problems after reinstallation.

All foreign contamination adhering to valve must be removed quickly using a dust/lint free cloth and a cleaning solvent such as hexane. After cleaning valve cap and tubing, shake excess cleaning fluid from tubes and let valve cap air dry before reassembling.

NOTICE
Do not allow polished face of valve cap to rest on any surface other than a lint free cloth. Clean metal parts using a syringe or ultrasonic cleaner and an appropriate cleaning solution as described in this procedure.

4.5.6 M20HT Procedure - Figures

The following figures are intended for use as a reference throughout the procedure. The numbers in the diagrams relating to individual components are referenced in parentheses in the procedure steps.

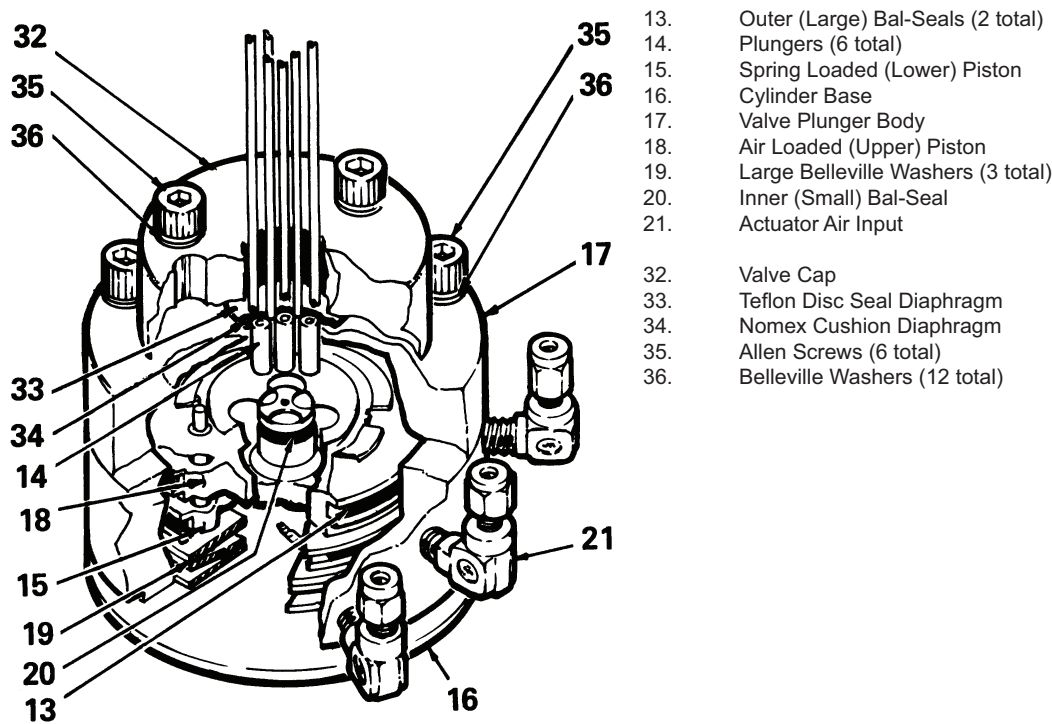
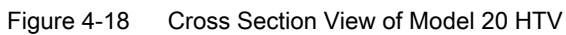


Figure 4-17 Cutout View of Model 20 HTV



4.5 Model 20 HT Valve

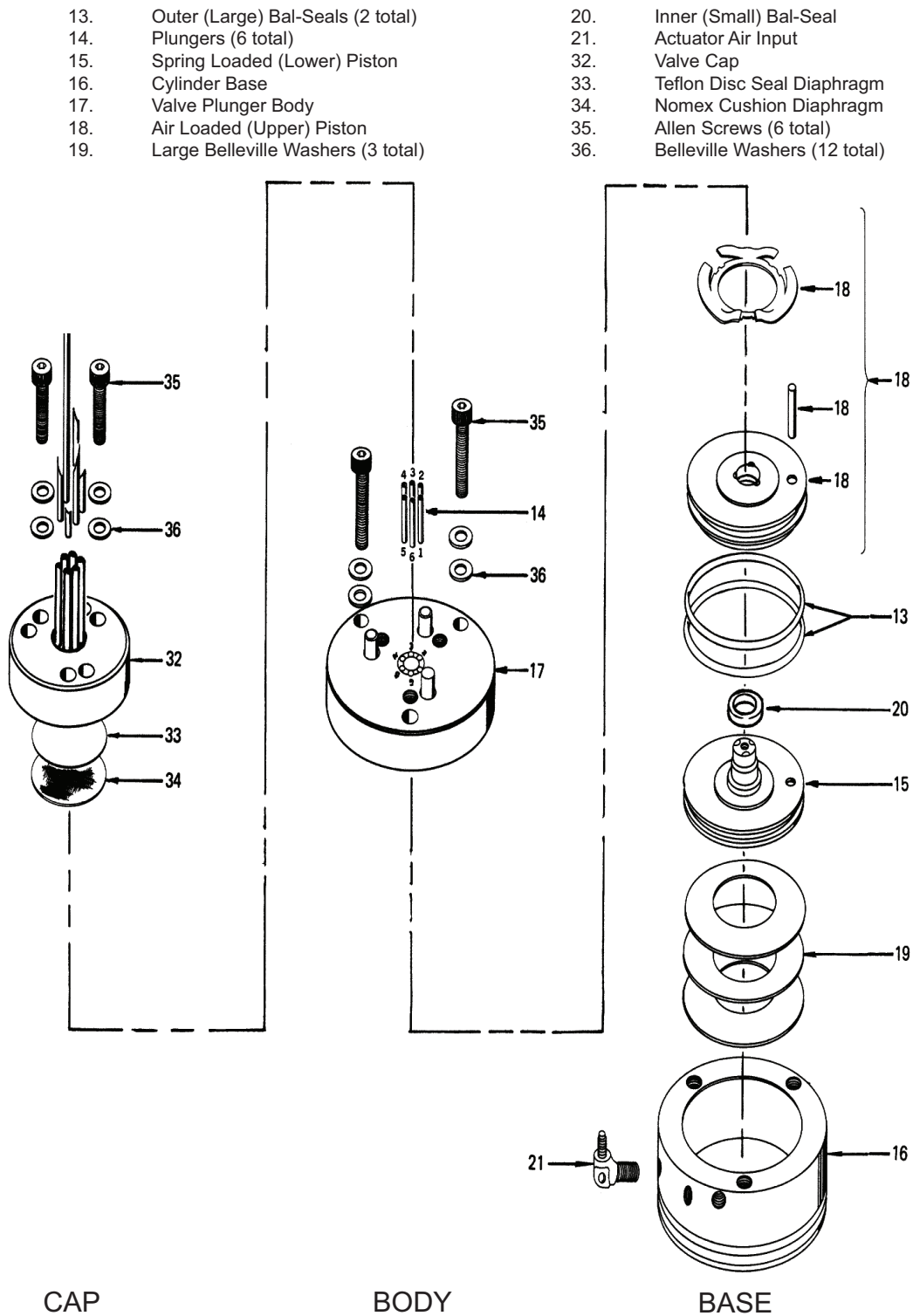


Figure 4-19 Exploded View of Model 20 HTV

4.5.7 M20HT Procedure - Cleaning of Parts

All parts must be inspected for cleanliness, including catalyst or polymer buildup on the valve cap. Before re-assembly, faces of the plunger valve body (17) should be wiped clean using hexane, acetone, or methanol and a lint free cloth.

An ultrasonic cleaner filled with a recommended cleaning solvent or detergent is recommended for cleaning all components. However, after cleaning, there must not be any remaining residue. If cleaning solution becomes contaminated during cleaning, it must be replaced with an uncontaminated supply.

A syringe and appropriate solvent can be used to flush the ports of the valve cap. This is described in the procedure.

It is important for proper procedures to be used when cleaning valve and detector parts. All foreign contamination adhering to the part should be removed using an appropriate cleaning solvent, such as hexane, acetone, or methanol and a dust/lint free cloth. Use of an ultrasonic cleaner is often helpful. After cleaning, it is necessary remove excess cleaning fluid from the components by blowing with clean air or shaking. Components must be air dry before reassembling.

It is possible and often better to use an appropriate detergent, such as Alconox® for cleaning instead of solvent. However, after cleaning with a detergent, it is necessary to rinse the part thoroughly with deionized water (distilled water is also acceptable) in order to remove detergent residue. All water must then be removed by blowing with clean air or shaking. Components must be completely dry before reassembling.

4.5.8 M20HT Procedure - Valve Cap Disassembly

1. Loosen the three Allen screws (35), holding the plunger valve body (17) to the valve cylinder base (16). The screws should be loosened to the point that most of the spring pressure is relieved (approximately 1/8" or 3.2 mm).
Do not remove the three Allen mounting screws at this time.
2. To remove valve cap (32), remove the three Allen screws (35) and six Belleville washers (36) holding the valve cap (32) to the valve plunger body (17).
3. Remove the valve cap (32) from the plunger valve body (17).

NOTICE
To prevent damage to the valve cap (32), do not place polished surface of the valve cap against any abrasive surface. Place it on a lint free cloth free of foreign contaminants.

4. Inspect the Teflon seal disc diaphragm (33) and the Nomex cushion diaphragm (34). Examine valve cap base seal (33) and cushion diaphragm (34) subassemblies for dirt, contamination or breaks.
Regardless of whether damage or contamination is evident, discard old seal and cushion, and replace them with new component(s).
5. Visually inspect the rest of valve. If it is clean and in good condition, install a new disc seal diaphragm (33) and cushion diaphragm (34).
To reassemble the valve cap, refer to the applicable steps later in this chapter.

Note

The valve cap and fittings will be cleaned before reassembly. This step will be executed later in this chapter.

4.5.9 M20HT Procedure - Actuator Disassembly

Note

In the next three steps, valve plungers (14) are checked for sticking.

1. Using even finger pressure around edges of plunger valve body (17), push valve plunger body against cylinder valve base (16). All six plungers should rise.
2. Release plunger valve body (17). The six plungers should drop. If plungers do not drop, check for oil film on plungers. This can prevent plungers from dropping.
3. Apply gentle pressure to the top of each of the six plungers. If plungers drop, without excessive pressure, the valve is operating normally and does not require additional disassembly. If plungers stick or are sluggish in their operation, they must either be thoroughly cleaned with a recommended cleaning solution, repaired, or the entire actuator must be replaced.
4. Remove all connections from the valve and remove the entire valve from the oven. While removing the valve, hold it upright to prevent plungers from falling out.
Additional work should be on a clean workspace.
5. Turn the actuator on its side. Remove the three socket head screws (35) which secure the plunger valve body (17) to the cylinder valve base (16).

Note

When performing the following step, DO NOT allow actuator plungers to fall from plunger valve body (17).

6. With plunger valve body (17) in the horizontal position, remove the assembly. Carefully remove all six plungers (14).

Note

Perform EITHER step 7 or step 8 to remove the actuator piston from the cylinder base.

7. Place cylinder valve base (16) in upright position. Insert a 6-32 hex threaded standoff screw into the center-threaded hole and pull to remove air loaded piston (18) and spring-loaded piston (15).

Note

In the following step, DO NOT use more than 30 psig (210 kPa) of air pressure when using this method.

8. *Alternate method for removing actuator piston.*
Carefully apply 10 psig (70 kPa) of air pressure on bottom port of cylinder valve base (16). This extends the pistons allowing them to be pulled out of cylinder valve base by hand.
9. Inspect actuator cylinder walls and the three Belleville washers (19). These components must be clean and show no evidence of damage. If necessary, clean parts or replace them.
10. Separate the upper air loaded piston (18) and lower spring loaded piston (15). Inspect pistons and spring loaded Bal-Seal (20) and Belleville washer (19). These components must be clean and show no evidence of damage. If necessary clean parts or replace them.

4.5.10 M20HT Procedure - Actuator Re-assembly

Note

It is extremely important that, when reassembling the actuator, that the assembly area be clean and dust free. Hands of maintenance personnel must be clean and not oily and tools must also be clean.

Note

Be certain valve cap (32) does not rest on abrasive surface and valve cap has completely air dried before reassembly. Rest valve cap on a clean lint free cloth.

1. Install the three large Belleville washers (19) in cylinder valve base (16). Washers must be positioned in an alternating bevel up, bevel down manner (to form a spring). Refer to Figures 6-2 and 6-3.
2. Apply a bead of Krytox 240 AC lubricant, or equivalent, in Bal-Seal grooves of spring loaded piston (15).
3. Lubricate outside diameter of assembly tool (Part Number A00145). Be certain spring-loaded Bal-Seal (13) is properly oriented with the associated spring facing up.
4. Using an "O" ring as a cushion, push spring loaded Bal-Seal (13) down on the assembly tool until it snaps firmly into spring loaded piston (15) ring groove. Refer to Figure 6-4 on the next page.

NOTICE
When installing Bal-Seals, handle them with extreme care. Do not remove Bal-Seal springs for installation and do not nick or scratch Bal-Seals.

4.5 Model 20 HT Valve

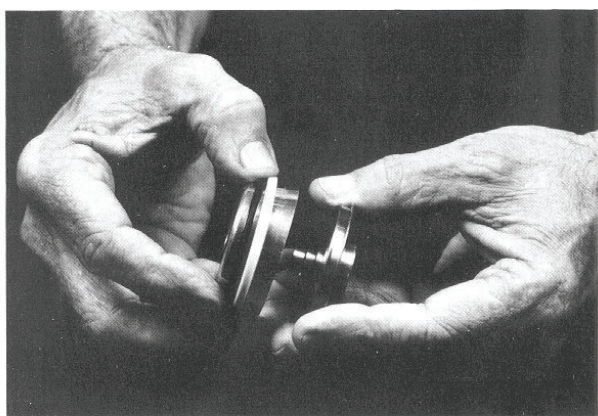
5. Apply a bead of Krytox 240 AC lubricant, or equivalent, in both Bal-Seal grooves of air-loaded piston (18).



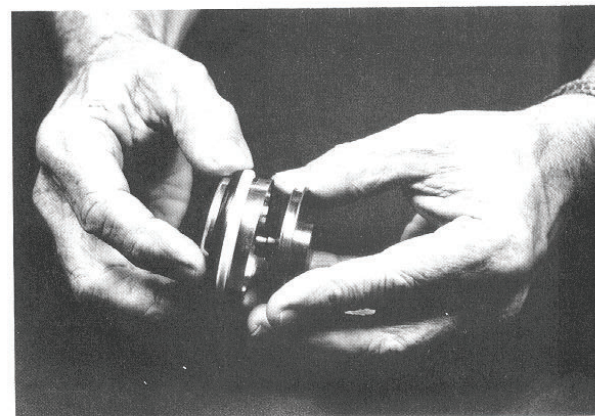
A.



B.



C.



D.

Figure 4-20 Assembling Bal-Seal (13) on Piston (15)

6. Using the pads of your fingers (or an "O" ring as a cushion), install the small spring loaded Bal-Seal (20) in air loaded piston (18) groove with associated spring facing up. DO NOT use a fingernail. Refer to Figure 6-5.
7. Push spring loaded Bal-Seal (20) to the bottom of groove.
8. Apply small bead of Krytox 240 AC lubricant, or equivalent, on the small Bal-Seal sealing surface of lower spring loaded piston (15).
9. Place upper air loaded piston (18) over the small diameter of lower piston (25). Position pistons using guide pin for proper orientation.
10. Screw the assembly stud and washer into the threaded hole in the lower spring loaded piston (15) and evenly force the spring loaded Bal-Seal (20) over the bearing surface of lower spring loaded piston (15). Leave the assembly stud and washer in place.
11. Moderately lubricate outsides of Bal-Seals with Krytox 240 AC lubricant, or equivalent. Also lubricate each of the six fingers of spring. This is where fingers contact plunger valve body (17).

12. Position valve upright with the three ports on the left. Place assembly guide tool (Part Number T11000) on the valve, with the cutout on the lip of assembly tool over the upper tube fitting. Refer to Figure 6-6.
13. Lift piston and Bal-Seal assembly and orient assembly with the upper piston index guide pin towards the maintenance person.
14. Firmly, but evenly, press the piston and Bal-Seal assembly through the assembly guide tool into the cylinder valve base (16). Refer to Figure 6-7.
15. Remove guide tool assembly stud and lock washer.



Figure 4-21 Installing Bal-Seal (20) in Piston Groove (18)



A



B

Figure 4-22 Placing Assembly Guide Tool on Valve Base (16)



Figure 4-23 Inserting Piston Assembly (15 and 18) into Base (16)

1. Align plunger valve body (17) and insert piston index guide pin into one of the three bottom plunger valve body holes.
2. Rotate plunger valve body (17) to align the plunger valve body screw holes with cylinder valve base (16) threaded holes.

3. Install three Allen screws (35) each with two Belleville washers (36). Hand tighten screws but DO NOT compress the Belleville washers (19) in cylinder valve base.
4. With the recessed tip facing up, install the six plungers (14) in the plunger valve body (17). A clean plunger will fall under its own weight and bounce when dropped into the plunger valve body.
5. Place a small drop of Krytox 143 AY or equivalent oil between each plunger.
6. Using a pair of tweezers, lift each plunger up and down to allow the oil to flow around a plunger.

4.5.11 M20HT Procedure - Valve Cap Re-assembly

Note

Before reassembling the valve cap, clean it as described below.

1. Prepare a large syringe with a Tygon tubing adapter installed. Fill syringe with a recommended cleaning solvent.
 2. Using syringe, flush solvent through each port in the valve cap.
-

Note

When reassembling the valve cap, always install a new Teflon Seal Disc diaphragm (33) and Nomex Cushion Disc (34) on plunger valve body (17). Do not install the previously used Teflon Seal (33) and/or Nomex Cushion Disc (34). Before reinstalling seal and cushion on plunger valve body, remove lint and any dust particles.

3. Place the actuator assembly upright on a clean lint free cloth surface. Refer to Figures 6-1 and 6-2.
 4. Position the Nomex cushion disc diaphragm (34) between the three alignment pins on the plunger valve body (17).
 5. Using tweezers hold the Teflon seal disc diaphragm (33) by its edges. Before reinstalling disc, remove lint, dust and oils by sliding disk between your index and middle fingers.
 6. Install Teflon seal disc diaphragm (33) over the Nomex disc cushion diaphragm (34).
 7. Align and lower valve cap (32) over the three guide pins of the valve plunger body (17). Then install valve cap (32) onto the plunger valve body.
 8. Install, but do not securely tighten the three Allen screws (35), each with two Belleville lock washers (36), that secure the valve cap (32) to the valve plunger body (17).
-

Note

To assure proper tightness in the following two steps, it is recommended to use the torque wrench (PN 1631005-002) and bit (PN 1631005-701) which are available from Siemens and can be adjusted over the range of torque measurements listed below.

4.5 Model 20 HT Valve

9. Referring to the following screw tightening rotation sequence, securely tighten the three Allen screws (35), that connect the valve cap (32) to the valve plunger body (17). One at a time, tighten each screw to first torque. Then continue with the next torque value until the final value is reached.
 - a. Finger tighten
 - b. 20 inch-pounds (2.3 Nm)
 - c. 40 inch-pounds (4.5 Nm)
 - d. 60 inch-pounds (6.8 Nm)
10. Tighten the three Allen screws (16) that secure the plunger valve body (13) to the cylinder base (14) to approximately 30 to 40 inch-pounds (3.4 to 4.5 Nm).
BE CERTAIN ALL ALLEN SCREWS ARE SECURELY TIGHTENED. DO NOT OVERTIGHTEN.

4.5.12 Model 20 High Temperature Valve Specifications

Internal loop sample size:	2 µl standard. (Other sizes are available on special request.)
External loop sample size:	170 µl standard. (Other sizes are available on special request.)
Sample filter:	5 µm recommended (not furnished with valve).
Maximum operating temperature:	150°C (300°F) at 3450 kPa (500 psig) maximum standard 234°C (450°F) at 690 kPa (100 psig) maximum for special applications
Maximum leak rate between ports:	Less than 1 µl per minute between ports.
Material in contact with sample:	316 stainless steel. Other materials are available on special request.
Connection size and type:	1.6 mm (1/16") O. D. tubing, with Swagelok® fittings
Actuating air:	345 kPa (50 psig) instrument air standard. 550 kPa (80 psig) required for operating pressure above 1380 kPa (200 psig). Helium or nitrogen may be substituted for air.
Total switching time:	150 ms (total time from initiation of command signal to completion of change in valve state)
Body size:	70 mm (2 ³ / ₄ ") diameter by 70 mm (2 ³ / ₄ ") height
Mounting:	Clamp type
Other:	A helium, hydrogen, or nitrogen purge may be used (an external supply of low pressure helium is required).

4.6 Model 11 Valve

This section presents information to disassemble, clean, and rebuild the Model 11 Valve (including the Model 11 Low Dead Volume Valve).

The Model 11 valve (M11) is available in two primary types, the standard Model 11 Valve and the Model 11 Low Dead Volume (LDV) valve. The primary difference between the Model 11 and the Model 11 LDV valves is the sample ports on the valve cap. The sample ports on the Model 11 valve have tubing connected as part of the cap. For the Model 11 LDV the ports are threaded holes and tubing is not part of the cap. Within this section, steps for these two types of valve are the same except where noted.

Further maintenance procedures for these valves, including port-to-port leak tests, are available in the Model 11 Valve Repair Manual (PN M06115) and the Model 11 LDV Valve Repair Manual (PN 2015584-001).

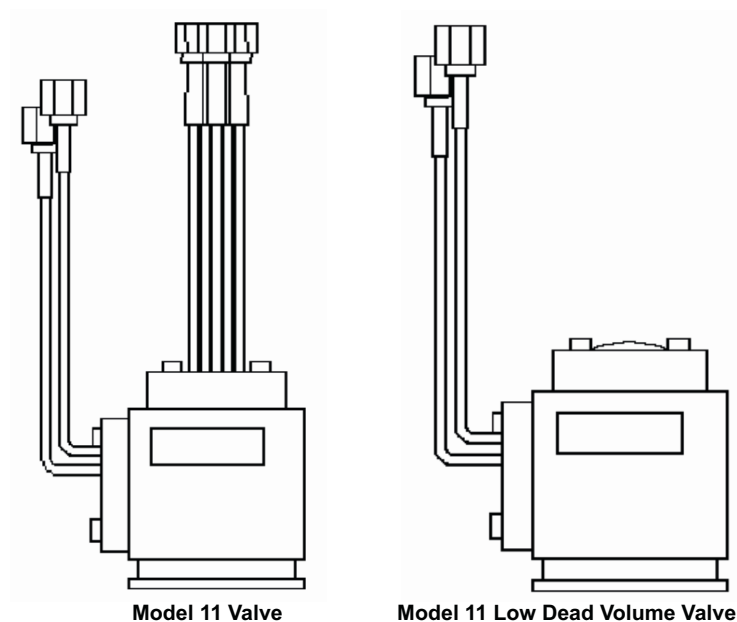


Figure 4-24 Model 11 Valve Types

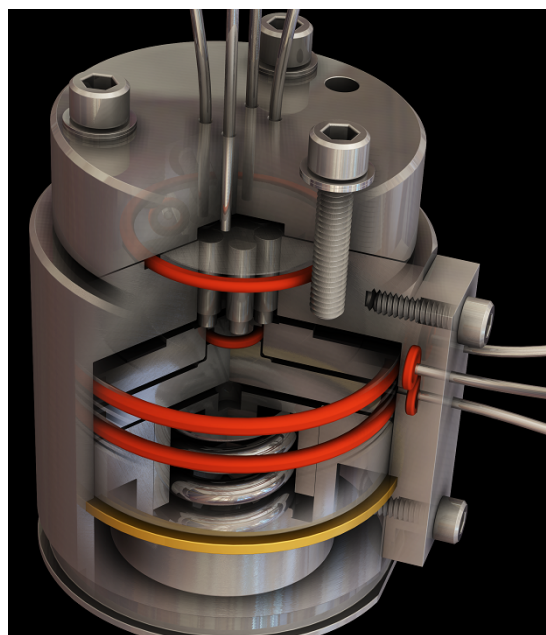
4.6.1 Valve Operation

The Model 11 valve can be applied in process chromatographs as a liquid or vapor sample valve, column switching valve, or a column backflush valve. It provides the uniform sample volume, high reliability (500,000 cycle life on clean gas), low internal volume, and high speed (switching time in milliseconds) required by process chromatography. Plus it provides the added benefits of minimum wear (critical parts move only thousandths of an inch for switching), dependable reproducibility and simplified construction for easy maintenance.

The Model 11 valve body and cap are constructed so cleaning or replacement of sealing and cushion discs can be done without removing the valve from the chromatograph oven. Removal of three bolts allows access to the disc with no special tools required. The specially constructed manifold eliminates leakage of air used for valve actuation. This feature is especially beneficial when bottled helium or nitrogen is used in place of instrument air.

The Model 11 valve is a 6-port, two-position, air-actuated valve. The six ports are arranged in a circular configuration.

Between each two ports is a plunger that opens or closes the passage between these two ports. A Teflon™ disc seals, prevents process fluids from contacting other components of the valve. Six plungers operate in two sets of three. Each set of plungers is controlled by a spring-loaded, air-actuated piston so that one set closes three passages between ports as the other set opens three passages between ports. Passages between ports 1 and 6, ports 5 and 4, and ports 3 and 2 are normally closed. The other three passages between ports 1 and 2, ports 3 and 4, and ports 5 and 6 are normally open.



Model 11 Valve, LDV Version

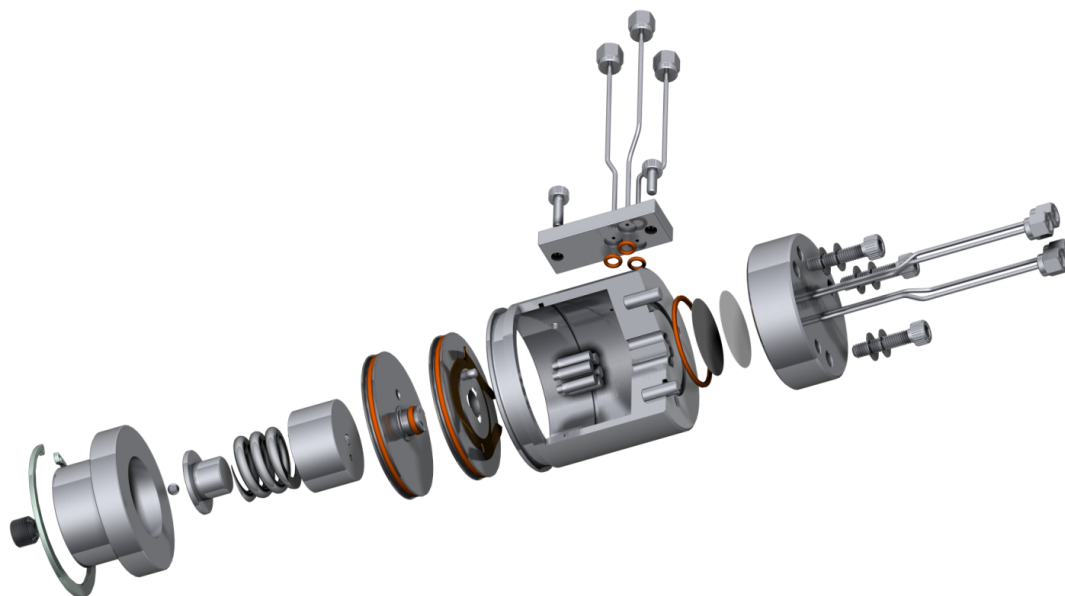


Figure 4-25 Model 11 Valve, LDV Version Exploded View

The two actuating pistons are spring loaded in a manner that assures that all six passages are momentarily closed during the switching operation (both energized and de-energized). This feature prevents unwanted mixing of gases during the switching cycle. The plungers and disc move only a few thousandths of an inch to permit flow through the passages.

For external loop sample valve applications, ports 2 and 5 are connected externally by means of tubing. The standard sample volume is 170 microliters. For internal loop sample valve applications, ports 2 and 5 are connected internally by means of a machined passage in the valve cap. The standard sample volumes are: 2, 5 and 10 microliters.

The Model 11 valve must be protected against dirt, filings, column packing material, or anything else that might affect the Teflon-to-metal seal. Filter elements should be 5 micrometer or finer.

Purging below the seal disc area may be necessary in a trap valve, when permeation through the seal disc causes air peaks or in a sample valve, when corrosive gases attack the seal disc cushion and/or other valve parts. (In the latter case the expected mean time between failure can be increased significantly.)

Purging is normally accomplished with the carrier gas. 1/16 tube fittings are provided as inlet and outlet connections for the purge gas. Typically a tee can be placed in the carrier inlet line and a needle valve can be used to regulate the flow at 5 cc/min.

4.6 Model 11 Valve

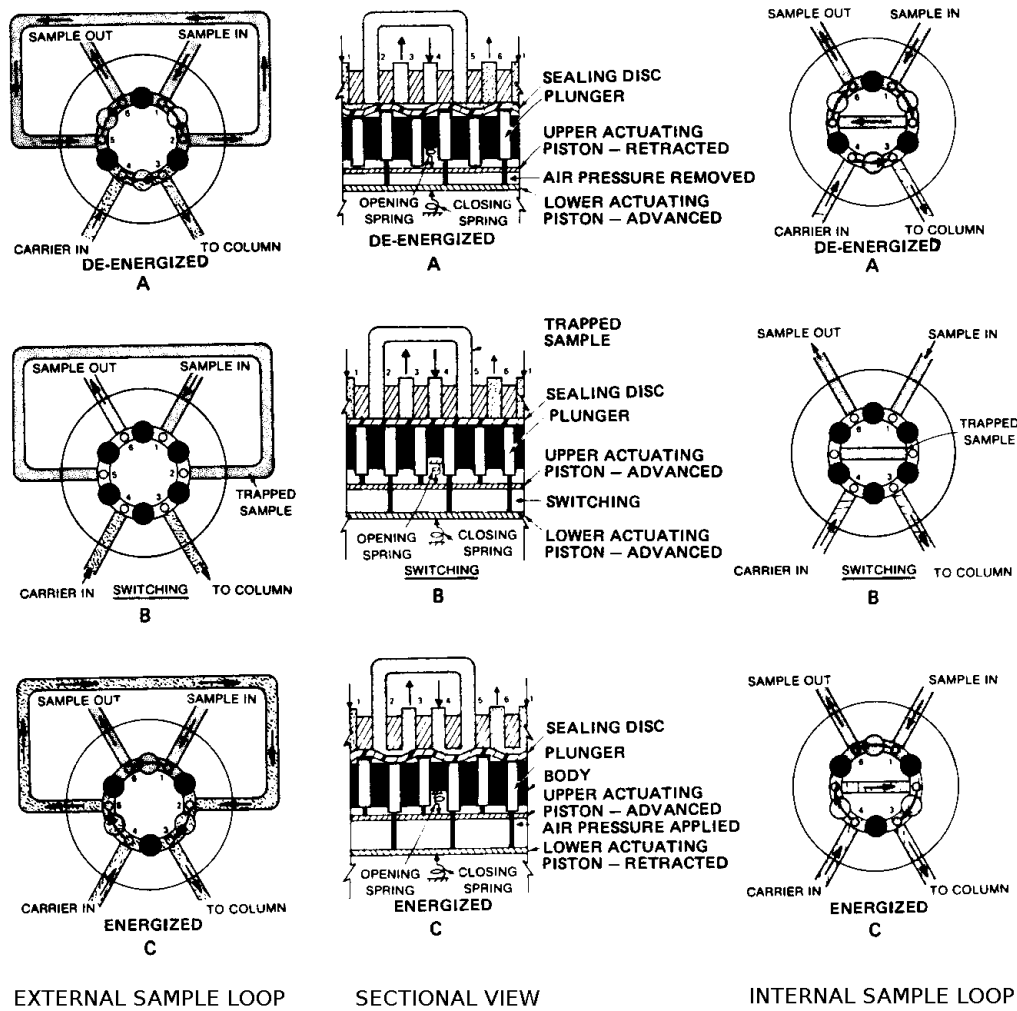


Figure 4-26 Model 11 Operational Diagrams

4.6.2 Model 11 Maintenance Overview

Maintenance procedures for the Model 11 Valves are grouped into two types, Mini-Maintenance procedures and Maxi-Maintenance procedures. Mini-Maintenance procedures involve working on the valve while it is still installed in the analyzer. Maxi-Maintenance procedures may be used when Mini-Maintenance does not correct a valve fault. This manual covers the Maxi-Maintenance procedures in the following order.

- Mini-Maintenance procedures:
 - Valve Cap Disassembly
 - Cleaning Fittings and Tubing
 - Valve Cap Assembly
- Maxi-Maintenance procedures
 - Valve Body Disassembly
 - Valve Body Cleaning
 - Valve Body Assembly

To assure optimum valve operation, a clean contaminant free work environment is required for this procedure. To repair the valve on site, the customer must have the necessary maintenance tools and replacement parts. Recommended valve spare parts, including the Model 11 Valve repair kit (PN K21040) and Model 11 LDV repair kit (PN 2015581-001), can be obtained from Siemens. Recommended tools include an ultrasonic cleaner and a clean workstation with lint-free cloth. In addition, special pliers that are available from Siemens (PN V16031) are required to completely disassemble the valve. These pliers are part of the tool kits mentioned above.

Additional procedures related to the Model 11 Valve can be found in the Model 11 Valve Repair Manuals, which can also be found on the Maxum II Documentation CD.

It may be easier and less expensive to replace a valve or return it to Siemens for service rather than perform Maxi-Maintenance.

4.6.3 M11 Intended Users

This procedure is intended for qualified users with sufficient training to safely repair a valve in the field. If customer maintenance personnel are not technically trained to repair the valve on site, it is recommended that the valve be returned to Siemens for repair or direct replacement.

In addition to training, the customer must have a clean work environment and the proper tools available for rebuilding and cleaning the valve. Performing the work in a contaminated environment, performing the work incorrectly, or using incorrect tools may damage the valve.

4.6.4 M11 Safety and Certification Information

This procedure is not likely to directly impact the safety systems of the analyzer. However, care must be exercised at all times when working with the analyzer. Since the valve is located in the oven of the Maxum II, appropriate care must be taken to ensure that the environment is safe to perform the work.

Maintenance work on the Maxum II analyzer should only be performed when the area is known to be safe for the work to be done.

Note

This procedure must only be executed with the consent and approval of all applicable local safety personnel and/or the local authority having jurisdiction.

4.6.5 Diagnostic Procedures

Depending on the installation, the following tests can be performed with the valve mounted in the analyzer. Other tests require the analyzer be shut down and valve ports disconnected. These diagnostic tests indicate specific areas of the fault or trouble.

Valve Leakage

Vapor analyzers generally have the sample at atmospheric pressure, so any leakage would be from a carrier-gas port to a sample port within the valve. With the sample inlet flow turned off, the sample outlet flow should be zero in either the "air off" or "air on" condition. Check for small leaks by immersing the sample outlet tubing in a beaker of water. Bubbles indicate internal leakage.

The liquid sample streams may have pressures several hundred pounds higher than the carrier gas. Leaking between ports will show up on the analyzer chromatogram as base-line shift when the sample pressure is removed from the valve.

Plugged Valve

Plungers in the valve are pressed upward by air or spring action, but when released depend on their own weight and sample pressure to drop them to the "open" position. For very small sample pressures, for example below 5 psi (34 kPa), it may be possible to see problems where the flow path may not open. This is more likely if the sealing disc has been held against the cap for a long time (such as a valve in storage). Check for flow across alternate flow paths, such as air on and air off. It may be necessary to temporarily increase the sample pressure to get the flow started, and then reduce it to normal after a few cycles. For the Model 11 valve, samples are typically run at 15 psi (103 kPa).

Ruptured Sealing Disc

To test for a ruptured sealing disc apply air to valve ports, one at a time, while sealing off all others. Place a small amount of soap solution such as Leak Tec® over the upper control port's bleed tube air signal manifold (23). Any escaping air at this point indicates a ruptured disc. If this occurs, proceed with a disc replacement.

If the disc does not appear to be ruptured, remove the valve from service and replace it with a new valve.

Slow Erratic Piston Switching

Excessive friction on the actuating pistons of the valve can be caused by lack of lubricant, or dirt or contamination on the O-rings. As a result, the valve may switch erratically, switch slowly or not switch at all. These conditions can cause a leak port to port, across the sealing disc, double sampling, or complete closing of flow between two or more ports.

This condition requires disassembly of the entire valve (maxi-maintenance). It is recommended that the valve be returned to Siemens for service.

4.6.6 M11 Procedure - Maintenance Facility

When cleaning the valve and associated components, it is imperative that the maintenance be performed in a clean and contaminant free facility. Components should be placed on a lint free cloth to prevent impurities from contaminating the valve and/or components. Hands should be clean and free of contaminants.

Presence of any foreign contamination can cause additional valve problems after reinstallation.

All foreign contamination adhering to valve must be removed quickly using a dust/lint free cloth and a cleaning solvent such as hexane. After cleaning valve cap and tubing, shake excess cleaning fluid from tubes and let valve cap air dry before reassembling.

NOTICE
Do not allow polished face of valve cap to rest on any surface other than a lint free cloth. Clean metal parts using a syringe or ultrasonic cleaner and an appropriate cleaning solution as described in this procedure.

4.6.7 M11 Procedure - Figures

The following figures are intended for use as a reference throughout the procedure. The numbers in the diagrams relating to individual components are referenced in parentheses in the procedure steps.

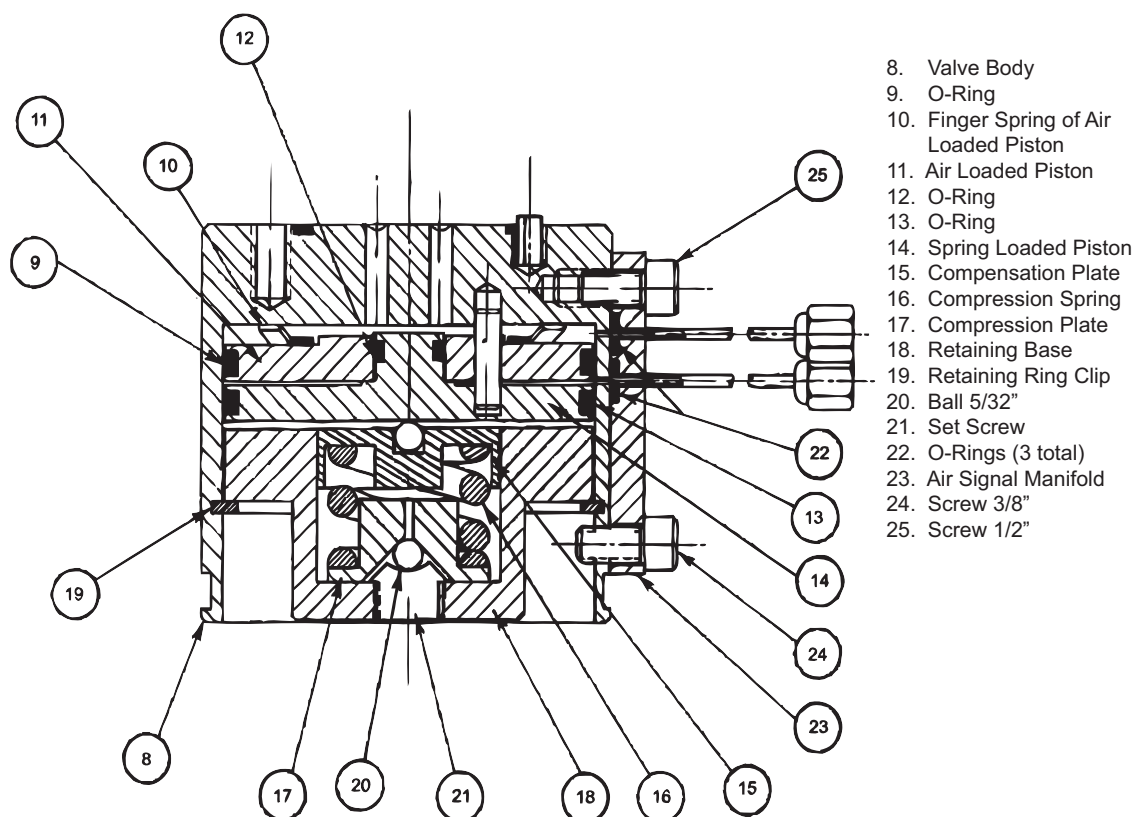


Figure 4-27 Model 11 (or Model 11 LDV) Valve without Valve Cap

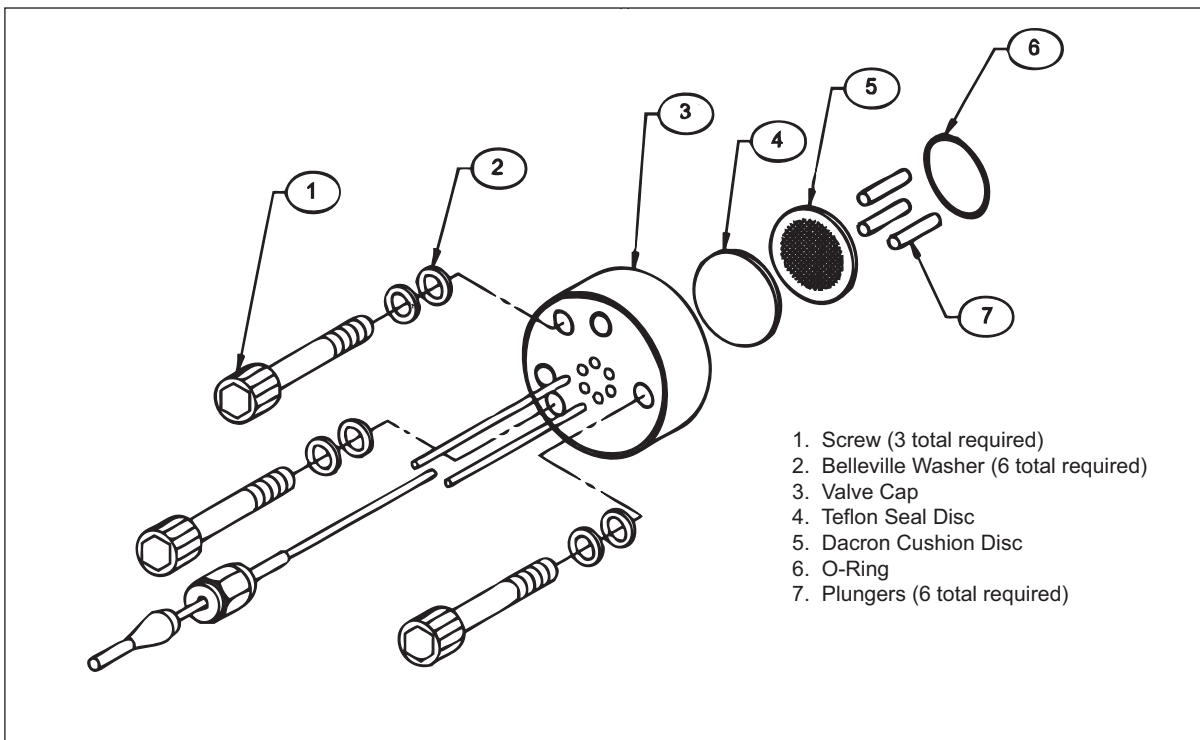


Figure 4-28 Model 11 Valve Cap Exploded View

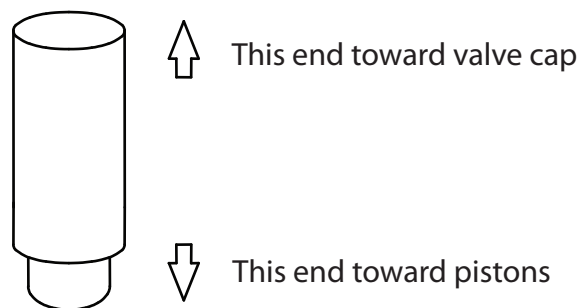


Figure 4-29 Model 11 Plunger Orientation

4.6 Model 11 Valve

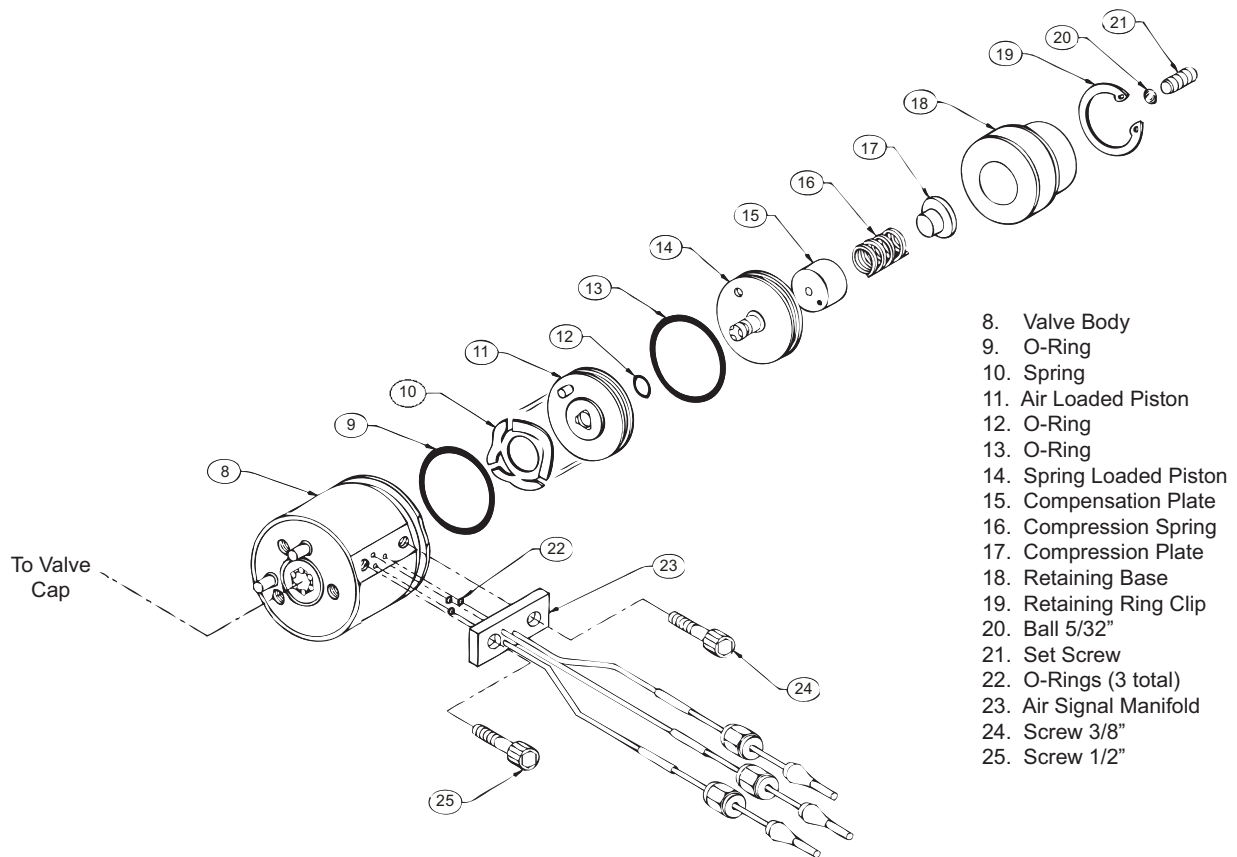


Figure 4-30 Valve Body Exploded View

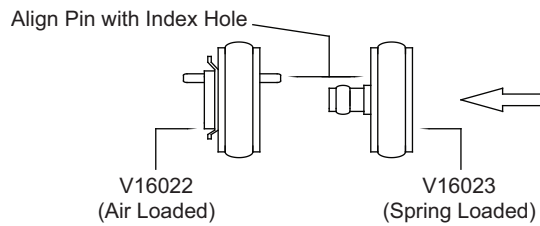


Figure 4-31 Valve Base Alignment Pin

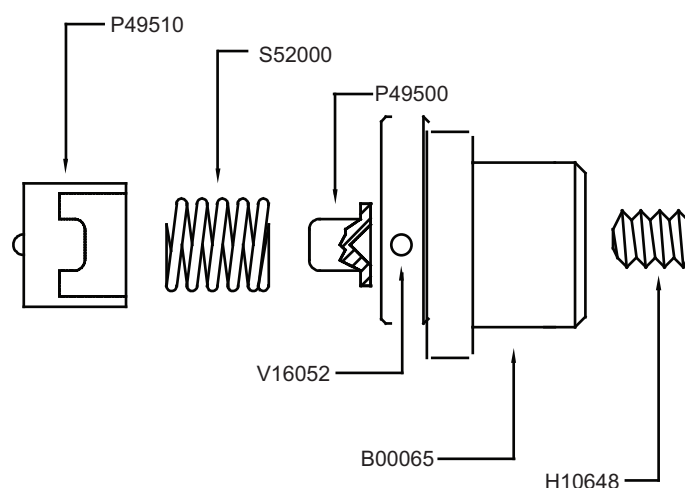


Figure 4-32 Assembly of Compression Spring

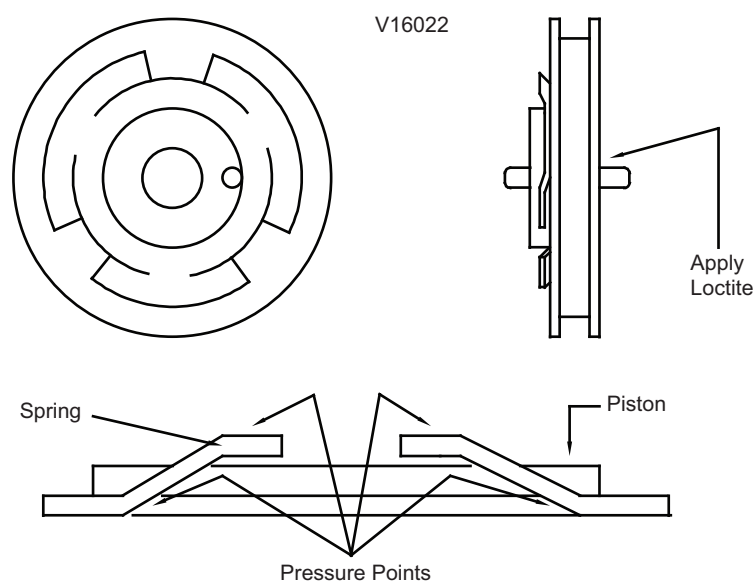


Figure 4-33 Greasing of Spring Pressure Points

4.6.8 Mini-Maintenance Procedures (Valve Cap and Fittings)

4.6.8.1 M11 Procedure - Valve Cap Disassembly

1. Perform a Job Safety Assessment (JSA). Review the procedure and take action to manage any safety risk.
2. Place the analyzer out of service and put the analyzer in HOLD.
3. Turn off the valve gas, carrier gas and sample gas by closing the block valves for each of these gasses.

4.6 Model 11 Valve

4. If the valve is a sample valve flush the sample lines through the valve with an inert gas such as the carrier gas to remove any residual sample that may pose a danger do the user.
5. Turn off the oven heater by disabling the controller in the application or by turning off the oven air.
6. The parts in the oven and oven door can be very hot. Allow the oven to cool and wear gloves if needed.
7. Optional Step: If the user would prefer to remove the valve from the oven to perform this work then all tubing connections should be marked and verified using custom documentation sheet 8.1. This procedure can be done with the valve in the analyzer oven to save down time and reduce potential problems from removing and replacing the valve.
8. Disconnect the Model 11 valve from the column and air lines and remove the valve from the analyzer.

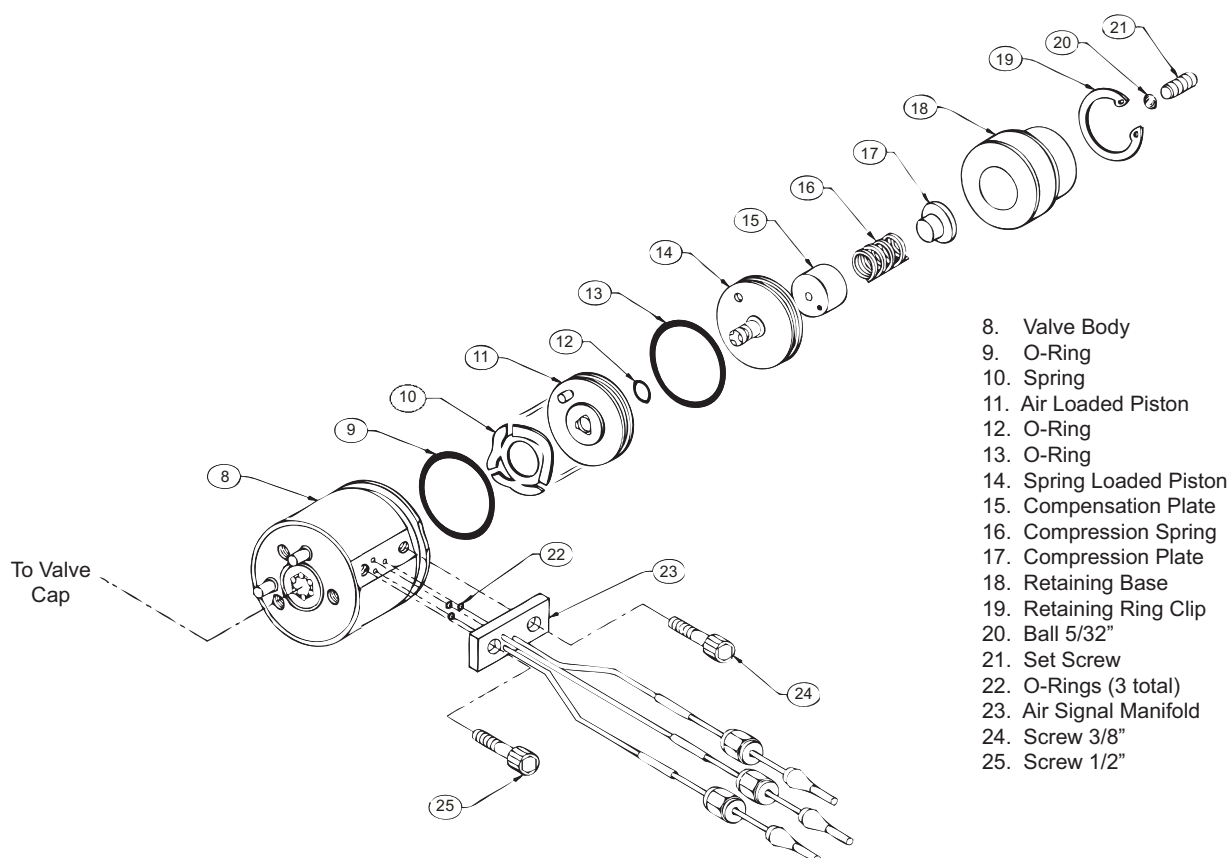


Figure 4-34 M11 - 4 Exploded View of Model 11 Valve Body

Disassembling the Valve Cap

1. Relieve the pressure on the base Allen Set Screw (21) by turning it counterclockwise until it turns easily.
2. Remove the three Allen head cap socket screws (1) and separate the cap (3) from the valve body (8). When the valve cap is removed, the following components are exposed. Refer to Figures 7-2 and 7-4.
 - Teflon Sealing disc (4) [clear]
 - Dacron Cushion disc (5) [white] and
 - "O" ring (6)
3. Inspect the Teflon sealing disc (4), Dacron cushion disc (5) and silicon rubber "O" ring (6) for dirt or breaks.
If damage is evident on the O-ring, discard damaged part and replace with new component(s). Regardless of whether damage or contamination is evident on the old seal and cushion, replace them with new components.
4. Visually inspect the rest of valve. If it is clean and in good condition, it may be possible to install a new disc seal diaphragm (4) and cushion diaphragm (5) and re-assemble the valve.
5. Examine each of the six plungers (7) for evidence of damage or contamination. If damage is evident, discard defective plunger(s) and replace with new ones. Refer to Figure 7-3.

Note

The valve cap and fittings must be cleaned before reassembly. This step will be executed later in this chapter.

To reassemble the valve cap (3), See the Valve Cap Assembly (Page 94) section later in this chapter. If the valve actuating piston assembly is contaminated or malfunctioning, refer to Valve Body disassembly.

4.6.8.2 M11 Procedure - Cleaning of Parts

All valve fittings and tubing must be clean and valve diaphragms inspected for cleanliness, catalyst or polymer buildup. Before re-assembly, valve cap and plunger valve body faces should be wiped clean using hexane, acetone or methanol and a lint free cloth.

An ultrasonic cleaner filled with a recommended cleaning solvent or detergent is recommended for cleaning all components. However, after cleaning, there must not be any remaining residue. If cleaning solution becomes contaminated during cleaning, it must be replaced with an uncontaminated supply.

A syringe and appropriate solvent can be used to flush the ports of the valve cap. This is described in the procedure.

It is important for proper procedures to be used when cleaning valve and detector parts. All foreign contamination adhering to the part should be removed using an appropriate cleaning solvent, such as hexane, acetone, or methanol and a dust/lint free cloth. Use of an ultrasonic cleaner is often helpful. After cleaning, it is necessary remove excess cleaning fluid from the components by blowing with clean air or shaking. Components must be air dry before reassembling.

It is possible and often better to use an appropriate detergent, such as Alconox® for cleaning instead of solvent. However, after cleaning with a detergent, it is necessary to rinse the part thoroughly with deionized water (distilled water is also acceptable) in order to remove detergent residue. All water must then be removed by blowing with clean air or shaking. Components must be completely dry before reassembling.

4.6.8.3 M11 Procedure - Valve Cap Cleaning and Re-assembly

Note

If solvent becomes contaminated during performance of the following cleaning steps, it must be replaced with a clean supply from a clean beaker.

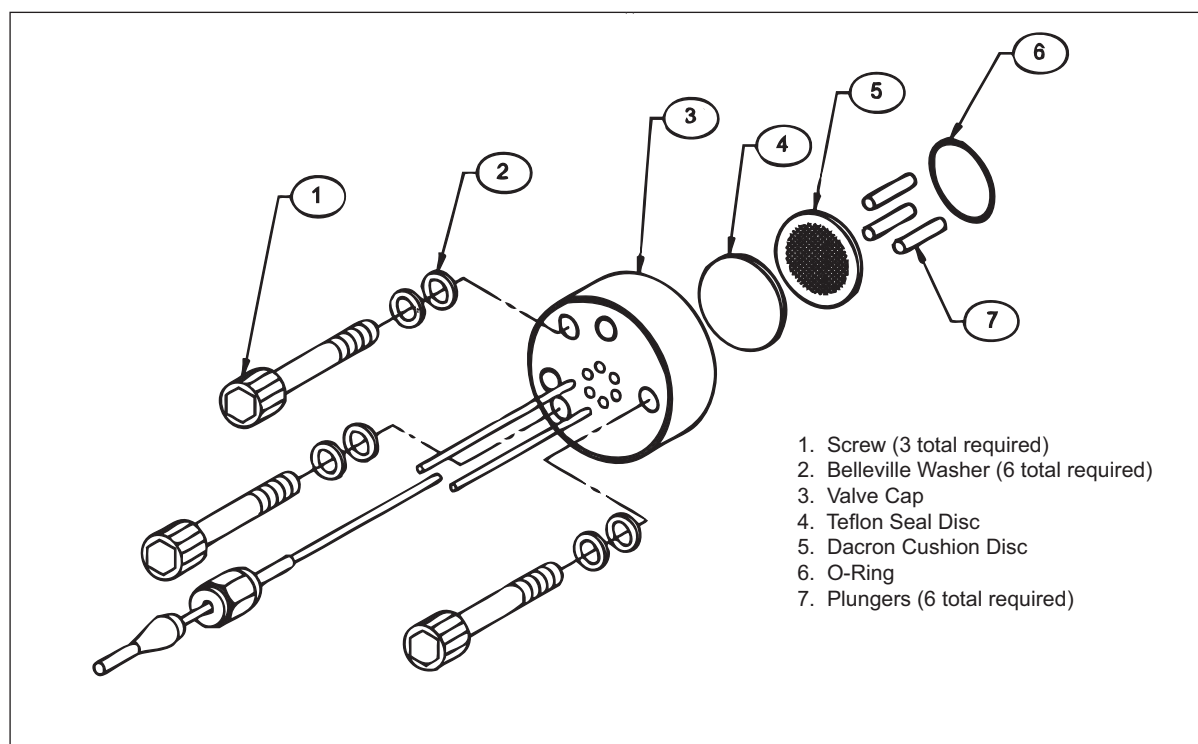


Figure 4-35 M11 - 2 Exploded View of Model 11 Valve Cap

1. (For Model 11 Valve) – Clean valve cap (3) while disassembled using a syringe and appropriate solvent. Clean each port and attached tubing on the valve cap by flushing solvent back and forth through each port while cap is immersed in a beaker of solvent.
2. (For the Model 11 LDV Valve) - Clean the valve cap (3) while disassembled and visually verify that ports are clear. Use of an ultrasonic cleaner and an appropriate cleaning solution is recommended.
3. Place the actuator assembly upright on a clean lint free cloth surface with the two valve cap guide pins facing upwards.

4. Using a syringe with Krytox 143 AY lubricating oil, place a drop of oil on sidewall of each valve body (8) plunger hole.
5. Reinstall the six plungers (7) into their valve body positions. Using tweezers, move each plunger up and down to thoroughly lubricate them. Plungers must not protrude above valve body (8) top surface. Refer to Figure 7-3 for plunger orientation.
6. Using clean lint free cloths wetted with acetone, remove excess lubricating oil from top of valve body (8).

NOTICE

When installing "O" ring (6), Dacron cushion disc (5) and clear Teflon seal disc (4), do not use any type of grease as a lubricant. There must be no foreign contaminants on discs.

7. Install silicon "O" ring (6), Dacron cushion disc (5) and clear Teflon seal disc (4). Do not lubricate "O" ring (6).

Note

The clear Teflon seal disc (4) must be mounted ON TOP of the Dacron cushion disc (5). Align discs over plungers (7).
--

8. Securely holding valve cap (3), blow out each port and/or tube with compressed air to remove all acetone and foreign matter.

NOTICE

Do not use grease when installing O-ring.

9. It is recommended that appropriate torque wrenches be used for this step (available from Siemens – PN's 1631005-002 and 1631005-003). Install valve cap (3) using the three 10-32 Allen screws (1). Screws must be tightened evenly in sequence 1, 2, 3, 1 sequence. Tightening steps are as follows. Refer to Figure 4-40.
 - Run screws down until they contact valve cap.
 - Tighten screws with Allen driver until they are finger tight.
 - Tighten screws to approximately 15 inch-pounds (1.69 Nm). This is a ¼ turn maximum.
 - Tighten screws to approximately 20 inch-pounds (2.26 Nm). This is another ¼ turn maximum.
 - Tighten screws to approximately 35 inch-pounds (3.95 Nm)
 - Torque bottom adjusting set screw to 6.5 inch-pounds (0.73 Nm).
10. Valve is now ready for reinstallation and placing into operational service.

4.6.9 Maxi-Maintenance Procedures (Valve Body)

4.6.9.1 M11 Procedure - Valve Body Disassembly

1. Remove the six plungers (7) by inverting valve body (8) and then shaking it. Plungers should fall into the palm of the hand.
If a plunger(s) is stuck and does not fall out, delay removing it until after the spring loaded and air loaded pistons (14 and 11) are removed. The plungers can then be forced out from bottom of valve body.

NOTICE
When shaking plungers from valve body, do not allow them to fall on any abrasive surface. It is recommended that a lint free cloth, free of contaminants, be placed under the hand to protect plungers from damage.

2. Examine plungers for damage. Any plunger showing defects, such as nicks, must be discarded and replaced with a new part.
3. Remove air signal manifold (23) by removing the two screws (24&25) that secure it to the valve body (8). After manifold is detached, inspect the three o-rings (22) and replace if necessary. If the o-rings are undamaged, then set them aside (on a clean surface) for installation later.
4. Use the special set of pliers supplied with the repair kit to remove the retaining ring clip (19). Inset the tips of the pliers into the holes in the clip and firmly squeeze. Extract the clip from the base of the valve, holding the pliers firmly to prevent clip from flying off.
5. Remove retaining base (18), compression plate (17), compression spring (16) and compensation plate (15) from bottom of valve body (8). Refer to Figure 7-4.
6. Use the special retaining clip pliers supplied with the repair kit to remove the spring-loaded piston (14) from valve body (8). Insert the tips of the pliers into the holes in the underside of the piston and pull slowly.
7. Remove air-loaded piston (11) from valve body (8)
8. Using care to catch plungers (7), remove any stuck plunger using one of the tips from the retaining ring pliers.
9. Examine plungers (7) for damage. Any plunger showing defects, such as nicks, must be discarded and replaced with a new part.
10. Inspect interior of valve body (8), spring loaded piston (14) and air loaded piston (11) and silicon rubber "O" rings (13, 12 and 9) for contamination, odor or mechanical wear. Any part showing evidence of excessive wear or defects must be replaced with a new component. Do not re-install any defective component.

4.6.9.2 M11 Procedure - Valve Body Cleaning

1. To clean the valve body, the following components are recommended:
 - Ultrasonic cleaner
 - Cleaning solution as described in the section of this chapter titled, Cleaning of Parts. Where indicated, use only Krytox 240AC grease (Siemens part # G87004)

If a strong detergent solution is used, all cleaned parts must be thoroughly rinsed with deionized water or distilled water to remove detergent residue before reassembly of valve body. All parts must be thoroughly dried by shaking, allowing to air dry, or blowing with clean air.

Note

If cleaning solution becomes contaminated during performance of the following steps, replace it with an uncontaminated supply.

NOTICE

Do not place polished valve body (8), or associated parts, against any surface in ultrasonic cleaner or against any abrasive surface. Place parts on a lint free cloth, free of foreign contaminants.
Do not wash O-rings in any type of cleaning solvent.

2. Fill Ultrasonic cleaner with cleaning solution.
3. Before placing valve body parts in Ultrasonic cleaner, wipe off all grease and foreign contaminants from valve parts.
4. Place valve body parts on a lint free cloth in ultrasonic cleaner.
5. Turn Ultrasonic cleaner ON and allow to run for 10 minutes.
6. Remove parts and shake cleaning solution from tubes. If detergent is used make sure that no residue remains by rinsing thoroughly with deionized water or distilled water. Let parts air dry before reassembling.

4.6.9.3 M11 Procedure - Valve Body Re-assembly

1. Before reassembling valve body parts, clean hands, tools and perform reassembly procedures in a clean dust free area.
2. Apply KRYTOX 240 AC in both "O" ring grooves of spring-loaded piston (14)
3. Install silicon rubber O-rings (12 and 13) and apply KRYTOX 240 AC grease to their outer surfaces.
4. Apply KRYTOX 240 AC grease to each of the fingers of the finger spring (10) of air-loaded piston (11).
5. Place air loaded piston (11) over the small diameter of spring-loaded piston (14) with finger springs (10) outside. Align piston with guide pin. Refer to Figure 7-5.
6. Apply a bead of KRYTOX 240 AC grease to the "O" ring air-loaded piston (11) groove. Refer to Figure 7-7.
7. Install silicone "O" ring (9) and apply KRYTOX 240 AC grease to the "O" ring outer surface.
8. Apply a thin film of KRYTOX 240 AC grease to inside of valve body (8) where the pistons (14 and 11) will be sliding.

4.6 Model 11 Valve

9. Insert both pistons (14 and 11) into the bottom of cylinder. Use retaining ring pliers to install the pistons with the guide pin in the hole of the valve body (8). Refer to Figure 7-5.

NOTICE

Exercise care not to damage the O-rings when sliding them past the lower retaining ring groove.

10. Apply KRYTOX 240 AC grease to the compression plate (17) beveled cone. Insert the ball (20) into the greased cone.
11. Insert both the compression plate (17) and ball (20) into retaining base (18). Refer to figure 7-6.
12. Apply KRYTOX 240 AC grease to base socket head set screw (21) then screw it into retaining base (18). Leave about one thread of set screw showing.
13. Place compression spring (16) on compression plate (17).
14. Place compensation plate (15) over the compression spring (16).
15. Before final assembly of components, apply a thin film of KRYTOX 240 AC grease to the outside of compensation plate (15) and inside of retaining base (18).
16. Place the compression spring (16), compression plate (17); socket head set screw (21), retaining base (18) and compensation plate (15) into the valve body (8).
17. Use the retaining ring pliers supplied with the repair kit to reinstall the retaining ring (19).

NOTICE

Be certain the retaining ring (19) sets into its mounting groove.

18. Prepare to install the manifold (23) by cleaning the flat surface on the side of the valve body (8) and then installing the three small O-rings (22) into the manifold (23).
19. Align and install manifold (23) onto valve body (26) with two 8-32 screws (24 and 25). The shorter screw is installed in the top. Attach the manifold so that inlet holes on the manifold align with inlet holes on the valve body. Refer to Figure 7-4.
When installing the manifold be careful not to damage the air tubes. If the tubes are bent too close to the manifold, it is possible to break them.

4.6.10 Model 11 Valve Specifications

Internal loop sample size:	0.5, 10, 20 µl standard. Other sizes on special request.
External loop sample size:	15 µl and larger. 170 µl is standard.
Sample filter:	5 µm recommended (not furnished with valve).
Cap screw (33) Torque Setting:	3.95±0.11 Nm (35±1 inch-pounds)
Base Screw (12) Torque Setting:	0.73±0.11 Nm (6.5±1 inch-pounds)
Maximum operating temperature:	122°C (250°F) standard 66°C (150°F) 2000627-014
Maximum sample pressure:	Up to 2068 kPa (300 psig). Up to 414 kPa (60 psig) 2000627-014

Minimum sample pressure before it is necessary to apply vacuum assistance to lower chamber:	34.5 kPa (5 psig)
Maximum leak rate between ports:	Less than 1 µl per minute
Material in contact with sample:	316 stainless steel and TFE, standard. Monel and Teflon, or Hastelloy and Teflon available on request. PFA available on request.
Connection size and type:	1.6 mm ($\frac{1}{16}$ ") O. D. tubing, with Swagelok® fittings
Actuating air: (Lower port on manifold)	Max. 345 kPa (50 psig) instrument air standard. Helium or nitrogen may be substituted for air. 20 ml (at standard temperature and pressure) of actuating air required for each valve operation.
Lower Seal Disc Purge Gas: (Upper 2 ports on the manifold)	5 cc/min of (typically) same gas as carrier
Total switching time:	150 ms (total time from initiation of command signal to completion of change in valve state)
Body size:	57.2 mm ($2\frac{1}{4}$ ") diameter by 76.2 mm (3") height
Mounting:	Clamp type

4.6.11 Model 11 Low Dead Volume Valve (LDV) Specifications

Internal loop sample size:	2 and 5 µl standard. Other sizes on special request.
External loop sample size:	15 µl and larger. 170 µl is standard.
Sample filter:	5 µm recommended (not furnished with valve).
Cap screw (33) Torque Setting:	3.95±0.11 Nm (35±1 inch-pounds)
Base Screw (12) Torque Setting:	0.73±0.11 Nm (6.5±1 inch-pounds)
Maximum operating temperature:	122°C (250°F) standard 66°C (150°F) 2000627-014
Maximum sample pressure:	Up to 2068 kPa (300 psig). Up to 414 kPa (60 psig) 2000627-014
Minimum sample pressure before it is necessary to apply vacuum assistance to lower chamber:	34.5 kPa (5 psig)
Maximum leak rate between ports:	Less than 1 µl per minute
Construction material in contact with sample:	316 stainless steel and Teflon, standard. Monel and Teflon, or Hastelloy and Teflon available on request.
Connection size and type:	1.6 mm ($\frac{1}{16}$ ") O. D. tubing, with Swagelok® fittings
Actuating air: (Lower port on manifold)	Max. 345 kPa (50 psig) instrument air standard. Helium or nitrogen may be substituted for air. 20 ml (at standard temperature and pressure) of actuating air required for each valve operation.
Lower Seal Disc Purge Gas: (Upper 2 ports on the manifold)	5 cc/min of carrier (normally helium)
Total switching time:	150 ms (total time from initiation of command signal to completion of change in valve state)
Body size:	57.2 mm (2.25") diameter by 76.2 mm (3") height
Mounting:	Clamp type

4.7 Live T Switch

The Live T Switch is a valve-less switch that can be used in place of a valve for switching columns. The Live T switch is virtually maintenance free since it has no moving parts, no temperature limitations and the sample only comes into contact with metal parts inside the switch. It can be used for heartcut and backflush functions.

The Live T Switch is essentially a tube with special built in air vents that are used to control carrier flow through the tube. Carrier gas is connected to the vents. Carrier gas pressure at the vents is adjusted such that carrier sample flow can be either stopped, diverted, or allowed to pass unimpeded through the switch,

Example Application

The following is an example of an actual application using the live tee. Actual flows and pressures are indicated and chromatograms are provided to illustrate the set up process.

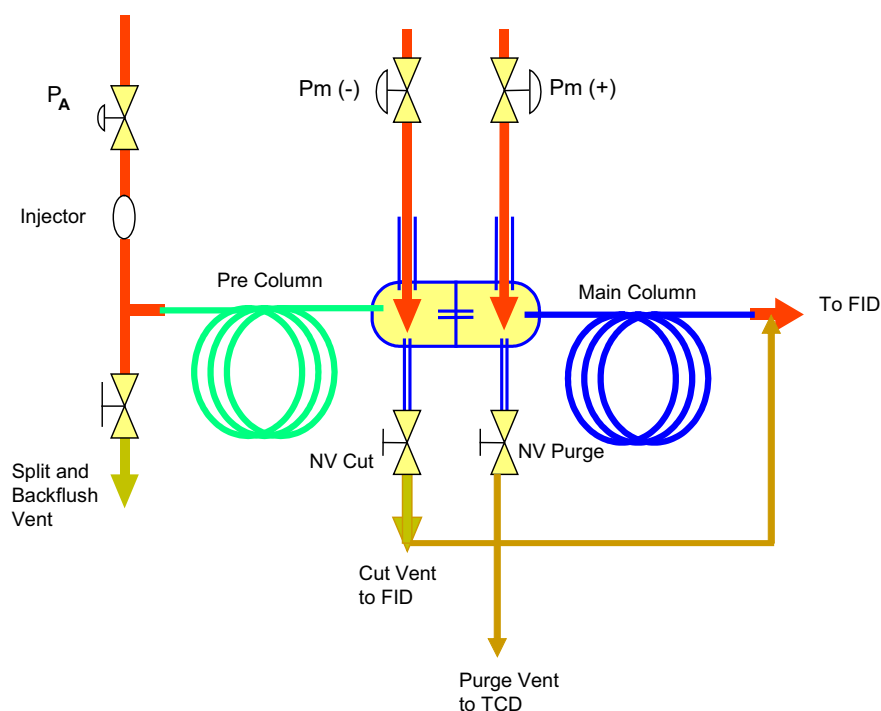


Figure 4-36 Live Tee Switch Example Application

Switching Configuration:	Split Vapor Injection
	Backflush To Vent With Heartcut (Cut Vent Flow To FID)
	Purge Flow to ITC (TCD)
Pre Column:	50 m, 0.32 mm id, 1.2 μ m, Carbowax FSOT
Main Column:	50 m, 0.32 mm id, 5 μ m, ALOX Na ₂ SO ₄ FSOT
Oven Temperature:	100°C

Switching Configuration:	Split Vapor Injection
Carrier Gas:	Nitrogen

Pa	EPC 2-1	Carrier Inlet
Pm(-)	EPC 3-1	T-Piece Inlet (end of A- or Pre Column)
Pm(+)	EPC 3-2	T-Piece Outlet (Inlet of B- or Main Column)

4.8 Valco Rotary Valves

4.8.1 Valco A4 C6UWE Valve Specifications

Many of the parameters for these valves are application dependent. See the custom documentation package for your analyzer and obtain the applicable specifications for your specific application at the Valco Instruments Co. Inc. web site, <https://www.vici.com>.

Maximum operating temperature (valve body only):	225°C (437°F)
Connection size and type:	1.6 mm (¹ / ₁₆ ") O. D. tubing, with Valco fittings
Actuating air:	276 - 345 kPa (50 psig) instrument air standard.

Heaters

5.1 Air Bath Oven Heaters

The air bath oven can be setup for a High Power Configuration or Medium Power Configuration. This table describes the differences between the two configurations. The high power heater has a red insulation cover and the medium power has a gray insulation cover.

Configuration	Heater and Temperature Control Hardware
HIGH POWER CONFIGURATIONS	
Two air bath ovens; either • Dual isothermal air bath • Programmed Temperature	High power heater control relay assembly and two 1400 watt air bath heater assemblies
Single isothermal air bath oven operating above 70°C control temperature	High power heater control relay assembly and 1400 watt air bath heater assembly
MEDIUM POWER CONFIGURATIONS	
Single isothermal air bath oven operating at 70°C or below control temperature	Medium power heater control relay board and 650 watt air bath heater assembly
Airless ovens: either • Single isothermal airless • Dual isothermal airless	Medium power heater control relay board and standard heaters for airless ovens.
Heated sample injection valves, heated Flame Ionization and Flame Photometric Detector Modules	Control relays on Power Entry and Control Module (PECM)

The PECM provides the voltage to the two pairs of 1400-Watt or 650-Watt AC Air Bath heater power switching circuits located on the rear wall of the EC. Connection to the heaters is made through a special cable. Each circuit consists of two series connected solid-state relays.

5.1 Air Bath Oven Heaters

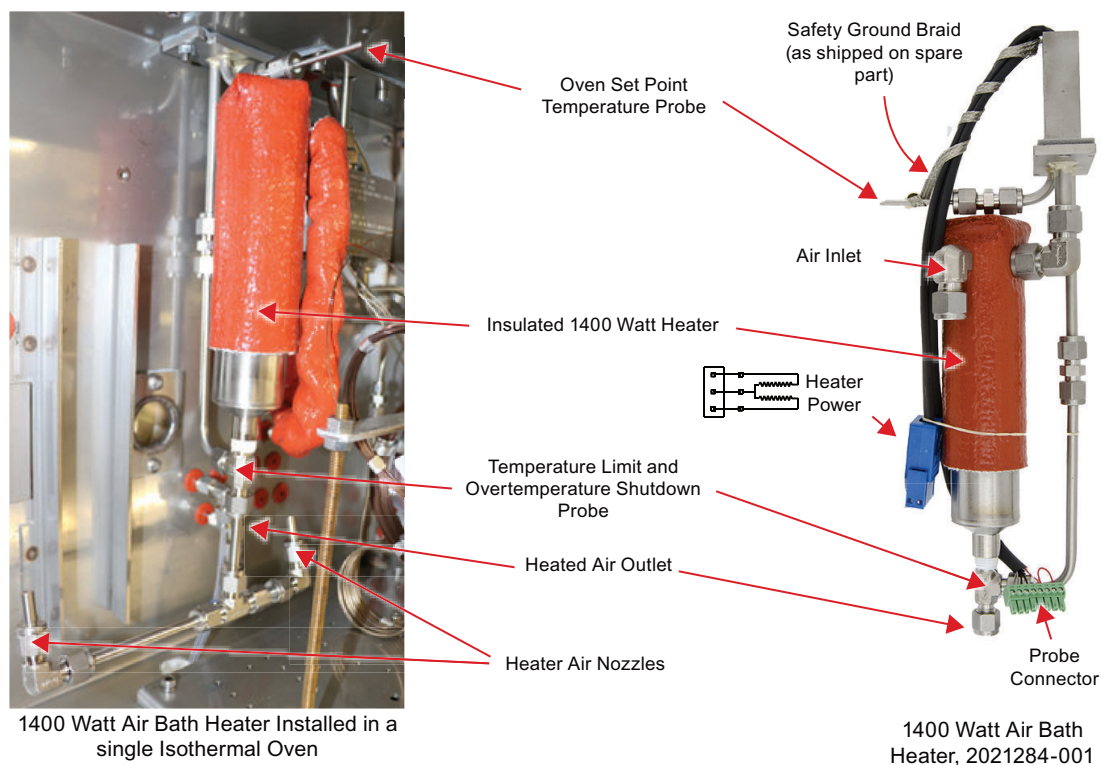


Figure 5-1 1400 Watt Air Bath Heater



Programmed Temperature Heater Assembly with Deflector (2021680-001)



Medium Wattage Heater Assembly (2021284-002)

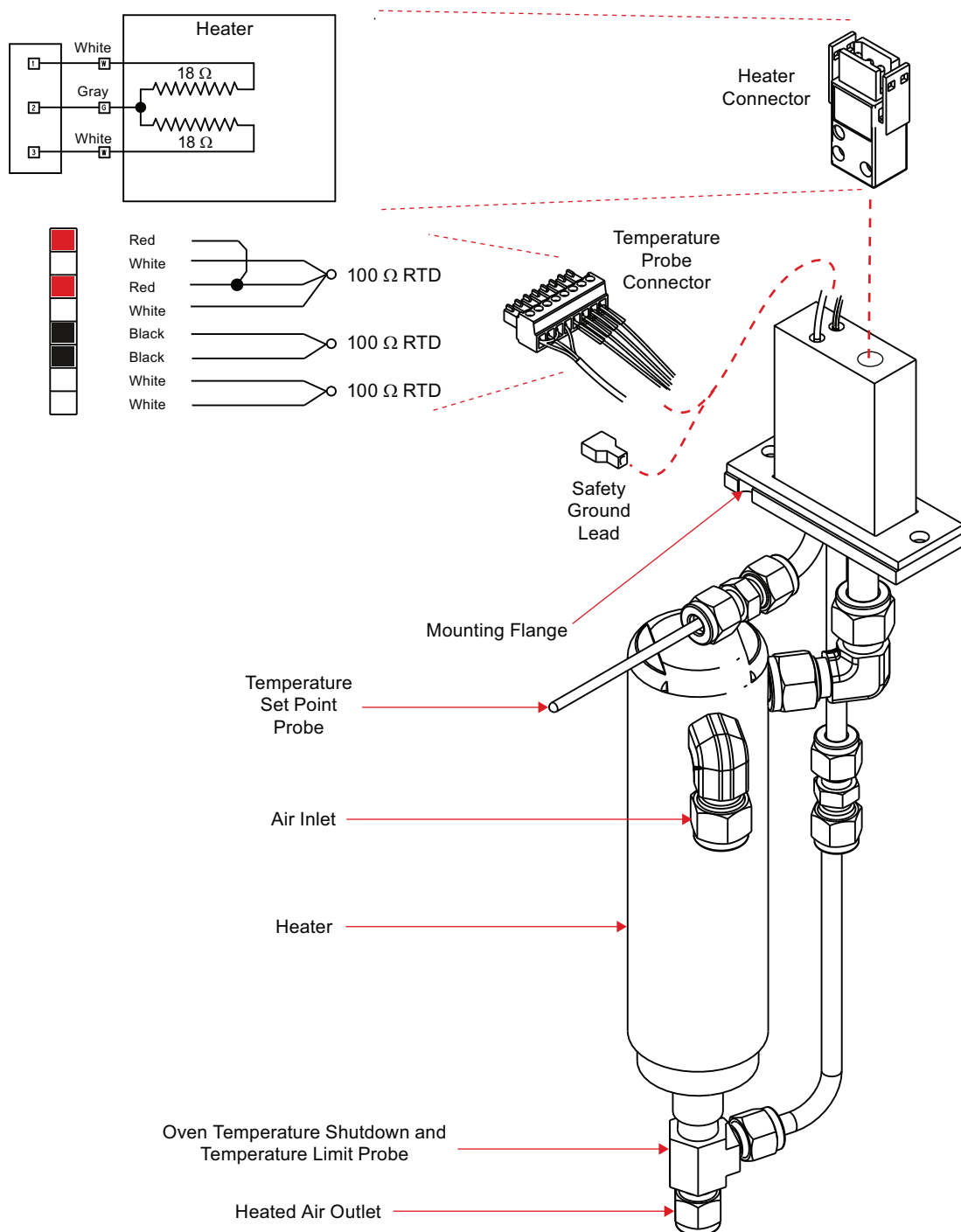


Figure 5-2 Air Bath Oven Heater Assembly

5.2 Airless Oven Heaters

The airless oven configuration uses the medium power relay configuration. There are two heaters located in each oven. They slide in from the front of the oven through a diagonal shaft in each side of the oven. The wiring connections are located on the top end of the heater which sticks out of the top of the oven in the purged area of the mezzanine. A threaded retainer cap is inserted in the shaft after the heater to keep it in place. Apply a small amount of Loctite silver Grade Anti-Seize 76732 or equivalent to the heater retainer cap.

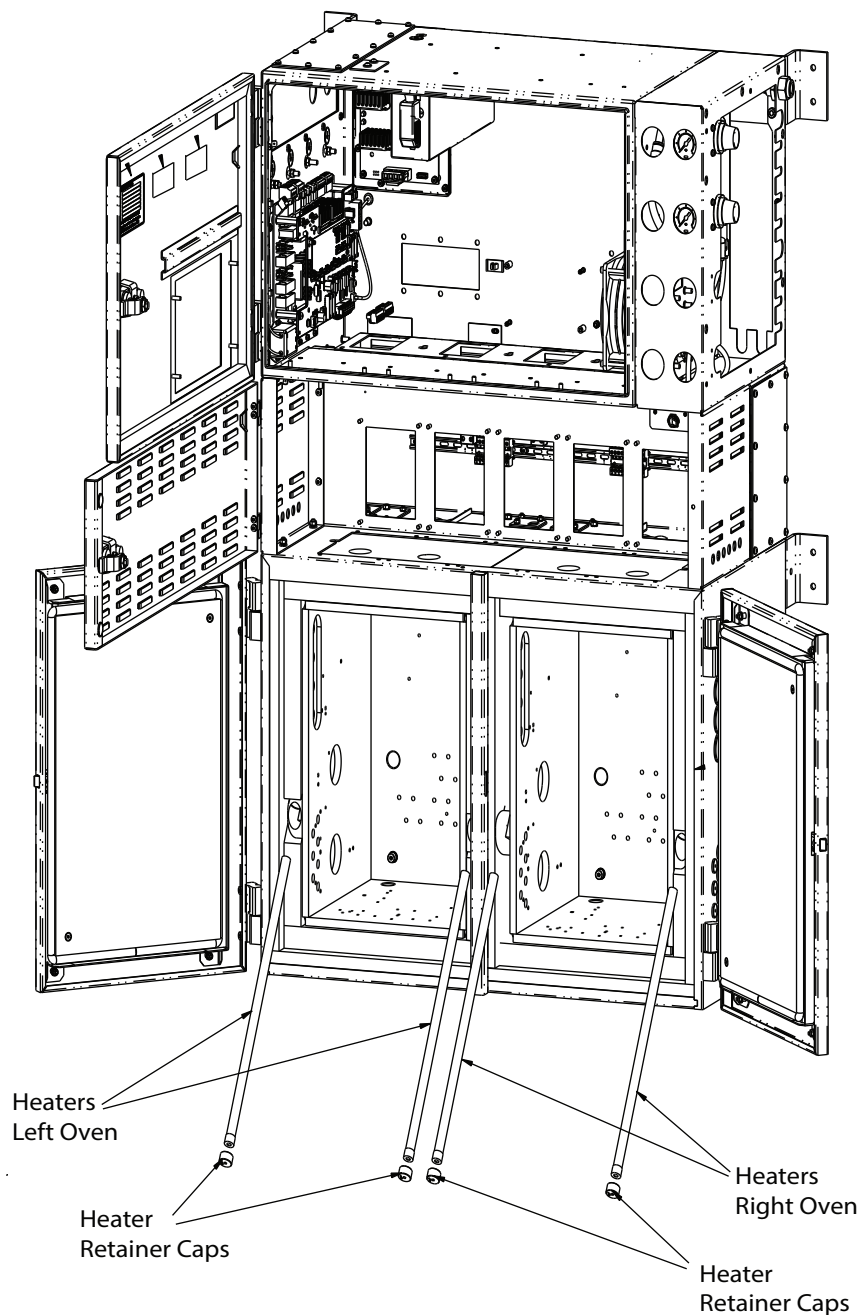


Figure 5-3 Airless Oven Heater Locations

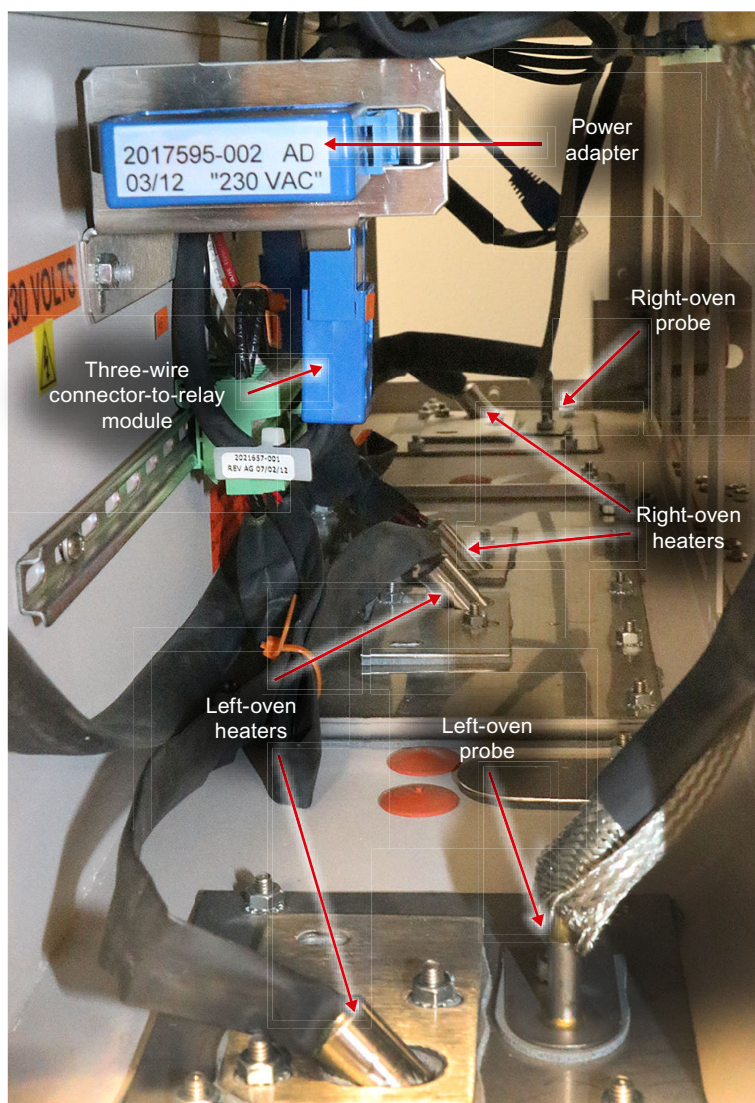


Figure 5-4 Airless Oven Heater Locations in Mezzanine Area

Appendix A - Contact Information

A.1 Product Information Availability

Information and instructions to use this product are available. The procedure can be obtained from the following web location:

www.usa.siemens.com/gc-manuals

- For Process Gas Chromatograph Manuals, click on the specific link.
- For MAXUM Edition II and MicroSAM Procedures and Updates, use the browser search function (Ctrl-F) to search for the part number or name of this product.

SIOS - Siemens Industry Online Support

The foundation for product information is the SIOS site at <http://support.industry.siemens.com/cs/products>.

Searching for Manuals

The following address starts a search for Maxum II manuals:

<http://support.industry.siemens.com/cs/products?dtp=Manual>

A.2 Contacts

Register at the Siemens Industry Online Support (SIOS) website:
<https://support.industry.siemens.com>

International	USA
Siemens AG I IA SC PA PM Process Analytics Oestliche Rheinbrueckenstrasse 50 76187 Karlsruhe Germany Web site: www.siemens.com/processanalytics Support Information: https://support.industry.siemens.com Spares Contact your local Siemens sales representative Support Requests www.siemens.com/automation/support-request	Siemens Industry, Inc. 5980 West Sam Houston Parkway North Suite 500 Houston, TX 77041 USA Tel: +1 713 939 7400 Fax: +1 713 939 9050 Email: saasales.industry@siemens.com Web site: www.usa.siemens.com/pa Training Tel: +1 800 448 8224 (USA) Email: saatraining.industry@siemens.com Spares Tel: +1 800 448 8224 (USA) Email: PAspareparts.industry@siemens.com Support Requests www.siemens.com/automation/support-request Tel: +1 800 448 8224 (USA) Email: GCsupport.industry@siemens.com

Singapore	Online Support Request
Siemens Pte. Limited I IA SC Process Analytics 9 Woodlands Terrace Singapore 738434 Web Site: http://www.siemens.com.sg	Web site: www.siemens.com/automation/support-request