



ACV-10 Automatic Control Valve

Installation, Operation & Maintenance



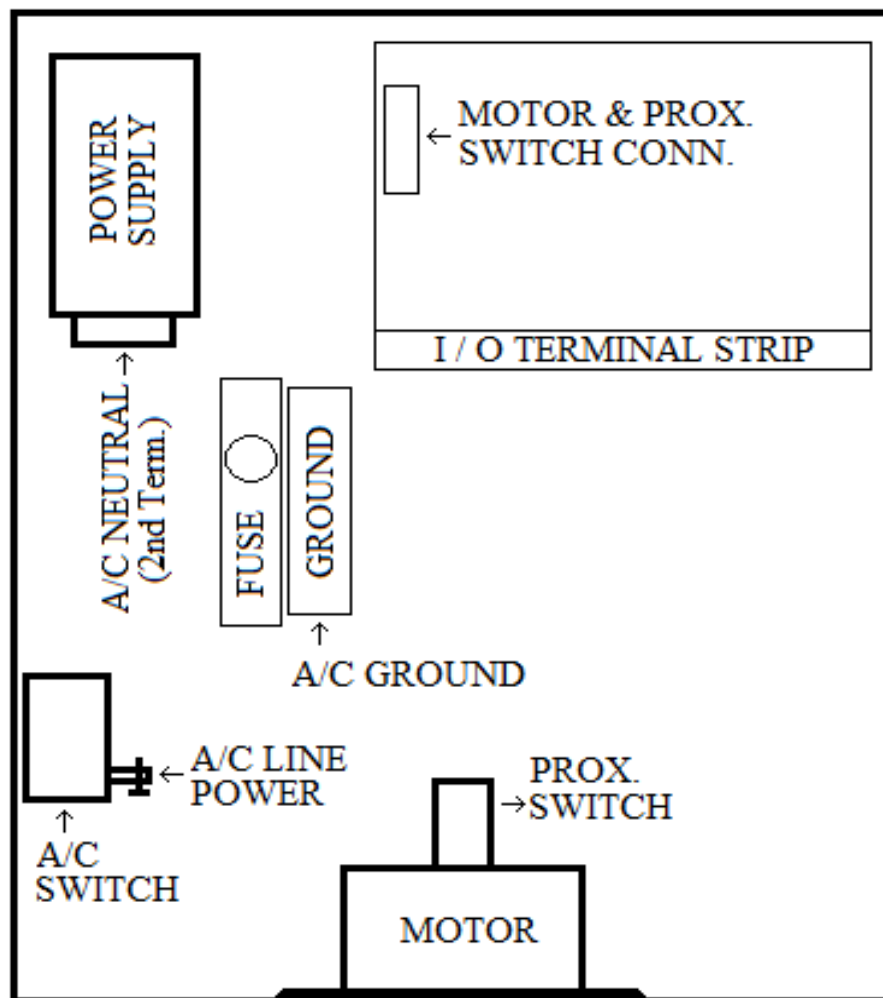
General: The Archer Instruments ACV-10 is a precision automatic feed rate control valve for use in vacuum systems feeding Chlorine, Sulfur Dioxide and other gases, as well as various liquid chemical solutions. The ACV-10 is field-configurable for a variety of control modes and can be provided for a wide range of feed capacities.

Installing the ACV-10:

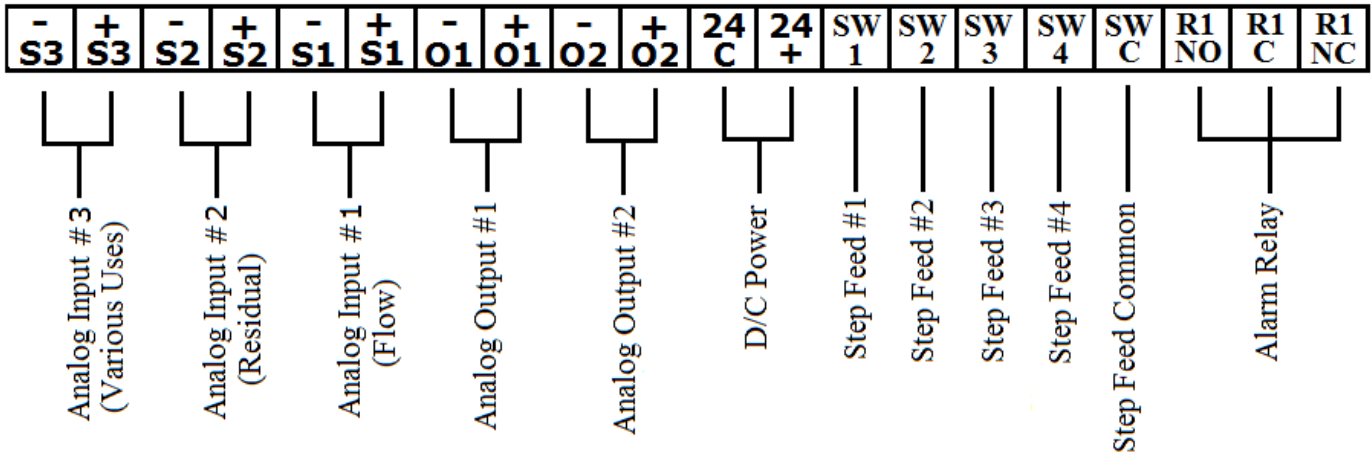
1. Installation:

- a. The ACV-10 is designed for wall-mounting. To protect the electronic circuitry, the ACV-10 should be installed in a location unlikely to be exposed to leaking water, etc. and the cover of the enclosure should remain shut at all times.
- b. Enclosure penetrations must be properly sealed to protect internal circuitry from exposure to corrosive fumes and gases.
- c. The ACV-10 can be powered using 115 VAC, 230 VAC or 24 VDC.
- d. Wiring Connections - Refer to the below drawings for AC power supply, DC power supply, 4-20mA inputs & outputs, step feed inputs and relay terminations:

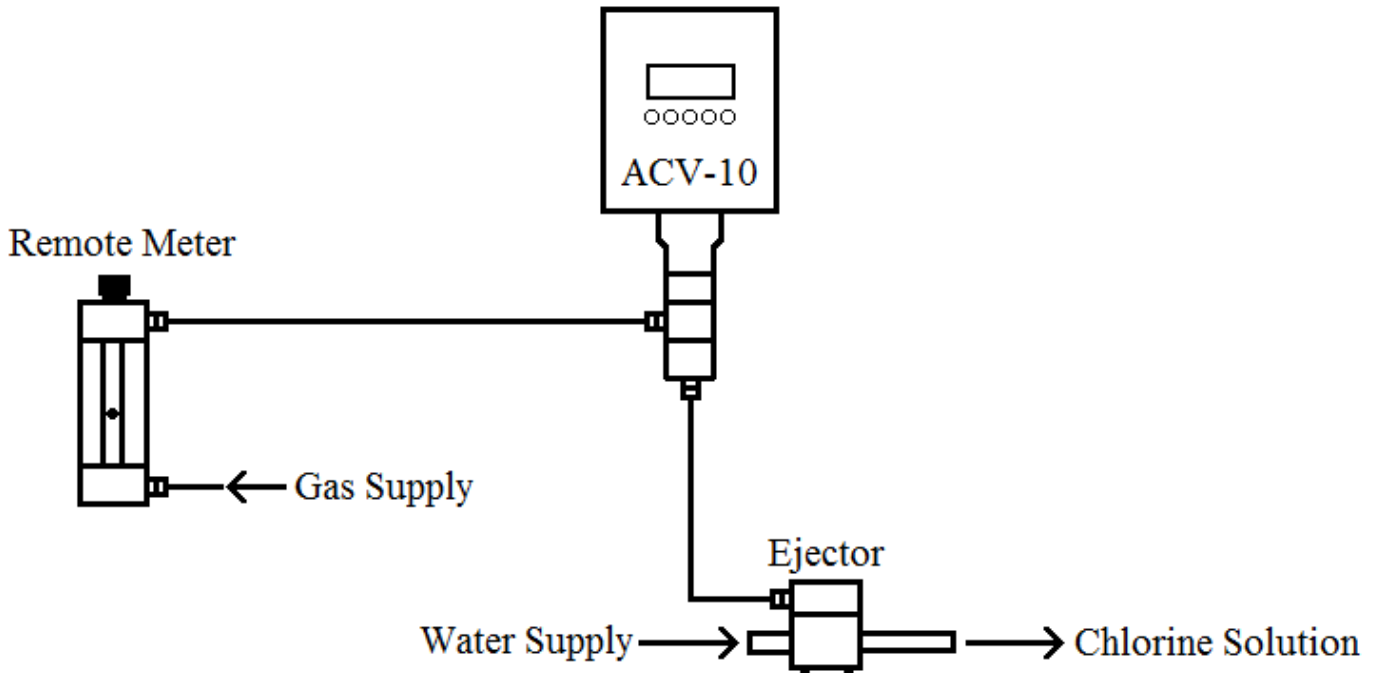
ACV-10 INTERNAL CONNECTIONS DIAGRAM



I / O TERMINAL CONNECTION DETAILS



- e. The inlet and outlet process connections should be made with the gas outlet (bottom of the valve) connected directly to the ejector and the gas inlet (on the side of the middle body) connected to the top of the remote meter panel.



Basic Installation

Operating the ACV-10:

User Interface:

- 1) The user-interface consists of a four line, eighty character display and five pushbuttons.
 - a. Up Arrow – Allows for navigation “up” on certain screens and also allows for increasing displayed editable values on certain screens.
 - b. Down Arrow – Allows for navigation “down” on certain screens and also allows for decreasing displayed editable values on certain screens.
 - c. Right Arrow – Allows for navigation “to the right” on certain screens. In the operation menu, this button scrolls through the operational screens.
 - d. Left Arrow – Allows for navigation “to the left” on certain screens. This button also allows the user to “back up” to the previous screen or menu.
 - e. Enter – The enter button is used to move forward to the next screen and also to select options on screens where multiple options are presented.

Control Modes:

- 1) Flow Pacing (Proportional): The chemical feed rate is adjusted in direct proportion to the input signal (typically from a flow meter) with no delay.
 - a. During operation, the user only needs to adjust the “Dosage” value to adjust the ratio of chemical feed rate to water flow rate.
- 2) Set Point (Residual): A 4-20 mA signal from a chlorine residual analyzer is used and the chemical feed rate is adjusted as needed to maintain the resultant chlorine residual at a programmed value (known as the “set-point”).
 - a. The chlorine residual sample point location is very important. The sample point should be ten or more pipe diameters downstream of the chemical injection point (to allow for complete mixing prior to sampling).
 - b. The lag time (the time it takes the chemical being fed to reach the residual analyzer) should be minimized to optimize control.
- 3) Compound Loop (P.I.D): Both flow pacing and set-point control are being carried out simultaneously.
- 4) Step Feed: Up to four digital inputs (relay closure signals) can be assigned to result in a fixed chemical feed rate. The ACV-10 controller will position the valve so that the feed rate is always equal to the sum of the feed rates allotted to the step feed inputs that are active.

Main Operating Screen:

- 1) During normal operation, the main screen will always display the process inputs being used, the valve output and whether the valve is in automatic or manual mode. In certain control modes, this screen will also display the dosage value.
- 2) To access the other operation screens, press the right arrow button. This will take you to screens where the mode can be switched between automatic and manual, the valve can be manually positioned and where the dosage and set-point values can be adjusted.
 - a. Editable operational settings and values will blink when selected. To change or edit a blinking item, use the up or down arrow. To return to the primary operating screen, press the left arrow. This backs up one screen at a time.
- 3) While on the main operating screen, pressing the up and down arrows simultaneously will reset any alarm condition, and pressing ENTER accesses the password-protected configuration and diagnostic menus.

Password Protected Menus:

- 1) The ACV-10 password (needed to change the valve's configuration, adjust set-point factors, re-linearize the valve or view the diagnostics menus) is 10.
- 2) The Menu: Once the password is entered, a menu appears with several possible selections. Use the up and down arrows to scroll through these selections:
 - a. **STEP FEED INPUTS:** This menu will only appear when Step Feed Control Mode is selected (under "Controller Set-Up").
 - i. This menu allows the user to assign a chemical feed rate value for each (up to 4) step feed input channel.
 - b. **SET UP INPUTS:** This menu allows the user to customize the displayed description, range, decimal position and engineering units used to display the process inputs (typically flow and residual inputs).
 - i. PVX Description: For either process variable input (PV1 or PV2), select from the available descriptions.
 - ii. Engineering Units: Select from the available list of engineering units.
 - iii. Full Scale: Enter the full scale value (in the engineering units selected) to match the full scale of the 4-20mA signal being received.

- iv. Locate Decimal Point: Enter the desired decimal location.
 - v. Zero Out Threshold: PV1 ONLY - This value (typically left at zero) allows the user to enter a value greater than zero, which the controller will treat as zero. Below this value, the value will consider PV1 to be at zero.
 - vi. Min Scale: PV2 ONLY – If the residual analyzer in use is providing the ACV-10 with a signal that represents a range not beginning at zero (for example: a range of 1.0 PPM to 10.0 PPM where 4 mA represents 1.0 PPM), enter the minimum value (1.0 PPM in the example).
- c. **CONFIGURE VALVE**: This menu allows the user to customize the displayed description, range, decimal position and engineering units used to display the valve output (chemical feed rate). This is typically pre-configured at the factory and generally should not be changed unless the valve stem is replaced (change of capacity) or the chemical application is changed.
- i. Output Description: To label the displayed feed rate value, select between "PO1" and "OUT".
 - ii. Engineering Units: Select from the available list of engineering units.
 - iii. Output Range: Enter the full scale value (in the engineering units selected) to the desired maximum feed rate. Note that this value cannot exceed the actual capacity of the variable area valve stem (AV7-XXX) installed in the valve assembly.
 - iv. Locate Decimal Point: Enter the desired decimal location.
- d. **LINEARIZATION**: The ACV-10 offers a ten point linearization process to allow the user to precisely calibrate the motorized valve so that the actual chemical feed rate precisely matches the displayed chemical feed rate. The valve must be installed and in operation to perform the linearization. Linearization should be performed whenever the displayed feed rate does not match the actual feed rate through the valve - typically after initial installation of the valve and sometimes after performing routine maintenance on the valve.
- i. The first screen will initially read "Exit Without Changes". To re-linearize the unit, press the up arrow once. The screen will then read "Press Enter".
 - ii. The linearization process consists of ten consecutive screens, each of which will instruct the user to adjust the valve (using the up and down arrows) until the displayed feed rate is achieved. The screen will also display a number that ranges from 0 to 2250. This is the actual number of motor steps. On each of the ten screens, carefully adjust the motor position until the displayed feed rate is achieved. Then press enter to

proceed to the next screen.

- iii. The ten consecutive linearization screens call for feed rates (in the configured engineering units) that represent 0%, 5%, 10%, 15%, 25%, 35%, 50%, 70%, 85% and 100% of the configured range of the valve. It is critical that each of the ten linearization points be completed.
- iv. After the 10th step is complete, the linearization will be saved.

e. CONTROLLER SETUP:

- i. Control Mode: The initial screen under this section allows the user to select the automatic control mode being used. Change the selection using the up and down arrows.
- ii. DI 4 Set Up: The valve is equipped with 4 digital inputs, used primarily for step-feed control. However, digital input #4 can also be used to remotely change the operating condition between automatic and manual control.
- iii. Auto Check Frequency: The ACV-10 will periodically perform an automatic verification of the motor position by briefly cycling the motor to a reference sensor attached to the top of the motor. This process takes roughly 30 seconds to complete. On this screen, the frequency of the self-check can be changed.
- iv. Purge Feature: Intended for use when metering liquid chemicals, the ACV-10 is equipped with a feature that allows the user to enable an automatic periodic purge. This purge fully opens the valve for a pre-set number of seconds and then returns to normal operation. Once enabled, a screen will follow where the frequency and duration of each purge can be specified.
- v. Alarm Delay: During an actual alarm condition, the controller will wait a certain number of seconds before activating the alarm relay. An actual alarm condition must exist continuously for the amount of time (seconds) entered. This is pre-set to 5 seconds and in most applications need not be changed.
- vi. Others: Depending on the control mode selected, additional screens will appear in the Controller Set Up section:
 - 1. Low Flow Alarm: When in Flow Pacing or Compound Loop control modes, this screen allows the user to enter flow value, below which the relay will trip.
 - 2. Valve Bias: When in Set Point or Compound Loop control modes, this screen allows the user to select between "Chlorination" and

“Dechlorination” based on the chemical being fed.

3. Residual Reset: When in Compound Loop control mode, this screen allows the user to enter a flow value, below which the controller will ignore the residual. When the flow drops below the entered value, the controller will only proportion based on the flow signal. Once flow returns above the entered value, the controller will return to compound loop operation. This can be useful in applications where the flow can drop significantly, causing the residual lag time to become problematically long.
4. Flow Stop: When in Compound Loop control mode, this screen allows the user to enter a flow value, below which the controller will fully close the valve. Once flow returns above the entered value, the controller will return to compound loop operation. This feature can be used as a safeguard to prevent overfeeding in applications where the flow can become very low.

f. SET POINT CONTROL: This menu only appears when the control mode is set to Set Point or Compound Loop:

- i. Set Point: Also found in the operating menu, the set point value is the desired residual.
- ii. Integral: The integral value allows the user to increase or decrease the automatic value feed rate adjustments whenever the actual residual value is different than the set-point. Decrease this value if the controller is making significant feed rate adjustments that over-shoot the set point. Increase this value if the controller is making small feed rate adjustments that do not significantly impact the residual. Typically set between 10% and 40%, the best Integral value will vary from one application to another.
- iii. Lag Time: This value (in seconds) represents the amount of time it takes for a change in feed rate to create a resulting change in residual. The lag time will vary from one application to another and should be checked by timing the residual analyzer response to a significant change in chemical feed rate.
- iv. Dead Band: This value allows the user to specify a range around the Set Point (plus or minus this value) inside of which the controller will not react. This is used to prevent changes when the residual is “close enough” to the Set Point.

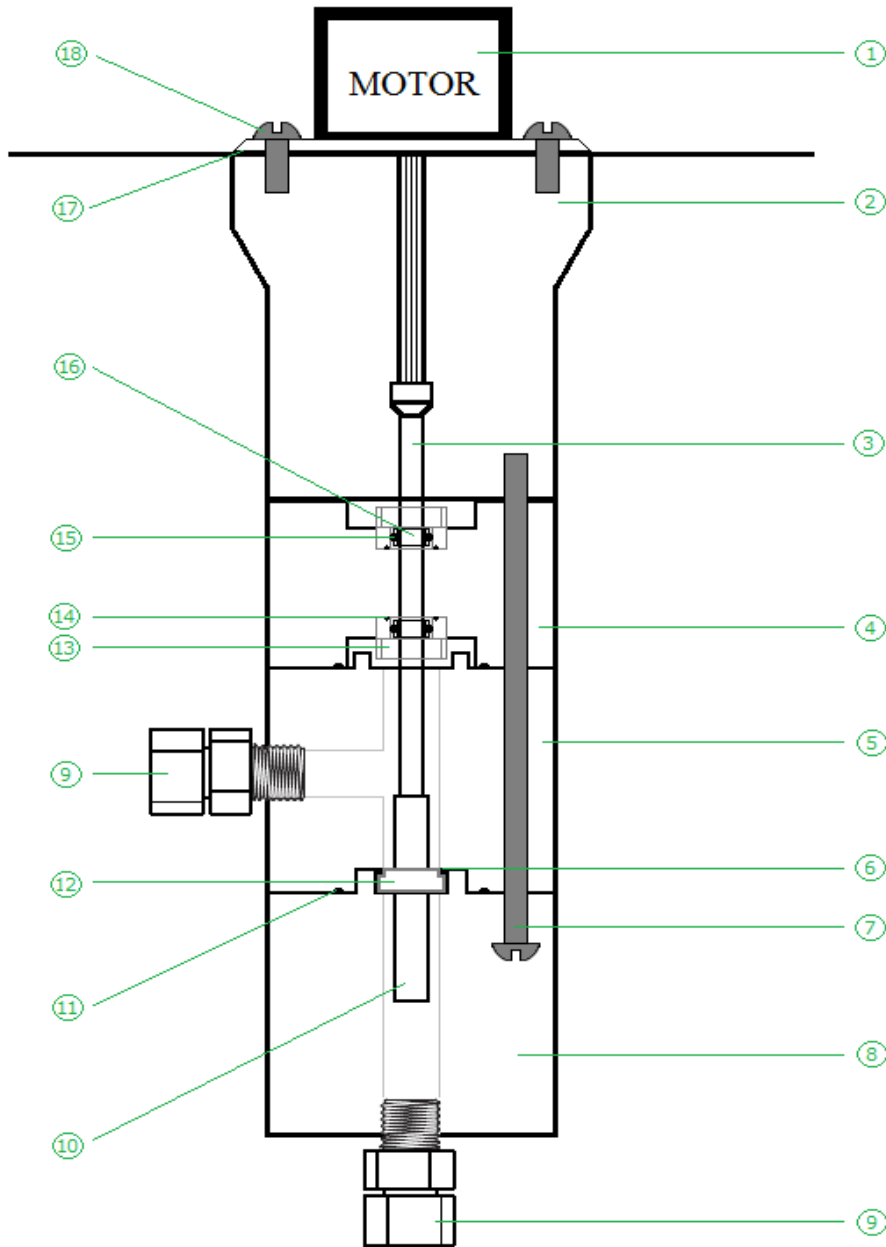
g. DIAGNOSTICS: This section of the program is for informational purposes only. It allows the user to view the actual input and output signal conditions, relay status and the actual motor position (given in motor steps 0 – 2,250).

h. MAIN SCREEN: Select this menu item to return to the operating menu.

Maintaining the ACV-10

- 1) The ACV-10 is designed for long periods of continuous operation. The required frequency of routine maintenance will vary based on the operational demands on the valve. If the valve is installed in an application where constant valve position adjustments are being made 24 hours per day, routine maintenance should be performed annually. In less demanding applications, routine maintenance should be performed every two years.
 - a. Safety: Before disassembly, be sure to evacuate any chemicals by drawing air through the valve and securing power to the controller.
 - b. Disassembly: Refer to the parts diagram found on the last page.
 - i. The 3 lower valve bodies are easily removed by unscrewing the 3 assembly screws (BTA-512).
 - ii. Carefully remove the AVB-4 and AVB-3 by sliding them straight off of the valve stem / shaft.
 - iii. Unscrew the valve stem (AV7-XXX) and intermediate shaft (AV2-12) from the motor shaft. Once the intermediate shaft is fully unscrewed from the motor shaft (visible though the AVB-1 upper body), the stem, shaft and shaft seal body (AVB-2) will be disconnected.
 - iv. Slide the stem and shaft out of the shaft seal body.
 - v. Remove the two seal cartridges (ASC-1) from the shaft seal body, preferably using a 9/16" wrench.
 - vi. Each seal cartridge contains a Teflon shaft seal (AVS-108) with o-ring. These should be removed and discarded.
 - c. Reassembly: Refer to the parts diagram found on the last page.
 - i. Apply a coating of Fluorolube grease to all o-rings prior to reassembly
 - ii. Install new shaft seals and o-rings in the cartridges.
 - iii. Replace all o-rings and (if necessary) the AVS-1 valve seat.
 - iv. Clean the valve stem v-notch.
 - v. Reassemble valve in reverse order.

-Should you have any questions during maintenance of your ACV-10 Automatic Control Valve, please contact your local service provider or Archer Instruments for support.



| Item# | Qty. | Part # | Description | Item# | Qty. | Part # | Description |
|-------|------|------------|------------------------|-------|------|--|------------------------|
| 1 | 1 | AV-MOTOR | Linear Stepper Motor | 10 | 1 | AV7-XXX 010 / 025 / 050 / 100 / 250 / 500 = PPD | Valve Stem |
| 2 | 1 | AVB-1 | Top Valve Body | 11 | 2 | OA-VIT-126 | O-Ring |
| 3 | 1 | AV2-12 | Intermediate Shaft | 12 | 1 | AVS-1 | Valve Seat |
| 4 | 1 | AVB-2 | Shaft Seal Body | 13 | 2 | ASC-1 | Seal Cartridge (9/16") |
| 5 | 1 | AVB-3 | Middle Valve Body | 14 | 2 | OA-VIT-014 | O-Ring |
| 6 | 1 | OA-VIT-116 | O-Ring | 15 | 2 | OA-VIT-108 | O-Ring |
| 7 | 3 | BTA-512 | ¼-20 x 5-1/2" SS Screw | 16 | 2 | AVS-108 | Shaft Seal |
| 8 | 1 | AVB-4 | Bottom Valve Body | 17 | 1 | AV-GASKET | Gasket |
| 9 | 2 | TCA-XX | Tube Connectors (note) | 18 | 4 | BTA-034 | ¼-20 x ¾" SS Screw |

Notes: Vacuum Tube Connector supplied as follows: 3/8" tubing for 100 PPD & below (TCA-64), ½" tubing for 250 PPD (TCA-84) and 5/8" tubing for 500 PPD (TCA-108).
*250 PPD & below has ¼" FNPT & 500 PPD has ½" FNPT



Date: Feb 2015
Drawing Number: ACV-10