Technical Manual

AEROBARRIER CONNECT

Contents

Scope

1.0) Ownership and Use of Manual

The Aerobarrier Technical Manual is the property of Aeroseal LLC (hereinafter referred to as "Aeroseal"). Dealers are urged to consult the manual for diagnostic information, aerosol sealing techniques, troubleshooting, repairs, and maintenance. Although there is a discussion on use and maintenance of 3rd party accessories, dealers are encouraged to refer to those manuals for specific nuanced details.

2.0) Confidential Information

All information in this Technical Manual is confidential and meant only for direct use by the dealer and their current employees who are engaged in providing duct sealing services. All information in the Technical Manual is proprietary and unauthorized release or use constitutes a violation of the sublicense agreement.

3.0) Job Site Safety Information

Customer and Contents' Protection: The Dealer is responsible for assuring the safety and well-being of the homeowner or your customer and the contents of their building on all jobs. The dealer should:

a) Keep customers and 3rd party trade technicians away from areas where high sealant overspray concentrations may exist without use of proper protective equipment.
b) Assure that pregnant women and people with breathing difficulties are not in the building during the injection process.
c) Ventilate using a scrubber fan and, if possible box fans in areas that may be exposed to escaping sealant.
d) Cover customer property that might be exposed to high sealant concentrations.
e) Keep customers away from work areas near ladders or in tight workspaces.
f) Prevent accidental spillage onto finished surfaces by using a tarp under equipment setup and performing any sealant transfer activities outside of the building. If accidental spillage occurs, clean up immediately using provided cleaners or other solvent(s).
g) Use a liquid-tight tarp under the aerosol injector to prevent spillage of liquid sealant onto finished floors. The tarp should extend at least 2 feet from the injector.
h) Keep the sealing equipment clean and free of liquid sealant at all times.
i) Ensure that heaters are clear of any sealant deposition and any maintenance is done offsite.

4.0) Technician Safety Information

The safety of technicians performing the sealing work should be assured at all times. Aeroseal recommends that proper respiratory protection should be worn at all times when in spaces with high aerosol concentrations (e.g. during the injection process in confined spaces and/or shaft sealing with significant duct leakage) and that technicians be provided with skin protection (gloves) for use with the solvent, and fiber masks or cartridge respirators with organic/particulate canisters for use in confined

spaces. Tyvek suits are also recommended for enclosed spaces. Additional recommended safety precautions include:

a) Not overextending reaches if using tall ladders during the diagnostic or sealing process.
b) Using only approved electrical connections for the injector machine, including GFI pigtails unless otherwise specified.
c) Using scrubber fans to ventilate areas where sealant material may escape from leaky duct sections.
d) Placing walking boards across ceiling joists to prevent stepping through the ceiling when working in an attic.
e) Wearing protective glasses when removing register grilles, carrying out prep work.
f) Wearing liquid-tight gloves when using solvents.
g) Wearing respiratory protection when working in areas with sealant particles in the air.
h) Sensitive individuals or individuals regularly submitted to high sealant particle concentrations should wear cartridge respirators with organic/particulate canisters.

Figure: Respiratory, Hands and Eyes safety protections.

5.0) Sealant Material Specifications

The aerosolized sealant is called Aerobarrier X1 and is a waterborne acrylic sealant. The datasheet along with Safety Data Sheets (SDS) can be found in the Appendix to this Manual along with SDS sheet for the standard cleaner provided with the Aerobarrier start-up kit

Dealer shall ensure that all SDS sheets are available to access on all job sites, including during diagnostics/sales.

Introduction to AeroBarrier Equipment

AeroBarrier™ process is a patented, cutting edge envelope sealing system that allows you to reach any level of air tightness in any building enclosure. The system comprises the following main sub-systems which monitor and measure critical parameters in the envelope to measures and report out the leakage level dynamically during the sealing process -

1.0) Main Control Unit
2.0) Smart Sealing Stations with Nozzle Assemblies
3.0) Fan-Heater cylinder Assembly
4.0) Blower Door Assembly
5.0) Power, Compressed Air, Sealant, and water
6.0) Laptop with proprietary Aeroseal software and license that controls the machine and the process

The main parts of the machine are the Main Control Unit (MCU), Sealing Stations (ST) with Nozzle tripod assemblies and the fan-Heater Cylinder Assembly. Needed utilities like power and compressed air are provided by accessories that can be packaged in a trailer or mobilized separately. The machine is controlled by the proprietary Smartseal software pre-loaded onto a laptop which acts as a user interface.

1.0) Main Control Unit (MCU)

The MCU is the brain and power bank of the machine and is responsible for controlling the sealing stations that inject sealant, the fan and electric heaters. It comprises all the power (high voltage) and control wiring and terminated to various outlets labelled on the unit. The unit also has LED indicators which indicate the 3status of the machine.

Please note that the orange color is representative only and the actual color of the MCU might be different (usually a black box with colored handles).

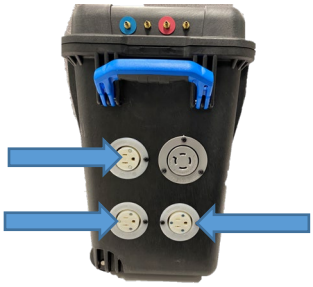
All the Utilities' (power) connections – both input and output are described in the below section

1.1.1. 240V 50A Power input

Input power to MCU is 240V, 50A

1.1.2. Heater Outlets

The MCU has three heater outlets that are used to power the three 1500W heaters in the fan-heater assembly. Each heater has its own power outlet (120 V) and protected by a 15A breaker in the MCU. Connect the three heater cords into the three power outlets. (Note: Order does not matter). When the heater is ON, the associated red LEDs will turn ON



1.1.3. Fan Outlet (240V/8A)

This outlet powers the three phase centrifugal fan. The speed controller is built into the box and the fan speed can be controlled via the computer or by using the manual knob.

1.2. Front Panel LEDs and illuminated switch for fan on the MCU:

The LED Array mounted on the MCU top panel indicates the status of the machine and aids troubleshooting. Please note that each 120V/240V outlet is associated with a breaker and LED status indicator. The illuminated “Red” switch should be turned on inorder for the software to take control of fan.

S.NO	Label	Description
1.	Status LED	Solid light Indicates Connected to Wi—Fi and GSM
1.	H1	Shows whether Heater 1 is “ON/OFF”
2.	H2	Shows whether Heater 1 is “ON/OFF”
3.	H3	Shows whether Heater 1 is “ON/OFF”
4.	Fan Power	FE1 – 120V, FE2 – 120V Shows whether both line voltages
3.	Fan Switch	ON- Red OFF – No Color
4.	Main Power	Indicates availability of input 240V Power

1.3. Side Panels of the MCU:

One of the sides of the MCU contains inlet sensor that measure ambient temperature and humidity. These sensors are protected with a sensor guard. It is important that the sensor guard and sensor assemblies are in place (the location and orientation of the sensors is important) in order to measure the correct temperature and humidity combitions. These values will determine how many heaters will be turned ON during the sealing process.

The handle side of the MCU has the bulkhead adaptors for connecting the compressed air inlet and outlet hoses. The T-connection basically provides the compressed air pressure signal to the MCU's controller.

1.4. Envelope Pressure and Fan flow measurement

The MCU also incorporates a calibrated manometer, signal interface boards to communicate with the laptop. The provided USB port is used to connect the MCU to the Aerobarrier laptop via a USB cable. The pressure signals from the fan inlet (red tubing) and the envelope pressure (blue tubing) are connected to the MCU lid at the ports shown. Note that the fan pressure tube is connected to the "brass bulkhead connector" on both the MCU side and the fan inlet side.

The software uses the Fan Pressure and the ring settings on the fan to calculate air flow supplied into the building envelope.

The other two ports on the lid are reference ports for the differential manometer. These ports detect the ambient pressure and play an important role in getting you a stable flow measurement reading. Hence locating the MCU in a place that is away from winds is important. When that is not feasible and wind is causing a lot of fluctuations on your flow, leakage and ACH readings, then you should run a tube from these reference ports to a remote place that eliminates these wind disturbances.

Color	Description
Red Tube	Fan Pressure
Clear Tube	Fan Reference
Blue Tube	Envelop Pressure
Clear Tube	Reference

2.0) Smart Sealing Stations

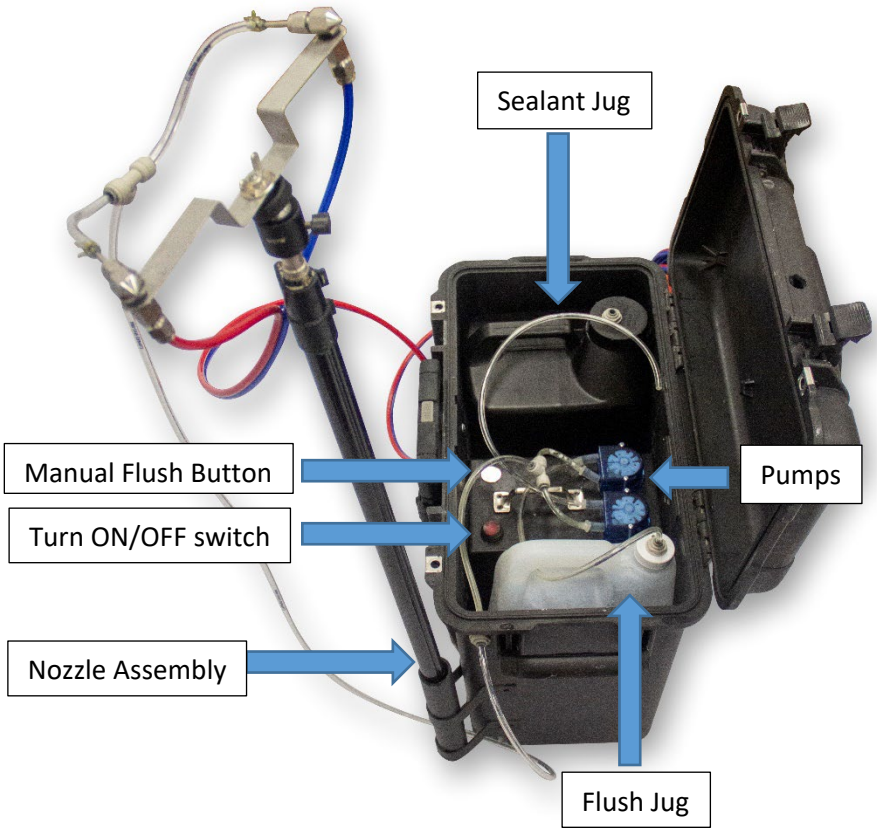
Each sealing station is responsible for monitoring the conditions of the enclosure and for managing sealant dispensing through the nozzles. Sealing Station consists of –

a. Pump 1 – Used in sealing mode
b. Pump 2 – Used in flushing mode
c. Sealant and flush (Water) Jug
d. Antenna
e. Sensors
f. Nozzle Assembly
g. Battery

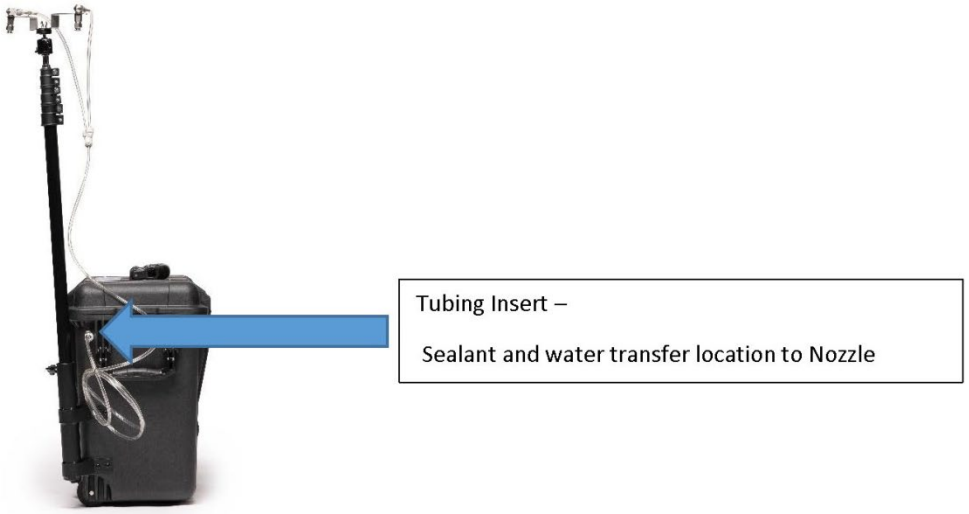
All the electronics are powered by 12V rechargeable Lead acid maintenance free batteries which are rated to run for over 8 hours when fully charged. Refer to the maintenance section of the manual for proper usage and storage. Built in electronics control the pumps and also reports the key parameters to the Main Control Unit (MCU) via mesh network.

Each station is individually programmed with set parameters that will allow the pump to turn ON/OFF" without any manual intervention as long as they are communicating with the MCU. Also, the stations are

programmed with fail safe mechanisms to stop spraying if communication with MCU is lost for any reason. Communication is established by a MESH network established by a XBee built into the board.



Note that there are two pumps installed – One for pumping sealant (during the sealing process) and the second for flushing the sealant lines and nozzle with water. The water flushing process is done as a part of the Aerobarrier sealing process,. Both pumps are interchangeable. You do not need to disassemble the pumps for cleaning as along as you flush them with water at the end of the job. At the end of your job you will find some residual sealant – and you can use the manual flush button to make sure that the liquid lines are flushed with water completely and then drained for storage.



Just like the MCU, each sealing station has temperature and humidity sensors that are protected by the sensor guards. The side panel of the MCU has push to connect which is used for dispensing sealant to the Nozzles mounted on the tripod stand.

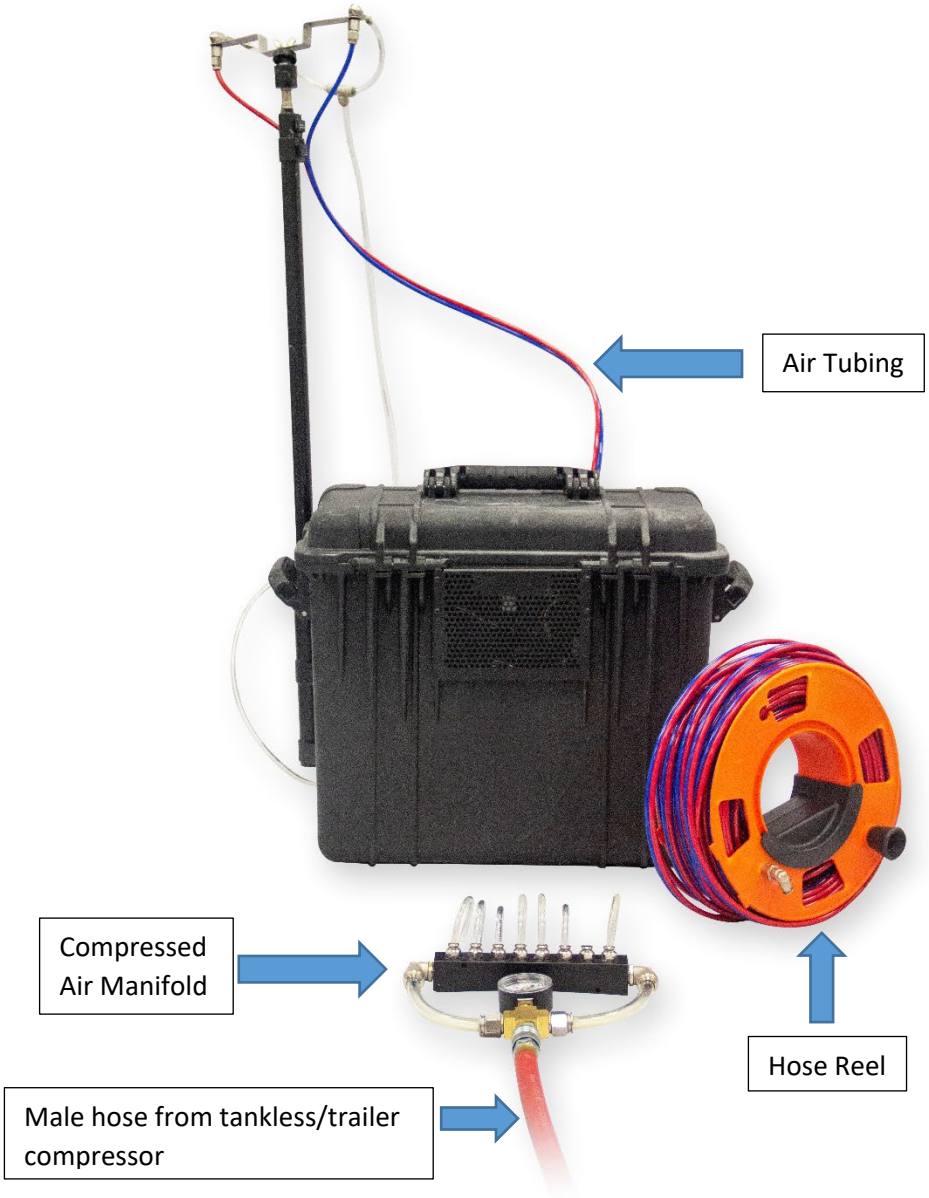
Below the sensor guard is the charging port for the batteries. A 120V/12V battery changer (not shown in the picture) is used to keep the batteries charged for the day of the job.

The battery charge level for each station can be viewed on software for you to plan accordingly. Unless overridden by the MCU/ software, the sealing stations will run until the relative humidity around the sealing stations reach around 90% Rh.

3.0) Nozzle Assembly with Air tube Reels and Compressed air manifold

Each nozzle assembly is fitted with two special Nozzles that are mounted on a U-Bracket onto the sealing stations. The nozzles atomize glue into fine particles using compressed air from the manifold. The colored

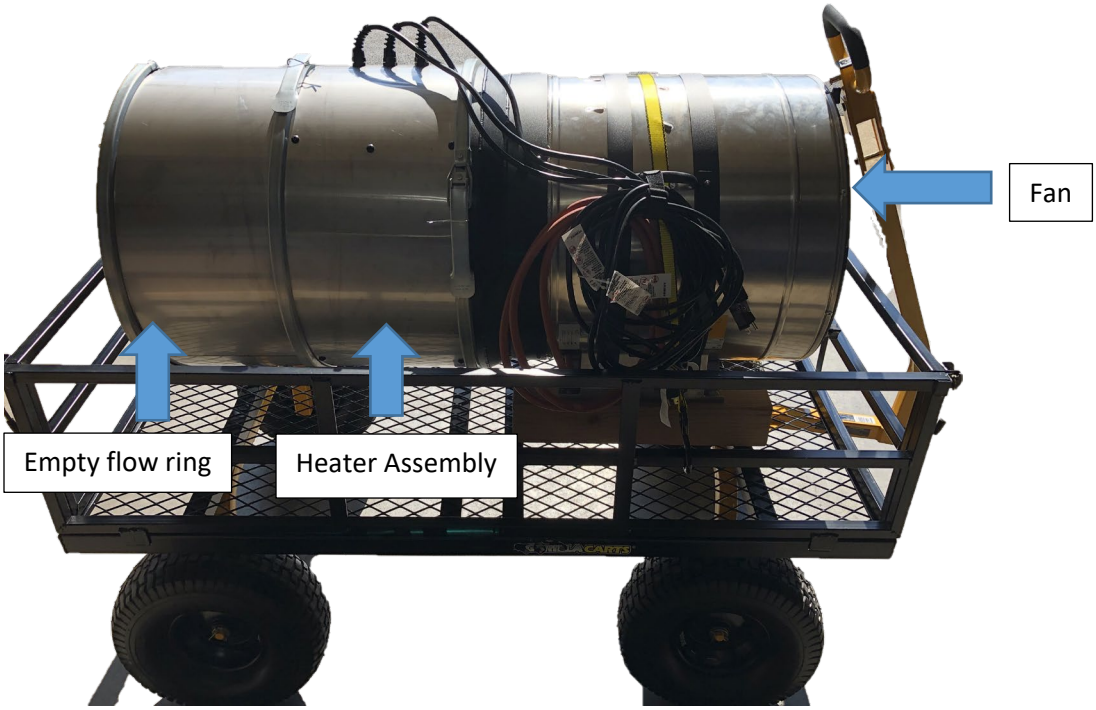
dual bonded tubes are used for running compressed air from the MCU manifold to the nozzles mounted on the tripod stand. Make sure that the air and liquid connections are pressed tight to prevent glue spills, sealant blocks or puddles on the floor.



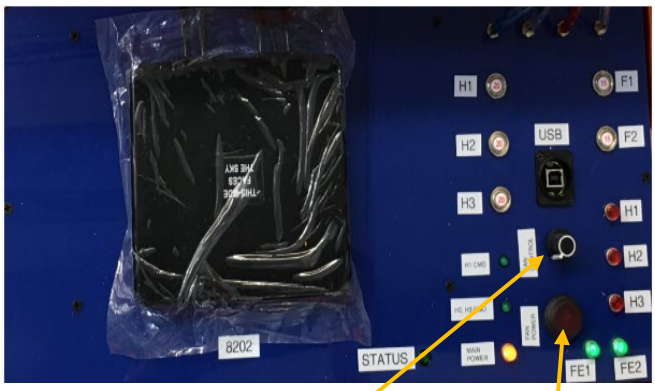
4.0) Fan and Heater Assembly

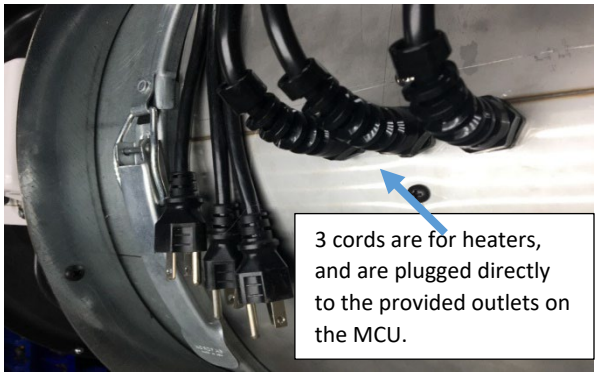
The Fan Heater Cylinder Assembly is a combo unit that comprises the centrifugal fan needed to pressurize the House, a detachable heater cylinder that contains 3 x 1500W, 120V heaters and an empty air flow ring to

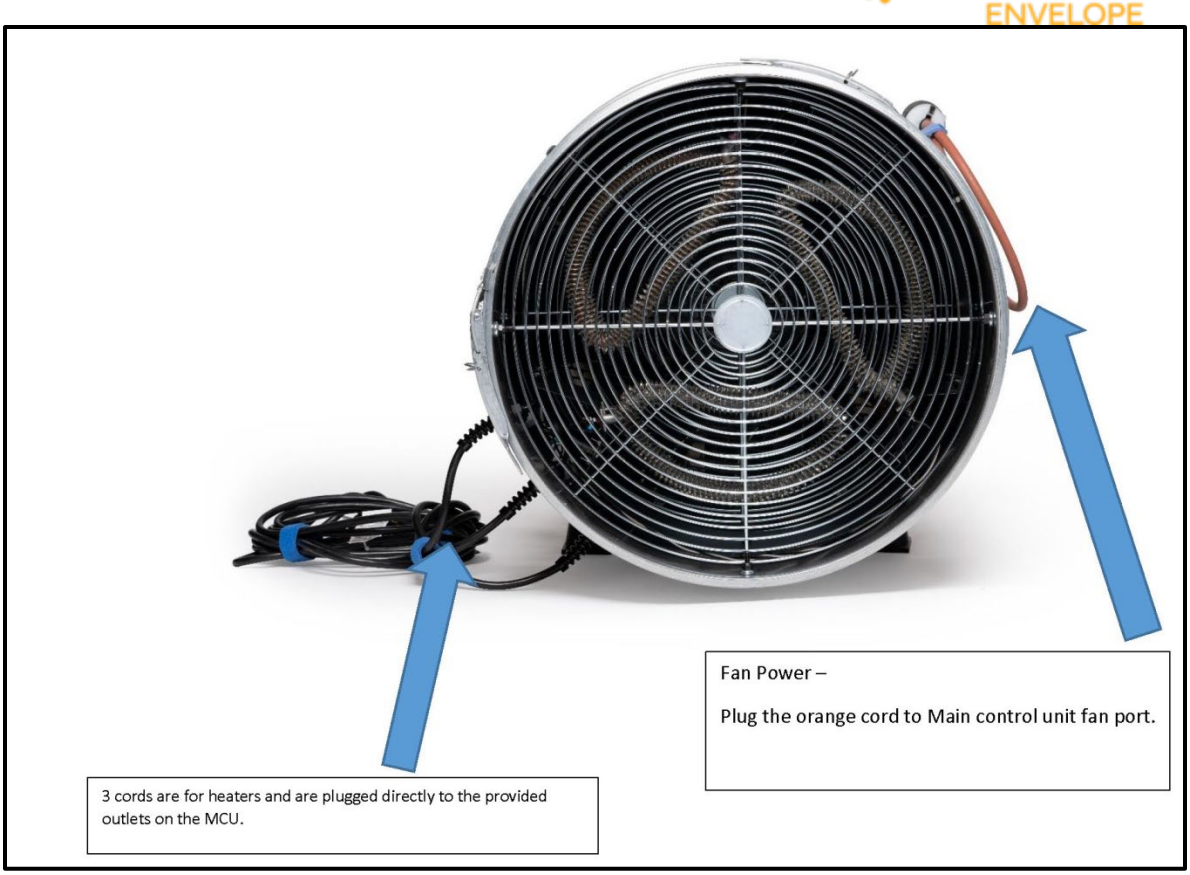
pressurize the enclosure. The detachable modules can be clamped together by a ring or can be used separately by an interconnecting 21" dia lay-flat tubing. This unit is connected to the red Blower door Assembly (after all the house prep is completed and the compressed air line is run from the MCU to the Manifold). Refer to the Appendix sections for different setups.



The Aero Barrier software controls the fan to maintain optimum envelope pressure for testing and sealing. The fan can also be manually controlled using a knob mounted inside the MCU. This provides the technician an ability to control over the pressurization process.







The heater cylinder has three circuits - 120V/ 1500W each.

Do NOT plug the heaters directly into a wall power outlet without the fan running to prevent damage / overheating on the heater coils. Typically these plugs are connect it to the assigned outlets on the MCU. The MCU and software will determine when to turn on the heaters.

The fan is driven by a three phase motor and is controlled by a variable frequency drive inside the MCU. The orange cord is for carrying three phase power from MCU to the fan motor.

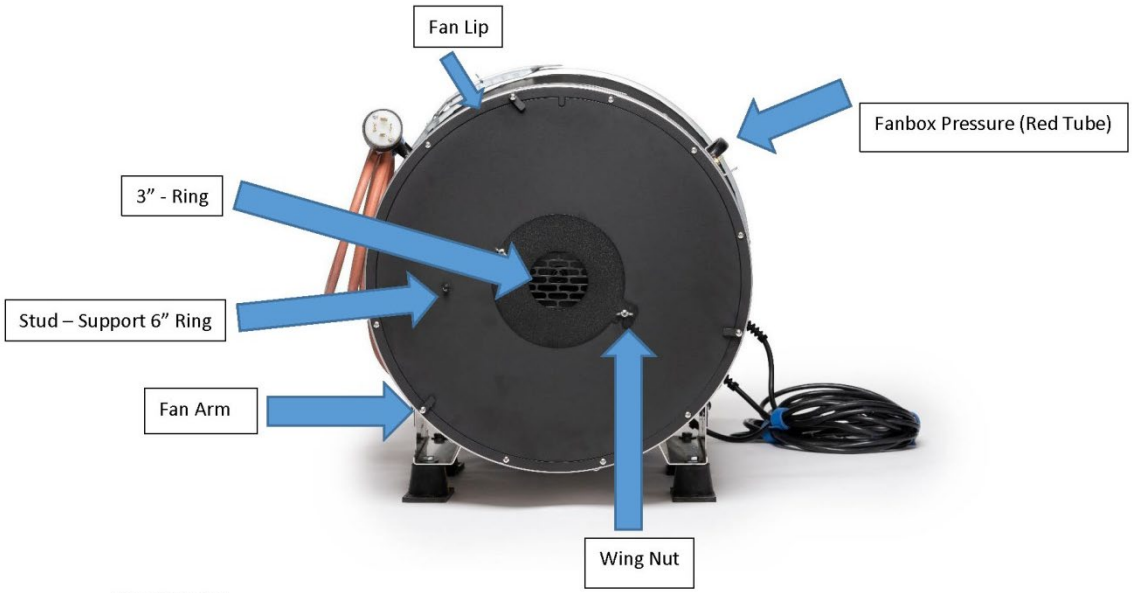
The rear (inlet side) of the fan Assembly incorporates calibrated ring openings. It is important that these do not bend or get damaged as they are the key to providing accurate flow measurement. Each of the three rings are calibrated for accurately measuring air flow through the fan.

3” Ring : 30 cfm to 250 cfm

6” Ring : 140 cfm to 950 cfm

No ring : 500 cfm to 4500 cfm

The fan incorporates a fan pressure port at the at 2’oclock position. Make sure this is clean and free of debris. This fan pressure port provides the signal to the MCU and the software which is used to calculate the air flow in CFM



Ring Opening

1. No Ring
2. 6"
3. 3"

Accessing various ring Setups

1. No Ring

   Using Fan arms (3 per fan), turn flush to fan lip to access "No Ring."

2. 6 "Ring

   Loosen "Wing nuts" (2 Turns) which loosens ring and turn it counter closer wise and make sure the ring is resting on stud for support.

5.0) Blower Door Assembly

The blower door frame assembly is mounted at the main door entrance of the house or apartment that is being sealed. It is installed after all the in-house prep work is completed and hoses laid out and connected to the machine.

The fan-Heater Assembly sits inside the round opening that seals tightly around the enclosure to prevent any air leaks when the envelope is pressurized.

6.0) Utilities required for running the AeroBarrier process

The necessary utilities for running the Aerobarrier process are electric power, compressed air, sealant and water.

a. Electric Power: 240V-120V / 50A – 4 pole electrical connection is required to run the MCU which powers Fan, 4.5kW heaters and electric compressors (if included). The electric compressor is an optional accessory for sealing high rise apartments. Machine is equipped with a 125/250V 50A 3Pole/4wire CS6365 plug. This can be plugged into a 10kW generator or an electrical cut-out.

b. Compressed Air: The amount of compressed air needed depends on the number of sealing stations you intend to use. This depends on how large of an enclosure you are trying to seal. The standard diesel trailer can provide 27 SCFM @ 100PSI for feeding 12 Nozzles (6 Nozzle stations) in the house version. When sealing small apartments which require less than 8 nozzles (4 Nozzle stations), a smaller electric compressor can be used. Do note that when operating at high altitudes, you will have to de-rate the compressor capacity.

c. Sealant: AeroBarrier X1 sealant is provided in 5GL buckets. Onsite, the technician will need to thoroughly mix the sealant with the provided paint stirrer and cordless drill. Be careful to start at low speed to avoid any spills. Also do remember to repeat the mixing process periodically (every hour) so that the glue / water mix is consistent. It is important to note that the sealant is stored between 40F and 120F only. Hence do NOT leave it on the job site or inside the trailer. Two paint stirrers (mixers) are provided in your start-up kit. One can be used for the 5GL pail and the other is used for the 2gl

bottles inside the sealing stations. Use the battery operated pump to transfer sealant from the pail to the individual bottles. If you have already transferred sealant to the 2gl jugs, then be sure to use the appropriate mixer (that reaches the bottom of the jug) to thoroughly mix the sealant. This is key to running an efficient job without your nozzles / sealant lines getting clogged by unmixed sealant mixture.

d. Water: Water is needed for flushing the sealant lines with water after every job so that the nozzles, and tubes do not gum up. You will need water for routine cleaning of equipment too and for use in a spray bottle to check for any compressed air leaks.

APPENDIX 1: AeroBarrier X1 Sealant Datasheet and Standards

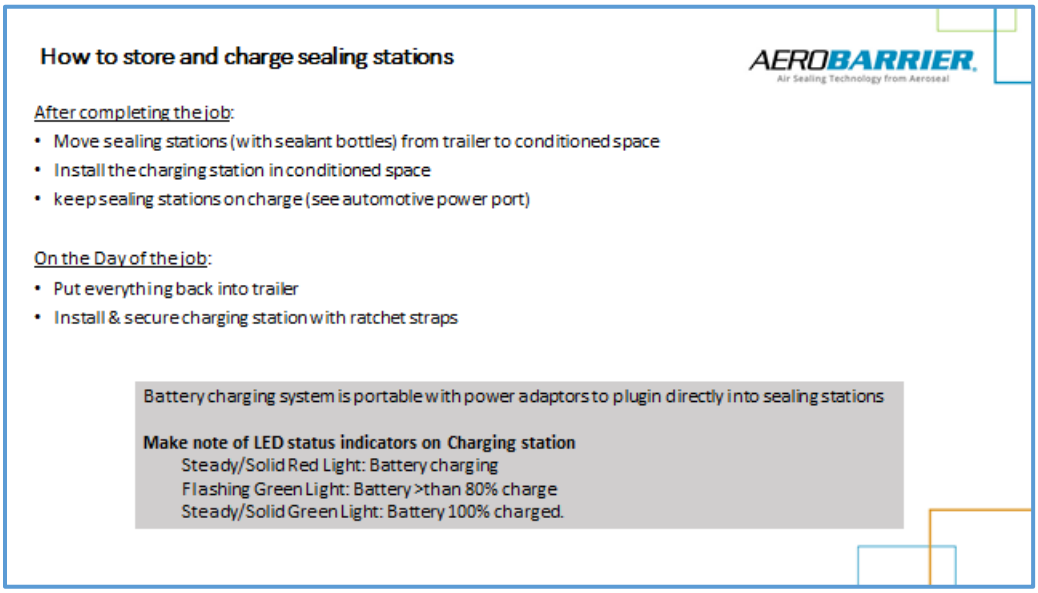
Aeroseal Data Sheets | Aeroseal

APPENDIX 2: AeroBarrier X1 Safety Datasheet (SDS)

AeroBarrier X1 sealant is a waterborne acrylic sealant. It is a stable emulsion, non-toxic and not flammable.

Aeroseal Data Sheets | Aeroseal

APPENDIX 3: How to Store Sealing Stations and AeroBarrier X1 Sealant



The above picture shows the recommended steps for storing your sealing stations and sealant. In most cases this might be the most efficient arrangement you want to follow.

However, the modular nature of the equipment gives you some flexibility depending on specific circumstances. One such example is described here – In moderate climates, it might be efficient to leave the sealing stations and the charger inside the trailer and run a 120V extension cord into the trailer. This will avoid handling, but please ensure that the sealant is not subjected to extreme temperatures. Some contractors choose to keep the trailer in conditioned space.

The sealant is water-based and needs to be between **40F and 100F.**

Sealant tends to settle at the bottom of the jug when stored. It is important to mix the sealant using the provided stirrers. On the job site, thoroughly mix with provided stirrer and every 2hours thereafter

APPENDIX 4: Transferring sealant from 5Gl Pail to sealing stations at Job site or the shop?

Sealant Management

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Air Sealing Technology from Aeroseal

On the Job Site

- **Always** flush sealing station with water **and**
- **Use compressed air** to dry (winterize) at end of job
- At end of job, top off sealant in each station
  - Use the provided battery-operated pump
  - Flush the pump with water after use

At the shop

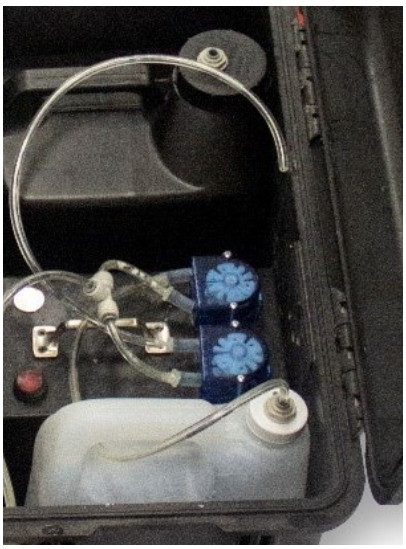
- Store sealing stations in conditioned space (stations are filled with sealant)
- Put all sealing stations on charge
  - Move the charging station from the trailer into conditioned space
  - Alternatively, backup trailer into conditioned warehouse
- Put everything back into trailer before going to job

The above set up will reduce bottle handling, sealant contamination, drying up (skinning), and any inadvertent running out of sealant during a job

Caution: Overnight parking - Do not store sealant & sealing stations inside trailer (especially in sub-zero conditions)

Use the provided Battery operated pump to transfer and top up sealant into the sealing station jugs.

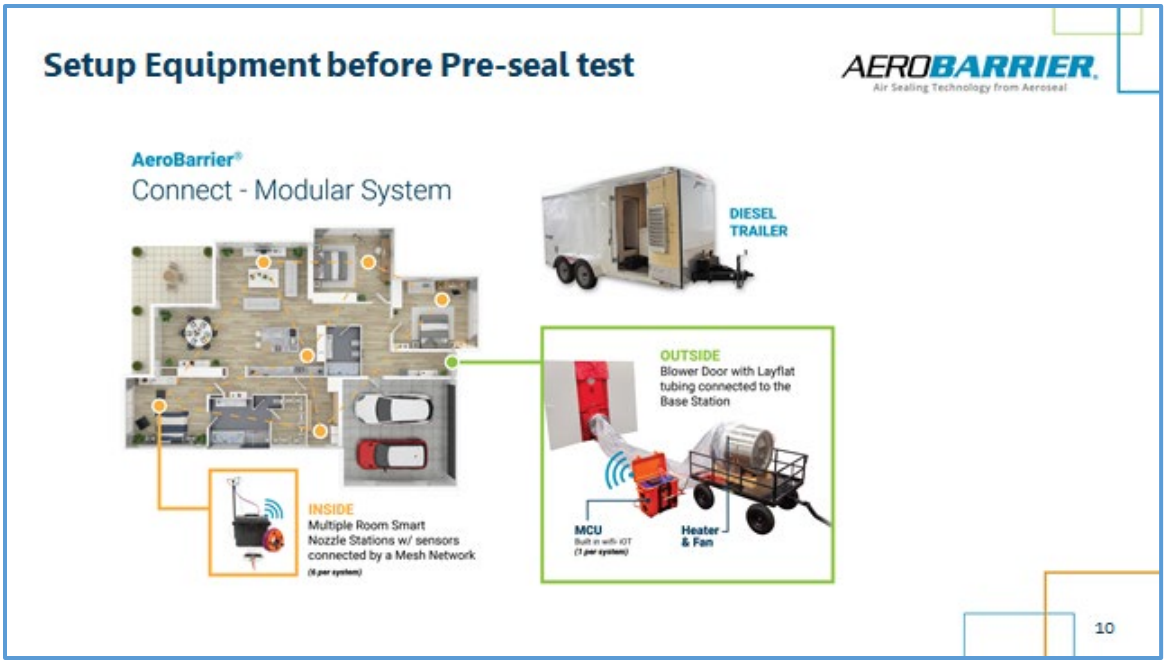
Another technique that technicians follow is to first consolidate all sealant into 5Gallon Pails after the job and then clean up all the sealant Jugs with warm water. This might be the way to go especially if you do not have jobs scheduled daily. It is important that you have clean jugs to avoid dry particles (skinning) being sent into the nozzle and clogging the nozzles.



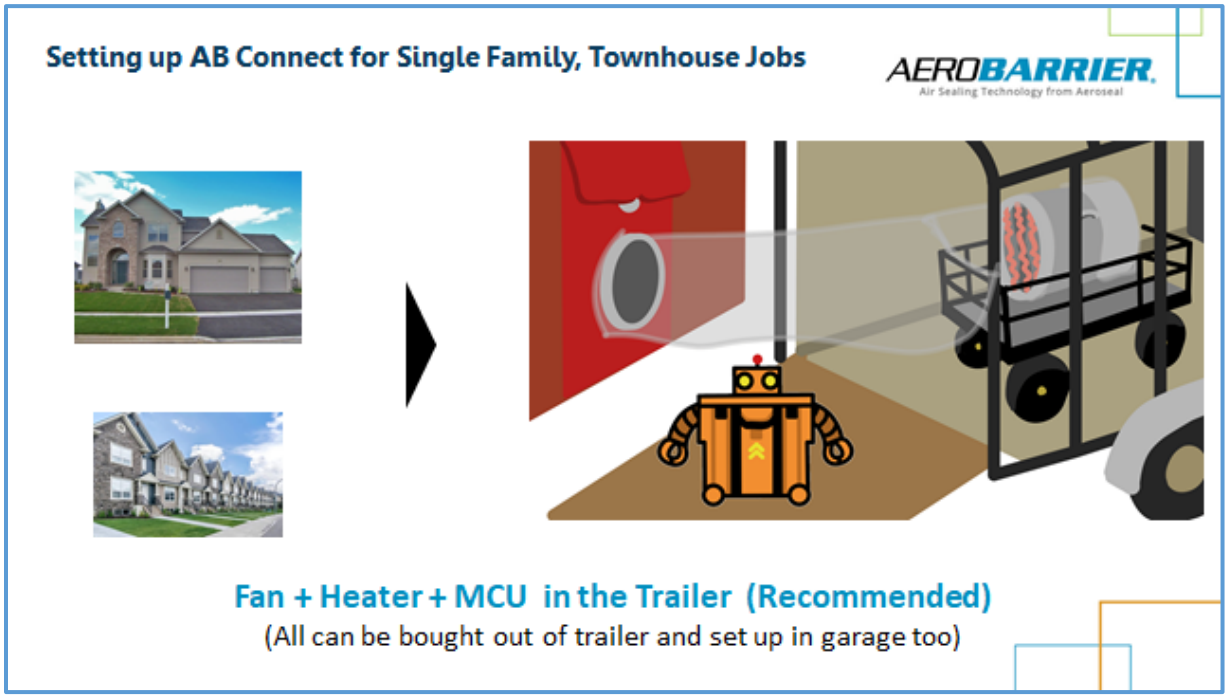
APPENDIX 5: Typical set ups for MCU and Fan-Heater Cylinder

This appendix provides a quick visual of the basic set up for applications you would encounter.

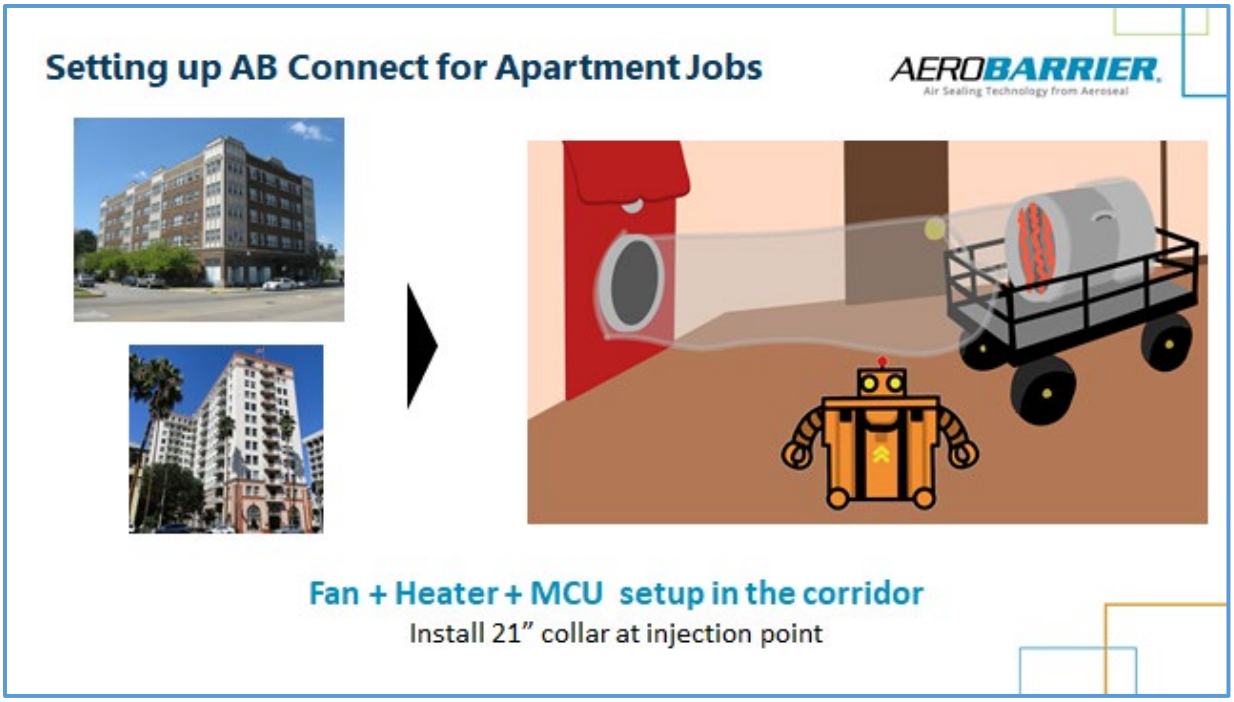
1) Overall Equipment set up



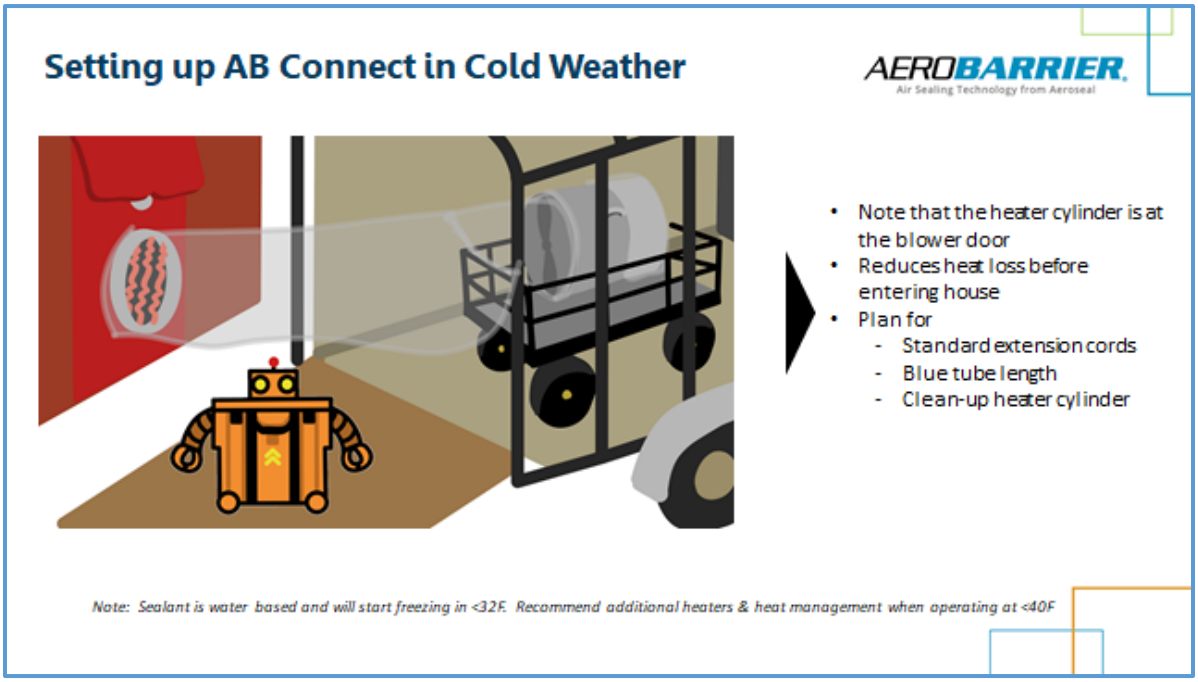
2) Single Family homes and Townhouses



3) Apartments



4) In cold climates: you can detach the 21" heater assembly from the fan and place it directly in the blower door to prevent any loss of heat. In this scenario keep the length of the layflat as short as feasible. In windy situations, use tiedowns to prevent layflat tubing from flapping around which might cause incorrect/ fluctuating pressure measurements.



APPENDIX 6: Typical Set ups for Sealing Stations

One of the key decision points that a technician has to make before he reaches the job site is to determine how many sealing stations to use on a particular job. A good starting rule of thumb would be one sealing station per 500 sqft floor area (minimum two). Many a times the room layout, wall restrictions, ceiling heights would determine fewer or more stations.

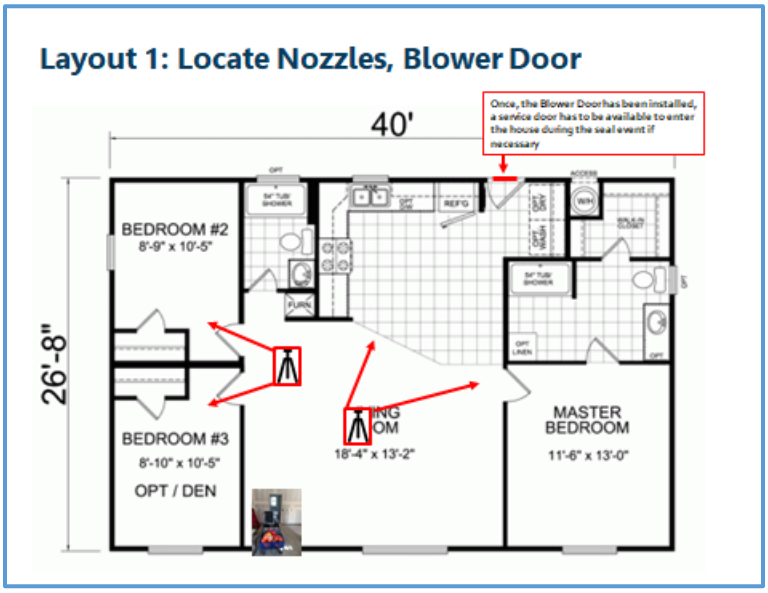
Keep Nozzles pointed away from the walls.

Do NOT manually block one nozzle as it might not result in good Aerosol particles (high risk of floors wetting)

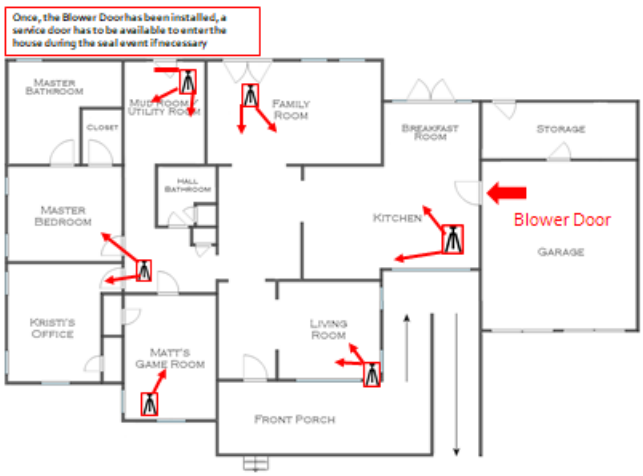
Identify an access door that you can use to go inside the room during the sealing event

Wear a respirator if entering confined space with Aerosol mist

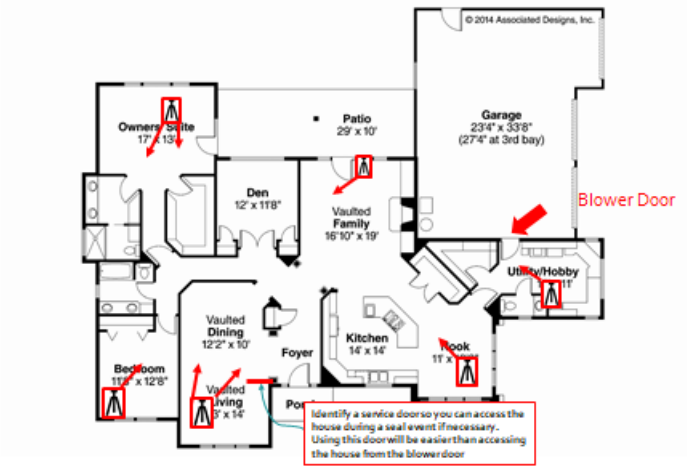
The below three sketches will help you get oriented on how one can place Nozzle stations in an apartment or home



Layout 2: Locate Nozzles, Blower Door



Layout 3: Locate Nozzles, Blower Door



APPENDIX 7: Trailer Accessories

A typical AB Startup Kit included a 7 x 14’ trailer up fitted with racks, generator, air compressor and typical tools and supplies needed for the first few jobs. Depending on the specific configuration ordered, there could be a diesel driven combo generator-compressor set (for delivering power and compressed air for up to 6 sealing stations) or a separate diesel generator set and Electric rotary compressor unit (for delivering power and air for up to 10 sealing stations).

Specification of Combo Generator – Compressor set

Specification for Separate Generator, Electric Compressor set

Apart from the main equipment in the trailer, the following are key special accessories needed for routine operation of the jig

1) Battery Charger
2) Sealant tube
3) Sealant Mixer
4) Battery operated sealant transfer pump
5) Tool bucket with basic tools
6) Air Scrubber 16” x 16” x 16”
7) PPE
8) Blower Door assembly with frame and cross members

Highlighted above are just key accessories that you would need for a performing a typical envelope sealing job. For a detailed picklist please contact Aeroseal customer service @ 937.428.9300

APPENDIX 8: Aerobarrier Standard Operating Procedure

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Breakthrough Envelope Sealing Technology by Aeroseal

rev May-23

Standard Operating Procedure for Aerobarrier Connect System

Pre Prep Blower Door Test and Envelope Preparation

☐ Set up the Machine for Pre Prep Test

- ___ Before Pulling Equipment, Ensure all exterior doors/windows are closed and locked
- ___ Get MCU, Fan/Heater Assembly, And Blower Door and place at injection point
- ___ Set up Blower Door Frame by attaching the four frame pieces together
- ___ Size Blower Door frame into injection point door(either front door or garage door)
- ___ Take Blower Door frame out of injection point and attach blower door canvas
- ___ Put Blower Door back in place, attach crossbars and lock cam levers into place
- ___ Connect Fan Pressure Tube (red) to fan+MCU
- ___ Connect Envelope Pressure Tube (blue) to MCU and run tube through Blower Door to the middle of the Envelope
- ___ Connect Layflat tubing to Fan/Heater assembly+21" injection collar
- ___ Place 21" Injection Collar to Blower door and attach Velcro on crossbar to rubber band on 21" injection Collar
- ___ Run 100ft 240v main power cord from trailer and plug it into MCU
- ___ Turn on Generator
- ___ Ensure Amber LED and Green Fan LED's light up when power is added
- ___ Power up fan by pressing fan switch (red button on MCU)
- ___ Make sure fan powers up by turning manual fan dial clockwise
- ___ Once fan is confirmed powering up, turn dial counterclockwise to the "just on" position
- ___ Open up Smartseal software and Run the pre prep Blower Door test (see Smartseal checklist)
- ___ Once test is complete, shut off generator
- ___ Ensure fan power switch is in the off position

☐ Prep House and plan equipment layout

- ___ Prep the Envelope for Sealing (See Prep Checklist)
- ___ Determine work space location outside of Envelope (I.e. in Garage, outside main door)
- ___ Determine access door for entry during the seal (back door,front door, or blower door)
- ___ Run 100ft Compressed Air hose from trailer to MCU

☐ Sealing Station Layout

Typically Use one seal station per 500 sqft

- ☐ Prep Sealant by mixing it with a paint mixer until solids at the bottom are mixed in.

Standard Operating Procedure for Aerobarrier Connect System

Setting up Seal Stations, nozzles and compressed air manifold

☐ Set up Seal Stations

___ Place Seal Stations in areas you have designated for the seal
___ Attach monopod to seal station
___ Attach Nozzle Bracket to monopod
___ Point nozzles away from walls and windows (allow 8ft of open space for the nozzles to spray)
___ Connect liquid Tube to seal station connector on the right side of seal station
Repeat the steps for each seal station

☐ Priming the Seal Stations

___ Fill the two Gallon Jug with sealant and the Half Gallon jug with water
___ Connect the left pump (closest to the Sealant jug) to the water Jug
___ Connect the right pump (closest to the water jug) to the sealant jug
___ Power on Seal Station by pressing the red button (button should light up when on)
___ Ensure all liquid tubes are connected to the seal station
___ Hold down the silver button to start the Priming process (let go of silver button when pumps start)
___ Observe sealant from inside the sealing station until it gets to the "Y" Piece on the nozzle bracket.

☐ Hook up all Compressed Air hoses

___ Connect 30ft Compressed Air Hose to MCU+Compressed air manifold
___ Place Compressed Air Manifold in a central part of the house where it reaches all seal Stations
Ensure unused ports are blocked using either jumper tubes or blocker pieces (both found in Spare Parts kit). Recommend to cover up the manifold after properly hooking up all tube to avoid any clean effort needed after the job.
___ Connect Dual Bonded Tubing to the manifold
Ensure dual bonded tubes are firmly connected to the manifold (feel for the sharkbite)
___ Run dual bonded tubes to seal stations and connect to nozzle brackets (bottom part of bracket)
Ensure dual bonded tubes are firmly connected to the nozzles (feel for the sharkbite)

Sealing Event

☐ Final Walkthrough before start of the seal

___ Check Prep of the envelope to ensure areas needing protection are prepped
___ Ensure all sealing stations are powered on and primed
___ Ensure Sealing stations, manifold and hose reels are covered with protective materials
___ Ensure Envelope pressure tube (blue tube) is centrally located in the envelope

☐ Setting Up Blower Door for Seal

___ Cut a piece of grid foam the width and length of the injection door frame
___ In the foam, cut a 1in canal to allow for clearence of the 30' compressed air hose to run under Blower Door
___ Put Blower Door back into injection point, adjusting as necessary and lock cam levers into place
___ Place 21" sleeve back into the blower door, and reattach Velcro to rubber band

☐ Starting the Seal

___ Start the Generator
___ Do the post prep pre seal test (see Smartseal Checklist)
___ Start the compressor on the trailer (ensure it has at least 100PSI on the trailer gauge)
___ Plug in the Cylinder Heaters to the 120v outlets on the MCU
___ Put Fan Switch in the "ON" position
___ Click 'Start' button in Smartseal software to start the sealing step (see Smartseal software Checklist)
___ Ensure all LED's light up (except for fan fault)
___ Ensure fan spools up to 100pa of pressure and the heater LED's light up

Standard Operating Procedure for Aerobarrier Connect System

☐ Monitoring the seal

___ Watch the computer to ensure seal is going as planned (See Smartseal Checklist)
___ Do a walk around on the outside of the envelope to look for sealant overspray (if applicable)
Sealant overspray appears as thin white cloud
Ensure Areas prepped are holding in place
___ 15-20 minutes into the seal, enter envelope through access door
Pause the seal (See Smarteal checklist)
Check "the fog" to ensure sealant is spraying properly
Ensure compressed air is at 90psi on manifold gauge
Fix any issues with the equipment (loose compressed air connections, liquid connections)
Ensure prep is holding up and fix any missed prep
Exit the envelope and continue the seal
___ Every 30 minutes after initial entry, enter envelope through access door
Pause the seal (See Smarteal checklist)
Check "the fog" and move sealing stations as needed
Do manual sealing as needed (using sprayfoam/caulk)
Exit the envelope and continue the seal
___ Continue the seal until desired leakage is reached
Ensure you take into account your pre prep Blower Door Leakage

☐ Ending the Seal

___ Stop the seal and flush the seal stations (see Smartseal Checklist)
___ Once flush is complete, shut off compressor and drain compressed air tank
___ Do the Post Seal test (see Smartseal checklist)
___ Create your sealing Certificate (see Smartseal checklist)

Equipment Clean Up

☐ Envelope Purge

___ Enter Envelope through access door
___ Open 2-3 Windows in the envelope
___ Exit the Envelope
___ On the MCU turn the manual fan control to max to push atomized sealant out
___ The envelope will purge for 15-20 minutes

☐ Seal Station Tear Down

___ Disconnect monopod and nozzle bracket from Seal Station
___ Disconnect nozzles from nozzle bracket and place nozzles in cleaning solution
___ Disconnect sealant line from Sealant Jug and connect the same tube to the water jug
___ Purge the sealant line by using the purge button on sealing station
___ Continue purging until line is free and clear of sealant
___ Disconnect sealant line and Purge the Seal Staion Lines with air using the purge button
___ Place any leftover sealant back into the 5 gallon buckets

☐ Cleanup and demoblization

___ Ensure all prep is down
___ Clean any overspray of sealant
___ Place equipment back in trailer
___ For maintenance - follow Maintenance checklist

Standard Operating procedure for Smartseal Software

Software Start and Pre Prep Blower Door Test

- [ ] Power up the software & Overall system checks
  - ___ Ensure that the laptop is started and is connected to the Aeroseal Wi-Fi (aerosealXXXX)
  - ___ Open Smartseal (blueprint icon on desktop)
    - Listen for the connection chime
    - Ensure Banner at bottom of page says "Connected to Aerobarrier Main Control Unit via Wi-Fi"
  - ___ open /view hardware and check to make sure all sensor readings are ok & you are able to control the fan
    - primarily check for inlet temperature and humidity readings (should be ambient)
    - check that the fan is ramping up / down
    - check that the manometer banner is 'green' and the pressures are reading zero
  - ___ Close out of the maintenance page
  - ___ Click Create New Customer

- [ ] Input all project information
  - ___ Input all project Information (Builder, development, address, etc.)
  - ___ Enter square footage, ACH target and volume of space being sealed
    - Ensure your measurements are accurate
  - ___ Click "next"

- [ ] Structure Description Page
  - ___ Input Construction Phase, Building Type, Number of Stories, and Insulation Type
  - ___ Input counts of windows, exterior doors, bathroom vents, range hood, fireplace and supply/return registers
  - ___ Click "Next"

- [ ] Pre Prep Preseal Test
  - ___ Set up Blower Door and MCU (see equipment Checklist)
  - ___ Input Ring Setting (most commonly open ring)
  - ___ Click "Start"
  - ___ Software will ramp fan to 50pa
    - Ensure fan pressure(red tube) is between 10pa-1000pa
    - If unable to reach 50pa envelope pressure (blue tube), adjust target pressure to match current pressure
    - (by pressing "target" button)
  - ___ Once test is complete, record the leakage as shown

- [ ] Prep the house for Sealing (see prep checklist)

- [ ] Set up Equipment (see Equipment Checklist)

Standard Operating procedure for Smartseal Software

Sealing

☐ Post Prep Pre Seal

___ Set up Blower Door and MCU (see equipment Checklist)

___ Input Ring Setting (most commonly open ring)

___ Click "Start"

___ Software will ramp fan to 50pa

Ensure fan pressure(red tube) is between 10pa-1000pa

If unable to reach 50pa envelope pressure (blue tube), adjust target pressure to match current pressure

(by pressing "target" button)

___ Use the difference between Pre Prep and post prep pre seal to determine leakage target

☐ Seal Station Setup

___ Click the orange box next to the "connected to Main Control Unit Via Wi-Fi"

Ensure the number of Seal Stations displayed match the number set up in the envelope

Ensure Seal Stations are communicating by checking the heartbeat node

___ Click the "edit all" button on the seal station page

___ Record the location and sealant amount on each seal Station

___ Close the seal Station Page

☐ Starting the Seal

___ Click "next" on Pre Seal Page

___ In the bottom center of the seal page, input ring setting

___ Ensure compressed air reads above 90psi

___ In the bottom left of the seal page, click the start button

Fan will ramp up to 100pa or 100% fan speed

Cylinder heaters will switch on

Sealing Stations will start sealing

☐ Monitoring the seal

___ Watch the CFM50 reading and make sure its coming down

___ Ensure all seal stations are injecting

___ Watch for Spikes in graph indicating high leakage/blown prep work

___ At the 15-20 minute mark, pause the seal by pressing the pause button

Enter the Enevelope(see equipment checklist)

___ Every 30 minutes after the 15-20 minute mark, pause the seal and enter the envelope

(See equipment checklist)

___ If alarm comes up, follow instructions that software gives

___ Ensure the envelope is at least 50 degrees F and under 90% relative humidity

Seal Stations will pause if humidity gets above 90%

Standard Operating procedure for Smartseal Software

Ending the seal

☐ Stopping and Flushing the Seal

___ Once Target ACH50 is achived, Click the stop button on the bottom left of the screen

The software will confirm you want to stop. Click yes

___ Start the flusing process by confirming flush is selected, then press start

The flusing process will run for 2 minutes

___ Once flush is complete, press next

☐ Post Seal

___ On the post seal page, select ring setting (most commonly last ring used during seal)

___ Click "Start"

___ Software will ramp fan to 50pa

Ensure fan pressure(red tube) is between 10pa-1000pa

If unable to reach 50pa envelope pressure (blue tube), adjust target pressure to match current pressure

(by pressing "target" button)

___ Once test is complete, click next

☐ Save results

___ On the last page of the software, press the certificate button

___ Click the "Print/Save Certificate" button

___ Select the printer "Microsoft Print to PDF"

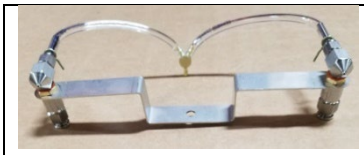
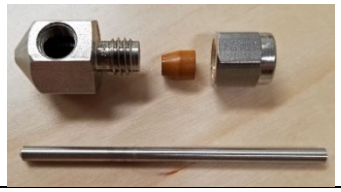
___ Save the certificate to your computer.

APPENDIX 9A: Cleaning tips for AeroBarrier Connect sealant delivery system (High level)

Please follow the cleaning procedures described below for optimal performance of the system:

- Once the sealing operation is complete, ALWAYS flush the system with CLEAN water. Use warm water if it is available.
- Make sure all tubing ends are clean before storage and before use (inserting them into connectors). Push the release flange back while fully seating the tubing.

Components of the sealant delivery system

 			
Nozzles	**Nozzle Clean out tool**	**Pump Head**	**Liquid and Air Tubing**

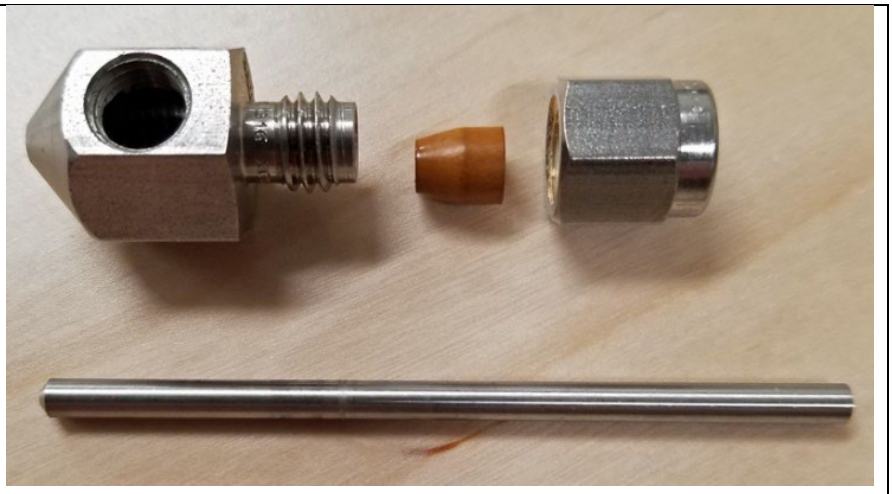
Maintenance tips for each component

Part	How often to clean	How to clean	Tips
Nozzles	Every seal	Flush with water – use warm water if available	Whenever there is sealant build-up on the nozzles, soak in Buckeye cleaner. Disassemble as needed to clean sealant build-up.
Tubing	Every seal	Flush with water – use warm water if available	Remember to clear lines of water with compressed air after flushing
Connectors & Manifolds	Whenever build-up is observed	Connectors will not require cleaning as long as CLEAN tubing is inserted. Also, be sure to insert tubing all the	Make sure tubing is clean every time you insert into connectors. This reduces the chance for leakage and

		way into the connector so it is fully seated.	air bubbles in the system.

Detailed instructions

Nozzles

	
Nozzles should be cleaned after each use. If there are minor sealant deposits, the nozzle assembly can be soaked in Buckeye cleaner, then purged with an air hose and/or the nozzle clean-out tool.	Nozzles that have heavy deposits and/or air flow restrictions should disassembled for soaking in Buckeye cleaner. Once the nozzle parts are clean, reassemble the nozzle parts. Make sure the liquid tube is adjusted about 1mm from the front of the nozzle.

Refer to the next Appendix section for more detailed explanation of why and how to do maintenance

APPENDIX 9B: Cleaning tips for Compressed Air Delivery subsystems and why?

Sealant puddles are the result of improper interaction between the fluid stream and surrounding compressed air supply (air flow and air pressure). When sealant droplets become too large, they fall from the surrounding air and create puddles on the floor.

The following list provides guidance on what causes, and how to prevent, sealant puddles from forming.

Potential causes of sealant puddling (in order of likelihood)

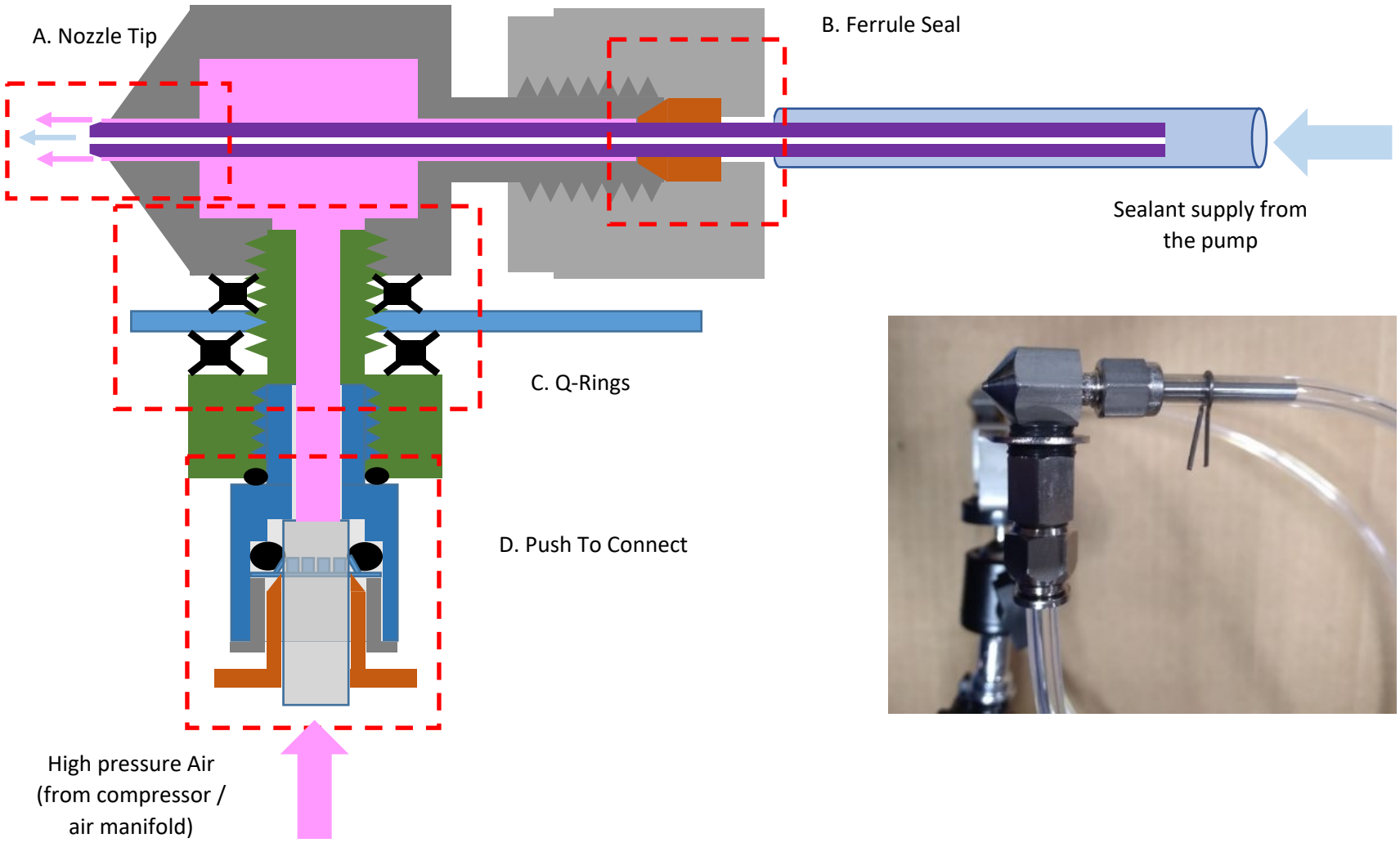
1. **Air leaks at the nozzle assembly (Q-ring, ferrule, push to connect)**
    - Leaks in the compressed air system (anywhere from compressor to nozzle body) reduce the pressure and air flow from the nozzle tip, where it's needed to create sealant droplets that can be suspended in air. Lower pressure and air flow at the nozzle tip will create larger droplets or even drips that fall out of the surrounding air and create puddles on the floor.
    - Critical Areas for a Correctly Functioning Nozzle (pg3) provides more detail surrounding the nozzle.
2. **Dirty nozzle bore and tip**
    - Dirt particles and other build-up in the compressed air gap at the tip of the nozzle (between the nozzle bore and fluid tube) restrict the opening for the compressed air. Restrictions of any type, especially in this area, will also create larger sealant droplets that will puddle on the floor.
    - Nozzle Disassembly and Cleaning (pg 9) and Nozzle Reassembly and Inspection (pg16) provide more detail on this issue.
3. **Air leaks at the compressed air manifold**
    - Leaks at the compressed air manifold have the same effect as leaks at the nozzle assembly. Although less common than nozzle leaks, care must be taken to ensure the compressed air generated at the compressor reaches the nozzle tip where it is needed
    - Manifold Disassembly and Cleaning (pg 20) covers this component.
4. **Air pressure setting at compressor (100 psi recommended)**
    - Increasing the compressor setting to 100 psi will help ensure the pressure and air flow seen at the nozzle tip is sufficient for proper sealant droplet creation (even if very small leaks are present in the compressed air lines)
5. **Fluid tube position in the nozzle**
    - Correctly positioning the fluid tube within the nozzle tip helps create an ideal direction / path for the air flow to interact with the sealant stream. Visually aligning the parts during nozzle reassembly works well if you understand how the air is flowing and key features that need to align.
    - Critical Areas for a Correctly Functioning Nozzle (pg3) and Nozzle Reassembly and Inspection (pg 16) cover fluid tube alignment needs.
6. **Air leaks at any other place**
    - While the nozzle assembly and compressed air manifold are more common leak points, other fittings and even a cut air hose will cause air leaks. If leaks are suspected, the system can be tested with a spray bottle and soap water (pg 25)

What You Will Need:	Soap water (for leak detection)
82AS1773 - Air Nozzle cleaning brushes	Disposable Shop Towels
82AS1923 - Dental Picks	Nitrile Gloves
82AS1726 - Fluid Tube Ram Rod	(2) Plastic Cups
AERO-005 - Buckeye Workout (cleaner)	Hot (Tap) Water

Additional Buckeye Workout cleaner is available from the Aeroseal Store

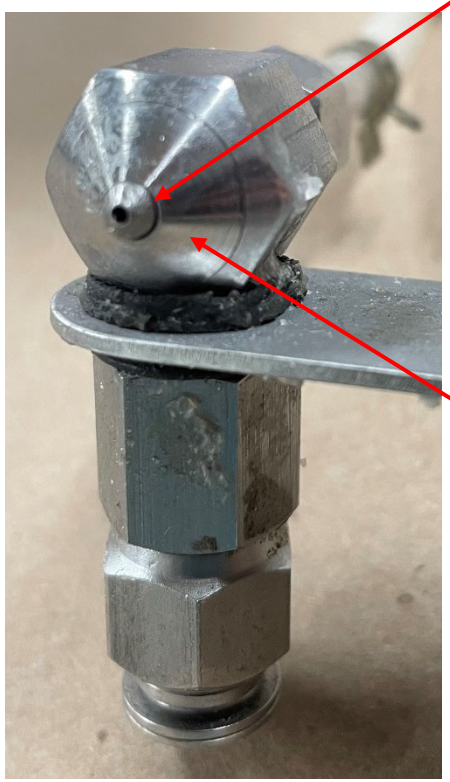
Brushes, picks, and the fluid tube ram rod are included in the Spare Parts Kit, or can be ordered from the Aeroseal Store

Critical Areas for a Correctly Functioning Nozzle Assembly

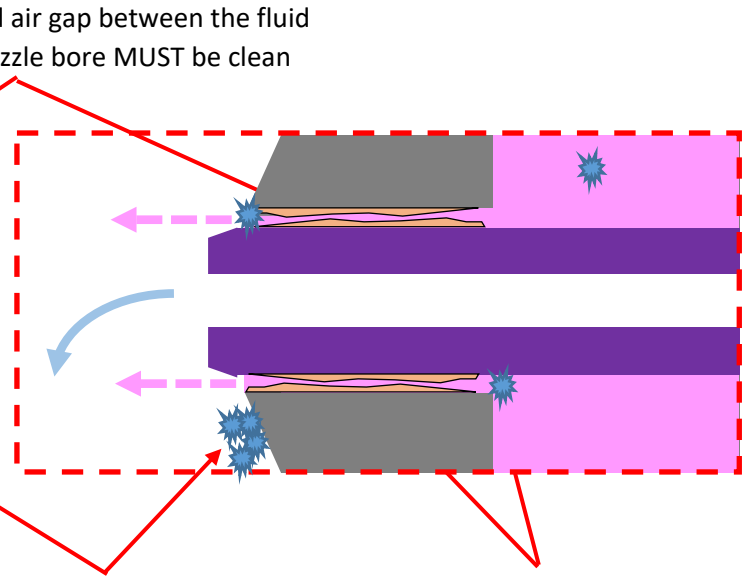


A. Nozzle Tip – (Build-up Reduces Air Flow)

- A small amount of sealant build up on the nozzle is normal and expected during a sealing job.
- This build up is typically on the outside of the nozzle, away from the compressed air flow path
- IF sealant or other contamination get into the gap between the outside of the fluid tube and the inside bore of the nozzle, it WILL restrict airflow and increase the chance of puddling

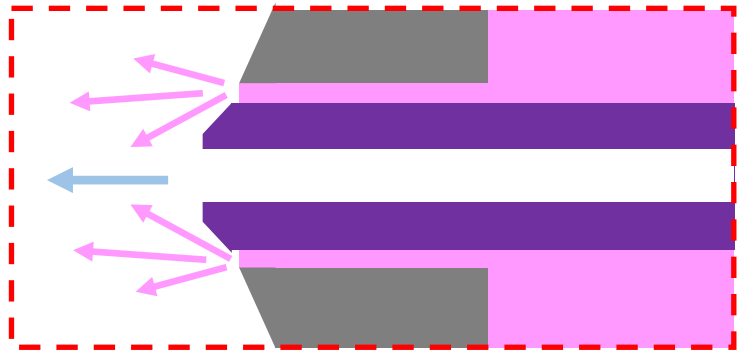


Functioning nozzle after a sealing job.

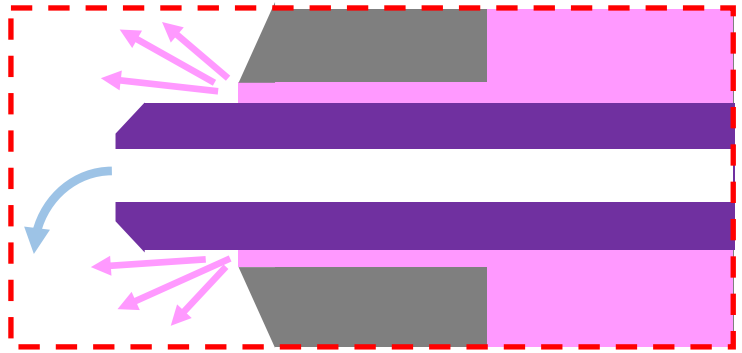


A. Nozzle Tip – (Fluid Tube Alignment Sets the Direction of Air Flow)

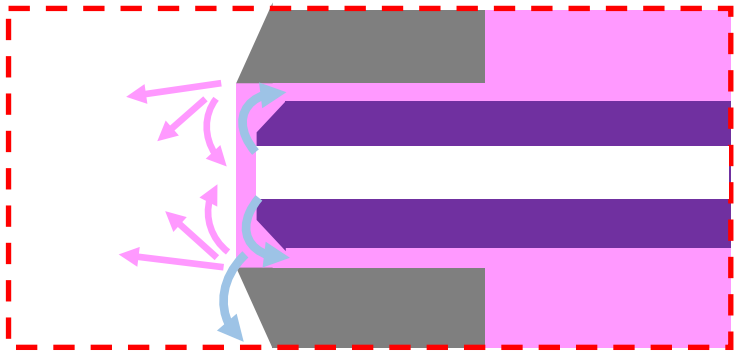
- The fluid tube must be positioned so the transition point of the angled tip aligns with the end of the nozzle body
- IF the tube sticks out too far, the compressed air will blow away from the sealant stream – this will not break the stream into small droplets and the sealant will puddle
- IF the tube is recessed, the compressed air will force sealant back into the nozzle and create blockage. This blockage will build and restrict air flow.



Correct Position – the transition point of the fluid tube is aligned with the tip of the nozzle



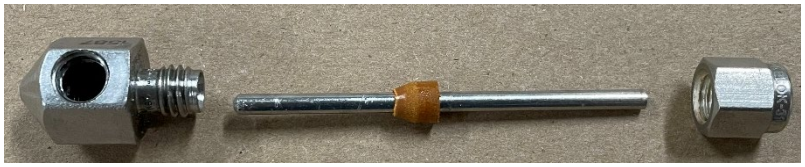
Fluid tube proud of the nozzle tip – compressed air is forced away from the fluid stream and the sealant will drip from the nozzle

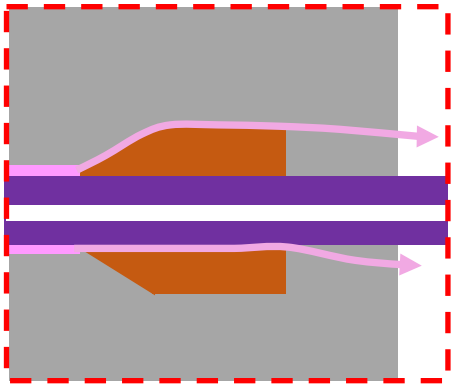


Fluid tube recessed into the nozzle tip – Compressed air will force sealant back into the nozzle, creating blockage

B. Ferrule Seal – (Leaks Steal Air Pressure and Flow from the Nozzle Tip)

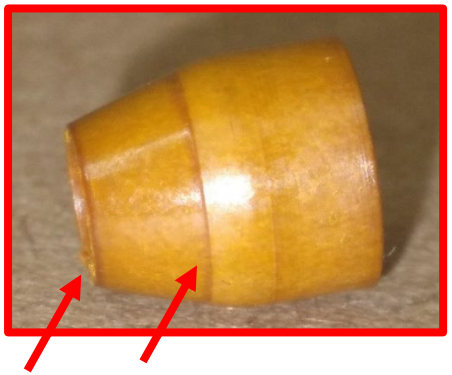
- The ferrule seals the rear of the nozzle to the fluid tube
- Damage from over-tightening, edge chips, or other surface damage can cause compressed air leaks (stealing air from the nozzle tip)





Functional Ferrule – smooth surfaces, clean edges

Leaking Ferrule – pitted and chipped surfaces (cleaned with harsh chemicals)



Leaking Ferrule – sharp ridge at end of tapered surface, chipped leading edge – beginning to crack (excessive compression from seal nut)

Leaking Ferrule – Installed and tightened backward in the nozzle body

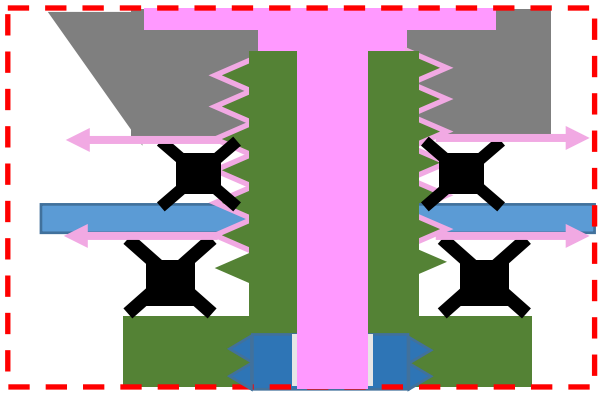
C. Q-Rings – (Leaks Steal Air Pressure and Flow from the Nozzle Tip)

- Q-Rings are used to seal the PTC adapter and nozzle to the nozzle bracket
- The cross section of the Q-Ring has 4 round lobes (making concentric circles). The inner surface creates the majority of the seal.
- Cuts and debris on surfaces will create air leaks
- Overtightening the nozzle to the bracket will squeeze the Q-Ring out of position where the seal can not be maintained.

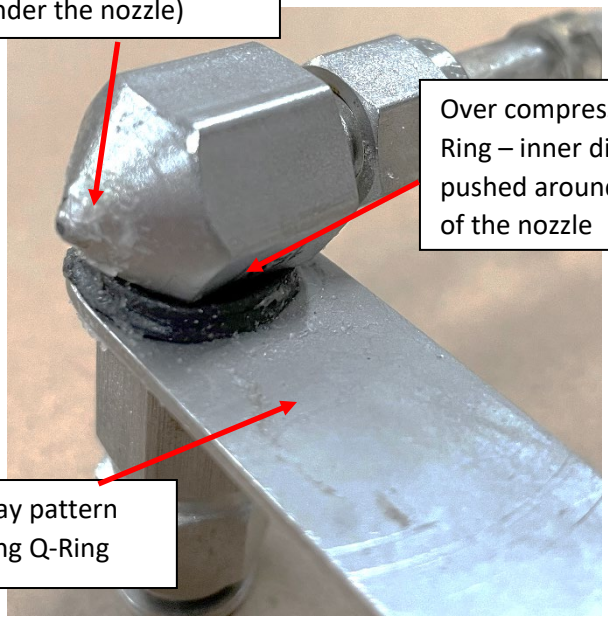
Functional Q-Ring (round, clean, all surfaces intact)

Damaged Q-Ring (Cut by twisting nozzle after assembly)

Damaged Q-Ring (distortion from over-compression and debris from incomplete cleaning)



Leak caused sealant build up across the compressed air gap at the nozzle tip (puddling under the nozzle)

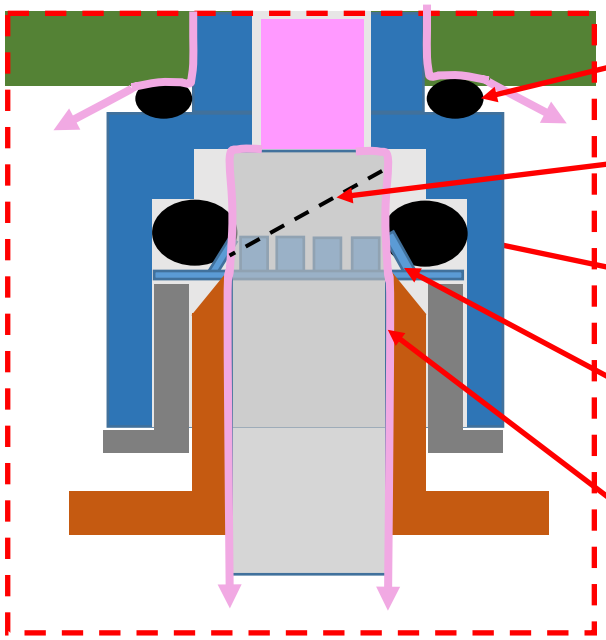


Over compressed Q-Ring – inner diameter pushed around the side of the nozzle

Visible spray pattern from leaking Q-Ring

D. Push To Connect – (Leaks Steal Air from the Nozzle Tip)

- The push to connect (PTC) both secures and seals the flexible compressed air tube to the bottom of the nozzle assembly
- There are 2 sealing surfaces on the part – both need to be clean and undamaged to prevent leaks:
    - O-ring on the exterior that seals to the threaded adapter
    - O-ring inside the PTC that seals to the flexible tube
- The PTC also has internal "teeth" that hold the flexible tube in position when its installed. The outer collar must be fully compressed to release the teeth before disassembly
- The flexible tube end condition (last 3/4") is also critical to creating a seal.
    - The tube surface must be clean and free from scratches
    - The cut end of the tube must be perpendicular to the length and free of any burrs
    - The tube must be fully installed past the teeth and o-ring.



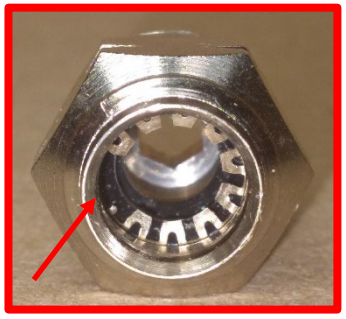
PTC must be tight to the threaded adapter

Angled end cuts can create leaks past the internal o-ring

Contamination on the internal o-ring

Damaged or bent teeth may prevent the tube from being fully installed or allow it to come loose during use

Dirty or scarred tube surfaces will create a leak path



Damaged retention teeth

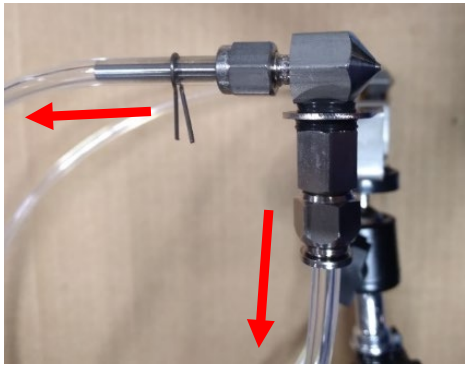
Gouged surfaces on the flexible tube (area inserted into the PTC)

Angled tube end cut

Nozzle Cleaning - Disassembly

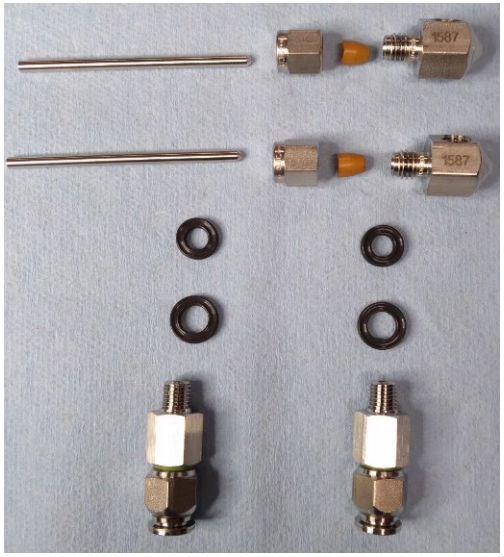
Remove Flexible Tubing

- Slide clamps back and remove fluid tubing
- Remove compressed air tubing from PTC
- Remove insert tubes



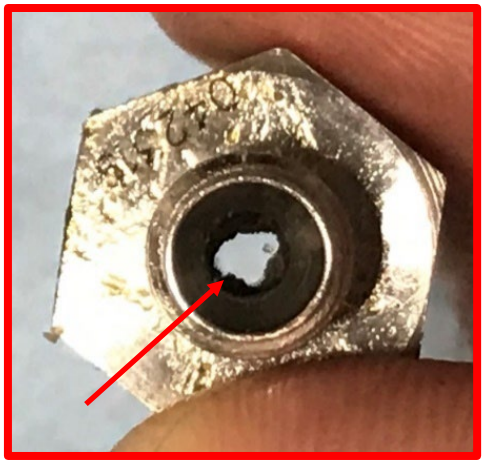
Disassemble Nozzle

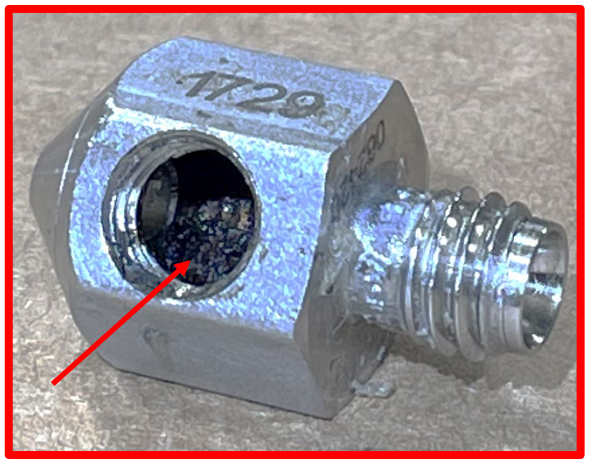
- Unthread the PTC / Threaded adapter from the bottom of the bracket (hold the nozzle body stationary)
- Remove the Q-Rings
- Fully remove the seal nut
- Separate the fluid tube, ferrule, and nozzle body



Inspect Parts

- Inspect for build-up and debris in nozzle ID and inside the body. This must be removed during cleaning.
- Inspect for damage on the Q-Rings. Replace the ring(s) if damaged.





Note: This is a severe case of buildup inside the nozzle, but ANY restriction in the inner diameter of the nozzle must be removed.

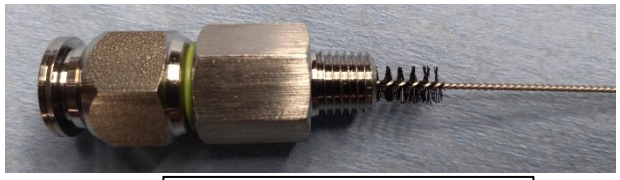
If any nicks, cuts, abrasions, or deformation are found on either Q-Ring, there WILL be a leak that impacts nozzle performance. Replace the ring with a new one (match the size) from the spare parts kit.

Buckeye Workout Soak • 5 minute soak in Buckeye Workout cleaner, Do not dilute (agitate during soak) 	 

Scrub

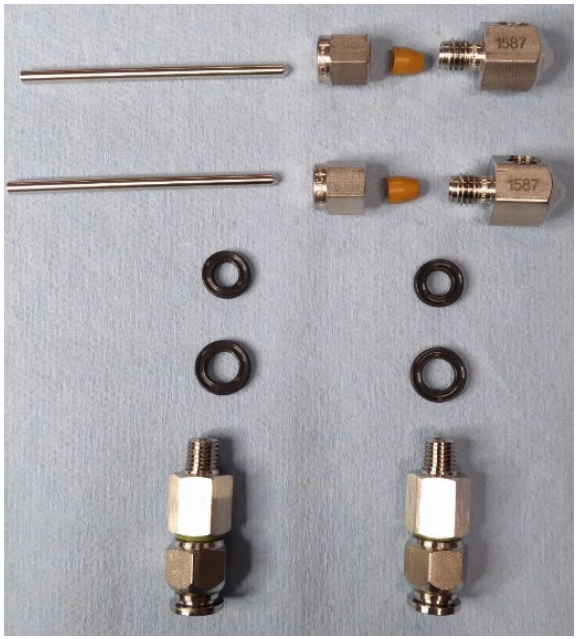
- Clean ALL interior surfaces with small spiral brushes
- USING BRUSHES REDUCES THE CHANCE OF LEAVING DEBRIS / LINT INSIDE THE NOZZLE COMPONENTS
- Twisting the brush clockwise during insertion into the part can help pull debris to the outside edges where it can be more easily cleaned
- A dental pick is also useful for removing debris from the interior of parts
- Use the ram rod for reaming the ID of the fluid tube
- Wipe the exterior surfaces with shop towels

Brush inside the nozzle bore (both ends), female thread, and inside the central cavity of the part



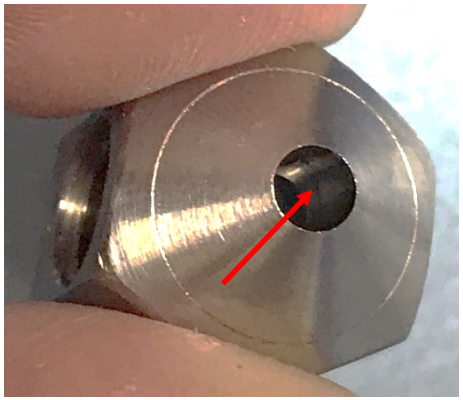
Brush the interior of the air inlet fittings (both ends)

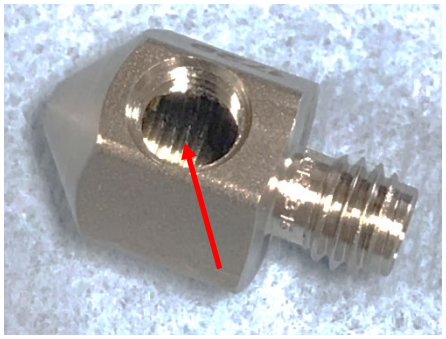
Ram rod for the interior of the insert tube

Rinse • 2 minute rinse in hot water (agitate during soak)	
Dry Parts • Blow dry (inside and outside) with filtered compressed air • **IF ANY SURFACE IS STILL TACKY OR HAS SMEARED SEALANT, REPEAT THE CLEANING PROCESS WITH FRESH SOLVENT AND WATER RINSE**	

Inspect Nozzle Body

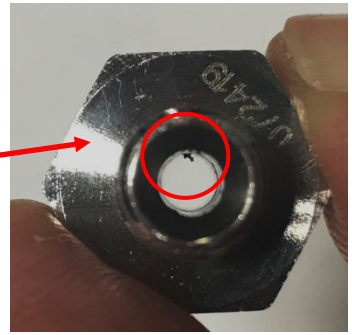
- The ID bore at the tip must be bright steel. Any build-up or film can restrict compressed air flow.
- The internal cavity must be clean and free of any contamination that can break free and block the compressed air gap from the inside of the nozzle.
- The ferrule mating surface must also be clean and free of contamination





Nozzle Tip: No build-up or debris in the tip ID, central cavity, or taper at the back of the part

NOTE: even small particles can restrict airflow enough to cause issues



Inspect Fluid Tube

- Fluid Tube – no debris, sealant build-up / film, or damage. The first 1/2” from the tapered end is critical (mates with the nozzle bore to create the compressed air path)

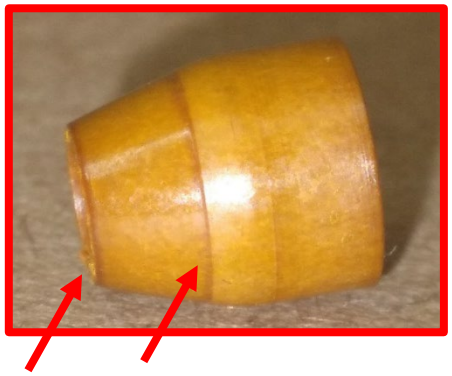
Fluid Tube: No debris on the ID, outside is bright steel – no build-up (if a fingernail catches on the surface, repeat cleaning) especially in the first 1/2” from the tapered end

Inspect Ferrule

- The surface of the ferrule must be clean and smooth.
- Pitting, ridges, or scratches will cause air leaks

Functional Ferrule – smooth surfaces, clean edges

Leaking Ferrule – pitted and chipped surfaces (cleaned with harsh chemicals)

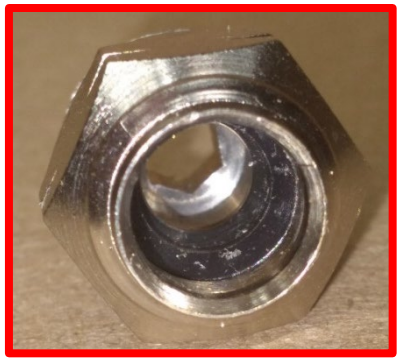


Leaking Ferrule – sharp ridge at end of tapered surface, chipped leading edge – beginning to crack (excessive compression from seal nut)

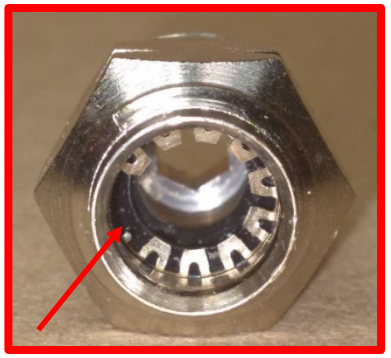
Leaking Ferrule – Installed and tightened backward in the nozzle body

Inspect the Push To Connect

- The center bore must be free of debris
- The release collar must move freely with respect to the body (must fully compress to release the retention teeth)
- After cleaning with brushes and Buckeye Workout, it may still be difficult to determine if the internal parts of the PTC have residue on them. One suggestion is to use a clean piece of 1/4" tubing – install and remove the tubing and feel for any resistance on the tube (sticking to the internal o-ring or dragging on the retention teeth)
-



PTC Contamination on the o-ring



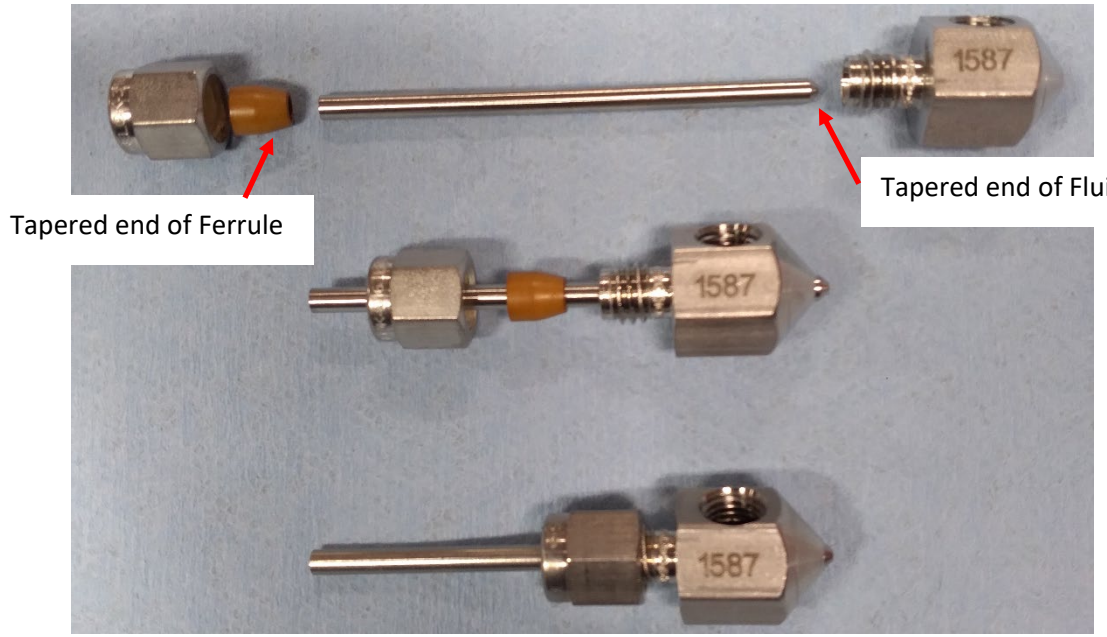
PTC Miss (Tube pu compres

Release collar must move freely (Fully press in and return on its own)

Nozzle Assembly

Assemble nozzle

- Loosely assemble the nozzle body, fluid tube, ferrule, and seal nut
- ENSURE THE TAPERED END OF THE FERRULE MATES WITH THE BACK OF THE NOZZLE BODY
- ENSURE THE TAPERED END OF THE FLUID TUBE IS INSERTED INTO THE NOZZLE BODY

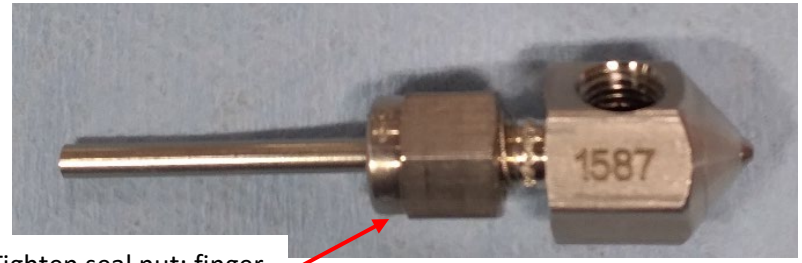


Adjust the Fluid Tube Position

- The transition point between the tapered end and the full body diameter of the fluid tube must align with the tip of the nozzle body
- Secure the fluid tube position by tightening the seal nut (finger tight + 1/4 turn MAX)
- Verify the fluid tube remained in position after tightening the seal nut

Fluid Tube Transition Point (before adjustment)

Adjust Insert Tube stick-out so the taper matches the nozzle.

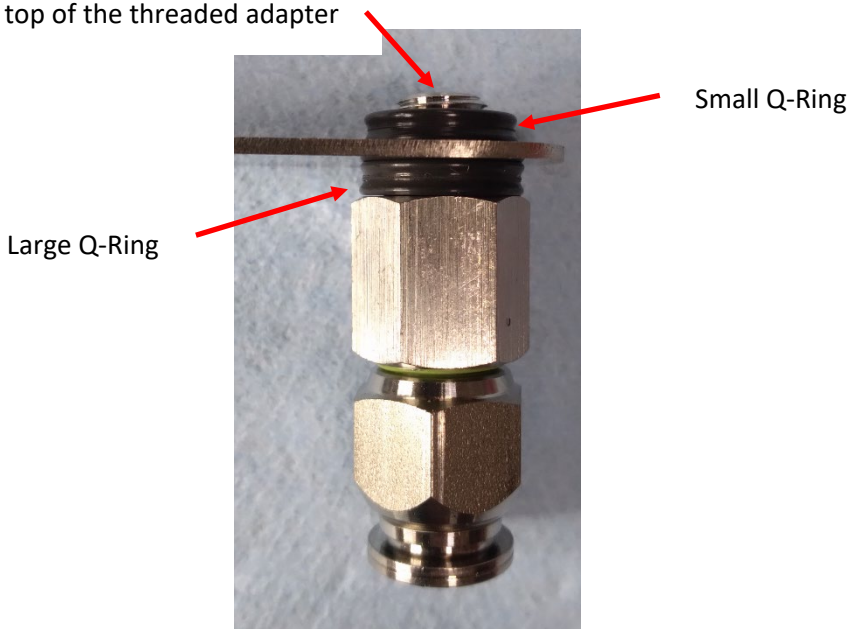


Tighten seal nut: finger tight + 1/4 turn MAX

Assemble PTC and Q-Rings

- Install the large Q-Ring fully onto the threaded adapter (push flush to the shoulder on the fitting)
- The small Q-Ring on top of the nozzle bracket (push flush to the bracket)

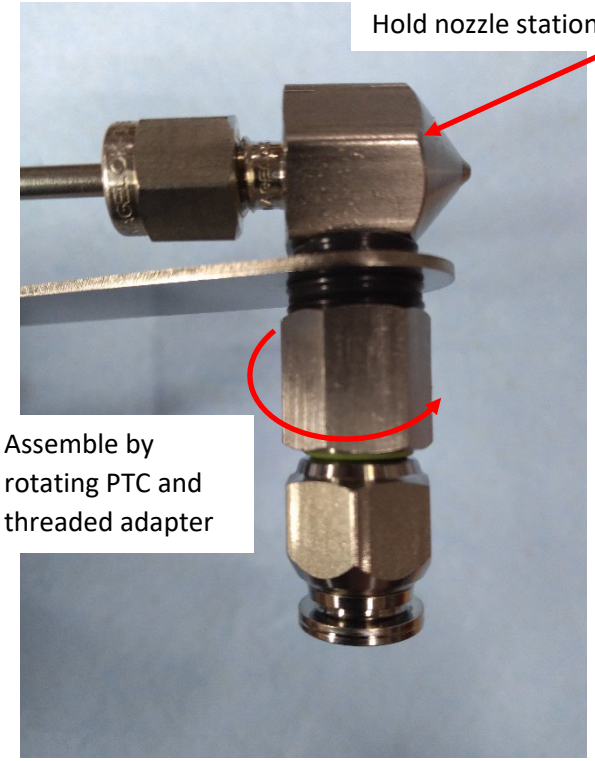
When assembled correctly, there should be appx 2 threads showing at the top of the threaded adapter



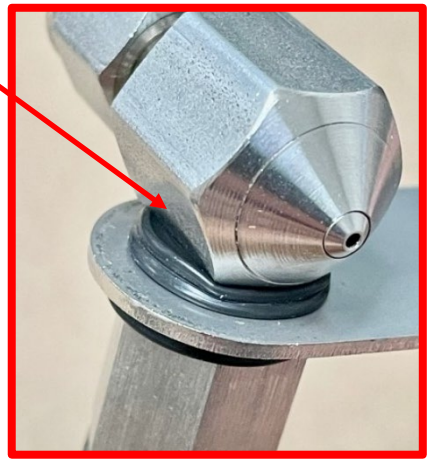
Assemble Nozzle Body

- Hold the nozzle stationary and thread the PTC 2 full turns into it (turn the PTC, NOT the nozzle during assembly)
- There is a thin edge at the bottom of the nozzle that can cut the Q-Ring if the nozzle is twisted
- **The nozzle assembly may not feel fully "tight" when correctly assembled. It should not rattle on the bracket, but overcompressing the Q-Rings (3rd turn on the inlet elbow) will create leaks and cause issues with droplet formation**

- NOTE: if the nozzle direction needs to be adjusted for setup on the job, loosen the PTC slightly prior to turning the nozzle body.



Properly tightened Q-Ring – Slight compression, inner seal surface of the Q-Ring is in contact with the bottom face of the nozzle body

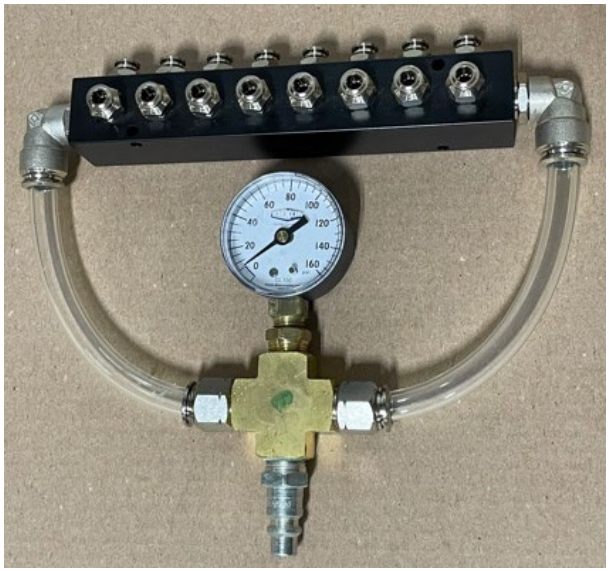


Overtightened Q-Ring – the inner seal surface is beginning to slide up the side of the nozzle body (leaks)

Compressed Air Manifold Cleaning

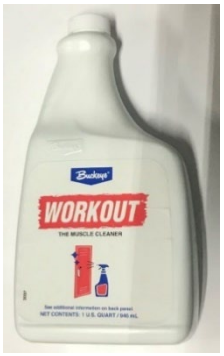
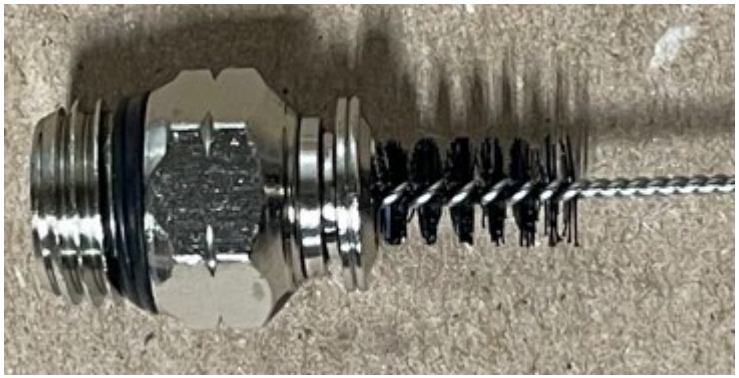
Wipe Exterior Surfaces

- Wipe the exterior surfaces of the manifold body, large tubes and fittings, and gauge prior to disassembly (this will help keep contamination out of the internal surfaces)
- Contamination inside of the manifold body may work its way out through the air lines and block nozzles from the inside.



Remove PTC from Manifold Body

- Remove all 16 of the PTC fittings from the manifold body

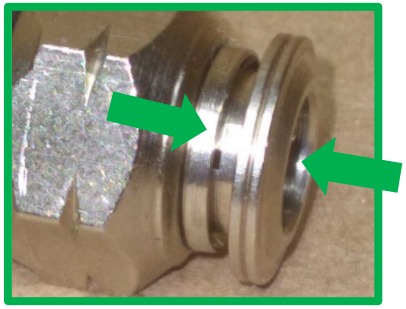
Buckeye Workout Soak • 5 minute soak in Buckeye Workout cleaner, Do not dilute (agitate during soak) 	 
Scrub • Clean ALL interior surfaces with small spiral brushes • USING BRUSHES REDUCES THE CHANCE OF LEAVING DEBRIS / LINT INSIDE THE NOZZLE COMPONENTS • Twisting the brush clockwise during insertion into the part can help pull debris to the outside edges where it can be more easily cleaned • **DO NOT USE DENTAL PICKS INSIDE THE PTC OR ON THE EXTERNAL O-RING SEAL** • Wipe the exterior surfaces with shop towels	 

Rinse • 2 minute rinse in hot water (agitate during soak) • Multiple rinse cycles may be needed	

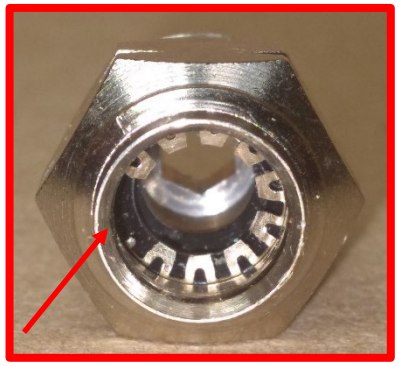
Inspect

- Inspect the interior and exterior of the push to connect.
- There should be no damage or contamination on the o-ring seals, retention teeth, or other surfaces that can cause an air leak.
- The retention collar must move freely (able to fully compress and will return to extended position)

Clean, Functional PTC – no damage and release collar moves freely



PTC Contamination on the o-ring

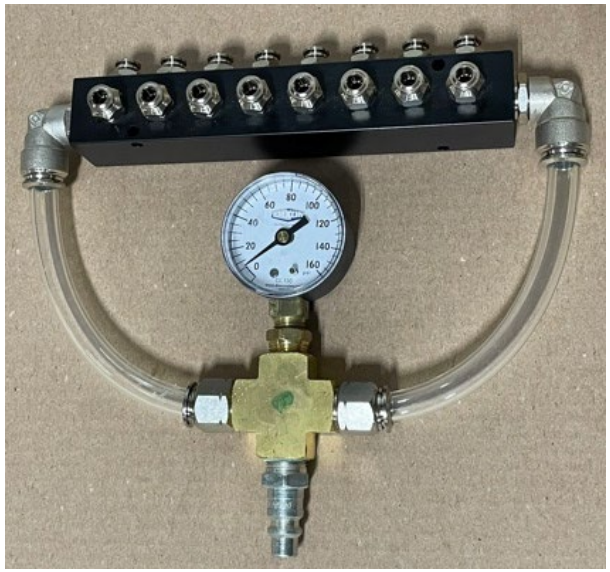


PTC Missing Retention Teeth (Tube pulled out without fully compressing collar)

Cut or Damaged O-Ri
(internal and externa

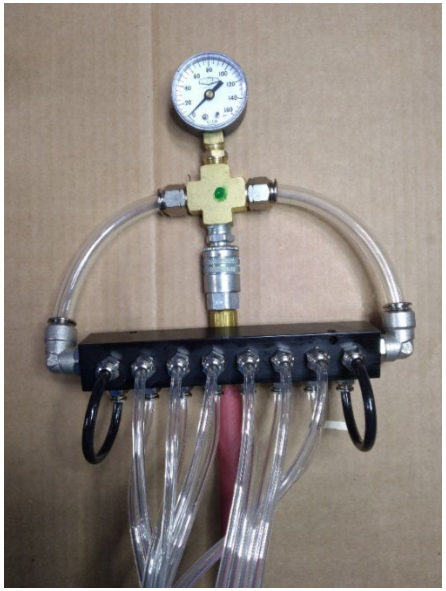
Reassemble

- Reassemble the PTC fittings into the manifold body.



PREVENTION IS KEY

- It is difficult to fully clean PTC fittings – preventing contamination is easier and more effective
- Covering the compressed air manifold during a job (plastic bag, pillowcase, etc) will keep sealant from settling on the components and make clean up and maintenance much easier.



Example of a working compressed air manifold. This was used in appx 70 sealing jobs and was covered with a pillowcase during sealing

Example of a non-functioning compressed air manifold. This was used in approx 100 sealing jobs without being covered.

Test for Leaks

Leak Testing

- The entire compressed air path can be leak tested using a spray bottle of soap water. Bubbles will form at any leak (threaded fittings, tube ends, push to connects, etc.)

Use Gloves when mixing sealant, and when using cleaners

Index of Symbols