Introduction to Smartseal® System

Equipment Setup

Welcome to AEROSEAL® training for the SmartSeal equipment. We will now go into an in depth presentation on the equipment, duct seal preparation, sealing and completion.

We have now divided the Aeroseal® training manual into seven segments so that the technician who needs to review a specific area of the training can find it easily. The seven segments are the Introduction, the Equipment, the Equipment Setup, Duct Sealing Process, System Preparation, Running Aeroseal® and Maintaining the Equipment.

Introduction is an overview of the Aeroseal® process. The Equipment segment is information about the pieces of equipment that make up the Aeroseal® system. Equipment Setup shows the way the equipment is powered, connected together and connected to the duct system to be sealed. Ready for sealing describes different applications of duct systems and some of the criteria that needs to be addressed for sealing. Running Aeroseal® describes operation of the computer control with the fan box air intake with the sealant injection rate. Maintaining the Equipment discusses and places emphasis on the injection nozzle, cleaning the nozzle as well as disassembly and replacing the nozzle components.

This segment is the first of the series, the Introduction to the Aeroseal® process.

Equipment Ready for Sealing

This section is to share internal and external best practices as you approach the job-site and some of the potential obstacles you may or may not encounter.

Discussion Topics to included:

1. Reviewing the job requirements
2. Occupants and Contents Safety
3. Power Requirements
4. Walk-through inspection
5. Blocking
6. Equipment Preparations
7. Injection Points
8. SmartSeal Operation
9. Safety walk through

Review Job Requirements

- Scope of Work
- Power Requirements
- Blocking location and potential issues concerning diffuser type and location
- Number and type of Scrubber fans and location
- Number of Fan Boxes needed and the Injection Point(s)
- Security Issues
- Accessibility to zones
- Location and potential restrictions to diffusers
- Crew size and Man-days allocated to project
- Material needed to complete project
- Building Automation Controls and FIS concerns
- Potential risks, hazards, critical zones and other safety concerns.

REVIEWING THE MECHANICAL DRAWINGS WILL ASSIST YOU IN GAINING INSIGHT TO YOUR PROJECT

Prior to sealing, the technician(s) should review customer information, work order task and installation instructions.

Review Mechanical Dwgs.

Safety – Occupants and Contents

1. Duct Inspection – Can it be sealed?
2. Occupancy – Should be kept at a minimum. Pregnant? Respiratory?
3. Use Scrubber Fans
4. Critical Zones

Figure3: Vapor Barrier

The Duct inspection is to insure that we can seal the duct. Finding disconnected ductwork is imperative before project commencement.

Pregnant and/or Person(s) with Respiratory issues should be removed. Even though we have a clean MSDS, it's still logical. Also, watch out for hypochondriacs or people that are allergic to everything!

Knowing the condition of the duct will give you the where with all of potential major overspray.

Critical Zones – Positive or negative pressure containment might need to be applied.

Safety – Critical Areas

Pressurization or Isolation Barrier

Critical areas should be discussed and have action plan in place to manage overspray in/around critical areas. Use remediation fans/blowers to create positive pressure area keeping overspray out of the area or create negative pressure area to keep overspray contained to that area. A good rule of thumb for scrubbing is as follows. 4800 cubing feet of space will require a scrubber with a minimum of 600cfm to exchange the air 5 times an hour.

Walk Through

Use the checklist in technical manual for reference. General Information:

1. Building Information
2. HVAC Equipment
3. Duct System
4. Register types
5. Special concerns
6. Electrical outlet locations

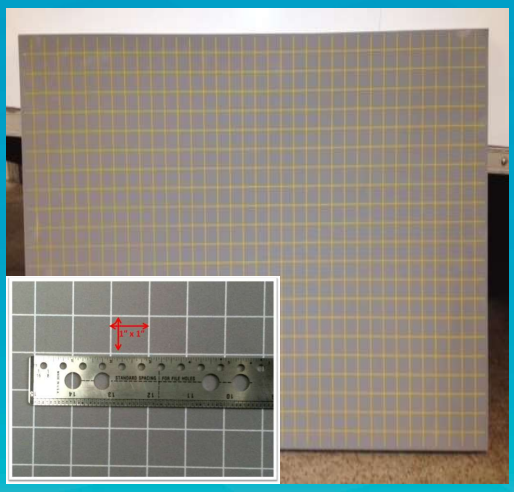
Preparation

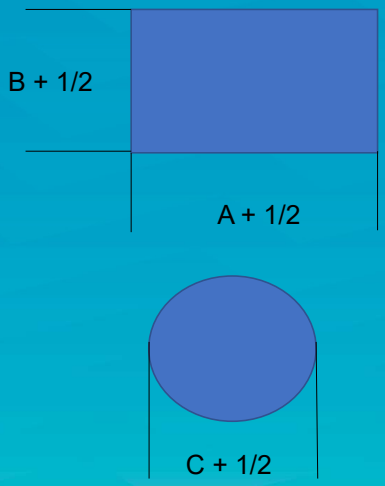
- Preparation is most time consuming
- Most problems occur:
  - Poor seals at registers
  - Failure to plug hidden registers
  - Failure to plug missing end caps
  - Leaks in “lay flat” tubing
- Remove registers carefully
- Advise customer of potential problem
- Install plugs so that gaps can be sealed
- Fit plugs tightly
  - ½-inch larger in each direction (W & L)
- Installer must use ingenuity

Preparing the duct and HVAC system prior to aerosol injection is generally the most time consuming part of the sealing process but it is also the most important part of the process. Careful attention to this phase of the work dramatically reduces the possibility of spending hours cleaning a building’s inner surface. Most problems that occur with the aerosol injection process are associated with poor seals at the diffusers/grilles, failure to plug hidden registers/grilles, or leaks in lay flat tubing connections allowing sealant to escape.

Care should be exercised when removing the registers/grillers so as not to damage paint or other coverings on ceilings, walls, or floors.

Blocking





In a commercial application the most time consuming and the most important aspect to the Aeroseal process is the Blocking! There are several methods to use for commercial duct work. Sheet metal pans, magnetic sheets and cardboard are common blocking methods.

Cutting the Blocks

- Cut plugs ½-inch oversize
- Identify duct size on plug
- Identify duct size on storage container
- Inventory the sizes
- Store like plugs together

During the walk-through you noted on your checklist the number and sizes of registers and grilles that will be required to be plugged so back at the shop is probably the best place to cut these foam rubber plugs. Since some commercial duct systems utilize standard duct sizes and since these plugs are reusable the plugs should be cut and stored in the following manner:

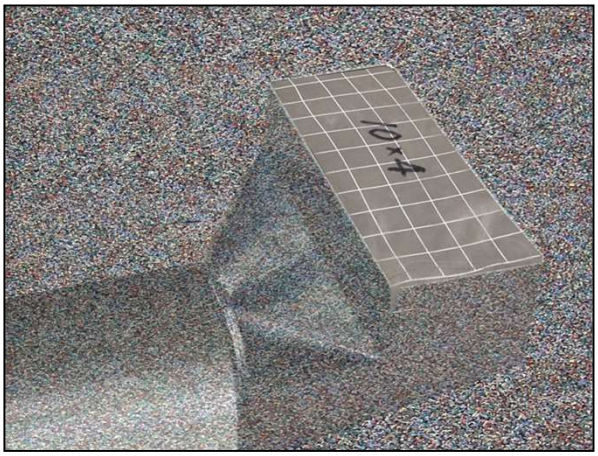
Cut the plugs ½-inch larger than the actual opening to be plugged. For example, if the opening is 14" by 2-1/2", cut the plug 14-1/2" by 3". To make them easy to reuse, cut them carefully and straight. The same is true for round ducts, for example, a 6-1/2-inch diameter plug should be cut for a 6-inch round duct; not a 7-inch plug.

Next, write the size of the opening on the plug. In this example: "14-x 2-1/2".

Find some boxes that can be used to store the plugs and use one box for each size plug writing the size of the opening on the box. Clear boxes are best, and storing plugs with the same small dimension together is fine (e.g. 6 X 8 with 6 by 10).

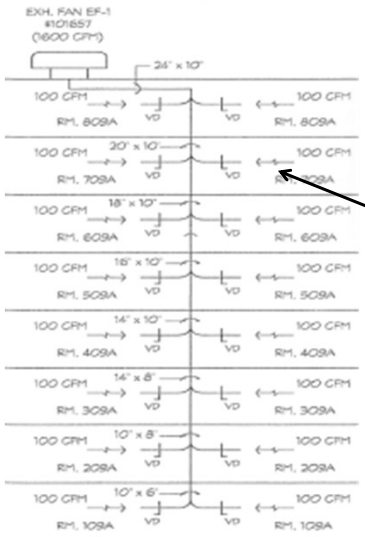
Identifying the plug sizes, storing like sizes and inventorying like sizes will make your duct sealing more efficient. You will always know what sizes you have, where they are located and how many you have at any one time. Knowing how many of each plug you have will provide a running inventory so that they don't have to be counted every time you have to utilize sizes. It is possible to use duct tape to combine two smaller pieces of foam if needed.

Installing the Blocks



Cut to the proper size, that is cut 1/2-inch larger than the actual opening as previously shown, the plugs can be easily installed and will seal the ducts or boots. The correct way to install the plugs is to compress one side to fit into the duct or boot and then to continue to compress the rest of the plug so that it will fit into the complete opening of the duct or boot. Round plugs can be inserted by first inserting part of the plug into the opening and then working the plug into the round opening. An additional layer of duct mask over the plugs is recommended for safety.

Blocking



Blocking location

Have a plan. Pre cutting plugs in advance will save time on the job site.

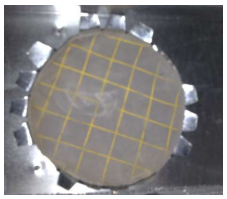
Blocking

Use of sheet metal at supply air discharge from rooftop packaged unit to block off sealant from the coils and fans.

Use of sheet metal at return air intake for rooftop packaged unit to block off sealant. Note that the opening had a damper that was closed, but which is not appropriate to serve as a block on its own. Also note the use of a pole to support the block on the low pressure side

Sometimes you will have to think outside the box.

Blocking



More examples. Note; larger size plugs will need some type of backing to withstand higher pressures. Common methods are spring rods, long drill bits and plumbers pipe hanging tape strapped across the plugs.

Blocking

Tape leading edges if possible

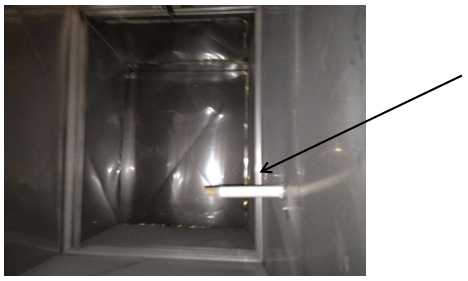
Set to wide open and seal through

Block VAV with Fan (FPSVAV, FPPVAV)!

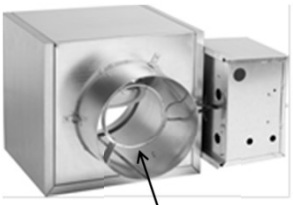
Although Laboratory testing assures that fire dampers are not adversely impacted by Aeroseal, when possible it is always preferable to tape over the leading edges. In the case of “Fire/Smoke” dampers, the smoke sensor MUST ALWAYS BE ISOLATED DURING INJECTION

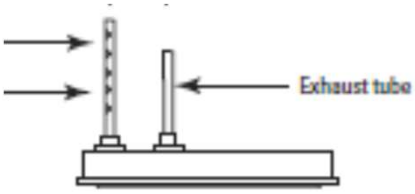
Balancing Damper – 100% wide open and seal through.

Isolate – Watch for these!



Humidity Sensor





Smoke Detectors

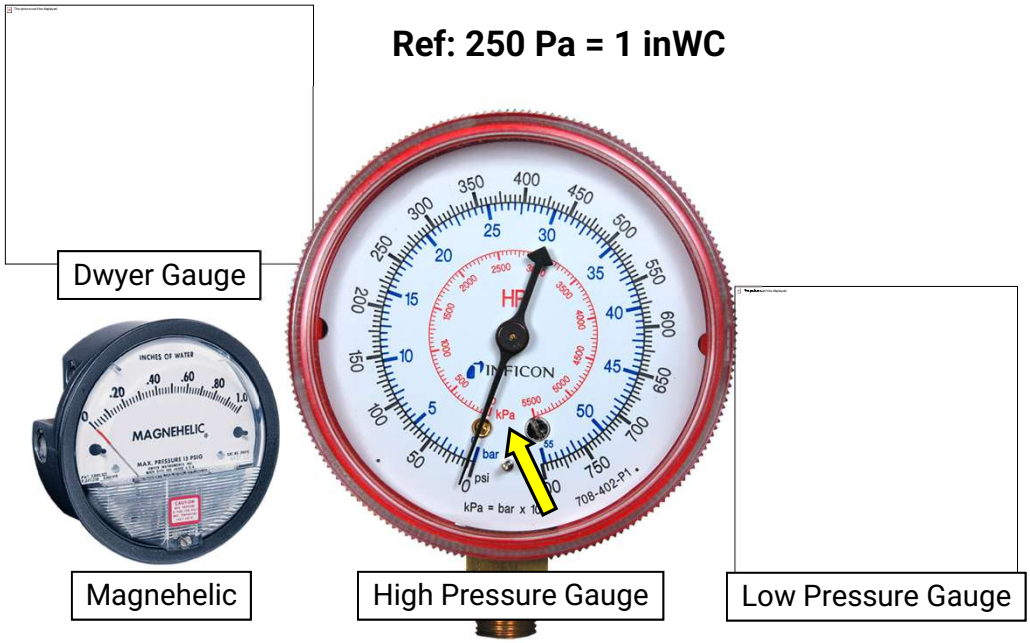
Flow Ring

Isolate any and all FIS equipment, Coils…

If possible the external best practices is to get in contact with BAU group and find partner…a lot of controls could have been implemented and are not on the plans. Gain access to the BAU front end (Siemens, Honeywell, JC etc.…)

Get at least 10Pa at furthest Run

Ref: 250 Pa = 1 inWC



A Pascal is a metric unit of measure that was named after the French scientist Blaise Pascal known for his theory on fluid pressure. One (1) Pascal is equal to a force of one (1) Newton per square meter. One (1) Newton is equal to the force required to accelerate one (1) kilogram one meter per second for each second (N = 1 kg.m/s²). Honestly, this is actually quite logical for physicists and engineers. 1psi = 6895pascals.

To make this simple, 0.1-inch of water is equal to about 25 Pascal and as service technicians we all are familiar with inches of water in terms of pressure especially in ducts. We will be sealing at about 250 to 500 Pascal which equates to 1-inch to 2-inch of water.

Injection Points

LOCATION, LOCATION, LOCATION

Critical areas should be discussed and have action plan in place to manage overspray in/around critical areas. Use remediation fans/blowers to create positive pressure area keeping overspray out of the area or create negative pressure area to keep overspray contained to that area. A good rule of thumb for scrubbing is as follows. 4800 cubing feet of space will require a scrubber with a minimum of 600cfm to exchange the air 5 times an hour.

Cutting the Injection Hole in Sheet Metal

Access for injection can be made by cutting a new opening, removing a connecting duct, or through the discharge plenums of HVAC equipment.

The hole for the Injection Flange in sheet metal plenums can be made with electric shears, hand shears, a Malco™ hole cutter, a nibbler, or a reciprocating saw. If using a Malco™ hole cutter or reciprocating saw, as well as some types of nibblers, care must be taken to avoid dropping filings into the ductwork and the opening site must be vacuumed.

The connection between the Injection Flange and the duct system is typically submitted to large forces, and therefore must be sealed and mechanically fastened with screws or similar items. Typically, adhesive backed foam seal strips are used for sealing the Injection Flange to the duct. For metal plenums, use 6 to 8 self-taping screws to connect the 12- or 14-inch Injection Flanges to plenum openings.

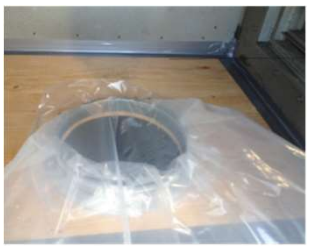
Tape the Injection Flange to the plenum from the inside of the flange and duct to prevent sealant particles from escaping. By taping from the inside, the pressure that builds up in the duct system during sealing tends to make the tape seal more tightly. Taping from the inside also tends to keep the flange clean. This taping can be avoided by applying a closed-cell-foam adhesive-backed gasket on the Injection Flange. When sealing is complete, cut a sheet metal patch, fit it with a closed-cell-foam adhesive-backed gasket, and then attach the patch to the duct. Glue any insulation onto the patch that was removed earlier to gain access to the duct. Mastic is recommended over the edges of high OP systems.

Using Duct Mask™

Always use Duct Mask™ on the entire inside duct walls near the injection point to avoid permanent deposition of sealant on those walls. Duct Mask™ should be used in an area up to two feet from the injection point on the inside of the duct at the injection point as well as the two adjacent sides of the duct and the opposite side wall of the duct. Note that Duct Mask™ does not stick well to many internal duct liners or duct board, but never the less, it should still be applied. Push pins will help in cases like this.

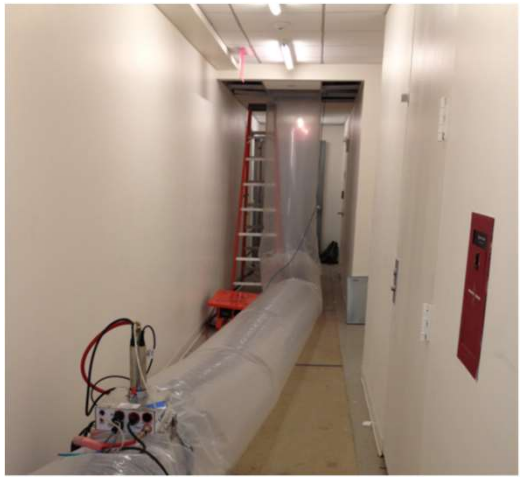
It is also recommended to line the entire inside of the wye and injection collar with Duct Mask™ prior to using it for sealing. Because of its size, sealant builds up on the interior of the wye and injection collars, and when they needs to be cleaned, it is much easier to remove the Duct Mask™ and then re-apply more new Duct Mask™. It can also be applied inside the outlet side of your heater cylinder for easy cleanup.

Exhaust System



Prefer to seal from the Top down – Utilize Gravity, In many cases while sealing vertical shafts you can mount the heater cylinder directly to the shaft. This will seal faster and save plastic tubing. You will need at least 8 feet of vertical shaft before any turns in this method.

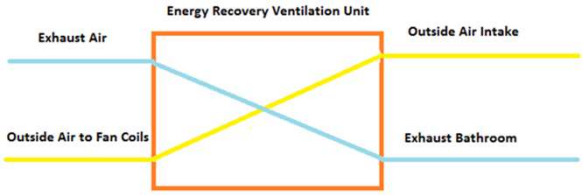
Supply/Return System

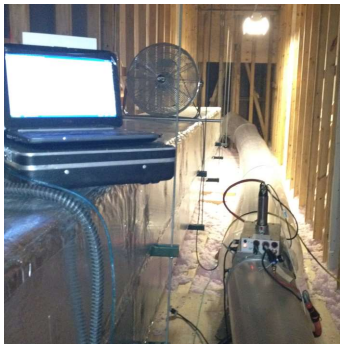


Ensuring the isolation of AHU's find the best possible injection point.

Watch long horizontal Duct Runs for shifting of the tubing. This can cause the sealant to deposit directly onto the plastic tubing.

Outside Air – ERV's





Like any other sealing episode….block coils, sensors and all equipment that you do not want to seal.

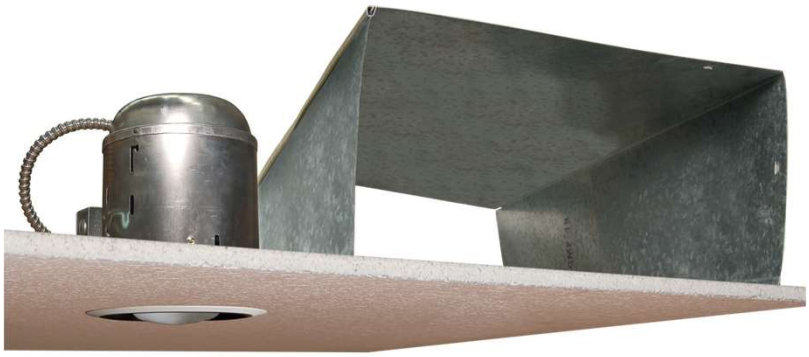
Duct Leaks

Manually Fixed

Take note if there are any large air gaps in the ductwork especially at corners, connections and elbows. The larger the opening, the longer it will take to seal and the more sealant that will enter the area where the leak is located. Although AEROSEAL® is capable of sealing opening up to 5/8-inch, we suggest manual sealing of any gaps greater than 1/4-inch in width.

Any hole greater than 5/8 use best practices to fix.

Watch for Over-Spray



Sealant particles can often exit the duct that is being sealed and enter the finished space through various means. Utilize the scrubber fan. Should a lot of over-spray occur put the equipment in pause mode to let your scrubbers catch up and clear the area.

Questions?

This is the end of this slide module. Do you have any questions?