OPERATING AND SERVICE MANUAL

--DO NOT REMOVE FROM EQUIPMENT--

SERIAL NUMBER:

For technical service or repair,

FIRST CALL - INSTALLING CONTRACTOR:

FINAL CALL: Col-Met Engineered Finishing Solutions - (972) 772-1919
SO# 57899

Please have serial number available when calling

MANUFACTURED BY:

Col-Met Engineered Finishing Solutions
2975 Discovery Blvd.,
Rockwall, TX 75032 - Phone 972-772-1919

WARNING

Improper installation, alteration, service or maintenace can cause property damage, injury or death. READ all the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

CAUTION

FOR YOUR SAFETY

If you smell gas:
1. Open windows.
2. DO NOT touch electrical switches.
3. Extinguish any open flames.
4. Immediately call your gas supplier.

The use and storage of gasoline and other flammable vapors and liquids in open containers in the vicinity of this appliance is HAZARDOUS.

NOTICE

LOW TEMPRATURE LIMT

If this heater is to be installed in an area of potential freeze up and a low temperature limit was not ordered, one should be installed to provide freeze protection in the event of a burner shut down.

NOTICE

For outdoor equipment with a variable frequency drive (VFD) factory mounted in the unit, main power should remain on at all times especially during cold weather. Even if the unit will not run at night or over a weekend, main power should remain on to allow internal VFD self-heating which extends VFD service life.

24 MONTH WARRANTY

Col-Met hereby warrants its products against defects in material and workmanship for a period of (24) twenty four months from date of shipment.

Start up checklist is due back within (30) thirty days of start-up or 120 days from date of delivery for 24 month warranty to be effective. After (30) thirty days, and up until (60) sixty days, a (13) thirteen month warranty will be observed. All warranties are null and void if start up checklist is not received within (60) sixty days from start-up or 120 days from date of delivery. NO EXCEPTIONS WILL BE MADE.

Col-Met reserves the right at Col-Met's option, to replace or repair free of charge, any part proven by Col-Met to be defective. Prompt notification of defective part must be given to Col-Met and defective part must be returned freight prepaid within (30) thirty days of notification.

WARRANTY INCLUDES ONLY PARTS SUPPLIED BY COL-MET INCIDENTAL COSTS AND LABOR CHARGES SHALL BE THE RESPONSIBILITY OF OTHERS. This warranty does not cover fuses, belts, filters, refrigerant or water damaged parts which are the result of improper storage or installation.

This warranty is void in event the product is improperly installed and/or operated under conditions other than normal published ratings, improperly maintained, misused or not in compliance with applicable codes or not in accordance with Col-Met's operating instructions.

This warranty is void if attempts to correct or repair any alleged defective part or parts are made by unauthorized personnel without Col-Met's written approval.

In no event shall Col-Met be held liable for any damage, incidental or consequential, arising from the installation, performance or operation of the product.

This warranty supersedes, voids, and/or is in lieu of any other verbal or written understanding which may not be in total accordance with this expressed warranty.

Warranted parts must be returned to Col-Met within 60 days to receive credit.

Purchased components such as Steam Generators Systems, Electric Coils, Refrigerant Condensers, Chillers, Coils, Heat Exchangers are covered under the original equipment manufacturer's warranty.

PURPOSE/ APPLICABILITY

This manual is intended to provide installation, operating and service information on Col-Met's CT Series H.O.T.™ (High Outlet Temperature) air make-up units. Other types of equipment including CTP Series H.O.T. ™ units are covered in other manuals.

A packet of reference materials for a specific unit (tracked by its Serial Number) is generally included with this Operating and Service Manual. The reference materials include Unit Specifications, Parts Lists, Gas Train and Burner Specifications, Electrical Schematic, and a Sequence of Operation. A start up checklist is also included in this packet. Review the reference materials for a specific unit and note any optional equipment or controls which are not specifically addressed in this manual prior to attempting start-up or service work.

The information and recommendations contained in this publication are based on general observation and are not intended to supplant requirements of federal, state or local codes having jurisdiction. These codes should be reviewed before installation of equipment. All units must be installed in accordance with national, state or local codes.

It is the responsibility of the purchaser at the time of order, to specify any and all code or insurance requirements that may dictate the addition of components to the equipment in order to comply with those requirements.

Only qualified personnel who have experience with the installation and operation of industrial/ commercial direct fired equipment should attempt to service Col-Met equipment..

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Note that operating and service manuals are occasionally requested prior to production of a unit. These manuals will be marked “Pre-Production Release” on the front cover.

The final copy of the operating and service manual for a specific unit will be sent with the unit. Additional copies of the manual for a specific unit are available.

A detailed unit specification sheet, parts/ legend sheet, schematic, sequence of operation and start-up procedure are provided in the start-up section of each operating and service manual generated for a specific unit. Selected vendor cut sheets on components will also be included.

EQUIPMENT ARRIVAL

When the air make-up unit arrives, be sure to inspect for shipping damage. The equipment was thoroughly inspected before leaving the factory. Also upon receipt check the shipment for items which shipped loose such as a remote box and remote sensors. Consult the Bill of Lading to identify the potential shipped loose items. It should be noted that these items may have been placed inside unit cabinet in multiple locations; however, more often than not, shipped loose items can be found in the blower section of the unit. Any damaged or missing items should be reported to the transporter immediately. DO NOT SEND DAMAGED FREIGHT BACK TO COL-MET! All claims must be filed with the transporter. Be sure to take photographs and get the driver's signature to confirm the damage. The driver will have a number for you to call to file a claim. Request a written inspection report from the carrier claims inspector to substantiate any necessary claim. Be sure to open the unit access doors and inspect for internal damage.

STORAGE

If for some reason you are unable to install the equipment immediately, be sure that the equipment is protected from the elements. Water damaged parts are not covered by Col-Met's warranty. If the equipment is stored for an extended length of time, be sure to completely check the unit for any internal damage which may have been caused by excessive condensation. Also check for damage caused by rodents, and be sure to eliminate any dust that may have built up on the components while the unit was in storage.

LONG TERM STORAGE

Please observe the following precautions if the unit is to be stored for an extended period of time. (NOTICE: The time elapsed during storage still counts against the warranty period.)

- Best place to store the equipment is on a clean level surface, in a dry location where the temperature can be controlled, if possible.
- Isolate equipment from shock and vibration or damage may occur to the stationary blower bearings.
- At least once a month enter the blower vestibule and slowly rotate the blower wheel about 30 times to redistribute the grease inside the bearings to help prevent corrosion from occurring.
- Reduce belt tension by at least 50% or remove belts completely.
- Do not allow coverings to trap moisture against unit casing.

CAREFULLY AND THOROUGHLY READ COL-MET'S PRODUCT WARRANTY

Each unit is tested at the factory prior to shipping. Because we are not able to simulate exact field conditions and sometimes actual conditions are different than what was stated on the order, you may need to make some adjustments in the field. This is why it is very important that only qualified personnel start-up and service Col-Met equipment. The start-up checklist (provided in packet with this manual) must be filled out and returned to Col-Met in order to validate equipment warranty.

For a fee, Col-Met personnel will travel to the job site, supervise start-up and provide operation and maintenance training for the equipment.

COMPONENTS

BLOWERS

The typical blower(s) used in Col-Met equipment are AMCA rated industrial type forward curve D.W.D.I. fans. Backward incline, backward airfoil, and plenum/plug fans are used occasionally. Models CT-109 through CT-136 utilize a single blower while models CT-215 through CT-242 utilize twin blowers. All blower wheels are mounted on a solid, turned, ground and polished shaft. 9" and 12" blowers are supported with permanently lubricated ball bearings. Larger blowers are supported by relubricatable pillow block ball bearings.

MOTOR & DRIVE

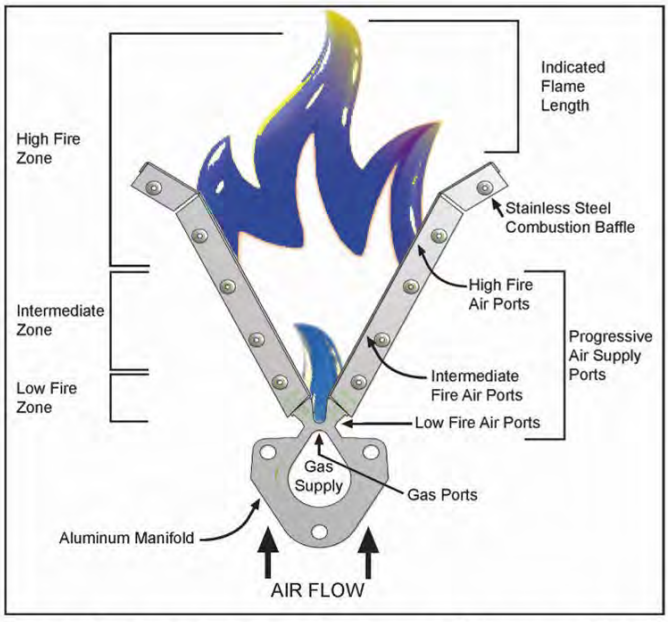
Rigid base, T-Frame, motors are utilized. The motor is mounted on an adjustable slide base. Equipment furnished with a supply VFD will typically have a fixed motor sheave. However, some equipment may still utilize a variable pitch sheave.

DIRECT FIRED HEATING

BURNER OPERATING PRINCIPLES

The direct fired burner is designed to operate in a cabinet of flowing fresh air. Fuel gas is fed directly to the burner; kinetic energy of the airstream furnishes combustion air. It will function properly at the design velocity and pressure associated with ventilating systems.

Two speed H.O.T.™ units feature a damper with actuator and controls to maintain proper velocity across the burner profile as air volume changes. Single speed H.O.T.™ units have slide plates on either side of the burner to allow manual adjustment of the burner profile area.



Note: Low fire air ports in casting are only present on Midco burners. Figure 1

The burner must be installed to fire with, and parallel to, the air flow. By virtue of velocity impact and suction generated by the diverging shape of the combustion baffles, air is induced through the air ports into the combustion zone. Although the air supply to the burner combustion zone is constant, only some of the air is actually mixing with the gas to produce combustion.

When a very small quantity of gas is admitted to the burner, sufficient mixing takes place in the low fire slot where combustion takes place. Since the low fire zone is contained within the burner casting it is effectively shielded from uncontrolled air entry.

As the gas supply is increased the flame progresses into the intermediate fire zone where an additional supply of air is available. At higher or full capacity, mixing occurs at the larger air ports of the high fire zone augmented by air flowing over the end of the baffles.

On a reduction of gas supply the reverse sequence takes place, the flame recedes to a location of lesser air supply until the low fire zone is reached. The burner is suitable for a turndown range of approximately 30 to 1.

AIR SUPPLY

The supply fan is typically positioned to draw air across the burner. Air flow across the burner must be substantially straight (laminar) and velocity must be within the proper range to develop the desired turndown and capacity.

The direct fired burner is designed to operate in an air make-up heater with all air crossing the burner taken directly from outdoors. Rare exceptions involve equipment that serves an unoccupied space.

Total pressure rating of the blower includes allowance for the pressure drop through the primary air handling unit including the burner, together with pressure losses at the inlet screen, inlet damper, filters, outlet damper if used, plus the external pressure rating of the system.

BURNERS

Burners are purchased in 6" and 12" straight lengths and 12" tee sections and are assembled to meet the BTU requirements of each piece of equipment.

According to national safety standards, the following factors could influence safe operation of a direct fired air make-up unit and must be interlocked to either prevent the burner from firing or shut it down if unsafe conditions occur.

1. AIR SOURCE – If a damper is used, it must be interlocked to prove it is open before the blower can start.
2. BLOWER STARTER/VFD INTERLOCK – A contact proving that the blower starter is energized or VFD is operating must be incorporated to prevent burner operation when the blower is not operating.
3. AIR FLOW SWITCHES – Monitor the air flow (pressure drop) across the burner. The switches (one high differential and one low differential) will not allow burner to operate if air pressure drop across burner is outside of the high and low set points.
4. HIGH TEMPERATURE LIMIT – A manual reset high temperature limit control must be utilized to prevent high temperature situations caused by excessive fuel pressure or lack of air flow.
5. FLAME SAFEGUARD – Monitors the combustion process during ignition and operation for safe conditions.
6. HIGH GAS PRESSURE SWITCH – Monitors gas pressure to the burner. This de-energizes the burner in the event gas pressure increases above its set point.

GAS CONTROLS

Col-Met H.O.T.™ equipment is constructed to meet ANSI Z83.25/CSA 3.19 standards. Components in the gas delivery manifold on standard equipment include: two manual shut-off valves, gas pressure regulator, two safety shut-off valves and an electronic gas modulating valve. The pilot control includes a shutoff valve, gas pressure regulator and a pilot solenoid.

ELECTRIC /ELECTRONIC CONTROLS

Col-Met H.O.T.™ units typically come standard with the following items: disconnect switch, starter and overload assembly(s) or variable frequency drive(s), control power transformer (if a 3 wire system), air proving switches, high temperature limit, electronic flame safeguard and electronic flame modulation with remote setpoint adjustment. Control systems can be designed to meet specific requirements. Numerous temperature controls are available. Since H.O.T. units usually temper outside air to replace the air exhausted from a paint booth, modulating discharge temperature control is typical. At least one additional setpoint is usually included for the high outlet temperature mode.

H.O.T.™ units are typically supplied with a remote control panel. This panel will include switching for blower & burner operation and temperature setpoint(s). Timers are often included to automate the bake cycle. Other options common for H.O.T.™ units include controls to interlock with paint booth lights and compressed air solenoid as well as control a paint booth exhaust fan. Some units feature operating lights, discharge temperature display, custom controls or contacts by others to enable blower and/or burner operation.

Refer to the unit specification sheets, parts list, schematic, sequence of operation and start-up procedure for a specific unit to determine the control options included.

IMPORTANT: If the malfunction of the heater creates a hazard to other fuel burning equipment in the served building (i.e. supplying make-up air to boiler room) it is to be interlocked to open an inlet air damper in case of failure.

NOTICE: The operating temperature control system must limit the discharge air temperature from exceeding 250°F in the process air heater mode and 160°F ventilation air heater mode.

AIR FLOW SWITCH OPERATION

BURNER PROFILE AIR PRESSURE DROP

ANSI standards, Z83.25/CSA 3.19, require manufacturers to monitor air moving across the burner for both high and low conditions. Col-Met utilizes air pressure drop across the burner to satisfy this requirement.

Certification testing demonstrated that the burner will function properly between a low pressure drop of 0.2" w.c. and high pressure drop of 0.95" w.c. The standards also mandate that the switches cannot be adjustable. This makes air pressure drop across the burner profile a very important factor at initial start up.

The design burner pressure drop at standard air conditions is 0.60” w.c. and will change as the temperature of outside air increases or decreases from 70°F. In order for the burner to operate within the range of the air flow monitoring switch set points, the pressure drop should be as close to 0.60” w.c. as possible.

Air pressure drop across the burner profile is dependent on OA temperature. When the burner is off, pressure drop will climb significantly during cold weather. The burner is always off on initial start -up. Therefore, if the burner profile air pressure drop is above 0.70” w.c. during a warm weather start-up, it may exceed 0.95” w.c. during a cold weather start-up in northern regions. Such a high air pressure drop would open the high airflow switch and prevent burner ignition.

The following chart will aid in equipment set up at outside air temperatures different from 70°F when the unit is operating with the burner off. The chart gives pressure drops, at various temperatures, equivalent to 0.60” w.c. at 70°F.

Note that two speed H.O.T. units feature controls to maintain pressure drop across the burner as air volume changes. Either high speed and low speed mechanical adjustments of damper actuator travel or a dual pressure switch assembly are used to control burner air pressure drop. Burner profile air pressure drop should be measured on high speed with the burner profile dampers near the full open position. If the burner profile dampers open less than 50% on high speed, the unit is probably delivering less than full rated airflow.

Burner Profile Air Pressure Drop at Various OA Temperatures (Burner Off)

OA Temp (˚F)	Burner Profile Drop (w.c.)	OA Temp (˚F)	Burner Profile Drop (w.c.)	OA Temp (˚F)	Burner Profile Drop (w.c.)
-40	0.76	10	0.68	60	0.61
-35	0.75	15	0.67	65	0.61
-30	0.74	20	0.66	70	0.60
-25	0.73	25	0.66	75	0.59
-20	0.72	30	0.65	80	0.59
-15	0.71	35	0.64	85	0.58
-10	0.71	40	0.64	90	0.58
-5	0.70	45	0.63	95	0.57
0	0.69	50	0.62	100	0.57
5	0.68	55	0.62	105	0.56

PRE-INSTALLATION

Inspect the equipment making sure all parts and accessories are on the job site. Check equipment against order and packing list. If the equipment has been sitting in storage for some time, inspect it for moisture (from condensation, rain or snow) and/or dust accumulation. Both can cause damage to electrical and electronic components as well as bearings and insulation.

INSTALLATION CODES

Care taken during the installation and start-up is vital to the longevity and reliability of the equipment. Confirm that gas and electric utilities match the rating on the equipment name plate.

- This heater shall be installed in accordance with local codes or, in the absence of local code, according to National Fuel Gas Code, ANSI Z223.1/ NFPA 54, or the CAN/ CSA B149.1 Natural Gas and Propane Installation Code.
- If the heater is to be installed in an aircraft hangar, refer to ANSI/NFPA 409.
- If the heater is to be installed in a parking garage, refer to ANSI/NFPA 88A.
- If the heater is to be installed in a repair garage, refer to ANSI/NFPA 30A.
- For installations in Canada, refer to CAN/CSA B149.1 National Gas and Propane Installation Codes.

INSTALLATION PREREQUISITES

- The heater inlet shall be located in accordance with the applicable building or mechanical code provisions for ventilation air.
- Adequate exhaust and/or relief must be provided to prevent over pressurizing the served space when the heater is operating at its rated capacity. It should be noted that this can be accomplished by taking into account, through standard engineering methods, the structure's designed infiltration rate; by providing properly sized relief openings; or by interlocking a powered exhaust system; or by a combination of these methods.
- Heaters installed with intake ductwork must purge at least four air changes the volume of the intake ductwork prior to an ignition attempt.
- Ventilation air to the heater shall be ducted directly from outdoors when heater is operated in the ventilation air mode.
- An electric disconnect switch having adequate ampacity (see name plate on the heater for voltage and ampacity), if not provided as part of the heater shall be installed in accordance with the National Electric Code, ANSI/ NFPA 70.
- If in doubt regarding the application of the direct fired heater, contact the sales representative or the factory.

PAINT BOOTH HEATER INSTALLATION PREREQUISITES

- Access opening(s) to the heated space must be equipped with door interlock switch(es) to prevent the operation of the heater during a bake cycle when an access door is open.
- It is recommended to post the following warning marking at each access opening. "Do not enter this space until the cool down cycle is complete."
- A post purge timer to purge contaminants from the space and cool the products to avoid a burn hazard must be provided following a bake/ drying cycle.

PAINT BOOTH HEATER INSTALLATION PREREQUISITES Contd.

- An interlock must be provided to:
  - Lock out paint spraying equipment unless process heater is operating in ventilation mode.
  - Lock out facility lighting with-in the heated space during bake cycle.
  - Ensure equipment has been operated in the ventilation mode for three minutes or a minimum of four air changes of the paint booth volume, whichever is greater at the start of the bake or drying cycle.
  - Initiate the heater fan in conjunction with the operation of the exhaust fan.

POSITIONING THE HEATER

Locate the heater exactly level, making certain minimum clearance required by local codes is maintained between the heater and any combustible materials. See name plate on unit for minimum recommended clearances.

When the makeup air equipment is located on a roof or at ground level on a concrete pad, the unit intake needs to be a minimum of 24" above the roof and/ or ground to prevent the intake of snow or splashed rain. The unit should be located in such a way to prevent prevailing winds from blowing directly into the unit intake. If the application is critical, provisions must be made to protect the unit inlet from the driving winds.

CLEARANCE

Select the installation location and support system (curb, stand or other) that meets or exceeds all of the minimum safety clearance requirements.

BOTTOM

Unit should be installed to allow clearance for proper condensate trap (If applicable). Do not install unit on combustible surfaces.

SIDES

The minimum recommended clearance on all sides of the unit except for the service side and bottom is 6 inches.

SERVICE

The service side should have a minimum of 24 inches of clearance; however it is recommended that the clearance be at least the width of the widest door.

Also, if the unit includes any coils or has twin blowers more clearance should be provided for removal of those components.

The minimum clearances listed above are set, in place, by the standard in which Col-Met builds their equipment to meet; however, one should consult with all authorities having jurisdiction to ensure they don't require larger clearances. Furthermore, the unit must be installed in such a way to facilitate smooth operation and maintenance of all built in sections and components. Also, it should be noted that the coil pull could be located on either side of the unit. Review the unit submittal drawing for the correct direction of the coil pull.

CURBING (OUTDOOR MOUNTING)

The use of a full perimeter curb or mounting rails under the heater is recommended. The only openings in the roof should be for the supply air duct, return air duct (if required), gas and electrical connections (if applicable). These openings must be sealed properly after installation. Col-Met ships all curbs unassembled and un-insulated. Installing contractor supplies gaskets, cant strips, insulation, etc.

INSTALLATION SAFETY

RIGGING

DANGER: Never enlarge lifting lug hole to accommodate larger anchor shackle.

WARNING: Never assemble unit sections or sub-assemblies together before rigging. Always rig unit the way it was shipped from the factory.

CAUTION: It is the installer's responsibility to confirm that the lifting equipment capacity exceeds unit weight by an adequate safety factor. Never stack inlet hoods or other components onto the unit **as the unit is being lifted.**

IMPORTANT: Apply appropriate sealant to roof curb and duct adapter(s) prior to setting the unit in place (If applicable).

Lifting Requirements:

- Protect coil connections, extending through unit casing, from damage by the rigging cables through the use of plywood or other suitable materials.
- Exercise care when moving the unit.
- Rig the unit using **ALL** the lifting points, in a fashion that holds it level and prevents it from tipping, falling and/ or twisting.
- Spreader bars of sufficient width **MUST** be used across the top of the unit, to ensure that the lifting cables clear unit cabinetry.
- Utilize the same rigging and lifting methods as the ones applied to the unit, for lifting the accessories.
- Remove all wooden shipping blocks before setting unit(s) onto curb (If applicable).
- After sections are set in place, assemble according to Unit Section Assembly (If applicable).
    - NOTICE: Warranty does not cover damage from the unit being severely twisted or dropped during handling.

GAS PIPING

Gas piping must be sized and installed in accordance with applicable codes. It must be able to deliver the specified CFH and gas pressure at full flow. Refer to unit nameplate or unit specification sheets for specified CFH and gas pressure.

NOTICE: A manual emergency fuel shut off valve is required to be installed in a location which is accessible to personnel in case of a fire or explosion at the equipment. This is the responsibility of the installing contractor.

Care must be taken with the gas piping to prevent problems at start-up and later during operation. Before the union between the supply line and the unit is connected, the supply line should be cleaned out to remove any foreign material (dirt, rust, metal shavings, etc.) and a drip leg should be utilized.

GAS PIPING Contd.

Refer to unit nameplate to determine the minimum gas supply pressure required to attain the maximum specified gas capacity.

All suitable gas controls, regulators and valves (equipped with a diaphragm) in this unit are furnished with an ANSI approved vent limiter. If local codes require these components be vented to the outside, it is the responsibility of the installing contractor.

> CAUTION: The heater and its individual shut off valve must be disconnected from the gas supply piping system during any pressure testing in excess of ½ PSIG.
>
> CAUTION: The heater must be isolated from the gas supply piping system by closing its individual shut off valve during any pressure testing of the supply system at pressures equal to or less the ½ PSIG.

During start-up, the technician should perform a gas leak check on all components and piping during the heater's normal operation. (See page 34)

DUCTWORK

Ductwork must be sized and installed in accordance with applicable codes and standards. As a recommendation follow SMACNA guides for proper ductwork design, size and installation. A size variation may exist from recommended duct size to unit or accessory flange size. Accessories on the unit intake or discharge may be larger than the openings on the unit. Be sure to check the unit submittal drawing for the correct equipment connection size. Recommended duct size applies to the size of the duct at the connection to the equipment. Factory also recommends 2 1/2 times the equivalent duct diameters of straight ductwork off the discharge outlet of the blower. A properly designed duct transition from the blower outlet to a larger duct is recommended for long ducts or ducts with numerous elbows. The unit was designed for a specific CFM and ESP (External Static Pressure) stated on unit rating plate. The ductwork attached to the unit will significantly affect its performance.

> NOTICE: When the heater is operated as a process air heater with airborne particulate matter in a recirculation mode, filters must be installed in the return air duct. The particulate removal filters shall be approved by the authority having jurisdiction. The return air duct system must also have doors/ access panels for inspection and cleaning. The filters and duct require periodic inspection and cleaning.
>
> NOTICE: The duct to a process air heater which will allow recirculation must be designed to prevent recirculation of insufficiently diluted products of combustion. A minimum amount of ventilation air must be supplied to exceed 200 CFM per 1000 CFH of natural gas based on maximum capacity of the heater plus an allowance to sufficiently dilute the VOC's created by the process to maintain the lower explosive level (LEL) below a 25 percent threshold value.

On heaters mounted outdoors, discharge ductwork should be insulated to minimize condensation during the "off" cycle in cold weather. A fresh air intake hood with bird screen is required. Discharge ductwork on a twin blower unit must be common to both blowers.

On a heater mounted indoors with through the roof intake, a "mushroom" type intake hood is recommended to prevent moisture entrainment. When using "through the wall" intake duct, the intake louver should have adequate moisture baffling characteristics. All intake ductwork exposed to

the heated space should be insulated. Also any ductwork passing through unconditioned spaces must be insulated and covered with a vapor barrier.

Factory not responsible for field retro fits due to difference of the actual ESP from the designed ESP.

SOUND AND VIBRATION CONTROL

Use of flex coupler between building ductwork and air makeup unit is highly recommended. Vibration isolators that mount between the unit and support structure are optional and can be supplied with the equipment for installation by others. Another option is internal isolation of the blower/motor assembly with internal flexible connections between the blower housing and the unit structure.

Appropriate insulation on the interior of ductwork significantly reduces sound levels.

DISCHARGE TEMPERATURE SENSOR BULB INSTALLATION & WIRING

The installing contractor may be responsible for field installation of the discharge temperature sensor. Field installation of the discharge temperature sensor in the discharge ductwork results in a better measurement of the average supply air temperature. For paint booth applications, the sensor should typically be located as close to the booth's supply air plenum as possible. ***Utilize shielded cable for field installed discharge sensor wiring***.

FIELD WIRING

Power supply wiring should be routed from a dedicated branch circuit per schematic. Depending upon how the equipment was ordered, a single point power connection may be subdivided to individual loads or multiple power supply circuits may be required.

If an intake or discharge damper was ordered as a loose accessory, it will have to be mounted as specified in the Damper Installation Instructions found on page 24 and the actuator must be wired. The remote panel must be mounted in a convenient location and wired to the unit. Interlocks between the exhaust, unit and possibly spray booth will have to be connected by field wiring.

Carefully review the schematic and associated schematic symbol legend. Note that legend may be on the parts/legend sheet rather than on the schematic.

Many codes require that low voltage wiring be routed in separate conduit from line voltage wiring. If low voltage wiring is routed with 120 VAC control voltage wiring, it must be placed in shielded cable(s) with appropriate insulation rating. Even if low voltage wiring is routed in separate conduit, very low voltage sensor outputs and actuator control signals should be routed in shielded cable.

NOTICE: All field wiring must conform to N.E.C. and/or any state or local codes.

POST INSTALLATION

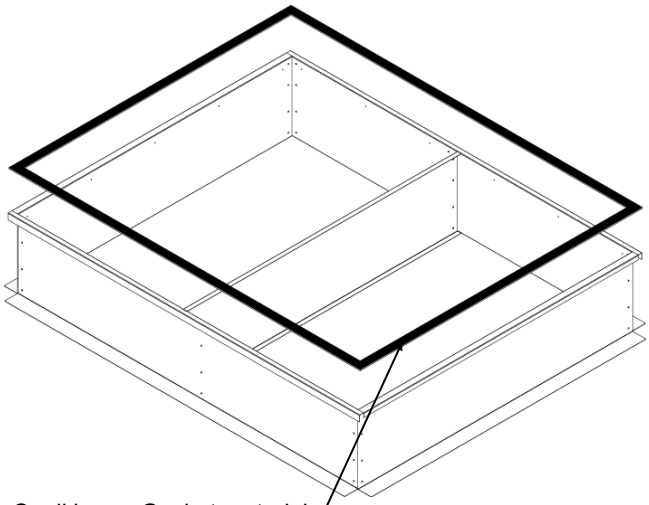
Sealing integrity should be rechecked on a yearly basis. Most of the unit will likely be under a negative pressure when the blower is operating. Dirt and moisture can be drawn into the unit. Check for water in outdoor units after operation during a rain shower. *Water damaged parts are not covered by Col-Met's warranty.*

Horizontal Unit-Supporting Options

Curb

Curbs are to be assembled in the field.

Assemble according to the letters marked on the top of each curb piece using factory supplied fasteners.

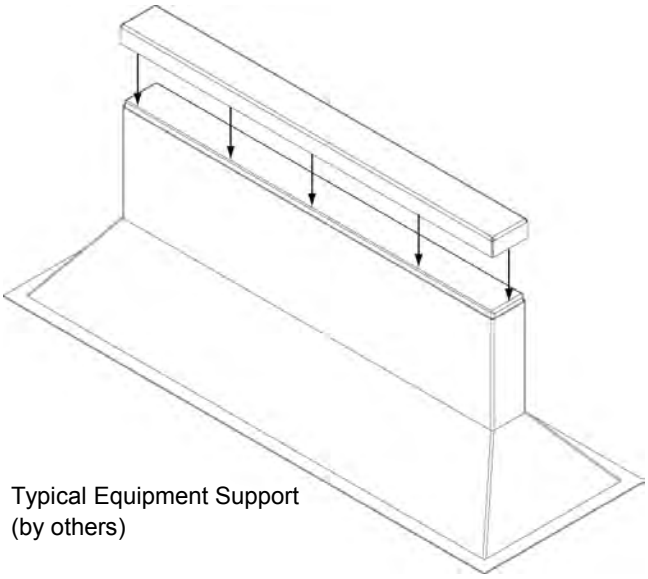


Caulking or Gasket material
(supplied by others)

Accessory-

Horizontal Unit Supporting Options

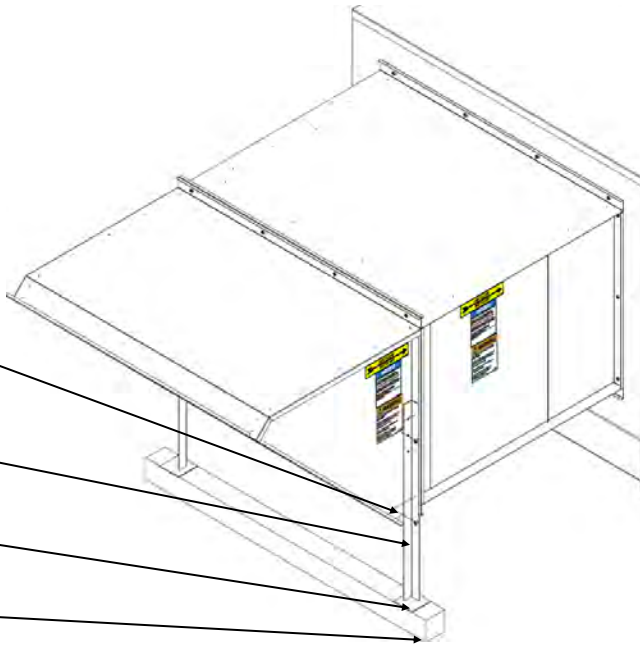
Recommended option for supporting accessories on a flat roof:



Typical Equipment Support
(by others)

Other method of installation using sheet metal support legs.

IMPORTANT: Not recommended for any unit larger than 125 model.



Attach support brace to accessory seam using field supplied fasteners.

Bent, 16 gauge (if supplied by factory), sheet metal support brace.

6 X 6 inch sheet metal pad welded to the support brace (if supplied by factory)

Wood Block (supplied by others)

SECTIONS

Horizontal Unit

Before beginning:

Be sure to check the tightness of all bolts, nuts and setscrews, which could have loosened during shipping.

Rotate blower fan shaft(s) by hand to make certain there is no interference or rubbing between components.

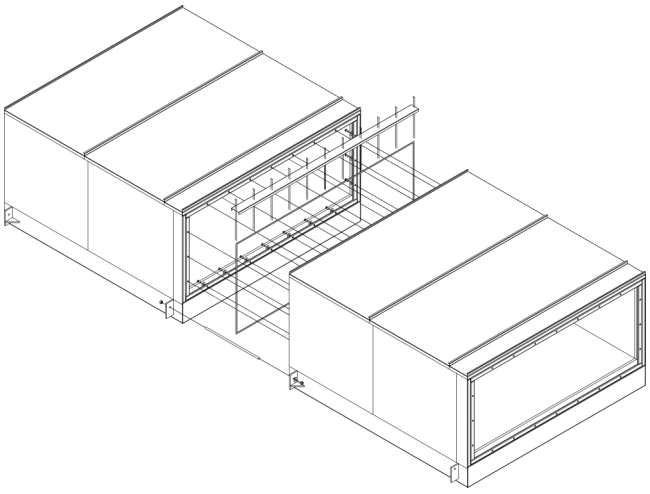
Verify installation surface is level before proceeding with unit installation.

Locate mounting hardware:

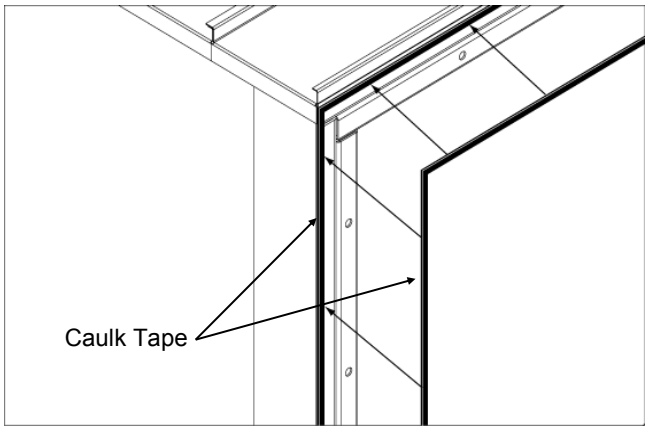
Items included: Caulk, Caulk Tape, Fasteners

Check all sections, of the unit, thoroughly for assembly hardware. The assembly hardware will be found packaged in either a clear plastic bag or corrugated box.

NOTICE: There may be more than one package of assembly materials provided.

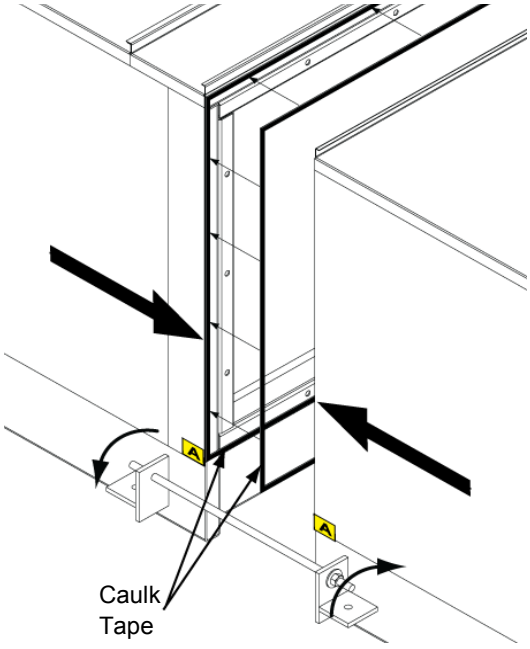


1. Apply provided caulk tape to the face of the joint to be bolted together, on one side only as shown below, before assembly. Ensure there are no gaps in the caulk tape when applying. **Do not** cover bolt holes with caulk tape.

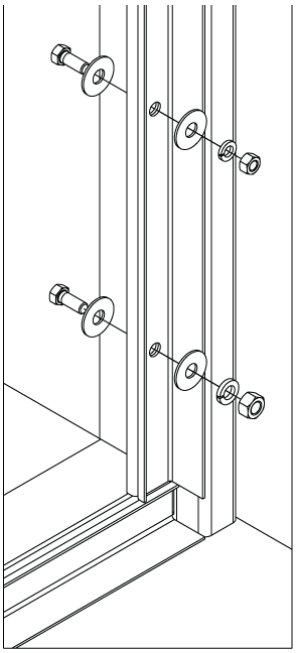


2. Locate and match each section letter on the service side of the unit with the corresponding letter on the other section. In addition, also refer to the unit submittal drawing for proper assembly order.

3. Pull sections together at the lifting lugs using, two, half inch rods w/ nuts and large washers as shown below.



4. Use the provided fasteners to secure the seam at the top and bottom before setting the next section into place.



IMPORTANT:
Use all of the bolt holes in the seam for joining the unit sections together and then tighten accordingly.

Trim off the excess caulk tape squeezed out of the joint at each unit joint to provide a clean appearance.

5. After all of the sections are bolted together, caulk the external section seam(s) to provide a water tight seal.

IMPORTANT: Check all external sheet metal seams for caulk shrinkage and re-caulk if necessary. *Col-Met. does not warranty water damage units.* Unit seam sealing integrity should be rechecked on a yearly basis.

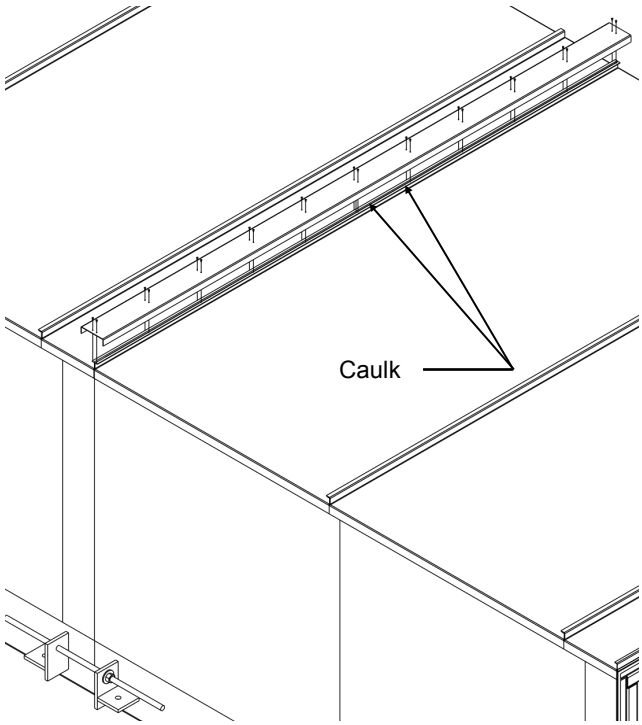
NOTICE: Access door swings MUST be kept free of installation piping and wiring to allow for service and maintenance.

8. Roof Cap Installation

Apply caulk to section roof tee before placing on the splice cap.

Fasten splice cap to roof tee using the provided self tapping screws from the top.

Caulk around all edges of the splice cap.



Vertical Unit

Before beginning:

Be sure to check the tightness of all bolts, nuts and setscrews, which could have loosened during shipping.

Rotate blower fan shafts by hand to make certain there is no interference or rubbing between components.

Verify installation surface is level before proceeding with unit installation.

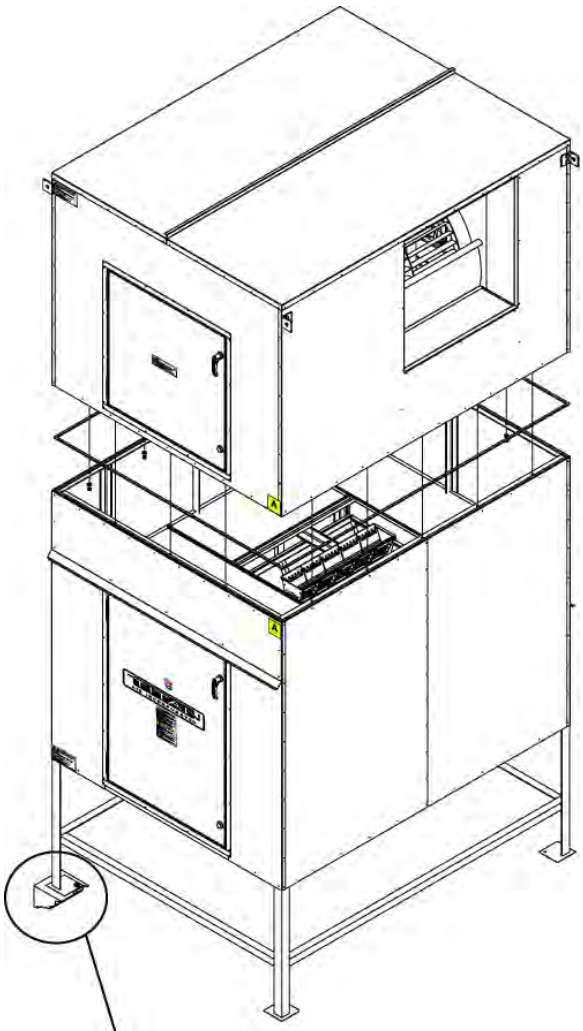
Locate mounting hardware:

Items included: Caulk, Caulk Tape, Fasteners

Field Supplied Hardware: Anchoring studs along with nuts and washers

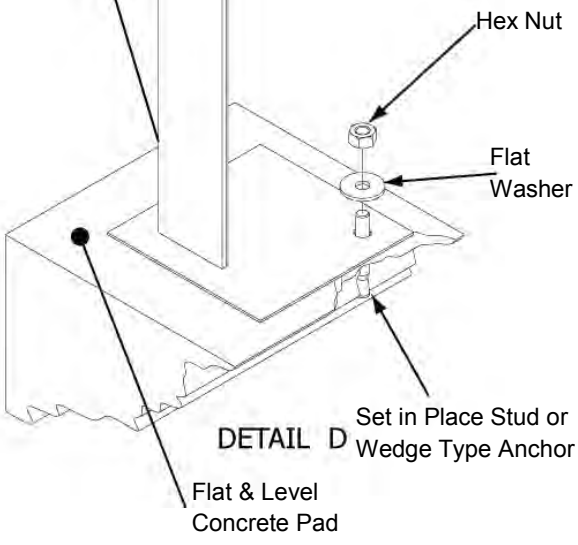
Check all sections, of the unit, thoroughly for assembly hardware. The assembly hardware will be found packaged in either a clear plastic bag or corrugated box.

NOTICE: There may be more than one package of assembly materials provided.

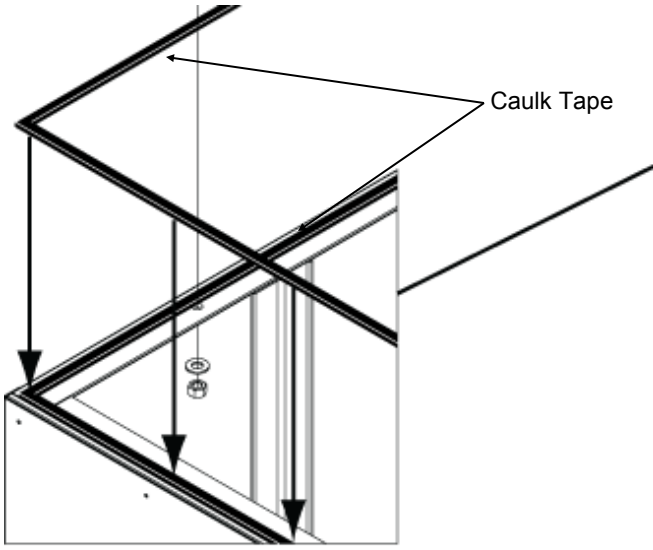


1. Anchor the stand on a level concrete pad using studs or by other means. Each stand foot pad needs to be secured.

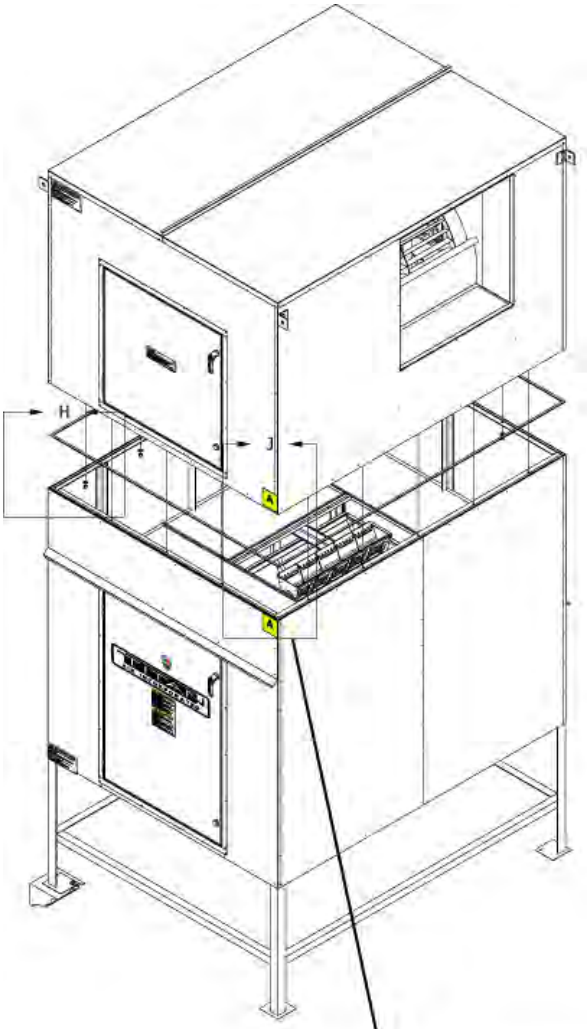
NOTICE: For indoor units, the stand must be enclosed (sometimes height is increased.) A transition (by others) must be made from enclosed stand intake opening to the intake damper or louver (a size variation may exist.)



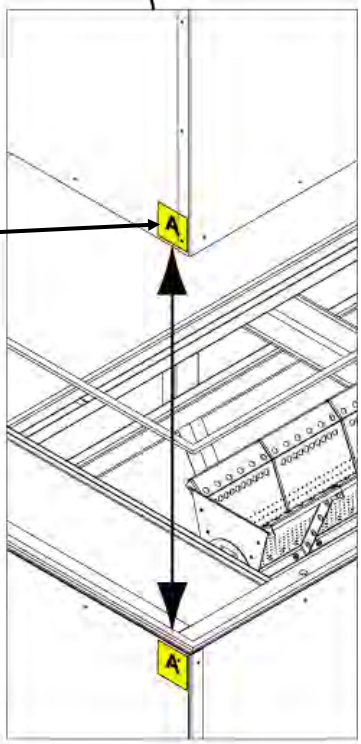
2. Apply provided caulk tape to one side of the joint to be assembled. Apply tape toward the outside of the bolt pattern as seen below. Ensure there are no gaps in the caulk tape when applying. **Do not** cover the bolt holes with caulk tape.



DETAIL H



3. Locate and match each section letter on the service side of the unit with the corresponding letter on the other section. In addition, also refer to the unit submittal drawing for proper assembly order.

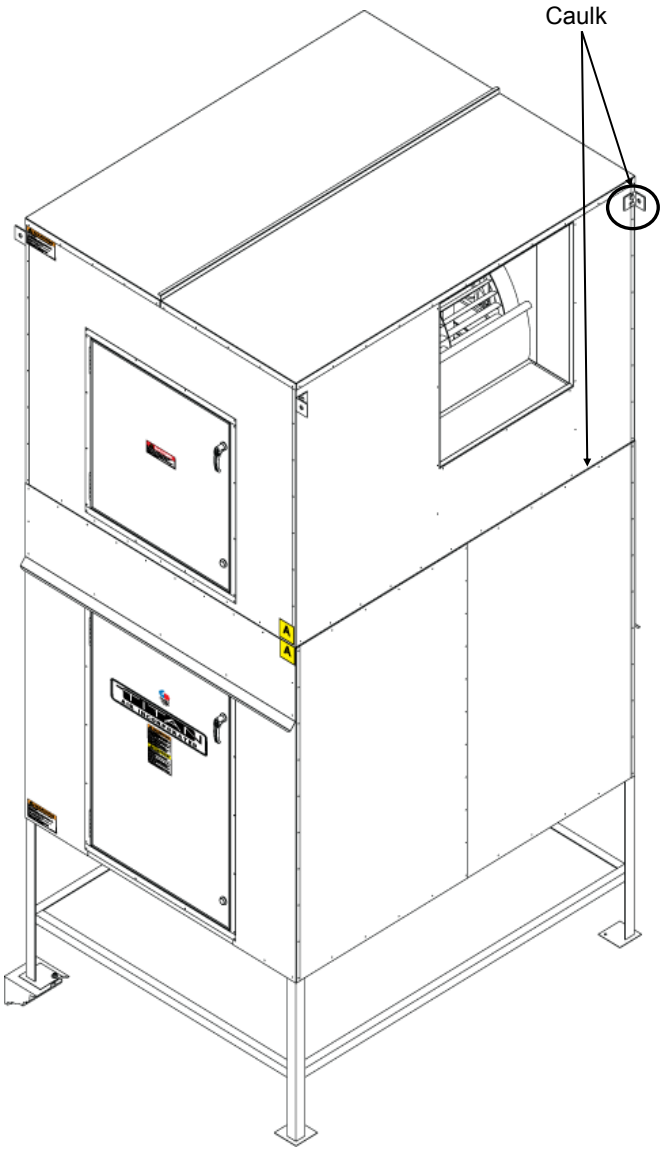


DETAIL J

4. Lift blower section and center it over burner section with the unit section letters lined up. After blower section is set in place use drift punches to line up seam bolt patterns. Fasten sections together using the provided bolts, nuts and washers filling all of the seam holes.

5. Caulk around the outside of each section seam.

IMPORTANT: Re-caulk unit lifting lugs after assembly. Check all external sheet metal seams for caulk shrinkage and re-caulk if necessary. *Col-Met. does not warranty water damage units.* Unit seam sealing integrity should be rechecked on a yearly basis.

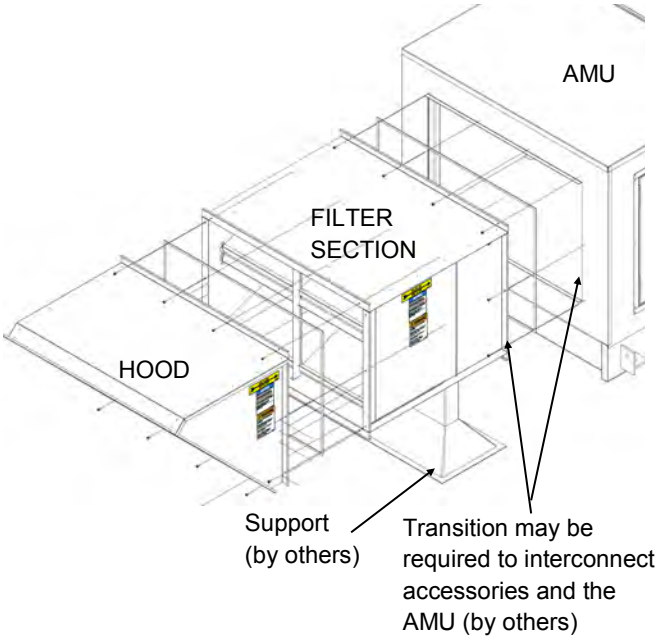


Accessory Installation

NOTICE: Unit accessories may be larger than unit intake and discharge opening or flanges. Due to infinite installation possibilities, a section of ductwork or transition may be required for proper accessory mounting (by others).

IMPORTANT: Installer **MUST SUPPORT** accessory items from a rigid point or points to ensure solid mounting using field or factory supplied hardware.

DESIGN CONSIDERATION: Col -Met strongly recommends using a flex coupler between the AMU and Ductwork.



Refer to Field Wiring section, under the installation section, for instructions on wiring the damper actuators.

Design Requirement: If intake accessories are supplied by others, the design shall minimize entry of snow/ rain and include an intake screen to meet ANSI standards.

Accessories on large equipment may be shipped in two pieces for field assembly. As a result, two damper actuators may need to be field wired.

Horizontal Unit

Before beginning:

Verify with roofing manufacture the method of installation preferred for supporting accessories (Rooftop Units Only).

Locate assembly supplies:

Items included: Caulk, Support Brackets (optional)

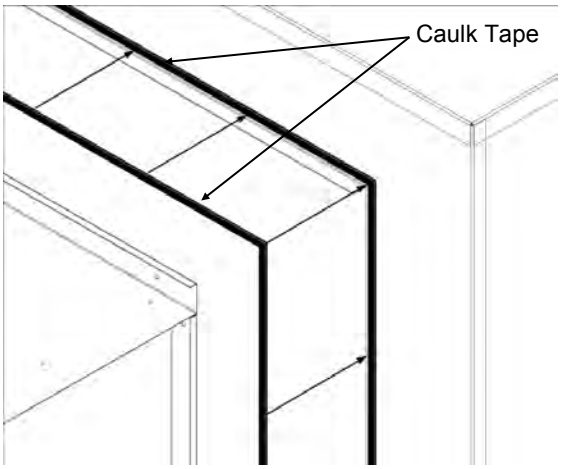
Field supplied hardware:

Caulk, Caulk Tape, Fasteners (Self tapping screws and ¼ inch bolts/ nuts/ washers)

1. Match serial number on the accessory to unit name plate inside control vestibule door.

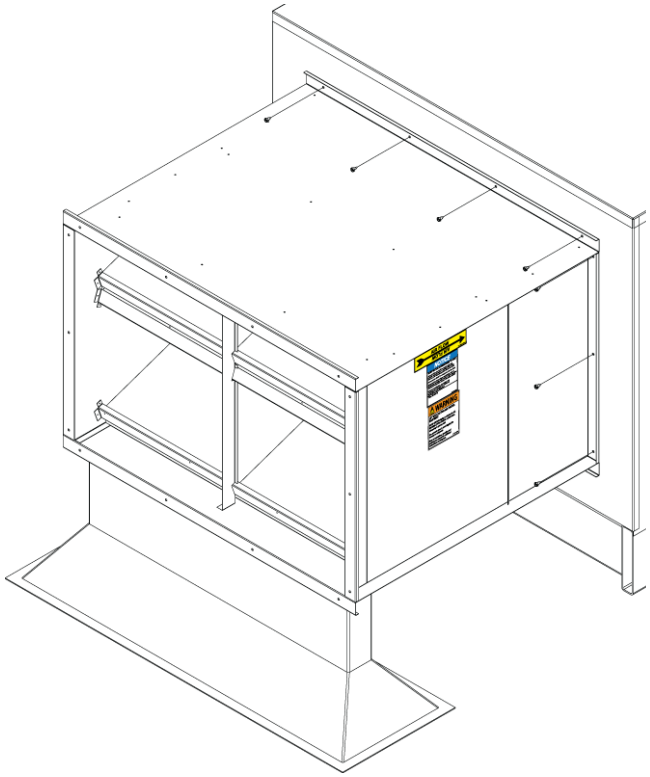
2. Check unit submittal drawings to verify if unit accessories need a transition to match up with the air handler unit intake or discharge opening.

3. Apply caulk tape (field supplied) directly to the flange, below the screw pattern of the joint to be fastened together.

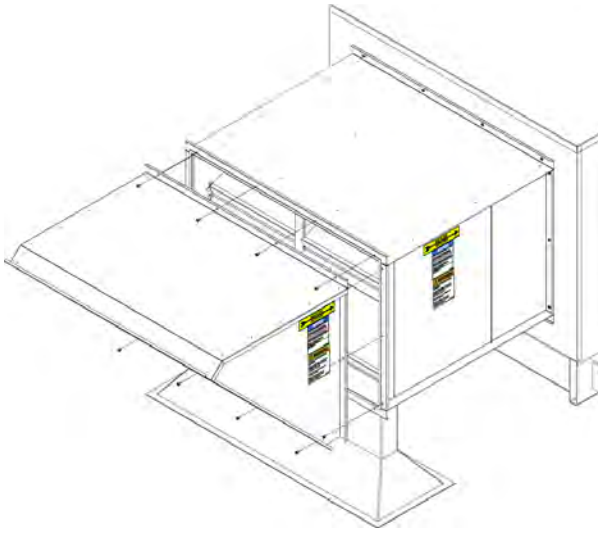


4. Hoist accessory using all lifting lugs, if provided; otherwise, a sling, to lift accessory and center it over the panel opening.

5. Affix the accessory to the unit using (field supplied) self tapping screws. Make certain every pre-punched hole in the flange is used in fastening.



6. Repeat steps three through five to attach the hood to the filter section; *except in step five substitute ¼ inch bolts in for self taping screws to attach the hood to the filter section.*

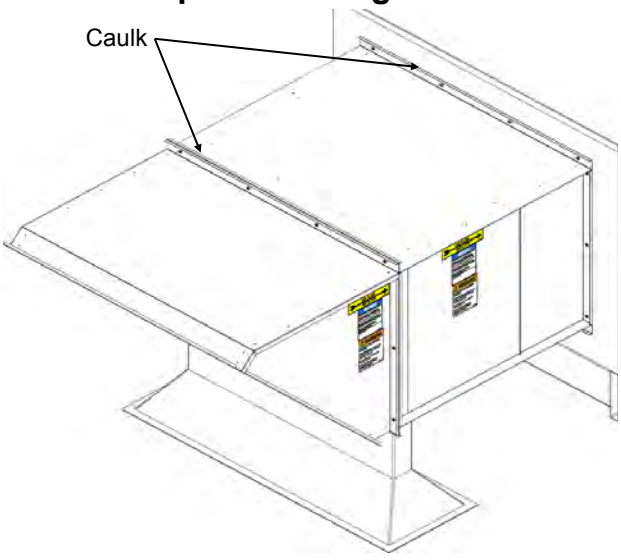


7. After all of the accessories are installed, caulk each seam to provide a water tight seal.

IMPORTANT: Re-caulk accessory lifting lugs after assembly (if applicable). Check all external sheet metal seams for caulk shrinkage and re-caulk if necessary. *Col-Met. does not warranty water damage units*. Seam sealing integrity should be rechecked on a yearly basis.

NOTICE: Access door swings MUST be kept free of installation piping and wiring to allow for service and maintenance.

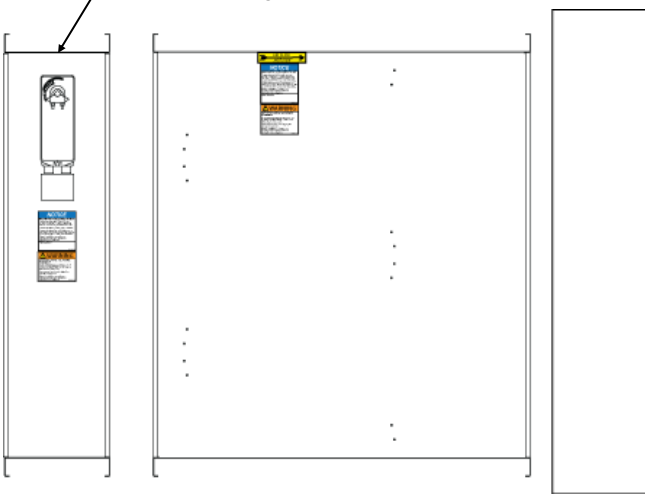
Intake Damper Mounting



Follow the Horizontal Accessory Installation instructions for proper installation and the diagrams below for mounting location of the intake damper.

Indoor Installation Location:

IMPORTANT: Intake damper should be mounted at the building wall or ceiling.



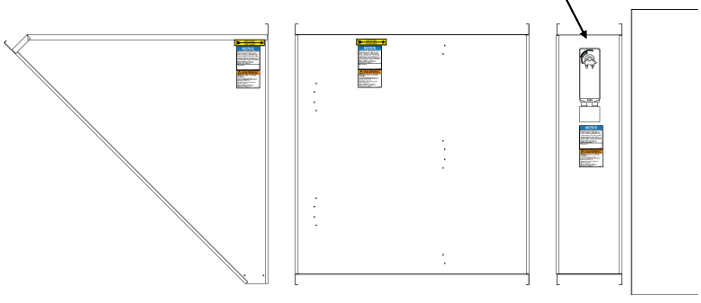
INTAKE DAMPE

FILTER RACK (SIDE VIEW)

UNIT

Outdoor Installation Location:

IMPORTANT: Col-Met recommends the intake damper be mounted with the damper actuator facing the service side of the unit. Make certain the damper actuator is PROTECTED from the outdoor elements with a sheet metal cover.



HOOD

FILTER RACK

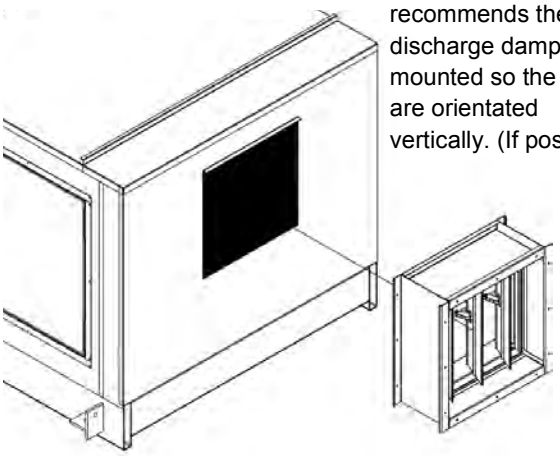
INTAKE DAMPER

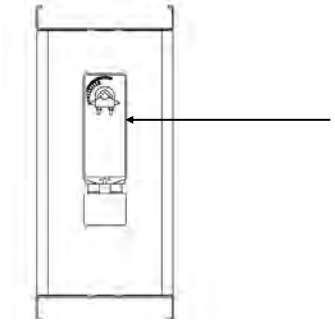
UNIT

Discharge Damper Mounting

Follow the Horizontal Accessory Installation instructions for proper installation and the diagram below for mounting location of the discharge damper.

NOTICE: If the Discharge Damper is being mounted within two to three duct diameters from the unit discharge opening Col-Met highly recommends the discharge damper be mounted so the blades are orientated vertically. (If possible)





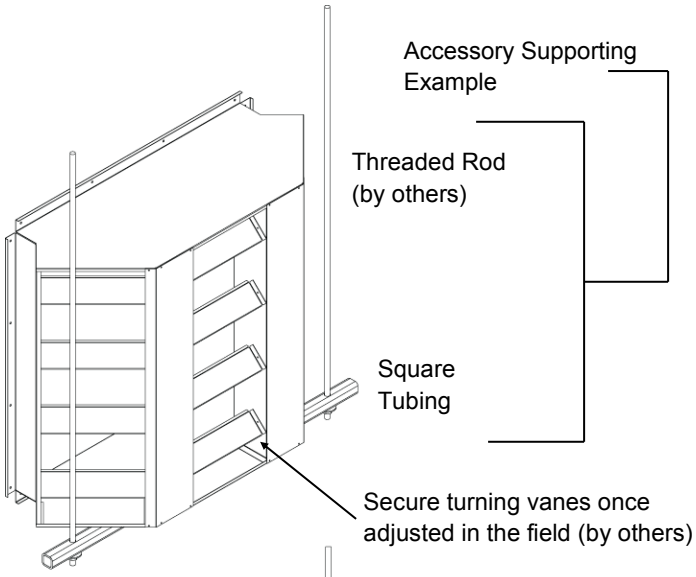
BOTTOM VIEW

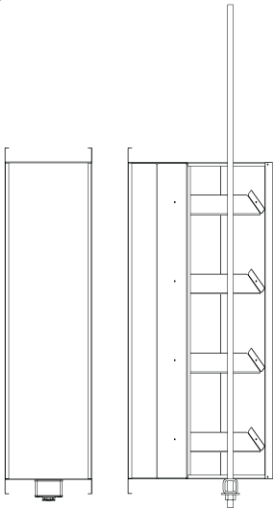
IMPORTANT: Col-Met also highly recommends the discharge damper be mounted at the wall or ceiling indoors. However, if the damper cannot be mounted indoors the damper actuator MUST BE PROTECTED from the outdoor elements (if applicable).

Vertical Unit Discharge Diffuser Mounting and Supporting

Ductwork between AMU and diffuser or discharge damper and diffuser is supplied by others.

Support diffuser at two points using field supplied materials (See example below).





Mount discharge diffuser after discharge damper (if applicable).

GENERAL MAINTENANCE

As with any equipment or machinery, a maintenance program should be implemented.

Equipment maintenance should include the following:

1. Check filters and clean or replace as needed.
2. Check burner and flame rod - clean if necessary.
3. Check belts, belt tension and sheave alignment. (Do not over tension.)
4. Confirm smooth operation of dampers.
5. Lube bearings.
6. Check all hardware (bearings, etc.) for tightness.
7. Check settings for all controls.
8. Check duct connections for leaks.
9. Re-caulk seams if needed.
10. Perform complete start-up procedure once per year (prior to heating season).

FILTERS

Dirty or clogged filters will restrict air flow which in turn affects the equipment performance. Therefore, it is necessary to check filters on a regular basis. Several standard filter types are available including 2" pleated 30% efficient, 2" disposable fiberglass, 2" linked panel, and 1" or 2" cleanable filters.

Cleanable filters should be removed from the filter rack and sprayed with a low pressure water. Always spray these filters in the opposite direction to air flow and apply new coating to filters when dry.

Note that cleanable filters alone may not adequately protect a coil from dust and dirt accumulation.

Filters in an unheated outdoor airstream can “freeze-up” when the humidity is high (foggy) and temperatures are near freezing.

Method of Prevention:

Install pre-filters in the outdoor airstream that can be removed during such weather.

BURNER

NOTICE: *Vertical Unit Burner Access*: Filter rack can be slid out through the unit door to allow access to the backside of the burner.

Maintaining the pilot assembly is essential to reliable operation. During pre-heating season maintenance, the burner should be lit numerous times to confirm reliability. If ignition system components require servicing, pay attention to the following:

1. Handle porcelain spark rod and flame rod with care. Small cracks lead to intermittent ignition problems.
2. Midco burners utilize the pilot gas tube as a ground point for the ignition rod. Keep this grounding point free from scale or other contaminant build-up.
3. Ignition wire routing should remain separated from sheet metal cabinet to maintain optimal spark strength.
4. Dielectric grease is utilized inside of the ignition and flame sensor connection boots to limit potential for moisture in the connection.
5. Maintaining low pilot regulator output pressure typically produces reliable ignition. Excess pilot pressure creates a gas rich region that will not ignite consistently.
6. The pilot solenoid is disabled following main flame ignition. The low fire setting must be high enough to maintain a proper amplified flame rectification signal.

Check that burner baffles are firmly attached to each other and to burner casting. Do not use excessive force on screws in casting. Clean baffles with wire brush if needed.

Burner orifices may need to be re-drilled due to rust or other build-up. Burners with aluminum castings will rarely require orifice cleaning. Use drill bit sizes listed below.

Fuel Type	Burner Model	Orifice Size
Natural Gas	Eclipse AH-MA	2.4 mm Bit
Natural Gas	Midco HMA-2 or 2A	1/8” Bit
LP Gas	Eclipse AH-MA	2.0 mm Bit
LP Gas	Midco HMA-2 or 2A	1/8” Bit
Low Fire Air Ports	Midco HMA-2 or 2A	#43 Bit

GENERAL V-BELT DRIVE TIPS

- Keep the belts and sheaves free from foreign materials that may cause slippage or damage to the belt and sheave surfaces.
- Maintain sheave alignment.
- Inspect the V-belt drive periodically. Re-tension the drive belts if they are slipping.
    - ♦ NOTE: Optimal belt tension is the lowest tension at which the belts will not slip under peak load. Peak load typically occurs at start-up.
- Over tensioning belts can cause premature bearing, sheave and belt failure.
- Particular attention should be given to these conditions:
    - Worn groove sidewalls
    - Shiny sheave groove bottom
    - Wobbling sheaves
    - Damaged sheaves

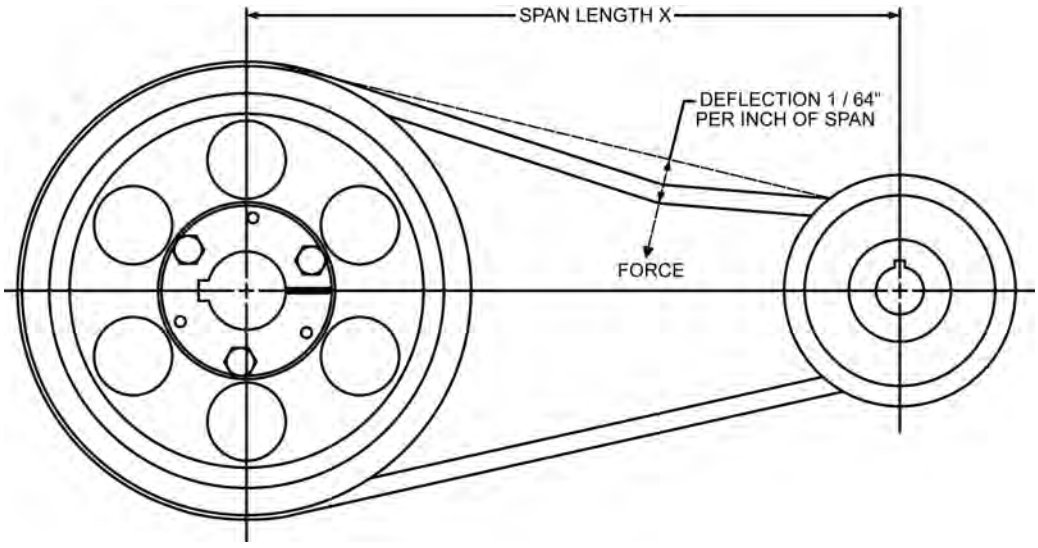
BELT TENSION

Proper sheave alignment and belt tension are critical to belt and bearing service life. Incorrect belt tension or misalignment of sheaves can cause any of the following:

- Premature failure of bearings.
- Premature failure of belts.
- Reduced air volume.
- Noise and vibrations.

Each Col-Met unit has as standard equipment an adjustable motor base. To adjust the belt tension, loosen the motor hold down bolts and adjust the slide base with adjusting bolt(s) on the end of the base (larger bases will have 2 adjustment bolts). Use a belt tension tester and associated tables to determine proper tension. Re-tension after the first day of operation with new belts and periodically thereafter.

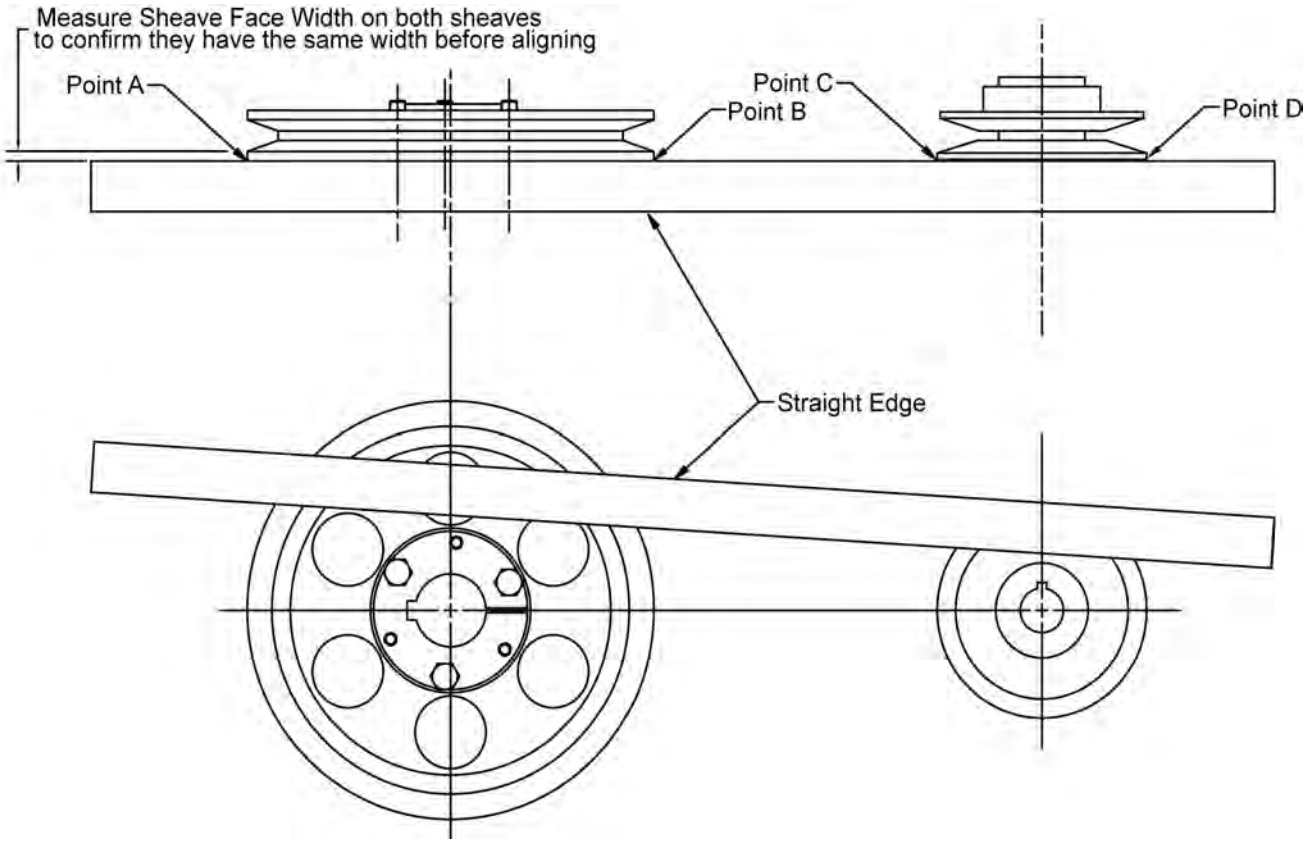
Common belt tension gauges will specify a force required to produce a deflection of 1/64” per inch of span. The force required to achieve this deflection is typically in the range of 3 lbs for A-belts, 5 lbs. for B-belts, and 15 lbs. for 5V belts. See Figure below.



SHEAVE ALIGNMENT

With the use of a straight edge, sheave alignment can be checked quickly and accurately. One of the sheaves will have to be loose on its shaft in order to make adjustment. Adjust until all 4 points are in contact with the straight edge (see Figure below). Repeat on the other side of sheaves and then re-tighten.

If a face width variation exists, measure the difference between each side of the narrowest sheave and adjust until both sides are an equal distance from the straight edge.



BELT REPLACEMENT CONSIDERATIONS

IMPORTANT: **Do not** force belts onto sheaves by using a pry bar or by rolling the sheaves.

NOTICE: Match the size of the new belts to existing ones, except if the sheave groove size was adjusted. Replace drive belts in complete sets. Purchase set of belts from the same manufacture.

BLOWER BEARINGS

Bearings must be checked during each periodic maintenance inspection. Bolts and set screws should be checked for tightness and the bearings may need lubrication.

Bearing Lubricate: Any good quality lithium or lithium complex base grease using mineral oil conforming to NLGI grade 2 consistency and an oil viscosity of 455-1135 SUS at 100˚F (100-250 cSt at 40˚C) may be used for re-lubrication.(Only applicable if unit blower bearings are Browning AH (Air Handler))

IMPORTANT: The following table is intended only as a guide to aid you in setting up your own schedule.

LUBRICATION GUIDE FOR BLOWER BEARINGS

Operating Conditions	*Bearing Temp. (˚F)*	*Grease Interval*
Clean	**32 – 120**	**6 – 10 ,months**
	120 – 150	**1 – 3 months**
	150 – 200	**1 – 4 weeks**
Dirty	**32 – 150**	**1 – 4 weeks**
	150 – 200	**Daily – 1 week**
Moisture	**32 - 200**	**Daily – 1 week**

MOTOR BEARINGS

Motor bearings in a clean environment should be lubricated every 2 to 3 years. Under more severe conditions of dirt or moisture, lubrication may be required every 6 months to 1 year.

Typical motor bearing lubrication procedure follows:

1. Remove fill and drain plugs.
2. Clean drain port of hard grease (with wire if necessary).
3. Add grease (cavity should be no more than ½ full.).
4. Start motor and let run for 10 minutes.
5. Wipe off any drained grease and replace fill and drain plugs.

IMPORTANT: Avoid adding an excessive amount of grease since this a common cause of motor failure.

BLOWER WHEEL

Ensure that blower hub is securely fastened to shaft. Inspect blower wheel and blades for signs of damage or cracks. Clean blades if necessary to maintain proper balance and performance. Avoid use of excessive grease on blower bearings that can coat fan blades and attract dirt.

FIREYE MICRO M SERIES LED INDICATING LIGHTS – STANDARD OPERATION

- Operating Control - Energized whenever the burner control switch is on and power is applied to terminal #7 in the flame safeguard.
- Interlock - Illuminated solid when power is applied on terminal # 6 in the flame safeguard to indicate that the air flow switch and other control & limit switches are closed. This light flashes once per second if the user has selected the fan-only mode (summer) or if an airflow switch or other safety circuit switch is open.
- PTFI - Illuminated only during the pilot trial for ignition period.
- Flame - Illuminated when flame signal is detected.
- Alarm - LED will flash once per second when an alarm condition is detected.

Symbol Legend					
Flashing Light		Solid Light		Light Off	

Lockout Description	OPR CNTL	INTRLK	PTFI	FLAME	ALARM
Line Frequency Noise Detected	●	○	○	●	☀
Flame Fail – PTFI	○	●	●	●	☀
Fault Unknown	●	●	●	●	☀
Amplifier High Count Fail	○	○	○	○	☀
Flame Fail – MTFI	○	○	●	●	☀
False Flame – Standby	○	●	○	○	☀
Interlock Open	●	●	●	○	☀
Interlock Closed	○	●	●	○	☀
Chassis Opto	●	●	○	●	☀
Flame Fail – Auto	○	●	○	●	☀
Check Chassis	○	○	○	●	☀
Check Programmer	○	○	●	○	☀
Amplifier Auto Check Fail	●	○	●	○	☀
Check Blown Fuse	●	○	●	●	☀
Check Sensor	●	●	○	○	☀

FIREYE MICRO M SERIES LED INDICATING LIGHTS – ALARM MODE

Line Frequency Noise Detected - At start up, the MICRO M measures the AC line to determine if the input is 50 Hz or 60 Hz and set its flag accordingly. As the system is running, line frequency is constantly monitored. Outside interference causing a momentary shift in line frequency could be from SCR controls, VFD's, etc.

Flame Fail - PTFI - No flame signal present at the end of pilot trial for ignition period.

Fault Unknown - A catch all message when, under certain high noise conditions, the lockout message may become garbled and not translatable into any existing message

Amplifier Count Fail - A message used to detect a failed amplifier module that would generate an inordinate amount of pulses to micro computer, usually due to a shorted transistor or oscillating electronic filter.

Flame Fail - MTFI - No flame signal present during main burner trial for ignition period.

Flame Fail - Standby - Flame signal present, for a constant 60 seconds, while control is in standby or off condition.

Interlock Open - Interlock safety circuit (terminal #6) has been detected open for longer than ten minutes during the purge cycle or during main flame period on MEP 562.

Interlock Closed - If selected by dip switches, air flow or interlock switch (terminal #6) is closed 30 seconds after the start of a cycle or when terminal #7 is closed. Col-Met does not use this function.

Chassis Opto - Opto coupler located on chassis has been found to be defective. Opto couplers are checked every 1/2 cycle of the AC main(s) to ensure they are off during the negative 1/2 cycle.

Flame Fail Auto - If dip switches selected for non-recycle, no flame is detected during the run cycle or main flame period.

Check Chassis - At beginning of cycle terminal #5 is energized.

Check Programmer - At beginning of cycle terminal #3 is energized or an internal diagnostics test for the Micro controller has failed.

Check Amplifier - Diagnostic problem with amplifier has been found.

Amplifier Auto Check - The amplifier is checked every 8 seconds by the micro computer to assure it is responding properly.

Check Blown Fuse - At the end of pilot try for ignition, no flame is detected and no power is present on terminal #3, indicating the fuse, located on chassis, is blown.

Check Scanner - The UV self check scanner (UV equipped units only) is producing flame pulses during the shutter closed period due to a malfunctioning shutter or a run-away UV tube.

GENERAL START-UP INFORMATION

Even though Col-Met equipment is tested prior to leaving the factory, a complete field start-up is essential for proper operation of the equipment. Qualified individuals should perform installation, start-up and maintenance tasks.

The factory cannot duplicate the conditions the equipment will see in the actual installation (i.e. gas pressure, static pressure, desired control settings, etc…). For this reason there are field adjustments that have to be made. Performing a complete start-up procedure will help ensure that correct adjustments are made and correct operation is verified. A step-by-step start-up procedure is provided on subsequent pages. While working through the start-up procedure, record information on the start-up checklist and return to Col-Met to validate the equipment warranty. The start-up checklist is provided on cardstock with Col-Met's address pre-printed on one side.

Because most component failures occur during start-up, it is very important that the function of every component be checked out during start-up. It is just as important that the start-up technician realize the malfunction of a component may be caused by other factors (i.e. air flow, gas pressure, field wiring, etc…) and should fully investigate a component malfunction and its cause before replacing the component.

Col-Met checks out all returned components and has found approximately 70% of returned parts are in full operational condition. This history has proven that a little extra time invested in troubleshooting will often save the considerable investment in parts, time, and paperwork associated with replacing components.

SUGGESTED TOOLS AND INSTRUMENTS NEEDED FOR START-UP:

- Volt/Ohm Meter
- Ammeter
- Tachometer (preferably non-contact style)
- Thermometer (preferably digital with remote probes and sufficient lead lengths)
- Gas pressure gauge (-10" to 0 to +10" of water column typical scale)
- Air differential pressure gauge (-2" to 0 to +2" of water column typical scale)
- Standard Hand Tools

Additional items for Maxitrol Series 14 or 44 temperature controls:

- 10,000 Ohm potentiometer
- ½ watt, 10,000 Ohm resistor
- ½ watt, 2,000 Ohm resistor

Additional items for temperature controls using Digital Programmable Controller:

- 1,070 Ohm resistor (supplied)

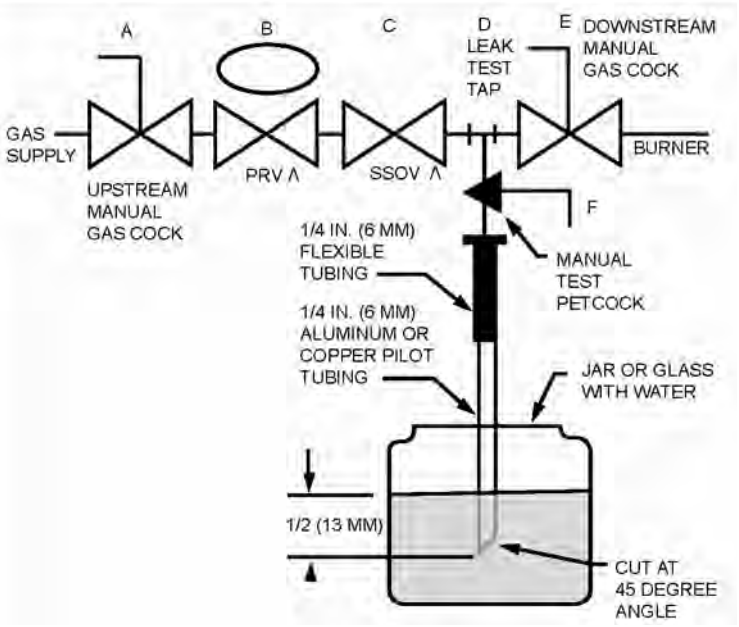
VALVE LEAK TEST

VALVE LEAK TEST

This is a test for checking the closure tightness of the gas safety shutoff valve. It should be performed by trained and experienced technicians. This test should be part of the scheduled inspections and maintenance procedures.

1. Close the upstream manual gas valve.
2. Make sure manual test cock on leak test assembly is closed.
3. Remove the test plug on leaving side of gas valve.
4. Close the downstream manual gas valve.
5. Open the upstream manual gas valve.
6. Through the safety system enable the gas valve momentarily.
7. Immerse a ¼" tube vertically into a jar of water.
8. Slowly open the test cock on the leak assembly.
9. Once the rate of bubbles through the test assembly stabilizes, count the number of bubbles appearing during the ten second time frame. Each bubble is approximately 0.001 cfh.
10. Do this test for each shut off valve.

Reference below leak test assembly and leakage rate chart.



Pipe Size (in)	Medium	Allowable Leakage SCCH	Max. # of Bubbles in 10 Sec.	Min. # of sec. for 10 bubbles
3/8 & 1/2	.64 gas	294	7	13
	1.57 LP	188	4	20.4
3/4 & 1	.64 gas	301	7	12.7
	1.57 LP	192	5	19.9
1-1/4 & 1-1/2	.64 gas	532	13	7.2
	1.57 LP	341	8	11.2
2	.64 gas	578	15	6.6
	1.57 LP	370	9	10.3
1-1/2	.64 gas	752	19	5.1
	1.57 LP	481	12	8
3	.64 gas	925	24	4.1
	1.57 LP	592	15	6.5

UNIT SPECIFICATIONS

Rep Job #	Quote #	Revision	Date	Serial #
	8618	0	08/02/18	17244
Job Name 57899				Tag #

Airhandling Specifications

Model: CT-120 NG HRD H.O.T
CFM: 12600
ESP: 0.5
Function: High Outlet Temperature | HOT
Systems: HOT | 2 Speed Cure
Location: Indoor
Configuration: HRD
Elevation: 0
Winter EAT: 0
TSP: 1.751
Fan Type: FC DWDI
Fan Model: Lau A20-20H
Fan RPM: 737
Fan BHP 8.047

Heat Source

Heating Type: Direct-Fired
Gas Type: NG
Gas Pressure: 2# - 2#
Agency: STD-ANSI
Temp. Rise: 100
BTU Min: 55440
BTU Max: 1386000

Voltage and Supply Motor Specifications

Power Supply: 208/120V, 3PH, 4-Wire
Motor HP: 10
Motor Type: 1750 rpm ODP Premium E
NEC Motor FLA: 30.8
Unit FLA: 55.2

Exhaust Fan Motor VFD Specifications

Power Supply: 208/120V, 3PH, 4-Wire
Motor HP: 1 @ 3 HP
VFD Control: Pressure Control
VFD Location: Mounted in Unit Vestibule

Unit Control Summary

Controls: Multiple Recipe Discharge Control (DDC-HOT)
Remote Panel: Remote Panel | Shipped Loose
Enclosure: NEMA-1
Communication:

Unit Construction

Exterior: G-90
Casing Type: Single Wall Insulated
Insulation: 1" 1.5#
Liner: None
Ins./Liner Loc.: Entire Airstream

Lighting Options

Fixture Qty: 10
Lighting Type: 120V Four Bulb T-8 (1.08 Amp/Fixture)
Location: Unit Vestibule
Pwr Connection: Single 4-Wire Power Connection for AMU, Exhaust and Lighting

NOTE: Supply/Exhaust Motor Circuits Sub-fused

UNIT SPECIFICATIONS

Rep Job #	Quote #	Revision	Date	Serial #
	8618	0	08/02/18	17244
Job Name 57899				Tag #

Model: CT-120 NG HRD H.O.T

Optional Equipment Included:

- Intake Damper & Actuator*
  - Type: Standard
  - Finish: G-90
- Outside Air V-Bank Filter Section*
  - Filters: 2" Cleanable
  - Finish: G-90

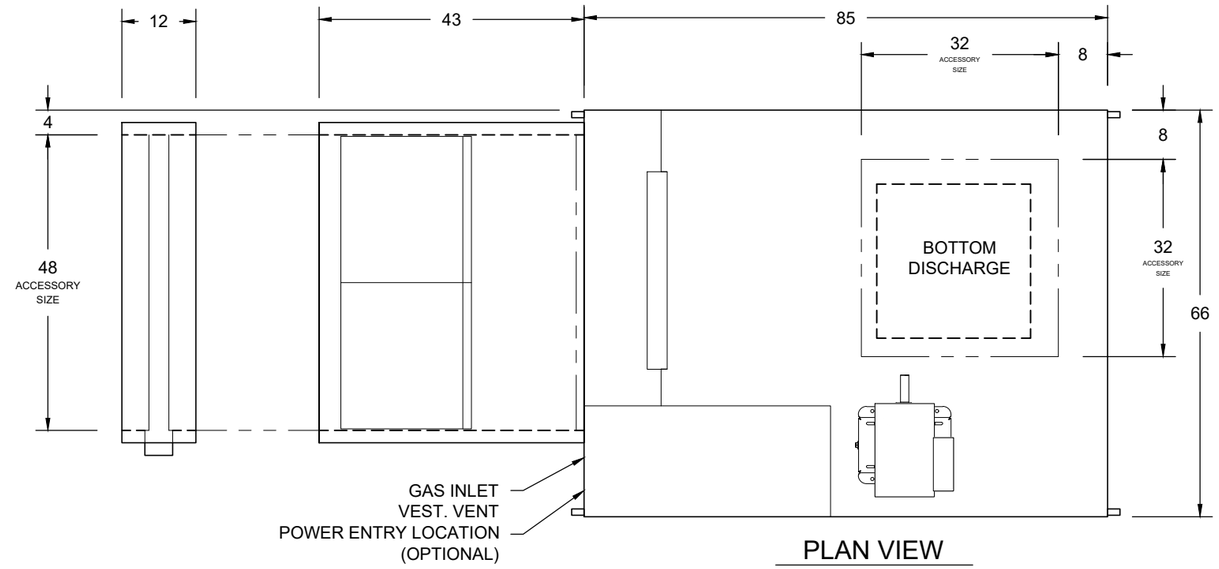
Optional Controls Included:

- ETL Label (ANSI Z83.25 / CSA 3.19)
- HOT Package: Basic | DDC
- Door Interlocked Non-Fused Disconnect
- Low Fire Start
- High Gas Pressure Switch
- Low Temp Safety via DDC
- Audible Alarm
  - DDC Fault
- HOT | 2 Speed Profile Package
- Electronic High Temp. Limit
- Factory Mounted VFD w/ Vent Package
  - VFD Fuses / Circuit Breakers (By Others)
- Light Lens Circuit
- Compressed Air Solenoid Interlock

NOTE: Options Ending With * Are Shipped Loose For Job Site Installation

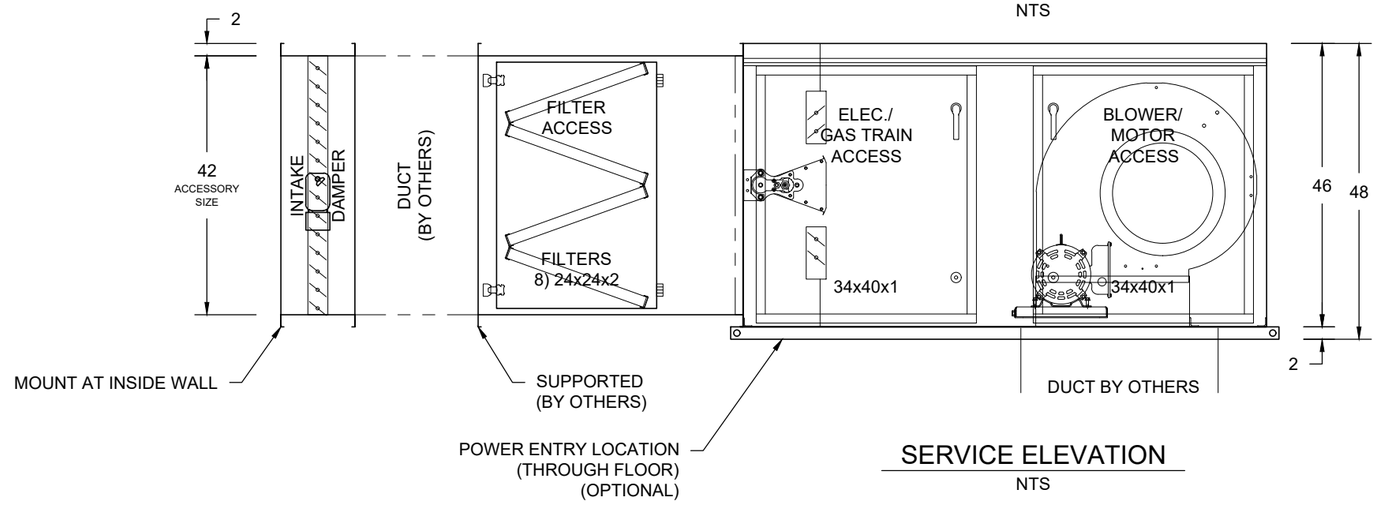
Design Specifications and Exceptions

Shipping to Canada



PLAN VIEW

NTS



SERVICE ELEVATION

NTS

NOTES: ACCESSORIES MAY BE LARGER THAN OPENINGS AND ARE SUPPORTED BY OTHERS

COL-MET Engineered Finishing Solutions	NOTICE: INFORMATION CONTAINED ON THIS DRAWING IS CONFIDENTIAL IN NATURE, IT MAY NOT BE REPRODUCED OR RELEASED WITHOUT PRIOR WRITTEN CONSENT.	QUOTE NUMBER: 8618	DRAWING NAME: DESCRIPTION: CT-120 HRD H.O.T.	JOB NAME:	DRAWN BY: W LARSON	SCALE: NTS	SHEET #: - OF -
		SERIAL NUMBER: 17244		REP. NAME: COL-MET	DRAWN DATE: 8/14/2018	DRAWING NUMBER: 0-00-000-0000	ISSUE #: 00

8/27/2018 10:28:00 AM

SEQUENCE OF OPERATION

TWO SPEED HIGH OUTLET TEMPERATURE (H.O.T.™) AMU w/ c.pCO DISCHARGE TEMP. CONTROL, BOOTH PRESSURE CONTROL & FOUR CURE RECIPES

SUMMER SPRAY MODE:

1. Summer mode selected on first setting screen of quick menu.
2. Start pushbutton pressed enabling start hold relay.
3. Damper (optional discharge or intake) will open.
4. Damper interlock switch closes, energizing the supply and exhaust motor VFDs.
5. Exhaust VFD will be enabled. Supply VFD is enabled as soon as exhaust VFD starts. Exhaust VFD speed will be controlled based on booth pressure. Supply VFD will run to programmed high speed setting. VFD ramp rates and min/max speed in each mode can be adjusted during initial start-up process to minimize pressure fluctuations while VFDs are ramping to desired speed.
6. Supply VFD operating relay (R-13) contact closes to confirm motor operation.
7. Air flow switch (P-1) makes when pressure drop across burner profile is sensed.
8. Burner circuit is not energized in summer-spray mode.

SUMMER CURE MODE:

9. Operator selects desired cure cycle recipe on first setting screen of quick menu. Adjustable flash, cure 1, cure 2 and cool down setpoints have been entered on associated password protected recipe screens (see following pages).
10. With unit operating in summer-spray mode, cure start pushbutton is pressed. *Note that desired recipe must be selected PRIOR to pressing cure start pushbutton*. Once cure mode is initiated, recipe selection changes will be disabled.
11. System will enter a flash mode for set duration. Compressed air solenoid will be disabled. Lighting will be disabled if interlocked through contactor. Customer has option of configuring some lights to remain on during cure cycle. Display will show total cure cycle time remaining, active recipe being followed, and currently active portion of cure cycle. Tech screen setting determines whether burner is enabled in summer flash mode.
12. Once flash time expires, system will switch to low speed operation and cure 1 time cycle will begin. VFD ramp rates and min/max speed in each mode can be adjusted during initial start-up process to minimize pressure fluctuations while VFDs are ramping to desired speed.
13. Burner will be enabled and discharge temp will be controlled at active recipe's cure 1 temp setpoint. All burner limit controls (described in winter-spray mode) will be functional.
14. Once cure 1 time setpoint expires, discharge temperature will be controlled at active recipe's cure 2 temp setpoint.
15. Once cure 2 time setpoint expires, system will enter a cool down cycle for a set duration. Burner will be disabled.
16. Following cool down cycle, system will either shut down or revert to spray mode as selected on password protected technician screen. Optional lighting contactor will be enabled (if optional light switch is on).
17. Interlocks between the unit and booth components (lights, lens switches, door switches, exhaust flow switch, air solenoid, etc.) are by others.

TWO SPEED HIGH OUTLET TEMPERATURE (H.O.T.™) AMU w/ c.pCO DISCHARGE TEMP. CONTROL, BOOTH PRESSURE CONTROL & FOUR CURE RECIPES

WINTER SPRAY MODE:

18. Winter mode selected on first setting screen of quick menu.
19. Start pushbutton pressed enabling start hold relay.
20. Damper (optional intake or discharge) will open.
21. Damper interlock switch closes, energizing the supply and exhaust motor VFDs.
22. Exhaust VFD will be enabled. Supply VFD is enabled as soon as exhaust VFD starts. Exhaust VFD speed will be controlled based on booth pressure. Supply VFD will run to programmed high speed setting. VFD ramp rates and min/max speed in each mode can be adjusted during initial start-up process to minimize pressure fluctuations while VFDs are ramping to desired speed.
23. Supply VFD operating relay (R-13) contact closes to confirm motor operation.
24. R-13 contact closes supplying power to burner circuit.
25. Air flow switch (P-1) makes when pressure drop across burner profile is sensed.
26. Air flow switch (P-1A) will open if air flow goes above design parameters.
27. Low temperature safety function will shut the unit down after 3 minutes of operation with discharge air temperature below associated set point.
28. Burner is always enabled in winter mode if optional outdoor temp sensor is not included (refer to tech screen). Most painters do not want burner to change state in middle of a paint cycle, so standard practice is not to include an OA temp sensor. Otherwise, if optional outdoor temp sensor is included and selected on tech screen, burner is enabled when OA temp drops below OA heat enable setpoint.
29. High temp limit (TL-1) is a normally closed safety switch and trips when temp exceeds its set point (this is a manual reset switch). A secondary high temperature limit function is built into the DDC controller (see following pages).
30. High (P-3) and low (P-2) gas pressure switches (optional) protect against abnormal gas pressure and are manual reset safety switches.
31. Pre-purge (built into FS-1) clears cabinet of combustible gases before ignition.
32. Flame safeguard relay (FS-1) monitors the ignition and burn process. If abnormal conditions exist, the control will shut down the unit. FS-1 is a manual reset control.
33. The blower will run with the burner operating. Discharge temperature is regulated with a discharge sensor (TS-1) and controlled at the active reccipe's spray mode discharge air setpoint. Refer to following pages for setpoint adjustment instructions.
34. When unit is shut off there is a fifteen second post purge. The blower will operate for fifteen seconds after the unit is switched off.

WINTER CURE MODE:

35. Winter cure mode functions like summer cure mode with the exception that the burner will be enabled during flash and cool modes.

TWO SPEED HIGH OUTLET TEMPERATURE (H.O.T.™) AMU w/ c.pCO DISCHARGE TEMP. CONTROL, BOOTH PRESSURE CONTROL & FOUR CURE RECIPES

CURE 1 - CURE 2 MODES AND MULTIPLE RECIPES:

Four recipes are provided to allow operators to save cure mode time/temp settings for four different types of finishes. For example, recipe A can be used as a short cure cycle for a primer coat while other recipes can be used for cure of base coats, top coats, etc. Within each recipe, two cure mode temperatures and times are provided to allow a higher or lower discharge temperature during the first few minutes of the cure cycle. A higher initial cure temp brings the vehicle or other booth contents up to temperature faster. Second cure cycle temp and time can then maintain desired temp for an appropriate time. On the other hand, for some finishes it is best to have a lower initial cure temp to avoid a dry film on exterior of finish with trapped liquid and/or vapors underneath. If only one discharge temperature is desired, simply set one of the time setpoints to zero minutes.

OPTIONAL PREP MODE:

Two speed H.O.T. units can be configured on advanced tech screen to go to low speed in a prep mode. Appropriate schematic revisions and associated components must be included. Do not enable prep mode on advanced technician screen unless schematic includes details regarding enabling prep mode and limiting modulating gas valve command in prep mode. Work through equipment sales personnel if this feature is not included and end user wants to make a field revision to include it.

TWO SPEED HIGH OUTLET TEMPERATURE (H.O.T.™) AMU w/ c.pCO DISCHARGE TEMP. CONTROL, BOOTH PRESSURE CONTROL & FOUR CURE RECIPES

CAREL PGD GRAPHIC DISPLAY DETAILS

The PGD will typically be located on a remote panel and provides an end user with operating mode displays and typical setpoint adjustment capability. For startup or service by a qualified technician, password protected screens display additional information and allow additional setpoint and loop tuning adjustments.

Arrow key function depends upon the screen currently displayed.
Default Display (shown above): Arrow keys scroll through the "quick menu" options in the upper right corner of the screen. Enter key will select the displayed quick menu item.

Quick Menu Options:

Input/Output Screens: display the current digital and analog input and output signals processed by the digital controller.

Set — Mode/Setpoints Screens: Allow personnel logged in with the User or Technician password to view and change unit operation modes and setpoints. The screens will be viewable only without entering a password.

TECH — Technician Screens: Allow personnel logged in with the Technician password to view and change advanced unit modes and setpoints. The settings will be viewable only by users with the User password or those who are not logged in.

Information Screens: Display information about the AMU and digital controller.

Select Mode: With cursor blinking at top left corner of a selected quick menu screen, the arrow keys will scroll through the available screens in the category. Pressing enter key will select the first editable item and the display will be in edit mode.

Edit Mode: On screens with changeable settings the enter key is used to select the next item on the screen that is available to edit. When desired item is selected, arrow keys are used to scroll the setting up or down and pressing enter key will save the current value. When the last item on the screen is reached pressing enter key will return the cursor to the top of the page and the display will return to select mode.

TWO SPEED HIGH OUTLET TEMPERATURE (H.O.T.™) AMU w/ c.pCO DISCHARGE TEMP. CONTROL, BOOTH PRESSURE CONTROL & FOUR CURE RECIPES

Key functions are dependent on current selected position on a screen.

Alarm Key: Key will be lit when an alarm is active. Pressing the key will display the most recent active alarm and silence buzzer if it is on. Arrow keys allow scrolling through all active alarms, if more than one is present. Holding alarm key will reset some alarms. When no alarms are currently active, pressing the alarm key will allow access to alarm history logs.

Prg Key: Press this button from any screen to enter a password. Once logged in pressing this button will allow access to other system functions. Users logged in with the "operator" password will be taken to the logout screen. Users logged in with "technician" or "advanced technician" passwords will be able to access the Main Menu.

Escape Key: Go back one level from any point in the menu tree. Cancels setting changes if pressed before enter key.

Up Key: Increase selected value. Scroll through screens within a group of screens if cursor is not at a changeable value.

Enter Key: Confirm selected value after a setting is changed. Select next changeable setting.

Down Key: Decrease selected value. Scroll through screens within a group of screens if cursor is not at a changeable value.

Operation Icons

Blower On: Displayed when airflow is proven.

Burner On: Displayed when burner is on.

Cooling On: Displayed when mechanical cooling stage is enabled.

TWO SPEED HIGH OUTLET TEMPERATURE (H.O.T.™) AMU w/ c.pCO DISCHARGE TEMP. CONTROL, BOOTH PRESSURE CONTROL & FOUR CURE RECIPES

Default Display:

Control panel display always returns to default display after no keypad activity is detected for a period of time. Default display shows discharge air temp and unit operation mode details (Fig. 1).

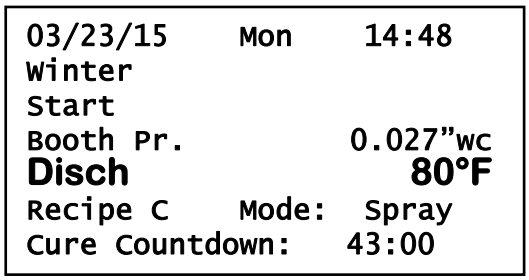


Figure 1: Default Display

Time and Date (read-only)
Summer/Winter Mode
Start-Stop Status
Booth Relative Pressure
Discharge Temperature
Active Recipe & Active Booth Mode
Cure Countdown Display (minutes & seconds)

Figure 1A: Default Display Description

Mode/Setpoints Screens:

Select Mode / Setpoints icon from the Quick Menu. The first "Active Settings" screen does not require a password to allow operator to make quick changes. Additional mode/setpoint screens require "OPERATOR" or higher level in order to change settings. The "OPERATOR" password is 2050.

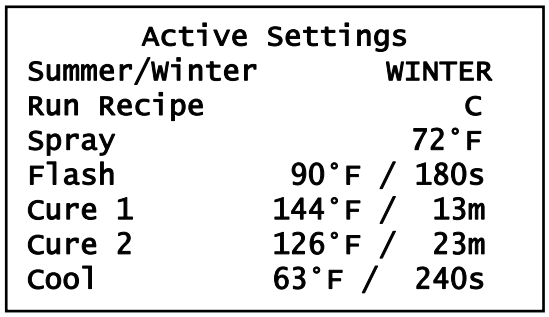


Figure 2: Mode/Setpoint Screen

Active Settings Menu Details
Summer or Winter Mode Selection
Run Recipe (Select Active Recipe)
Spray Mode Disch Temp Set (Read-Only)
Flash Mode Disch Temp/Time Set (Read-Only)
Cure 1 Mode Disch Temp/Time Set (Read-Only)
Cure 2 Mode Disch Temp/Time Set (Read-Only)
Cool Mode Disch Temp/Time Set (Read-Only)

Figure 2A: Mode/Setpoint Screen Descriptions

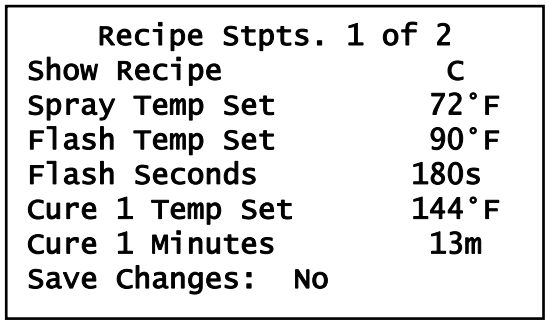


Figure 2B: Mode/Setpoint

Recipe Setpoints Menu Details
Select Recipe Setpoints to Display
Spray Mode Discharge Temp Setpoint
Flash Mode Discharge Temp Setpoint
Flash Mode Time Setpoint
Cure 1 Mode Discharge Temp Setpoint
Cure 1 Mode Time Setpoint
Save Changes (Yes or No)

Figure 2C: Mode/Setpoint Screen Descriptions

TWO SPEED HIGH OUTLET TEMPERATURE (H.O.T.™) AMU w/ c.pCO DISCHARGE TEMP. CONTROL, BOOTH PRESSURE CONTROL & FOUR CURE RECIPES

```
    Recipe Stpts. 2 of 2
Showing Recipe          C
Cure 2 Temp Set      126°F
Cure 2 Minutes        23m
Cool Temp Set        126°F
Cool Seconds         240s

Save Changes:  No
```

Figure 2D: Mode/Setpoint

Recipe Setpoints Menu Details
Showing Recipe on Display
Cure 2 Mode Discharge Temp Setpoint
Cure 2 Mode Time Setpoint
Cool Mode Discharge Temp Setpoint
Cool Mode Time Setpoint
Save Changes (Yes or No)

Figure 2E: Mode/Setpoint Screen Descriptions

```
      Other Setpoints
OA Temp Included:       NO
OA Ht Enbl Set         65°F
Booth Pr Set       0.025"wc
```

Figure 2D: Mode/Setpoint

Other Setpoints Menu Details
OA Temp Sensor Included (Read Only)
OA Heat Enable Setpoint (If Included)
Booth Relative Pressure Setpoint

Figure 2E: Mode/Setpoint Screen Descriptions

Input Screens: Access these screens from the Input/Output icon on the Quick Menu. These values represent analog and digital inputs to the controller or internal calculated values based upon direct inputs. Use up / down arrow keys to switch between screens.

```
      ANALOG INPUTS
1: Disch Temp          71°F
Eff Disch Set        72.0°F
OA Temp Included:       NO
2: Opt. OA Temp       ###°F
3: Booth Pr.       0.027"wc
```

Figure 3: Input Screen

Analog Input Menu Details
Discharge Temperature
Effective Discharge Temp. Setpoint
Outdoor Temp Included (Read-Only, Set @ Tech)
Optional Outdoor Air Temp
Booth Relative Pressure

Figure 3A: Input Screen Descriptions

```
     DIGITAL INPUTS 1
D1: Start Relay:        ON
D2: Cure Enable:       OFF
U6: Airflow:            ON
U7: Burner:             ON
U8: VFD Above Min:      ON
U9: Flame Safety:       OK
U10: Prep Enable:      OFF
```

Figure 4: Input Screen

Digital Input Menu Details
Start Relay Status
Cure Enable Status
Airflow Status
Burner Status
VFD Above Minimum Speed Status
Flame Safeguard Status
Optional Prep Mode Enable Status

Figure 4A: Input Screen Descriptions

TWO SPEED HIGH OUTLET TEMPERATURE (H.O.T.™) AMU w/ c.pCO DISCHARGE TEMP. CONTROL, BOOTH PRESSURE CONTROL & FOUR CURE RECIPES

DIGITAL INPUTS 2	
U5 Opt Clog Filter	OFF

Figure 4B: Input Screen

Digital Input Menu Details
Optional Clogged Filter Switch Status

Figure 4C: Input Screen Descriptions

Output Screens: Access these screens from the Input/Output icon on the Quick Menu. These values represent analog and digital outputs of the controller.

ANALOG OUTPUTS	
Y1: VFD Spd Cmnd	89%
Y2: Gas Valve	42%

Figure 5: Output Screen

Analog Output Menu Details
Exhaust VFD Speed Control Loop Cmnd. Pct.
Heating Control Loop Command Percentage

Figure 5A: Output Screen Descriptions

DIGITAL OUTPUTS	
D1: Unit Enable	OFF
D2: General Alarm	OFF
D3: Burner Enable	OFF
D4: Full Cure	OFF
D5: Lo Spd Enable	OFF
D6: Shtdwn Alarm	OK

Figure 6: Output Screen

Digital Output Menu Details
Fan Enable Output Status
General Alarm Status
Heat Enable Output Status
Full Cure Cycle Output Status
Low Speed Enable Output Status
Unit Shutdown Alarm Contact Output Status

Figure 6A: Output Screen Descriptions

Technician Setup Screens: Access this screen from main menu. TECH level password is required to change these settings.

TECHNICIAN 1	
Lo Tmp Sfty Set	39°F
Lo Tmp Sfty Time	180s
Aux Hi Tmp Limit	240°F
Heat Gain	3
Heat Integ Time	45s
Disch. Temp Adj.	0.0°F
OA Temp Adjust	0.0°F

Figure 7: Technician Screen #1

Technician 1 (Up/Down key for Tech #2-4)
Low Temperature Safety Temp Setpoint
Low Temperature Safety Timer Setpoint
Auxiliary High Temperature Limit Setpoint
Heating Loop Proportional Band Gain
Heating Loop Integral Time
Discharge Temp. Sensor Input Adjustment
Outside Air Temp. Sensor Input Adjustment

Figure 7A: Tech Screen #1 Descriptions

TWO SPEED HIGH OUTLET TEMPERATURE (H.O.T.™) AMU w/ c.pCO DISCHARGE TEMP. CONTROL, BOOTH PRESSURE CONTROL & FOUR CURE RECIPES

TECHNICIAN 2	
Exh VFD Start Ref	90%
Spray Exh VFD Min	80%
Spray Exh VFD Max	100%
Cure Exh VFD Min	40%
Cure Exh VFD Max	75%

Figure 7B: Technician Screen #2

Technician 1 (Up/Down key for Tech #2-4)
Exhaust VFD Initial Start Speed Reference
Spray Mode Minimum Exhaust VFD Speed
Spray Mode Maximum Exhaust VFD Speed
Cure Mode Minimum Exhaust VFD Speed
Cure Mode Maximum Exhaust VFD Speed

Figure 7C: Tech Screen #2 Descriptions

Advanced Technician Screen: Access this screen from the tech section of the quick menu. Note that Advanced Tech will be available in view only mode for all users. ADV.TECH level password is required to change these settings.

Advanced Tech 1	
Disch Temp Filter	3
Disch Deriv Time	0s
Airflow Alrm Dly	30s
OA Temp Included	NO
Strtr/VFD Loss During Run Fault Timer	10s

Figure 8: Advanced Tech 1 Screen

Advanced Tech 1
Discharge Temp Input Filter Value
Discharge Derivative Time
Low Airflow Alarm Delay Time
Optional OA Temp Sensor Included
Starter/VFD Loss During
Run Fault Timer Setpoint

Figure 8A: Advanced Tech 1 Descriptions

Advanced Tech 2	
Alarm Buzzer	ENABLED
Shtdwn After Cool	YES
Brnr On Sum Flash	NO
Prep Mode Allow	NO
Prep DI Delay	2s

Figure 9: Advanced Tech 2 Screen

Advanced Tech 2
Alarm Buzzer Status
Shutdown After Cool Down Cycle
Burner Forced On In Summer Flash Mode
Prep Mode Allow
Prep Mode Digital Input Delay Timer Setpoint

Figure 9A: Advanced Tech Descriptions

Advanced Tech 3	
Pr. Loop Params.	AUTO
Auto Loop Group	SLOW
Bth Pr Gain	2.2
Bth Pr Intg Time	20s
Bth Pr Derv Time	1s
Pr. Filter	8
Pr. Avg. Count	18

Figure 9B: Advanced Tech 3 Screen

Advanced Tech 3
Pressure Loop Parameter Adjust (Auto or Man.)
Auto Loop Group (Slower, Slow, Medium, Fast)
Booth Press. Loop Gain
Booth Press. Loop Integral Time
Booth Press. Loop Derivative Time
Booth Press. Sensor Filter Constant
Booth Press. Moving Average Count

Figure 9C: Advanced Tech Descriptions

TWO SPEED HIGH OUTLET TEMPERATURE (H.O.T.™) AMU w/ c.pCO DISCHARGE TEMP. CONTROL, BOOTH PRESSURE CONTROL & FOUR CURE RECIPES

Information Screens: Access these screens from quick menu. Use up / down arrow keys to switch between screens while screens are in select mode.

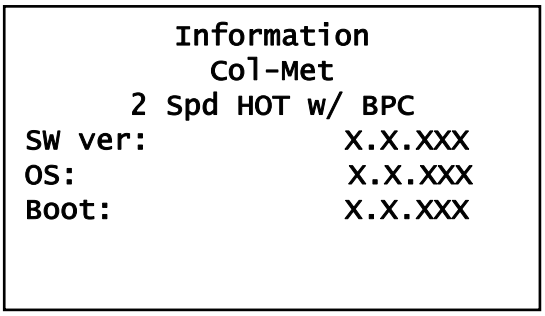


Figure 10: Information Screen

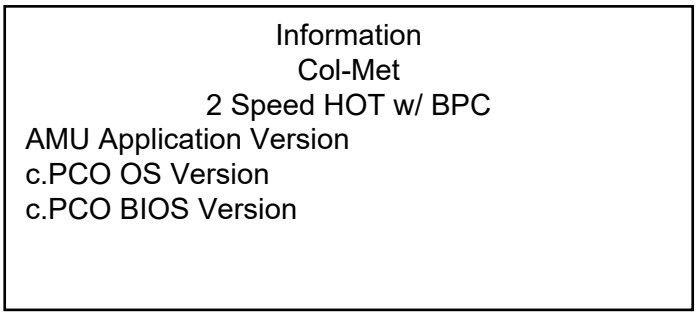


Figure 10A: Information Screen

Alarm Screen: This screen is accessed if an alarm condition exists (pressing blinking alarm symbol) or it can be accessed from the main menu. Some alarms require acknowledgement in order to silence the alarm horn and/or reset the alarm. Press and HOLD the alarm key in order to acknowledge an alarm. If the alarm is based upon a direct external input from a sensor or external safety control (for example a motor overload), the alarm will remain active (key will blink red) until the external input is corrected. In other cases where the c.pCO module is acting as the safety device, holding the alarm key for a slightly longer duration will reset the alarm condition. Two "Sampled Values" will also be displayed. These values show the state of the named value at the time the alarm is triggered.

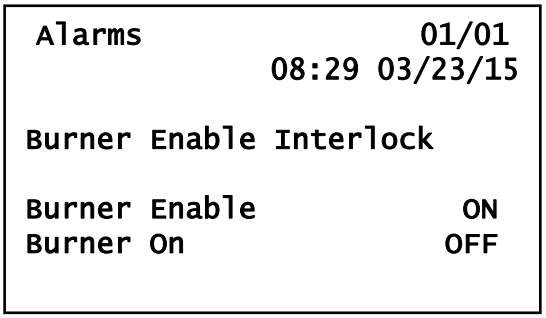


Figure 11: Alarm Screen

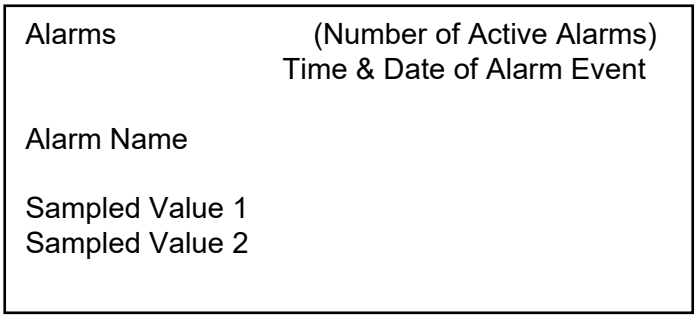


Figure 11A: Alarm Screen Descriptions

TWO SPEED HIGH OUTLET TEMPERATURE (H.O.T.™) AMU w/ c.pCO DISCHARGE TEMP. CONTROL, BOOTH PRESSURE CONTROL & FOUR CURE RECIPES

Alarm Logs: This screen can be accessed by pressing the alarm key when there is no active alarm. Pressing enter while the "NO ALARMS" screen is displayed will show the alarm log screens These screens display all recorded alarm events in a format similar to the active alarm display screens. The time and date displayed will show the time of the event on the "Event" line (start or stop). Use the up and down arrow keys to scroll through alarm event records.

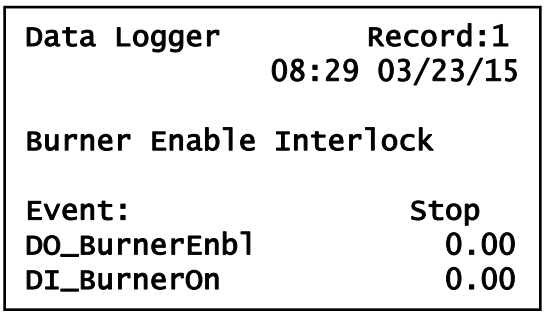


Figure 12: Alarm Log Screen

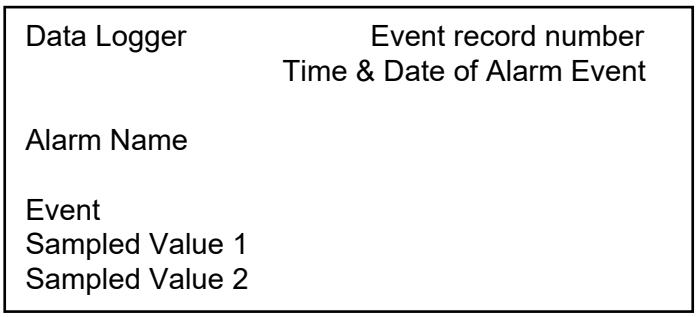


Figure 12A: Alarm Log Screen Descriptions

List of Alarms:

Display	Description
☼♪ Low Discharge Temp	Low Temperature Safety Fault
☼♪ Aux High Disch Temp	Auxiliary High Temperature Fault
☼♪ Flame Safeguard	Flame Safeguard Fault
☼♪ Burner Enable Interlock	Burner Enable Fault
☼♪ Blower Start Fault	Blower Start Fault
☼♪ Low Airflow	Low Airflow Fault
☼♪ Extended Sensor Fault	Extended Sensor Fault Duration
☼ Disch Temp Sensor	Discharge Temperature Sensor Fault
☼ OA Temp Sensor	Optional OA Temperature Sensor Fault

Password Screen: Access this screen from main screen by pressing the PRG key. Log in on this screen with either the "operator" password of 2050 or the "technician" password (supplied to installing contractor). Press Prg key when prompted to log in. Password level is automatically selected based on password entered. Use up and down arrow keys to select numbers and enter key to set active digit to enter appropriate password. The log in remains effective until no keypad activity is detected for a period of time, until power is cycled, or until the user logs off. The user can log off at any time by pressing the Prg key while logged in. Users logged in with the operator password will be directed to the logout screen. Users logged in as technician or higher level will be directed to the Main Menu which has a logout option. The manufacturer recommends leaving passwords at default values to simplify service work and technical support.

TWO SPEED HIGH OUTLET TEMPERATURE (H.O.T.™) AMU w/ c.pCO DISCHARGE TEMP. CONTROL, BOOTH PRESSURE CONTROL & FOUR CURE RECIPES

Main Menu: The Main Menu can only be reached by users logged in with the technician or higher level password. The Main Menu can be accessed by pressing the Prg key while already logged in. The factory settings page can only be accessed by factory personnel.

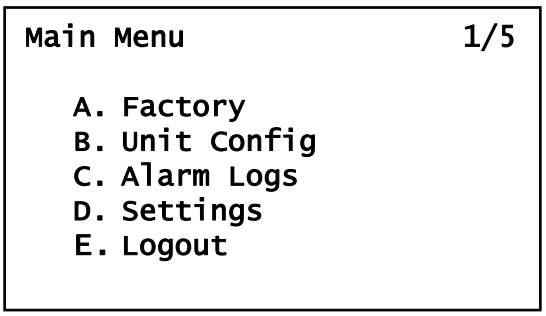


Figure 13: Main Menu Screen

Main Menu	Menu Item Number
A.	Factory Settings (Not User Accessible)
B.	Unit Configuration (Import/Export settings)
C.	Alarm Logs
D.	Settings Menu (Region/Setup settings)
E.	Logout

Figure 13A: Main Menu Screen Descriptions

Unit Config: Not used in this application.

Alarm Logs: See Alarm Logs section above.
Settings: The Settings Menu contains the regional and initial configuration settings for the c.pCO unit.

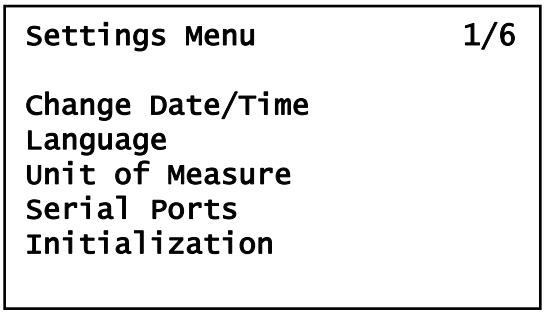


Figure 14: Settings Menu Screen

Settings Menu	Menu Item Number
Date/Time	
Language	
Unit of Measure (Temperature Units)	
Serial Ports	
Initialization	

Figure 14A: Settings Menu Screen Descriptions

Individual settings screens are relatively self explanatory. If additional assistance is needed, contact installing contractor or sales rep. A PGD user interface navigation guide is shipped with the equipment.

System Menu:
Carel cpCO controller's system menu is accessed by holding down the alarm and enter keys simultaneously. For unit's with IP communication, IP address is configured within system menu. There are other functions for appropriately trained personnel. Tech password (extended with another leading 0) is needed to access some functions of the system menu.

UNIT PARTS LIST

Rep Job #	Quote #	Revision	Date	Serial #
	8618	0	08/02/18	17244
Job Name				Tag #

Model: CT-120 NG HRD H.O.T

Abbr.	Man. Part #	Qty	Description
DM-1	Belimo NFBUP-S	1	Damper Actuator
DM-3	Belimo NMCB24-3	1	Damper Actuator
FQ-1	Mitsubishi FR-F820-00340-3-N6	1	Supply VFD
FQ-2	Mitsubishi FR-F820-00105-3-N6	1	Exhaust VFD
FS-1	Fireye MERT4	1	Flame Safeguard Amplifier
FS-1	Fireye MEP537	1	Flame Safeguard Programmer Module
FS-1	Fireye MEC120	1	Flame Safeguard Chassis
FS-1	Fireye 61-3060	1	Flame Safeguard Base
FU-1	HSJ50	3	Class J High Speed 50a 600vac Fuse
FU-1	US6J3I	1	3-pole Class J Fuse Holder
FU-3	6SM30A1-C	1	1 Pole Fuse Holder
FU-3	Mersen TRM3	1	250 VAC - Midget Type: 3 Amp
FU-4	USCC3I	1	3-pole Class CC Fuse Holder
FU-4	ATMR20	3	Fus Atmr20 - Class CC Fast Acting 20a 600vac Fuse
GA-1	Carel S90CONN002	1	Graphic Display Adaptor & Cable
GA-1	ASI 16000	1	Graphic Display Adaptor
GD-1	Carel PGDE000FZ0	1	Graphic Display Interface
LC-1	Eaton XTCE018C10T	1	Contactor
LF-1	USCC1I	1	1-pole Class Cc Fuse Holder
LF-1	ATDR20	1	Fus Atdr20 - Class Cc Time Delay 20a 600vac Fuse
LT-1	AB 800F-N5G	1	120V Light Module - Green
MT-1	OVH 215 Motor Base	1	Motor Base
MT-1	Leeson 140472.00	1	10hp Motor
P-1	Cleveland DDP-109-187	1	Airflow Switch (0.2" & 0.95")
PB-1	MPDB63133	1	Power Distribution Block
PB-1	MPDBC6263	4	Power Distribution Block Cover
PB-1	MPDB63130	1	Power Distribution Block
PC-1	Carel P+D000UE1DEF0	1	Programmable Controller
PS-1	Ashcroft CX8MB210P25IWL	1	Pressure Transmitter
R-	Idec SJ2S-07LW	12	Relay Base
R-1	Idec RJ2S-CL-A24	1	24 Vac Relay
R-2	Idec RJ2S-CL-A24	1	24 Vac Relay
R-6	Idec RJ2S-CL-A24	1	24 Vac Relay
R-6A	Idec RJ2S-CL-A24	1	24 Vac Relay
R-7	Idec RJ2S-CL-A24	1	24 Vac Relay
R-9	Idec RJ2S-CL-A120	1	120 Vac Relay
R-10	Idec RJ2S-CL-A120	1	120 Vac Relay
R-11	Idec RJ2S-CL-A120	1	120 Vac Relay
R-13	Idec RJ2S-CL-D24	1	24 Vdc Relay
R-16	Idec RJ2S-CL-A120	1	120 Vac Relay
R-21	Idec RJ2S-CL-A24	1	24 Vac Relay
R-31	Idec RJ2S-CL-A120	1	120 Vac Relay
SW-1	ABB OT100F3	1	Equipment Disconnect
SW-1	ABB OXP6X265	1	Disconnect Shaft
SW-1	ABB OTPN80FP	1	Neutral Block
SW-1	ABB OA1G10	1	Equipment Disconnect
SW-1	ABB OHZX10	1	Disconnect Shaft Guide
SW-1	ABB OHB65J6	1	Disconnect Handle
SW-2	AB 800FP-LF3	1	Start Pushbutton Switch - Green
SW-2	AB 800F-ALP	1	Mounting Latch
SW-2	AB 800F-X10	1	N.O. Contact
SW-2A	AB 800F-X01	1	N.C. Contact

COL-MET
Engineered Finishing Solutions

Model: CT-120 NG HRD H.O.T

UNIT PARTS LIST

Rep Job #	Quote #	Revision	Date	Serial #
	8618	0	08/02/18	17244
Job Name				Tag #

Abbr.	Man. Part #	Qty	Description
SW-2A	AB 800F-ALP	1	Mounting Latch
SW-2A	AB 800FP-F4	1	Stop Pushbutton Switch - Red
SW-3	AB 800F-ALP	1	Mounting Latch
SW-3	AB 800F-X01	1	N.C. Contact
SW-3	AB 800FP-MT44	1	E-Stop - Twist To Release Switch - Red
SW-3	AB 800F-15YE112	1	E-Stop Legend Plate
SW-5	Carling 111-16-73/18	1	Service Switch
SW-6	Carling 111-16-73/18	1	Service Switch
SW-7	AB 800F-ALP	1	Mounting Latch
SW-7	AB 800F-X10E	1	N.O.E.M. Contact
SW-7	AB 800FP-F5	1	Cure Pushbutton Switch - Yellow
SW-8	AB 800F-ALP	1	Mounting Latch
SW-8	AB 800FP-SM22	1	2 Position Selector Switch
SW-8	AB 800F-X10	1	N.O. Contact
T-11	2511F003-351	1	Vestibule Cooling Stat
TDR-1	Eaton TRL04	1	Time Relay
TL-1	Future Design FDC-L91-4110	1	High Temperature Limit
TL-1	Future Design DRA16	1	Plastic Mount
TR-2	Honeywell Q652B1006/B	1	Ignition Transformer
TR-3	Dwyer APT-50-5DB	1	Transformer
TS-1	ACI A/1K-2W-D-18-GD	1	Discharge Temperature Sensor
TS-7	ACI A/100-3W-D-12"-GD	1	High Temp Limit Sensor
VF-1	Mechatronics UF12A12-BTH	1	Fan Ac Die Cast Frame 115vac 14/12w 50/60hz
VF-1	SC120-W5	1	Finger Guard For Vestibule Ventilation Fans
VM-1	Belimo LMCB24-SR-T	1	Gas Valve Actuator
	Lau 05037917J	1	A20-20H Blower Assembly w/ 1-15/16" Bore
	WIE NP1616	1	Remote Panel
	WIE LOH161906	1	Remote Enclosure
	B74 (CD 21.5")	2	Drive Belt
	Browning VPB-231-AH	2	Bearing 1-15/16"
	2VP65 1-3/8 3 Turns Open	1	Variable Pitch Sheave
	SK 1-15/16	1	QD Bushing
	2B136SK	1	QD Sheave

GAS TRAIN/BURNER SPECS

Rep Job #	Quote #	Revision	Date	Serial #
	8618	0	08/02/18	17244

Job Name	Tag #

Model: CT-120 NG HRD H.O.T

CFM: 12600 **Temp. Rise F:** 100 **BTU Max:** 1386000

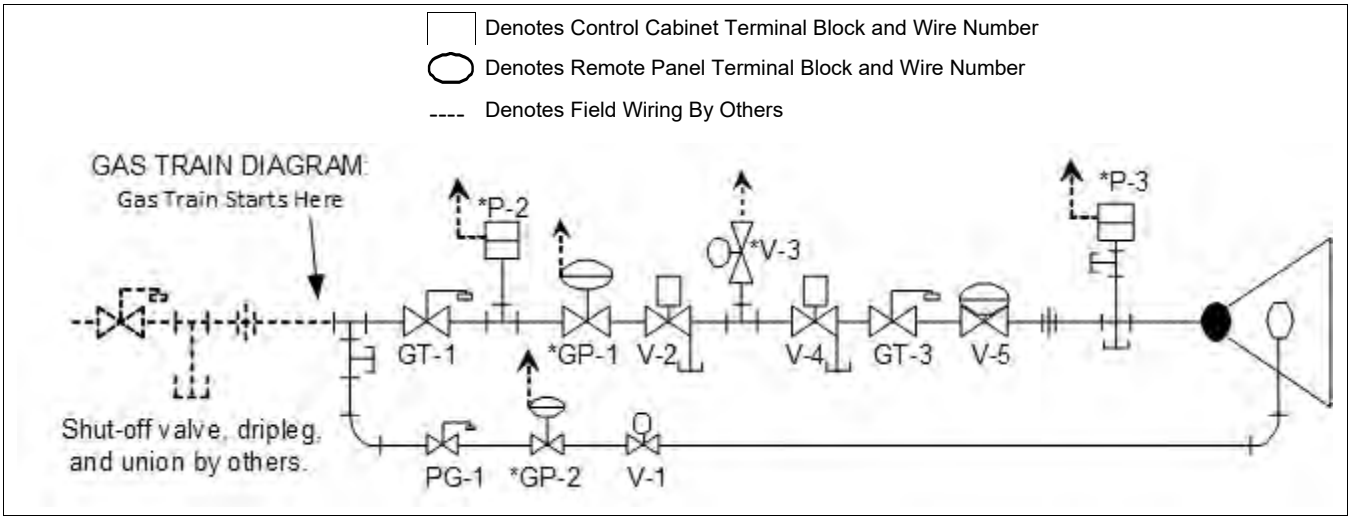
Gas Pressure: 2# - 2# At 1387 CFH.

Burner Manifold Pressure = 4.4`` w.c. For Specified BTU and Burner

Burner Length in Feet: 2.5 with 0 Tees **Burner Type:** Midco HMA-2A

Profile: 38 in. W x 13.5 in. H **2 - OA Dmprs @** 38 in. W x 8 in. H

Abbr.	Man. Part #	Qty	Description
GP-1	Maxitrol R600S-88-0020	1	Main Gas Pressure Regulator
GP-2	OARA 44-1-390-0025	1	Pilot Gas Pressure Regulator
GT-1	1" Hand Valve	1	Shut-Off Valve (manual)
GT-3	1" Hand Valve	1	Shut-Off Valve (manual)
P-3	Honeywell C6097B1028/U	1	High Gas Pressure Switch
PG-1	Maxitrol BV250T-22	1	Pilot Shutoff Valve (manual)
V-1	Honeywell V4046C1047	1	Pilot Solenoid Valve
V-2	Honeywell V4295A1031	1	Safety Shut-Off Valve
V-4	Honeywell V4295A1031	1	Safety Shut-Off Valve
V-5	RTC ABV-1.2NN-VO	1	Modulating Ball Valve

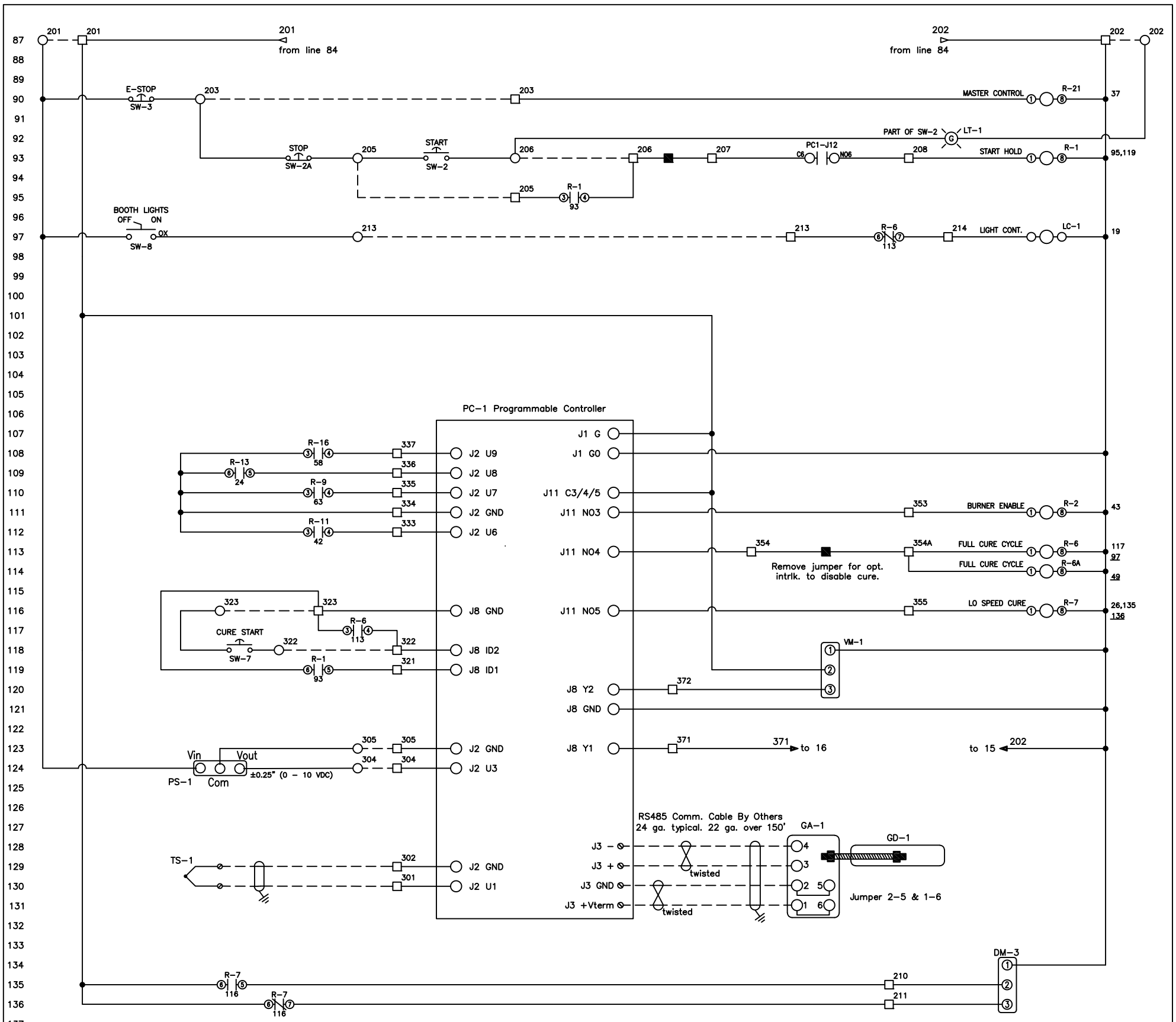


Largest Motor: 10 Hp
Largest Motor NEC FLA: 30.8
Unit FLA: 55.2
MCA: 63
MOP: 90
SCCR: 5 kA RMS Symmetrical at 240 VAC Maximum

208 VAC 3Ø 4 wire 60Hz protected supply by others
L1
L2
L3
NEUTRAL
GND
SW-1
6 ga.
PB-1
FU-4
14 ga.
14 ga.
FQ-2
L1
L2
L3
GND
RT
A2
STF
SD
C2
U
V
W
GND
5
2
VFD power output in shielded power cable or separate metallic conduit.
14 ga.
EX MTR
Exhaust Fan Motors (By Others) May Require Additional Disconnects
202 from 123
371 from 123
Booth Lights by Others
LC-1
97
LF-1
12 ga.
FQ-1
SD
A1
STF
RT
FU
PC
SE
A2
C1
JOG
C2
VFD MIN SPD
R-13
220
44,109
R-10
56
221
222
R-7
116
224
223
227
226
VFD power output in shielded power cable or separate metallic conduit.
FU-1
8 ga.
8 ga.
8 ga.
L1
L2
L3
GND
U
V
W
GND
MT-1
On units with split cabinets, wiring between FQ-1 & motor must be connected after unit is assembled.
2
Safety Interlocks (fire, smoke, etc.) (by Others)
1
R-21
90
1A
1B
FU-3
T-11
30
VF-1
SW-5
PC1-J10
C1
NO1
3
BLOWER ON
R-11
112
R-2
111
12
SW-6
11
P-1A
10A
P-1
10
R-13
24
4
TDR-1
A1
A2
B1
Off Delay
Initial Set = 5 sec.
49
Optional Delayed Comp. Air Solenoid Interlocks (man door switches, etc., by others).
Contacts close to enable spray.
72
R-6A
114
71
TDR-1
44
73
R-31
66
74
Optional Instantaneous Comp. Air Solenoid Interlocks (product door switches, etc., by others)
Contacts close to enable spray.
Comp. Air Solenoid (by Others)
401
402
403
TS-7
TL-1
13
14
14A
P-3
15
DM-1
H
N
C
NC
5
6
7
VFD START
R-10
23
16
FLAME FAIL INDICATION
R-16
108
TR-2
19
18
V-1
V-2
V-4
FS-1
BURNER ON
R-9
110
LAMP LIMIT SWITCHES (BY OTHERS)
31
R-31
49
Circuit Breaker in TR-3
120VAC
TR-3
24VAC
to line 87
201
to line 87
202

Refer to Parts List for Schematic Symbol Legend
Separate low voltage and line voltage wiring. Sensor and actuator signal wiring in shielded cable.
Profile damper open on shutdown.

COL-MET Engineered Finishing Solutions	100% OA cpCOmini 2Spd H.O.T. w/ MulitiSetpoint Discharge Temp Control & Booth Press. Control	JOB NAME:	REFERENCE NO.: 17244	BY: kittelsonk	DATE: 8/9/2018	SHEET #: 1 of 2
			17244 HOT-2S cpCOmn BPC F8B F8BE LC 4W.dwg 4:42:51 PM			



Refer to Parts List for Schematic Symbol Legend

Separate low voltage and line voltage wiring. Sensor and actuator signal wiring in shielded cable.

Profile damper open on shutdown.

COL-MET Engineered Finishing Solutions	100% OA cpCOmini 2Spd H.O.T. w/ MulitiSetpoint Discharge Temp Control & Booth Press. Control	JOB NAME:	REFERENCE NO.: 17244	BY: kittelsonk	DATE: 8/9/2018	SHEET #: 2 of 2
			17244 HOT-2S cpCOmn BPC LC 4W.dwg			4:42:45 PM

START-UP PROCEDURE

100% OUTSIDE AIR MAKE-UP UNITS WITH DISCHARGE TEMPERATURE CONTROL & c.pCO DIRECT DIGITAL CONTROL MODULE

Start-up must be performed by a trained, experienced service person.

The following general start-up procedure applies directly to 100% OA air make-up units. Please note any added options for a specific unit which may affect the control sequence or terminal numbering prior to attempting start-up or service work. Read the entire start-up procedure and review all reference material (Unit Specifications, Gas Train/Burner Specifications, Sequence of Operation, Parts Lists, and Electrical Schematic) supplied with each unit.

STEP 1

Turn off incoming electrical power and gas supply. Disconnect electrical power at the unit disconnect. Shut off gas supply at inlet to unit's gas manifold.

STEP 2

Verify that incoming electrical and gas supply match the name plate requirements (i.e., voltage/amp capacity, gas pressure and volume capacities, etc). If they do not, stop at this point and contact the factory.

STEP 3

Open the access doors to blower and control vestibule sections. Check all electrical connections and hardware (blower drives, bearings, damper linkages, etc.) for tightness and correct field wiring connections.

STEP 4

Check that all gas, pilot, vent, and pressure sensing lines are properly connected and unobstructed. Verify that the incoming gas line was "blown out" to flush out debris prior to connecting gas line to unit. Also verify that incoming gas line has been purged of air up to unit's gas inlet.

STEP 5

At the manifold pressure test port, downstream of the modulating gas valve (VM-1), connect a gas pressure gauge (pressure gauge must read inches of water column to 10" with the capability of reading a negative pressure).

STEP 6

Turn on incoming electrical power at unit disconnect. Verify that the digital user interface powers up and confirm that main screen and input screen sensor readings are valid. Referring to the sequence of operation, set the blower mode to auto (SW-2) and ensure that no external interlocks are calling for the unit to operate. Set the HVAC mode to fan-only (no heat).

STEP 7

Make sure the blower access door is securely held open. Start the unit in the summer mode by placing the service switch (SW-5) in the on position.

STEP 8

If an optional intake or discharge damper is installed, the blower will not start until the damper motor's internal "proof open" end switch closes (damper motor and end switch wiring are generally completed in the field after damper is mounted). If an intake or discharge damper is not installed, the blower should start immediately. Check the blower for proper rotation direction. If the rotation is reversed, turn both the service switch and the disconnect switch off. For 3 phase motors, reverse any two leads. For single phase motors, see instructions on the motor.

STEP 9

With proper blower rotation verified, check and record the RPM of the blower. If the blower speed has to be either decreased or increased (to achieve the rated CFM of the unit), adjust the motor sheave to desired setting.

STEP 10

Turn the unit off. Close and latch the blower access door.

STEP 11

Start unit with SW-5. Check and record the motor amp draw. If the motor amp draw exceeds listed Full Load Amps (FLA), stop and call the factory.

STEP 12

Check and record the negative pressure reading on your burner manifold pressure gauge. This measurement is necessary for proper setting of the burner manifold pressure when the unit is put in high fire mode. At this time, also measure the pressure drop across the airflow switch ports (remove cap from plastic tees and connect tubes to tee fittings). This measurement can be used as a simple indication of proper airflow through the unit. If this second measurement is not between 0.7" w.c. and 0.5" w.c., the blower speed may need to be adjusted. If assistance in taking or interpreting these measurements is needed, contact the factory.

STEP 13

Turn the unit off. Check the pilot gas line for proper and tight connections with no leaks. For shipping purposes, the pilot lines are disconnected.

STEP 14

Turn on the main gas valve, slowly open the manual pilot gas valve. If the unit is supplied with a low gas pressure switch (P-2), reset to on position.

STEP 15

Place the run-check switch (located on flame safeguard programmer module) to the check position. This will allow the pilot to light without lighting the main burner. Start unit with SW-5 and enable the burner with the burner service switch (SW-6).

Note the burner should not be operated continuously in the check position for more than 1 minute because the ignition transformer is not rated for continuous duty.

STEP 16

The unit should go through its complete burner ignition sequence with only the pilot ignited. The sequence can be observed by following the indicating LED's on the flame safeguard. On new installations, resetting of the flame safeguard may be required to purge air from the pilot line. If the unit does not cycle through its burner ignition sequence after a few attempts, refer to the service information in the following section for troubleshooting instructions.

STEP 17

In the center of FS-1 are 2 voltmeter test ports. Set the volt-ohm meter to approximately 30 VDC scale and insert the meter leads into the test ports (common lead in black port, positive lead in red port).

STEP 18

With only the pilot operating, record the DC volt signal. The DCV range is noted on the amplifier module of the controller (FS-1). There should be a steady DCV signal on the upper range stated on the controller.

STEP 19

Once stable pilot is achieved, shut unit down and place the run-check switch in the run position. Wire the 1000 ohm test resistor in place of the discharge sensor (this will simulate approximately 70°F discharge temperature). Adjust discharge air temperature set point to 50°F. This will force the burner into low fire. Start unit allowing it to operate in low fire. Make sure low fire flame is contained within the burner casting and extends the full length of the burner with no breaks in the flame AND the flame sensing signal at the flame safeguard remains stable. Check and record DC voltage as in step 18. If required, low fire can be adjusted with the actuator's mechanical stop at the counter clockwise end of the actuator's stroke.

STEP 20

Once stable pilot and low fire are achieved (with test resistor in place of the discharge temperature sensor) check the discharge temperature reading on the digital control panel (default display - see sequence of operation), it should indicate approximately 70°F. Adjust the discharge temperature set point to 95°F. This will force the burner into high fire. Start the unit, turn SW-5 & SW-6 on. Once the burner is operating, check the manifold pressure. The reading on your manifold pressure gauge needs to be added to the negative pressure recorded in step 12. The resulting total manifold pressure should be compared to the unit's rated manifold pressure. If the total is higher or lower than the rated pressure, adjustment can be made at the gas pressure regulator (GP-1). Do not set the total manifold pressure over 5.5" w.c. for natural gas.

Note that the modulating valve actuator rotation is mechanically and electronically limited. Do NOT change this maximum rotation limit.

Because of possible variations in the BTU content of gas, it may be necessary to set the manifold pressure to the rated temperature rise (temperature difference between the incoming air and the unit discharge air). Again, note the maximum manifold pressure settings noted at the end of the preceding paragraph.

The high fire flame should be visually observed to verify proper combustion. Experienced service personnel should be able to assess the appearance of a proper high fire flame. If assistance is needed, contact the factory.

STEP 21

With the burner on high fire, turn the high temperature limit (TL-1) to its lowest setting. The limit should trip out and shut down the burner. Turn TL-1 back to the factory setting of 185 deg. F and reset the control.

STEP 22

The next step is to check the operation of the Low Temperature Safety function internal to the DDC module. Wire the 1000 ohm and 10K ohm test resistors in parallel and in place of the discharge sensor to achieve a simulated discharge temperature reading of approximately 50°F. Adjust the low temperature safety (LTS) setpoint above the simulated discharge temperature reading. After the set amount of time operating at this simulated discharge temperature, the unit should shut down on low temperature safety alarm. See the sequence of operation for details on the alarm indication and steps to reset the alarm. Note that it may be necessary to manually throttle or cut the gas flow during this step to prevent overheating or cooling the served space. Remove the test resistors and re-install the discharge temperature sensor wires. Set the LTS setpoint back down to the desired setting.

STEP 23

With the unit again running normally, turn off the 2nd manual gas shutoff valve GT-3. The burner should shut down in a few seconds (look for flame LED to go out on FS-1) with the unit shutting down in 30 seconds or less. Open GT-3 and reset FS-1 by pressing button protruding through cover.

STEP 24

Open the test ports for the airflow switch (P-1) and verify that burner will not operate without proper pressure differential sensed at P-1. Replace the test port covers.

STEP 25

Turn the disconnect off. Remove test resistors and store in unit for future use. Re-connect discharge temperature sensor wiring. Verify all terminals, electrical connections and hardware (bearings, sheaves, blower wheels, etc.,) are securely tightened. Adjust all controls to desired settings. Remove all gauges, meters, and hand tools from the unit. Replace all covers on controls. Make sure all safety devices are reset.

STEP 26

Turn the disconnect on. Set the HVAC mode to auto and discharge temperature setpoint to desired setting. Start the unit from the remote panel (refer to sequence of operation and control panel symbol description).

Observe modulation of the burner. If the burner does not modulate, contact the factory for troubleshooting assistance. Verify proper operation according to unit's sequence of operation.

Be sure to check any optional controls (listed on Unit Specification and/or Sequence of Operation) which are not covered in this start-up procedure.

STEP 27

Verify that unit is interlocked with appropriate exhaust or that some sort of building relief vents are installed to prevent the unit from overpressurizing the building.

The unit should be ready for operation. To assure long lasting and efficient operation of equipment, a regular service inspection should be set up. Refer to the maintenance section at the back of this manual for detailed maintenance information.

Figure 1

BELIMO ACTUATOR COUPLED WITH MODULATING VALVE

Low Fire Adjustment:
Disconnect wire at terminal #1 on actuator. Press "clutch" to manually rotate shaft as needed. Adjust mechanical stop at counterclockwise end of actuator's stroke to set low fire. Need contintous flame across burner AND strong amplified signal at flame safeguard test ports.

High Fire Adjustment:
Adjust high fire at seperate regulator Do NOT adjust mechanical stop at clockwise end of actuator's stroke. Refer to instructions in start-up procedure.

Actuator Replacement/ Installation:
Installation of a replacement actuator should be made with actuator rotated to high fire position. Clockwise high fire mechanical stop should be set and line mark on modulating valve stem should be parallel with pipe as shown in "High Fire Position" photo above. Set low fire mechanical stop similar to original actuator. Adjust low fire per start-up procedure.