Ingersoll Rand

Instruction Manual

Model EP
Exhaust Purge
Regenerative Air Dryer





Prior to installation and start-up of this dryer, please read and implement the "Installation & Start-up" section of this manual.

Prior to operating this dryer, it is advised that this entire instruction manual be studied and clearly understood.

Please have the following information available, when contacting Ingersoll-Rand regarding this dryer:

Model No. EP-1540

Serial No. 110001

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INTRODUCTION

➢ Read this Instruction Manual carefully

This instruction manual from Ingersoll-Rand is an aid in becoming familiar with the air dryer, its operation, and application in accordance with its intended use as described herein.

The information in this instruction manual can help the user take full advantage of the air dryer's many features and ensure years of safe, reliable operation. This instruction manual must always be kept within reach of the air dryer at the site of installation/operation.

All maintenance, inspection, and assembly work is to be carried out by personnel who are authorized and qualified, who are adequately informed, and who have read the instruction manual in its entirety with a complete understanding of the contents and the air dryer's operation. Should personnel not possess the necessary knowledge, they must be trained and instructed by qualified personnel. This training may be carried out by the manufacturer at the request of the user.

➢ Know these Symbols

This instruction manual contains important information for safe, proper, and economic operation. The safety tips and advice contained in this instruction manual, as well as all safety labels printed directly on, or attached to the air dryer, must be followed at all times and must be kept completely legible.

Symbols of important note in this instruction manual, whose disregard could endanger people and/or equipment, are indicated by the following symbols:



Danger against electrical voltage!

This symbol indicates that dangerous voltage constituting a risk of electric shock is present.



Attention / Warning!

This symbol indicates that there are important operating and maintenance instructions which any and all operators should read closely to avoid danger and prevent problems. The instructions must be followed to avoid serious injury and/or damage to components.



Advice

This symbol indicates an instruction or procedure of particular interest or importance that must be followed to avoid damage to components and/or to ensure proper use of the air dryer.

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SECTION 1: INSTALLATION & START-UP

Prior to installation and start-up of this dryer, please read and implement this section.

1.0 Installation

Attention / Warning!

Upon delivery of the air dryer, it must be checked for damage that may have occurred during transport. If there is any evidence of damage due to shipping, immediately enter a claim with the carrier. Shipping damage is not covered by warranty.

Use the appropriate, load-rated lifting equipment and observe safe lifting procedures during all operations of installation. The equipment should be unloaded as close as possible to the installation site to minimize any chances of equipment damage.

If the air dryer is to be stored for a prolonged period of time, it should be stored in a dry place, preferably indoors; protected from the elements, including freezing or extremely warm temperatures.

1.0.1 Dryer Location and Mounting Specifications

1.0.1.1 The EP dryer is designed for indoor operation with ambient temperatures between 35°F to 100°F / 1.67°C to 37.78°C. The standard electrical components are designed specifically for NEMA 1. Reference the "Documentation" section of this manual for the Specification Sheet particular to this dryer.

Should it be desirable to locate the air dryer outdoors, special considerations will need to be made. These may include, but not be limited to, upgrading the electrical construction to NEMA 4 or better, adding freeze protection, etc. Contact Ingersoll-Rand, or your sales representative, for details.

1.0.1.2 Remove all protective shipping crates, flange covers, etc.

1.0.1.3 Utilizing the mounting holes provided on the skid, anchor the EP dryer to a solid, level foundation designed to support the dryer.

Should vibrations occur on the installation location, the dryer is to be placed onto vibration dampeners.

1.0.1.4 Because of vibration during shipping and installation, some lines, fittings, bolts, and connections may have loosened; therefore, inspect all and, if required, tighten.

1.0.1.5 Locate and install any items that may have shipped loose from the dryer, such as exhaust mufflers, auxiliary filters, etc.

SECTION 1: INSTALLATION & START-UP

1.0.1 Dryer Location and Mounting Specifications (continued)

1.0.1.6 If the desiccant shipped separately and must be installed, reference the "Operation & Maintenance" section of this manual for desiccant fill-up/replacement instructions.



Attention / Warning!

Reference the "Desiccant SDS" section of this manual for the Safety Data Sheet (SDS). Wear protective goggles and mask when working with desiccant.

1.0.1.7 **Connect the dryer to a correctly sized power supply. For voltage and current requirements, reference the "Documentation" section of this manual for the Specification Sheet or the "Engineering Drawings & Documents" section of this manual for the electrical drawing. Operation at different voltage than specified may cause equipment damage or failure.**



1.0.1.8 **Ground the frame of the dryer in accordance with the end user's local electrical codes.**



1.0.1.9 **If a disconnect switch was not purchased with the dryer, one must be supplied by the end user with proper overload protection according to local electrical codes.**



1.0.1.10 **For electrical connections, reference the "Engineering Drawings & Documents" section in this manual for the Electrical drawing. Be sure to look for any auxiliary connections, such as remote alarm contacts or analog (4-20mA) signals.**



1.0.1.11 Ensure that the inlet and outlet connections to and from the dryer are made using the correct rated fittings and piping to meet the design conditions. For connection details, reference the "Engineering Drawings & Documents" section of this manual for the Flow Schematic.

1.0.1.12 Do not hydrostatically test the pressure vessels. All standard EP air dryer pressure vessels are hydrostatically tested at 1.3x the design pressure, per ASME code, after fabrication and before assembly of the dryer.

1.0.1.13 Attention / Warning!



If the equipment is installed in a high traffic area, protective barriers may be required to prevent possible damage of equipment and to prevent contact with hot surfaces.

SECTION 1: INSTALLATION & START-UP

1.0.2 Preventive Maintenance Prior to Start-up



This preventive procedure will save time and money in the long run, as well as help keep the air dryer covered under warranty. Failure to follow this bolt torque procedure may result in premature gasket failure which is not covered under warranty.

1.0.2.1 All air dryers are tested at the factory for leak-tight joints and tightness of bolts; however, during shipment, some bolts may vibrate loose. We have no control over the handling our compressed air systems receive after leaving our factory. To prevent costly problems at start-up and operation, all bolts should be checked for tightness prior to system pressurization. This will assure gasket life, as well as prevent possible gasket blowout. Gasket joints should be bubble tested after four or five complete cycles of the dryer, to ensure gaskets are sealed. Any loose joints will need to be re-tightened and re-tested for leaks.

1.0.2.2 If the dryer includes manual ball or butterfly valves, valves must be totally closed before re-torquing bolts.

1.0.2.3 Following is a comprehensive procedure for tightening all pressurized gasketed joints:

1. Align component parts and clamp together with hold down.
2. Lubricate stud (or bolt) threads in area of nut (or forged ring) engagement. Also lubricate face of nuts (or bolt head) using a suitable lubricant.
3. Install all bolts and nuts finger tight.
4. Number bolts so that torquing requirements can be followed.
5. Apply torque in 20% (1/5) steps of required final torque. Loading all bolts at each step before proceeding to next step.

Reference the next page for continuation of the flange bolt torque procedure.

SECTION 1: INSTALLATION & START-UP

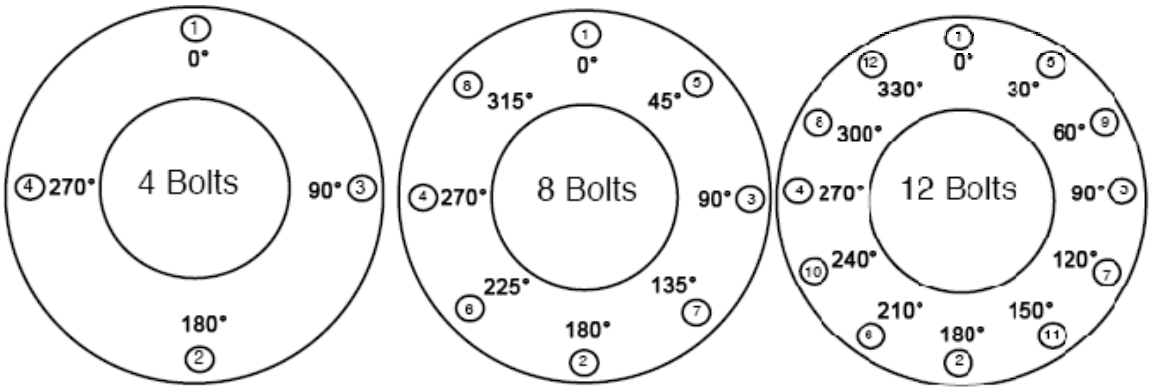
1.0.2 Preventive Maintenance Prior to Start-up (continued)

1.0.2.3 Following is a comprehensive procedure for tightening all pressurized gasketed joints (continued):

6. TIGHTEN BOLTS IN SEQUENTIAL ORDER (i.e. 0-180°, 90°-270°, 45°-225°, 135°-315° for 8 Bolt pattern as illustrated below) at each step until final torque is reached.

FLANGE BOLT TORQUE PROCEDURE

SEQUENTIAL ORDER		
4 BOLTS	8 BOLTS	12 BOLTS
1-2	1-2	1-2
3-4	3-4	3-4
	5-6	5-6
	7-8	7-8
		9-10
		11-12



Reference the next page for continuation of the flange bolt torque procedure.

SECTION 1: INSTALLATION & START-UP

1.0.2 Preventive Maintenance Prior to Start-up (continued)

1.0.2.3 Following is a comprehensive procedure for tightening all pressurized gasketed joints (continued):

7. Use ROTATIONAL TIGHTENING until all bolts are stable at final torque level (two complete rotations are usually required). Start at recommended torque value and if not sealed, slightly increase torque wrench and proceed with rotational tightening until leak is sealed. Do not go over maximum torque ratings shown in chart.

FLANGE BOLT TORQUE PROCEDURE

ROTATIONAL ORDER		
4 BOLTS	8 BOLTS	12 BOLTS
1	1	1
3	5	5
2	3	9
4	7	3
	2	7
	6	11
	4	2
	8	6
		10
		4
		8
		12

FLANGE BOLT TIGHTENING TORQUES

SIZE	BOLT QTY.	BOLT SIZE	RECOMMENDED TORQUE / BOLT (FT. LBS.)	MINIMUM TORQUE (FT. LBS.)	MAXIMUM TORQUE (FT. LBS.)
1"	4	1/2"	44	37	49
1 ½"	4	1/2"	44	37	49
2"	4	5/8"	87	73	97
3"	4	5/8"	87	73	97
4"	8	5/8"	87	73	97
6"	8	3/4"	155	125	172
8"	8	3/4"	155	125	172
10"	12	7/8"	150	125	167

- *Based on SA307 GR B bolts and 1/16" gasket material.*

1.0.2.4 Make certain all electrical connections are sound. Reference the electrical torque chart which can be found inside the dryer electrical panel.

SECTION 1: INSTALLATION & START-UP

1.0.3 Prefilter Installation

1.0.3.1 The prefilter eliminates liquid water and oil carryover into the desiccant dryer. The desiccant dryer cannot remove liquid water or oil from the air stream, so it is important for the dryer to have a prefilter. This prefilter will need to be manually drained several times a day or by equipping it with an automatic drain which is recommended.

1.0.3.2 As standard, the dryer is shipped with the prefilter loose.

1.0.3.3 Prefilter Installation Steps



Attention / Warning! If a bypass piping arrangement option was purchased with this dryer, reference the "Bypass Piping Arrangement Options" section of this manual for the applicable prefilter installation steps.

- Mount prefilter in such a way as to allow clearance for the element installation and removal.
- The prefilter must be piped, so that the correct flow direction indicated on the prefilter is followed.
- Ensure that all piping and valves are equivalent or larger in size to the prefilter inlet connection.
- If the prefilter does not have a drain already mounted on bottom, install an automatic drain to remove water and oil out of the prefilter.
- If the prefilter has a factory mounted drain already installed, connect power or pneumatic lines to dryer skid as required.

SECTION 1: INSTALLATION & START-UP

1.0.4 Afterfilter Installation

1.0.4.1 The afterfilter virtually eliminates the possibility of desiccant dust carryover into the instrument air system.

1.0.4.2 As standard, the dryer is shipped with the afterfilter loose.

1.0.4.3 Afterfilter Installation Steps



Attention / Warning!

If a bypass piping arrangement option was purchased with this dryer, reference the "Bypass Piping Arrangement Options" section of this manual for the applicable afterfilter installation steps.

- Mount the afterfilter in such a way as to allow clearance for the element installation and removal.
- The afterfilter must be piped, so that the correct flow direction indicated on the afterfilter is followed.
- Ensure that all piping and valves are equivalent or larger in size to the afterfilter inlet connection.

SECTION 1: INSTALLATION & START-UP

1.0.5 Bypass Piping Arrangement Options

1.0.5.1 In situations where the dryer is operating 24 hours per day and it is undesirable to interrupt the airflow, a bypass system is recommended to permit servicing the dryer and/or the prefilter and afterfilter.

1.0.5.2 Bypass piping arrangements are available completed from the factory or can be installed in the field. Reference the "Engineering Drawings & Documents" section of this manual for drawings that indicate the options purchased from the factory for this dryer.

1.0.5.3 The following illustration shows typically available dryer and/or filter bypass piping arrangements.

Bypass Options Legend:

SM = Skid-Mounted
BB = Block and Bypass
DB = Dual Block
XV = # of Valves

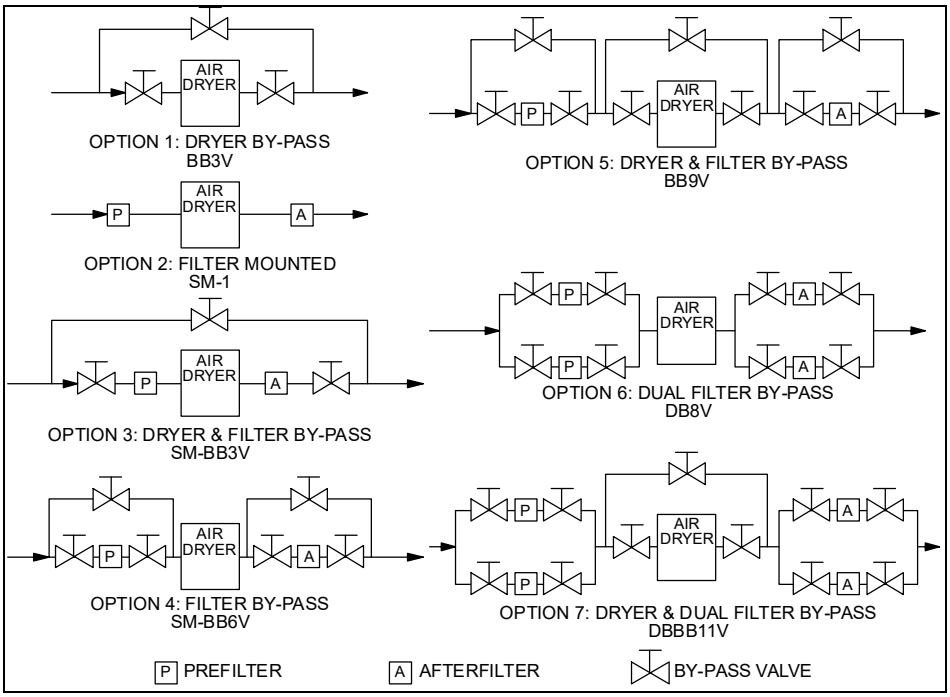


Illustration: Typical bypass piping arrangement options

SECTION 1: INSTALLATION & START-UP

1.0.5 Bypass Piping Arrangement Options (continued)

1.0.5.4 Prefilter installation steps for the Skid-Mounted with 3-Valve Bypass or Dual Filter Arrangement options (if filter and dryer skids are separate)

- Prefilter skid should be located as close to dryer as possible. Use the skid bolt holes to secure the assembly.
- Check the flow direction of each prefilter to ensure the proper air flow direction is followed.
- Connect the prefilter skid piping and dryer skid piping, using materials and fabrication procedures that are suitable for compressed air pressure piping.
- If the prefilter does not have a drain already mounted on the bottom, install an automatic drain trap to remove water and oil out of the prefilter.
- If the prefilter has a factory mounted drain already installed, connect power or pneumatic lines to dryer skid as required.

1.0.5.5 Afterfilter installation steps for the Skid-Mounted with 3-Valve Bypass or Dual Filter Arrangement options (if filter and dryer skids are separate)

- Afterfilter skid should be located as close to dryer as possible. Use the skid bolt holes to secure the assembly.
- Check the flow direction of each afterfilter to ensure the proper air flow direction is followed.
- Connect the afterfilter skid piping and dryer skid piping using materials and fabrication procedures that are suitable for compressed air pressure piping.

SECTION 1: INSTALLATION & START-UP

1.0.6 Air Supply

1.0.6.1 The air supply for a standard EP dryer should be between 80-100°F / 26.67°C-37.78°C and 100-125 PSIG / 6.90 Bar(G)-8.62 Bar(G) compressed air. Reference the "Documentation" section of this manual for the Specification Sheet which will indicate the dryer design conditions specific to this air dryer.

1.0.6.2 In piping the air to the dryer, use a pipe size equal to, or larger than, the dryer line size.

1.0.6.3 The compressed air generated by a reciprocating compressor contains some pulsation; the amplitude and frequency being related to the number of stages, speed, etc. Normally, the pulsation associated with a multi-stage compressor will not affect the operation of the dryer; however, it is recommended that a PULSATION DAMPENER be installed between a reciprocating compressor and the dryer to prevent excessive desiccant breakup and component fatigue.



A pulsation dampener should be used in any installation where the pulsation seems excessive.

1.0.6.4 If the compressed air system cannot be shut down during dryer maintenance periods, a three-valve block and bypass valving arrangement should be installed prior to start-up to allow for isolating and depressurizing the dryer, while still maintaining compressed air delivery. Reference the "Engineering Drawings & Documents" section of this manual for the Flow Schematic which will indicate the factory supplied arrangement. Note that the bypassed air will not be dried. Reference the “Maintenance” section of this manual for the suggested preventive maintenance schedule.

1.0.7 Air Discharge Piping

1.0.7.1 If an air receiver is required in the compressed air system for air storage, it should be installed after the dryer. Here it will store dry air. This will eliminate the possibility of overloading the dryer with stored air in wet receivers.

1.0.8 Drain Piping (on mounted prefilter)

1.0.8.1 All the moisture removed from the prefilter is drained away through the drain valves under the prefilter. The prefilter drain port should be connected to a suitable drain through piping of sufficient size for its length (reference the table on the following page for purge exhaust piping sizes), to avoid pressure drop or blockage due to contaminants in the draining water.



It is recommended that at some convenient point in the drain piping, the water flow should be visible, so proper drain operation can be visually verified.

SECTION 1: INSTALLATION & START-UP

1.0.9 Purge Exhaust Piping

1.0.9.1 If the dryer has a purge exhaust valve and the exhaust is going to be piped away from the dryer location, the following table must be followed to insure that no back pressure builds in the regenerating tower.

Equivalent installed straight length of exhaust pipe	Pipe size required
Up to 10 ft. (3.048 m)	Same size as the dryer exhaust
Up to 25 ft. (7.62 m)	One size larger than dryer exhaust
Up to 50 ft. (15.24m)	Two sizes larger than dryer exhaust
Up to 100 ft. (30.48m)	Three sizes larger than dryer exhaust

Table: Purge exhaust piping sizes

1.0.10 Installation of Insulation and Aluminum (if shipped loose)

1.0.10.1 Remove insulation from boxes. Parts will be labeled for proper location.

1.0.10.2 Install bottom piece of insulation on proper tower. Cut out for legs. Leg height will be pre-marked to height to cut to.

1.0.10.3 Use tape to hold insulation in place at front seam.

1.0.10.4 Slide insulation down until insulation is resting on top of the legs and piping.

1.0.10.5 Install middle piece, if needed. Secure with tape, then install top piece of insulation. Repeat on second tower.

1.0.10.6 Remove aluminum from container. Find bottom piece of aluminum and carefully wrap around correct tower and slide down onto legs and piping.

1.0.10.7 Use a piece of steel banding and a bander to snug aluminum around insulation. Use self-tapping screws in the lower half of aluminum to keep aluminum in place.

1.0.10.8 Install middle piece using the same method as in the last step, if needed.

1.0.10.9 Install pieces of aluminum around name plate and use tape to hold them in place (shipped in aluminum container). Then, install the top piece using same method. Use caution placing aluminum around name plate.

1.0.10.10 Cut out holes for pressure gauge and temperature gauges. Measure up from tower name plate for hole placement.

1.0.10.11 Install sleeves and collars around top of aluminum (shipped in aluminum container).

SECTION 1: INSTALLATION & START-UP

1.1 Start-up



Attention / Warning!

Prior to start-up:

It is recommended that the operational program of the dryer and the wiring schematic be studied before operating the dryer.

Check that the voltage source supplied to the dryer is per the electrical schematic in the "Engineering Drawings & Documents" section of this manual.

Desiccant level must be checked. Wear protective goggles and mask when working with desiccant. If the desiccant was shipped separately, reference the "Maintenance" section in this manual for the desiccant first-time fill-up instructions. The SDS can be referenced in the "Desiccant SDS" section of this manual.

All pipes and wire connections must be tightened. Reference the "Installation & Start-up" section of this manual for preventive maintenance prior to start-up.

Pipes must be checked for presence of scale, abraded material from the threading, or other similar impurities.

All shut-off valves on the dryer, prefilter, afterfilter, and on the bypass line should be closed.

The ambient temperature must not be less than 33°F / 0.56°C.

SECTION 1: INSTALLATION & START-UP

1.1.1 Safety Precautions



Attention / Warning!

As with any piece of industrial machinery, common sense and safety precautions should be observed. Please adhere to the following:

1.1.1.1 Portions of the dryer and related piping will reach temperatures which could cause serious burns, if not insulated or shielded. Personnel working on or near the dryer should be cautioned to this particular danger.

If the equipment is installed in a high traffic area, protective barriers may be required to prevent possible damage of equipment and to prevent contact with hot surfaces.

1.1.1.2 Pull the main disconnect switch before attempting to work or perform maintenance on the dryer.

1.1.1.3 Do not attempt to remove any dryer parts while the dryer is pressurized. First, isolate the dryer (if bypass valving has been installed) or shut off the compressor. Then, slowly depressurize the dryer through the afterfilter bleed.

1.1.1.4 Do not allow tools or other obstructions to interfere with the shaft of the switching valves. Keep all body parts away from the switching valve shafts while the dryer is operating. The actuation is sudden and can cause bodily injury.

SECTION 1: INSTALLATION & START-UP

1.1.2 Pressurizing Dryer

1.1.2.1 Prior to pressurizing the dryer, verify the following:

- Dryer ON/OFF switch is in the OFF position.
- System outlet block valve is closed.

1.1.2.2 Slightly open the inlet isolation valve, slowly flowing compressed air to the system. Opening this valve too quickly may cause damage to the dryer including the desiccant, tower screens, and filter elements.

1.1.2.3 When full system operating pressure has been reached, all connections should be soap bubble tested for leaks. Any leaks should be repaired and retested, prior to placing the equipment in service. Fully open the inlet isolation valve.



If some gas other than the process air will be used for leak testing, consult Ingersoll-Rand for its compatibility with system components before proceeding.

1.1.2.4 **Attention / Warning!**



Please note that excessive flows or rapid change in pressure may cause damage to the air dryer skid. Every time there is no line pressure, the dryer must be valved out and brought up to line pressure slowly, as described in the following steps.

1.1.2.6 When the system is filled with process air, is leak tight, and start-up is completed, then slowly open the system outlet valve to pressurize the downstream piping. During the procedure, ensure that the dryer system pressure does not fall below 95% of its reading prior to opening the system outlet valve. This will protect the equipment internal components (i.e. filter elements, desiccant) from gas velocities above design conditions.

1.1.2.7 When pressurizing is complete, fully open the system outlet valve to place the equipment in service. Reference the "Auxiliary Manuals" section of this manual for the operator interface user guide.

1.1.2.8 Verify the system inlet pressure and temperature are at the design operating levels.

SECTION 1: INSTALLATION & START-UP

1.1.2 Pressurizing Dryer (continued)



Attention / Warning!

Protect the dryer from overloads. The dryer can become overloaded, if:

- **inlet flow is too high**
- **inlet air temperature is too high**
- **minimum operating pressure is too low**
- **prefilter drain failure**
- **reference the "Documentation" section of this manual and check the Specification Sheet for proper operating conditions**

1.1.2.9 The dryer should be carefully monitored during the first few hours of operation to check for malfunction.

1.1.3 Operator Interface



Reference the "Auxiliary Manuals" section of this manual for the operator interface user guide for this air dryer.

1.1.4 Optional Dew Point Demand System

Reference the "Auxiliary Manuals" section of this manual for the dew point demand system user guide, if the option is installed on this air dryer.

SECTION 2: OPERATION & MAINTENANCE



Prior to operating this dryer, it is advised that this entire manual be studied and clearly understood.



2.0 Operation



Carry out maintenance work only when the dryer is switched off, depressurized (even though gauges may read 0, there may still be air in the dryer), and disconnected from the electric power supply.

Multiple power sources may exist in the electrical panel. All possible power sources must be disconnected before servicing dryer.

Never make any changes to the dryer that are not specifically authorized by Ingersoll-Rand.



Only use original spare and accessory parts.

2.0.1 General Information

The EP dryer is used for the purpose of drying compressed air and other gases according to its respective design. The standard model EP dryer is equipped with two desiccant vessels and provides pure, dry, compressed air or gases when used under the design conditions as specified upon purchase.



Attention / Warning!

Use of the dryer can endanger personnel and can lead to considerable damage to the dryer and other material assets if:

- **it is operated by personnel not trained or instructed in its use**
- **it is improperly used**
- **it is improperly maintained or serviced**

This can result in the loss of all damage claims.



This dryer is designed for neutral media (gas) free of aggressive water, oil, and solid elements. Ingersoll-Rand accepts no liability for corrosion damage and malfunctions caused by aggressive media.

Applications other than those mentioned in this manual must be agreed to by Ingersoll-Rand and confirmed in writing.

In the interest of further development, Ingersoll-Rand reserves the right to make changes at any time which, in keeping with the essential characteristics of the air dryer described here, may be necessary for increasing efficiency or for reasons relating to safety or to normal business practice.

SECTION 2: OPERATION & MAINTENANCE

2.0.2 Description

The Ingersoll-Rand EP air dryer is a complete system consisting of the following major components:

2.0.2.1 Drying Vessels (insulation optional)

Two ASME Code stamped vessels containing activated alumina desiccant (reference the "Documentation" section of this manual for the Specification Sheet and Spare Parts List which will indicate the desiccant quantity) are firmly mounted on a structural steel base. Each vessel is provided with stainless steel desiccant retaining screens at both inlet and outlet. Separate desiccant fill and drain connections allow for fast and easy desiccant replacement without disturbing process piping (reference the "Maintenance: Fill-Up / Replacement of Desiccant" section of this manual for desiccant fill-up/replacement instructions). A safety relief valve is installed on each vessel.

2.0.2.2 Switching Valves

Main compressed air flow through the Ingersoll-Rand EP dryer is controlled by reinforced teflon-seated high performance butterfly valves (3" and larger) or 2-way rack and pinion operated ball valves (2" and smaller). This improved 2-way valve design provides for lower overall system pressure drop and it eliminates undesirable wet air transfer between compressed air streams simultaneously flowing through the same valve internal plug, rotor, or ball.

The valves are opened and closed by over-sized actuators. These actuators are driven by well filtered, cool, dry air supplied by the control air filter. The coalescing quality filter element contained therein removes all particulates above 0.3 micron in size; thereby assuring long pneumatic actuator life. Control air lines need no lubricators as the pneumatic actuators have been permanently pre-lubricated.

The inlet and outlet switching valves are piloted by a four-way dual coil solenoid and speed/flow control valves within the control air runs. The speed/flow control valves assure fast opening of either switching valve and slow closing of either switching valve. This prevents any possibility of dead-heading the upstream compressor.

2.0.2.3 Coalescing Prefilter (optional)

After the compressed air leaves the compressor, it will contain liquid water and oil. This will cause a problem for the dryer as it will not remove liquid water from the air stream. It is essential that the dryer be fitted with a prefilter located directly before the dryer inlet. This prefilter will need to be manually drained several times a day or by equipping it with an automatic drain which is recommended.

SECTION 2: OPERATION & MAINTENANCE

2.0.2 Description (continued)

2.0.2.4 High Temperature Afterfilter (optional)

After the compressed air leaves the second drying vessel, it may contain small particles of desiccant dust. This material is inert, harmless, and presents no health or safety problems; however, to provide absolute top quality compressed air, a high temperature particle removal filter is recommended.

2.0.2.5 Control Group

The complete operation of the EP air dryer is fully automatic and pre-programmed to shift drying vessels continuously before the design water load can be reached (breakthrough). With the optional Dew Point Demand System, the dryer will not switch towers until the drying tower reaches the dew point setpoint. The standard control is done with a PLC and operator interface which operates the pilot air solenoids, which in turn actuate the switching valves; all without operator attention.

Any optional alarms, such as the "Fail-to-Shift" alarm or the "High Dewpoint" alarm, will be in the dryer control group, if purchased.

2.0.2.6 Instrument Panel

The standard instrument panel assures that operating personnel are always informed of all phases of the EP dryer operation. Tower status indication and alarms are displayed here.

An optional highly visible "color change" moisture indicator makes clear at a glance the actual dew point condition of the delivered air.

Locally mounted temperature and pressure gauges are included as standard. Also included as standard is a purge adjustment valve with calibrated flow gauge.

SECTION 2: OPERATION & MAINTENANCE

2.0.3 Theory of Operation

2.0.3.1 Drying

Wet compressed air enters the dryer at the top and is directed by non-lubricated switching valves into the drying tower. The wet air encounters dry desiccant and moisture is transferred from the air to the desiccant. The direction of airflow during drying is downflow. At the bottom of the dryer, the dry process air is directed to the outlet of the dryer; also through non-lubricated switching valves.

2.0.3.2 Heating

The desiccant in the regenerating tower is regenerated using dried air. The air is heated with an electric heater (steam optional) and the hot air is directed through the tower. After removing the moisture from the desiccant, the purge air exits the dryer through the purge exhaust valve and is blown to atmosphere. On Models EP-350 and smaller, the purge air is exhausted through the depressurization valve and muffler. Heating continues for three hours and will take all the moisture off the desiccant. After heating is completed, the desiccant needs to be cooled before it can be used to dry air again. Cooling will occur for one hour and will end the cycle.

2.0.3.3 Cooling

During cooling, the air is directed to the regeneration tower to cool the desiccant before switchover. At the end of cooling, the regenerating tower is gradually repressurized to prepare for the tower shift. The optional Dew Point Demand System can provide lower dew points and less tower shift temperature spikes by using the Dewpoint Cycle to place the dryer in standby mode.



The Flow Schematic can be referenced in the "Engineering Drawings & Documents" section of this manual.

2.0.4 Pressure Vessel Regulations



Attention / Warning!

Never weld on, or alter, a pressure vessel in any way.

The pressure vessels are designed according to the standard technical requirements. They fulfill the test and the certifying procedure, as required by ASME Code and carry the **“U”, “UM”** ASME Symbol as required.

2.0.5 Airtightness Test

All EP dryers are subjected to a pneumatic air test prior to shipment using compressed air and soap solution. System should be re-tested after installation to ensure system integrity and joints are sealed.

SECTION 2: OPERATION & MAINTENANCE

2.1 Maintenance

2.1.1 Suggested Preventive Maintenance Schedule

The EP dryer requires a minimum of maintenance as most components are maintenance-free; however, a certain amount of preventive maintenance is recommended to assure years of trouble-free, high performance service.

Whereas it is recommended that the dryer be observed and inspected as often as it is practical, the following is a minimum requirement:

2.1.1.1 DAILY

1. Check operating conditions: inlet flow, inlet pressure, temperature, and purge flow.
2. Check filter differential pressures.
3. Check dryer operating cycle.
4. Check outlet dew point.
5. Test drain for proper operation.

Note: Maintenance steps above can be accomplished while the dryer is operating.

2.1.1.2 EVERY 8,000 HOURS OR 12 MONTHS

1. Perform steps 1 through 5 as outlined in "DAILY".
2. If dryer has optional Dew Point Demand System:
   a. Recalibrate or replace dew point probe/transmitter. Contact Ingersoll-Rand for instructions which will include the issue of a Return Merchandise Authorization (RMA) to return the dew point equipment for recalibration.
   b. Replace inline filter for dew point sample cell.

Note: Maintenance steps above can be accomplished while the dryer is operating.

3. Replace all filter elements.

Note: If filters are able to be isolated by themselves, dryer can continue to operate. Isolate and depressurize the filters only.

Reference the next page for continuation of the Suggested Preventive Maintenance Schedule: EVERY 8,000 HOURS OR 12 MONTHS.

SECTION 2: OPERATION & MAINTENANCE

2.1.1 Suggested Preventive Maintenance Schedule (continued)

2.1.1.2 EVERY 8,000 HOURS OR 12 MONTHS (continued)

Note: Reference the "Maintenance: Prefilter Maintenance & Afterfilter Maintenance" sections of this manual for the detailed maintenance procedures for replacing filter elements.

4. Isolate and depressurize the dryer.
5. Disconnect power to the dryer.
6. Replace mufflers.
7. Inspect electric heater contactor for excessive wear and replace, if necessary. (Not applicable for steam heater.)
8. Make certain all air and electrical connections are sound. Reference the electrical torque chart which can be found inside the dryer electrical panel.
9. Repressurize the dryer (or filters) and place "onstream".
10. Reconnect power to the dryer.

2.1.1.3 EVERY 16,000 HOURS OR 24 MONTHS

1. Perform steps 1 through 7 as outlined in "EVERY 8,000 HOURS OR 12 MONTHS".



Attention / Warning!

DO NOT REPRESSURIZE DRYER OR RECONNECT POWER TO THE DRYER YET!

2. Disassemble and clean the drain.
3. Test desiccant for dynamic capacity. Contact Ingersoll-Rand for instructions which will include the issue of a Return Merchandise Authorization (RMA) to send in desiccant samples for testing.
4. Make certain all air and electrical connections are sound. Reference the electrical torque chart which can be found inside the dryer electrical panel.
5. Repressurize the dryer (or filters) and place "onstream".
6. Reconnect power to the dryer.

SECTION 2: OPERATION & MAINTENANCE

2.1.1 Suggested Preventive Maintenance Schedule (continued)

2.1.1.5 EVERY 32,000 HOURS OR 48 MONTHS

1. Perform steps 1 through 2 as outlined in "Every 16,000 Hours or 24 Months".



Attention / Warning!

DO NOT REPRESSURIZE DRYER OR RECONNECT POWER TO THE DRYER YET!

2. Drain all the desiccant from both vessels through the drain at the bottom of each vessel. If a handhole/manway is available, the desiccant can be removed using a vacuum truck **(recommended).**
3. Refill both vessels with the proper amount of desiccant. Reference the "Documentation" section of this manual for the Specification Sheet and Spare Parts list which indicate the required desiccant quantity. Reference the "Maintenance: Fill-Up / Replacement of Desiccant" section of this manual for the desiccant fill-up/replacement instructions.
4. Rebuild the actuators and valves by installing repair kits in the major switching valves. If dryer has check valves, replace the check valves at this time.
5. Carefully disassemble and clean the solenoid valves in the control group; rebuild with new parts only if damage or serious wear is evident.
6. Make certain all air, electric, and water connections are sound. Reference the electrical torque chart which can be found inside the dryer electrical panel.
7. Repressurize the dryer and place "onstream".
8. Reconnect power to the dryer.

2.1.2 Fill-Up / Replacement of Desiccant

The air dryer is filled from the top and can be emptied by either vacuuming from the top (recommended) or emptying from the bottom. Reference the "Engineering Drawings & Documents" section of this manual for the General Assembly drawing for location of fill and drain ports.



Advice for protection:

- **A small dust mask must be worn.**
- **If desiccant comes into contact with the eyes, rinse eyes immediately with large amounts of clear water.**
- **If the desiccant is spilled, clean up to minimize the formation of dust.**
- **In case of fire, there is no restriction on the use of fire extinguishing material.**
- **The desiccant Safety Data Sheet (SDS) can be referenced in the "Desiccant SDS" section of this manual.**



For EP dryers with a mixed desiccant bed:

If a mixed bed with molecular sieve is required, the molecular sieve should be installed on the bottom of the drying bed with the activated alumina on the top.

2.1.2.1 For first time fill-up:

- For first time fill-up, remove nuts, bolts, yokes, cover, and gasket from the manway at the top of the tower (ON LARGE TOWERS WITH MANWAYS).
- Remove plug from desiccant fill (ON SMALL TOWERS WITH THREADED DESICCANT FILLS).
- Pour specified amount of desiccant into the tower. Reference the "Documentation" section of this manual for the Specification Sheet and Spare Parts List which indicate the required desiccant quantity.
- Do not tamp the desiccant.
- Replace the manway cover components, or the desiccant fill plug, and tighten.
- Repeat process for other tower.
- Make sure all drain and fill ports are in place and properly tightened. Soap test for leaks before placing the dryer in service.

2.1.2 Fill-Up / Replacement of Desiccant (continued)

2.1.2.2 To replace used desiccant:

- To replace used desiccant, do not attempt any maintenance while dryer is pressurized.
- First, isolate the dryer (IF BYPASS VALVING HAS BEEN INSTALLED), or shut off compressor, turn off dryer, then slowly depressurize the dryer.
- Remove desiccant from tower. We recommend removing desiccant from the top handhole via a vacuum truck. If a vacuum truck is not available, or there is no handhole, drain desiccant from tower by removing the plug at the bottom of the tower and catch the old desiccant in a suitable container.
- On large towers with manways, remove nuts, bolts, yokes, cover, and gasket from the manway at the top of the tower. Take care not to drop the manway cover into the tower.
- On small towers with threaded desiccant fills, remove plug from the desiccant fill.
- The tower can be blown clean with an air hose or may be washed out with a water hose, if desired, but time must be allowed if this is done to completely dry the tower before refilling it with desiccant.
- If drain plug removed during removal of desiccant or cleaning the tower, replace drain plug in bottom of the tower.
- If equipped with manway, visually inspect both upper and lower desiccant retainers in each tower. Replace, if damaged.
- Pour desiccant into the tower.
- The tower may not be completely full. The amount of desiccant per tower will be specific. Reference the "Documentation" section of this manual for the Specification Sheet and Spare Parts List which indicate the required desiccant quantity.
- Do not tamp the desiccant.
- Reinstall the handhole or manway cover and components, or desiccant fill plug, and tighten.
- A new gasket will be needed for re-assembly.

2.1.2 Fill-Up / Replacement of Desiccant (continued)

2.1.2.2 To replace used desiccant (continued):

- Repeat process for the other tower.
- Make sure all drain and fill ports are in place and properly tightened. Soap test for leaks before returning the dryer to service.
- Slowly repressurize the dryer and turn on.

2.1.3 Prefilter Maintenance

2.1.3.1 General comments and use

The prefilter eliminates liquid water and oil carryover into the desiccant dryer. The desiccant dryer cannot remove liquid water or oil from the air stream, so it is important for the dryer to have a prefilter.

2.1.3.2 Function

The soiled medium flows through the filter element from the inside to the outside. Liquids are filtered out by impact or by the effect of inertia.

2.1.3.3 Assembly and installation



The piping system must be cleaned before assembling filter.

The filter must always be installed vertically.

2.1.3.4 Maintenance

The filter element(s) should be replaced when a differential pressure of 7-10 PSID / 0.48 Bar(G)-0.69 Bar(G) has been reached, plant pressure demands more often, or at least after 12 months of operation.

- If the dryer **is** equipped with filter block & bypass, the filter housings can be isolated and depressurized by themselves and the dryer can continue to operate.



- If the dryer **is not** equipped with filter block & bypass, the full dryer skid must be isolated and depressurized. **The dryer should be powered off before performing this maintenance work!**

2.1.3 Prefilter Maintenance (continued)

2.1.3.5 Changing of prefilter elements



Attention / Warning! The filter housings must be DEPRESSURIZED prior to replacing elements!

- If the dryer **is** equipped with filter block & bypass, the filter housings can be isolated and depressurized by themselves and the dryer can continue to operate.



- If the dryer **is not** equipped with filter block & bypass, the full dryer skid must be isolated and depressurized. **The dryer should be powered off before performing this maintenance work!**



Filter elements should NOT be cleaned with compressed air.

The prefilter elements are to be changed using the following steps:

2.1.3.5.1 HEF-350 and smaller

- Isolate the filter by closing the manual valves before and after the filter, if supplied, or by isolating complete drying system.

  Note: When changing the filter element in the HEF-60 pilot air filter, if equipped with isolation valves, can isolate pilot air line only.
- Completely depressurize the filter or dryer as required.
- Disconnect and move the drain piping to accommodate lowering of the filter bowl.
- Support the lower part of the housing.
- Remove bowl assembly.
- Unscrew element from its stud.
- Install the new element to the stud. Make sure the element seats perfectly.
- Replace housing seal.
- Reinstall bowl assembly.
- Reconnect the drain piping to the bottom of the filter bowl.
- Slowly repressurize the filter or dryer as required.
- Check for air leaks with soap solution.
- Place back into service.

SECTION 2: OPERATION & MAINTENANCE

2.1.3 Prefilter Maintenance (continued)

2.1.3.5 Changing of prefilter elements (continued)



Attention / Warning! The filter housings must be DEPRESSURIZED prior to replacing elements!

- If the dryer **is** equipped with filter block & bypass, the filter housings can be isolated and depressurized by themselves and the dryer can continue to operate.



- If the dryer **is not** equipped with filter block & bypass, the full dryer skid must be isolated and depressurized. **The dryer should be powered off before performing this maintenance work!**



Filter elements should NOT be cleaned with compressed air.

The prefilter elements are to be changed using the following steps:

2.1.3.5.2 HEF-700 and larger with split bowl design
(for HEF-700 and larger with handhole design, reference following page)

- Isolate the filter by closing the manual valves before and after the filter, if supplied, or by isolating complete drying system.
- Completely depressurize the filter or dryer as required.
- Disconnect and move the drain piping to accommodate lowering of the filter bowl.
- Support the lower part of the housing.
- Remove bolts and nuts from filter rings which hold the two halves of housing together.
- Lower the lower half of the housing 18”-20” / 457.2mm-508mm to allow access to elements.
- Unscrew each element from its stud.
- Install a new element to each stud. Make sure the elements seat securely.
- Replace o-ring gasket.
- Be sure o-ring is arranged neatly in gasket groove in lower ring before mating the housing rings.
- Raise the lower half of the filter housing back into place. Install bolts and nuts and tighten in a cross pattern.
- Reconnect the drain piping to the bottom of the filter bowl.
- Slowly repressurize the filter or dryer as required.
- Check for air leaks with soap solution.
- Place back into service.

2.1.3 Prefilter Maintenance (continued)

2.1.3.5 Changing of prefilter elements (continued)



Attention / Warning! The filter housings must be DEPRESSURIZED prior to replacing elements!

- If the dryer **is** equipped with filter block & bypass, the filter housings can be isolated and depressurized by themselves and the dryer can continue to operate.



- If the dryer **is not** equipped with filter block & bypass, the full dryer skid must be isolated and depressurized. **The dryer should be powered off before performing this maintenance work!**



Filter elements should NOT be cleaned with compressed air.

The prefilter elements are to be changed using the following steps:

2.1.3.5.3 HEF-700 and larger with handhole design

- Isolate the filter by closing the manual valves before and after the filter, if supplied, or by isolating complete drying system.
- Completely depressurize the filter or dryer as required.
- Disconnect and move the drain piping to accommodate lowering of the filter bowl.
- Open the handhole. Take care not to drop the handhole cover in the vessel.
- Unscrew each element from its stud.
- Install a new element to each stud. Make sure the elements seat securely.
- Replace the handhole gasket.
- Put back handhole, then reattach yoke assembly and tighten.
- Slowly repressurize the filter or dryer as required.
- Check for air leaks with soap solution.
- Place back into service.

2.1.4 Afterfilter Maintenance

2.1.4.1 General comments and use

The afterfilter virtually eliminates the possibility of desiccant dust carryover into the instrument air system.

2.1.4.2 Function

The soiled medium flows through the afterfilter element from the outside to the inside. Solids are filtered out by impact or by the effect of inertia.

2.1.4.3 Assembly and installation



The piping system must be cleaned before assembling filter.

The filter must always be installed vertically.

2.1.4.4 Maintenance

The filter element should be replaced when a differential pressure of 7-10 PSID / 0.48 Bar(G)-0.69 Bar(G) has been reached, plant pressure demands more often, or at least after 12 months of operation.

- If the dryer **is** equipped with filter block & bypass, the filter housings can be isolated and depressurized by themselves and the dryer can continue to operate.



- If the dryer **is not** equipped with filter block & bypass, the full dryer skid must be isolated and depressurized. **The dryer should be powered off before performing this maintenance work!**

SECTION 2: OPERATION & MAINTENANCE

2.1.4 Afterfilter Maintenance (continued)

2.1.4.5 Changing of afterfilter elements



Attention / Warning! The filter housings must be DEPRESSURIZED prior to replacing elements!

- If the dryer **is** equipped with filter block & bypass, the filter housings can be isolated and depressurized by themselves and the dryer can continue to operate.



- If the dryer **is not** equipped with filter block & bypass, the full dryer skid must be isolated and depressurized. **The dryer should be powered off before performing this maintenance work!**



Filter elements should NOT be cleaned with compressed air.

The afterfilter elements are to be changed using the following steps:

2.1.4.5.1 AFH-350 and smaller

- Isolate the filter by closing the manual valves before and after the filter, if supplied, or by isolating complete drying system.
- Completely depressurize the filter or dryer as required.
- Disconnect and move any drain piping, if installed, to accommodate lowering of the filter bowl.
- Loosen and drop bottom bowl.
- Remove the element from the filter housing.
- Install new element to original position in housing.
- Replace housing seal.
- Screw bottom bowl assembly to top head.
- Slowly repressurize the filter or dryer as required.
- Check for air leaks with soap solution.
- Place back into service.

2.1.4 Afterfilter Maintenance (continued)

2.1.4.5 Changing of afterfilter elements (continued)



Attention / Warning! The filter housings must be DEPRESSURIZED prior to replacing elements!

- If the dryer **is** equipped with filter block & bypass, the filter housings can be isolated and depressurized by themselves and the dryer can continue to operate.



- If the dryer **is not** equipped with filter block & bypass, the full dryer skid must be isolated and depressurized. **The dryer should be powered off before performing this maintenance work!**



Filter elements should NOT be cleaned with compressed air.

The afterfilter elements are to be changed using the following steps:

2.1.4.5.2 HAF-550 and HAF-1000

- Isolate the filter by closing the manual valves before and after the filter, if supplied, or by isolating complete drying system.
- Completely depressurize the filter or dryer as required.
- Remove cover plate.
- Remove the wing nut from the filter top plate(s) and remove the plate(s).
- Remove the element(s) from the filter housing.
- Inspect the filter top plate(s), base plate(s), and t-bar(s). Replace as needed.
- Install new element(s) to original position in housing.
- Put back top plate and wing nut.
- Replace o-ring.
- Be sure o-ring is arranged neatly in gasket groove in lower ring before mating the housing rings.
- Put back cover plate and tighten.
- Slowly repressurize the filter or dryer as required.
- Check for air leaks with soap solution.
- Place back into service.

2.1.4 Afterfilter Mainteance (continued)

2.1.4.5 Changing of afterfilter elements (continued)



Attention / Warning! The filter housings must be DEPRESSURIZED prior to replacing elements!

- If the dryer **is** equipped with filter block & bypass, the filter housings can be isolated and depressurized by themselves and the dryer can continue to operate.



- If the dryer **is not** equipped with filter block & bypass, the full dryer skid must be isolated and depressurized. **The dryer should be powered off before performing this maintenance work!**



Filter elements should NOT be cleaned with compressed air.

The afterfilter elements are to be changed using the following steps:

2.1.4.5.3 HAF-1400 and larger

- Isolate the filter by closing the manual valves before and after the filter, if supplied, or by isolating complete drying system.
- Completely depressurize the filter or dryer as required.
- Open the handhole. Take care not to drop the handhole cover in the vessel.
- Remove the wing nut from the filter top plate(s) and remove the plate(s).
- Remove the element(s) from the filter housing.
- Inspect the filter top plate(s), base plate(s), t-bar(s), and filter union(s) (if applicable). Replace as needed.
- Install new element(s) to original position in housing.
- Put back top plate and wing nut.
- Replace the handhole gasket.
- Put back handhole, then reattach yoke assembly and tighten.
- Slowly repressurize the filter or dryer as required.
- Check for air leaks with soap solution.
- Place back into service.

2.1.5 Optional **Filter Accessory**



We recommend installing a pressure differential gauge.

This will indicate the degree to which the elements are soiled and show when they need to be replaced.

SECTION 3: TROUBLESHOOTING & CUSTOMER SERVICE

3.0 Troubleshooting

Following proper preventive maintenance procedures will go far toward assuring trouble-free dryer performance; however, failures may still occur. This section will help to identify the source of the problem and to affect a remedy.

Problem	Probable Cause	Remedy
Elevated Dew Point	Inlet gas pressure below design condition	Increase pressure
	Flow rate higher than design condition	Reduce flow rate
	Drying temperature above design condition	Check intercooler at compressor
	Desiccant contamination	Replace desiccant
	Towers not reversing	Check PLC, solenoid valve, switching valves, and, if supplied, dew point meter
	Dew point indication in error	Check calibration/operation of dew point measuring equipment (reference the "Auxiliary Manuals" section of this manual for the dew point demand system user guide, if option was purchased)
	Valve leakage which is allowing relatively wet inlet air into the dry outlet air stream or restricting purge air flow, thereby raising the dew point of the composite air.	Inspect, repair, or replace switching valves, as necessary
Excessive Pressure Drop in Dryer	Inlet pressure below design condition	Increase pressure
	Valve leakage which is allowing air to escape through exhaust valve	Inspect, repair, or replace switching valves, as necessary

SECTION 3: TROUBLESHOOTING & CUSTOMER SERVICE

3.0 Troubleshooting (continued)

Problem	Probable Cause	Remedy
Failure to Switch Towers	No input power	Check fuse
	Defective solenoid valves	Check solenoid valves; electrical connection, coil, and valve seat.
	Low pilot air caused by tubing leakage	Check pilot air line, pilot air filter, and system pressure
	Switching valve actuator leakage causing switching valve to malfunction. Low pilot pressure due to leakage (or solenoid valve failure) will cause fail-to-shift alarm to activate.	Check for leakage
	Depressurization or purge exhaust valve failed to open.	Inspect, repair, or replace, as necessary.
Dryer Fails to Repressurize	Purge adjustment valve is closed	Check purge valve adjustment
	Depressurization or purge exhaust valve failed to close.	Inspect, repair, or replace, as necessary.
Prefilter Drain Failure	Sediment plugging orifice or impeding proper operation of float	Check drain trap for proper operation. Disassemble, inspect, and clean as necessary.

3.0.1 Short-Term Shut-down



Attention!

After the following step, dryer will remain pressurized!

The following sequence is to be heeded when switching off the dryer:

- **First close all the shut off valves up and downstream of dryer.**
- **Then immediately switch off the dryer.**

3.0.2 Shut-down in Case of a Fault or for Maintenance



Danger!

Before any kind of maintenance or repair work is done, the dryer must be depressurized and disconnected from the power source. Apply the general safety regulations!

SECTION 3: TROUBLESHOOTING & CUSTOMER SERVICE

3.1 Customer Service

3.1.1 Contact

For information, parts, or service, contact your local Ingersoll-Rand service provider or reach us at www.air.irco.com.

3.1.2 Inquiry Information

When contacting Ingersoll-Rand, please have the following information available:

- Serial Number, which can be found on the front cover of this manual, on the ASME code nameplate on the dryer towers, or in the electrical enclosure.
- Model Number, which can be found on the front cover of this manual, on the ASME code nameplate on the dryer towers, or in the electrical enclosure.
- Inlet air temperature and pressure (for service inquiries).
- Actual inlet flow rate, if known (for service inquiries).

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SECTION 4: WARRANTY

4.0 Warranty

The Company warrants that the equipment manufactured by it and delivered hereunder will be free of defects in material and workmanship for a period of twelve months from the date of placing the Equipment in operation or eighteen months from the date of shipment from the factory, whichever shall first occur. The Purchaser shall be obligated to promptly report any failure to conform to this warranty, in writing to the Company in said period, whereupon the Company shall, at its option, correct such nonconformity, by suitable repair to such equipment or, furnish a replacement part F.O.B. point of shipment, provided the Purchaser has stored, installed, maintained and operated such Equipment in accordance with good industry practices and has complied with specific recommendations of the Company. Accessories or equipment furnished by the Company, but manufactured by others, shall carry whatever warranty the manufacturers have conveyed to the Company and which can be passed on to the Purchaser. The Company shall not be liable for any repairs, replacements, or adjustments to the Equipment or any costs of labor performed by the Purchaser or others without Company's prior written approval.

The effects of corrosion, erosion and normal wear and tear are specifically excluded. Performance warranties are limited to those specifically stated within the Company's proposal. Unless responsibility for meeting such performance warranties are limited to specified tests, the Company's obligation shall be to correct in the manner and for the period of time provided above.

THE COMPANY MAKES NO OTHER WARRANTY OR REPRESENTATION OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED.

Correction by the Company of nonconformities whether patent or latent, in the manner and for the period of time provided above, shall constitute fulfillment of all liabilities of the Company for such nonconformities whether based on contract, warranty negligence, indemnity, strict liability or otherwise with respect to or arising out of such Equipment.

The purchaser shall not operate Equipment which is considered to be defective, without first notifying the Company in writing of its intention to do so. Any such use of Equipment will be at Purchaser's sole risk and liability.

Note that this is Ingersoll-Rand standard warranty. Any warranty in force at the time of purchase of the equipment or negotiated as part of the purchase order may take precedence over this warranty.

SECTION 5: DOCUMENTATION

5.0 Specifications

The Specification Sheet which is included on the following pages in this section is specific to the air dryer identified on this instruction manual's cover (reference Model No. and Serial No.) and contains information/specifications for the following:

- Design Operating Conditions
- Detail Specifications
- Utilities
- Instrumentation
- Accessory Equipment

5.1 Spare Parts List

The Spare Parts List which is included on the following pages in this section is specific to the air dryer identified on this instruction manual's cover (reference Model No. and Serial No.).

It is a complete spare parts list which includes the recommended spare parts that the user should keep in stock in case of an emergency. We cannot guarantee that specific parts needed will be available immediately from our stock.

5.2 Preventive Maintenance Parts List

The Preventive Maintenance Parts List which is included on the following pages in this section is specific to the air dryer identified on this instruction manual's cover (reference Model No. and Serial No.).

The Preventive Maintenance Parts List includes the parts necessary to conduct both short term and long term preventive maintenance on the air dryer.

5.3 Data Reports (as applicable)

The manufacturer's Data Reports for pressure vessels which are included on the following pages in this section are specific to the air dryer identified on this instruction manual's cover (reference Model No. and Serial No.).

These documents are in accordance with provisions of the National Board Inspection Code and as required by the provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1.

Date 8/3/23

EXHAUST PURGE REGENERATIVE AIR DRYER SPECIFICATION SHEET

Model No.:	EP-1540 V4X ABDIRX	Customer:	AIR PRODUCTS
Serial No.:	110001	Customer P.O. No.:	413459-24
Job Order No.:	200987	Customer Tag No.:	
		Project Reference:	

DESIGN OPERATING CONDITIONS:

Gas Composition:	AIR	
Inlet Flow Rate:	1487	SCFM (Referred to 70°F and 14.7 PSIA)
Inlet Pressure:	120-130	PSIG
Inlet Temperature:	90-97.7	°F
Inlet Moisture Content:	SATURATED	
Outlet Moisture Content:	-40	°F Dew Point at Line Pressure ☒ at Atmosphere ☐

DETAIL SPECIFICATIONS:

Operation:	Automatic ☒					
Dryer Cycle (NEMA):	8	Hrs.				
Cycle Time:	4	Hrs. on Stream	3	Hrs. Heating	1	Hrs. Cooling
Adsorbent Type:	3/16" ACTIVATED ALUMINA				880	# per Chamber
Buffer Absorbent Type:	N/A				N/A	# per Chamber
Purge Rate:	108	SCFM	Open System ☒	Closed System ☐		
Source:	Dried Gas ☒	Other ☐				
Heatless Mode:	N/A	SCFM				
Design Pressure:	150	PSI	ASME Code Stamped: Yes ☒	No ☐		
Pressure Drop:	3	PSID (Max.)				
Connection Size	4" RF		Chamber Relief Valves: Yes ☐	No ☐		
Chamber Insulation:	None ☐	Indoor ☒	Outdoor ☐			

UTILITIES:

Elect. Construction NEMA Class:	4X	Input	460	V	60	CY	3	PH
Conduit Type:	EMT ☐	Rigid ☒		Aluminum ☐				
Heater Size:	12	KW						
Average Power Consumption:	169	KW Hrs. per 24 Hrs.						
Average Control Consumption:	95	Watts @	115	V	60	CY	1	PH
Control Transformer:	Included ☒	Not Required ☐						
Steam PPH:	N/A	@	N/A	PSIG				
Dryer Control Air (Supplied):	80	PSIG (Min.)						

INSTRUMENTATION:

Dewpoint Demand System:	Yes ☒ No ☐
Pressure Gauges:	Locally Mounted ☒ Panel Mounted ☒
Temperature Gauges:	Locally Mounted ☒ Panel Mounted ☐
Moisture Indicator:	☐
Indicating Lights:	☐
Switching Failure Alarm:	☒
Heater Overtemp Alarm:	☒
Other:	• HEF-2100 Coalescing Prefilter, Skid-Mounted • Robo-drain Automatic Drain Trap for Prefilter, Mounted • HAF-2400 High Temperature Particulate Afterfilter, Skid-Mounted • Upgrade Controls for Class 1, Division 2, Group B,C&D required) • UL Listed Control Panel • Equipment Painted IR Beige(Includes Deep Hinged Window Kit for Control Panel, Z-purge System, NEMA 7 rated Solenoid Valves and Other Equipment (as required) • UL Listed Control Panel • Equipment Painted IR Beige • Upgrade Electrical Enclosure & Window Kit to NEMA 4X, 304 SS • Add Additional HEF-2100 Coalescing Prefilter, Skid-Mounted for Dual Mounted Prefilters with 4-Valve Isolation • Differential Pressure Gauge (Common to Both Prefilters) • Add Differential Pressure Switch for High Differential Pressure Alarm (NEMA 7 rated) • Add Additional Robo-drain Automatic Drain Trap for Second Prefilter, Mounted • Add Additional HAF-2400 High Temperature Particulate Afterfilter, Skid-Mounted, for Dual Mounted Afterfilters with 4-Valve Isolation • Differential Pressure Gauge (Common to Both Afterfilters) • Add Differential Pressure Switch for High Differential Pressure Alarm (NEMA 7 rated) • Note 8 - Common Trouble Alarm, with Signal from PLC to DCS • Note 8 - Low Purge Pressure Alarm, with Signal from PLC to DCS Add Dual PRVs with Bronze, Locking Handle Ball Valves and FS Fittings for Each Tower Add Single Mode Fiber Optic Converter with LC Connector Type for Each Panel

ACCESSORY EQUIPMENT:

Prefilter Model No.:	HEF-2100	Cartridge No.:	16D150	Quantity:	6
Afterfilter Model No.:	HAF-2400	Cartridge No.:	712-1H	Quantity:	2

Prefilter Drain Trap: Automatic ☐ Manual ☐

Type Automatic Drain Trap:

Other: • Note 16 - Seismic Calculations (Stamped by P.E.) • Note 20 - 3D Drawing Model • Note 24 - Skid Lift Lugs Items per Data Sheets A8KM-PP-000-400002 Rev 0A • Add Two Lift Lugs to each Lower Section of the Prefilters • Add Diamond Plate to Top of Skid (painted)

Shipping Weight: 4961 Lbs. (approximately)

6721 Lbs (approximately) w/Desiccant
6880 Lbs. (approximately) Operating Weight

Overall Dimensions: 138"L x 97"W x 98"H (68" REQ'D FOR HEATER REMOVAL)

INGERSOLL-RAND
Air Dryer
Spare Parts List
with Stock Recommendations

Model No.: EP-1540
Serial No.: 110001
Prepared August 2024

The following is a complete spare parts list. Items with quantities in the "Recommended Spare Qty." column are the minimum we advise that you place in your stock to have on hand in case of an emergency.

Qty.	Description	Rec. Spare Qty.	CCN
1	MicroLogix 1400 VAC PLC (PLC)	---	17926842
1	PanelView 800 7" (HMI)	----	49206949
1	Henderson Dewpoint Transmitter, with cable (HDT) REV TRANSMIT	---	
1	Regulator, ¾", 0-125# (R1)	---	17928376
2	12' Thermocouple cable	1	38059002
2	18' Thermocouple cable	1	23815269
1,760 lbs.	3/16" activated alumina desiccant (880 lbs./tower)	---	23989908
2	Robo drain, w/test button (FD1,2)	---	38341525
1	Z-Purge, Class1, Div 1&2, GRP A,B,C,D (PURGE)	---	
1	¼" inline filter, particle removal (F2)	1	38335600
2	HAF-2400 Filter, particle removal (F5,6)	---	
	712-1H filter element, high temp (2 per filter)	4	38435947
	Gasket, grafoil, 12", 150# ring, 1/16" (1 per filter)	2	38338877
1	HEF-60 filter, high efficiency (F1)	---	38453882
	16D33 filter element	1	38335584
	Housing seal	1	24267205
2	HEF-2100 Filter, high efficiency (F3,4)	---	
	16D150 filter element (6 per filter)	12	38390811
	Seal, O-Ring cord, Buna ¼" (3.16 ft. per filter)	6.32 ft	38339115
1	1" orifice union, 3000# (OU1) drill 3/8" Note: Air dryer S/N required when ordering.	---	
2	Fuse, 2 AMP, 600 VAC	2	38058848
1	Fuse, 3 AMP, 250 VAC	1	38339610
3	Fuse, 20 AMP, 600 VAC	3	24756991
3	Fuse, 25 AMP, 600 VAC	3	17926906
2	Std. pressure gauge, 200 PSI (P1,2)	---	38339180
1	Pressure gauge, 0-200# ¼" LM 2" D/S dial (P3)	---	38339198

Air Dryer Spare Parts List
Model No.: EP-1540
Serial No.: 110001

Qty.	Description	Rec. Spare Qty.	CCN
1	Gauge, purge, #6 (P4) Note: Air dryer S/N required when ordering.	---	
2	Gauge, diff'l pressure, 0-10# w/switch (DP1,2)	---	
4	Thermowell, ½"x ½" NPT, U=2 ½" (TW)	---	38059358
1	Temp gauge, 0-200F 3" dial 4" stem (T1)	---	
1	Std temp gauge, 50/550 DegF ½ NPT (T2)	---	23815335
1	Heater, 12 KW, NEMA 4, 460/3/60 B=63" (HX)	---	
5	Muffler, ¼" NPT male (SM1-5)	---	38338828
1	Muffler, 1" MNPT air dryer (M1)	1	46794657
2	Relay, 120VAC SPDT w/socket, tension terminals (CR1,2)	1	17930052
28	Gasket, grafoil, 4", 150# ring, 1/16"	14	38342499
1	Gasket, grafoil, 5", 150# ring, 1/16"	1	38342242
1	Contactor, 100-250V 50/60HZ-DC REV2020 (C1)	1	Contact IR
1	Power supply, 24 V DC, 30 W, class 2	---	
1	Transformer, 460V, 500 VA	---	23814262
1	Switch, pressure, 3-30#, SPDT (PS1) Note: Air Dryer S/N required when ordering.	1	38338901
1	Switch, selector, block, contact	---	38339511
3	Transmitter, temp., 32-662F, 4-20 mA (TT1-3)	---	23815426
4	Vale, ball, 1", brass, w/DA actuator (V6,8,12,13)	---	23815749
	Valve only, actuator ready (Valve repair kit not available)	4	23920283
	Actuator repair kit	4	23815434
1	Valve, ball, 1" brass, w/SR actuator (V5)	---	23815756
	Valve only, actuator ready (Valve repair kit not available)	1	23920283
	Actuator repair kit	1	17928325
2	Valve, ball, 2" brass, w/DA actuator (V3,4)	---	23815806
	Valve only, actuator ready (Valve repair kit not available)	2	23920325
	Actuator repair kit	2	17928325
1	Valve, ball, 2" brass, w/SR actuator (V7)	---	23815814
	Valve only, actuator ready (Valve repair kit not available)	1	23920325
	Actuator repair kit	1	17928327
2	Valve, ball, ¼", brass, w/lever (V15,16)	2	17926851
4	Valve, ball, ½", brass, w/lever (V31-34)	4	17926852
3	Valve, ball, ¾", brass, w/lever (V14,27,28)	3	17926853

Air Dryer Spare Parts List
Model No.: EP-1540
Serial No.: 110001

Qty.	Description	Rec. Spare Qty.	CCN
4	Valve, butterfly, 4", 150# wafer, w/pneum DA act (V1,2,10,11)	---	38457693
	Repair kit, butterfly valve	4	38058913
	Repair kit, actuator	4	38451977
8	Valve, butterfly, 4", 150# wafer, w/lever handle (V19-26)	---	23815871
	Repair kit, butterfly valve	8	38058913
1	1" bronze globe valve, threaded, no silicone (V9)	---	
2	¼" brass flow control valve (FCV1,2)	---	38059473
2	¼" OD x ¼" OD std brass needle valve (V29,30)	---	38059481
4	4-way, single, NEMA7 Solenoid (SV2-5)	4	17926360
1	4-way, dual coil, explosion proof, brass (SV1)	1	17926362
4	½", 150#, bronze relief valve (PRV1-4)	1	38339230

Ingersoll-Rand
Air Dryer
Preventive Maintenance Parts List

Model No.: EP-1540
Serial No.: 110001
August 2024

Short Term / Annual

Qty.	Description	Required for Maintenance	CCN
1	Henderson Dewpoint Transmitter w/cable (HDT) REV TRANSMIT	---	
	Recalibrate (recommended annually)	1	RECAL - HDT
1	¼" inline filter, particle removal (F2)	1	38335600
2	HAF-2400 Filter, particle removal (F5,6)	---	
	712-1H filter element, high temp (2 per filter)	4	38435947
	Gasket, grafoil, 12", 150# ring, 1/16" (1 per filter)	2	38338877
1	HEF-60 filter, high efficiency (F1)	---	38453882
	16D33 filter element	1	38335584
	Housing seal	1	24267205
2	HEF-2100 Filter, high efficiency (F3,4)	---	
	16D150 filter element (6 per filter)	12	38390811
	Seal, O-Ring cord, Buna ¼" (3.16 ft. per filter)	6.32 ft	38339115

Long Term / 3-4 Years

Qty.	Description	Required for Maintenance	CCN
1,760 lbs.	3/16" activated alumina desiccant (880 lbs./tower)	1,760 lbs.	23989908
4	Vale, ball, 1", brass, w/DA actuator (V6,8,12,13)	---	23815749
	Valve only, actuator ready (Valve repair kit not available)	4	23920283
	Actuator repair kit	4	23815434
1	Valve, ball, 1" brass, w/SR actuator (V5)	---	23815756
	Valve only, actuator ready (Valve repair kit not available)	1	23920283
	Actuator repair kit	1	17928325
2	Valve, ball, 2" brass, w/DA actuator (V3,4)	---	23815806
	Valve only, actuator ready (Valve repair kit not available)	2	23920325
	Actuator repair kit	2	17928325
4	Valve, butterfly, 4", 150# wafer, w/pneum DA act (V1,2,10,11)	---	38457693
	Repair kit, butterfly valve	4	38058913
	Repair kit, actuator	4	38451977
	Gasket, grafoil, 4", 150# ring, 1/16" (2 per valve)	8	38342499

FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS

110001

(Alternative Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)

As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by Henderson Engineering Co., Inc., 95 N. Main Street, Sandwich, Illinois, 60548, USA
(Name and address of Manufacturer)

2. Manufactured for Ingersoll Rand, 525 Harbour Place Drive #600, Department 11, Davidson, NC 28036
(Name and address of Purchaser)

3. Location of Installation World Energy Paramount, 14700 Downey Ave., Paramount, CA 90723
(Name and address)

4. Type: Vertical (Horizontal or vertical, tank) | 110001L (Manufacturer's serial number) | N/A (CRN) | 21077 (Drawing number) | 14043 (National Board number) | 2024 (Year built)

5. ASME Code, Section VIII, Division 1: 2021/ N/A [Edition and Addenda, if applicable (date)] | N/A (Code Case numbers) | N/A [Special service per UG-120(d)]

6. Shell: SA-516 70 (Material spec. number, grade) | .250 in (Nominal thickness) | 0 in (Corr. allow.) | 2' 6" (OD) (Inner diameter) | 4' 6.75" [Length (overall)]

Body Flanges on Shells

No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

7. Seams: 1 [Long. (welded, dbl., sngl., lap, butt)] | None [R.T.(spot or full)] | 70% (Eff.,%) | N/A (H.T. temp) | N/A (Time, hr) | 2 [Girth. (welded, dbl., sngl., lap, butt)] | None [R.T. (spot or full)] | 65% (Eff., %) | 1 (No. of courses)

8. Heads: (a) SA-516 70 (Material spec. number, grade or type) (H.T. - time and temp.) (b) SA-516 70 (Material spec. number, grade or type) (H.T. - time and temp.)

	Location (Top, Bottom, Ends)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full, Spot, None	Eff.
(a)	TOP	.226	0	N/A	N/A	2:1	N/A	N/A	N/A		X	N/A	N/A	N/A
(b)	BOTTOM	.226	0	N/A	N/A	2:1	N/A	N/A	N/A		X	N/A	N/A	N/A

Body Flanges on Heads

No.	Location	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
(a)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A

9. MAWP 150 psi (Internal) | N/A (External) at max. temp. 500 °F (Internal) | N/A (External)

Min. design metal temp. 20 °F at 150 psi. Hydro, pneu., or comb. test pressure 200

Proof test N/A.

10. Nozzles, inspection and safety valve openings:

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
In/Outlet	2	4"	RFSO	SA-53 E/B	SA105	Sch 40	0		UW-16.1c	Fig. 2-4 (3)	Shell
Fill/Drain	2	2"	CPLG	SA105	N/A	1500#	0		UW-16.2c	N/A	Top/Btm Hd.
Relief	1	1/2"	CPLG	SA105	N/A	3000#	0		UW-16.1c	N/A	Pipe
Misc.	1	2"	CPLG	SA105	N/A	3000#	0		UW-16.1c	N/A	Pipe
Gauge	1	1/4"	CPLG	SA105	N/A	3000#	0		UW-16.1c	N/A	Shell
Misc.	1	1"	CPLG	SA105	N/A	3000#	0		UW-16.1c	N/A	Pipe

11. Supports: Skirt No (Yes or no) | Lugs 1 (Number) | Legs 4 (Number) | Other (2) Brackets (Describe) | Attached Top Hd./Shell - Welded (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors, have been furnished for the following items of the report:

N/A
(Name of part, item number, Manufacturer's name and identifying stamp)

Hydro tested in vertical position UG-20(f) External pressure not design consideration

Manufactured by Henderson Engineering Co., Inc., 95 N. Main Street, Sandwich, Illinois, 60548, USA

Manufacturer's Serial No. **110001L** CRN N/A National Board No. **14043**

CERTIFICATE OF SHOP/FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. "U" Certificate of Authorization Number 7982 expires March 30, 2025 .

Date 09/24/2024 Co. name **Henderson Engineering Co., Inc.** (Manufacturer) Signed (Representative)

CERTIFICATE OF SHOP/FIELD INSPECTION

Vessel constructed by **Henderson Engineering Co., Inc.** at **95 N. Main Street, Sandwich, Illinois, 60548, USA**

I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and employed by The Hartford Steam Boiler Inspection and Insurance Company, of Hartford, CT

have inspected the component described in this Manufacturer's Data Report on September 25, 2024 , and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 09/25/2024 Signed (Authorized Inspector) Commissions 12343, IL2007, WI838881, IN1738, IA1501 (National Board Authorized Inspector Commission number)

FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS

110001

(Alternative Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)

As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by Henderson Engineering Co., Inc., 95 N. Main Street, Sandwich, Illinois, 60548, USA
(Name and address of Manufacturer)

2. Manufactured for Ingersoll Rand, 525 Harbour Place Drive #600, Department 11, Davidson, NC 28036
(Name and address of Purchaser)

3. Location of Installation World Energy Paramount, 14700 Downey Ave., Paramount, CA 90723
(Name and address)

4. Type	(Manufacturer's serial number)	(CRN)	(Drawing number)	(National Board number)	(Year built)
Vertical (Horizontal or vertical, tank)	**110001R**	N/A	21077	**14044**	2024

5. ASME Code, Section VIII, Division 1 — 2021/ N/A [Edition and Addenda, if applicable (date)] — N/A (Code Case numbers) — N/A [Special service per UG-120(d)]

6. Shell:	(Nominal thickness)	(Corr. allow.)	(Inner diameter)	[Length (overall)]
SA-516 70 (Material spec. number, grade)	.250 in	0 in	2' 6" (OD)	4' 6.75"

Body Flanges on Shells

No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
N/A	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

7. Seams:	[R.T.(spot or full)]	(Eff.,%)	(H.T. temp)	(Time, hr)	[Girth. (welded, dbl., sngl., lap, butt)]	[R.T. (spot or full)]	(Eff., %)	(No. of courses)
1 [Long. (welded, dbl., sngl., lap, butt)]	None	70%	N/A	N/A	2	None	65%	1

8. Heads: (a) SA-516 70 (Material spec. number, grade or type) (H.T. - time and temp.) (b) SA-516 70 (Material spec. number, grade or type) (H.T. - time and temp.)

	Location (Top, Bottom, Ends)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full, Spot, None	Eff.
(a)	**TOP**	**.226**	**0**	**N/A**	**N/A**	**2:1**	**N/A**	**N/A**	**N/A**		**X**	**N/A**	**N/A**	**N/A**
(b)	**BOTTOM**	**.226**	**0**	**N/A**	**N/A**	**2:1**	**N/A**	**N/A**	**N/A**		**X**	**N/A**	**N/A**	**N/A**

Body Flanges on Heads

No.	Location	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
(a)	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**		**N/A**	**N/A**	**N/A**

9. MAWP 150 psi (Internal) N/A (External) at max. temp. 500 °F (Internal) N/A (External)

Min. design metal temp. 20 °F at 150 psi . Hydro, pneu., or comb. test pressure 200

Proof test N/A .

10. Nozzles, inspection and safety valve openings: .

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
In/Outlet	**2**	**4"**	**RFSO**	**SA-53 E/B**	**SA105**	**Sch 40**	**0**		**UW-16.1c**	**Fig. 2-4 (3)**	**Shell**
Fill/Drain	**2**	**2"**	**CPLG**	**SA105**	**N/A**	**1500#**	**0**		**UW-16.2c**	**N/A**	**Top/Btm Hd.**
Relief	**1**	**1/2"**	**CPLG**	**SA105**	**N/A**	**3000#**	**0**		**UW-16.1c**	**N/A**	**Pipe**
Misc.	**1**	**2"**	**CPLG**	**SA105**	**N/A**	**3000#**	**0**		**UW-16.1c**	**N/A**	**Pipe**
Gauge	**1**	**1/4"**	**CPLG**	**SA105**	**N/A**	**3000#**	**0**		**UW-16.1c**	**N/A**	**Shell**
Misc.	**1**	**1"**	**CPLG**	**SA105**	**N/A**	**3000#**	**0**		**UW-16.1c**	**N/A**	**Pipe**

11. Supports: Skirt **No** (Yes or no) Lugs 1 (Number) Legs 4 (Number) Other **N/A** (Describe) Attached **Top Hd./Shell - Welded** (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors, have been furnished for the following items of the report:

N/A
(Name of part, item number, Manufacturer's name and identifying stamp)

Hydro tested in vertical position UG-20(f) External pressure not design consideration

Manufactured by Henderson Engineering Co., Inc., 95 N. Main Street, Sandwich, Illinois, 60548, USA

Manufacturer's Serial No. **110001R** CRN N/A National Board No. **14044**

CERTIFICATE OF SHOP/FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. "U" Certificate of Authorization Number 7982 expires March 30, 2025 .

Date 09/24/2024 Co. name **Henderson Engineering Co., Inc.** (Manufacturer) Signed (Representative)

CERTIFICATE OF SHOP/FIELD INSPECTION

Vessel constructed by **Henderson Engineering Co., Inc.** at **95 N. Main Street, Sandwich, Illinois, 60548, USA**

I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and employed by The Hartford Steam Boiler Inspection and Insurance Company, of Hartford, CT

have inspected the component described in this Manufacturer's Data Report on September 25, 2024 , and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 09/25/2024 Signed (Authorized Inspector) Commissions 12343, IL2007, WI838881, IN1738, IA1501 (National Board Authorized Inspector Commission number)

FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS

110001

(Alternative Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)

As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by Henderson Engineering Co., Inc., 95 N. Main Street, Sandwich, Illinois, 60548, USA
(Name and address of Manufacturer)

2. Manufactured for Ingersoll Rand, 525 Harbour Place Drive #600, Department 11, Davidson, NC 28036
(Name and address of Purchaser)

3. Location of Installation World Energy Paramount, 14700 Downey Ave., Paramount, CA 90723
(Name and address)

4. Type: Vertical (Horizontal or vertical, tank) | 110001AA (Manufacturer's serial number) | N/A (CRN) | IR91160 (Drawing number) | 14045 (National Board number) | 2024 (Year built)

5. ASME Code, Section VIII, Division 1: 2021/ N/A [Edition and Addenda, if applicable (date)] | N/A (Code Case numbers) | N/A [Special service per UG-120(d)]

6. Shell: SA-53 E/B (Material spec. number, grade) | .250 in (Nominal thickness) | 0 in (Corr. allow.) | 1' 0.75" (OD) (Inner diameter) | 3' 6" [Length (overall)]

Body Flanges on Shells

No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

7. Seams: ERW [Long. (welded, dbl., sngl., lap, butt)] | None [R.T.(spot or full)] | 85% (Eff.,%) | N/A (H.T. temp) | N/A (Time, hr) | 2 [Girth. (welded, dbl., sngl., lap, butt)] | None [R.T. (spot or full)] | 65% (Eff., %) | 1 (No. of courses)

8. Heads: (a) SA-516 70 (Material spec. number, grade or type) (H.T. - time and temp.) (b) N/A (Material spec. number, grade or type) (H.T. - time and temp.)

	Location (Top, Bottom, Ends)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full, Spot, None	Eff.
(a)	BOTTOM	.221	0	N/A	N/A	2:1	N/A	N/A	N/A		X	N/A	N/A	N/A

Body Flanges on Heads

No.	Location	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
(a)	TOP	RFSO	12"	N/A	B16.5	150#	SA105	Welded	(12) 7/8"	SA449	N/A	N/A

9. MAWP 150 psi (Internal) | N/A (External) at max. temp. 500 °F (Internal) | N/A (External)

Min. design metal temp. 20 °F at 150 psi. Hydro, pneu., or comb. test pressure 200

Proof test N/A.

10. Nozzles, inspection and safety valve openings:

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
In/Outlet	2	4"	RFSO	SA-53 E/B	SA105	Sch 40	0		UW-16.1c	Fig. 2-4 (3)	Shell
Drain	2	3/4"	CPLG	SA105	N/A	3000#	0		UW-16.1c	N/A	Btm. Hd./Shell
Gauge	2	1/4"	CPLG	SA105	N/A	3000#	0		UW-16.1c	N/A	Shell

11. Supports: Skirt No (Yes or no) | Lugs 1 (Number) | Legs N/A (Number) | Other N/A (Describe) | Attached Top - Welded (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors, have been furnished for the following items of the report:

N/A

(Name of part, item number, Manufacturer's name and identifying stamp)

Hydro tested in vertical position UG-20(f) External pressure not design consideration

Manufactured by Henderson Engineering Co., Inc., 95 N. Main Street, Sandwich, Illinois, 60548, USA

Manufacturer's Serial No. **110001AA** CRN N/A National Board No. **14045**

CERTIFICATE OF SHOP/FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. "U" Certificate of Authorization Number 7982 expires March 30, 2025 .

Date 09/24/2024 Co. name **Henderson Engineering Co., Inc.** (Manufacturer) Signed (Representative)

CERTIFICATE OF SHOP/FIELD INSPECTION

Vessel constructed by **Henderson Engineering Co., Inc.** at **95 N. Main Street, Sandwich, Illinois, 60548, USA**

I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and employed by The Hartford Steam Boiler Inspection and Insurance Company, of Hartford, CT

have inspected the component described in this Manufacturer's Data Report on September 25, 2024 , and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 09/25/2024 Signed (Authorized Inspector) Commissions 12343, IL2007, WI838881, IN1738, IA1501 (National Board Authorized Inspector Commission number)

FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS

110001

(Alternative Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)

As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by Henderson Engineering Co., Inc., 95 N. Main Street, Sandwich, Illinois, 60548, USA
(Name and address of Manufacturer)

2. Manufactured for Ingersoll Rand, 525 Harbour Place Drive #600, Department 11, Davidson, NC 28036
(Name and address of Purchaser)

3. Location of Installation World Energy Paramount, 14700 Downey Ave., Paramount, CA 90723
(Name and address)

4. Type: Vertical (Horizontal or vertical, tank) | 110001AB (Manufacturer's serial number) | N/A (CRN) | IR91160 (Drawing number) | 14046 (National Board number) | 2024 (Year built)

5. ASME Code, Section VIII, Division 1: 2021/ N/A [Edition and Addenda, if applicable (date)] | N/A (Code Case numbers) | N/A [Special service per UG-120(d)]

6. Shell: SA-53 E/B (Material spec. number, grade) | .250 in (Nominal thickness) | 0 in (Corr. allow.) | 1' 0.75" (OD) (Inner diameter) | 3' 6" [Length (overall)]

Body Flanges on Shells

No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

7. Seams: ERW [Long. (welded, dbl., sngl., lap, butt)] | None [R.T.(spot or full)] | 85% (Eff.,%) | N/A (H.T. temp) | N/A (Time, hr) | 2 [Girth. (welded, dbl., sngl., lap, butt)] | None [R.T. (spot or full)] | 65% (Eff., %) | 1 (No. of courses)

8. Heads: (a) SA-516 70 (Material spec. number, grade or type) (H.T. - time and temp.) (b) N/A (Material spec. number, grade or type) (H.T. - time and temp.)

	Location (Top, Bottom, Ends)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full, Spot, None	Eff.
(a)	BOTTOM	.221	0	N/A	N/A	2:1	N/A	N/A	N/A		X	N/A	N/A	N/A

Body Flanges on Heads

No.	Location	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
(a)	TOP	RFSO	12"	N/A	B16.5	150#	SA105	Welded	(12) 7/8"	SA449	N/A	N/A

9. MAWP 150 psi (Internal) | N/A (External) at max. temp. 500 °F (Internal) | N/A (External)

Min. design metal temp. 20 °F at 150 psi. Hydro, pneu., or comb. test pressure 200

Proof test N/A.

10. Nozzles, inspection and safety valve openings:

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
In/Outlet	2	4"	RFSO	SA-53 E/B	SA105	Sch 40	0		UW-16.1c	Fig. 2-4 (3)	Shell
Drain	2	3/4"	CPLG	SA105	N/A	3000#	0		UW-16.1c	N/A	Btm. Hd./Shell
Gauge	2	1/4"	CPLG	SA105	N/A	3000#	0		UW-16.1c	N/A	Shell

11. Supports: Skirt No (Yes or no) | Lugs 1 (Number) | Legs N/A (Number) | Other N/A (Describe) | Attached Top - Welded (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors, have been furnished for the following items of the report:

N/A

(Name of part, item number, Manufacturer's name and identifying stamp)

Hydro tested in vertical position UG-20(f) External pressure not design consideration

Manufactured by Henderson Engineering Co., Inc., 95 N. Main Street, Sandwich, Illinois, 60548, USA

Manufacturer's Serial No. **110001AB** CRN N/A National Board No. **14046**

CERTIFICATE OF SHOP/FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. "U" Certificate of Authorization Number 7982 expires March 30, 2025 .

Date 09/24/2024 Co. name **Henderson Engineering Co., Inc.** (Manufacturer) Signed _____ (Representative)

CERTIFICATE OF SHOP/FIELD INSPECTION

Vessel constructed by **Henderson Engineering Co., Inc.** at **95 N. Main Street, Sandwich, Illinois, 60548, USA**

I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and employed by The Hartford Steam Boiler Inspection and Insurance Company, of Hartford, CT

have inspected the component described in this Manufacturer's Data Report on September 25, 2024 , and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 09/25/2024 Signed _____ (Authorized Inspector) Commissions 12343, IL2007, WI838881, IN1738, IA1501 (National Board Authorized Inspector Commission number)

FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS

110001

(Alternative Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)

As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by Henderson Engineering Co., Inc., 95 N. Main Street, Sandwich, Illinois, 60548, USA
(Name and address of Manufacturer)

2. Manufactured for Ingersoll Rand, 525 Harbour Place Drive #600, Department 11, Davidson, NC 28036
(Name and address of Purchaser)

3. Location of Installation World Energy Paramount, 14700 Downey Ave., Paramount, CA 90723
(Name and address)

4. Type Vertical (Horizontal or vertical, tank) | **110001A** (Manufacturer's serial number) | N/A (CRN) | IR93042 (Drawing number) | **14047** (National Board number) | 2024 (Year built)

5. ASME Code, Section VIII, Division 1 | 2021/ N/A [Edition and Addenda, if applicable (date)] | N/A (Code Case numbers) | N/A [Special service per UG-120(d)]

6. Shell: SA-53 E/B (Material spec. number, grade) | .250 in (Nominal thickness) | 0 in (Corr. allow.) | 1' 0.75" (OD) (Inner diameter) | 2' 1.75" [Length (overall)]

Body Flanges on Shells

No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
2	**Rings**	**11.25"**	**17.5"**	**3/4"**	**N/A**	**SA-516 70**	**Welded**	**Shell**	**12 / 3/4"**	**SA-449**	**N/A**	**N/A**

7. Seams: ERW [Long. (welded, dbl., sngl., lap, butt)] | None [R.T.(spot or full)] | 85% (Eff.,%) | N/A (H.T. temp) | N/A (Time, hr) | 2 [Girth. (welded, dbl., sngl., lap, butt)] | None [R.T. (spot or full)] | 65% (Eff., %) | 1 (No. of courses)

8. Heads: (a) SA-516 70 (Material spec. number, grade or type) (H.T. - time and temp.) (b) SA-516 70 (Material spec. number, grade or type) (H.T. - time and temp.)

	Location (Top, Bottom, Ends)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full, Spot, None	Eff.
(a)	**TOP**	**.221**	**N/A**	**N/A**	**N/A**	**2:1**	**N/A**	**N/A**	**N/A**		**X**	**N/A**	**N/A**	**N/A**
(b)	**BOTTOM**	**.221**	**N/A**	**N/A**	**N/A**	**2:1**	**N/A**	**N/A**	**N/A**		**X**	**N/A**	**N/A**	**N/A**

Body Flanges on Heads

No.	Location	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
(a)	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**		**N/A**	**N/A**	**N/A**

9. MAWP 150 psi (Internal) | N/A (External) at max. temp. 500 °F (Internal) | N/A (External)

Min. design metal temp. 20 °F at 150 psi . Hydro, pneu., or comb. test pressure 200

Proof test N/A .

10. Nozzles, inspection and safety valve openings: .

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
In/Outlet	**2**	**4"**	**RFSO**	**SA53 E/B**	**SA105**	**Sch 40**	**0**		**UW-16.1c**	**Fig. 2-4 (3)**	**Shell**
Vent	**1**	**1/4"**	**CPLG**	**SA105**	**N/A**	**3000#**	**0**		**UW-16.1c**	**N/A**	**Top Head**
Drain	**1**	**3/4"**	**CPLG**	**SA105**	**N/A**	**3000#**	**0**		**UW-16.1c**	**N/A**	**Btm. Head**
Relief	**1**	**1/4"**	**CPLG**	**SA105**	**N/A**	**3000#**	**0**		**UW-16.1c**	**N/A**	**Pipe**

11. Supports: Skirt **No** (Yes or no) Lugs 2 (Number) Legs N/A (Number) Other **N/A** (Describe) Attached **Shell - Welded** (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors, have been furnished for the following items of the report:

N/A

(Name of part, item number, Manufacturer's name and identifying stamp)

Hydro tested in vertical position UG-20(f) External pressure not design consideration

Manufactured by Henderson Engineering Co., Inc., 95 N. Main Street, Sandwich, Illinois, 60548, USA

Manufacturer's Serial No. **110001A** CRN N/A National Board No. **14047**

CERTIFICATE OF SHOP/FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. "U" Certificate of Authorization Number 7982 expires March 30, 2025 .

Date 09/24/2024 Co. name **Henderson Engineering Co., Inc.** (Manufacturer) Signed _____ (Representative)

CERTIFICATE OF SHOP/FIELD INSPECTION

Vessel constructed by **Henderson Engineering Co., Inc.** at **95 N. Main Street, Sandwich, Illinois, 60548, USA**

I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and employed by The Hartford Steam Boiler Inspection and Insurance Company, of Hartford, CT

have inspected the component described in this Manufacturer's Data Report on September 25, 2024 , and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 09/25/2024 Signed _____ (Authorized Inspector) Commissions 12343, IL2007, WI838881, IN1738, IA1501 (National Board Authorized Inspector Commission number)

FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS

110001

(Alternative Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)

As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by Henderson Engineering Co., Inc., 95 N. Main Street, Sandwich, Illinois, 60548, USA
(Name and address of Manufacturer)

2. Manufactured for Ingersoll Rand, 525 Harbour Place Drive #600, Department 11, Davidson, NC 28036
(Name and address of Purchaser)

3. Location of Installation World Energy Paramount, 14700 Downey Ave., Paramount, CA 90723
(Name and address)

4. Type	(Manufacturer's serial number)	(CRN)	(Drawing number)	(National Board number)	(Year built)
Vertical (Horizontal or vertical, tank)	**110001B**	N/A	IR93042	**14048**	2024

5. ASME Code, Section VIII, Division 1 — 2021/ N/A [Edition and Addenda, if applicable (date)] — N/A (Code Case numbers) — N/A [Special service per UG-120(d)]

6. Shell:	(Nominal thickness)	(Corr. allow.)	(Inner diameter)	[Length (overall)]
SA-53 E/B (Material spec. number, grade)	.250 in	0 in	1' 0.75" (OD)	2' 1.75"

Body Flanges on Shells

No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
2	**Rings**	**11.25"**	**17.5"**	**3/4"**	**N/A**	**SA-516 70**	**Welded**	**Shell**	**12 / 3/4"**	**SA-449**	**N/A**	**N/A**

7. Seams:	[R.T.(spot or full)]	(Eff.,%)	(H.T. temp)	(Time, hr)	[Girth. (welded, dbl., sngl., lap, butt)]	[R.T. (spot or full)]	(Eff., %)	(No. of courses)
ERW [Long. (welded, dbl., sngl., lap, butt)]	None	85%	N/A	N/A	2	None	65%	1

8. Heads: (a) SA-516 70 (Material spec. number, grade or type) (H.T. - time and temp.) (b) SA-516 70 (Material spec. number, grade or type) (H.T. - time and temp.)

	Location (Top, Bottom, Ends)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full, Spot, None	Eff.
(a)	**TOP**	**.221**	**N/A**	**N/A**	**N/A**	**2:1**	**N/A**	**N/A**	**N/A**		**X**	**N/A**	**N/A**	**N/A**
(b)	**BOTTOM**	**.221**	**N/A**	**N/A**	**N/A**	**2:1**	**N/A**	**N/A**	**N/A**		**X**	**N/A**	**N/A**	**N/A**

Body Flanges on Heads

No.	Location	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
(a)	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**		**N/A**	**N/A**	**N/A**

9. MAWP 150 psi (Internal) N/A (External) at max. temp. 500 °F (Internal) N/A (External)

Min. design metal temp. 20 °F at 150 psi . Hydro, pneu., or comb. test pressure 200

Proof test N/A .

10. Nozzles, inspection and safety valve openings: .

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
In/Outlet	**2**	**4"**	**RFSO**	**SA53 E/B**	**SA105**	**Sch 40**	**0**		**UW-16.1c**	**Fig. 2-4 (3)**	**Shell**
Vent	**1**	**1/4"**	**CPLG**	**SA105**	**N/A**	**3000#**	**0**		**UW-16.1c**	**N/A**	**Top Head**
Drain	**1**	**3/4"**	**CPLG**	**SA105**	**N/A**	**3000#**	**0**		**UW-16.1c**	**N/A**	**Btm. Head**
Relief	**1**	**1/4"**	**CPLG**	**SA105**	**N/A**	**3000#**	**0**		**UW-16.1c**	**N/A**	**Pipe**

11. Supports: Skirt **No** (Yes or no) Lugs 2 (Number) Legs N/A (Number) Other **N/A** (Describe) Attached **Shell - Welded** (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors, have been furnished for the following items of the report:

N/A

(Name of part, item number, Manufacturer's name and identifying stamp)

Hydro tested in vertical position UG-20(f) External pressure not design consideration

Manufactured by Henderson Engineering Co., Inc., 95 N. Main Street, Sandwich, Illinois, 60548, USA

Manufacturer's Serial No. **110001B** CRN N/A National Board No. **14048**

CERTIFICATE OF SHOP/FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. "U" Certificate of Authorization Number 7982 expires March 30, 2025 .

Date 09/24/2024 Co. name **Henderson Engineering Co., Inc.** (Manufacturer) Signed (Representative)

CERTIFICATE OF SHOP/FIELD INSPECTION

Vessel constructed by **Henderson Engineering Co., Inc.** at **95 N. Main Street, Sandwich, Illinois, 60548, USA**

I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and employed by The Hartford Steam Boiler Inspection and Insurance Company, of Hartford, CT

have inspected the component described in this Manufacturer's Data Report on September 25, 2024 , and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 09/25/2024 Signed (Authorized Inspector) Commissions 12343, IL2007, WI838881, IN1738, IA1501 (National Board Authorized Inspector Commission number)

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SECTION 6: AUXILIARY MANUALS (AS APPLICABLE)

6.0 Operator Interface User Guide

The operator interface user guide which is included on the following pages in this section is specific to the air dryer identified on this instruction manual's cover (reference Model No. and Serial No.).

6.1 Dew Point Demand System User Guide

If the optional dew point demand system was purchased with this dryer, the dew point demand system user guide will be included in this section and is specific to the air dryer identified on this instruction manual's cover (reference Model No. and Serial No.).

User Guide

Allen-Bradley PanelView 800

For Use With

INGERSOLL-RAND
MODEL EP
EXHAUST PURGE
REGENERATIVE AIR DRYER

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INTRODUCTION

A programmable controller with individual input/output modules controls the dryer's operation. The operator interface to this controller is the Allen-Bradley PanelView 800. This should be used as a reference guide to ensure the dryer is cycling. A manual mode is included in the dryer program to allow for fast cycling to verify the operation of the dryer.

The PanelView 800 uses a touch sensitive screen. All control functions are performed by touching the appropriate on-screen button or display. Buttons in a dark blue, green, or yellow color may be pressed to change screens, modify a setting, or enter a value.

It is recommended that the dryer instruction manual and the wiring schematic be studied before operating the dryer.

SECTION 1: GENERAL USE

- Turn ON/OFF switch to the ON position.

- Power On. Indication is provided by the operator interface. When the dryer is on, the interface is on. After 30 minutes of idle time, the interface enters a sleep mode; however, in this mode an Allen-Bradley logo is shown slowly moving around the screen to indicate the unit is active. Touch anywhere on the screen to exit sleep mode.

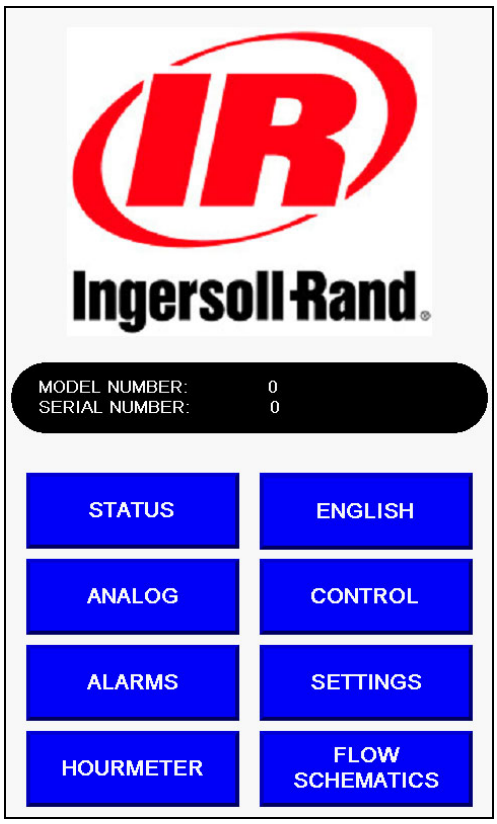
- Tower A or Tower B Online. The tower that is onstream is shown on the STATUS screen.

- Tower A or Tower B Regenerating. The tower that is regenerating is shown on the STATUS screen.

- Models EP-420 and smaller will be equipped with dual internal tower heaters. This will lead to additional temperature readings displayed on the STATUS and ANALOG screens.

NOTE: All screens are reviewed further in the following sections.

SECTION 2: MAIN

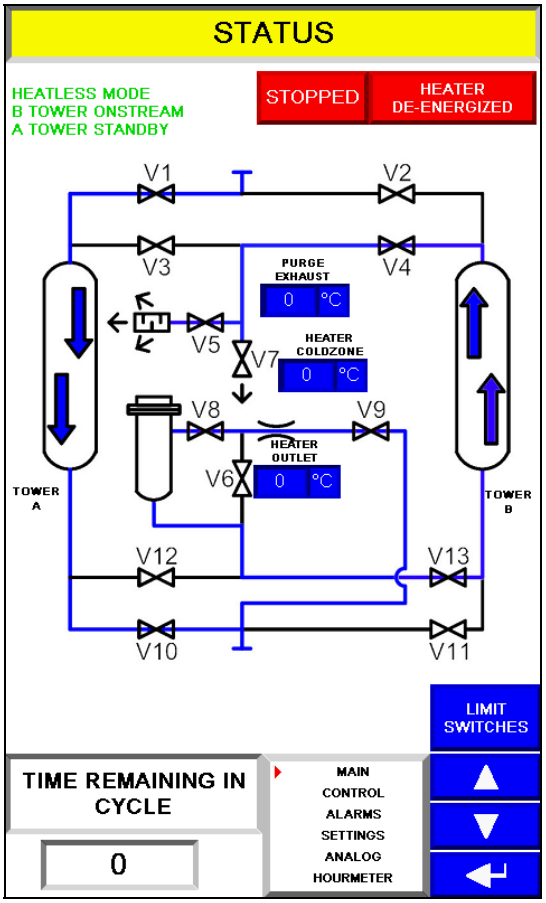


This screen is the start-up screen. The display will go directly to this screen upon power-up.

The MAIN screen displays the model and serial number of the dryer. It also has contact information for Henderson Engineering should the user need assistance with the dryer.

Touch one of the blue buttons to navigate to the other screens.

SECTION 3: STATUS



Note: The screen displayed above is a sample only and may vary, depending on dryer specifications at time of purchase.

The STATUS screen will display the dryer's current status with a description at the top left, as well as a flow chart of the current state. The description displays which tower is onstream and which regeneration cycle the other tower is in.

The regeneration cycle will toggle between HEATING, PRE-COOLING, COOLING, and RE-PRESSURIZING. If the optional Dew Point Demand System (DPDS) is installed, STANDBY will also be displayed in the cycle.

At top right is displayed whether the heater is energized or de-energized. When dual tower heaters are present, these indicators are located next to the LIMIT SWITCH button.

The LIMIT SWITCHES button will open a Limit Switch status screen. This button will only be present if limit switches are installed (Alarm for Individual Valve Failures).

SECTION 3: STATUS

Current temperature readings can be found at the locations given on the status flow screen.

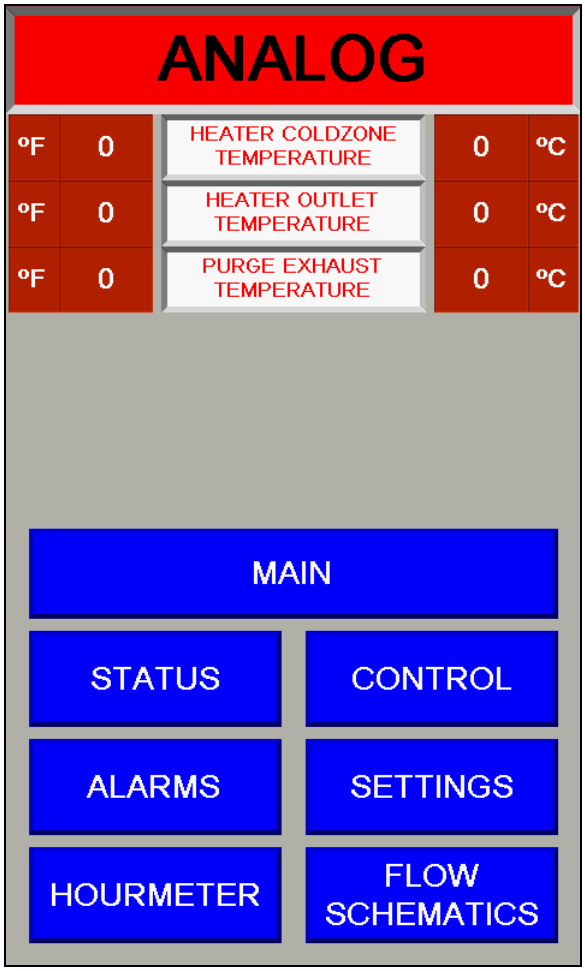
The indicated temperature unit of measure can be either °F or °C. This is adjustable on the SETTINGS screen.

The bottom left of the STATUS screen gives the time remaining in the current regeneration cycle.

Note: When the dryer is in STANDBY for the optional DPDS, the time remaining will read zero.

The lower right hand of the screen is a screen selector list. Use the up or down arrow button to select a screen name and touch the enter button.

SECTION 4: ANALOG



Note: The screen displayed above is a sample only and may vary, depending on dryer specifications at time of purchase.

The ANALOG screen will display the current analog readings on the dryer.

HEATER COLDZONE TEMPERATURE measures the temperature at the heater's coldzone. This is the air at the heater's inlet.

HEATER OUTLET TEMPERATURE measures the temperature of the air going out of the heater.

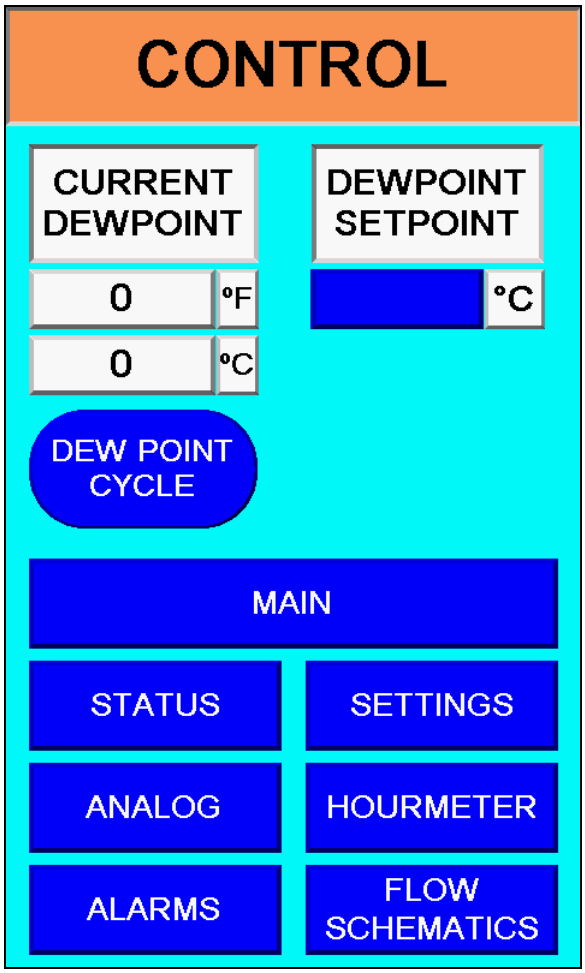
PURGE EXHAUST TEMPERATURE measures the temperature of the air going out of the purge exhaust.

Temperatures will read in both °F and °C.

At the bottom of this touch screen are screen selector buttons which enable the user to navigate to other screens.

SECTION 5: CONTROL

Note: The CONTROL screen will only be present on the operator interface if the dryer has the optional dew point demand system.



The CONTROL screen will display the CURRENT DEWPOINT, allow adjustment of the DEWPOINT SETPOINT, and allow the user to switch between DEWPOINT CYCLE and TIME CYCLE.

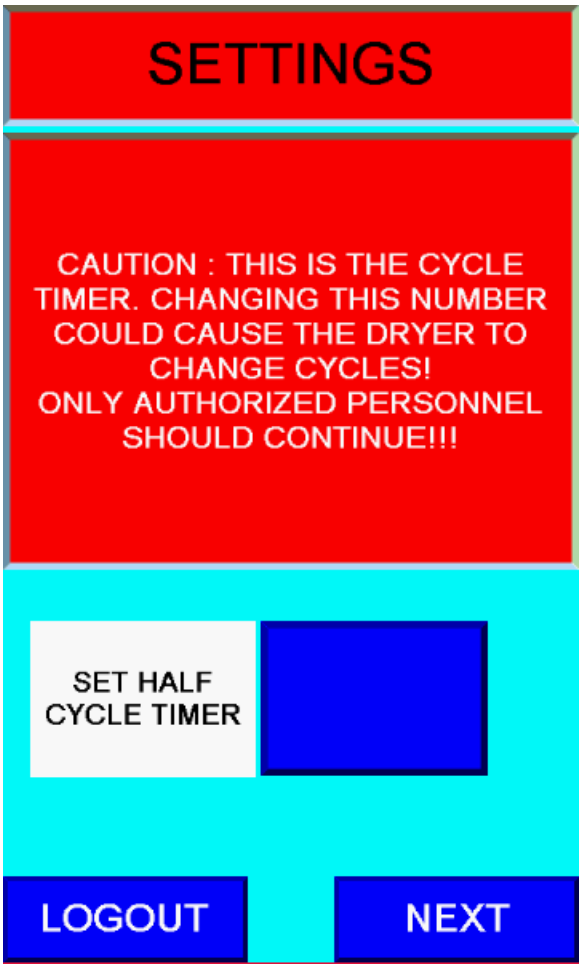
The dewpoint setpoint can be adjusted by pressing the blue area on the touch screen under the DEWPOINT SETPOINT heading.

The cycle end condition can be toggled by touching the button which will state either DEWPOINT CYCLE or TIME CYCLE. While in time cycle, the dryer will shift towers every four hours. When utilizing the optional DPDS, the dryer will complete its four-hour regeneration and go into a standby mode until the outlet dew point has reached the dew point monitor's setpoint.

CURRENT DEWPOINT will read in °F and °C. The DEWPOINT SETPOINT will read in either °F or °C, depending on option selected.

A screen selector list is provided on the touch screen to navigate to the other screens.

SECTION 6: SETTINGS



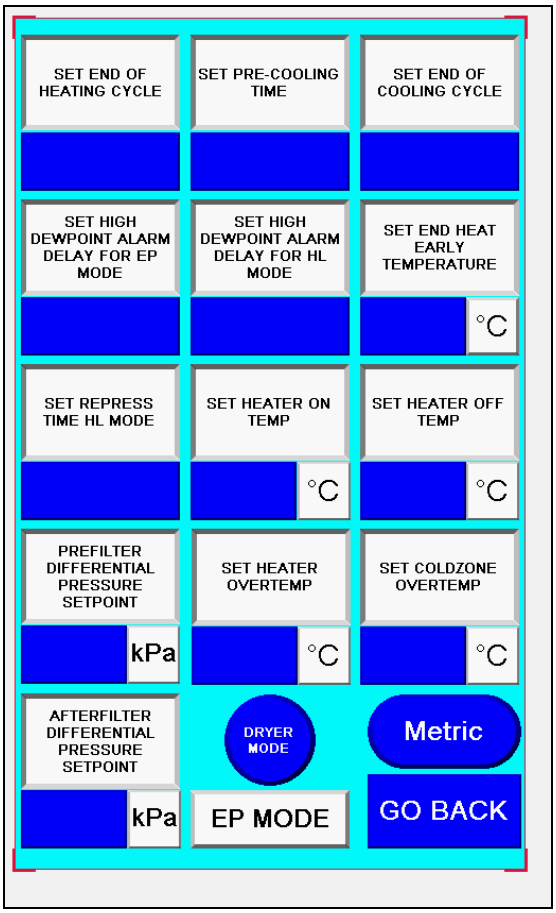
The SETTINGS screen allows the user to set the half cycle counter or advance through a cycle for troubleshooting purposes.

The SET HALF CYCLE TIMER changes the half cycle timer to advance the dryer.

The log-in is always as follows:

Username: 1
Password: (serial number of the dryer)

SECTION 6: SETTINGS



Note: The screen displayed above is a sample only and may vary, depending on dryer specifications at time of purchase.

This screen will allow the user to adjust the factory presets. The times are set for optimum conditions and should not be changed. If a change needs to occur, please contact the manufacturer.

SET END OF HEATING CYCLE allows the user to adjust the final minute of the heating cycle.

SET PRE-COOLING TIME allows the user to adjust the length (minutes) of the pre-cooling cycle.

SET END OF COOLING CYCLE allows the user to adjust the final minute of the cooling cycle.

SET HIGH DEWPOINT ALARM DELAY FOR EP MODE allows the user to adjust the time delay, in minutes, for the “High Dewpoint” alarm while in the EP MODE of operation.

SECTION 6: SETTINGS

SET HIGH DEWPOINT ALARM DELAY FOR HL MODE allows the user to adjust the time delay in seconds, for the “High Dewpoint” alarm while in the HL MODE of operation. (Only available on dryers with HL Mode.)

SET END HEAT EARLY TEMPERATURE allows the user to adjust the temperature setpoint to end the heating cycle early.

SET REPRESS TIME HL MODE sets the length of time allowed for the dryer to re-pressurize in seconds. (Only available on dryers with HL Mode.)

SET HEATER ON TEMP allows the user to adjust the temperature for when the heater will cycle off during the heating cycle.

SET HEATER OFF TEMP allows the user to adjust the temperature for when the heater will cycle off during the heating cycle.

PREFILTER DIFFERENTIAL PRESSURE SETPOINT allows the user to adjust the pressure set point for the pre-filter differential pressure alarm. (Only available on dryers equipped with pre-filter differential pressure transmitters.)

SET HEATER OVERTEMP allows the user to adjust the temperature setpoint for the heater "Heater Overtemp" alarm.

SET COLDZONE OVERTEMP allows the user to adjust the temperature setpoint for when the heater "Coldzone Overtemp" alarm is triggered.

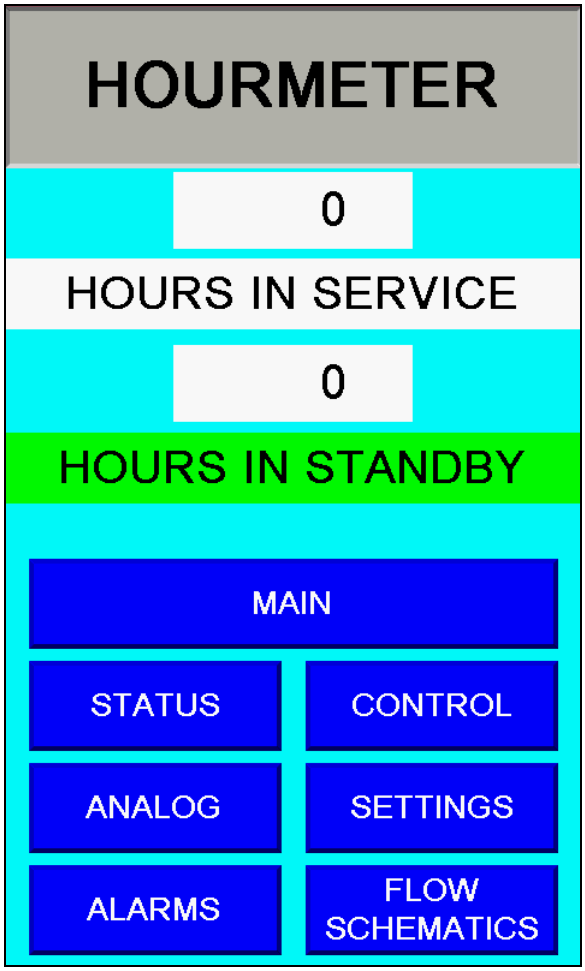
AFTERFILTER DIFFERENTIAL PRESSURE SETPOINT allows the user to adjust the pressure set point for the afterfilter differential pressure alarm. (Only available on dryers equipped with afterfilter differential pressure transmitters.)

The Metric/Imperial button allows the user to toggle the units of measure used for control and indication on the HMI. This button will change the units on the SETTINGS, STATUS, and CONTROL screens.

NOTE: If these times are changed, the half cycle timer numbers will change as well. Pre-cooling will always be a 10 minute minimum.

NOTE: If changes are made without manufacturer’s notification, this may void the dryer warranty.

SECTION 7: HOURMETER

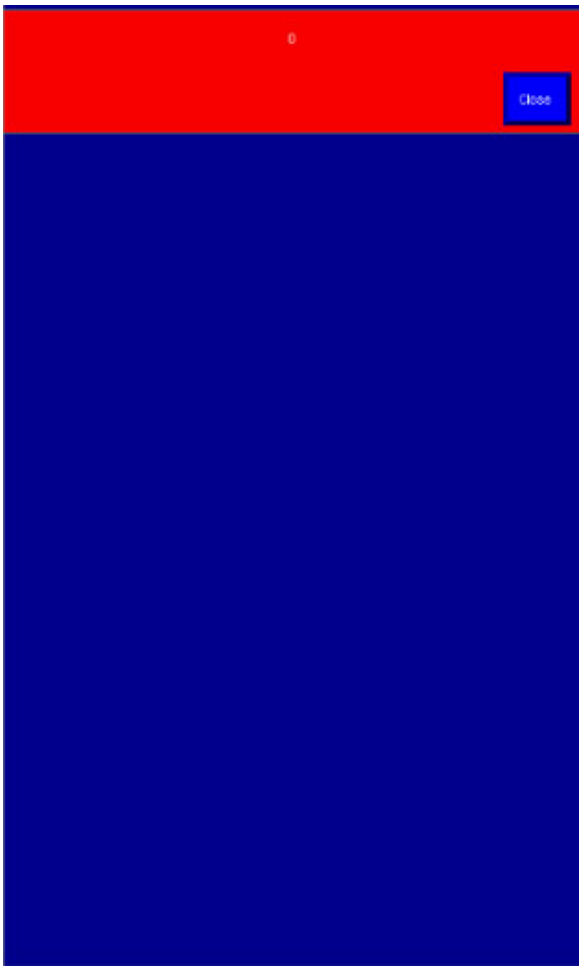


The HOURMETER screen displays how many hours the dryer has been in service.

The HOURS IN STANDBY displays the hours the dryer has remained in standby for the length of time the dryer has been in service. The counter for this display will only increase for the length of time the dryer is in standby, not using any energy to regenerate the offline tower.

A screen selector list is provided on the touch screen to navigate to the other screens.

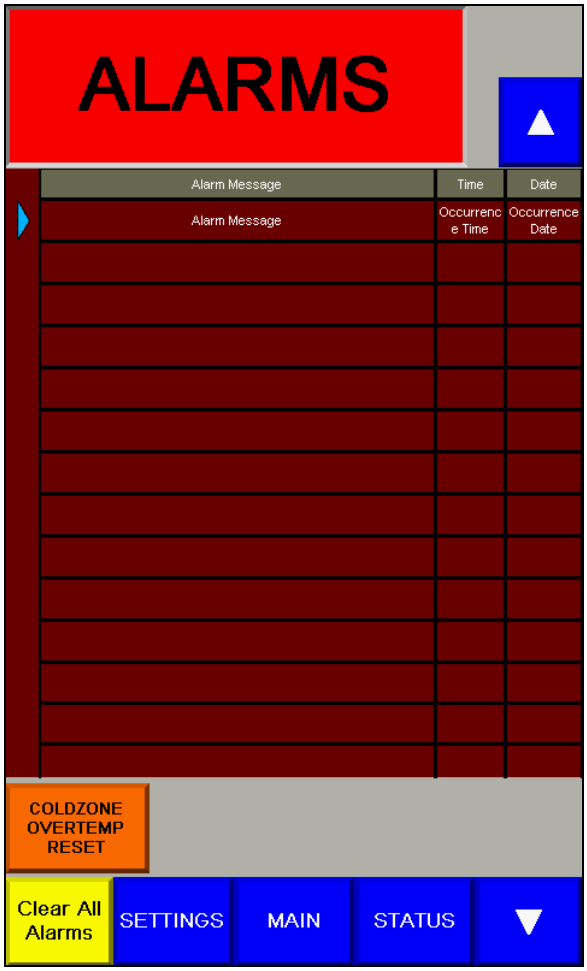
SECTION 8: ALARMS



The Alarms banner, as shown above, will appear on the screen anytime a current alarm is in effect.

The user must acknowledge this banner by touching the CLOSE button which will then allow the user to access the other screens.

SECTION 8: ALARMS



The ALARMS screen will display current and previous alarms. Alarms are displayed in the order in which they occur, with the most recent alarm at the top of the list. Current alarms will be shown as white letters on a blue background. Previous alarms will be shown as blue letters on a white background.

If a heater overtemperature alarm is reached from the coldzone, then a latching alarm will occur. The COLDZONE OVERTEMP RESET button will have to be touched to re-enable the heater. As long as the temperature is lower than the setpoint, the heater will be enabled and the alarm will deactivate.

Use the arrow buttons on the top and bottom right of the screen to scroll up and down through the alarm list. Pressing "Clear All Alarms" will clear all current and previous alarms that are logged on this screen.

SECTION 8: ALARMS

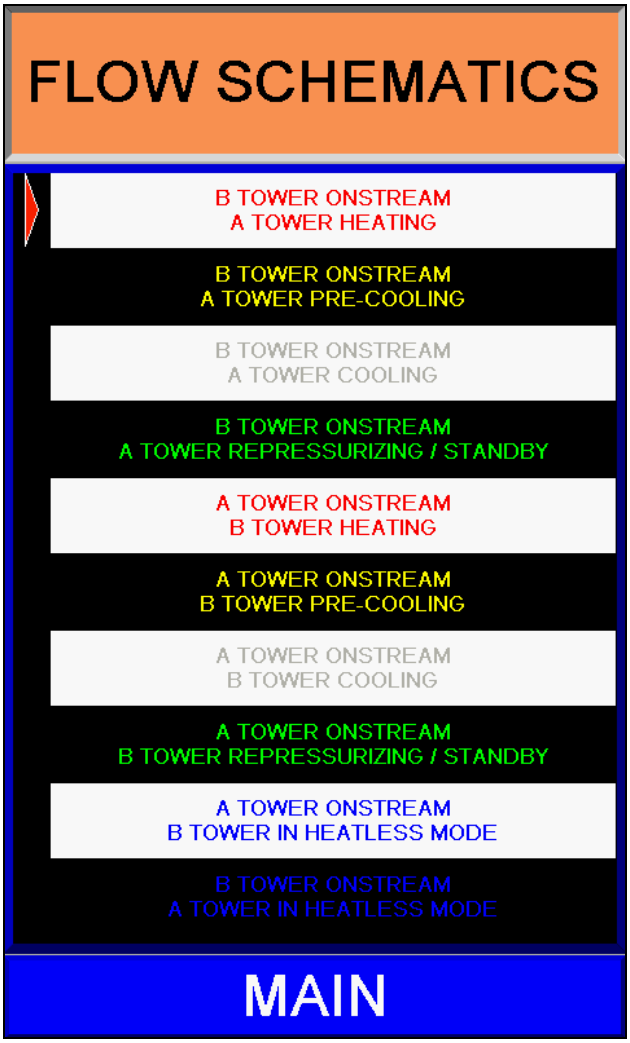
The alarm option(s) for standard equipment on an EP regenerative air dryer are:

- Heater Overtemperature
  The Heater Outlet Temperature is higher than SET HEATER OUTLET OVERTEMP ALARM SETPOINT.
- Heater Coldzone Overtemperature
  This latching alarm occurs when the Heater Coldzone Temperature is above the SET COLDZONE OVERTEMP ALARM SETPOINT for more than 15 seconds. This alarm disables the heater until the COLDZONE OVERTEMP RESET button is touched with the temperature below the alarm setpoint. The heater will then resume normal operation.

The alarm(s) for dryer options, if purchased, for the EP regenerative air dryer are:

- High Dew Point
  This alarm indicates that the current dew point has been above the DEWPOINT SETPOINT for longer than the SET HIGH DEWPOINT ALARM DELAY FOR EP MODE.
- Dew Point Transmitter Above or Below Scale
  Indicates that the dew point transmitter is outputting a value above or below the range of the transmitter.
- Fail-to-shift
  Gives an indication that after 3 minutes the dryer has not changed towers when expected.
- High Differential Pressure for the Prefilter & Afterfilter
  These alarms indicate that the pressure drop across the filter exceeds the setpoint.
- Individual Valve Failure Alarms
  These alarms indicate a failure of a specific valve when moving in a specific direction (e.g. "V4 Fail-to-Open").

SECTION 9: FLOW SCHEMATICS



Note: The screen displayed above is a sample only and may vary, depending on dryer specifications at time of purchase.

The FLOW SCHEMATICS screen allows the user to display either the flow schematics for Tower A or Tower B, each of which includes a description of the sequence of operations.

At the right of this touch screen is a screen selector list. Use the up or down arrow button to select a screen name and press the enter button.

[This concludes the Operator Interface User Guide]

User Guide

Attention Prior to operating the HDT, it is advised that this entire User Guide be studied and clearly understood.

Henderson Dewpoint Transmitter (HDT)



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INTRODUCTION

This User Guide should be kept with the Henderson Dewpoint Transmitter (HDT).

Please read this User Guide carefully from the beginning.

The user must observe the safety information included in this User Guide.

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SECTION 1: SAFETY INSTRUCTIONS

Safety First

Local health and safety regulations should be obeyed, as should the safety critical prohibitions, warnings, and notes included in this User Guide.

Symbol Key used in this User Guide

	**Do Not** – Prohibited actions or behaviors
	**Warning –** Danger to personnel and/ or damage to equipment
	Additional useful information



Warning

- The Henderson Dewpoint Transmitter (HDT) delivered to you has been tested for safety, calibrated, and approved as shipped from the factory. Note the following precautions:



- Do not modify the unit. Improper modification can damage the product or lead to malfunction.



- The transmitter body does not have user serviceable parts inside and is not designed to be opened. Opening the transmitter will void the warranty.



Warning

- Before mounting the HDT into any system, ensure the system is safe to work on. Depressurize and verify that all power connections are isolated in the off position.
- Installation should be carried out by trained technicians and following local safety protocols.

1.1 Definitions

Hazardous voltages have been defined as the ranges: 75 to 1500 volt DC and 50 to 1000 volt AC.

Technicians are qualified persons educated or trained to mount, operate, troubleshoot and validate operation, in accordance with safety regulations.

Operators/Users are persons, being familiar with the content of this User Guide, able to adjust and operate the HDT during normal operation.

SECTION 1: SAFETY INSTRUCTIONS

1.2 Receipt and Unpacking

Unpack the HDT without damaging it and make sure the User Guide always follows the HDT and is always available. The packaging materials should always follow the HDT, until it has been permanently mounted.

1.3 Environment

Avoid direct sunlight, dust, high temperatures, mechanical vibrations and shock, as well as rain and heavy moisture. If avoidance of high moisture is not possible, employ ventilation, rather than increased temperature, to prevent condensation.

SECTION 2: INSTALLATION

NOTE: Section 2 provides instructions for installing a new or recalibrated transmittier. An air dryer that has been purchased with an HDT comes with all mounting and wiring completed. Section 3 provides additional instructions for other installations.

2.1 Unpacking the HDT

On removing the transmitter from the box, please check that all of the following standard components are included:

- Henderson Dewpoint Transmitter (HDT)
- MiniDIN Connector

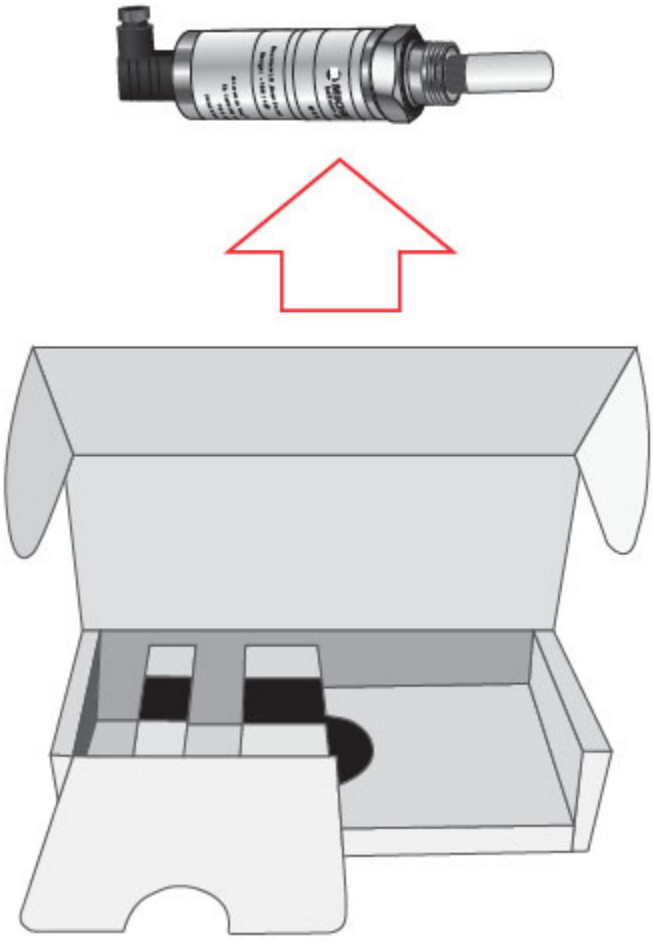


Figure 1: DIN43650 Transmitter Unpacking Method

The transmitter will also be supplied with a process seal, which will be fitted to the unit. This will be a bonded seal (5/8").

SECTION 2: INSTALLATION

2.1 Unpacking the HDT (continued)

The transmitter sensing element is protected while in transit by a blue plastic cover containing a small desiccant capsule. The cover should be removed before operation but should be retained in case required for return shipping.

The transmitter will come with the electrical connector fitted to protect the transmitter pins during transit. Keep the connector in a safe place until ready to wire up the transmitter.

2.2 HDT

NOTE: The transmitter's sensing element is shown for illustration purposes only. Please keep the guard fitted at all times.

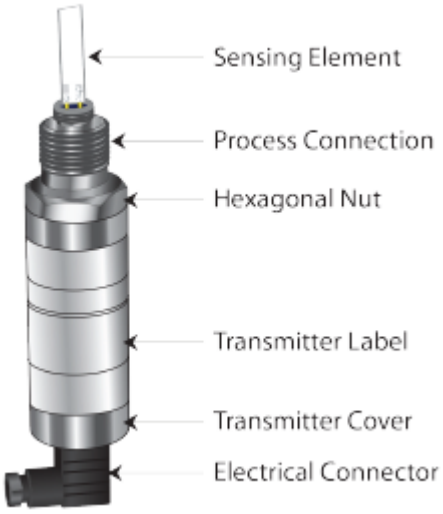


Figure 2: HDT



SECTION 2: INSTALLATION

2.2.1 Electrical Connections



Connector Pin	Standard Conductor Colour	Function
1	Green	4 - 20 mA Signal Return (Power Supply -ve)
3	Red	Power Supply +ve
GND	Blue	Ground, Cable Screen Connection This pin directly connects to the metal casing of the transmitter, but not to the transmitter electronics, and is intended for cable screening only.

Warning

The transmitter must be operated with the 4 - 20 mA signal return connected to a suitable load, or negative power supply connection. Leaving this pin unconnected may result in damage to the transmitter. Refer to wiring schematics in Section 3 of this document for connection examples.

2.2.2 Cable Connection to Transmitter

To ensure the specified ingress protection is achieved, when installing the connector, the securing screw (with the O-ring and washer) must be tightened to a minimum torque of 3.4 Nm (2.5 ft-lbs). The transmitter cable used must be a minimum diameter of 4.6 mm (0.2”).



Figure 3: Connector Installation

2.2.3 Installing and Commissioning the HDT

It is advisable to carry out an initial purge routine of the sample loop, before installing the transmitter, in order to remove the possibility of transmitter damage on start-up.

Open the inlet isolation valve slowly, until a small flow of air/gas at atmospheric pressure flows through the inlet pipework to the sample block and exhausts through the sample block exit valve.

Allow this purge to continue for about 15 to 20 minutes to remove any residual moisture from the sample pipework and components.

Close the inlet isolation valve, install the sensor into the sample block and ensure that the sensor cable connector is correctly positioned, that the sealing cup is in place and the retaining screw is screwed down securely to create a weatherproof seal.

Fully open the inlet valve again and slowly open all valves after the sample block to allow a low-pressure purge through the whole sample system. (**Note:** If a closed by-pass loop is installed, this section of the procedure is not possible).

Set the required pressures and flows within the sample loop.

This completes the installation and commissioning but, on initial start-up, it could take several hours for the system to reach equilibrium, depending on the number and type of components used in the sample loop.

The instrument will now indicate the dew/frost point of the air/gas surrounding the transmitter, at system pressure and the analog output will be giving a mA signal proportional to the indicated dew/frost point or other engineering units.

2.2.4 Operation

The system is designed to operate continuously, with a minimum amount of operator input.

It is, however, advisable to inspect the sample loop periodically to ensure that the required pressures and flows are being maintained.

The number and type of items employed in the sample loop will determine what, if any, other routine checks should be made. If, for instance, a filter is used, the filter element should be inspected periodically and changed when necessary.

The instrument should not require any routine maintenance but if any malfunction is suspected it is advisable to contact Ingersoll-Rand.

Should it be necessary, at any time or for whatever reason, to change either the HDT, it should be noted that the components of the system are fully and completely interchangeable provided that the same 4 - 20mA range is maintained. The only adjustment necessary would be the alarm set points in the case of the display.

While the transmitter should give several years of operation, it is advisable to confirm the calibration, from time to time, to ensure accurate operation of the system.

Ingersoll-Rand recommends annual recalibration.

2.2.5 Transmitter Installation

To mount the transmitter into the sample block (preferred method), proceed as follows, refer to Figure 9.

1. Ensure that the protective cover (2), and its desiccant capsule (2a), have been removed from the tip of the transmitter.

2. Fit the bonded seal (4) over the threaded part of the transmitter body.



WARNING: Under no circumstances should the sensor guard be handled with the fingers.

3. Screw the transmitter (1) into the sample block (3) and tighten to the recommended torque setting.

   NOTE: Use the flats of the hexagonal nut and not the sensor body.

4. Fit the transmitter cable/connector assembly to the plug located on the base of the transmitter and tighten the fixing screw (see Section 2.3.4.1).

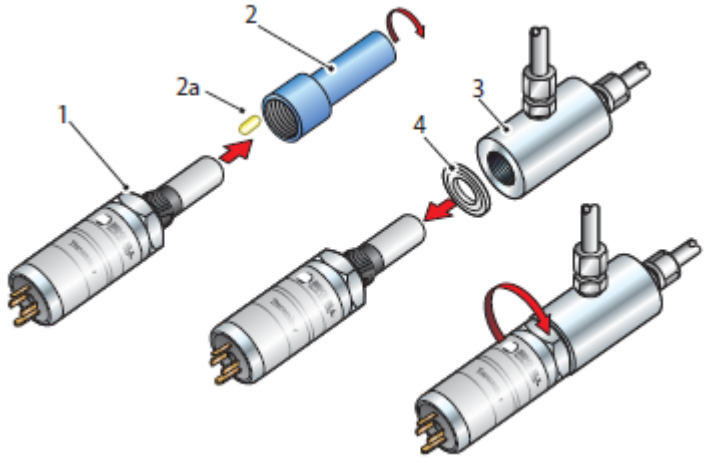


Figure 9: Transmitter Mounting – Sample Block

SECTION 2: INSTALLATION

2.2.6 HDT Installation: Sample Block / Sample System*

Warning: Before mounting the HDT into any system, ensure the system is safe to work on. Depressurize and verify that all power connections are isolated, in the off position.

Installation should be carried out by trained technicians and following local safety protocols.

1. Ensure that the selected location for the sample block or sample system provides adequate working space and safe clearance for the proper installation and removal of the transmitter.

2. Check that all pipe/tube connections & fittings are tightly secure. Leak testing prior to the installation of the transmitter is recommended.

3. It is advisable to carry out an initial purge routine of the sample loop, before installing the transmitter, to remove the possibility of sensor damage on start-up.

4. Ensure upstream/inlet isolation valves, as well as any downstream isolation valves are closed prior to the installation of the transmitter.

5. Remove the shipping tube cover from the HDT before installing.

6. Install the HDT into the sample block/transmitter holder and tighten firmly to properly compress the O-ring seal.

7. Ensure there is adequate transmitter cable length to make connection to the data acquisition system.

8. Orient the cable connector such that the transmitter pins correctly mate with the cable connector.

9. The HDT is a 2-Wire 4 - 20mA transmitter, loop powered by 12 to 28V DC.

Notes:
a. Pin 1 connects to the 4 - 20mA signal return (green wire in the supplied transmitter cable).
b. Pin 3 connects to the power supply +ve (red wire in the supplied transmitter cable).

*** If using the HDT in conjunction with a sample block, consult the sample system instructions for proper start-up procedure and use.**

Do not apply power until all wiring is completed and checked.

SECTION 3: ADDITIONAL INSTALLATION INSTRUCTIONS

3.1 Transmitter Cable Self-Assembly

For guidance on type of cable refer to Section 2.2.5, Cable Selection for Self-Assembled Cables.

3.1.1 Assembly Instructions

1. Remove the screw from the rear of the DIN connector housing.
2. Lever the terminal block from the connector housing by inserting a small screwdriver in the notch on the front face of the terminal block.
3. Ensure the small sealing O-ring and washer and retained with the screw.

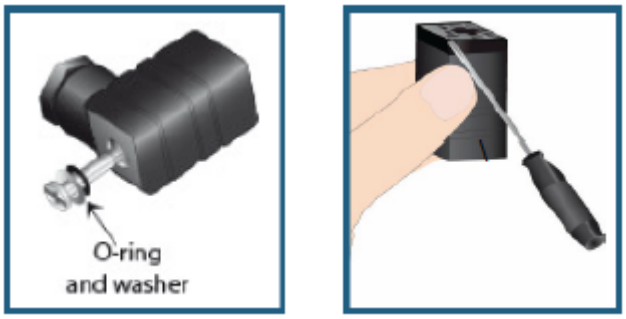


Figure 4: Connector Terminal Block Removal

4. Cable should be assembled according to Figure 5.

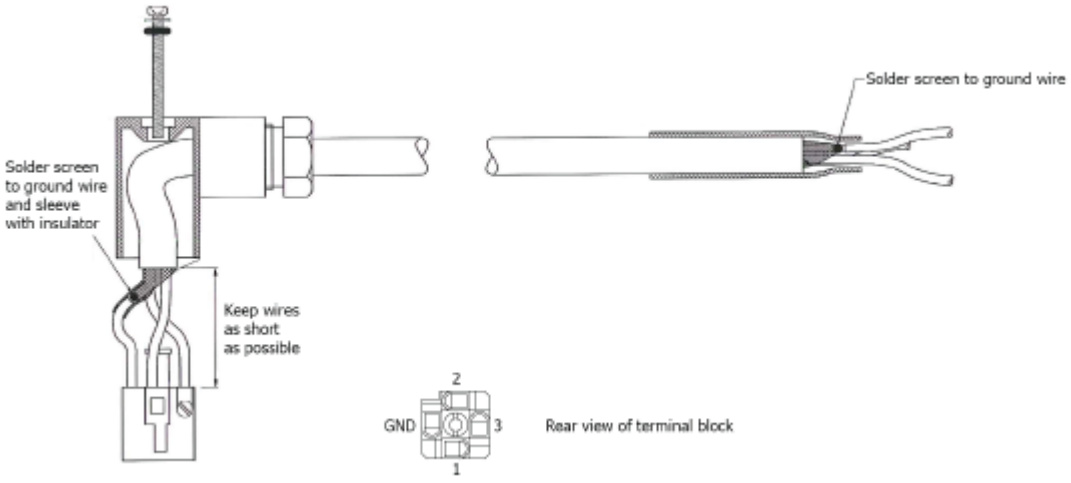
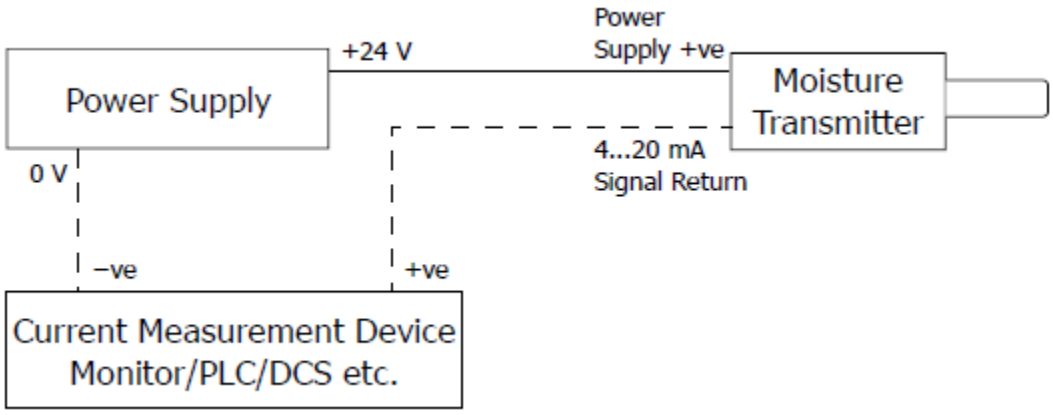


Figure 5: Cable Assembly

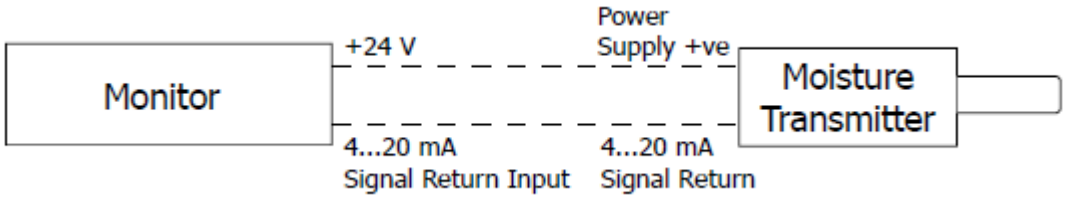
SECTION 3: ADDITIONAL INSTALLATION INSTRUCTIONS

3.2 4-20 mA Wiring Schematics

Example 1: Connecting the transmitter using an external power supply to provide the excitation voltage:



Example 2: Connecting the transmitter to a device that provides its own excitation voltage:



3.3 Cable Selection for Self-Assembled Cables

NOTE: This section is provided, should the user need to use their own custom length cable.

It is recommended to use 3-core screened cable. For short runs, a cable with individual conductor sizes of 24 AWG / 0.21mm2 would be a typical choice. For longer runs, a cable with larger conductors may be required to keep loop resistance within allowable limits. A chart of maximum loop resistance vs supply voltage is provided in the following section to aid in cable selection.

SECTION 3: ADDITIONAL INSTALLATION INSTRUCTIONS

3.4 Maximum Loop Resistance vs Supply Voltage

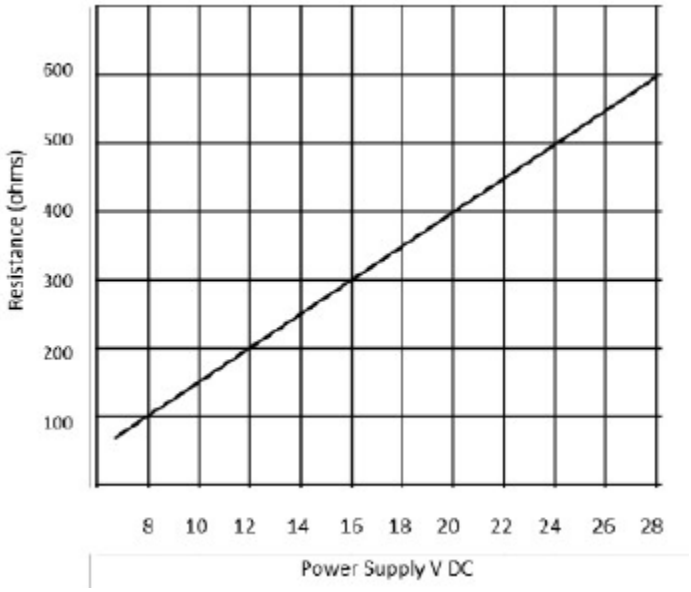


Figure 7: Maximum Load of HDT – Including Cable Resistance

NOTE: Cable resistance of the entire loop must be considered when calculating loop resistance.

3.5 Transmitter Mounting

3.5.1 5/8” 18 UNF Version

1. Remove the protective cover and desiccant capsule from the transmitter and retain for future use.

2. Prevent any contamination of the sensor before installation by handling the transmitter by the main body only, avoiding contact with the sensor guard.

3. Pass the bonded seal over the 5/8”- 18 UNF mounting thread.

4. Screw the transmitter into the sampling location or sample block by hand using the wrench flats only. DO NOT grip and twist the sensor cover when installing the sensor.

5. When installed, fully tighten using a wrench to a torque setting of 30.5 Nm (22.5 ft-lbs.).

3.5.2 Transmitter Mounting – Sample Block (Optional)



These procedures must be carried out by a qualified installation engineer.

3.5.2.1 Sample Block Gas Connections

Sample gas connections are made to the Gas In and Gas Out ports on the sample block; see Figure 8. Either port on the sample block may be used as the Gas Input port (i.e. for connection purposes the ports are interchangeable).

Normally, connections are made via stainless steel pipework, in which case the sensor block/transmitter assembly will be self supporting. If PTFE tubing is used it may be necessary to support the assembly with a body clip.

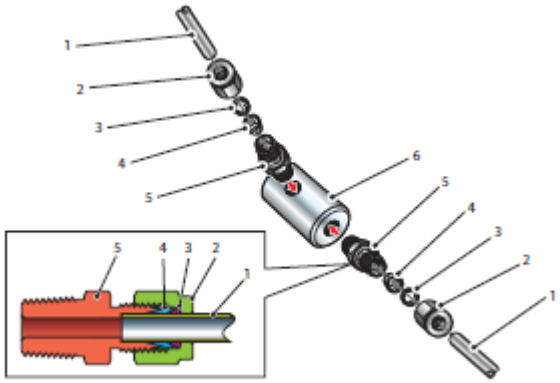


Figure 8: Sample Block Gas Connections

Both the Input and Output gas connections are ⅛" NPT. It is recommended that both the Gas Input and Output connections are made via ⅛" NPT to 6mm or ⅛" NPT to ¼" stainless steel tube adaptors (2 to 5 – Figure 8). The method of connection to the sensor block (6) is as follows:

3.5.2.1 Sample Block Gas Connections (continued)

NOTE: The following description relates to 6mm tube fixings. The sample block ports are both ⅛" NPT female process connections. Tube adaptors are not supplied with the equipment, but can be obtained by contacting Ingersoll-Rand.

1. Cut a suitable length of 6mm (¼" U.S.) stainless steel tubing (1) and, if necessary, bend to shape to suit the location of the sensor block assembly.

   NOTE: To facilitate ease of connection to the port, at least 75mm (3") of the tubing coming out of the Gas In port should be straight.

2. Clean and deburr the inside and outside rim of the tubing at the connection point.

3. Using gas-fitters PTFE tape, wrap the NPT thread 2–3 times. The wrapping should leave the first thread clear and follow the direction of the thread.

4. Screw the ⅛" NPT Swagelok adaptor (5) into the ⅛" NPT inlet port in the sensor block (6) and tighten to a torque setting of 35 Nm (25 lbf-ft).

5. Pass the stainless steel tubing (1) through the locking nut (2). NOTE: Threads towards the gas port.

6. Fit the back ferrule (3) over the stainless steel tubing (1) with the bevelled end facing the back of the front ferrule (4).

7. Place the front ferrule (4) over the stainless steel tubing (1), bevelled end towards the adaptor (5).

8. Push the stainless steel tubing (1) as far as it will go into the adaptor (5) and tighten up the locking nut (2) finger tight.

9. Hold the adaptor (5) flats with a spanner and tighten up the locking nut (2) to a torque setting of 35 Nm (25 lbf-ft) (1¼ turns). This action compresses the front ferrule (4) and back ferrule (3) onto the tubing to form a gas tight seal.

10. Connect up the other gas port as described in steps 1 to 9 above.

3.5.3 Transmitter Mounting – Direct Pipeline Connection

The transmitter may be directly mounted into a pipe or duct, as shown in Figure 10.



CAUTION: Do not mount the transmitter too close to the bottom of a bend where any condensate in the pipeline might collect and saturate the probe.

The pipe or duct will require a thread to match the transmitter body thread. Fixing dimensions are shown in Figure 10. For circular pipework, to ensure the integrity of a gas tight seal, a mounting flange will be required on the pipework in order to provide a flat surface to seal against.



The following procedure must be carried out by competent personnel.

1. Ensure that the blue protective cover, and the desiccant capsule, have been removed from the tip of the transmitter.



WARNING: Under no circumstances should the sensor guard be handled with the fingers.

3.5.3 Transmitter Mounting – Direct Pipeline Connection (continued)

1. Fit a bonded seal (2) over the threaded part of the transmitter body.
2. Screw the transmitter (3) into the pipe (1). Tighten enough to obtain a gas tight seal. (Torque will depend upon the pipeline material.)

   NOTE: Do not overtighten or the thread on the pipework may be stripped.

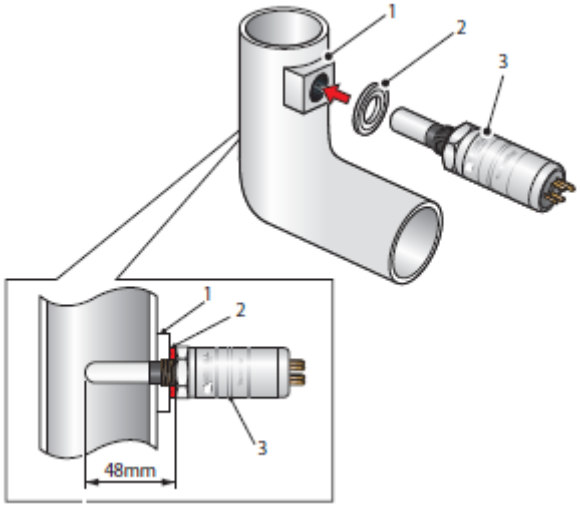


Figure 10: Transmitter Mounting – Pipe or Duct

3.5.4 Transmitter Mounting – With Additional Process Connection Adapter

The following procedure must be carried out by a qualified installation engineer.

To mount the adapter into the transmitter, proceed as follows (see Figure 11):

1. Ensure that the protective cover (2), and its desiccant capsule (2a), have been removed from the tip of the transmitter.
2. Fit the bonded seal (3) over the threaded part of the transmitter body.
3. Screw the adapter (4) onto the threaded part of the transmitter and tighten to torque settings recommended in Section 4.

   NOTE: Use the flats of the hexagonal nut and not the sensor body.

3.5.4 Transmitter Mounting – With Additional Process Connection Adapter (continued)

WARNING: Under no circumstances should the sensor guard be handled with the fingers.

4. Screw the transmitter (1) with its seal (3) and adapter (4) into the sample block (see Section 2.3.4) or pipeline (see Section 2.3.5) and fully tighten using a wrench until the seal is fully compressed and to the following torque settings:

   G 5/8" – 18 UNF 40 Nm (29.5 ft-lbs)

   NOTE: **Use the flats of the hexagonal nut and not the sensor body.**

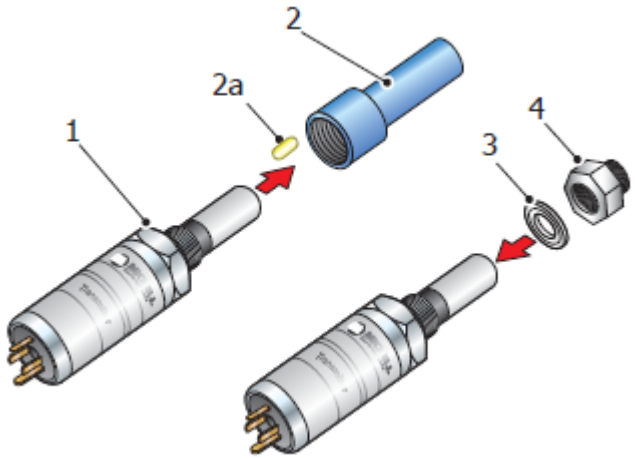


Figure 11: Transmitter Mounting with Adapter

SECTION 4: SYSTEM COMPONENTS

4.1 HDT Specifications

Dew Point Range:	**Standard Dew/Frost Point ranges are:** -148°F to +68°F (-100°C to +20°C) **Available upon request:** -112F to +86°F (-80°C to +30°C) -148°F to +86°F (-100°C to +30°C) **NIST/NPL traceable for range:** -130°F to +68°F (-90°C to +20°C)
Analog Outputs:	4 to 20 mA Linear (2-wire current loop)
Power Supply:	24 V dc (7 to 28 V dc); reverse polarity protected
Dew Point Accuracy:	± 3.6°C from +68°F to -130°F dew/frost point temperature (± 2°C from +20°C to -90°C dew/frost point temperature) ± 5.4°C from -130°F to -184°F dew/frost point temperature (± 3°C from -90°C to -120°C dew/frost point temperature)
Operating Temperature:	-4°F to +140°F (-20 to +60°C)
Operating Pressure:	45 Mpa (450 barg) maximum
Ingress Protection:	IP66
Process Thread:	5/8”-18 UNF (18 tpi) with integral Viton "O" ring seal
Dimensions:	Length: 5.19 inches (132 mm) (including cable connector)

NOTE: Additional technical specifications can be referenced in Section 8.1.

SECTION 5: FUNCTIONAL CHECKS

Note: This section assumes that all required electrical wiring and mounting has been completed. See the Installation section for further information, if necessary.

Use of the HDT is extremely simple. There are no controls to operate during normal use, as these devices are designed for long-term unattended operation. With the analog output, connected to a data acquisition system, recorder, or process controller, the user has only to periodically monitor the system for normal operation.

5.1 Faults/Errors

- Sensor fault: 23 mA output
- Under-range dew point: 4 mA output
- Over-range dew point: 20 mA output

SECTION 6: MAINTENANCE

There are no serviceable parts on an HDT; however, It is recommended that the HDT is calibrated at regular intervals to maintain accuracy. Annual calibration at the factory is recommended.

SECTION 7: DISPOSAL



Dispose of the unit according to statutory regulations. Do not dispose of with regular household refuse.

SECTION 8: TECHNICAL SPECIFICATIONS

8.1 Technical Specifications

Performance Specifications	
Measurement range	-148°F - +68°F (-100 - +20°C) dew point Available upon request: -112F - +86°F (-80°C - +30°C) -148°F - +86°F (-100°C - +30°C)
Accuracy	±3.6°F (±2°C) dew point
Response time	5 mins to T95 (dry to wet)
Repeatability	0.9°F (0.5°C) dew point
Calibration	Traceable 13-point calibration certificate
Electrical Specifications	
Output signal	4 - 20 mA (2-wire connection, current source); User configurable over range
Output	Dew point or moisture content
Analog output scaled range	**Dew point:** -148°F up to +48°F (-100 up to +20°C) **Moisture content in gas:** 0 up to 3000 ppm
Supply voltage	12 - 28 V DC
Load resistance	Max 250 Ω @ 14 V (500 Ω @ 24 V)
Current consumption	23 mA max, depending on output signal
Compliances	CE & UKCA
UL approval	Approved
	UL61010-1 & CAN/CSA C22.2 No. 61010-1
Operating Specifications	
Operating temperature	-40 - +140°F (-40 - +60°C)
Compensated temperature range	-4 - +122°F (-20 - +50°C)
Storage temperature	-40 - +140°F (-40 - +60°C)
Operating pressure	45 Mpa (450 barg) maximum
Flow rate	1 - 5 N/min mounted in standard sampling block 0 - 10 m/sec direct insertion

SECTION 8: TECHNICAL SPECIFICATIONS

8.1 Technical Specifications (continued)

Mechanical Specifications	
Ingress protection	IP66 in accordance with standard BS EN 60529:1992; NEMA 4 protection in accordance with tandard NEMA 250-2003
Oxygen service	Optional: cleaned for enriched oxygen service
Housing material	316 stainless steel
Dimensions	MiniDIN 43650 form C L-132 mm x Ø45 mm (with connector cable)
Filter (sensor protection)	Standard: HDPE <10µm Optional: 316 stainless steel sintered guard <80µm
Process connection	5/8” – 18 UNF
Weight	5.29 ounces (150 g)
Electrial connections	MiniDIN 43650 form C
Mating Electrical Connectors	Mating connector supplied as standard
Diagnostic conditions (factory programmed)	**Condition:** **Output:** Sensor fault: 23 mA output Under-range dew point: 4 mA output Over-range dew point: 20 mA output

APPENDIX A - WARRANTY AND RETURNS

Warranty

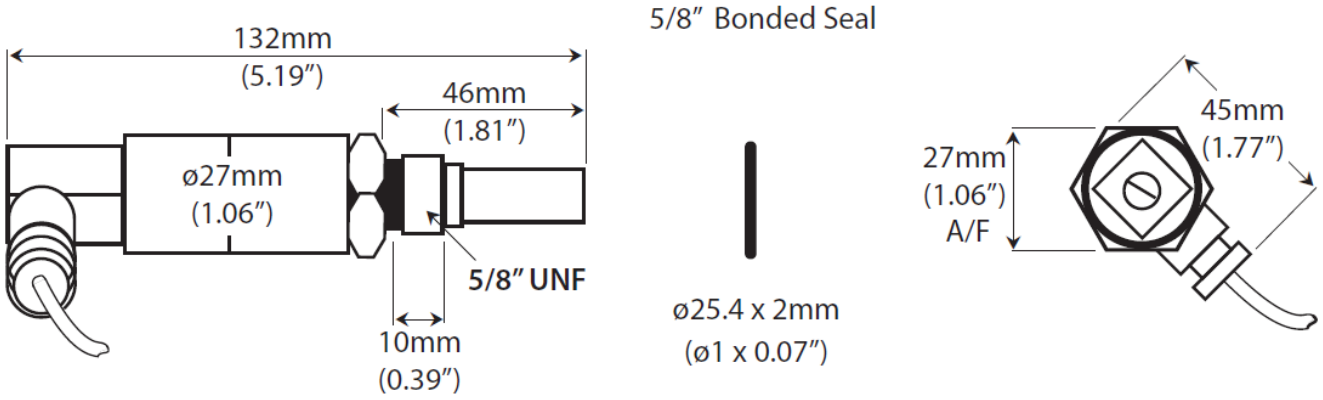
Ingersoll-Rand warrants the transmitter to be free from defects in material and workmanship for a period of 12 months from the date of placing the equipment in operation, but no later than 18 months from the date of shipment from the factory or from the date of notice of equipment ready for shipment, in case the shipment cannot be effected for reasons not under Ingersoll-Rand's control; whichever shall occur first. Our liability under this warranty is limited to repairing or replacement of the transmitter free of charge as our inspection deems warranted. This warranty applies to transmitters which have been operated within normal capacity rating and operating conditions. Warranty is withdrawn in the event the user makes any repairs or alterations which have not been authorized by Ingersoll-Rand in writing. This warranty excludes cost of shipment to and from our factory.

Return Policy

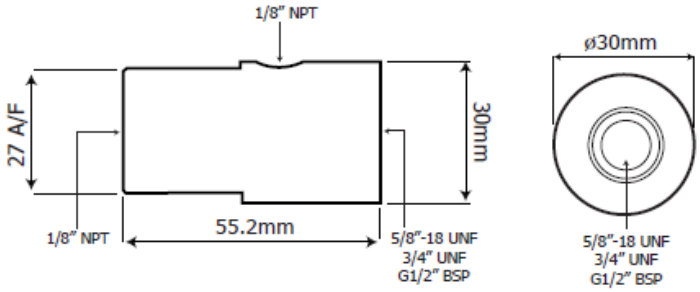
If returning an HDT for warranty service or annual recalibration, the user must contact Ingersoll-Rand for instructions, which will include the issue of a Return Merchandise Authorization (RMA), and the user will issue a Purchase Order for the itemized service and/or parts. No credit will be issued for items returned without proper authorization.

Ingersoll-Rand will inspect all items returned prepaid. If inspection proves the equipment to be defective, full credit will be issued. If inspection proves the equipment to be in good working condition, or it is found to be damaged by abuse, an estimate of the charges will be made before work begins, provided the equipment is not covered under warranty. Upon completion of work as approved by user, the equipment will be returned F.O.B. factory, and payment for items issued against the user's purchase order will be required.

APPENDIX B – HDT WITH CONNECTOR GENERAL ARRANGEMENT



APPENDIX C – SAMPLE BLOCK GENERAL ARRANGEMENT



This concludes the HDT User Guide

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SECTION 7: SDS & CUT SHEETS

7.0 Desiccant SDS

The Desiccant SDS (Safety Data Sheet) which is included on the following pages in this section is specific to the air dryer identified on this instruction manual's cover (reference Model No. and Serial No.).

7.1 Product Component Cut Sheets

The product component cut sheets which are included on the following pages in this section are specific to the air dryer identified on this instruction manual's cover (reference Model No. and Serial No.).

Reference the Spare Parts List in the "Documentation" section of this manual for a complete list of spare parts which includes the recommended spare parts that the user should keep in stock in case of an emergency.

Safety Data Sheet
Activated Alumina Desiccant

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product Name : aSORB
Synonym : Aluminum Oxide, hydrate; Activated Alumina

1.2 Relevant identified uses of the substance or mixture and uses advised against

Recommended use :Adsorbent

1.3 Details of the supplier of the safety data sheet

Supplier : Henderson Engineering Co., Inc.
: 95 North Main Street
: Sandwich IL 60548
: USA
Telephone :+1 (815) 786-9471

1.4 Emergency telephone number

Emergency :+1 (847) 292-8600

2. HAZARD(S) IDENTIFICATION

2.1 Classification of the substance or mixture

GHS classification in accordance with 29 CFR 1910 (OSHA HCS)
Not a hazardous substance or mixture. No need for classification under GHS.

2.2 GHS label elements, including precautionary statements

Not a hazardous substance or mixture. No need for classification under GHS.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

No other specific dangers known at this time, if properly stored and handled pursuant to these instructions and industry standards.

According to Regulation 1994 OSHA Hazard Communication Standard; 29 CFR Part 1910.1200

Emergency Overview

CAUTION: May be harmful if inhaled. May cause difficulty breathing. Inhalation of dust may result in respiratory irritation. Prolonged and repeated exposure of dust may cause lung damage. Contact with the eyes or skin may cause mechanical irritation. Avoid inhalation of dusts. Avoid contact with the skin, eyes and clothing.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical identity : Al_2O_3
Common name : Activated Alumina
Numbers of identity : CAS-Nr.: 1344-28-1
: EC-No.: 215-691-6

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Remove contaminated clothing. Consult a qualified medical professional. Show this data sheet to the doctor in attendance.

If ingested
Not a hazard under normal use conditions. If large amounts are ingested, get medical advice.

Skin contact
Wash with soap and water. Get medical attention if irritation persists.

Eye contact
Flush eyes with plenty of water. Check for and remove any contact lenses if possible. Continue flushing eyes with water for at least 15 minutes. Get medical attention if irritation occurs.

Inhalation
Move individual to fresh air. Aid in breathing, if necessary, and get immediate medical attention.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or section 11.

4.3 Indication of any immediate medical attention and special treatment needed
Note to physician Treatment: Treat according to symptoms (decontamination, vital functions), no known specific antidote.

5. FIRE-FIGHTING MEASURES

5.1 Extinguishing media
Suitable extinguishing media : Any media suitable for the surrounding fire.

5.2 Special hazards arising from the substance or mixture
Fire hazards : None known
Explosion hazards : None known

5.3 Advice for firefighters
Follow standard fire fighting procedures.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing dust. Ensure adequate ventilation. For personal protection see section 8.

6.2 Environmental precautions
Prevent spread over a wide area (e.g. by containment or oil barriers). Do not discharge into drains/surface waters/groundwater. Contain contaminated water/firefighting water.

6.3 Methods and materials for containment and cleaning up
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Vacuuming may be used to avoid dust dispersal. Dispose of material according to local and regional requirements.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid dust formation. Avoid breathing dust.

7.2 Conditions for safe storage, including any incompatibilities
Segregate from reducing agents.

Do not store super sacks outside; ultraviolet radiation and other adverse conditions will negatively impact its integrity and may eventually cause the bag to fail.

Suitable materials for containers: carbon steel (iron), Low density polyethylene (LDPE), High density polyethylene (HDPE).

Suitable for any general chemical storage area. Do not store in areas where temperatures may exceed 35 °C.

Keep container tightly closed in a cool, well-ventilated area. Keep container dry.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2, no other specific uses are stipulated.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters/exposure limits

OSHA PEL

Activated Alumina	: 5 mg/m^3 (Inhalation Respirable) (TWA)
Activated Alumina	: 15 mg/m^3 (TWA)
Activated Alumina	: 1 mg/m^3 (TLV)

Lower respiratory tract irritation.
Pneumoconiosis.
Neurotoxicity.
Not classifiable as a human carcinogen

8.2 Appropriate engineering controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

8.3 Personal protective equipment

Safety glasses, lab coat, and dust respirator. Be sure to use an NIOSH approved respirator or equivalent.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

Physical state	: Solid
Color	: Off-white
Odor	: Odorless
Odor threshold	: No data available
pH-value	: 9.4 – 10.1 (in 5% slurry)
Melting point	: No data available
Freezing Point	: No data available
Initial boiling point	: 2050 °C
Flash point	: No data available
Evaporation rate	: No data available
Flammability (solid, gas)	: Non-flammable
Explosion limits	: No data available
Vapor pressure	: Not applicable
Vapor density	: Not applicable
Relative density	: No data available
Solubility	: Insoluble
Partition coefficient	: No data available
Auto-ignition temperature	: No data available
Decomposition temperature	: No data available
Viscosity	: No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
Moisture (adsorbs water with evolution of heat).

10.2 Chemical stability
The product is stable under normal ambient and anticipated storage and handling conditions of temperature and storage.

10.3 Possibility of hazardous reactions
None known.

10.4 Conditions to avoid
Avoid deposition of dust and dust formation.

10.5 Incompatible materials
None known.

10.6 Hazardous decomposition products
None anticipated.

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effect
Primary routes of exposure Routes of entry for solids and liquids are ingestion and inhalation, but may include eye or skin contact. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquefied gases. Acute Toxicity/Effects Acute toxicity Assessment of acute toxicity: Virtually nontoxic after a single skin contact. Virtually nontoxic by inhalation. Virtually nontoxic after a single ingestion.

Oral

Information on	: Aluminum oxide
Type of value	: LD50
Species	: Rat
Value	: > 10,000 mg/kg (similar to OECD guideline 401)

The data refer to a preparation of the substance.
No mortality was observed.
No systemic toxicity.

Inhalation

Information on	: Aluminum oxide
Type of value	: LC50
Species	: Rat
Value	: > 2.3 mg/l (similar to OECD guideline 403)
Exposure time	: 4 hours

Tested as dust aerosol.
No mortality was observed.

Irritation / corrosion
Assessment of irritating effects: Inhalation of dust may cause respiratory tract irritation, coughing and breathing difficulties. Contact with the eyes or skin may cause mechanical irritation.

Chronic Toxicity/Effects

Other Information
The product has not been tested. The statements on toxicology have been derived from the properties of the individual components. The product has been assessed on the basis of the components' available data. To some extent data gaps exist for individual components. According to our present knowledge and experience dangers which are not covered by the current labeling are not to be expected.

Symptoms of Exposure
No significant reaction of the human body to the product known.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish Information on: Aluminum oxide

LC50 (96 h) > 218.64 mg/l, Pimephales promelas (Fish test acute, semistatic) The product has not been tested. The statement has been derived from substances/products of a similar structure or composition. Tested above maximum solubility.

Aquatic invertebrates Information on: Aluminum oxide

No observed effect concentration (48 h) > 100 mg/l, Daphnia magna (OECD Guideline 202, part 1, static)

Tested above maximum solubility. The details of the toxic effect relate to the nominal concentration.

Aquatic plants
Information on: Aluminum oxide
No observed effect concentration (72 h) > 100 mg/l (growth rate), Selenastrum capricornutum (OECD Guideline 201, static)
Tested above maximum solubility. The details of the toxic effect relate to the nominal concentration.

Chronic toxicity to fish
Information on: Aluminum oxide
EC10 (7 d) 0.0938 mg/l, Pimephales promelas (semistatic)

Chronic toxicity to aquatic invertebrates
Information on: Aluminum oxide
No observed effect concentration (21 d) 0.076 mg/l, Daphnia magna (OECD Guideline 211, semistatic)
The statement of the toxic effect relates to the analytically determined concentration. The product has not been tested. The statement has been derived from substances/products of a similar structure or composition.

12.2 Persistence and degradability
Assessment biodegradation and elimination (H2O) Not applicable for inorganic substances.

Additional information
Other ecotoxicological advice: The product has not been tested. The statements on ecotoxicology have been derived from the properties of the individual components. The product has been assessed on the basis of the components' available data. To some extent data gaps exist for individual components. According to our present knowledge and experience dangers which are not covered by the current labeling are not to be expected.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product:
Dispose of in accordance with federal, state, and local environmental control regulations. All waste materials should be reviewed to determine applicable hazards.

14. TRANSPORT INFORMATION

DOT (U.S.A.)
Not a dangerous good.

IMDG
Not a dangerous good.

Transport hazard classes
Not applicable.

Packing group
Not applicable.

Environmental hazards
See section 12.

Transport in bulk
Not applicable.

Special precautions for users
Not applicable.

15. REGULATORY INFORMATION

15.1 SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313
The following components are subject to reporting levels established by SARA Title III, Section 313.
Aluminum oxide
CAS-No.: 1344-28-1
Revision date: 1994-04-01

Massachusetts Right to Know Components
Aluminum oxide
CAS-No.: 1344-28-1
Revision date: 1994-04-01

Pennsylvania Right to Know Components
Aluminum oxide
CAS-No.: 1344-28-1
Revision date: 1994-04-01

New Jersey Right to Know Components
Aluminum oxide
CAS-No.: 1344-28-1
Revision date: 1994-04-01

California Proposition 65 Components
This product does not contain any chemicals known to the State of California to cause cancer, birth defects, or any other reproductive harm.

Toxic Control Substances Act (TSCA)
TSCA (U.S.A.) released / listed.

15.2 Other classifications

HMIS (U.S.A.)

Health hazard	: 1
Fire hazard	: 0
Reactivity	: 0

National Fire Protection Association (U.S.A.)

Health	: 1
Flammability	: 0
Reactivity	: 0

WHMIS (Canada)
Class D, Division 2, Subdivision B

16. OTHER INFORMATION

16.1	**Preparation date**	:June 1, 2015
	Revision Number	:2
	Revision date	:July 9, 2019
	Revised By	:KT
	Approved By	:BW

16.2 Warranty

The information contained herein is based upon data considered true and accurate. However, the Supplier makes no warranties, express or implied, as to the accuracy or adequacy of the information contained herein or the results to be obtained from the use thereof. This information is offered solely for the user’s consideration, investigation and verification. Since the use and conditions of this information and the material described herein are not within the control of the Supplier, it assumes no responsibility for injury to the user or third persons. The material described herein is sold only pursuant to the Supplier's Terms and Conditions of Sale, including those limiting warranties and remedies contained therein. It is the responsibility of the user to determine whether any use of this data and information is in accordance with applicable federal, state or local laws and regulations.

REGULATOR



CCN	Port Size	High Flow
17928376	¾” NPT	300 SCFM
Consult I-R	1” NPT	400 SCFM

SPECIFICATIONS

Supply pressure, maximum	300 PSIG (20.7 bar)
Reduced pressure range	2 to 125 PSIG (0.15 to 8.5 bar)
Temperature rating	40°F to 125°F (4.4°C to 52°C)
Weight	6.2 lb. (2.81 kg)

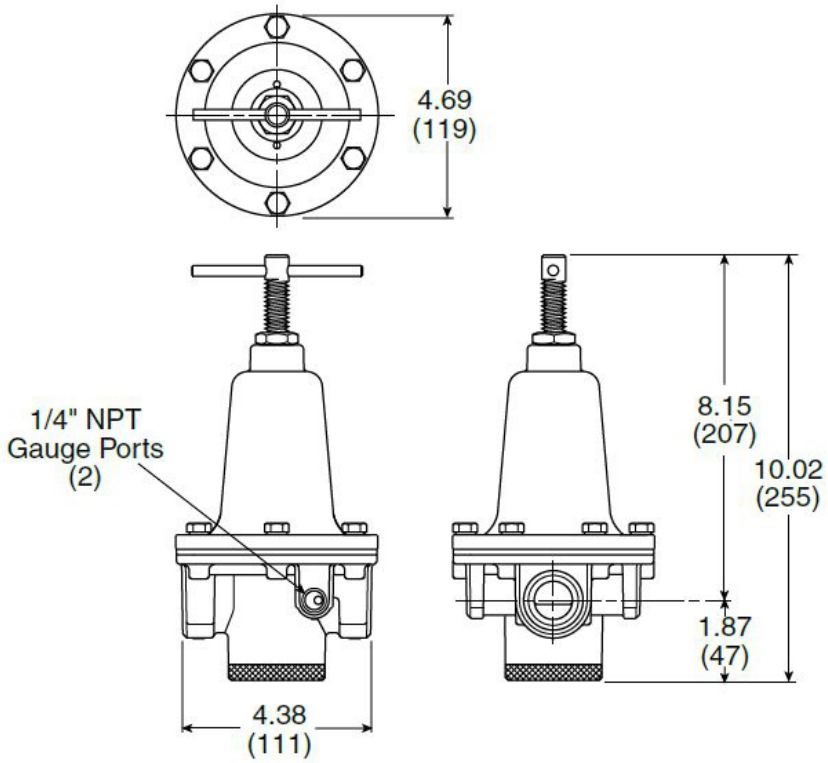
MATERIALS OF CONSTRUCTION

Adjusting screw, Springs	Steel
Body, Spring cage	Zinc
Bottom plug	Nylon
Innervalve	Brass
Seals	Buna N

⚠ WARNING

Product rupture can cause serious injury.
Do not connect regulator to bottled gas.
Do not exceed maximum primary pressure rating.

DIMENSIONS



Dimensions in inches (mm)

ROBO DRAIN
With Test Button

CCN	Robo Drain with Bronze Ball Valve	Robo Drain with SS Ball Valve	SS Fittings & Tubing	Liquid Level Switch
38341525	√	NA	NA	NA
17928377	NA	√	NA	NA
23815285	NA	√	√	NA
17928378	NA	√	√	√

Reference page 2 of this cut sheet for Robo Drain parts list.



FEATURES

- See-Through Vessel
- Fully Pneumatic
- No Wasted Air
- Low Profile
- Test Button
- Made in U.S.A.
- Ball Valve Stem Support System
- Ideal for Oil/Water Separators
- Non-Clogging Ball Valve
- No Strainers to Clean
- Operates On Demand

MATERIALS

Reservoir: Aluminum and Composite
Float: Stainless Steel
Seat: Stainless Steel
Seal: Viton

SPECIFICATIONS

Inlets: (2) 3/4" NPT
Outlet: 1/2" NPT
Power: Clean, Dry Compressed Air 80 to 130 PSI
Pressure: 0 to 250 PSI
Operating Temperature: 32° to 180°F
Weight: 16 lbs.
Discharge: 24 ounces per cycle

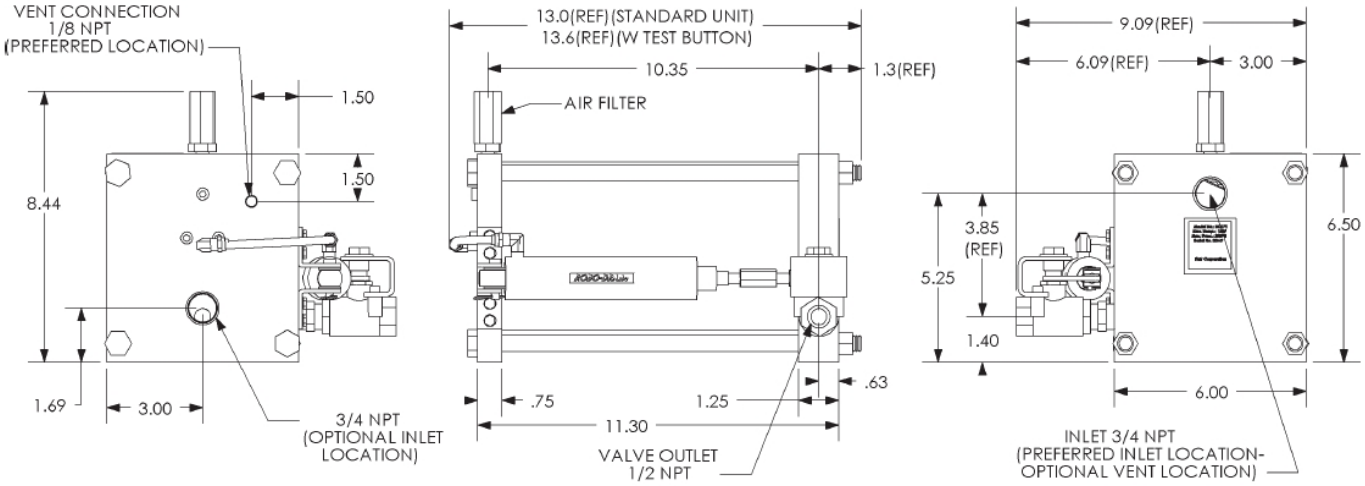
All design specifications are subject to change without notice.

DESIGN

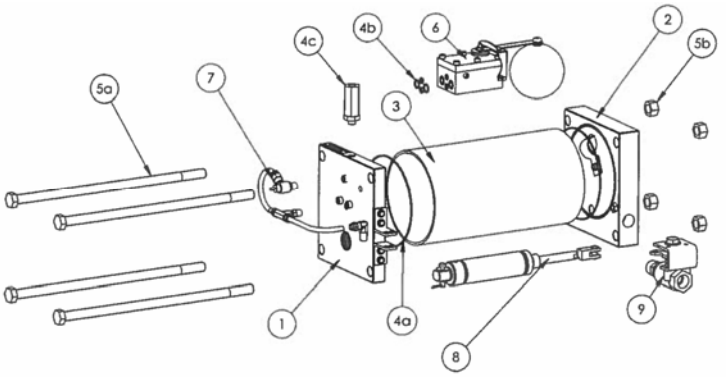
The Robo Drain is the ultimate demand operated drain. The unit is fully automatic, no electricity is required. Its low profile gives you the advantage of installing it in areas where the vessel to be drained is only a few inches from the ground. The Robo Drain's design also eliminates the need for the installation of a vent line for most applications. A unique air valve design uses a magnetic force to ensure both a positive opening and closing that will prevent any air loss. The magnetic force is cleverly positioned away from the condensation level to prevent any attraction of metal particulate. An innovative ball valve support and positioning system prevents the side-loading problem which otherwise would cause premature sealing failure around the valve stem. Rifle drilled discharge porting ensures that scale and rust will exit through a full ported 1/2" ball valve. The Robo Drain will not clog -- no strainer required.

OPERATION

Condensation enters through one of two ports. The see-through vessel allows visual inspection of the condensation as it rises. A stainless steel float rises with the level of condensation and positions a magnetic force over the valve housing. When the liquid level reaches the desired level, the magnet in the valve housing snaps upward and allows air to pass through a stainless steel seat. The air then moves to a non-lubricated air cylinder causing it to extend and open the ball valve. Condensation, scale and rust particles rapidly exit the unit. Before any air is lost, the float removes the magnetic force from the valve and the seat is covered with a Viton seal. A powerful spring returns the air cylinder to its normal position and rotates the positive closing ball valve back to its normally closed position. The pilot air used to actuate the air cylinder is isolated from the air in the drain's reservoir.



ROBO DRAIN PARTS LIST			
Item	**Qty.**	**Description**	**CCN**
1	1	Control head assembly	17928286
2	1	Inlet head assembly	17928287
3	1	Translucent vessel	17928285
4a,b,c	2,2,1	Seal kit: Cylinder o-rings, trigger block rings, Robo Drain filter	17928282
4c	1	Robo Drain filter	17928279
5a,b	4,4	Bolt kit: Tie rods, nuts	17928293
6	1	Float and trigger block assembly	17928288
7	1	Control tubing assembly	17928289
7 (SS)	1	Control tubing assembly, stainless steel	17928290
8	1	Air cylinder assembly	17928291
9	1	Ball valve assembly (bronze)	17928280
	1	Ball valve only, bronze	38478434
	1	Ball valve only, stainless steel	17928281
	1	Liquid level switch	17928283
*	1	Upgrade kit for units built prior to 6/2003	17928294



* Upgrade kit includes longer vessel, bolts, and actuation cylinder.

INSTALLATION INSTRUCTIONS

CAUTION: COMPRESSED AIR CAN BE DANGEROUS

The Robo Drain is designed for trouble-free and maintenance-free draining of unwanted accumulations of condensation and other foreign matter from any collection point in a compressed air system without the need for electricity.

Before attempting to install the drain, be certain that the pressure vessel on which the drain will be installed is completely depressurized.

The drain should not be installed in areas that are exposed to freezing temperatures (heater option is available). Be certain the air system pressure does not exceed the 250 PSI working pressure of the drain and the pressure to the control system does not exceed 120 psi. The inlet temperature should not exceed 180 degrees F.

Connecting the drain to the air system should be done by using one of the recommended installation diagrams shown herein. The installation of a strainer is not required or recommended.

Install the drain as close to the source to be drained as possible. Since the Robo Drain uses gravity to fill the reservoir, the entire drain must be installed below the vessel to be drained when using the top inlet. If flexible tubing is used on the discharge, be certain it is properly fastened to prevent it from whipping when the drain discharges the condensation.

The Robo Drain will accept condensation from either the top or the bottom of the reservoir. We recommend the use of the top entry port. If the bottom inlet is used, then a vent line must be used. The vent line should be installed down stream from the vessel that is being drained. This will insure that the air in the reservoir will properly exit as the condensation fills the tank and replaces the air. Install the vent line in the 1/8" port located on the side of drain. The other end of the vent line should be run back to the air system to a point just down stream from the source that is being drained. Use nongalling pipe sealant on all joints. The use of shut-off valves, unions and bypass valves is recommended. A backup wrench should be used on the discharge ball valve to prevent it from turning and causing the linkage to bind.

The inlet port that is not used must be plugged by using a standard 3/4" NPT plug. When using the top inlet, any reduction in the 3/4" pipe size is not recommended and the Robo Drain reservoir cannot be higher than the bottom of the vessel that is being drained. It is best to run the drain in a downward pitch from the bottom of the vessel being drained to the Robo Drain inlet. The power to operate the Robo Drain comes from compressed air. **ONLY CLEAN DRY AIR SHOULD BE USED.** The supply pressure should be between 80 and 120 psig.

The Robo Drain is supplied with an inlet pilot air filter, which should be installed in the Robo Drain head (reference Dwg. 2 on the following page). The use of unfiltered air can cause the drain to fail.

Once the drain is installed, close the By-Pass drain valve and open the Shut-Off valve. The pressure vessel can now be repressurized.

CHECKING THE DRAIN'S OPERATION

After installation is complete and the drain is on line, a check should be made that the condensation is properly entering the reservoir. This can easily be done by looking through the translucent reservoir.

If condensation is not entering the reservoir, check for the following:

1. Make sure the auxiliary shut-off valve is open.
2. Do not use the bottom inlet on the Robo Drain without installing a vent line.
3. If a vent line is installed, make sure it is down stream from the vessel that is being drained.
4. Be certain that the Robo Drain reservoir is not higher than the vessel that is being drained. This is very important when using the top inlet on the Robo Drain reservoir.
5. Check to make sure the vessel being drained has condensation in it.

If the top inlet is being used and no condensation is entering the Robo Drain reservoir, and all the above items have been checked, we recommend that the bottom inlet be used with a vent line out of the top.

If condensate fills the reservoir and the drain does not operate, check to see if control line air is supplied to control line port. If the drain is supplied with an optional test button, the supply of control line air can be checked by pushing the test button. If the unit does not operate, then no air is being supplied or the inlet filter is plugged.

INSTALLATION DIAGRAMS

IN GENERAL

In order for the condensate to properly enter the Robo Drain reservoir, the condensate line to the Robo Drain must always be installed below the bottom of the vessel to be drained. It is equally important to provide a means for the air that is contained in the reservoir to escape (vent) as the condensate enters the reservoir. If the air can not escape, the condensate will not enter the reservoir. Below are suggestions on how to best install the Robo Drain on typical types of vessels that have to drained of condensate. However, it is possible to install the Robo Drain without a balance line (Dwg. not shown), providing the condensate enters the top inlet and the flow rates are less than 9 GPH (750 cfm for an aftercooler or 1500 cfm drier) for a 1/2" drain line and 19 GPH (1500 cfm for an aftercooler or 3000 cfm drier) for a 3/4" line. The use of unions and shut-off valves are recommended for both the condensate line and the balance line.

RECEIVER TANK

The preferred installation for a Robo Drain on a receiver tank is having the condensate enter the top inlet port and having the balance line go back to the tank at a position that is above the level of the condensate (Dwg. 1).

FILTER and AFTERCOOLER MOISTURE SEPARATOR

If a cyclone separator or filter has pipe plugs located in the top of the head, the plug closest to the discharge pipe should be removed and the balance line should be installed (Dwg. 2). If there is no provision on the cyclone separator or filter for a balance line, install it in the discharge side of the pipe line and as close to the cyclone separator as possible.

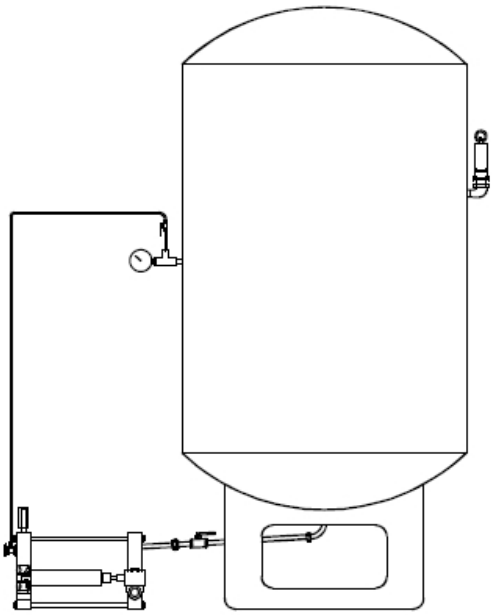
INTERCOOLERS

Install the condensate drain line into the upper port only. This will prevent the possibility of condensate being drawn back into the intercooler on some systems. It is important that the vent line be installed on the same stage that is being drained or to atmosphere.

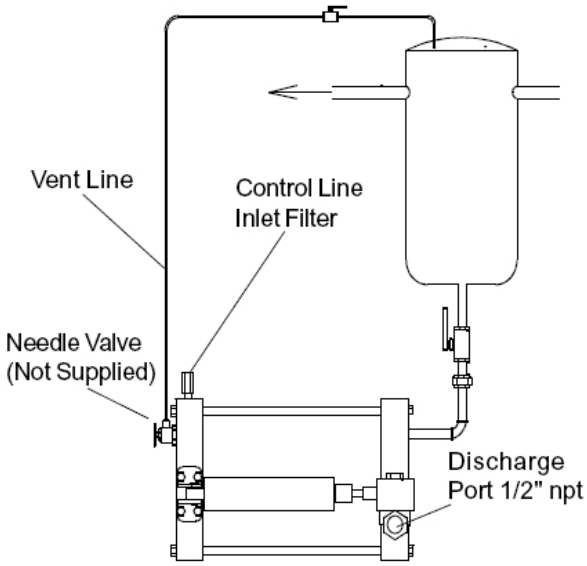
BALANCE LINE

As mentioned above, both the use and the placement of a balance line is very important. Most drain failures are the result of an improper balance line installation. The balance line should be 1/4" tubing or larger, and installed on top of a pipe or vessel, not the bottom. A needle valve is recommended for controlling the air flow. Avoid having any loops or low areas in the balance line that might allow moisture to collect in the line and prevent the passage of air from the drains reservoir.

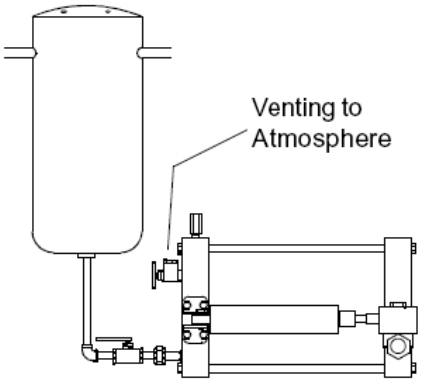
Dwg. 1



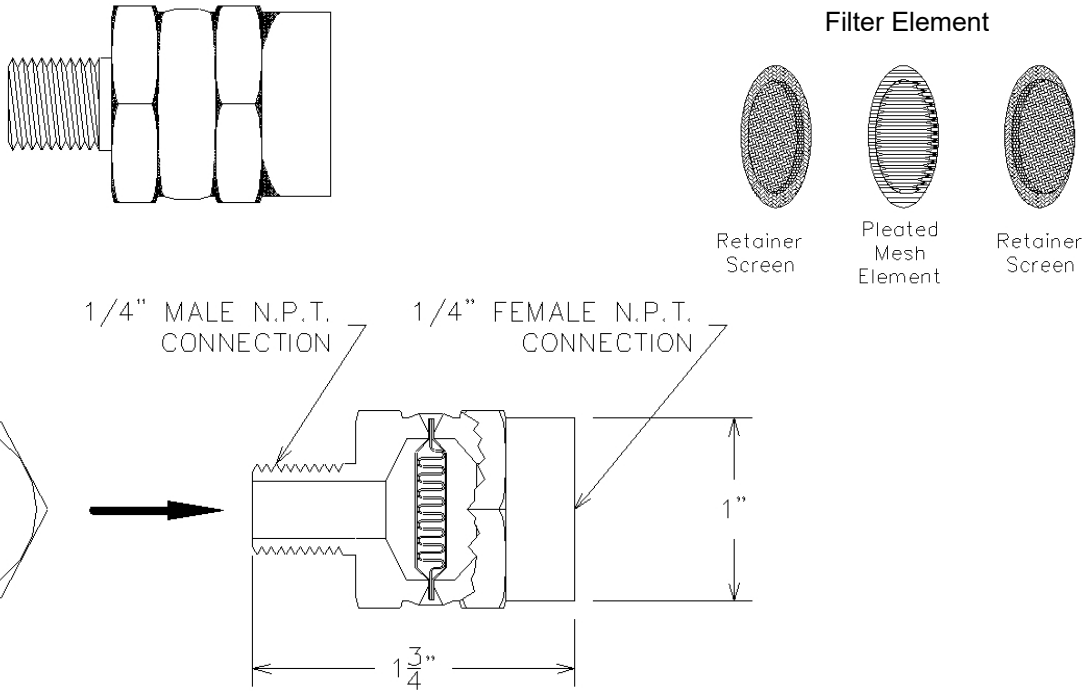
Dwg. 2



Dwg. 3



MINIATURE INLINE FILTER
for Dew Point Demand System



CCN 38335600

OPERATION

System fluid passes from the upstream housing area through the filtration element. The 7 micron size has a pleated mesh element supported by retainer screens. The filtration element is welded around its circumference, preventing bypass and sealing the body sections to atmosphere. The element traps contamination and allows the cleaned fluid to pass through the system. To maintain maximum flow, the filter element may be cleaned periodically. This can be done by back-flushing with a clean solvent which is compatible with the filter and system materials of construction.

MATERIALS

Body Parts: 316 stainless steel
Retainer Screens: 316 stainless steel
Pleated Element: 316 stainless steel

DIMENSIONS

Micron Size: 7
Connection Size: ¼" Male NPT to ¼" Female NPT
Length: 1 ¾"
Port Orifice: 0.281" (7.1 mm)

TECHNICAL DATA

Filtration Area	Maximum Differential Pressure Rating	Working Pressure @ -20ºF to 100°F (-28ºC to 37°C)
2.25 sq. in.	100 PSIG	6000 PSIG
1450 sq. mm	6.8 Bar	413 Bar

HIGH TEMPERATURE PARTICULATE

FILTER ELEMENT SPECIFICATION DATA SHEET

CCN: **38435947**

Description: **712-1H Filter Element**

Filter Material: Microflex Borosilicate Glass Fiber Media with Fixed Pore Structure

Filtration Rating: 99.98% @ 0.9 micron

Core/Retainer Material: Carbon Steel

End Cap Material: Zinc Plated Carbon Steel

End Cap Configuration: Double Open Ended

Seal/Gasket Material: Viton O-Ring

Direction of Flow: Outside-In

Recommended Change out Differential Pressure:	7-10 psid
Maximum Operating Pressure:	100 PSIG @ 400°F
Maximum Operating Temperature:	400°F @ 0 PSIG
Temperature Rating:	400°F
Nominal I.D.:	4.5” Nominal
Nominal O.D.:	7.0” Nominal
Nominal Length:	12.00”

FILTER ELEMENT SPECIFICATION DATA SHEET

CCN:	**38335584**
Description:	**16D33 Filter Element**
Element Type:	Pneumatic Coalescing Filter
Separation Media:	Microflex Borosilicate Glass Fiber Media with Fixed Pore Structure
Filtration Rating:	DOP Efficiency 99.97% @ 0.3 micron
End Cap Material:	Aluminium
End Cap Configuration:	Single Open Ended
Seal/Gasket Material:	Buna O-Ring

Direction of Flow:	Inside-Out
Recommended Change-out Differential Pressure:	7-10 psid
Temperature Rating:	225°F
Nominal I.D.:	1.6”
Nominal O.D.:	2.8”
Nominal Length:	5.5”

FILTER ELEMENT SPECIFICATION DATA SHEET

CCN: **38390811**

Description: **16D150 Filter Element**

Element Type: Pneumatic Coalescing Filter

Separation Media: Microflex Borosilicate Glass Fiber Media with Fixed Pore Structure

Filtration Rating: DOP Efficiency 99.97% @ 0.3 micron

End Cap Material: Aluminium

End Cap Configuration: Single Open Ended

Core/Retainer Material: Polypropylene

Seal/Gasket Material: Buna O-Ring

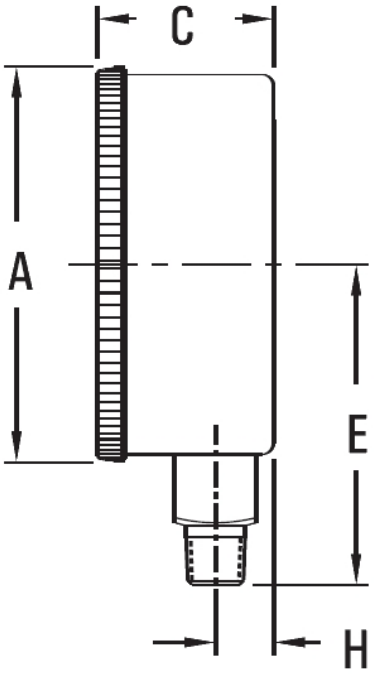
Direction of Flow:	Inside-Out
Recommended Change-out Differential Pressure:	7-10 psid
Temperature Rating:	225°F
Nominal I.D.:	1.6”
Nominal O.D.:	2.8”
Nominal Length:	19.4”

PRESSURE & PURGE GAUGES

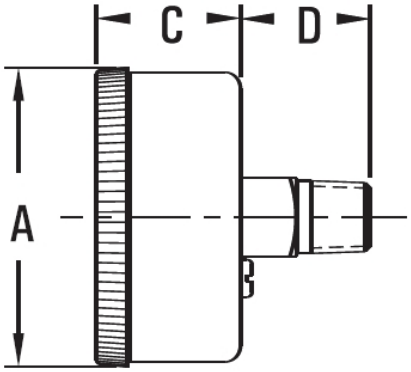
FEATURES

Accuracy: ASME Grade B- ±3/2/3%
(±2% of range across middle half of scale)
Dial Standard: Dual scale PSI and kPa

Case Material: Black finish steel
Pointer Material: Black finish aluminum
Window Material: Plastic/Acrylic



Lower Mount



Center Back Mount

SPECIFICATIONS & DIMENSIONS

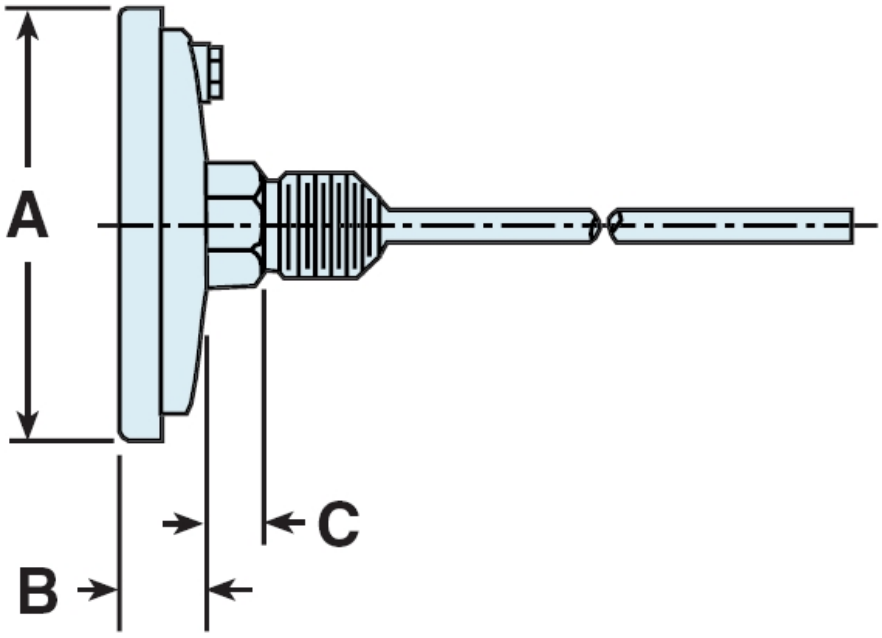
CCN	Dial Size	NPT	PSI Range	Mount Location	Tube & Socket	A	C	D	E	H
PRESSURE GAUGE										
38339180	2 ½”	¼”	0-200	Center Back	Bronze Tube Brass Socket	2.48”	1.13”	.74	NA	NA
17926974	2 ½”	¼”	0-600	Center Back	Bronze Tube Brass Socket	2.49”	1.21”	.28”	NA	NA
38339198	2”	¼”	0-200	Lower	Copper alloy	2.20”	1.22”	NA	1.82”	.40”
PURGE GAUGE *(Must specify dryer serial number when purchasing.)*										
Consult I-R	2 ½”	¼”	0-160	Lower	Copper alloy	2.73”	1.22”	NA	2.10”	.40”

** Can also be used as a pressure gauge.*

TEMPERATURE GAUGE

FEATURES

- Hermetically sealed to prevent entry of moisture into casing
- External adjustment in the rear of the case
- Dial eliminates parallax by placing pointer on same plane as graduations
- 1% full-span accuracy (ASME B40.3 Grade A)
- All welded stainless steel construction
- Silicone on coil provides vibration dampening and superior time response
- Heavy-duty glass standard



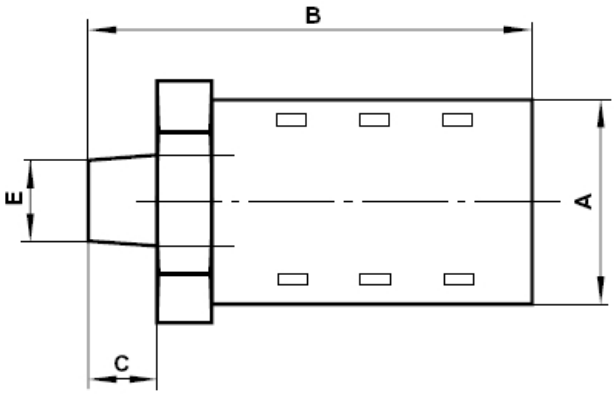
CCN 23815335

SPECIFICATIONS & DIMENSIONS

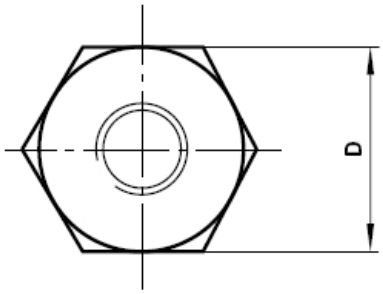
Gauge Dial Size	Temperature Range	NPT	Stem Length	Stem Location	Weight	A	B	C
3”	50/550°F	½”	4”	Rear	7 ounces	3-5/32”	19/32”	5/16”

Note: Thermowells must be used on all pressure or velocity applications, to protect the stem of temperature gauge from corrosion and physical damage, and to facilitate removal of the thermometer without disturbing the process.

SOLENOID MUFFLER







FEATURES

- Reduces noise levels
- Prevents open line exhaust dangers
- Corrosion resistant
- Brass mesh screen and aluminum construction provide improved flow, longer life, and cleanable element
- High flow capacity with low back pressure
- Prevent metal chips, abrasive grits, dust, and other contaminants from entering open exhaust ports
- Aluminum base and shell, brass wire element
- Maximum pressure: 300 psig / 20.7 bar
- Maximum temperature: 176°F / 80°C

SPECIFICATIONS & DIMENSIONS

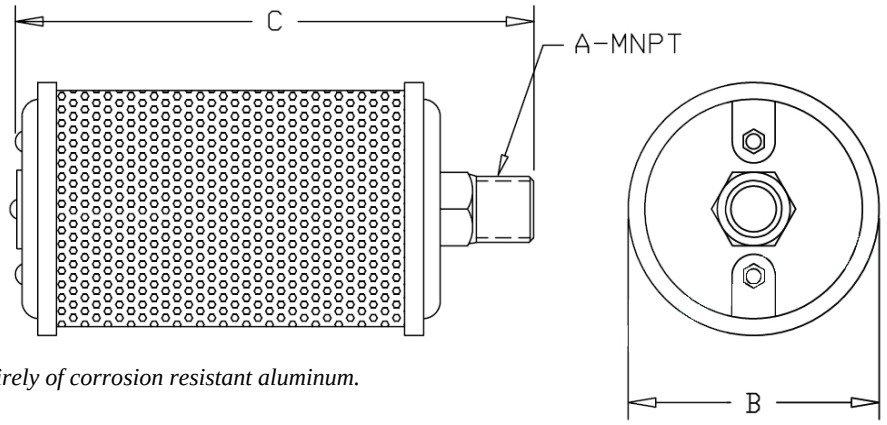
CCN	NPT	Flow Factor (Cv* / C**)	Weight	A	B	C	D	E
38338828	¼"	2.3 / 9.4	1.05 oz. 0.03 kg.	0.83" 2.11cm	2.17" 5.51cm	0.51" 1.29cm	0.81" 2.05cm	¼" 0.63cm
23815350	½"	6.8 / 27.7	3.17 oz. 0.09 kg.	1.26" 3.20cm	3.62" 9.19cm	0.67" 1.70cm	1.25" 3.17cm	½" 1.27cm
17928304	¾"	14.8 / 60.4	15.9 oz. 0.45 kg.	2.01" 5.10cm	5.28" 13.41cm	0.79" 2.00cm	2.00" 5.08cm	¾" 1.90cm
45692654	1"	18.0 / 73.4	14.0 oz. 0.39 kg.	2.01" 5.10cm	5.43" 13.79cm	0.91" 2.31cm	2.00" 5.08cm	1" 2.54cm

* *Cv measured in US/gal/min*
** *C measured in $dm^3/(s.\ bar)$*

WARNING: FLOW AND BACK PRESSURE MAY CHANGE WITH USE DUE TO POSSIBLE CONTAMINATION OF ELEMENT.

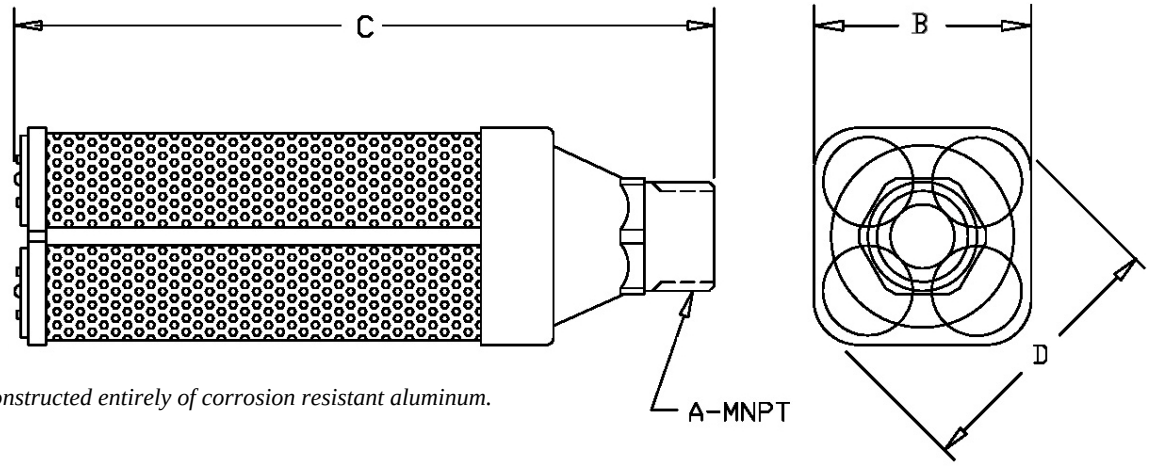
MUFFLER

SINGLE CHAMBER



Constructed entirely of corrosion resistant aluminum.

FOUR CHAMBER



Constructed entirely of corrosion resistant aluminum.

SPECIFICATIONS & DIMENSIONS

CCN	A MNPT	B (in.)	C (in.)	D (in.)	Diameter (in.)	Length (in.)	Flow SCFM @ 90 PSI	Weight (lbs.)
SINGLE CHAMBER								
17928303	½"	3.15	6.00	NA	3 5/32	6	243	1.10
38390829	¾"	3.40	7.18	NA	3 3/8	7 3/16	517	1.42
46794657	1"	3.90	8.75	NA	3 7/8	8 ¾	760	2.10
45709425	1 ½"	5.25	13.56	NA	5 ¼	13 9/16	1664	5.00
38338836	2"	5.25	18.87	NA	5 ¼	18 7/8	3040	7.00
FOUR CHAMBER								
17928305	3"	6.87	22.87	8.25	6 7/8	22 7/8	6840	16.35

WARNING: FLOW AND BACK PRESSURE MAY CHANGE WITH USE DUE TO POSSIBLE CONTAMINATION OF ELEMENT.

GENERAL PURPOSE RELAY

SPDT with Socket

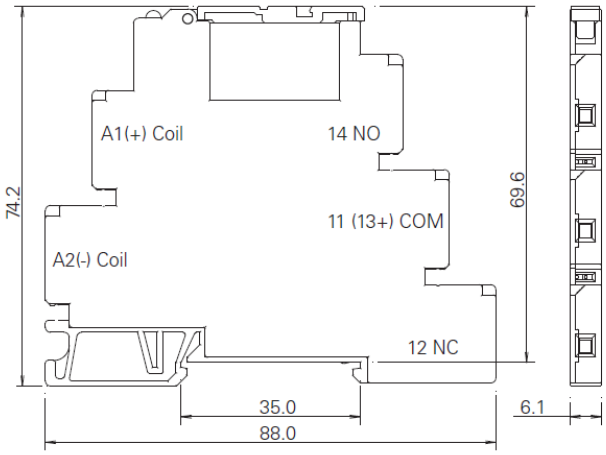


Illustration displayed with universal screw terminals

FEATURES

- Class 1, Division 2
- Only 70mm in height from DIN rail
- Gold-plated contacts
- Pre-assembled relay and DIN mount socket
- Universal screw terminals or tension (spring clamp) terminals
- Universal AC/DC socket with built-in surge suppression and green LED
- Lever for easy locking and removal of relay
- Operating temperature of -40°C ~ +70°C
- RoHS compliant

DIMENSIONS (mm)



SPECIFICATIONS

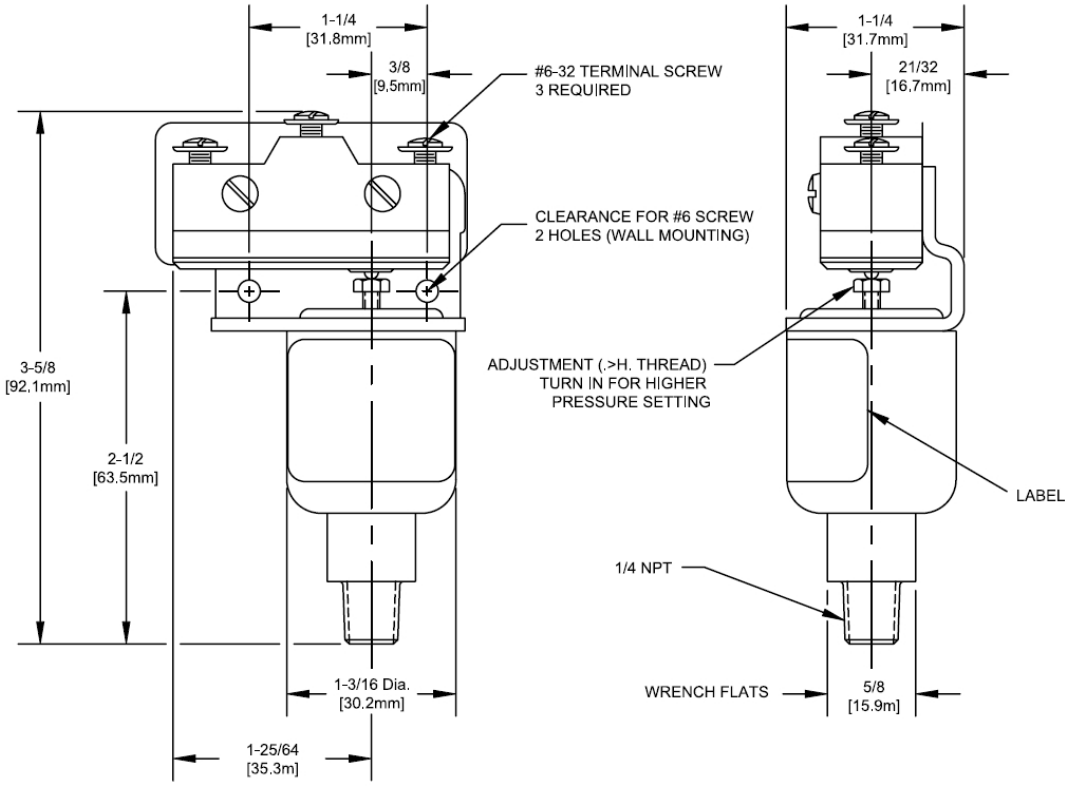
CCN	17928883	17926454	17926455 17930052 [1]
Rating	Class 1, Division 2		
Number of Poles	1 pole		
Contact Configuration	1 form C (SPDT)		
Contact Material	AgNi (Au plating)		
Contact Rating	6A		
Weight	Approx. 30g		
Coil Voltage Rating	220V – 240V AC/DC	24V DC	110V – 125V AC/DC

[1.] *With tension (spring clamp) terminals.*

PRESSURE SWITCH

FEATURES

- Open frame (skeleton) construction
- Compact size
- One SPDT output
- Hex adjustment (no reference dial)
- Pressure connection is ¼" NPT (male)
- Set point repeatability is ±1% of adjustable range
- Electrical rating is 15A 125/250/480 VAC resistive
- Weight is approximately 12 oz.



SPECIFICATIONS

CCN	Set Point Range	Deadband	Over Range Pressure*	Proof Pressure**	Storage Temperature	Ambient Temperature Limit
38338893	30 - 300 psi 2.1 - 20.7 bar	1.3 - 4 psi 89.6 - 275.8 mbar	100 psi above set point	200 psi above set point Max 600	-65 to 160°F -54 to 71°C	0 to 160°F -18 to 71°C
38338901	3 - 30 psi 0.2 - 2.1 bar	0.4 - 1.3 psi 27.6 - 89.6 mbar	50 psi	200 psi above set point Max 600	-65 to 160°F -54 to 71°C	0 to 160°F -18 to 71°C

* *The maximum pressure that may be applied continuously without causing damage and maintaining set point repeatability.*

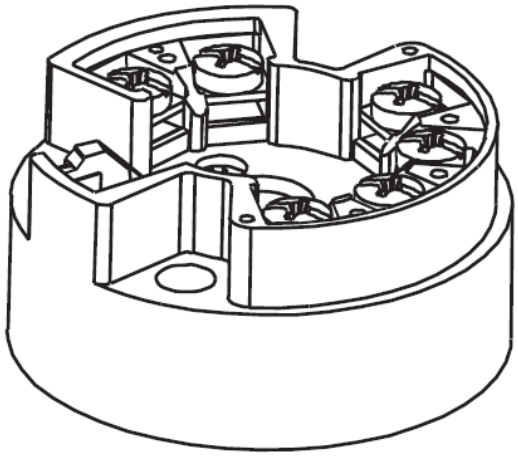
** *The maximum pressure to which a pressure sensor may be occasionally subjected, which causes no permanent damage. The unit may require calibration (e.g. start-up, testing).*

Note: Must specify dryer serial number when purchasing replacement.

TEMPERATURE TRANSMITTER

32-662°F

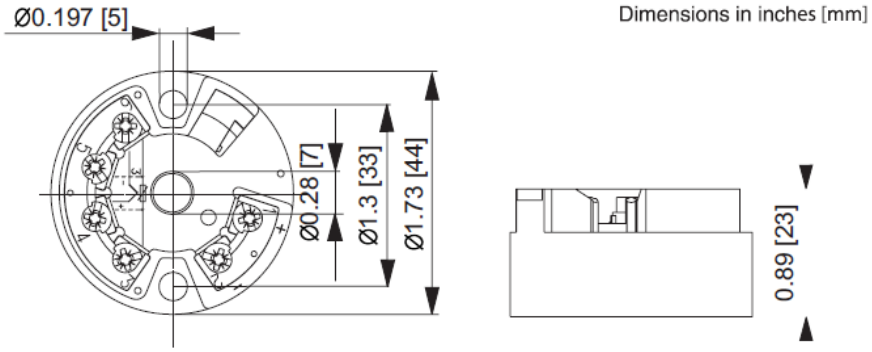
CCN 23815426



FEATURES

- Variety of sensors can be used
- Upscale burnout ≥ 21.0 mA
- Universally PC programmable for various signals
- Galvanic isolation
- 2 wire technology, (4 to 20) mA analog output
- High accuracy in total ambient temperature range
- Fault signal on sensor break or short circuit
- RFI/EMI protected, CE marked
- UL recognized component
- Intrinsically safe and non-incendive for hazardous locations

DIMENSIONS



SPECIFICATIONS

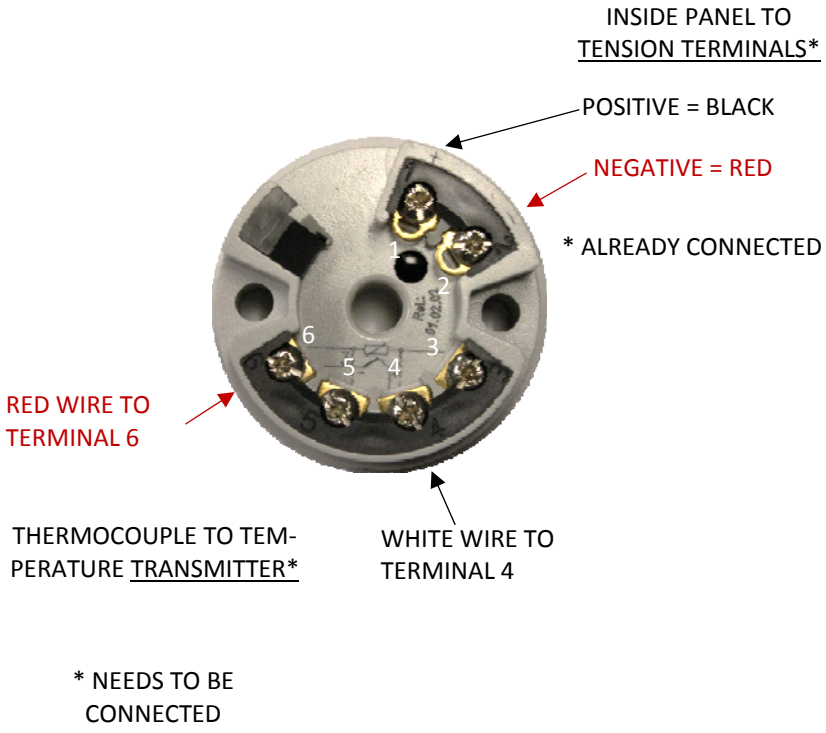
- Weight: Approximately 40 g
- Materials: Housing: Polycarbonate; Potting: Polyurethane
- Terminals: 15 AWG (maximum)

CONNECTING THERMOCOUPLE CABLE(S)

If it becomes necessary to connect any thermocouple cable(s) to the temperature transmitter(s) in the electrical panel (i.e. electrical panel is upgraded), please follow these instructions:

When connecting the thermocouple cable(s) to the temperature transmitter(s), the thermocouple cable(s) will need to be installed in the electrical panel by routing them through the white cord connector located at the bottom of the electrical panel.

Route the thermocouple cable to the temperature transmitter designated (i.e. thermocouple cable 1 connects to temperature transmitter 1, etc.). Strip the end of both the red and white wires. Connect the red wire to terminal 6 on the temperature transmitter. Connect the white wire to terminal 4 on the temperature transmitter.



Note: If wires are not installed correctly, this can cause incorrect readings and adverse component operation. Incorrect installation may void warranty coverage.

BALL VALVE
Brass with Actuator



FEATURES

- Direct mount
- 2-way
- Female/female, with ISO 5211 pad for actuator
- Pressure rating 600 WOG – 150 WSP
- Temperature to 366°F
- Blow out proof stem, chrome plated brass ball
- PTFE seats with o-ring backing for low operating torque
- PTFE seats and double o-ring stem packing
- 100% electronically tested in the open and closed position at 80 psi

CCN's

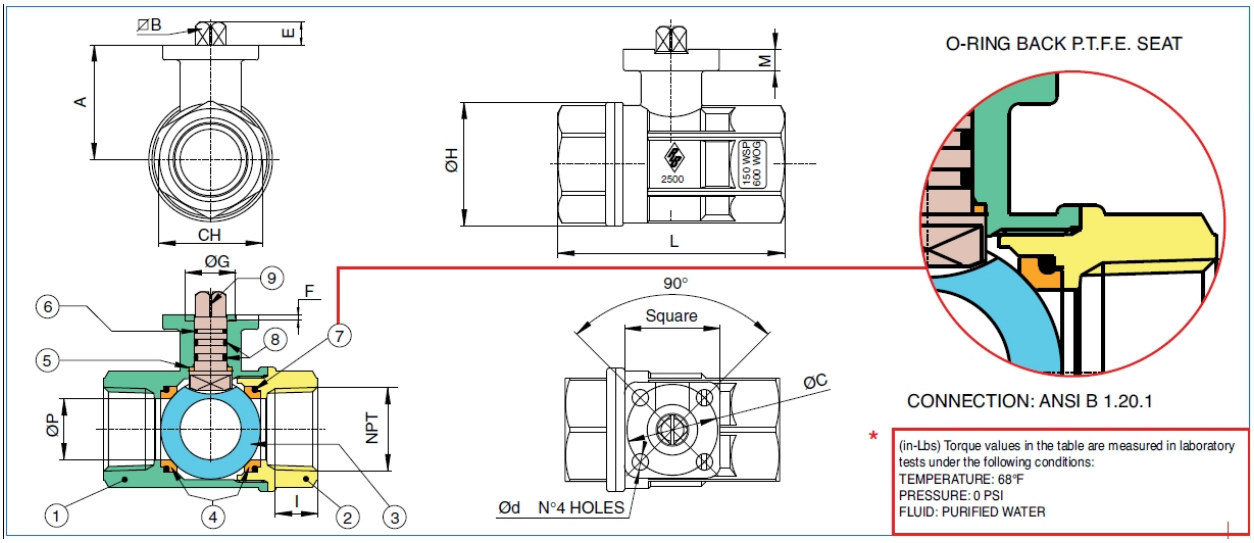
Size	Complete Valve Assy.[1]	Replacement Valve	Valve Repair Kit [2]	Actuator Repair Kit [3]
Double Acting (D.A.)				
¼"	23920101	23920192	NA	23815434
½"	23815665	23920218	NA	23815434
¾"	23815707	23920267	NA	23815434
1"	23815749	23920283	NA	23815434
1½"	23807092	23920309	NA	17928325
2"	23815806	23920325	NA	17928325
Spring Return (S.R.), Normally Closed (N.C.)				
¼"	23920119	23920192	NA	17928325
½"	23815673	23920218	NA	17928325
¾"	23815715	23920267	NA	17928325
1"	23815756	23920283	NA	17928325
1½"	23807100	23920309	NA	17928327
2"	23815814	23920325	NA	17928327
Spring Return (S.R.), Normally Open (N.O.)				
¼"	17928329	23920192	NA	17928325
½"	17928331	23920218	NA	17928325
¾"	17928333	23920267	NA	17928325
1"	17928336	23920283	NA	17928325
1½"	17928338	23920309	NA	17928327
2"	17928340	23920325	NA	17928327

[1] *Complete valve assembly includes valve and actuator.*

[2] *Valve repair kit not available.*

[3] *These actuator kit part numbers effective 2014-present. If dryer built in 2013, contact Ingersoll-Rand for confirmation of repair kit required. Reference the components list on page 4 of this cut sheet for parts included in repair kit.*

SPECIFICATIONS



Size	Square	A	⍁B	ØC	Ød	E	F	ØG	ØH	I	L	CH	M	ØP	CV	psi	Lbs	* In-Lbs
¼"	1.49	1.28	0.35	1.42 (ISO F03)	0.24	0.35	0.08	0.98	1.32	0.39	2.64	1.06	0.22	0.39	5.4	600	0.82	53.10
½"	1.49	1.28	0.35	1.42 (ISO F03)	0.24	0.35	0.08	0.98	1.32	0.53	2.64	1.06	0.22	0.56	16.3	600	0.66	53.10
¾"	1.49	1.36	0.35	1.42 (ISO F03)	0.24	0.35	0.08	0.98	1.57	0.55	3.00	1.26	0.22	0.75	29.5	600	0.91	53.10
1"	1.49	1.79	0.35	1.42 (ISO F03)	0.24	0.35	0.12	0.98	1.93	0.66	3.35	1.61	0.24	0.95	43	600	1.55	53.10
1 ½"	1.96	2.52	0.43	1.97 (ISO F05)	0.27	0.43	0.12	1.38	2.87	0.68	4.13	2.16	0.39	1.49	230	600	3.71	150.46
2"	1.96	2.88	0.43	1.97 (ISO F05)	0.27	0.43	0.12	1.38	3.60	0.70	4.80	2.75	0.31	1.97	265	600	5.52	150.46

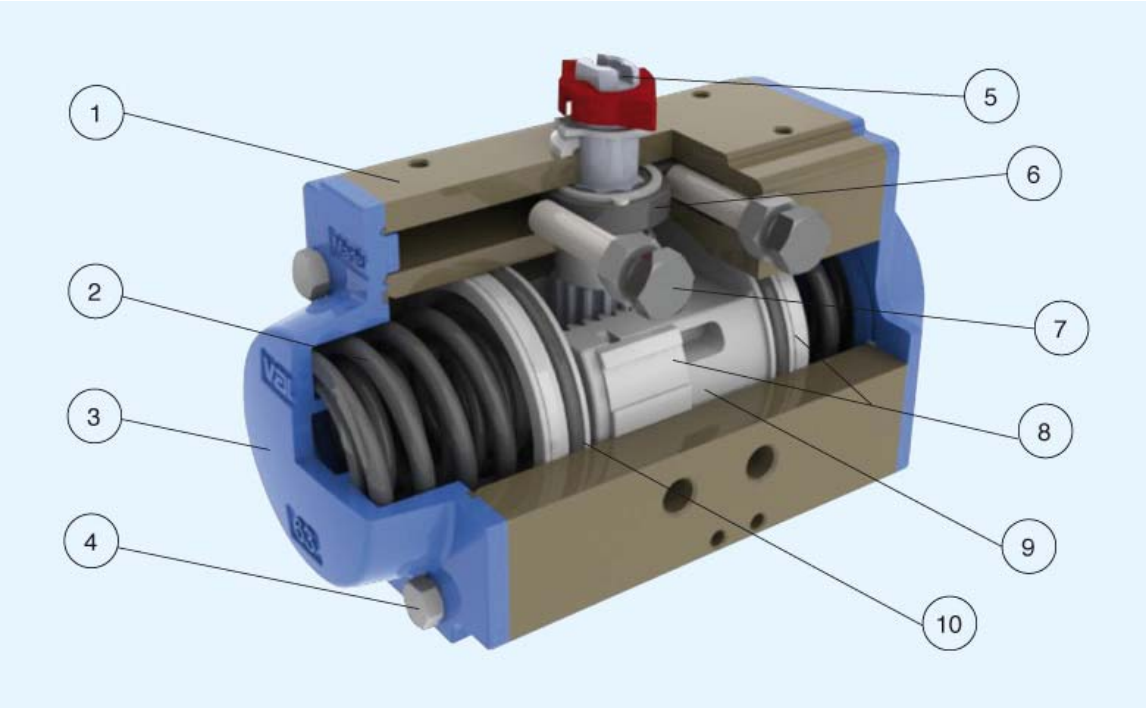
N POS	PART NAME	MATERIAL	N PCS
1	BODY	BRASS CW 617N UNI EN 12165	1
2	END CONNECTION	BRASS CW 617N UNI EN 12165	1
3	BALL	BRASS CW 617N UNI EN 12165	1
4	BALL SEAT	P.T.F.E	2
5	THRUST WASHER	P.T.F.E	1
6	STEM SEAL	P.T.F.E	1
7	O-RING	FKM (Viton®)	2
8	O-RING	FKM (Viton®)	2
9	STEM	BRASS CW 614 NUNI EN 12164	1

ACTUATOR

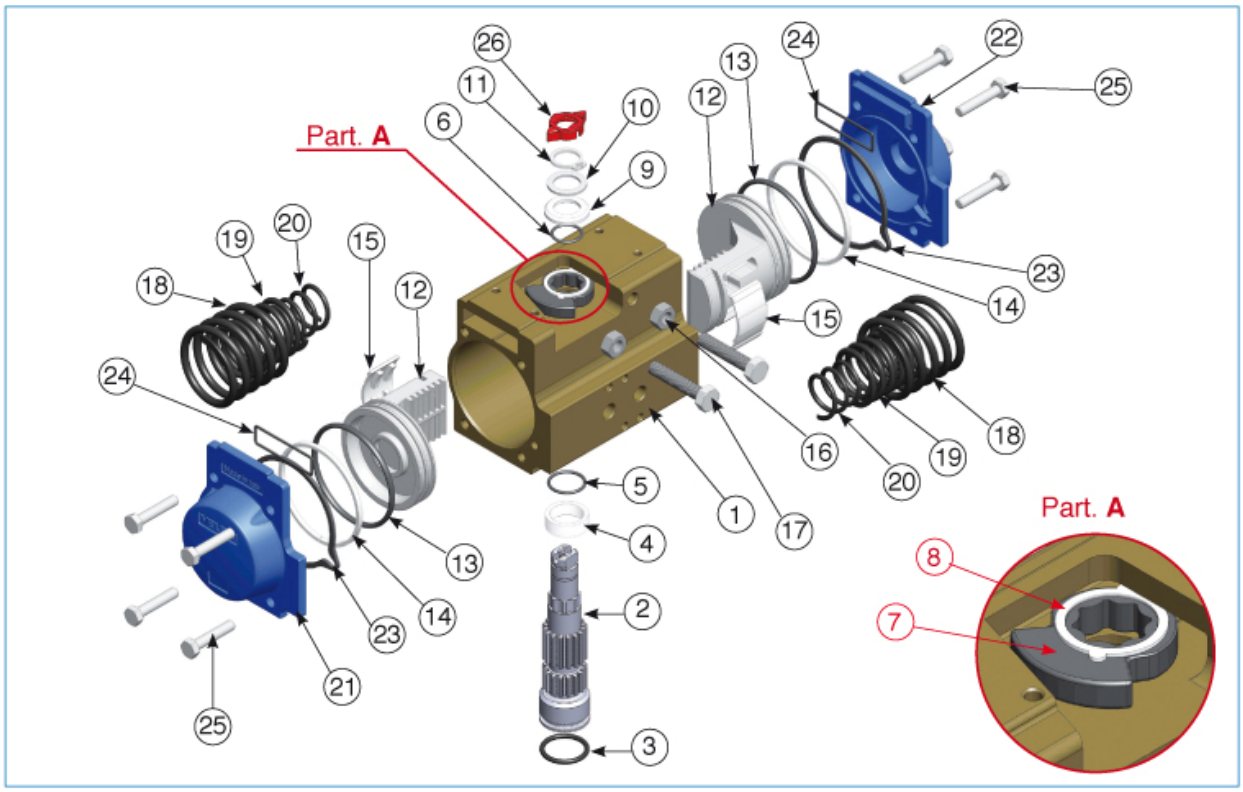


FEATURES

1) Body manufactured from extruded aluminum UNI 6060
2) Concentring spring sets with long securing screws to allow safe dismantling for maintenance
3) Die cast aluminium end caps
4) Stainless steel assembling screw
5) Pinon made in steel; anti-blowout design
6) CAM for limit position adjustment 0°-90°; stainless steel
7) 0-90° adjustment screws; stainless steel
8) Piston guides in POM; large contact area
9) Pistons made from die cast aluminium
10) Seals; NBR standard version



ACTUATOR



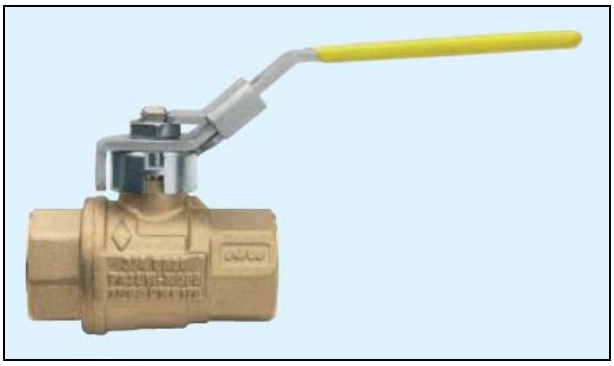
COMPONENTS

Item No.	Description	Material
1	Body	Extruded aluminium
2	Anti-blowout pinion	Steel
3 *	O-ring	NBR
4 *	Spacer ring	POM
5 *	O-ring	NBR
6 *	O-ring	NBR
7	Cam	Stainless steel
8	Spacer	POM
9 *	Spacer	POM
10	Washer	Stainless steel
11	Snap ring	Steel
12	Piston	Die cast aluminium
13 *	O-ring	NBR
14 *	Antifriction ring	POM
15 *	Thrust block	POM
16	Stop bolt retaining nut	Stainless steel
17	Stop bolt	Stainless steel
18 **	External spring	Steel
19 **	Central ring	Steel
20 **	Internal spring	Steel
21	Left end cap	Die cast aluminium
22	Right end cap	Die cast aluminium
23	End cap seats	NBR
24	O-ring	NBR
25	End cap fixing screw	Stainless steel
26	Position indicator	Thermoplastic rubber TPE

* *Included in actuator repair kit. Quantities of each component will vary by model.*

** *On spring return actuators only.*

BALL VALVE
Brass with Lever

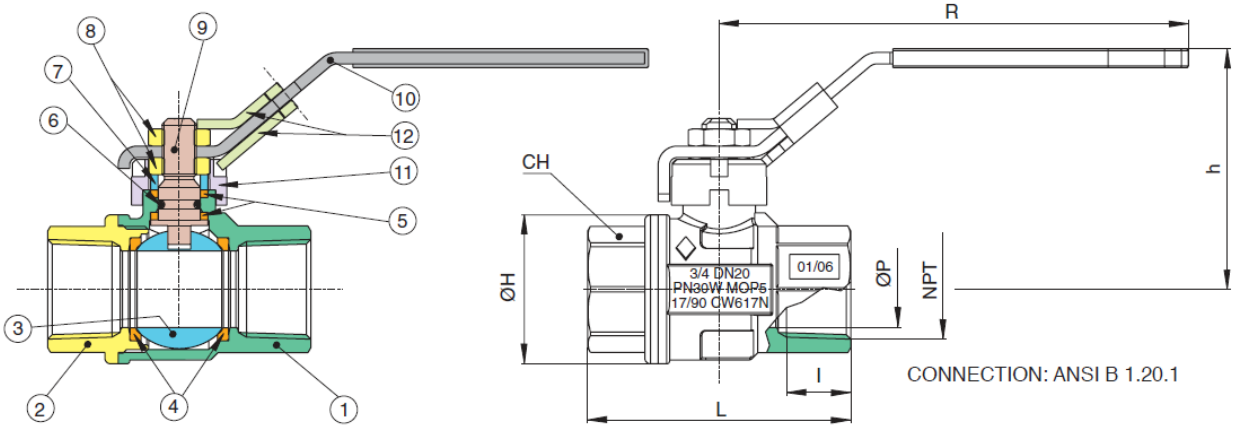


FEATURES

- Female/female
- Latch lock handle
- Pressure rating 600 WOG – 150 WSP
- Temperature to 366°F
- Blow-out proof stem, chrome plated brass ball
- PTFE seats, seals, and thrust washer
- Adjustable stem packing
- 100% electronically tested in open and closed position at 80 psi

MATERIALS

1. **Body:** Brass CW 617N UNI EN 12165
2. **End connection:** Brass CW 617N UNI EN 12165
3. **Ball:** Brass CW 617N UNI EN 12165
4. **Ball seat:** PTFE
5. **Thrust washer/Stem seal:** PTFE
6. **O-ring:** NBR
7. **Packing gland:** Brass CW 614N UNI EN 12164
8. **Nut:** Steel 6S
9. **Stem:** Brass CW 614N UNI EN 12164
10. **Handle:** Fe DD11 UNI EN 10111
11. **Bush:** Zama G Zii A14 UNI EN 1774
12. **Locking device:** Fe DD11 UNI EN 10111



SPECIFICATIONS

CCN	Size	ØP	I	L	ØH	CH	R	h	CV	Weight (Lbs.)
17926851	¼"	0.39	0.39	2.02	0.90	0.78	3.78	1.83	6.29	0.33
17926852	½"	0.59	0.53	2.44	1.25	0.98	3.78	1.99	19.00	0.48
17926853	¾"	0.79	0.55	2.71	1.53	1.22	4.84	2.48	34.40	0.79
17926854	1"	0.98	0.66	3.07	1.92	1.49	4.84	2.64	50.10	1.22
17926855	1½"	1.57	0.68	3.89	2.87	2.12	5.94	3.38	268.40	3.20
17926856	2"	1.95	0.69	4.33	3.38	2.63	6.30	3.74	309.20	4.08

Note: Valve repair kits not available.

BUTTERFLY VALVE
With Actuator

CCN's

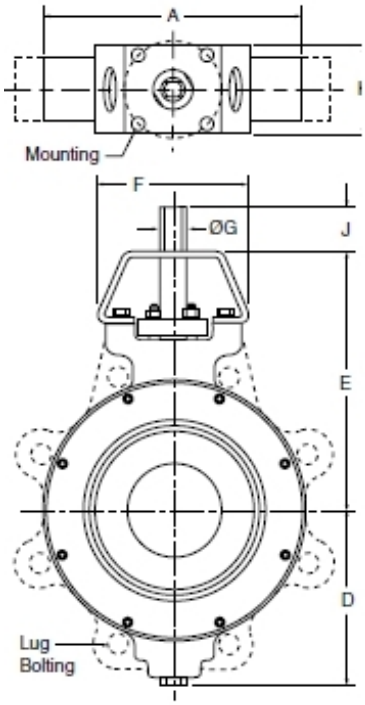
Size	Complete Valve Assy.	Valve Repair Kit [1]	Actuator Repair Kit [2]	Valve Weight (Lbs.)
BUTTERFLY VALVE WITH SPRING RETURN ACTUATOR				
150# Wafer				
3”	38059457	38454476	38454484	16
4”	38058905	38058913	49156045	20
BUTTERFLY VALVE WITH DOUBLE ACTING ACTUATOR				
150# Lug Style				
3”	23806383	38454476	38451977	15
4”	23806391	38058913	38451977	23
4" (no silicone)	38058657	Contact I-R	38451977	23
6”	23806409	38454492	49156045	47
300# Lug Style				
3”	23806417	23806466	38454484	17
4”	23806425	23806474	49156045	23
6”	23806433	23806482	23806573	54
150# Wafer				
3”	38059416	38454476	38451977	16
3" (no silicone)	38058145	17928990	38451977	16
4”	38457693	38058913	38451977	20
6”	38059424	38454492	49156045	33
8”	38058954	38058962	49156045	46
10”	23806342	23806458	38058988	79
12"	24625238	24625246	38058988	123
300# Wafer				
3”	23806359	23806466	38454484	16
4”	23806367	23806474	49156045	20
6”	23806375	23806482	23806573	40

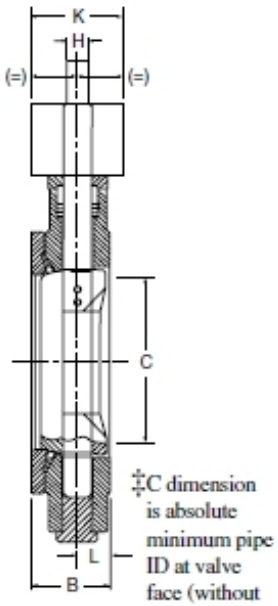
[1] *Valve repair kit includes seat and stem seal kit. No silicone valve repair kits are the same as the standard, except the RTFE/silicone o-ring is replaced with an FKM o-ring.*

[2] *Actuator repair kit includes upper bearing, lower bearing, retaining ring, nylon washer, acetal-bearing pad, acetal spacer, o-ring piston, o-ring end cap, o-ring shaft top, and o-ring shaft bottom.*

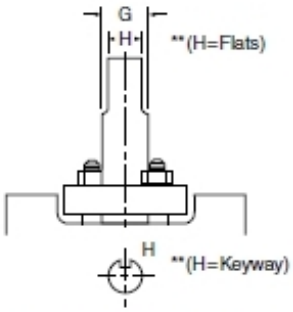
VALVE







‡C dimension is absolute minimum pipe ID at valve face (without gasket).

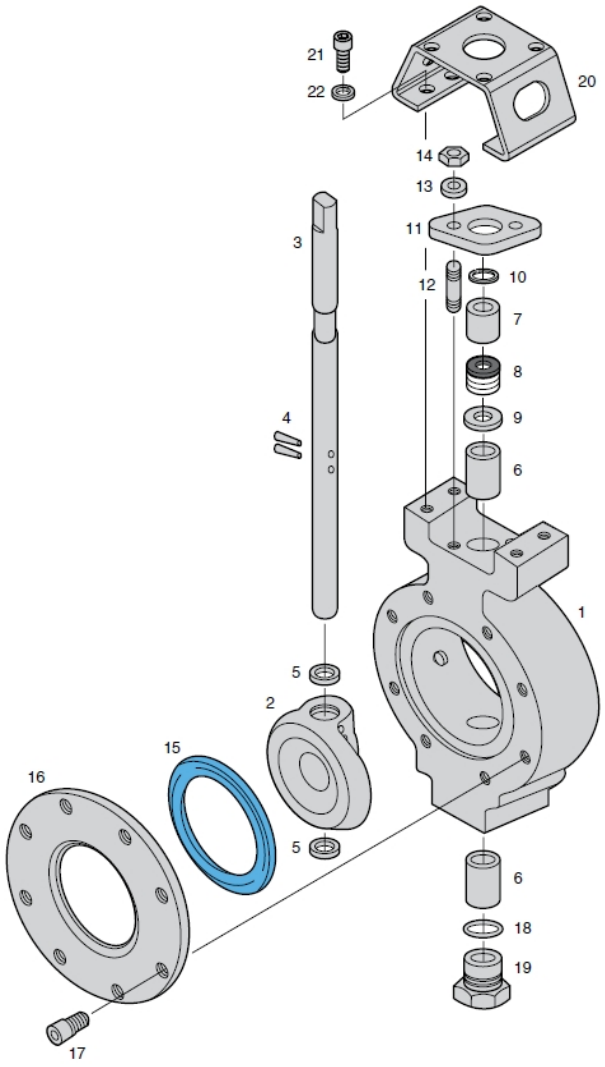


** Keyway is applicable on valve sizes 14"-54" Class 150, 10"-48" Class 300, and 8"-30" Class 600.

VALVE SPECIFICATIONS

Size	A	B	C	D	E	F	G	H**	J	K	L
ANSI 150											
3” (80 mm)	5.25	1.88	2.86	4.09	6.63	4.36	0.63	0.43	1.25	2.50	0.77
4” 100 mm)	6.75	2.03	3.72	4.71	7.50	4.36	0.63	0.43	1.25	2.50	0.75
6” (150 mm)	8.62	2.23	5.88	5.57	8.00	5.12	0.75	0.51	1.25	4.50	0.94
8” (200 mm)	10.75	2.40	7.80	6.94	9.50	5.12	0.87	0.63	1.25	4.50	0.94
10” (250 mm)	13.06	2.75	9.78	8.56	10.75	6.12	1.18	0.87	2.00	4.50	1.07
12" (300 mm)	15.50	3.08	11.74	10.18	12.25	6.12	1.18	0.87	2.00	4.50	1.13
14” (350 mm)	17.50	3.73	12.90	11.95	14.50	7.75	1.38	.39x.39	2.00	6.50	1.42
ANSI 300											
3” (80 mm)	5.25	1.88	2.86	4.09	6.63	4.36	0.63	0.43	1.25	2.50	0.77
4” 100 mm)	6.75	2.03	3.72	4.71	7.50	4.36	0.63	0.43	1.25	2.50	0.75
6” (150 mm)	8.88	2.42	5.75	6.25	8.75	5.12	0.87	0.63	1.25	4.50	0.97
8” (200 mm)	10.94	2.82	7.56	7.55	10.00	6.12	1.18	0.87	2.00	4.50	1.10
10” (250 mm)	13.26	3.28	9.44	9.36	11.38	6.12	1.38	.39x.39	2.00	4.50	1.28
12" (300 mm)	15.57	3.62	11.31	10.89	13.50	7.75	1.38	.39x.39	2.00	6.50	1.40
14" (350 mm)	17.90	4.66	11.38	12.50	18.25	10.38	1.97	.47x.39	2.50	6.50	2.13

VALVE



VALVE COMPONENTS

Item No.	Components
1	Body
2	Disc
3	Stem
4	Taper pins
5	Disc spacers
6	Bearing assembly
7	Gland ring
8	Stem seal
9	Thrust washer
10	Retaining ring
11	Gland retainer
12	Stud
13	Lock washers
14	Hex nut
15	Seat assembly
16	Seat retainer plate
17	Cap screws
18	Gasket
19	Locating plug
20	Mounting plate
21	Cap screws
22	Lock washers

VALVE MAINTENANCE

1. Reasonable precautions should be taken before beginning work on the valve. Protective clothing, as required, should be worn.
2. **WARNING:** Before removing handle from the valve, or before removing seat retainer from a valve in dead end service, close the valve and depressurize the line.

   The eccentric design of the valve may allow line pressure to open the valve if the handle is not in place while the valve is under pressure.

   WARNING: Do not pressurize the line without a handle on the valve.
3. The valve must be in the closed position to be removed from the line.
4. Begin all work on a valve that has been removed from the line by cleaning the valve, removing any grit or scale.

   CAUTION: When handling the valve, care should be taken not to scratch the disc edge or seat.
5. Replacement seats, seals and other parts are available from Ingersoll-Rand.

STEM SEAL REPLACEMENT

Refer to the component drawing on the previous page of this cut sheet for parts identification.

1. If required, remove handle assembly. Remove socket head cap screws (21) and lock washers (22). Remove mounting bracket (20).

   NOTICE: Note assembly positions before removal.
2. Remove gland retainer nuts (14) and lock washers (13). Remove gland retainer (11) anti-blowout retaining ring or split ring (10) (depending on size), and gland ring (7).
3. Hook out stem seals (8).

   CAUTION: When handling stem seals, care should be taken not to scratch stem or stuffing box bore.

   Do not remove thrust washer (9), unless further valve disassembly is required.
4. Examine stuffing box bore and stem, clean as necessary to remove any corrosion or foreign matter before installing new seals.
5. Install new seals in stuffing box one at a time, TFE (white) seals first, with the carbon fiber ring at the top. Stagger seal ring joints 180° apart when installing. Tamp each ring to bottom before installing next ring.

   NOTICE: On the larger valves, it will be necessary to compress each seal before adding the next.
6. Slide gland ring (7) over stem on top of seals (8). Install anti-blowout retaining ring or split ring (10) (depending on valve size). Slide gland retainer (11) over stem and onto gland studs (12). Place lock washers (13) and hex nuts (14) on studs (12) and tighten finger tight. Tighten gland nuts (14) evenly and alternately to the proper torque value given in Table 1 on page 4 of this cut sheet.
7. Remount mounting bracket (20) with lock washers (22) and cap screws (21) and handle assembly.
8. Operate valve open and closed several times to check for binding and to set the stem seals. Loosen gland nuts (14) and retighten to torque value given in Table 1 on page 4 of this cut sheet.

SEAT REPLACEMENT

Refer to the component drawing on the previous page of this cut sheet for parts identification. With the disc in the closed position, remove the valve from the line.

1. Lay the valve down with the disc in the closed position and the seat retainer side facing up.
2. Remove the socket head cap screws (17), the seat retainer (16), and seat (15).
3. Carefully clean the seat area in the body and seat retainer. Remove foreign matter, dirt, etc. Check disc seating area for nicks or scratches.
4. Place the new seat (15) on disc (2), carefully centering it in the recess in the body.
5. Align the holes in the seat retainer (16) with matching holes in body and carefully place in position on top of seat (15).

   CAUTION: Do not shift the retainer in order to align holes. It may shift from its correct position.

   Lightly grease cap screw (17) threads and tighten down evenly, alternating from top to bottom and side to side. Tighten to the torque values in Table 1 shown below.
6. Operate valve several times and examine seat for any damage before reinstalling the valve in the line.

TABLE 1

GLAND RETAINER NUT AND SEAT RETAINER SCREW TORQUES				
Valve Size	**Gland Nut**		**Seat Retainer Screws**	
	150	300	150	300
3”	60	60	100	100
4”	60	60	175	175
6”	80	120	100	175
8”	80	140	175	175
10”	110	190	175	300
12"	130	220	300	300

PNEUMATIC ACTUATOR

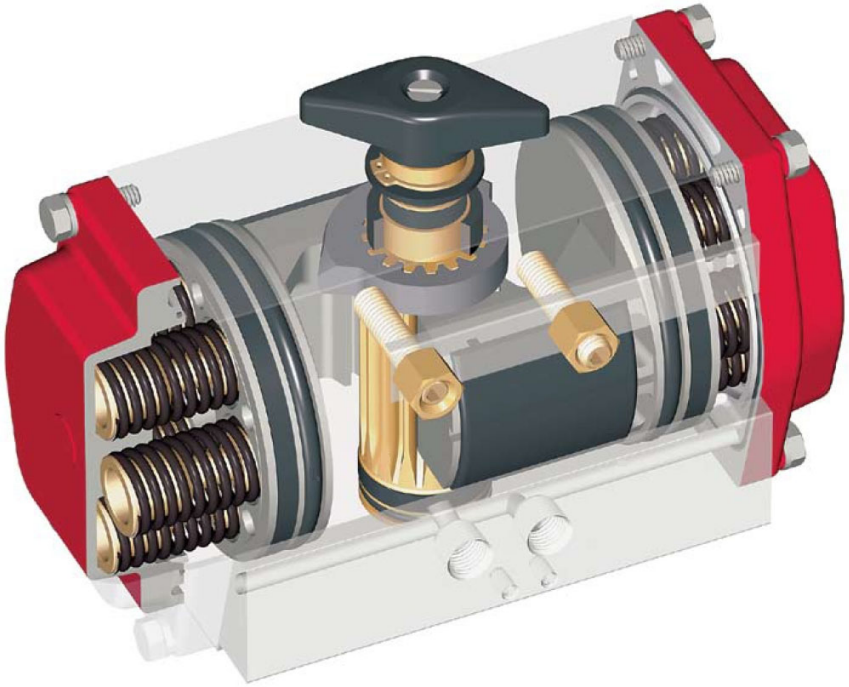


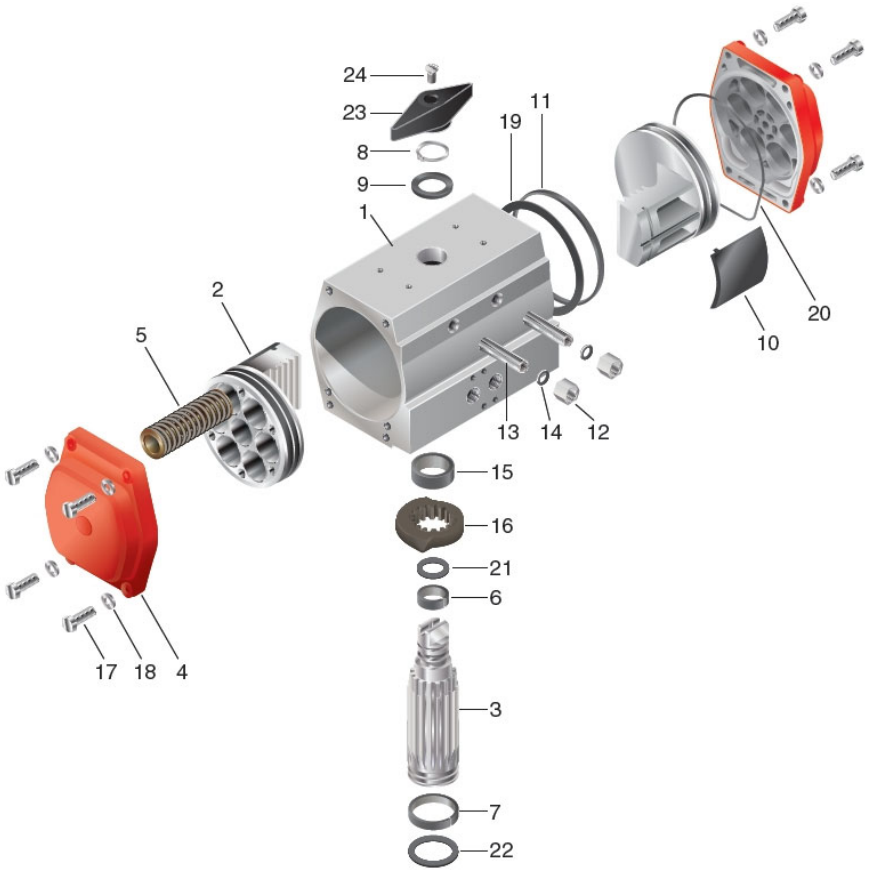
ACTUATOR FEATURES

- Rack and pinion, opposed-piston
- Maximum pressure of 140 psig (10 bar)
- Temperature ranges of -40°F (-40°C) to +200°F (+95°C)
- Completely enclosed and self-contained
- Permanently lubricated factory packed bearings and guides

STANDARD MATERIALS

Body:	Extruded aluminum alloy, anodized
End caps:	Die cast aluminum alloy with corrosion resistant polyester coating
Pistons:	Die cast aluminum alloy
Output shaft/pinion:	Carbon steel, zinc plated
Travel stop:	Alloy steel
Shaft bearings:	Acetal
Piston guides:	Acetal
Fasteners:	Stainless steel
Springs:	Spring steel, protective coating
O-Ring seals:	Buna-N





Spring Return unit shown above. Spring cartridges not included in Double Acting.

ACTUATOR COMPONENTS

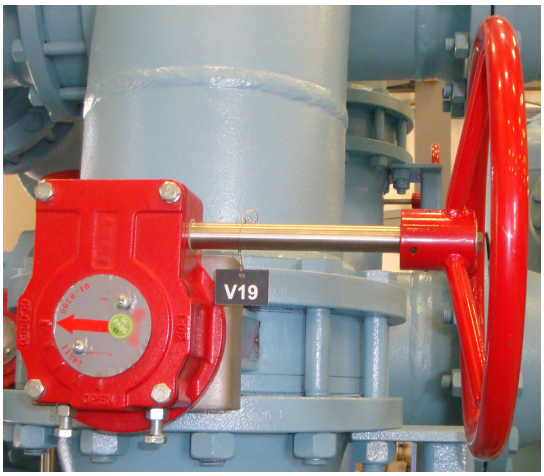
Item No.	Qty.	Description
1	1	Body
2	2	Piston
3	1	Pinion
4	2	End cap
5	12 max.	Spring cartridge assembly
6	1	Upper bearing *
7	1	Lower bearing *
8	1	Retaining ring *
9	1	Nylon washer *
10	2	Acetal bearing pad *
11	2	Acetal guide ring
12	2	Stop nut
13	2	Travel adjusting screw stop
14	2	O-ring travel stop
15	1	Acetal spacer *
16	1	Travel stop
17	8	Hex head cap screw
18	8	Washer
19	2	O-ring piston *
20	2	O-ring end cap *
21	1	O-ring shaft top *
22	1	O-ring shaft bottom *
23	1	Indicator pointer
24	1	Indicator pointer screw

* *Actuator repair kit includes upper bearing, lower bearing, retaining ring, nylon washer, acetal-bearing pad, acetal spacer, o-ring piston, o-ring end cap, o-ring shaft top, and o-ring shaft bottom.*

BUTTERFLY VALVE
With Lever or Gear Operator



w/Lever



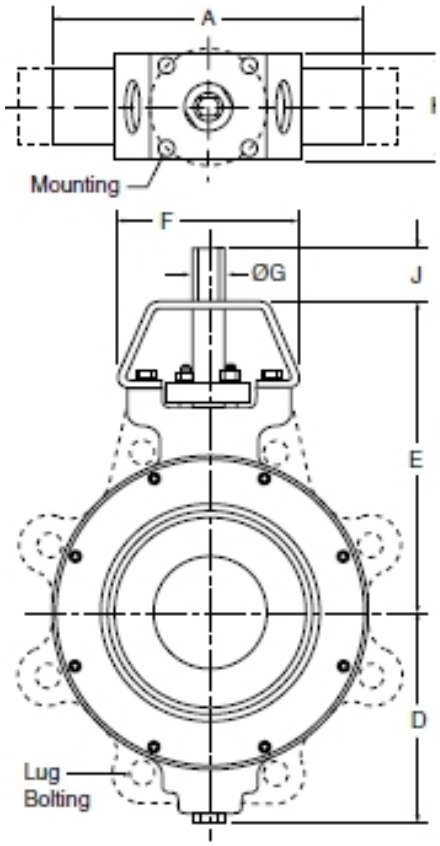
w/Gear Operator

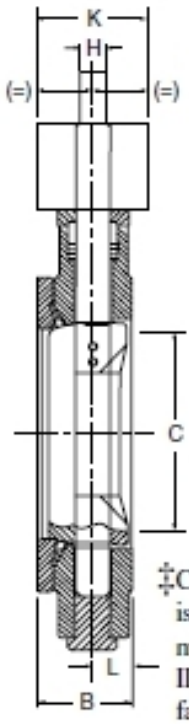
CCN's

Size	Complete Valve Assy.	Valve Repair Kit [1]	Valve Weight (Lbs.)
BUTTERFLY VALVE WITH LEVER			
150# Lug Style			
6”	23815848	38454492	47
300# Lug Style			
3”	23815855	23806466	17
4”	23815863	23806474	23
6”	23961980	23806482	54
150# Wafer			
3”	38059556	38454476	16
4”	23815871	38058913	20
6”	38059440	38454492	33
8”	38058996	38058962	46
300# Wafer			
3”	23815897	23806466	16
4”	23815905	23806474	20
BUTTERFLY VALVE WITH GEAR OPERATOR			
150# Wafer			
10"	23815889	23806458	79
12"	17927137	24625246	123

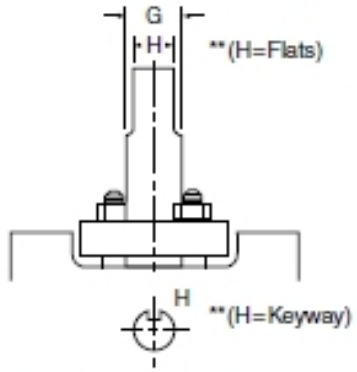
[1] *Valve repair kit includes seat and stem seal kit.*

VALVE





‡C dimension is absolute minimum pipe ID at valve face (without gasket).

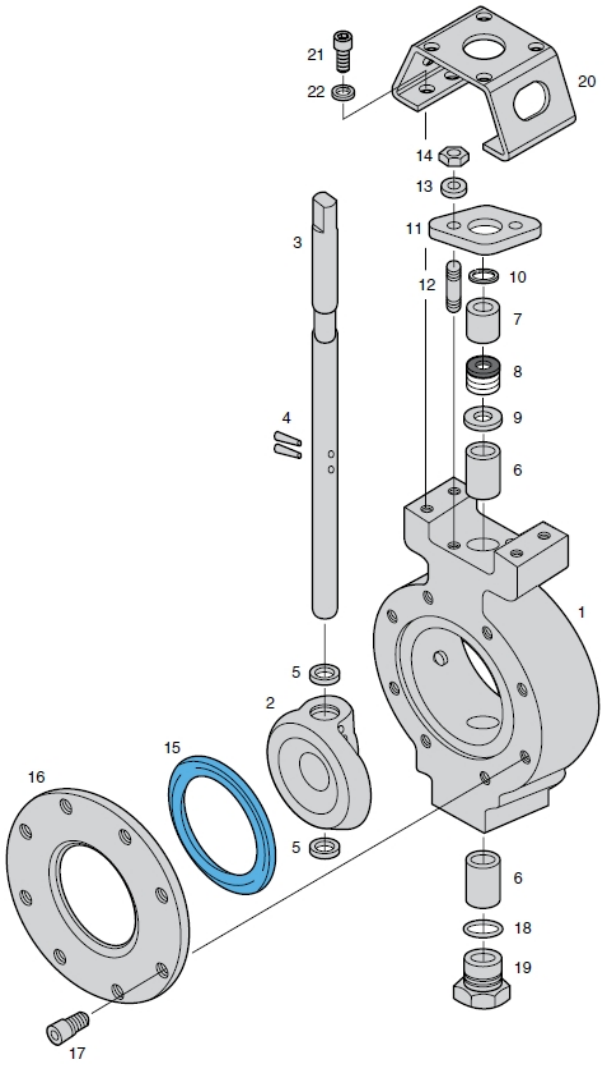


** Keyway is applicable on valve sizes 14"-54" Class 150, 10"-48" Class 300, and 8"-30" Class 600.

VALVE SPECIFICATIONS

Size	A	B	C	D	E	F	G	H**	J	K	L
ANSI 150											
3” (80 mm)	5.25	1.88	2.86	4.09	6.63	4.36	0.63	0.43	1.25	2.50	0.77
4” 100 mm)	6.75	2.03	3.72	4.71	7.50	4.36	0.63	0.43	1.25	2.50	0.75
6” (150 mm)	8.62	2.23	5.88	5.57	8.00	5.12	0.75	0.51	1.25	4.50	0.94
8” (200 mm)	10.75	2.40	7.80	6.94	9.50	5.12	0.87	0.63	1.25	4.50	0.94
10” (250 mm)	13.06	2.75	9.78	8.56	10.75	6.12	1.18	0.87	2.00	4.50	1.07
12" (300 mm)	15.50	3.08	11.74	10.18	12.25	6.12	1.18	0.87	2.00	4.50	1.13
14" (350 mm)	17.50	3.73	12.90	11.95	14.50	7.75	1.38	.39x.39	2.00	6.50	1.42
16" (400 mm)	19.81	4.11	14.68	12.94	17.75	10.38	1.97	.47x.39	2.50	6.50	1.66
ANSI 300											
3” (80 mm)	5.25	1.88	2.86	4.09	6.63	4.36	0.63	0.43	1.25	2.50	0.77
4” 100 mm)	6.75	2.03	3.72	4.71	7.50	4.36	0.63	0.43	1.25	2.50	0.75
6” (150 mm)	8.88	2.42	5.75	6.25	8.75	5.12	0.87	0.63	1.25	4.50	0.97

VALVE



VALVE COMPONENTS

Item No.	Components
1	Body
2	Disc
3	Stem
4	Taper pins
5	Disc spacers
6	Bearing assembly
7	Gland ring
8	Stem seal
9	Thrust washer
10	Retaining ring
11	Gland retainer
12	Stud
13	Lock washers
14	Hex nut
15	Seat assembly
16	Seat retainer plate
17	Cap screws
18	Gasket
19	Locating plug
20	Mounting plate
21	Cap screws
22	Lock washers

VALVE MAINTENANCE

1. Reasonable precautions should be taken before beginning work on the valve. Protective clothing, as required, should be worn.
2. **WARNING:** Before removing handle from the valve, or before removing seat retainer from a valve in dead end service, close the valve and depressurize the line.

   The eccentric design of the valve may allow line pressure to open the valve if the handle is not in place while the valve is under pressure.

   WARNING: Do not pressurize the line without a handle on the valve.
3. The valve must be in the closed position to be removed from the line.
4. Begin all work on a valve that has been removed from the line by cleaning the valve, removing any grit or scale.

   CAUTION: When handling the valve, care should be taken not to scratch the disc edge or seat.
5. Replacement seats, seals and other parts are available from Ingersoll-Rand.

STEM SEAL REPLACEMENT

Refer to the component drawing on the previous page of this cut sheet for parts identification.

1. If required, remove handle assembly. Remove socket head cap screws (21) and lock washers (22). Remove mounting bracket (20).

   NOTICE: Note assembly positions before removal.
2. Remove gland retainer nuts (14) and lock washers (13). Remove gland retainer (11) anti-blowout retaining ring or split ring (10) (depending on size), and gland ring (7).
3. Hook out stem seals (8).

   CAUTION: When handling stem seals, care should be taken not to scratch stem or stuffing box bore.

   Do not remove thrust washer (9), unless further valve disassembly is required.
4. Examine stuffing box bore and stem, clean as necessary to remove any corrosion or foreign matter before installing new seals.
5. Install new seals in stuffing box one at a time, TFE (white) seals first, with the carbon fiber ring at the top. Stagger seal ring joints 180° apart when installing. Tamp each ring to bottom before installing next ring.

   NOTICE: On the larger valves, it will be necessary to compress each seal before adding the next.
6. Slide gland ring (7) over stem on top of seals (8). Install anti-blowout retaining ring or split ring (10) (depending on valve size). Slide gland retainer (11) over stem and onto gland studs (12). Place lock washers (13) and hex nuts (14) on studs (12) and tighten finger tight. Tighten gland nuts (14) evenly and alternately to the proper torque value given in Table 1 shown below.
7. Remount mounting bracket (20) with lock washers (22) and cap screws (21) and handle assembly.
8. Operate valve open and closed several times to check for binding and to set the stem seals. Loosen gland nuts (14) and retighten to torque value given in Table 1 shown below.

SEAT REPLACEMENT

Refer to the component drawing on the previous page of this cut sheet for parts identification. With the disc in the closed position, remove the valve from the line.

1. Lay the valve down with the disc in the closed position and the seat retainer side facing up.
2. Remove the socket head cap screws (17), the seat retainer (16), and seat (15).
3. Carefully clean the seat area in the body and seat retainer. Remove foreign matter, dirt, etc. Check disc seating area for nicks or scratches.
4. Place the new seat (15) on disc (2), carefully centering it in the recess in the body.
5. Align the holes in the seat retainer (16) with matching holes in body and carefully place in position on top of seat (15).

   CAUTION: Do not shift the retainer in order to align holes. It may shift from its correct position.

   Lightly grease cap screw (17) threads and tighten down evenly, alternating from top to bottom and side to side. Tighten to the torque values in Table 1 shown below.
6. Operate valve several times and examine seat for any damage before reinstalling the valve in the line.

TABLE 1

GLAND RETAINER NUT AND SEAT RETAINER SCREW TORQUES				
Valve Size	Gland Nut		Seat Retainer Screws	
	150	300	150	300
3”	60	60	100	100
4”	60	60	175	175
6”	80	120	100	175
8”	80	140	175	175
10”	110	190	175	300
12"	130	220	300	300

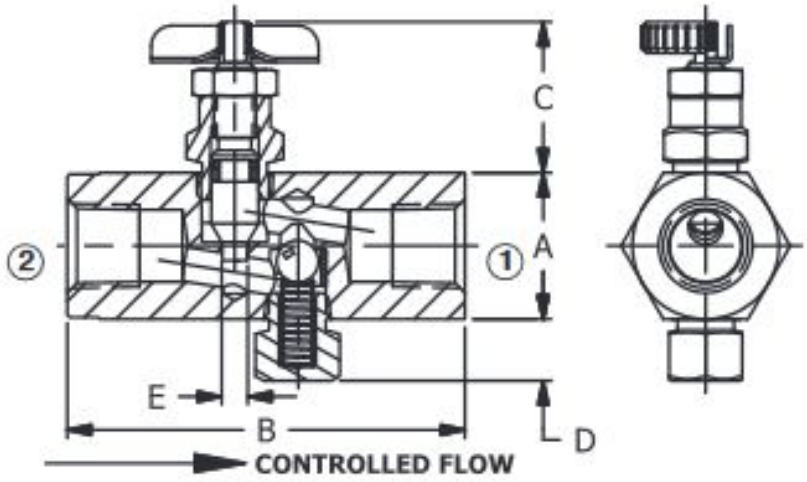
FLOW CONTROL VALVE



CCN 38059473 pictured above

FEATURES

- Wide range of flow adjustability
- Lock nut to maintain flow setting
- Positive shut-off
- Leak-tight ball check standard
- NPTF thread
- Female-to-female
- Maximum operating pressure:
  Brass: 2,000 psi (138 bar)
  Carbon steel: 5,000 psi (345 bar)
  Stainless steel: 5,000 psi (345 bar)
- Cracking pressure:
  1 to 2.5 psi (.07 to .17 bar)
- Operating temperature range:
  -15° to +400°F (-26° to +204°C)



SPECIFICATIONS

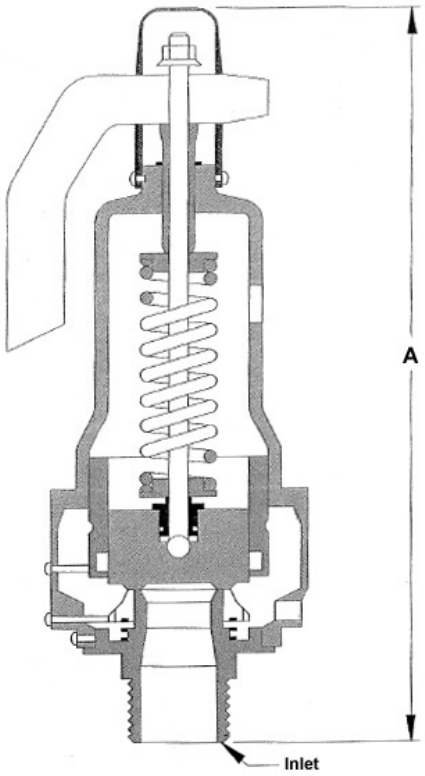
CCN	SIZE	MATERIAL	A HEX	B	C OPEN	D	E ORIFICE
38059473	¼"	Brass	7/8 (22.2)	2 3/8 (60.3)	1 1/16 (27.0)	23/64 (9.1)	.156 (4.0)
23815970	¼"	Carbon Steel	7/8 (22.2)	2 3/8 (60.3)	1 1/16 (27.0)	23/64 (9.1)	.156 (4.0)
17927833 *	¼"	Stainless Steel	7/8 (22.2)	2 3/8 (60.3)	1 1/16 (27.0)	23/64 (9.1)	.156 (4.0)
17928351	½"	Steel	1 5/16 (33.4)	3 3/16 (81.0)	1 15/32 (37.3)	15/32 (11.9)	.281 (7.1)

** With knob*
( ) Parentheses = Millimeters

Pressure Relief Valve

FEATURES

- ASME Code (UV) National Board Certified
- Top outlet
- Full nozzle design



SPECIFICATIONS

CCN	Inlet (inches / mm)	A (inches / mm)	Approx. Wt. (lb / kg)	Set Pressure (PSIG)	Flow Rate (SCFM)	Trim
Contact I-R	½" / 12.7	6 ½ / 165	1 ¼ / 0.6	135	318	Bronze/brass
Contact I-R	½" / 12.7	6 ½ / 165	1 ¼ / 0.6	145	339	Bronze/brass
38339230	½" / 12.7	6 ½ / 165	1 ¼ / 0.6	150	350	Bronze/brass
Contact I-R	½" / 12.7	6 ½ / 165	1 ¼ / 0.6	160	371	Bronze/brass
23814288	½" / 12.7	6 ½ / 165	1 ¼ / 0.6	165	382	Bronze/brass
17929444	½" / 12.7	6 ½ / 165	1 ¼ / 0.6	170	393	Bronze/brass
Contact I-R	½" / 12.7	6 ½ / 165	1 ¼ / 0.6	175	403	Bronze/brass
23816051	½" / 12.7	6 ½ / 165	1 ¼ / 0.6	185	425	Stainless steel
38339669	½" / 12.7	6 ½ / 165	1 ¼ / 0.6	200	457	Bronze/brass
Contact I-R	½" / 12.7	6 ½ / 165	1 ¼ / 0.6	210	478	Bronze/brass
Contact I-R	¾" / 19.0	7 ½ / 191	2 ¼ / 1.0	150	625	Bronze/brass
Contact I-R	¾" / 19.0	7 ½ / 191	2 ¼ / 1.0	200	816	Bronze/brass
Contact I-R	1" / 25.4	8 ½ / 222	3 ¼ / 1.5	150	972	Bronze/brass
Contact I-R	1 ½" / 38.0	10 5/8 / 270	7 ¼ / 3.3	150	2496	Bronze/brass

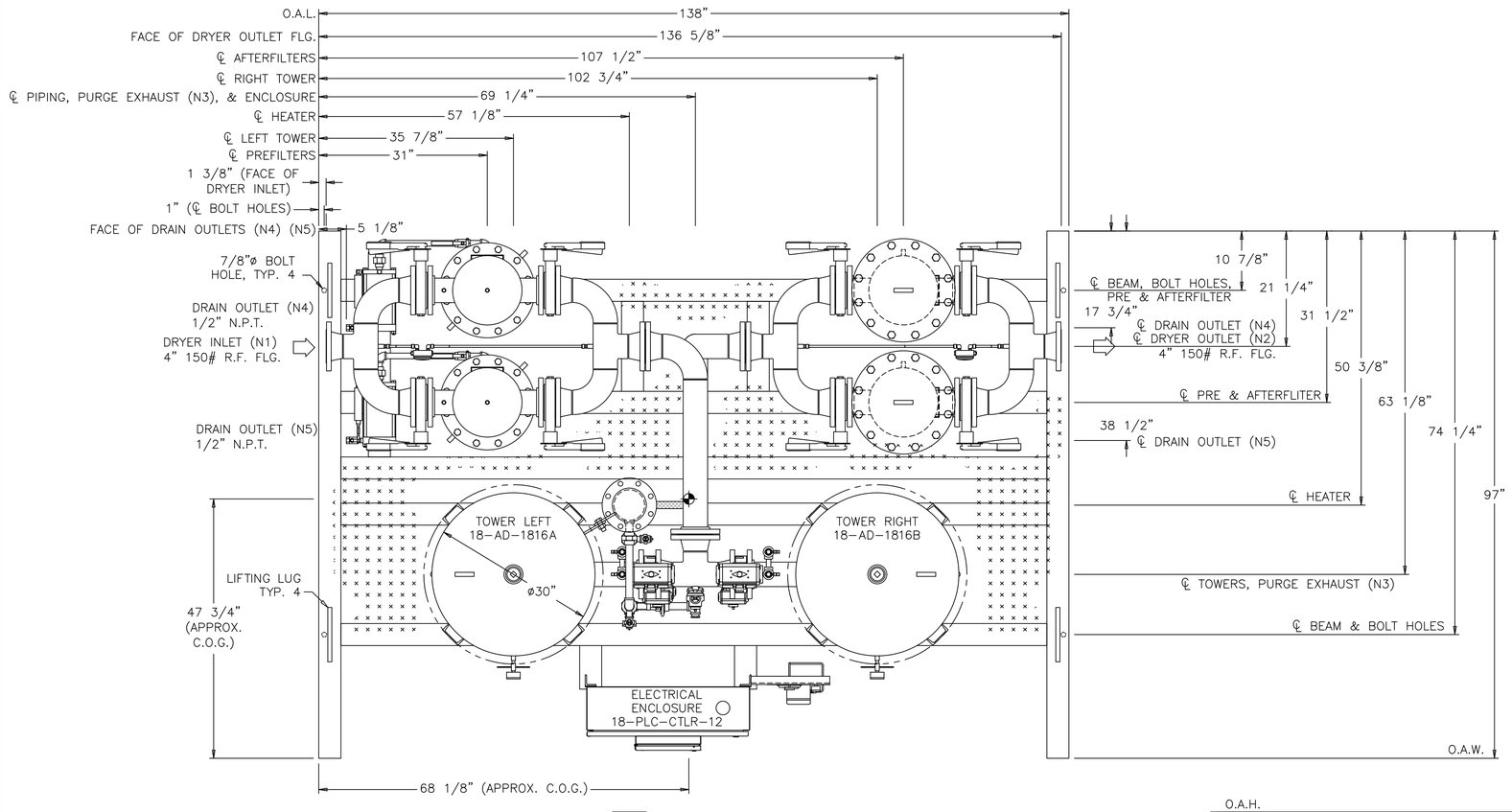
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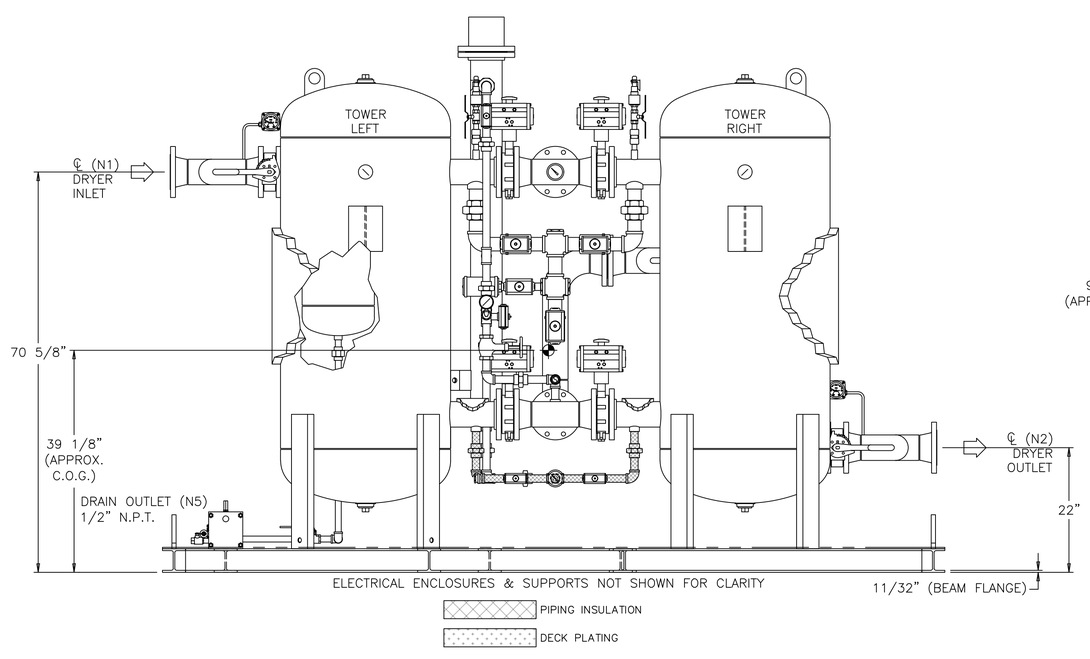
SECTION 8: ENGINEERING DRAWINGS & DOCUMENTS

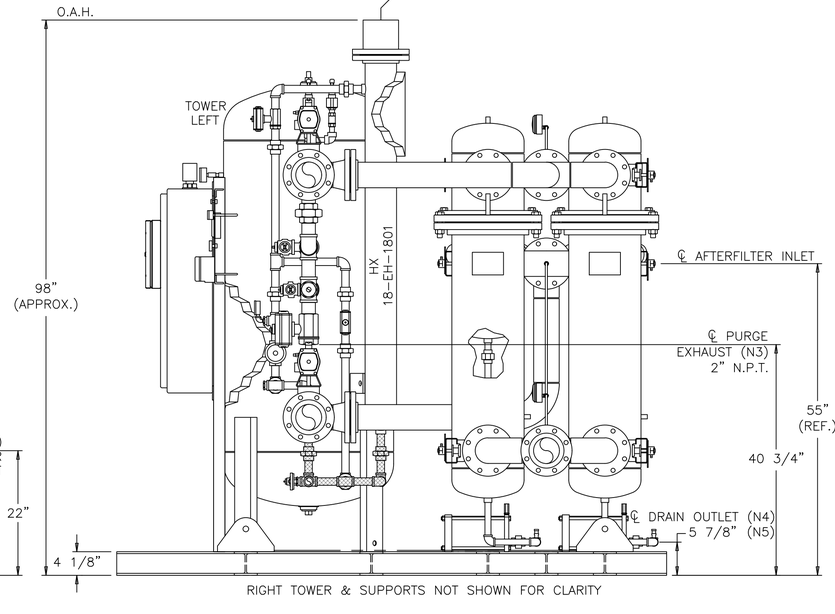
8.0 Engineering Drawings & Documents

The drawings which are included on the following pages in this section are specific to the air dryer identified on this instruction manual's cover (reference Model No. and Serial No.).

NOZZLE LIST		
N1	INLET	4" 150# R.F. FLANGE
N2	OUTLET	4" 150# R.F. FLANGE
N3	PURGE EXHAUST	2" N.P.T.
N4	DRAIN OUTLET	1/2" N.P.T.
N5	DRAIN OUTLET	1/2" N.P.T.







WEIGHTS (APPROX.):

EMPTY – 4961 LBS.
DESSICANT – 1760 LBS. (880 PER. TWR.)
W/DESICCANT – 6721 LBS.
OPERATING WT. – 6880 LBS.

TAG NUMBER: 17-C-08AB

REV.	DATE	DESCRIPTION OF REVISION	APPROVED
5	8/15/24	ECN: I1186	JLT
4	10/27/23	ECN: I1173	DTW
3	08/25/23	ECN: I1172	JLT
2	07/28/23	ECN: I1170	DTW
1	06/07/23	ECN: I1167	SMM

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Ingersoll Rand

EXHAUST PURGE DRYER EP-1540-X GENERAL ASSEMBLY

SCALE: NONE	DRAWN BY: JLT	DATE: 09/15/22	APPROVED:
UNLESS SPECIFIED TOLERANCES ARE ENGLISH: +/- METRIC: +/-	SERIAL NO.	JOB ORDER NO.	DWG.NO. 21048-2

	INSTRUMENTATION CONNECTION
4NPT	1/4" NATIONAL PIPE THREAD
4FC	1/4" FULL COUPLING
4HC	1/4" HALF COUPLING
8NPT	1/2" NATIONAL PIPE THREAD
8FC	1/2" FULL COUPLING
8HC	1/2" HALF COUPLING
12FC	3/4" FULL COUPLING
12HC	3/4" HALF COUPLING
12NPT	3/4" NATIONAL PIPE THREAD
24FLG	1 1/2" FLANGE

SYMBOL LEGEND

- ACTUATED BUTTERFLY VALVE
- ACTUATED BALL VALVE
- ACTUATED SPRING RETURN BALL VALVE
- MANUAL BUTTERFLY VALVE
- PRESSURE REGULATOR
- BALL VALVE
- PRESSURE RELIEF VALVE
- NEEDLE VALVE
- GLOBE VALVE
- GAUGE VALVE
- FLOW CONTROL VALVE
- 4-WAY DUAL COIL SOLENOID VALVE
- 4-WAY SINGLE COIL SOLENOID VALVE
- FILTER
- ORIFICE UNION
- MUFFLER
- LOCAL MOUNT
- ROBODRAIN

VALVE FAIL ORIENTATION (FX):

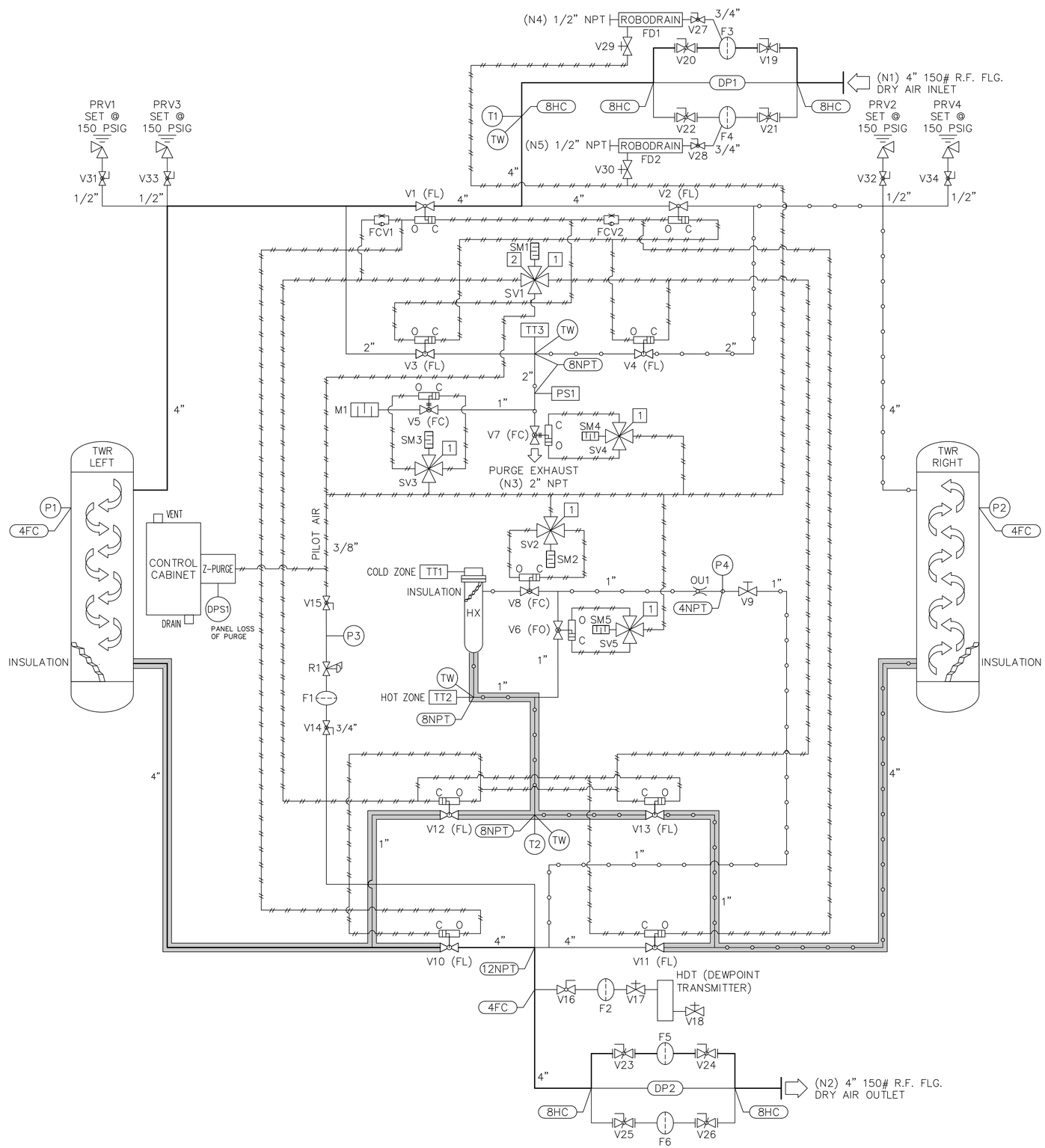
FO = FAILED OPEN
FC = FAILED CLOSED
FL = FAILED LAST

LINE LEGEND

- PROCESS AIR
- PILOT AIR
- PURGE AIR (HEATING)
- PIPING INSULATION

INSULATION THICKNESS: 1 1/2" W/ALUMINUM COVER

NOZZLE LIST		
N1	INLET	4" 150# R.F. FLANGE
N2	OUTLET	4" 150# R.F. FLANGE
N3	PURGE EXHAUST	2" N.P.T.
N4	DRAIN OUTLET	1/2" N.P.T.
N5	DRAIN OUTLET	1/2" N.P.T.



ITEM	DESCRIPTION
DP1	PREFILTER DIFF PRESSURE GAUGE W/SWITCH
DP2	AFTERFILTER DIFF PRESSURE GAUGE W/SWITCH
F1	PILOT AIR FILTER
F3 & F4	PREFILTERS
F5 & F6	AFTERFILTERS
FCV1	FLOW CONTROL VALVE
FCV2	FLOW CONTROL VALVE
FD1 & FD2	PREFILTER DRAINS
HX	REGENERATION HEATER
M1	DEPRESSURIZATION MUFFLER
OU1	ORIFICE UNION
P1 & P2	TOWER PRESSURE GAUGES
P3	PILOT AIR GAUGE
P4	PURGE PRESSURE GAUGE
PRV1 & PRV3	TOWER PRESSURE RELIEF VALVE
PRV2 & PRV4	TOWER PRESSURE RELIEF VALVE
PS1	PURGE EXHAUST PRESSURE SWITCH
R1	PRESSURE REGULATOR
SM1 – SM5	SOLENOID MUFFLERS
SV1	4-WAY DUAL COIL SOLENOID VALVE
SV2	4-WAY SINGLE COIL SOLENOID VALVE
SV3	4-WAY SINGLE COIL SOLENOID VALVE
SV4	4-WAY SINGLE COIL SOLENOID VALVE
SV5	4-WAY SINGLE COIL SOLENOID VALVE
T1	INLET TEMPERATURE GAUGE
T2	HEATER OUTLET TEMPERATURE GAUGE
TT1	HEATER INLET TEMPERATURE TRANSMITTER
TT2	HEATER OUTLET TEMPERATURE TRANSMITTER
TT3	PURGE EXHAUST TEMPERATURE TRANSMITTER
TW	THERMOWELLS
TWR LEFT	DESICCANT TOWER
TWR RIGHT	DESICCANT TOWER
V1	INLET SWITCHING VALVE
V2	INLET SWITCHING VALVE
V3	OUTLET PURGE SWITCHING VALVE
V4	OUTLET PURGE SWITCHING VALVE
V5	DEPRESSURIZATION VALVE
V6	REPRESSURIZATION/COOLING VALVE
V7	PURGE EXHAUST VALVE
V8	HEATING VALVE
V9	PURGE FLOW REGULATING VALVE
V10	OUTLET SWITCHING VALVE
V11	OUTLET SWITCHING VALVE
V12	INLET PURGE SWITCHING VALVE
V13	INLET PURGE SWITCHING VALVE
V14	PILOT AIR SHUT-OFF VALVE
V15	PILOT AIR BLOCK VALVE
V19 – V22	PREFILTER BLOCK VALVES
V23 – V26	AFTERFILTER BLOCK VALVES
V27 & V28	DRAIN BLOCK VALVES
V29 & V30	DRAIN PILOT AIR BLOCK VALVES
V31 – V34	PRESSURE RELIEF BLOCK VALVES
	HDT DEWPOINT TRANSMITTER
HDT	DEWPOINT DEMAND SYSTEM PROBE
F2	MINIATURE IN-LINE FILTER
V16	DPDS SHUT-OFF VALVE
V17 & V18	DPDS PROBE ISOLATION VALVES
	Z-PURGE
DPS1	DIFFERENTIAL PRESSURE SWITCH

TAG NUMBER: 17-C-08AB

REV.	DATE	DESCRIPTION OF REVISION	APPROVED
4	07/28/23	ECN: I1172	JLT
3	07/28/23	ECN: I1169	DTW
2	06/07/23	ECN: I1167	SMM
1	4/12/23	ECN: I1156	JLT

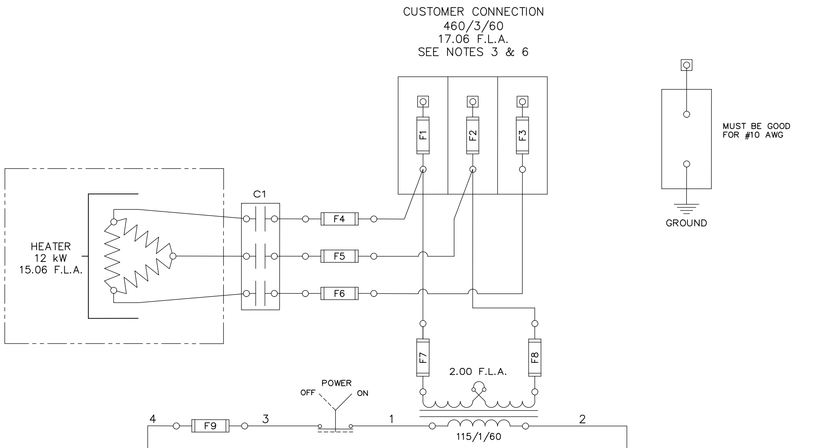
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Ingersoll Rand
INDUSTRIAL AIR SOLUTIONS, HEAVY INDUSTRIAL SYSTEMS
P.O. BOX 1600, 800-A BEATY ST. DAVIDSON, N.C. 28036

EXHAUST PURGE DRYER
EP-1540-X
FLOW DIAGRAM

SCALE:	DRAWN BY:	DATE:	APPROVED:
NONE	JLT	09/15/22	

UNLESS SPECIFIED TOLERANCES ARE ENGLISH: +/- METRIC: +/-	SERIAL NO.	JOB ORDER NO.	DWG.NO.
	110001	200987	21047-2



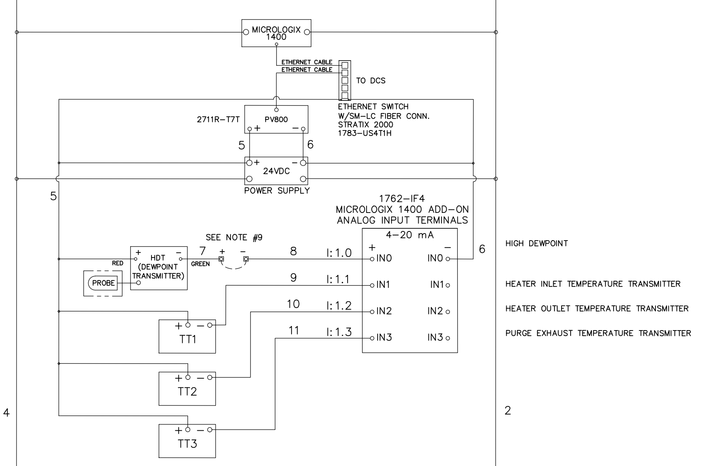
FUSE	AMPS	VOLTAGE	TYPE
F1	25	600	LPJ-25SP
F2	25	600	LPJ-25SP
F3	25	600	LPJ-25SP
F4	20	600	LPJ-20SP
F5	20	600	LPJ-20SP
F6	20	600	LPJ-20SP
F7	2	600	FNQ-R-2
F8	2	600	FNQ-R-2
F9	3	250	FLN-R3

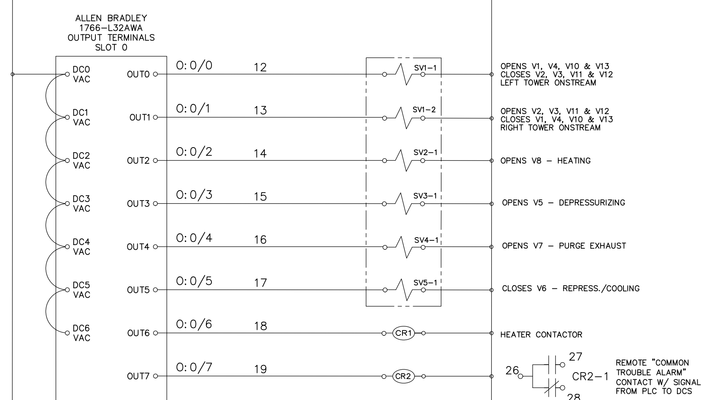
WARNING: TO REDUCE THE RISK OF FIRE, REPLACE ONLY WITH THE SAME TYPE & RATING OF FUSE.

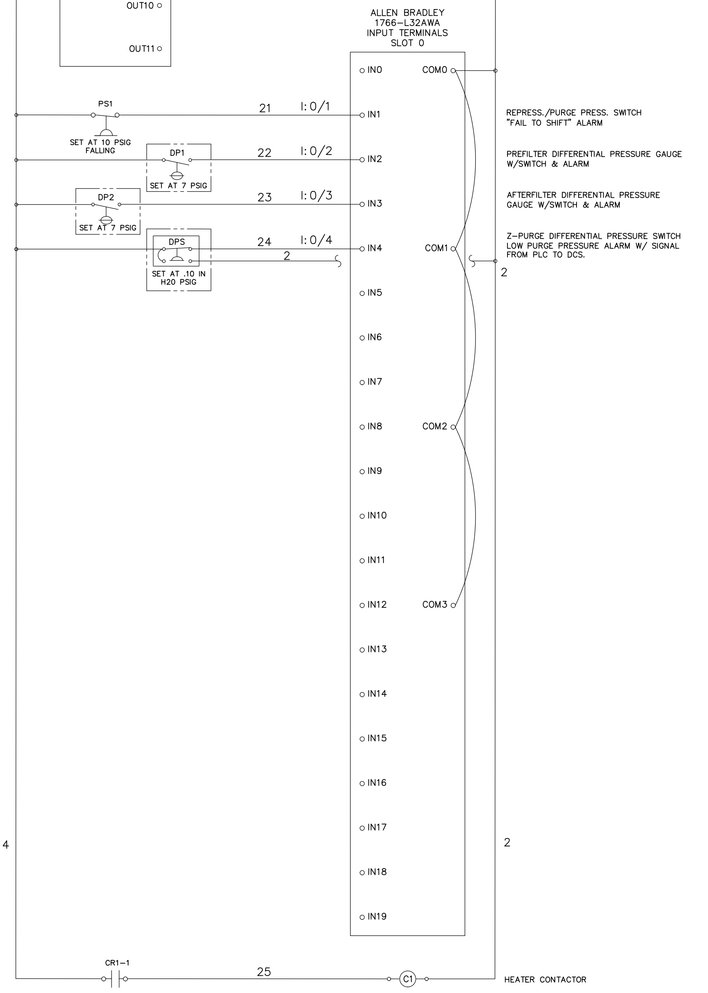
WIRE & CONDUIT CHART

HEATER WIRE SIZE
PANEL DISTRIBUTION – #14 AWG THHN
PANEL TO HEATER – #14 AWG SRML
CONDUIT SIZE – 1/2"

ALL FUNCTIONS/CONTROL OPTIONS & INDICATIONS NOT SPECIFICALLY SHOWN HERE WILL BE PROGRAMMED INTO THE PANELVIEW INTERFACE.







NOTES:

1. ALL FIELD WIRING TO BE #14 A.W.G. MINIMUM COPPER WIRE WITH INSULATION RATED AT 75°C.
2. SMALL TERMINAL BLOCKS TO BE TIGHTENED TO 20 POUND INCHES.
3. MAIN TERMINAL BLOCKS TO BE TIGHTENED TO 25 POUND INCHES.
4. GROUND LUG TO BE TIGHTENED TO 35 POUND INCHES.
5. CIRCUIT BREAKER OR DISCONNECT PROVIDED BY OTHERS PER NEC.
6. BEFORE SERVICING PANEL, ANY AND ALL EXTERNAL POWER SOURCES MUST BE TURNED OFF.
7. ——— – – ——— LOCATED OUTSIDE OF PANEL.
8. ⊡ CUSTOMER CONNECTION TERMINALS.
9. TERMINALS 7 & 8 FOR REMOTE 4–20 mA SIGNAL. REMOVE JUMPER WIRE ONLY AFTER RECORDING DEVICE IS ATTACHED.
10. NEMA 4X ENCLOSURE
11. NEMA 7 SOLEOIDS AND OTHER EQUIPMENT.
12. UL LISTED

TAG NUMBER: 17-C-08AB

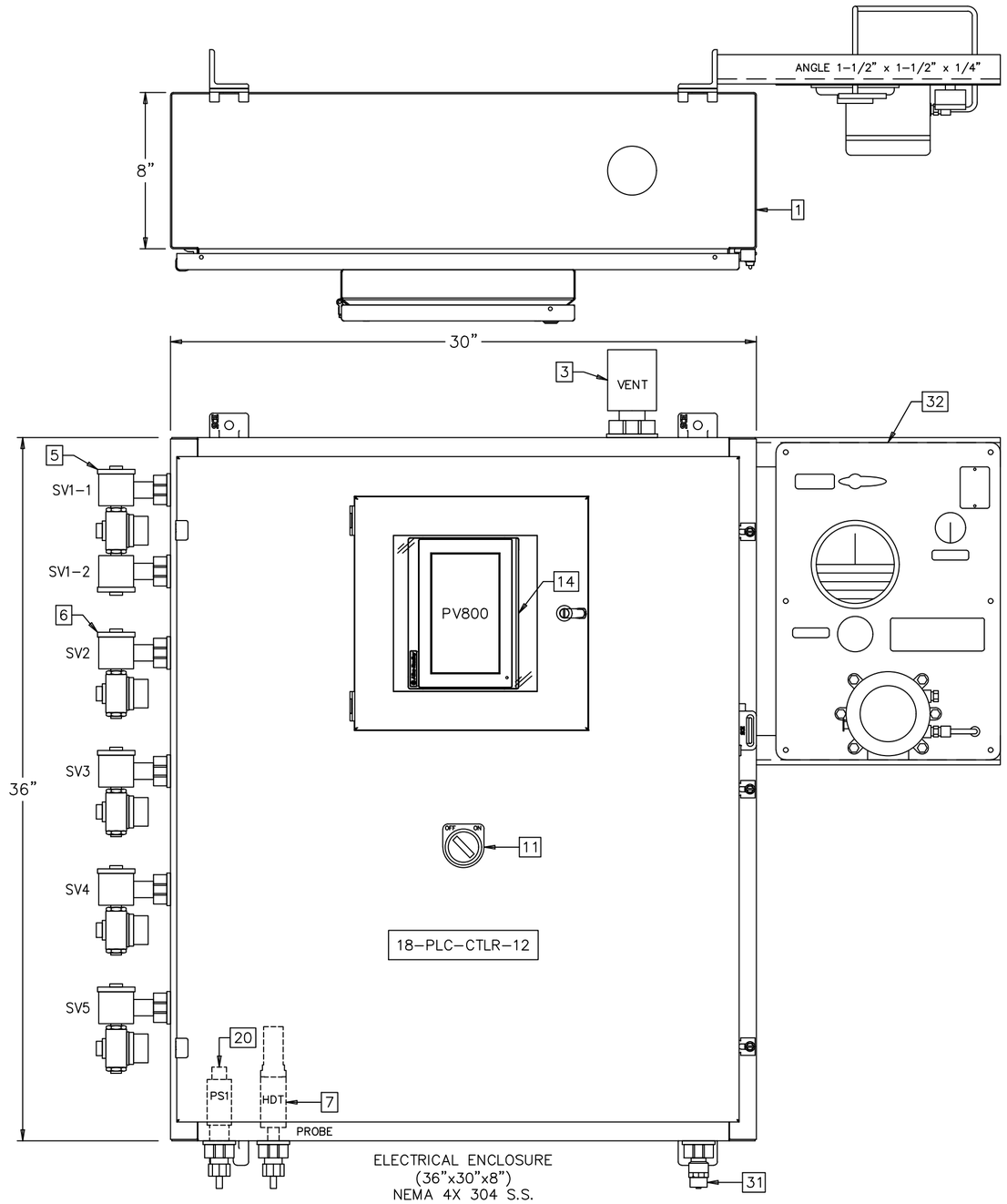
REV.	DATE	DESCRIPTION OF REVISION	APPROVED
4	09/27/24	AS BUILT	JLT
3	07/28/23	ECN: I1172	JLT
2	06/07/23	ECN: I1167	SMM
1	4/12/23	ECN: I1156	JLT

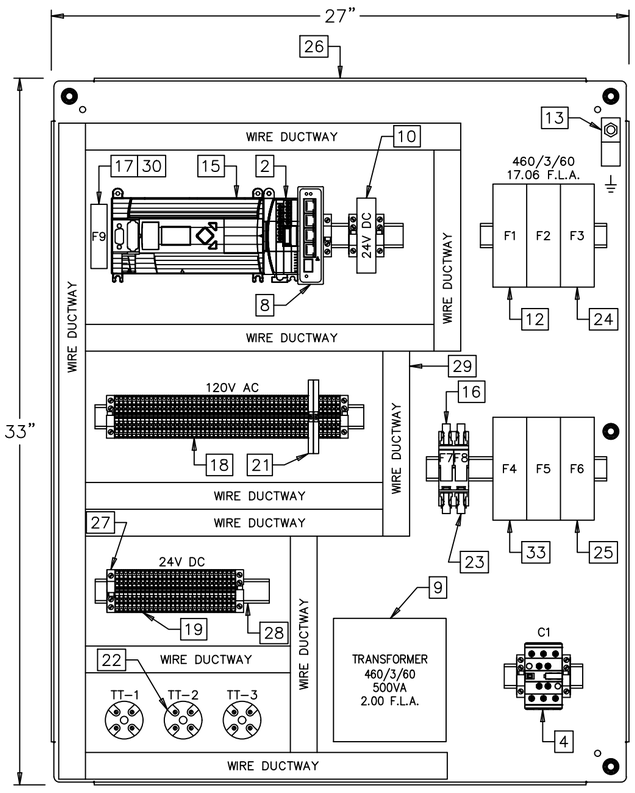
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EXHAUST PURGE DRYER
EP-1540-X
ELECTRICAL SCHEMATIC

SCALE: NONE	DRAWN BY: JLT	DATE: 9/23/22	JOB ORDER NO.	DWG NO. 21049-2
UNLESS OTHERWISE SPECIFIED TOLERANCES ARE DECIMAL: +/- METRIC: +/-	SERIAL NO.	APPROVED:		





TAG NUMBER: 17-C-08AB

NO.	QTY.	DESCRIPTION	SUPPLIER	PART NO.
1	1	ELECTRICAL ENCLOSURE	SAGINAW	SCE-36H3008SSLP
2	1	ANALOG INPUT MODULE (4-20mA)	ALLEN BRADLEY	1762-IF4
3	1	Z-PURGE VENT	KGA	PV-2-T
4	1	CONTACTOR	ABB	AF09-30-10-13
5	1	4-WAY DUAL COIL SOLENOID VALVE	ASCO	EF8342C020
6	4	4-WAY SINGLE COIL SOLENOID VALVE	ASCO	EF8342C001
7	1	MOISTURE TRANSMITTER	MICHELL	EASIDEW
8	1	ETHERNET SWITCH W/SM-LC FIBER	ALLEN BRADLEY	1783-US4T1H
9	1	TRANSFORMER 460/3/60 500VA	HEVI-DUTY	E500
10	1	POWER SUPPLY 24VDC	IDEC	PS5R-VC24
11	1	ON/OFF POWER SWITCH	SQUARE D	9001KS11B
12	2	FUSE HOLDER	BUSSMANN	JM60030-3MW14
13	1	GROUND LUG	BURNDY	KA25U
14	1	HMI, PANELVIEW 800	ALLEN BRADLEY	2711R-T7T
15	1	MICROLOGIX 1400	ALLEN BRADLEY	1766-L32AWA
16	2	FUSE	BUSSMANN	FNQ-R-2

17	1	FUSE	LITTELFUSE	FLN-R3
18	A/R	TERMINAL BLOCKS 120V AC	WEIDMULLER	1706060000
19	A/R	TERMINAL BLOCKS 24V DC	WEIDMULLER	1772060000
20	1	PRESSURE SWITCH	UNITED ELECTRIC	J54S-24
21	2	CONTROL RELAY (6 AMP)	IDEC	RV8H-S-AD110
22	3	TEMPERATURE TRANSMITTER	PYROMATION	441-1JU-S
23	1	FUSE HOLDER	BUSSMANN	BC6032B
24	3	FUSE	BUSSMAN	LPJ-25SP
25	3	FUSE	BUSSMAN	LPJ-20SP
26	1	ENCLOSURE SUB-PANEL	SAGINAW	SCE-36P30
27	A/R	END STOP	WEIDMULLER	9540000000
28	A/R	DIN MOUNTING RAIL	WEIDMULLER	0514500000
29	A/R	WIRE DUCTWAY 1" x 2"		
30	1	FUSE HOLDER	LITTELFUSE	LFR250301C
31	1	ECLOSURE DRAIN	APPLETON	ECDB50B
32	1	Z-PURGE ASSEMBLY	D&M INST.	YZ102
33	3	FUSE HOLDER	BUSSMANN	JTN60030

REV.	DATE	DESCRIPTION OF REVISION	APPROVED
2	06/07/23	ECN: I1167	SMM
1	4/12/23	ECN: I1156	JLT

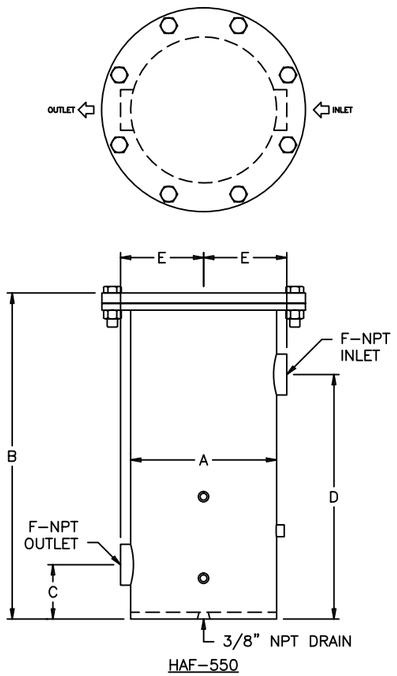
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Ingersoll-Rand
INDUSTRIAL AIR SOLUTIONS, HEAVY INDUSTRIAL SYSTEMS
P.O. BOX 1600, 800-A BEATY ST. DAVIDSON, N.C. 28036

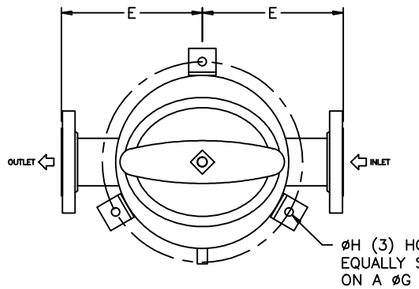
EXHAUST PURGE DRYER
EP-1540-X
CONTROL PANEL LAYOUT

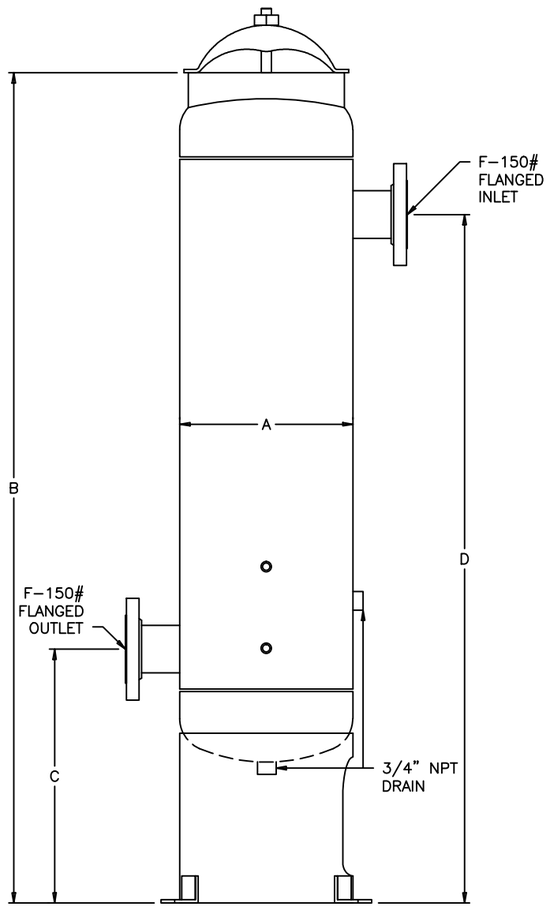
SCALE:	DRAWN BY:	DATE:	APPROVED:
NONE	JLT	09/26/22	

UNLESS SPECIFIED TOLERANCES ARE ENGLISH: +/- METRIC: +/-	SERIAL NO.	JOB ORDER NO.	DWG.NO.
			21050-2

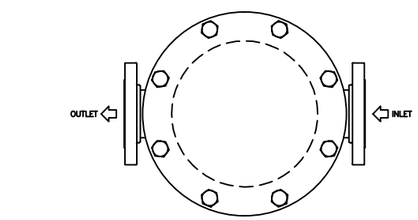


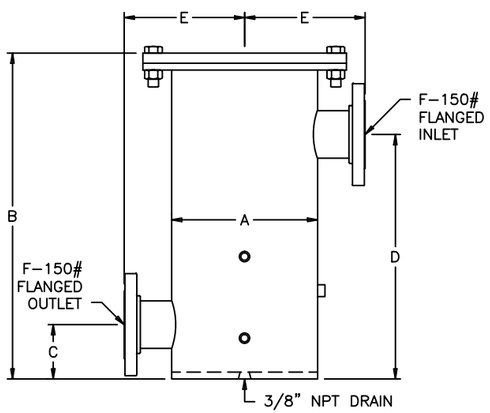
HAF–550





HAF–1400 THRU HAF–7200
SHOWN W/OPTIONAL SKIRT
AND MOUNTING ANGLES





HAF–1000

MODEL NUMBER	RATED FLOW 100 PSI @ 100°F SCFM	ΔP PSI	MAX. OPER. PRESS. PSI	MAX. OPER. *TEMP. °F	APPROX. DIMENSIONS IN INCHES (STANDARD FILTERS) A	B	C	D	E	F	G	H	EST. WT. LBS.	REPLACEMENT CARTRIDGE QTY.	ORDER NO.
HAF–550	550	.30	200	200	10 3/4	24	4	18	6 1/8	2			135	1	712–1H
HAF–1000	1000	.50	200	200	10 3/4	24	4	18	8 7/8	3			150	1	712–1H
HAF–1400	1400	.40	150	200	12 3/4	61	18 1/2	50 1/2	10 3/8	3	14 3/4	7/16	235	2	712–1H
HAF–2400	2400	.60	150	200	12 3/4	61	18 3/4	51 3/4	10 3/8	4	14 3/4	7/16	245	2	712–1H
HAF–3600	3600	.60	150	200	20	57	21 1/2	43 1/2	14	6	22	3/4	405	3	712–1H
HAF–7200	7200	.60	150	200	20	74 3/4	23 1/2	59 1/2	15	8	22	3/4	485	6	712–1H
HAF–9000	9000	.60	150	200	24	78 7/8	26	63	16	8	26	5/8	659	8	712–1H
HAF–10,000	10,000	.60	150	200	30	89 3/4	35 1/4	73 3/4	23	8	32	5/8	819	10	712–1H
HAF–12,000	12,000	.60	150	200	30	88 3/4	36	71 1/2	23	10	32	5/8	903	12	712–1H

*CONTINUOUS OPERATION: 200° F MAXIMUM TEMPERATURE INTERMITTENT OPERATION: 250° F MAXIMUM TEMPERATURE

FOR COMPRESSED AIR LINES WHERE DELIVERED AIR MUST BE FREE OF FINE PARTICLE CONTAMINANTS AND CORROSIVE INPURITIES.

COMPRESSED AIR LINES ARE THOROUGHLY CONTAMINATED WITH CORROSIVE INPURITIES AND FOREIGN PARTICLES, SUCH AS RUST, DIRT, WATER, SCALE, DETERIORATED OIL, WAX, RESINS, AND OTHER DESTRUCTIVE AGENTS. THESE IMPURITIES CAUSE DAMAGE TO AIR OPERATED PRODUCTION EQUIPMENT, INSTRUMENTATION AND OTHER VITAL AIR OPERATED COMPONENTS.

ELIMINATE COSTLY REPAIRS AND EXPENSIVE DOWN TIME WITH PROTECTION AFFORDED BY FINE QUALITY FILTRATION.

THE AFTERFILTER IS RECOMMENDED FOR INSTALLATION IN CONJUNCTION WITH AIR DRYERS TO FILTER OUT DESICCANT DUST CARRYOVER WHICH MIGHT OCCUR IN THE AIR DRYING PROCESS. THIS TYPE OF INSTALLATION WILL ENSURE CLEAN, DRY FILTERED AIR.

FOR REMOVING:
- RUST, DIRT, SCALE, CARBON GRANULES AND FOREIGN PARTICLES
- DESICCANT DUST
- ENTRAINED WATER
- WAX
- RESINS

FEATURNG:
- QUICK, EASY CARTRIDGE CHANGE
- HIGH FILTRATION EFFICIENCY
- ECONOMY
- LONGER CARTRIDGE LIFE
- TWO STAGE FILTRATION

IDEAL FOR THE FOLLOWING APPLICATIONS:*
- ELIMINATING DESICCANT DUST CARRYOVER
- AIR AND GAS FILTRATION
- SENSITIVE PNEUMATIC INSTRUMENTS
- CRITICAL APPLICATIONS
- PAINT SPRAYING SUPPLY AIR
- SHOP AIR TOOLS
- ASSEMBLY LINE AIR TOOLS

*WHERE PARTICULATE MATTER MUST BE REMOVED. (NOT RECOMMENDED FOR OIL AND WATER VAPOR REMOVAL. REFER TO PREFILTER SERIES FOR OIL REMOVAL APPLICATIONS).

SPECIFICATIONS:
- THE RUGGED CARTRIDGE IS CONSTRUCTED OF A HIGH QUALITY RESIN IMPREGNATED PLEATED PAPER WITH A PERFORATED METAL CENTER TUBE
- THE DURABLE END COVER IS A UNITIZED MOLDED COVER, INCORPORATING A RADIAL SEAL WHICH ASSURES A POSITIVE SEAL AGAINST LEAKAGE
- THE RELIABLE CARTRIDGE IS MANUFACTURED TO RIGID SPECIFICATIONS
- THE CARTRIDGE IS RATED AT 1.0 MICRONS
- CARTRIDGE WILL WITHSTAND A 30 PSI P DIFFERENTIAL COLLAPSE PRESSURE
- THE PRESSURE VESSEL IS MANUFACTURED TO ASME SPECIFICATIONS
- MODELS HAF–550 AND LARGER ARE ASME CODED

INSTALLATION:
- BEFORE INSTALLING FILTER, BLOW OUT PIPE LINES, TO REMOVE SCALE AND FOREIGN MATTER
- FILTER SHOULD BE INSTALLED AS CLOSE AS POSSIBLE TO AIR DRYER OUTLET. (IF NOT USED IN CONJUNCTION WITH AN AIR DRYER, INSTALL AS CLOSE AS POSSIBLE TO POINT OF USE)
- INSTALL FILTER IN THE VERTICAL POSITION AND BOLT BASE TO FLOOR. (EXCEPT FOR HAF–550 AND HAF–1000, WHICH DO NOT BOLT TO FLOOR)
- THE "IN" AND "OUT" PORTS ARE IDENTIFIED ON THE FILTER AS AN AID FOR PROPER INSTALLATION

CONSTRUCTION:
- THE PRESSURE VESSEL IS CONSTRUCTED OF CARBON STEEL, BUILT TO ASME STANDARDS AND IS ASME CODED. THE VESSEL INTERIOR HAS A CORROSION RESISTANT COATING. THE BASE CONNECTOR, TOP CONNECTOR, (AND CONNECTOR BETWEEN CARTRIDGES, WHERE APPLICABLE) ARE MADE OF ALUMINUM. THE TY–ROD ASSEMBLY IS CONSTRUCTED OF STAINLESS STEEL. (THE HOUSING SEAL ON MODELS HAF–550 AND HAF–1000 IS BUNA N).
- THE CARTRIDGE IS CONSTRUCTED OF RESIN IMPREGNATED PAPER, PERFORATED STEEL CENTER TUBE, AND POLYVINYLCLORID MOLDED ENDS. POLYESTER AND POLYURETHANE MATERIALS ARE ALSO USED IN THE CONSTRUCTION OF THE CARTRIDGE. THE RESIN IMPREGNATED PAPER IS TOTALLY RESISTANT TO 95% OF ALL ATMOSPHERIC CHEMICALS.

SERVICING:
- CARTRIDGES REQUIRE CHANGING ONLY WHEN CONTAMINATED. THIS WILL VARY WITH EACH APPLICATION. THEREFORE WHEN FILTER IS INITIALLY INSTALLED IT SHOULD BE WATCHED CLOSELY TO ESTABLISH A SCHEDULE FOR FREQUENCY OF CARTRIDGE CHANGING.
- TO MAINTAIN MAXIMUM FILTERING EFFICIENCY AND TO AVOID EXCESSIVE PRESSURE DROP THE FILTER MUST BE KEPT CLEAN. A VISIBLE COATING OF SLUDGE OR DIRT ON THE OUTSIDE OF THE CARTRIDGE OR AN EXCESSIVE PRESSURE DROP IS AN INDICATION THAT A CARTRIDGE CHANGE IS NECESSARY. A DIFFERENTIAL PRESSURE GAUGE(OR TWO GAUGES, ONE ON THE INLET AND ONE ON THE OUTLET) CAN ALSO BE INSTALLED TO DETERMINE DIFFERENTIAL PRESSURE. IF THIS METHOD IS EMPLOYED, IT IS RECOMMENDED THAT THE CARTRIDGE BE CHANGED WHEN A DIFFERENTIAL PRESSURE OF 5 PSI IS REACHED.
- TO CHANGE CARTRIDGE, SIMPLY DEPRESSURIZE FILTER AND REMOVE MANWAY COVER. (ON MODELS HAF–550 AND HAF–1000 REMOVE COVER BOLTS AND COVER). REMOVE LOCK NUT(S). REMOVE TY–GRACKET(S) ON MODELS HAF–3600 AND LARGER. REMOVE TOP CONNECTOR(S) AND CARTRIDGE(S). ON MODELS HAF–1400, HAF–2400 AND HAF–7200 REMOVE CONNECTOR(S) BETWEEN CARTRIDGES. CLEAN AND REUSE TOP CONNECTOR(S), CONNECTOR(S) BETWEEN CARTRIDGES, TY–BRACKET(S) AND LOCK NUT(S). DISCARD CONTAMINATED CARTRIDGE(S). INSTALL NEW CARTRIDGE(S) AND REASSEMBLE MAKE CERTAIN THAT CARTRIDGE(S) ARE PROPERLY SEATED ON THE CONNECTORS, THAT TY–BRACKET(S) ARE INSTALLED AND LOCK NUT(S) ARE SECURELY TIGHTENED.
- TO ORDER SPARE PARTS SPECIFY QUANTITY, MODEL NUMBER OF FILTER AND PART NAME. EXAMPLE: TO ORDER A TY–BRACKET FOR AN HAF–3600 USE THE FOLLOWING DESCRIPTION: QUANTITY 1–HAF–3600 TY–BRACKET.

RECOMMENDED SPARE PARTS:

QUANTITY	ITEM
1 SET	NO. 712–1H CARTRIDGE (SPECIFY FILTER MODEL NUMBER)
1	HOUSING SEAL (ONLY FOR HAF–550 AND HAF–1000)
1	MANWAY GASKET (ONLY FOR HAF–1400 AND LARGER)

INCREASED CAPACITIES CAN BE ACCOMPLISHED BY INSTALLING MULTIPLE FILTERS IN PARALLEL.

REFER TO DWG. NO. 55007 FOR PREFILTERS WITH CAPACITIES UP TO 6000 SCFM

REFER TO DWG. NO. 55006 FOR AFTERFILTERS WITH CAPACITIES UP TO 350 SCFM

CONSULT FACTORY FOR LARGER CAPACITIES, HIGHER PRESSURES AND FOR OTHER FILTRATION APPLICATIONS SUCH AS FILTERING WATER, COOLANTS, LUBRICANTS, SOLVENTS, CHEMICALS, ETC.

CAUTION:
DO NOT ATTEMPT TO SERVICE THE FILTER UNTIL IT HAS BEEN DEPRESSURIZED.

REV.	DATE	DESCRIPTION OF REVISION	APPROVED

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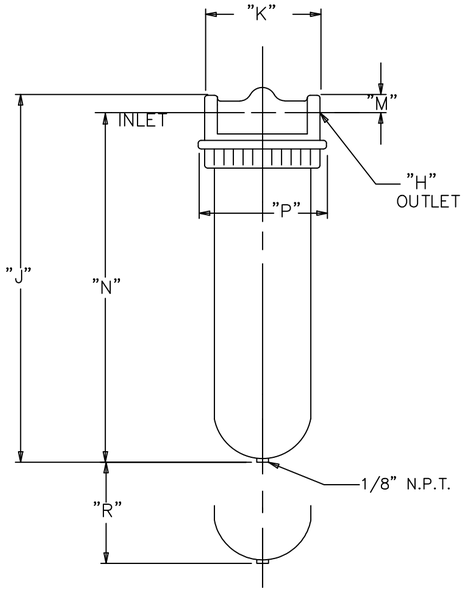
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INDUSTRIAL AIR SOLUTIONS, HEAVY INDUSTRIAL SYSTEMS
P.O. BOX 1600, 800–A BEATY ST. DAVIDSON, N.C. 28036

AFTERFILTER
HAF SERIES
HAF–550 THRU HAF–12,000

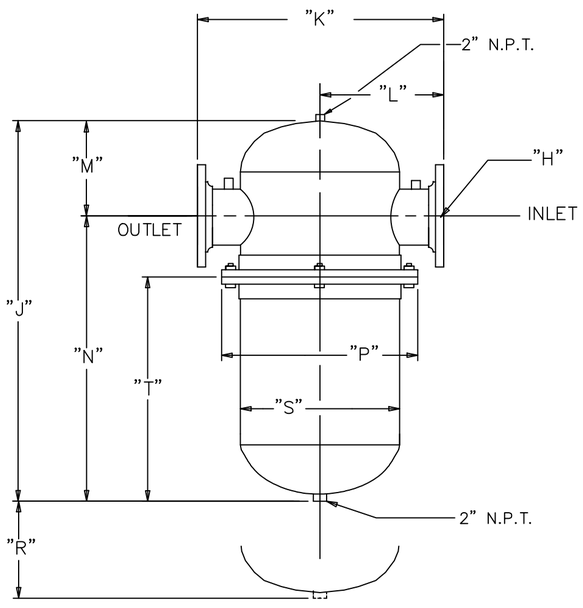
SCALE:	DRAWN BY:	DATE:	APPROVED:
NONE	JLT	3/30/16	

UNLESS SPECIFIED TOLERANCES ARE ENGLISH: +/– 1/4" METRIC: +/– 5mm	SERIAL NO.	JOB ORDER NO.	DWG.NO.
			IR91113

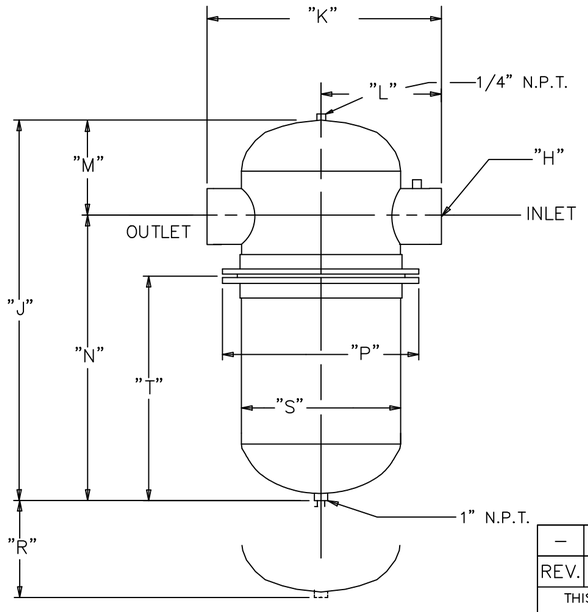
MODEL NO.	TYPE FILTER	S.C.F.M.	H PIPE SIZE	J	K	L	M	N	P	R ELEMENT REMOVAL CLEARANCE	WEIGHT	FILTER ELEMENT ELEMENT NUMBER	FILTER ELEMENT QUANTITY	MAXIMUM SUPPLY PRESSURE PGSI	MAXIMUM OPERATING TEMP.	S	T	FILTER LENGTH
HEF 20	A	20	3/8" N.P.T.	9 7/8"	3 1/4"	1 3/8"	5/8"	9 1/4"	3 3/4"	4"	3	8D20F	1	300#	250°F	2 1/2"		2 5/8"
HEF 30	A	30	1/2" N.P.T.	9 7/8"	3 1/4"	1 3/8"	5/8"	9 1/4"	3 3/4"	4"	3	8D28F	1	300#	250°F	2 1/2"		3 7/8"
HEF 60	A	60	3/4" N.P.T.	15 1/2"	4 9/16"	2 9/32"	1"	14 1/2"	4 15/16"	4"	7	16D33F	1	300#	250°F	3 1/2"		4 1/2"
HEF 100	A	100	1" N.P.T.	15 1/2"	4 9/16"	2 9/32"	1"	14 1/2"	4 15/16"	4"	8	16D50F	1	300#	250°F	3 1/2"		6 5/8"
HEF 165	A	165	1 1/2 N.P.T.	24 1/2"	5 1/4"	2 5/8"	1 1/4"	23 1/2"	4 15/16"	4"	12	16D100F	1	300#	250°F	3 1/2"		12 7/8"
HEF 250	A	250	1 1/2 N.P.T.	24 7/8"	5 1/4"	2 5/8"	1 1/4"	23–1/2"	4 15/16"	4"	14	16D150F	1	300#	250°F	3 1/2"		19 1/8"
HEF 350	A	350	2" NPT	34 3/4"	6"	3"	2"	32 3/4"	6"	4"	16	16D150F	1	300#	250°F	3 1/2"		19 1/8"
HEF 700	C	700	2" NPT	35 1/4"	13 7/8"	7 7/8"	5"	45 1/4"	13 1/2"	13"	66	16D150F	2	150#	250°F	10 3/4"	23 1/4"	19 1/8"
HEF 1400	B	1400	3" FLG	35 1/2"	19"	9"	7 1/2"	27 3/4"	15"	14"	155	16D150F	4	150#	250°F	10 3/4"	22 1/4"	19 1/8"
HEF 2100	B	2100	4" FLG	38"	21"	11"	10 1/2"	27 1/2"	17 1/2"	16"	175	16D150F	6	150#	250°F	12 3/4"	20"	19 1/8"
HEF 2800	B	2800	4" FLG	39"	25"	13"	9"	30"	22"	16"	250	16D150F	8	150#	250°F	16"	22 1/2"	19 1/8"
HEF 3500	B	3500	6" FLG	44"	25"	13"	12"	32"	22"	17"	255	16D150F	10	150#	250°F	16"	23"	19 1/8"
HEF 4200	B	4200	6" FLG	45 1/2"	30"	15"	11 7/8"	33 5/8"	24"	17"		16D150F	12	150#	250?F	18"	23 5/8"	19 1/8"
HEF 4900	B	4900	6" FLG	45 1/2"	30"	15"	11 7/8"	33 5/8"	24"	17"		16D150F	14	150#	250°F	18"	23 5/8"	19 1/8"
HEF 5600	B	5600	6" FLG	46 3/8"	36"	18 1/2"	13"	34"	30"	17"		16D150F	16	150#	250°F	18"	23 3/16"	19 1/8"
HEF 6300	B	6300	6" FLG	46 3/8"	36"	18 1/2"	13"	34"	30"	17"		16D150F	18	150#	250°F	24"	23 3/16"	19 1/8"
HEF 7000	B	7000	6" FLG	46 3/8"	36"	18 1/2"	13"	34"	30"	17"		16D150F	20	150#	250°F	24"	23 3/16"	19 1/8"
HEF 7700	B	7700	8" FLG	46 3/8"	36"	18 1/2"	13"	34"	30"	17"	700	16D150F	22	150#	250°F	24"	23 3/16"	19 1/8"
HEF 8400	B	8400	8" FLG	46 3/8"	36"	18 1/2"	13"	34"	30"	17"		16D150F	24	150#	250°F	24"	23 3/16"	19 1/8"
HEF 9100	B	9100	8" FLG	46 3/8"	36"	18 1/2"	13"	34"	30"	17"		16D150F	26	150#	250°F	24"	23 7/16"	19 1/8"
HEF 9800	B	9800	8" FLG	46 3/8"	36"	18 1/2"	13"	34"	30"	17"		16D150F	28	150#	250°F	24"	23 7/16"	19 1/8"
HEF 10500	B	10500	8" FLG	46 3/8"	36"	18 1/2"	13"	34"	30"	17"	720	16D150F	30	150#	250°F	24"	21"	19 1/8"
HEF 11200	B	11200	8" FLG	47 3/4"	42"	21 1/2"	12 5/8"	35 1/8"	36"	17"		16D150F	32	150#	250°F	30"	23 1/8"	19 1/8"
HEF 11900	B	11900	8" FLG	47 3/4"	42"	21 1/2"	12 5/8"	35 1/8"	36"	17"		16D150F	34	150#	250°F	30"	23 1/8"	19 1/8"
HEF 12600	B	12600	10" FLG	49 1/2"	42"	21 1/2"	13"	36 1/2"	36"	17"	845	16D150F	36	150#	250°F	30"	20 1/2"	19 1/8"



TYPE "A" FILTER



TYPE "B" FILTER



TYPE "C" FILTER

–	–	–	–
REV.	DATE	DESCRIPTION OF REVISION	APPROVED

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PREFILTER
HEF SERIES
HEF–20 THRU HEF–12,600

SCALE: NONE	DRAWN BY: SMM	DATE: 08/12/16	APPROVED:
UNLESS SPECIFIED TOLERANCES ARE ENGLISH: +/– 1/4" METRIC: +/– 5mm	SERIAL NO.	JOB ORDER NO.	DWG.NO. IR93028

PLC/HMI MicroLogix1400 with Panelview 800
Model # **EP - 1540**
Serial # **110001**
IP: **192.168.10.10**
Subnet: **255.255.255.0**

AIR DRYER TAG LIST

TAG TYPE	TAG NUMBER / SYMBOL	DESCRIPTION	PLC ADDRESS	MODBUS ADDRESS	DATA TYPE	ENGINEERING UNIT RANGE	4X HOLDING REGISTER	STATE 0	STATE 1
Digital			I:0/0	N9:0/0	Bit	N/A	40001	FALSE	TRUE
Digital	PS1	Pressure switch for purge and fail to shift alarm	I:0/1	N9:0/1	Bit	N/A		FALSE	TRUE
Digital	DPS1	Prefilter differential pressure switch	I:0/2	N9:0/2	Bit	N/A		FALSE	TRUE
Digital	DPS2	After filter differential pressure switch	I:0/3	N9:0/3	Bit	N/A		FALSE	TRUE
Digital	DPS	Z-Purge differential pressure switch	I:0/4	N9:0/4	Bit	N/A		FALSE	TRUE
Digital	SV1-1	Left Tower Onstream Opens V1&4 Closes V2&3	O:0/0	N9:1/0	Bit	N/A	40002	FALSE	TRUE
Digital	SV1-2	Right Tower Onstream Closes V1&4 Opens V2&	O:0/1	N9:1/1	Bit	N/A		FALSE	TRUE
Digital	SV2-1	Heating Opens V8	O:0/2	N9:1/2	Bit	N/A		FALSE	TRUE
Digital	SV3-1	Depressurize opens V5	O:0/3	N9:1/3	Bit	N/A		FALSE	TRUE
Digital	SV4-1	Purge Opens V7	O:0/4	N9:1/4	Bit	N/A		FALSE	TRUE
Digital	SV5-1	Cooling Closes V6	O:0/5	N9:1/6	Bit	N/A		FALSE	TRUE
Digital	HEATER	Heater Enabled	O:0/6	N9:1/6	Bit	N/A		FALSE	TRUE
Digital	REMOTE	Remote common trouble alarm relay	O:0/7	N9:1/7	Bit	N/A		FALSE	TRUE
Digital	LEFT	Left Tower Onstream	B3:0/0	N9:2/0	Bit	N/A	40003	FALSE	TRUE
Digital	RIGHT	Right Tower Onstream	B3:0/1	N9:2/1	Bit	N/A		FALSE	TRUE
Digital	HEATEN	Heating Cycle Enabled	B3:0/2	N9:2/2	Bit	N/A		FALSE	TRUE
Digital	COOLEN	Cooling Cycle Enabled	B3:0/3	N9:2/3	Bit	N/A		FALSE	TRUE
Digital	REPRESS	Repressurization Enabled	B3:0/4	N9:2/4	Bit	N/A		FALSE	TRUE
Digital	PRE_COOL	Pre cooling cycle enabled	B3:0/6	N9:2/6	Bit	N/A		FALSE	TRUE
Digital	STDBY	Standby Enabled	B3:0/10	N9:2/10	Bit	N/A		FALSE	TRUE
Digital	SW1	Dewpoint Time cycle switch 0=DEW 1=TIME	B3:1/0	N9:3/0	Bit	N/A	40004	DEW	TIME
Digital	COLDZONE_RESET	Manual reset for coldzone overtemp alarm	B3:1/4	N9:3/4	Bit	N/A		FALSE	TRUE
Digital	HL_MODE	HL Mode enabled	B3:1/7	N9:3/7	Bit	N/A		FALSE	TRUE
Digital	EP_MODE	EP Mode enabled	B3:1/8	N9:3/8	Bit	N/A		FALSE	TRUE
Digital	COMMON	Common Trouble for Panel View	B3:1/15	N9:3/15	Bit	N/A		FALSE	TRUE
Digital	COLDZONE_OVERTEMP	Latching coldzone overtemp alarm	B20:0/0	N9:4/0	Bit	N/A	40005	FALSE	TRUE
Digital	HTR_OVERTEMP	Heater overtemp alarm hotzone	B20:0/1	N9:4/1	Bit	N/A		FALSE	TRUE
Digital	HIDEW	High Dewpoint Alarm	B20:0/2	N9:4/2	Bit	N/A		FALSE	TRUE
Digital	TT1_LL	Temp. Transmitter 1 Below Range	B20:0/3	N9:4/3	Bit	N/A		FALSE	TRUE
Digital	TT2_LL	Temp. Transmitter 2 Below Range	B20:0/4	N9:4/4	Bit	N/A		FALSE	TRUE
Digital	FTSA	Fail to shift alarm	B20:0/5	N9:4/5	Bit	N/A		FALSE	TRUE
Digital	VALVE FAILURE	Valve failure (if limit switches installed)	B20:0/7	N9:4/7	Bit	N/A		FALSE	TRUE
Digital	LL	Dewpoint Trans Below Range	B20:1/0	N9:4/8	Bit	N/A		FALSE	TRUE
Digital	HH	Dewpoint Trans Above Range	B20:1/1	N9:4/9	Bit	N/A		FALSE	TRUE
Digital	A_DIFFPRESS	Afterfilter differential pressure alarm (if installed)	B20:1/2	N9:4/10	Bit	N/A		FALSE	TRUE
Digital	P_DIFFPRESS	Prefilter differetial pressure alarm (if installed)	B20:1/3	N9:4/11	Bit	N/A		FALSE	TRUE
Digital	Z_DIFFPRESS	Z-Purge differential pressure alarm (if installed)	B20:1/4	N9:4/12	Bit	N/A		FALSE	TRUE
Analog	DEWPOINT	Current dewpoint reading from transmitter in °F	N7:50	N9:60	Integer	-148 to 86 °F	40061	--	--
Analog	TT1	Heater inlet (Coldzone) temperature in °F	N7:51	N9:61	Integer	32 to 662 °F	40062	--	--
Analog	TT2	Heater outlet temperature in °F	N7:52	N9:62	Integer	32 to 662 °F	40063	--	--
Analog	TT3	Purge exhaust temperature in °F	N7:53	N9:63	Integer	32 to 662 °F	40064	--	--
Analog	C_SMT	Current dewpoint reading from transmitter in °C	N7:60	N9:70	Integer	-100 to 30 °C	40071	--	--
Analog	C_TT1	Heater inlet (Coldzone) temperature in °C	N7:61	N9:71	Integer	0 to 350 °C	40072	--	--
Analog	C_TT2	Heater outlet temperature in °C	N7:62	N9:72	Integer	0 to 350 °C	40073	--	--
Analog	C_TT3	Purge exhaust temperature in °C	N7:63	N9:73	Integer	0 to 350 °C	40074	--	--
Analog	Half.pre	Cycle half counter preset	C5:0.PRE	N9:8	Integer	240 Minuter	40009	--	--
Analog	Half.acc	Current half cycle time	C5:0.ACC	N9:9	Integer	0 to 240 Minutes	40010	--	--
Analog	END_HEAT	Set Final minute for Heating Cycle	N7:1	N9:11	Integer	0 to 235 Minutes	40012	--	--
Analog	END_COOL	Set Final minute for Cooling Cycle	N7:2	N9:12	Integer	0 to 235 Minutes	40013	--	--
Analog	PRE COOL TIME	Set Length of Pre Cooling	N7:4	N9:14	Integer	10 to 30 Minutes	40015	--	--
Analog	DEW_SET	Dewpoint Setpoint	N7:8	N9:18	Integer	-148 to +86ºF	40019	--	--
Analog	Hidew_Delay_EP	Set high dewpoint alarm in PV EP mode	N7:9	N9:19	Integer	5 to 240 Minutes	40020	--	--
Analog	END_HEAT_TIME	Final minute for Heating Cycle	N7:11	N9:21	Integer	30 to 235 Minutes	40012	--	--
Analog	END PRE COOL	Final minute for Pre Cooling cycle	N7:14	N9:24	Integer	40 to 235 Minutes	40015	--	--
Analog	Service_Huns	For hourmeter	N7:20	N9:30	Integer	0 to 999 hours	40031	--	--
Analog	Service_Thous	For hourmeter	N7:21	N9:31	Integer	0 to 999 hours	40032	--	--
Analog	Standby_Huns	For hourmeter	N7:22	N9:32	Integer	0 to 999 hours	40033	--	--
Analog	Standby_Thous	For hourmeter	N7:23	N9:33	Integer	0 to 999 hours	40034	--	--
Analog	Service_Counter	For hourmeter	C5:2.ACC	N9:34	Integer	0 to 60 minutes	40035	--	--
Analog	Standby_Counter	For hourmeter	C5:3.ACC	N9:35	Integer	0 to 60 minutes	40036	--	--
Analog	REGENCYCLE	Regneration cycles for panelview	N7:26	N9:36	Integer	0 to 9 States	40037	--	--
Analog	Timer_Remain	Time Remaining in Regeneration Cylce	N7:27	N9:37	Integer	240 to 0 Minutes	40038	--	--
Analog	END_HEAT_EARLY_SET	End heat early temperature setpoint in °F	N7:30	N9:40	Integer	150 to 250 °F	40041	--	--
Analog	HEAT_ON_SET	Temperature to cycle heater on in °F	N7:33	N9:43	Integer	0 to 400 °F	40044	--	--
Analog	HEAT_OFF_SET	Temperature to cycle heater off in °F	N7:34	N9:44	Integer	0 to 400 °F	40045	--	--
Analog	COLDZONE_TEMP_SET	Set temperature for coldzone overtemp alarm	N7:35	N9:45	Integer	0 to 450 °F	40046	--	--
Analog	HEATER_OVERTEMP_SET	Set temperature for heater overtemp alarm	N7:36	N9:46	Integer	0 to 450 °F	40047	--	--
Analog	PF_DIFFP_SET	Prefilter differential pressure setpoint	N7:37	N9:47	Integer	0 to 15 psi	40048	--	--
Analog	AF_DIFFP_SET	After-filter differential pressure setpoint	N7:38	N9:48	Integer	0 to 15 psi	40049	--	--
Analog	HIDEW_COUNTER	Delay high dewpoint counter	N7:39	N9:49	Integer	0 to N7:9 or N7:19	40050	--	--

*CHART 1

STATE	DESCRIPTION	STATE	DESCRIPTION
0	EXHAUST PURGE MODE LEFT TOWER ONSTREAM RIGHT TOWER HEATING	6	EXHAUST PURGE MODE RIGHT TOWER ONSTREAM LEFT TOWER PRE-COOLING
1	EXHAUST PURGE MODE LEFT TOWER ONSTREAM RIGHT TOWER PRE-COOLING	7	EXHAUST PURGE MODE RIGHT TOWER ONSTREAM LEFT TOWER COOLING
2	EXHAUST PURGE MODE LEFT TOWER ONSTREAM RIGHT TOWER COOLING	8	EXHAUST PURGE MODE RIGHT TOWER ONSTREAM LEFT TOWER RE- PRESSURIZING
3	EXHAUST PURGE MODE LEFT TOWER ONSTREAM RIGHT TOWER RE- PRESSURIZING	9	EXHAUST PURGE MODE RIGHT TOWER ONSTREAM LEFT TOWER STANDBY
4	EXHAUST PURGE MODE LEFT TOWER ONSTREAM RIGHT TOWER STANDBY	10	EXHAUST PURGE MODE LEFT TOWER ONSTREAM RIGHT TOWER DE- PRESSURIZING
5	EXHAUST PURGE MODE RIGHT TOWER ONSTREAM LEFT TOWER HEATING	11	EXHAUST PURGE MODE RIGHT TOWER ONSTREAM LEFT TOWER DE- PRESSURIZING