SPX®
WHERE IDEAS MEET INDUSTRY

INSTRUCTION MANUAL

Heat of Compression Desiccant Air Dryers

HCD SERIES
350 - 10000 scfm (595 - 16990 nm³/h)

FORM NO.: 7429789 REVISION: 03/2015

READ AND UNDERSTAND THIS MANUAL PRIOR TO OPERATING OR SERVICING THIS PRODUCT.

Hankison®

Contents

1.0 General Safety Information

This equipment is designed and built with safety as a prime consideration; industry-accepted safety factors have been used in the design. Each dryer is checked at the factory for safety and operation. All pressure vessels which fall under the scope of ASME Section VIII, are hydrostatically tested in accordance with the latest addenda. A factory-installed safety relief valve is standard on each dryer.

WARNING — The following safety rules must be observed to ensure safe dryer operation. Failure to follow these rules may void the warranty or result in dryer damage or personal injury.

1. Never install or try to repair any dryer that has been damaged in shipment. See the Receiving and Inspection instructions in this manual for appropriate action.
2. This equipment is a pressure-containing device. Never operate the dryer at pressures or temperatures above the maximum conditions shown on the data plate.

   Never dismantle or work on any component of the dryer or compressed air system under pressure. Vent internal air pressure to the atmosphere before servicing.
3. This equipment requires electricity to operate. Install equipment in compliance with national and local electrical codes. Standard equipment is supplied with NEMA 4,4X electrical enclosures and is not intended for installation in hazardous environments.

   Never perform electrical service on the dryer unless the main power supply has been disconnected. Parts of the control circuit may remain energized when the power switch is turned off.
4. Air treated by this equipment may not be suitable for breathing without further purification. Refer to OSHA standard 1910.134 for the requirements for breathing quality air.
5. Certain parts of the dryer are not insulated and may become hot during normal operation of the dryer. Do not touch any of these areas without first determining the surface temperature.
6. Use only genuine replacement parts from the manufacturer. The manufacturer bears no responsibility for hazards caused by the use of unauthorized parts.

Safety instructions in this manual are boldfaced for emphasis. The signal words ***DANGER***, ***WARNING*** and ***CAUTION*** are used to indicate hazard seriousness levels as follows:

DANGER—Immediate hazard which will result in severe injury or death.

WARNING—Hazard or unsafe practice which could result in severe injury or death.

CAUTION—Hazard or unsafe practice which could result in minor injury or in product or property damage.

The dryer data plate, attached to the electrical control box, contains critical safety and identification information. If the data plate is missing or defaced, immediately contact your local distributor for a replacement.

2.0 Receiving, Storing, and Moving

2.1 Receiving and Inspection

This shipment has been thoroughly checked, packed and inspected before leaving our plant. It was received in good condition by the carrier and was so acknowledged.

Immediately upon receipt, thoroughly inspect for visible loss or damage that may have occurred during shipping. If this shipment shows evidence of loss or damage at time of delivery to you, insist that a notation of this loss or damage be made on the delivery receipt by the carrier's agent. Otherwise no claim can be enforced against the carrier.

Also check for concealed loss or damage. When a shipment has been delivered to you in apparent good order, but concealed damage is found upon unpacking, notify the carrier immediately and insist on his agent inspecting the shipment. The carrier will not consider any claim for loss or damage unless an inspection has been made. If you give the carrier a clear receipt for goods that have been damaged or lost in transit, you do so at your own risk and expense. Concealed damage claims are not our responsibility as our terms are F.O.B. point of shipment. Shipping damage is not covered by the dryer warranty.

2.2 Storing

Store the dryer indoors to prevent damage to any electrical or mechanical components. All packaging material should be left in place until the dryer is in position.

2.3 Handling

The dryer is designed to be moved by means of the shipping skid or the base channels. The dryer may also have lifting lugs for use with an overhead crane. Be sure to attach all of the lift points and use appropriate spreader bars to prevent damage to the dryer.

CAUTION — Never lift the dryer by attaching hooks or slings to the piping, or to any part other than the lifting lugs. Severe structural damage could occur.

3.0 Description

3.1 Function

Heat of Compression Air dryers are an economical and reliable way to dry compressed air to dew points below the freezing point of water. Desiccant dryers lower the dew point of compressed air by adsorbing the water vapor present in the compressed air onto the surface of the desiccant. Adsorption continues until equilibrium is reached between the partial pressure of the water vapor in the air and that on the surface of the desiccant.

These dryers continuously dry compressed air by using two identical towers, each containing a desiccant bed. While one tower is on-stream drying, the other tower is being regenerated (reactivated, i.e. dried out). The towers are alternated on- and off-stream so that dry desiccant is always in contact with the wet compressed air. In this way a continuous supply of dry air downstream of the dryer is possible. The switching from one tower to the other is controlled by a solid-state controller based on a fixed time, the time required to heat the off-line tower (standard) or dew point basis (optional).

1. Fixed Cycle
   When a tower is configured for regeneration, the desiccant is regenerated by driving off (desorbing) the water collected on its surface. Regeneration is accomplished with the hot air from the final stage of compression. The elevated air temperature and resultant low relative humidity creates the necessary dry purge air for regeneration. The hot purge air flows down through the desiccant bed, desorbs the moisture from the desiccant, and carries the desorbed water out of the tower. Heating continues until the minimum drying time has expired at which time the towers switch.

2. Standard Cycle
   When a tower is configured for regeneration, the desiccant is regenerated by driving off (desorbing) the water collected on its surface. Regeneration is accomplished with the hot air from the final stage of compression. The elevated air temperature and resultant low relative humidity creates the necessary dry purge air for regeneration. The hot purge air flows down through the desiccant bed, desorbs the moisture from the desiccant, and carries the desorbed water out of the tower. Heating is “complete” when the temperature of the air exiting the bottom of the bed sensor rises to a preset level. The heating flow rate and thus heat time will vary depending upon the downstream air demand. High air demand will shorten the time and low air demand will lengthen the heat time. If heating completes quickly, purge air continues to flow through the off-stream tower until the Minimum Drying Time set point been met.

3. Dew Point Control (Option)
   The regenerating tower is heated through in exactly the same way as described previously; however, the Dew Point Control makes use of an outlet dew point transmitter sampling the dried air to monitor the outlet air dew point and extend the drying period until the bed capacity is exhausted before tower switchover is initiated. Longer drying times extend bed life by minimizing thermal cycling of the adsorbent. In addition, extended drying times also minimize the frequency of switchover temperature & dew point “spikes” and increase overall reliability by minimizing valve cycles.

4.0 Installation

4.1 System Arrangement

Install the dryer as close as possible downstream of the compressor to minimize temperature drop between the compressor outlet and the dryer inlet. Air to the dryer must be no more than 450°F and contain no oil liquids or vapors.

The standard dryer package includes a water-cooled heat exchanger followed by a moisture separator to cool the air and remove condensed water prior to passing into the drying tower. The system is designed for 85°F maximum cooling water temperature to achieve a maximum 95°F air temperature to the drying bed. Temperatures above 95°F (35°C) reduce drying capacity. Contact your local distributor for information on proper dryer sizing at elevated water and/or inlet air temperatures.

To ensure downstream air purity (prevent desiccant dust from traveling downstream) adequate filtration downstream of the dryer is required. A High Temperature Afterfilter, typically rated at 450°F (232°C) operating temperature and capable of removing all desiccant fines 1 micron and larger should be installed at the dryer outlet.

WARNING — The afterfilter, if installed, must be rated for 450°F (232°C).

4.2 Ambient Air Temperature

Locate the dryer under cover in an area where the ambient air temperature will remain between 35°F (2°C) and 120°F (49°C).

NOTE: If dryer is installed in ambients below 35°F (2°C), low ambient protection requiring heat tracing and insulation of the separator bowl, auto drains, and lower piping with inlet switching valves is necessary to prevent condensate from freezing. If installing heat tracing, observe electrical class code requirements for type of duty specified.

NOTE: Low ambient temperature increases heat loss from the vessel shell, resulting in lower adsorbent regeneration temperature and higher outlet dew points. The tower insulation option is recommended for installations exposed to temperatures below 50°F.

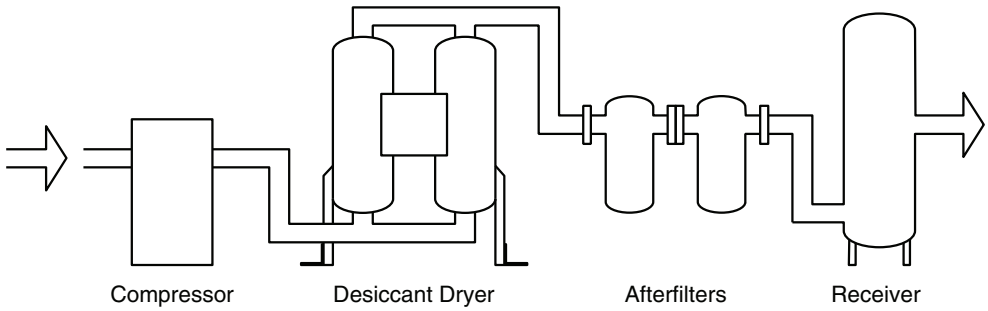


Figure 1
Typical System Configuration

4.3 Location and Clearance

Install the dryer on a level pad. Ensure the dryer is level by grouting or shimming as necessary. Holes are provided in the dryer base members for floor anchors. Securely anchor the dryer frame to the floor. Allow 24 inches clearance on all sides of the dryer for servicing. Provide adequate clearance for separator element and afterfilter element replacement. Provide protection for the dryer if it is installed where heavy vehicles or similar portable equipment is likely to cause damage.

4.4 Piping and Connections

All external piping must be supplied by the user unless otherwise specified. Refer to the General Arrangement Drawings in the back of the manual for connection sizes. Inlet and outlet isolation valves and a vent valve are recommended so the dryer can be isolated and depressurized for servicing. The connections and pipe fittings must be rated for or exceed the maximum operating pressure given on the dryer nameplate and must be in accordance with industry-wide codes. Be sure all piping is supported. Do not allow the weight of any piping to bear on the dryer or filters. Piping should be the same size as or larger than the dryer connection. Piping smaller than the dryer connections will cause high pressure drop and reduce drying capacity.

Consult the factory for piping details if required.

Dryer bypass piping may be installed to allow uninterrupted airflow during servicing. If the downstream application cannot tolerate unprocessed air for short periods, install a dryer system in the bypass line.

CAUTION — Do not hydrostatically test the piping with the dryer in the system. The desiccant will be damaged if saturated with water.

4.5.1 Water Connections

Connect cooling water inlet and outlet. See Table 1 for cooling water requirements.

Dryer	Parallel Exchangers	Water Flow	Water Connection(s)
Model	**Required**	**GPM**	**MPT**
350	1	8.7	1.5
450	1	11.2	2.0
600	1	15.0	2.0
800	1	19.9	2.0
1025	1	25.6	2.0
1300	1	32.4	2.0
1500	2	37.4	2.0
1800	2	44.9	2.0
2100	2	52.3	2.0
2400	2	59.8	2.0
3250	2	81.0	2.0
3700	3	92.2	2.0
4425 5000 6100 7500 8500 10000	Consult Factory		

TABLE 1
COOLING WATER REQUIREMENTS
(Maximum Cooling Water Supply Temperature: 85°F)
(Maximum Cooling Water Return Temperature: 120°F)

4.5.2 Automatic Condensate Drains

An automatic electric demand drain discharges condensate removed by the separator. A second, timer drain, is provided as back-up. Condensate should be piped to an open, vented floor drain or sump. See Table 2 for expected water flow from separator drain.

NOTE: Discharge is at system pressure. Drain line should be anchored.

Model	Peak Drain Rate
scfm	gph
350	4.0
450	5.1
600	6.8
800	9.1
1025	11.6
1300	14.7
1500	17.0
1800	20.4
2100	23.8
2400	27.2
3250	36.8
3700	41.9
4425 5000 6100 7500 8500 10000	Consult Factory

TABLE 2
EXPECTED WATER FLOW FROM SEPARATOR

4.5 Electrical Connections

WARNING — These procedures require entering gaining access to the dryer's electrical enclosure(s). All electrical work must be performed by a qualified electrical technician.

Connect the proper power supply to the dryer according to the electrical drawings in the back of this manual. Be sure to follow all applicable electrical codes.

NOTE: A disconnect switch is not provided as standard equipment and therefore, must be supplied by the customer.

Dry contacts (voltage free) are provided in the low tension electrical enclosure for a remote alarm. The contact ratings are shown on the electrical drawing.

Connections to voltage-free common alarm contacts with a minimum 5-amp rating can be made at terminals TB4-1 through 3.

- Terminal TB4-3 is the common alarm connection.
- Terminal TB4-1 is the N.O.. (normally open) contact connection.
- Terminal TB4-2 is the N.C. (normally closed) contact connection.
- The alarm relay coil is energized when power is supplied to the controller input terminals and there are no alarms.
- The coil is de-energized when power is removed or when an alarm condition exists.
- The common alarm is designed to activate on: a) either a dryer fault condition or a service reminder, or b) a dryer fault condition. This is user selectable.
- For the common alarm to activate on either a dryer fault condition or a service reminder, the jumper at JP6 is removed. This is the default configuration.
- To have the common alarm activate on a dryer fault condition only, the jumper at JP6 is installed.

4.5.1 RS-232 Connections

RS-232 connections can be made at the 3-pin connector labeled J3 and located at the upper left-handed corner of the control board. A cable for this connection can be purchased through your distributor.

4.6 Initial Desiccant Charge

Heat of Compression Air dryers use activated alumina as the desiccant in the dryer towers.

All desiccant shipped loose must be added to the dryer towers before the dryer is put into service.

Refer to TABLE 3, DESICCANT REQUIREMENTS for desiccant type and quantity per tower.

To Add Desiccant

WARNING — The following procedure provides instructions for adding the initial desiccant to the towers. If replacing desiccant, refer to the Maintenance section of this manual.

1. Verify pressure gauges of both towers indicate 0 psig. If not, depressurize the towers according to the shutdown instructions in the Operation section of this manual.
2. Remove the pipe plug or fill port flange cover (where applicable) from the desiccant fill port at the top of each tower. Refer to the General Arrangement drawings in the back of the manual for the fill port location.

CAUTION – Pouring desiccant creates a fine dust; safety goggles, gloves and a dust mask should be worn by personnel installing desiccant. Refer to the Material Safety Data Sheet that accompanies desiccant shipped loose for more complete information.

CAUTION – Do not tamp the desiccant in the towers. Tamping damages desiccant and causes dusting.

3. Refer to Table 3 for desiccant **quantity per tower.**

   When using Table 3 you will find the desiccant quantities listed in layers. Each layer will vary in depth due to the type, quantity and purpose of the desiccant. Layer 1 must be installed first at the bottom of the tower followed by layer number 2 etc., until the complete charge of desiccant has been installed.

4. Utilizing an appropriate sized funnel, fill each desiccant tower as follows:

   a. Install the required quantity of tower media in layer 1 of each tower.

   b. Level layer 1 and each subsequent layer of desiccant as added to each tower.

   c. Finish filling each tower with desiccant until all desiccant has been installed. LIGHT tapping on the tower sides with a soft-face mallet should yield additional free space to allow installation of all desiccant required. **DO NOT TAMP OR RAM DESICCANT**.

5. Clean the fill port closure. Replace the fill plug using Teflon tape or another pipe thread sealant suitable for compressed air service. Reinstall fill port flange cover (where applicable) in each desiccant tower.

Layer / Model	1	2
350	200# 1/4" bead AA*	—
450	200# 1/4" bead AA*	—
600	350# 1/4" bead AA*	—
800	350# 1/4" bead AA*	—
1025	450# 1/4" bead AA*	—
1300	575# 1/4" bead AA*	—
1500	675# 1/4" bead AA*	—
1800	90# 1/2" Bed Support	850# 1/4" bead AA*
2100	120# 1/2" Bed Support	925# 1/4" bead AA*
2400	120# 1/2" Bed Support	1075# 1/4" bead AA*
3250	180# 1/2" Bed Support	1375# 1/4" bead AA*
3700	300# 1/2" Bed Support	1625# 1/4" bead AA*
4425 5000 6100 7500 8500 10000	Consult Factory	

* AA = Activated Alumina

TABLE 3
DESICCANT REQUIREMENTS
(Quantity per Tower)

5.0 Instrumentation

The following instrumentation helps in monitoring dryer operation and performance. Instruments which are available as options are so noted.

Heat of Compression Air dryers are rated NEMA 4 and include the following:

- Solid State Controls
- Tower Pressure Gauges
- Color Change Moisture Indicator
- Dryer Inlet, Left Tower, Right Tower & Dryer Outlet Temperature Sensors
- Switch Failure Alarm (Option)
- Dew Point Transmitter (Option)

5.1 Controls

The solid-state dryer controls are located in a polycarbonate, NEMA Class 4/4X, IP66 rated electrical enclosure mounted to a center panel located between the two desiccant towers. Control features include:

- 15 LED's to indicate operating status and fault conditions.
- Two line text display to provide status and diagnostic messages.
- Upon power loss, dryer "fails safe" (valves remain in position). On power recovery, controller resumes where power was lost.

5.2 Tower Pressure Gauges

Panel mounted gauges indicate pressure in each desiccant tower.

5.3 Color Change Moisture Indicator

A color-change moisture indicator mounted on the outlet piping manifold that provides a constant visual indication that dry gas is being supplied to the dryer outlet connection. A sampling line installed at the dryer's outlet, supplies a small, continuous gas sample to the moisture indicator for circulation.

As illustrated in Figure 2, the gas sample supplied from the dryer outlet enters the moisture indicator's inlet connection (1), and circulates through a desiccant-filled sight dome (2). The granular indicator (3), is a specially treated "silica gel" which gradually changes from blue to pink in color whenever a "wet" gas sample is received. The color will return to blue when dry gas is once again supplied to the dryer outlet. The indicator's change

from blue (dry) to pink (wet), alerts personnel of a dryer-associated moisture problem which requires investigation. The gas exits the indicator through a porous disc (4) and then vents to atmosphere through an adjustable bleed valve (5).

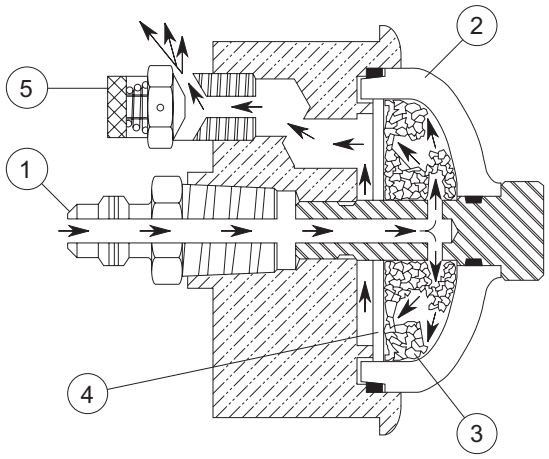


Figure 2
Color Change Moisture Indicator

5.4 Valve Switch-Failure Alarm (Option)

Limit switches are located on each switching valve to trigger an alarm when any valve is not in the correct position. If triggered, the dryer control system will energize the red alarm LED on the control panel and de-energize the common alarm relay. The alarm automatically clears once the alarm conditions are corrected.

5.5 Dew Point Control (Option)

This option monitors and displays outlet pressure dew points and provides an alarm signal if the dew point exceeds user-specified set point. Recommended calibration interval is 12 months. Contact the service department for details.

Operation – The dew point is measured at the dryer operating pressure and is displayed in the operator interface. When the controller is configured for Dew Point Control mode, the on-stream tower will not switch and regenerate until a predetermined dew point has been reached. This elimination of unnecessary heat cycles extends dryer desiccant and component life.

To protect the dew point transmitter from high temperatures and dew point, a solenoid valve is used to isolate the transmitter immediately after tower reversal.

If the dew point transmitter fails or reports a reading outside of its operating range, the display will indicate a sensor failure alarm condition. If the dryer is configured for Dew Point Control mode when a transmitter alarm occurs the controller will revert to the Standard Cycle until the alarm condition clears.

6.0 Operation

6.1 Controls

A solid-state controller monitors all critical operating conditions, and indicates operating status on a 2-line LCD display operator interface. The controller receives input data from temperature sensors, limit switches (option), the Dew Point Transmitter (option) and the operator interface. The operator interface displays information about the dryer operating status and is used to change the dryer operating mode.

6.2 Operating Modes

6.2.1 Automatic and Manual Advance

The drying and regeneration cycles are divided into discrete steps. The operator selects either one of the automatic modes (Fixed Cycle, Standard Cycle or Dew Point Control) or manual advance mode (Manual Mode) through the operator interface.

Selecting any of the automatic modes enables the controller to advance the program step-by-step according to the programmed schedule.

Setting up the controller for manual advance allows the operator to advance the program one step at a time. This mode is used for diagnostic purposes.

6.2.2 Fixed Cycle, Standard Cycle and Dew Point Control

Fixed Cycle: Each tower is on-line (drying) for a set minimum time period.

Standard Cycle: Each tower is on-line (drying) for a set minimum time period plus any additional time required to complete bed heating during low flow conditions. At lower than design flow rates, the time required for bed heating will increase which will result in a longer drying time between regenerations and fewer desiccant heat cycles.

Dew Point Control: Each tower remains on-line (drying) until the desiccant bed has been fully utilized. For lower than designed moisture loads, this results in longer drying cycles, longer time between regenerations and fewer desiccant heat cycles. Dew Point Control is an optional feature.

The operator interface is used to select the operating mode.

6.3 Operating Sequence Description
(Refer to P&ID drawing in back of manual)

6.3.1 Fixed Cycle and Standard Cycle

1. Left Tower Regenerating – Right Tower Drying

Valves Opened:
- Left Purge Inlet Valve (V2)
- Left Purge Outlet Valve (V4)
- Right Drying Inlet Valve (V5)
- Right Drying Outlet Valve (V7)

Valves Closed:
- Right Purge Inlet Valve (V1)
- Right Purge Outlet Valve (V3)
- Left Drying Inlet Valve (V6)
- Left Drying Outlet Valve (V8)

Flow:

Hot compressed air flow:

a. Left Purge Inlet Valve (V2)

b. Left Tower – flowing downward as previously adsorbed moisture is removed from the desiccant.

c. Left Tower Purge Outlet Valve (V4)

d. Purge Air Cooler – The compressed air flow is cooled before being dried.

Cool compressed air flow:

e. Purge Air Separator – removes condensed water from the air to be dried

f. Right Tower Drying Inlet Valve (V5)

g. Right Tower – flowing upward as the air is dried

h. Right Tower Drying Outlet Valve (V7) - Dry air exits the dryer

Fixed Cycle: The towers switch after the minimum drying time has expired.

Standard Cycle: When the Left Tower has heated through it is fully regenerated and ready for another drying period. The Left Tower continues to heat until heated through as detected by the temperature sensor in the lower pipe manifold. Once the Left Tower is heated through the towers switch once the Minimum Drying Time expires.

2. Right Tower Drying – Left Tower Regenerating
Operation is as described above except all valves positions are opposite.

State Transition Conditions

ID	State Description	Fixed Cycle	Standard Cycle	Dew Point Control Cycle	Manual Cycle
0	Left Heat (1) Transition to: Left Heat (2)	State Timer > Fixed Heat (1) Time	LT Temperature > Heat (1) Complete Temperature	LT Temperature > Heat (1) Complete Temperature	Manual Advance Button Pressed
1	Left Heat (2) Transition to: Left Standby	Drying Timer > Minimum Drying Time	LT Temperature > Heat (2) Complete Temperature	LT Temperature > Heat (2) Complete Temperature	Manual Advance Button Pressed
2	Left Standby Transition to: Right Heat (1)	Drying Timer > Minimum Drying Time	State Timer > Standby Time AND Drying Timer > Minimum Drying Time	Dew Point > Dew Point Control Set Point AND Drying Timer > Minimum Drying Time	Manual Advance Button Pressed
3	Right Heat (1) Transition to: Right Heat (2)	State Timer > Fixed Heat (1) Time	RT Temperature > Heat (1) Complete Temperature	RT Temp > Heat (1) Complete Temperature	Manual Advance Button Pressed
4	Right Heat (2) Transition to: Right Standby	Drying Timer > Minimum Drying Time	RT Temperature > Heat (2) Complete Temperature	RT Temperature > Heat (2) Complete Temperature	Manual Advance Button Pressed
5	Right Standby Transition to: Left Heat (1)	Drying Timer > Minimum Drying Time	State Timer > Standby Time AND Drying Timer > Minimum Drying Time	Dew Point > Dew Point Control Set Point AND Drying Timer > Minimum Drying Time	Manual Advance Button Pressed

TABLE 4
State Transition Conditions

6.3.2 Dew Point Control (option)

Operation of the DEW POINT Control is identical to the Standard Cycle except the drying time is extended until the desiccant bed in the on-line tower has been fully utilized. The off-line tower is regenerated and remains in a stand-by mode after being repressurized.

At tower switchover, a 2-way solenoid valve isolates the dew point transmitter until the sequence advances to "Heat(2)". This protects the dew point transmitter from the temperature and humidity "bump" that occurs at tower switchover. The transmitter detects the dew point of an outlet air sample then exhausts to atmosphere. The drying tower remains on-line until the outlet dew point rises to the level set by the user through the Program Mode.

6.4 Control Board Jumpers

In the upper left hand corner of the control board there are eight two-pin jumpers labeled JP1 through JP8. Only four of the eight jumper pairs are utilized. The jumper is a removable bridge that is used to make or break continuity between two pins that form a pair. When installed in the ON position, the jumper is place on both pins of the pair and continuity between the pins is established. When installed in the OFF position, the jumper is removed or stored on a single pin and continuity is broken. Jumper functions are as follows:

1. **JP1 – Reserved**
2. **JP2 – Reserved**
3. **JP3 – Dew Point Transmitter**
   Jumper JP3 is installed in the ON position when a Dew Point Transmitter is installed.

   If DEW POINT CONTROL is not selected then the dew point signal does not control the dryer cycle but still serves a monitoring and alarm function.
4. **JP4 – Low Inlet Temperature**
   Jumper JP4 is installed in the ON position to enable Low Inlet Temperature Alarm.
5. **JP5 – Reserved**
6. **JP6 – Common Alarm**
   Jumper JP6 is installed in the OFF position to enable both the dryer fault alarms and service alarms to activate the common alarm. This is the default configuration. Install jumper JP6 in the ON position if the common alarm is to activated by a dryer fault alarm only.
7. **JP7 – Reserved**
8. **JP8 – MODBUS RS-232**
   Jumper JP8 is installed in the OFF position to enable MODBUS RS-232.

6.5 Operator Interface

Refer to *Figure 3, Front Panel Overlay* for information regarding the location and function of the LEDs, switches, and text display.

6.5.1 Front Panel LED's

- Power On - green
- Alarm - red
- Service / Maintenance reminder - amber
- Filters (separator, afterfilter, and pilot) service / maintenance reminders - amber
- Switching valve status (On = valve open; Off = valve closed) - green
- Left and right tower status (heating) - amber
- Left and right tower status (drying) - green

6.5.2 Front Panel Switches

The front panel contains four momentary-contact push-button switches. Refer to *Figure 3, Front Panel Overlay* for the appropriate icon associated with each switch. Pushing on the overlay icon actuates the switch.

Data Display Switch
This switch is used to step through the display screens.

Select Switch
This button is located to the left of the text display window. Refer to the Front Panel Operation Section for additional information.

ENTER Switch
This button is located to the right of the text display window. Refer to the Front Panel Operation Section for additional information.

Alarm Reset Switch
This button is normally used to reset an alarm or service reminder. Refer to the Front Panel Operation Section for additional information.

6.5.3 Front Panel Operation

1. There are three controller menu modes for the Heat of Compression Dryer.
   a. Program Mode
   b. Setup Mode
   c. Display Mode
2. Each Mode is described below.

6.5.4 Program Mode

1. Press and hold ↵ and ◡ for 3 seconds to enter Program Mode.
2. Program Mode is comprised of the screens that are described below and over the next few pages and illustrated in Figure 4.
3. There are three (3) ways to exit Program Mode.
   a. Press ↵ after making the selection in the final screen.
   b. At any screen, press and hold ↵ for 3 seconds.
   c. The controller automatically exits Program Mode if no button is pressed within 60 seconds.

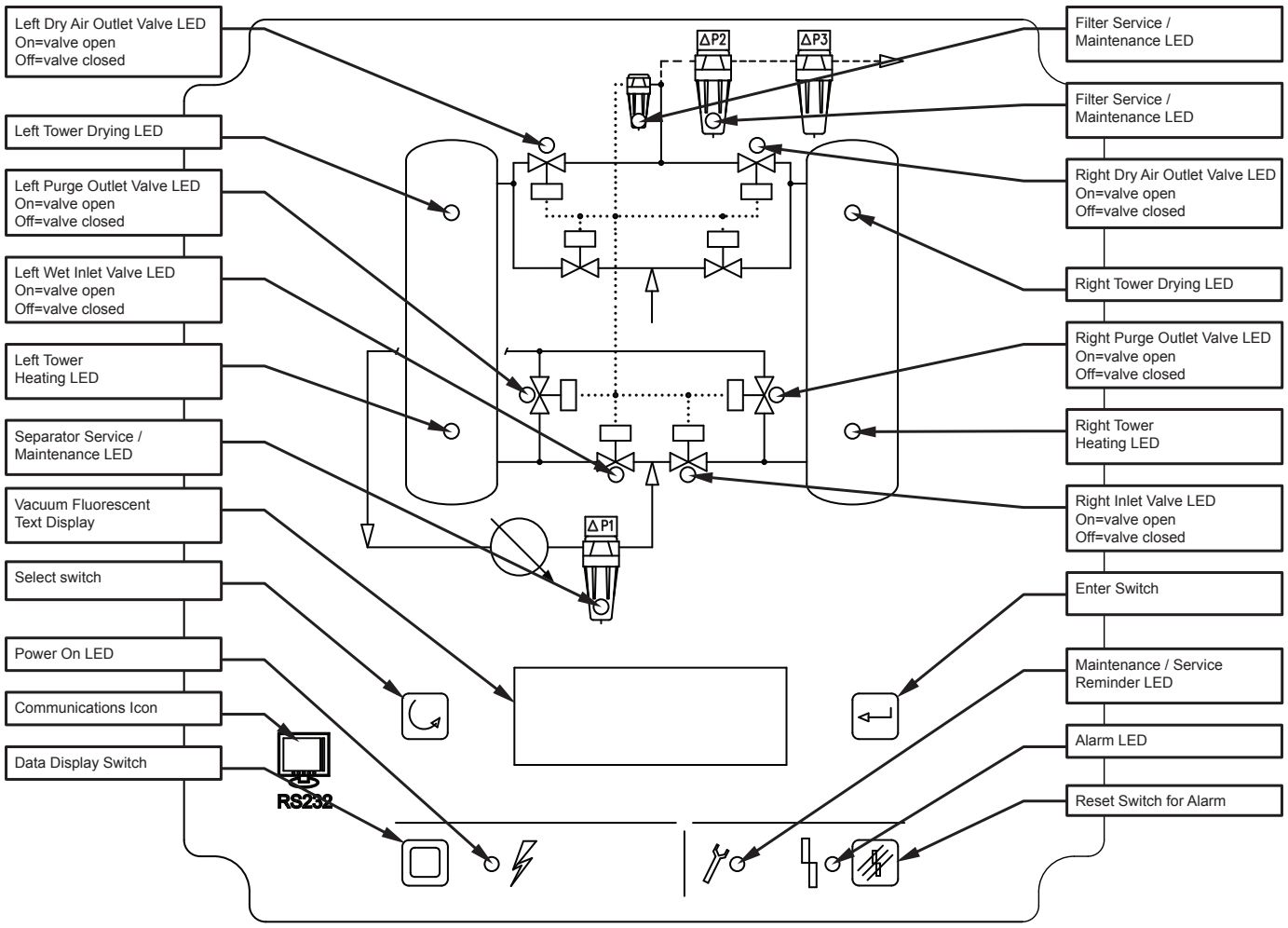


Figure 3
Front Panel Overlay

4. Upon exiting Program Mode the controller will switch to Display Mode.

Screen 1: Select the Language

ENGLISH

1. Press ↻ to scroll through the choices: ENGLISH, FRANCAIS and ESPANOL.
2. When finished, press ↵ to save the selection and move to the next screen.

Screen 2: Select the Service Level

SERVICE LEVEL
NORMAL

1. Press ↻ to toggle between NORMAL and SEVERE.
   a. NORMAL Service Intervals are:
      i. 4000 hours for filters
      ii. 8000 hours for desiccant
      iii. 8000 hours for valves
   b. SEVERE Service Intervals are:
      i. 2000 hours for filters
      ii. 4000 hours for desiccant
      iii. 4000 hours for valves
2. When finished, press ↵ to save the selection and move to the next screen.

Screen 3: Reset the Timer for Filter Service

FILTER SERVICE
RESET? NO

1. Press ↻ to toggle between NO and YES.
2. When finished, press ↵ to acknowledge the selection and move to next screen.

Screen 4: Reset the Timer for Valve Service

VALVES SERVICE
RESET? NO

1. Press ↻ to toggle between NO and YES.
2. When finished, press ↵ to acknowledge the selection and move to next screen.

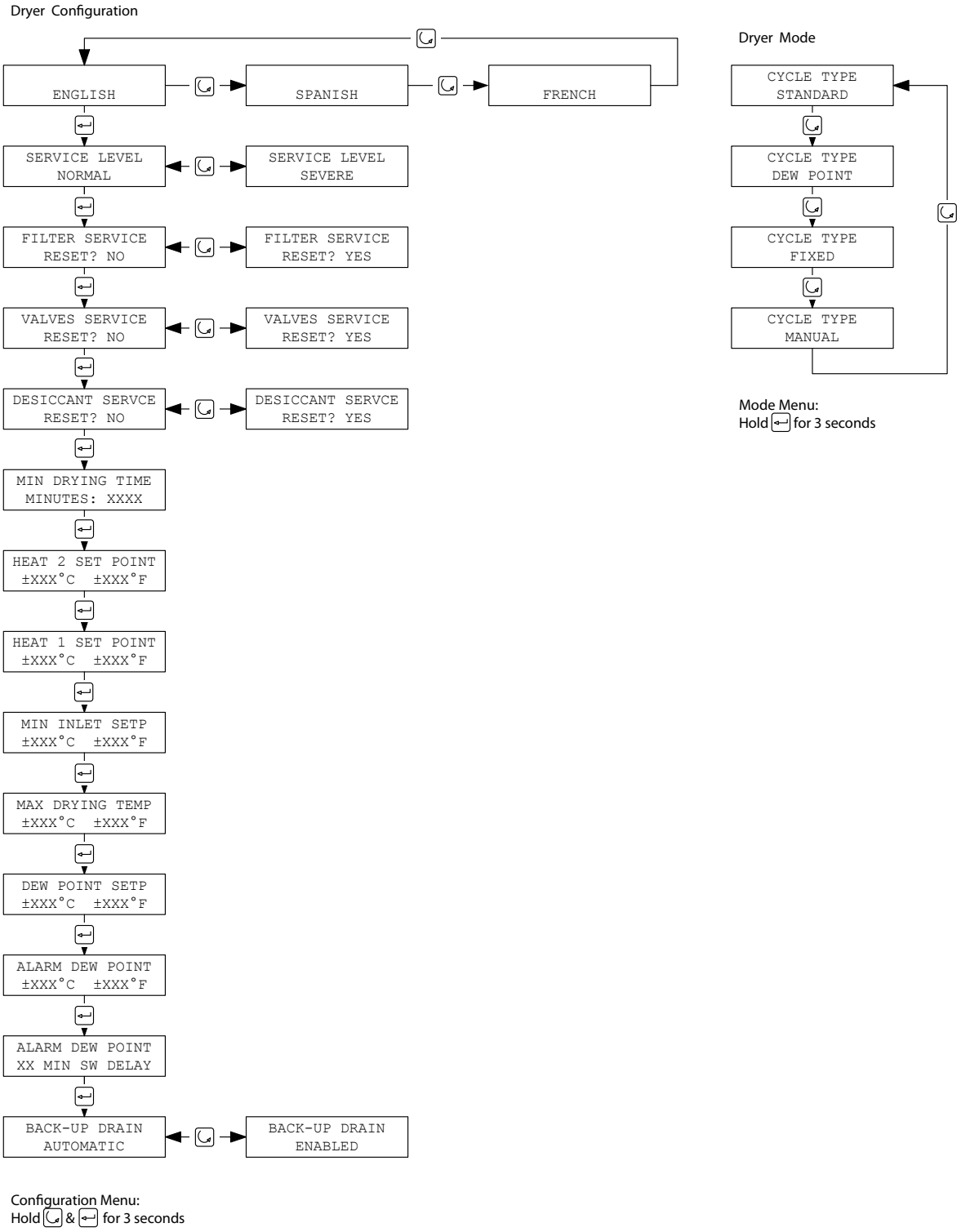


Figure 4
Program and Setup Mode Screen Illustrations

Screen 5: Reset the Timer for Desiccant Service

DESICCANT SERVICE
RESET? NO

1. Press ↻ to toggle between NO and YES.
2. When finished, press ↵ to acknowledge the selection and move to next screen.

Screen 6: Set Minimum Drying Time

MIN DRYING TIME
MINUTES: XXXX

1. Press ↻ to increment the setting to the desired value.
   a. Standard set point is 30 minutes.
   b. The allowable range of values is from 20 to 180 minutes in 5 minute increments.
2. When finished, press ↵ to acknowledge the selection and move to next screen. Exit Program Mode when there are no more active screens to display.

Screen 7: Set the Heat (2) Complete Set Point

HEAT 2 SET POINT	
±XXX°C	±XXX°F

1. Press ↻ to increment the setting to the desired value.
   a. Standard set point is 100°C (212°F).
   b. The allowable range of values is a minimum 75°C (167°F) to a maximum 150°C (302°F) in 5°C (9°F) increments.

   NOTE: The standard set point is suitable for most applications. The set point is adjustable to accommodate very low, or very high, compressor discharge temperatures where an adjustment may be required.
2. When finished, press ↵ to acknowledge the selection and move to next screen. Exit Program Mode when there are no more active screens to display.

Screen 8: Set the Heat (1) Complete Set Point

HEAT 1 SET POINT	
±XXX°C	±XXX°F

1. Press ↻ to increment the setting to the desired value.
   a. Standard set point is 75°C (167°F).
   b. The allowable range of values is 65°C (149°F) to "HEAT (2) COMPLETE SET POINT" minus 10°C (18°F) in 5°C (9°F) increments.

   NOTE: The standard set point is suitable for most applications. The set point is adjustable to accommodate very low, or very high, compressor discharge temperatures where an adjustment may be required.
2. When finished, press ↵ to acknowledge the selection and move to next screen. Exit Program Mode when there are no more active screens to display.

Screen 9: Set the Minimum Inlet Temperature Set Point

MIN INLET SETP	
±XXX°C	±XXX°F

1. Press ↻ to increment the setting to the desired value.
   a. Standard set point is "HEAT (2) COMPLETE SET POINT" plus 30°C (54°F).
   b. The allowable range of values is: "HEAT (2) COMPLETE SET POINT" plus 10°C (18°F) to 60°C (108°F) in 5°C (9°F) increments.
2. When finished, press ↵ to acknowledge the selection and move to next screen. Exit Program Mode when there are no more active screens to display.

Screen 10: Set the Maximum Drying Temperature Set Point

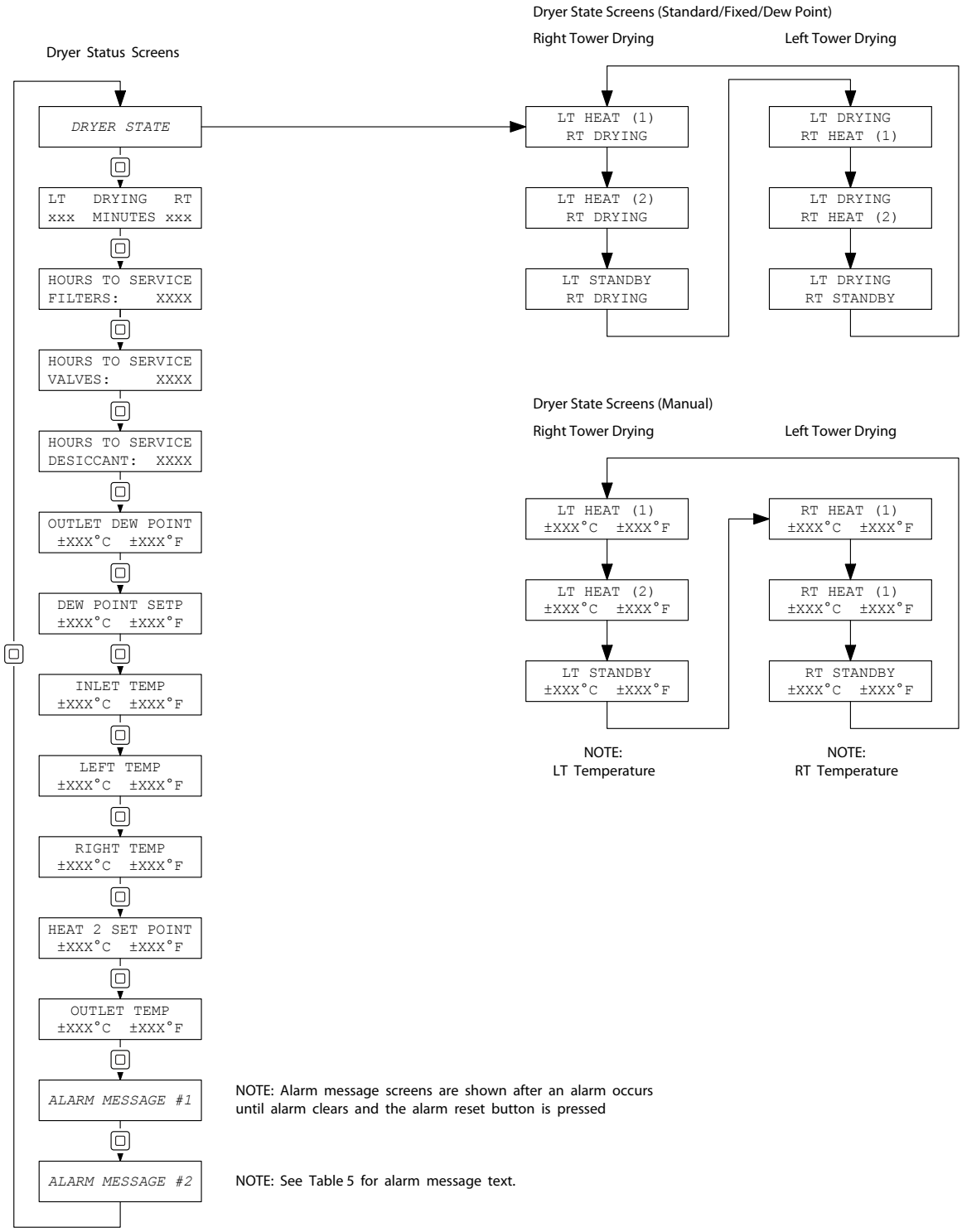
MAX DRYING TEMP	
±XXX°C	±XXX°F

1. Press ↻ to increment the setting to the desired value.
   a. Standard set point is 40°C (104°F).
   b. The allowable range is: 10°C (50°F) to 56°C (133°F) in 2°C (4°F) increments.
2. When finished, press ↵ to acknowledge the selection and move to next screen. Exit Program Mode when there are no more active screens to display.

Screen 11: Set Point for Dew Point Control
(Displayed only when JP3 "on")

DEW POINT SETP	
±XXX°C	±XXX°F

1. Press ↻ to increment the setting to the desired value.
   a. Standard set point is -5°C (23°F).
   b. The allowable range of values is from -60°C (-76°F) to 15°C (59°F) in 5°C (9°F) increments.
   2. When finished, press ↵ to acknowledge the selection and exit the Program Mode.



NOTE: Alarm message screens are shown after an alarm occurs until alarm clears and the alarm reset button is pressed

NOTE: See Table 5 for alarm message text.

Figure 5
Dryer State and Status Screens

Screen 12: Set Alarm Point for the Dew Point Transmitter (Displayed only when JP3 "on")

ALARM DEW POINT	
±XXX°C	±XXX°F

1. Press ↻ to increment the setting to the desired value.
   a. Standard set point is 0°C (32°F).
   b. The allowable range of values is from a minumum "DEW POINT CONTROL SET POINT" (set in Screen 11) plus 5°C (18°F) to a maximum 20°C (68°F) in 5°C (9°F) increments.
2. When finished, press ↵ to acknowledge the selection and move to next screen. Exit Program Mode when there are no more active screens to display.

Screen 13: Set Alarm Delay for the Dew Point Sensor (Displayed only when JP3 "on")

ALARM DEW POINT
XX MIN SW DELAY

1. Press ↻ to increment the setting to the desired value.
   a. Standard set point is 5 MINUTES.
   b. The allowable range of values is 1 to 10 MIN in 1 minute increments.
2. When finished, press ↵ to acknowledge the selection and move to next screen. Exit Program Mode when there are no more active screens to display.

Screen 14: Configure Back-up Drain Valve – Automatic or Enabled

BACK-UP DRAIN
AUTOMATIC

1. Press ↻ to toggle between AUTOMATIC or ENABLED.

   In AUTOMATIC mode, electrical power is supplied to the back-up drain circuit only in the event of a primary drain failure. When the Back-up Drain is ENABLED, the back-up drain circuit is continuously powered.
2. When finished, press ↵ to acknowledge the selection and move to next screen. Exit Program Mode when there are no more active screens to display.

6.5.5 Setup Mode

1. Press and hold ↵ for 3 seconds to enter Setup Mode.
2. Setup Mode is comprised of the screens that are described below and illustrated in Figure 4.
3. There are two ways to exit Setup Mode.
   a. Press ↵ after making the selection in Screen 1.
   b. The controller automatically exits Setup Mode if no button is pressed with 60 seconds.
4. One of two things will happen upon exiting Setup Mode.
   a. The controller will switch to Display Mode if FIXED CYCLE, STANDARD CYCLE or DEW POINT CONTROL is selected.
   b. The controller will switch to Manual Mode if MANUAL CYCLE is selected.

Screen 1: Select the Cycle Type

CYCLE TYPE
STANDARD

1. Press ↻ to scroll through the choices:
   a. STANDARD
   b. FIXED
   c. DEW POINT (displayed only when JP3 is in the ON position)
   d. MANUAL
2. When finished, press ↵ to save the selection and exit the Setup Mode.

6.5.6 Display Mode

1. Display Mode is active when the user exits Program Mode or Setup Mode.
2. Display Mode is comprised of Dryer State Screens, Dryer Status Screens and Alarm & Service Messages.

6.5.6.1 Dryer State Screens

The State Screens show the current state of the drying sequence. Examples of the dryer states are shown in Figure 5.

6.5.6.2 Dryer Status Screens

By pressing ↻ the user can step through each of the **Dryer Status Screens**. Examples of the dryer status screens are shown in Figure 5.

6.5.6.3 Alarm & Service Messages

1. Local alarm consists of a blinking alarm LED and an alarm message display.
2. After an alarm condition has been corrected:
   a. The alarm LED stops blinking (LED on); the alarm message continues to be displayed.
   b. The alarm reset button must be depressed to clear the alarm LED (LED off) and the alarm message.
   c. When an alarm condition has not been corrected and the "alarm reset" button is pressed, the alarm will not clear.
3. Refer to Table 5 for explanation of alarm conditions.
4. Service Messages

There are two service levels (normal and severe) as described in Program Mode. Each service level has preset time intervals for servicing the filters, desiccant, and valves. Time continues to accumulate as long as power is supplied to the controller, whether the controller is switched on or off

When a service time interval expires the controller operates as follows:

a. The service LED blinks and the appropriate service message is shown on the text display.
   i. When the service interval for filters has expired (see also d below), the three filter LED's also blink.

b. The dryer continues to cycle normally

c. Press the Reset button to extinguish the service LED and to clear the service message from the text display

d. If the dryer has 1 or 2 filter monitors, the timer for filter service is disabled. When the filter monitor(s) send an alarm signal (change filter) to the controller, the controller displays the same LED's and messages it would if the timer for filter service had expired.

RTD Alarm Conditions

Alarm Text	Alarm Trigger	Exit Condition	States	Alarm Action
ALARM LEFT TOWER TEMPERATURE SENSOR FAILURE	LT RTD < -28°C (-18°F) OR LT RTD > 454°C (849°F)	LT RTD > -28°C (-18°F) AND LT RTD < 454°C (849°F)	ALL	Fixed Cycle Activate alarm relay Display local alarm message
ALARM RIGHT TWR TEMPERATURE SENSOR FAILURE	RT RTD < -28°C (-18°F) OR RT RTD > 454°C (849°F)	RT RTD > -28°C (-18°F) AND RT RTD < 454°C (849°F)	ALL	Fixed Cycle Activate alarm relay Display local alarm message
ALARM INLET TEMPERATURE SENSOR FAILURE	Inlet RTD < -28°C (-18°F) OR Inlet RTD > 454°C (849°F)	Inlet RTD > -28°C (-18°F) AND Inlet RTD < 454°C (849°F)	ALL	Activate alarm relay Display local alarm message
ALARM OUTLET TEMPERATURE SENSOR FAILURE	Outlet RTD < -28°C (-18°F) OR Outlet RTD > 454°C (849°F)	Outlet RTD > -28°C (-18°F) AND Outlet RTD < 454°C (849°F)	ALL	Activate alarm relay Display local alarm message
ALARM INLET LOW TEMPERATURE	Inlet RTD < Min. Inlet Temp[1]	Inlet RTD > Min. Inlet Temp	ALL	Activate alarm relay Display local alarm message
ALARM RIGHT TWR HIGH INLET TEMPERATURE	RT RTD > Max. Drying Temp.	RT RTD < Max. Drying Temp	1,2	Activate alarm relay Display local alarm message
ALARM LEFT TOWER HIGH INLET TEMPERATURE	LT RTD > Max. Drying Temp.	LT RTD < Max. Drying Temp	4,5	Activate alarm relay Display local alarm message

[1] Low inlet temperature alarm jumper must be installed.

TABLE 5
Conditions for Alarm and Service Messages
(continued on next page)

Drain Valve Alarm Conditions

Alarm Text	Alarm Trigger	Exit Condition	States	Alarm Action
ALARM DRAIN VALVE FAILURE	Demand drain valve common alarm contact open	Common alarm contact closed	ALL	Activate alarm relay Energize Backup Timer Drain Display local alarm

Pilot Pressure Alarm Conditions

Alarm Text	Alarm Trigger	Exit Condition	States	Alarm Action
ALARM PILOT LOW PRESSURE	Pilot pressure switch open	Pilot pressure switch closed	ALL	Activate alarm relay Halt cycle transitions Display local alarm

Dew Point Control Alarm Conditions[2] (Option)

Alarm Text	Alarm Trigger	Exit Condition	States	Alarm Action
ALARM LEFT TOWER OUTLET DEW POINT	Outlet dew point > dew point alarm set point AND dew point alarm delay	Outlet dew point < dew point alarm set point	4,5	Activate alarm relay Display local alarm
ALARM RIGHT TWR OUTLET DEW POINT	Outlet dew point > dew point alarm set point AND dew point alarm delay	Outlet dew point < dew point alarm set point	1,2	Activate alarm relay Display local alarm
ALARM DEW POINT SENSOR FAILURE	Dew point < -100°C (-148°F) AND dew point alarm delay	Dew point > -100°C (-148°F)	1,2,4,5	Standard Cycle Activate alarm relay Display local alarm

[2] Dew point alarms are checked only when dew point transmitter is installed by setting the dew pointer installed jumper.

Valve Position Control Alarm Conditions (Option)

Alarm Text	Alarm Trigger	Exit Condition	States	Alarm Action
ALARM VALVE LT DRY RT HEAT	IN2 contact open AND 10 sec. delay	IN2 contact closed	3,4,5	Activate alarm relay Display local alarm
ALARM VALVE LT HEAT RT DRY	IN3 contact open AND 10 sec. delay	IN3 contact closed	0,1,2	Activate alarm relay Display local alarm

Service Messages

Alarm Text	Alarm Trigger	Exit Condition	States	Alarm Action
SERVICE DRYER FILTERS	Filter service timer > Filter service interval	Filter service timer reset	ALL	Display local alarm
SERVICE DRYER VALVES	Valve service timer > Valve service interval	Valve service timer reset	ALL	Display local alarm
SERVICE DRYER DESICCANT	Desiccant service timer > Desiccant service interval	Desiccant service timer reset	ALL	Display local alarm

TABLE 5
Conditions for Alarm and Service Messages
(continued from previous page)

6.5.7 Manual Mode

1. Manual Mode is active when the user exits Program Mode after selecting operation in MANUAL CYCLE.
2. Manual Mode is comprised of six (6) screens (see Figure 5 for examples of each screen). Each screen corresponds to one of six (6) program states (described in Table 4).
3. Press ↻ to advance from one screen (Manual step) to the next.

   IMPORTANT: Be sure to read and understand all cautions listed with the screen (program step) descriptions.
4. Upon entering Manual Mode, the program can be at any one of the six steps.
5. To exit Manual Mode:
   a. Press and hold ↵ for 3 seconds to exit Manual Mode. The display switches to Screen 2 of Setup Mode.
   b. Use ↻ to select FIXED, STANDARD, or DEW POINT CONTROL.
   c. Press and hold ↵ for 3 seconds to exit Setup Mode and activate Display Mode.
   d. Dryer operation continues from the last step active when exiting the Manual Mode.

6.6 Start-up

6.6.1 Controller Settings

Set or verify settings on Controller. Detailed operational points are presented in section 6.5

WARNING - Enclosure may have live electric parts. De-energize dryer before opening enclosure.

6.6.2 Initial Pressurization

SLOWLY pressurize dryer to full line pressure. (If the dryer was installed with inlet and outlet isolation valves, the inlet isolation valve should be slowly opened while the outlet isolation valve remains closed.)

During initial start-up, check the entire system for leaks. If necessary, de-pressurize the dryer and correct any leaks.

6.6.2.1 Dew Point Sensor (if installed)

Ensure that the supply air valve is open (one turn). When the dryer is at any step other than LT Heat (1) or RT Heat (1), open and adjust the sample exhaust valve until a very slight, continuous gas bleed is felt exhausting out of the sample cell. (Sensor is isolated with a solenoid valve during LT or RT Heat (1) to protect it from the momentary heat and high humidity condition which occurs at tower switchover.)

6.6.3 Energizing the Dryer

Energize the dryer controls.

6.6.4 Bringing the Dryer Online

Establish a normal flow through the dryer. Slowly open the outlet isolation valve if present. Close any dryer bypass valves.

6.7 Operational Check Points

6.7.1 Power to unit

Check periodically that there is power to the unit (indicating lights illuminated).

6.7.2 Alarms

Periodically check for flashing red alarm LED.

6.7.3 Tower Status LEDs

Illuminated LEDs indicate which tower is on-line drying or off-line regenerating.

6.7.4 Tower Pressure Gauges

Periodically check tower pressure gauges to verify that the pressure gauges read line pressure.

6.7.5 Process Valves

Determine if air control valves are operating and sequencing correctly.

6.7.5.1 Valves – Models 350 & 450

Switching valves are double acting, pneumatically piston-actuated, Y-angle poppet valves.

A 12 volt DC, two position, 5-way pilot solenoid valve wired to the controller is used to direct pilot air to the actuators of the process switching valves.

6.7.5.2 Valves – Models 600 and above

Switching valves are High Performance Butterfly Valves with double acting pneumatic rack and pinion actuators. A yellow arrow indicator located on the top of the actuator output shaft points to valve position indicator icons. Pilot air is directed to actuator ports to open both inlet valves upon loss of power.

A 12 volt DC, two position, 5-way pilot solenoid valve wired to the controller is used to direct pilot air to the actuators of the process switching valves.

6.8 Dryer Shut Down

1. If the dryer installation is equipped with dryer bypass and inlet and outlet isolation valves, the bypass valve should be opened and the inlet and outlet isolation valves closed.
2. De-energize the dryer's electrical supply.
3. SLOWLY open the tower blow down valves (refer to General Arrangement drawings in the back of the manual for general location) to vent the dryer internal pressure.
4. When all dryer pressure gauges indicate zero pressure, close the tower blow down valves. Depressurization is complete.

6.9 Loss of Power

Control valves are designed so that upon loss of power the air dryer is capable of drying air until the desiccant exposed to the airflow is saturated.

6.9.1 Power Recovery:

6.9.1.1 On loss of electrical power –

All controller outputs turn off causing the dryer operating valves to remain in last position.

6.9.1.2 On restoration of power –

The sequence simply resumes at the step where power was lost.

6.10 Using the RS-232 Port

The RS-232 port is used to monitor dryer operation from a host computer.

RS-232 connections are made at the 3-pin connector labeled J3 and located at the upper left-hand corner of the control board. (See Figure 6)

Interface to a PC requires a (1 to 1) DB-9 cable.

Cable Pin Out:

- Data received by host computer on pin 2
- Data transmits from host computer on pin 3
- Ground is pin 5
- Jumper installed between pins 7 and 8

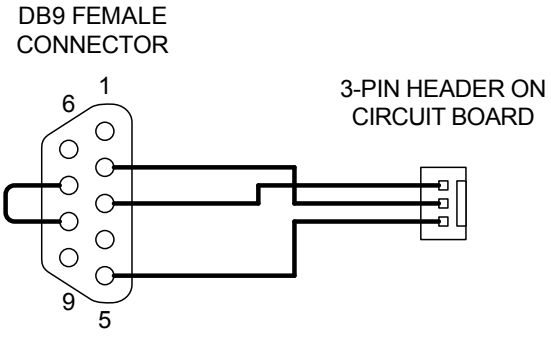


Figure 6
Wiring Diagram for RS-232 Port

Communication Parameters:

RS-232 Parameters	
Baud Rate	9600
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None
Slave ID	1

Modbus Registers

Holding Register		Name	Units	Description
Reference	Address			
40001	0x0000	DRYER_STATUS	Integer	State ID for the current dryer state
40002	0x0001	ALARM_STATUS	Flag Bits	Alarm flag bits
40003	0x0002	WARNING_STATUS	Flag Bits	Warning flag bits
40004	0x0003	SERVICE_STATUS	Flag Bits	Service flag bits
40005	0x0004	OUTLET_DEWPT	Deg C	Outlet air dew point
40006	0x0005	INLET_TEMP	Deg C	Dryer inlet air temperature
40007	0x0006	OUTLET_TEMP	Deg C	Dryer outlet air temperature
40008	0x0007	RT_TEMP	Deg C	Right tower air temperature
40009	0x0008	LH_TEMP	Deg C	Left tower air temperature
40010	0x0009	STATE_TIMER	Minutes	Current state time
40011	0x000A	DRYING_TIMER	Minutes	Current drying tower time
40012	0x000B	LAST_LEFT_TIMER	Minutes	Last left tower drying time
40013	0x000C	LAST_RIGHT_TIMER	Minutes	Last right tower drying time
40014	0x000D	FILTER_USAGE	Hours	Filter usage timer
40015	0x000E	VALVE_USAGE	Hours	Valve usage timer
40016	0x000F	DESICCANT_USAGE	Hours	Desiccant usage timer
40033	0x0020	DRYER_MODE	Integer	Dryer operating mode [0=Standard Cycle, 1=Dew Point Cycle, 2=Fixed Cycle, 3=Manual Cycle]
40034	0x0021	LANGUAGE	Integer	Language [0=English, 1=Spanish, 2=French]
40035	0x0022	SERVICE_LEVEL	Integer	Service level [0=Normal, 1=Severe]
40036	0x0023	FILTER_SRVC_TIME	Hours	Filter service interval
40037	0x0024	VALVE_SRVC_TIME	Hours	Valve service interval
40038	0x0025	DESICCANT_SRVC_TIME	Hours	Desiccant service interval
40039	0x0026	MIN_DRYING_TIME	Minutes	Minimum drying time set point
40040	0x0027	STANDBY_TIME	Minutes	Standby time set point
40041	0x0028	HEAT_1_TERM_TEMP	Deg C	Heat stage 1 termination temperature set point
40042	0x0029	HEAT_2_TERM_TEMP	Deg C	Heat stage 2 termination temperature set point
40043	0x002A	MIN_INLET_TEMP	Deg C	Minimum dryer inlet air temperature set point
40044	0x002B	MAX_DRYING_TEMP	Deg C	Maximum drying tower inlet air temperature set point
40045	0x002C	DEWPT_CTRL	Deg C	Dew point control set point
40046	0x002D	DEWPT_ALRM	Deg C	Dew point alarm set point
40047	0x002E	DEWPT_DELAY	Minutes	Dew point alarm delay
40048	0x002F	BACKUP_DRAIN	Integer	Back-up Drain [0=Automatic, 1=Enabled]
40065	0x0040	JUMPERS	Flags	Jumper flag bits

Modbus Register Details

Dryer State	
Register	40001

Integer		
Decimal	Hexadecimal	Description
0	0x0000	Left Heat 1
1	0x0001	Left Heat 2
2	0x0002	Left Standby
3	0x0003	Right Heat 1
4	0x0004	Right Heat 2
5	0x0005	Right Standby

Alarm ID	
Register	40002

Flags		
Bit	Mask	Description
0	0x0001	Left tower temperature sensor failure
1	0x0002	Right tower temperature sensor failure
2	0x0004	Primary drain valve failure
3	0x0008	Left tower drying limit switch failure
4	0x0010	Right tower drying limit switch failure
5	0x0020	Dew point sensor failure
6	0x0040	Low pilot pressure alarm
7	0x0080	Reserved
8	0x0100	Reserved
9	0x0200	Reserved
10	0x0400	Reserved
11	0x0800	Reserved
12	0x1000	Reserved
13	0x2000	Reserved
14	0x4000	Reserved
15	0x8000	Reserved

Warning ID	
Register	40003

Flags		
Bit	Mask	Description
0	0x0001	Inlet temperature sensor failure
1	0x0002	Low dryer inlet air temperature
2	0x0004	Left tower high air temperature
3	0x0008	Right tower high air temperature
4	0x0010	Left tower high outlet dew point
5	0x0020	Right tower high outlet dew point
6	0x0040	Outlet temperature sensor failure
7	0x0080	Reserved
8	0x0100	Reserved
9	0x0200	Reserved
10	0x0400	Reserved
11	0x0800	Reserved
12	0x1000	Reserved
13	0x2000	Reserved
14	0x4000	Reserved
15	0x8000	Reserved

Modbus Register Details

Service ID	
Register	40004

Flags		
Bit	Mask	Description
0	0x0001	Service dryer filters
1	0x0002	Service dryer valves
2	0x0004	Service dryer desiccant
3	0x0008	Reserved
4	0x0010	Reserved
5	0x0020	Reserved
6	0x0040	Reserved
7	0x0080	Reserved
8	0x0100	Reserved
9	0x0200	Reserved
10	0x0400	Reserved
11	0x0800	Reserved
12	0x1000	Reserved
13	0x2000	Reserved
14	0x4000	Reserved
15	0x8000	Reserved

Jumpers	
Register	40065

Flags		
Bit	Mask	Description
0	0x0001	DIP Switch 1 - Reserved
1	0x0002	DIP Switch 2 - Reserved
2	0x0004	DIP Switch 3 - Dew Point Monitor [0=Not Installed, 1=Installed]
3	0x0008	DIP Switch 4 - Low Inlet Temperature Alarm [0=Disabled, 1=Enabled]
4	0x0010	DIP Switch 5 - Reserved
5	0x0020	DIP Switch 6 - Service Alarms [0=Enabled, 1=Disabled]
6	0x0040	DIP Switch 7 - Reserved
7	0x0080	DIP Switch 8 - RS-232 Debug [0=Disabled, 1=Enabled]
8	0x0100	Reserved
9	0x0200	Reserved
10	0x0400	Reserved
11	0x0800	Reserved
12	0x1000	Reserved
13	0x2000	Reserved
14	0x4000	Reserved
15	0x8000	Reserved

7.0 Maintenance

WARNING - This equipment is a pressure-containing device. Depressurize before servicing.

NOTE: The Dryer Controller is equipped with Service Reminder functions for filters, desiccant and valves.

7.1 Desiccant Replacement

NOTE: The use of the correct replacement desiccant is necessary for proper dryer operation. Never use hygroscopic salts of the type commonly used in "deliquescent " type dryers.

1. **Frequency Of Desiccant Replacement**
   Desiccant should be replaced whenever the required dew point cannot be maintained while the dryer is being operated within its design conditions and there are no mechanical malfunctions.

   NOTE: Desiccant life is determined by the quality of the inlet air. Typical desiccant life is up to 2 years.

2. **Procedure for Desiccant Charge Replacement**
   a. Depressurize and de-energize the dryer.

   b. Remove the fill and drain plugs or flanges (where applicable) from the desiccant tower and drain the spent desiccant. Place a container at the base of the vessel to collect the desiccant. If necessary tap the sides of the vessels with a rubber mallet to loosen desiccant.

   NOTE: Use extreme care when inserting rods or other tools through the desiccant fill or drain ports to loosen packed desiccant. Internal flow diffusers at the ends of the desiccant beds can be damaged or punctured by sharp instruments. These diffusers are necessary to distribute the airflow and keep the desiccant beads within the tower. Desiccant beads in exhaust mufflers, afterfilters, or the piping connected to the desiccant towers may indicate a perforation of a diffuser.

   c. Replace the drain plug using Teflon tape or another pipe thread sealant suitable for compressed air service. Reinstall drain port flange cover (where applicable) in each desiccant tower.

   d. Refer to Table 3 for desiccant **quantity per tower.**

      When using Table 3 you will find the desiccant quantities listed in layers. Each layer will vary in depth due to the type, quantity and purpose of the desiccant. Layer 1 must be installed first at the bottom of the vessel followed by layer number 2 etc., until the complete charge of desiccant has been installed.

   e. Utilizing an appropriate sized funnel, fill each desiccant tower as follows:

      1) Install the required quantity of bed support or activated alumina in layer 1 of each tower.

      2) Level layer 1 and each subsequent layer of desiccant as added to each tower.

      3) Finish filling each tower with desiccant until all desiccant has been installed. LIGHT tapping on the tower sides with a soft-face mallet should yield additional free space to allow installation of all desiccant required. **DO NOT TAMP OR RAM DESICCANT**.

   f. Clean the fill port closure. Replace the fill plug using Teflon tape or another pipe thread sealant suitable for compressed air service. Reinstall fill port flange cover (where applicable) in desiccant tower.

3. **Insuring Desiccant Dryness**
   Replacement desiccant is shipped in airtight containers. Keep the covers on these containers tightly closed until use to avoid moisture contamination. If desiccant is exposed to air it can be heated in an oven at 400°F (204°C) for four hours before use. Alternatively, if the dryer is not refilled with dry desiccant, it may require several drying cycles before the outlet dew point falls to a steady state condition.

7.2 Valves

Process and pilot valves should be checked frequently for leaks and proper operation.

7.3 Pilot Air Filter Element Replacement

1. Frequency of replacement
The pilot air filter contains a filter element that should be changed yearly. Replacement may be required sooner if pressure drop across cartridge prevents valves from actuating properly.

WARNING – The pilot air filter housing is a pressure-containing device, depressurize before servicing. Slowly open manual drain valve on bottom of filter bowl by turning clockwise to verify that the housing is depressurized before removing bowl.

2. Procedure for element replacement
   a. Isolate dryer from air supply

   b. Depressurize dryer by running dryer and allowing system pressure to purge to atmosphere. Loss of pilot pressure will eventually prevent purge/repressurization valves from opening. Remaining pressure can be vented to atmosphere through the manual drain on the pilot air filter. The system must be fully depressurized before removing the bowl.

c. Remove the filter bowl by pushing up, turning counterclockwise and then pulling straight down.

d. Clean the filter bowl.

e. Replace the element.

f. Clean and lubricate o-ring at top of bowl and reassemble in reverse order.

7.4 Dew Point Analyzer Filter (optional) Element Replacement

1. **Frequency of replacement**
   The Dew Point Analyzer filter contains a filter element that should be changed yearly. Replacement may be required sooner if pressure drop across the cartridge prevents the Dew Point Analyzer from operating properly.

WARNING – The Dew Point Analyzer filter housing is a pressure-containing device, depressurize before servicing. Slowly open manual drain valve on bottom of filter bowl by turning clockwise to verify that the housing is depressurized before removing bowl.

2. **Procedure for element replacement**
   a. Close Sensor Service Valve to isolate the sample filter from the compressed air supply.

   b. Depressurize sensor housing through Sample Throttling Valve at the sensor outlet. The Dew Point Sensor system including the filter housing must be fully depressurized before removing the bowl.

   c. Remove the filter bowl.

   d. Clean the filter bowl.

   e. Replace the element.

   f. Clean and lubricate o-ring at top of bowl and reassemble in reverse order.

7.5 Separator Filter Element Replacement

1. Frequency of replacement

NOTE: Unless separator core is damaged outer sleeve only is replaced.

a. Initial (dry) pressure drop:
   1 psi (0.07 kgf/cm^2) to 2 psi (0.14 kgf/cm^2). Further pressure drop occurs as element loads with solid particles.

b. Operating pressure drop: As filter becomes liquid loaded (wetted), pressure drop will increase to 2 to 6 psi (0.14 to 0.42 kgf/cm^2). Further pressure drop occurs as element loads with solid particles.

c. FOR MAXIMUM FILTRATION EFFICIENCY, REPLACE ELEMENT WHEN PRESSURE DROP REACHES 4 PSI (0.28 KGF/CM^2) OR ANNUALLY, WHICHEVER OCCURS FIRST.

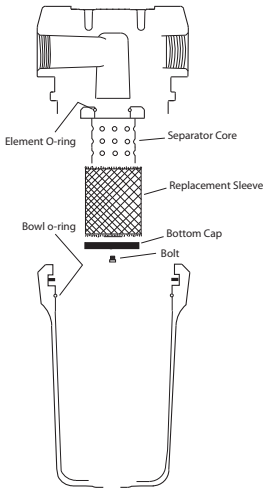
WARNING — Vent internal pressure to atmospheric pressure before performing any maintenance.

2. **Procedure for element replacement**

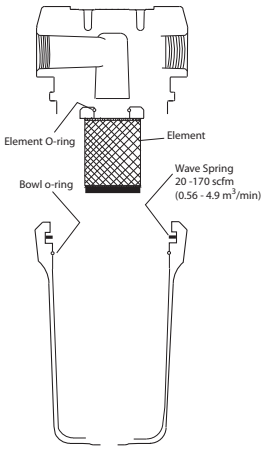
CAUTION – This is a pressure containing device. Depressurize before servicing. If filter has not been depressurized before disassembly, an audible alarm will sound when the bowl begins to be removed from the head. If this occurs, stop disassembly, isolate and completely depressurize filter before proceeding.

1. Isolate filter (close inlet and outlet valves if installed) or shut off air supply.
2. Depressurize filter by slowly opening manual drain valve.
3. Remove bowl by unscrewing bowl from head using hand, strap wrench or C spanner.
4. Clean filter bowl.
5. Replace element
   a. Replacing complete element
      1) Pull off old element and discard.
      2) Make certain o-ring inside top of replacement element is in place and push element onto filter head.

   b. Replacing sleeve only
      1) Pull element straight down to remove.
      2) Remove bolt and bottom cap and remove disposable filter sleeve.
      3) Clean separator core with soap and water if necessary.
      4) Slide new filter sleeve over separator core and replace bottom cap and hand tighten bolt.
      5) Make certain o-ring inside top of element is in place and push element onto filter head.



Separator/Filter - Sleeve Replacement



All Types - Element Replacement

6. After making certain that o-ring inside top of bowl (and on bayonet mount heads, wave spring) are in place, reassemble bowl to head.

NOTE: Make certain o-ring is generously lubricated.

NOTE: Wave spring ends should be pointed down to prevent the wave spring from interfering with reassembly.

NOTE: Threaded bowl to head connection, generously lubricate threads with a high grade/temperature lubricant good for 150°F, 66°C.

7.6 AfterFilter Element Replacement

1. **Frequency of replacement**
   At rated flow conditions, pressure drop will normally be less than 1 psig (0.07 bar). An increase in pressure drop will occur only as the element becomes contaminated with solid particles.

   IT IS RECOMMENDED THAT THE ELEMENT BE REPLACED FOR MAXIMUM FILTRATION EFFICIENCY IF PRESSURE DROP EXCEEDS 5 PSI (0.35 kgf/cm^2).

WARNING — Vent internal pressure to atmospheric pressure before performing any maintenance.

2. **Procedure for element replacement**

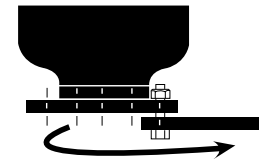
CAUTION – This is a pressure containing device. Depressurize before servicing.

a. By-pass the filter assembly to permit servicing.

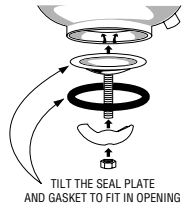
b. Depressurize the filter assembly slowly by opening depressurization valve.

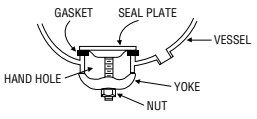
   1) 400 & 600 SCFM filter housings — Loosen bottom blind flange bolts. Remove all but one bolt. Swing flange to one side exposing filter elements

   2) 1200 to 11,400 SCFM filter housings — Remove handhole cover. Remove nut and yoke. Lift seal plate and turn so that seal plate and gasket can be removed from inside of vessel.



Filter Housings 400 & 600 scfm





Filter Housings
1200 to 11,460 scfm

c. Starting in the center, unscrew the filter element(s) by turning bottom cap.

d. Clean face of inlet manifold with a mild detergent using a long-handled brush or clean rag attached to a rod. Manifold face must be free of dirt and grease to insure proper o-ring seal between top cap and manifold.

e. Install new o-ring(s) into groove in top cap(s) — Use high temperature silicone grease on o-ring to ensure seal.

f. Starting from outside (element closest to vessel wall) screw filter element(s) into inlet manifold connections. A cone in the manifold will guide the cartridge bolt into the female threads. It is only necessary to finger tighten the cartridge to insure the seal. DO NOT WRENCH TIGHTEN.

   1) 400 & 600 SCFM filter housings — Swing blind flange bottom plate into position. Rebolt after inspecting flange gasket to insure its integrity.

   2). 1200 to 11,400 SCFM filter housings — Reinsert seal plate and seal plate gasket into vessel and position on lip as shown in drawing. Reinstall yoke and nut. Tighten nut, making sure gasket is properly positioned under seal plate.

g. Pressurize unit slowly; by slowly opening inlet valve, then opening outlet valve, and finally closing by-pass valve.

Restart the dryer according to the start-up instructions.

7.7 Moisture Indicator Recharging Procedure

NOTE: Dryer shutdown is not necessary to perform the following procedure and can be accomplished without removing the entire assembly.

1. Close the Moisture Indicator Supply Valve, and ensure that the Moisture Indicator has fully depressurized through bleed valve [5] before proceeding to step #2 for disassembly. (See following WARNING.)

WARNING - Ensure that Moisture Indicator is fully depressurized before attempting disassembly. Failure to do so may result in serious personal injury and/or equipment damage.

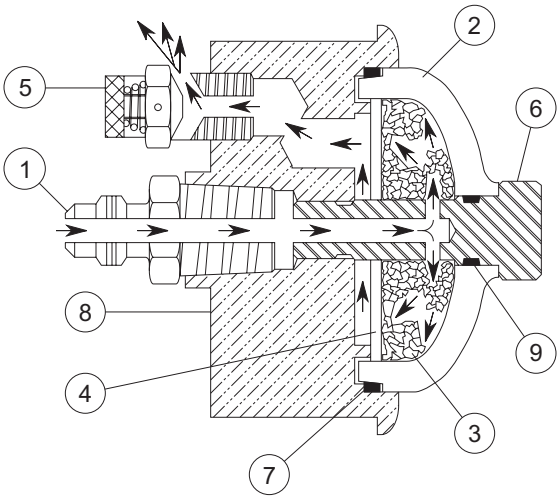
2. Remove sight dome assembly (items [2], [4], [6], [7], and [9]) from body [8] by turning screw [6] counterclockwise.

3. Remove screw [6] from sight dome [2] by exerting pressure on screw's threaded end. Drain granular indicator.

4. Remove porous disc [4] and clean sight dome. (see following CAUTION.)

   CAUTION: Sight Dome [2] is an acrylic plastic. **Do Not** clean with any type of solvent.

5. Replace O-ring [9], and re-install screw [6] in sight dome [2].
6. Carefully pour new granular indicator into sight dome [2]. Slide porous disc [4] into place.
7. Replace O-ring [7] and re-install sight dome assembly (items [2], [4], [6], [7], and [9]) in body [8].
8. Fully open the moisture indicator's gas supply valve (not shown).
9. Adjust bleed valve [5] until only a very slight constant gas bleed valve is felt exhausting from valve's bleed port. Ensure that granular indicator remains motionless after final adjustment.



Moisture Indicator

8.0 Troubleshooting

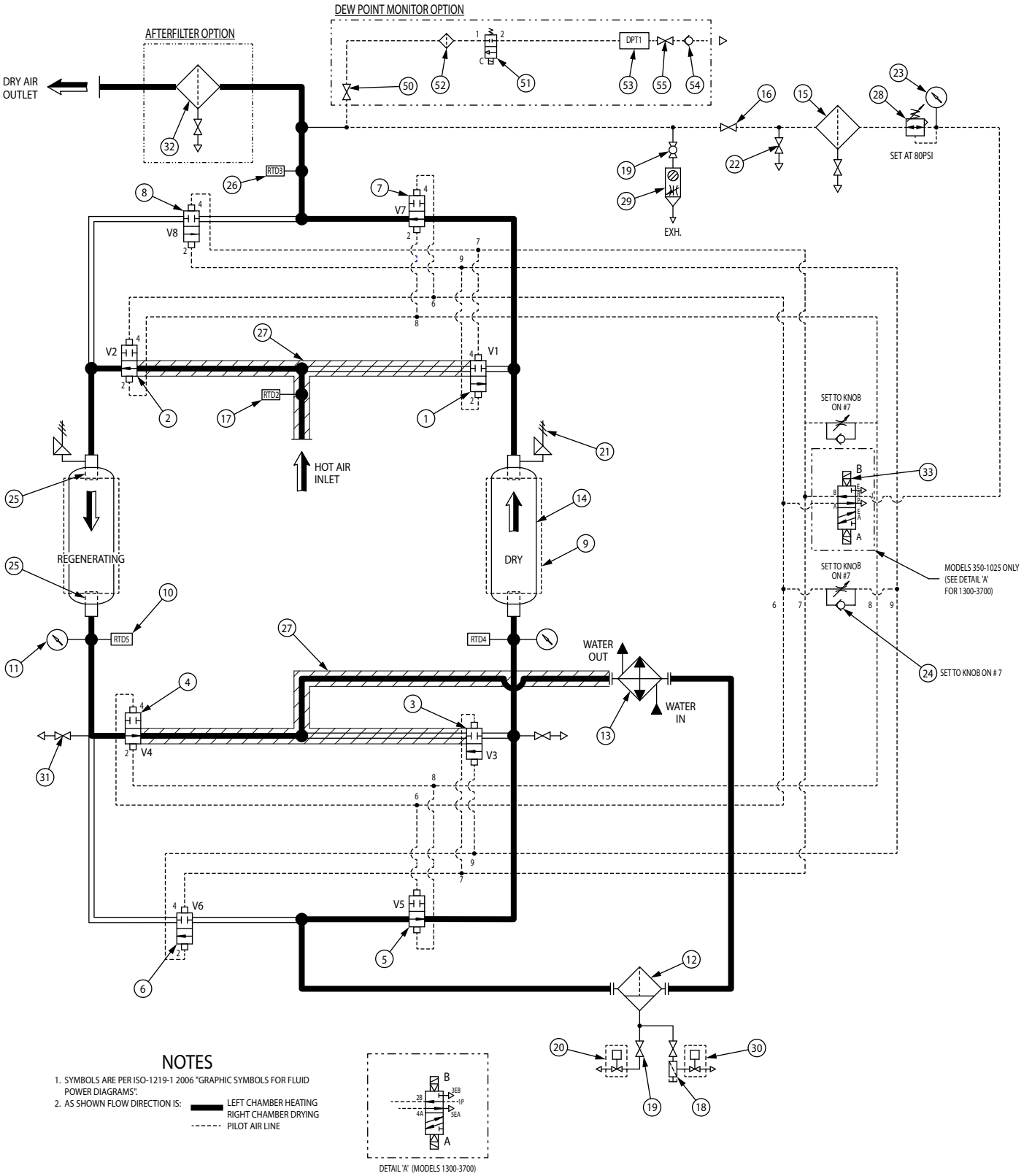
WARNING - A POTENTIAL ELECTRICAL SHOCK HAZARD EXISTS. Some of the troubleshooting checks may require gaining access to the dryer's electrical enclosure(s) while the power supply is energized and should be performed by a qualified electrical technician.

WARNING - Before performing any electrical or mechanical repairs or maintenance, or removing or disassembling any component, be sure to de-energize and depressurize the dryer.

SYMPTOM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
Indicator lights not illuminated	1. No power to unit. 2. Loss of power supply to (or at) dryer's electrical disconnect switch or breaker. (customer supplied) 3. Blown fuse. 4. Board malfunction.	1. Check voltage at terminal board. 2. Check disconnect switch or breaker closed. If tripped breaker or blown fuse is noted, investigate and remedy cause. 3. Replace fuse. 4. Replace board.
Excessive pressure drop in dryer	1. Filter elements are loaded with solid particles. 2. Excessive flow rate. 3. Inlet/Outlet screens in desiccant towers are dirty.	1. Check separator and afterfilter pressure drop. Replace element(s) if pressure drop is excessive. 2. Check flow rate of inlet air. Reduce to design flow rate. 3. Clean screens; follow desiccant removal instructions in the Maintenance Section.
Sensor Failure Alarm Inlet, Left Tower, Right Tower or Outlet	1. Tower temperature sensor failure. Either a Short circuit or Open circuit on sensor.	1. Check RTD for reasonable resistance value (32°F = 1000 ohms). Repair or replace as necessary.
Outlet Dew Point Alarm Left Tower or Right Tower	1. Alarm set point too low. 2. Inlet air flow higher than the sizing condition. 3. Liquids entering the drying tower. 4. Drying air temperature too high. 5. Desiccant degraded.	1. Check and adjust alarm set point. 2. Reduce inlet flow to sizing condition. 3. Inspect separator outlet for liquids. Inspect filter separator and drain system. Clean, repair or replace automatic drain valve. 4. Check the cooling system. Reduce inlet air temperature to sizing condition. 5. Check air pressure, airflow and airflow surges and correct as necessary. Consult factory concerning need for desiccant replacement.

P&ID Schematic

(Contact factory to request certified drawings)

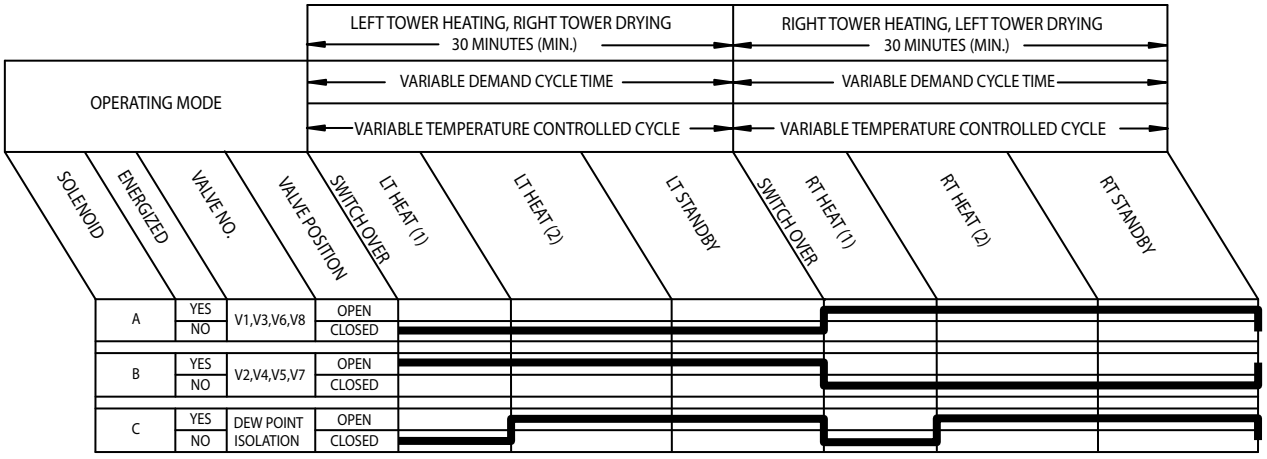


LEGEND

1. V1 RIGHT TOWER HOT AIR INLET VALVE
2. V2 LEFT TOWER HOT AIR INLET VALVE
3. V3 RIGHT TOWER PURGE OUTLET VALVE
4. V4 LEFT TOWER PURGE OUTLET VALVE
5. V5 RIGHT TOWER WET AIR INLET VALVE
6. V6 LEFT TOWER WET AIR INLET VALVE
7. V7 RIGHT TOWER DRY AIR OUTLET VALVE
8. V8 LEFT TOWER DRY AIR OUTLET VALVE
9. TOWER PERSONNEL PROTECTION (STANDARD), INSULATION (OPTION)
10. PURGE OUTLET/DRYING INLET TEMPERATURE SENSOR
11. TOWER PRESSURE GAUGE (PANEL MOUNTED)
12. SEPARATOR
13. COOLER
14. DESICCANT TOWER
15. PILOT AIR FILTER W/PETCOCK
16. PILOT SUPPLY VALVE
17. HOT AIR INLET TEMPERATURE SENSOR
18. STRAINER
19. SERVICE VALVE
20. DEMAND DRAIN VALVE
21. TOWER PRESSURE RELIEF VALVE
22. DRY AIR SAMPLE VALVE
23. PILOT PRESSURE GAUGE
24. VALVE SPEED CONTROL (SLOWS VALVE CLOSING)
25. DESICCANT RETAINING SCREENS (TOP AND BOTTOM)
26. OUTLET TEMPERATURE SENSOR
27. PIPE INSULATION
28. PRESSURE REGULATOR
29. COLOR CHANGE MOISTURE INDICATOR (PANEL MOUNTED)
30. BACK-UP TIMER DRAIN VALVE
31. BLOW DOWN VALVE
32. DRYER AFTERFILTER (OPTION)
33. DUAL COIL SOLENOID VALVE

DEW POINT CONTROL OPTION

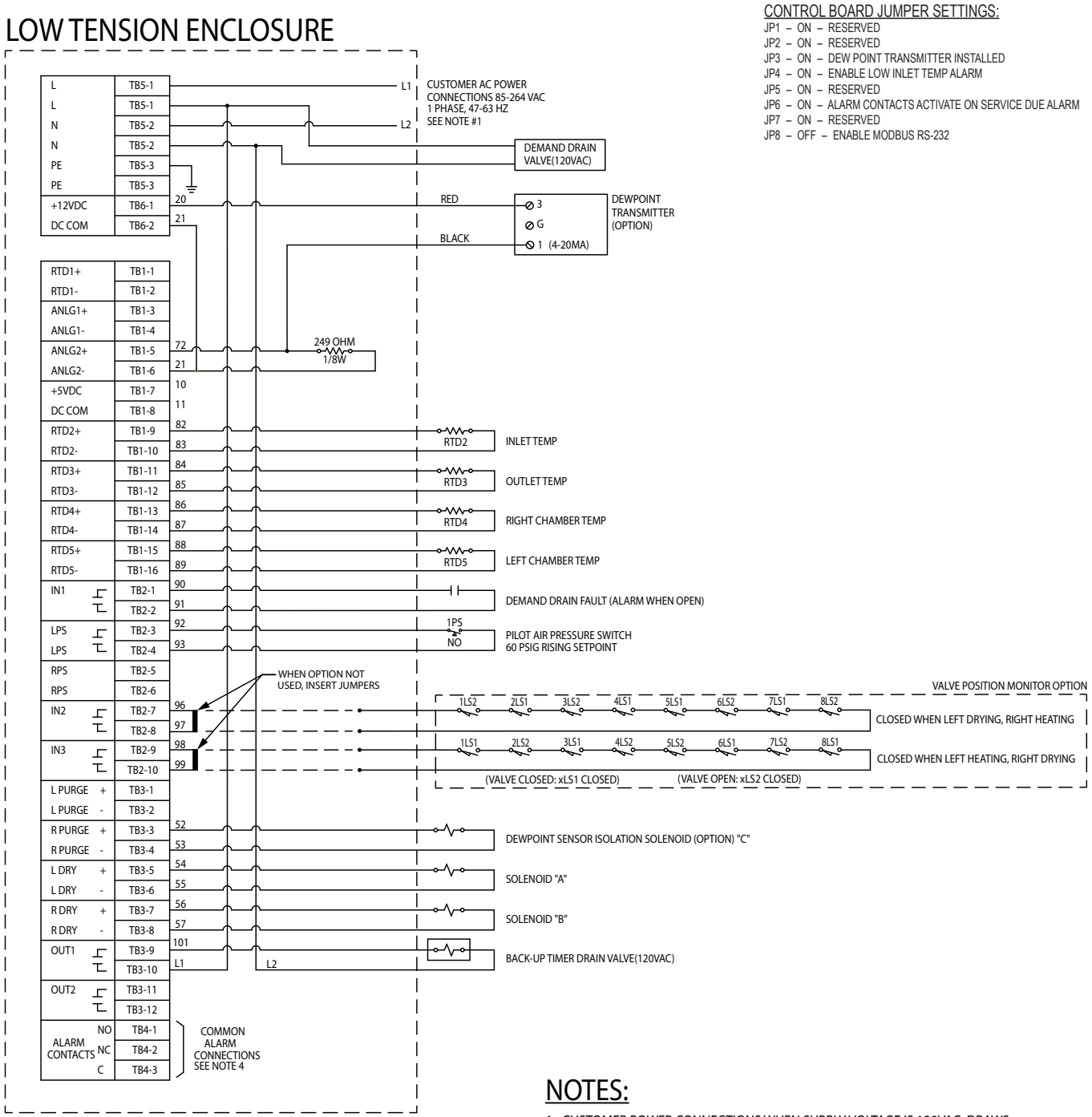
50. SENSOR SERVICE VALVE
51. SENSOR ISOLATION SOLENOID VALVE
52. SAMPLE FILTER
53. DEW POINT SENSOR
54. SAMPLE CHECK VALVE
55. SAMPLE THROTTLING VALVE



Sequence of Operation

Electrical Schematic

(Contact factory to request certified drawings)

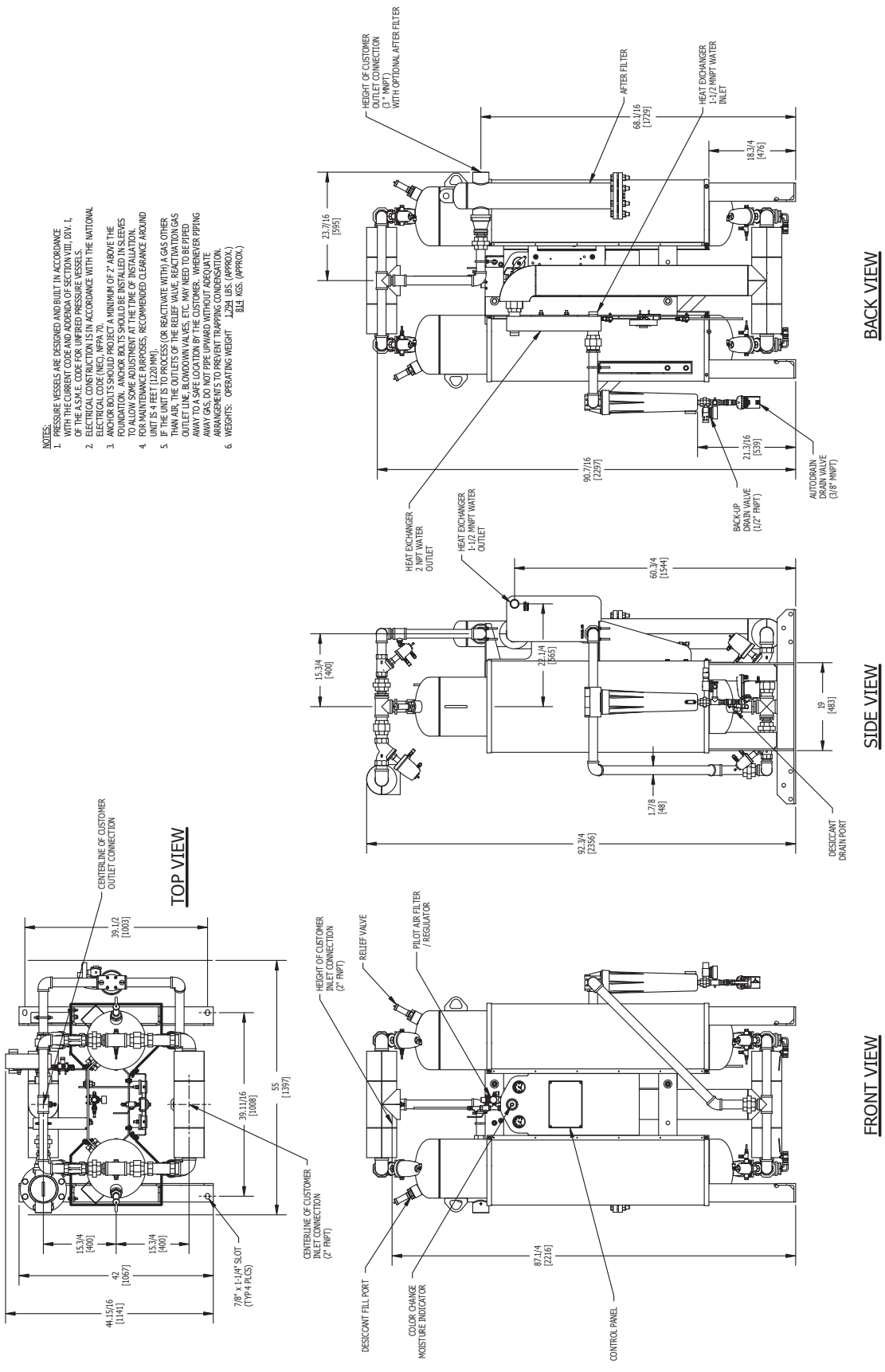


NOTES:

1. CUSTOMER POWER CONNECTIONS WHEN SUPPLY VOLTAGE IS 120VAC, DRAWS LESS THAN 1 AMP. AC (ALTERNATING CURRENT). TERMINALS TB5-1, TB5-2 AND TB5-3
2. VOLTAGE RATING OF SOLENOID VALVES IS 12 VDC.
3. VOLTAGE RATING OF SWITCHES IS 5 VDC.
4. WITH UNIT ON AND NO ALARMS, THERE SHOULD BE CONTINUITY BETWEEN TERMINALS TB4-1 AND TB4-3. CONTACTS ARE RATED AT 5 AMPS.

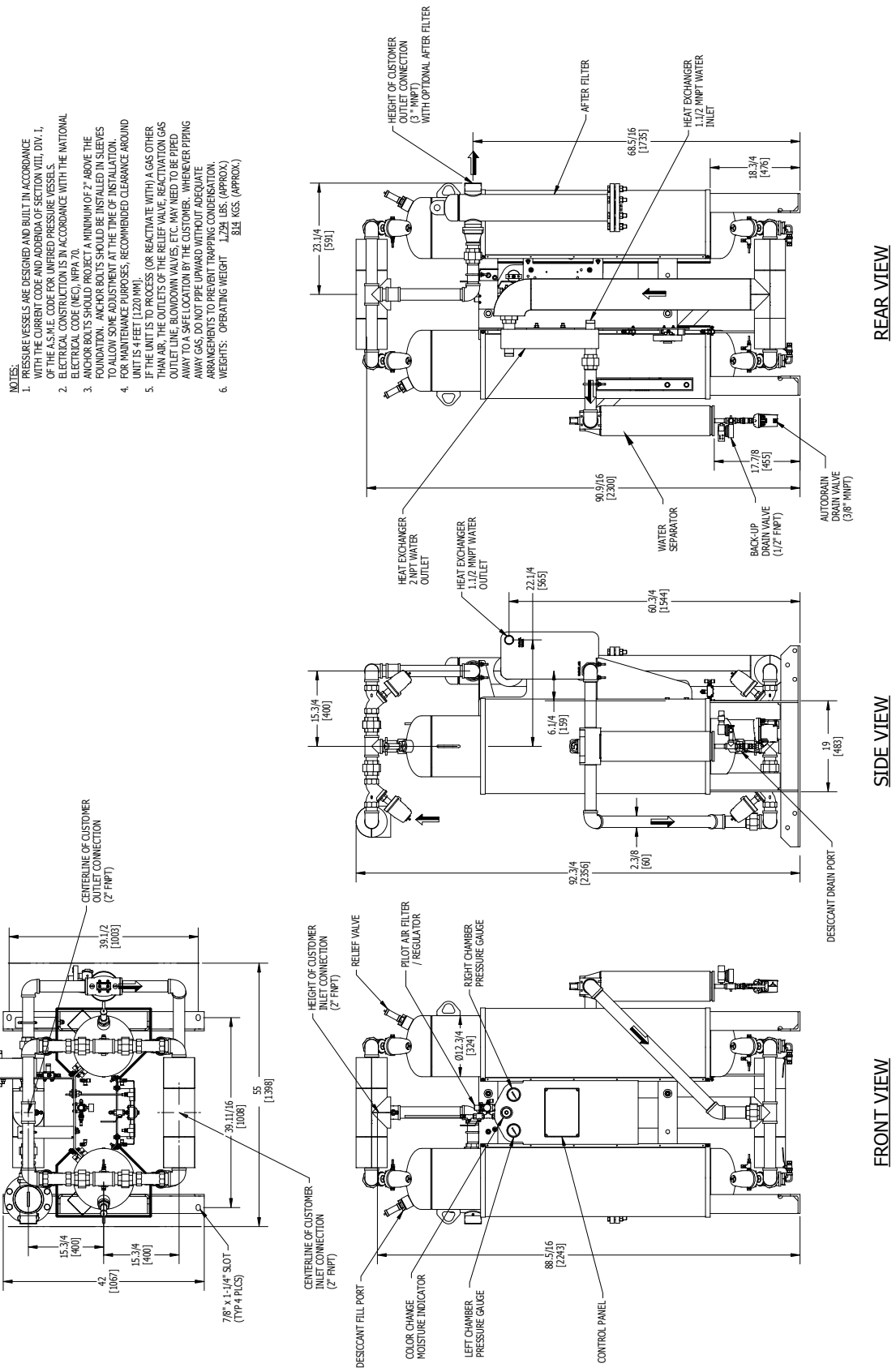
General Arrangement - 350 scfm

(Contact factory to request certified drawings)



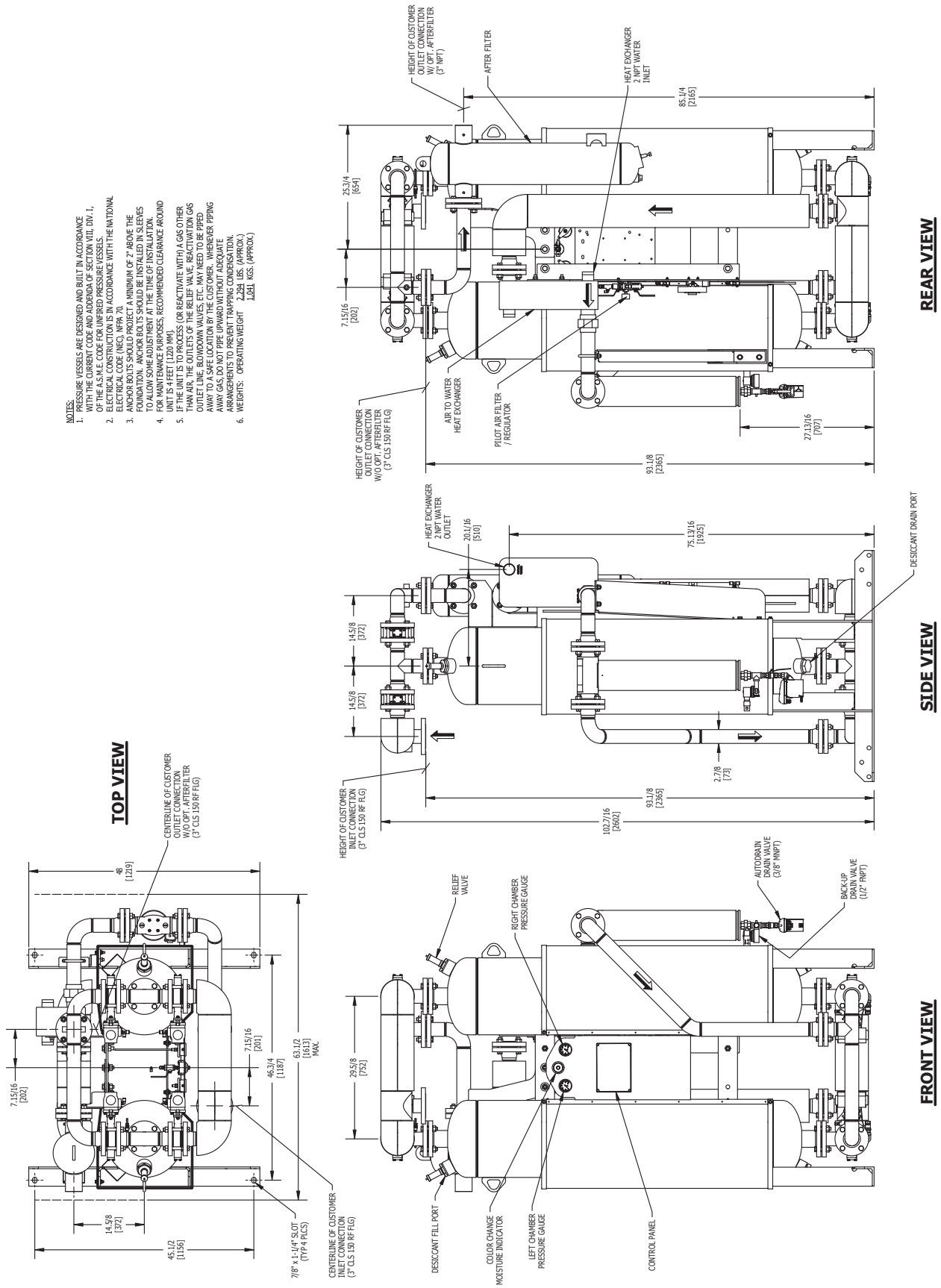
General Arrangement - 450 scfm

(Contact factory to request certified drawings)



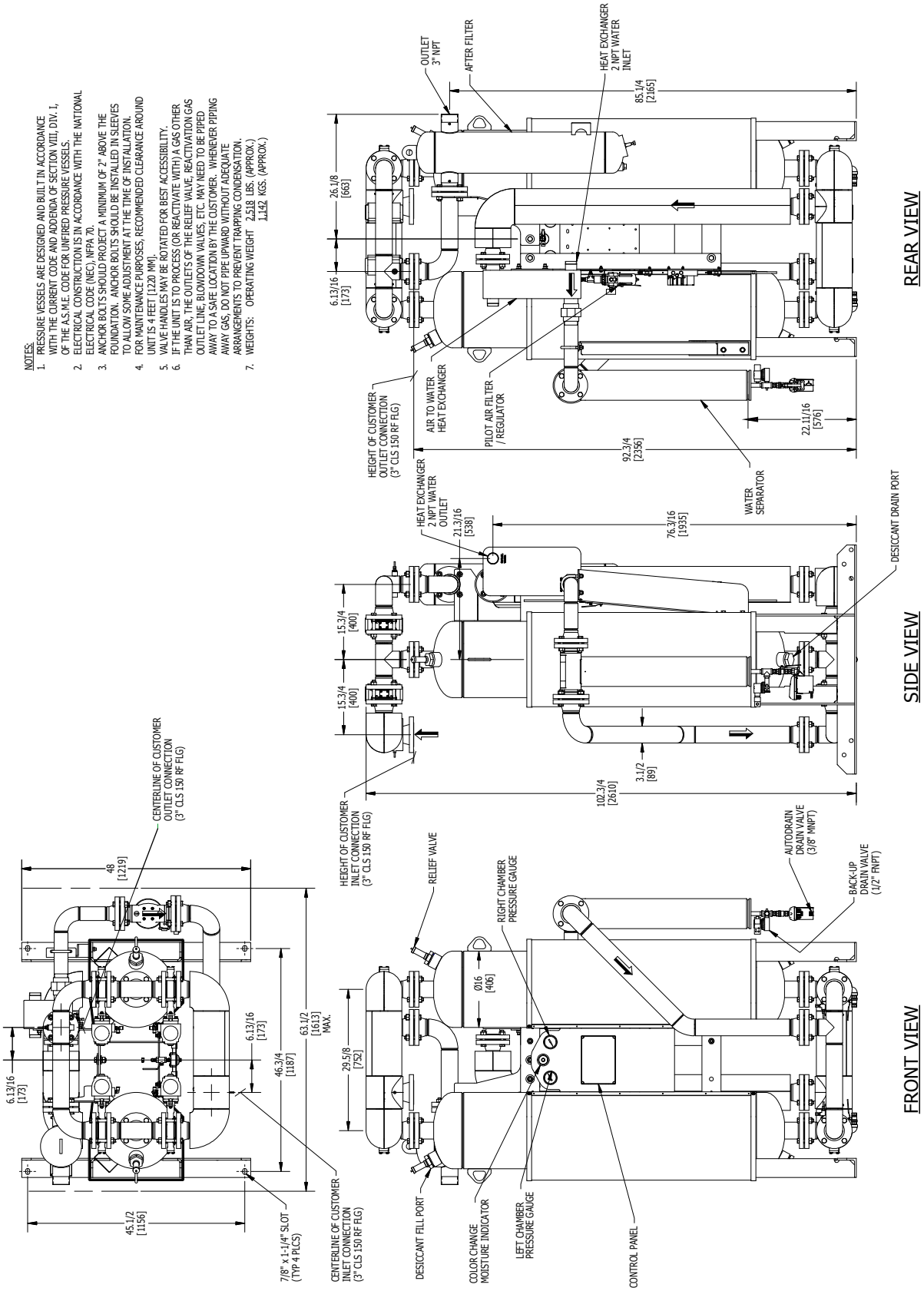
General Arrangement - 600 scfm

(Contact factory to request certified drawings)



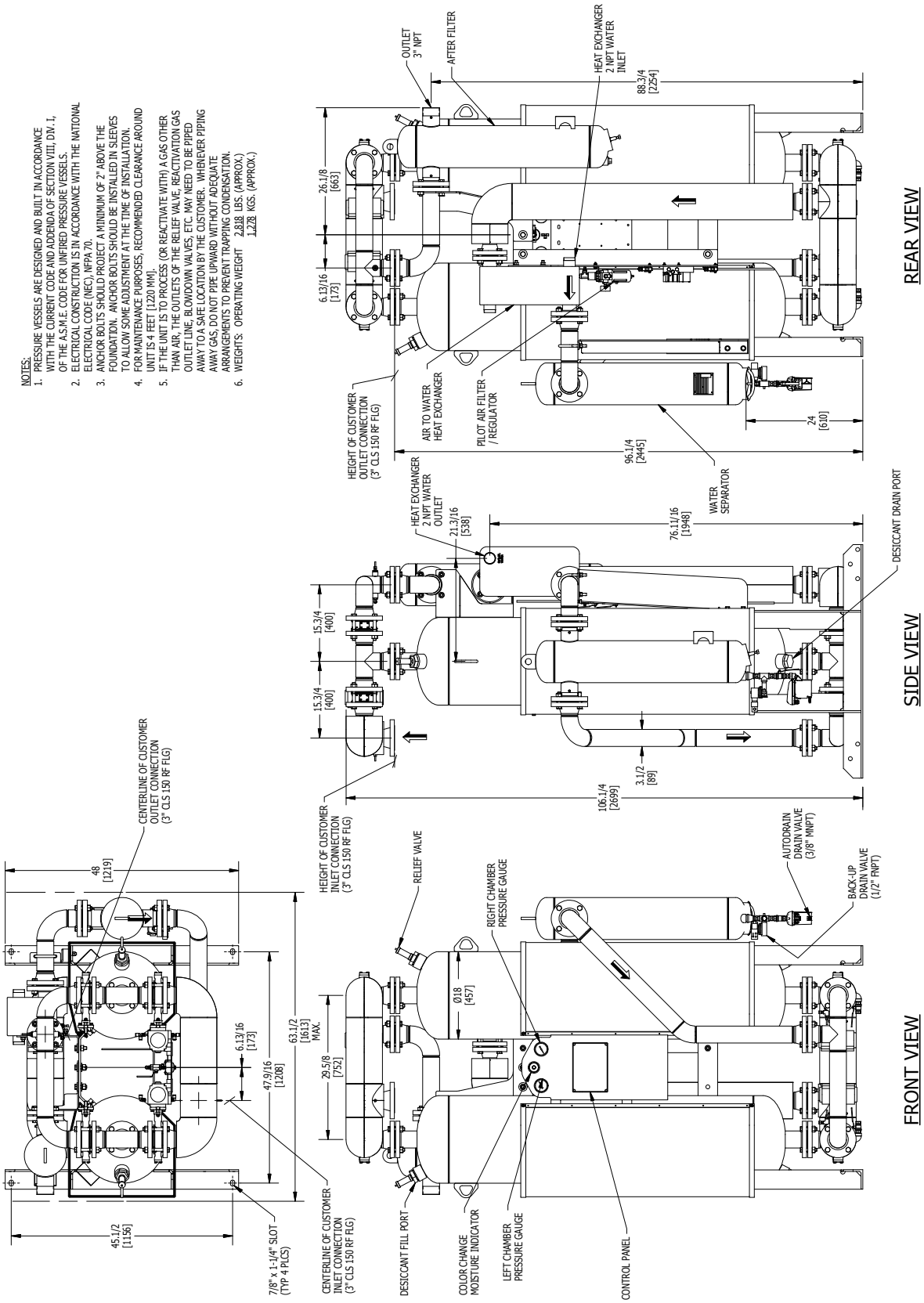
General Arrangement - 800 scfm

(Contact factory to request certified drawings)



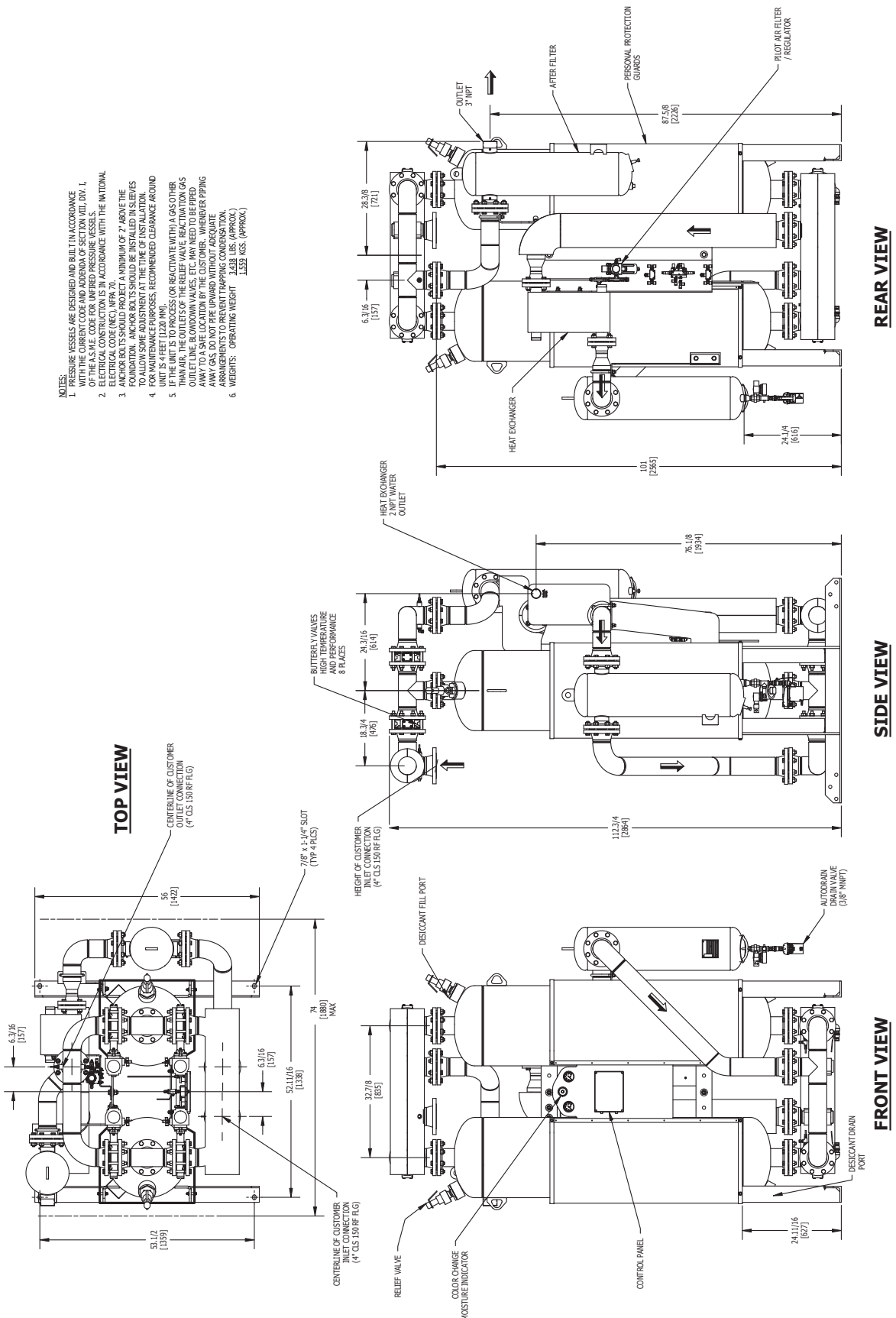
General Arrangement - 1025 scfm

(Contact factory to request certified drawings)



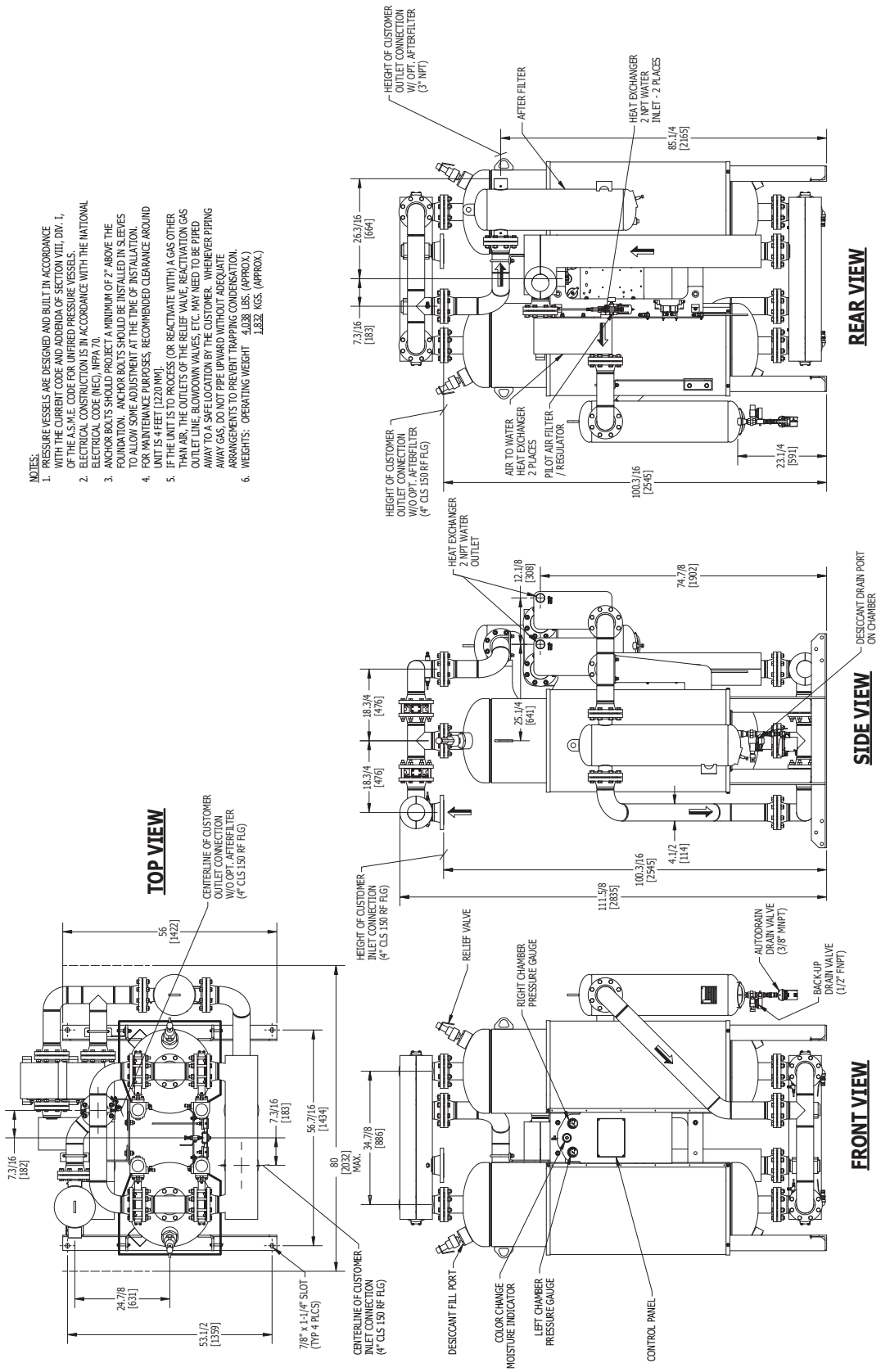
General Arrangement - 1300 scfm

(Contact factory to request certified drawings)



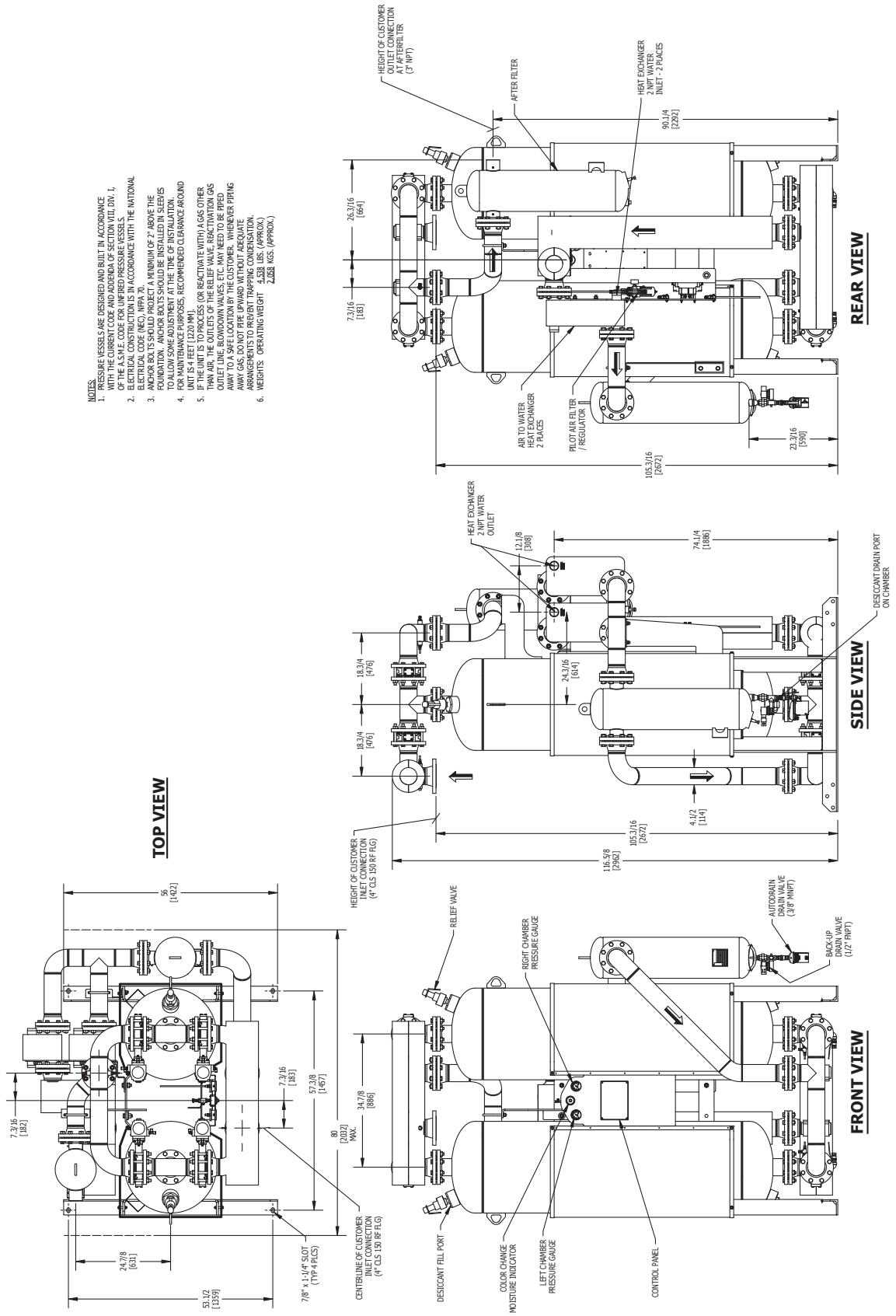
General Arrangement - 1500 scfm

(Contact factory to request certified drawings)



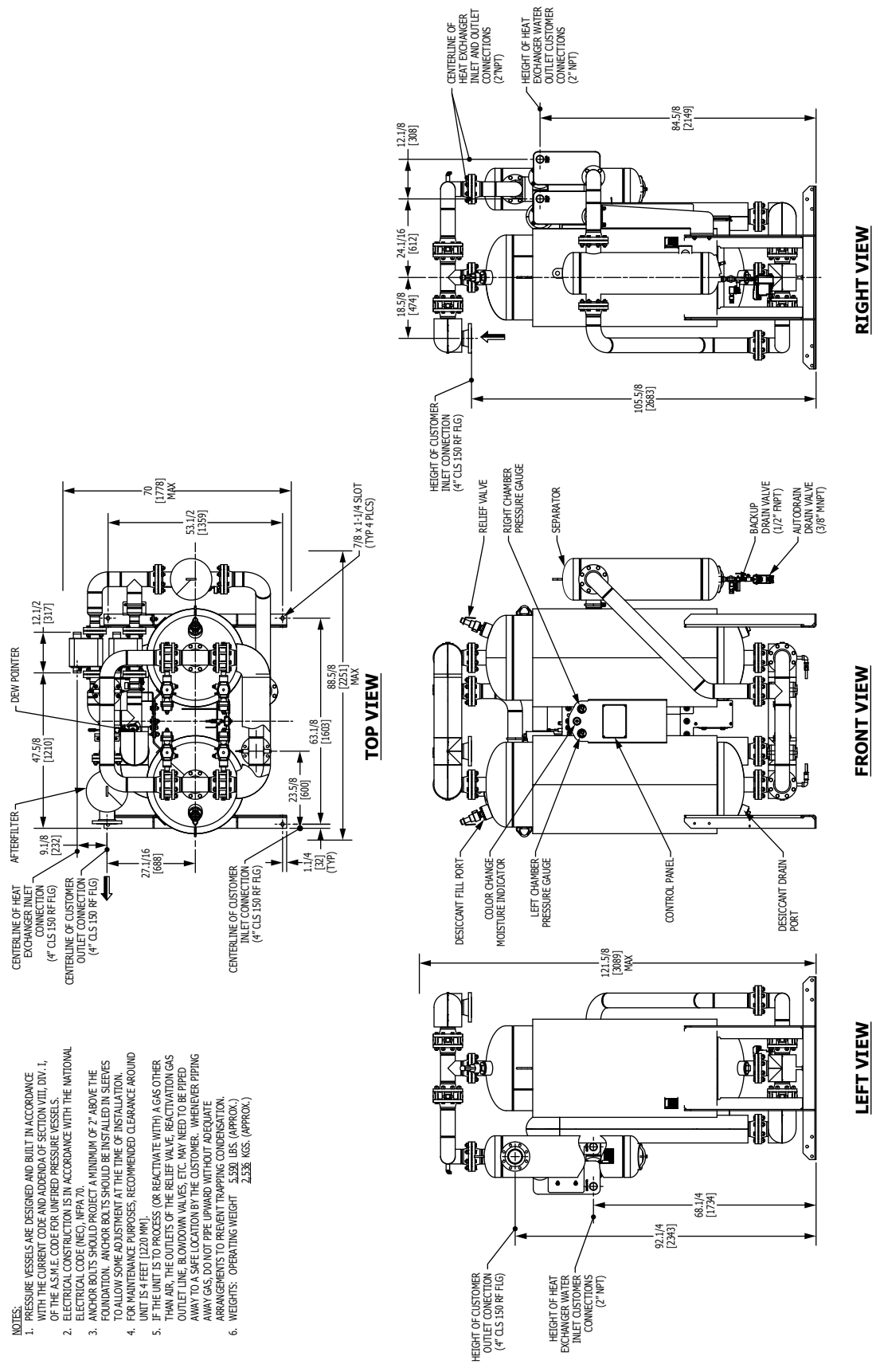
General Arrangement - 1800 scfm

(Contact factory to request certified drawings)



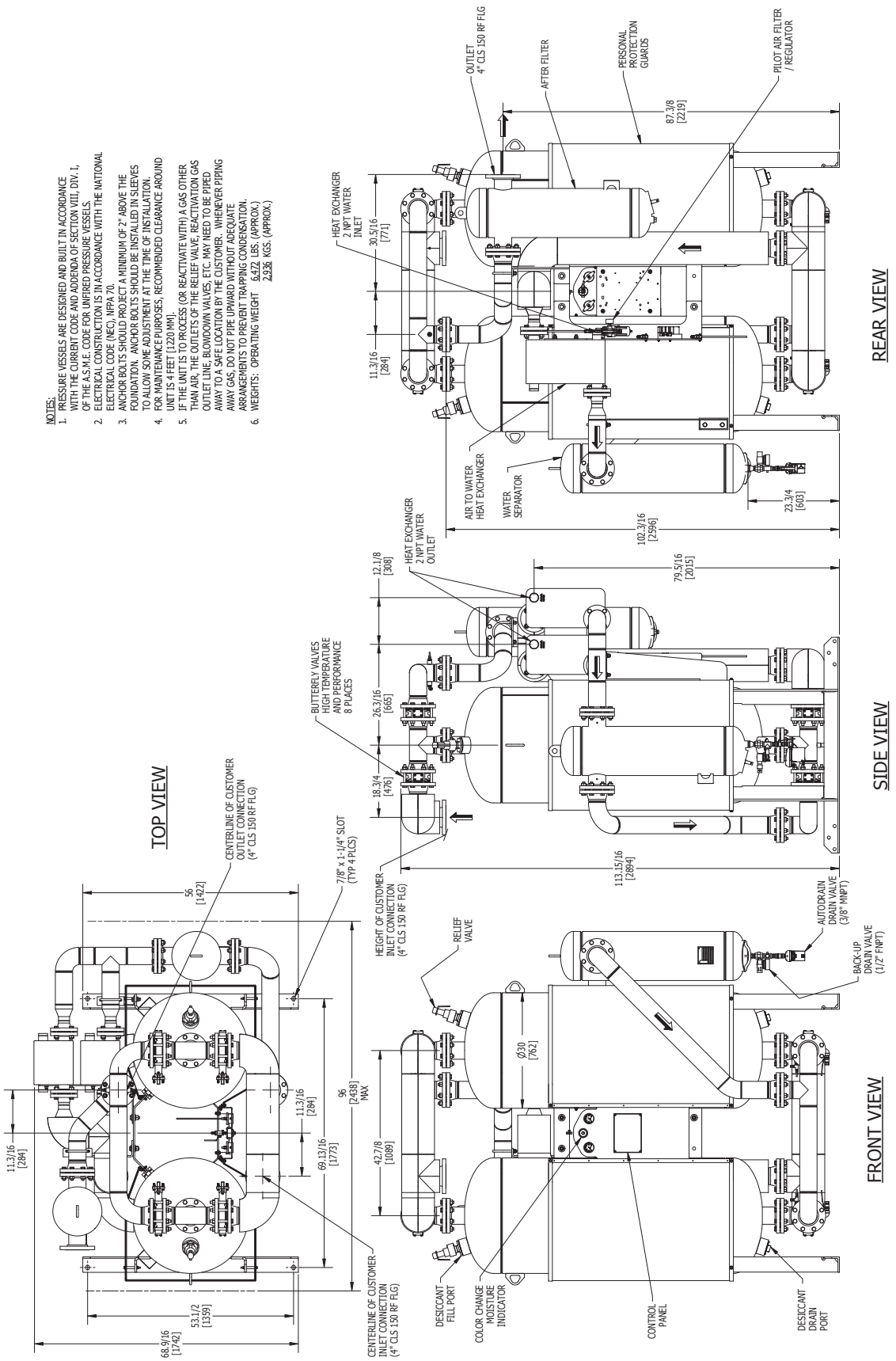
General Arrangement - 2100 scfm

(Contact factory to request certified drawings)



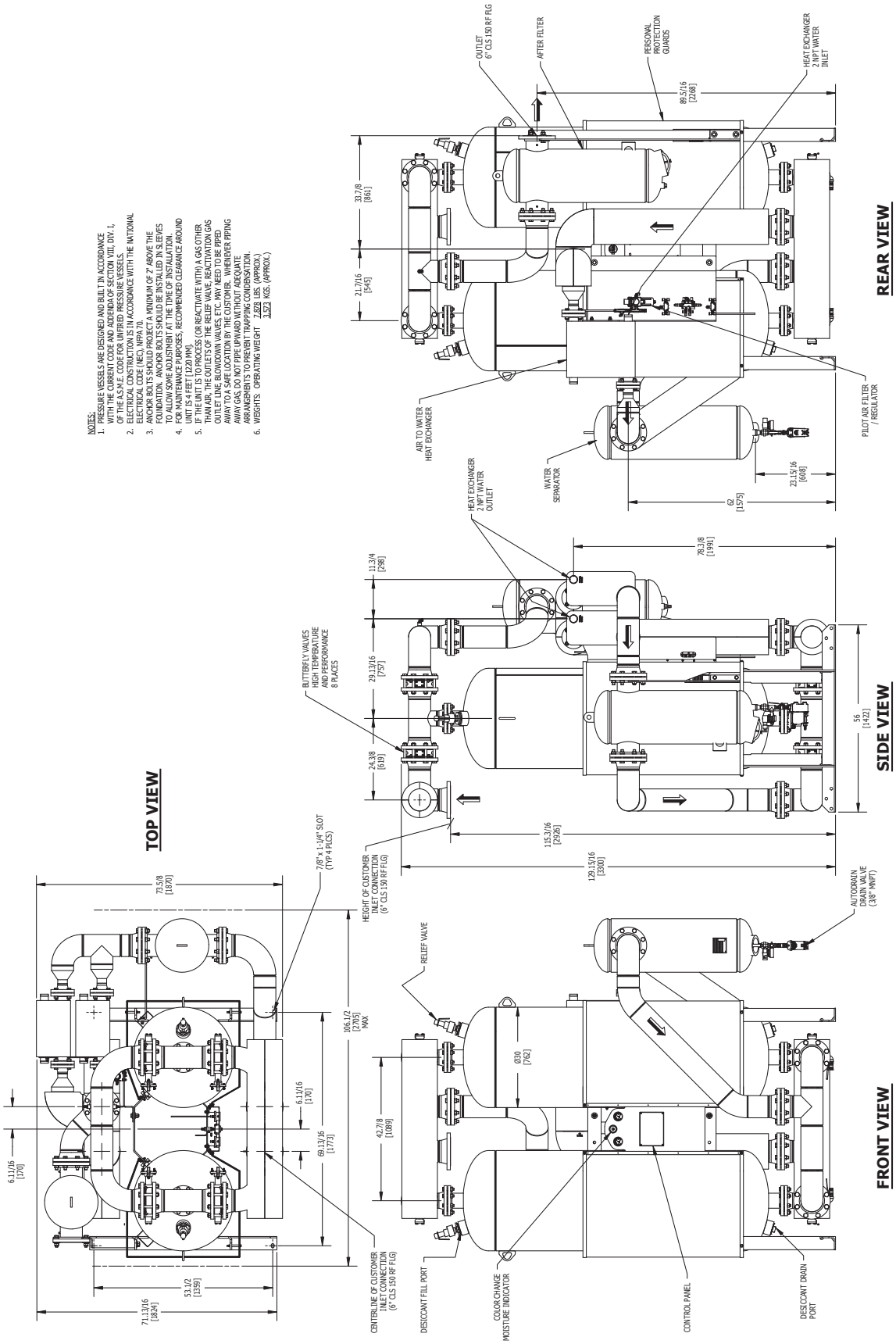
General Arrangement - 2400 scfm

(Contact factory to request certified drawings)



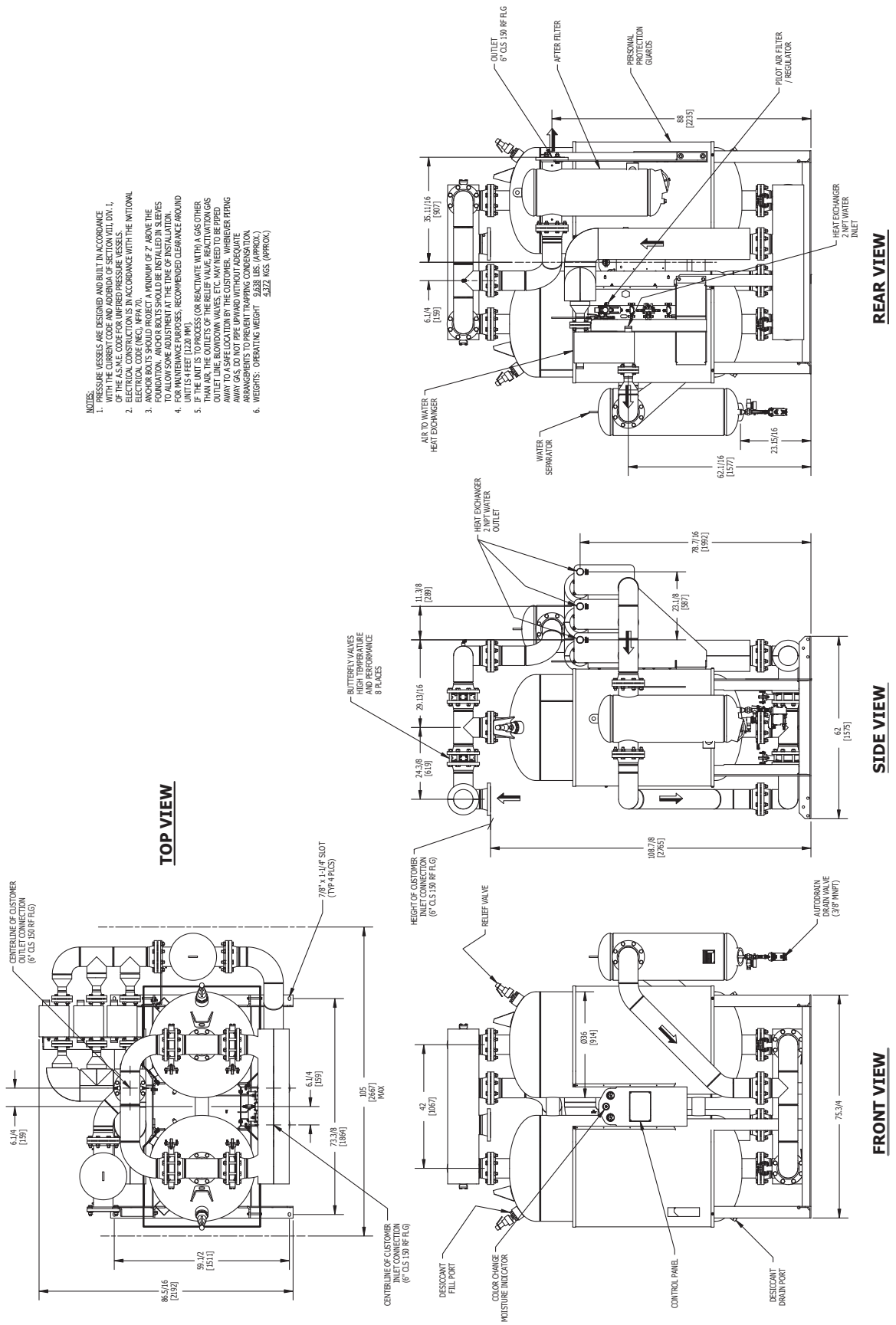
General Arrangement - 3250 scfm

(Contact factory to request certified drawings)



General Arrangement - 3700 scfm

(Contact factory to request certified drawings)



WARRANTY

The manufacturer warrants the product manufactured by it, when properly installed, operated, applied, and maintained in accordance with the procedures and recommendations outlined in the manufacturer's instruction manuals, to be free from defects in material or workmanship for a period of one (1) year from the date of shipment from the manufacturer or the manufacturer's authorized distributor, or eighteen months from the date of shipment from the factory, whichever occurs first, provided such defect is discovered and brought to the manufacturer's attention the aforesaid warranty period. The manufacturer will repair or replace any product or part determined to be defective by the manufacturer within the warranty period, provided such defect occurred in normal service and not as the result of misuse, abuse, neglect, or accident.

The warranty covers parts and labor for the warranty period. Repair or replacement shall be made at the factory or the installation site, at the sole option of the manufacturer. The manufacturer must first authorize any service performed on the product by anyone other than the manufacturer. Normal maintenance items requiring routine replacement are not warranted. Unauthorized service voids the warranty and any resulting charge or subsequent claim will not be paid.

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