



# Installation & Operations Manual

## Desiccant Air Dryers

### AHLD E-Series Heatless Regenerative

Models 70, 100, 150, 200, 250, 300, 350,  
450, 500, 600, 750, 1000, 1250, 1500,  
2000, 2500, 3000, 3500, 4500, 5000 scfm



## DRYER DATA SHEET

Model Number: \_\_\_\_\_ Serial Number: \_\_\_\_\_

Dryer Type: \_\_\_\_\_ Date of Manufacture: \_\_\_\_\_

Ship Date: \_\_\_\_\_ Installation Date: \_\_\_\_\_

Customer Name: \_\_\_\_\_

Customer Address: \_\_\_\_\_

Customer City: \_\_\_\_\_ State/Zip: \_\_\_\_\_

Accessories: \_\_\_\_\_

Other: \_\_\_\_\_

## INTRODUCTION

Thank you for purchasing Aircel's AHLD E-Series Heatless Regenerative Desiccant Air Dryer with integrated Energy Management Purge Reduction System. You are now the proud owner of one of the finest desiccant dryers on the market. Aircel AHLD E-Series dryers are engineered and manufactured to provide you with many years of trouble-free service and provides energy efficient operation by reducing the overall dry purge air required for regeneration, saving energy and money. To ensure that you get first class service from this equipment, we recommend you take some time and read the contents of this manual.

This manual contains all the information required for installing and maintaining your new equipment. It also includes the safety procedures and corresponding drawings. We strongly suggest that all personnel involved with the machine, read the entire contents of the manual before proceeding with the installation or maintenance activities.

The manufacturer reserves the right to make changes without any prior notification and is not obligated in any manner. Information in this manual is deemed current at the time of publication and Aircel disclaims all liability for any errors resulting in any loss or damage.

If you have questions, need additional copies, or would like to schedule an Aircel service technician visit, contact your distributor.

## DRYER DATA SHEET

Dryer Inlet Air Flow Rate: \_\_\_\_\_

Dryer Inlet Temperature: \_\_\_\_\_

Dryer Ambient Temperature: \_\_\_\_\_

Dryer Voltage: \_\_\_\_\_

Dryer MCA Minimum Circuit Ampacity: \_\_\_\_\_

Dryer MOP Maximum Overcurrent Protection: \_\_\_\_\_

Dryer Operating Pressure: \_\_\_\_\_

Dryer Maximum Operating Pressure: \_\_\_\_\_

Dryer Vessel Pressure Relief Valve Setting: \_\_\_\_\_

Dryer Desiccant Type: \_\_\_\_\_

Dryer Desiccant Weight Total for System: \_\_\_\_\_

Dryer Outlet Dew Point: \_\_\_\_\_

Dryer Control Time Cycle: \_\_\_\_\_

Dryer EMS Dew Point Sensor Setting (for sensor outlet dew point): \_\_\_\_\_

High Dew Point Setting: \_\_\_\_\_

Demand Cycle Setting: \_\_\_\_\_

Outlet Dew Point Readout on Display: \_\_\_\_\_

Electrical Drawing Number: \_\_\_\_\_

Mechanical Drawing Number: \_\_\_\_\_

PLC Software Program Number: \_\_\_\_\_

Control Air Filter Element Number: \_\_\_\_\_

Inlet Pre-Filter Element Number (option): \_\_\_\_\_

Outlet After-Filter Element Number (option): \_\_\_\_\_

Inlet Valve: \_\_\_\_\_

Purge Exhaust Valve: \_\_\_\_\_

Vessel National Board Number (Left and Right Vessels): \_\_\_\_\_

Dryer System Weight: \_\_\_\_\_

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## NOTICE

Throughout this manual, signal words are present to advise of safety precautions and/or standard practices. Obey these signal words as defined below:

**DANGER!** - Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

**WARNING!** - Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

**CAUTION!** - Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Notice: used to address practices not related to personal injury.



## WARNING!

### GENERAL SAFETY PROCEDURES:

- Improper installation, operation, or maintenance may contribute to conditions in the work area or facility that could result in personal injury and product or property damage. Check that all equipment is properly selected and sized for the intended use.
- Consult and comply with national and local codes relating to fire or explosion and all other appropriate codes when determining the location and operation of this equipment.
- Safe and efficient operation of the unit depends on proper installation.
- Authorities with jurisdiction should be consulted before installing to verify local codes and installation procedures. In the absence of such codes, install unit according to the National Electric Code, NFPA No. 70-latest edition.
- A qualified installation and service agent must complete installation and service of this equipment.
- DO NOT weld on / to pressure vessel or modify it in any way.
- DO NOT remove, modify, or adjust protective or safety devices.
- Lock out power supply and depressurize system before performing maintenance or service work.
- DO NOT operate the equipment with the control panel door open.

**Notice:** For optimum performance, use only Aircel replacement parts.

**Notice:** For information and notes specific to custom designed and built dryers, reference the drawing package provided with the unit. See warranty on manual back cover for custom engineered products.

## SAFETY INSTRUCTIONS

### Safety Symbols Used in Manual



**IMPORTANT INFORMATION:** Readers of the manual must pay extra attention to instructions and information succeeding this symbol.



**WARNING:** This indicates that it is dangerous and could result in physical injury and death if the instructions are not followed correctly.



**ELECTRICAL DANGER HIGH VOLTAGE:** This means that there is a risk of electrical shock and only authorized personnel with proper gear must approach it.



**HIGH NOISE AREA:** All personnel are required to wear ear protectors before approaching the vicinity of the equipment.



**HAZARDOUS FUMES & GASES:** Personnel must wear protective gear to prevent inhaling of the gases and fumes.



**SUSPENSION POINTS:** Look for these symbols before making any attempt to move or relocate your equipment.



**TIPS & SUGGESTIONS:** Following these tips can make your work easier.



**EXTREME CAUTION:** This indicates that there might be possible risk of material damage and personnel are advised to exercise extra caution.

## GENERAL SAFETY INSTRUCTIONS

### What You Must Do



1. Certified/authorized electricians must perform electrical work.
2. Electrical work must conform to the specifications indicated by Aircel and any local or state laws that may apply.
3. Personnel must wear appropriate safety gear before working on any electrical or mechanical aspects of the machine.
4. Appropriate tools have to be used for all installation and maintenance work. If special tools are required and are not available to the installation crew, contact the factory or your Aircel representative.
5. A copy of the Operation Manual must be made available to all personnel involved with the installation, operation, and maintenance of the equipment.
6. Before performing any maintenance operations on the equipment, the unit must be shut down, isolated, electrical power removed, and completely depressurized.
7. To ensure compatibility and continued trouble free operation, only genuine Aircel parts must be used.

### What You Must Not Do



1. Do not make any constructional changes to the unit. Only Aircel or its authorized representatives with the prior approval can perform any constructional work on the machine.
2. Do not use foreign parts.
3. Compressed air from the dryers is not to be used for breathing purposes - install a breathing air package to ensure conformance with OSHA regulations.
4. Do not disable or disengage any protective equipment used on the machine.

### Safe Operating Procedures



1. Pressurize and depressurize compressed air SLOWLY! Always open air valves slowly when pressurizing the airline system or equipment. Repair air slowly when depressurizing your air system or equipment.
2. Circuit breakers, fusible disconnect, and wiring should conform to national and/or local electrical codes. Make certain that qualified electrical personnel perform the electrical installation for this unit.
3. Only use original fuses for the rated voltage and current.
4. Shut down the unit in the correct recommended procedure.
5. Before any work on system, always depressurize the unit and remove all electrical power.
6. After shut down, put up warning notice to prevent the unit from being switched "ON" accidentally.
7. Inspect all piping, hoses, and connections. Make sure that all hoses are in good condition and are rated for the correct working pressure. Do not allow hoses to come into contact with oils, chemicals, or sharp objects.
8. Secure condensate drain lines. Unsecured, flexible drain lines may whip violently under pressure and may cause bodily harm.

Aircel air dryers do not remove carbon monoxide (CO) and are not safe for human respiration (breathing). Breathing air must be at least Grade D quality as described in Compressed Air and Gas Association (CAGI) commodity specifications 67.1-1966. User may refer to OSHA 29 CFI 1910.134 for special precautions and equipment suitable for breathing air applications. Aircel disclaims any liability whatsoever for loss, injury, or damage.

## DESICCANT SAFETY PRECAUTIONS



### **WARNING!**

#### **INHALATION, SKIN, & EYE IRRITANT:**

The desiccant used in this equipment is not considered hazardous. Contact with and disposal of desiccant must be in accordance with the relevant MSDS and all local codes and regulations. The following lists the more common safety measures to be observed during loading and unloading operations. Reference the MSDS in the appendix for complete safety measures.

### **Desiccant First Aid Recommendations**

#### **INHALATION**

Use a contoured dust mask during loading and unloading operations. If high concentrations are inhaled, immediately move to fresh air. Keep person calm. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

#### **SKIN CONTACT**

In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes.

#### **EYE CONTACT**

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

#### **SPILLS**

Clean accidental spills by vacuuming, sweeping, or flushing to a sewer treated for suspended solids. Avoid creating excess dust.

## Why We Need Compressed Air Dryers

Untreated compressed air contains many contaminants such as water, compressor oil, pipe scale, and contamination from ambient air. All these contaminants cause excessive corrosion, erosion, freezing, and regenerative type dryer system with all recommended filtration will remove these contaminants to harmless levels. The end result is that instruments that come in contact with the dry compressed air stay clean and do not corrode, therefore lasting much longer. Products that may come in contact with clean, dry, compressed air are virtually unaffected. Therefore, rejection rates are reduced.

## Purpose and Intended Use

Misuse or modification of this equipment may result in personal injury. Do not misuse or modify. The high efficiency heated regenerative desiccant dryer is used exclusively for purifying compressed air in non-hazardous locations.

The state-of-the-art system is designed and constructed in accordance with the rules and regulations regarding adsorption technology and industrial safety. There are hazards accompanying this type of product if not operated for the intended purpose by trained and specialized personnel.

## Inspection on Arrival

All heated regenerative desiccant dryers are tested and operated before shipment. However, shipping vibration may cause damage such as loosening of certain parts. To ensure smooth installation, it is recommended that immediately upon receipt of the unit, the system is checked for the following:

1. Inspect unit on delivery.
2. Report any damage to the delivery carrier.
3. Request a written inspection report from the Claims Inspector to substantiate the claim.
4. File claims with the delivery carrier.
5. Compare unit received with description of product ordered. Check the serial plate label and make sure that it is the correct Model was ordered. Note the equipment Capacity and Power Supply requirements and ensure that they are in accordance with your specifications. The rated conditions of the dryer are indicated on the serial plate label. If there is any discrepancy, contact your representative listed on the manual back cover.
6. Vibration during shipping can loosen the connections. Inspect all pipe and tubing and make sure they are all tightened and secured.
7. Report incomplete shipments to the delivery carrier and your service representative.



### WARNING!

- Failure to lift the unit correctly can result in severe personal injury or property damage.
- Use appropriate lifting equipment and adopt all safety precautions needed for moving and handling the equipment.
- A hand cart, fork lift, or crane is recommended for unloading and installation.
- Lift unit by lifting lugs and frame only. Do not lift by piping.



### WARNING!

- Follow proper lock out/tag out procedures before performing service or maintenance work.
- Electrical installation must be performed by a qualified electrician and comply with all applicable national and local codes.



### CAUTION!

- A copy of the Operation Manual must be made available to all personnel involved with the installation, operation, and maintenance of the equipment, to avoid injury to personnel or property damage.
- Appropriate tools must be used for all installation and maintenance work, to avoid injury to personnel or property damage.

## FEATURES & OPTIONS

### Standard Features

- Integrated Energy Management Purge Reduction System for efficient energy savings and reduced cost of operation.
- Optimal tower size for low velocities reducing desiccant fluidization, and high contact time for efficient low dew point performance.
- Tower pressure relief valves.
- Standard design capacity based on 100 psig, 100°F inlet air, 100°F ambient air, and Pressure dew point of -40°F.
- Purge exhaust mufflers for quiet operation.
- Tower pressure gauges for additional visual operation of dryer operation.
- Stainless steel desiccant supports and air diffusers to prevent channeling.
- Counter-current reactivation for efficient desiccant regeneration.
- PLC Controlled Electrical System
- Adjustable (5 min., 10 min.) cycle times: 10 minute cycle for the standard -40°F Pressure dew point outlet dew point systems, 5 minute cycle used in the optional -100°F Pressure dew point outlet dew point systems.
- Controlled repressurization to slowly repressurize the regenerated vessel to line pressure prior to switch over preventing desiccant bed movement and attrition.
- Fail safe design: Failure of power and/or pilot air causes the purge exhaust valves to close, eliminating loss of air pressure. The system also provides uninterrupted drying air flow, preventing a deadheading affect.
- Control pilot air filter provides clean air to air control system for long trouble-free reliable operation.
- Desiccant towers are designed, fabricated, and stamped according to ASME code.
- Desiccant fill and drain ports for ease of desiccant replacement.
- Structural steel frame.
- Highly reliable non-lubricated air inlet and outlet valves (APV) Automatic Piston Valve (AHLD 70 E - AHLD 750 E) and high performance, non-lubricated butterfly valves (AHLD-1000 E - AHLD-1500 E).
- Highly reliable angle seat design purge exhaust valves.
- Tower operating LED status lights (left and right tower dryer, left and right tower regenerating).
- On/Off switch and power On light.
- NEMA 4 weather resistant electrical system construction.

### Additional Options

- -100°F outlet pressure dew point.
- Failure-to-shift alarm with pressure transducers.
- Outlet dew point sensor with dew point readout on system display.
- High humidity alarm.
- Outlet dew point 4-20 ma signal.
- Mounted, piped, and wired filtration packages.

## DESIGN PARAMETERS

Type of dryer: Desiccant

Desiccant type: Premium Grade Activated Alumina

Power supply: 460 Volt / Three Phase / 60Hz

### All Models

Parameter Description	Air Pressure	Air Inlet Temperature	Ambient Temperature
Maximum	135 psig	120 (°F)	120 (°F)
Minimum	60 psig	40 (°F)	38 (°F)

## DRYER DESCRIPTION

### How It Works

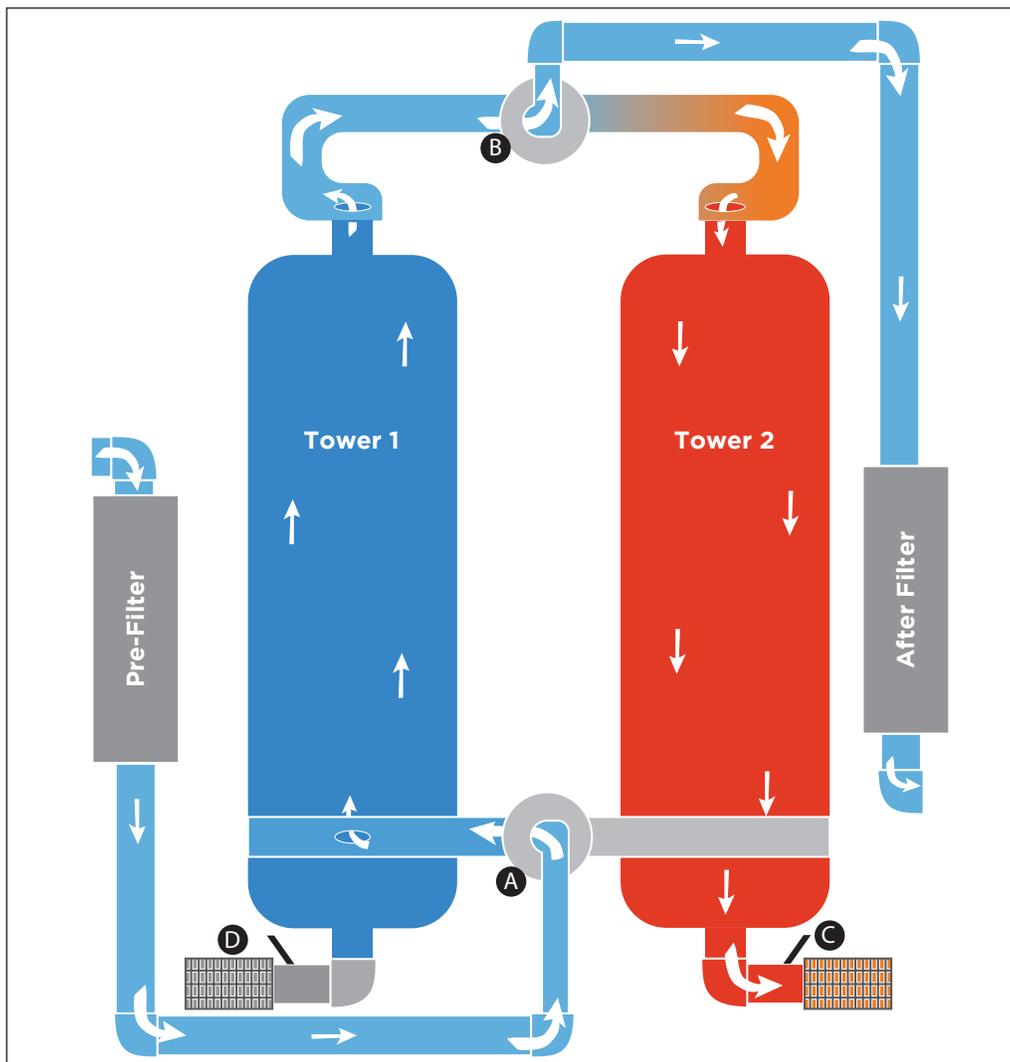
- Moisture saturated compressed air enters the coalescing pre-filter, where aerosols are coalesced then drained via an automatic drain system.
- The moist water vapor-laden inlet air free of liquid water flows to the inlet of the dryer through the APV (Automatic Piston Valve) (A), which diverts the inlet air to one of the towers - in this example, Tower 1.
- Air flows upward through the adsorbent bed removing the moisture vapor; the dried airflow exits the tower through the outlet valve (B), flowing to the outlet particulate after filter, which removes particulates from the air stream. Clean and dry air now flows to the customer process air distribution system.
- As one tower is drying air, the other tower will be regenerating (purging) the adsorbent bed. In this example, Tower 2 will be regenerating. Prior to regeneration, the exhaust valve (C) is opened and the tower is depressurized to near atmospheric pressure, the tower will now be regenerating. During the regenerating process, a small portion of dry outlet compressed air is used, 15% on average based on standard design capacity of 100 psig, 100°F inlet air, 100°F ambient air, and pressure dew point of -40°F.
- The dry regeneration airflow is channeled through the outlet orifice to the regenerating tower, removing moisture from the adsorbent bed and exits the regenerating tower through exhaust valve (C) and exhaust muffler to ambient. After regeneration cycle is complete, valve (C) closes, causing Tower 2 to repressurize to line pressure.
- Next, the tower will switch when exhaust valve (D) opens, causing Tower 1 to depressurize and regenerate. Simultaneously, the inlet and outlet APV valves (A) will shift the pistons to the low pressure Tower 1, causing the inlet airflow to be diverted to Tower 2, which will now be the drying tower. This switching process will continue repeatedly.
- The dryer control system is completely automatic and cycles the system through the drying and regeneration cycles. The standard cycle drying time is 5 minutes, regeneration cycle is 4 minutes, and repressurizing cycle is 1 minute.

8. The Aircel AHLD E-Series Heatless Dryer incorporates a unique energy saving control system to reduce purge air loss with its integrated Energy Management Purge Reduction System. This system utilizes a moisture sensor sampling the air from mid-bed of the on-stream drying tower, after the fixed purge time is complete, the regenerating/purging tower will repressurize. If the moisture sensor senses a low moisture condition or low load in the drying tower, the drying tower will remain in the drying mode after the fixed drying time cycle for an extended period of time. The end result is an overall purge reduction and significant energy savings.



## CAUTION!

- Do not misuse or modify under any conditions. Misuse or modification of this equipment may result in personal injury.



TYPICAL SCHEMATIC FLOW DIAGRAM

## INSTALLATION

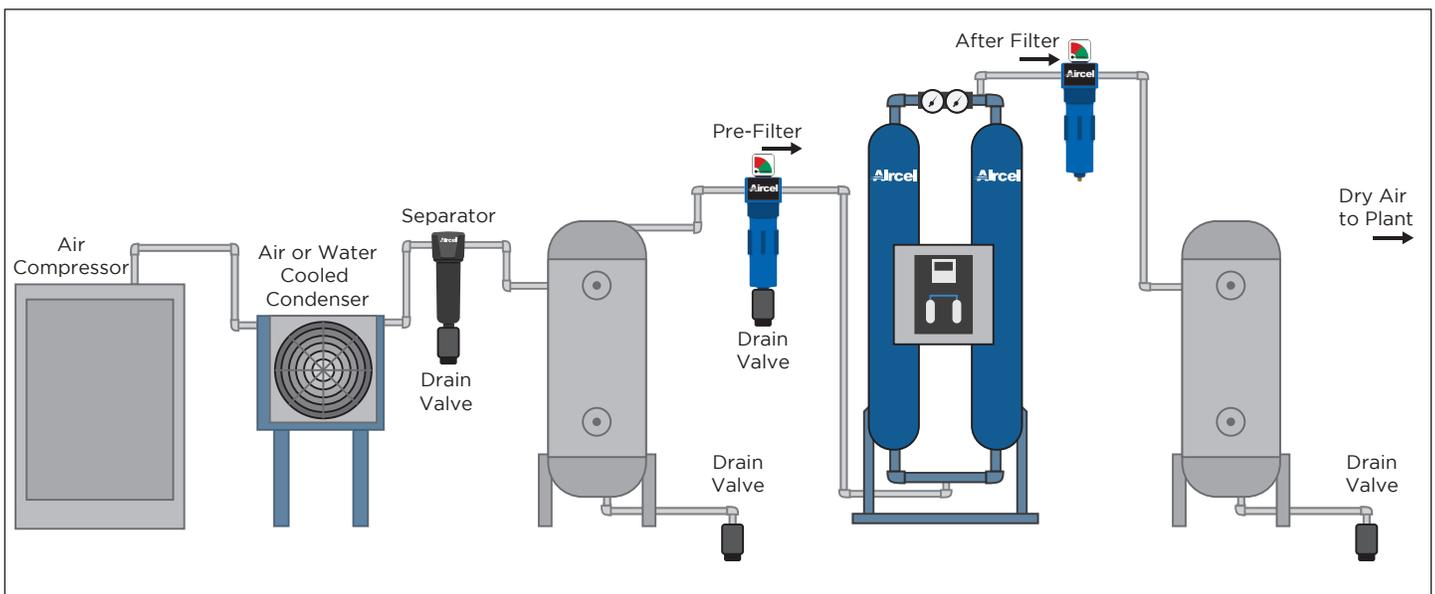
### Pre-requisites for Installation

To ensure a safe and smooth installation, we recommend you go through the steps indicated below:

- Make sure that all personnel involved have read this operation manual thoroughly. If you have any questions, please contact your Aircel representative or the factory and we will be glad to assist you. If you need help with the commissioning, we will be glad to schedule an Aircel factory service technician to visit your site and commission the dryer for a nominal fee.
- Have extra copies of the operation manual.
- Special care must be taken while transporting the unit to the installation site.
- Dryer must not be moved or lifted by the attached piping.

### Location

- Careful consideration should be given to the location of the dryer in order to assure optimum results. Ensure that the load bearing weight of the floor is adequate for the weight of the dryer.
- The dryer should be located in an open area and a level ground. Dryer should be bolted to the floor to eliminate vibrations.
- The ambient temperature should be between 40°F and 100°F. Low temperature could affect the dryer process and result in high outlet dew point.
- In conditions where the ambient drops below freezing, Aircel recommends the use of heat trace on any coalescing filter sumps and drain lines and the use of heated type drainings.
- Dryer and accompanying filters should be installed with at least 2-5 feet clearance from the adjoining walls to provide easy access for routine maintenance.



TYPICAL INSTALLATION DIAGRAM

## INSTALLATION

Only qualified personnel should make electrical and mechanical connections.

- **EQUIPMENT FOR INSTALLATION:** This dryer does not need any special tools for installation. Foundation: Dryer should be mounted on a suitably structured flat and level floor or base that is free from vibration. Special care must be used when lifting the dryer to prevent tip-over.
- **MOUNTING:** Bolt dryer to the foundation using the bolt holes provided in the frame.
- **PIPING:** Connect the inlet of the dryer to the moist gas from the compressor/receiver/inlet filter. Install the inlet piping and the inlet shutoff valve, Install the Outlet piping and the outlet shutoff valve (a union with a valve by-pass can be installed at the inlet and outlet valves to accommodate isolation of the dryer for maintenance). Compressed air piping has to be at least the same size as the of the inlet and outlet connections of the dryers. Larger pipe sizes can be used with reducers.
- **BACK PRESSURE REGULATOR:** Install backpressure regulator to prevent any possibility of fluidization of the desiccant bed. When there is a sudden increase in the demand for compressed air downstream of the dryer, a huge pressure drop develops and can affect the performance of the dryer and the drying material (desiccant).
- **DESICCANT:** Make sure that the dryer towers are filled with desiccant. Larger dryers may have desiccant shipped separately – in which case, the media has to be filled into the pressure vessels from the desiccant fill ports. Care must be taken when filling the media and it must be done gradually to prevent powdering.
- **MUFFLER:** If the event that mufflers have been shipped loose, they must be installed and secured.
- **BY-PASS:** If the dryer is not supplied with optional by-pass valve it is highly recommended that by-pass valve be installed around the dryer and filters. These by-pass shut-off valves will permit the dryer and filters to be removed from the compressed air system for servicing without shutting down the entire compress air system.
- **ELECTRICAL:** Make all electrical connections to the dryer as shown on the wiring diagram. Special care must be taken in connecting the proper voltage as indicated on the specification sheet and wiring schematic.
- **ADDITIONAL VALVING/PIPING:** When installing equipment or components keep in mind the serviceability of the equipment and provide additional valves to isolate, bypass, and to depressurize as needed.
- **EXHAUST:** If you intend to vent your exhaust with additional piping, the discharge piping from the exhaust should not be piped upward without arrangement for removing trapped condensate. Make sure that you do not apply a backpressure on this exhaust system. If exhaust piping is to be extended, try to stay within 15 to 20 feet and use the next larger pipe size.

**NOTE:** It is mandatory that dryer be grounded. Use of your plants frame as a ground may cause problems with the control. A fused disconnect is not supplied with this equipment therefore one must be supplied by customer. All electrical fuses, breakers, etc. should be properly sized.

Aircel is not liable for any code violations, component damage, downtime, or consequential damage related to customer supplied electrical components and connections.

## START-UP AND SHUT DOWN PROCEDURES

### Start-Up Procedure

At any point during the process of startup or shutdown, you notice anything unusual; we recommend you refer to the operation manual immediately. If you cannot find the answer in the troubleshooting section, contact your Aircel representative or the factory at once.

1. Ensure that the dryer is connected to a suitable compressed air supply. Make sure that the pressure of the supply is equal to the normal operating pressure of the dryer.
2. Check to make sure the "shut-off" valves are closed and that by-pass valve is open.
3. Close all manual drain/vent valves.
4. Slowly pressurize the dryer by gradually (slowly) opening the inlet shut-off valve to the OPEN position.
5. When both towers of the dryer are completely pressurized, check the complete system for possible air leaks. Use soap and water to test all joints and fittings. If any leaks are detected, immediately depressurize the unit and correct the leaks.
6. Make certain that any automatic condensate drain isolation valves are in the open position so proper condensate draining can occur.
7. When normal operating pressure is reached, switch on electrical power (Turn switch to ON position).
8. With by-pass valve closed, open the outlet valve slowly to allow air downstream.
9. When energized one of the towers should depressurize.
10. Check the operation of several cycles completely by following the control panel display screen operation, the panel lights on the electrical box, and the tower pressure gauges to make certain the dryer system is operating as displayed. Also refer to the how it works section, flow diagram, electrical drawing, dryer control display screen descriptions, and sequence of operation in this manual for reference.
11. Check the drain valve for proper operation and discharge of liquid (filters and separators, etc.).
12. Near the dryer outlet (APV) valve, check the control air/pilot air regulator secondary pressure, the regulator gauge should read 100 psig. Increase or decrease regulator knob to achieve a 100 psig control air secondary pressure reading.
13. Make certain the purge exhaust valves slowly open within an 8 to 12 second time period, some adjustment of the flow control valve attached to the actuator may be

required, after adjustment tighten down the locking collar.

14. Make certain a slight amount of air flow is felt at the end of the EMS RH sensor sample cell exhaust coil tube (this is normally located at the back of the dryer) adjust the needle valve to give more or less flow.
15. Review the dryer system display screen shots (in this manual) to make certain the parameters are set as needed in the customer dryer.
16. Purge air flow is preset and not adjustable.

After the initial startup, the dryer operation is completely automatic. To understand the details of the operation, we recommend you use the how it works section, flow diagram, electrical drawing, dryer control display screen descriptions, and sequence of operation in this manual for reference.

### Shut-Down Procedure

At any point during the process of startup or shutdown, you notice anything unusual; we recommend you refer to the operation manual immediately. If you cannot find the answer in the troubleshooting section, contact your Aircel representative or the factory at once.

1. Slowly OPEN the by-pass valve.
2. Slowly CLOSE the Inlet and outlet "shut-off" valves.
3. To depressurize the dryer after the Dryer is isolated. Turn the power ON ... a purge exhaust valve will open and the dryer system starts to depressurize, also the manual vent valve on the outlet afterfilter can be opened to depressurize the Dryer until the tower pressure gauges read '0' psig.
4. Switch off electrical power after both towers have been depressurized.

## SEQUENCE OF OPERATION

### 1. STEP ONE - Vessel 2 Depressurizing (0 - 5 seconds):

Vessel 2 (T2) purge exhaust pilot solenoid valve is energized which supplies control air to the purge exhaust valve (V4) which opens slowly, depressurizing vessel 2 (T2). Simultaneously the inlet valves V1 and V2 shift positions with a pneumatic signal from vessel 2 (T2) purge exhaust pilot solenoid valve to the inlet tower selector pneumatic pilot valve which in-turn supplies a pneumatic signal to the inlet valve (V1) and close valve (V2), directing the inlet air to vessel 1 (T1) to be drying the air. The air flows up through the desiccant bed and exits to the outlet valve (V5) to the outlet particulate filter then to custom dry process air system.

### 2. STEP TWO - Vessel 2 Regenerating (6 - 240 seconds):

Step 2 is a continuation of step 1 except vessel 2 (T2) will be regenerating, vessel 2 (T2) purge exhaust valve (V4 is still open vessel 1 (T1) is drying the inlet air. A small portion of dry outlet air from vessel 1 (T1) (15% average based on standard design capacity of 100 psig, 100°F inlet air, 100°F ambient air and PDP of -40°F is taken through a small orifice in the outlet line and used to regenerate the desiccant bed in vessel 2 (T2) until 240 seconds has been reached.

### 3. STEP THREE - Vessel 2 Repressurizing (241 - 300 seconds):

Vessel 2 (T2) purge exhaust pilot solenoid valve will de-energize causing vessel 2 (T2) purge exhaust valve (V4) to close, this allows vessel 2 (T2) to repressurize to line pressure, since air continues flowing through the small outlet orifice pressurizing vessel 2 (T2). The inlet tower selector pneumatic pilot valve maintains the inlet valve (V1 & V2) positions.

### 4. STEP FOUR - Vessel 1 Extended Drying:

A few seconds before the end of repressurization the AHLD E-SERIES Controller's integrated Energy Management Purge Reduction System looks at the moisture sensor, if the moisture load is low enough, vessel 1 (T1) will continue to dry for an extended drying period until the moisture load has reached a set high level, the controller will then advance to step 5 and the vessels will switch. This feature reduces the overall purge consumption saving energy and money.

### 5. STEP FIVE - Vessel 1 Depressurizing (0 - 5 seconds):

Vessel 1 (T1) purge exhaust pilot solenoid valve is energized which supplies control air to the purge exhaust valve (V3) which opens slowly, depressurizing vessel 1 (T1). Simultaneously the inlet valves V2 and V1 shift positions with a pneumatic signal from vessel

1 (T1) purge exhaust pilot solenoid valve to the inlet tower selector pneumatic pilot valve which in-turn supplies a pneumatic signal to the inlet air to vessel 2 (T2) to be drying the air. The air flows up through the desiccant bed and exits to the outlet valve (V6) to the outlet particulate filter then to the customer dry process air system.

### 6. STEP SIX - Vessel 1 Regenerating (6 - 240 seconds):

Step 6 is a continuation of step 5 except vessel 1 (T1) will be regenerating, vessel 1 (T1) purge exhaust valve (V3) is still open, vessel 2 (T2) is drying the inlet air. A small portion of dry outlet air from vessel 2 (15% average based on standard design capacity of 100 psig, 100°F ambient air and PDP of -40°F) is taken through a small orifice in the outlet line and used to regenerate the desiccant bed in vessel 1 (T1) until 240 seconds has been reached.

### 7. STEP SEVEN - Vessel 1 Repressurizing (241 - 300 seconds):

Vessel 1 (T1) purge exhaust pilot solenoid valve will de-energize causing vessel 1 (T1) purge exhaust valve (V3) to close, this allows vessel 1 (T1) to repressurize to line pressure, since air continues flowing through the small outlet orifice pressurizing vessel 1 (T1). The inlet tower selector pneumatic pilot valve maintains the inlet valve (V2 and V1) positions.

### 8. STEP EIGHT - Vessel 2 Extended Drying:

A few seconds before the end of repressurization the AHLD E-SERIES Controller's integrated Energy Management Purge Reduction System looks at the moisture sensor, if the moisture load is low enough, vessel 2 (T2) will continue to dry for an extended drying period until the moisture load has reached a set high level, the controller will then advance to step 1 and the vessels will switch. This feature reduces the overall purge consumption saving energy and money.

## MAINTENANCE

### Maintenance

Prior to performing and maintenance on the dryer, all personnel are strongly advised to familiarize themselves with the equipment by reading the entire contents of this operation manual. Aircel strongly recommends the strict adherence of all the safety procedures prior to any performing and maintenance activity on the dryer.

1. The pressure differential indicator referred to as the "Delta-P" is a very good indicator of the state of the filter elements. Maintenance personnel must pay attention to these to keep the drying running with full efficiency. Change filter elements on a regular basis, once a year maximum for a 1-shift operation. Change more frequently if operating 2 or 3 shifts such as every 6 months.
2. The useful life of a filter element depends on the quality of air. Free open areas for input and exhaust will ensure lesser intake of dirt and particles.
3. Powder desiccant can accumulate in the muffler and increase the backpressure in the regenerating tower. Change mufflers on a regular basis typically every 2-3 months for optimum performance.
4. Oil and oil vapor can drastically reduce the life of the desiccant. Take precautions to eliminate all traces of oil from the airflow.
5. Fluctuating dew point indicates uneven drying and regeneration between the towers, an exhaust valve may not be working properly or muffler may be clogged or dirty, also vessel diffuser screen may be clogged.

### Weekly Checklist

1. Check all drain valves, prefilter, afterfilter and separators.
2. Check any pressure differential indicators (Delta-P) on the pre-filter and afterfilter (filter elements should still be changed on regular basis once a year maximum for a 1 shift operation. Change more frequently if operating 2 or 3 shifts such as every 6 months).
3. Check dryer for correct operation.
4. Verify dryer is purging at the purge exhaust, after dryer depressurizes.
5. Check the dew point (if available) to ensure the dew point is being achieved.
6. Check back pressure in regenerating tower, if more than a few psig on the pressure gauge, clean or replace exhaust mufflers (change mufflers on a regular basis typically every 2-3 months for optimum performance).

### Semi-Annual Checklist

1. Remove and inspect all filters for excessive particulate loading and physical damage – if required replace prefilters, afterfilters, pilot air filter and mufflers (filter elements should still be changed on regular basis once a year maximum for a 1 shift operation. Change more frequently if operating 2 or 3 shifts such as every 6 months).
2. Check pressure differential indicator and if it turns red, replace the element.
3. Remove exhaust mufflers. Knock out excess particulate and back flow with dry compressed air. If particulate cannot be removed completely change the exhaust mufflers. Check backpressure in regenerating tower, if more than a few psig on the pressure gauge, clean or replace exhaust mufflers. (Change mufflers on a regular basis typically every 2-3 months for optimum performance).
4. Check desiccant condition. Powder in the mufflers is an indication of the status of the desiccant.
5. Check all solenoid valves – coil condition and control circuit.
6. Check dryer operation.
7. Inspect and clean inlet and outlet APV (Automatic Piston Valves).

### Annual Checklist

1. Replace elements in prefilters, afterfilters, and pilot air filter.
2. Replace mufflers.
3. Recalibrate dew point analyzer probe (if used) or send back to factory for recalibration.
4. Check inlet and outlet valve seals. Clean or replace as needed.
5. Check dryer for proper operation



### WARNING!

- Follow any proper lock out/tag out procedure before performing service or maintenance work.
- Follow all safety procedures prior to performing any maintenance activating on the dryer.

## NORMAL OPERATION SETUP

### Normal Dryer System Operation Setup

The following operational sequence should be followed for normal dryer system operation.

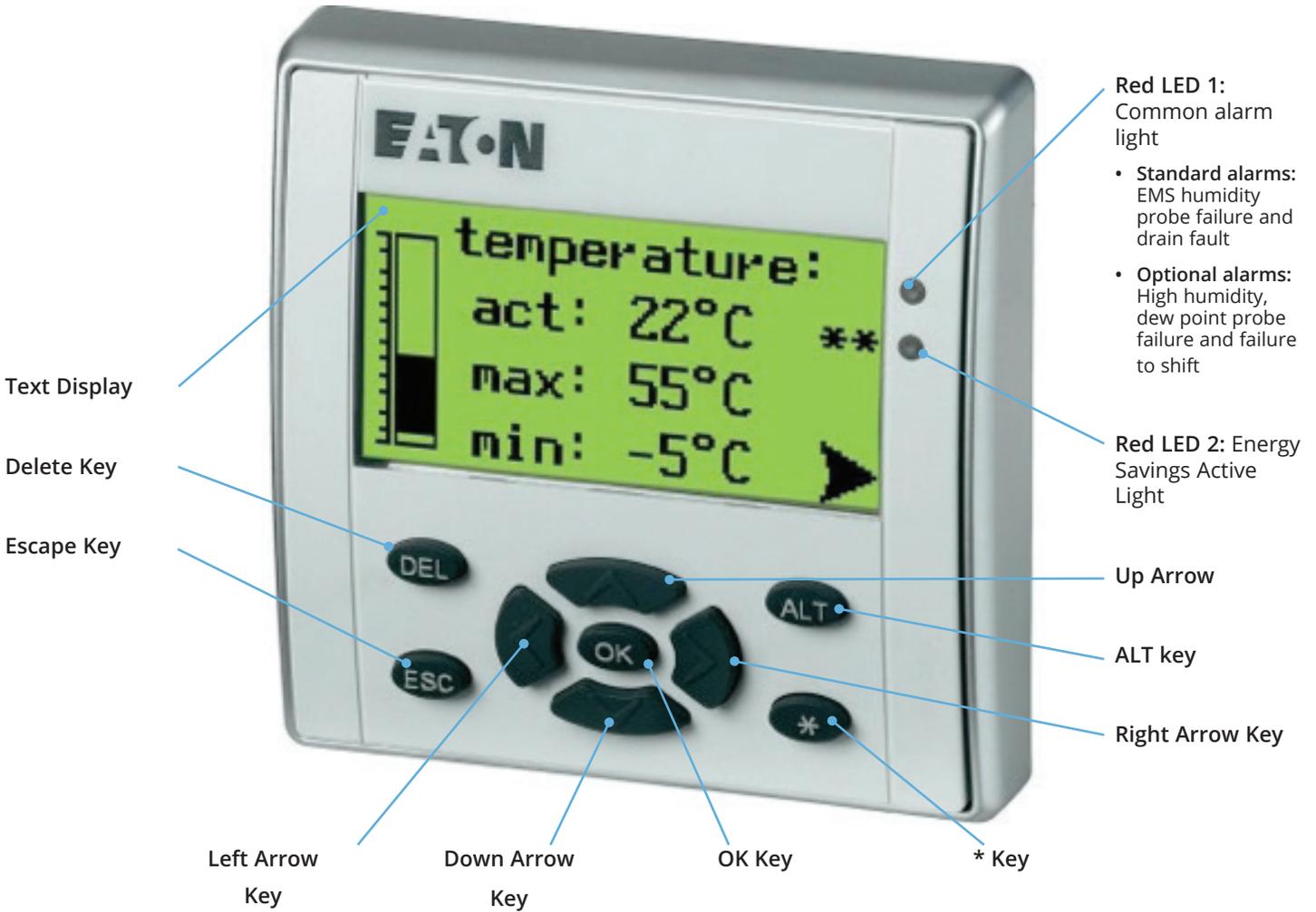
1. Make certain all gauge isolation valves, vent valves, instrument valves, pre-filter drain valves, etc. are in the correct positions.
2. Make certain the system has been pressurized to line pressure.
3. Ensure blower intake adjustment valve has been preset and locked down. Slight adjustment might be needed to maintain 400°F downstream of heater during the heat regeneration cycle.
4. Verify control air has pressure, set at 100 psi
5. Confirm the valve upstream of the dew point sensor is fully open, and valve downstream of the dew point sensor is slightly open - a slight air flow should be noticed at the end of the exhaust coil.
6. The Power On/Off switch is set to ON.
7. The System On/Off button must be turned On. This is accomplished by pressing the System On button on the control panel in the Main Menu screen. The color will be green for on and red for off.
8. Service Mode should not be active. Service Mode will not be visible or shown on the Running Sequence screens when not active. If Service Mode is shown, the service routine is active and needs to be place into normal operation. To deactivate Service Mode from the Running/ Step screens, press the Screen Unlock button until it starts blinking, then press the Main Menu button, displaying the Control/Main screen. Next, press the Service Menu button to activate the service screen. From here, press the Deactivate Service button. The Service Mode that was visible on each screen will disappear and the dryer will resume normal operation.
9. Check the temperature settings in the Control/Main menu by pressing the Temp Settings button and verify all settings are correct as needed.
10. Dew point Demand can be turned On or Off in the Control/Main menu. When On (Green in color), Dew point Demand is energy saving demand mode, extending the drying period if below outlet Dew point Demand setting in the Temp Settings screen. When the Dew point Demand button is Off (Red in color), the dryer is in fixed time mode, switching continuously on a standard time cycle.
11. Dry Cool Purge can be turned On or Off in the Control/Main menu. When On (Green in color), a portion of the dry air outlet will help cool the regenerating bed and minimize the pressure dew point swing at switchover.
12. Blower Cool can be turned On or Off in the Control/Main menu. When On (Green in color), the heater sheath cooling process will initiate for a total of 8 minutes prior to the Dry Cool Purge.
13. Typically, the Running Screens/Steps screens should be displayed on the system screen when in operation. Other screens (such as the Flow Diagram) can be displayed as the normal operation screen, if needed.
14. Verify no Common Shutdown alarms are active and require attention.
15. Make certain any filter, dryer, or user block and bypass valves are in the correct positions.
16. The system is ready to go on line and dry the process air.

Normal Settings	Heat Control	400
	Dew point Demand	- 50
	High Humidity	- 10

## AIRCEL PROGRAMMABLE CONTROLLER (APC)

### System Navigation

System display shows the dryer operations and provides the user the ability to change certain dryer settings.



## AIRCEL PROGRAMMABLE CONTROLLER (APC)

### Dryer Operations

#### STEP ONE: Select Vessel 2 Depressurizing (0 - 5 seconds)

Vessel 2 (T2) purge exhaust pilot solenoid valve is energized, supplying control air to slowly open the purge exhaust valve (V4), depressurizing vessel 2 (T2).

Simultaneously, the inlet valves V1 and V2 shift positions with a pneumatic signal from vessel 2 (T2) purge exhaust pilot solenoid valve to the inlet tower selector pneumatic pilot valve. This action supplies a pneumatic signal to the inlet valves to open valve (V1) and close valve (V2), directing the inlet air to vessel 1 (T1) to dry the air.

The air flows up through the desiccant bed and exits outlet valve (V5) to the outlet particulate filter. The air then moves down the line, to the customer dry process air system.



#### STEP TWO: Vessel 2 Regenerating (6 - 240 seconds)

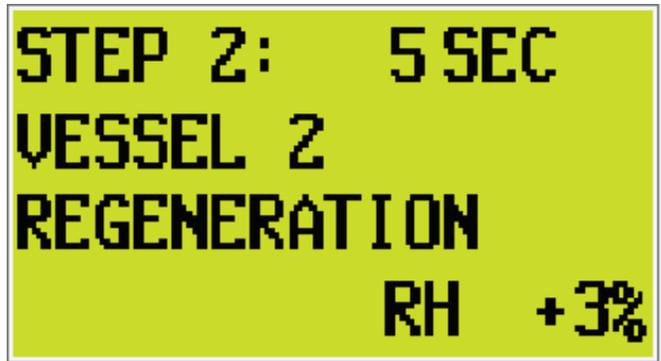
Vessel 2 (T2) is regenerating, Vessel 2 (T2) purge exhaust valve (V4) is still open, Vessel 1 (T1) is drying the inlet air.

A small portion of dry outlet air from Vessel 1 (T1) (15% average based on standard design capacity of 100 psig, 100°F ambient air and PDP of -40°F) is taken through a small orifice in the outlet line and used to regenerate the desiccant bed in Vessel 2 (T2) until 240 seconds has been reached.

The timer on this step counts to 240 seconds (4-minutes).

A warning sign will flash in the upper right hand portion of the screen and a red LED alarm light will flash on the PLC display for any alarm. To view alarms, press the left arrow once from the main screen.

The screen also displays the relative humidity reading and dew point (optional).



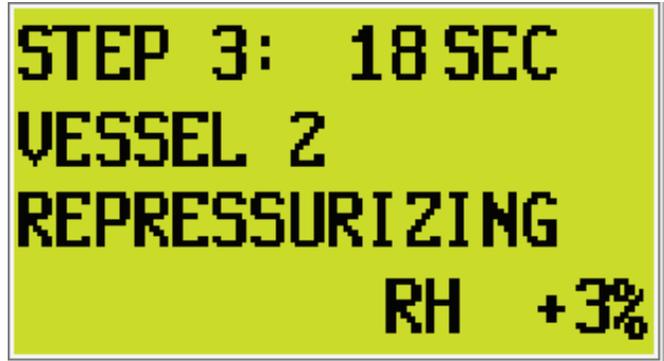
## AIRCEL PROGRAMMABLE CONTROLLER (APC)

### Dryer Operations, Cont.

#### STEP THREE: Opens Vessel 2 Repressurizing (241 - 300 seconds)

Vessel 2 (T2) purge exhaust pilot solenoid valve will de-energize, causing Vessel 2 (T2) purge exhaust valve (V4) to close, repressurizing Vessel 2 (T2).

The inlet tower selector pneumatic pilot valve maintains the inlet valve (V1 & V2) positions.



#### STEP FOUR: Vessel 1 Extended Drying

A few seconds before the end of repressurization, the integrated Energy Management Purge Reduction System's moisture sensor determines the tower moisture load. If Vessel 1 (T1)'s moisture load is low enough, the tower will continue to dry for an extended drying period until the moisture load has reached a set high level or an additional 30 minutes, whichever comes first. After 30 minutes, the unit will switch and continue normal operation until the next extended savings step.

At the start of each extended savings step, the PLC checks for faults, EMS relative humidity sensor value, and high outlet dew point setting (optional) to ensure if the dryer needs to continue drying. If so, the dryer will go into extended drying.

This feature reduces the overall purge consumption, saving energy and money.



**Note:** If the dryer needs to continue to the next step to regenerate based on humidity, the extended savings step 4 will be skipped.

## AIRCEL PROGRAMMABLE CONTROLLER (APC)

### Dryer Operations, Cont.

#### STEP FIVE: Vessel 1 Depressurizing (0 - 5 seconds)

Vessel (T1) purge exhaust pilot solenoid valve is energized, supplying control air to the purge exhaust valve (V4), depressurizing vessel 1 (T1).

Simultaneously, the inlet valves V2 and V1 shift positions with a pneumatic signal from vessel 1's (T1) purge exhaust pilot solenoid valve to the inlet tower selector pneumatic pilot valve. This supplies a pneumatic signal to the inlet valves to open valve (V2) and close valve (V1), directing the inlet air to vessel 2 (T2) to begin drying the air. The air flows up through the desiccant bed and exits to the outlet valve (V6) to the outlet particulate filter and through to downstream equipment.



#### STEP SIX: Vessel 1 Regenerating (6 - 240 seconds)

Vessel 1 (T1) is regenerating, Vessel 1 (T1) purge exhaust valve (V3) is still open, Vessel 2 (T2) is drying the inlet air.

A small portion of dry outlet air from Vessel 2 (T2) (15% average based on standard design capacity of 100 psig, 100°F ambient air and PDP of -40°F) is taken through a small orifice in the outlet line and used to regenerate the desiccant bed in Vessel 1 (T1) until 240 seconds has been reached.

The timer on this step counts to 240 seconds (4-minutes).



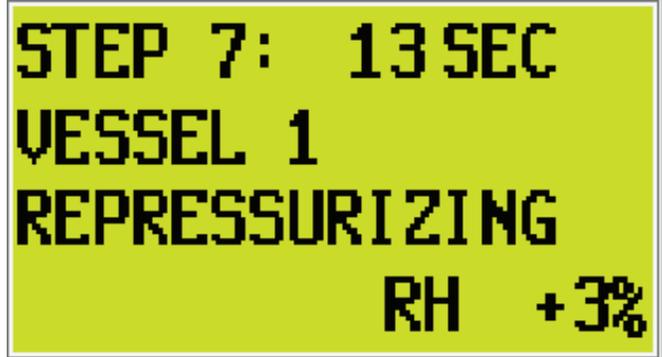
## AIRCEL PROGRAMMABLE CONTROLLER (APC)

### Dryer Operations, Cont.

#### STEP SEVEN: Vessel 1 Repressurizing (241 - 300 seconds)

Vessel 1 (T1) purge exhaust pilot solenoid valve will de-energize, causing Vessel 1 (T1) purge exhaust valve (V3) to close, repressurizing Vessel 1 (T1).

The inlet tower selector pneumatic pilot valve maintains the inlet valve (V1 & V2) positions.



#### STEP EIGHT: Vessel 2 Extended Drying

A few seconds before the end of repressurization, the integrated Energy Management Purge Reduction System's moisture sensor determines the tower moisture load. If Vessel 2 (T2)'s moisture load is low enough, the tower will continue to dry for an extended drying period until the moisture load has reached a set high level or an additional 30 minutes, whichever comes first. After 30 minutes, the unit will switch and continue normal operation until the next extended savings step.

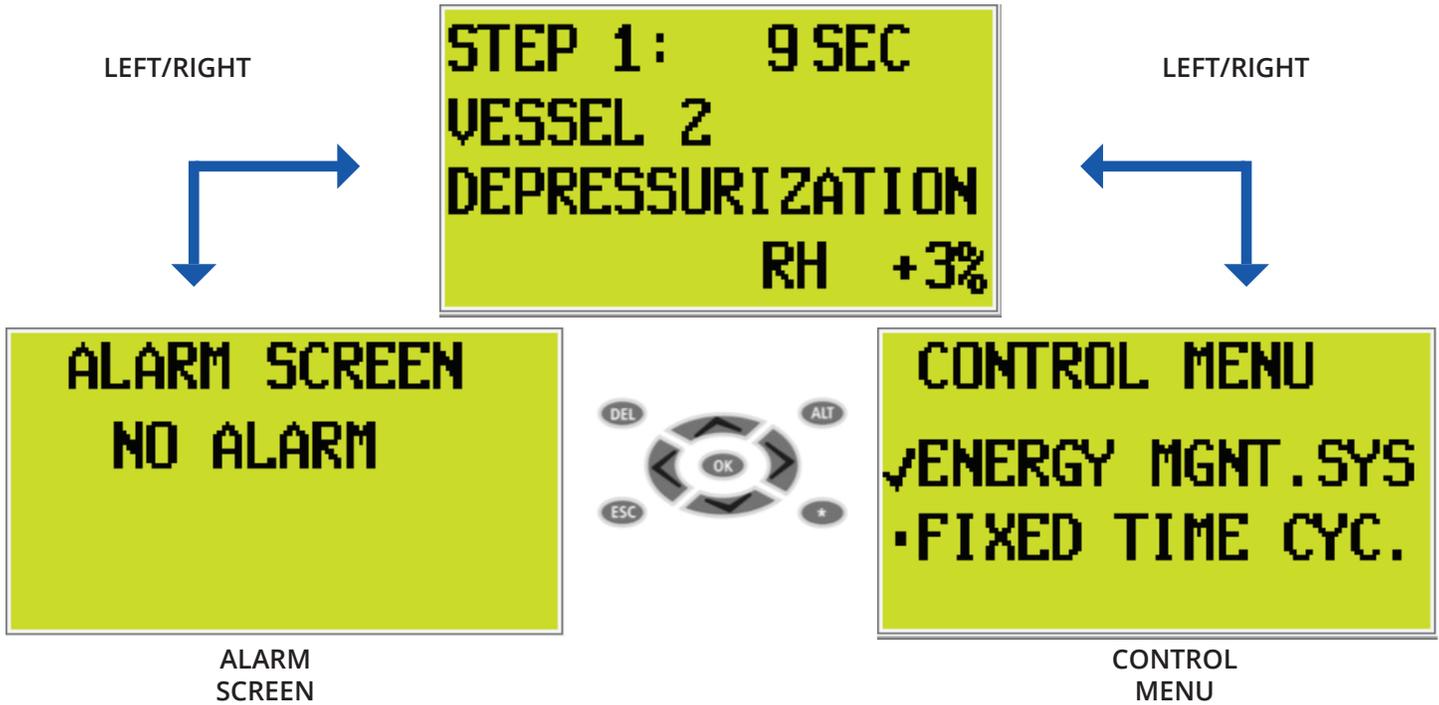
At the start of each extended savings step, the PLC checks for faults, EMS relative humidity sensor value, and high outlet dew point setting (optional) to ensure if the dryer needs to continue drying. If so, the dryer will go into extended drying.

This feature reduces the overall purge consumption, saving energy and money.

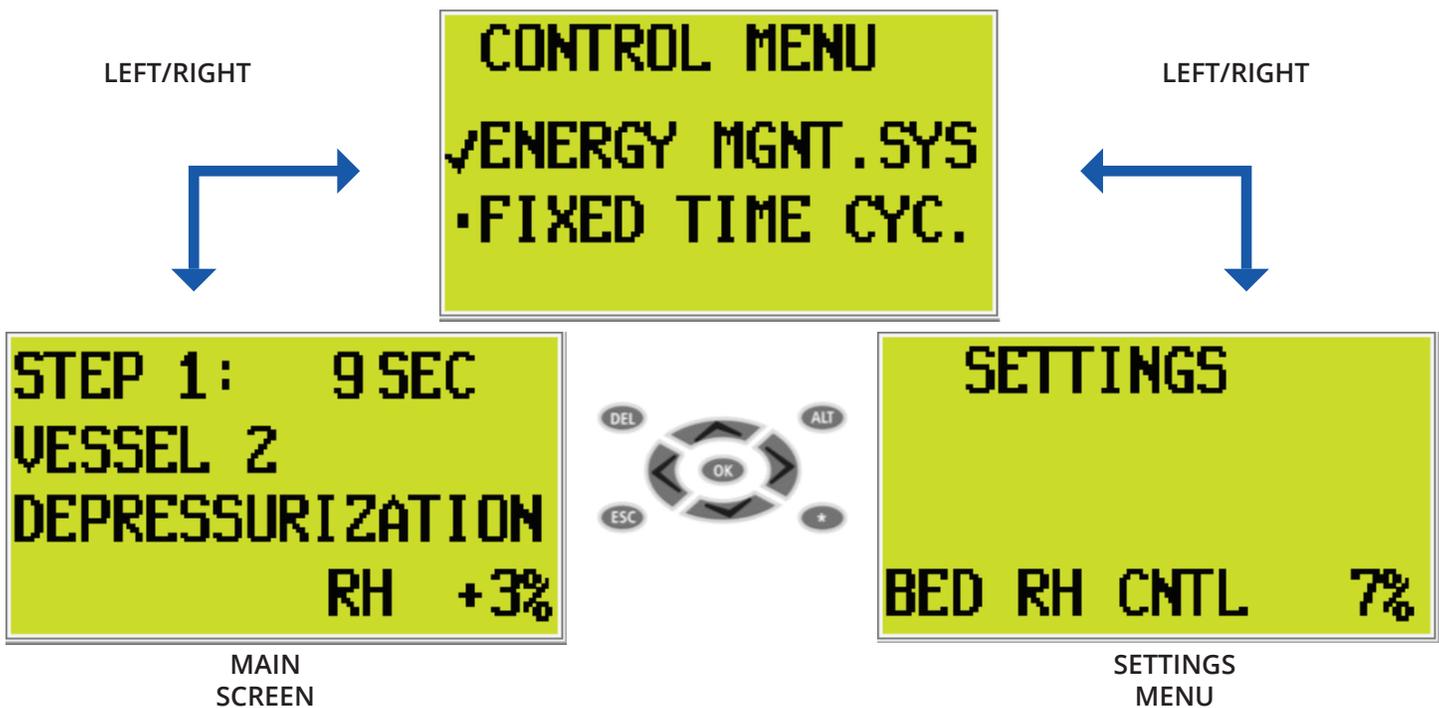


## AIRCEL PROGRAMMABLE CONTROLLER (APC)

### Main Screen Navigation

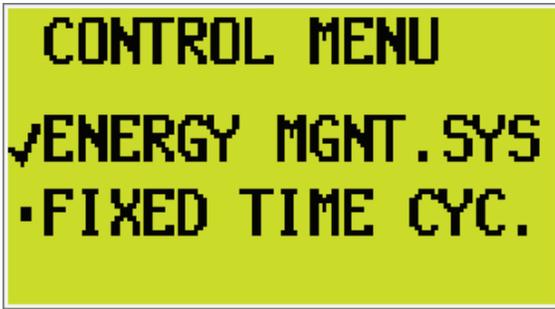


### Control Menu Navigation



## AIRCEL PROGRAMMABLE CONTROLLER (APC)

### Control Menu Operation



CONTROL  
MENU

- Push OK to engage the menu
- Scroll to the desired selection and push OK

### Settings Screen Operation



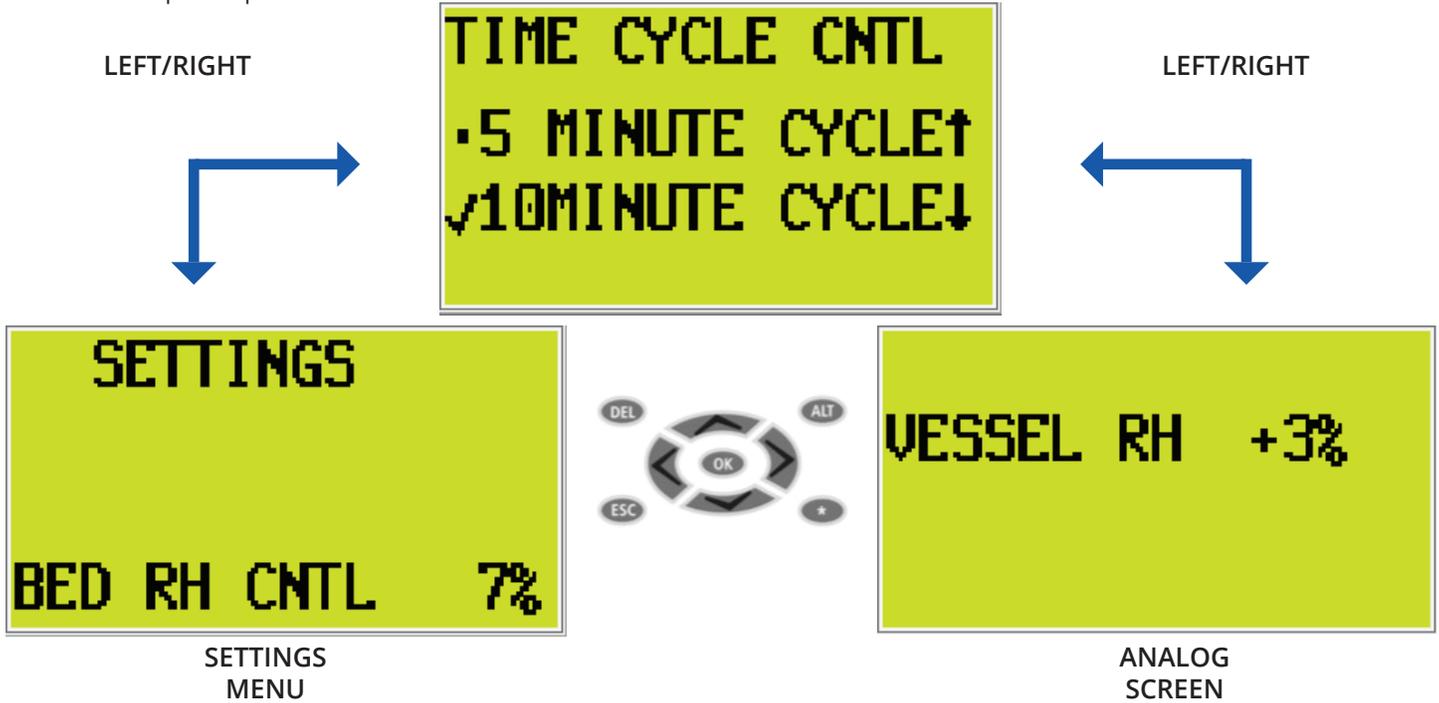
**Settings Screen:** For use with optional dew point display and high humidity alarm

- To engage, push OK then scroll to the desired set point to be changed.
- Push OK on the set point to be changed and use the up or down arrows to change the set point.
- Push OK to complete the change and ESC to de-select the screen. Push ESC again to exit to the main screen or use the left or right arrows to scroll to the next screen.

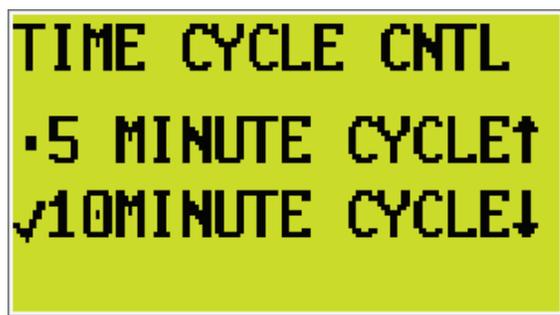
## AIRCEL PROGRAMMABLE CONTROLLER (APC)

### Time Control Main Navigation

This time cycle control menu allows the user to choose between a 10 minute standard time cycle and a shorter 5 minute cycle for lower dew point option.



### Time Control Menu Operation



- To change the time cycle, push OK then scroll to the time cycle to be selected. Push OK then push ESC.
- When changes are complete, push ESC to exit changes. Push ESC again to return to the main screen.



## AIRCEL PROGRAMMABLE CONTROLLER (APC)

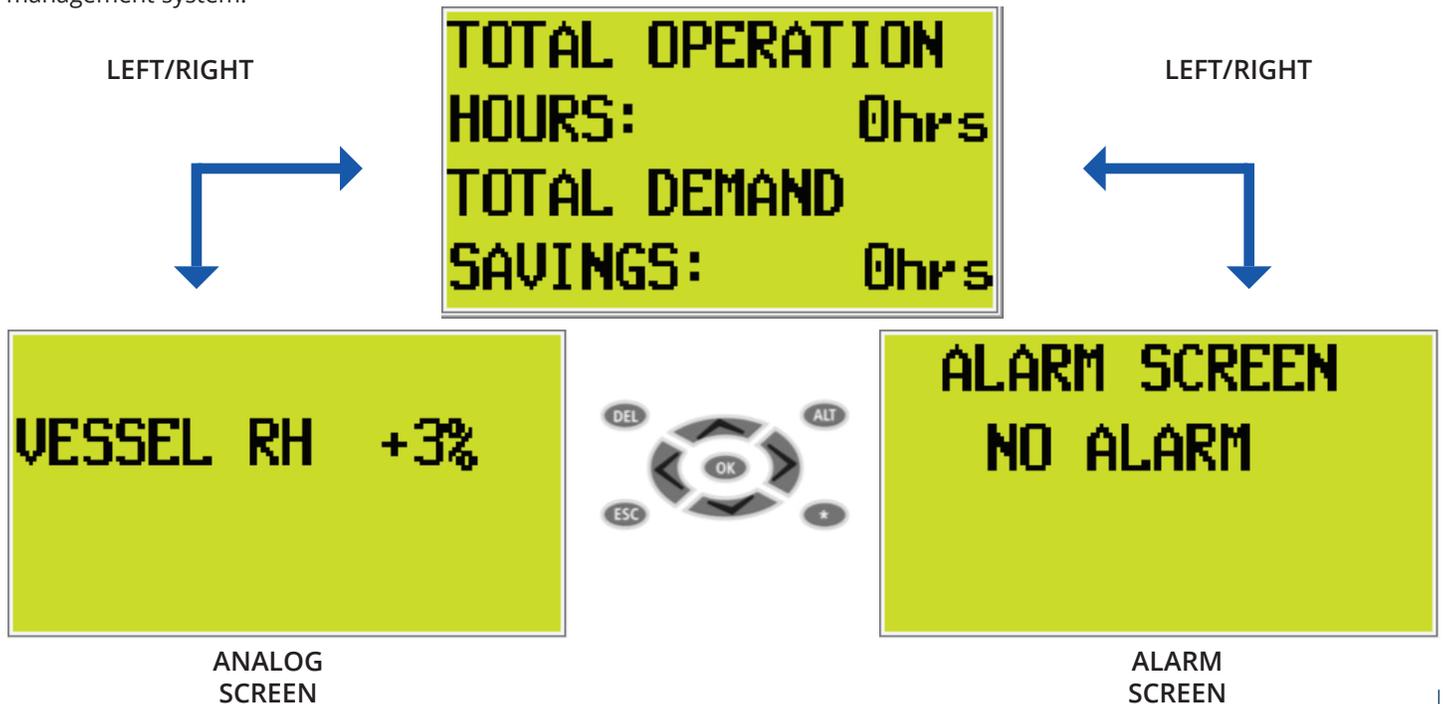
### Analog Screen Navigation

The analog screen simply displays the analog output signals.



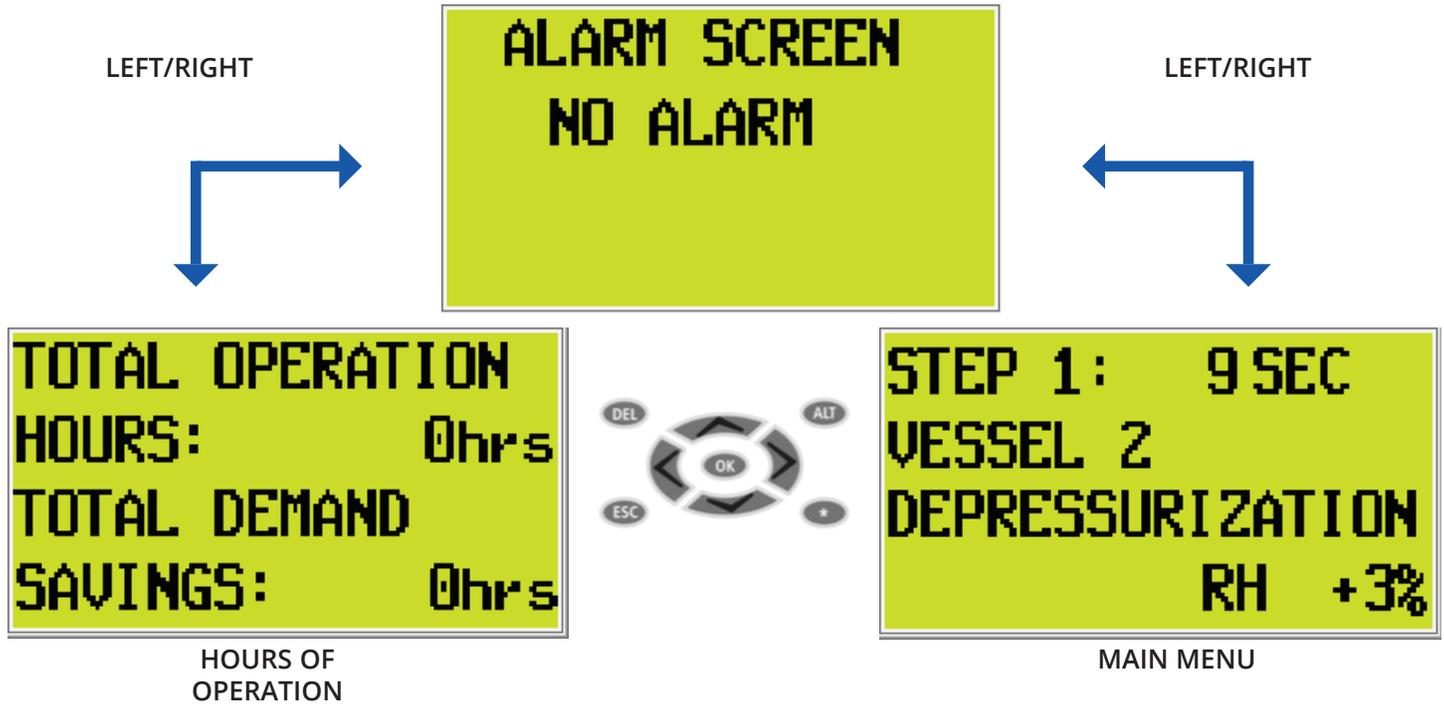
### Hours of Operation Screen Navigation

The hours of operation screen gives the user the amount of run time as well as the total amount of hours saved with the energy management system.



## AIRCEL PROGRAMMABLE CONTROLLER (APC)

### Alarm Screen Navigation



### ALARM POP-UPS

- **No Alarm:** Alarm has been corrected
- **Bad Probe:** The EMS sensor has reached an out of range signal (check sensor and cable)
- **High Outlet Dew Point (Option):** Dew point has reached set point (check desiccant, pre-filters, control system)
- **Failure to Shift (Option):** Tower did not properly repressurize

## AIRCEL PROGRAMMABLE CONTROLLER (APC)

### Alarm Pop-Up Screens



**No Alarm:** The normally closed state of the common alarm relay.



**Drain Fault:** Shows when the relative humidity (EMS) probe is out of range. This can be either high out of range or low out of range. When this happens, the signal has either been lost or the sensor may need to be replaced.



**Bad RH Probe:** Shows when the relative humidity (EMS) probe is out of range. This can be either high out of range or low out of range. When this happens, the signal has either been lost or the sensor may need to be replaced.



**Bad Dew-P Probe:** Alarm for the dew point sensor probe out of range. The out of range can be either high or low. This can be either a complete loss of signal/voltage, the resistor can be disconnected or the sensor may need to be calibrated.



**High Humidity Alarm:** Alarm that is visible when the dew point is higher than the set point. The set point for the high humidity alarm can be changed but it is not recommended.



**The FTS Alarm (Failure-to-Shift):** Alarm present when a vessel does not depressurize correctly or if a vessel that is to be drying does not have pressure at or above a certain set pressure.

## TROUBLESHOOTING TABLE

Problem	Probable Cause	Remedy
High Dew Point	High inlet air flow	Reduce inlet air flow
	Inlet air temperature above design spec	Reduce inlet air temperature to design spec
	Poor pre-filtration	Check pre-filter element, replace if needed
	Inlet air pressure below design spec	Increase pressure to the dryer
	Desiccant contaminated	Replace desiccant
	Purge flow orifice in the outlet APV valve may be clogged	Dismantle outlet APV valve, and clean out the orifice
	Back pressure in regenerating chambers	Mufflers are clogged, install new mufflers
	Exhaust valve(s) not fully opening or closing	Check pilot valve and pilot air supply, dismantle and clean exhaust valve, check flow control valve attached to purge exhaust valve actuator may not be adjusted properly (should be adjusted so exhaust valve opens within a 8-12 minute time period)
	APV valve leaking	Dismantle and clean, replace seals and piston if needed
	No input power	Check that dryer is on with correct voltage
High Pressure Drop	Controller failure	Check, replace if needed
	Low inlet pressure	Increase inlet pressure to design pressure
	Desiccant dusting	High inlet flow velocities due to high flow
	Inlet pre-filter dirty	Inspect and replace as needed
	High inlet flow rate	Reduce inlet flow rate to meet dryer spec
	Outlet filter dirty	Inspect and replace as needed
High Back Pressure in Regenerating Tower	Desiccant diffuser screens clogged	Inspect and clean as needed
	Purge muffler clogged	Clean and replace if needed
	Desiccant diffuser screens clogged	Inspect and clean as needed
	Restrictive purge exhaust piping	Clean and replace with larger pipe if required

## TROUBLESHOOTING TABLE

Problem	Probable Cause	Remedy
Dryer Fails to Shift Towers	Exhaust valve(s) not functioning	Check pilot valve and pilot air supply, dismantle and clean exhaust valve. Check flow control valve attached to purge exhaust valve actuator may not be adjusted properly (should be adjusted so exhaust valve opens within a 8-12 second time period).
	No input power	Check that dryer is on with correct voltage
	Controller failure	Check, replace if needed
	Pilot air supply restricted	Check pilot filter, and pilot tubing restriction
	Purge flow orifice in the outlet APV valve may be clogged	Dismantle outlet APV valve, and clean out the orifice
	Input APV valve malfunction	Dismantle, clean, and reinstall
	Outlet APV valve malfunction	Dismantle, clean, and reinstall
Purge Failure	Purge muffler clogged	Remove and clean, replace if needed
	Purge flow orifice in the outlet APV valve may be clogged	Dismantle outlet APV valve, and clean out the orifice
	Controller failure	Check, replace if needed
	Exhaust valve(s) not functioning	Check pilot valve and pilot air supply, dismantle and clean exhaust valve purge exhaust valve actuator may not be adjusted properly (should be adjusted so exhaust valve opens within an 8-12 second time period). Check control system.
Pressurization Failure	Purge flow orifice in the outlet APV valve may be clogged	Reduce inlet flow rate to meet dryer spec
	Exhaust valve(s) not functioning	Check pilot valve and pilot air supply, dismantle and clean exhaust valve purge exhaust valve actuator may not be

## APPENDIX

### Desiccant Material Safety Data Sheet



The Chemical Company

## Safety data sheet

### F200

Revision date : 2009/12/04

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(30286124/MDS\_GEN\_US/EN)

#### 1. Substance/preparation and company identification

Company

BASF CORPORATION  
100 Campus Drive  
Florham Park, NJ 07932, USA

24 Hour Emergency Response Information

CHEMTREC: 1-800-424-9300  
BASF HOTLINE: 1-800-832-HELP

#### 2. Composition/information on ingredients

CAS Number

1333-84-2

Content (W/W)

>= 94.0 - <= 100.0 %

Chemical name

Aluminum oxide (Al<sub>2</sub>O<sub>3</sub>), hydrate

#### 3. Hazard identification

Emergency overview

CAUTION: MAY CAUSE EYE, SKIN AND RESPIRATORY TRACT IRRITATION.

May cause difficulty breathing.

Prolonged or repeated contact may result in dermatitis.

Contact with the eyes or skin may cause mechanical irritation.

Contains material which may indicate/cause the possibility of sensory and pulmonary irritation.

Avoid contact with the skin, eyes and clothing.

Avoid inhalation of dusts.

Use with local exhaust ventilation.

Wear a NIOSH-certified (or equivalent) particulate respirator.

Wear safety glasses with side-shields.

Wear chemical resistant protective gloves.

Wear protective clothing.

Eye wash fountains and safety showers must be easily accessible.

Potential health effects

**Primary routes of exposure**

Routes of entry for solids and liquids include eye and skin contact, ingestion and inhalation. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquified gases.

#### 4. First-aid measures

**If inhaled:**

Keep patient calm, remove to fresh air. If necessary, give oxygen. If not breathing, give artificial respiration.

Seek medical attention if necessary.

## APPENDIX

## Desiccant Material Safety Data Sheet

## Safety data sheet

## F200

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**If on skin:**

After contact with skin, wash immediately with plenty of water and soap. Consult a doctor if skin irritation persists.

**If in eyes:**

In case of contact with the eyes, rinse immediately for at least 15 minutes with plenty of water. Immediate medical attention required.

**If swallowed:**

No hazards anticipated. If large quantities are ingested, seek medical advice.

## 5. Fire-fighting measures

Flash point:

Non-flammable.

**Additional information:**

Use extinguishing measures to suit surroundings.

**Hazards during fire-fighting:**

No particular hazards known.

**Protective equipment for fire-fighting:**

Wear self-contained breathing apparatus and chemical-protective clothing.

**NFPA Hazard codes:**

Health : 0      Fire: 0      Reactivity: 1      Special:

## 6. Accidental release measures

**Cleanup:**

Vacuum up spilled product. Place into suitable container for disposal.

## 7. Handling and storage

**Handling****General advice:**

Avoid dust formation in confined areas. Avoid contact with the skin, eyes and clothing. Ensure adequate ventilation.

**Storage****General advice:**

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

**Storage stability:**

Keep container dry.

## 8. Exposure controls and personal protection

**Components with workplace control parameters**

Aluminum oxide (Al <sub>2</sub> O <sub>3</sub> ), hydrate	OSHA	PEL 5 mg/m <sup>3</sup> Respirable fraction ; PEL 15 mg/m <sup>3</sup> Total dust ;
	ACGIH	TWA value 1 mg/m <sup>3</sup> Respirable fraction ;

## APPENDIX

### Desiccant Material Safety Data Sheet

#### Safety data sheet

#### F200

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**Advice on system design:**

Provide local exhaust ventilation to control dust. Provide local exhaust ventilation to maintain recommended P.E.L.

**Personal protective equipment**

**Respiratory protection:**

Wear a NIOSH-certified (or equivalent) particulate respirator. Observe OSHA regulations for respirator use (29 CFR 1910.134). Wear appropriate certified respirator when exposure limits may be exceeded.

**Hand protection:**

Wear chemical resistant protective gloves., Consult with glove manufacturer for testing data.

**Eye protection:**

Safety glasses with side-shields.

**Body protection:**

Body protection must be chosen based on level of activity and exposure.

#### 9. Physical and chemical properties

Form:	powder, granules, pellets, balls	
Odour:	odourless	
Colour:	off-white	
pH value:	9.4 - 10.1	
Melting point:	2,050 °C	
Boiling point:		No data available.
Vapour pressure:		No data available.
Density:		No data available.
Bulk density:	approx. 650 kg/m3 38.0 - 52 lb/ft3	( 68 °F)
Partitioning coefficient n-octanol/water (log Pow):		No data available.
Viscosity, dynamic:		No data available.
Solubility in water:		insoluble

#### 10. Stability and reactivity

**Substances to avoid:**

water

**Hazardous reactions:**

The product is chemically stable.  
Addition of water leads to increase in temperature.

#### 11. Toxicological information

**Oral:**

Information on: Aluminum oxide  
LD50/rat: > 5,000 mg/kg (OECD Guideline 401)

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## APPENDIX

## Desiccant Material Safety Data Sheet

**Safety data sheet****F200**

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**Skin irritation:**

*Information on: Aluminum oxide  
rabbit: non-irritant (OECD Guideline 404)*

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**12. Ecological information**

*Information on: Aluminum oxide  
Acute and prolonged toxicity to fish:  
DIN 38412 Part 15 static  
golden orfe/LC50 (96 h): > 500 mg/l  
The product has not been tested. The statement has been derived from products of a similar structure and composition.*

-----

*Information on: Aluminum oxide  
Acute toxicity to aquatic invertebrates:  
OECD Guideline 202, part 1 static  
Daphnia magna (48 h): > 100 mg/l*

-----

**13. Disposal considerations****Waste disposal of substance:**

Dispose of in accordance with local authority regulations.  
Check for possible recycling.  
Disposal requirements are dependent on the hazard classification and will vary by location and the type of disposal selected.  
All waste materials should be reviewed to determine the applicable hazards (testing may be necessary).

**14. Transport information****Land transport**

USDOT

Not classified as a dangerous good under transport regulations

**Sea transport**

IMDG

Not classified as a dangerous good under transport regulations

**Air transport**

IATA/ICAO

Not classified as a dangerous good under transport regulations

**15. Regulatory information****Federal Regulations**

## APPENDIX

### Desiccant Material Safety Data Sheet

#### Safety data sheet

#### F200

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**Registration status:**

TSCA, US released / listed

**OSHA hazard category:** ACGIH TLV established

**SARA hazard categories (EPCRA 311/312):** Acute

**SARA 313:**

<u>CAS Number</u>	<u>Chemical name</u>
1333-84-2	Aluminum oxide (Al <sub>2</sub> O <sub>3</sub> ), hydrate

State regulations

**State RTK**

<u>CAS Number</u>	<u>Chemical name</u>	<u>State RTK</u>
1333-84-2	Aluminum oxide (Al <sub>2</sub> O <sub>3</sub> ), hydrate	MA, NJ, PA

#### 16. Other information

**HMIS III rating**

Health: 1      Flammability: 0      Physical hazard: 1

HMIS uses a numbering scale ranging from 0 to 4 to indicate the degree of hazard. A value of zero means that the substance possesses essentially no hazard; a rating of four indicates high hazard.

**Local contact information**

prod\_reg@basf.com

IMPORTANT: WHILE THE DESCRIPTIONS, DESIGNS, DATA AND INFORMATION CONTAINED HEREIN ARE PRESENTED IN GOOD FAITH AND BELIEVED TO BE ACCURATE, IT IS PROVIDED FOR YOUR GUIDANCE ONLY. BECAUSE MANY FACTORS MAY AFFECT PROCESSING OR APPLICATION/USE, WE RECOMMEND THAT YOU MAKE TESTS TO DETERMINE THE SUITABILITY OF A PRODUCT FOR YOUR PARTICULAR PURPOSE PRIOR TO USE. NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE REGARDING PRODUCTS DESCRIBED OR DESIGNS, DATA OR INFORMATION SET FORTH, OR THAT THE PRODUCTS, DESIGNS, DATA OR INFORMATION MAY BE USED WITHOUT INFRINGING THE INTELLECTUAL PROPERTY RIGHTS OF OTHERS. IN NO CASE SHALL THE DESCRIPTIONS, INFORMATION, DATA OR DESIGNS PROVIDED BE CONSIDERED A PART OF OUR TERMS AND CONDITIONS OF SALE. FURTHER, YOU EXPRESSLY UNDERSTAND AND AGREE THAT THE DESCRIPTIONS, DESIGNS, DATA, AND INFORMATION FURNISHED BY BASF HEREUNDER ARE GIVEN GRATIS AND BASF ASSUMES NO OBLIGATION OR LIABILITY FOR THE DESCRIPTION, DESIGNS, DATA AND INFORMATION GIVEN OR RESULTS OBTAINED, ALL SUCH BEING GIVEN AND ACCEPTED AT YOUR RISK.  
END OF DATA SHEET

APPENDIX

Electrical Schematic Drawings

AHLD E-SERIES  
HEATLESS DESICCANT AIR DRYER  
ELECTRICAL SCHEMATICS

WIRING METHODS  
POWER 460V = BLACK THHN  
120VAC = RED 16AWG  
NEUTRAL = WHITE 16AWG  
24VDC = BLUE 16AWG  
24V COMMON = WHITE/BLUE 16AWG  
GROUND = GREEN

SCHEMATIC TYPICAL INDEX  
POWER DISTRIBUTION/BRANCH CIRCUITS  
PLC BASE UNIT INPUT/OUTPUTS  
PLC OUTPUT CARD  
PLC THERMOCOUPLE CARD  
TERMINAL LAYOUTS  
ENCLOSURE

MAX VOLTAGE 115  
TOTAL MCA 0.5 AMP  
LARGEST MOTOR FLA N/A  
NUMBER OF PHASES 1  
FREQUENCY 60HZ  
Underwriters Laboratories Inc. LISTED

Test Wire Size Installed in Connector AWG or MCM (mm <sup>2</sup> )	Slotted Head No. 10 and Larger <sup>1</sup>		Hexagonal Head-External Drive Socket Wrench	
	Slot Width - 0.047 inch (1.19 mm) or Less (14 inch (6.4 mm) or Less	Slot Length - Over 0.82 inch (20.8 mm) or Slot Length - Over 14 inch (6.4 mm)	Slot Width - 0.047 inch (1.19 mm) or Less (14 inch (6.4 mm) or Less	Slot Length - Over 0.82 inch (20.8 mm) or Slot Length - Over 14 inch (6.4 mm)
18-10 (1082.5.3)	20 (2.3)	35 (4.0)	80 (9.0)	75 (8.5)
8 (6.4)	25 (2.8)	40 (4.5)	80 (9.0)	75 (8.5)
6-4 (13.3-21.2)	35 (4.0)	45 (5.1)	105 (18.6)	110 (12.4)
3 (28.7)	35 (4.0)	50 (5.6)	275 (31.1)	150 (16.9)
2 (33.8)	40 (4.5)	50 (5.6)	275 (31.1)	150 (16.9)
1 (42.4)	-	50 (5.6)	275 (31.1)	150 (16.9)
10-20 (63.5-67.4)	-	50 (5.6)	385 (43.5)	180 (20.3)
30-40 (65.9-107.2)	-	50 (5.6)	500 (56.5)	250 (28.2)
250-350 (127-177)	-	50 (5.6)	650 (73.4)	325 (36.7)
400 (203)	-	50 (5.6)	825 (93.2)	325 (36.7)
500 (253)	-	50 (5.6)	825 (93.2)	375 (42.4)
600-750 (304-380)	-	50 (5.6)	1000 (113.0)	375 (42.4)
800-1000 (406-508)	-	50 (5.6)	1000 (113.0)	500 (56.5)
1250-2000 (635-1016)	-	50 (5.6)	1100 (124.3)	600 (67.5)

TABLE 7.4: Tightening Torque. Pounds-inches (N.m) for screws or bolts not corresponding to those specified, select the largest torque value associated with the conductor size. Slot width is the internal design value. Slot length is measured at the bottom of the slot.

NOTES: OPTION "D" = DEW POINT OPTION "F" = FAILURE TO SHIFT	REV	REVISION DESCRIPTION	APPROVAL/DATE	DATE
5	PRODUCTION REDLINES	02/03/2015	TRAVIS RYAN	02/15/2012
6	PRODUCTION REDLINES	08/13/2015	MICHAEL SCHWEIBER	02/15/2012
7	PRODUCTION REDLINES	06/02/2016	C2	AC93936000 - 1 of 6

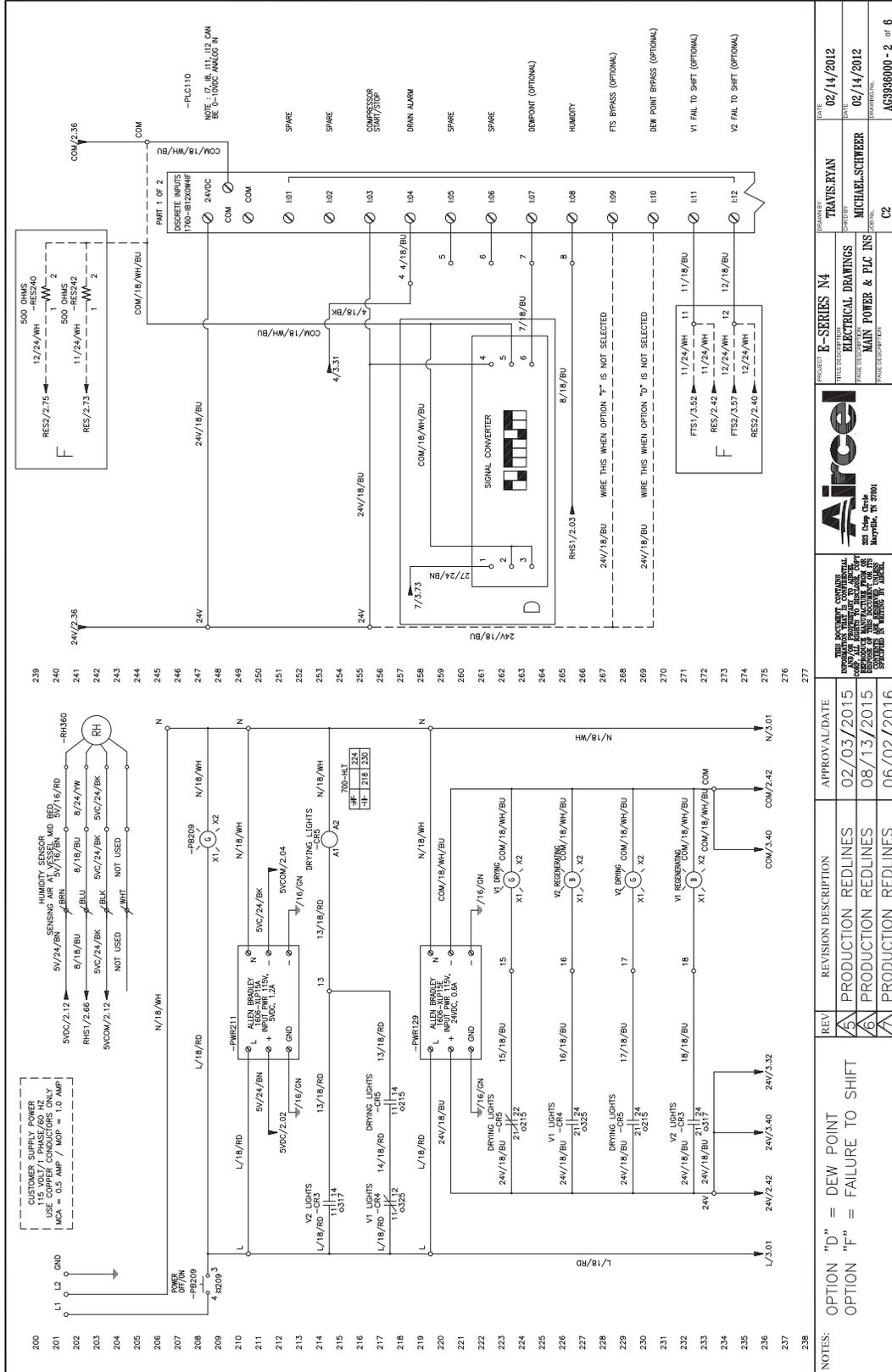
THIS DOCUMENT CONTAINS ALL INFORMATION RELATIVE TO THE DESIGN AND CONSTRUCTION OF THE AIRTEL SYSTEMS BY AIRTEL IN THE UNITED STATES OF AMERICA AND IN FOREIGN COUNTRIES.



PROJECT: E-SERIES N4  
TITLE: ELECTRICAL DRAWINGS  
TABLE NO.: TORQUE TABLE

# APPENDIX

## Main Power & PLC Input Drawings



REV	REVISION DESCRIPTION	APPROVAL DATE
1	PRODUCTION REDLINES	02/03/2015
2	PRODUCTION REDLINES	08/13/2015
3	PRODUCTION REDLINES	06/02/2016

PROJECT	DATE
E-SERIES N4	02/14/2012
ELECTRICAL DRAWINGS	02/14/2012
MAIN POWER & PLC INS	
TRADE DESCRIPTION	

DESIGNER	CHECKED	DATE
TRAVIS RYAN	MICHAEL SCHWEER	02/14/2012

PLANT NO.	PLANT NAME
C2	AC9396000 - 2 of 6

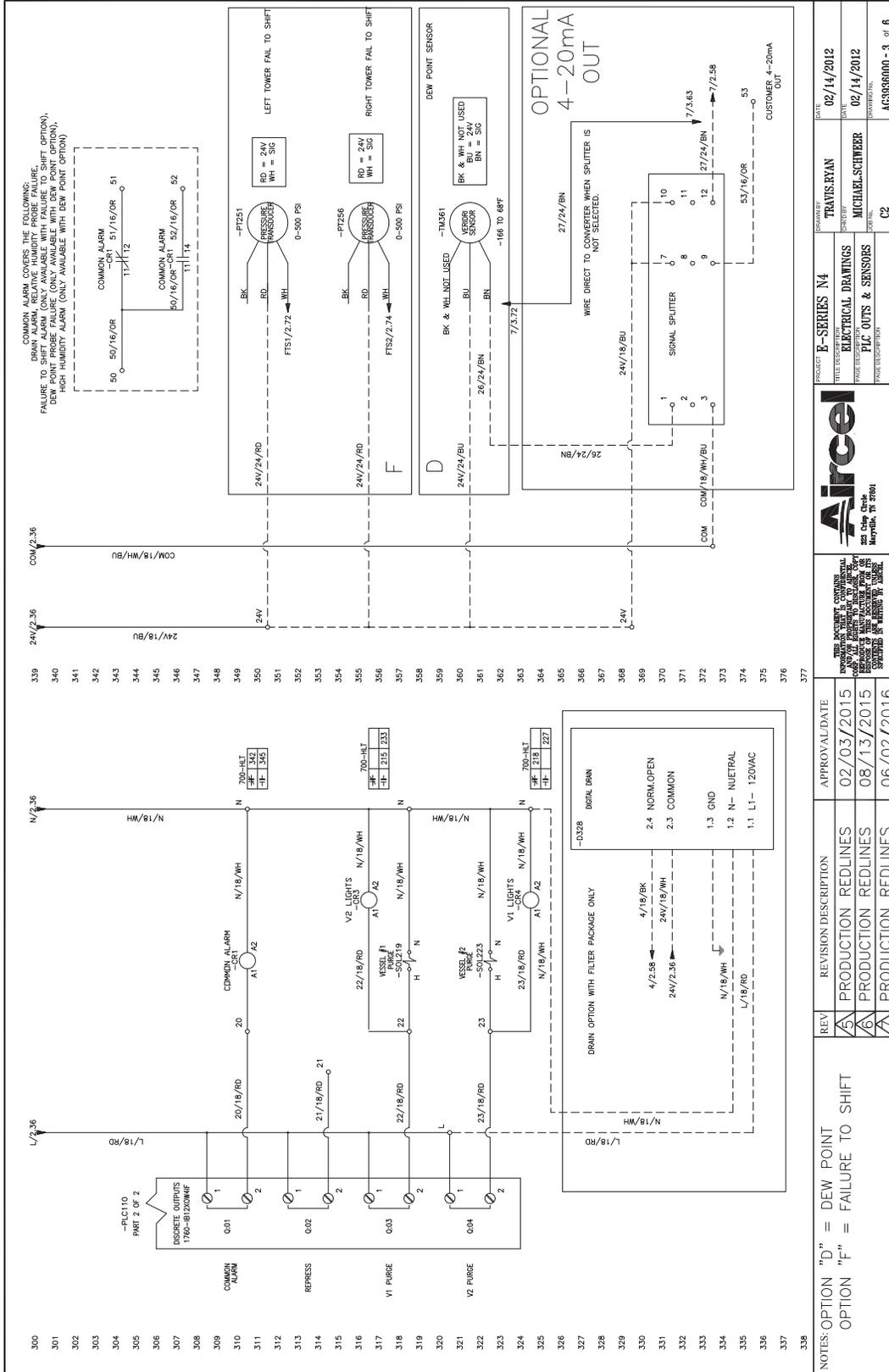
NOTES:  
 OPTION "D" = DEW POINT  
 OPTION "F" = FAILURE TO SHIFT



323 Chip Circle  
 Murfreesboro, TN 37051

APPENDIX

PLC Outlet & Sensor Drawings



339	24V/2.36	COM/18/WH/BU	COM/18/WH/BU	340	24V/2.36	COM/18/WH/BU	COM/18/WH/BU
341				342			
343				344			
345				346			
347				348			
349				350			
351				352			
353				354			
355				356			
357				358			
359				360			
361				362			
363				364			
365				366			
367				368			
369				370			
371				372			
373				374			
375				376			
377				378			

PROJECT	E-SERIES N4	DATE	02/14/2012
DESIGNER	TRAVIS RYAN	DATE	02/14/2012
CHECKED BY	MICHAEL SCHWEBER	DATE	02/14/2012
TITLE DESCRIPTION	ELECTRICAL DRAWINGS	PROJECT NO.	AC59395000 - 3 of 6
PLC OUTS & SENSORS		DATE	
PLC OUTS & SENSORS		DATE	

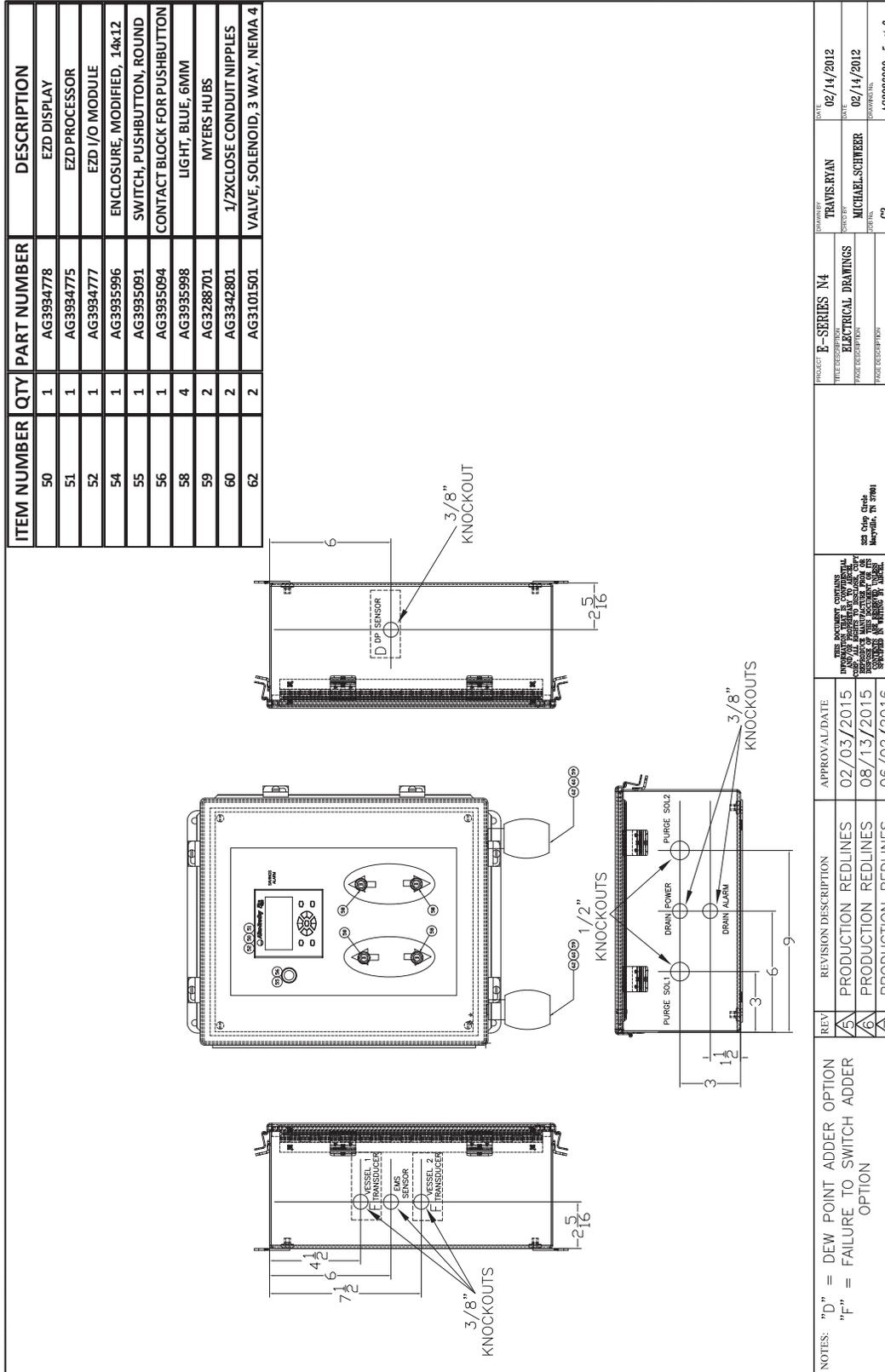


339	24V/2.36	COM/18/WH/BU	COM/18/WH/BU	340	24V/2.36	COM/18/WH/BU	COM/18/WH/BU
341				342			
343				344			
345				346			
347				348			
349				350			
351				352			
353				354			
355				356			
357				358			
359				360			
361				362			
363				364			
365				366			
367				368			
369				370			
371				372			
373				374			
375				376			
377				378			



## APPENDIX

### Enclosure Layout Drawings



REV	REVISION DESCRIPTION	APPROVAL/DATE	DATE
1	PRODUCTION REDLINES	02/03/2015	02/14/2012
2	PRODUCTION REDLINES	08/13/2015	02/14/2012
3	PRODUCTION REDLINES	06/02/2016	02/14/2012

PROJECT: E-SERIES N4	DESIGNED BY: TRAVIS RYAN	DATE: 02/14/2012
TITLE: ELECTRICAL DRAWINGS	CHECKED BY: MICHAEL SCHWABER	DATE: 02/14/2012
PROJECT DESCRIPTION:	DRAWN BY:	DATE:
PAGE DESCRIPTION:	C2	AG3938000 - 5 of 6

USE ONLY APPROVED PARTS AND MATERIALS FROM THE MANUFACTURER'S SPECIFICATIONS. ALL PARTS TO BE USED MUST BE APPROVED BY THE DESIGN ENGINEER.

## APPENDIX

### Electrical Part Drawings

Stock Number	Stock Description	Quantity	Spare?
AG 3934778	EZD CONTROLLER, PROCESSOR	1	Y
AG 3934775	EZD CONTROLLER, 12 DC INPUTS	1	Y
AG 3934777	EZD CONTROLLER, CPU	1	Y
AG 3935996	ENCLOSURE, MODIFIED, 14X12	1	N
AG 3935091	SWITCH, PUSHBUTTON, ROUND	1	Y
AG 3935094	SWITCH, CONTACT BLOCK, FOR ALL	1	Y
AG 3935095	LIGHT, FOR 8008 SWITCH, LED	1	Y
AG 3935096	LENS FOR PUSHBUTTON, GREEN	1	Y
AG 3935998	LIGHT, PILOT, 115V, 8MM, BLUE	4	Y
AG 3288701	HUB, MYERS, 1/2"	2	Y
AG 3342801	NIPPLE, CONDUIT, 1/2" X CLOSE,	2	N
AG 3481168	STRAIN RELIEF, 3/8"	3	N
AG 3481158	LOCK NUT, 3/8"	3	N
AG 3481159	RING SEAL, 3/8"	3	N
AG 3948855	RELAY, SCREW TYPE TERMINAL, DPDT	3	Y
AG 3197201	PANEL, BACKPLATE, FITS 14x12	1	N
AG 3948924	POWER SUPPLY, 24VDC	1	Y
AG 3934769	POWER SUPPLY, 5VDC	1	Y
AG 3251901	ANCHOR, SCREW END, GRAY	6	N
AG 3253101	TERMINAL BLOCK, GRAY, J4	2	N
AG 3253001	TERMINAL BLOCK, GREEN/YELLOW, J4	1	N
AG 3933672	TERMINAL BLOCK, BLU, J3	4	N
AG 3933345	TERMINAL BLOCK, GRAY, J3	30	N
AG 3948856	RELAY, SCREW TYPE TERMINAL, SPDT	1	Y
AG 3182201	DUCT, WHITE, NARROW SLOT, 1x2	3	N
AG 3101501	VALVE, SOLENOID, 3 WAY, NEMA 4, 1/4"	2	Y
AG 3933346	TERMINAL BK, GREEN/YELLOW, J3	3	N
AG 3480590	COVER, WHITE DUCT, 1"	3	N
AG 3481460	CORD, SFEOWM, 18/3	10	N
AG 3480463	WIRE #18, BLUE	80	N
AG 3480947	WIRE #18, RED	98	N
AG 3480948	WIRE #18, WHITE	17	N
AG 3480991	WIRE #18, WHITE/BLUE	9.5	N
AG 3373901	WIRE #16, ORANGE	6	N
AG 3372301	WIRE #16, GREEN	12	N

<b>Aircel</b> THE AIRCCEL COMPANY 2225 W. STATE ST. SUITE 200 HOUSTON, TX 77058 282 Chap Circle Houston, TX 77051	PROJECT: E-SERIES N4 TITLE: ELECTRICAL DRAWINGS PAGE: ELECTRICAL BOB DRAWING NO.	DRAWN BY: TRAVIS RYAN CHECKED BY: MICHAEL SCHWEER APPROVED BY: C2	DATE: 06/15/2012 DATE: 06/15/2012 DRAWING NO: ACS936000 - 6 of 6
	REVISION DESCRIPTION APPROVAL/DATE	REVISION #1 PRODUCTION REDLINES 02/03/2015	REVISION #2 PRODUCTION REDLINES 08/13/2015
	REVISION #3 PRODUCTION REDLINES 06/02/2016	REVISION #4 PRODUCTION REDLINES 06/02/2016	REVISION #5 PRODUCTION REDLINES 06/02/2016
	REVISION #6 PRODUCTION REDLINES 06/02/2016	REVISION #7 PRODUCTION REDLINES 06/02/2016	REVISION #8 PRODUCTION REDLINES 06/02/2016









## WARRANTY

### Desiccant Air Dryers (1 Year Limited Warranty Coverage)

Standard desiccant air dryers come with a limited one year warranty covering parts and labor.

**NOTE:** Any unit shipped to us without prior return authorization will be refused.

#### WARRANTY PARTS COVERAGE

- Exhaust valves (all models)
- Wafer check valves (800 - 5,000 scfm models)
- Heater
- Blower
- Control board (all heatless models)
- Programmable controller (all heat regenerative models)
- Automatic piston valves
- Control solenoids
- Re-pressurization valves
- Depressurization valves
- Electrical components (temperature and over-temperature controllers)
- Instrumentation (air and differential pressure gauges, temperature gauges)

#### SERVICE COVERAGE

- Parts supplied by us to dealer, authorized service repair center, or job site (end user). *See note 5 on page 6.*
- Labor provided by us, dealer, authorized service repair center, or factory.

### Zero Loss Drains (1 Year Limited Warranty Coverage)

#### COVERAGE

- Parts supplied by us to dealer, authorized service repair center, or job site (end user). *See note 5 on page 6.*
- Labor is not covered by our warranty. Customer is responsible for all labor.

#### NOTES:

1. Aircel reserves the right to require units to be shipped back to the factory for proper repair if it deems necessary. We will make return freight arrangements in this instance. Aircel warranty will only cover freight charges for shipments within the continental United States.
2. Warranty does not cover the removal & installation of a dryer(s) or parts within its warranty period or beyond.
3. Desiccant is not covered under warranty. The average life expectancy of desiccant is 3 to 5 years when proper maintenance is performed.



## **Parts and Service**

For genuine Aircel replacement parts, call:

**800.767.4599**

For faster service, please have unit's model and serial number, part number, or description.

**[AircelDryers.com](http://AircelDryers.com)**

**Aircel, LLC.  
323 Crisp Circle  
Maryville, TN 37801**

**[Sales@AircelDryers.com](mailto:Sales@AircelDryers.com)  
[OrderEntry@AircelDryers.com](mailto:OrderEntry@AircelDryers.com)**