DESICCANT DRYER USER MANUAL

AHLD Series | Heatless Regenerative | 70 - 4,000 scfm

WARRANTY NOTICE

Failure to follow the instructions and procedures in this manual, or misuse of this equipment, will void its warranty.

WARNING!

Users are required to read the entire User Manual before handling or using the product. Keep the User Manual in a safe place for future reference.

DRYER DATA SHEET

Model Number: _____ Serial Number: _____

Date of Manufacture: _____

Ship Date: _____ Installation Date: _____

Customer Address: _____

Customer City: _____ State/Zip: _____

Other: _____

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SECTION 1: SAFETY

1.1 Introduction

Thank you for purchasing Aircel's AHLD E-Series Heatless Regenerative Desiccant Air Dryer with integrated Energy Management Purge Reduction System. To ensure maximum performance and safe operation of an Aircel desiccant dryer covered by this manual, everyone involved with the dryer's installation, operation, and maintenance must read and carefully follow the instructions in this manual.

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.

1.2 Safety Signal Words

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.

NOTICE

For optimum performance, use only Aircel replacement parts.

1.3 General Safety Procedures

CAUTION!

Misuse / modification hazard

Misuse or modification of this equipment may result in personal injury.

Do not misuse or modify this equipment under any conditions.

- Electrical work must conform to the specifications indicated by Aircel and any local or state laws that may apply.
- Personnel must wear appropriate safety gear before working on any electrical or mechanical aspects of the machine.
- 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.
- A copy of the Operation Manual must be made available to all personnel involved with the installation, operation, and maintenance of the equipment.
- Before performing any maintenance operations on the equipment, the unit must be shut down, isolated, electrical power removed, and completely depressurized.
- To ensure compatibility and continued trouble free operation, only genuine Aircel parts must be used.
- **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.
- **DO NOT** use foreign parts.
- **DO NOT** use compressed air from the dryers for breathing purposes - install a breathing air package to ensure conformance with OSHA regulations.
- **DO NOT** disable or disengage any protective equipment used on the machine.

1.4 Safe Operating Procedures

- 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.
- 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.
- Only use original fuses for the rated voltage and current.
- Shut down the unit in the correct recommended procedure.
- Before any work on system, always depressurize the unit and remove all electrical power.
- After shut down, put up warning notice to prevent the unit from being switched "ON" accidentally.
- 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.
- Secure condensate drain lines. Unsecured, flexible drain lines may whip violently under pressure and may cause bodily harm.

1.5 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.

1.5.1 DESICCANT FIRST AID RECOMMENDATIONS

1.5.1.1 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.

1.5.1.2 SKIN CONTACT

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

1.5.1.3 EYE CONTACT

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

1.5.1.4 SPILLS

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

1.6 Implementation of lockout/tag-out

The energy control procedure defines actions necessary to lockout a power source of any machine to be repaired, serviced, or set-up, where unexpected motion, or an electrical or other energy source, would cause personal injury or equipment damage. The power source on any machine shall be locked out by each employee doing the work except when motion is necessary during setup, adjustment, or troubleshooting.

1.6.1 PROCEDURES

The established procedures for the application of energy control shall cover the following elements and actions and shall be initiated only be Authorized Persons and done in the following sequence:

1. Review the equipment or machine to be locked and tagged out.
2. Alert operator and supervisor of which machine is to be worked on, and that power and utilities will be turned off.
3. Check to make certain no one is operating the machine before turning power off.
4. Turn off the equipment using normal shut-down procedure.
5. Disconnect the energy sources:
   a. Air and hydraulic lines should be bled, drained, and cleaned out. There should be no pressure in these lines or in the reservoir tanks. Lockout or tag lines or valves.

b. Any mechanism under tension or pressure, such as springs, should be released and locked out or tagged.

c. Block any load or machine part prior to working under it.

d. Electrical circuits should be checked with calibrated electrical testing equipment and stored energy and electrical capacitors should be safely discharged.

6. Lockout and/or tag out each energy source using the proper energy isolating devices and tags. Place lockout hasp and padlock or tag at the point of power disconnect where lockout is required by each person performing work. Each person shall be provided with their own padlock and have possession of the only key. If more than one person is working on a machine, *each* person shall affix personal lock and tag using a multi-lock device.

7. Tag-lock devices shall be used only when power sources are not capable of being locked out by use of padlocks and lockout hasp devices. The name of the person affixing the tag to power source must be on tag along with date tag was placed on power source.

8. Release stored energy and bring the equipment to a “zero mechanical state.”

9. Verify isolation: Before work is started, test equipment to ensure power is disconnected.

1.6.2 GENERAL SECURITY

1. The lock shall be removed by the Authorized Person who put the lock on the energy-isolating device. No one other than the person/persons placing padlocks and lock out hasps on power shall remove padlock and lockout hasps and restore power. However, when the authorized person who applied the lock is unavailable to remove it, her or his Supervisor may remove padlock(s) and lock out hasp(s) and restore power only if it is first:

   a. verified that no person will be exposed to danger..

   b. verified that the Authorized Person who applied the device is not in the facility.

   c. noted that all reasonable efforts to contact the Authorized Person have been made to inform her or him that the lock out or tag out device has been removed.

   d. ensured that the Authorized Person is notified of lock removal before returning to work.

2. Tag out system - Tags are warning devices affixed at points of power disconnect and are not to be removed by anyone other than the person placing tag on power lockout. Tags shall never be by-passed, ignored, or otherwise defeated.

SECTION 2: DESCRIPTION

2.1 Introduction

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.

2.2 System

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.

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.

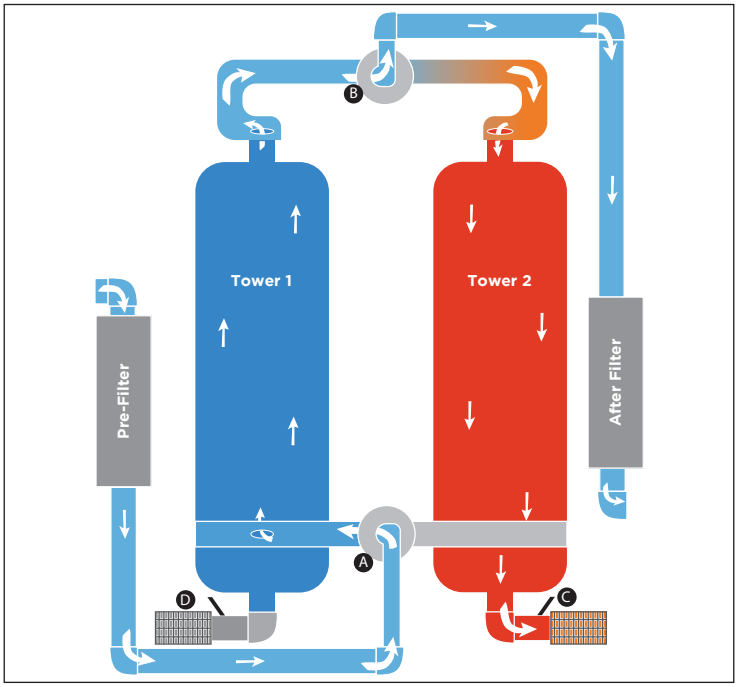

FIGURE 2-1: **TYPICAL SCHEMATIC FLOW DIAGRAM**
AHLD Series 70 - 4,000 scfm rated model

2.3 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 dead heading effect.
- 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.

2.4 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.

SECTION 3: INSTALLATION

3.1 Inspection on Arrival

All 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 unity 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.

3.2 Lifting Information

WARNING!

Lifting Hazard

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 forklift, or crane is recommended for unloading and installation.
- Lift unit by lifting lugs and frame only. Do not lift by piping.

1. Use all lifting points provided. Special care must be used when lifting the dryer to prevent tip-over.
2. Use clevis connectors, not hooks, on lifting slings.
3. Only lift unit under support frame/base by using the fork lift openings provided. Do not lift by piping.
4. Check the approximate weight provided on the specification control drawing to ensure adequate lift truck capacity.
5. Allow only qualified operators to lift the equipment.
6. Refer to applicable OSHA regulations and local codes when using cranes, forklifts, and other lifting equipment.

3.3 Installation Codes and Procedures

WARNING!

Electric Shock Hazard

This machine is connected to high-voltage power, which can cause severe electrical shock and injury.

- 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.

- 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 and NFPA No. 70-latest edition.
- A qualified installation and service agent versed in all regulatory codes must complete installation of this unit.
- All shipping materials, including shipping covers, must be removed from the unit prior to, or during, unit installation.

3.4 Locating and Installing the Dryer

WARNING!

Inappropriate tools hazard

Using inappropriate tools for installation or maintenance work can lead to personal injury or property damage.

Appropriate tools must be used for all installation and maintenance work.

1. Locate unit on a level foundation. Dryer should be mounted on a suitably structured flat and level floor or base that is free from vibration.
2. Before bolting dryer skid to the foundation, shim skid(s) as needed. Additional mounting clip angles can be attached to base frame for ease of bolting to foundation, if necessary. The frame(s) must be securely bolted to the foundation to prevent movement resulting from earth tremors and induced piping vibration.
3. Make certain all shipping materials have been removed such as crating, plastic wrap, fitting covers, etc.
4. Install unit to provide adequate clearance for maintenance services. Dryer and accompanying filters should be installed with at least three (3) feet clearance from the adjoining walls to provide easy access for routine maintenance and adequate air flow.
6. Unit should be located in a weather protected area with an ambient temperature range between 40 - 100°F. 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 drains.
7. Install flanges, fittings, and piping on system using the correct pipe size and pressure rating. See drawing package provided with the unit. Connect dryer wet air inlet to the flange attached to the inlet pre-filter with the automatic condensate drain on the bottom of the filter bowl. This typically runs to the bottom of the dryer vessels. Connect dry air outlet to plant process to the flange attached to the outlet after-filter with a manual drain/vent valve on the bottom of the filter bowl. Dryer outlet piping to filter is typically from top of dryer.
8. Optional system configuration: Install a dryer bypass or isolation valve to allow isolation of the dryer for service and maintenance without interrupting the compressed air flow.

NOTICE

Adequate sealing

The bypass system valves require bubble tight sealing.

CAUTION!

Moisture contamination hazards

Air supplied while the regenerative desiccant dryer is bypassed will be wet and saturated. Some downstream processes may not tolerate this air supply due to the risk of contamination of sensitive equipment.

9. Provide adequate power supply. See rating and specification information on dryer data label and drawing package information. Make certain dryer system is properly grounded.
10. It is recommended to supply power to the dryer through a

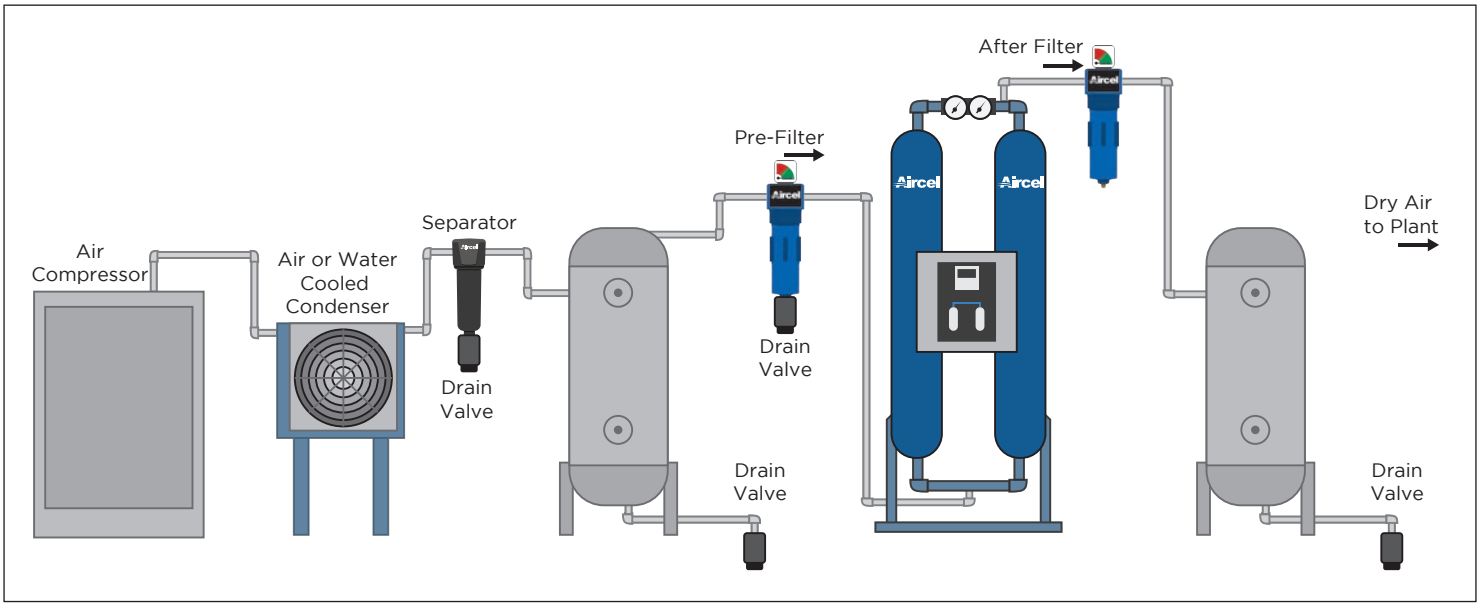

FIGURE 3-1: **Typical Installation Setup**

customer-supplied disconnect switch to remove all power to the dryer system.

11. The regeneration air outlet (typically located at the back of the dryer on the bottom line between the vessels) should be piped away from all equipment and occupied spaces. The pressure loss through the regeneration outlet piping should not exceed two (2) inches of water column to prevent excessive back pressure on the blower. If the regeneration outlet line is to be piped upwards, a manual drain valve **must** be installed at the lowest point to drain any liquid water.

12. Connect any remote dry alarm contacts to control room or signaling device to warn of dryer malfunction. Refer to the electrical schematic for connections.

13. The dryer relief valves are designed and sized to relieve excess pressure resulting from the thermal expansion of air trapped in the vessels in the event the vessels are subjected to heat, such as in a conflagration. Valves are set to relieve at the maximum design pressure of the desiccant vessels.

14. It is recommended to have manual vent valves in strategic locations to aide in depressurizing the system for repair or maintenance.

15. Ensure 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 at top of each vessel. Care must be taken when filling the media and must be done gradually to prevent powdering.

WARNING!

Unsafe personnel conditions hazard

Keep personnel safely away from desiccant dryer relief valves. In the event of discharge, the relief valves can cause an unwanted condition or hazard to personnel.

Some discharge ports could be piped to a safe location.

NOTICE

Refer to system data label and/or drawing package for desiccant media type and quantity per each vessel.

16. Install the Aircel inlet compressed air particulate pre-filter drain to an open drain system for safety and to prevent puddling of water at dryer system area. Piping should be secured and angled slightly downward to drain condensate. Drain system must have a vented air gap to prevent a pressurized condition.

17. If there are any changes in the operating conditions of the system from those published in this manual, contact Technical Support at the number published on the back of this manual.

3.5 Preliminary Start-Up Checklist

In addition to the below notes, cautions and warnings, refer to the previous sections on General Safety Procedures, Safe Operating Procedures and any safety procedures required by end user.

CAUTION!

Follow local codes

Before connecting condensate to open drainage system make certain this is allowed, user or local codes may require treatment before discharging into drain system.

NOTICE

- Refer mechanical drawing, electrical drawing, flow diagram, and the display screen shots and descriptions located in this manual for reference.
- It is recommended to have isolation valves before and after the dryer to maintain low dew point when system is not in use in use.
- It may take days to a few weeks of operation to stabilize the system and produce the specified dew point. Some customer processes may not tolerate a higher dew point air supply. DO NOT use the outlet air from the system until the air meets the customer's system requirements.
- During transport and storage of the equipment, desiccant can become preloaded with atmospheric moisture and cause poor outlet dew point. Regenerate both desiccant beds before placing the dryer in service to avoid contaminating sensitive downstream systems with higher moisture concentration. Installation must be complete and process air available to regenerate the desiccant beds.

WARNING!

- Tower/vessel relief valves are set from manufacturer. DO NOT adjust these valves.
- Always pressurize and depressurize the system slowly.
- This system must be operated or serviced by qualified persons familiar with pressurized systems and electrical controls.
- Before servicing any component make certain the system is depressurized and de-energized.
- Hearing protection is recommended for personnel protection when the system is in operation and/or pressurized in order to protect from any loud bursts of pressurized air to atmosphere. This can occurs through the depressurization and purge exhaust mufflers, vent ports, and filter drain ports.
- Eye protection safety glasses are recommended for personnel protection when the system is in operation and/or pressurized in order to protect from possible flying debris expelled from the purge exhaust mufflers during tower, vent, or drain depressurization or any other possible flying debris.
- The dryer must not be subjected to low operating pressures for an extended period of time. Extremely high velocities in the desiccant bed would cause serious attrition of the desiccant and possible rupture the filter elements. Some control over the flow through the desiccant dryer on start-up must be exercised.
- Do not use the dryer without the inlet filter element or outlet filter element.
- Do not use the dryer without the vessel desiccant media in place.
- DO NOT turn dryer power on until instructed.
- Make certain air inlet and air outlet are connected correctly.
- Make certain the power supply is connected to the system properly.

1. Check the inlet and outlet connections are the correct size, pressure rating, and tightened securely.
2. Ensure the inlet air line is connected to the inlet pre-filter with automatic drain valve (typically, the inlet piping flows from inlet pre-filter to bottom of vessels).
3. Ensure the dry outlet air is connected to the outlet after filter with the manual drain valve which is piped from top of vessels to outlet after filter.
4. Check that the correct power supply is connected to the desiccant air dryer system with an adequate disconnect switch.
5. Check that all manual valves are in correct open and closed positions and that compressed air is available to be supplied to the desiccant air dryer system.
    a. Dryer system block and bypass valving (if applicable): Initially, dry air outlet isolation block valve should be closed, and the inlet isolation block valve should be closed. If a bypass valve is used in system and customer can tolerate wet air into process for a short amount of time, the bypass valve can be slowly opened to allow air into customer process system.
    b. Inlet coalescing pre-filter automatic drain isolation valve should be open.
    c. If a manual vent/drain valve is used near the inlet coalescing pre-filter automatic drain valve to ambient, this valve should be closed. (This inlet pre-filter manual drain valve is used in some systems in case of automatic drain valve failure.)
    d. Outlet particulate after filter manual drain/vent valve should be in closed position.
    e. Any filter differential pressure gauge isolation valves should be in open position.
    f. Any pressure gauge isolation valves should be in open position.
6. With the customer-supplied compressed air to the system, OPEN the inlet valve slowly (two to three minutes) to gradually pressurize the system. Do not open valve too quickly. Opening valve and suddenly pressurizing the system can cause damage to the dryer heat exchanger and other components.
7. Check the complete dryer system for leaks. If found, repair all leaks and re-test.
8. Check the control pilot air pressure is set to between 80 - 100 psi. Typical setting is 100 psig; adjust control air pressure regulator if needed.
9. Turn on the customer-supplied main disconnect switch and verify correct voltage to dryer electrical panel.
10. 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.
11. 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.
12. 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.
13. 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.
14. After the preliminary start up checklist has been completed, system as been verified, and outlet dew point is at an acceptable low level, the compressed air outlet isolation valve on the dryer system can now be slowly opened to supply clean dry compressed air to the facility.
15. 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.
16. Review the dryer system display screen shots (in this manual) to make certain the parameters are set as needed in the customer dryer.
17. Purge air flow is preset and not adjustable.
18. After approximately one to two weeks of service, replace the depressurization mufflers. New systems may have more desiccant dusting and cause the mufflers to become clogged, which could cause a depressurization or muffler failure. Check flange bolts for tightness, torque as needed.

SECTION 4: OPERATION

4.1 Operating Procedures

After the initial startup, the dryer operation is completely automatic. To understand the details of the operation, see *Figure 2-1: Typical Schematic Flow Chart* on page 4.

4.2 Short-Term Shut Down (For Maintenance)

WARNING!

Electric Shock Hazard

This machine is connected to high-voltage power, which can cause severe electrical shock and injury.

- Follow proper lock out/tag out procedures before performing service or maintenance work.
- When the system is shutdown and power removed, lock out power supply and depressurize system before performing maintenance or service work to avoid injury to personnel or property damage.

WARNING!

Regenerate both desiccant beds before unit shutdown.

When the system is shut down and power removed, open the dryer bypass valve and close the inlet valve to prevent the adsorption vessel from moisture overload.

The desiccant air dryer system can be shut down at any time.

Some systems may have a customer supplied bypass valve. This can be slowly opened to allow air downstream.

WARNING!

Non-purified/moist bypass air could damage sensitive downstream equipment components. Some operations may not tolerate the contaminated air.

In these situations, do not utilize a bypass valve.

- If applicable, slowly open the bypass valve.
- Slowly close the outlet shut off valve.
- Slowly close the inlet shut off valve.
- 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. The manual vent valve on the outlet after filter can be opened to depressurize the dryer until the tower pressure gauges read 0 psig.
- Next, turn on power off/on switch to off position at the dryer system electrical enclosure.

WARNING!

- Some circuits may be still be active or have voltage even with main power disconnect in off position such as, the dryer customer alarm contacts which may have a separate external power source connected to the dryer alarm contacts.
- If possible, remove any external power sources to electrical enclosure
- Always remove fittings slowly in case some residual pressure is remaining in system, and double check to make certain electrical power is not present.

- Disconnect main electrical power supply to dryer system by switching the upstream electrical power supply disconnect to the off position.

4.3 Short-Term or Long Term Non-Usage Period Shut Down

The most ideal time to shut the system down is in the re-pressurization mode when both vessels are pressurized to line pressure.

For best purity, the system is best left isolated and pressurized.

Some systems may have a customer supplied bypass valve. This can be slowly opened to allow air downstream.

WARNING!

Non-purified/moist bypass air could damage sensitive downstream equipment components. Some operations may not tolerate the contaminated air.

In these situations, do not utilize a bypass valve.

- Slowly close the outlet shut off valve (customer supplied).
- Slowly close the inlet shut off valve (customer supplied)
- Next, turn on power off/on switch to off position at the dryer system electrical enclosure.
- The system should now be isolated and pressurized and power switch at the dryer system is off.

WARNING!

Electric Shock Hazard

This machine is connected to high-voltage power, which can cause severe electrical shock and injury.

Main electrical power supply will still be supplied to dryer and the dryer customer alarm contacts may be energized from customer supplied external power source.

- If needed, main electrical power supply can be fully removed from dryer system by switching the upstream customer supplied electrical power supply disconnect to the off position.

4.4 Shut Down Emergency

The dryer can be shut down under emergency conditions at any time by using the dryer power off/on switch or by turning the customer main disconnect switch off for the dryer system.

WARNING!

Some circuits may be still be active or have voltage even with main power disconnect in “OFF” position.

Dryer customer alarm contacts which may have a separate external power source connected to the dryer alarm contacts

Some systems may have a customer supplied bypass valve. This can be slowly opened to allow air downstream.

WARNING!

Make certain air is not flowing through dryer system when dryer is not operating.

If air flows through dryer it will overload the dryer vessel with moisture.

- Slowly close the outlet shut off valve (customer supplied).
- Slowly close the inlet shut off valve (customer supplied)
- Next, turn on power off/on switch to off position at the dryer system electrical enclosure.
- Make certain the two outlet dew point sensor flow control needle valves attached to the sample cell are closed, isolating the dew point sensor while steam is down for maintenance. These are located upstream and downstream of the dew point sensor.
- The system should now be isolated and pressurized and power switch at the dryer system is off.

SECTION 5: CONTROLLERS

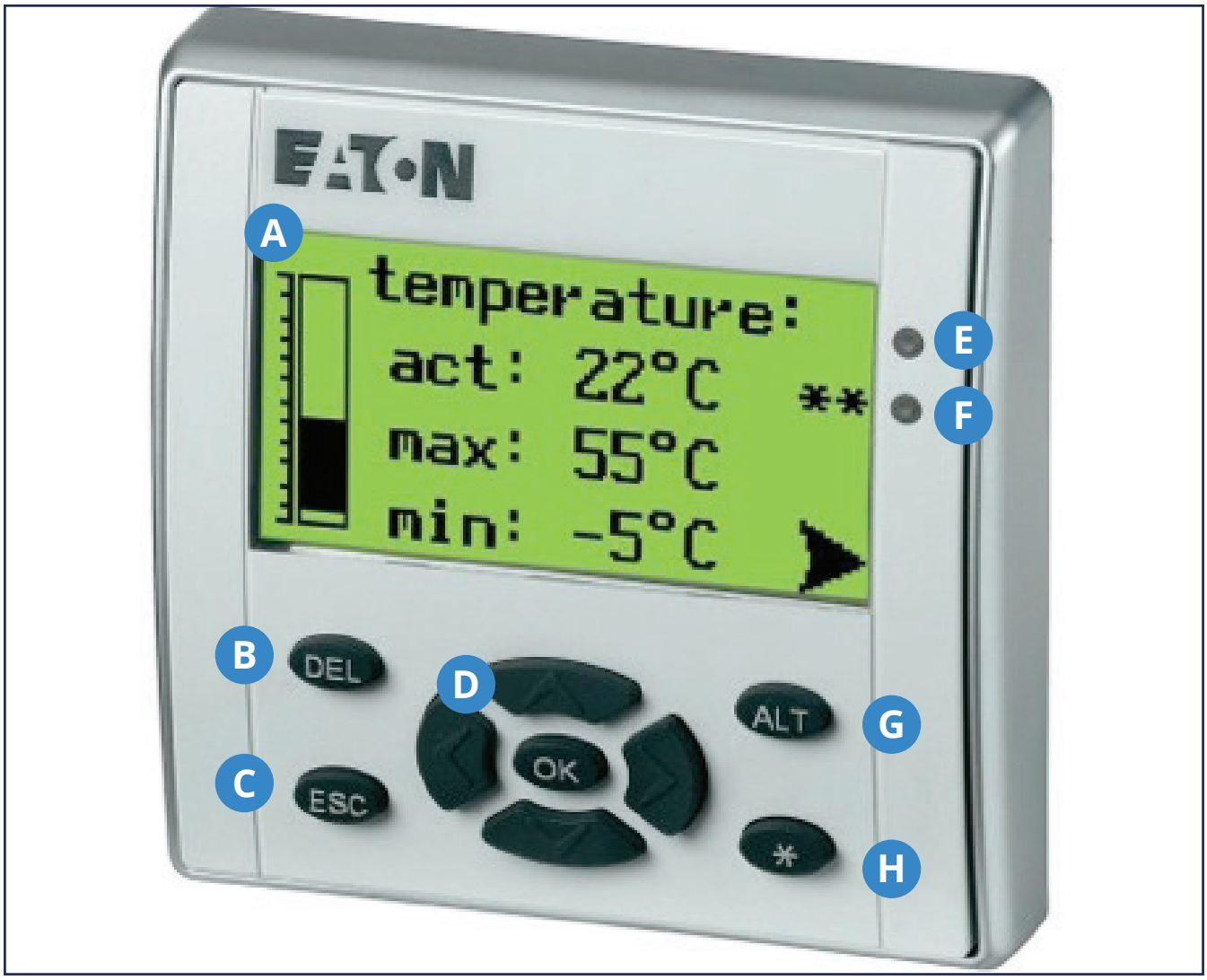

FIGURE 5-1: **Running Screen**

5.1 System Navigation

System display shows the dryer operations and provides the user the ability to change certain dryer settings. The functions are as follows:

A. Text display

B. Delete key

C. Escape key

D. Arrow and OK keys

E. Red LED 1: Common alarms

- **Standard alarms:** EMS humidity probe failure and drain fault
- **Optional alarms:** High humidity, dew point probe failure and failure to shift

F. Red LED 2: Energy savings light active

G. Alt key

H. * key

5.2 Dryer Operation Screens

System display shows the dryer operations and provides the user the ability to change certain dryer settings. Review the following menu screens for navigation.

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

FIGURE 5-2: Step One

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

Simultaneously, the inlet valves and shift positions with a pneumatic signal from vessel 2 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 and close valve, directing the inlet air to vessel 1 to dry the air.

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

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

FIGURE 5-3: Step Two

Vessel 2 is regenerating, Vessel 2 purge exhaust valve is still open, Vessel 1 is drying the inlet air.

A small portion of dry outlet air from Vessel 1 (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 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).

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

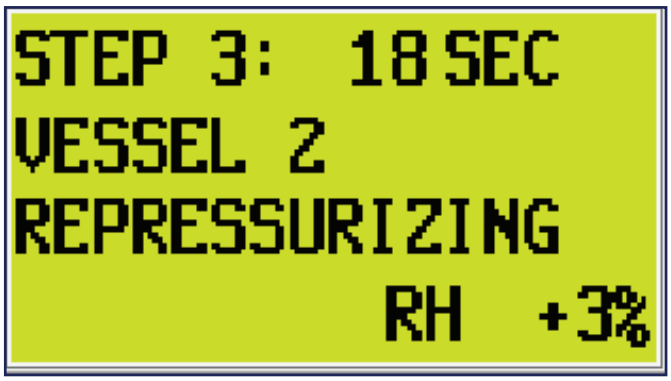

FIGURE 5-4: Step Three

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

The inlet tower selector pneumatic pilot valve maintains the inlet valve positions.

5.2.4 STEP FOUR: Vessel 1 Extended Drying

FIGURE 5-5: Step Four

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'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.

NOTICE

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

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

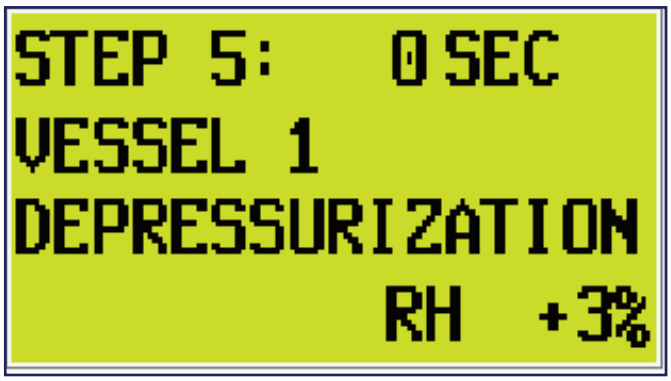

FIGURE 5-5: Step Five

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

Simultaneously, the inlet valves and shift positions with a pneumatic signal from vessel 1's 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 and close valve, directing the inlet air to vessel 2 to begin drying the air. The air flows up through the desiccant bed and exits to the outlet valve to the outlet particulate filter and through to downstream equipment.

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

FIGURE 5-6: Step Six

Vessel 1 is regenerating, Vessel 1 purge exhaust valve is still open, Vessel 2 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 until 240 seconds has been reached.

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

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

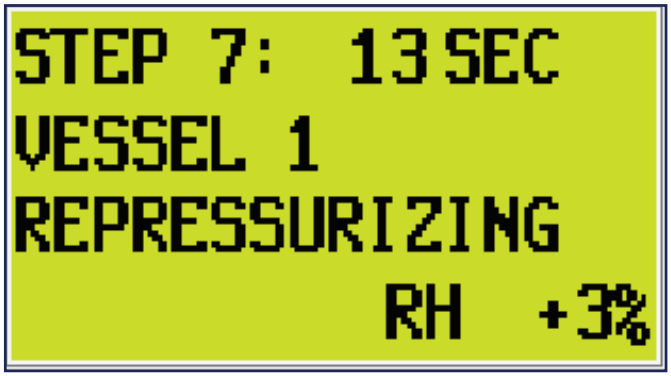

FIGURE 5-7: **Energy Savings**

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

The inlet tower selector pneumatic pilot valve maintains the inlet valve positions.

5.2.8 STEP EIGHT: Vessel 2 Extended Drying

FIGURE 5-8: **Parallel Cooling Mode**

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'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.

5.3 Navigation

5.2.9 MAIN SCREEN

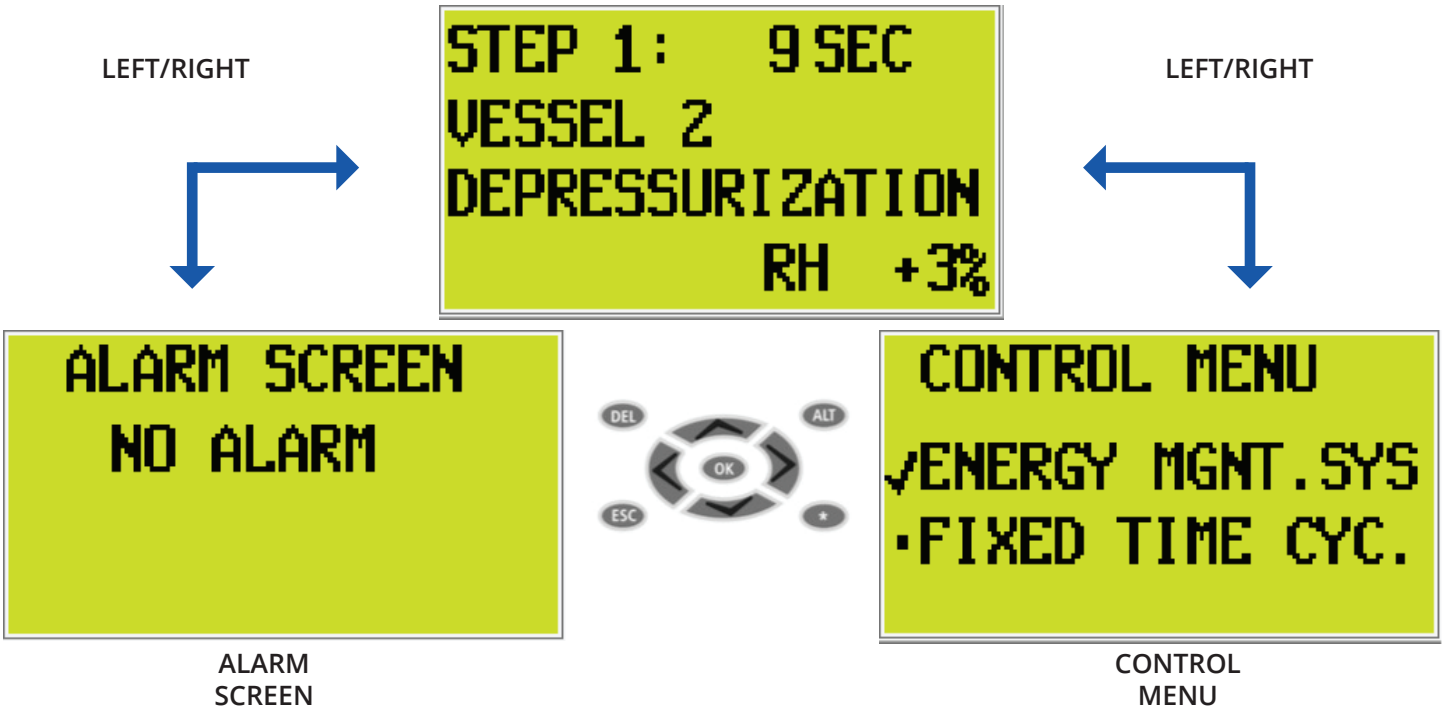

FIGURE 5-9: Main Screen Navigation

5.2.9 CONTROL MENU

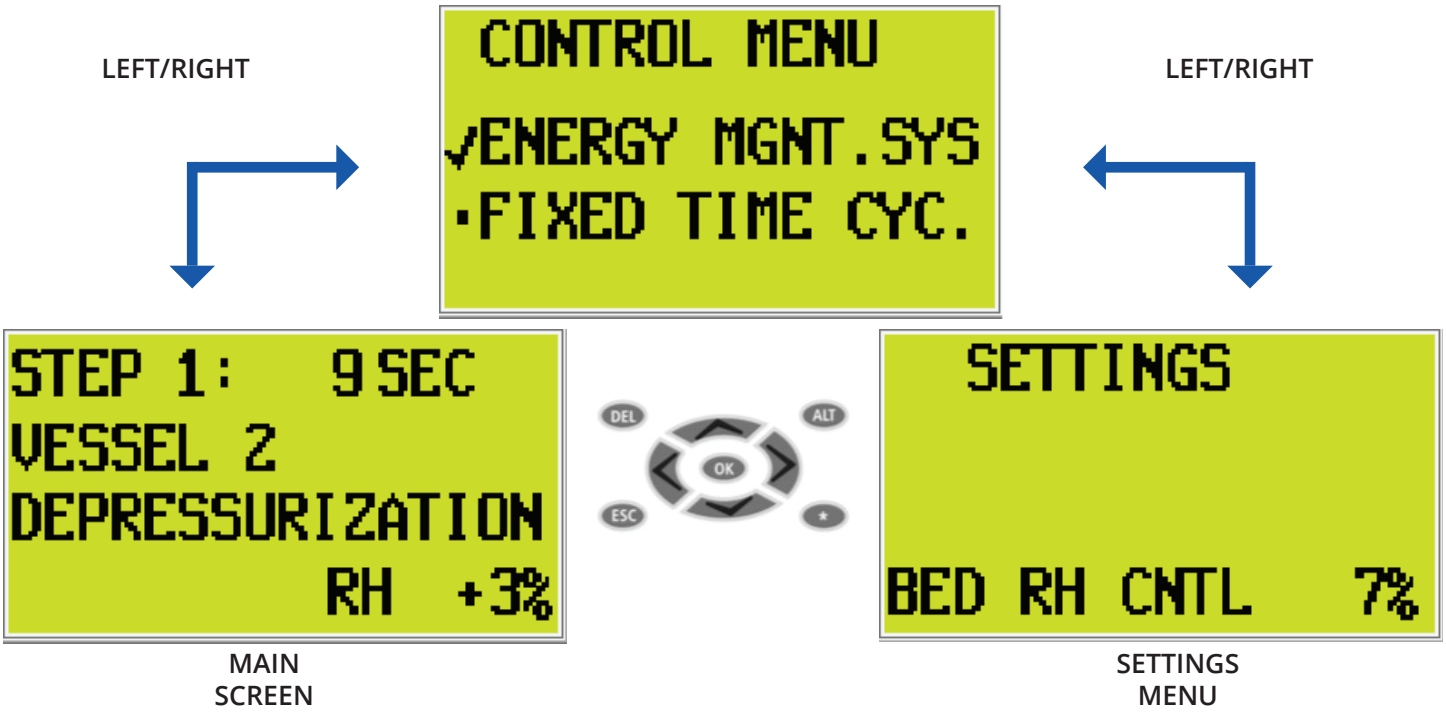

FIGURE 5-10: Control Menu Navigation

5.2.9.1 CONTROL MENU: Operation

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

5.2.9.2 SETTINGS MENU: Operation

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 unselect the screen. Push ESC again to exit to the main screen or use the left or right arrows to scroll to the next screen.

5.2.10 TIME CONTROL MENU

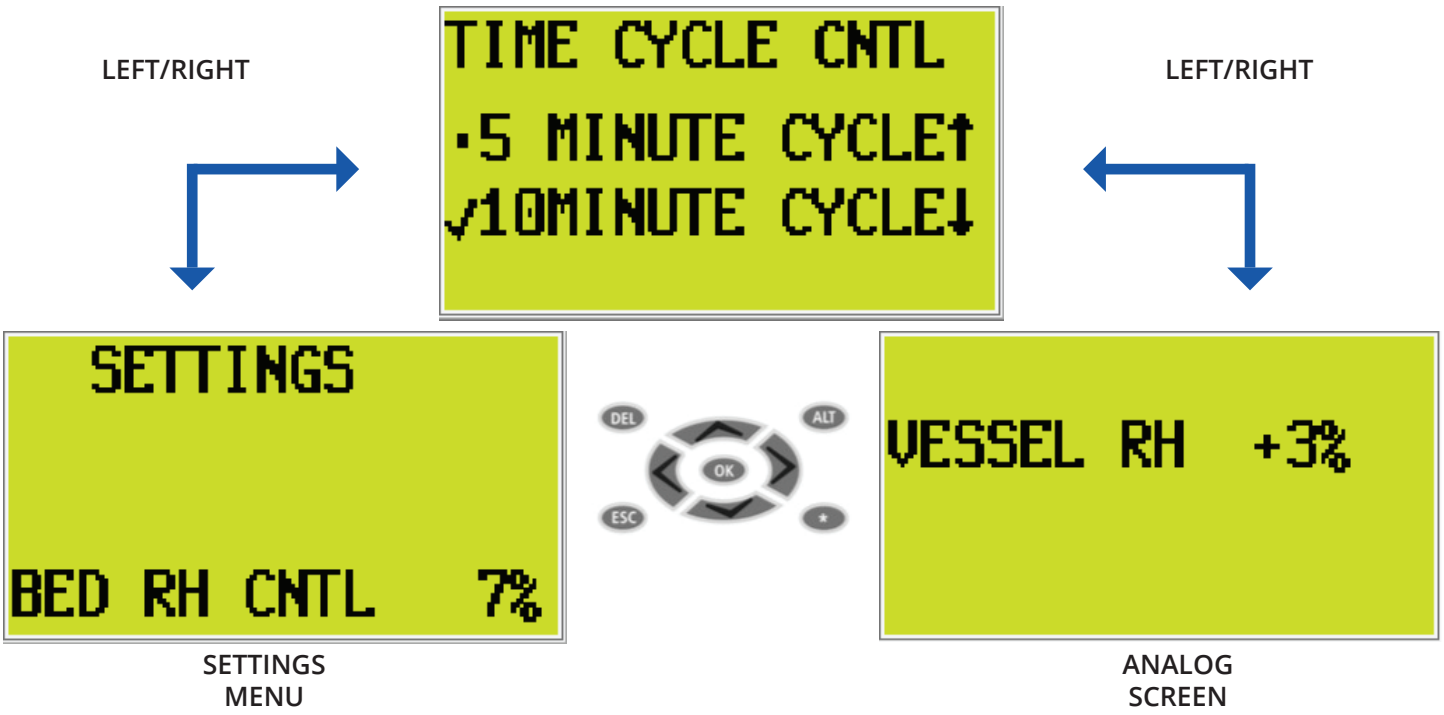

FIGURE 5-11: Time Control Menu Navigation

5.2.10.1 TIME CONTROL MENU: Operation

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.

- 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.

5.2.11 ANALOG SCREEN: Analog Output Signals

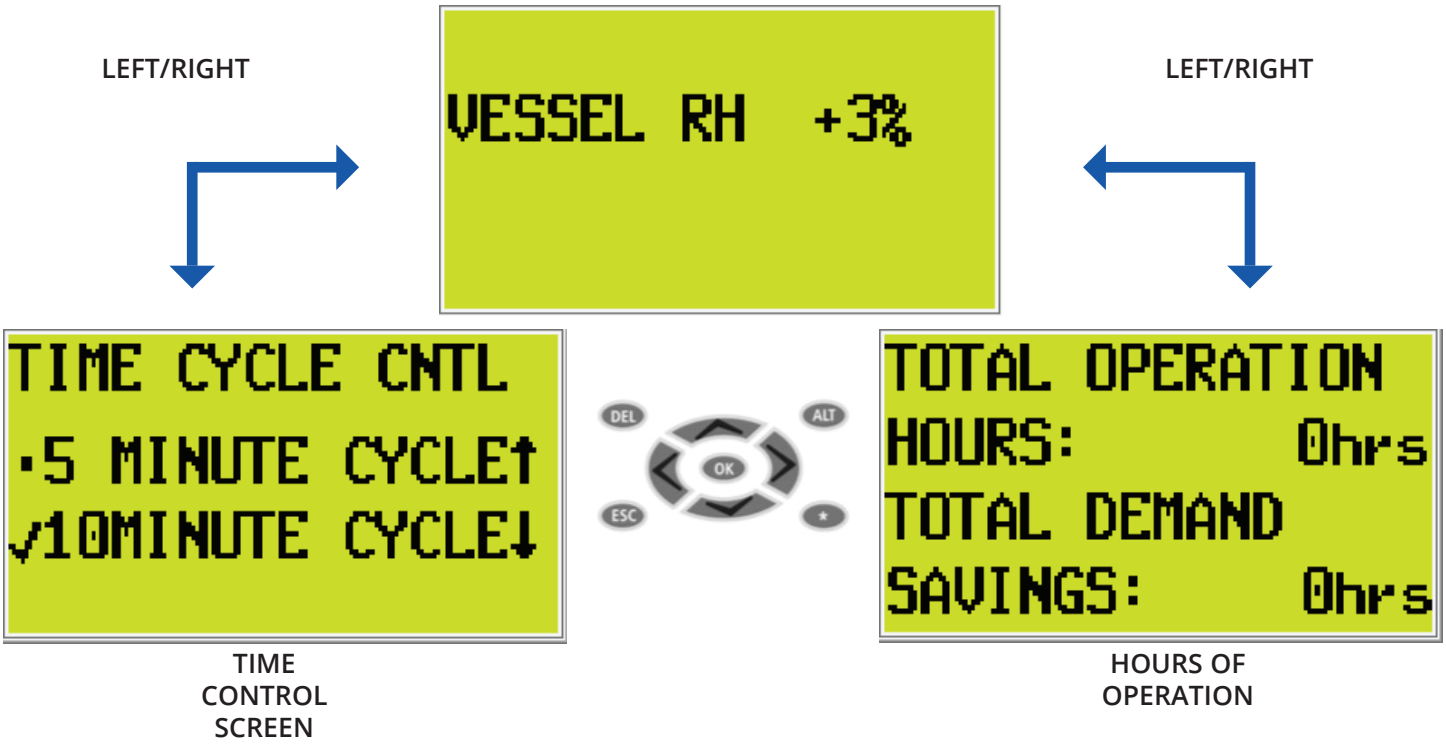

FIGURE 5-12: Analog Screen Navigation

5.2.12 HOURS OF OPERATION

Displays the amount of run time as well as the total amount of hours saved with the energy management system.

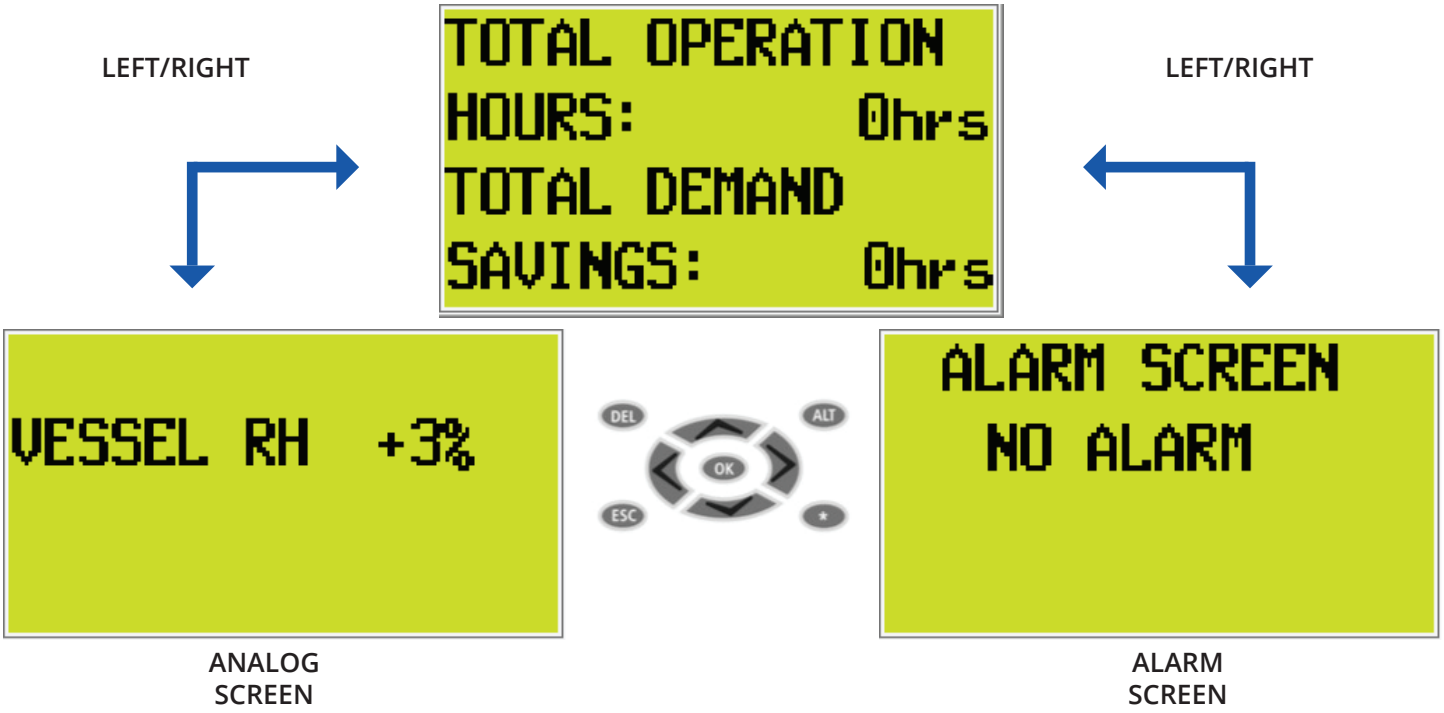

FIGURE 5-13: Hours of Operation Navigation

5.2.13 ALARM SCREEN

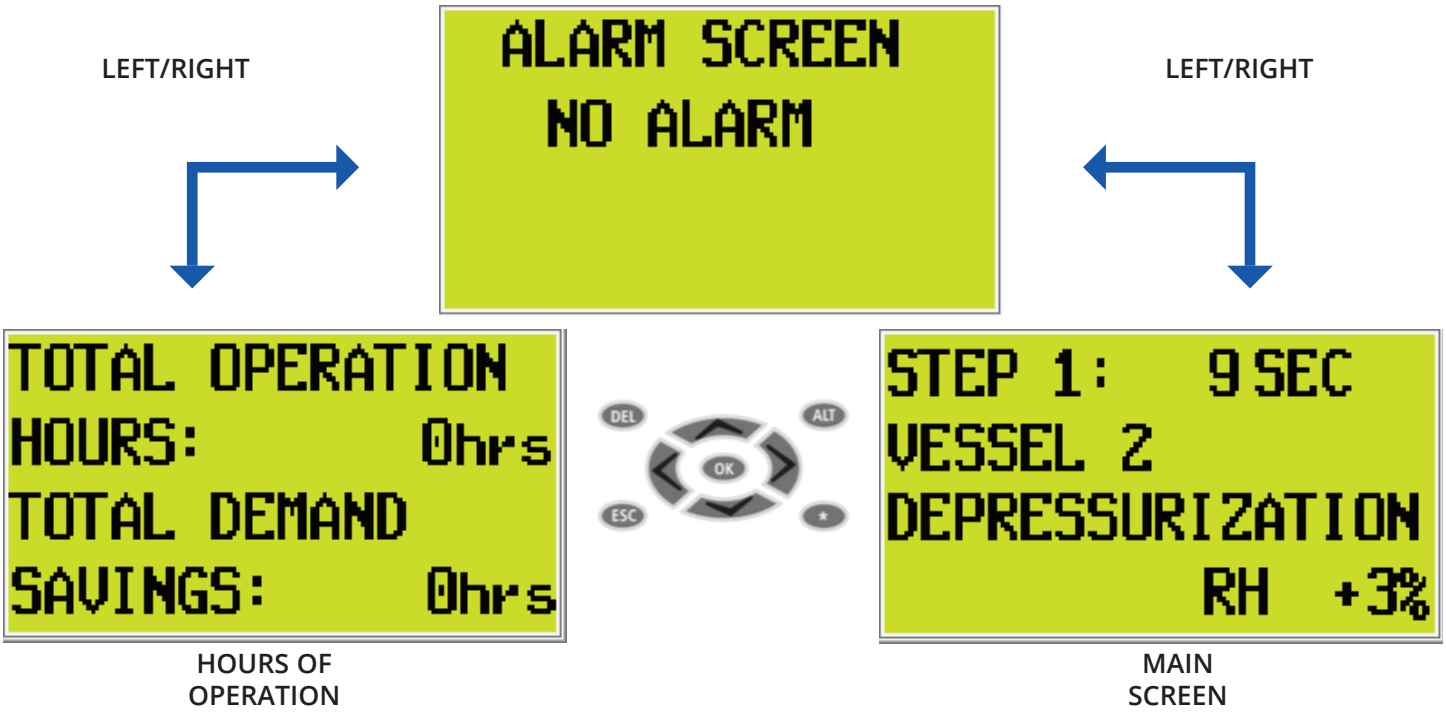

FIGURE 5-14: Alarm Screen Navigation

5.2.13.1 ALARM SCREEN MENU: Operation

- **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

5.2.14 ALARM POP-UP SCREENS

FIGURE 5-15: No Alarm

5.2.14.1 NO ALARM

- The normally closed state of the common alarm relay.

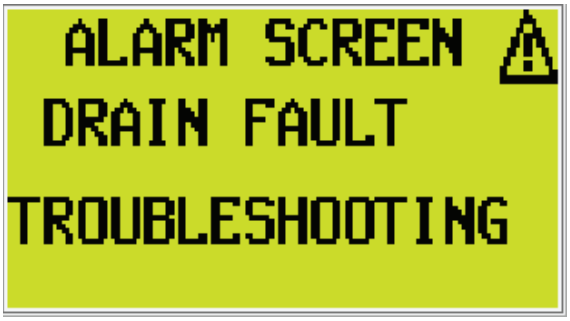

FIGURE 5-15: No Alarm

5.2.14.2 DRAIN FAULT

- Displays 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.

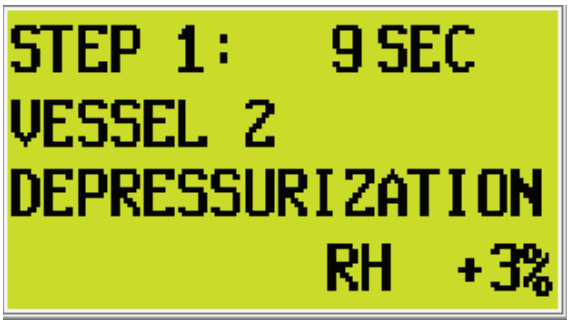

FIGURE 5-15: No Alarm

5.2.14.3 BAD RH PROBE

- Displays 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.

5.2.14 ALARM POP-UP SCREENS (CONT.)

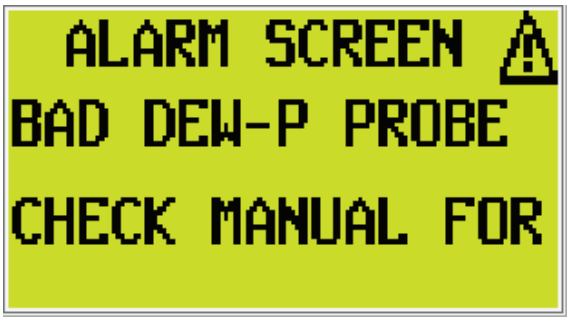

FIGURE 5-15: No Alarm

5.2.14.4 BAD DEW POINT CONTROL

- 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.

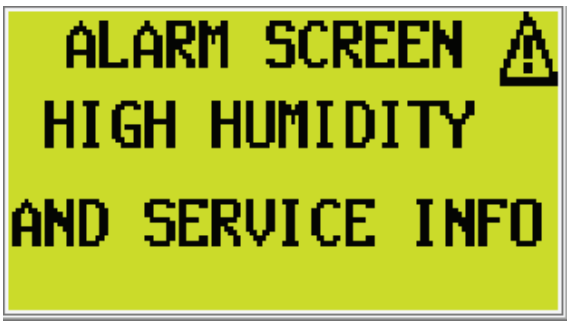

FIGURE 5-15: No Alarm

5.2.14.5 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.

FIGURE 5-15: No Alarm

5.2.14.6 FAILURE TO SHIFT ALARM

- 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.

SECTION 6: MAINTENANCE

6.1 Introduction

To reach a field service technician or for technical support, please call the number on the manual back cover.

WARNING!

Refer to shutdown procedures for maintenance in Section 3 prior to starting any maintenance on the dryer system

WARNING!

Electric Shock Hazard

This machine is connected to high voltage power, which can cause severe electrical shock and injury.

- Follow proper lock out/tag out procedures before performing service or maintenance work.
- Prior to performing any maintenance on the dryer, all personnel are strongly advised to familiarize themselves with the equipment by reading the entire contents of this operation manual.
- Follow all safety procedures prior to performing any maintenance activity on the dryer.

CAUTION

Inappropriate Tools Hazard

Using inappropriate tools for installation or maintenance work can lead to personal injury or property damage.

Appropriate tools must be used for all installation and maintenance work.

6.2 Maintenance

Desiccant air dryers require regular maintenance for satisfactory operation. Optimum performance can be expected if the following routine maintenance steps are taken.

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 back pressure 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.

6.2.1 DAILY CHECKLIST

With the dryer on-line:

- Verify the after-filter vent valve is closed and the inlet pre-filter drain isolation ball valve is open.
- Verify the control air pressure is reading between 80 - 100 psig on the control air pressure gauge; adjust as needed (normal setting is 100 psig).
- Document the general operating data/conditions of the dryer system in a maintenance log *(refer to Section 5 for sample)*. Data includes vessel pressures and outlet dew point, found in the flow diagram screen during heating mode.
- Check the Alarm Log screen. For any alarms have been logged, note the time and date of any alarms are listed. This may help in determining possible cause for the listed alarm(s). The alarm(s) can be cleared for ease of use when near 50 alarms have been logged or if no longer needed.

6.2.2 WEEKLY CHECKLIST

- Repeat all daily inspections and record data in the Maintenance Log in this manual.
- Check all drain valves, pre-filter, after filter and separators.
- Check any pressure differential indicators (Delta-P) on the pre-filter and after filter (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).
- Check dryer for correct operation.
- Verify dryer is purging at the purge exhaust, after dryer depressurizes.
- Check the dew point (if available) to ensure the dew point is being achieved.
- 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).

6.2.3 SEMI-ANNUAL CHECKLIST

- Remove and inspect all filters for excessive particulate loading and physical damage – if required replace pre-filter, after filters, 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).
- Check pressure differential indicator and if it turns red, replace the element.
- 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 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).
- Check desiccant condition. Powder in the mufflers is an indication of the status of the desiccant.
- Check all solenoid valves – coil condition and control circuit.
- Check dryer operation.
- Inspect and clean inlet and outlet APV (Automatic Piston Valves).

6.2.4 ANNUAL CHECKLIST

With the dryer on-line:

- Repeat all monthly inspections.
- Replace elements in pre-filter, after filters, and pilot air filter.
- Replace mufflers.
- Recalibrate dew point analyzer probe (if used) or send back to factory for recalibration.
- Check inlet and outlet valve seals. Clean or replace as needed.
- Check dryer for proper operation

6.3 Desiccant Replacement

WARNING!

Refer to shutdown procedures for maintenance in Section 3 prior to starting any maintenance on the dryer system

WARNING!

Electric Shock Hazard

This machine is connected to high voltage power, which can cause severe electrical shock and injury.

- Follow proper lock out/tag out procedures before performing service or maintenance work.
- Prior to performing any maintenance on the dryer, all personnel are strongly advised to familiarize themselves with the equipment by reading the entire contents of this operation manual.
- Follow all safety procedures prior to performing any maintenance activity on the dryer, making sure the system is depressurized and de-energized.

The following is the basic procedure for desiccant unloading and desiccant loading. There are other methods (not discussed below) that could be used for larger systems to reduce change-out time; such as, vacuum, pneumatic, or mechanical loading/unloading.

CAUTION

Inappropriate Tools Hazard

Using inappropriate tools for installation or maintenance work can lead to personal injury or property damage.

Appropriate tools must be used for all installation and maintenance work.

NOTICE

The desiccant fill port, located at the top of each desiccant vessel, is where the desiccant will be loaded into the vessel when vessel is empty. This fill port may have either a plug, blind flange or relief valve attached to the port.

The desiccant drain port, located at the bottom of each vessel, is where the desiccant will be drained or removed from each vessel. This drain port may have either a plug or blind flange attached to the port.

1. Turn electrical power off, depressurize the compressed air dryer to zero (0) psi, and lock-out / tag-out.
2. To drain the desiccant, place a bucket or a bin beneath the desiccant drain port located on the lower section of the desiccant vessel.
3. Loosen the bolts on the blind flange, or loosen the threaded plug at the desiccant drain port. If a blind flange is used, remove all bolts except for the upper flange bolt. This bolt can be used as a pivot to open and close the flange while draining the desiccant into buckets. If a plug is used, the plug is removed to drain the desiccant into a bucket. The plug can be reinserted slightly to stop flow of desiccant or place palm of hand over drain port to temporarily stop the desiccant from draining.
4. When the smaller bucket is nearly full of desiccant, stop the desiccant from draining as described above, dump the desiccant from the smaller bucket into a larger container or drum for proper disposal when finished.
5. Replace the bucket or bin under the drain port and repeat the draining process until all of the desiccant is removed from the tower.
6. On the desiccant drain port, reposition the blind flange, install and secure bolts to flange, or re-install the threaded plug.
7. Repeat the desiccant removal process as described above on the second vessel. After desiccant has been removed from both vessels, properly dispose of the spent desiccant.

NOTICE

Refer to the mechanical drawing, electrical drawing, flow diagram, and the display screen shots and descriptions for reference.

8. To load the new desiccant, remove the desiccant fill port flange or plug located on the top vessel head.
9. Install the amount and type of desiccant listed on the data label or other specifications listed for the system into each vessel.
10. Spread the desiccant evenly during several stages of the filling process
11. Reinstall the flange covers or plugs on the desiccant fill ports.
12. Leak test all plugs and flanges removed in the change process. Repair and retest leak sites if necessary.

SECTION 7: TROUBLESHOOTING

7.1 Introduction

The following section briefly discusses the various faults that can occur in the desiccant air dryer, the reason of the fault, and how it can be rectified. If you do not find the solution to your problem, contact your Aircel representative or the factory. All necessary safety and precautionary steps must be followed before attempting to perform any of the recommended measures to resolve any faults in the air dryer. Before any attempt is made to replace any electrical or mechanical component the machine must be shut down, isolated, depressurized, and electrical power disconnected *(see Section 3 for more information)*.

Do not assume these are the only problems that may occur. All available data concerning a problem should be systematically analyzed before undertaking any repairs or component replacement procedures.

WARNING!

In addition to the below notes and warnings, refer to general safety procedures, safe operating procedures, and any safety procedures required by end user. Section 3 prior to starting any maintenance on the dryer system

WARNING!

Pressure Hazard

This machine contains contents under low to medium pressure, which can cause injury.

- To avoid possible hazard or injury, the operator should be fully familiar with the refrigerated dryer system and its operation.
- When the system is shutdown and power removed, lock out power supply and depressurize system before performing maintenance or service work to avoid injury to personnel or property damage.

WARNING!

Electric Shock Hazard

This machine is connected to high voltage power, which can cause severe electrical shock and injury.

- Follow proper lock out/tag out procedures before performing service or maintenance work.
- Prior to performing any maintenance on the dryer, all personnel are strongly advised to familiarize themselves with the equipment by reading the entire contents of this operation manual.
- Follow all safety procedures prior to performing any maintenance activity on the dryer.
- Some troubleshooting may have to be done while system is pressurized and energized. Use extreme caution.

CAUTION

Inappropriate Tools Hazard

Using inappropriate tools for installation or maintenance work can lead to personal injury or property damage.

Appropriate tools must be used for all installation and maintenance work.

7.2 Initial Checks

1. Check for external damage or missing parts from system.
2. Verify electrical power supply corresponds to that mentioned on the dryer data plate.
3. Verify there is proper electrical power and voltage to all electrical connections in the machine.
4. Ensure control air is available at the proper pressure to all pneumatically operated components.
5. Verify all isolation valves and vent valves are in the correct positions.
6. Check the airflow, inlet temperature, and pressure falls within the operating range on the data label.
7. When ready to perform maintenance, depressurize and de-energize the dryer system. *Refer to Section 3 in this manual for more information.*

7.3 AHLD Series Troubleshooting Guide

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
	Controller failure	Check, replace if needed
High Pressure Drop	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
	Desiccant diffuser screens clogged	Inspect and clean as needed
High Back Pressure in Regenerating Tower	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

7.3 AHLD Series Troubleshooting Guide

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
	Controller failure	Check, replace if needed
High Pressure Drop	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
	Desiccant diffuser screens clogged	Inspect and clean as needed
High Back Pressure in Regenerating Tower	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

APPENDIX A: SPECIFICATIONS

A.1 Tables of specifications - AHLD Series

For dimensions, weights, and connection sizes, see the drawing of the dryer model provided at purchase.

Type of dryer: Desiccant

Power supply: 460 VAC, 3 Ph, 60 Hz

Desiccant type: Premium grade activated alumina

Parameter Description	Air Pressure	Air Inlet Temperature	Ambient Temperature
Maximum	135 psig	120°F	120°F
Standard Operating	100 psig	100°F	100°F
Minimum	60 psig	40°F	38°F

Normal Settings	Heat Control	400°F
	Dew Point Demand	- 50°F
	High Humidity	- 10°F

APPENDIX B: MATERIAL SAFETY DATA SHEETS

B.1 Activated Alumina Desiccant

BASF
The Chemical Company

Safety data sheet
F200

Revision date : 2009/12/04 Page: 1/5
Version: 3.0 (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	Content (W/W)	Chemical name
1333-84-2	>= 94.0 - <= 100.0 %	Aluminum oxide (Al2O3), 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.

B.1 Activated Alumina Desiccant

Safety data sheet
F200

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 (Al2O3), hydrate	OSHA	PEL 5 mg/m3 Respirable fraction ; PEL 15 mg/m3 Total dust ;
	ACGIH	TWA value 1 mg/m3 Respirable fraction ;

B.1 Activated Alumina Desiccant

Safety data sheet
F200

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)

B.1 Activated Alumina Desiccant

Safety data sheet
F200

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

B.1 Activated Alumina Desiccant

Safety data sheet
F200

Revision date : 2008/12/04 Page: 5/5
Version: 3.0 (30286124/MDS_GEN_US/EN)

Registration status:
TSCA, US released / listed

OSHA hazard category: ACGIH TLV established

SARA hazard categories (EPCRA 311/312): Acute

SARA 313:

CAS Number	Chemical name
1333-84-2	Aluminum oxide (Al2O3), hydrate

State regulations

State RTK

CAS Number	Chemical name	State RTK
1333-84-2	Aluminum oxide (Al2O3), 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

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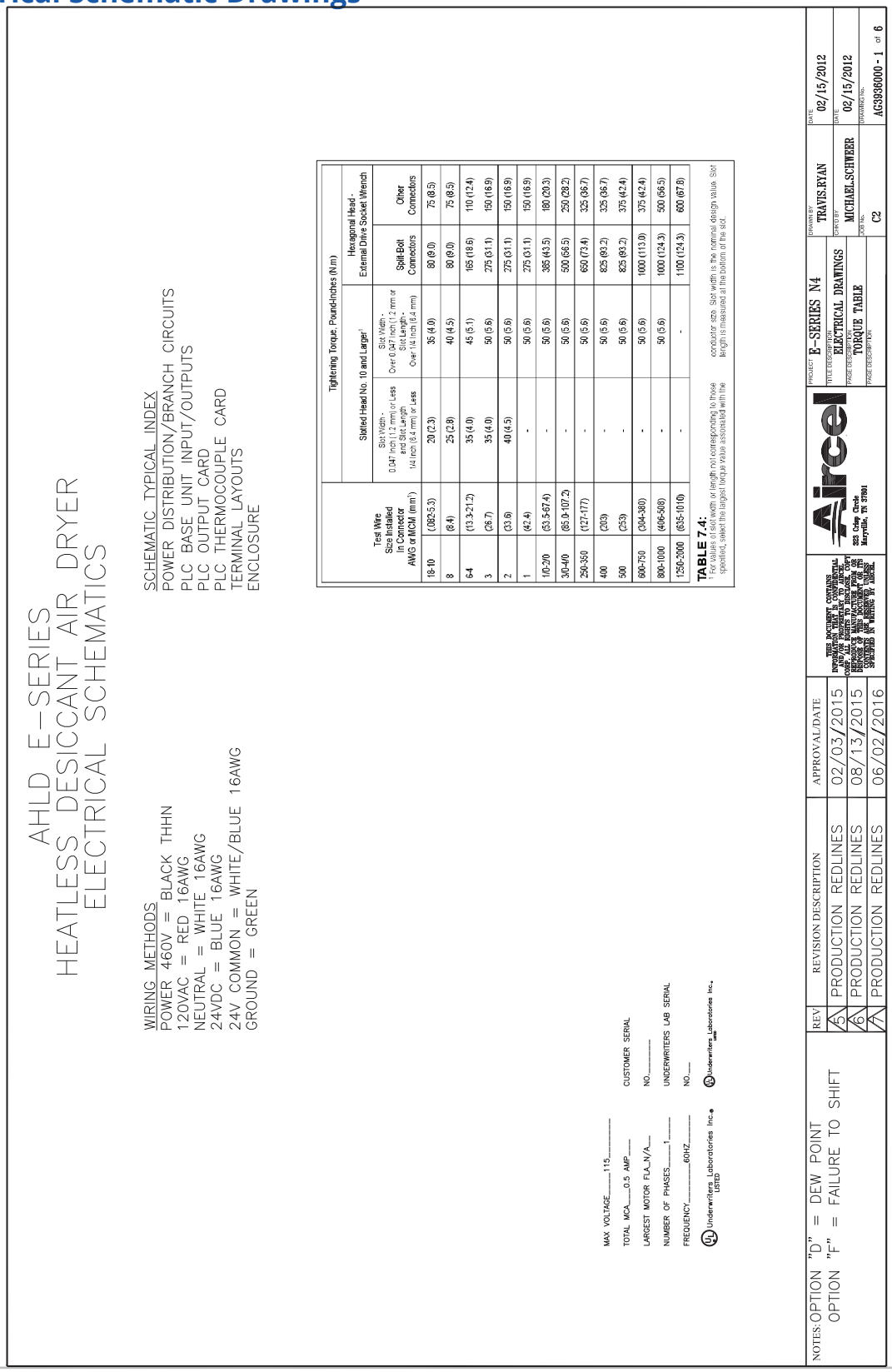
END OF DATA SHEET

APPENDIX C: DRAWINGS

C.1 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

Test Wire Size Installed In Connector AWG or MCM (mm²)	Tightening Torque, Pound-Inches (N.m)			
	Slotted Head No. 10 and Larger[1]		Hexagonal Head - External Drive Socket Wrench	
	Slot Width - 0.047 Inch (1.2 mm) or Less and Slot Length - 1/4 Inch (6.4 mm) or Less	Slot Width - Over 0.047 Inch (1.2 mm or and Slot Length - Over 1/4 Inch (6.4 mm)	Split-Bolt Connectors	Other Connectors
18-10 (.0823-5.3)	20 (2.3)	35 (4.0)	80 (9.0)	75 (8.5)
8 (8.4)	25 (2.8)	40 (4.5)	80 (9.0)	75 (8.5)
6-4 (13.3-21.2)	35 (4.0)	45 (5.1)	165 (18.6)	110 (12.4)
3 (26.7)	35 (4.0)	50 (5.6)	275 (31.1)	150 (16.9)
2 (33.6)	40 (4.5)	50 (5.6)	275 (31.1)	150 (16.9)
1 (42.4)	-	50 (5.6)	275 (31.1)	150 (16.9)
1/0-2/0 (53.5-67.4)	-	50 (5.6)	385 (43.5)	180 (20.3)
3/0-4/0 (85.0-107.2)	-	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 (124.3)	500 (56.5)
1250-2000 (635-1010)	-	-	1100 (124.3)	600 (67.8)

TABLE 7.4:
[1] For values of slot width or length not corresponding to those specified, select the largest torque value associated with the conductor size. Slot width is the nominal design value. Slot length is measured at the bottom of the slot.

MAX VOLTAGE_____115_____
TOTAL MCA_____0.5 AMP_____
LARGEST MOTOR FLA_N/A_____
NUMBER OF PHASES_____1_____
FREQUENCY_____60HZ_____

CUSTOMER SERIAL NO._____
UNDERWRITERS LAB SERIAL NO.___

Underwriters Laboratories Inc.® LISTED

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

REV	REVISION DESCRIPTION	APPROVAL/DATE
5	PRODUCTION REDLINES	02/03/2015
6	PRODUCTION REDLINES	08/13/2015
7	PRODUCTION REDLINES	06/02/2016

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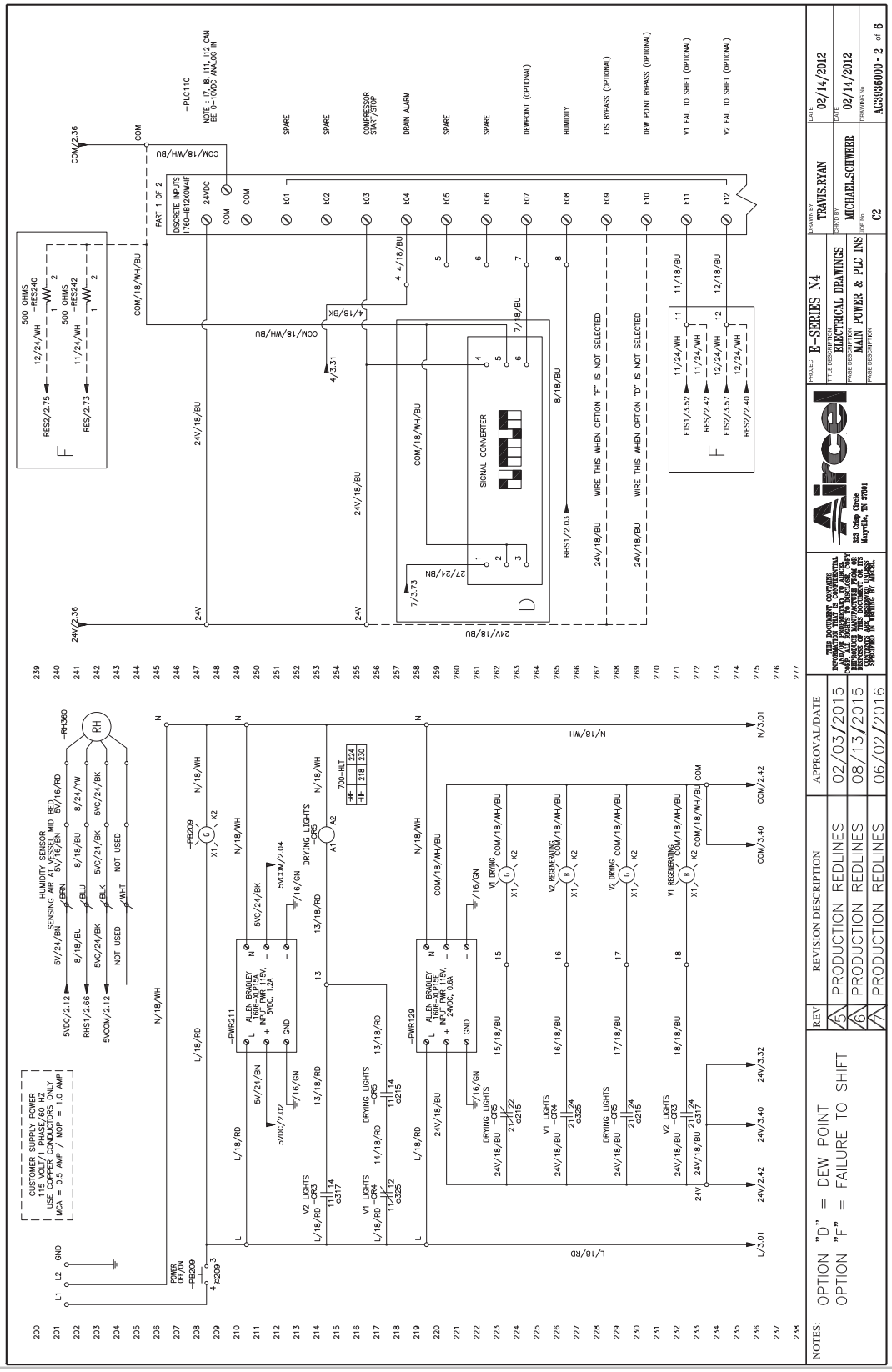
825 Crisp Circle
Maryville, TN 37801

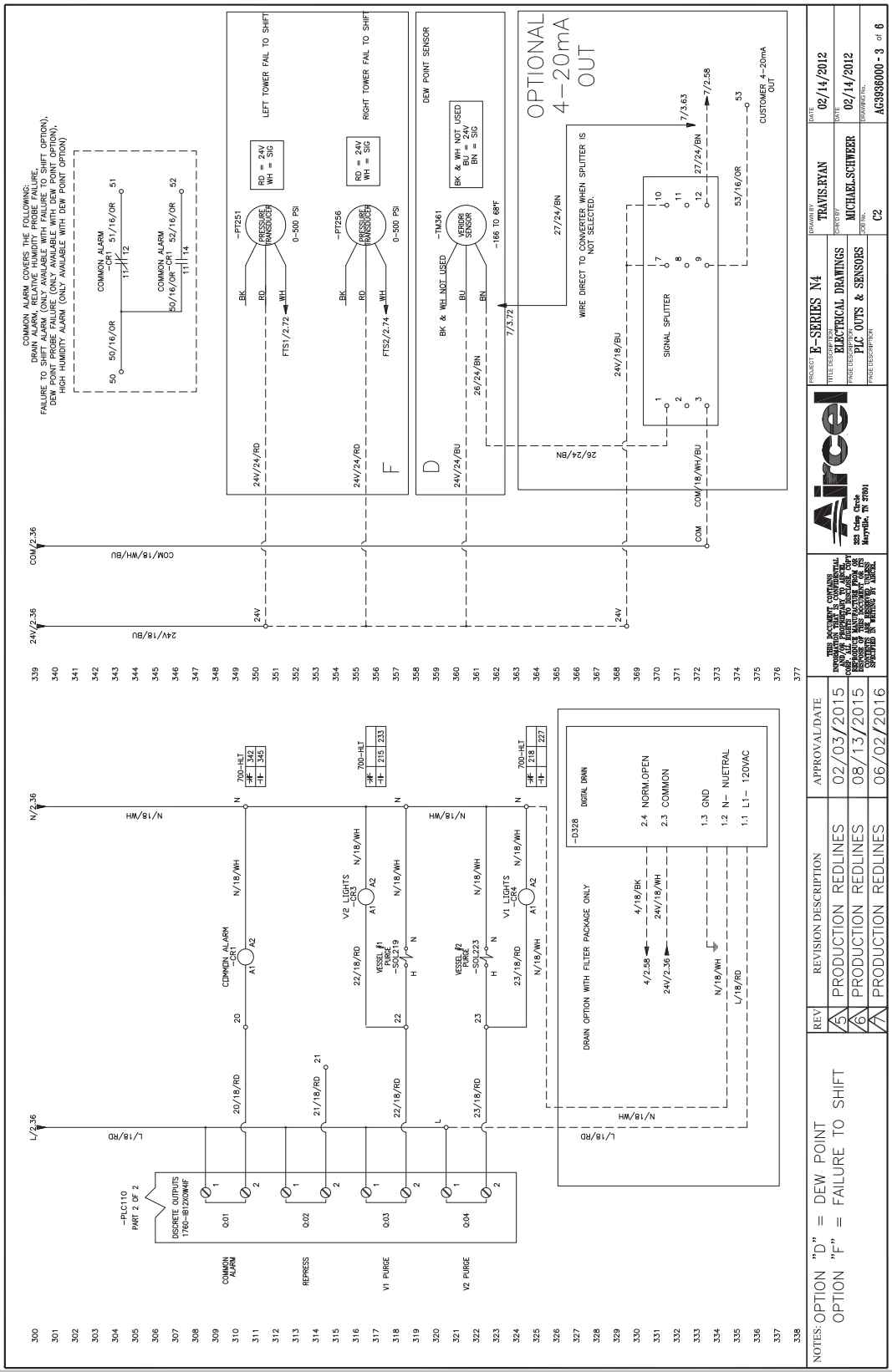
PROJECT: E-SERIES N4
TITLE DESCRIPTION: ELECTRICAL DRAWINGS
PAGE DESCRIPTION: TORQUE TABLE
PAGE DESCRIPTION:

DRAWN BY: TRAVIS.RYAN
DATE: 02/15/2012
CHKD BY: MICHAEL.SCHWEBER
DATE: 02/15/2012
JOB NO.: C2
DRAWING NO.: AC93936000 - 1 of 6

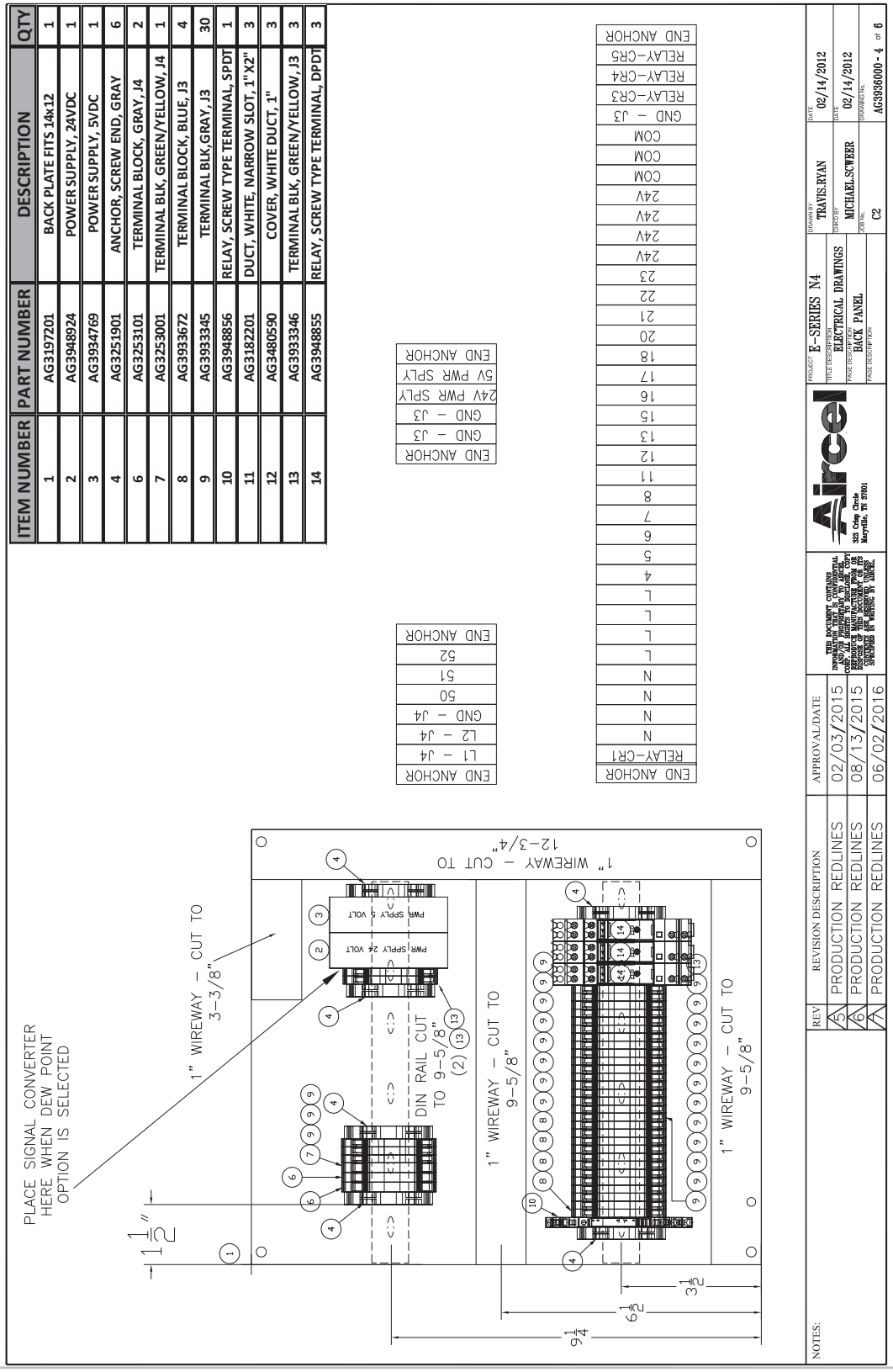
C.2 Main Power & PLC Input Drawings



C.3 PLC Outlet & Sensor Drawings

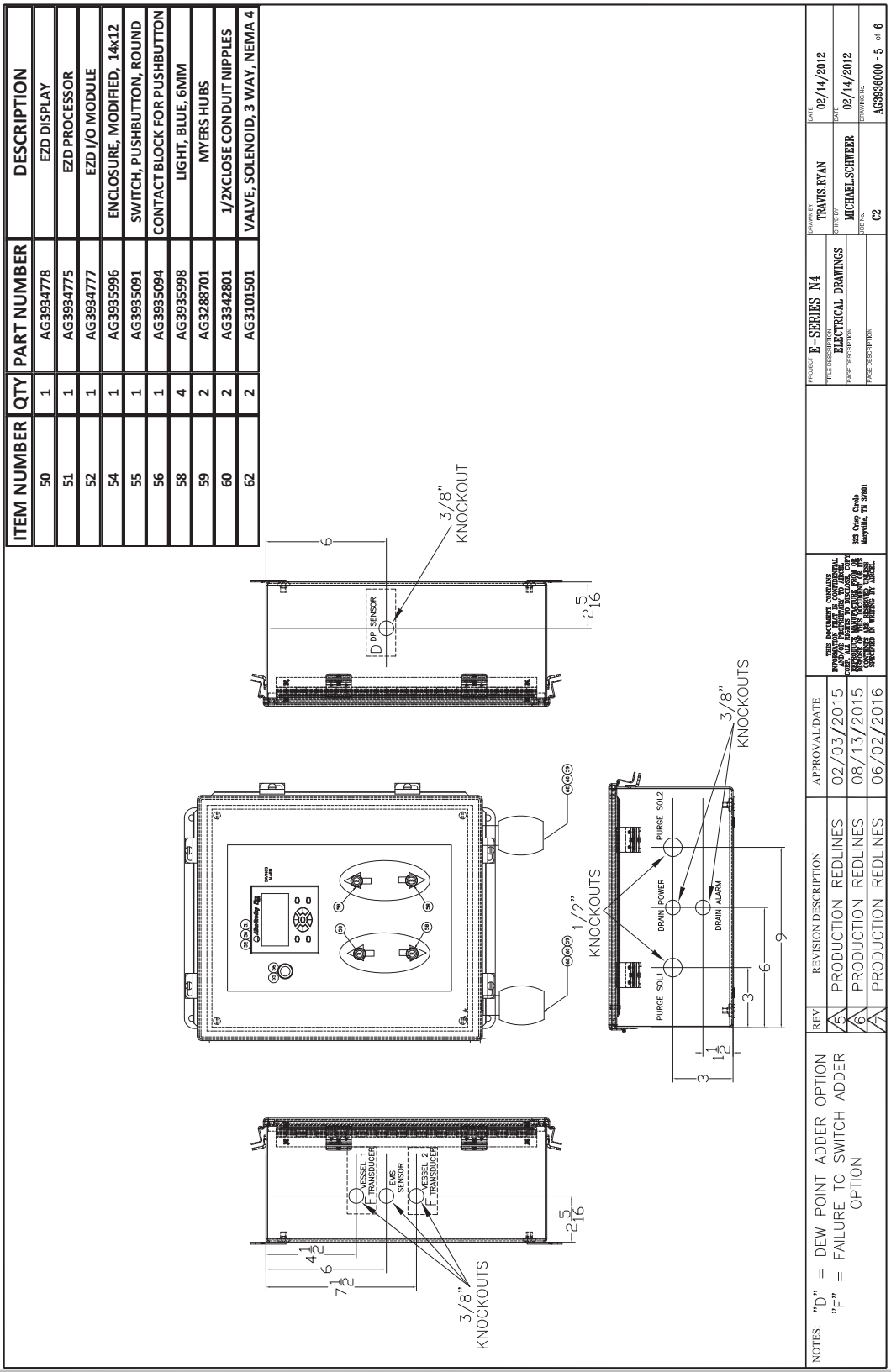


C.4 Back Panel Drawings



C.5 Enclosure Layout Drawings

ITEM NUMBER	QTY	PART NUMBER	DESCRIPTION
50	1	AG3934778	EZD DISPLAY
51	1	AG3934775	EZD PROCESSOR
52	1	AG3934777	EZD I/O MODULE
54	1	AG3935996	ENCLOSURE, MODIFIED, 14x12
55	1	AG3935091	SWITCH, PUSHBUTTON, ROUND
56	1	AG3935094	CONTACT BLOCK FOR PUSHBUTTON
58	4	AG3935998	LIGHT, BLUE, 6MM
59	2	AG3288701	MYERS HUBS
60	2	AG3342801	1/2XCLOSE CONDUIT NIPPLES
62	2	AG3101501	VALVE, SOLENOID, 3 WAY, NEMA 4



C.6 Electrial Part Drawings

Stock Number	Stock Description	Quantity	Spare?
AG3934778	EZD CONTROLLER, PROCESSOR	1	Y
AG3934775	EZD CONTROLLER, 12 DC INPUTS	1	Y
AG3934777	EZD CONTROLLER, CPU	1	Y
AG3935996	ENCLOSURE, MODIFIED, 14X12	1	N
AG3935091	SWITCH, PUSHBUTTON, ROUND	1	Y
AG3935094	SWITCH, CONTACT BLOCK, FOR ALL	1	Y
AG3935095	LIGHT, FOR 800B SWITCH, LED	1	Y
AG3935096	LENS FOR PUSHBUTTON, GREEN	1	Y
AG3935998	LIGHT, PILOT, 115V, 8MM, BLUE	4	Y
AG3288701	HUB, MYERS, 1/2"	2	Y
AG3342801	NIPPLE, CONDUIT, 1/2" X CLOSE,	2	N
AG3481168	STRAIN RELIEF, 3/8"	3	N
AG3481158	LOCK NUT, 3/8"	3	N
AG3481159	RING SEAL, 3/8"	3	N
AG3948855	RELAY, SCREW TYPE TERMINAL, DPDT	3	Y
AG3197201	PANEL, BACKPLATE, FITS 14x12	1	N
AG3948924	POWER SUPPLY, 24VDC	1	Y
AG3934769	POWER SUPPLY, 5VDC	1	Y
AG3251901	ANCHOR, SCREW END, GRAY	6	N
AG3253101	TERMINAL BLOCK, GRAY, J4	2	N
AG3253001	TERMINAL BLOCK, GREEN/YELLOW, J4	1	N
AG3933672	TERMINAL BLOCK, BLU, J3	4	N
AG3933345	TERMINAL BLOCK, GRAY, J3	30	N
AG3948856	RELAY, SCREW TYPE TERMINAL, SPDT	1	Y
AG3182201	DUCT, WHITE, NARROW SLOT, 1x2	3	N
AG3101501	VALVE, SOLENOID, 3 WAY, NEMA 4, 1/4"	2	Y
AG3933346	TERMINAL BLK, GREEN/YELLOW, J3	3	N
AG3480590	COVER, WHITE DUCT, 1"	3	N
AG3481460	CORD, SJEEOW, 18/3	10	N
AG3480463	WIRE #18, BLUE	80	N
AG3480947	WIRE #18, RED	98	N
AG3480948	WIRE #18, WHITE	17	N
AG3480991	WIRE #18, WHITE/BLUE	9.5	N
AG3373901	WIRE #16, ORANGE	6	N
AG3372301	WIRE #16, GREEN	12	N

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325 Crisp Circle
Maryville, TN 37801

PROJECT: E-SERIES N4
TITLE DESCRIPTION: ELECTRICAL DRAWINGS
PAGE DESCRIPTION: ELECTRICAL BOM
PAGE DESCRIPTION

DRAWN BY: TRAVIS.RYAN — DATE: 06/15/2012
CHKD BY: MICHAEL.SCHWERER — DATE: 06/15/2012
DCR No.: C2
DRAWING No.: AG3938000 - 6 of 6

AHLD E-SERIES ELECTRICAL DRAWING, AIRCEL PROGRAMMABLE CONTROLLER, NEMA-4 WITH ENERGY MANAGEMENT.

NOTES

DATE	SERVICE PERFORMED	NOTES

NOTES

DATE	SERVICE PERFORMED	NOTES

NOTES

DATE	SERVICE PERFORMED	NOTES

NOTES

DATE	SERVICE PERFORMED	NOTES

NOTES

DATE	SERVICE PERFORMED	NOTES

NOTES

DATE	SERVICE PERFORMED	NOTES

WARRANTY INFORMATION

Aircel warrants that its Standard Refrigerated Air Dryers are free from defects in materials and workmanship for two years from the date of invoice. Warranty coverage for this time period will be parts and labor for the first year and parts only for the second. Custom engineered products, desiccant dryers, chillers and nitrogen generators are warranted to be free from defects in materials and workmanship for one year from date of invoice. Warranty coverage for this time period will be for parts and labor.

Aircel warranty excludes damages due to corrosion, lack of proper maintenance, incorrect installation, modification, or misapplication of equipment. Routine maintenance or adjustment required under normal operation as outlined in the Aircel operation and maintenance manuals are not covered under warranty.

Once Aircel has been given adequate opportunity to remedy any defects in material or workmanship in accordance with Aircel Warranty Policy and Procedures, Aircel retains the sole option to accept return of the goods, with freight paid by the purchaser, and to refund the purchase price for the goods after confirming the goods are returned undamaged and in usable condition. Such a refund will be the full extent of Aircel liability. Aircel shall not be liable for any other costs, expenses or damages whether direct, indirect, special, incidental, consequential or otherwise. The terms of this warranty may be modified only by a special warranty document signed by a CEO, General Manager or Vice President of Aircel.

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Parts & Service

For genuine Aircel replacement parts, call

800.767.4599

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