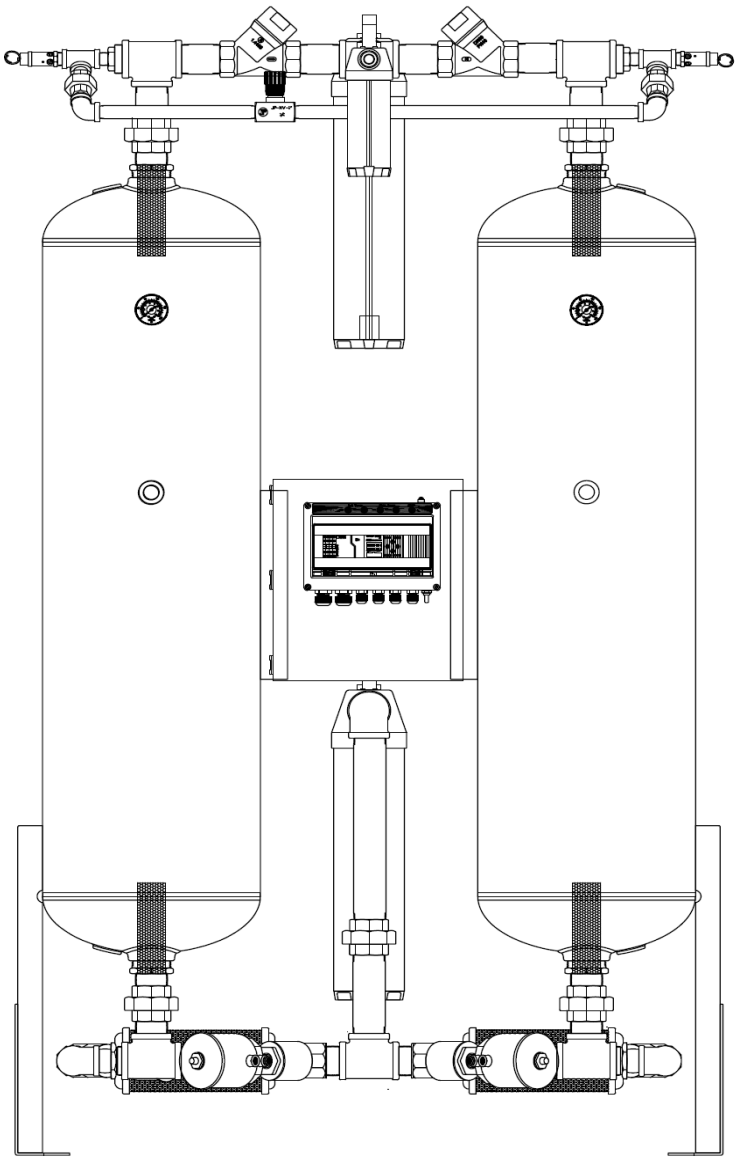
INSTALLATION, OPERATION & MAINTENANCE MANUAL
FOR
HEATLESS REGENERATIVE
COMPRESSED AIR DRYERS
MODELS
80-NHL through 5000-NHL



Dear Customer,

Thank you for choosing our product. In order to get the best performances in the use of this product, please read carefully this manual. To avoid incorrect operation of the equipment and possible physical risk to the operator, please read and strictly follow the instructions contained in this manual. Note, these instructions are in addition to the safety rules that apply in the country where the dryer is installed.

Before packing for shipment each **NHL** series heatless adsorption air dryer is subjected to a rigorous test to ensure the absence of any manufacturing faults and to demonstrate that the device can perform all the functions for which it has been designed.

Once the dryer has been properly installed according to the instructions in this manual, it will be ready for use without any further adjustment. The operation is fully automatic, and the maintenance must be performed regularly, as detailed in the following chapters.

This manual must be maintained available in any moment for future references and it has to be intended as inherent part of the relevant dryer.

Due to the continuous technical evolution, we reserve the right to introduce any necessary change without giving previous notice.

Should you experience any trouble, or for further information, please do not hesitate to contact us.

IDENTIFICATION PLATE

The product identification plate shows all the primary data of the machine. Upon installation, fill in the table shown on the side copying the data shown on the identification plate. These data must always be referred to the manufacturer or to the dealer when information or spare parts are needed, even during the warranty period.

The removal or the alteration of the identification plate will void the warranty rights.

Model	⇨
Serial No.	⇨
Code	⇨ Heatless Regenerative Dryer
Nominal Flow Rate	⇨ SCFM
Max Air Pressure	⇨ PSIG
Max Inlet Air Temperature	⇨ ^{0}F
Ambient Temperature	⇨ ^{0}F
Desiccant (type and Q.ty)	⇨ Activated alumina / LBS
Electric Supply	⇨ 115/1/60
Electric Nominal Power	⇨ 10W
Fuse Max.	⇨ 2 AMP
Manufactured	⇨

WARRANTY CONDITIONS

For 12 months from the installation date, but no longer than 14 months from the delivery date, the warranty covers eventual faulty parts, which will be repaired or replaced free of charge, except the travel, hotel and restaurant expenses of our engineer.

The warranty doesn't cover any responsibility for direct or indirect damages to persons, animals or equipment caused by improper usage or maintenance, and it's limited to manufacturing faults only.

The right to warranty repairs is subordinated to the strict compliance with the installation, use and maintenance instructions contained in this manual.

The warranty will be immediately voided in case of even small changes or alterations to the dryer.

To request repairs during the warranty period, the data reported on the identification plate must be notified.

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1.1 DEFINITION OF THE SAFETY SYMBOLS USED

Before attempting any intervention on the dryer, read carefully the instructions reported in this use and maintenance manual.

General warning sign. Risk of danger or possibility of damage to the machine. Read carefully the text related to this sign.

Electrical hazard. The relevant text outlines conditions which could result fatal. The related instructions must be strictly respected.

Danger hazard. Part or system under pressure.

Danger hazard. Component or system which during the operation can reach high temperature.

Danger hazard. It's absolutely forbidden to breathe the air treated with this apparatus.

Danger hazard: It's absolutely forbidden to use water to extinguish fire on the dryer or in the surrounding area.

Danger hazard; It's absolutely forbidden to operate the machine when the parts (under pressure or electric panels) are not in place or have been tampered with and changed.

Danger hazard: machine level noise could be higher than 85 dBA. It is mandatory to install the machine in dedicated area where people are not normally present. The installator and/or the user is responsible for correct installation of the dryer, in order to prevent noise propagation to the near work environment. The installator and/or the user is also responsible for the safety signs affixing into installation site.

Attention: the user that intervenes to the machine must wear hearing protection before to operate into the dryer. Each employee must select proper PPD (Personal Protection Device) hearing protector (earmuffs, ear canal caps and earplugs) in order to prevent any uneasiness that could cause dangerous situation for him.

Maintenance and/or control operation to be very carefully performed by qualified personnel [1].

Compressed air inlet connection point.

Compressed air outlet connection point.

Condensate drain connection point.

Operations which can be worked out by the operator of the machine, if qualified [1].

NOTE : Text to be taken into account, but not involving safety precautions.

In designing this unit a lot of care has been devoted to the protection of the environment:

- Dryer and relevant packaging composed of recyclable materials.
- Energy saving design.

Not to spoil our commitment, the user should follow the few ecological suggestions marked with this sign.

1.2 WARNINGS

Compressed air is a highly hazardous energy source. Never work on the dryer with parts under pressure. Never point the compressed air or the condensate drain jet towards anybody.
The user is responsible for the installation of the dryer, which has to be executed on the basis of the instructions given in the “Installation” chapter. Otherwise, the warranty will be voided and dangerous situations for the personnel and/or damages to the machine could occur.

Only qualified personnel can use and service electrically powered devices. Before attempting any maintenance action, the following conditions must be satisfied :

- Ensure that any part of the machine is under voltage and that it cannot be connected to the mains.
- Ensure that any part of the dryer is under pressure and that it cannot be connected to the compressed air system.

Any change to the machine or to the relevant operating parameters, if not previously verified and authorised by the Manufacturer, in addition to create the possibility of dangerous conditions it will void the warranty.

Don’t use water to extinguish fire on the dryer or in the surrounding area.

1.3 PROPER USE OF THE DRYER

This dryer has been designed, manufactured and tested only to be used to separate the humidity normally contained in compressed air. Any other use has to be considered improper. The Manufacturer will not be responsible for any problem arising from improper use; the user will be in any case responsible for any resulting damage.
Moreover, the correct use requires the compliance with the installation conditions, in particular:

- Voltage and frequency of the mains.
- Pressure, temperature and flow-rate of the incoming air.
- Ambient temperature.

This dryer is supplied tested and fully assembled. The only operation left to the user is the connection to the plant in compliance with the instructions given in the following chapters.

The purpose of the machine is the separation of water and eventual oil particles present in compressed air. The dried air cannot be used for respiration purposes or for operations leading to direct contact with foodstuff, unless subject to further treatments.

1.4 INSTRUCTIONS FOR THE USE OF PRESSURE EQUIPMENT

To ensure the safe operation of pressure equipments, the user must conform strictly to the above directive and the following:

1. The equipment must only be operated within the temperature and pressure limits stated on the manufacturers name/data plate.
2. No welding is allowed on the shell and end caps.
3. The equipment must not be stored in badly ventilated spaces, near a heat source or inflammable substances.
4. Vibration must be eliminated from the equipment to prevent fatigue failure.
5. An internal inspection must be carried out at 12 month intervals to check for pressure equipment corrosion. **The actual wall thickness of the towers after corrosion should not be less than the data indicated in the chart on the side.**
6. Automatic condensate drains should be checked for operation every day to prevent a build up of condensate in the pressure equipment.
7. The maximum working pressure stated on the manufacturers data plate must not be exceeded.
8. All documentation supplied with the equipment (manual, declaration of conformity etc.) must be kept for future reference.

2.1 TRANSPORT

Once verified the integrity of the packaging, place the unit near to the installation point and unpack the contents.

- To move the packaged unit we suggest to use a suitable crane or forklift. We do not recommend using hands.
- Handle with care. Heavy blows could cause irreparable damage.
- Even when packaged, keep the machine protected from severity of the weather.

The packaging materials are recyclable. Each single material must be properly disposed in a manner complying with the rules in force in the destination country.

2.2 INSTALLATION SITE

Particular care is required in selecting the installation site, as an improper location could jeopardise the proper operation of the dryer.
This unit is not suitable to be used in explosive atmosphere, where risk of fire could exist, or in presence of gaseous or solid polluting material.

Don't use water to extinguish fire on the dryer or in the surrounding area.

Machine level noise could be higher than 85 dBA. It is mandatory to install the machine in dedicated area where people are not normally present. The installator and/or the user is responsible for correct installation of the dryer, in order to prevent noise propagation to the near work environment. The installator and/or the user is also responsible for the safety signs affixing into installation site.

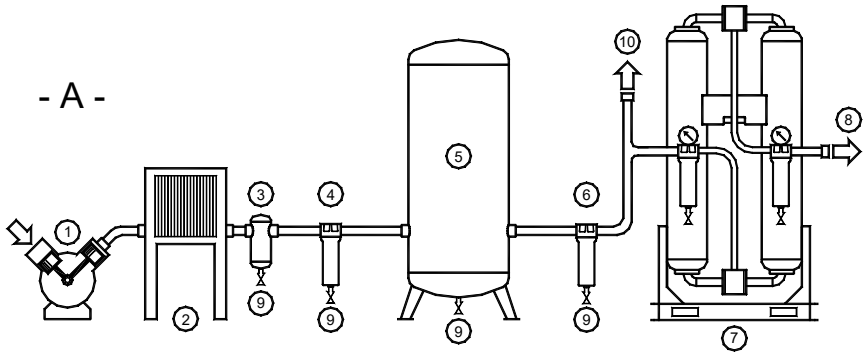
The user that intervenes to the machine must wear hearing protection before to operate into the dryer. Each employee must select proper PPD (Personal Protection Device) hearing protector (earmuffs, ear canal caps and earplugs) in order to prevent any uneasiness that could cause dangerous situation for him.

Minimal installation requirements:

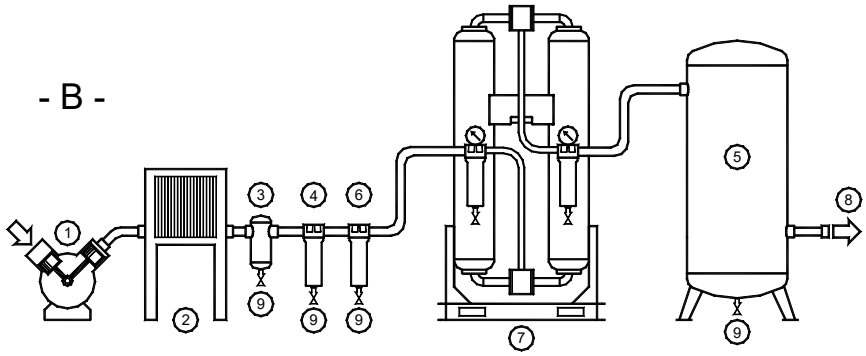
- Select a clean room dry, free from dust, and protected from atmospheric disturbances.
- The supporting area must be smooth, horizontal and able to hold the weight of the dryer.
- Minimum ambient temperature +1 ºC.
- Maximum ambient temperature +50 ºC.
- Allow at least a clearance of 1 m on each side of the dryer to facilitate possible maintenance operations.
- The dryer doesn't require to be fixed to the supporting surface.

2.3 INSTALLATION LAYOUT

- A -



- B -



1. Air Compressor
2. Final After Cooler
3. Condensate separator
4. Filter 5 micron
5. Air Receiver
6. Filter 1 micron
7. Adsorption Dryer
8. Dried Air Outlet
9. Condensate drain

Dryer is supplied with 0.01 micron filter on the inlet and a 1 micron filter on the outlet. It is recommended to install both 5 micron and 1 micron filter before the dryer, in order to protract the life of the inlet filter.

Type A installation is suggested when the compressed air treated from the dryer is only a part of the total flow rate of the compressor; or when the compressor operates at reduced intermittence and the total consumption equals the compressor flow rate.

2.4 CORRECTION FACTORS

Correction Factor for inlet Pressure															
PSIG	50	60	70	80	90	100	110	120	130	140	150	175	200	225	250
BAR	3.5	4.1	4.8	5.5	6.2	6.9	7.6	8.3	9.0	9.7	10.3	12.1	13.8	15.5	17.3
F1 Factor	**0.56**	**0.65**	**0.74**	**0.83**	**0.91**	**1.0**	**1.06**	**1.08**	**1.12**	**1.16**	**1.2**	**1.29**	**1.37**	**1.45**	**1.52**

Correction factor for Inlet Temperature								
^{0}F	70	80	90	100	105	110	115	120
^{0}C	21	27	32	38	40	43	46	49
F2 Factor	1.12	1.09	1.06	1.0	0.93	0.86	0.80	0.75

Operating Conditions

- Maximum working pressure 150 PSIG (10 Bar) for higher pressure contact factory.
- Minimum working pressure 60 PSIG (4 bar)
- Maximum inlet temperature 120 ^{0}F (49 ^{0}C)
- Minimum ambient temperature: 34 ^{0}F (1.6 ^{0}C) for lower ambient temperature contact factory.

Sizing a Dryer:

How to find the air flow capacity:

Air Flow Capacity	=	Nominal Capacity of dryer	X	Factor F1	X	Factor F2

Example: A (NHL-250) has a nominal capacity of 250 SCFM.
What is the maximum allowable flow through the dryer at following operating conditions:
Air Inlet Pressure : 110 Psig (7.6 Bar) From table for pressure correction F1=1.04
Air Inlet temperature: 105 ^{0}F (40 ^{0}C) From table for temperature correction F2=0.93

Air Flow Capacity	=	250 SCFM	X	F1 1.04	X	F2 0.93

Air Flow Capacity= 241.8 SCFM. This is the maximum air flow rate that the dryer can accept under those operating conditions.

2.5 CONNECTION TO THE COMPRESSED AIR SYSTEM

Operations to be performed by qualified personnel. Never operate with plants under pressure.
The user is responsible to ensure that the dryer will never be operated with pressure exceeding the nominal values. Eventual over-pressure could be dangerous both for the operator and the machine.

The temperature and the amount of air entering the dryer must comply with the limits reported on the data plate. In case of treatment of air at particularly high temperature, the installation of a final refrigerator could result necessary. The cross section of the connecting piping, which must be free from dust, rust, chips and other impurities, and must be consistent with the flow-rate of the dryer.
In realising the dryer, particular measures have been taken in order to limit the vibration which could occur during the operation. Therefore we recommend to use connecting pipes able to insulate the dryer from possible vibrations originating from the line (flexible hoses, vibration damping fittings, etc.).

2.6 CONNECTION TO THE MAINS

The connection to the mains, to be carried out by qualified personnel, and the safety systems must comply with local rules and laws.

Before connecting the unit to the electric power, verify that the voltage and the frequency available on the mains correspond to the data reported on the data plate of the dryer. In terms of voltage, a ±5% tolerance is allowed. The dryer comes with a mains connecting cable already installed (6 ft).

The mains socket must be provided with a **mains magneto-thermal differential breaker** (I∆n=0.3A).

The cross section of the power supply cables must comply with the consumption of the dryer, while keeping into account also the ambient temperature, the conditions of the mains installation, the length of the cables, and the requirements enforced by the local Power Provider.

It is mandatory to ensure the connection to the ground terminal.

2.7 INLET FILTER CONDENSATE DRAIN

The condensate is discharged at the same pressure of the air entering the dryer.
Never point the condensate drain jet towards anybody.

The dryer is already designed to be connected to the condensate collecting plant through a flexible plastic pipe,1/4" in diameter and 6 ft. long.

Connect and properly fasten the condensate drain to a collecting plant or container.

The drain cannot be connected to pressurised systems.

Don't dispose the condensate in the environment.
The condensate collected in the dryer contains oil particles released in the air by the compressor.
Dispose the condensate in compliance with the local rules.
We suggest to install a water-oil separator where to convey all the condensate drain coming from compressors, dryers, tanks, filters, etc.

3.1 PRELIMINARY OPERATION

Verify that the operating parameters match with the nominal values reported on the data plate of the dryer (voltage, frequency, air pressure, air temperature, ambient temperature, etc.).

Before delivery, each dryer is submitted to accurate tests simulating real operating conditions. Nevertheless, the unit could be damaged during transportation. We therefore suggest to check the integrity of the dryer upon arrival and to keep it under control during the first hours of operation.

The start-up must be performed by qualified personnel.
It's mandatory that the engineer in charge will adopt safe operational conditions complying with the local safety and accident prevention requirements.

The same engineer will be responsible for the proper and safe operation of the dryer.
Never operate the dryer if their panels are not in place.

3.2 FIRST START-UP

At the first start-up, or in case of start-up after a long inactivity period or following to maintenance operations, comply with the instructions given below. The start-up must be performed by qualified personnel.

The user that intervenes to the machine must wear hearing protection before to operate into the dryer. Each employee must select proper PPD (Personal Protection Device) hearing protector (earmuffs, ear canal caps and earplugs) in order to prevent any uneasiness that could cause dangerous situation for him.

Sequence of operations:

- Verify that the factory settings, indicated in the plate “REMOVE BEFORE THE 1ST START UP” (on the instrument), match the real operating conditions requested.
- Verify that all the steps of the “Installation” chapter have been observed.
- Verify that the connection to the compressed air system is correct and that the piping is suitably fixed.
- Verify that the condensate drain pipe is properly fastened and connected to a collection system or container.
- Remove any packaging and other material which could obstruct the area around the dryer.
- Pressurize the dryer slowly.
- Activate the mains switch.
- Verify that the DDC15 instrument is on.
- Check the piping for air leakage.
- Test the drain of the inlet filter.
- After 2 minutes from the start-up the adsorption tower B is depressurized.
- Wait for the dryer to make some cycles (there is an alternation of depressurization from tower A to tower B)
- The cycle is inverted every 2 minutes (DewPoint of -70°C) or every 5 minutes (DewPoint of -40°C) or every 7.5 minutes (DewPoint of -20°C); it depends on the dryer set-up.

NOTE : During the first days of working, the DewPoint is not ensured because the adsorption material can contain humidity.
At the first start-up, or in case of start-up after a long inactivity period or following to maintenance operations, we recommend using the dryer at a reduced nominal flow of 50% during the first two days.

3.3 OPERATION AND SWITCHING OFF

The user that intervenes to the machine must wear hearing protection before to operate into the dryer. Each employee must select proper PPD (Personal Protection Device) hearing protector (earmuffs, ear canal caps and earplugs) in order to prevent any uneasiness that could cause dangerous situation for him.

Operation :

- Pressurize the dryer slowly.
- Activate the mains switch.
- Verify that the DDC15 instrument is on.
- Wait for the first interventions of the inlet filter drain or make the drain test manually.
- During the first two minutes both the towers are pressurized
- Wait for the dryer to make some cycles (there is an alternation of depressurization from tower A to tower B).

Switching off:

- Check if the inlet filter condensate drain works regularly.
- Stop the air flow.
- Depressurize the dryer.
- Deactivate the mains switch.

NOTE : During the working of the dryer, both the towers are cyclic depressurized in order to be regenerated. The depressurized tower is crossed from part of the compressed air already dried, which will be expelled outside. The noise of the compressed air during the draining is muffled by silencers.

SHDC-2200 Controller for NHL Dryers

TECHNICAL DESCRIPTION

6.1 CONTROL PANEL

The NHL series of dryers are incorporated with an easy to use controller that acts as the interface between the dryer and operator. The SHDC-2200 has many features that will assist the operator to ensure that the dryer operates properly and continuously monitors the dryer performance. The control panel is shown below.

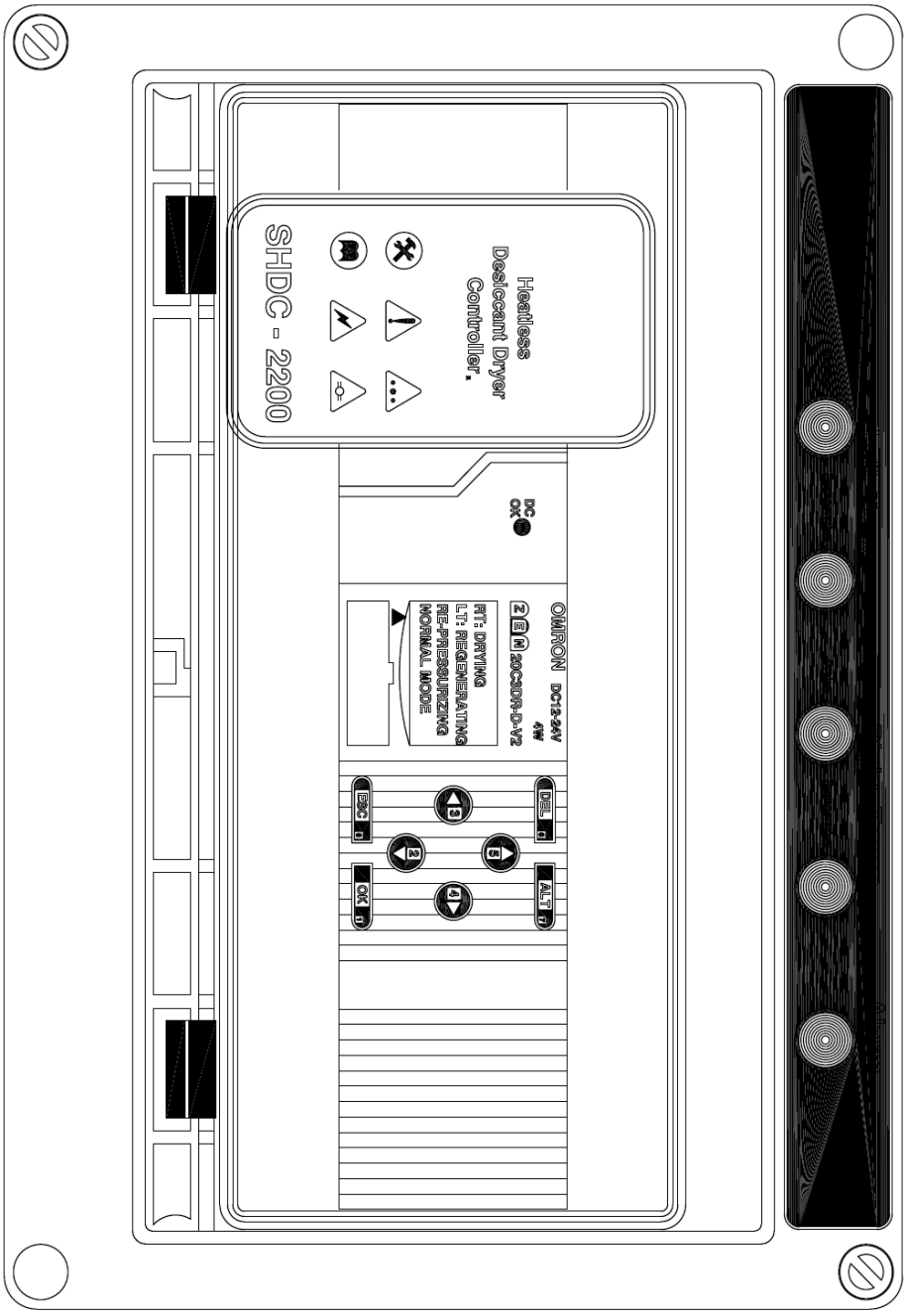


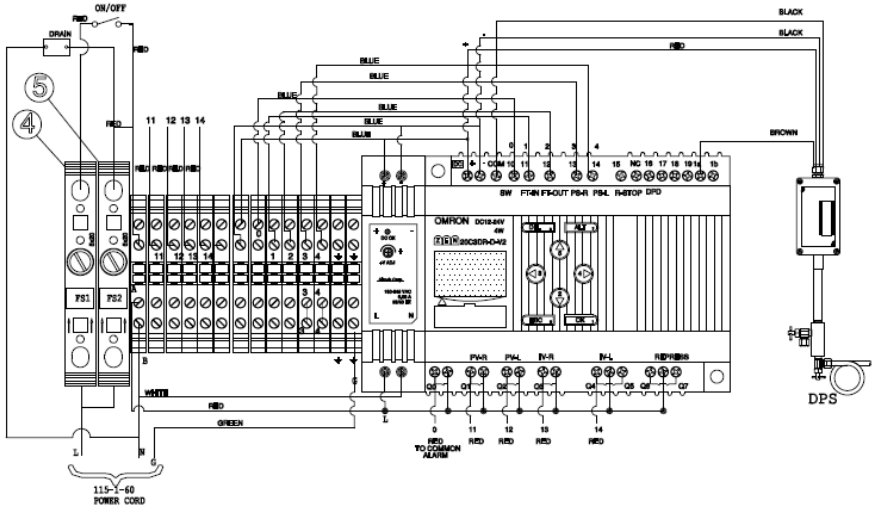
FIGURE 6-1 SHDC 2200 CONTROL PANEL 1. Controller Module 2. Power supply

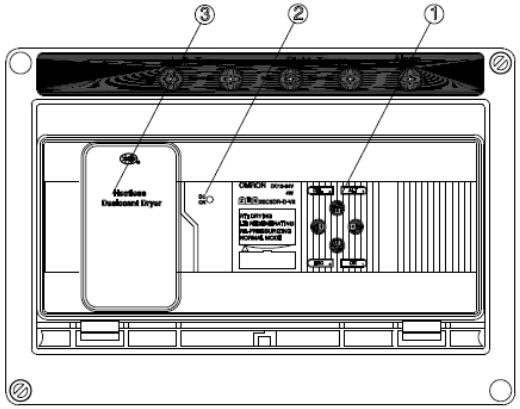
3. Terminal Module
4. Fuse Block

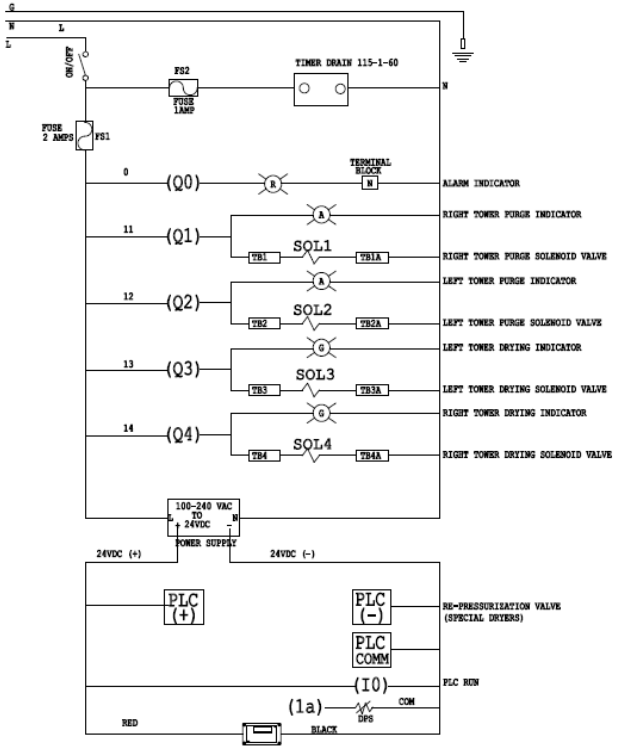
Operating Principle:

The NHL series of regenerative adsorption dryers consists of two tanks filled with Activated Alumina. At any given time, one tower will be drying the compressed air while the other tower is regenerating the saturated desiccant be (Activated Alumina). A small portion of the dry air (termed Purge Air) is used for the regeneration of the saturated desiccant. The condensate that is stripped from the desiccant bed is purged into the atmosphere through the purge exhaust valve and the purge exhaust mufflers.

SECTION 6 **NHL HEATLESS REGENERATIVE DRYER**







SYM	DESCRIPTION
SOL1	RIGHT TOWER PURGE EXHAUST PILOT SOLENOID VALVE
SOL2	LEFT TOWER PURGE EXHAUST PILOT SOLENOID VALVE
SOL3	LEFT TOWER INLT PILOT SOLENOID VALVE
SOL4	RIGHT TOWER INLET PILOT SOLENOID VALVE
DPS	DEW POINT SENSOR

Item	Name	Quantity	Description	Part Number
1	Controller Module	1	DC 12-24 V, 4W	20C3DR-D-V2
2	Power Supply	1	100-240 VAC, 0.88 A, 50/60 Hz	PS-1524
3	Terminal Block	7	20-30 A	UT 4-QUATTRO BU
4	Fuse Block	1	5MMX20mm 2 Amps	N-6976K749
5	Fuse Block	1	5MMX20mm 1 Amp	N-6976K749

FINISH:
☐ 125 UNLESS NOTED
☐ AS CAST UNLESS NOTED

MATERIAL SPEC	
HEAT TREAT	
TORQUE SPEC	
MANF SPEC	
HARDNESS	
FINISH SPEC	

THIRD ANGLE PROJECTION
DO NOT SCALE DRAWING

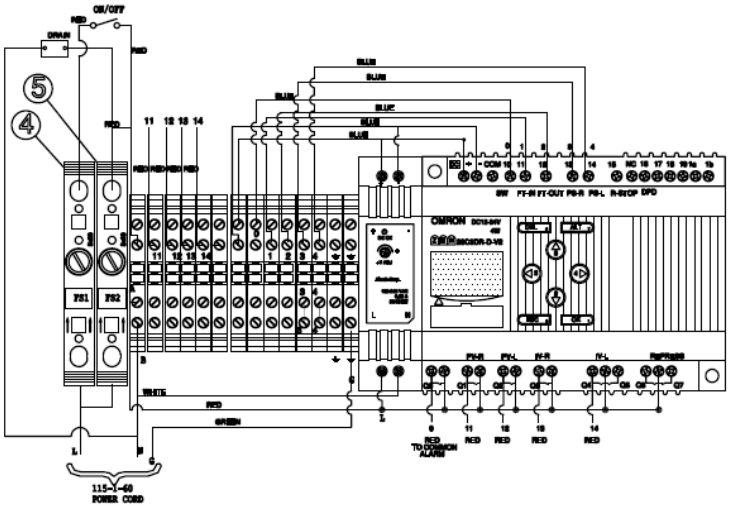
NANP

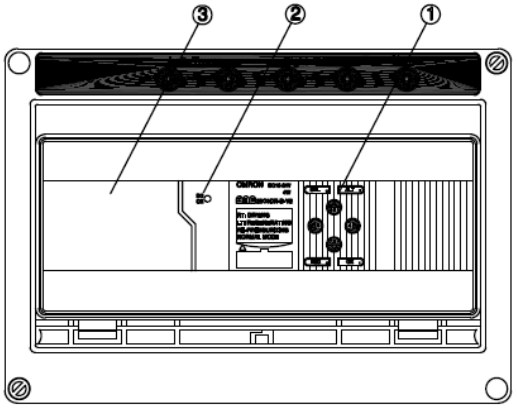
WD, NHL-0600-E1
W/ENERGY SAVER

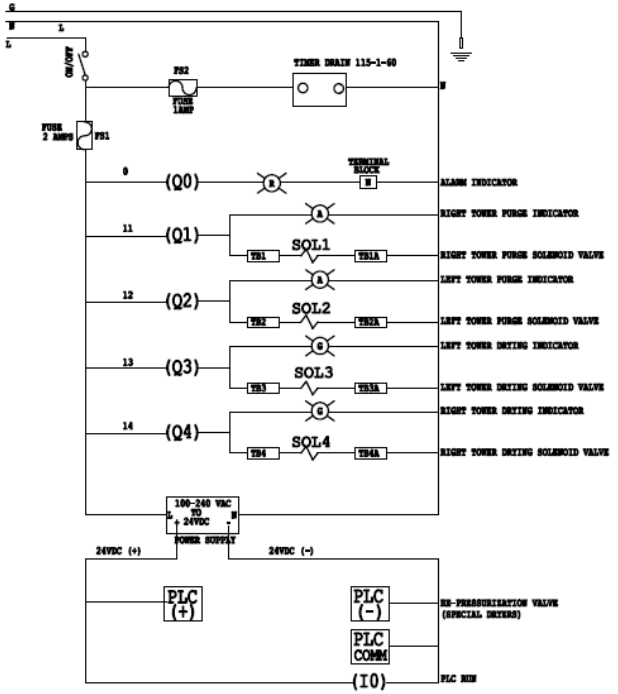
PROD CODE	DRAWN BY	DATE
XO1Q	MZ	1-22-13

SIZE	CAGE CODE	DWG NO	REV
C	31654	NHL-0600ES-E1	00

SCALE NONE WEIGHT SHEET 1 OF 1







SYM	DESCRIPTION
SOL1	RIGHT TOWER PURGE EXHAUST PILOT SOLENOID VALVE
SOL2	LEFT TOWER PURGE EXHAUST PILOT SOLENOID VALVE
SOL3	LEFT TOWER INLT PILOT SOLENOID VALVE
SOL4	RIGHT TOWER INLET PILOT SOLENOID VALVE

Item	Name	Quantity	Description	Part Number
1	Controller Module	1	DC 12-24 V, 4W	20C3DR-D-V2
2	Power Supply	1	100-240 VAC, 0.88 A, 50/60 Hz	PS-1524
3	Terminal Block	7	20-30 A	UT 4-QUATTRO BU
4	Fuse Block	1	5MMX20mm 2 Amps	N-6978K749
5	Fuse Block	1	5MMX20mm 1 Amp	N-6978K749

FINISH:
☐ UNLESS NOTED
☐ AS CAST UNLESS NOTED
MATERIAL SPEC
HEAT TREAT
TORQUE SPEC
MANF SPEC
HARDNESS
FINISH SPEC

THIRD ANGLE PROJECTION
DO NOT SCALE DRAWING

CONFIGURATION

NHD-electrical

PROD CODE	DRAWN BY	DATE
XO1Q	MZ	12/14/12

SIZE	CAGE CODE	DWG NO	REV
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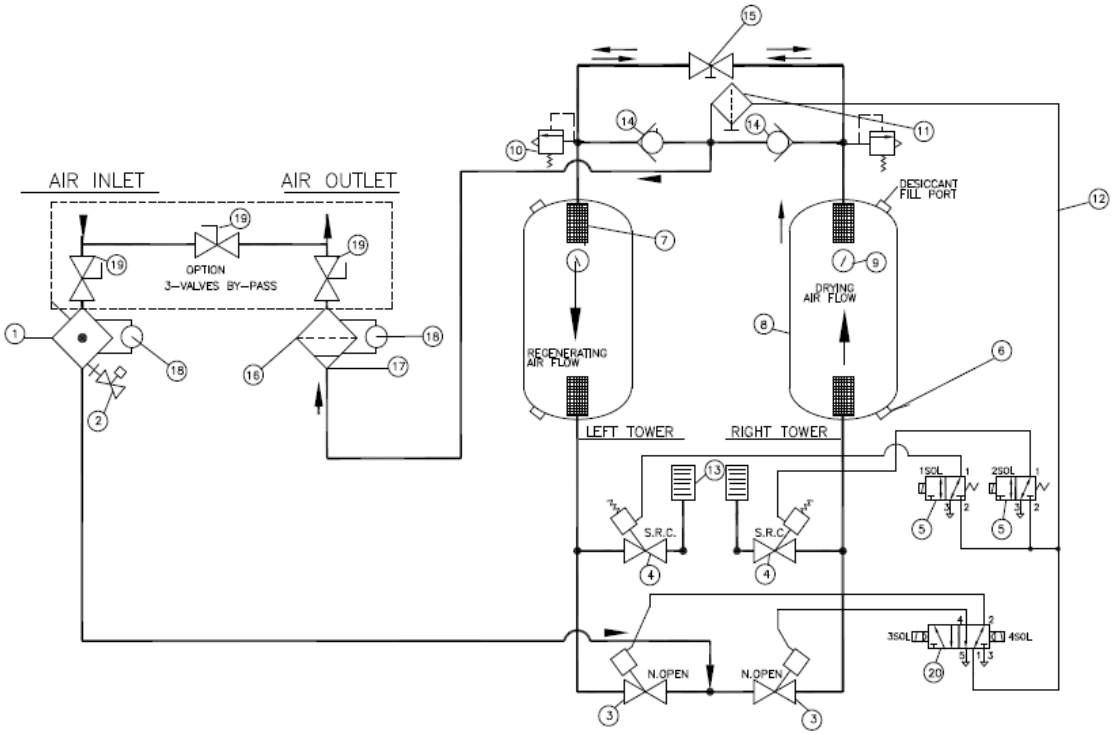
SCALE NONE | WEIGHT | SHEET 1 OF 1



ITEM	QTY	DESCRIPTION
1	1	COALESCING PRE-FILTER
2	1	PRE-FILTER ELECTRONIC DRAIN VALVE
3	2	INLET VALVES N/O
4	2	ANGLE BODY PURGE EXHAUST VALVE
5	2	PURGE PILOT VALVE
6	2	DESICCANT DRAIN PORT
7	4	STAINLESS STEEL DEFUZER
8	2	PRESSURE VESSELS
9	2	PRESSURE GAUGE
10	2	PRESSURE RELIEF VALVE (SET @ 200 PSIG)
11	2	CONTROL AIR FILTER
12	1	CONTROL AIR TUBING (1/4")
13	2	PURGE EXHAUST MUFFLERS
14	2	OUTLET CHECK VALVE
15	1	PURGE ADJUSTMANT VALVE
16	1	AFTER FILTER PARTICULATE TYPE
17	1	INTERNAL FLOAT DRAIN
18	2	PRESSURE DIFFERENTIAL INDICATOR
19	3	BY-PASS VALVES
20	1	INLET PILOT VALVE 4-WAY-2POS

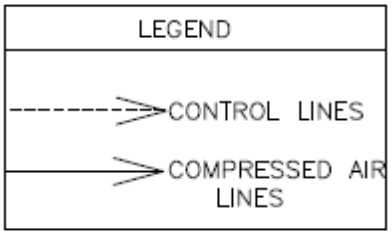


Figure 6.2: Flow diaram of NHL Regenerative dryer

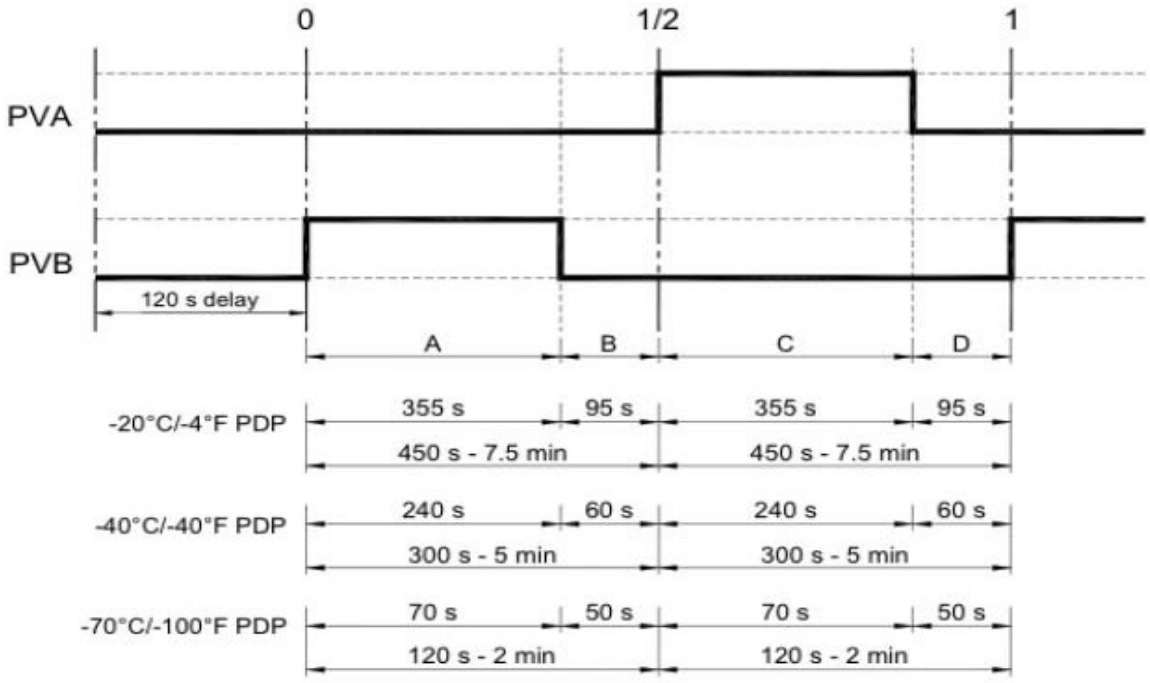


Figure 6-3: Timing Sequence Diagram

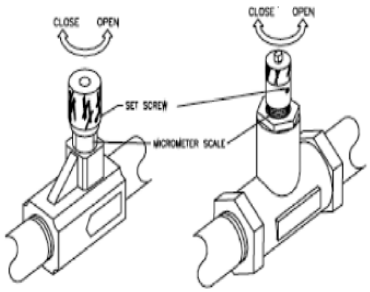
6.3 OPERATION

The desiccant dryer uses the absorption properties Of the desiccant material to retain the moisture and Prevent it from flowing downstream

Cyclic regeneration of the towers removes the moisture from the desiccant bed and prepares it for drying next cycle.

The twin desiccant towers are identical and are filled With desiccant (Activated Alumina/Molecular sieve/ Silica Gel etc.). The cycle time is set during the Manufacturing phase (as well as the regeneration nozzle) according to the Pressure Dew Point (PDP)

- 15 minutes for -4°F-20°C Figure
- 10 minutes for -40°F-40°C
- 6 minutes for -94°F-70°C



6.4 Purge metering valve settings

Table 6-1: Purge Metering Valve Settings						
	INLET PRESSURE					
MODEL	70 PSIG	80 PSIG	90 PSIG	100 PSIG	125 PSIG	150 PSIG
DHL-80	3.5 turns	3.4 turns	3.3 turns	3.2 turns	3.0 turns	2.8 turns
DHL-100	3.7 turns	3.6 turns	3.5 turns	3.5 turns	3.3 turns	3.1 turns
DHL-150	4.5 turns	4.3 turns	4.2 turns	4.0 turns	3.8 turns	3.6 turns
DHL-200	3.5 turns	3.4 turns	3.3 turns	3.2 turns	3.0 turns	2.8 turns
DHL-250	3.7 turns	3.6 turns	3.5 turns	3.5 turns	3.3 turns	3.1 turns
DHL-300	4.5 turns	4.3 turns	4.2 turns	4.0 turns	3.8 turns	3.6 turns
DHL-350	3.5 turns	3.4 turns	3.3 turns	3.2 turns	3.0 turns	2.8 turns
DHL-400	3.7 turns	3.6 turns	3.5 turns	3.5 turns	3.3 turns	3.1 turns
DHL-450	4.5 turns	4.3 turns	4.1 turns	3.9 turns	3.8 turns	3.6 turns
DHL-500	5.5 turns	5.2 turns	5.0 turns	4.8 turns	4.5 turns	4.2 turns
DHL-600	2.6 turns	2.5 turns	2.4 turns	2.3 turns	2.2 turns	2.0 turns
DHL-750	2.7 turns	2.6 turns	2.5 turns	2.4 turns	2.3 turns	2.2 turns
DHL-800	2.8 turns	2.7 turns	2.6 turns	2.5 turns	2.4 turns	2.3 turns
DHL-900	3.0 turns	2.9 turns	2.8 turns	2.7 turns	2.6 turns	2.5 turns
DHL-1000	3.2 turns	3.1 turns	3.0 turns	2.9 turns	2.8 turns	2.7 turns
DHL-1250	3.5 turns	3.4 turns	3.3 turns	3.2 turns	3.1 turns	3.0 turns
DHL-1500	3.1 turns	3.0 turns	2.9 turns	2.8 turns	2.7 turns	2.5 turns
DHL-2000	3.6 turns	3.5 turns	3.4 turns	3.3 turns	3.1 turns	2.8 turns
DHL-2500	4.0 turns	3.9 turns	3.8 turns	3.7 turns	3.4 turns	3.1 turns
DHL-3000	4.3 turns	4.2 turns	4.1 turns	4.0 turns	3.6 turns	3.3 turns
DHL-3500	Contact Factory	Contact Factory	Contact Factory	Contact Factory	Contact Factory	Contact Factory
DHL-4000	Contact Factory	Contact Factory	Contact Factory	Contact Factory	Contact Factory	Contact Factory
DHL-4500	Contact Factory	Contact Factory	Contact Factory	Contact Factory	Contact Factory	Contact Factory
DHL-5000	Contact Factory	Contact Factory	Contact Factory	Contact Factory	Contact Factory	Contact Factory
3/8" Valve is used on models DHL80-150						
1/2" Valve is used on models DHL200-300						
3/4" Valve is used on models DHL 350-500						
1" Valve is used on models DHL600-1250						
1.5" Valve is used on models DHL1500-3000						

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6.5 CYCLE DESRIPTION

When the dryer is turned ON, both the purge solenoid valves (PVA and PVB) are closed for approximately 120 seconds. This will pressurize both the towers to line pressure before the drying process starts and will ensure the proper functioning of the dryer.

Stage 1:

The right tower inlet valve is opened and it starts to dry the saturated compressed air. The purge exhaust valve left of the tower is opened and the left tower is depressurized.

As the wet compressed air flows through the right tower, the desiccant bed absorbs the moisture and the dry compressed air exits from the right tower and flows downstream. A small portion of this dry air (termed “Purge Air”) is redirected towards the left tower (flow controlled by the Repressurization Valve). This compressed purge air expands to near atmospheric pressure in the left tower, thereby increasing its moisture absorbing capacity. As this expanded dry air flows through the left tower, it absorbs the moisture from the desiccant bed and exits the left tower into the atmosphere through the purge solenoid valve and the purge exhaust muffler. At the end of this stage, the left tower desiccant bed will have completely regenerated (i.e. completely free of moisture) and is ready for absorbing moisture from the incoming wet compressed air.

Stage 2:

The left tower purge solenoid valve is closed and the left tower is re-pressurized to line pressure. Once it is re-pressurized, the left tower is ready to start the drying process.

Stage 3:

The left tower inlet valve is opened and it starts to dry the wet compressed air. The right tower inlet valve is closed and the right tower purge solenoid valve is opened. This process depressurizes the right tower. Now, as the dry air exits the left tower, a small portion of this dry air (termed “Purge Air”) is redirected towards the right tower (flow controlled by the repressurization valve). This compressed purge air expands to near atmospheric pressure in the right tower, thereby increasing its moisture absorbing capacity. As this expanded dry air flows through the right tower, it absorbs the moisture from the purge exhaust muffler. At the end of this stage, the right tower desiccant bed will have completely regenerated (i.e. completely free of moisture) and is ready for absorbing moisture from the incoming wet compressed air.

Stage 4:

The right tower purge solenoid valve is closed and the right tower is re-pressurized to line pressure. Once it is re-pressurized, the right tower is ready to start the drying process.

This process is termed as one cycle and it continues automatically without any need for user intervention.

NOTE:

The desiccant material, if contaminated from lubricant oil, loses its absorption property. Moreover during operation, the desiccant can release solid particles (powders) particularly abrasive and extremely damaging for the final users.

For this reason the dryer is equipped with two high efficiency filters:

- Inlet filter, 0.01 micron filtration grade, with differential gauge and electronic timer drain or optional zero loss drain.
- Outlet filter, 1 micron filtration grade, with differential gauge and manual drain.

SECTION 6 NHL HEATLESS REGENERATIVE DRYER

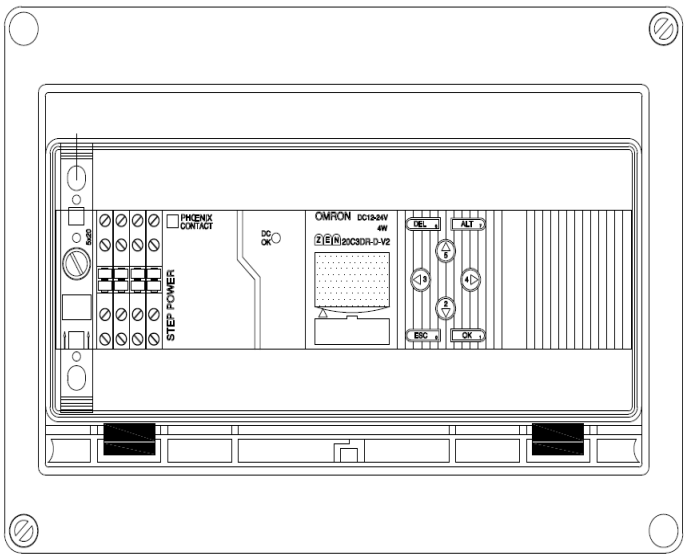
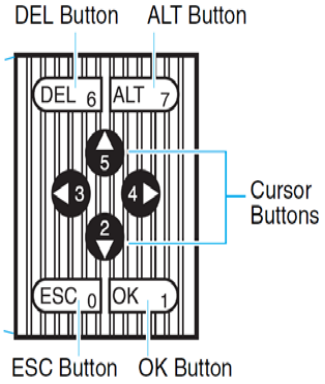


Figure 6-5-SHDC-2200 Controller



Icon Meaning

Icon	Meaning
RUN	Displayed while in RUN mode.
ERR	Indicates an error.
▲	Displayed when there is a higher-level menu or ladder program line than the one currently displayed.
▼	Displayed when there is a lower-level menu or ladder program line than the one currently displayed.
O-key	Displayed when a password has been set.

SECTION 6 NHL REGENATIVE HEATLESS DRYER

The correct operation sequence of the dryer is controlled and monitored constantly by the SHDC-2200 device. The controller displays the operating status of the dryer in the controller LCD Panel.

The LCD Panel has 4 lines and each line is reserved for a particular function.

Line 1 of LCD Panel:

This represents the right tower status. At any given time, operation mode of the right tower of the desiccant dryer is displayed on this line.

Line 2 of LCD Panel:

This represents the left tower status. At any given time, operation mode of the left tower of the desiccant dryer is displayed on this line.

Line 3 of LCD Panel:

This represents any alarm conditions/faulty conditions in the operation of dryer. It can also represent other dryer status information that is useful for the operator.

Line 4 of LCD Panel:

This represents the operation mode of the dryer. If the optional DCC (Demand Cycle Control) has been installed on the computer, it will display the operating mode (Normal Mode or Energy Saving Mode)

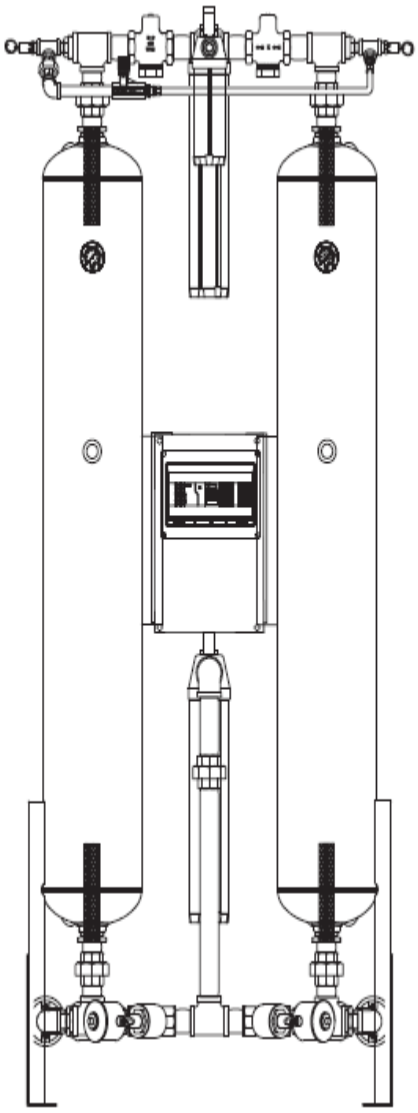
The controller is designed to operate/control the dryer continuously without any operator input. However, during alarm conditions, the operator may have to clear the alarm by taking the corrective steps.

	Only qualified personnel must operate the dryer. Before any changes are made, verify that: The machine is completely powered OFF and that the electrical connection has been disconnected. Access the part by removing the terminal board cover of the SHDC-2200.
	Any modifications to the operating configuration not compatible with the ones recommended by the manufacturer can cause malfunctioning, possible damages to parts of the machine and a premature deterioration of the adsorbent material and of the inlet and outlet dryer filters.

SECTION 6 **NHL HEATLESS REGENERATIVE DRYER**

NOTE:

The left and right of the dryer is from the perspective of the operator standing in front of the dryer (the controller side)



6.7Sequence of Operation:

The ON/OFF switch is located at the bottom right side of the controller and must be ON for the dryer to operate.

Turning ON the ON/OFF switch will initiate the controller and it will follow its operating sequence automatically. Every action of the dryer is displayed on the LCD display.

When the power switch is turned ON, the dryer pressurizes both the towers for approximately 120 seconds. During this time both the Purge solenoid valves are closed and the compressed air enters both the towers until the line pressure is reached.

FIGURE 6-7: TYPICAL NHL DRYER

Right Tower Drying / Left Tower Regenerating:

The right tower starts to dry the compressed air. After approximately 120 seconds, the left tower purge solenoid valve opens and the compressed air is released into the atmosphere from the left tower. Upon depressurization, the left tower starts to regenerate (it can be 2 minutes, 5 minutes or 7.5 minutes depending on the cycle time).

At the end of the regeneration cycle, the left tower purge exhaust valve is closed and the repressuization valve/purge adjustment valve is opened for approximately 55 seconds to repressurize the left tower.

After repressurization, both the towers are at line pressure and the left tower goes into a standby mode for 5 seconds during which the optional pressure switch indicator is activated as a secondary check before switching towers.

Left Tower Drying / Right Tower Regenerating:

Upon successful repressurization and pressure switch activation, the towers are switched. Now the left tower starts to dry the compressed air.

The right tower purge exhaust valve is opened and the right tower depressurizes and the regeneration of the right tower commences. The moisture laden purge air is dispensed into the atmosphere via the purge exhaust valve and muffler. The regeneration time (can be 2 minutes, 4 or 6.5 minutes depending on the cycle time).

At the end of the regeneration cycle, the right tower purge exhaust valve is closed and the repressurization valve / purge adjustment valve is opened for approximately 55 seconds to repressurize the right tower.

Upon successful repressurization the pressure switch activation, the towers are switched. Now the right tower starts to dry compressed air while the left tower is regenerated and cycle continues.

If the optional Energy-Save module has been installed on the machine, the controller continuously monitors dew point. If the dried compressed air is well below the set dew point, the drying continues in the same tower while the other tower is in standby mode. When the dew point starts to climb and crosses the set-point, then the controller switches to standard cycle time and the towers switch and the drying cycle continues in the normal mode.

6.8 Operating Cycles:

The dryer is designed to operate in two different operating modes:

1. **Fixed Cycle (Normal Mode)**
2. **Demande Cycle (Energy Save Mode)**

In the Fixed Cycle mode, the cycle time is as follows:

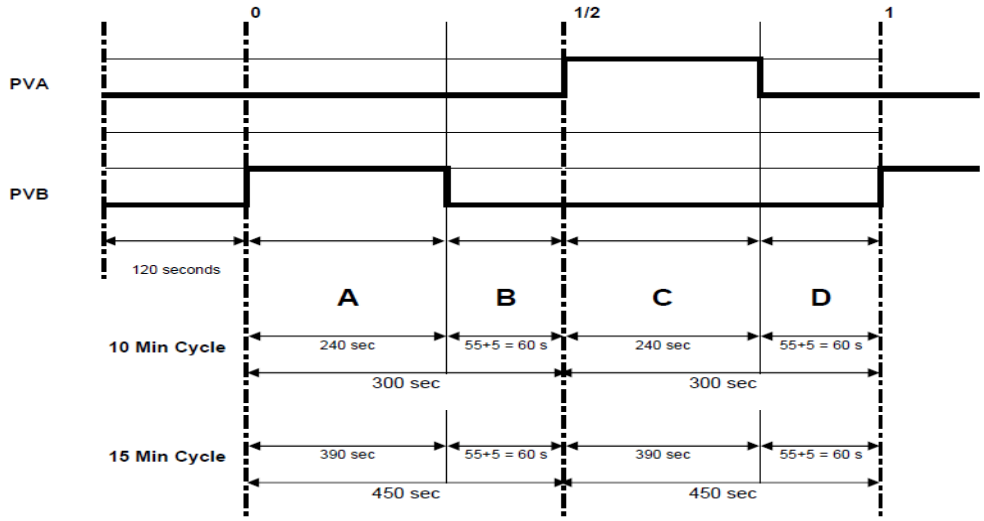
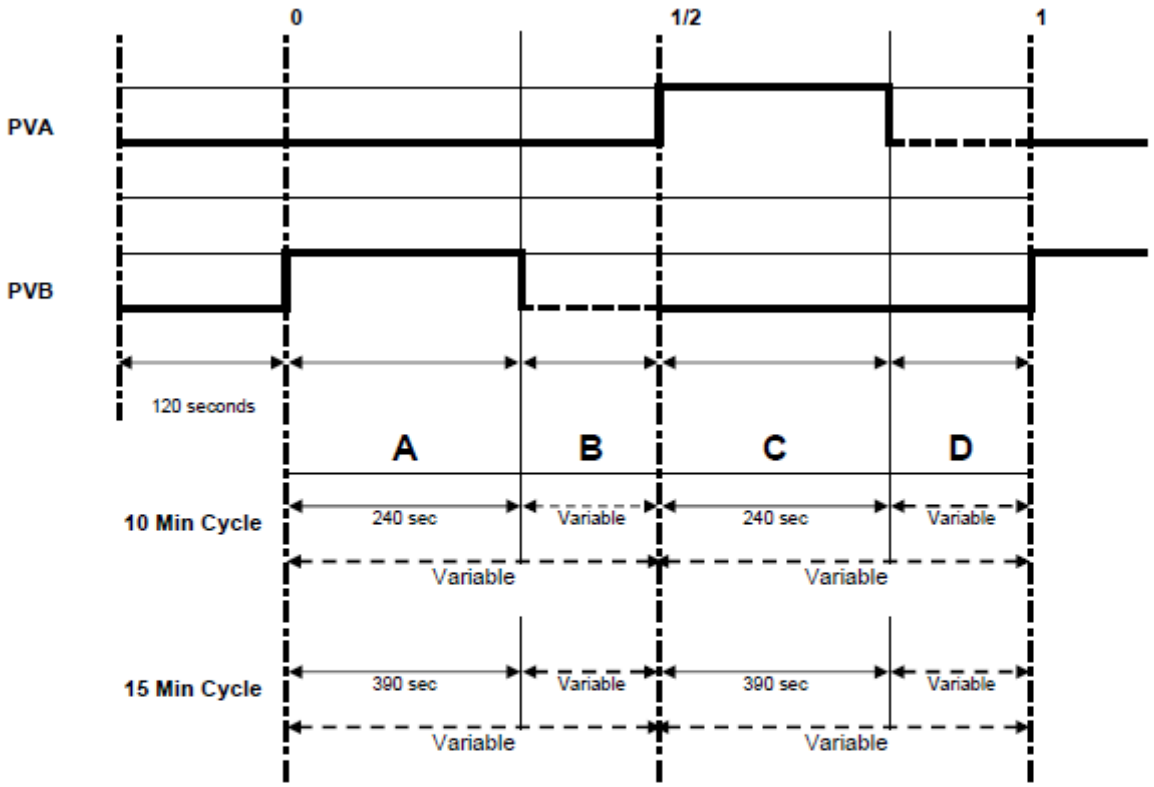


Figure 6-8: Fixed Cycle Mode (Normal Mode)

The dryer operates based on the factory set timing – either 10 minute or 15 minutes cycle.

A=C=4 minutes or 6.5 minutes
B=D=55 seconds (Re-pressurization) + 5 seconds (stand-by)=1minute

1 cycle = A+B+C+D



A	Regeneration time of Left Tower (FIXED)
B	Repressurization + Standby mode of Left Tower (VARIABLE)
C	Regeneration time of Right Tower (FIXED)
D	Repressurization + Standby mode of Right Tower (VARIABLE)

Figure 6-9: Demand Cycle Mode (Energy save Mode)

In the Demand Cycle mode (Energy Save mode), the cycle time varies based on the dew point. The energy save mode requires the Dew Point Meter and will control the switching of the towers based on the set dew point and actual dew point.

At startup the dryer always operates on fixed cycle mode then switches to Energy Save mode.

6.9 Selecting the Cycle Time:

The SHDC-2200 controller provides you the option of selecting the cycle time depending on your pressure dew point (PDP) requirement.

Selecting the 15 minute cycle:

On the SHDC-2200 controller keypad, press and hold the cursor keys marked “5” and “3” simultaneously for **15 seconds.** This will change the controller cycle time to 15 minutes.

Selecting the 10 minute cycle:

On the SHDC-2200 controller keypad, press and hold the cursor keys marked “5” and “2” simultaneously for **10 seconds.** This will change the controller cycle time to 10 minutes.

NOTE: If the cycle time is changed, the dryer must be restated.

SECTION 6 **NHL HEATLESS REGENERATIVE DRYER**

6.10 DEW POINT METER (Optional)

The MT-1000 is a superior quality / high accuracy dew point meter installed on the NHL dryer. When installed in the NHL range of dryer the MT-1000 dew point meter kit helps the dryer operate in both Fixed Cycle mode and Energy Save mode.

By installing the Dew Point meter it is possible to:

- Display the Dew Point in the drying tower
- Operates he dryer in Demand Cycle Mode (Energy Save Mode)
- Display High Dew Point (HI-PDP) alarm

The dew point sampling kit essentially has 3 key components.

1 Working tower selector valve

2 Sampling cell with Dew Point meter

3 Air flow adjuster

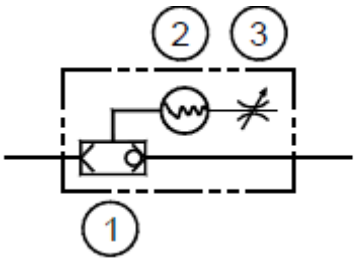


Figure 6-10: Dew Point meter sampling cell display unit

In order to obtain an accurate pressure dew point (PDP) reading, a continuous flow of regulated dried air must come in contact with the sensor. To achieve this, the sensor is housed in a sampling cell (item #2) that is incorporated with an air flow adjuster valve (item #3). This provides the user the ability to control the amount of air passing through the sampling cell. An automatic working tower selector valve (item#1) ensures that a constant supply of dried air is available for the sampling sell without any interruption. The SHDC-2200 controller uses the signal provided by the dew point transmitter to actively control the cycle time of the dryer. This feature will provide significant energy savings.

Monitoring the Dew point:

The SHDC-2200 controller provides multiple outputs-

Visual Display:

The optional dew point display can provide the user a continuous reading of the pressure dew point (PDP) in Deg. F.

Analog Signal:

The optional dew point meter kit provides a 4-20 mA signal that can be used for additional displays or for monitoring the humidity level or for any other operation as desired by the user.

Connecting the 2 wires marked (4-20 mA) (Red Wire-Signal, Black Wire- Common) will provide an accurate reading of the dew point in the range of 4mA (corresponding to -50 Deg. F) and 20mA (corresponding to +68 Deg F)

6.11 FAILURE TO SWITCH-PRESSURE SWITCHES (OPTIONAL)

When the optional pressure switches are installed on the towers (PSA- left tower and PSB- right tower), the controller monitors the statues of the pressure switches and provides visual indication to the user when an alarm condition is detected.

In both the Normal and Energy save mode, the controller checks the pressure switches prior to switching towers

and ensures that the tower is pressurized before the switch-over occurs. In the event of low pressure due to malfunction of the repressurization valve or the purge exhaust valve, the controller will display the message RT-PRES-FAIL or LT-PRES-FAIL, the alarm condition is activated and the tower switch over is temporarily stalled and the dryer will continue the drying process in the same pressurized tower. The alarm light at the top of the controller will turn ON and will stay ON till a corrective action is taken.

Once the pressure switch alarm condition has been resolves, the dryer will proceed with the repressurization and will continue with the Fixed Cycle Mode or Energy Save Mode depending on its configuration.

6.12 CALIBRATION PRESSURES:

Dryer operating pressure:		Pressure switch closing pressure:		Pressure switch opening pressure:	
[barg]	[psig]	[barg]	[psig]	[barg]	[psig]
4 - 5,9	58 -86	≥ 3	≥ 43,5	≤ 1	≤ 14,5
6 - 8,9	87 - 129	≥ 4	≥ 58	≤ 1	≤ 14,5
9 - 11,9	130 - 173	≥ 6	≥ 87	≤ 1	≤ 14,5
> 12	> 174	≥ 8	≥ 116	≤ 1	≤ 14,5

6.13 Controller Display Messages:

Display Message	Message Description
RT - DRYING	Right Tower is Drying
RT - REGEN	Right Tower is Regenerating
RT - REPRESS	Right Tower is Re-pressurizing
RT - STANDBY	Right Tower is in Standby Mode
RT-PRES-FAIL	Right Tower Pressure Fail
LT - DRYING	Left Tower is Drying
LT - REGEN	Left Tower is Regenerating
LT - REPRESS	Left Tower is Re-pressurizing
LT - STANDBY	Left Tower is in Standby Mode
LT-PRES-FAIL	Left Tower Pressure Fail
10 MIN CYCLE	10 Minute Cycle has been selected
15 MIN CYCLE	15 minute cycle has been selected
HI-DEW POINT	Outlet air has a Pressure Dew Point (PDP) of greater than 33 Deg F
CHNGE FILTER	Change Filter Element
NORMAL MODE	Dryer is operating in Normal mode
ENERGY SAVE	Dryer is operating in Energy Save Mode

6.14 Maintenance:

The NHL series of absorption dryers requires very little maintenance. However, periodically the Filter Elements and the Desiccant material have to be changed to ensure that the dryer provides you with reliable and uninterrupted service.

Every 6000 hour (or when the optional filter differential switch is activated), the alarm light turns ON and the inlet/outlet filters will have to be replaced to ensure minimal pressure drop across the dryer.

In addition, perform periodic maintenance as mentioned in section 7.

SECTION 7

MAINTENACE, TROUBLESHOOTING, SPARES AND DISMANTLING

7.1 CONTROLS AND MAINTENANCE

	The maintenance operations must be worked out by qualified personnel. **Before any intervention, verify that:** • **No part of the machine is powered** and that it cannot be connected to the main power supply. • **No part of the machine is under pressure** and that it cannot be connected to the compressed air system.
	The user that intervenes to the machine must wear hearing protection before to operate into the dryer. Each employee must select proper PPD (Personal Protection Device) hearing protector (earmuffs, ear canal caps and earplugs) in order to prevent any uneasiness that could cause dangerous situation for him.
	DAILY • Check if the inlet filter condensate drain works regularly. • Check the clogging state of the filters by reading the differential pressure gauge installed. • Check that the tower switching operation takes place correctly and in the set cycle times. • Check that the differential pressure gauge, of the regenerating tower, indicates 0 bar.
	YEARLY – 3000 HOURS • Replace the inlet and outlet filter cartridge. • Clean the silencers or if necessary replace them. • Check if the regeneration drain solenoid valves (PVA e PVB) work regularly. • Check if all screws of the electrical wiring are correctly tightened. • After the checking operating, control the working of the dryer.
	EVERY 2 YEARS – 6000 HOURS In addition to the programmed maintenance, every year: • Replace the membrane of the regeneration drain solenoid valves (PVA and PVB). • Replace the purge exhaust valves if required. • After the repalcement, check the operation of the dryer.
	EVERY 3 YEARS – 9000 HOURS • Replace the adsorption material. The estimated average life of the adsorption material is 3-5 years, with 10-minute cycle times and 3000 hours/year in any case it depends on the quality and temperature of the inlet air and on the correct programmed maintenance.

SECTION 7 NHL HEATLESS REGENERATIVE DRYER

7.2 TROUBLESHOOTING

	The troubleshooting and the eventual checks have to be performed by qualified personnel. **We suggest enabling the TEST modality to make troubleshooting operations easier (see *Section 6.11*) and gradually verify that the operating steps are performed correctly.**
	Maintenance personnel must wear hearing protection while operating the dryer. Each employee must select proper PPD (Personal Protection Device) hearing protector (earmuffs, ear canal caps and ear-plugs) in order to prevent any discomfort or damage to the operator's hearing..

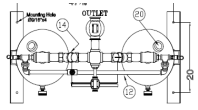
No.	Problem	Possible Cause / Suggested Action
1	Moisture in the Outlet Air	The dryer is switched OFF — Turn it ON.
		The dryer has just been commissioned and the adsorption material can contain humidity— use the dryer at a reduced flow of approximately 50% for at least 2 days and verify the correct operation of the dryer.
		The dryer does not perform the switching cycles—refer to problem "Dryer towers do not Switch"
		The inlet air is too hot - restore the nominal conditions.
		The inlet air pressure is too low—verify that the installed regeneration nozzle is for the rated working pressure of the dryer. If you have doubts or problems, please contact your distributor.
		The inlet air flow rate is higher than the rate of the dryer—reduce the flow rate to rated inlet conditions of the dryer.
		Inlet filter does not drain the condensate—check the proper operation of the drain timer
		Electronic timer of the inlet filter drainer is not adjusted correctly—reduce the drain pause timer
		The pressure gauge of the tower under regeneration shows a pressure higher than 0—silencers are clogged—clean or replace them immediately.
		Cycle time on SHDC-2200 Electronic Controller has been modified—restore the time to recommended timing.
		Desiccant is completely saturated - either regenerate desiccant completely or replace desiccant.
2	Purge Solenoid valves are never activated.	Check for electrical supply or on/off switch failure.
		Verify the electrical wiring.
		Verify the fuse on SHDC-2200 Electronic Controller.
		The valve is blocked—open and clean it.
		The solenoid valve has gone bad — replace it.

No.	Problem	Possible Cause / Suggested Action
3	Dryer towers do not switch correctly	Solenoid valve PVA and/or PVB are never activated - see specific point.
		Inlet and/or outlet valve is blocked or inlet solenoid is not working – carry out maintenance operation
		Check the purge exhaust mufflers and make sure it is clean. Replace if required.
4	All the inlet air is discharged through the purge exhaust mufflers	The dryer does not perform the switching cycles— refer to Step 2.
		The Purge solenoid valve PVA and/or PVB is blocked—open and clean it.
		The SHDC-2200 Electronic controller always supplies solenoid valve PVA and/or PVB - check the wiring and replace if necessary
		The cycle times on the SHDC-2200 electronic controller have been changed—restore to original settings
		Regeneration nozzle is clogged—open and clean it.
5	Liquid at the purge exhaust mufflers	Humidity in outlet air – Refer to "Moisture in the Outlet Air" to resolve the issue.
6	Hi-Dew point message is displayed on the SHDC-2200 controller screen	The probe of the Dew Point Meter (optional) detects a high Dew Point, for one of the following reasons
		Humidity at dryer outlet—Refer to "Moisture in the Outlet Air" to resolve the issue.
		The dew point meter air flow adjuster has been changed. Make sure that there is a constant flow of air passing through the dew point measuring cell.
		The selector valve of the air being supplied to the dew point meter is blocked. Clean and make sure that the dry air flows from the towers when its drying.
		Verify the electric connection of the probe.
		The probe is broken—replace it.
		There is an air leak on the pipes and/or joints that connect the equipment—verify the connections and replace the damaged parts.
		A pipe or a joint which connects the equipment is clogged—replace it.
7	Alarm Light is ON	Filter has to be replaced - Check Display.
		If optional differential pressure switches are installed on the filters, replace the filter elements.
		If no switches are installed on the filters, then it means that it has been 6000 hours and the filter elements needs to be replaced. Replace the element. To clear the Alarm and "CHNG FILTER" display message, press "DEL" and "ALT".
		High Dew point Alarm. When the dew point at the dryer outlet is greater than 33 Deg. F, the "Hi - Dew point" message and the alarm light is turned ON. Refer to "Moisture in the Outlet Air" to resolve the issue.
		The (optional) pressure switch in the Right or Left Tower has failed. This indicates that the corresponding tower has failed to pressurize. Refer to the screen to identify the tower that has not been pressurized. Follow the steps in 2, 3 and 4. Replace the pressure switch if it has gone bad.

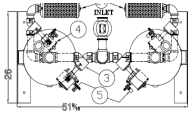
7.3 DISMANTLING OF THE DRYER

If the dryer is to be dismantled, it has to be split into homogenous groups of materials.

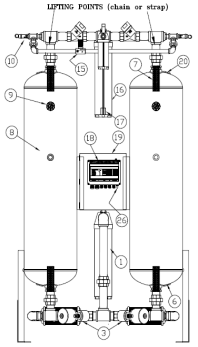
Part	Material
Desiccant material	Activated Alumina or molecular sieve optional
Frame and supports	Carbon steel
Piping	Carbon steel
Towers and diffuser	Carbon steel, Stainless steel
Inlet valve	Stainless Steel / Carbon Steel
Filter housing	Aluminum
Filter cartridge	Filtering material, PVC, Oil
Solenoid valve	Bronze
Condensate Drain	Bronze
Silencers	Aluminum
Safety Valves	Brass
Gaskets and O-Ring	Graphite, synthetic elastomer
Electric cables	Copper, PVC
Electric Parts	PVC, Copper, Bronze
We recommend that you comply with the safety rules in force for the disposal of each type of material. The adsorption material and the filter cartridge contains droplets of lubrication oil. Do not dispose these materials into the environment but rather deliver/dropoff at proper disposal centers.	



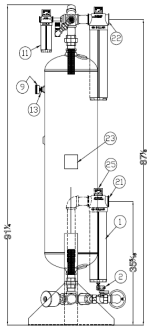
Top View of Upper Piping



Top View of Lower Piping



Front View



Side View

	00	XXXXX	RELEASED	XXX

ITEM	QTY	DESCRIPTION
1	1	2" COALESCING PRE-FILTER
2	1	PRE-FILTER ELECTRONIC DRAIN VALVE
3	2	2" INLET VALVE (N/O)
4	2	1_1/2" ANGLE BODY PURGE EXHAUST VALVE
5	2	PURGE PILOT VALVE
6	2	Ø2" DESICCANT DRAIN PORT
7	4	Ø2" STAINLESS STEEL DEFUZER
8	2	Ø16" PRESSURE VESSELS
9	2	PRESSURE GAUGE
10	2	3/4" PRESSURE RELIEF VALVE (SET @ 200 PSIG)
11	2	1/2"CONTROL AIR FILTER
12	1	3/4" PURGE AIR TUBING
13	2	GAUGE BUSHING
14	2	2" OUTLET CHECK VALVE
15	1	3/4" PURGE ADJUSTMANT VALVE
16	1	2" AFTER FILTER PARTICULATE TYPE
17	1	INTERNAL AUTOMATIC DRAIN
18	1	DRYER CONTROLLER
19	1	CONTROLLER ENCLOSURE
20	2	DESICCANT FILL & DRAIN PORT, 2" NPT
21	1	INLET 2" NPT
22	1	OUTLET 2" NPT
23	2	ASME & CRN TAG
24	2	1_1/2" PURGE EXHAUST MUFFLER
25	2	PRESSURE DIFFERENTIAL INDICATOR
26	1	POWER ON/OFF SWITCH

SPECIFICATIONS

DESICCANT TYPE: 3/16" DIA. ACTIVATED ALUMINA
DRYING AIR FLOW: UPDRAFT
REGENERATING AIR FLOW: DOWNDRAFT
DESIGN INLET TEMPERATURE: 100 DEG F
DESIGN INLET PRESSURE: 100 PSIG
MAXIMUM ALLOWABLE WORKING PRESSURE: 150 PSIG
MAXIMUM TOWER DESIGN TEMPERATURE: 450 DEG F

NOTES:
1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

TOLERANCES U.O.S	FINISH:					THIRD ANGLE PROJECTION	NANO		
DIMENSIONS ARE IN INCHES	☐ 125" UNLESS NOTED					DO NOT SCALE DRAWING			
	☐ AS CAST UNLESS NOTED								
ALL DIMENSIONS: ±1/16	MATERIAL SPEC:					ID,DRYER REGEN NHL-600			
	HEAT TREAT								
ANGULAR DIMENSION: ±1.0°	TORQUE SPEC								
	MAINT SPEC:								
HOLE DIAMETER: ±0.03	HARDNESS								
	FINISH SPEC:	SEE NOTE	PROD CODE	DRAWN BY	DATE	SIZE	CAGE CODE	DWG No	REV
			XQ1Q	SA	9-14-12	C	31654	NHL0600	02
						SCALE NONE	WEIGHT 1250 LBS	SHEET 1 of 1	