흡착식 에어드라이어 Adsorption Air Dryer

Heatless (SAD-Series) Type Air Dryer

취급설명서 Instruction Manual

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1. Introduction

Dehumidification in compressed air is the most important process in all fields where compressed air is used. The moisture in compressed air ill affects the commercial production process, facility, and humans. Therefore, economical and safer ‘Heatless Type Dryer’ can be recommended to obtain clean compressed dry air.

The ‘Heatless Type Air Dryer’ provides as high power as ‘Heater External Type Air Dryer. It removed all costs relates to a consumption of desiccant and recycling of desiccant to provide economically feasible dryer.

SAD-Series’ ‘Heatless Type Dryer’ reduced high dew point temperature, capacity and weight. It simplified the **pipe(수발관설비) installation**. It is compact and has simple structure to maintain the low cost by removing the cost of desiccant exchange in a renewal heating process. It also has a simple operation process.

This instruction manual provides functions, structures, installation, operation and maintenance of standard control system of ‘Heatless Type Air Dryer.’ Therefore, the operator must read before operating a ‘dryer.’ If any problem occurs or have questions, please contact our office.

압축공기 제습설비 용도에 따른 기본구성도	Diagram for the uses of compressed air dehumidifier
의약산업, 산소/질소발생장치, 반도체공정, 초정밀산업, 분체이송, 분체도장, 오존, 화학, 나노, 바이오	Pharmaceutical Industry, Oxygen/Nitrogen Generator, Semiconductor Process, Precision Industry, Powder transfer, Powder coating, Ozon, Chemistry, Nano, Bio
계측장비, 정전도장, 정밀라인, 부품건조, 섬유, 일반전자산업, 식품 공정 등	Measuring Equipment, Electric painting, Precision line, Drying equipments, Textiles, Electronics industry, Food process
일반공압라인, 에어공구, 일반도장, 계장용	Pneumatic Line, air tool, coating, instrumentation

2. Explanation of Dehumidification System

2-1 Drying
-Standard SAD-Series Type Drying Cycle: 5.0min
The compressed air from a compressor flows into the first tower through dryer inlet 3-way shuttle v/v or 2-way butterfly v/v. Then, the compressed air passes desiccant in a tower to head upwards. While heading upwards, it removes the moisture in a particle and discharges the dry air to an outlet. This process is called drying cycle and run by a timer.
-Standard SAD-Series Type Drying Cycle: 5.0 min

2-2 Regeneration
It sends some dry air to the other side of a tower while discharging to dehumidify and purify desiccant. Then, it purges through a muffler. This process is called regeneration.
-Standard SAD-series type regeneration cycle: 4.0 min

2-3 Pressurizing
Once a machine is on for 4 minutes, the purge valve on a regeneration tower closes to remove all purge air. Then, the pressure in a regeneration tower gradually gets higher to become as same condition as a drying tower. This process is called pressurizing and run by a timer.
-Standard SAD-Series Type Pressurizing cycle: 1 min.

2-4 Repressurizing
To make a complete pressurized condition, the air that did not pass Orifice flows into the regeneration tower before pressurizing cycle. It operates by letting solenoid open and close by a timer on a panel.
Caution: It is not applicable on some small models.

2-5 Depressurizing purge (1st stage)
The depressurizing purge v/v on a drying tower opens to let air out after pressurizing. This is depressurizing purge (1st stage). The air exhaustion time can be set by a timer.
Caution: Can be ordered by a buyer or as it is an additional option, only applicable for some large models.

2-6 Main Purge (2nd stage)
The purge valve on a drying tower opens to discharge the pressure in a tower after enough pressurizing. This is called a purge (2nd stage). If depressurizing purge v/v is installed, then main purge will occur after depressurizing purge.

3. SAD-Series P&ID

Note: Above P&ID can be changed without any notice for the quality enhancement.

4. Explanation of Main Components

4-1 Drying Tower
"SAD" Heatless type dryer is composed with two towers. In a tower, active alumina (an absorbent) is filled to provide dry air by adsorbing moisture of compressed air that passes through a drying tower. In an upper and lower in/outlet of a tower nozzle, the stainless screen is installed to prevent any desiccant grains flow into a pipe line. The nozzle is attached for filling and discharging of desiccant.
Note: The standard outlet temperature is -40C, however if low dew point temperature of down to -80C is needed, please contact our Engineering team.

4-2 Air Inlet Valve
무급유식 = Non-Fueling System
It induces compressed air that inflows to "SAD" Dryer to tower A or B. The operating cycle can be set up on a timer. The operating cycle for standard product shows in a table below. If a 2-way butterfly v/v is used, solenoid v/v must be used and operate actuator.
Note: Above table can be changed by a special order or a quality enhancement.

4-3 Purge v/v: (Refer to 2nd Clause Article 6)
It runs when operating and pressurizing to discharge the regeneration air. The operating cycle runs automatically by a timer. Use solenoid v/v to run the actuator.

4-4 Depressurizing Purge v/v: (Refer to 2nd Clause Article 5)
It runs when operating and pressurizing. Discharges regenerated air before purge v/v operates. The valve opens and closes by a depressurizing timer. (Applicable on some large-sized model)
Note: Above table can be changed by a special order or a quality enhancement
무급유식=Non-Fueling System

4-5 Air outlet check valve
Dry compressed air that has passed through the desiccant in a drying tower flows into the upper pipe in a tower to pass a line.

4-6 Regeneration check valve
It operates by using some of dry compressed air to send other side's tower of drying tower. At the same time, the air passes through purge air check valve to go into a tower. This check valve uses air outlet check valve to flow the air in one direction only to prevent the mixture of drying and regeneration air.

4-7 Purge adjusting valve
Before the regeneration air flows into a regeneration tower, it passes through a purge adjusting valve to adjust flow rate. The regenerating flow rate is controlled by a pressure of purge flow pressure gauge. Also, it can be controlled by an operating condition of a dryer. (Est. 0.25-0.35mpa)
*SAD-Series standard regenerating pressure is 0.32mpa.

4-8 Purge shut off valve
It closes after pressurizing and before depressurizing purges. When depressurizing purges, it discharges a regenerating air in a regeneration tower. Opens after purging. (Only applicable for some large models)

4-9 4-way solenoid valve
It operates the actuator valve and cylinder valve installed on a dryer that open/close by pressurized air. A double 4-way solenoid v/v is used for an air inlet actuator valve and single 4-way or 3-way solenoid valve is used on other purge v/v.

4-10 Pressure gauge
A pressure gauge is installed on a regeneration pipe on a drying tower and dryer to check its operating condition. Specially, as a pressure gauge shows the amount of regenerating air, it must maintain 0.30-0.32mpa. When pressure is low, the regeneration of adsorbent gets unstable. When it gets higher, outlet pressure can be dropped. Therefore, must be cautious when setting.

4-11 Control Panel
For dryer's automatic operation, s/w, timer, relay are installed on a panel. Also, A/B tower drying, pressurizing lamp is installed on. A dew point meter can be installed on a special request.

1) 각 model 별 적용 panel (Panel type application table)

   전 Model (All models) 주문자 option (Special Order)

4-12 Air unit (FRL unit)
Composed of filter, regulator, and lubricator has functions below:

1) Filter: It filters debris in instrumentation air in a dryer
2) Regulator: It controls instrumentation air to right pressure for the actuator operation. (Standard 5.5bar)
3) Lubricator: Uses lubricant oil for smoothness of actuator. Turbine oil (ISO VG32) is used. Our company's actuator v/v works by non-fueling system.
   Note: Not applicable on some small models

4-13 Low pressure switch
Installed on the outlet pipe on a dryer. It senses the pressure provides on a dryer, so when the set pressure falls, it sends a low pressure alarm to a control panel. Then purge valve closes and it goes emergency shutdown. When it becomes right set pressure it automatically recovers.
The set pressure will set at least 4.0-5.0kg/cm to stay normal operation of Pneumatic actuator valve.
Note: Not applicable on some small models

5. Installation Requirements

5-1 Installation

1) Must secure the surrounding space of at least 1m for maintenance and check-up
2) Secure the level and fasten with basic bolt
3) Place where anti-explosion proof type is allows
4) Place where no vibration (Must check with compressor vibration)
5) Place with temperature between 10-45C

5-2 Pipe
Mist separator or filter must be installed on an inlet when air contains oil mist or dust. By-pass should be installed for maintenances and checkups. The pipe should flush to remove all scales and debris before connecting on a dryer.

1) Pre filter (recommended)
   The adsorbent must avoid any contact with condensed water. Therefore, moisture separator should be installed in front of dryer. Also pre-filter should be installed to remove dust. Pre filter has efficiently combined the effects of Centrifugal force, collision and filter. The condense water discharged by a drain valve or trap.
   Internal filter element can be set at 40/5/1 micron of grain size depends on a situation. Monthly check up is required.

2) After filter (recommended)
   The air might contain adsorbent debris after dryer, so after filter is recommended at outlet of dryer to prevent any damage on instrumentation machines. Internal filter element can be set at 1/0.01 micron of grain size depends on a situation. Monthly check up is required.

5-3 Electric Wiring

1) Dryer's liner power and power supply must be same
2) Electric wiring is all set in a dryer, so just need to plug into a power plug
3) After connecting to a power plug, check a voltage and insulation
4) Check a gauge connection of a panel

6 Operation of Air Dryer

6-1 Preparation

1) Check the electric power
2) Open the by-pass and let pressurize on drying tower A,B
3) Check the temperature of air. It must not exceed 40C
4) Be aware by following the orders in control panel (refer to ch3-11)

6-2 Control Panel method of operation

1) Formation of a control panel

   건조시 점등 – Lights on when drying

   균압 공정시 점등 – Lights on when pressurizing

   설정 값 및 운전 진행 시간등을 표시 – Shows setting and operating time

   운전 시간등 설정 값 입력시 사용 – Operating time and setting

   Alarm Buzzer Reset 기능 - Alarm Buzzer Reset

   건조기 전원 ON-OFF 선택기능 – Dryer On/Off

2) Explanation of symbols on display

   표시 기호 – Symbols

   설정 시간 - Setting time

   균압 시간 입력 표시 – Indicates Pressurizing time to be entered

   건조 시간 입력 표시 – Indicates drying time to be entered

   설정 값 입력 완료 표시 – Indicates setting is done

   A tower 건조 진행 시간 표시 – Indicates A tower drying operation time

   균압 시간 표시 – Indicates pressurizing time

   B tower 건조 진행 시간 표시 - Indicates B tower drying operation time

3) Method of entering Operating time

3 초간 – 3 seconds

“00” 깜빡임 – “00” blinks

“초” 입력 - “seconds” enter (up/down)

“0” 깜빡임 – “0” blinks

“분” 입력 - “minutes” enter (up/down)

0.5 초 표시 – indicates 0.5 seconds

완료 - Done

자동으로 현 운전상태 Display 로 전환됨 –

4) Test mode operation method

“UP”을 누른다 - Press “UP”

“P0.02” 표시 – Shows “P0.02”

2 초후 – 2 seconds later

“a0.02” 표시 – shows “a0.02”

“b0.02” 표시 – shows “b0.02”

반복 – repeats

5) External structure

사용상 주의 – Caution

주위온도가 최대 50 도 이상이 되지 않도록 하십시오 – Surrounding temperature should not exceed 50C

6-3 Operation

1) Turn on a control power on a panel and follow (5^{th} Clause Article 2).
2) After purging, check pressure and inlet air temperature of tower A&B
3) Set a regenerating pressure using purge adjusting valve
   *SAD-series standard regenerating pressure is 0.32mpa
4) Check operation and light of valve and lamp
5) check if the processing works on order of 5^{th} Clause Article 4
6) Operate

6-4 Check operating cycle on display

1 분후 – 1minute later

10 초후 – 10seconds later

4 분후 – 4 minutes later

반복 운전 – Repeats operation

Note) The operation time above is a standard setting time. When running, it can change a little depends on an operating situation.

6-5 Operating choice
-Dew point meter installed PPD Panel can be installed by special request to run a dew point operation
-Timed operation and local /remote operation can be chosen

1) Timer Control
   Drying, Regeneration, Pressurizing process cycle repeats by timer. It is a ST'D system
2) Dew Point Demand Control – Option
   Please contact our office for more information.

6-6 Stopping the operation
When stopping the operation, it is advisable to stop after Tower change. However when stopped in the middle of operation, additional time of running dryer is needed. At this moment, the outlet dew point at drying tower gets bad due to exceed amount of time of dehumidification.

1) Stopping for a short time
   Turn off power switch. Close in/outlet valve. Open by-pass v/v
2) Stopping for a long time
   Turn off power switch. Close in/outlet valve. Remove pressure completely on a drying tower. Open by-pass v/v (Must stop utility and turn off power switch)
3) Emergency stop due to Low pressure alarm
   When Low pressure alarms, the light comes on alarm lamp and purge v/v closes. Then, open the by-pass v/v. Close dryer in/outlet valve. Check power equipments about air pressure providence. (Not applicable for some small models)

7 Management of Air Dryer
Adsorbent and Mufflers need regular management and maintenance for dryer operation.

7-1 Desiccant
Usual lifespan for adsorbent is 2 years or more. However depends on a air compressor (fueling or non-fueling system), content of oil, and adsorption inlet temperature (under 40C) and inlet pressure (0.7mpa), the lifespan can change. Especially, the inflow of oil should be minimized to protect adsorbent.

An adsorbent need to be changed depends on hours of use. Use dew point instrument to readout the replacement time.

An adsorbent must be replaced when:

1) Unable to maintain outlet dew point
2) Increase of outlet dew point
3) In/outlet of dryer's pressure difference is getting bigger
4) Adsorbent in tower is turning brown or black
   (minor discoloration can be ignored)
5) Moisture is formed

7-2 Purge muffler

The air discharges through purge muffler after regeneration. If discharging is not working well, the humidity accumulates in a tower to ill affect the adsorbent. The replacement period for muffler is once or more per year. When below situation occurs, you must replace it:

1) When purging after pressurizing the pressure at regenerating tower does not drop
2) Air leak at Muffler

When inlet reversing valve is 3-way shuttle v/v, must check muffler quarterly its blockage to prevent malfunctioning of adsorption tower transfer.

7-3 Check valve and actuator v/v

The valves on a dryer pipe affect the operations directly. Therefore extra care is recommended. Disassemble the part to remove debris on a disc and seat regularly.

: SAD-series air dryer switchovers the adsorption tower every 5 minutes, so must check its packing quarterly.

8. Maintenance of Air Dryer

8-1 Order of desiccant replacement

1) Turn off Dryer and By-pass (open or close?) and reduce all pressure.
2) Open desiccant removal port at drying tower to take out desiccant and use Teflon tape and gasket to seal.
3) Open Drying tower desiccant fill port to insert desiccant. Use tape and gasket to seal.
4) Operate (refer to section 5)

8-2 Replacing Purge Muffler

: Refer to sec 7-1 article 1 to stop the dryer and replace it.

9 Causes of malfunction and solutions

Problem	Reason	Solution
Increase of Dew point	Lack of regenerating air	Check purge adjusting v/v to 0.32 mpa (3.2kg/cm2)
	Low pressure at inlet	Check air compressor capacity when design pressure runs under 0.7mpa
		Check pressure difference of dryer equipment
	High outlet temperature	Check cooling situation of after cooler
	Contaminated desiccant	Replace desiccant
	Rundown of desiccant	
	Purge v/v/ and muffler disorder	Check blockage and operating condition and replace
Pressure loss	Run down of element in pre filter	Check filter condition and operation time and replace element
	Leaking at v/v and pipe	Fix or replace the pipe or valve where it leaks
	Contaminated desiccant	Accumulated moisture and oil occurs the blockage on desiccant. Replace
	Rundown of desiccant	
Discharge error	Regenerating air does not flows in	Check and adjust purge adjusting v/v
	Blockage of muffler	Replace muffler
Cannot replace tower	Valve error	Check inlet or purge v/v, sol/ v/v and replace
	Power off	Check On/OFF switch or fuse and replace
	Control Panel error	Replace Board or panel

*Reference: Types of air filter and optimal replacement period
Main filter:
+Front of after cooler
+Main line of plant pipe
+Pipes with plentiful of moisture

Pre Filter:
+ Front of Refrigeration Air dryer
+Install particulate filter (PSF-310/130/150) in front to increase lifespan and efficiency
+Front of Adsorption air dryer

Line Filter:
+Front and back of Adsorption air dryer (collects desiccant powder)
+ Install particulate filter (PSF-310/130/150) in front to increase lifespan and efficiency

Coalescer filter:
+ Install on a line which has removed debris and moisture to remove ultrafine impurities.
+ Distillate eliminator
Install on back of adsorption air dryer to collect desiccant powder

Adsorber filter:
+respiratory compressed air line
+odor eliminator
+distillate eliminator

0.3 bar 이상 또는 6,000hr – 0.3bar higher or 6,000hr

Note) Please contact our office for the element model assembled in an air filter.