or

Dessicant vs Refrigerant Dryer

CONTENTS

1.What is air compressor dryer?

- A compressed air dryer is a piece of equipment **designed to separate water vapor or moisture (de-humidify) from industrial process air**.
- In the typical system, a compressor draws in humid air and compresses it, which raises the air temperature and then cooling the air condensing water vapor out of the unit.

2. Four primary types of air compressor dryers

- Refrigerated dryers.
- Desiccant dryers.
- Chemical dryers.
- Membrane air dryers.

3.What is desiccant in the dryer?

- In summary, in a desiccant dryer, adsorbing the water vapors onto the large, dry surface area of a highly porous material called desiccant **dries the compressed air.**
- The water remains on the surface of the desiccant until it is stripped off, and finally, desiccant can be regenerated and used again and again.

Activated silica desiccant

4.What are the most common desiccant materials used in dryers?

The most common desiccant is **silica**, a nontoxic, water-insoluble white solid used in several industries. Some other desiccants include activated charcoal, calcium chloride, calcium sulfate and molecular sieves.

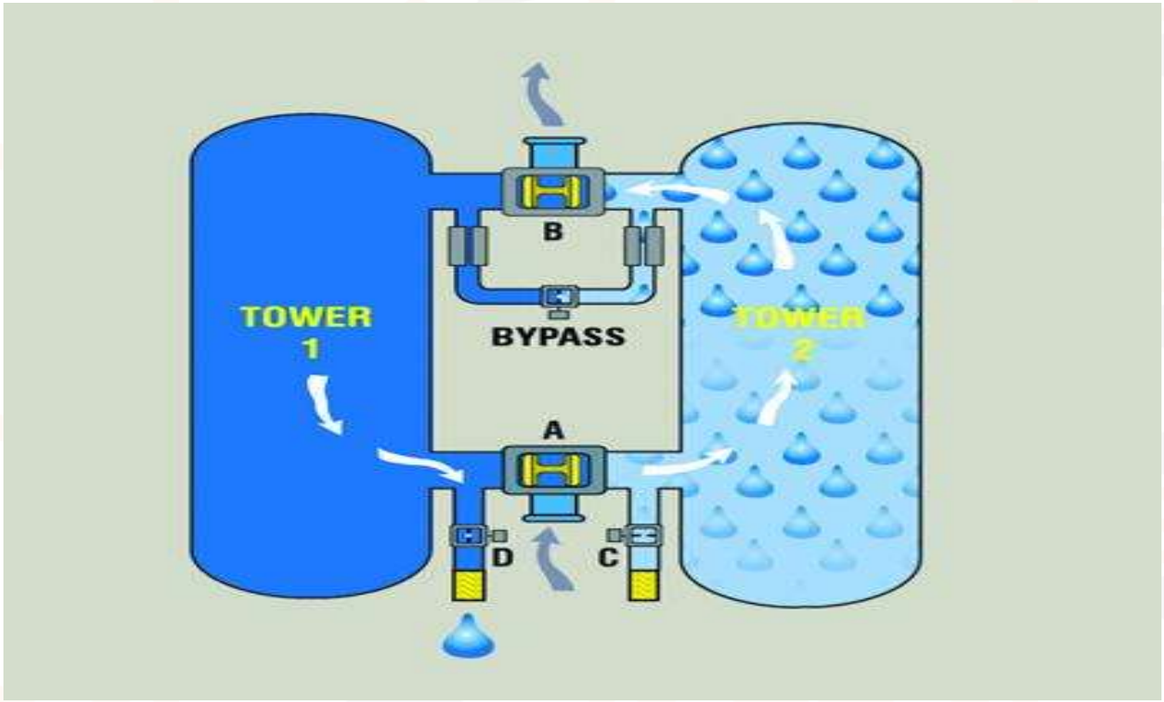
Reference Image for Schematic representation

5.How long do desiccant dryers last?

- With proper maintenance of pre-filters, activated alumina desiccant should last **up to 5 years in heatless dryers**.
- For heat regenerated dryers the desiccant should last 2 to 3 years.
- Desiccants can be visually inspected to look for discoloration and oil contamination.

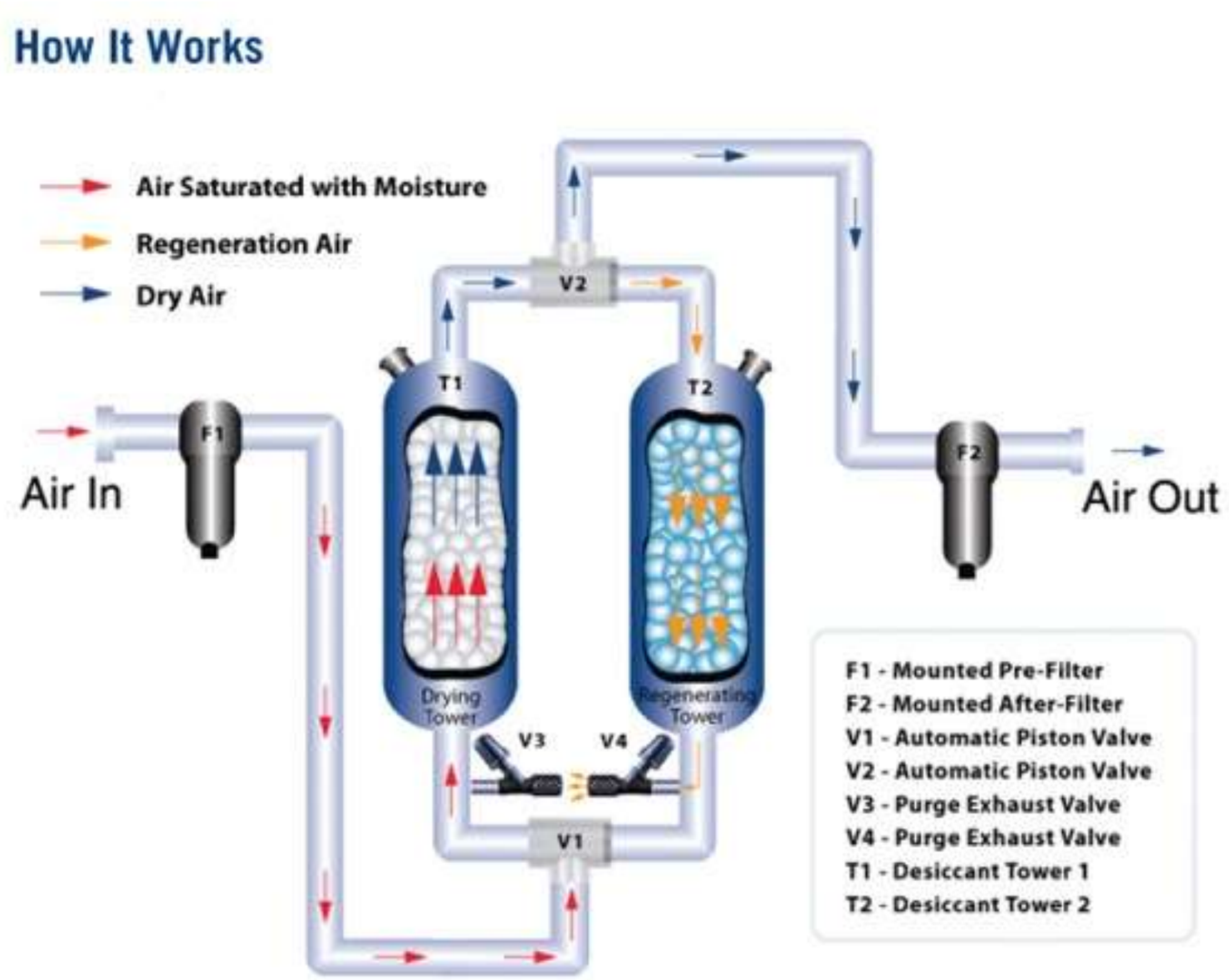
6.What is a desiccant dryer ?

- A desiccant dryer or an adsorption dryer is **a piece of industrial equipment that uses desiccant materials to eliminated water from the air channeled through it**.
- A standard desiccant dryer system uses a two-tower setup to ensure a continuous air-drying cycle.



Reference graphical Image

How it Works


How It Works
Air Saturated with Moisture
Regeneration Air
Dry Air
Air In
F1
V2
T1
T2
F2
Air Out
Drying Tower
Regenerating Tower
V3
V4
V1
F1 - Mounted Pre-Filter
F2 - Mounted After-Filter
V1 - Automatic Piston Valve
V2 - Automatic Piston Valve
V3 - Purge Exhaust Valve
V4 - Purge Exhaust Valve
T1 - Desiccant Tower 1
T2 - Desiccant Tower 2

7.How does it work?

- The adsorption Dryer has two towers. Tower 1 and Tower 2 are both filled with desiccated. At a time, one Tower is used for drying and the other Tower is regenerated.
- When Tower A is under drying, and Tower B is under regeneration. The compressed air, which comes from the compressor, enters the system through the inlet and then moves into the pre-filter, which removes dust particles from compressed air.
- The air then passes through the piston valve and enters Tower A, where the desiccant adsorb its moisture. The dry air then passes through a check valve and enters a filter where any desiccant dust is removed. The clean and dry air has then proceeded downstream into the planned during the above process.
- The 12 to 15 per cent dry purge air, which came from Tower A passes to purge valve and then enters Tower B. It then passes over the saturated desiccant beds, which dries the desiccant and is exhausted from the system. The atmosphere through the evolved outlet, which is fitted with a silencer to reduce noise.
- This is a 10-minute automatic cycle that is a five-minute drying cycle. And five minutes regeneration cycle, which is controlled by a microprocessor-based system.

Sample Photo

8.How do you decide size of a desiccant air dryer?

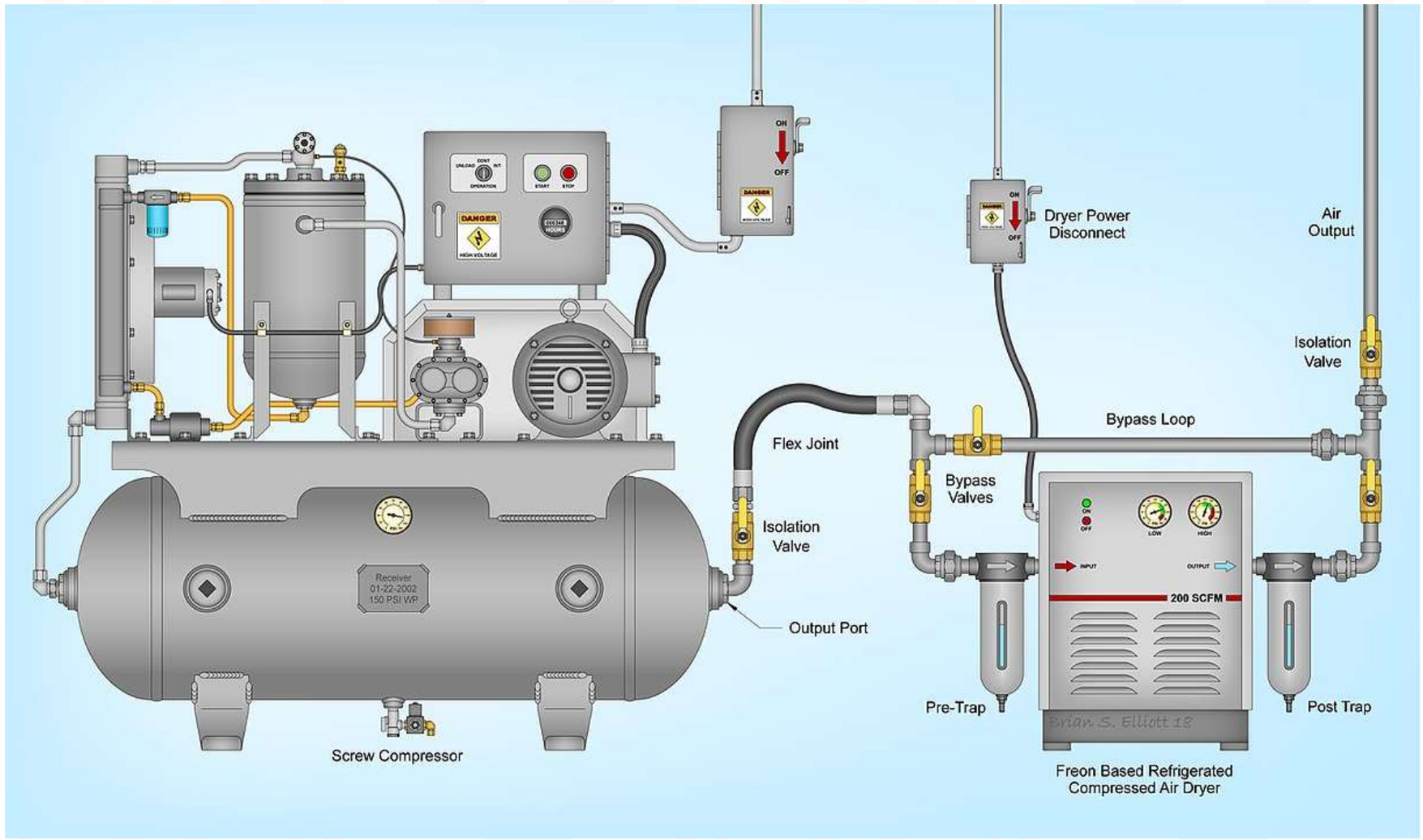
- To size the desiccant air dryer to match the compressor, we need to calculate **65% of the total CFM**.
- The max output is no more than 13 CFM or 65% of the total CFM of 20.
- The desiccant air dryer only needs to work at 13 CFM to fit the compressor and match the total dry air needed.



9.What is a refrigeration dryer?

- Refrigerated dryers are the **most common type of compressed air dryer**.
- They remove water from the air stream by cooling the air to approximately 3 °C (38 °F) and effectively condensing out the moisture in a controlled environment.

Sample Photo



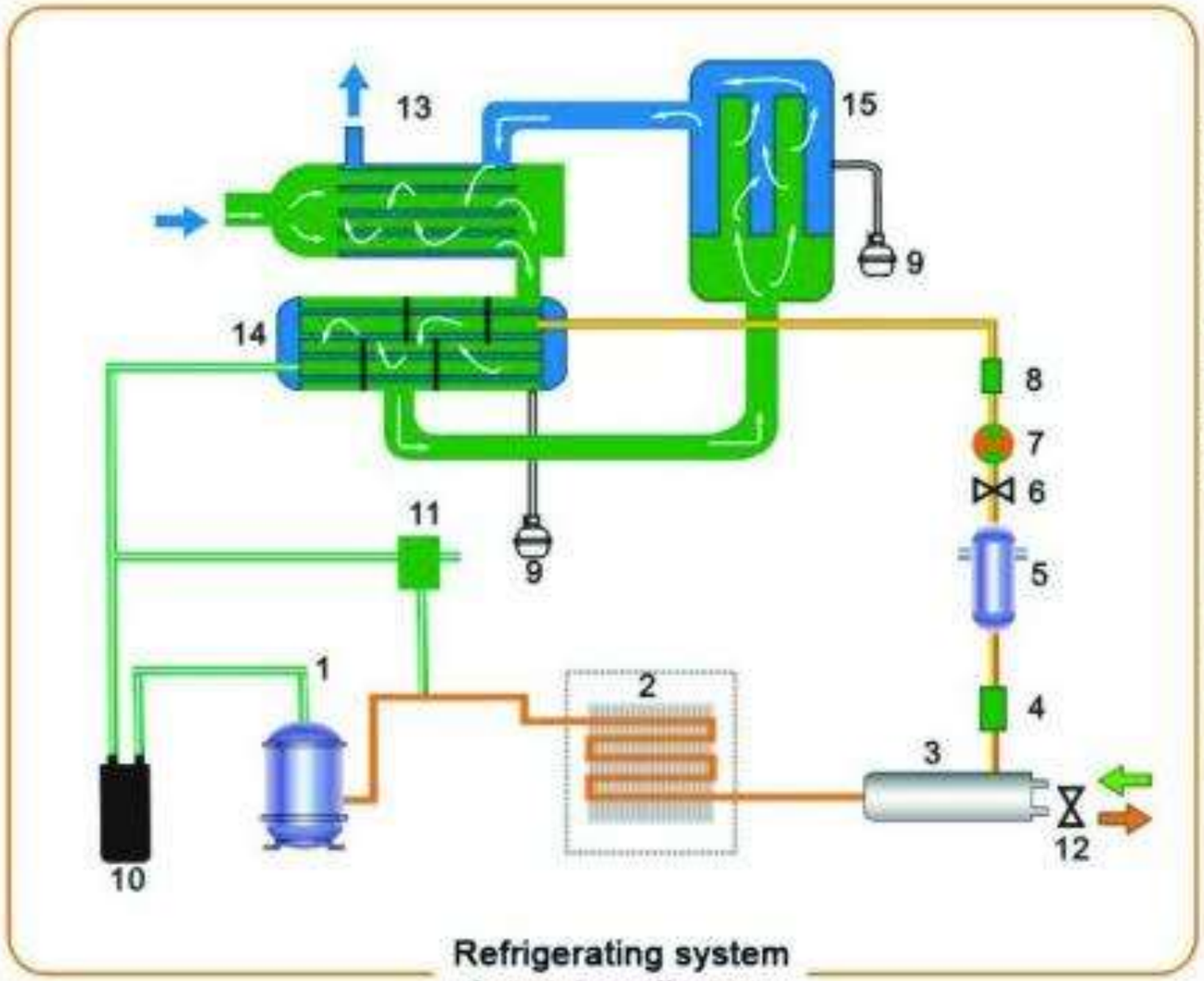
Reference Image for Schematic representation

Inside picture of Refrigerant air dryer

10.How do you decide the size of a refrigerator air dryer?

To figure out the right-sized dryer, **divide the total flow by the total correction factor**: 200 cfm / 0.861= 232 cfm (at standard conditions).

Now, you can look at the dryers' stated capacity on the dryer literature and see which one will dry 232 cfm effectively.



Refrigerating system elementary diagram

1、cooling medium compressor
2 、air condenser
3、 water condenser
4 、magnetic valve
5 、drying filter
6 、manual valve
7 、cooling medium sight glass
8 、expansion valve
9 、automatic drainer
10、gas water separator
11、hot gas bypass valve
12、water volume adjustable valve
13、pre cooling gas
14、evaporator
15、effective separator

How does it work?

- Air refrigeration type dryer operates on the method of cooling the air to near freezing point to remove the moisture. The refrigeration dryer consists of two circuits:- Refrigeration circuit and compressed air circuit.
- In the refrigeration circuit, the compressor pumps refrigerant gas into the volume liquid accumulator where there's hot refrigerant gas transfers, its heat to the cold refrigerant which is coming in liquid form from air to refrigerant heat exchanger.
- There's high pressure and high temperature. Refrigerant goes into a condenser, which can be either good or water cool. The condenser transfers the heat from the refrigerant gas to the ambient air or cooling water. As the gas condenses into a liquid, which is collected into a liquid receiver.
- Then it travels through filter vent impurities and absorbed the liquid gas, then passes through an expansion valve, which reduces the pressure of liquid gas, which leads to a reduction in its temperature down to 0 degrees Celsius.
- This enters the air to the refrigerant heat exchanger, and the heat from the hot, compressed air is absorbed by the cold refrigerant. This refrigerator is sucked by the compressor and the cycle starts over again.

What is the basic difference between a desiccant dryer & a refrigerant dryer?

- Desiccant dryers operate **at significantly lower dew points** which facilitates the elimination of moisture more efficiently than a refrigerated dryer.
- By comparison, refrigerated air dryers are typically operated at higher dew points than desiccant dryers.

Refrigerated vs. Desiccant Air Dryer Quick Reference Chart

	Desiccant Air Dryers	Refrigerated Air Dryers
Application	Metal finishing, paint lines, pharmaceutical, medical, food processing and other applications requiring ultra-dry air (ISO Quality Classes 1, 2 & 3); low-temperatures below freezing applications	Standard manufacturing and service application removes liquid water only(ISO Quality Classes 4, 5 & 6)
Typical Dew Point	-40°F to -100°F	+38°F
Initial Investment Cost	High	Low
Operating Cost	High to Moderate	Relatively Low
Maintenance Cost	Moderate	Low

ISO standard 8573.1 for the classification of compressed air quality

Quality class	Solid particle content		Water content		Oil content
	Max size mu	Max amount g/m3	Dew point c	Amount g/m3	Max amount mg/m3
1	0.1	0.1	-70	0.003	0.01
2	1	1	-40	0.11	0.1
3	5	5	-20	0.88	1.0
4	40	10	+3	6.0	5
5	-	-	+7	7.8	25
6	-	-	+10	9.4	-

References

- YouTube link for reference: https://www.youtube.com/watch?v=hwFYmkDiF5Y
- YouTube link for reference: https://www.youtube.com/watch?v=Kop_K-94MdA
- https://www.airbestpractices.com/system-assessments/air-treatmentn2/desiccant-dryers-ten-lessons-learned
- https://nigen.com/desiccant-air-dryer-vs-refrigerated-compressed-air-dryer-types
- http://theworkshopcompressor.com/learn/compressed-air-systems/compressed-air-dryer/refrigerated-compressed-air-dryer/

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