power plant
preservation

Simple cycles, Thermoelectric plants, Combined cycles, Nuclear power plant,
Hydroelectric power plants, Thermosolar plant, Refinery

fisair
air humidity control

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air humidity control

“controlling air humidity, we help industries to progress”

Fisair is a leading company in the field of humidification control with a broad infrastructure for the manufacture of equipment and solutions to add value to society, with systems that control air humidity according to changing conditions; systems with a level of control of power consumption and hygiene, by precisely controlling multiple parameters.

We also help to boost the performance and quality of many industrial proceses.

Fisair complies with the most rigorous standards, and provides our products with the best quality.

Fisair has its headquarters in Madrid, with several service locations in all countries to cover all the needs of our customers.

With a staff of over 60 people and 2 production plants, it has manufactured over 10,000 equipment units since its inception.

Design, raw materials warehouse, mechanical transformation, welding, paintshop, electrical assembly, functional and performance testing.

fisair.com

Built for today, **designed for tomorrow**

our equipment
operates
in more than

5.000 MW

worldwide:
present in more than

40
countries

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introduction to **standard preservation**

With the boom in renewable energy, conventional power generation plants began to have very long downtimes. On seeing the problems faced by power plants, we began to develop high precision equipment to achieve maximum product quality.

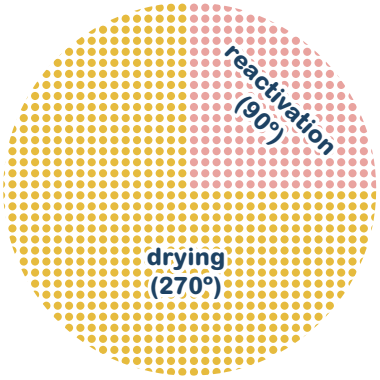
FISAIR works with large turbine companies, equipment companies and owners of power plants to achieve the optimum product to be used in each process, and has thus acquired great experience in these types of products.

FISAIR is a specialist in the conservation of the following equipment in power plant shutdowns

…introduction to **standard preservation**

Power generation plants are very subject to corrosion during a shutdown. If the appropriate conservation measures are not taken, corrosion can cause great damage to different components in a system and greatly disrupt the start-up.

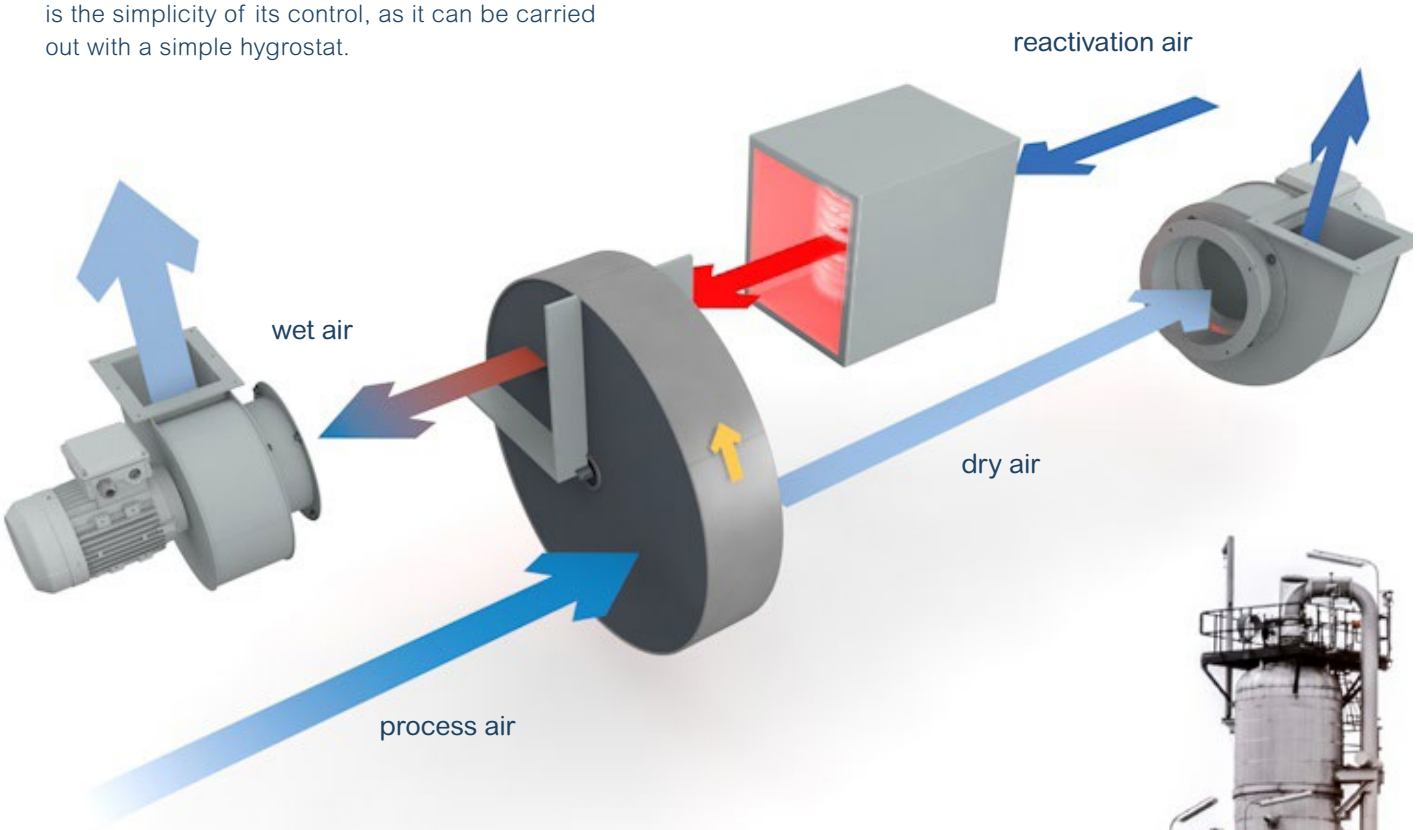
Due to the importance of the problem, great efforts have been made to find appropriate solutions. Different existing methods have been compared, and the dry air method, using drying rotor dehumidifiers, has proven to be the most effective.



DRY AIR METHOD

The dry air method has replaced other previous methods, as it is the simplest, cheapest and fastest.

One advantage of the dry air method over others is the simplicity of its control, as it can be carried out with a simple hygrostat.



10 advantages

Cuando se utiliza el método de aire seco con deshumidificadores de ambiente externo, se obtienen muy buenos resultados:

01. **It is easy to check if there is a risk of corrosion** by simply checking the humidity in the air vents.

02. **Very good** in humid climates.

03. **It allows access to the conserved parts,** while protection is performed.

04. **Removes small areas of trapped water** quickly (in a matter of hours).

05. **It requires less energy** than the heating method, and does not require the dangerous or expensive chemicals needed in wet conservation.

06. **Water pockets or conservation failures are detected** quickly.

07. **Chemical products are not used.**

MAIN OBJECTIVE

The main goal in power plants is to prevent corrosion in both operation and non-operation times. Mostly without operation.

The first thing to realise is that corrosion rates are 100-2,000 times higher in high relative humidity environment (60-100%) than at lower humidity (30-50%).

08. **Cleaning intervals increase** from 3 to 12 years, when dry air circulation is introduced in existing power plants.

09. **Simple** and effective.

10. **Avoids costly repairs** and lack of availability due to the sudden entry of moisture.

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Fisair is a specialist in the conservation

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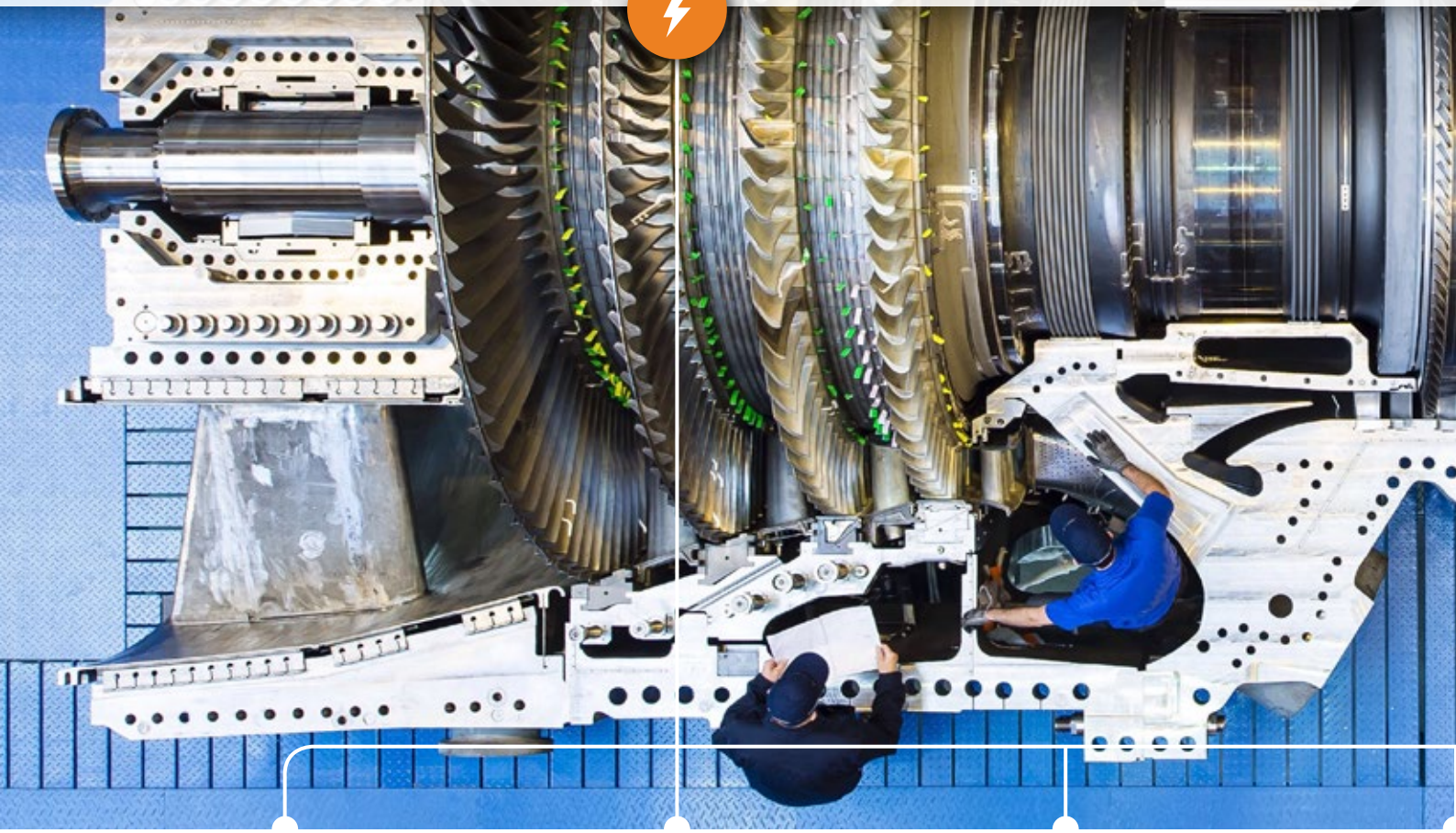


Simple cycles

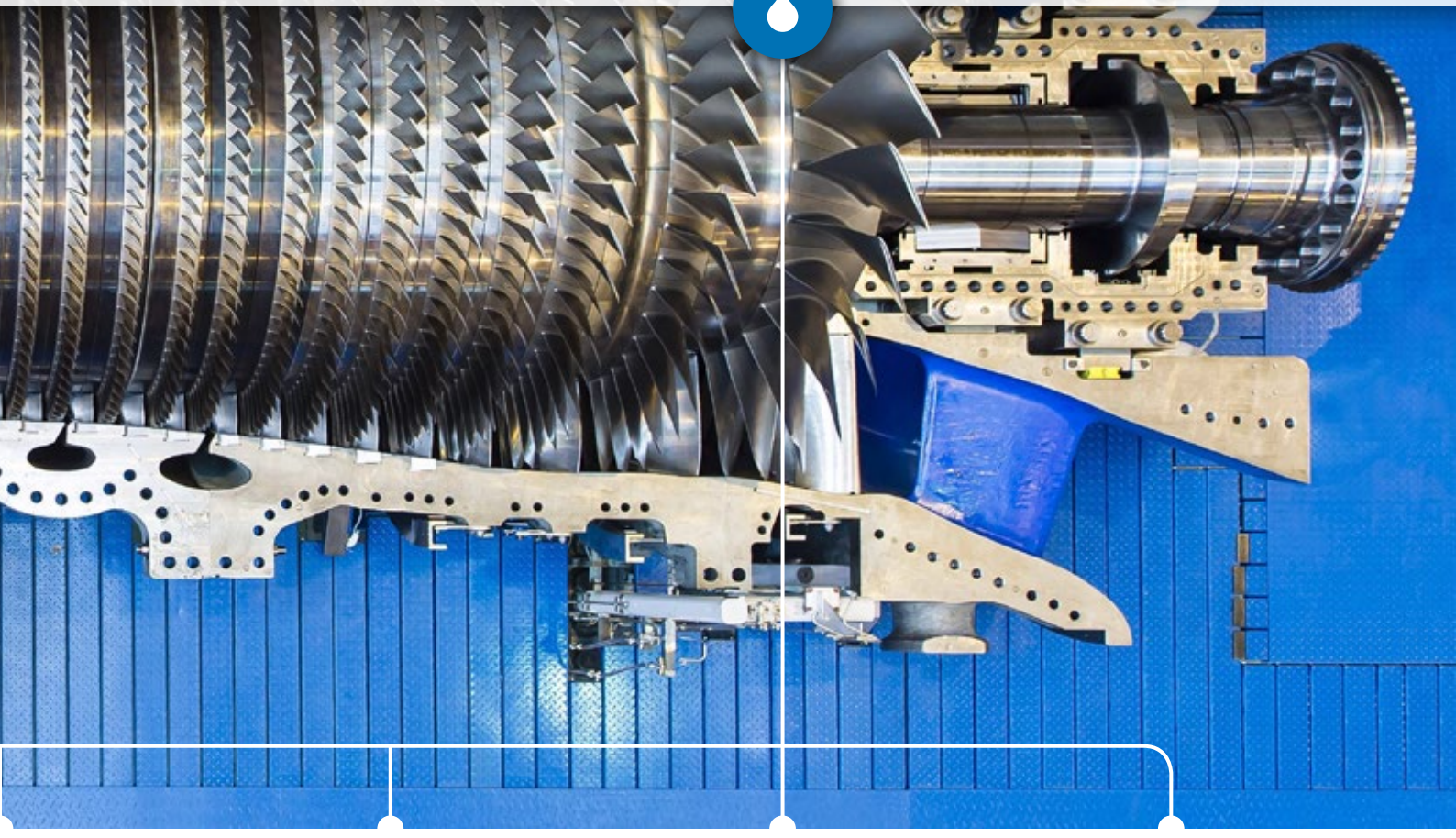
Thermoelectric plants

Combined cycles

Nuclear

of equipment in power plants shutdowns

At a high relative humidity of 60-100%
corrosion rates are 100-2.000 times higher
than at moisture values than 30%.



power plant

Hydroelectric power plants

Thermosolar plant

Refinery

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equipment to be conserved in power plants

1

HRSG WATER/STEAM SIDE

This is the most complicated system as it requires a precise procedure to ensure all equipment and pipes subject to water and/or steam are emptied and drained before introducing dry air through them. You should realise that, as long as pockets of water remain, the relative humidity will not fall.

- Due to the large number of valves operated in a position different to that of Operation and equipment needing to be drained, a system needs to spend a lot of time being conserved for a quick start-up.

- This requires a very accurate conservation procedure to minimise time.

- The established procedure prepares the equipment for conservation at the same time or staggered to facilitate operation. At the end of the procedure, all the equipment and subsystems have been communicated with.

- Dehumidifiers are used interchangeably for several subsystems and equipment to be conserved. This is done by providing them with short individual runs to allow this versatility

- Sections furthest from the dehumidifier in each circuit, or in the upper part of the equipment in conservation, should have a continuous “escape” of dry air.

- The humidity of the air in conserved systems should be periodically measured to verify proper application.

  - Relative humidity should be kept at 30%.
  - The variation of absolute humidity with respect to the temperature difference with the outside should be taken into account when dimensioning.
  - Operating in an open system (all outside air).
  - Drive the air to the parts most sensitive to humidity.
  - The air conditions must be measured at the outlet.

HRSG GAS SIDE

- Corrosion is due to the presence of sulfuric acid. This is less aggressive when the concentration increases, which it does upon dehumidifying the environment. According to the diagrams, the relative humidity required is 5%, although experience tells us that 20% is sufficient.

Basic operation: The main principle is to introduce dry air on the compressor side where it goes to the gas turbine, and from there it flows freely through the exhaust to the gas side of the boiler, which will be “bottled” (short, closed runs through the flue and manholes).

For effective conservation in this system, according to the environmental conditions of pressure, temperature and relative humidity, the equipment is supplied with 3,000-6,000 m3/h. FISAIR has them in its catalogue (DFRC). FISAIR will provide you with the optimal solution.

The air loss through the short flue runs is enough to keep the RH in the boiler and gas side at around 20-30%.

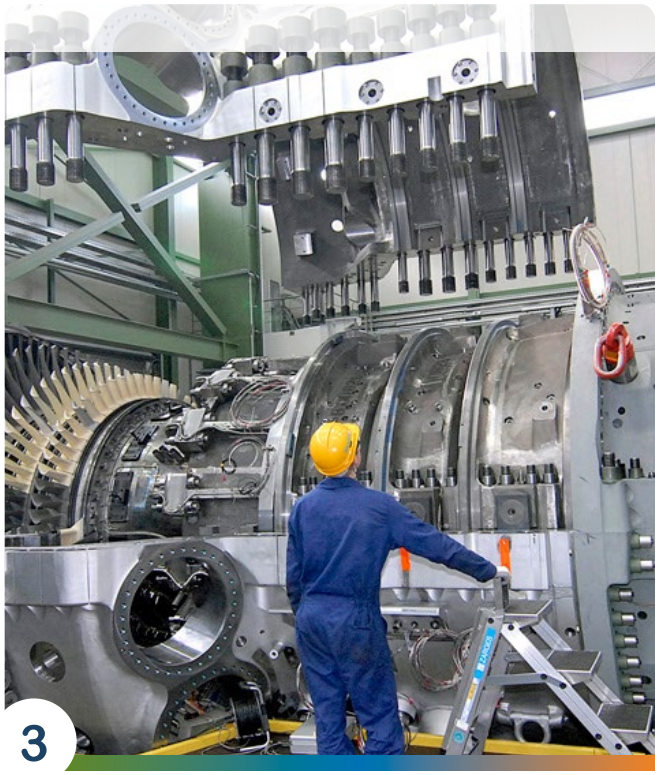
The conservation of this system can be approached from two locations: - Through the inlet plenum, by means of shields - Through compressor bleed valves.

STEAM TURBINES

2

The blades of the turbine are subject to high stress during operation and are designed for maximum efficiency. Attack when not under load comes in the form of general corrosion or pitting under humid conditions in the presence of aggressive ions, particularly chloride, with austenitic steel also being susceptible. General corrosion decreases the efficiency when restarting and pitting on the roots of the blade can cause fracture with catastrophic results. Dry air supplied to the turbine casing and discharged via the condenser eliminates these risks and also preserves the condenser; this, in turn, shortens the restart cleaning of the condensation system. This can save at least $200,000 per day for a 500 MW unit. Heating does not provide a good solution, as the moisture absorbed initially re-condenses when the air comes into contact with colder machine parts; thus re-establishing the danger of corrosion. To avoid this, the entire turbine has to be heated at considerable cost.

GAS TURBINE



3

Storing turbine/compressor units not under load in dry air is recommended to prevent potentially dangerous contamination of highly stressed alloy steel blades and to minimise corrosion of lower alloy components. Corrosion of the turbine shaft itself can cause some imbalance and the corroded blades heat unevenly, which leads to unacceptable vibration, especially during the normal fast start-up of gas turbines. The proven method is to close the air inlet valve (shock absorber) and admit dry air, which is allowed to escape through the hot gas system.

CONDENSER AND TANKS

4

Equipment that needs to be coated should be dried and sometimes heated before surface preparation. For some tanks, especially square ones, heat alone is not enough, as corners are difficult to heat at the proper temperature. The new flue-gas desulphurisation plants must be covered on site with materials that have to be applied under rigorously controlled humidity and temperature conditions to be successful. Failure of the coating causes carbon to accumulate, which causes moments of anxiety during operation and even close down, until the ramps are released to allow carbon to flow to the mills and boiler. For condenser water boxes, the drying equipment can dry a complete unit in a week, compared to the heat of a fan, which can easily take 2-3 weeks.

All that is needed to supply dry air around the volume of the tank here.

PIPES

5

At each scheduled maintenance or shutdown of a power generation system, the pipes used for cooling water have to be dried. Water is removed from the system, but there is always some remaining water due to the structure of the pipes.

And this moisture, if left unchecked, causes corrosion inside the pipes. To dry this system, the piping volume must be known and a unit with the exact air flow selected.

some examples and experiences of our equipment in plants for HRSG, Steam turbines, Gas turbines and Condensers

All the projects are very different. FISAIR offers its conservation technical team to provide the best solution.

1 Conservation of the whole cycle

product used:

DFRC-0300-E

2 Conservation of HP steam

product used:

DFRD-036-E

3 MP/LP Steam Turbine / Gas Turbine Conservation and Condenser

product used:

DFRC-0100-E

4 HRSG conservation

product used:

DFRC-0160-E, DFRC-0300-E, DFRC-0500-E, DFRC-0651-E y DFRC-0900-E

(Flows most used 2,000-6,000 m3/h)

5 HRSG and GT conservation

product used:

DFRC -0651-E

(5000m3/h)

fisair
air humidity control

DFRC series

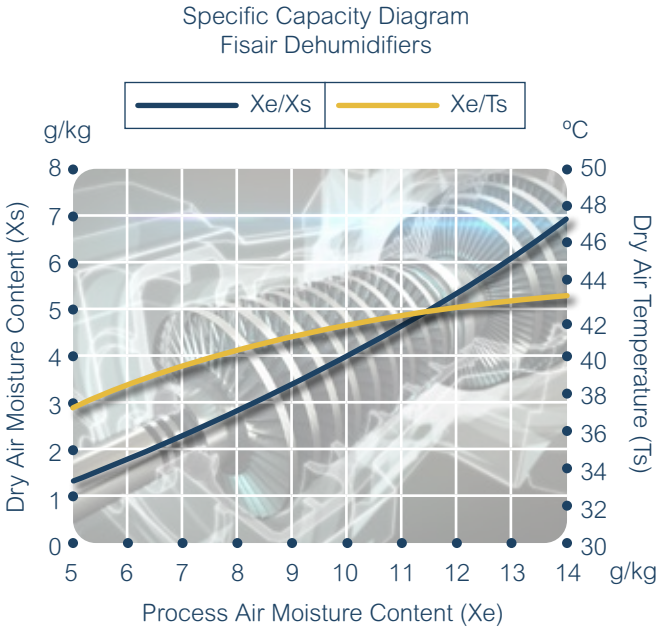
desiccant air dehumidifier

Settled Parameters:

- Process/Reactivation Air Temperature: 20 ºC
- △T Reactivation Heater According To Nominal Power
- Equal Process/Reactivation Air Moisture Content

(*) At other operating conditions.pls.ask for the corresponding performances

capacity diagram (*)



DFRC serie technical information

Model	Nominal Airflow	Heater ower	Total Power	Nominal Drying Capacity (*)	Dry Air Available Pressure
	m^3/h	kW	kW		Pa
DFRC-0175	1.200	13,5	15	9,1	300
DFRC-0300	2.100	22,5	25,8	14,3	700
DFRC-0400	2.700	27	31,2	18,8	800
DFRC-0500	3.600	36	39,3	24,6	150
DFRC-0650	4.500	45	49,2	29,7	400
DFRC-0651	5.000	54	60,5	36	300
DFRC-0900	6.000	63	70,7	41	600
DFRC-1100	7.500	81	90,7	52,2	500
DFRC-1300	9.000	99	109,5	64,8	300
DFRC-1700	12.000	126	144	85	800
DFRC-2100	15.000	162	181	106,2	800

(*) Nominal capacity: 20ºC y 60% H.R.

(**) Capacity diagram for DFRC-1300-E model with the specified settled parameters.

Other models capacities to be furnished under request.

DFRB-036E serie technical information

Dry air	Available external pressure	Wet air	Available external pressure	Power (kW)			Power supply	Current (A)		Overall dimensions (mm)			Weight	Wn
(m^3/h)	(Pa)	(m^3/h)	(Pa)	PTC heater	Motors	Total	Electric	Nominal	Magnetic	Lenght	Widht	High	(Kg)	(Kg/h)
300	300	90	100	2,4	0,5	2,9	230V/1N/50Hz	11	4 x IN	510	660	525	40	1,4

O&M

Fisair is committed to a high quality product, which also includes the following services:

EQUIPMENT RENTAL

TECHNICAL ASSISTANCE

REPLACEMENT PARTS

ADVICE

WARRANTY EXTENSION

TRAINING

FISAIR is committed to a high quality product, which also includes the following scopes of application:

SIMPLE CYCLES | THERMOELECTRIC POWER PLANTS | COMBINED CYCLES | NUCLEAR POWER PLANTS | HYDROELECTRIC POWER PLANTS | SOLAR THERMAL POWER STATIONS

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