DFRA-E series
Desiccant rotor air dehumidifiers
Electric reactivation
General description

The quality and efficiency requirements demanded by today’s society in terms of human comfort, and the control and stability of production processes, have made humidity control increasingly necessary or even essential.

The fact that the water vapour content of air varies greatly, and relative humidity depends on this, means it is vital to employ a dehumidification system for the reduction and control of this value whenever the water vapour content exceeds the humidity content permitted by the process.

That is why Fisair, which has been manufacturing since 1994, designs air dehumidifiers that enable the constant attainment of required humidity levels in a simple and precise manner, for minimal investment and operating costs.
Operating principles of desiccant rotors

DFRA series Fisair air dehumidifiers work using a high performance silica gel desiccant rotor, which is chemically and thermally stable, to prevent the deliquescence of the material it is made of, as occurs with other desiccant materials. Its cylindrical shape with a large number of small channels provides a large surface area for contact between the air and the desiccant material, which enables high levels of dehumidification, with a minimal volume of material.

Its simple method involves two air flows moving continuously and simultaneously as counter-currents across the desiccant rotor. The desiccant rotor is equipped with a rotation device and a series of perimeter seals to make the drying process continuous and uniform, and to optimize performance.

The flow of air for drying (process air), is filtered and passes through the desiccant rotor material (270º), and a proportion of the water vapour molecules in the air are adsorbed. This air (dry air) is supplied to the controlled humidity zone by means of a fan.

The regeneration air flow from the desiccant rotor (reactivation air), is filtered and heated using a steam heater coil. It then passes through the desiccant rotor material (90º), and the water vapour molecules retained in the desiccant rotor are adsorbed, which regenerates the rotor for a new drying cycle. This air (wet air) is expelled outside of the controlled humidity zone, by means of a fan.

Fisair dehumidifiers have a long operating life because of the chemical resistance of the rotor and the possibility of washing it in water.

Standard dehumidifiers can ensure dry air humidity reaches dew point temperatures of up to -20ºC, or even lower on demand.
**Data chart and general dimensions**

<table>
<thead>
<tr>
<th>DFRA-E models</th>
<th>Process/Dry Air</th>
<th>Dry Air Available Pressure</th>
<th>Reactivation/Wet Air</th>
<th>Wet Air Available Pressure</th>
<th>BR Electrical Power (Reactivation Coil)</th>
<th>BR Electrical Power (Reactivation Coil) with Heat Recovery</th>
<th>Total Electrical Power</th>
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<tbody>
<tr>
<td></td>
<td>(m³/h)</td>
<td>(Pa)</td>
<td>(m³/h)</td>
<td>(Pa)</td>
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<td>(kW)</td>
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(*) Process and reactivation air input conditions 20°C/60% R.H.
To calculate the drying capacity in other conditions, consult the percentage variation table.

**Percentage variation table**

<table>
<thead>
<tr>
<th>Correction Coefficient Percentage (%) to be applied to the drying capacity (*)</th>
<th>Process/Reactivation Air Temperature (ºC)</th>
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<tr>
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<td>Relative Humidity of the Process and Reactivation Air (% R.H.)</td>
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**Practical example:** Starting with a DFRA-0300-E with 14.3 kg/h (at 20ºC and 60% R.H.), we want to know the capacity if the air being handled is at 30ºC and 70% R.H. The table shows us that a Correction Coefficient of 135% must be applied, which gives a new capacity of 14.3·1.35 = 19.31 kg/h (at 30ºC and 70% R.H.).

(*) Approximate data used for quick capacity estimates, to be confirmed in each case.
Unit performance based on the reactivation heater nominal power. 
Standard electrical connection 400V/III/50Hz and handling voltage 24Vca (others on demand). 
Technical data subject to change without prior notification.

<table>
<thead>
<tr>
<th>DFRA-E models</th>
<th>Total Electrical Power with Heat Recovery</th>
<th>$\Delta x$ (*) [Specific Capacity]</th>
<th>$\Delta t$ (*) [Dry/Process Air]</th>
<th>Drying Capacity (*)</th>
<th>Dimensions (mm)</th>
<th>Weight (kg)</th>
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<tr>
<td></td>
<td>(kW)</td>
<td>(g/kg)</td>
<td>(°C)</td>
<td>(kg/h)</td>
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Unit performance based on the reactivation heater nominal power. 
Standard electrical connection 400V/III/50Hz and handling voltage 24Vca (others on demand). 
Technical data subject to change without prior notification.
Specifications - Mechanical Components

Standard mechanical components

- **A self-supporting compact unit design made of galvanized steel with a phosphate coating and enamel finish in line with RAL 7035, with removable seals, covers and accesses to enable inspection and maintenance. (**) (Rock wool thermal insulation up to 50 mm thick and 1.5 mm of galvanized steel).**

- **Desiccant rotor made of inert, fire-resistant, high performance silica gel material, which is thermally and chemically stable to prevent deliquescence.**

- **Centrifugal air fans (M1 Process/dry air fan and M2 Reactivation/wet air fan) with a single ear and blades curved forwards, with a direct transmission engine, made from galvanized steel with a phosphate coating and enamel finish according to RAL 7035.**

- **A rotation gear motor for the rotor with a pulley and V belt dragging system for the perimeter transmission with tensioner.**

Optional mechanical components

- **Integrated pre-cooling coils (BF1) and/or post-cooling (BF2) for cold water, glycol water or gas. (**)**

- **Integrated pre-heating coils (BC1) and/or post-heating (BC2) for coils, water or steam.**
  - Basic module made of stainless steel AISI-304.
  - High pressure fans up to 15,000 Pa.
  - Plug-Fans managed using a frequency variator.
  - Turbine fans with reaction blades, made of stainless steel or transmission by belts/pulleys.
  - Metal air filters with G3 classification,
  - Synthetic fibre air filters with >G4 classification.
  - Double electric / steam coil, or another thermal fluid, for reactivation air.
  - Indirect evaporative cooler in the dry air.
  - Heat recovery from the wet air to preheat the reactivation air.
  - Wet air condenser for closed circuit operation.
  - Motorized air dampers.
(*) Optional components

**(*) BF1 and/or BC1

(1) M1

(1) M3

(1) M2

(1) CP

(1) FP

(90º) Drying

(270º) Reactivation

Wet air

Dry air

Process air

Reactivation air
Specifications – Control and safety components

Standard control and safety components

(1) Electrical control panel with general isolator, circuit breaker switches, contacts and all the control gear necessary for a safety and handling device.

Handling voltage 24Vca.

(LED) Signalling LEDs (Voltage, On/Off and Fault).

(SEF-013) Remote signalling cards with three signals (voltage, on/off and fault).

(PLR) PLR microprocessor, for the management and operational monitoring of the dehumidifier in real time, and the configuration of its controls and regulation.

Equipment with PLR including the following components as standard:

(S1) Desiccant rotor rotation detector.

(SSR) Solid state relay for PID modulation of the heaters of the reactivation coil BR.

(P0) Differential pressure switch for safety in the reactivation/wet air flow.

(ST1) PT100 Temperature sensor placed in the reactivation air after the heaters.

(M4) Electrical control panel fan.

Optional control and safety components

(P1 and P2) Differential pressure switches for the filters (process filter P1 and reactivation filter P2).

Humidistat, humidity sensors, temperature, dew point, actuators, valves, servomotors, etc.

(ST2) Intake process air flow temperature sensor.

(SH1) Intake process air flow humidity sensor.

(ST3) Temperature sensor for the process air flow after BF1 and/or BC1.

(ST4) Temperature sensor for the dry air flow after BF2 and/or BC2.

(SH2) Humidity sensor for the dry air flow after BF2 and/or BC2.

(MV2) Actuator-valve for regulating the BC1 heating coil.

(MV3) Actuator-valve for regulating the BF1 cooling coil.

(MV4) Actuator-valve for regulating the BF2 cooling coil.

(MV5) Actuator-valve for regulating the BC2 heating coil.
Breakdown of control and safety components
Functions provided by the PLR microprocessor

CONFIGURATIONS FOR DIFFERENT OPERATIONS (CONF)

1ª) STAGES (S)
In order to control the reactivation coil BR by means of one/two external digital signal/s on/off (in two stages).

2ª) PROPORTIONAL (P)
In order to control the reactivation coil BR by means of an external analogical signal 0… 10Vcc, from a regulator/humidity controller.

3ª) MEASUREMENT SIGNAL (M)
In order to act as a regulator/controller of the reactivation coil BR and possible pre or post cooling/heating coils (on demand), by means of 0… 10Vcc analogical signals from the humidity and temperature sensors.

MEASUREMENT AND SUPERVISION (SUP)

- Reactivation air temperature measured after the reactivation coil BR.
- On-screen diagram of the working of the components (motor-fans and gear motor).
- Supervision of the power supplied by the reactivation coil BR.
- Supervision of the measurement of the humidity sensor.
- Supervision of the setpoint for humidity and temperature.
- Supervision of the setpoint for the maximum humidity alarm.
- Rotor rotation.
- Minimum flow of the reactivation air.
- Supervision of the temperature of the SSR.
- Process air temperature measured after the pre or post (cooling or heating) coil (on demand).
- Supervision of the proportional opening of the valve of the pre or post (cooling or heating) coil (on demand).
- Pressure switches in filters (on demand).
SECURITY AND ALARMS

- Timing of the disconnection of the motor-fan of the wet air and the dragging gear motor for cooling the equipment.
- Stoppage of the BR heater because of excessive temperature in the reactivation.
- Alarm and stoppage of the unit because of a lack of air in reactivation.
- Alarm and stoppage of the unit because of a lack of rotation in the desiccant rotor.
- Alarm and stoppage of the unit because any of the thermal switches of the motors are set off.
- Alarm and stoppage of the unit because any of the electrical protections of the heaters are set off.
- Alarm and stoppage of the BR heater because the maximum temperature of the SSR is continuously exceeded.
- Alarm because process and reactivation filters are blocked (on demand).
- Alarm because the maximum deviation for the humidity setpoint is exceeded.
- Alarm and stoppage of the heater because of an electro-mechanical fault in the contacts of the BR or excess temperature in reactivation.

ADJUSTMENTS (ADJ)

1) Adjusting the power supplied by each stage when configuration by stages is selected (S).
2) Adjusting the humidity setpoint when configuration by measurement signal is selected (M).
3) Adjusting the maximum deviation of the humidity alarm when configuration by measurement signal is selected (M).
4) Adjusting the setpoint of the temperature of the range of pre/post cooling coils (BF1 and/or BF2) or pre/post heating coils (BC1 and/or BC2) (on demand).
Types of installation

Closed system
Recirculated air 100%

Open system
Exterior air 100%

Mixed system
Mixture exterior / recirculated air
Mixed system
Dehumidifier in air-handling unit
return by-pass

Mixed system
Dehumidifier in air-handling unit
exterior air intake

Leyenda:

- Dehumidifier
- Process air
- Exterior process air
- Return process air
- Dry air
- Reactivation air
- Wet air
- Regulation dampers
- Interior installation
- Exterior installation
- Extractor
- Air-handling unit
Typical applications

**MANUFACTURING PROCESSES**
Pharmaceutical industry, polymer plastics, textiles, chemicals...

**PRODUCT DRYING**
Cured meats, cheeses, sweets, chocolate, powdered foods, photographic paper...
COLD WAREHOUSES AND CHAMBERS
Slippery floors, defrosting, electrical faults, high consumption levels…

CONSERVATION
Dry warehouses, paper and wood, covered swimming pools, works of art, granular materials…

PREVENTING CORROSION
Automotive industry, shipbuilding, electricity plants, weaponry, electronic materials…
**Graphs of capacities (*)**

Technical data subject to change without prior notification
**Fixed parameters:**
- Process/Reactivation Air Temperature: 20 ºC
- ΔT Coil according to Nominal Power
- Absolute Humidity of the Reactivation Air same as Process Air

(*) For other operating conditions, request the corresponding capacity
Graphs of capacities (*)

Absolute Humidity of Dry Air (Xs)
Dry Air Temperature (Ts)
Absolute Humidity of Process Air (Xe)

Technical data subject to change without prior notification
Fixed parameters:
- Process/Reactivation Air Temperature: 20 °C
- ΔT Coil according to Nominal Power
- Absolute Humidity of the Reactivation Air same as Process Air

(*) For other operating conditions, request the corresponding capacity