Deltech

Filter- und Trocknertechnik GmbH
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Synergy results in economic

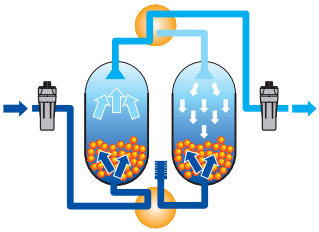
Compressed air for highest requirements

Certain production processes such as instrument air, air for pneumatic control systems and process engineering solutions, feed air for the transport of powdery materials in the chemical, pharmaceutical and food processing industries etc. require dependably treated, high-quality compressed air – technically oil-free and very dry – with pressure dew points of under 0°C down to -40°C.

If the compressed air is channeled through extensive pipe networks or in areas exposed to ambient weather conditions, disturbances due to frozen condensate are – especially in winter time – the order of the day.

Until now the economical treatment of a dew point under 0°C was only achievable by using desiccant dryers. For capacities over 1000m3/h mostly heated regenerative desiccant dryers (blower purge dryers) were used, which, in comparison to heatless regenerative desiccant dryers, are more cost-effective.

The principle of the desiccant dryer



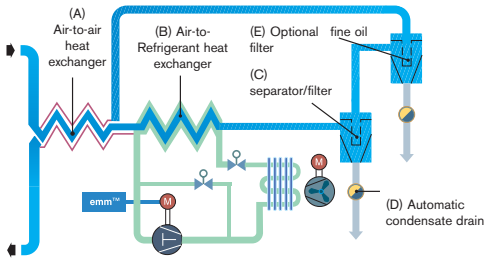
Desiccant dryers are being used, when the compressed air system is exposed to temperatures below the freezing point or when a particularly low dew point is required for a specific applications.

The air is channeled through a vessel filled with an adsorption media (activated Alumina), where the water vapor is being captured at the surface of the adsorbent.

These drying agents can be regenerated and used again and again. The dryers have two desiccant vessels.

The compressed air supply is being controlled, so that only one vessel dries, whereas the other vessel is being regenerated. Heated regenerative desiccant dryers (blower purge dryers) are being regenerated using a blower and mostly an electric operated heater.

Ways to compressed air treatment

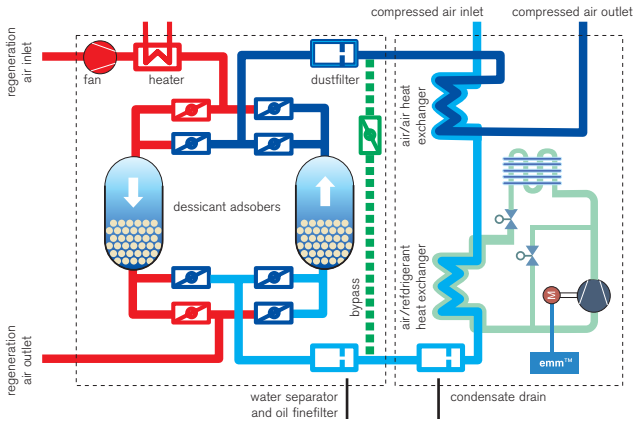


The principle of the refrigerated compressed air dryer

They are used in areas, where the compressed air network is exposed only to temperatures above the freezing point.

Warm, saturated compressed air is firstly being cooled down via an Air-to-Air heatexchanger (A) and than further cooled down in an Air-to Refrigerant heatexchanger (B), which is being controlled by a expansion valve. The water vapor condenses into liquid and is than separated from the compressed air stream in the cyclone/demister separator/filter (C) and discharged by the fully automatic condensate drain (D).

The cool, dry air is now being used to cool the warm incoming compressed air by means of the Air-to-Air heat exchanger (A).



The HybriDryer unites all advantages

The DELTECH Hybridryer is a combination of a refrigeration dryer and a heated regenerative desiccant dryer. The saturated compressed air first enters the refrigeration dryer, it is cooled down to +3°C and the water vapor is condensed. The condensate is then separated from the compressed air flow in the separator filter.

After that the air leaves the refrigeration dryer circulation. The absolute temperature and the dew point are still at +3°C and the relative humidity is 100%! - the ideal condition of the adsorbent is achieved!

The compressed air is then introduced into the desiccant dryer, where it is dried to dew points of -25°C to - 40°C.

The still cold compressed air is then supplied to the integrated air-to-air heat exchanger and thus cools the inflowing compressed air.

An ambient air temperature controlled bypass in the combination makes it possible to bypass the desiccant dryer during the summer period and only use it in the winter time, as required. Thus the slightly higher investment costs justify themselves even more clearly by the considerably lower operating expenses.

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cal advantage: the DELTECH HybriDryer Series

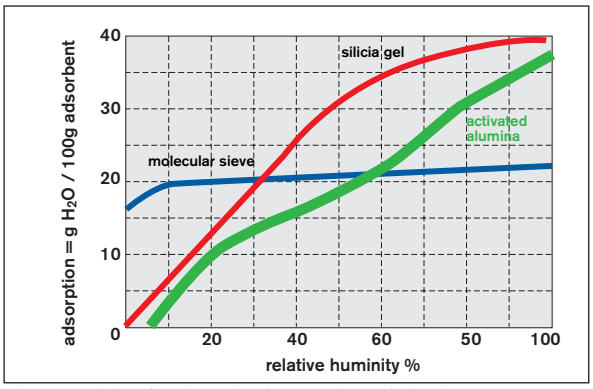
All the advantages of the HybriDryer at a glance

Flexible

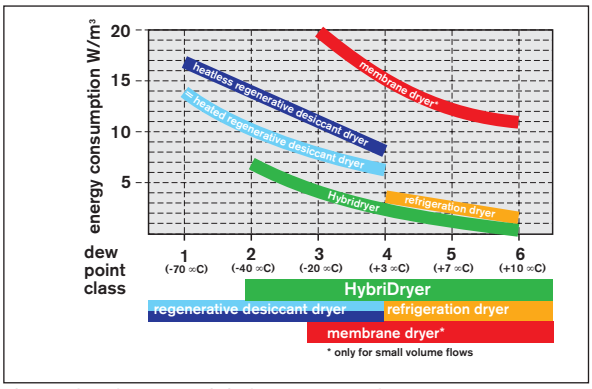
Environmentally friendly

Economical

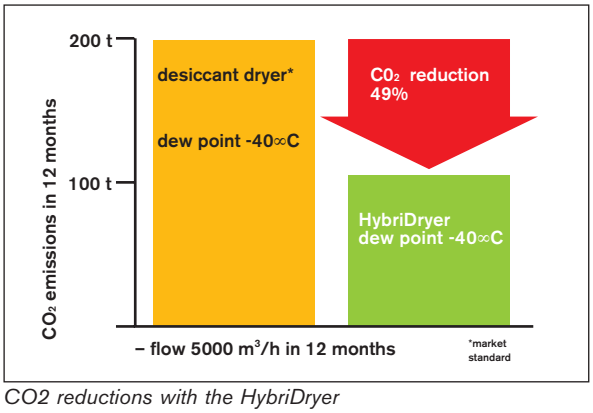
- Low operating expenses in comparison with heated regenerative desiccant dryers
- Selectable summer/winter operation (+3°C / -25°C / -40°C)
- Constant pressure dew point
- No temperature or dew point peaks during switch over
- No loss of compressed air
- Efficient finest oil filtration at the coolest point
- Extended lifetime of the absorbent through extremely low regeneration temperatures
- Optimal outlet temperatures
- Volume flows of 1200 to 9000 m3/h (higher capacities upon request)
- Lowest operating expenses



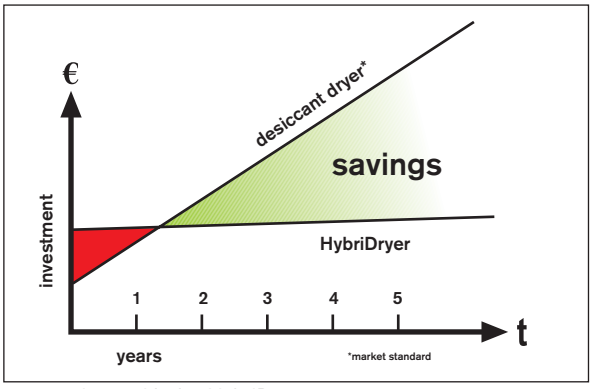
ideal condition for the adsorbent activated alumina



dew point classes and their energy requirements



CO2 reductions with the HybriDryer



cost savings with the HybriDryer

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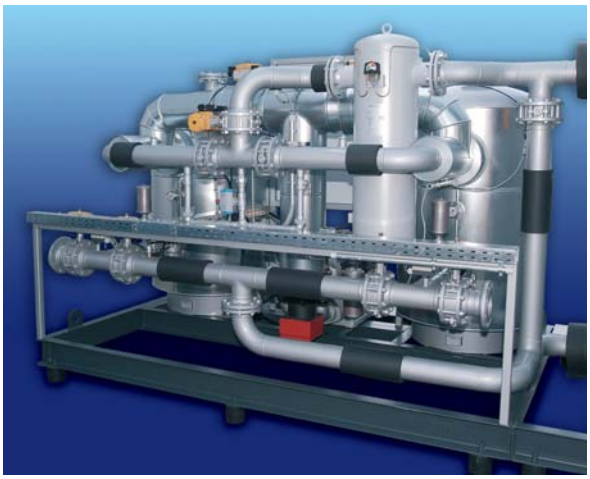

The desiccant dryer section displaying the bypass for "summer/winter" operation

The refrigeration dryer section of the HybriDryer with the refrigeration specifics

Technical Data

					operation +3°C	operation -40°C
DHD 400	1200	4300	2250	1550	3,1	5,7
DHD 500	1500	4300	2250	1550	4,3	7,5
DHD 670	2000	4600	2250	1900	6,7	10,8
DHD 835	2500	4600	2250	1900	7,5	12,4
DHD 1000	3000	4600	2250	1900	9,4	15,7
DHD 1335	4000	4600	2250	1900	11,5	19,4
DHD 1670	5000	5150	2600	3250	11,5	21,2
DHD 2000	6000	5150	2600	3200	13,8	25,4
DHD 2335	7000	5500	2600	3600	15,3	28,6
DHD 2670	8000	5500	2600	3600	17,7	32,7
DHD 3000	9000	5550	2600	3700	20,0	35,7

Volume flow acc. to VDI 2045 for suction conditions +20°C and 1 bar absolute, operating pressure 7 bar, compressed air inflow temperature +35°C, ambient temperature +25°C, power connection 400/3/50

Subject to technical alterations

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Deltech Hybridryer

Deltech introduces an innovative compressed air filter- and dryer system, which will reduce energy consumption by more than 50%. A perfect combination and integration of refrigerant- and adsorption-technologies offers highest efficiency. This unique system adapts automatically to changing demands in both compressed air and pressure dew point. The enormous potential in energy savings allows the replacement of existing adsorption dryers (both heatless- or heat- reactivated) with very short pay-back time.

Energy saving-CO2 reduction!
Modern technology!
Reliable Quality and Performance!

These are the key issues to which new industrial developments are measured. In compressed air systems where the quality demands of the application (ref. to ISO 8573-1class 1 to 7) often requires high investments and implementation of the wrong technologies will result in excessive operational- and service- costs. In order to meet required quality standards drying and filtration of compressed air are unavoidable. Only the right choice of equipment to this purpose will increase the efficiency and economical use of the compressed air installation.

Quality Class	Dust filtration µm	Oil filtration mg/m³	Pressure dew point °C	Water content gr/m³
1	0,1	0,01	-70	0,003
2	1	0,1	-40	0,12
3	5	1	-20	0,88
4	15	5	3	6
5	40	25	7	7,8
6	-	-	10	9,4
7	-	-		
Not specified			35	39

Compressed air quality according to ISO 8573-1

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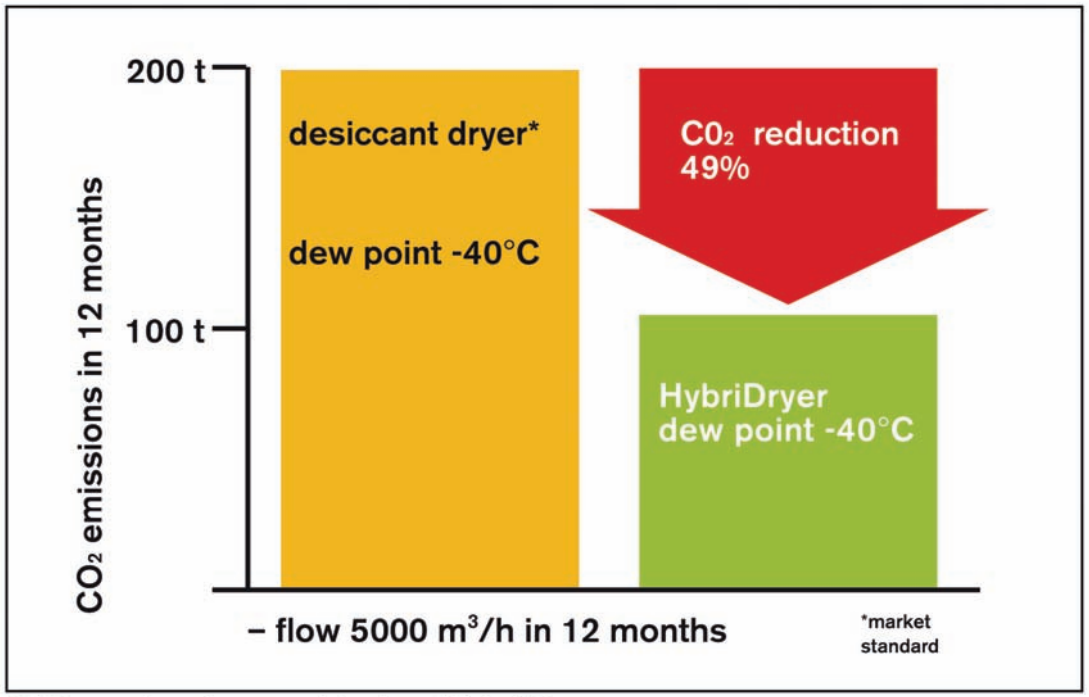
In many cases the selection of the right compressor from the right manufacturer is given much more attention than the selection of the required air treatment equipment. Unfortunately for many compressor vendors, the prime consideration is selling the compressor. The level of knowledge of filtration and drying often does not match the priority which should be given to this subject.

The energy consumption of the air treatment package can vary from 5% (Class 4 air quality) to 30% (Class 1 air quality), depending on the technology used. In view of the fact that compressor manufacturers compete with energy-saving arguments of far below 5% over their competitors, it is obvious that the “real” savings are to be made with the right selection of the air-treatment equipment.

Deltech has over 60 years of experience in developing filtration- and drying- systems for compressed air. With the newly developed Hybrid system, **Deltech** offers a package which suits most industrial applications, offering the highest possible economical use. Hybrid technology will offer an important contribution to today’s *desire* and *obligation* for energy savings and CO2 reduction.



CO_2 reductions with the HybriDryer

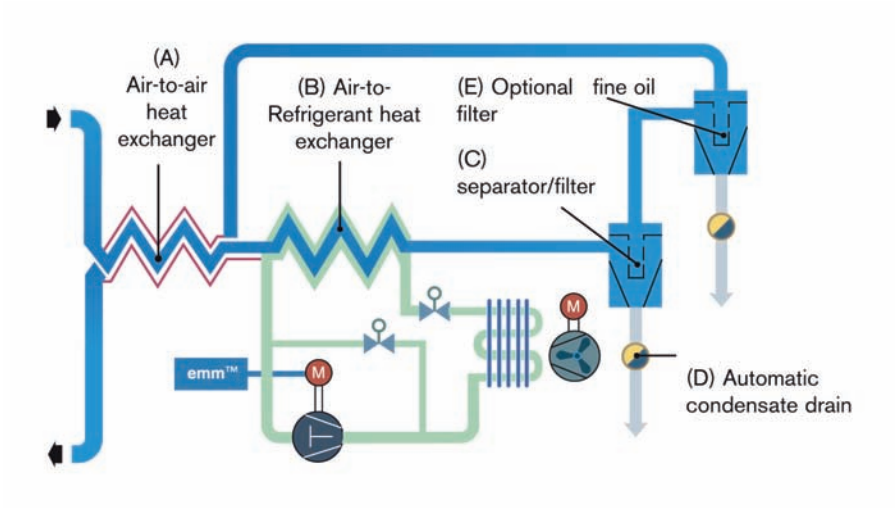
Basic requirement

Many industrial processes (e.g. instrument air, pneumatic cylinders and valves, conveying of powder or granular matter, or other chemical, pharmaceutical and food production processes) demand a relatively high compressed air quality, which means free from oil and particles and with a pressure dew point as low as -40°C.

In all compressed air installations condensation of remaining water vapour must be avoided. While under “summer conditions” a pressure dew point of +3°C can be sufficient, remaining water vapour might condense and freeze under “winter conditions”. Freezing condensate will cause costly problems to products, processes and equipment. Hybrid technology adapts to these requirements by offering the required pressure dew point (as low as -40°C) matching most process- and ambient- conditions.

Refrigeration dryers

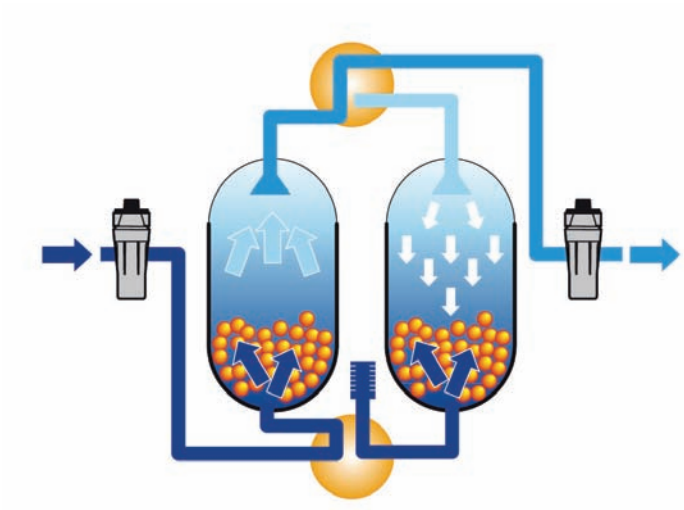
provide 3°C pressure dew point and use about 2% of the compressor power consumption. It is however not possible to use this pressure dew point under “winter conditions”.



Schema: Refrigeration dryer.

Adsorption dryers

So far pressure dew points below 0 °C could only be achieved by using standard adsorption technology, whereby the regeneration of the saturated adsorbents require about 15% of the compressor capacity (for heatless systems) or about 8% of the compressor power consumption (for heated systems). The energy saved by means of heated regeneration justifies the somewhat higher investment with a short pay-back time.



Schema: Adsorption dryer.

Combining technologies

A simple calculation shows the basic logic of combining a refrigerant system with an adsorbent system:

- Compressed air at 35°C (standard to ISO 7183) contains 39 gr. of water vapour.
- Compressed air at 3°C (standard to ISO 7183) contains 6 gr. of water vapour.
- Compressed air at -40°C (standard to ISO 7183) contains 0,12 gr. of water vapour.

Below an example for drying 2,500 m^3/h of compressed air at 7 bar (g) and 35˚C.

1. Drying to a pressure dew point of +3°C using a refrigeration dryer.
   The energy consumption of the dryer is approx. 5 kW.
   The reduction of water vapour content is 39 – 6 = 33 gr.
   The energy consumption per gram of water reduction is 5 : 33 = 0,15 kW/gr.

2. Drying to a pressure dew point of -40°C using a heat regenerated adsorption dryer.
   The energy consumption is approx. 20,6 kW.
   The reduction of water vapour content is 39 – 0,12 = 38,88 gr. Energy consumption per gram of water is 20,6 : 38,88 = 0,53 kW/gr., which is 3,5 times higher compared to refrigeration systems.

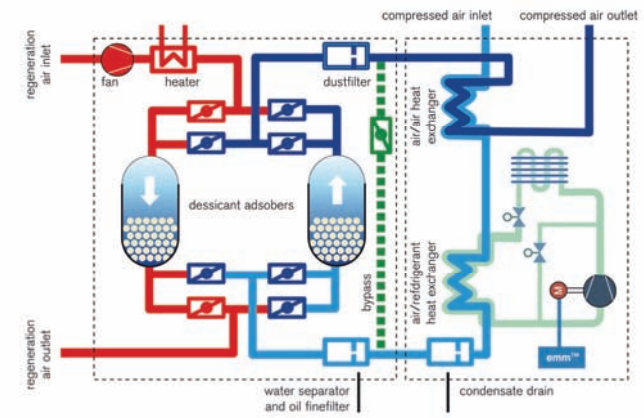
3. Using the combination of refrigeration dryer and an adsorption dryer will result in following energy consumption:
   Refrigeration dryer uses 5 kW. Remaining water vapour content is 6 grams.
   The adsorption dryer removes 5,88 grams and uses 5,88 x 0,53 kW = 3,1 kW.
   Total energy consumption of the combination is 5 kW + 3,1 kW = 8,1 kW.

Conclusion

Providing a pressure dewpoint of -40°C using only an adsorption dryer costs 20,6 kW.
Providing a pressure dewpoint of -40°C using the combination costs 8,1 kW.

The logic consequence would be a combination of the two drying systems, where pre-drying is done with a refrigeration dryer and the final pressure dew point of -40°C is reached with an adsorption dryer. This principle is not new and already in use in many applications.

The **Hybrid technology** is a further development of this principle, where both systems are integrated. As shown in the schema below, the refrigeration system supplies cold (+3°C) compressed air to the adsorption dryer. The adsorption process shows its highest efficiency when the compressed air is cold (+3°C) and fully saturated (R.H. is 100%). Since 85% of the water content has been removed by the refrigerant dryer, the adsorption dryer only needs to remove the remaining 15%, under ideal process conditions. This allows long adsorption times using an adsorption dryer of reduced size. After the adsorption process the cold dry air (-40°C pressure dew point) is led back to the air/air heat exchanger of the refrigerant dryer, where it is reheated to 27°C.



Schematic Hybridryer.

Before entering the adsorption dryer, the cold air flows through a high-efficiency demister/water separator and through a 0,01 micron oil fine-filter. At this low filtration temperature the efficiency of the oil fine-filter is about 10 times higher than at a filtration temperature of 20°C. Before entering back into the refrigeration dryer the air is cleaned from desiccant dust particles in a 1 micron dust filter.

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Energy Management

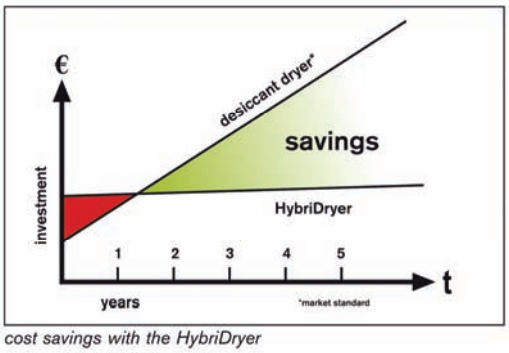
Further savings are automatically achieved whenever the operating conditions become more favourable. In case the air capacity or the inlet temperature is reduced, the energy management systems on both the refrigerant dryer and the adsorption dryer adapt their drying capacity immediately. For this purpose the refrigerant dryer is equipped with digital scroll technology, which controls the cooling capacity of the refrigerant system. The adsorption dryer is equipped with a dew point controller, which measures the saturation degree of the adsorbing material and starts the regeneration cycle as required.

Dew point Selection

Hybridryers offer the user the possibility of selecting his required pressure dew point. Under “winter conditions” the pressure dew point of the adsorption dryer can be selected from between -25 and -40°C.
A real Highlight of the Hybridryer is the selection of the “summer” mode.
The adsorption dryer can be bypassed so that the refrigeration dryer provides +3°C pressure dew point without using energy for the adsorption dryer. Operation of the bypass can also be done automatically by using an ambient temperature sensor (optional).

The following summary shows the extraordinary advantage of the Hybrid technology and the savings which can be achieved by the synergy of this combination:

- Lowest operating cost compared to standard adsorption dryers (heatless and heat regenerated)
- Winter/Summer selection mode offers significant saving potential.
- Constant and selectable pressure dew point.
- Efficient cooling of the regenerated adsorber by means of 1% cold compressed air, thus avoiding temperature- and dew point spikes at cycle changeover.
- Most efficient oil fine filtration by „Cold Coalescing“ filter.
- Extended desiccant life time due to low regeneration temperature (only 130°C) and very long adsorption time (min. 8 hours).
- Automatic energy reduction using Digital Scroll Technology and dew point-controlled adsorption time under low-load conditions.
- Compact skid-mounted design, saving floor space and allowing container packaging.
- The important savings in energy consumption measured against the relatively low investment cost enable a very short pay-back time for this state-of-the-art air treatment package.



cost savings with the HybriDryer

Schema: Energy savings versus investment cost.

Deltech designs and produces Hybrid packages in their production facilities in Moers/Germany. Hybrid dryers contribute to energy and CO2 reducing programs and are subsidized in many European countries. Please check your local authorities for support programs.

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