CDAS Clean Dry Air System
OFAS Oil Free Air System

COMPRESSED AIR TREATMENT
REDEFINED

White Paper

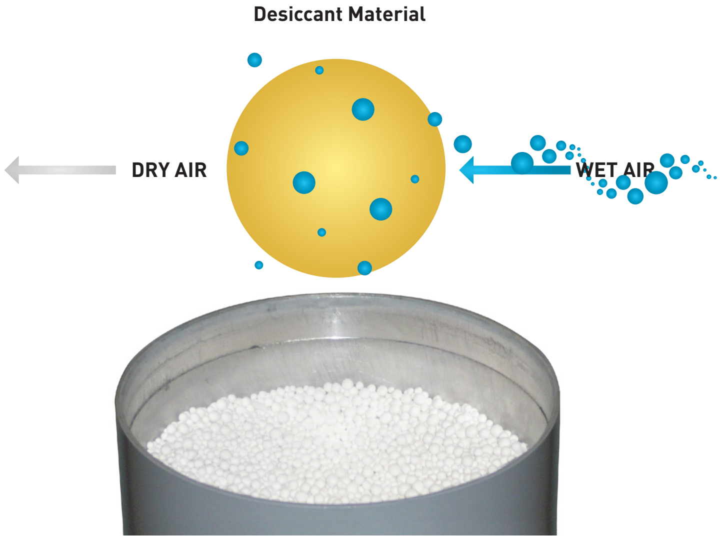
CDAS / OFAS Energy Saving Technologies

By Mark White - Applications Manager

Parker

ENGINEERING YOUR SUCCESS.

Adsorption Dryers

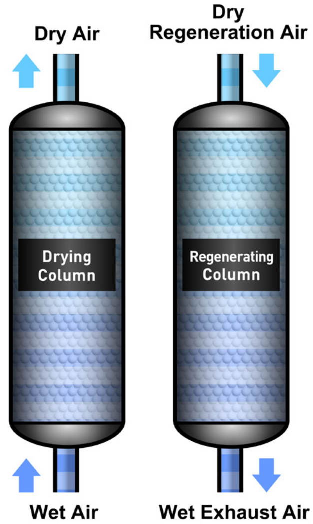


Adsorption dryers are commonly employed to dry compressed air when pressure dewpoint's below freezing and / or the control of micro-organism growth is required.

They use an adsorbent (desiccant) material to dry compressed air and the dryness of the compressed air (measured as a pressure dewpoint) is achieved through the contact between the air and the desiccant material. The longer the contact time, the drier the air becomes.

Principles of Operation

As the desiccant material has a finite ability to adsorb water vapour, an adsorption dryer will typically utilise two adsorbent beds to ensure the desiccant is not saturated and dewpoint is maintained. At any time, one of the adsorbent beds will be "on-line", drying the process air whilst the other is "off-line", being regenerated and readied for use. At a pre-set time, the dryer control system will "change over" i.e. it will divert the process air from one adsorbent bed to the other.



Sizing Adsorption Dryers

To ensure the required dewpoint (dryness) is achieved, adsorption dryers must sized to match a specific set of inlet parameters and then deliver the selected dewpoint at these conditions.

The three important parameters used for dryer selection are:

- Maximum flow rate
- Minimum Inlet pressure
- Maximum Inlet Temperature (In summer. Not at time of selection)

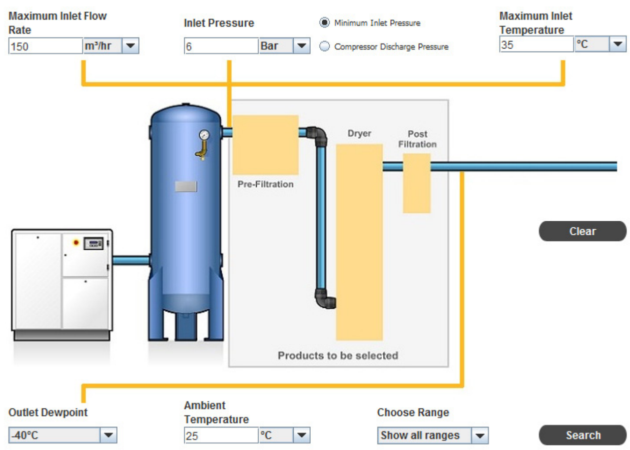
These are worst case conditions and at these conditions, the dryer will see the maximum amount of water vapour.

When sized correctly and operated at these conditions, the adsorption bed will be fully used at the time of changeover (i.e. it cannot adsorb any more water vapour without affecting the outlet dewpoint).

Max Inlet Flow

Min Inlet Pressure

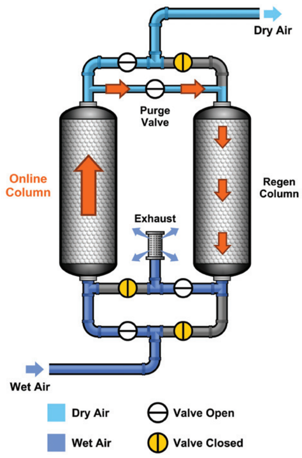
Max Inlet Temperature



Heatless Dryer Operation

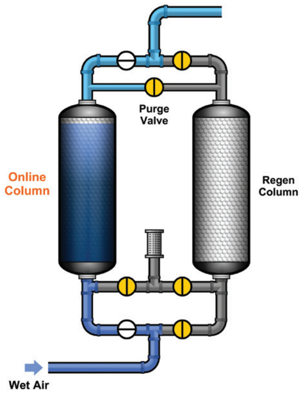
CDAS / OFAS dryers are heatless adsorption dryers, i.e. the regeneration cycle (purge cycle) uses clean, dry purge air to ensure that moisture is fully removed from the off-line desiccant bed prior to re-pressurisation and being brought back on-line.

As there is a cost to generate compressed air, the energy consumed by the CDAS / OFAS dryer comes from the regeneration air (purge air) it uses to regenerate the off-line desiccant bed.



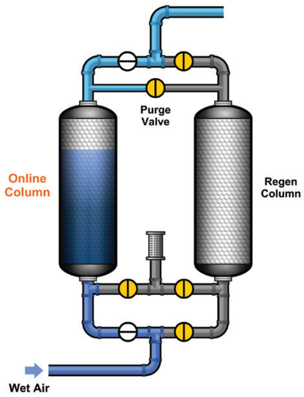
Consuming Energy

As dryers must be sized for the worst possible moisture loading (i.e. operating at full flow in summer at minimum operating pressure), the energy consumed by the dryer is therefore based upon the assumption that the desiccant bed requiring regeneration has been fully utilised at the time of change over.



Real World Operation

In operation, due to the constant changes in compressed air usage, inlet temperature and inlet pressure, the CDAS / OFAS dryer is rarely operating to 100% of its capacity 100% of the time (for example temperature differences from day to night time, summer to winter and varying shift patterns).



Wasting Energy

Whenever the parameters are not at the 100% full load conditions, there will be drying capacity left remaining in the adsorption bed at changeover. This is because less water vapour has entered the dryer than it was sized for.

Typically, energy management systems are expensive options and are not fitted to dryers as standard. Without energy management, the dryer will automatically change over at the end of its regeneration cycle and it will use the same amount of regeneration air (purge air) as it would need for a fully used bed.

This is wasteful as compressed air costs money to generate and it also uses up duty hours on the compressor.

Unique in its class

Unlike other dryers of its size, each CDAS or OFAS dryer is fitted with an energy management system as standard.

Called EST – Energy Saving Technology, the system uses a propriety dewpoint sensor to constantly monitor the condition of the outlet air and control the regeneration cycle.

EST Operation

At the point of changeover, the off-line column will be fully pressurised and ready to start drying the process air.

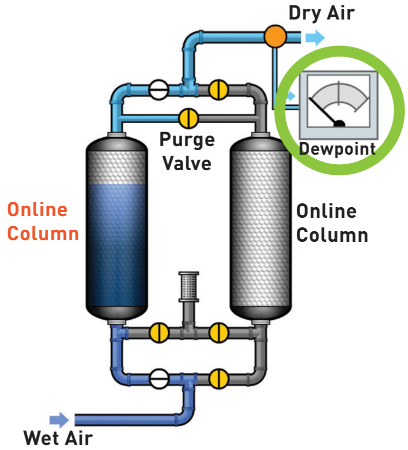
At this point the EST - energy saving technology will check the dewpoint of the outlet air and if necessary, override the standard control cycle.

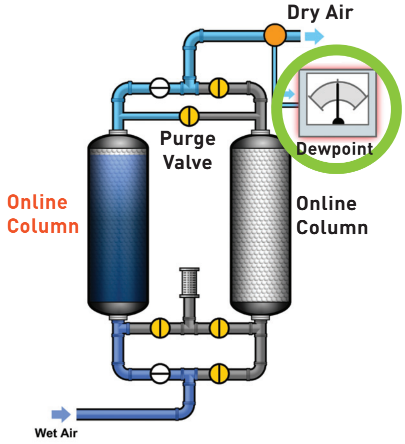
If the outlet compressed air is drier than the required dewpoint, the control system knows that there is drying capacity remaining in the on-line bed.

Unlike a fixed cycle dryer, instead of changing over, the dryer continues to dry using the same column, whilst the regenerated column waits to be called upon.

During this extension of the drying cycle, no purge air is consumed, saving air, energy and compressor duty hours.

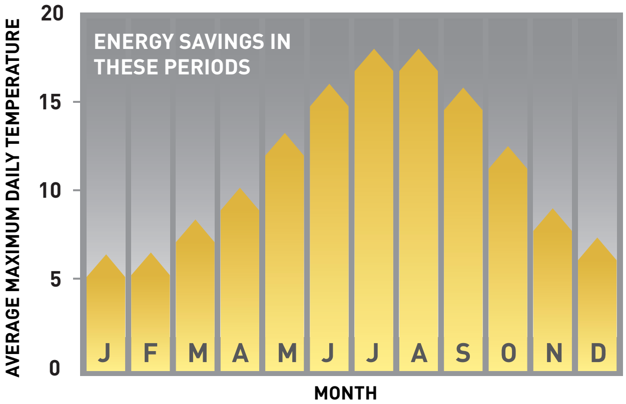
The EST - Energy Saving Technology continues to monitor the outlet dewpoint and only at the point when the dryer bed is fully used will the dryer columns change over.





Proportional Energy Usage

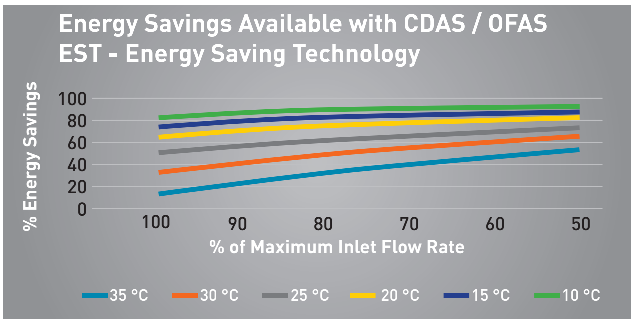
The CDAS / OFAS EST - Energy Saving Technology ensures the energy consumed by the dryer is proportional to the amount of water vapour present and not the dryers maximum rated capacity.



Example of % energy savings available with EST

The following example highlights the percentage energy savings available with EST Energy Saving Technology in operation.

	% Saving					
% Flow	35 °C	30 °C	25 °C	20 °C	15 °C	10 °C
100	14 %	35 %	52 %	65 %	74 %	81 %
90	23 %	42 %	57 %	68 %	77 %	83 %
80	31 %	48 %	62 %	72 %	79 %	85 %
70	40 %	55 %	66 %	75 %	82 %	87 %
60	49 %	61 %	71 %	79 %	85 %	89 %
50	57 %	68 %	76 %	82 %	87 %	91 %



Example based upon a CDAS HL 075 / OFAS HL 075 Purification System and referenced to a 3 Minute Standard Cycle.
Energy savings are applicable to all CDAS / OFAS models.

Sizing Conditions : Min System pressure: 6.5 bar g / Max Inlet Temp: 35°C / Max System flow: 180 m^3/hr
Average Conditions : Inlet pressure: 7.5 bar g / Average Temp: 10°C - 35°C / Average Flow: 50% - 100%

EST provides financial savings proportional to climatic conditions

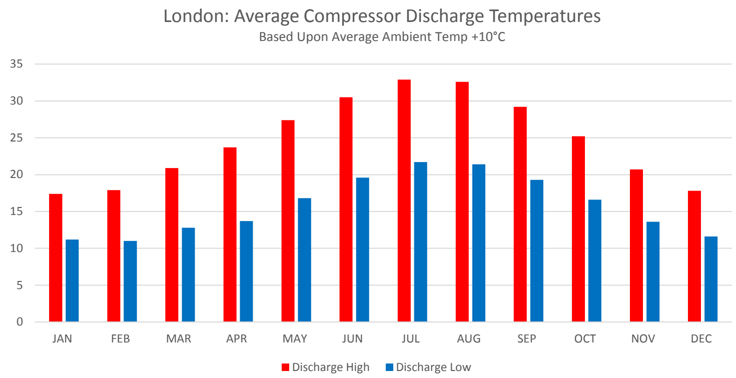
The following example highlights the potential financial savings from enviormental changes whilst operating at full flow and constant system pressure.

Savings based upon:

Facility Operating a 2 Shift System, each operating for 8 Hours (16 hours per day) / 5 Days per week / 4 weeks per month Total hours 3840 per year Dryer Model: CDAS HL 075 or OFAS HL 075

Max Inlet Flow Rate - Fixed flow of 160m3/hr Minimum Inlet Pressure - Fixed Pressure of 7 bar g Inlet Temperature: 1 Shift operating at highest average inlet temperature and 1 Shift operating at lowest average inlet temperature Cost per kWh: £0.10

Important Note: This example highlights savings associated only with inlet temperature variation. EST savings will increase as inlet flow rate and pressure vary to meet system demand.



Average Max / Min compressor dischage temperatures for London were calculated based upon recorded weather data plus 10°C for after cooler discharge temperature.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
Running Cost without EST	£131	£131	£131	£131	£131	£131	£131	£131	£131	£131	£131	£131	£1.572
Estimated Saving with EST	£98	£97	£90	£85	£75	£62	£54	£55	£69	£79	£90	£96	£952
Estimated Running Cost with EST	£33	£34	£41	£46	£56	£69	£77	£76	£62	£52	£41	£35	£620
Average Saving Per Month with EST	75%	74%	69%	65%	58%	48%	41%	42%	53%	61%	69%	74%	61%

EST not only provides energy savings, it provides environmental savings too

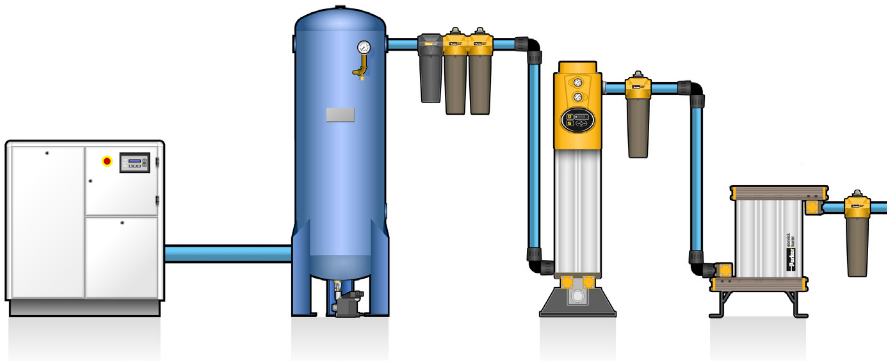
The following example highlights the potential energy savings (in kW) and environmental savings (in kg/CO2) over a 12 month period of operation.

Air Demand %	Energy Saving %	Energy Saving P/A KW	Environmental Saving P/A Kg / Co_2
100	35	12.218	6.598
90	42	14.662	7.917
80	48	16.756	9.048
70	55	19.200	10.368
60	61	21.295	11.499
50	68	23.738	12.819

Dryer Positioning

The preferred installation for any compressed air dryer is downstream of an air receiver as the air receiver not only stores compressed air, it actually reduces the temperature of the compressed air slightly and can help reduce "excessive peaks" in moisture loading should they inadvertently occur.

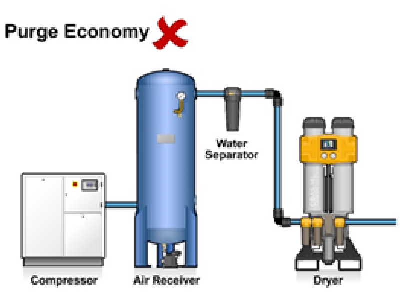
Installing downstream of the air receiver is not always possible or desired (for example some installations require a store of clean dry air) and CDAS / OFAS can also be installed prior to an air receiver.

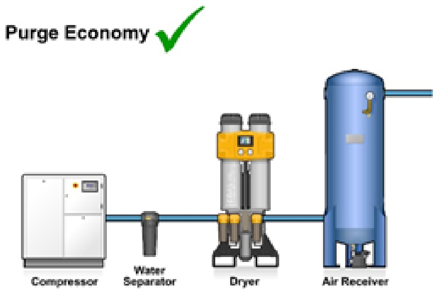


Additional Energy Savings

For installations where CDAS / OFAS is installed between the air compressor and the air reciever, an additional energy saving feature built into the controller can also be implemented.

Called Purge Economy, it is an energy saving feature for CDAS /OFAS heatless dryers where the dryer is placed directly after the compressor and before the air receiver

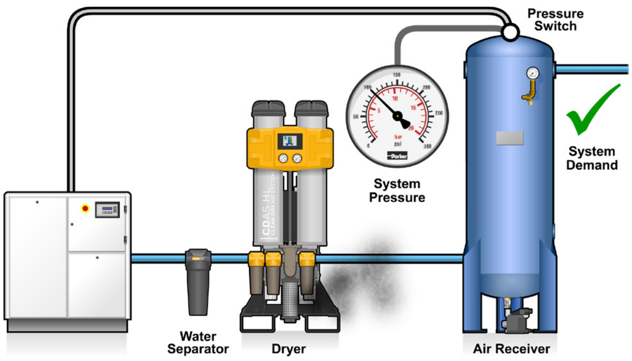




A Typical Installation

In a typical installation, the compressor will use a pressure switch connected to the air receiver to sense the system pressure.

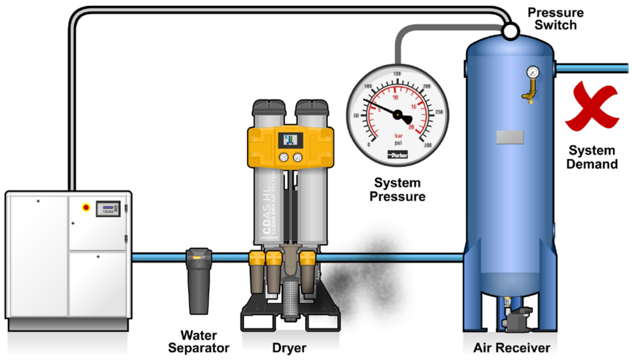
When system pressure is achieved, the compressor goes off load. If there is no system demand, i.e. evenings and weekends, in theory the compressor should remain off load, using no energy.



Air loss

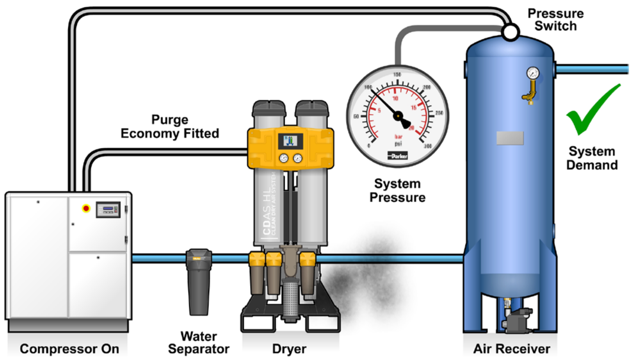
In this installation, even though there is no system demand and the compressor is off load, the dryer will continue to cycle, using purge air to regenerate the off-line column.

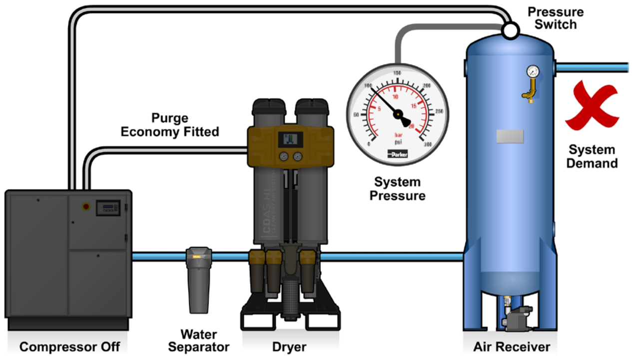
As the dryer purges the off-line column, it will slowly reduce the system pressure, eventually dropping to a point where the compressor will come back on-load to maintain pressure.



Purge Economy Operation

Purge economy is designed to stop the dryer regeneration cycle when the compressor goes off load. It uses a signal from the compressor to stop the dryer regeneration cycle and close the exhaust valve. This prevents unnecessary use of purge air, saving energy & money. Once the system pressure drops due to actual air demand, the compressor re-starts and the normal drying cycle will be resumed.





Built in Protection

In certain geographical locations, a dryer can be operated for extended periods with low amounts of water vapour in the inlet air (for example, some countries can have an ambient temperature up to +40 °C in summer and as low as -40 °C in winter).

As the dryer must be sized for summer conditions, during winter, months, the EST – Energy Saving Technology will save the user air, energy & money. However, due to the way a desiccant bed adsorbs water vapour, during winter months with low levels of water vapour in the incoming air, the saturation profile of the desiccant bed changes and a condition may occur where the bed becomes too saturated to be regenerated by the standard purge regeneration cycle.

Therefore the CDAS / OFAS EST – Energy Saving Technology also incorporates a safety feature to protect the desiccant material. The safety feature, called Moisture Override activates after 30 minutes, interrupting the energy management function and changing the drying columns over. This allows a full 2 ½ minute regeneration cycle of the desiccant material to take place before going back into energy saving mode. Now energy savings can be realised without causing damage to the desiccant bed.

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