### Efficient Refrigerated Compressed Air Dryer

###### Description

An air dryer is an essential component in a compressed air system that prevents condensate from being deposited in the compressed air supply lines of a facility. If the warm, saturated compressed air is supplied directly into the plant, excess condensate will form in the compressed air supply lines. Uncontrolled condensate can damage demand-side tools and process equipment. Secondly, in an oil-flooded rotary screw compressor, the residual oil from compression can be carried along the supply lines potentially damaging process equipment. Industries that use compressed air for processes make use of various types of dryers including refrigerated dryers (both cycling and non-cycling). For this measure, three types of refrigerated air dryers will be considered: thermal mass, variable speed and digital scroll. All of these technologies offer better part load performance compared to non-cycling refrigerated dryers, thereby offering energy savings during periods when the dryer is not operating at peak capacity.

This measure was developed to be applicable to the following program types: TOS.

If applied to other program types, the measure savings should be verified.

###### Definition of Efficient Equipment

###### A new, high efficiency thermal mass dryer, variable speed dryer, or digital scroll dryer.

###### Definition of Baseline Equipment

A standard non-cycling refrigerated compressed air dryer of comparable capacity.

###### Deemed Lifetime of Efficient Equipment

###### The measure life is 10 years[[1]](#footnote-1).

###### Deemed Measure Cost

The incremental capital cost for this measure is $6 per CFM.[[2]](#footnote-2)

###### Loadshape

Loadshape C35 – Industrial Process

###### Coincidence Factor

The coincidence factor equals 0.95

**Algorithm**

###### Calculation of Savings

###### Electric Energy Savings

ΔkWh*=* Ps x (EC50baseline - EC50efficient) x HOURS x CFM

Where:

Ps  = Full flow specific power of the dryer

= 0.007 kW/CFM[[3]](#footnote-3) (for both baseline and efficient equipment)

EC50baseline = Energy consumption ratio of baseline dryer at 50%[[4]](#footnote-4) inlet load capacity as compared to fully loaded operating conditions.[[5]](#footnote-5)

= 0.843

ECF50efficient = Energy consumption ratio of efficient dryer at 50% inlet load capacity as compared to fully loaded operating conditions.

= Dependent on efficient dryer type, refer to the following table[[6]](#footnote-6):

|  |  |
| --- | --- |
| **Dryer Type** | **EC50efficient** |
| Thermal-Mass | 0.729 |
| VSD | 0.501 |
| Digital Scroll | 0.551 |

HOURS = Compressed air system pressurized hours, depending on shift. If unknown, use weighted average. This value is the weighted average of facility owner responses from the DOE evaluation of the Compressed Air Challenge. Facility owners with compressed air systems were surveyed detailing the number of shifts their facilities operated.

|  |  |  |  |
| --- | --- | --- | --- |
| **Shift** | **Hours** | **Distribution of Facilities by Hours of Operation[[7]](#footnote-7)** | **Weighted Hours** |
| Single Shift  7 AM – 3 PM, weekdays, minus some holidays and scheduled down time | 1,976 | 16% | 316 |
| Two Shifts  7AM – 11 PM, weekdays, minus some holidays and scheduled down time | 3,952 | 23% | 909 |
| Three Shifts  24 hours per day, weekdays, minus some holidays and scheduled down time | 5,928 | 25% | 1,482 |
| Four Shifts or Continual Operation  24 hours per day, 7 days a week minus some holidays and scheduled down time | 8,320 | 36% | 2,995 |
|  |  | Total weighted average | 5,702 |

CFM = Cubic feet per minute, rate of airflow through the dryer.

= Assume 50% of actual rated capacity.

###### Summer Coincident Peak Demand Savings

ΔkW*=* ΔkWh / HOURS \* CF

Where:

CF = 0.95

###### Natural Gas Energy Savings

N/A

###### Water Impact Descriptions and Calculation

N/A

###### Deemed O&M Cost Adjustment Calculation

N/A

###### Measure Code: CI-CPA-CADR-V01-160601

1. State of Wisconsin Public Service Commission, Focus on Energy Evaluation, Business Programs: Measure Life Study, August 25, 2009. [↑](#footnote-ref-1)
2. Analysis of material cost between cycling and non-cycling dryers according to prices from Grainger. Cost provided is the average incremental cost when comparing non-cycling and cycling dryers of the same CFM capacity. <http://www.grainger.com/category/refrigerated-compressed-air-dryers/compressed-air-treatment/pneumatics/ecatalog/N-kk5?bc=y> [↑](#footnote-ref-2)
3. Compressed Air Challenge: Compressed Air Best Practice; “Cycling Air Dryers – Are Savings Significant?” Fox, Timothy J. and Marshall, Ron. http://www.compressedairchallenge.org/library/articles/2011-11-CABP.pdf [↑](#footnote-ref-3)
4. Engineering judgement, based on the assumption that on average, compressed air systems will operate at 50% capacity. [↑](#footnote-ref-4)
5. Compressed Air Challenge: Compressed Air Best Practice; “Cycling Air Dryers – Are Savings Significant?” Fox, Timothy J. and Marshall, Ron. http://www.compressedairchallenge.org/library/articles/2011-11-CABP.pdf [↑](#footnote-ref-5)
6. Compressed Air Challenge: Compressed Air Best Practice; “Cycling Air Dryers – Are Savings Significant?” Fox, Timothy J. and Marshall, Ron. http://www.compressedairchallenge.org/library/articles/2011-11-CABP.pdf [↑](#footnote-ref-6)
7. DOE evaluation of the Compressed Air Challenge, section 2.1.5 Facility Operating Schedules. [↑](#footnote-ref-7)