Economical drying by controlled-airflow air wipes

By Joe Snee, Huestis Industrial, Bristol, RI, USA

This paper will discuss the drying of extruded products by use of air wipes which operate on the principle of controlled air flow. These air wipes, which use compressed air, are compared to other types of drying apparatus with respect to energy costs and the savings to be derived.

It is essential that extruded products, such as wire and cable, be economically dried following emersion into cooling troughs. This also applies to other products such as plastic or medical tubing, rod and extruded profiles.

The removal of water and other cooling solutions is necessary to insure proper inspection, testing, printing, and packaging. It is equally essential to use the most cost effective drying system. This not only pertains to unit cost but also the energy cost neede to operate the system.

Through the years, many drying systems have been employed, from a rag or sponge to a variety of home-grown or commercially available compressed air wipes or centrifugal blowers.

While most of these have performed their function, consideration must be given to using the most energy efficient system available. Too often the operating cost of drying systems becomes part of the overhead, an expense that must be considered because the savings can be significant.

Rags, sponges and other non-mechanical dryers can easily be dismissed. Rapid saturation requires frequent changing which is not truly practical. Changing becomes mandatory since the media, once saturated, simply smears the fluid on the wire or cable surface rather than actually drying the product. It is easy to see how this approach will affect the quality of the product being produced.

A simple open pressurized air line, which is often used, may dry the product but it will consume an enormous amount of compressed air. In reality, this type of dryer should really be viewed as a large, controlled leak.

Centrifugal blowers, while seemingly effective, very often prove to be more costly, not only in the initial cost of the unit itself, but more importantly, in the energy cost to operate the unit. This additional cost will easily erode profit margins in a very short time.

Likewise, adjustable style air wipes are also inefficient. Because they must dry a wide range of products, the total air consumption can be quite high. Additionally, since a correlation can be drawn between air flow and noise, adjustable air wipes typically emit noise at high decibel (dB) levels. Controlled air flow air wipes typically emit noise below 80 dB.

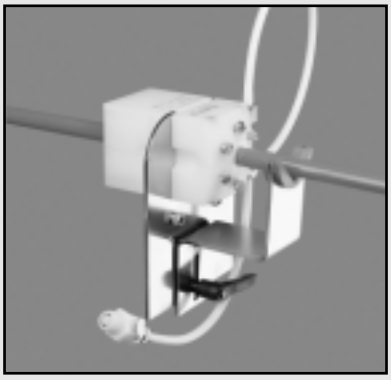

Figure 1.

What then is an acceptable solution to economic drying? One solution is a controlled air flow air wipe (Fig.1). Use of this type of product, which controls the air consumption to minimal levels, provides manufacturers with one of the most cost effective systems available.

Controlled air flow air wipes, are typically constructed of non-corrosive materials. The body, usually made of UHMW polyethylene, employs a manifold to distribute the air to a series of "jets". The orifice of the jets restricts the air flow to provide efficient drying at the lowest possible air consumption.

The air wipe works by creating turbulence around the product to remove the water from the surface. This turbulence is created by controlling the direction and flow of the compressed air. Additionally, a Venturi effect is created at the entrance of the air wipe thus increasing the air flow over the product being dried.

Various parameters have an effect on the drying. These include line speed, material size, the viscosity of the solution being removed, and the temperature of the product as it leaves the cooling trough.

Line speed is one of the most important aspects of drying. The amount of time available for a product to spend inside the air wipe greatly affects the end result. Obviously, the greater the line speed the more difficult it will be to dry. Some applications will require multiple units for a satisfactory result.

It is critical to size the air wipe properly in order to obtain maximum drying power yet still maintain the lowest possible air consumption. As seen in Table 1, the diameter of the product will dictate the size of the air wipe which is needed. Generally speaking, the diameter of the product is in the range of 50 - 90 % of the air wipe orifice size.

This will insure sufficient clearance to allow the air to circulate around the product. Too large or too small of a gap between the product and the air wipe chamber will not allow sufficient air flow to effectively remove the liquid.

The amount of compressed air needed for a controlled air flow air wipe, is significantly less than that of an adjustable air wipe. The cost is also significantly less than that for a centrifugal blower.

The majority of manufacturing facilities already use compressed air for a variety of reasons. The additional requirements of controlled air flow air wipes, in nearly all instances, do not require additional compressor capacity. Very often, a changeover to a controlled air flow air wipe has resulted in reducing the number of compressors on line.

To demonstrate the potential savings, consider .590" (15mm) dia. product and an air pressure of 80 PSI (5.6 bar).

The typical air consumption of an adjustable air wipe can approach 20 CFM (577 liters/min.) while the air consumption of a controlled air flow air wipe would be in the range of 3.9 to 5.7 CFM (112-164 liters/min.). Actual consumption would depend upon model.

Likewise, the air consumption of a 1/4" (6.4mm) open tube can reach a flow rate of over 85 CFM (2,400 l/min.)[2]

During the course of a continuous eight hour shift, the air consumption would be approximately 14,000 cubic feet (394,000 liters) for the adjustable design and only 2,730 cubic feet (80,000 liters) for the controlled air flow design. The savings over an open tube are even more dramatic.

Air consumption can be reduced by nearly 90%, which viewed another way, represents a savings sufficient to run controlled air flow, air wipes on an additional 7-8 production lines for the same cost as one adjustable design.

Based upon the above comparisons, it can be concluded that controlled air flow air wipes will provide more efficient and more economical drying than rags, open tubes and adjustable style air wipes.

A cost comparison of controlled air flow air wipes and centrifugal blowers is not a comparison of air consumption, but rather of the electrical consumption needed to produce the end result.

Controlled air flow air wipes require only fractional horsepower to generate the air flow needed for successful drying. This requirement is so small that the demand on existing systems is negligible. At the same time, a centrifugal blower requires much more horsepower to function and, over time, will consume a great deal more electricity.

Opening Size	Max Wire Size	Min Wire Size
.125" MWO125*	.093" (2.4 mm)	N/A
.187" (4.8 mm)	.125" (3.2 mm)	.093" (2.4 mm)
.250" (6.4 mm)	.187" (4.8 mm)	.125" (3.2 mm)
.375" (9.5 mm)	.312" (7.9 mm)	.187" (4.8 mm)
.500" (12.7 mm)	.437" (11.1 mm)	.312" (7.9 mm)
.625" (15.9 mm)	.562" (14.3 mm)	.437" (11.1 mm)
.750" (19.1 mm)	.687" (17.5 mm)	.562" (14.3 mm)
1.00" (25.4 mm)	.937" (23.8 mm)	.687" (17.5 mm)
1.25" (31.8 mm)	1.187" (30.2 mm)	.937" (23.8 mm)
1.50" (38.1 mm)	1.375" (34.9 mm)	1.187" (30.2 mm)
2.00" (50.8 mm)	1.875" (47.6 mm)	1.375" (34.9 mm)
2.50" (63.5 mm)	2.375" (60.3 mm)	1.875" (47.6 mm)
3.00" (76.2 mm)	2.75" (69.9 mm)	2.375" (60.3 mm)
3.50" (88.9 mm)	3.25" (82.6 mm)	2.75" (69.9 mm)
4.00" (101.6 mm)	3.75" (95.3 mm)	3.25" (82.6 mm)

General Sizing Guide
Sizes are recommendations only. Specific applications may require less or greater clearance for proper drying.

Table 1.

A typical centrifugal blower employs 7.5 horsepower which is totally dedicated to the purpose of drying one production line. The electrical power needed to operate such a system over the course of a year (24 hours/day, 6 days/week) is approximately 41,900 KwH.

By contrast, a controlled air flow, air wipe, utilizing a two-stage compressor, will require only .84 horsepower to generate the required volume of air.

Cost Per KwH	Annual Blower Cost	Cost For Controlled Air Flow	Annual Cost Savings
$0.05	$2,095.00	$235.00	$1,860.00
$0.08	$3,352.00	$376.00	$2,976.00
$0.10	$4,190.00	$470.00	$3,720.00

Table 2.

This is based upon a pressure of 80 PSI (5.6 bar). The electrical power needed for this system, for the same production cycle, is approximately 4,700 KwH, a savings of 89%[3].

By applying these consumption calculations to typical power costs, the savings to be realized can be seen in Table 2.These savings may seem small on an individual extrusion line, however, when multiplied by the large number of lines a medium to large factory will typically have, the savings will be significant. Additionally, a controlled air flow air wipe is generally priced in the $500- $1,000 range while a typical centrifugal blower cost between $5,000 and $10,000.

Conclusion

By using controlled air flow air wipes, manufacturers are able to accomplish the task of drying with the most economical system which is currently available in the marketplace. Cost savings are significant, immediate and ongoing.

References

1. Published literature.
2. Ingersoll-Rand compressed air tables.
3. Womack's Fluid Power Data Book.

Joseph F. Snee has been Product Manager/ Industrial Products for Huestis Industrial, Bristol, RI, USA since joining the company in 1992. He is responsible for the marketing and sales of Huestis products for the wire and cable industries. He holds a degree in management from Bryant College. He is a member of the Wire Association International and also of the New England Chapter where he is treasurer. He is also a member of the New England Wire & Cable Club and is a New England District Export Council member