DRYING OF WATER-BASE INKS & COATINGS IS SPEEDED BY ELECTRIC INFRARED

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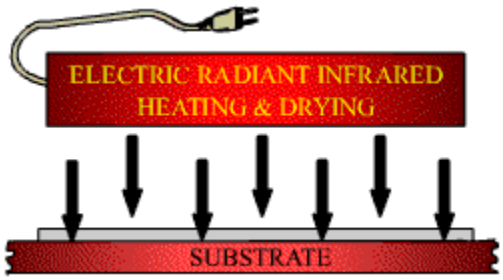

Today's manufacturing and converting processes have become complex, calling for automation and increased production. The use of computer controls and state-of-the-art technology is becoming more evident. In the meantime, the cost of energy, industry's biggest necessity, has become more expensive, especially for heating and drying. Industry has, therefore, demanded that equipment manufacturers provide better and more efficient heating systems.

These demands have resulted in the use of new technology by some of the suppliers of infrared dryers. IR (infrared) heating has opened many opportunities for converters of paper, paperboard, film and foils. Getting the proper heat source to the right place at the right time can be tricky in some processes. IR heaters can provide simple solutions for compact, low-cost, energy-efficient drying systems that can usually fit onto existing production equipment.

WATER is the CULPRIT

When many manufacturers of folding cartons and converters of flexible packaging changed from solvent to water-base inks and coatings, they found that they were no

longer able to maintain quality or high production speeds. The reason was that water-base materials require more energy to heat than was capable of being generated by conventional hot air dryers. Some converters decided to try infrared. Some of the reasons why these converters chose electric infrared dying equipment are:

Faster production: By adding IR heating units to off-line or existing in-line printers or coaters, the drying time can be decreased significantly. This means higher line speeds and increased production can be realized, especially since water-base products can be dried in a fraction of a second, rather than several seconds required with hot air.

Less energy consumed: Infrared is transmitted directly from heater elements to the printed or coated surface. At full operating power, as much as 86% of the electrical energy is converted to usable radiant heat. IR energy is quickly and efficiently absorbed by the coating thus raising the coating temperatures, causing the volatiles to be driven out by evaporation.

Volatiles or vapors must then be removed from the product surface by adequate air movement and exhausted from the area. Air handling equipment required for IR drying systems is usually a fraction of the size required by conventional hot air dryers. The overall use of energy can be reduced by 75% or more, depending upon the application. IR dryers producing 230,000 BTU/hr replaced a 1,000,000 BTU/hr gas fired hot air drying system.

SPEED DRYING

Less space required: By heating the coated surface directly with radiant infrared energy, the product can be heated in far less time then if heated by hot air, which requires a double transfer of energy in transmitting the heat through a long duct system. Since the hot air dryer uses a high velocity blower to push the heat from the heat source, i.e., burner box of electric heater coils, more than two thirds of the heat is lost in the duct-work before it reaches the product.
Typically, an infrared oven or dryer can be a fourth to a sixth of the size of a hot air system. Several IR dryer manu- facturers build modular units that can be put into small spaces. It should be noted that even though compact modular dryers can be added to most printing or coating equipment, the drying speed is determined by the amount of energy that the product can absorb at a given speed. This is called “dwell time”.

By adding IR heating units, drying time can be decreased significantly

Fast heatup: Low mass heating elements, such as tungsten T3 lamps, foil ribbon heaters or quartz heater tubes, can produce uniform heating in as little as five to 30 seconds, enabling faster start up. Additional savings are realized when the

machine is stopped, since there is no need to keep the heaters running until the line starts up again, at which time heat up occurs within a few seconds.

Maintenance: IR dryers for converting and other industrial applications have proven to be cost effective, not only for increased production but also in maintenance-free operation. Occasional heater replacement may be required, but this can usually be done in a few minutes, depending upon dryer design.
Many infrared heaters currently available have ratings of between 5,000 to 10,000 hours of life at full power. Heaters operated at reduced power output through a solid state power of a thermocouple feedback temperature controller will have extended element life. Replacement of heater elements requires very little or almost no maintenance skills.

Typically, IR drying units cost less than conventional hot air or steam drying systems

Power source: Most infrared drying and heating systems used today in the printing and converting industries use efficient, clean electric power which is readily available. Electrical costs in some areas f the United States may be higher per kilowatt hour than gas, but because of the efficiency of direct radian IR heating, in all probability the cost for drying and curing can still be much lower.
Electric infrared also offers better control of process temperatures that can be duplicated again and again with temperatures maintained to within one or two degrees of set point. More importantly, since electric radiant heat is produced by electromagnetic energy causing the tungsten or nichrome filaments to heat up, no hazardous vapors of pollutants are dumped into the atmosphere.

Equipment cost and safety: Typically, IR drying units cost less than conventional hot air or steam drying systems – sometimes nearly three to four times less. One reason is that they are a lot smaller and usually easier to install, requiring less structural, piping and duct work. In many cases, little or no modification is needed on existing machinery and usually they require less floor space, which can be costly at today's prices for commercial real estate.

Industry has demanded that equipment suppliers provide better & more efficient heating systems

Since radiant infrared heat does not produce toxic fumes or radiation, such as x-rays or ultraviolet rays, special shielding or pollution controls are not required.
as with most machinery, there are always some safety precautions that must be taken, such as heater guards and interlocks. The operator also has responsibility for his or her own safety around heating equipment, the same as one would be careful when working or cooking around a stove or oven in the home. Common sense should be used.

Drying water-base inks and coatings on narrow web label presses can be a problem, mainly due to lack of space

TYPICAL APPLICATIONS

Folding cartons: Installation of several infrared dryers between colors and after the final print unit, similar to the installation shown in **Figure 1**, has increased production by 100% on an in-line flexographic folding carton press. The press now has the capability of printing several colors with waterbase inks and applying a waterbase coating over the inks at over 400 fpm.

Application of the waterbase over-coating was not possible with previous hot air dryers due to the fact that the inks were not thoroughly dried; therefore re-wetting occurred. Compact modular IR dryers mounted after the last print unit to insure drying of the coatings.

Flexible Packaging: Infrared drying modules were installed after each color on a stack-type flexo press with limited space and the overhead hot-air dryer as retrofitted with radiant heaters. After the presses was fitted with infrared, the converters claimed increases of 50 to 100% when running both conventional and water-base inks on paper, polyethylene films and foil substrates at speeds up to 500+ fpm.

Wide Web: Infrared dryers can be adapted to web applications over 120 inches wide. The flexographic press was designed to print on poly laminated substrates used for large multiwall bags, lumber and steel wrappers, and moisture barrier materials used in the building industry. The flexo printer with modular infrared dryer was installed in line after film extrusion and laminating equipment for printing with water-base inks on polyethylene at 300 fpm.

Drying speed is determined by the amount of energy that the product can absorb at a given speed

Narrow Web: Drying water-base inks and coatings on narrow web label presses can be somewhat of a problem, mainly due to the lack of space for adequate drying systems. In many cases space problems can be overcome by providing ultra-compact IR heaters for inter-station use, along with a larger unit mounted after the final print unit. Because of the limited size, the inter-station units are designed to partially set the inks to prevent picking prior to final drying. It is possible to build modular IR dryers as narrow as seven inches with nearly 9,000 BTU/hr capable of drying water-base inks at 300 to 500 fpm, depending upon ink coverage.

Coating and Laminating: Recent conversion to infrared ovens mounted on the overhead structure of a coater/laminator has increased laminator speeds from 4600 to 10,000 yards per hour. Prior to installing the two 5-foot long, 70 inch wide IR ovens, laminating foils to paper with cold water-base adhesives required several shifts to meet user demands and rejection rates were quite high. The same ovens are also used to dry various water-base primers and wash coats on the films and foils.

Environmentally Friendly Infrared Drying – "We Are Not Just Full Of Hot Air"

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