Avoiding Ink Transfer on Wound Cable and Tubing

Videojet Application Note

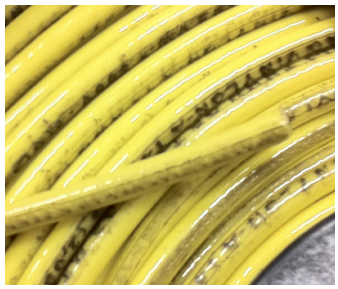
The Challenge

If printed codes are not fully dried, cured and fixed to the surface of wire insulation or cable jacketing, ink can transfer onto adjacent areas when the product is wound onto spools. These "ghost images" degrade the perceived quality of the product but are often entirely preventable.

What Causes Ink Transfer?

Four factors are at work in causing ink transfer and contributing to its severity:

Hot temperatures. Even after being cooled in a water bath, the temperature of cable and other extruded products wound onto spools is often 40°C (104°F) or more. This prolonged heat and pressure can cause many inks to transfer.

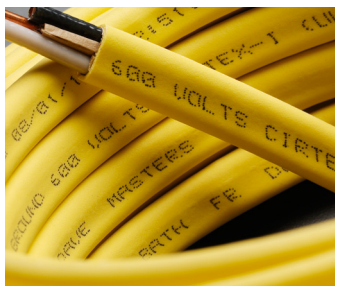


Example of ink transfer

Plasticizers. Chemical additives called plasticizers are often used to enhance properties of the jacketing material including the flexibility and durability of the final product. Plasticizers can also be aggressive ink solvents and inhibit coding especially before excess plasticizers have had time to evaporate or be otherwise removed. Some manufacturers wind product onto large spools that are allowed to fully cool, then perform coding when the wire or cable is unwound and then rewound onto smaller spools for distribution to market. Even in this scenario, plasticizers may still be migrating to the surface and causing adhesion problems nearly as severe as if the coding had been done hot off the extrusion line.

Incomplete curing of inks. Although most coding inks dry to the touch very quickly, they may not cure completely in time to avoid ink transfer.

Pressure. None of these contributing factors would matter if not for the need to wind wires and cables under tension onto spools. The resulting pressure allows any ink that has not fully adhered to transfer onto adjacent surfaces within the spool.



Example of excellent ink adhesion

VIDEOJET

What Can You Do to Stop It?

There are three basic ways you can influence the coding process to promote optimum ink adhesion and eliminate transfer from one surface to another on spooled wire or cable.

- **Consider your ink.** It is imperative that you select an ink that is specifically formulated for your application and operating conditions. All inks are not equal.

  For example, inks that dry to the touch in under a second are ideal for inline coding between the extruder and the cooling bath. But dry to the touch does not mean fully dry. Inks that subsequently fully cure within a few seconds can achieve maximum adherence in the short time before product is wound on the spool. Additionally, inks designed for compatibility with plasticizers resist dissolving and transfer as the plasticizers migrate to the surface and evaporate.

- **Consider your material.** Materials with formulas comprised of high amounts of volatile plasticizers tend to resist good ink adhesion for a long periods of time. Transfer tends to be worse on PVC jacketing material like polyvinyl chloride and polyvinyl chloride/vinyl acetate due to the strong affinity for solvent based inks to adhere and transfer onto this plastic. When coding on these materials, performance must be checked and suitable precautions made. Transfer may not be as much of an issue on other surfaces, such as cross-linked polyethylene (PEX or XLPE), polypropylene and chemically inert, low surface energy plastics. However, if adhesion is particularly poor, transfer may still occur. Selecting an ink with the chemistry appropriate to obtain good adhesion on your substrate is essential.

- **Consider your processes.** It may be possible to alter your processes for better ink adhesion. For example, coding immediately after the wire or cable has exited the extruder, instead of waiting until it exits the cooling bath, can promote rigorous initial adhesion due to thermally induced interaction between the wire/cable surface and the ink. It may be necessary to experiment with the coding location, particularly if plasticizers are initially present and subsequently removed in the process. Also, consider ways to reduce the temperature of the wire/cable surface as low as possible prior to the winding step so that the coded ink is well below its softening point temperature. A non-contact IR type thermometer is invaluable to check these process parameters.

  Major process changes can be expensive and impractical, but you may be able to find more practical alternatives. For example, when dealing with cross-linked polyethylene, many manufacturers use a flame or corona treatment step to temporarily alter the surface structure of PEX/XLPE and promote ink bonding.

The Bottom Line.

The best advice is to get help. Choose a vendor that has installation expertise and the widest possible selection of inks. Provide samples of all the materials and colors you'll be printing on, and have your vendor run tests while replicating your production environment as closely as possible. Solutions are available to solve almost any transfer problem, the key is finding the right one.

Videojet understands ink. With the broadest portfolio of CIJ inks and the industry's leading team of chemists, Videojet has spent years developing specialty formulations ideal for operating conditions just like this. Whether your challenge is cable spool ink transfer, harsh outdoor product storage, post-extrusion vulcanization or code contrast for product installation, Videojet likely has the answer.

Ask your local Videojet representative for guidance on ink transfer, a production line audit or for sample testing in Videojet's specialized sample laboratories.

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