

# ***CTI* TECHNICAL BULLETIN**

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## Moisture Problems in Electrical Systems

When selecting a facilities wiring system, the potential for the wiring system to allow moisture to flow into the electrical equipment enclosures should be evaluated. This is true for all wiring requirements: electrical power, instrumentation data, communication data, computer data, alarm signals, etc. A wiring system should provide safe service and it should be maintenance free for many years after its initial installation. The wiring system should not be the source of or a contributor to the electrical system outage problems. Electrical system outages in modern industrial facilities may be very costly. For many continuous processes, an electrical power or control system outage, may present critical safety problems for the facility's personnel and the people in the adjacent community.

In most cases, the wiring systems being considered are cable tray wiring systems or conduit wiring systems. When cost evaluations are made between these two systems rarely is the cost of moisture in the conduit systems considered.

Wiring systems should be designed and installed so that they minimize the amount of condensed moisture or rain water that they carry into the electrical equipment enclosures. For any wiring system, this requires some extra attention to installation details.

Any above ground wiring system may be designed and installed so that it will not transmit significant amounts of moisture into the electrical equipment enclosures. Cable tray wiring systems are more desirable than conduit wiring systems where moisture is a problem. Conduit wiring systems require careful attention to many details to prevent the moisture in the conduits from getting into the electrical equipment enclosures. Conduits breathe, they draw in moisture laden air during the day and the moisture condenses when the temperature falls at night. This moisture builds up in the conduit system and it drains into the electrical equipment enclosures. The moisture may cause the deterioration or failure of electrical equipment. Electrical equipment failures may result in electrical system outages and excessive maintenance costs. Seals are sometimes installed in conduit systems as moisture barriers. Conduit seals don't prevent the movement of moisture or vapors at normal pressures in conduit systems. With atmospheric pressure on both sides of the seal, moisture and vapors normally leak past the seal between the sealing compound and the seal wall. It is also possible that moisture will leak along the conductor insulation surfaces past the seal.

There is no way to block all moisture from a conduit system. The engineered conduit system has to be designed with provisions to harmlessly expel the moisture. In some installations, the conduits need to be installed with controlled slopes for drainage. Breathers, drains, and drain holes must be placed at critical positions in the conduit system in addition to the enclosure itself. Cable tray wiring systems do not require the degree of details to cope with the moisture problems as do the conduit wiring systems.

Incidents have occurred where moisture was found in conduit systems and ultimately in contact with components such as switches. The water was unable to drain and therefore caused issues that may have been avoided with proper installation. Enclosures without drains and vertical conduit entries tend to exhibit these problems. In these types of situations modifications such as drilling drainage holes

may be required. Open systems such as cable trays and bottom fed cable entries are easy ways to alleviate these issues.

The industry has found that the use of tray cables in cable tray (systems) results in wiring systems that require less maintenance than had previously been required for an equivalent conduit wiring system. Tray cables in cable tray systems do not provide significant moisture paths.

There are some good rules to follow when any type of wiring system enters outdoor equipment enclosures. Enter from the bottom if possible. The next best choice is to enter from the side. Use a drip loop in the cable with the bottom of the drip loop below the enclosure entry point. This will allow any rain water to have a position where it will drip off the cable.

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