

***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 (explosion proof) 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 moisture from a conduit system. The conduit system has to be designed with provisions to harmlessly expel the moisture. This is done by engineering

the conduit system details, something which is rarely done. In some installations, the conduits need to be installed with controlled slopes for drainage. Breathers and drains must be placed at critical positions in the conduit system. Drain holes may need to be drilled in some enclosures. Cable tray wiring systems do not require the degree of details to cope with the moisture problems as do the conduit wiring systems.

At an industrial facility just north of New Orleans on the Mississippi River, a new compressor's vibration trip switches were housed in cast iron boxes which were mounted on the compressor's frame. This was an outdoor installation. Vertical conduits contained the trip circuit conductors from the vibration switches. Moisture from the conduits had totally immersed the vibration switches. At a minimum, a 1/4" weep hole should have been drilled at the low point in the vibration switches cast iron boxes to get the moisture supplied from the conduits out of the enclosures. This was not a total solution as the moisture from the conduits would still keep the vibration switches in a high moisture environment. The conduit systems to the vibration switches needed to be redesigned.

A good solution would have been to use a cable tray wiring system for the circuits associated with this compressor. Multiconductor control cables could have entered the vibration switch cast iron enclosures via Cabletrays Institute Technical Bulletin 2 of 2 cable compression fittings. No moisture would flow into the enclosure from the wiring system. The cable tray wiring system would have provided superior service. There would not have been any remedial work to do.

Industry has found that the use of tray cables in cable trays results in wiring systems that require less maintenance than had previously been required for an equivalent conduit wiring system. Tray cables in cable tray 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. A top entry is the last choice. 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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