

## Oily Residue Found in Electrical Distribution and Control Equipment

### Introduction

Customers are concerned about oily residues found inside electrical distribution and control equipment. They come to Schneider Electric and other electrical equipment manufacturers seeking answers to what it is, possible effects, and what can be done to eliminate it.

### Oily Residue

Tests have shown that the oily residue is actually the plasticizer that is a component of the resin used to make the thermoplastic PVC wire insulation. The plasticizer is added by the wire manufacturer to make the insulation more flexible.

Research<sup>1</sup> has shown that elevated temperatures and humidity can destroy the relatively weak chemical bond between the plasticizer and the PVC. Given sufficient heat and time, the plasticizer can separate from the PVC wire insulation. Once the plasticizer begins to separate, the process will continue.

Unless prevented by an outer jacket of nylon, such as with THHN for example, the plasticizer can exude through the outer surface of the insulation. The plasticizer can also migrate along the stranded wire of the conductor to the end of the insulation via capillary action, and possibly enhanced by a process known as "electroendosmosis".<sup>2</sup>

### Why does the plasticizer separate from the insulation?

Other than having some relation to elevated temperature and humidity, the electrical wire and cable manufacturers do not completely understand why this phenomenon occurs in some installations and not others.

### Effects of the Oily Residue (Plasticizer Separation) on Electrical Equipment

When the plasticizer separates from the PVC insulation, several undesirable effects can occur:

- Wire insulation can become hard and brittle. The purpose of the plasticizer is to keep the insulation flexible.
- Oily residue (plasticizer) on surfaces of electrical equipment and electrical components can reduce the life of the products and cause performance issues similar to other foreign contaminants like dust, dirt, water, condensation, hydrocarbon sprays or compounds, etc.

### Recommended Action

Schneider Electric recommends that inspection for oily residue (plasticizer separation) be added to your routine inspection and maintenance activities.

If oily residue is found:

- Do not try to clean the surfaces
- Make sure the oily residue is not from the lubricant applied to the wires to facilitate pulling wires through the conduits into the electrical equipment.
  - Oily residue caused by plasticizer separation is normally found at the ends of the wires where they are stripped for connections etc.
  - Lubricant applied for pulling activities is normally on the outer surfaces of the insulation.
- If you suspect that the oily residue is caused by plasticizer separation, contact the wire manufacturer that supplied the wiring to your contractor.
- If oily residue (plasticizer) contamination is found on the surfaces of the electrical equipment and components, the equipment and components are probably damaged. Since there is no practical way to inspect the insulators, etc. in the equipment or the internal parts of the components, Schneider Electric recommends that the contaminated parts of the electrical system be replaced.

<sup>1</sup> Peter Wronski, "Exudation of Plasticizers from PVC Insulation Components" presented to the IEEE PSC-ICC Committee on 10/31/2000.

<sup>2</sup> National Electrical Code, 2011 Edition, Informational Note for section 310.10.

## FAQs

- Q** I have found an “oily” appearing substance on some of the insulators, circuit breakers, terminal blocks, etc. on some of my electrical equipment. What is this stuff?
- A** See the explanation under “Oily Residue”.
- Q** I have also found that some of the insulators in my electrical equipment have deteriorated, or are falling apart. Why is this, and what is causing it?
- A** The plasticizer used in the manufacturing of the wire insulation is typically a hydrocarbon based petroleum derivative. This type of petroleum derivative will cause deterioration of some types of insulating materials commonly used by manufacturers of electrical equipment.
- Q** Why is the “oily” plasticizer coming out of the wire insulation?
- A** We suggest you contact the wire manufacturer for more information. Based upon reports to us, the problem seems to be more prevalent with circuit wires running up a distance above the electrical equipment. Longer runs of wire also seem to experience the greatest loss of the plasticizer. Heat and humidity tend to accelerate the loss of the plasticizer.
- Q** Why does the “oily” substance appear only in the equipment and not on the surface of the wires?
- A** Typical wire insulation is THHN or THWN. This type of wire insulation has an outer jacket of nylon. The plasticizer cannot migrate or penetrate through the nylon jacket so it runs down the strands of the wire until it reaches a point where it can escape. This point is normally where the wire insulation has been stripped away from the conductors.
- Q** Is it typical for wire to lose the plasticizer such as we are seeing?
- A** No, to our knowledge that does not seem to be typical; however the wire manufacturer should be contacted for more specific information.
- Q** How does the “oily” substance get all over the circuit breakers, insulators, and other parts of the electrical equipment?
- A** The plasticizer will tend to continue to migrate over other parts through surface tension.
- Q** What should I do if I discover this condition of “oily” substance on or in my electrical equipment?
- A** Follow the “Recommended Action” section of this Bulletin (above).