



Think Ahead™

The Hartford Steam Boiler Inspection and Insurance Co.

RISKS ASSOCIATED WITH THE CORROSION OF ELECTRICAL EQUIPMENT

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Introduction

This article discusses the effects of corrosion on electrical and electronic equipment and basic steps to minimize these effects. For complete details on the maintenance of electrical equipment and other equipment care related documents, visit the Information Resources section of HSB.com.

Risks

Corrosion can be defined as the deterioration of a material due to the material's reaction to its environment. In electrical equipment, corrosion can result in the thinning, pitting or cracking of the materials that are typically used in electrical equipment such as copper, aluminum, tin and silver. In addition, under certain conditions, corrosion can result in the growing of thin conductive filaments know as whiskers. Affected components may include: circuit breakers and fused disconnects; busways; contactors and starters;



process control equipment; batteries; DC motors and electrical equipment enclosures. The factors that affect the rate of corrosion include a material's corrosion susceptibility, the concentration of the corrosive elements, temperature, humidity, and length of exposure time.

Corrosion can occur in an environment that contains: Hydrogen Sulfide (H₂S), Sulfur Dioxide (SO₂), Ammonia(NH₃), Salt, and Chlorine(CL) to name a few. Corrosive environments can be found in: waste water and sewage plants, grain processing facilities, chemical plants, pulp and paper plants, refineries, mines, and marine environments.

Mitigation Steps

The most effective means to minimize corrosion is to limit the exposure of a piece of equipment to the corrosive environment. The relocation of equipment to a non-corrosive environment or the installation of a positive pressure ventilation system for equipment may be the most cost

effective solution if additional maintenance costs and premature failures are considered in the evaluation process. If this is not possible an effective maintenance program based on the environment must be developed. Key parts to this maintenance program include visual inspections, cleaning of components, and documentation of the condition of the equipment. Electrical equipment should be deenergized, electrically isolated, and thoroughly inspected for signs of corrosion. When corrosion is found, the location and extent of corrosion should be documented, the material should be cleaned and the base metal should be inspected to ensure adequacy for continued use.

It is important to document and track the corrosion levels because this information can be used to determine an appropriate maintenance frequency. A one month frequency may be appropriate for certain pieces of equipment in certain areas of a facility whereas an annual maintenance frequency may be appropriate for other equipment and locations. Corrosion rates can vary widely for each facility and each piece of equipment.

Summary

The manufacturers' recommendations for maintenance of equipment in corrosive environments should be followed. The below chart outlines typical types of equipment, potential effects of corrosion, and activities which may mitigate these affects.

Type of Equipment	Effects	Actions
Circuit breakers Disconnects Contactors Starters Busways Electrical enclosures	High resistance contacts Binding of operating mechanism Ground faults and arcing Weakening of the enclosure	Inspect and clean all internal components Cycle operating mechanism Perform contact resistance checks, insulation resistance testing, infrared surveys Remove corrosion, clean and paint enclosure
Process control equipment	Intermittent or failed operations	Inspect and clean all circuit boards, communication circuits, sensors and ribbon cables If possible unplug connections and cables and inspect and clean mating surfaces
Batteries Battery charging systems	Deterioration of the battery case or battery support structure High resistance connections Battery charger failure	Inspect and clean all components Perform individual cell and battery system testing Verify proper operation of charging system
DC motors	Poor commutator surface Brush contamination	Inspect and recondition (as appropriate) the surface of the commutator and brush faces. Ensure brushes move freely in brush box Inspect and clean all brush connections