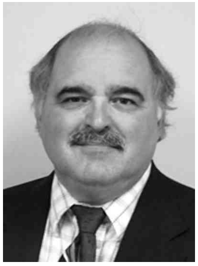
Rectifier Clinic



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Chemical & Dirt Damage

As you prepare for summer it is important to prepare your rectifiers for the rigors of warmer weather and higher humidity. Because most shops create ambient conditions that are not conducive to optimum rectifier operation, a little extra care can avert catastrophic failures.

Various components have different degrees of susceptibility to chemicals and dirt. Generally speaking, dirt can affect the cooling efficiency of components, while a build-up of chemicals can create a path for short-circuits. This column will address major components, their susceptibility, and possible remedies.

Circuit Boards

Because many circuit boards carry high voltage, the build-up of any material, whether chemical or dirt, can offer an avenue for currents to stray. The conductivity of the material may also increase, if humidity condenses on the surface of the board, allowing high voltage to travel unwanted paths and destroy circuits or components.

Many manufacturers will cover their boards with an insulating varnish that resists this action, but it can break down with time and temperature. Most manufacturers will locate boards in a separate part of the enclosures to minimize exposure, but if covers are removed, and are not replaced properly, air flow can draw in contaminants.

Preventive measures include keeping boards isolated from ambient air and materials, keeping enclosure panels tightly closed, and minimizing the effect of condensation. The latter may be accomplished by leaving the rectifier on when condensation conditions are prevalent, or drying the unit off with a heater prior to start-up.

Remedial measures may include blowing any extraneous material off both board surfaces with gentle, dry compressed air. If this does not satisfactorily remove the material, a board cleaning solvent may be employed. If damage has already occurred, the board will need to be repaired or replaced.

Diode or SCR Heat Sinks

Heat sinks are predominantly extruded aluminum, and occasionally copper. If air-cooled, they are vulnerable to the build up of dirt on the surface, which can dramatically reduce their efficiency in transferring heat away from the semi-conductors. If water-cooled, the build-up of lime in the water passages constricts the flow of water and reduces cooling efficiency.

The effect of either of these conditions is to over-heat the semi-conductors and cause failure, or over-heat to the point where the thermals will shut the unit down. This will interrupt production, or effectively restrict the output amperage so that this over-heating will not occur.

Preventive measures for air-cooled units include: providing clean, dry air that will reduce the build-up of dirt; oil mist; or corrosive chemicals that will pit the heat sink and accelerate the build-up of dirt. If the rectifiers cannot be placed in a separate room to facilitate this approach, then filters may be employed to assist in this effort.

Remedial measures for air-cooled units include removing material build-up with compressed air or a wire brush. If necessary, a degreaser may be used to remove difficult material.

Preventive measures for water-cooled units include use of a cooling tower and a closed loop cooling system. Remedial measures include flushing the system with a mild acid solution, or replacing hoses and tubing.

Main Transformer

If the unit is water-cooled, it will be relatively impervious to material build-up unless the material is unusually corrosive under damp conditions. An air-cooled transformer must have sufficient air-flow around the most vulnerable areas, which are usually the primary windings. Chemical damage can also affect the primary windings, if not the entire rectifier. A new rectifier placed on a platform over an acid clean tank can be reduced to scrap within a year of installation.

If the transformer is supplied with thermal overloads, the rectifier will shut down before damage can occur from over-heating. Units without this protection may over-heat to the point that the transformer varnish breaks down and a catastrophic failure may occur. This is a very expensive and time-consuming component to replace. The outcome will be lost production, or even the total disposal of the rectifier.

Preventive measures for air-cooled units include providing clean, dry air if possible, or placing filters over the air intake vents. Filters will need to be replaced as often as material build-up impedes air-flow.

Remedial measures should start with a blow down with compressed air. Transformers can be removed and cleaned with high-pressure water, but if the varnish is cracked it may be blown off with the water. In either case, the transformer will need to be dried thoroughly and the primary coils re-sealed with transformer varnish.

Control Components

This category includes contactors, step down transformers, fuse blocks, thermals, tapswitches, start/stop switches, and other 110 VAC components. These components are usually most susceptible to short circuits from the build up of conductive material. The short circuits may occur from phase-to-phase of three-phase power, or to the cabinet ground with a single phase circuit.

Regardless, these failures will destroy the affected component, and may destroy other adjacent components as well. Even though the parts are replaceable, the expense of the component, and the resulting downtime should be avoided.

Water-cooled rectifiers are usually relativly immune to damage to these components, unless the panels are removed and are not securely replaced. Air-cooled rectifiers also will often have some of these components in sealed compartments, in which case they will be as resistant to this sort of damage as their water-cooled cousins. Any components that are exposed to ambient air will be vulnerable.

Preventive measures are similar to those previously discussed—providing clean air if possible, and keeping compartments provided for these components sealed.

Remedial measures for air-cooled units are not very effective, because it is often difficult to remove the offending material due to the configuration of the component. When possible, compressed air may be useful to reduce a build-up. Another approach involves the use of an insulating varnish that may reduce the susceptibility to short circuits between phases, or to the cabinet ground.

The cost of replacement rectifiers, as well as the potential of lost business caused by downtime, suggests that some efforts to prevent the component damage, which can occur from dirt and chemicals, is well justified. At the very least, periodic cleaning may help to extend the life of a critical piece of equipment. *P&SF*