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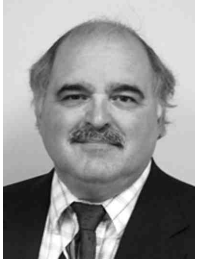

Shunts & Amperage Monitoring

Although a shunt is an integral part of a rectifier, it is often overlooked and neglected insofar as maintenance is concerned. It is extremely important that the finisher be aware of how important these simple devices are to the operation of the rectifier and the process.

Similarly, process and tank amperage are neglected as indicators of performance and the various ways this important attribute can contribute to efficient operation.

Shunt Function

A shunt is a resistor sized to the amperage of the rectifier. They may measure between one amp and 20,000 amps or more. It is typically made of brass, with thin pieces of resistive material connecting two larger pieces of brass. You will find it either inside the rectifier just before the output bus, or on the outside of the rectifier where the connection to the tank is made. It generates a signal, typically 0–50 millivolts or 0 –100 millivolts when current passes through it. The size of the signal is proportionate to the amperage that is passed. For example, if you have a 2,000 amp rectifier with a 50 millivolt shunt the shunt will generate 10 millivolts if the rectifier is producing 400 amps, 25 millivolts if the rectifier is producing 1,000 amps, and 50 millivolts at full 2,000 amp output.

This linear relationship is the same regardless of the rectifiers amperage or voltage or the millivolt output of the shunt. The greater the amperage of the rectifier, the larger the shunt must be to pass this current.

This millivolt signal is then interpreted by the ammeter on the rectifier, whether it is an analog meter or a digital meter. Because this signal is very low in voltage it is extremely important to have clean, tight connections on both ends of the wire lest corrosion impede the signal and give you a false amperage reading. If you suspect that you have a bad connection, measure the millivolt reading at the shunt with a multimeter and compare if to a reading taken at the ammeter. If you suspect you have a defective ammeter, take a millivolt reading at the meter and use it in this formula:

(millivolt reading/50) x maximum amperage of the rectifier

If this total does not agree with the meter reading or the meter cannot be adjusted to this value the meter may need replacement.

Because this millivolt signal is also used by the firing boards on a silicon controlled rectifier (SCR), a dirty connection will indicate that the rectifier is generating less amperage than it actually is. If you are operating the rectifier in amperage control mode you will raise the voltage seeking the desired amperage, possibly above the desired range for the process creating a defective coating.

Other concerns involve damage to the shunt such as by severe overheating due to undersizing or poor connections or an imbalance that causes the transformer to overheat and transfer the heat to the shunt. If this occurs, it is possible that the solder used to bond the resistive material to the shunt body will exceed its melting point and drip out of the shunt, causing it to change it's signal value or even fall apart. If you have had overheating in your rectifier, examine the shunt closely for signs of melted solder.

Usage of Shunts

Typical shunt usage is one shunt sized to the maximum amperage output of the rectifier. Occasionally a manufacturer will use a smaller shunt at a place where only a portion of the output current is flowing within the rectifier and then multiply the result proportionately. This may lead to a situation where secondary diode failure may not be easily diagnosed since the shunt can only measure that segment of the rectifier's output within it's measurement loop. This situation may manifest itself with an amperage reading that is actually less than is being produced. If you are aware of this particular design in your rectifier you can compare input kva vs output kva to determine if this may be occurring.

If you have multiple tanks or stations powered by one large rectifier, you may also place additional smaller shunts downstream of the rectifier to determine amperage draw for each tank, or each station. Barrel platers may find this particularly useful if they use this signal to compare performance at each station. If these shunts are monitored by "Amp-Hour Meters" a signal may be used to indicate when each barrel has accumulated enough amp-hours to achieve coating requirements. This can reduce over-coating and increase productivity.

Another application involves the use of even smaller shunts to monitor individual anode performance. By tracking anode performance you can determine when the anode has degraded to the point where it cannot carry sufficient current for effective performance. If there are sufficient anodes in the tank and the monitoring method is sufficiently sophisticated, a profile of the bath is created indicating where insufficient current flow may cause thinner coating in a given area. This will then allow replacing or adding anodes to boost performance. This technique of monitoring anodes is very common among electro-coaters but less so among platers and anodizers.

For such a simple device, the effective use and application of shunts is critical to optimizing your operation. Consult your rectifier service source for additional assistance. *P&SF*