Liquid Rheostat

Read on to understand the importance of liquid rheostats for your electric motors & powertrains.

You've just received word that the liquid rheostat that you use to start or control the speed of one of your facility's large AC wound rotor induction motors needs some attention. Before you make any major decisions about what to do and who will do it, you need a quick refresher on liquid rheostats and what is involved in their repair or refurbishment. Let's get that review started!

What is a Liquid Rheostat?

A rheostat is a variable resistor that allows you to control current. A liquid rheostat does the same thing as a standard rheostat but takes a slightly different approach. In the context of electric motors, a liquid rheostat is usually responsible for performing one of two key tasks:

- Control the speed of a large AC wound motor
- Dissipate AC motor heat during startup

In addition, a liquid rheostat can also act as a starting resistor for slip ring motors or as a dummy load. Because of their straightforward design (which we'll discuss in a minute), liquid rheostats are known for being very low maintenance and easy to operate, which explains why they are so popular.

How Does a Liquid Rheostat Work?

The basics of how a liquid rheostat work are fairly straightforward. Stainless steel electrodes are submerged in an electrolytic solution (a liquid solution that conducts electricity, such as brine or soda ash). The electrolytic solution and electrodes are held within a tank that is electrically insulated from the surface that it rests upon. The tanks are usually made from steel sheet metal. Metal tanks are either stainless, painted or powder-coated, which not only makes them look nice but can help protect the tank from corrosion.

The rheostat load varies depending on the height displacement of the electrodes with respect to the electrolytic solution. The resistance in the liquid

rheostat is adjusted by moving the electrodes in and out of the electrolytic solution: raising the electrode will increase the electrical resistance while lowering the electrode will decrease the resistance.

In automated systems, the position of the electrodes can be regulated by a PLC-controlled (Programmable Logic Controller) DC motor, pneumatic cylinders, or a winch system. In manual systems, the height of the electrodes can usually be adjusted by a wrench. In some systems, the electrolyte level may be regulated while the electrodes remain stationary.

The electrolytic solution is often run through a heat exchanger to dissipate heat, especially during the startup of an AC motor. That is why you'll see heat exchangers included in the design of more powerful liquid rheostats: that electrical resistance is going to generate substantial heat, and you don't want to see the electrolyte starting to boil! Let's just say that boiling electrolyte is not a good idea.

Design of Liquid Rheostats

Design factors for liquid rheostats include the type of electrolytic fluid used, the volume of fluid used, the heat dissipation method implemented, and the AC motor power. These factors are determined by the application for the liquid rheostat.

Most modern liquid rheostats have a low-conducting stainless steel tank (often with an anti-alkaline coating). Low-conducting stainless steel works very well for such applications because of its corrosion resistance, reduced potential for electrical arcing, and overall durability.

Electrolytes include sodium borate, sodium carbonate, salt water (brine), or soda ash.

Some designs include an agitator to reduce the heat of the fluid by stirring it, and others use a heat exchanger.

Liquid Rheostat Maintenance

Most liquid rheostats can go for 20 or more years without needing repairs if they have been properly maintained. Regular maintenance includes …

- Regularly scheduled cleaning
- Checking electrolyte levels and topping off as needed

- Checking the condition of the electrodes
- Verify that all safety features are working correctly
- Lubricating appropriate components
- Checking the tightness of connections
- General system testing and sensor calibration

Typical Liquid Rheostat Repairs

Typical repairs that a liquid rheostat requires includes the following:

- Electrode drive motor repair and replacement
- Replacement of electrodes
- Tank cleaning
- Replacement of electrolytic fluid
- Repair or replacement of the PLC

Other components, like bearings and seals, need to be replaced periodically due to normal wear and tear. They have a limited service life, and if they aren't replaced when they've worn out they will cause even more expensive problems for your liquid rheostat and AC motor.

HECO -- Your Rheostat Expert

At HECO, we manufacture, recondition, maintain, and repair liquid rheostats. Reconditioning is performed in our shop by our experienced team of technicians, while preventative maintenance (including cleaning) and high-quality repairs can be performed on-site or in the field. We can service any brand or manufacture a custom liquid rheostat solution for you. We also sell, refurbish, and supply the AC induction wound rotor motors that liquid rheostats drive, offering a complete package to meet your needs. If you are looking for reliability and high quality, then contact us today to find out how we can help you with your liquid rheostat challenges!