SILICON RECTIFIER COOLING SYSTEM USING AIR-TO-WATER HEAT EXCHANGER

A cooling system is required for all silicon rectifiers to dissipate the heat due to the forward drop losses. One method of cooling is by using air. When the air is clean it may be used directly. In locations where it is contaminated, an air-to-water heat exchanger is used.

The piping schematic diagram for the air-to-water heat exchanger type of water system used with the rectifier is referenced on the rectifier nameplate. Refer to the diagram when using these instructions.

The silicon rectifier cells are cooled by passing air through the cooling fins on which the rectifier cells are mounted.

The air-to-water heat exchanger consists of a blower, radiator, pressure relay, temperature regulator, strainer, pressure regulator valves and associated piping.

The radiator is the conventional finned tube design having a cleanable tube water coil but it is used in the opposite to the normal manner. Heat from the air is absorbed by the cooling fins and transferred to the circulating water in the tubes.

The rectifier cubicle is sealed to prevent outside air from entering the cubicle. The captive air is recirculated over the cooling fins and through the radiator. The temperature regulator controls the amount of water needed to cool the air. The temperature regulator is set to maintain the air leaving the rectifier cells at 60°C at full load. As the load decreases, the amount of cooling water required is decreased due to the action of the temperature regulator. For protection against loss of water or low water pressure, a pressure relay device 63W is provided.

On the air side of the system an air flow relay device 63A and an air overtemperature relay device 26A are provided.

Raw water, after passing through a strainer, pressure regulator, and temperature regulator, passes into the tubes of the heat exchanger and out into the drain. The temperature regulator receives its operating force from a bulb inserted in the air stream at a point where the air leaves the last rectifier cell and is therefore the hottest. The temperature of the air here is the one kept constant. A bypass is provided with isolating valves so that operation may be continued with the strainer and pressure and temperature regulators removed from the system. If this is necessary, the temperature must be manually controlled by adjusting the amount of raw water admitted to the heat exchanger. The pressure regulator is used to limit the line pressure and to hold the pressure constant under conditions of fluctuating pressure, thereby allowing the temperature regulator to operate more smoothly.

The settings of the protective and regulating devices are given on the rectifier nameplate or in the instruction book.

OPERATION

Connect the inlet piping to the water supply and the outlet to the drain. Open the valve in the main line and adjust the pressure regulator for the correct pressure and the temperature regulator for the proper discharge temperature. This latter adjustment must be made with the rectifier carrying load.

MAINTENANCE

The water system should be cleaned at yearly intervals or as often as proves to be necessary with the quality of water being used. Either of the following methods of cleaning the system are recommended:

(1) Remove the headers on the radiator and mechanically clean out the tubes. The water piping is designed using sufficient unions so that it can be disassembled to facilitate the removal of the headers.

Soft deposits may be cleaned out by inserting a bristle brush through the tubes and in some cases may even be washed out with a hose.

Hard deposits may be satisfactorily removed by a brass wire brush or even a solid rod. In using a metal brush some care should be exercised so as not to score the internal tube surfaces.

(2) Change the series water system to a recirculating system; that is, disconnect the inlet and outlet connections to the rectifier and connect them together through a water pump and reservoir tank. The water pump should have a capacity of about 5 to 10 GPM at 50 lbs./sq. in. pressure, and the reservoir tank a capacity of about 5 to 10 gallons.

Fill the system to approximately 95% capacity. Add any good commercial radiator flushing compound provided it contains an oxalic base. (When using a commercial flush it is very important that the directions contained on the can are followed.)

The compound should be circulated for the required time (as per the manufacturer's directions).

The system should then be drained and refilled with tap water which should be circulated for about 15 minutes and then drained.

The temperature control switches should be checked once a year for operation and temperature of operating point.

Under conditions of constant load and constant water temperature, the temperature regulator should be actuated to prevent sticking. Raise the valve stem several times to make sure that the valve operates freely. This should be done by lifting the spring, using the tool provided.