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Jet Pump Motors for Decoking

About one half of the oil refineries in North America have a coking operation for the conversion of the residual oil. The delayed coking process is most common. This process takes the last fractions of the oil and by adding heat, creates a dry coal-like product that, depending on further processing, may be used in cement kilns, steam generators or in manufacturing processes for aluminum or steel making.

The delayed coking process utilizes a motor to power the jet pump that is used to cut the dried coke from the drums after each 16-24 hour cycle. Each drum in the coking process will be cut on this same cycle. This means, in a typical four drum delayed coker, that the jet pump motor (typically 2000HP, 3600rpm) will be started 4 to 6 times per day. Special considerations must be made when choosing the motor for this application to withstand the frequency of starting the operation.

Understanding the stresses caused by the many starts is the basis for design in this application. API 541 requires that a motor be capable of 5000 starts over a 25 year life. In this application, 5000 starts can easily be achieved in the third year of operation. To provide suitable motor life and performance, special review is given to all parts of the motor: stator, bearings and enclosure, but especially the rotor.

Proper rotor design for this application requires that stresses on the rotor cage be evaluated based upon the starting conditions. Special rotor slot designs are used to minimize bending stresses. Rotor endplates are designed to allow for greater pressure on the outside diameter of the rotor core. Rotor bars are made of special copper-nickel alloys to improve the starting conditions, and the bars are manufactured to a tighter straightness tolerance to limit the amount of bow. The rotor end rings are a copper alloy forging that assists in the reduction of thermal stresses. The end rings will have shrink rings added to supply additional support.

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The stator must be durable enough to withstand these many starts. Additional bracing is added, with particular attention to the end turns. Some designs include two insulated steel bracer rings on each end, additional coil blocking, and fiberglass bracer rope weaved through the coil and lashed to the heads. All stators will receive 3 VPI cycles. Surge tests are done prior to insertion, after insertion, and after connection.

The enclosure for the decoking motor is typically TEWAC, IP55, to keep dust contaminants out of the motor. Special duty seals are also typical. TEFC motors have been successfully applied in lower HP's but TEAAC designs are not encouraged. These motors are subject to tube fouling and clogging from the coke dust. Likewise WPII designs are guaranteed to collect considerable contamination internally from this fine coke dust. The dust sticks to the windings and clogs air passages. This causes motor temperatures to rise slowly while they run. If a WPII motor is used, it is recommended that it be removed and cleaned and reconditioned every 6-12 months. The coke dust can be as small as a few microns in diameter allowing it to pass through even the best seals results in oil contamination. Because of this motors should be on a monthly bearing oil change schedule.

We have successfully supplied Baldor•Reliance motors for this difficult application for over 35 years. Each installation is given careful review in order to meet customer expectations.

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