INSTALLATION TOOLS FOR HYDRAULICALLY FITTED COUPLING HUBS—PRECAUTIONS AND DESIGN REQUIREMENTS

by
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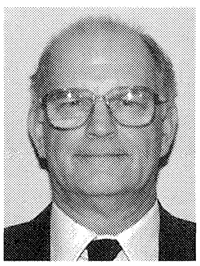

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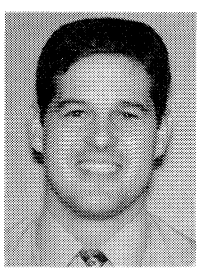
Mr. Gibbons graduated from the University of Rochester and is a registered Professional Engineer in the State of New York.



A. Nigel Hearne is a Rotating Equipment (Critical) Engineer for Texaco Limited at their Pembroke Refinery in West Wales, United Kingdom. He joined the company in 1989 as a Reliability and Power Engineer and in 1993 he took up his present position. Mr. Hearne is responsible for performance and condition monitoring, planning and executing major overhauls, repair standards, and capital expenditure programs for all critical rotating equipment. He currently holds the position of Team Leader for the Cat. Cracking Hardware Group at Pembroke Refinery, which is responsible for maintenance, capital expenditure projects, and reliability initiatives for the FCCU.

Mr. Hearne graduated from the University of Sussex with a B.Sc. degree in Mechanical Engineering (1989).

ABSTRACT

The tools used to install hydraulically fitted hubs need to be as carefully designed and manufactured as the couplings themselves. The authors describe an installation of coupling hubs on upgraded machines where tools that were designed to be used on a coupling for a 6.0 in diameter shaft were adapted to mount a coupling on an 8.0 in shaft.

The larger forces involved caused a threaded rod to fracture and the coupling hub to be expelled from the shaft end with considerable force and velocity. An after-the-fact analysis of these "design alpha" tools is presented, along with a technical description of the forces acting upon a newly mounted hub and the velocity with which such a hub could be expelled from a shaft end. The 8.0 in hub was successfully installed on the shaft using modified "design alpha" tooling for expediency, but this modification was considered to be only a stopgap solution.

The authors designed new "design beta" tools to accomplish the installation of the coupling hubs safely. The analysis of the "design beta" tools is described along with the important criteria to be considered for coupling hub installation tools.

INITIAL INSTALLATION ATTEMPT

The coupling hub for the 8.0 in diameter motor shaft was to be installed while the motor was on a transport trailer, prior to being mounted on its base plate. The plant technicians had reviewed the limited instructions that had come with the "design alpha" tooling intended for the 6.0 in diameter shaft couplings and attempted to use this same equipment on the 8.0 in motor shaft coupling. The machinery train arrangement (Figure 1) is an expander/axial compressor/steam turbine/gear/motor layout. Figure 2 is a cross section view of the motor shaft with its coupling hub.

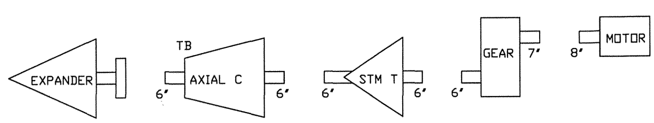


Figure 1. Schematic of Equipment Train.

During the first try to mount the motor hub, the "design alpha" tooling was used as-supplied with its "20 ton, two inch stroke" hydraulic cylinder. The configuration of the "design alpha" tools is shown schematically in Figure 3. The dilation pressure was raised to 25,000 psi and the advancing pressure was raised to 8000 psi on the 4.70 sq in cylinder reaching about 38,000 lb. The coupling was advanced to within 1/8 in of the desired position. However, it was not possible to advance the coupling any further with the existing equipment.

For the second attempt, the technicians used a larger "30 ton, 2.5 in stroke" hydraulic cylinder that had been stored with the tooling and had been used previously with the "design alpha" tooling on the 6.0 in shaft coupling hubs. Again, the dilation pressure was raised to 25,000 psi and the advancing pressure to 8000 psi. This was sufficient to advance the coupling hub to the desired position. However, with the larger piston area, 7.22 *vs* 4.70sq in, the axial