

Date: January 11, 2007

Vendor Visiting:

Hydratight Sweeney, 9 Commerce Street, Branchburg, NJ 08776

PPPL Attendees:

T. Brown, L. Dudek, M. Viola, J. Edwards, W. Reiersen

Contacts:

Jon Slocum, Mgr. Nuclear Division

Robert W. Karol, Applications Engineer

Subjects Discussed:

Hydraulic Torque Wrenches

Ultrasonic Tensiometer

Hydraulic Tensioners

Hydraulic Nuts

Joint Design and Tech Support

Ultrasonic Tensiometer (Boltscope II)

Ultrasonic Tensioning and Hydraulic tensioners together will allow tensioning up to 1% of the yield strength of the bolt.

UT device measures the bolt tension using sound and time of flight measurement through the length of the bolt or stud. A sample of the material from the same lot allows precise calibration of the instrument. It can store calibration and torque information for 10,000 fasteners. Digital readout display, Load, Time of Flight, Elongation, Length or Stress. It has a computer interface and software to track tensions. It works by comparing the unloaded length to the stretched length and calculating the other values. Calculates length to 0.0001" precision. Allows tensions to be monitored quickly after assembly. This device was demonstrated while they were here. Price of the UT tester is \$16K.

Hydraulic Tensioner

Hydraulic Tensioners have several advantages over torquing the bolts.

1. Studs can be tensioned higher since they do not have the stress of the wrench torque to deal with (90% vs 60% with a wrench).
2. They are safer since you don't have to worry about a wrench slipping.

3. A joint can be pulled down evenly, and quickly by using several tensioners ganged to one hydraulic pump.

4. Simpler operation: No back wrench is needed on the far side of the flange.

NSTX already owns an air operated hydraulic pump that can be used for NCSX stud tensioning. We would only have to buy the hydraulic tensioner and hoses. The tensioner operate on hydraulic pressures up to 21,000 psig.

Standard Hydraulic tensioner in our size range would cost around \$2800. A tensioner for each tensioned position would be needed along with the required hosing.

Hydraulic Nuts

Hydraulic nuts are smaller than the hydraulic tensioners. Hydratight makes Nitronic versions for the nuclear industry. Can be used together with the hydraulic tensioners in tight locations. Cost of a 2" Nitronic hydraulic nut is approx. \$700-800.

Hydraulic Torque Wrenches

Limited to about 60% of yield due to uncertainty of friction, galling, etc. A new head for the existing Hydratight hydraulic unit would fit in the areas required. Torquing some of the final field joints might be problematic finding a suitable location to plant the reaction bar.

Joint Design and Tech Support

In order to insure proper tensioning there should be approximately 4 diameters between nut centers. They prefer that all studs are the same length, studs in threaded holes can use a spacer bushing, called a "stool", to take up the extra length of the stud. Joints reach their ultimate tension after about 30 days. Expect approximately 11-15% relaxation to seat the bolts in.

Spherical washers create problems for torquing and tensioning. They create another interface which bleeds off tension and they can slide to an incorrect angle and change the torque after tensioning.

They use ProE and can provide models of their tools for us to fit to our models.

Normally they don't charge for engineering if they can make modest mods to standard components. Hydratight can provide support and training for the use of their tools. They also have a 300 technician support crew that can do the tensioning work for us.

In addition to tensioning they have another group, DL Ricci, that does Field Machining which could drill the new holes for us in the nose section of the castings.

Photos of Hyrdatight Hydraulic Tensioners in Tight Locations



