

From: FNAL::JBS 26-JAN-1991 11:01:04.42
To: DELCHTS, KOSKA, TJAFFERY, LAMM, WAKE, BOSSERT
CC: MYSELF
Subj: Shell Gauges for DSA323

TS-SSC 91-015

Because the new yoking tooling has provision to leave slots in the upper as well as lower tooling (by leaving out a 2" EDMed lamination) it is possible to have strain gauges mounted on the shell during the welding of the shell. This will allow us to measure the azimuthal shell stress that results from assembly and to understand if the new tooling is behaving as expected. Because if the significant uncertainties in any individual measurement, we will probably need to do this on several magnets to verify the conclusions. Therefore I would like to make this a regular practice on the short magnets beginning with DSA323.

I suggest that we mount five gauges measuring azimuthal strain before welding, and then mount the remainder of the "standard" array afterwards. The "pre-welding" gauges should be at the following azimuthal locations:

Distance from mid-plane	Angle
1.25"	11 degrees
2.5"	21
5.0"	43
7.5"	64
10.5"	90

These should be mounted near the center of the magnet and all components and wires must be within a 2" band so as to clear the tooling. At this stage there should be one compensating gauge which could either be welded to the shell between the 5" and 7.5" gauge or be disconnected from the shell.

These gauges should be measured at the following points during assembly:

- 1) In the yoking press at zero load.
- 2) At "line" pressure.
- 3) At full press load* before welding.
- 4) After the first weld pass.
- 5) After the second weld pass.
- 6) After the press load has been released.
- 7) After the magnet has been removed from the tooling.

*For yoking 50 mm dipoles in the new 84" press, the hydraulic system pressure should be 3500 psi. This corresponds to the clamping force of a shell tension of 37 kpsi, which is about 25% larger than what I expect to achieve and about 25% larger than the load that I calculate will be required to close the yoke parting plane gap under the most pessimistic assumptions. This is very close to the same load as at 4500 psi in the old press or in the long yoking press.

If Lab 2 can deal with two more channels, then the gauges mounted after welding should be a second set of azimuthal gauges at the same locations but about 3" over in z, axial gauges at 5" from the mid-plane next to the azimuthal gauges, axial-azimuthal pairs about 1" from the ends of the yoke and the usual compensating gauges. (To the extent that details differ from the standard array on 40 mm magnets use the 40 mm locations.) If Lab 2 can deal with only as many shell gauges as have been used on the 40 mm magnets, they can skip wiring the gauge at 7.5" from the mid-plane and this gauge need not be mounted in the "post-welding" array, but I would like it to be used for the welding measurement.

cc: Nick Hassan
Mike Gordon

From: FNAL::JBS 26-JAN-1991 13:12:36.16
To: DELCHTS,KOSKA,TJAFFERY,LAMM,WAKE,BOSSERT
CC: MYSELF
Subj: Shell Gauges for DSA323: Errata and Addenda

Erratta

- 1) Wherever I referred to the "mid-plane" I meant the yoke parting plane, not the magnet mid-plane.
- 2) In laying out the azimuthal positions of the shell gauges I had forgotten that there is a cutout for lifting fixtures at 45 degrees. A strain gauge at 43 degrees would overlap this and its readings would contain a very large bending component making it largely useless for measuring tension. I do not have a copy of the yoke drawing with me, but my recollection is that the notch is about 0.5" on each side. The nearest gauge should be about 3 times the shell thickness from the edge of the cutout. Thus the gauge at 5" needs to be moved to 4.25". To make the distribution of gauges a little more regular the 7.5" gauge should be moved to 7.0". The corrected array is:

Distance from parting plane	Angle
1.25"	11 degrees
2.5"	21
4.25"	36
7.0"	60
10.5"	90

Addenda

- 1) I was not explicit about from where to where the distances specifying the gauge positions are to be measured. I would like these to be from the intersection of the yoke parting plane with the shell radius to the center of the strain gauge which is somewhat beyond the end of the shell. We will have to consult the shell drawings to translate these into distances from the shell edge. If this places the first gauge too close to the edge of the shell then the first two gauges should be moved to positions such that the first gauge is as close as possible to the edge.
- 2) When the shell is welded there is risk that the gauge closest to the parting plane may be damaged or its adhesive may creep, invalidating its readings. If possible this gauge should be glued with a high temperature curing adhesive (which can be done since it is applied before the shell is mounted on the magnet) and the gauge should be cooled with wet rags during the welding operation.