



Extreme Fiber Elongation

Fiber elongation of formed heads often requires stress relieving after cold forming of the heads. The stress relieving time and temperatures are outlined in UCS 56 of the ASME Section VIII Div 1 Code. The formula for calculating the fiber elongation is located in ASME Section VIII Div 1 UCS-79. For heads the calculation is:

$$\% \text{ extreme fiber elongation} = \frac{75t}{R_f} \left(1 - \frac{R_f}{R_o} \right)$$

t = nom. thickness

R_f = Inside Corner Radius (ICR)

R_o = Dish Radius (infinity for flat flanged only)

When the extreme fiber elongation is exceeded by 5% and any of the following conditions exist a stress relieve is required:

- 1) The vessel will contain lethal substances either liquid or gaseous.(Would need to be specified to Brighton Sales Representatives from the customer)
- 2) Material requires impact testing .(Would need to be specified to Brighton Sales Representatives from the customer)
- 3) The thickness of the part before cold forming exceed 5/8".
- 4) The reduction by cold forming from the as-rolled thickness is more than 10% at any location where the extreme fiber elongation exceeds 5%(the ICR can not have a min. thickness less than 10% of the nominal thickness to avoid stress relieving if the fiber elongation exceeds 5%)
- 5) The temperature of the material during forming is in the range of 250 Deg F to 900 Deg F.

Due to the increasing energy costs for fuels for furnaces, there are economic advantages to avoiding the stress relieving requirements. Sometimes this can be avoided if the ICR is increased in size (within reason) to lower the fiber elongation. An example would be a 72" OD x .625" ASME F & D Head SA 516-70 w/ a 72"IDR, 4.75" ICR and 1.5" SF. This head would have an extreme fiber elongation of 9.2%. By increasing the ICR to 8.5" the fiber elongation is reduced to 4.86%, thus avoiding the requirement for stress relieving.

When there is not an alternative and stress relieving is required, Brighton has in-house computer controlled furnaces to economically stress relieve the heads. This is a unique capability, since many of our competitors must outsource this heat treatment, causing increased time for shipment and added cost. Brighton continues to strive to deliver the most economical quality product in the industry. Contact you Brighton Sales Representative for additional questions concerning heat treatment or methods to avoid the requirements of stress relieving.