Nozzle Weld Beads

Yan Zhan

Stony Brook University

12/27/2011

Location of the Interested Weld

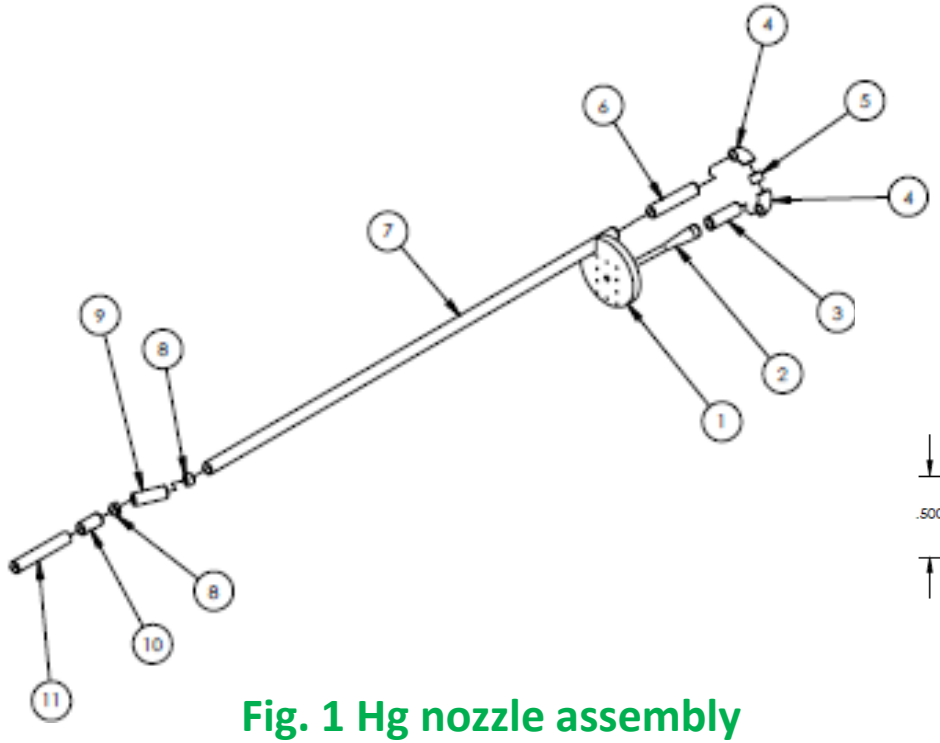


Fig. 1 Hg nozzle assembly

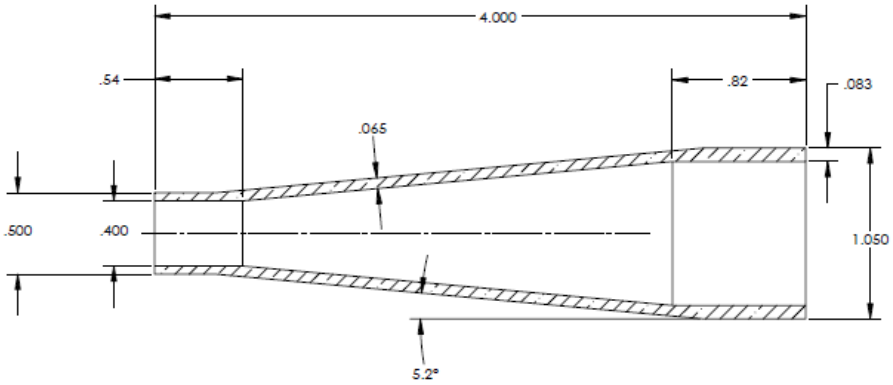


Fig. 2 Dimensions of item 2 (unit: inch)

Location of interests: welded-joint between items 2 and 3;
item 2: Ti-6Al-4V; item 3: Ti Grade 2.

Surface Topology of the Weld Bead

- To understand the effect of bead geometry on the turbulence level of the flow at pipe exit.
  - Flat surface is a crude assumption
  - Start with a symmetric torus geometry
    - Circular axis is the nominal line of the weld
    - Major radius = 0.884”
    - Minor radius = 1/16”
  - Incorporate variations that were desired
    - Cut azimuthal sections out of the torus, leaving, for example only 30^o of azimuth from -15^o to $+15^o$ relative to “up”

Surface Topology of the Weld Bead --Cont'd

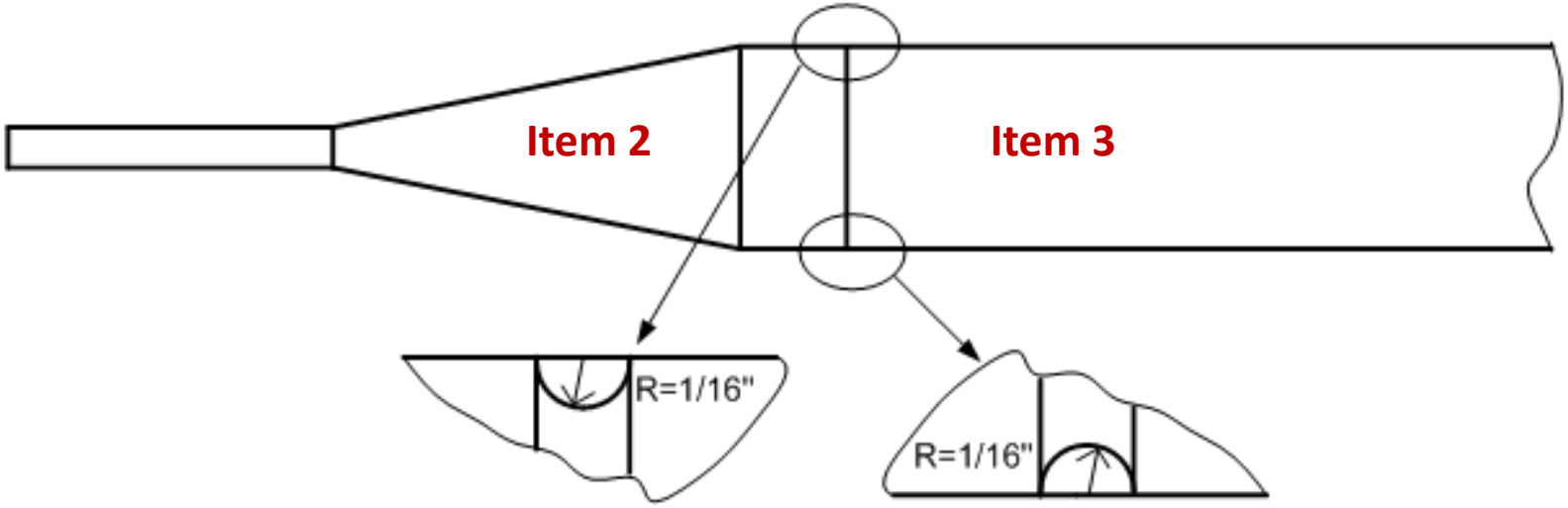


Fig. 2 Fairly continuous torus weld in the azimuthal direction

Mesh for the Nozzle with Weld

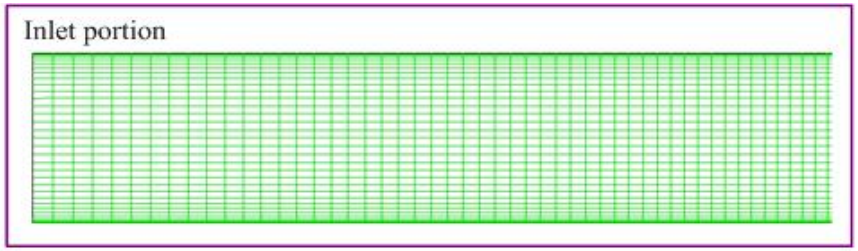
$$\mathrm{Re}_{H_2O} = \frac{u\rho D}{\mu} = \frac{4.136\times10^{3}\times0.0224536}{0.8\times10^{-3}} = 1.16\times10^{5},$$

$$y^{+} = \frac{u_{*}y\rho}{\mu} \Rightarrow y = \frac{y^{+}\mu}{u_{*}\rho}, \quad \text{(the first cell height)}$$

where u_{*} is friction velocity.

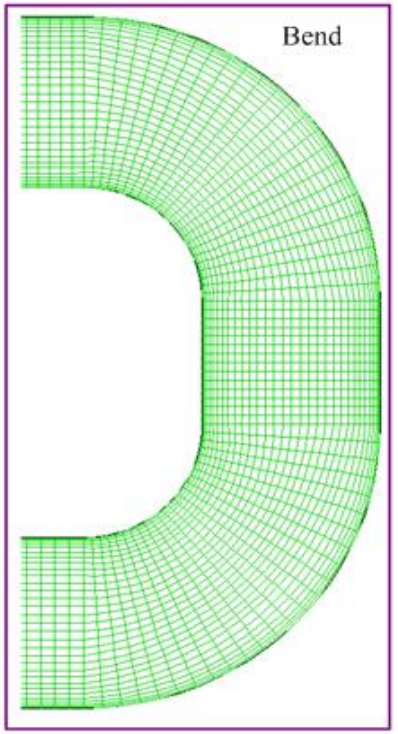
- Mesh required for EWT (Enhanced Wall Treatment)
  - y+ < 4 to 5;
  - At least 10 cells within Rey<200;

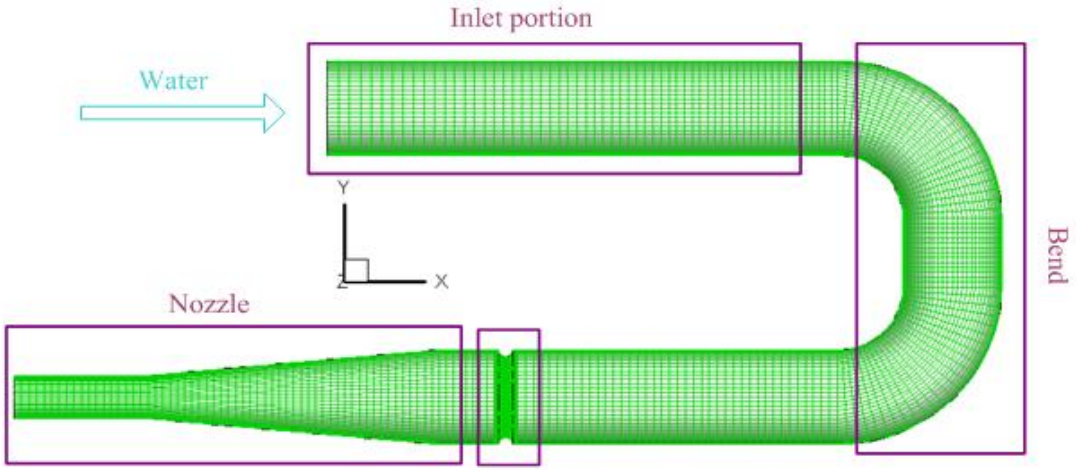
Mesh for the Nozzle with Weld --Cont'd

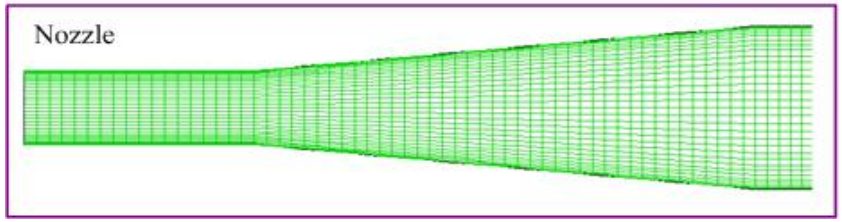


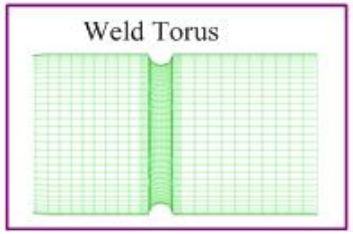
$$n_\theta = 32, n_r = 65, n_{\tilde{z}} = 260$$

$$n_{tot} = n_\theta (n_r - 1) n_z = 0.53248 \text{ million}$$









Velocity Result for Pipe without Weld