Hitting the Bulls-Eye
How to Cut-In a 108” Outlet to a 108” Vertical Shaft 230’ Beneath a Lake

Glenn A. Davidenko, P.E.
Northwest Pipe Company, Inc.

Gedas Grazulis, Welding Engineer
National Welding Corp.
Presentation Breakdown

Manufacturer’s Perspective-Presented by Glenn Davidenko

Installation Perspective-Presented by Gedas Grazulis

Closing-Presented by Glenn Davidenko

Q & A-Both Presenters
Manufacturer’s Perspective

Hydraulic Profile Schematic for Austin Water Treatment Plant No. 4.
Pressure-Diameter Value (PDV)

\[
PDV = \frac{Pd^2}{DSin^2\Delta}
\] (Equation 1)
Pressure Diameter Value (PDV)

(All values are in US customary units)

Where $P = \text{Design Pressure (from Hydraulic Profile)}, \text{ in psi}$
$d = \text{Branch OD, in inches}$
$D = \text{Main Pipe OD, in inches}$
$\Delta = \text{Outlet Angle, in degrees}$

Main Pipe and Branch OD = 110 ½”
Design Pressure = $P = 150$ psi
Delta = 90 Degrees
Pressure Diameter Value (PDV)
Based upon the above requirements, the PDV for this Outlet is around 16,575. According to the AWWA M11 Guidelines, this application would require a 3” thick crotch plate type reinforcement with a depth of plate, dw and db of around 70” and a width of plate, dt around 23”, resulting in the fitting being over 10 feet long and nearly 13 feet wide.
Sample Full Diameter Outlets with Crotch Plate Reinforcement
Why would a fitting with Crotch Plates NOT work for this installation?

• Space Limitations within the work area

• Requirement for crotch plates to be cut into halves for movement down the intake tunnel

• Fit-up and welding concerns associated with field-installation of crotch plates
Proposed Design Alternatives

• Change Cut-In Outlet to 90° Elbow

• This Alternative was not accepted
Proposed Design Alternatives

• Design the Outlet per a Design Methodology that would eliminate the crotch plates.
• Engineer would only accept a methodology that was recognized, been used previously, and could be fully documented as an acceptable practice.
• Pipe manufacturer required that the procedure be able to utilize current manufacturing practices.
THE SOLUTION

• Utilize the ASME Code – Section VIII-Division 1 as the design methodology.
• Allowed pipe and outlet steel wall thicknesses to fully reinforce the outlet without any additional reinforcement.
• Worked with engineer to develop design calculations for review and approval
• Engineer Accepted!!
Pattern Detail for Cut-In Outlet

Detail A

Detail B

Detail C
Planning
Installation
Welding
Transportation
Installation
Measure, Scribe, Cut and Repeat!!!!
Measure, Scribe, Cut and Repeat!!!
Measure, Scribe, Cut and Repeat!!!!
Changing Joint Profile
Bracing

• Weld on “ears” installed at location

• Angle iron at excessive length to allow for height variation
Welding Operations

- FCAW Flux Cored Arc Welding
- Inverter style welding machines