

Alternative Forming Technique for Large Bore, Seamless Alloy 625 Elbows Successfully Implemented on CVN 78

Status: Implemented

PROBLEM / OBJECTIVE

Nuflo, Inc., uses a proprietary closed-die, cold-forming technique to form seamless elbows using various materials. This forming process is attractive in that it results in minimal thinning of the wall thickness in the heel of the elbow and, therefore, uses pipe of a significantly reduced wall thickness when compared with traditional forming techniques. Furthermore, the process requires only a single wall thickness in the starting material of each diameter regardless of the radius of the elbow to be formed. The reduced wall thickness and uniform starting material sizes could result in substantial raw material cost savings when compared to traditional elbow forming techniques for manufacturing seamless pipe elbows. In an effort to reduce fabrication and construction costs for the Virginia Class Submarine (VCS), General Dynamics Electric Boat (EB) initiated discussions to evaluate this method for manufacturing large bore, seamless INCONEL® Alloy 625 fittings. Although Nuflo has been producing elbows using this process for more than 25 years, it had not yet applied the process to forming INCONEL Alloy 625 elbows, primarily because the material strain-hardens during cold-forming.

ACCOMPLISHMENTS / PAYOFF

Process Improvement:

This Navy Metalworking Center (NMC) project has demonstrated that Nuflo's closed-die, cold-forming technique can be successfully applied in forming large bore, seamless INCONEL Alloy 625 pipe elbows for VCS. The prototype elbows were thoroughly evaluated and found to meet all dimensional, mechanical, and metallurgical requirements as stipulated in the EB purchasing specification and as further imposed by the NMC project team. The overall quality and functionality of the formed fittings were confirmed via burst tests in accordance with ASME/ANSI B16.9-1986.

Implementation and Technology Transfer:

The current cost of seamless INCONEL Alloy 625 pipe and the specialized tooling required for the unique bend radii did not support full-scale VCS implementation. However, as a result of the technical work completed on this project Nuflo won a competitive bid from Newport News Shipbuilding (NNS) for INCONEL Alloy 625 elbows on CVN 78. Future implementation and cost savings potential also exists for CVN 79.

S2229 Cold Forming of Alloy 625 Fittings
Rev A (AUG11)



A close-die, cold forming technique was successfully applied in forming large bore, seamless INCONEL Alloy 625 pipe elbows for CVN 78. (National Technical Systems photo)

Expected Benefits and Warfighter Impact:

The cost savings associated with implementing the improved forming process for large diameter seamless INCONEL Alloy 625 elbows are linked to the cost of the starting material. Therefore, market fluctuations will directly affect the cost savings that may be realized. Based on current market prices for seamless INCONEL Alloy 625 pipe, EB estimates cost savings between \$150K and \$660K per VCS shipset.

TIME LINE / MILESTONE

Start Date:	December 2007
End Date:	December 2009

FUNDING

Navy ManTech Investment:	\$1.168M
Cost Share (Nuflo):	\$75K

PARTICIPANTS

NMC	KAPL (Knoll's Atomic Power Lab)
PMS 450	BPMI (Bechtel Plant Machinery, Inc)
NSWCCD	EB
Nuflo, Inc.	NNS

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