

# Inspection of Mill Certificates

Mill certificates documentation showed all samples with same test results

During the fabrication of the subsea boarding valve skid for a major offshore platform in the Gulf of Mexico, the fabricator purchased several large forgings. These large forgings, from 8" to 12" in diameter, were to be machined into block valve bodies rated to 15,000 psig. As part of the agreed-upon Inspection and Test Plan, the mill certificates for the forgings were reviewed by the fabricator and by the company inspector.

They noticed that a set of mill certificates for the 4130 forged blocks looked suspicious. Part of the purchase order for the boarding valve skid required that the materials meet the Boiler and Pressure Vessel Code requirements for 95 ksi steel.

The forging documentation showed that they were Charpy V-Notch (CVN) impact tested to -20°F and every single CVN test had the same impact energy: 20 ft-lbf. The lead Corrosion and Materials engineer and other members of the team agreed that this was statistically extremely unlikely so the forgings were sent to a third-party testing lab. Standard CVN and UTS/AYS samples were prepared from each forging and a complete set of mechanical properties were obtained.

All the submitted samples failed to meet the minimum CVN requirements – in several cases the impact energies were as low as 2 ft-lbf! The other mechanical properties easily exceeded the minimum requirements for 95 ksi forgings. The technical team decided that there were two choices:

1. Send the forgings to a heat-treatment facility and heat treat them (normalization followed by quenching and tempering) to achieve the desired properties, or
2. Reject the forgings outright as having counterfeit paperwork and source new material.

## TECHNICAL ACHIEVEMENTS & BENEFITS

- The company and supplier joint team decided to use Option 2 and only consider Option 1 if an unacceptable delay in delivery would result. Option 2 worked successfully.
- The mill which provided the forgings was informed that no more forgings would be sourced from them until they corrected their material quality control and documentation procedures and passed a quality audit. The mill complied with this request.
- Additionally, GATE developed tools to make it simpler for any inspector to confirm that the data in the mill certificate or MTR meets the selected standard or specification.

## LOCATION

Gulf of Mexico

## CHALLENGE

**A set of mill certificates looked suspicious. The documentation showed that were Charpy V-Notch impact tested to -20°F and every single CVN test had the same impact energy: 20 ft-lbf, the precise average value required to meet the Code.**

## SOLUTION

**GATE also developed tools to make it simpler for any inspector to confirm that the data in the mill certificate or MTR meets the selected standard or specification.**

**This tool collects mechanical and chemical properties from the material reports and compares them with the requirements in published ASTM/ASME/API standards for materials generally used in the oil and gas industry.**

**This means that screening of materials can be directly handled at the inspection level, which will speed up identification and resolution of problems.**