Rogue Materials for Pressure Equipment Supplied from New Markets

Joint EEMUA / IMechE Discussion Day

Held in Institution of Mechanical Engineers, London
2nd December 2008

Summary

Industrial users and procurers of pressure equipment have been reporting a significant increase in the number of cases where materials for pressure equipment and fabricated items supplied from the newer, non-traditional markets around the world were either found to be incorrect, defective or the associated documentation appeared fraudulent. The Association for users of engineering equipment and materials, EEMUA, together with the Pressure Systems Group (PSG) of IMechE, therefore organised a meeting in December 2008 to determine the scale of the problem, identify any common issues and possible solutions.

This document summarises the discussions that took place and is an agreed statement of the situation as understood by those present at the meeting.

The next step is to consult more widely on the extent of the problem, with a view to the development of guidelines to minimise the risks associated with sourcing pressure equipment materials, parts and fabrications from the newer markets.

Introduction

A meeting to discuss the problem of rogue and defective materials for pressure equipment being supplied from new markets was organised jointly by the Engineering Equipment and Materials Users Association (EEMUA) and the Pressure Systems Group (PSG) of the Institution of Mechanical Engineers. Attendance was restricted to procurers and users of materials, with representation from the oil and gas, power generation, and chemicals industries as well as engineering contractors. It was agreed the purpose was to highlight its existence, determine the scale of the problem in general and to identify any common issues rather than to focus on any particular problems, markets or companies.

An exchange of experience found that all the companies present had encountered problems with the quality of materials for pressure equipment purchased from markets that had not historically supplied European industry. It was agreed that from about 2003 the volume of material purchased from such markets had increased progressively, and, in the same period, the rate at which materials were found to be defective, or were not what had been specified, had also increased significantly and was continuing to do so. In the absence of industry wide data, the scale of the problem was uncertain. Rogue materials, often discovered late in the procurement chain or during installation, were having a major impact on the companies affected, and would in some cases had they not been discovered, have given rise to early failure in-service with serious safety and production consequences.

A wide range of quality problems were being reported. These included:

- parent material that did not meet specified composition
- castings and forgings that contained defects in excess of specified limits
- instances of uncontrolled specified material substitution
- incorrect or no heat treatment when specified
- failure to meet strength or creep strength requirements
- defective fabrications and uncontrolled repairs

In many instances, the information in the paperwork supplied did not correspond to the materials supplied, and had apparently been incorrectly stated or fraudulently fabricated, or different material had been substituted somewhere along the supply chain.

Examples of how the problems came to light included:

- 300 flanges ordered to an ASTM specification arrived in the UK with the material not compliant with either the technical specification or the suppliers own documentation and containing cracks in excess of the specified limit;
- Cast tubes did not conform to the documentation and were found by radiography to contain serious casting defects;
- Out of specification P91 supplied as P9 resulting in the potential incompatibility of weld procedures;
- Valve bodies that were required to be heat treated had clearly not been.
- Casting defects had been repaired without a qualified repair procedure and using a mixture of different welding consumables;
- Certificates for bolts had plainly been counterfeited, and in one case bolts had been necked to an unacceptable reduced diameter;

A separate issue was that in some instances the materials supplied, while meeting the basic technical specification, were not of the quality that procurers and users had come accustomed to expect from traditional fabrication sources. The interpretation of the specification could be variable where these documents were not translated or not fully understood.

Origins and Root Causes

The origins of the problems were often difficult to ascertain because the supply chain between steelmaker and end user could be long and involve many different parties. For example, a steel maker could supply a local material stockist, who could deliver material to one or more fabricators manufacturing the component. The manufactured component could then be supplied to a local stockist, then a European stockist before being delivered to the subcontractor of the engineering contractor for delivery to the end user.

At different stages the material and the paperwork are subject to quality checks and inspection by yet further organisations. The data on original test certificates are frequently copied onto new paperwork, sometimes not always accurately and sometimes fraudulently. When problems arise, it is clear that at some point these control systems are not functioning correctly.

An analysis of the problems identified several root causes. In some cases there was clearly a lack of competence of manufacturers and fabricators to produce material and constructions to the appropriate European standards of quality, even when using their best efforts. In other instances, there appeared to be a lack of commitment to inspection and quality in a production driven culture, and this was aggravated in environments driven by economic and cost considerations. Long supply chains meant a lack of accountability to the end user, particularly if the end user did not have any representation on site. There was a perceived lack of competence and commitment in some local statutory inspection bodies and independent inspectorates, particularly where the latter were outsourced. In the worst cases there was the perception of a purposeful intent to deceive for monetary gain or other motives.

For the end users and procurers it was recognised that some of the problems were due to the lack of clarity of their technical documentation, and that national standards for materials had not been updated for many years to align with modern practice. While some companies were providing very detailed specifications over and above the standards, others were of a view that such detail could confuse suppliers. Achieving clear communication of the technical requirements to fabricators and ensuring understanding was a major challenge, particularly where supply chains were long.

Controlling the Problems

It was agreed that the ability of end users to control the quality problems of materials from new markets was limited by the logistics of the purchasing and manufacturing processes and the length of the supply chain. Special care was required when purchasing pressure parts and materials from new markets since conventions and expectations that are well recognised in traditional markets were not necessarily understood elsewhere. ISO 9000 certification was not in itself sufficient to ensure that the materials meet the technical requirements, and there should not be over-reliance on the paperwork and data supplied without its authenticity being tested and validated.

Particular companies were taking special measures to safeguard themselves. Some had developed lists of selected countries, suppliers or manufacturers, either because they had a proven good track record of quality, or because they were regarded as potentially unreliable. Careful selection and pre-qualification of suppliers was beneficial, but could be time-consuming. Other end-users had their own inspectors on-site to oversee the manufacture and material supply at every stage, and although this was expensive, it was an effective approach. It was agreed that it was good practice to ask for the original test certificates, but these were often difficult to obtain. Independent post-manufacturing

inspections and material validation at selected stages were considered to be valuable alternatives.

It was thought that it was worthwhile trying to make specifications clearer and unambiguous, aligning the engineering and procurement parts, and supplementing national materials standards with additional requirements as appropriate. Reliable translation of the specification into the local language could also help. Ensuring the communication and understanding of the specification by the local fabricators was essential, even if this meant more time spent on site, and it was important to engage and explain requirements to senior management at an early stage. Particular care by the procuring engineer was needed when suppliers offered substitute materials different from those specified to ensure these had all the required properties.

A level of overseeing the fabrication was necessary in line with the perceived risk. Fabricators with limited experience of delivering to European standards were more of a risk, as was the use of outsourced local inspection agencies. The communication of the inspection and test plan to inspection organisations was a key aspect, and there was a general need to invest in more inspectors and their training. The effectiveness by which the control measures over materials supply within the Pressure Equipment Directive were being implemented needed to be examined more closely.

Next steps

In the first instance it was decided to announce the findings of the meeting by publication of this summary though EEMUA and the Institution of Mechanical Engineers Pressure Systems Group. It was agreed to consult more widely with the Conformity Assessment Bodies and others, acting though the offices of EEMUA or the Institution of Mechanical Engineers. A meeting for these interested parties is expected to be held in the first half of 2009.

EEMUA and IMechE expect then to initiate a more detailed study and survey of the problems with quantified data. The intention is to produce guidelines on how companies, particularly the end users, can best protect themselves against the risks. Anyone wishing to support or assist in the production of such guidelines should contact EEMUA (Andrew.Pearson@eemua.org) in the first instance.

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