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Offshore steelwork fabrication – An engineering perspective

Offshore fabrication presents a different set of challenges from a compliance perspective. Compared to local fabrication there are the issues of alternative materials, different standards for materials and fabrication practices and the tyranny of distance, which primarily affects the ability to simply just go and have a look at a partly completed fabrication (and the costs associated with that look!).

This article is written by a Structural Engineer who, over the last decade, has had to “self educate” on the requirements of steelwork fabrication, particularly the requirements defined in Australian, American and ISO Standards. It has resulted in visits to fabricators and standards workshops in countries such as Australia, Poland, Malaysia, China and the USA.

The alignment of what occurs in an offshore workshop to the original design requirements and design intentions is of vital importance. This is most aptly described in the following phrase from the foreword of ISO 2394 *General principles on reliability for structures*:

“It is important to recognize that structural reliability is an overall concept comprising models for describing actions, design rules, reliability elements, structural response and resistance, workmanship, quality control procedures and national requirements, all of which are mutually dependent.

The modification of one factor in isolation could therefore disturb the balance of reliability inherent in the overall concept”.

This article describes a set of common issues/principles that have arisen through certain experiences in recent times with offshore fabrication. Suggested strategic

actions to deal with those issues, to prevent them becoming a major factor in the quality of the finished product, are defined.

Many of these issues require management by the local Contractor who is responsible for engaging the offshore fabricators.

Safety

Some of the workshops in different areas of the world have totally different standards from what Australians are used to. Moral of the story – take your own Personal Protective Equipment.

Basis of design

Fabricators cannot be expected to understand the basis or intention of the design. They are expected to comply with the requirements as outlined on drawings and other related documents. They need to understand that if they change what is shown on a drawing, standard or specification that this requires engineering approval. This includes material (i.e. from materials defined in an Australian Standard to something else), welding standards (i.e. from AS 1554 to AWS), tolerances (from AS 4100 to AISC). Sometimes a team approach of Design Engineer and fabricator is required.

Standards and specifications

It is impossible to know what is in a document without actually reading it. Simple but often not recognised.

What is often found is that, provided a workshop effectively implements the requirements of a recognised standard, the client-specified additional requirements will generally be met quite easily.

by Doug Hawkes

Alternative standards

The majority of welding standards around the world originated from either Europe or America. In general they are all similar with different detail requirements. Therefore, while it may be necessary to assess some of those detail differences, it is more important that the standard to which the workshop wishes to work is a recognised standard and that the workshop actually uses it. Imposition of an unfamiliar standard upon a workshop can cause more problems that it will solve. The piece of steel or the weldment does not know what standard it is being manufactured to!

ISO 3834 provides a good basis for assessing workshops processes and practices against an international standard.

Alternative materials

This can be an area of potentially serious consequences. Designs done to Australian Standard materials are not easily substituted with other worldwide materials. Australian structural steel materials (AS 3678/AS 3679) generally have higher strengths than similar thicknesses in other standards, such as EN 10025. This is particularly noticeable as plates become thicker. An engineered assessment of substituted materials is required. A subsequent outcome from using overseas materials is that the original design thickness often requires substitution with a thicker plate, resulting in a weight and potentially a cost penalty.

There are large savings to be made by use of selected overseas material standards for use, at the design stage.

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Offshore Steelwork Fabrication

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Acceptance criteria

This primarily incorporates all the points made above: the basis of design, the applicable or alternative standards, specifications and materials. What is vitally important is that all this detail is resolved either pre-award or pre-commencement of (material or fabrication contractor) procurement.

Application of the acceptance criteria at the workshop floor is one of the most violated of all principles. Once the acceptance criteria are established – use them. If a welder requires re-qualification, re-qualify him. If a joint preparation is out of tolerance, fix it – before the welding starts.

It complies or it does not. If it does not comply fix it. Yes, it is that simple. This is highly important with sub-contract works offshore. In many cultures, the acceptance of defective material once then implies that it will be forever accepted.

Qualified people

The great mining boom has seen qualified people become scarce and has seen unqualified people assume roles they should not. If they are not qualified, train them.

Detailed workshop audits/reviews

It is imperative that selection of an offshore workshop be determined by attending that workshop, auditing its quality processes and practices, what standards they use and how effectively they implement them, before they are awarded work. An ISO certificate at the front entrance is a wonderful starting point, but it does require verification that it is being used throughout the organisation. The perception that a very large workshop must have a great quality system can be a serious error of judgement. A good tactic is to sit in different parts of the workshop for at least a couple of hours and observe how the tradesmen go about their work. Poor quality workshops are generally quite easy to identify by the lack of skills shown by those performing the most basic of tasks, like cutting and weld preparations.

Another general observation made is that places that effectively control the basic items like personnel and proce-



dures qualifications, or tasks like joint preparations, and have good records for traceability generally deal with the detail requirements as well. Those that have poor control of the basic requirements tend to have little or no control over the detail requirements.

Differing levels of quality

Some workshops provide differing levels of 'quality'. The key here is that the unsuspecting don't actually know about this until they observe the better 'quality' level (on someone else's work) when works are already under way. They are told by a fabricator that they 'bought' the lower level of quality and the alternative is available at a higher price! The prospective workshop must be probed as whether they provide priced-based 'quality levels'.

Non-destructive testing

What a wonderful invention, often used in a very poor way. Many NDT providers will disagree, but the overuse and abuse of NDT as a detection mechanism provides a false impression that it can find anything and everything. The substitution of more NDT for poor quality joint fit-up, or use of unqualified welders does not change the fact that you are simply testing non-compliant and poor quality fabrication.

Schedule and Cost

A quote occasionally seen; "Quality, Schedule, Cost – Which two can I do for you?". Sadly, a true statement in many instances. The statements of "We have not allowed for that" or "We won't be able to meet the schedule by doing all that" should be greeted with "It's in the Contract when you agreed to conduct the fabrication to the Standard and Specification".

Information

There is no real excuse for a fabrication workshop not to know the basic and detail requirements of structural steelwork fabrication. There is an enormous amount of reference data available straight from the internet, from all the relevant technical societies like WTIA, AWS, IIW, TWI etc.

Be prepared

Offshore fabrication brings up some humorous experiences, both at the workshop and elsewhere. A laugh can get you through some of the most trying times.

All the above should be considered in the legal context, that the importer of the finished product will, in essence, take on the responsibility both for the Designer and for the Manufacturer of the product if they are outside the jurisdiction of the State in which the product will be used. This is a whole other area best left to the lawyers (therefore best to avoid!).

Of course all the principles discussed apply to local fabrication as well.

The above items primarily require resolution before award of a Contract or sub-contract.

What is generally obvious is that good (good means better than, or easily achieving, the minimum acceptance criteria) quality fabrication should always be admired and respected, irrespective of the location. Poor quality fabrication you can get anywhere, for any price.

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