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DIRECTIVE

Interpretation of Code Requirements in Paragraph UG-84 Relative to the Determination of the Number of Vessel (Production) Impact Test Plates Required

1.0 Introduction

When production impact testing is required for a pressure vessel that is to be fabricated in accordance with the rules of ASME Section VIII, Division 1, it is necessary to determine how many vessel (production) test plates will be required to ensure the proper representation of production welding used in the fabrication of the vessel. The test plate welding is meant to represent the quality and type of welding that is used in the production welding. Within the Code the “type” of welding means automatic, semi-automatic, or manual welding. The most accurate means of ensuring the test plate weld represents the production weld is by welding the test plate in an identical manner to the production weld, hence the use of an “extension of the production weld”, or as is commonly known to industry a “run-off tab”.

The minimum Code requirement is for one test plate for each Welding Procedure Specification used for joints of Category A and B, and in the case of a vessel having a longitudinal seam in a cylindrical shell, this coupon must be prepared as an extension to the end of the longitudinal seam. In addition, if the type of welding used to produce the head-to-shell joint is not the same as that used for the longitudinal joint, then additional test plates are required to represent the type of welding used to produce the additional joint(s).

2.0 Background

With respect to the number of vessel (production) test coupons required by the Code paragraphs UG-84(i)(1) and UG-84(i)(3), there may be some variation amongst Manufacturers and ABSA Authorized Inspectors in the understanding of the combined requirements of these two Code paragraphs.

The key language, extracted from the respective paragraphs, reads as follows:

From UG-84(i)(1)

“For Category A joints, the test plate shall, where practicable, be welded as an extension to the end of a production joint so that the test plate weldment will represent as nearly as practicable the quality and type of welding in the vessel joint.”

From UG-84(i)(3)

“(a) For each vessel, one test plate shall be made for each welding procedure used for joints of Categories A and B, unless the vessel is one of several as defined in (b) or (c) below.

In addition, for Category A and B joints the following requirements shall apply:

(a)(1) If automatic or semi-automatic welding is performed, a test plate shall be made in each position employed in the vessel welding.

(a)(2) If manual welding is also employed, a test plate shall be made in the flat position only, except if welding is to be performed in other positions a test plate need be made in the vertical position only (where the major portions of the layers of welds are deposited in the vertical upward direction). The vertically welded test plate will qualify the manual welding in all positions.”

The issue or possible misunderstanding of Code requirements stems from the fact that many Manufacturers are using a single welding procedure specification (WPS) that includes multiple processes (e.g., GMAW, SMAW, & SAW) and types of welding (e.g.,¹ automatic, semi-automatic and manual) to weld all Category A and B joints in any given vessel. Additionally, in some instances these Manufacturers may elect to weld Category A and B joints with different processes or combinations of processes using the multiple-process WPS.

Because of differences in the types of welding used (i.e., automatic, semi-automatic, manual) for Category B joints as compared to the Category A joints, it may not be possible to meet the requirements of UG-84(i)(3)(a)(1) and UG-84(i)(3)(a)(2) with respect to the Category B weld joints using the Category A weld joint run-off-tab test plate, prepared as required by UG-84(i)(1).

In an attempt, therefore, to meet all of the requirements with only one test coupon, and thus save on the cost of additional mechanical testing, some Manufacturers have proposed to prepare a test coupon with all of the types of welding included, as required by UG-84(i)(3)(a)(1) and UG-84(i)(3)(a)(2). However, this test plate weldment would conceivably not represent *as nearly as practicable* the quality and type of welding in the vessel Category A joint(s). The thinking appears to be that, provided the welding type used in the Category A joint is present in the vessel impact test plate, that is all that matters in satisfying UG-84(i)(1). But, a test plate weldment that includes two or three types of welding does not represent a Category A joint made with a single type of welding *as nearly as practicable*. According to the Oxford Canadian Dictionary, practicable means “that can be done” or “possible in practice”. Hence, as nearly as practicable means as nearly as can be done. The run-off tab *can* be welded the same as the Category A joint in a cylinder is welded, albeit with some probable differences in cooling rate, and that is what the Code requires. A test coupon that is a composite of all the types of welding that exist in the Category A plus Category B joints is not what the Code requires.

To promote uniformity of application of the above Code requirements in Alberta, this directive describes the interpretation of the Code rules that shall be enforced during ABSA shop inspections.

¹ For the purposes of UG-84(i)(3)(a)(1) the machine welding type may be interpreted as being included under the term automatic welding.

3.0 Interpretation

The decision process illustrated in Figure 1 of this directive shall be applied for ABSA shop inspections.

This decision diagram indicates that unless it is impracticable to do so, a vessel Category A weld joint vessel (production) test plate will be required to be prepared in order to represent the quality and type of welding in the vessel Category A weld joint(s). It may be possible that under some circumstances, when the type of welding would be different and therefore not meet the requirements of UG-84(i)(3)(a)(1) and UG-84(i)(3)(a)(2), that more than one test plate could be required to adequately represent the types of welding used in all of the vessel Category A weld joints. After this Code requirement relative to Category A weld joints has been met, it will then be necessary to determine if the remainder of the Code requirements related to the type of welding used in all Category A and B joints are satisfied. If all Code requirements cannot be met with the Category A weld joint test plate(s), then additional test plates shall be prepared as required by the Code paragraphs for the Category B joints.

Examples of the Application of the Interpretation:

Given: A simple vessel that requires production impact testing, having a cylindrical shell and semi-ellipsoidal heads. The selected welding procedure is qualified for GMAW, SMAW and SAW.

1. The longitudinal joint and all the circumferential joints will be made using a GMAW root, followed by 3 passes of SMAW with the remainder of the weld completed by SAW.

Under these circumstances one test plate welded as an extension to the longitudinal joint may be used to represent all welding on the vessel.

2. The longitudinal joint will be made using SAW only. The circumferential joints will be made using a GMAW root (flat position), followed by 3 passes of SMAW (flat position) with the remainder of the weld completed by SAW.

Under these circumstances one test plate welded as an extension to the longitudinal joint is required to represent the type of welding within the longitudinal joint. An additional test plate is required to represent the types of welding in the circumferential joints.

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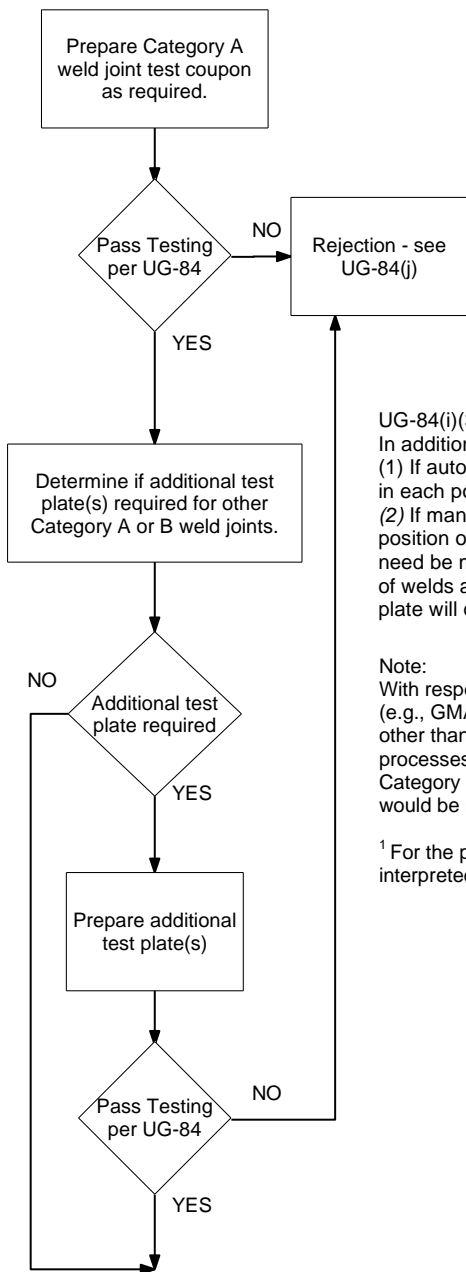
Figure 1

ASME Section VIII, Division 1, Paragraph UG-84 Vessel (Production) Impact Test Plates

Example 1

- a) Vessel contains both Category A and Category B weld joints.
- b) Category A and B joints are welded using the same multi-process (GMAW-SMAW-SAW) WPS.
- c) The vessel is not one of several per UG-84(i)(3)(b).

START



UG-84(i)(1)
For Category A joints, the test plate shall, where practicable, be welded as an extension to the end of a production joint so that the test plate weldment will represent as nearly as practicable the quality and type of welding in the vessel joint.

UG-84(j)
Rejection. If the vessel test plate fails to meet the impact requirements, the welds represented by the plate shall be unacceptable. Reheat treatment and retesting or retesting only are permitted.

UG-84(i)(3)
In addition, for Category A and B joints the following requirements shall apply.
(1) If automatic or semiautomatic welding is performed, a test plate shall be made in each position employed in the vessel welding.
(2) If manual welding is also employed, a test plate shall be made in the flat position only, except if welding is to be performed in other positions a test plate need be made in the vertical position only (where the major portions of the layers of welds are deposited in the vertical upward direction). The vertically welded test plate will qualify the manual welding in all positions.

Note:
With respect to the requirements of UG-84(i)(3); if ¹automatic, semiautomatic (e.g., GMAW) or manual welding (e.g., SMAW) is performed on Category A joints other than the joint with the run-off tab or on Category B joints and these processes and positions (as applicable) were not represented as required in the Category A joint run-off tab, then an additional production impact test coupon would be required.

¹ For the purposes of UG-84(i)(3)(a)(1) the machine welding type may be interpreted as being included under the term automatic welding.

END