

Information Bulletin No. IB11-020 WITHDRAWN 2022-02-07
Replaced by IB22-001

December 21, 2011

Responsibility for NDE During Pressure Vessel Fabrication

Introduction

Nondestructive examination (NDE) is used during construction of pressure vessels as a quality indicator of base materials and the fabrication processes (e.g., weldments, etc.). The aim of NDE, be it radiography (RT), ultrasonic (UT), magnetic particle (MT) or other examinations, is to provide a reasonable assurance that the finished vessel may be operated with the margin of safety intended by the design factor.

The parties common to most pressure vessel construction are the owner, the manufacturer, the subcontracted NDE service provider and the “Authorized Inspector” (AI). Each has responsibilities for NDE that must be clearly understood by and among all parties concerned. This information bulletin identifies and provides a brief explanation of the key responsibilities of each party.

Owner’s responsibilities

The owner is responsible for the safe operation of the vessel once it is in service. Service typically causes some deterioration of the pressure vessel over time, and some services are more severe than others. The owner needs to be fully cognizant of the service conditions the vessel will be exposed to, and may, in some circumstances, find it prudent to specify NDE that exceeds the requirements specified in the Code of construction. This may include specifying additional NDE with acceptance criteria established by the owner, or specifying defect acceptance criteria that is more restrictive than stated in the Code of construction.

It must also be recognized that NDE techniques are not all equal and some may be better suited for detecting certain/different flaws/inclusions/defects than others. Even with a single NDE technique (e.g., UT), there may be more than one methodology (e.g., TOFD and Phased Array) each more suitable than another for certain applications. However, in most Codes of construction, more than one technique (e.g., UT or RT) may be deemed as equally acceptable. When not specified by the owner, as far as a majority of construction codes and standards go, the choice of NDE would be left to the Manufacturer to decide. Thus, if the owner were to favour a certain NDE over another, for whatever reasons, the owner must clearly detail such provisions in the contract.

Manufacturer’s responsibilities

Manufacturer’s responsibilities are established by the Code of construction. For example, according to ASME Section VIII Division 1 paragraph UG-90(b), *“The Manufacturer has the responsibility of assuring that the quality control, the detailed examinations [i.e NDE] and the tests required by this Division are performed.”* This broad statement means the Manufacturer is accountable for all aspects of NDE: that it is performed to the extent

required and performed and interpreted by qualified personnel, that the results are acceptable, that unacceptable defects are remedied, and that the results are properly documented.

The Manufacturer's accountability for these responsibilities are not absolved when the NDE is performed by a subcontractor. The Manufacturer is responsible to review and accept the NDE subcontractor's written practices, which must use SNT-TC-1A or CP-189 as a guide, and to ensure that NDE personnel have been properly qualified and certified in accordance with this written practice. ASME Section V T-150 states that when NDE is required by the construction Code, it must be done to a written procedure. A procedure demonstration must be performed to the satisfaction of the Authorized Inspector. The Manufacturer must verify these demonstrations have been completed prior to allowing Code required NDE to be performed. This verification must be documented and included in the NDE subcontractor's NDE manual. The Manufacturer is also responsible to review and accept the results of the NDE performed, and to maintain records of the NDE, all in accordance with their quality management system.

The Manufacturer may have additional responsibilities established and agreed with the owner and documented in the purchase contract. It is noted these are additional contractual responsibilities over the minimum responsibilities as specified in the Code of construction that must always be met.

NDE Subcontractor's responsibilities

The NDE subcontractor's responsibilities are established by the contract, the details that are pertinent to this discussion would include requirements to the effect: NDE is to be performed in accordance with the requirements established in ASME Section V, and to the subcontractors *Written Practices* as well as specified in the code of construction. The NDE subcontractor's personnel are responsible to perform the NDE, to interpret and document the results, and to provide the results to the Manufacturer.

Authorized Inspector's Responsibilities

The AI's responsibilities are established in the Code of construction. For example, according to ASME Section VIII Division 1 Paragraph UG-90(c)(1)(i), the AI is responsible for "verifying that required nondestructive examinations, impact tests, and other tests have been performed and that the results are acceptable".

The AI fulfills this duty by verifying the NDE was performed and interpreted by qualified personnel and that it is documented properly. The AI is also responsible to witness demonstrations of NDE procedures for UT, MT, and PT when these non-destructive examinations are required by the construction Code.

In Alberta, to ensure uniformity across the Province, this witnessing is conducted on behalf of the AI's by the Authorized Inspector Supervisors (AIS), and the outcome is documented in the NDE subcontractor's documentation. Prior to witnessing the demonstration of the NDE procedures, the AIS will review the "Written Practice" and NDE procedures to ensure they meet the minimum requirements set out in the ASME Codes (e.g. addressing the essential and non-essential variables listed in the various Articles of ASME Code Section V). This review of written practices and NDE procedures is done to verify the procedure may be suitable for Code work and to confirm the demonstration is in accordance with the written practices and procedures.

The outcome of the procedure demonstration is typically documented in a letter issued by the NDE subcontractor which identifies the procedures demonstrated, and includes the names and signatures of the company representative and the AIS that witnessed the demonstration. A copy of this letter is usually kept in the NDE subcontractors manual and provides evidence to the Manufacturer that the NDE subcontractor's procedures were demonstrated to the AI. It does not satisfy the Manufacturer's Code responsibility to review and accept the written practices of the NDE subcontractor.

It is good to note that generally, NDE, as performed in Alberta, has always been well regarded helping greatly to promote pressure equipment safety in our province. As stated in the introduction, this information bulletin provides only a brief explanation of key responsibilities. With this information bulletin, everyone involved with NDE may get a basic understanding of others' responsibilities. But it is important that one should have a thorough understanding of one's own responsibilities not only for the sake of public safety but also one's legal accountability and liability as well. All parties need to work together with respect to NDE as well as other aspects of pressure equipment construction to ensure the integrity of the pressure equipment when it leaves the Manufacturer's control.

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