

# P R E S S U R E P O I N T S

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After a bit of a hiatus we are pleased to be able to publish this issue of *Pressure Points* for our clients and colleagues. We are looking forward to resuming our normal publication schedule and bringing you the latest developments and technical guidance in the Pressure Vessel industry.

Thomas Pastor, Director, HSB Codes and Standards

## ASME CODE N E W S

by Thomas P. Pastor, Director, HSB Codes and Standards

### ASME Interpretation VIII-1-01-04

The following interpretation was recently published by ASME:

Interpretation: VIII-1-01-04  
Subject: Section VIII, Division 1 (1998 Edition, 1999 Addenda) (U-1 (e))  
Date Issued: September 28, 2000  
File: BC00-500

**Question (1):** May a pressure vessel, which does not contain an upper head but instead bolts directly to a piping header via a body flange be “U” stamped as a completed vessel.

**Reply (1):** Yes.

**Question (2):** A pressure vessel employs a bolted removable cover as part of the vessel assembly. The cover contains no welding, and may or may not be purchased as a standard pressure part. Must this cover and its bolting be included within the stamping scope of the pressure vessel, and thus satisfy all Code construction requirements including material, design, testing, and inspection?

**Reply (2):** Yes.

**Question (3):** A pressure vessel employs a bolted removable cover as part of the assembly. The cover contains one or more welded nozzles. Must this cover and its bolting be included within the stamping scope of the pressure vessel, and thus satisfy all construction requirements including material, design, testing, and inspection?

**Reply (3):** Yes.

**Question (4):** In the manufacture of multiple duplicate pressure vessels employing removable upper heads, is it permissible to separately pressure test the vessel body and the removable head in satisfying the requirements of UG-99 or UG-100?

**Reply (4):** No, both UG-99 and UG-100 require pressure testing of the completed vessel as a whole.

### Explanation

This interpretation was published to clear up a misunderstanding regarding geometric scope of vessels constructed to Section VIII, Division 1. By geometric scope, I mean when a pressure vessel is “U” stamped, which pressure parts are covered by the stamping? The simple answer is all the parts required to hold pressure. Thus, a bolted cover or blind flange used as a head on a vessel is clearly within the stamping scope of the vessel.

Things get complicated when connections are made to the vessel. This is covered in U-1 (e) of the Introduction chapter. Basically, where connections are made to piping, other pressure vessels, or mechanical devices (pumps, mixers, etc.), the vessel boundary ends at:

1. The welding end connection for the first circumferential joint for welded connections. (**Note:** the nozzle attachment weld to the shell or head is not considered the first circumferential joint; welded nozzles are always within the scope of the vessel!)
2. The first threaded joint for screwed connections.
3. The face of the first flange for bolted, flanged connections.
4. The first sealing surface for proprietary connections and fittings.

Many code users have misinterpreted item 3 above as allowing them to end the vessel boundary at the face of a flange to a bolted head or manway cover. This is incorrect considering that U-1 (e)(1) only concerns connections to piping, other vessels, and mechanical equipment! Thus all permanent pressure covers must be included as part of the stamped vessel; this includes manway and handhole covers, bolted heads such as used on oil separators or paint pots, and lugged heads such as used on autoclaves.

Finally, the last question of the interpretation clarifies that when conducting the required hydrostatic or pneumatic test of the completed vessel, the entire vessel [all pressure parts] must be installed at the time of the test.

# Questions and Answers

**Q** I understand that the welds attaching nonpressure parts to the pressure boundary of a vessel are considered Code welds, and must meet the requirements of Section IX. But does this also mean that these attachment welds have to meet the PWHT rules of Section VIII, Division 1?

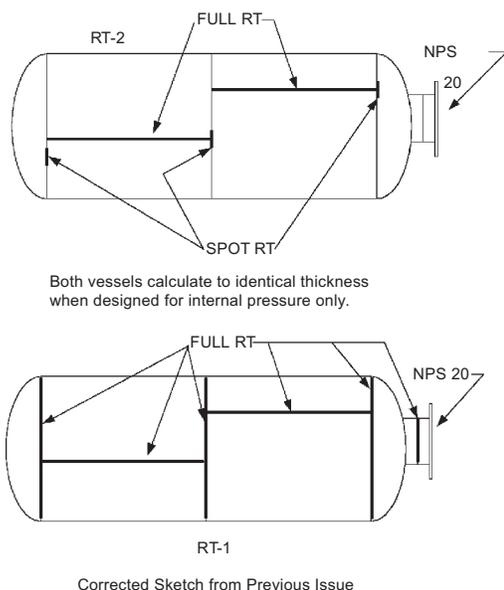
**A** The answer is yes. Per UW-40 (f)(5)(g), the governing thickness for PWHT consideration of nonpressure attachment weld to a pressure part is the thickness of the weld. However, for many carbon and low alloy steels, an exemption to PWHT for welds attaching nonpressure parts is possible depending on the size of the weld and material being joined.

## Section VIII, Division 1 Joint Efficiency Rules and 'RT' Marking (Parts 3 & 4)

by Thomas P. Pastor, Director, HSB Codes and Standards

In this article I will complete the explanation of 'RT' marking by discussing 'RT-3' and 'RT-4'.

But before I begin, I need to correct a sketch from the previous issue dealing with 'RT-2' (Volume 4, No. 3). Shortly after publication, it was pointed out that I indicated the need for a Spot RT at the Category B weld in the NPS20 nozzle to satisfy an RT-2 condition. This was incorrect; the corrected sketch is shown at the right.



### 'RT-3' Vessels

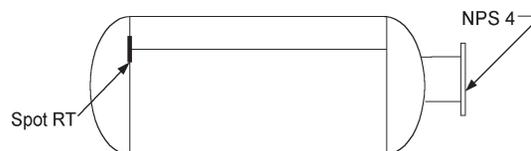
An 'RT-3' vessel is one in which the entire vessel satisfies the spot radiography requirements of UW-52. One exception is those Category B & C butt welds in small nozzles and communicating chambers that neither exceed NPS10 nor 1 1/8" in thickness. Furthermore, spot radiographs to satisfy the requirements of UW-11 (a)(5)(b) cannot be applied to any other increment. Per UW-12 (b), a joint efficiency from column (b) of Table UW-12 shall be used in the design calculations for spot radiographed butt welded joints.

In essence, spot radiography is a statistical check of a welder's ability to deposit sound weld metal. Per UW-52 (b)(1), only 1% (6 in. per 50 ft. of weld) of a welder's work need be radiographed. The location of the spot radiograph is to be chosen by the Authorized Inspector, however when agreed to in advance, the fabricator may select the location of the radiograph. Each 50 ft. of weld placed by a welder is defined as a weld increment. A weld increment can be made up of different joint types [Type 1 or 2], different weld processes [SAW, GTAW, SMAW,...] and extend across multiple vessels. The cost of this

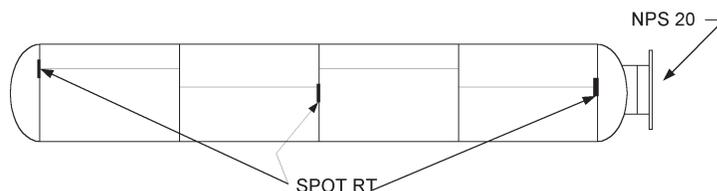
reduced examination is a decrease in design efficiency from 1.0 to 0.85 for Type 1 joints, and 0.90 to 0.80 for Type 2 joints. Depending on the vessel, this is a suitable tradeoff.

The following two sketches show a couple of typical examples of spot RTed vessels meeting a RT-3 marking requirement. One item to note is that the seamless heads are designed with a joint efficiency of 0.85, since the additional requirements of UW-12 (d) and UW-11 (a)(5)(b) have not been met. If an additional spot radiograph is taken to satisfy UW-11 (a)(5)(b) and hence design the heads with an E=1.0, then this would be a mixture of RT-2 and RT-3 rules, and the correct marking would be RT-4. More on that later.

### RT-3 Examples



Ex. (1) All welds made by same welder and total less than 50 ft. - 1 Spot RT Required



Ex. (2) Assume 3 weld increments requiring 3 Spot RT's

### Design Efficiencies [All Type 1 Joints]:

Shell: Longitudinal Seam - E = 0.85  
Circumferential Seams - E = 0.85  
Heads: Seamless, however UW-11(a)(5)(b) not satisfied; E = 0.85

To summarize, spot radiography provides a reasonable alternative to either full or no radiography conditions. Although there is a reduction in the design efficiency from that used for full RT, often the savings in examination cost offset the increase in material cost. It is interesting to note, that other foreign pressure vessel standards also contain spot examination options, but unlike ASME, they typically require from 10-20% of the weld to be examined

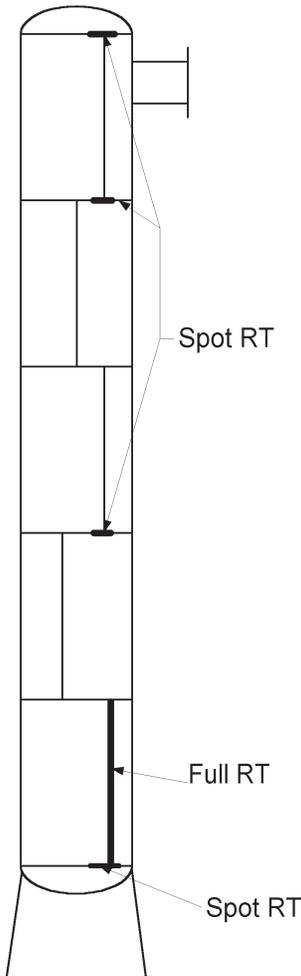
### 'RT-4' Vessels

The purpose of the 'RT' marking system is to indicate that radiographic examination of the vessel welds were performed, and to what extent. The simplest way to describe 'RT-4' is to state that as a minimum, one or more welds were RTed, but the extent of RT did not satisfy an 'RT-1, 2, or 3' condition. Put another way, 'RT-4' means some radiographic examination took place, but one cannot describe the amount with a simple numbering system.

One common application of RT-4 is the vessel shown in Ex. (2) above. As depicted, this is an RT-3 vessel. However, if an additional spot RT is taken to satisfy UW-12 (d) and UW-11 (a)(5)(b), thus allowing the seamless heads to be designed with an E=1.0, then it becomes RT-4. Why? Because there is a mixture of the RT-2 and RT-3 rules. This situation is further clarified in the following code interpretation:

Interpretation: VIII-1-89-210R  
Subject: Section VIII, Division 1 (1989 Edition),  
UG-116 (e) and UW-12 (d)  
Date Issued: June 17, 1991  
File: BC90-418\*

### RT-4 Example



**Question:** Which of the marking requirements under UG-116 (e) apply for a vessel that consists of seamless ellipsoidal or torispherical heads when the vessel joints are spot radiographed and after the circumferential seams attaching the heads are separately spot radiographed per UW-11 (a)(5)(b)?

**Reply:** RT-4.

The tower shown to the left would be another example of an RT-4 vessel, where the lower shell course is fully radiographed, while the remainder of the vessel is spot RTed per UW-11 (b) and UW-11 (a)(5)(b).

### SUMMARY

ASME Section VIII, Division 1 provides much flexibility to the vessel manufacturer in the way of balancing radiographic examination of welds against design and fabrication requirements. Once understood, the definitions of weld joint *Category* and joint *Type* along with the joint efficiency rules of UW-12 provide an elegant solution to a sometimes daunting problem. Once vessel fabrication is completed, the RT marking system of UG-116 (e) provides a shorthand system for identifying that radiographic examination was performed, and to what extent.

### ■ PED Guidelines Offer a Reference for Consistent Application (Part 1 of 2)

by Alex Garbolevsky, PED Project Manager

November 2001 marks the two-year anniversary of the transitional implementation phase of the European Union Pressure Equipment Directive (97/23/EC).

HSB's experience through the first two years is that with few harmonized pressure vessel-related standards, and no relief currently available through the European Approval of Material (Article 11) approach, material concerns abound. The scope of the Directive also has generated questions.

The 115 Notified Bodies, among them Hartford Steam Boiler International GmbH (Germany) and Hartford Steam Boiler Inspection Quality Limited (UK), participate in regular forums in an attempt to clarify procedures and to better administer their responsibilities within the PED.

One means of clarification is found in the "Guidelines" published by the European Commission's Working Group

"Pressure." The "Guidelines" are not legally binding interpretations; however, they represent a reference for ensuring consistent application of the Directive by all those involved.

### Common Topics

Here are a few Guidelines that address the most common topics:

- What happens if a CE-Marked vessel is repaired on-site in Europe?
- Do "used vessels" exported to the European Union come under the PED?

### Guideline 1/3

**Question:** Are replacements, repairs or modifications of pressure equipment in use covered by the directive?

- Answer:**
- 1) Entire change: the complete replacement of an item of pressure equipment by a new one is covered by the PED.
  - 2) Repairs are not covered by the PED but are covered by national regulations (if any).
  - 3) Pressure equipment that has been subject to important modifications that *change* its original characteristics, purpose and/or type after it has been put into service has to be considered as a new product covered by the directive. This has to be assessed on a case-by-case basis.

The Guidelines do not specifically address "used vessels," but the *Guide to the Implementation of Directives Based on New Approach and Global Approach*, drawn up by the European Commission's Directorate-General III (Industry) is clear: "Products must be in compliance with the applicable New Approach directives, and other Community legislation, when they are placed on the market. Accordingly, new products manufactured in the Community and *all products imported from third countries - whether new or used - must meet the provisions of the applicable directives when made available for the first time on the Community market.*" (Chapter 2.3.1)

It remains to be seen how Notified Bodies will "reverse engineer" used vessels to meet the Pressure Equipment Directive.

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- I have a jacketed pressure vessel to be CE-Marked. The jacket is under vacuum. Since the PED only covers pressures greater than 0.5 bar, can I ignore the PED's essential safety requirements with regard to the jacket?

### Guideline 1/13

**Question:** Is the pressure equipment directive applicable to vacuum insulation of pressure vessels?

**Answer:** Yes.

**Reason:** Vacuum casings which do not have a maximum allowable pressure greater than 0.5 bar are therefore not pressure equipment in their own right. However as structural elements attached to pressurized parts, they are part of pressure equipment and any negative effects of the vacuum casing and insulation on the pressurized parts must be taken into account and avoided.

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