PRESSURE POINTS
THE QUARTERLY NEWSLETTER OF ENGINEERING SERVICES
THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
MARCH 2000 VOLUME 4 NO. 1

ASME CODE NEWS

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

Questions and Answers

Subcommittee VIII recently approved several interpretations that would benefit from some explanation.

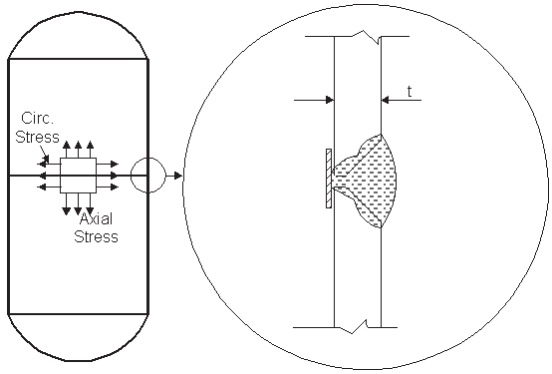
Backing Strips & MDMT

Q When performing an impact test exemption/MDMT review of a backing strip to be left in place on a circumferential joint, may the longitudinal stress at the joint be used in the Alternative Ratio in Fig. UCS-66 of Section VIII, Division 1 for figuring the coincident ratio per UCS-66(b)?

A No.

Explanation: With the A97 Addenda, UCS-66 was revised to require backing strips left in place to be Code material. An exemption from impact testing was provided in UCS-66(h) for backing strips assigned to Curve A with a thickness not exceeding 1/4 in., and when the MDMT is -20°F or warmer. The main point of the question is to determine what stress should be used when applying the low-stress exemption rules of UCS-66(b) to justify an MDMT colder than -20°.

Fig.UCS-66.1 is used to determine the reduction in MDMT based on reduced stress in the material. Either the ratio of the required thickness to nominal thickness is used, or the ratio of the actual general primary membrane stress to allowable stress. At a circumferential joint in a vessel [see below sketch], the weld is subject to both axial stresses and circumferential hoop stresses. Since the backing strip material is fused to the base material in the welded joint, it experiences the same level of stress as the base material. Thus, if a low-toughness quality material is used for a backing strip, the risk of brittle fracture is increased. The largest stress in the area of the weld, in this case the hoop stress, should then be used to determine any possible reduction in MDMT per Fig.UCS-66.1.



Modified ASME B16.5 Flanges

Q An ASME B16.5 or ASME B16.47 raised-face blind flange (or a blind flange machined to the dimensional requirements of B16.5 or B16.47) has its center portion drilled with an array of holes to accept immersion heater elements that are attached by welding or brazing. Is it acceptable for Section VIII, Division 1 construction to use the B16.5 or B16.47 pressure-temperature ratings of these standards without performing any additional design calculations as allowed by UG-44?

A No.

Q If the answer to the above question is "no," what additional requirements apply?

A The design method of bolted circular flat heads is covered by paragraph UG-34(c)(2), formula (2). When openings that do not satisfy the provisions of UG-39(a) are present in flat heads, the reinforcement requirements of UG-39 must be satisfied.

Explanation: Flanges, pipe fitting, etc. purchased to a reference standard in accordance with UG-11 are acceptable for use in Section VIII-1 construction. This means that the pressure-temperature ratings published in the reference standard may be used without any additional design consideration. One exception to this rule is when the flange or fitting is modified or altered. In this case, the dimensional standard's ratings no longer apply, and the component must be designed in accordance with Code rules. This is the essence of Question 1 above.

Question 2 addresses the design of the modified blind flange. The rules of UG-34 cover the design of blind flange absent the holes. Once the flange is sized, the small openings are evaluated. Depending on the size and spacing of the holes, UG-39(a) may provide an exemption from reinforcement calculations. If not, then reinforcement calculations per UG-39 are required.

Code Errata

The following errata have been identified in the A99 Addenda:

Section II, Part D, Table 1a, Page 14, line 13 should read SA-266, not SA-226.

Section VIII Division 1, Appendix 2, Table 2-7.1 "Flange Factors in Formula Form"

The equation number (27) should read as follows:

$$(27)\quad C_{25} = [C_1C_7C_{15} + C_2C_{11}C_3 + C_6C_8C_2 - (C_3C_7C_6 + C_8C_{11}C_1 + C_2^2C_{15})]/C_{16}$$

↑

Applying A98 Allowable Stress Values to A99 Construction

by John Swezy and Thomas P. Pastor, HSB Codes and Standards

We have received several calls asking if it would be acceptable to use allowable stresses published in the 1998 Edition, 1998 Addenda for vessels constructed today to the A99 Addenda. Since the 1999 Addenda is now mandatory, there has been some question of the legitimacy of this design approach.

Care needs to be taken when considering this approach. It may not be obvious, but some of the A99 allowable stress values may be ***lower*** than the A98 values. The revisions to Tables 1A and 1B in A99 reflect a change in the design margin on ultimate tensile strength from 4.0 to 3.5, plus a comprehensive re-evaluation of the material trend curve data.

Below is a comparison of the allowable stresses for a common stainless steel alloy. As you can see, the values increased in the lower temperature range, but decreased at some intermediate temperatures. This is due to some adjustments to the yield strength trend curve.

SA-240 Type 304 Hi

T	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
A98	18.8	17.8	16.6	16.2	15.9	15.9	15.9	15.2	14.7	14.1	9.8	6.1	3.7	2.3	1.4
A99	20.0	20.0	18.9	18.3	17.5	16.6	15.8	15.2	14.6	*14.0*	*9.8*	*6.1*	*3.7*	*2.3*	*1.4*

If a line-by-line comparison reveals that the allowable stress values of A99 are higher than the stress values of A98, the A98 values may be used and the vessel will still be in compliance with A99. If the A99 allowable stress values are lower, they must be observed. Keep in mind that the allowable stress values found in the Tables of Section II, Part D are ***maximums***, and nothing prohibits the designer from assigning more conservative values than the maximum allowable values.

Two other points to keep in mind regarding the revised Tables 1A and 1B. First, an *A99* appears in the margin of the Tables to identify only those lines where changes unrelated to the stress allowable change were made. For example, the Notes for many lines were changed, or there was further consolidation and merging of stress lines. The key point is that, although an A99 may not appear next to a stress line that was revised, these stresses are still valid as A99 revisions.

The second point has to do with the italicized stress values. In any given stress line, an italicized stress value signifies where the allowable stresses are controlled by time-dependent properties (creep range).

Using 1.5 X MAWP Test Pressure for A99 Construction

A related question to the above is: If I use the A98 allowable stresses to design the pressure vessel, can I then conduct the hydrostatic test at the old 1.5 X MAWP test pressure?

With the revision to the allowable stresses, Section VIII, Division 1 chose to also revise the pressure test ratios from 1.5 to 1.3 for hydrostatic test, and 1.25 to 1.1 for pneumatic test. Unlike other Code sections, Section VIII-1 does not have an upper limit on hydrostatic test pressure. However, once a decision is made to test at a pressure higher than the minimum required by UG-99(b), the Manufacturer should determine the *calculated test pressure* value based on new and cold conditions per UG-99(c). The Authorized Inspector has the right to review these calculations, and prior agreement from the user should be attained if the vessel is to be tested at this value or higher. Finally, if the test pressure exceeds the value determined by UG-99(c) to such a degree that yielding causes visible permanent distortion, the vessel is subject to rejection by the AI.

Use of Ultrasonic Examination in Lieu of Radiography for ASME Section VIII, Div. 1 and 2 Pressure Vessel Construction

by Richard E. Feigel, Vice President – Quality, HSB Engineering

The ASME Boiler and Pressure Vessel Committee has approved a revision to Code Case 2235 (Case 2235-2) that will permit the use of ultrasonic examination in lieu of radiography for the required examinations of pressure vessel welds ½ in. and thicker. The original Code Case was limited to welds 4 in. and thicker. Approval of this case will bring ASME examination practice more closely in line with long standing use of ultrasonic examinations permitted by many other pressure vessel codes. As a Code Case, these new provisions are optional, but they should be a substantial benefit to many vessel manufacturers.

Some of the potential benefits include:

- Cost — Ultrasonic examination can be less expensive than radiography, especially for relatively thick sections.
- Less disruptive — Workflow management radiography can disrupt work scheduling due to the necessity of protecting workers in the vicinity from radiation exposure.
- Inservice baseline — Some customers may specify ultrasonics as more appropriate for establishing inservice baselines.

Structural Integrity (SI) Associates, an HSB Group company, is a recognized leader in the field of ultrasonic services and equipment. SI has developed advanced time of flight diffraction (TOFD) systems and software that meets the requirements of Code Case 2235-2 for automatic computerized data acquisition. TOFD has a number of advantages over conventional ultrasonic techniques including:

- Rapid implementation relative to conventional techniques, including automated methods;
- Easily understood, and therefore relatively simple, time efficient analysis and interpretation;
- Improved reliability;
- Superior flaw classification and sizing accuracy; and,
- Permanent, hard copy record of the inspection (similar to, but more accurate than, a radiograph).

SI has worked with fabricators to integrate this technology into their manufacturing process, including system configuration, procedure development, training, and support. SI also has extensive experience and expertise in applying TOFD successfully in unique and complex applications. Several major ASME pressure vessel fabricators are currently using TOFD techniques quite successfully under the original Code Case. SI can assist you in determining how you too may benefit from this Code Case through the use of TOFD ultrasonics.

For further information regarding Structural Integrity's TOFD services, check their Web site, www.structint.com, or contact Larry Nottingham (704-573-1369 or lnotting@structint.com).

ISO 9000 UPDATE

Highlights of the new ISO 9000 standard

by Phil Dobyns, Technical Manager, HSB Registration Services

The following is the first in a series of articles regarding the new ISO 9000 standards.

The existing ISO 9001/2/3: 1994 standard is under revision; the ISO 9001: 2000 has been released (11/99) as a Draft International Standard (DIS) for review.

A Final Draft International Standard (FDIS) is planned for the 3rd quarter of 2000 prior to the release of the formal ISO 9001:2000 International Standard (IS) during the 4th quarter of 2000.

The DIS version is available presently from national standardization organizations.

Once the ISO 9001:2000 (IS) is formally released, there will be a three-year phase-in period in which existing Certificates to ISO 9001/2/3:1994 will still be valid. All ISO 9001/2/3:1994 certificates will expire on the third anniversary of the date of publication of the ISO 9001:2000 (IS).

While registrars cannot issue certificates until ISO has released the ISO 9001:2000 (IS), they are encouraged to take advantage of the opportunity for assessment to the latest draft issues. Registrars can work with organizations to conduct assessments to the latest ISO 9001:2000 drafts as part of scheduled surveillance audits during the year 2000.

Organizations currently registered to ISO 9001/2/3:1994 are encouraged to make the transition to the ISO 9001:2000 (IS) as soon as possible. A document titled "Transition Planning Guidance," prepared by ISO/TC176/SC2 N439, reviews the fundamental changes from the 1994 series of standards (also available from national standardization organizations).

What Is ISO 9001:2000 DIS?

The ISO 9001:2000 DIS consists of three standards:

ISO 9001:2000 Quality Management Systems - Fundamentals and Vocabulary.

ISO 9001:2000 Quality Management Systems - Requirements.

ISO 9004:2000 Quality Management Systems - Guidelines for Performance Improvement.

The most obvious change in the ISO 9001: 2000 (DIS) is the deletion of the ISO 9002 and ISO 9003 standards. All organizations will now be required to use the ISO 9001 standard, but can exclude design and development from their scope. Specific rules for the deletion of any/all inapplicable requirements as stated in the ISO 9001 standard are handled in Clause 1.2 (Reduction of Scope) of the ISO 9001:2000 document.

ISO 9001:2000 (DIS) includes a description of the basic approach to quality management, as well as a revised vocabulary reflecting usage of both new and revised terms and definitions. A more dynamic application of the concept diagram approach (produced by ISO/TC 37) was used in the development of the terms and definitions of the 2000 standard series.

The ISO 9001:2000 (DIS) is focused towards **"providing confidence, as a result of demonstration, in product conformance to established requirements."**

The ISO 9004:2000 (DIS) is focused towards providing **"benefits for all interested parties through sustained customer satisfaction."**

Eight Quality Management Principles

There are eight Quality Management Principles that are the basis for both the ISO 9001:2000 and ISO 9004:2000 (DIS) standard. These principles are the binding theme that is woven into the fabric of the revised standard and differentiate it from the 1994 series. The eight Quality Management Principles will be used, by the registrar, as the basis for the audit of an organization's compliance to the 2000 series standard.

Quality Management Principle: *A quality management principle is a comprehensive and fundamental rule or belief, for leading and operating an organization, aimed at continually improving performance over the long term by focusing on customers while addressing the needs of all other stakeholders.*

Principle 1 Customer-Focused Organization
Organizations depend on their customers and therefore should understand current and future needs, meet customer requirements and strive to exceed customer expectations.

Principle 2 Leadership
Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives.

Principle 3 Involvement of People
People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit.

Principle 4 Process Approach
A desired result is achieved more efficiently when related resources and activities are managed as a process.

Principle 5 System Approach to Management
Identifying, understanding and managing a system of interrelated processes for a given objective improves the organization's effectiveness and efficiency.

Principle 6 Continual Improvement
Continual improvement should be a permanent objective of the organization.

Principle 7 Factual Approach to Decision Making
Effective decisions are based on the analysis of data and information

Principle 8 Mutually Beneficial Supplier Relationships
An organization and its suppliers are interdependent, and a mutually beneficial relationship enhances the ability of both to create value.

In the next issue we will discuss some of the changes in more detail.

"Managing Pressure Vessel Equipment as a Capital Asset"

The impact of boilers and pressure vessel equipment on the bottom-line, as well as an organization's reputation, particularly in a college, is discussed in the September/October 1999 issue of *Facilities Manager*. "Managing Pressure Vessel Equipment as a Capital Asset" outlines the rationale for and steps involved in developing a long-term equipment strategy that may potentially save hundreds of thousands of dollars.

The article is co-authored by Glenn Robinson, program manager, and Robert Trombley, director, HSB Pressure Equipment Technologies; and Kenneth Shultes, director of physical plant at Dickinson College.

For a reprint of the article, contact Jill Smolnik, 800-472-1866, extension 5294, or via e-mail at jill_smolnik@hsb.com.

ENGINEERING SERVICES SOLUTIONS

Engineering Services provides the following services to clients around the world:

- **ASME Codes and Standards Services** provides authorized inspection services to boilers, pressure vessels, nuclear components, and process and power plants. Services also include pressure vessel and piping design, finite element analysis, and quality assurance program development. Contact Tom DiMartino, 303-838-5323, or via e-mail at thomas_dimartino@hsb.com.
- **HSB Registration Services** provides document reviews, pre-audits, certification audits, and registration to ISO 9000 quality system management standards, QS-9000 requirements (automotive focus), AS-9000 requirements (aerospace focus) and ISO 14000 environmental management systems standards (through a partnership with AWM, US). Contact Dennis Palmer, 610-962-8488, or via e-mail at dennis_palmer@hsb.com, or visit our Web site at www.hsbiso.com.
- **HSB Thermography Services** provides fully detailed surveys and recommendations to help clients detect problems in electrical and mechanical equipment to help avert losses. Contact Sandy Sanor at 800-231-0907, extension 1120, or via e-mail at sandy_sanor@hsb.com.
- **Mechanical and Materials Engineering** helps utility, pulp and paper, chemical and other clients avoid industrial equipment failures and improve equipment reliability by providing services including accident investigations - failure analysis, materials selection - design review/ modifications, corrosion engineering, weld repair consulting, risk assessment, rotating equipment troubleshooting, and boiler water chemistry audits and improvement programs. M&M Engineering has a full lab and field metallurgical analysis capability. Contact Doug Sherman, 800-421-9185, douglas_sherman@mmengineering.com.
- **Pressure Equipment Technologies** provides comprehensive engineering surveys of critical plant equipment designed for pressure service such as boilers, deaerators, paper machine dryers, general service pressure vessels, and piping systems. Contact Bob Trombley, 925-602-515, or via e-mail at robert_trombley@hsb.com.
- **Technical Resource Support** provides independent and objective analyses of equipment, processes, and systems through the following services: vendor surveillance, third-party inspection, expediting, auditing, and project management. Contact Chuck Galen, 610-992-8547, or via e-mail at charles_galen@hsb.com.
- **Customized Seminars.** We provide technical seminars that are tailored to meet the individual needs of our clients. Contact Ron Howard, 860-722-5356, or via e-mail at ron_howard@hsb.com.

For more information on Engineering Services, contact:
- Jill Smolnik at 800-472-1866 extension 5294
- Or visit our Web site, www.hsb.com, and click on the Engineering icon.

READ PRESSURE POINTS ON THE WEB

You can also find current and past articles from *Pressure Points* on The Hartford Steam Boiler Inspection and Insurance Company's Web site at www.hsb.com/presspts.htm. If you're looking for information on a specific topic, click on the Search icon on the bottom of the page.

PRESSURE POINTS

THE QUARTERLY NEWSLETTER OF ENGINEERING SERVICES

THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

P.O. Box 5024
One State Street
Hartford, Connecticut 06102-5024

BULK RATE
U.S. POSTAGE PAID
HARTFORD, CT
PERMIT NO. 4258