2600SEG117
SAFETY STANDARD FOR THE INSPECTION OF BOILERS AND PRESSURE VESSELS

1.0 PURPOSE

Establish uniform safety requirements for the inspection of boilers and pressure vessels located in installations or on board floating equipment of the Autoridad del Canal de Panama (ACP), thus attaining appropriate protection of persons, equipment, and installations.

2.0 BACKGROUND

The Power Division *(EAE)* has established maintenance and safety procedures for boilers and pressure vessels in its operating and maintenance manuals[1]. Through the ACP Purchases, Warehousing and Inventory (IAC) and Engineering (IAI) Divisions, contractors perform inspections of the pressure vessels and boilers located in ACP[2] facilities. The Floating Equipment Inspectors of the Marine Safety Unit carry out pressure vessel and boiler inspections of certain ACP and contractor floating equipment, as well as of commercial ships sailing in Canal waters.

3.0 SCOPE

This Standard applies to all ACP employees, contractor, and third party boilers and pressure vessels located in facilities, floating equipment, or areas under ACP responsibility.

4.0 LEGAL FOUNDATION

This Standard is established pursuant to Agreement No. 12 of the Board of Directors of the Panama Canal Authority (ACP), Safety and Health Regulations, Chapter II, Article 16, numeral 3,

5.0 DEFINITIONS

The following definitions are established for the purpose of this Standard:

5.1 API 510: American Petroleum Institute (API), Inspection Code used by the Inspector of equipment subjected to pressure.

5.2 Boiler: Equipment used for steam generation or heating of a liquid.

5.3 ASME Code: Abbreviation of American Society of Mechanical Engineers - Boiler and Pressure Vessel Code.

5.4 Pressure Vessels Certificate: Certificate the Inspector places on the pressure vessel inspected.

5.5 Code: Group of technical rules on which the design and construction of the pressure equipment is based.

5.6 ANSI/NB-23: National Board Inspection Code, inspection code utilized by the Inspector of the equipment subjected to pressure.

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[1] See Safety Manual, Section VI. Power Generation: Part 11a, Boilers.

2 See List of charges, terms and conditions of the Biennial Competitive Contract Bid for Pressure Equipment and Boiler Inspection. *División de Contratos* (FMC).

5.7 Pressure equipment: For the purpose of this Standard, the term shall be used to indistinctly denote pressure containers, vessels or boilers designed to withstand internal or external pressures.

5.8 Periodic inspection: Inspection performed by the users or owners of the equipment to verify compliance with this Standard, and with other pressure equipment operational or maintenance requirements.

5.9 Pressure equipment Inspector. Qualified person authorized by ACP to perform inspections to pressure equipment in its facilities, in accordance with ASME applicable requirements.

5.10 Design pressure: Pressure value considered during design of the pressure equipment elements.

5.11 Operation pressure: Pressure at which the pressure equipment normally functions for a safe operation.

5.12 Maximum allowable working pressure: Is the maximum pressure for which the equipment was designed and constructed, in accordance with the principles established by ASME. A safety margin is established between the pressure design, and the maximum allowable working pressure.

5.13 Hydrostatic test: A test to which the pressure equipment shall be subjected. It is a water tightness and resistance test. It is performed by means of a water pressure hand pump. The pressure equipment is tested hydrostatically at 1.5 times the maximum allowable working pressure.

5.14 Register of pressure equipment identification: Register which states the manufacturer's name, operating, and design characteristics of the pressure vessel.

5.15 Inspection register: Documentation, automated system or control of inspections and tests performed to the pressure equipment.

5.16 Owner's representative: A person representing the owner or user, who accompanies the Inspector during the inspection, but does not necessarily evaluate the information unless trained to do so, and is a duly authorized competent person.

5.17 Applicable requirements of the ASME Code: The inspection requirements established by ACP which are in agreement with the ASME Code.

5.18 Imminent risk: Any condition that arises during the pressure equipment inspection that represents a danger to the personnel or equipment.

5.19 Safety Relief Valve (SRV): Automatic device which relieves the pressure. It is used mainly for liquid applications.

5.20 Safety Valve (SV): Automatic device which relieves the pressure. It is used for gas or steam applications.

5.21 Floating equipment: All vessel types, with or without propulsion, utilized or which can be used as a means of water transportation.

5.22 Canal waters: Are those waters found within the geographical area that follow the path of the Panama Canal channel, and that are adjacent to it from the Pacific Ocean to the Atlantic Ocean.

They include anchorage areas, ports of Cristobal and Balboa, shorelines, and areas in which activities, exclusively compatible with Canal operations, are carried out.

6.0 REQUIREMENTS

If there exists a situation of imminent danger that cannot be corrected, the pressure equipment shall be shut down following the safety procedures established in the installation.

6.1 Pressure equipment

6.1.1 The pressure equipment shall be repaired or installed at locations where the installation personnel's exposure to risk is minimal.

6.1.2 Persons laboring inside the equipment shall be informed when outside work is to be performed that could affect them.

6.1.3 An equipment log shall be maintained that shall include, as a minimum, the following information: Serial number, hydrostatic test, manufacturer's data, date of inspection, design specifications, design calculation, construction drawings.

6.2 Pressure equipment inspection

All pressure equipment shall have instructions available regarding its proper use, maintenance, and safety which shall be verified during inspections.

6.2.1 The pressure equipment inspections shall be carried out by ACP personnel, or by qualified contracted personnel. The pressure equipment shall be inspected, as a minimum, at the frequency indicated by the manufacturers or reference codes of this Standard.

6.2.2 The tests and inspections performed by contractors shall be executed in the presence of an owner's representative for his/her certification.

6.2.3 All tools and safety equipment necessary for the inspection shall be checked, calibrated and in good condition before initiating such inspection.

6.2.4 The Inspector shall attach a label to the equipment subjected to pressure certifying the inspection.

6.2.5 A log shall be kept of the inspections and tests performed on the pressure equipment.

6.2.6 Internal, external, thickness measurements, repair, and welding alteration inspections shall comply with those indicated in API 510, Pressure Vessel Inspection Code: Maintenance Inspection, Rating, Repair, and Alteration. American Petroleum Institute.

6.2.7 Inspection, repair, or alterations of boilers on board floating equipment shall additionally comply with those indicated in the ASME Code, Section I, Section IX, or in ANSI/NB-23.

6.2.8 Inspections, repairs, or alterations of pressure vessels on board floating equipment shall comply with those indicated in the ASME Code, Section VIII, Division I, Section IX, or ANSI/NB-23.

6.2.9 Inspections of parts, piping, connections, valves, shall follow the practices recommended in API 510, Pressure Vessel Inspection Code: Maintenance Inspection, Rating, Repair, and Alteration. American Petroleum Institute.

6.2.10 Inspections, repairs and alterations of the parts, piping, connections and pressure valves on board floating equipment shall additionally comply with those indicated in the ASME Code, Section I or Section VIII, Division 1, and in ANSI B31.1.

6.2.11 The equipment shall be isolated and sealed to control liquid, gas, or vapor leaks.

6.2.12 The equipment shall be drained, purged, cleaned, ventilated, and the atmosphere tested before entering it. The required personal protective gear shall be used that will protect eyes, lungs and other body parts.

6.2.13 Persons who are near the pressure equipment shall be informed that there are workers inside.

6.3 Tests during inspection

6.3.1 Calibration of all devices utilized for the pressure testing shall be duly calibrated.

6.3.2 Surface preparation: To avoid inspection faults, adequate surface preparations shall be effected.

6.3.3 Radiographic tests: If radiographic tests are to be performed to the pressure equipment, the Safety and Industrial Hygiene Unit (RHSH) shall be notified.

6.4 Pressure equipment relief devices

6.4.1 All pressure equipment shall contain safety and measuring devices that are appropriately calibrated and protected.

6.4.2 Accesses to safety devices shall be kept free of obstructions at all times.

6.4.3 The pressure valves and vessel pressure shall have a considerable adjustment percentage to prevent its malfunctioning.

6.4.4 The pressure relief devices of pressure equipment shall be tested at adequate intervals and frequencies in order to verify that they are operating in a reliable manner.

6.4.5 The safety valve release shall be performed at a safe location.

6.4.6 The valve selected shall have sufficient relief capability when installed to the pressure equipment, and such capability shall be one that conforms to the National Board Inspection Code (NBIC), Appendix A-Pressure Relief Valves.

6.4.7 The safety valves in boilers on board floating equipment shall additionally comply with the indications in the ASME Code, Section I, with the exception of paragraphs PG-67 to PG-73, which have been modified. The relief valves in pressure vessels on board floating equipment shall additionally comply with the indications in the ASME Code, Section VIII, Division 1, with the

exception of paragraphs UG-125 to UG-136, which have been modified. For information on the modified paragraphs, see Section 8.0 of this Standard.

6.4.8 The operating pressure of pressure equipment shall not exceed the calibration pressure of the safety valves.

6.4.9 The calibration pressure of the safety valves utilized shall not exceed the maximum allowable working pressure.

6.4.10 Corrosion

6.4.10.1 Corrosion tests indicated in the ASME Code shall be performed to estimate the equipment wall thickness.

6.4.10.2 The corrosion evaluation and the minimum thickness of the pressure equipment shall be considered according to the indications in API 510, Pressure Vessel Inspection Code: Maintenance Inspection, Rating, Repair, and Alteration. American Petroleum Institute.

6.5 Repairs

6.5.1 Each repair shall be appropriately documented.

6.5.2 Welding work. Only ACP certified welders, or welders with certifications recognized by ACP shall weld pressure equipment.

6.5.3 Welder selections shall be in accordance with the regulations established in ACP and applicable requirements of the National Board Inspection Code (NBIC).

6.5.4 For welding work on pressure equipment on board floating equipment, the *welder performance qualification*, and the *welding procedure specification*, shall comply with the ASME Code, Section IX.

6.5.5 Any repairs made to pressure equipment on board floating equipment shall be in accordance with the *National Board Inspection Code* and the corresponding ASME Code section.

6.6 Modifications to Floating Equipment codes.

6.6.1 Boilers. The following paragraphs of the ASME Code, Section I, have been modified: PG-1, PG-5 to PG-13, PG-16 to PG-39, PG-42 to PG-55, PG-58 to PG-61, PG-67 to PG-73, PG-90 to PG-100, PG-112 to PG-113, PW-1 to PW-54, PWT-1 to PWT-15, PFH-1, PMB-1 to PMB-21, PEB-1 to PEB-19, PVG-1 to PVG-12, and A-19 to A-21.

6.6.2 Pressure vessels. The following ASME Code, Section VIII, Division 1 have been modified: U-1, U-2, UG-11, UG-22, UG-25, UG-28, UG-84, UG-90 to UG-103, UG-115 to UG-120, UG-125, UG-127, UW-1 to UW-65, UB-1, UB-2, UCS-6, UCS-25, UCS-56, UCS-57, UCS-65 to UCS-67, UHA-23(b), UHA-33, UHA-51, UHT-57, and UNF-57.

6.6.3 Welds. The following paragraphs of the ASME Code, Section IX have been modified: QW-101, QW-103, QW-201, QW-202, QW-202.1, QW-210, QW-211, QW-253, QW-254, QW-255, QW-305, QW-451, QB-101, QB-103, QB-201, QB-202, and QB-305.

6.6.4 Pressure piping systems. The following sections of ANSI B31.1 have been modified: 100.1, 100.2, 101 to 104.7,105 to108, 110 to 118, 119.5.1, 119.7, 122.3, 122.6, 122.10, 123, 126.1, 127 to 135.4, 136, and 137.

6.6.5 For information regarding the modified paragraphs, see Section 8.0 of this Standard.

7.0 RESPONSIBILITIES

7.1 The responsibilities to guarantee compliance with this Standard are described in the ACP Safety and Occupational Health Management Standard 2600SEG101

7.1.1 The owner or user of the vessel is responsible:

7.1.1.1 For developing, documenting, implementing, executing and establishing the inspection procedures in accordance with the applicable requirements of the ASME Code.

7.1.1.2 Maintaining pressure equipment log properly updated.

7.1.1.3 Assigning his/her representatives during equipment inspection.

7.1.1.4 Documenting test results.

7.1.1.5 Documenting new design calculations established for the equipment.

7.1.1.6 Taking corrective actions.

8.0 INQUIRIES

8.1 All information or clarification regarding the contents or application of this Standard shall be requested in writing to Safety and Industrial Hygiene Unit (*RHSH*).

8.2 All technical information or clarification regarding the contents or application of the safety or operational requirements indicated in the list of charges for the pressure equipment and boiler inspection contract shall be requested to *IAI*.

8.3 All technical information or clarification regarding the contents or application of this Standard related to the modifications to the ASME Code and the ANSI B31.1 shall be requested in writing to the Marine Safety Unit.

9.0 EXCEPTIONS

Deviations or temporary exceptions in complying with this Standard shall be requested in writing to Safety and Industrial Hygiene Unit (*RHSH*).

10.0 TERM

This Standard shall remain in force until amended or revised.

11.0 REFERENCES

11.1 *Manual de Seguridad y Salud Ocupacional de la ACP*.

11.2 *Manual de Trabajos en Espacios Confinados de la ACP*.

11.3 *Procedimiento de Libranza de la ACP*.

11.4 ACP safety specifications established in contracts for boilers and pressure equipment inspections.

11.5 American Petroleum Institute. API 510, Pressure Vessel Inspection Code: Maintenance Inspection, Rating, Repair, and Alteration.

11.6 American Bureau of Shipping (ABS) The Application of Ergonomics to Marine Systems, pages 42, 43, 44.

11.7 American Society of Mechanical Engineers (ASME A13.1-1996), pg. 1: Section 2- Definitions and References, pg. 2: Section 3- Method of Identification, pg. 3: Section 3.4- Type and size of letters.

11.8 ANSI A13.1 – August 13, 1996 Scheme for the Identification of Piping Systems.

11.9 National Board Inspection Code (NBIC). A Manual for Boiler and Pressure Vessel Inspectors. ANSI/NB-23.

11.10 American National Standards Institute, ANSI B31.1

11.11 American Society of Mechanical Engineers, ASME Boiler and Pressure Vessel Code, Sections I, VII, VIII (Division 1) y IX.