U.S. COAST GUARD MARINE SAFETY CENTER PLAN REVIEW GUIDELINE

REVIEW OF MAIN & AUXILIARY BOILERS

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Purpose

This Plan Review Guideline (PRG) provides guidance regarding the information required to be submitted to the Marine Safety Center (MSC) for review of boiler system arrangements on U.S. flag inspected vessels.

Contact Information

If you have any questions or comments concerning this document, please contact the Marine Safety Center (MSC) by e-mail or phone. Please refer to Procedure Number E1-18.

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1. Applicability

This Plan Review Guideline (PRG) is applicable to boiler system installations, both main and auxiliary, installed on U.S. flag vessels.

2. Background

Service and pressure temperature boundaries	Part of subchapter regulating mechanical design	Part of subchapter regulating automatic control
Main (power) boiler: All	52	62
Pressure vessel: All	54	NA
Fired auxiliary boiler [1] (combustion products or electricity):		
(a) Steam:		
More than 103 kPa (15 psig)	52	[2] 62 or 63
Equal to or less than 103 kPa (15 psig)	53	63
(b) Hot water heating:		
More than 689 kPa (100 psig) or 121 °C (250 °F)	52	63
Equal to or less than 689 kPa (100 psig) and 121 °C (250 °F)	53	63
(c) Hot water supply:		
More than 689 kPa (100 psig) or 121 °C (250 °F)	52	63
Equal to or less than 689 kPa (100 psig) and 121 °C (250 °F)	53	63
Other:		
(a) Fired thermal fluid heaters*: All	52	63
(b) Unfired steam boiler:		
More than 206 kPa (30 psig) or 454 °C (850 °F) [3]	52	NA
Equal to or less than 206 kPa (30 psig) and 454 °C (850 °F)	54	NA
(c) Evaporators and heat exchangers: More than 103 kPa (15 psig) [4]	54	NA
(d) Unfired hot water supply or heating boiler: More than 103 kPa (15 psig) [4]	54	NA

[1] Including exhaust gas types.
[2] Boilers with heat input ratings ≥12,500,000 Btu/hr. must have controls that meet part 62. Boilers with heat input ratings <12,500,000 Btu/hr. must have controls that meet part 63.
[3] Temperature of working fluid.
[4] Relief device is required even if designed for less than 103 kPa (15 psig).

3. References

Title 46 CFR Part 52 – Power boilers
Title 46 CFR Part 53 – Heating boilers
Title 46 CFR Part 56 – Piping systems & appurtenances
American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code (BPVC)

4. Definitions

a. Main (power) boiler – steam boiler used for generating steam for main propulsion
b. Auxiliary boiler – steam boiler used for all purposes, including emergency propulsion, for which steam may be required other than main propulsion

5. Content

Main Power Boilers (46 CFR Part 52)

a. Main power boilers and auxiliary boilers shall be designed, constructed, inspected, tested and stamped in accordance with Section I, Power Boilers, of the American Society of Mechanical Engineers (ASME) Code, July 2001 edition, as limited, modified or replaced by specific sections in 46 CFR Part 52. This includes the appendix to Section I where made mandatory by Section I. Table 46 CFR 52.01-1(a) lists those parts of Section I which are limited, modified or replaced by 46 CFR Part 52. (46 CFR 52.01-2)

b. The submittal must include the following information: (46 CFR 52.01-5(b))

   (1) Calculations for all pressure containing components including: maximum allowable working pressure (MAWP), hydrostatic or pneumatic test pressure, maximum steam generating capacity and the intended safety valve settings.
   (2) Joint design and method of attachment of all pressure containing components.
   (3) Bill of materials.
   (4) Diagram of assembled components of system.
   (5) ASME Manufacturer's Data Report Form (P-2, P-3, etc).

c. The plans and calculations must be certified by a registered Professional Engineer as meeting the design requirements of 46 CFR Part 52 and Section I of the ASME Code. (46 CFR 52.01-5(a))

d. The boiler automatic control system must be designed in accordance with 46 CFR Part 62 or with 46 CFR Part 63, as noted in Table 54.01-5(a). Control system arrangements should be included with this submittal but may be submitted separately. Plans for control systems required to meet Part 62 or Part 63 will be reviewed by the MSC Electrical Branch; see MSC Guidelines for Boiler Control System, Procedure No. E2-22 for additional guidance.

e. Fusible plugs, when required, must comply with 46 CFR 52.01-50.

f. Materials must meet the requirements in 46 CFR 52.01-90.

g. Openings and reinforcements must comply with 46 CFR 52.01-100.

h. Piping, valves and fittings comply with 46 CFR 52.01-105.

i. Safety valves and safety relief valves must comply with 46 CFR 52.01-120.

j. Piping within the jurisdiction of the ASME Code shall comply with ASME Code Section I (PG-58 and PG-59) as modified by 46 CFR 52.01-105.

k. Piping outside the jurisdiction of the ASME Code shall comply with 46 CFR Part 56 piping requirements.

l. Water-level indicators and pressure gauges comply with ASME Code Section I (PG-90) as modified by 46 CFR 52.02-110.

m. Feedwater supply must comply with ASME Code Section I (PG-61) as modified by 46 CFR 52.01-115 and with 46 CFR 56.50-30.

n. The submittal shall address the special requirements for boilers fabricated by welding:

(1) ASME Section I (PW-1 through PW-54).
(2) Heat treatment per PW-38 and PW-39 and 46 CFR 52.05-15.
(3) Radiographic & ultrasonic examination per 46 CFR 52.05-20.
(4) Attachment welds per 46 CFR 52.05-30.
(5) Circumferential joints in pipes, tubes and headers per 46 CFR 52.05-45.

o. Watertube boilers must comply with ASME section I (PWT-1 through PWT-15) except as modified in 46 CFR 52.15.

p. Firetube boilers must comply with ASME Section I (PFT-1 through PFT-49) except as modified in 46 CFR 52.20.

q. Feedwater heaters must comply with ASME Section I (PFH-1) or 46 CFR Part 54 per 46 CFR 52.25-3.

r. Exhaust gas boilers must comply with 46 CFR 52.25-20.

s. Certification by stamping shall be in accordance with the ASME Code and 46 CFR 52.01-140.

Auxiliary Boilers (46 CFR Part 53)

a. Heating boilers that meet the service restrictions listed in 46 CFR 53.01-10 must be designed, inspected, tested, and stamped in accordance with Section IV of the ASME code, as modified by 46 CFR Part 53. (46 CFR 53.01-3)

b. Heating boilers that exceed the service restrictions listed in 46 CFR 53.01-10 shall be designed, inspected, and tested in accordance with 46 CFR Part 52.

c. Heating Boilers may be constructed to ASME Section I if additional restrictions in 46 CFR 53.01-10 are met and operating parameters of 46 CFR 53.01-10(b)(1) are met. Plans must comply with 46 CFR 52.01-5.

d. The boiler automatic control system must be designed in accordance with 46 CFR 63.25. Control system arrangements should be included with this submittal, but may be submitted separately. The control system plans will be reviewed by the MSC Machinery Branch.

e. Steam boilers must have at least one pressure vessel relief valve that complies with ASME Section IV (HG-400 and HG-401). Hot water supply boilers shall have at least one safety relief valve or a pressure-temperature relief valve (setting must not exceed 210° F). (46 CFR 53.05)

f. Instruments, fittings and controls comply with ASME Section IV, Parts HG-600 through HG-640. (46 CFR 53.12)

g. Testing, inspection and stamping must comply with ASME Section IV, Part, HG, Article 5 to the satisfaction of the OCMI. (46 CFR 53.10)

h. Electric water heaters less than 120 gallons in volume and a heat input less than 58.6 kW (200,000 BTU) which are listed under UL 174 or UL 1453 and are provided with a relief valve are exempt from Part 53. (46 CFR 53.01-10(c)(1))

General Piping (46 CFR Part 56)

Steam and Exhaust

a. Hot water temperature in heating systems shall not exceed 375 ºF. (46 CFR 56.50-15(h)(4))

b. Steam pressure in steam heating piping must not exceed 150 psig. Heating for public spaces and accommodation space heating shall not exceed 45 psig per 46 CFR 56.50-15(h)(2).

c. Pipe maximum allowable working pressure (MAWP) shall not be greater than the internal design pressure calculated using ANSI-B31.1. System MAWP shall be determined by the lowest MAWP of a system component. (46 CFR 56.07-10(a)(2)

d. The pressure design of piping components shall comply with the material requirements of 46 CFR 56.07-10(e). Material selection shall meet 46 CFR 56.60-1(a) with allowable stresses indicated in ANSI-B31.1. The temperature of the material for allowable stress determination shall be the saturated steam temperature.

e. The design pressure of steam piping connected to the boiler shall not be less than the safety valve pressure setting. (46 CFR 56.50-15)

f. Steam stop valves exceeding 6 inches shall be fitted with bypasses for heating the line and equalizing pressure. (46 CFR 56.50-15(c))

g. Two valves shall be provided on steam lines for multiple boiler installations – one a stop valve and one a stop-check valve. Stop valves shall be readily accessible. (46 CFR 56.50-15(d))

h. Protection from overpressure on the exhaust lines of steam machinery shall comply with 46 CFR 56.50-15(h)(3).

i. A means shall be provided for draining steam piping where water hammer may occur. (46 CFR 56.50-15(k))

j. Shore steam connections shall have a relief valve not exceeding the design pressure of the piping. (46 CFR 56.50-15(j))

k. Steam piping (except for heating) may not pass through passageways, accommodation spaces, or public spaces. (46 CFR 56.50-15(h))

Fuel oil

a. Fuel oil piping shall comply with 46 CFR 56.50-65.

b. Materials shall comply with 46 CFR Part 56. Cast iron or malleable iron are prohibited. See MSC Marine Technical Note 02-10 for guidance.

c. Piping shall comply with pressure classification design criteria found in 46 CFR 56.04-2.

d. Fuel pumps shall meet the performance and test requirements of ANSI/UL 343.

e. Fuel heating devices are permitted provided a high temperature limit device is installed per 46 CFR 63.15-3.

f. Natural gas fuel is prohibited unless specifically approved by the MSC.

g. Strainers shall be installed in the fuel supply line (46 CFR 63.15-5)

Boiler Feed

a. Feed discharge piping shall be designed to the feed pump relief valve setting or the shutoff head of the pump. (46 CFR 56.50-30(a)(3))

b. Feed piping from the boiler to the stop and stop-check valve shall be designed to a pressure 25% greater than the boiler MAWP or 225 psig. (46 CFR 56.50-30(a)(3))

c. Allowable stress values shall be selected per 46 CFR 56.50-30.

d. Feed valves shall comply with 46 CFR 56.50-30(b).

e. Power boilers may use the "Group Feed System" or "Unit Feed System" as described in 56.50-30(d) & (e).

Condensate Pumps

a. Generally, two means shall be provided for discharging condensate from the main condenser, one of which shall be independent of main propelling machinery. (46 CFR 56.50-35)

Blowoff Piping

a. Blowoff piping for the boiler shall be designed to 125% of the boiler's MAWP 225 psig in addition to the MAWP. If design pressure is greater than 100 psig, the wall thickness shall not be less than schedule 80. Design shall be to 56.07-10(e). (46 CFR 56.50-40(b))

b. Where blowoff valves are connected to a common discharge form two or more boilers, a non-return valve shall be provided for each boiler. (46 CFR 56.50-40(a))

c. Globe valves shall not be used for blowoff service. (46 CFR 56.50-40(d))

Testing Requirements

a. Installation tests for piping systems which are outside the scope of the ASME Code shall comply with the requirements of 46 CFR 56.97-40.

6. Disclaimer

This guidance is not a substitute for applicable legal requirements, nor is it itself a rule. It is not intended to nor does it impose legally-binding requirements on any party. It represents the Coast Guard's current thinking on this topic and may assist industry, mariners, the general public, and the Coast Guard, as well as other federal and state regulators, in applying statutory and regulatory requirements. You can use an alternative approach for complying with these requirements if the approach satisfies the requirements of the applicable statutes and regulations. If you want to discuss an alternative, you may contact MSC, the unit responsible for implementing this guidance.