

# MSC Guidelines for the Review of Main/Auxiliary Boiler Systems

Procedure Number: E1-18

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## References

- a. 46 CFR Part 52 –Power Boilers
  - b. 46 CFR Part 53 –Heating Boilers
  - c. 46 CFR Part 54 –Pressure Vessels
  - d. 46 CFR Part 56 –Piping Systems
  - e. 46 CFR Part 62 –Vital System Automation
  - f. 46 CFR Part 63 –Automatic Auxiliary Boilers
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## Disclaimer

These guidelines were developed by the Marine Safety Center staff as an aid in the preparation and review of vessel plans and submissions. They were developed to supplement existing guidance. They are not intended to substitute or replace laws, regulations, or other official Coast Guard policy documents. The responsibility to demonstrate compliance with all applicable laws and regulations still rests with the plan submitter. The Coast Guard and the U. S. Department of Transportation expressly disclaim liability resulting from the use of this document.

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## Contact Information

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# MSC Guidelines for the Review of Main/Auxiliary Boiler Systems (continued)

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General  
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## Boilers and Hot Water Heaters

- Determine Applicable Parts of 46 CFR Subchapter F for the specific design and operating parameters. See the table below.

Table 54.01-5(a) Applicable Regulation Reference

<b>Service/ Temperature/Pressure</b>	<b>Design</b>	<b>Automatic Control</b>
Main Boiler – Propulsion	Part 52	Part 62
Fired Auxiliary Boiler (combustion/electric)		
Steam		
Steam (> 15 psig) & (>12,500,000 BTU/hr)	Part 52	Part 62
Steam (> 15 psig) & (<12,500,000 BTU/hr)	Part 52	Part 63
Steam (<= 15 psig) (<12,500,000 BTU/hr)	Part 53	Part 63
Hot Water Heating or Hot Water Supply		
HWH (>100 psig or >250 °F)	Part 52	Part 63
HWH (<= 100psig and <= 25 °F)	Part 53	Part 63
Unfired Steam Boiler (USB)		
USB (>30 psig or > 850 °F)	Part 52	N/A
USB (<30 psig and < 850 °F)	Part 54	N/A

46 CFR Part 52

## 46 CFR Part 52 – Power Boilers

- Acceptance Criteria [ 46 CFR Part 52]
  - ❑ Required plans submitted per Part 52.01-5. Plans and calculations must be certified by a registered Professional Engineer as meeting Part 52 and Section I of the ASME Code.
    - ❑ Calculation for all pressure components
    - ❑ MAWP
    - ❑ Hydrostatic/Pneumatic testing pressure
    - ❑ Steam capacity
    - ❑ Joint design and method of attachment
    - ❑ Bill of materials meeting ASME Section I and Part 52 as modified
    - ❑ Diagram of assembled components of system
  - ❑ Design, inspected, tested, and stamped in accordance with section I of the ASME Code as modified by Part 52 of the Code per §52.01-2.
  - ❑ Automatic controls comply with §62.35-20(a)(1).

## MSC Guidelines for the Review of Main/Auxiliary Boiler Systems (continued)

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### General Review Guidance

- Further Review Items
  - ❑ Examine for Appropriate Compliance with Design Criteria of ASME Code Section I.
  - ❑ Examine for Compliance with Part 52 Modifications to ASME Code.
    - ❑ Fusible plugs comply with §52.01-50.
    - ❑ Safety valves and safety relief valves shall comply with Part 52.01-120.
    - ❑ Materials shall meet the requirements in §52.01-90.
    - ❑ Design shall comply with §52.01-95.
    - ❑ Openings and reinforcements shall comply with part §52.01-100.
    - ❑ Piping, Valves and Fittings Shall Comply with Part §52.01-105.
      - ❑ Piping within the jurisdiction of the ASME Code shall comply with ASME Code Section I (PG-58 and PG-59) with modifications in §52.01-105.
      - ❑ Piping outside the jurisdiction of the ASME Code shall comply with Part 56 piping requirements.
    - ❑ Water-level Indicators and pressure gauges (§52.01-110).
      - ❑ Comply with ASME Code Section I (PG-90).
      - ❑ Comply with modifications in §52.02-110.
    - ❑ Feedwater Supply (§52.01-115)
      - ❑ Shall comply with ASME Section I (PG-61).
      - ❑ Shall Comply with §56.50-30.
    - ❑ Certification by stamping.
      - ❑ All boilers shall be stamped for compliance with the ASME Code is required by §52.01-140.
    - ❑ Special requirements for boilers fabricated by welding. (Part 52.05)
      - ❑ Shall comply with ASME Section I (PW-1 through PW-54)
      - ❑ Boilers and components shall be heat treated per PW-38 and PW-39. (§52.02-15)
      - ❑ Radiographic & ultrasonic examination shall comply w/ §52.05-20.
      - ❑ Attachment welds shall comply with Part 52.05-30.
      - ❑ Circumferential joints in pipes, tubes and headers shall comply with §52.05-45.
    - ❑ Requirements for Watertube Boilers
      - ❑ Shall comply with ASME section I (PWT-1 through PWT-15) except as modified in Part 52.15.
    - ❑ Requirements for Firetube Boilers
      - ❑ Shall comply with ASME Section I (PFT-1 through PFT-49) except as modified in Part 52.20.
    - ❑ Feedwater Heaters shall comply with ASME Section I (PFH-1) or Part 54 per §52.25-3.
    - ❑ Exhaust Gas Boilers shall comply with §52.25-20.

# MSC Guidelines for the Review of Main/Auxiliary Boiler Systems (continued)

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General  
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- Review of all calculation details for requirements.
  - ❑ Review design calculations and verify that the calculations are correct.
  - ❑ Equivalency Determination(s)
  - ❑ Manufacturers data report shall be available to the marine inspector per 52.01-145.
  - ❑ Review of installation details.
    - ❑ Boiler support details shall be approved by the OCMI.

46 CFR Part 53

## 46 CFR Part 53 – Heating Boilers/ Hot Water Boilers

- Acceptance Criteria [ 46 CFR Part 53]
  - ❑ Plans and calculations may be certified by a registered Professional Engineer as meeting Part 53 and the ASME Code Section IV.
    - ❑ Calculation for all pressure components
    - ❑ MAWP
    - ❑ Hydrostatic/Pneumatic testing pressure
    - ❑ Steam capacity
    - ❑ Joint design and method of attachment
    - ❑ Bill of materials meeting ASME Section I and Part 52 as modified
    - ❑ Diagram of assembled components of system
  - ❑ Design, inspected, tested, and stamped in accordance with section IV of the ASME code as modified by Part 53 of the code per §52.01-2.
  - ❑ Heating Boilers may be constructed to ASME Section I if additional restrictions in §53.01-10 are met and operating parameters of §53.01-10(b)(1) are met.
  - ❑ Automatic controlled boilers shall comply with part 63.
  
- Further Review Items
  - ❑ Examine for Appropriate Compliance with Design Criteria of ASME Section IV.
  - ❑ Service restrictions shall comply with §53.01-10.
  - ❑ Pressure Relief Devices (Part 53.05)
    - ❑ Steam Boilers shall have at least one pressure vessel relief valve complying with ASME Section IV (HG-400 and HG-401).
    - ❑ Hot Water Boilers shall have relief valves complying with Article 4 of ASME Section IV.
      - ❑ Hot Water Heating Boilers shall have at least one safety valve.

## MSC Guidelines for the Review of Main/Auxiliary Boiler Systems (continued)

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- Hot Water Supply Boilers shall have at least one safety relief valve or a pressure-temperature relief valve (setting must not be more than 210° F).
  - Materials for safety valves shall comply with ASME Section IV (HG-401.2).
  - Discharge capacity of relief valves shall meet ASME Section IV (HG-401.2). The National Board of Boiler and Pressure Vessel Inspectors shall certify valve capacities.
  - Testing, inspection and stamping shall comply with ASME Section IV (Article 5 section HG) and modifications per Part 53.10.
  - Instruments, fittings and controls, shall comply with ASME Section IV (HG-600 through HG-640)
  - Details of the automation system shall be evaluated to determine compliance with Part 63.
- Review of all calculation details.
- Review design calculations and verify that the calculations are correct.
  - Equivalency Determination(s).
  - Manufacturer's data report forms shall be made available to the marine inspector per §53.10-15.

46 CFR Part 56

### **46 CFR Part 56 – Piping System Requirements for Steam Service and Boiler Feed**

- This section details general requirements for steam piping that fall outside the piping requirements found within Part 52 or Part 53.
- **Steam and Exhaust Piping** Acceptance Criteria [46 CFR Part 56]

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- Hot water temperature in heating systems shall not exceed 375 °F per §56.50-15(i)(1).
- Steam pressure in steam heating piping must not exceed 150 psig. Heating for public spaces and accommodation space heating shall not exceed 45 psig.
- Pipe maximum allowable working pressure (MAWP) shall not be greater than the internal design pressure calculated using ANSI-B31.1.
- System MAWP shall be designed to the lowest components MAWP. (§56.07-10(e))

## MSC Guidelines for the Review of Main/Auxiliary Boiler Systems (continued)

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- ❑ The pressure design of piping components shall comply with the material requirements of §56.07-10(e). Material selection shall meet §56.60-1(a) with allowable stresses indicated in ANSI-B31.1. The temperature of the material shall for allowable stress determination shall be the saturated steam temperature.
  - ❑ The design pressure of steam piping connected to the boiler shall not be less than the safety valve pressure setting per §56.50-15.
  - ❑ Steam stop valves exceeding 6 inches shall be fitted with bypasses for heating the line and equalizing pressure per §56.50-15(c).
  - ❑ 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.
  - ❑ Protection from overpressure on the exhaust lines of steam machinery shall comply with §56.50-15(h)(3).
  - ❑ A means shall be provided for draining steam piping where waterhammer may occur.
  - ❑ Shore steam connections shall have a relief valve not exceeding the design pressure of the piping.
  - ❑ Steam piping (except for heating) may not pass through passageways, accommodation spaces, or public spaces.
- **Boiler Feed Piping** [46 CFR 56.50-30]
- ❑ Feed discharge piping shall be designed to the feed pump relief valve setting or the shutoff head of the pump.
  - ❑ 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.
  - ❑ Allowable stress values shall be selected per §56.50-30.
  - ❑ Feed valves shall comply with §56.50-30(b).
  - ❑ Power boilers may use the “Group Feed System” or “Unit Feed System” as described in §56.50-30(d) & (e).
- **Condensate Pumps** [46 CFR 56.50-35]
- ❑ Generally, two means shall be provided for discharging condensate from the main condenser, one of which shall be independent of main propelling machinery.
- **Blowoff Piping** [46 CFR 56.50-40]
- ❑ 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 100psig, the wall thickness shall not be less than schedule 80. Design shall be to §56.07-10(e).

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- Where blowoff valves are connected to a common discharge from two or more boilers, a non-return valve shall be provided for each boiler.
- Globe valves shall not be used for blowoff service.
- **Review Testing Requirements** [46 CFR 56.97-40]
  - Installation tests for piping systems shall comply with the requirements of §56.97-40.

46 CFR Part 62

### 46 CFR Part 62 – Vital System Automation

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E2-1

- See General Review Guidance E2-1 for details on requirements for vital system automation for power boilers.

46 CFR Part 63

### 46 CFR Part 63 - Automated Auxiliary Boilers

- Acceptance Criteria [46 CFR Part 62]
  - Submittal of Test procedures and certification report per §63.10-1.
    - Detailed instructions for operationally testing each automatic auxiliary boiler, its controls, and safety devices.
    - A certification report by the manufacturer for each automatic auxiliary boiler containing:
      - A statement that the system complies with CG-510 of ANSI/ASME CSD-1a “Controls and Safety Devices for Automatically Fired Boilers.”
      - A statement that the boiler system complies with the control and safety device requirements in Part 63.
  - **Controls**
    - An electric control used to shut down the boiler shall comply with §58.01-25. Fuel supply must be stopped to the fuel burning equipment.
    - Following emergency safety trip, air-flow to the boiler must not automatically increase. Post purge must be accomplished manually (§63.20-1).
    - Low fire interlock must insure low fire start when variable firing rates are used. (§63.20-1)
    - Water level controls and low water cutoff controls shall comply with §63.20-1(c).

## MSC Guidelines for the Review of Main/Auxiliary Boiler Systems (continued)

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- **Fuel System** (§63.15-3)
  - Fuel oil piping shall comply with §56.50-65.
  - Materials shall comply with Part 56. Cast iron or malleable iron is prohibited.
  - Piping shall comply with pressure classification design criteria found in §56.04-2.
  - Fuel pumps shall meet the performance and test requirements of ANSI/UL 343.
  - Fuel heating devices are permitted provided a high temperature limit device is installed per §63.15-3.
  - Natural Gas Fuel is prohibited unless approved by the MSC.
  - Strainers shall be installed in the fuel supply line. (§63.15-5)
  - Alarms shall comply with the requirements of §63.15-7.
  - Mercury tube actuated controls are prohibited.
- **Small Automatic Auxiliary Boilers** (<400,000 Btu/hr) shall meet the following additional requirements (§63.25-1):
  - Visual indicators indicating when the low water cutoff is activated shall be provided.
  - An air prepurge cycle of 4 changes in the combustion chamber and stack shall be provided. This cycle shall not be less than 15 seconds. Ignition must occur only before or simultaneously with the opening of the fuel valve.
- **Electric Hot Water Supply Boilers** shall meet the following additional requirements:
  - Electrical components shall comply with §62.25-3(c)&(d)
  - Iron and steel parts shall be protected from corrosion by enameling, galvanizing, or plating. Iron and steel storage tanks less than ¼ inch thickness shall be protected from corrosion on the inside surface.
  - Each heating element shall have a temperature regulating device limiting temperature to 194°F per §63.25-3(f).
  - An independent temperature-limiting device shall prevent water in upper 25% of tank from rising above 210°F per §63.25-3(g).
  - Both pressure and temperature relieving devices are required. These safety devices shall comply with §53.05. The maximum temperature setting is 210°F. The maximum pressure setting is the working pressure of the boilers.
- **Exhaust Gas Boilers** shall comply with the following:
  - Controls for the feed water system shall supply the feed water to maintain the proper level. See §63.25-7(b) for further requirements.

## MSC Guidelines for the Review of Main/Auxiliary Boiler Systems (continued)

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- With inadequate heat transfer a high temperature (exceeding maximum operating temperature) or low flow alarm shall be activated. Additionally, both audible and visual alarms shall indicate when a soot fire is present per §63.25-7(c).
  - Further Plan Review Details
    - All components shall operate satisfactorily in the marine environment with a momentary rise of 30°, a list of 15° and permanent trim of 5° with it installed in a position as specified by the manufacturer. (§63.15-1).
    - Details of the compliance with the requirements for ANSI/ASME CSD-1/CSD-1a shall be examined.
    - Boiler Feed Piping shall comply with §56.50-30. (§63.20-1(c))
    - Inspection and testing of the boiler shall meet Part 61. (§63.15-9)
    - Inspection and testing of electric hot water heaters shall comply with §63.25-3(j).
    - Information required to be marked electric hot water heaters is contained in §63.25-3(h).
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