
U.S. COAST GUARD



MACHINERY INSPECTOR (MI)

PERFORMANCE AND QUALIFICATION STANDARD



Marine Inspection and Investigation School
Training Center Yorktown

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Machinery Inspector Performance and Qualification Standard

References:

- (a) U.S. Coast Guard Sector Organization Manual, COMDTINST M5401.6 (series)
- (b) Marine Safety Manual, COMDTINST M16000 (series)
- (c) Performance, Training & Education Manual, COMDTINST M1500.10 (series)
- (d) Safety and Environmental Health Manual, COMDTINST 5100.47 (series)

This Performance and Qualification Standard (PQS) workbook is your On the Job Training (OJT) performance checklist for the tasks for the Machinery (MI) inspector qualification. It is your responsibility to document all completed unit training items and keep track of all inspections completed during this process by filling out the Inspection Log located in appendix B in this workbook.

This PQS is intended for all Coast Guard Marine Inspectors (Active Duty Officers and Civilian GS Personnel).

This PQS workbook contains the tasks and steps required for a MI qualification. **This is to be completed follow or in conjunction with the Core PQS.** Those members who will be pursuing the MI competencies are required to complete all tasks and steps in this PQS workbook. **No competency will be assigned until the requirements of the Core and MI PQS workbooks are completed.**

***The Machinery Inspector – Steam Job Aids are an additional resource available for qualifying members. They can be found as enclosures to this PQS workbook.**

The following is a brief overview of how this PQS workbook works. On each task card you will find:

1. **Job:** The formal title of the qualification.
Example: "Offshore Supply Vessel Inspector"
2. **Job Accomplishment:** The main deliverable for the qualification.
Example: "Certificate of Inspection"
3. **Major Accomplishment:** The valuable products of a job or specialty which collectively make up the job accomplishment.
Example: "Lifesaving Equipment Inspection"
4. **Vessel types:** The specific type of vessels within the formal title of the qualification that the task is associated with.
Example: "Small Passenger Vessel (T)"
5. **Task:** Action to be performed on the job. A unit of behavior which has value for producing major accomplishments/output; has a definite beginning (stimulus); is made up of two or more steps; and results in a measurable output.
6. **Condition:** Specifies assistance, aids, or constraints the trainee will be given. It states the condition(s)/limit(s) under which the task will be performed.

7. **Standard:** Specifications of the levels of accuracy and quality necessary for success - that is, how well a trainee must carry out the desired performance to complete the task.
8. **Steps:** Sequence of actions which collectively make up the task's completion.

All tasks and steps must be validated by a certified Verifying Officer (VO). The VO shall observe the successful performance of each task and document such with signatures in the specific task card. VOs shall be experienced and competent personnel who have demonstrated the ability to evaluate, instruct and observe other personnel in the performance task criteria. VOs must be certified and recent in the competencies for which they are to verify and must be designated in writing, by the command. VOs must enter their title, name and initials in the Record of Verifying Officer's section before making entries in your PQS workbook.

With the exception of the training prerequisites listed on page (I), the Officer in Charge of Marine Inspection (OCMI) or designee may defer PQS items as authorized by references (a) and (d). The deferment of tasks should only be done when all reasonable attempts have been exhausted that would allow the apprentice the opportunity to demonstrate proficiency with a particular task. If a task is deferred, the reason for the deferment must be clearly articulated in both the PQS workbook and the certification letter for record keeping and accountability. The certification will be considered a "local certification" per reference (b) (MSM I/7.C.2.g) and limited to the cognizant OCMI's zone. Upon transfer of the inspector or OCMI, the certification will be rescinded until the deferred items have completed to the satisfaction of the new OCMI. **Division Chiefs shall examine all qualifications and prerequisites of newly reported Marine Inspectors to identify any deferred items necessary for their port.**

Prior to any prerequisite being deferred the individual's command must seek a waiver from the Office of Commercial Vessel Compliance (CG-CVC-1).

A Certification Board should only be completed after all the tasks and steps are signed by a VO. Upon satisfactory completion of the board, a Letter of Certification/Designation will be issued and the **Unit Training Coordinator should enter the certification in Training Management Tool (TMT).**

Appendices:

- A. Glossary
- B. Inspection Log

Enclosures:

PQS Job Aids

- 1-1 External Examination of a Watertube Boiler
- 1-2 Waterside Examination of a Watertube Propulsion Boiler
- 1-3 Fireside Examination of a Watertube Boiler
- 1-4 Hydrostatic Test of the Boiler
- 1-5 Required Valves
- 1-6 Required Mountings and Studs/Bolts and Nuts
- 2-1 Main Steam Turbine
- 2-2 Main / Auxiliary Condensate and Sea Water Circulating Systems
- 2-3 Feed-water Systems
- 2-4 Boiler Fuel Oil Service and Transfer System
- 3-1 Operational Test of Forced Draft Fans and Shutdowns
- 3-2 Steam Gauges
- 3-3 Lifting and Re-seating of Safety Valves
- 3-4 Operational Test of Periodic Safety Test Procedures (PSTP) of Steam Propulsion Automation

PQS Verifying Officer Signature Verification Log

RATE/ RANK	SIGNATURE/ PRINT NAME	EMPLID	INITIALS	UNIT
REMARKS:				

Machinery Inspector PQS

RECORD OF COMPLETION		
Training Prerequisites	Date	Training Coordinator's Signature
A. Completion of the following resident and on-line courses:		
1. Marine Inspector Course (501869); and		
2. Introduction to Confined Space Entry and Shipyard Competent Person for Marine Inspection/Port State Control (100028)		
B. Completion of Core (HI/MI) PQS Workbook		
C. Completion of this PQS Workbook		
D. Successful completion of final assessment under observation of Verifying Officer		
E. Successful completion of the final oral board by MI Certification Board		
MICB Members Present for Board:		
F. Certification/Designation Letter submitted for approval		
G. Once Certification/Designation Letter is signed, enter competency and certification in TMT		
REMARKS:		

Machinery Inspector PQS

Task Number	Task Description	Date Completed
MI-PI01	Research vessel details & inspection dates in Marine Information for Safety and Law Enforcement (MISLE) system	
MI-LM01	Review vessel's auxiliary boiler manual	
MI-LM02	Review Oil Record Book Part I (ORB)	
MI-LM03	Review Automation Test Procedures and Operations Manual	
MI-MI01	Inspect steering gear system	
MI-MI02	Inspect fuel oil service systems	
MI-MI03	Inspect main and auxiliary machinery and related systems	
MI-MI04	Inspect non-metallic expansion joints	
MI-MI05	Witness operational test of main propulsion automation	
MI-MI06	Inspect Unfired Pressure Vessels (UPVs)	
MI-MI07	Inspect refrigeration/air conditioning fixed system(s)	
MI-MI08	Inspect bilge system(s)	
MI-MI09	Inspect ballast water system	
MI-MI10	Inspect gasoline fuel systems	
MI-MI11	Inspect diesel fuel oil systems	
MI-MI12	Inspect lubricating oil systems	
MI-MI13	Inspect fuel tank components	
MI-MI14	Inspect boiler valves for auxiliary boilers	
MI-MI15	Inspect boiler mounts for auxiliary boilers	
MI-MI16	Inspect studs and bolts	
MI-MI17	Witness hydrostatic test of boiler and main steam piping for auxiliary boilers	
MI-MI18	Inspect boiler fireside for auxiliary boilers	
MI-MI19	Inspect boiler waterside for auxiliary boilers	
MI-MI20	Inspect boiler gauges for auxiliary boilers	
MI-MI21	Inspect feedwater system for auxiliary boilers	
MI-MI22	Inspect lifting and reseating of safety valves	
MI-MI23	Verify operation of automatic auxiliary boiler controls and safety devices	
MI-MI24	Inspect fuel oil service system for auxiliary boilers	

Machinery Inspector PQS

Task Number	Task Description	Date Completed
MI-MI25	Witness testing of Periodic Safety Test Procedures (PSTP)	
MI-MI26	Inspect safeties on specific types of small automatic auxiliary boilers	
MI-MI27	Inspect electric hotwater heater(s)	
MI-MI28	Inspect fired thermal fluid heaters	
MI-MI29	Inspect exhaust gas boilers	
MI-ES01	Inspect switchboard(s)	
MI-ES02	Inspect main service and propulsion generator(s) and prime mover(s)	
MI-ES03	Inspect emergency generator(s) and prime mover(s)	
MI-PP01	Inspect Oily Water Separator (OWS)	
MI-PP02	Inspect sewage system	
MI-PP03	Review fuel oil transfer procedures	
MI-PP04	Inspect incinerator(s)	
MI-PP05	Conduct an IOPP (MARPOL Annex I) survey	
MI-PP06	Conduct an international air pollution prevention (MARPOL Annex VI) survey	
MI-WR01	Evaluate structural repair proposal for boilers	
MI-WR02	Verify welding Procedure Qualification Records (PQR) for work on boilers	
MI-WR03	Verify welder is qualified to perform repair work on boilers	
MI-WR04	Inspect fit-up on boilers	
MI-WR05	Inspect welds on boilers	
MI-FU01	Document boiler inspection information in MISLE	

Appendix A

Glossary: The following terms are used in this workbook and should be reviewed in order to better understand its contents:

Advise: to counsel or recommend

Assign: to give responsibility, to place under the control of a task

Amend (Modify): to make minor changes in/to

Brief: to give information or final precise instructions

Change: to make different in some particular way

Check: to inspect for satisfactory condition, accuracy, safety or performance

Compare: to examine (two or more objects, ideas, people, etc.) in order to note similarities and/or differences

Communicate: to convey knowledge of or information about: make known

Confirm: to validate, establish the truth, accuracy or genuineness of something

Create: to cause to happen; bring about; arrange, as by intention or design

Discuss: to verbally present a topic in detail for examination or consideration

Determine: to settle or decide by choice of alternatives or possibilities. "Decide" refers to arriving at a conclusion and to pronounce that decision. "Determine" is to settle or decide by choice of alternatives or possibilities and to fix precisely.

Endorse: to approve, support or sustain; to sign one's name on a document or other instrument

Ensure: to make certain, to guarantee

Enter: to make a record of; record or register

Evaluate: to determine the significance or worth of, usually by careful appraisal and study

Examine: to look at or consider a thing carefully and in detail in order to discover something about it

Identify: to determine critical or necessary conditions or other factors; to determine the specific model of an item; to ascertain the origin, nature or definitive characteristics of; to recognize or establish as being a particular person or thing

Inspect: to examine officially; to look carefully at or over; view closely and critically

Issue: to serve legally binding federal documentation, notices or declarations to an individual, business or other distinctive entity

Appendix A

Locate: to determine or set the position of; to find

Make: to create or cause to happen

Modify (Amend): to make minor changes in/to

Observe (Witness): to watch carefully

Obtain: to gain or attain

Open: to set in action, begin, start or commence

Prepare: plan, gather and assemble information to produce a document (i.e. COI); to put together, to combine elements and produce a product, to make ready

Provide: to supply or make available

Review: to go over for the purpose of determining correctness or currency; to examine a document or process for accuracy in content and/or format and report errors or updates to the author or controlling authority

Schedule: to appoint, assign, or designate for a fixed time

Update: to bring up to date or make current

Validate: to substantiate accuracy or truth of by comparison or investigation

Verify: to confirm or establish the accuracy or truth of something

Witness (Observe): to watch carefully

Appendix B

DATE	LOCATION	VESSEL NAME	VESSEL TYPE	INSPECTION TYPE	LEAD INSPECTOR

Appendix B

DATE	LOCATION	VESSEL NAME	VESSEL TYPE	INSPECTION TYPE	LEAD INSPECTOR

Pre-Inspection (PI)

D, H & I Vessels

Task: MI-PI01 Research vessel details & inspection dates in Marine Information for Safety and Law Enforcement (MISLE) system

Condition: During preparation for inspection

Standard: In compliance with applicable policies, laws, regulations and standards

References: 1. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections

Steps		References	Initials
PI01.1	Hydrostatic inspection dates (boilers/main steam piping)	46 CFR 61.05-10(a) 46 CFR 61.15-5	
PI01.2	Fireside/waterside inspection dates	46 CFR 61.05-10(a)	
PI01.3	Safety valves setting(s) and inspection dates	46 CFR 61.05-10(a)	
PI01.4	Mount inspection dates	46 CFR 61.05-10(a)	
PI01.5	Valve inspection dates	46 CFR 61.05-10(a)	
PI01.6	Stud/bolt inspection dates	46 CFR 61.05-10(a)	
PI01.7	Gauge calibration dates	46 CFR 61.05-10(a)	
PI01.8	Pressure vessel(s)	46 CFR 61.10-5(b)	
PI01.9	Safety relief valve(s)	46 CFR 61.10-5(i)	
PI01.10	Non-metallic expansion joint(s)	46 CFR 61.15-12(b)	

Verifying Officer Guidance: Trainee shall note the safety valve data information for use during inspection.

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Logs and Manuals Inspection (LM)**D, H & I Vessels****Task:** MI-LM01 Review vessel's auxiliary boiler manual**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 46, Code of Federal Regulations Part 54 Pressure Vessels
 2. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 3. Vessel's Boiler Manual

Steps		References	Initials
LM01.1	Verify MAWP/design pressure	46 CFR 61.01-1(b) 46 CFR 54.10-20(a)(4) Boiler Manual	
LM01.2	Verify safety valve setting	46 CFR 61.01-1 46 CFR 61.05-20 Boiler Manual	
LM01.3	Verify maximum steam produced	46 CFR 61.01-1(b) Boiler Manual	

Verifying Officer Guidance:**Inspector's Name:** (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Logs and Manuals Inspection (LM)

D, H & I Vessels

Task: MI-LM02 Review Oil Record Book Part I (ORB)

Condition: While validating logs and manuals

Standard: In compliance with applicable policies, laws, regulations and standards

- References:**
1. Title 33, Code of Federal Regulations Part 151 Vessels Carrying Oil, NLS, Garbage, Municipal or Commercial Waste & Ballast Water
 2. IMO Resolution MEPC.187(59) Amendments to the Annex of the Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, 1973
 3. CG-CVC Letter, 16711 Serial #756 dated August 21, 2013 - Continued Use of 2007 Oil Record Book, CG-4602A (Rev. 11-16)
 4. International Convention for the Prevention of Pollution from Ships (MARPOL) 1973, as amended

Steps		References	Initials
LM02.1	Verify presence	33 CFR 151.25(a),(j) & (k)	
LM02.2	Verify edition of ORB	33 CFR 151.25(b) IMO MEPC.187(59) CG-CVC Letter	
LM02.3	Verify signatures	33 CFR 151.25(h) & (j)	
LM02.4	Verify entries	33 CFR 151.25(d), (e) & (f) 33 CFR 151.25(h) MARPOL I/17 Appendix III	
LM02.5	Compare overboard discharge rate entries with filtering equipment data plate or supplement to IOPP certificate	33CFR 151.25 (d) & (e) MARPOL I/17 & 36 MARPOL I/Appendix III	

Verifying Officer Guidance: Trainee shall demonstrate a working knowledge of format, purpose and how to use the information contained therein in order to verify active compliance of both ORB part I and ORB part II.

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Logs and Manuals Inspection (LM)

D, H & I Vessels

Task: MI-LM03 Review Automation Test Procedures and Operations Manual

Condition: While validating logs and manuals

Standard: In compliance with applicable policies, laws, regulations and standards

- References:**
1. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 2. Title 46, Code of Federal Regulations Part 62 Vital System Automation
 3. International Convention for the Safety of Life at Sea (SOLAS) 1974, as amended
 4. ABS Rules for Building and Classing Steel Vessels, 2003 Part 4 Vessel Systems and Machinery
 5. COMDTINST M16000.8B Marine Safety Manual Volume III Marine Industry Personnel Ch-2

Steps		References	Initials
LM03.1	Verify approval	46 CFR 62.20-1, -3 & -5	
LM03.2	Witness tests	46 CFR 61.20-3 46 CFR 61.40-6	
LM03.3	Verify accuracy	46 CFR 61-40, 62.30-10 46 CFR 62.35-50 ABS 4-9	
LM03.4	Verify manning	MSM III/B.6.A.3 SOLAS 20 II-I/31.3	

Verifying Officer Guidance: Trainee shall demonstrate a working knowledge of test procedure format, layout, purpose and how to use the information contained therein.

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI01 Inspect steering gear system

Condition: During machinery equipment inspection

Standard: In compliance with applicable policies, laws, regulations and standards

- References:**
1. Title 46, Code of Federal Regulations Part 35 Tank Vessels - Operations
 2. Title 46, Code of Federal Regulations Part 58 Main & Auxiliary Machinery & Related Systems
 3. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 4. Title 46, Code of Federal Regulations Part 78, & 97
 5. International Convention for the Safety of Life at Sea (SOLAS) 1974, as amended
 6. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2

Steps		References	Initials
MI01.1	Verify operation of main and auxiliary steering systems	46 CFR 58.25-10 MSM II/C.4.B	
MI01.2	Verify operation of communications between bridge and steering gear space	46 CFR 58.25-15 SOLAS 20 II-1/29.10	
MI01.3	Examine pumps and piping associated with hydraulic system	46 CFR 58.25-20 MSM II/C.4.B	
MI01.4	Witness operational test of alarms	46 CFR 58.25-25 SOLAS 20 II-1/29.8.4 SOLAS 20 II-1/29.12.2	
MI01.5	Verify automatic restart of powered equipment	46 CFR 58.25-30	
MI01.6	Verify accuracy of rudder angle repeaters	46 CFR 58.25-25(a) & 35, 78.47-55 SOLAS 20 II-1/29.11 & MSM II/C.4.C.4	
MI01.7	Examine steering gear compartment arrangement	46 CFR 58.25-40 SOLAS 20 II-1/29.13	
MI01.8	Witness operational test of systems in all modes from main and emergency steering station(s)	46 CFR 61.20-1 & 58.25-70 SOLAS 20 II-1/29.3.2 & 4.2 MSM II/C.4.C.4	
MI01.9	Verify availability to switch from automatic pilot to manual control	46 CFR 58.25-80	
MI01.10	Verify special requirements for tankships	46 CFR 58.25-85	
MI01.11	Verify markings and operating instructions	46 CFR 35.40-30 & 78.47-55 46 CFR 97.37-33 SOLAS 14 V/26.3.1	

Verifying Officer Guidance:

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI02 Inspect fuel oil service systems

Condition: During machinery equipment inspection

Standard: In compliance with applicable policies, laws, regulations and standards

- References:**
1. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances
 2. Title 46, Code of Federal Regulations Part 58 Main & Auxiliary Machinery & Related Systems
 3. International Convention for the Safety of Life at Sea (SOLAS) 1974, as amended

Steps		References	Initials
MI02.1	Examine piping arrangements	46 CFR 56.50-60(a)	
MI02.2	Examine piping heating coil arrangement	46 CFR 56.50-60(b)	
MI02.3	Examine filling piping arrangements	46 CFR 56.50-60(c)	
MI02.4	Verify valve arrangement inside and outside fuel oil tank	46 CFR 56.50-60(d)(1) & (2)	
MI02.5	Verify power operated valves configurations, instructions & operations	46 CFR 56.50-60(d)(3), (4)	
MI02.6	Verify tanks/piping/valves not located in prohibited locations	46 CFR 56.50-60(e)-(h)	
MI02.7	Verify flange or mechanical joints fitted with suitable shield	46 CFR 56.50-60(j) SOLAS 20 II-2/4.2.2.5 & .6	
MI02.8	Verify drip pan installation	46 CFR 56.50-60(k)	
MI02.9	Verify storage, distribution and use of oil in systems	46 CFR 56.50-60(m) & (n)	
MI02.10	Examine nonmetallic flexible hoses and fittings	46 CFR 56.50-60(n)(2)	
MI02.11	Verify locations, markings and operation of transfer/service pump shutdowns	46 CFR 58.01-25	

Verifying Officer Guidance: Trainee shall demonstrate a working knowledge of equipment's arrangements, components and safe operation and have a basic understanding of engineering principles and concepts.

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI03 Inspect main and auxiliary machinery and related systems

Condition: *During machinery equipment inspection*

Standard: *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances
 2. Title 46, Code of Federal Regulations Part 58 Main & Auxiliary Machinery & Related Systems
 3. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 4. International Convention for the Safety of Life at Sea (SOLAS) 1974, as amended
 5. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2

Steps		References	Initials
MI03.1	Examine condition, installation and arrangements of system components	46 CFR 58.05-1 & 61.20-3(a) SOLAS 20 II-1 26, 27 & 28 MSM II/B.1.F.4	
MI03.2	Verify installation of protective covers or guards	46 CFR 58.01-20 SOLAS 20 II-1/26.1 SOLAS 20 II-2/4.2.2.6.1	
MI03.3	Verify means of stopping machinery	46 CFR 58.01-25 46 CFR 61.20-3(b)	
MI03.4	Examine inlet and discharge piping	46 CFR 56.50-95(d)(1) & (2) SOLAS 20 II-1/26.3.6	
MI03.5	Verify machinery space ventilation	46 CFR 58.01-45 SOLAS 20 II-1/35	

Verifying Officer Guidance: *Trainee shall demonstrate a working knowledge of equipment's arrangements, components and safe operation based on level of automation. Also, have a basic understanding of engineering principles and concepts.*

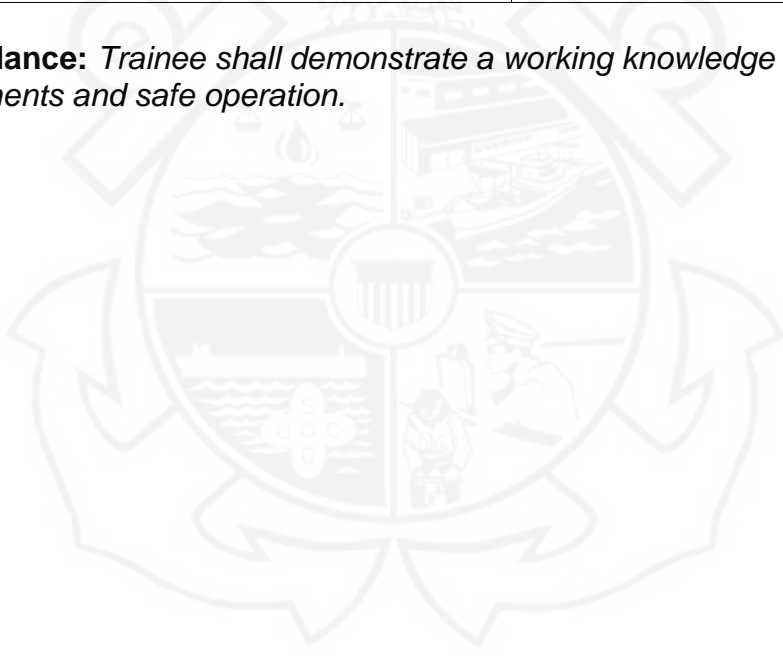
Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)**D, H & I Vessels****Task:** MI-MI04 Inspect non-metallic expansion joints**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 2. International Convention for the Safety of Life at Sea (SOLAS) 1974, as amended
 3. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2

Steps		References	Initials
MI04.1	Examine condition	46 CFR 61.15-12(a) SOLAS 20 II-1/26.9	
MI04.2	Verify compliance with 10 year "in-service" requirement	46 CFR 61.15-12(b) MSM II/B.3.F.3	

Verifying Officer Guidance: *Trainee shall demonstrate a working knowledge of equipment's arrangements, components and safe operation.*



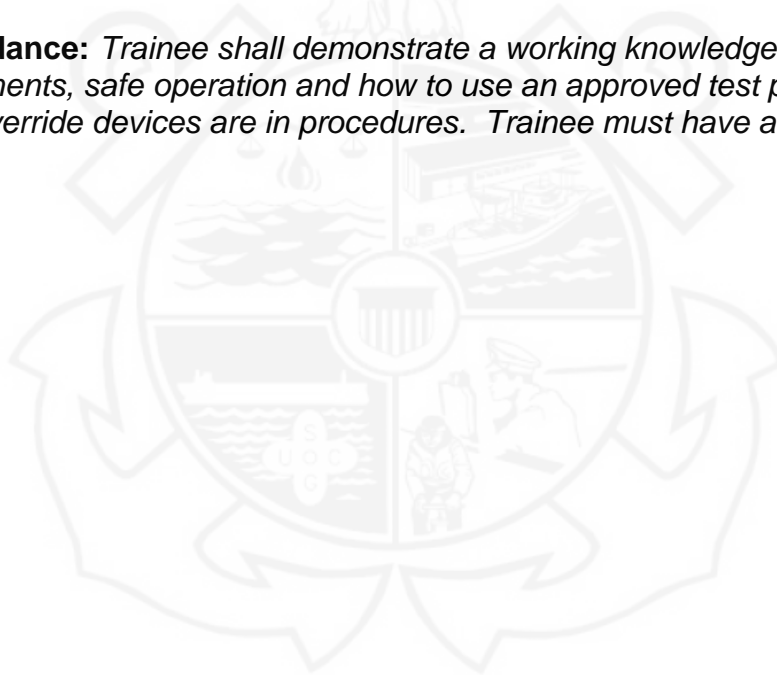
Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)**D, H & I Vessels****Task:** MI-MI05 Witness operational test of main propulsion automation**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 2. Title 46, Code of Federal Regulations Part 62 Vital System Automation

Steps		References	Initials
MI05.1	Witness operation of alarms, shutdowns, controls & internal communications (engineer assistance), IAW approved test procedure	46 CFR 62.30-10 46 CFR 61.40-3	
MI05.2	Verify bridge controls/alarms function in sync with engineroom control panel	46 CFR 61.40-3	

Verifying Officer Guidance: *Trainee shall demonstrate a working knowledge of equipment's arrangements, components, safe operation and how to use an approved test procedure to ensure no unapproved manual override devices are in procedures. Trainee must have a basic understanding of*



Inspector's Name: (Last, First, Initial)

EMPLID:

Verifying Officer's Signature:

Date:

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI06 Inspect Unfired Pressure Vessels (UPVs)

Condition: During machinery equipment inspection

Standard: In compliance with applicable policies, laws, regulations and standards

- References:**
1. Title 46, Code of Federal Regulations Part 54 Pressure Vessels
 2. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 3. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2

Steps		References	Initials
MI06.1	Verify if exempt from shop inspection and plan approval	46 CFR 54.01-15	
MI06.2	Verify data plate(s) are legible	46 CFR 54.10-20	
MI06.3	Verify external and/or an internal exam and/or hydrostatic test needs	46 CFR 61.10-5(b), (d) & (e)	
MI06.4	Examine externally	46 CFR 61.10-5(b)(1)	
MI06.5	Examine internally (when accessible)	46 CFR 54.10-1 & 01-35 46 CFR 61.10-5(b)(2) MSM II/B.1.O	
MI06.6	Witness hydrostatic test	46 CFR 61.10-5(d), (e)(4) MSM II/B.1.O	
MI06.7	Verify installation and operation of pressure gauges	46 CFR 54.15-5(f)	
MI06.8	Verify installation and operation of pressure-relieving devices	46 CFR 54.15-5 46 CFR 54.15-10(a) & (g) 46 CFR 61.10-5(i)	

Verifying Officer Guidance: Trainee shall demonstrate a working knowledge of equipment's arrangements, component, safe operation, and testing procedures and have a basic understanding of engineering principles and concepts.

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)**D, H & I Vessels****Task:** MI-MI07 Inspect refrigeration/air conditioning fixed system(s)**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 40, Code of Federal Regulations Part 1043 Control of NOx, SOx & PM Emissions from Marine Engines & Vessels Subject to the MARPOL Protocol
 2. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances
 3. Title 46, Code of Federal Regulations Part 58 Main & Auxiliary Machinery & Related Systems
 4. International Convention for the Prevention of Pollution from Ships (MARPOL) 1973, as amended

Steps		References	Initials
MI07.1	Verify plan approval and design	46 CFR 56.01-10 46 CFR 58.20-5	
MI07.2	Verify and examine pressure relieving devices	46 CFR 58.20-10	
MI07.3	Examine installation location and ventilation	46 CFR 58.20-15	
MI07.4	Examine refrigeration/air conditioning piping	46 CFR 58.20-20	
MI07.5	Verify testing of system repairs	46 CFR 58.20-25	
MI07.6	Verify compliance with MARPOL Annex VI	40 CFR 1043.10 MARPOL VI/12 Appx I	

Verifying Officer Guidance: *Trainee shall demonstrate a working knowledge of equipment's arrangements, components and safe operation and have a basic understanding of engineering principles and concepts.*

Inspector's Name: (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI08 Inspect bilge system(s)

Condition: *During machinery equipment inspection*

Standard: *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 33, Code of Federal Regulations Part 155 Oil or Hazardous Material Pollution Prevention Regulations for Vessels
 2. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances
 3. International Convention for the Safety of Life at Sea (SOLAS) 1974, as amended

Steps		References	Initials
MI08.1	Verify pumping capabilities & piping arrangements	46 CFR 56.50-50(a) & (h) SOLAS 20 II-1/35-1	
MI08.2	Verify location of manifolds & installation of non-return valves	46 CFR 56.50-50(b) & (c)	
MI08.3	Verify size of piping, locations of strainers & suction points	46 CFR 56.50-50(d) & (g)	
MI08.4	Examine independent & emergency suction capabilities	46 CFR 56.50-50(e) & (f)	
MI08.5	Verify number of pumps	46 CFR 56.50-55(a)	
MI08.6	Verify location and operation of pumps	46 CFR 56.50-55	
MI08.7	Verify capabilities of other pumps used as bilge pumps	46 CFR 56.50-55(f)	
MI08.8	Verify pollution placard is posted	46 CFR 56-50-50(n) 33 CFR 155.450	
MI08.9	Verify operation and labeling of remotely operated valve controls	46 CFR 56.50-1(g)(2)(ii)	

Verifying Officer Guidance: *Trainee shall demonstrate a working knowledge of equipment's arrangements, components and safe operation and have a basic understanding of engineering principles and concepts.*

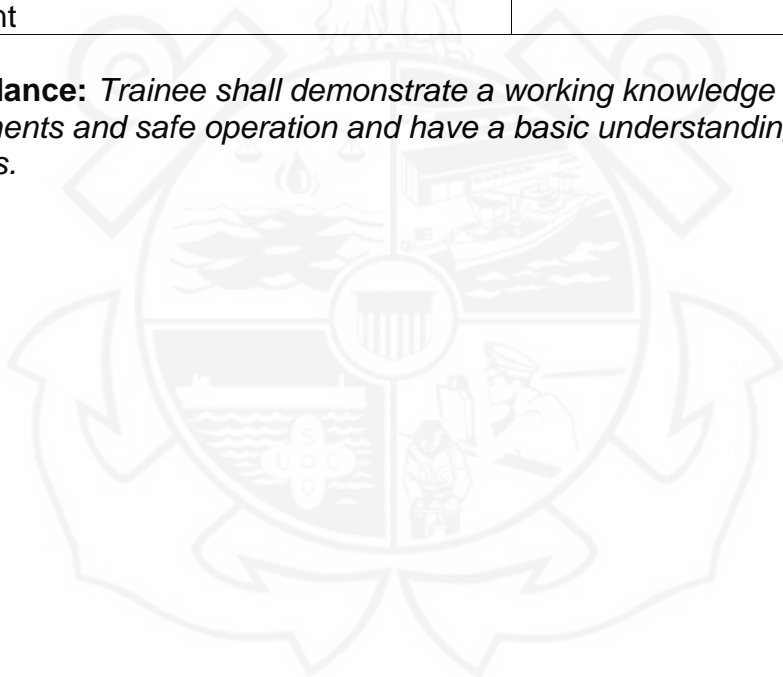
Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)**D, H & I Vessels****Task:** MI-MI09 Inspect ballast water system**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 33, Code of Federal Regulations Part 151 Vessels Carrying Oil, NLS, Garbage, Municipal or Commercial Waste & Ballast Water
 2. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances

Steps		References	Initials
MI09.1	Verify ballast piping, valve and pumping arrangements	46 CFR 56.50-50(h)-(k)	
MI09.2	Verify remote valve controls are fitted with nameplates	46 CFR 56.50-1(g)(2)(iii)	
MI09.3	Verify compliance for Ballast Water Management	33 CFR 151.2000-.2075	

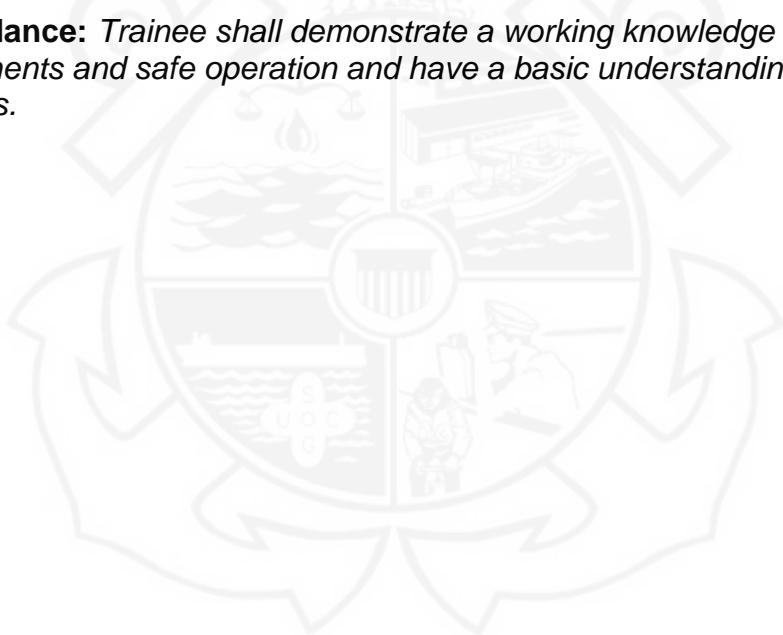
Verifying Officer Guidance: *Trainee shall demonstrate a working knowledge of equipment's arrangements, components and safe operation and have a basic understanding of engineering principles and concepts.*

**Inspector's Name:** (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Machinery Equipment Inspection (MI)**D, H & I Vessels****Task:** MI-MI10 Inspect gasoline fuel systems**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards***References:** 1. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances

Steps		References	Initials
MI10.1	Verify valves/piping/fitting arrangements	46 CFR 56.50-70	
MI10.2	Verify nonmetallic flexible hoses and fittings installation	46 CFR 56.50-70(b)(2)	
MI10.3	Verify location of shutoff valves	46 CFR 56.50-70(c)	
MI10.4	Verify location and configuration of strainers	46 CFR 56.50-70(d)	
MI10.5	Verify locations, markings and operation of transfer/service pump shutdowns	46 CFR 56.50-70(j) 46 CFR 58.01-25	

Verifying Officer Guidance: *Trainee shall demonstrate a working knowledge of equipment's arrangements, components and safe operation and have a basic understanding of engineering principles and concepts.*

**Inspector's Name:** (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI11 Inspect diesel fuel oil systems

Condition: *During machinery equipment inspection*

Standard: *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances
 2. International Convention for the Safety of Life at Sea (SOLAS) 1974, as amended
 3. IMO MSC.1/Circ. 1321 Guidelines for Measures to Prevent Fires in Engine Rooms and Cargo Pump-Rooms

Steps		References	Initials
MI11.1	Examine piping arrangements	46 CFR 56.50-75(a)(1)	
MI11.2	Examine piping heating coil arrangement	46 CFR 56.50-75(a)(1)	
MI11.3	Examine fill piping arrangements	46 CFR 56.50-75(a), (b)(6)	
MI11.4	Verify manual control valves arrangements	46 CFR 56.50-75(a)(2) & (4)	
MI11.5	Verify power operated valve configurations, instructions and operations	46 CFR 56.50-75(a)(1) SOLAS 20 II-2/4.2.2.3 IMO MSC Circ. 1321	
MI11.6	Verify tanks/piping/valves not located in prohibited locations	46 CFR 56.50-75(a)	
MI11.7	Verify flange/mechanical joints fitted with suitable shield	46 CFR 56.50-75(a)(1) SOLAS 20 II-2/4.2.2.5 & 6	
MI11.8	Verify drip pan installation	46 CFR 56.50-75(a)(1)	
MI11.9	Verify oil storage, distribution and use in systems	46 CFR 56.50-75(a)(1)	
MI11.10	Examine nonmetallic flexible hoses and fittings	46 CFR 56.50-75(a)(1)	
MI11.11	Verify locations, markings and operation of transfer/service pump shutdowns	46 CFR 56.50-75(a)(1) SOLAS 20 II-2/4.2.2.3.4	

Verifying Officer Guidance:

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI12 Inspect lubricating oil systems

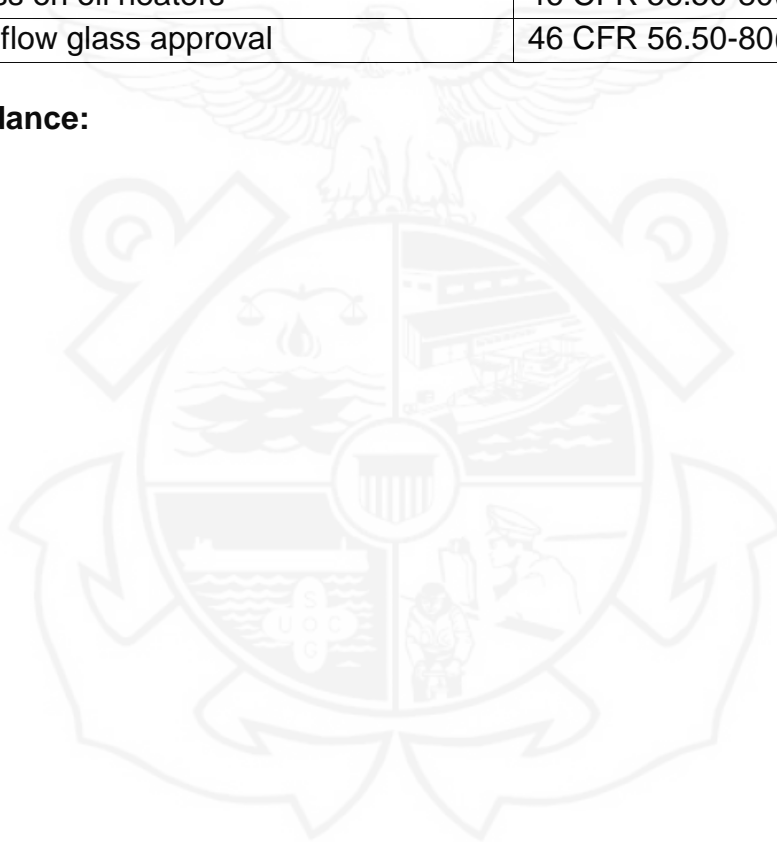
Condition: *During machinery equipment inspection*

Standard: *In compliance with applicable policies, laws, regulations and standards*

References: 1. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances

Steps		References	Initials
MI12.1	Verify components on internal combustion engine	46 CFR 56.50-80(d)	
MI12.2	Verify bypass on oil heaters	46 CFR 56.50-80(e)	
MI12.3	Verify sight-flow glass approval	46 CFR 56.50-80(h)	

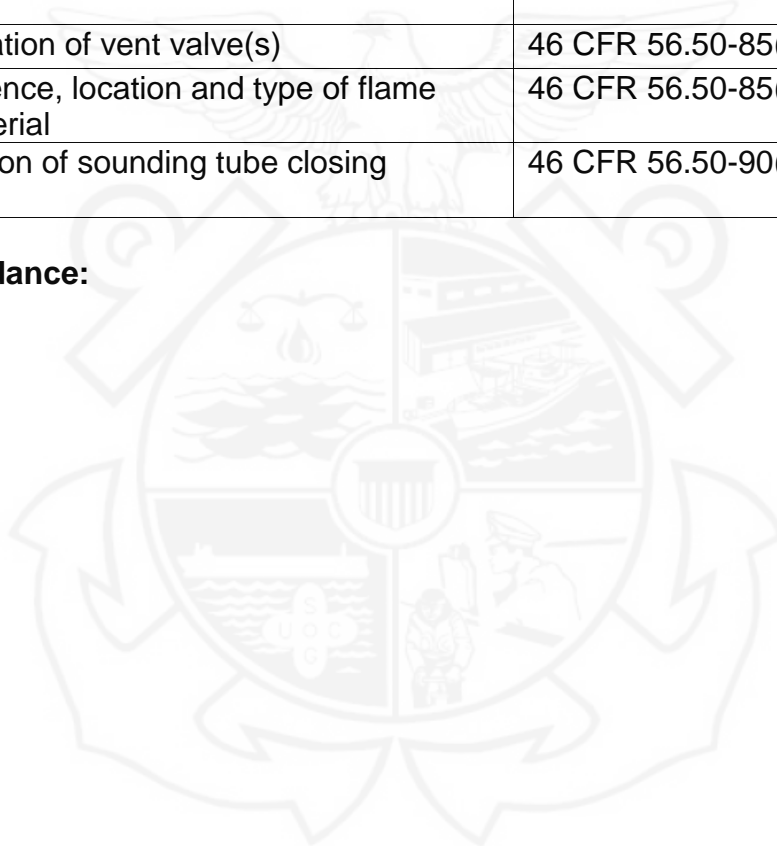
Verifying Officer Guidance:



Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)**D, H & I Vessels****Task:** MI-MI13 Inspect fuel tank components**Condition:** *During machinery equipment inspection and/or on deck walk***Standard:** *In compliance with applicable policies, laws, regulations and standards***References:** 1. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances

Steps		References	Initials
MI13.1	Verify number of vents	46 CFR 56.50-85(a)(2)	
MI13.2	Verify vent height from weather deck and their locations	46 CFR 56.50-85(a)(4) & (b)	
MI13.3	Verify operation of vent valve(s)	46 CFR 56.50-85(a)(7)	
MI13.4	Verify presence, location and type of flame screen material	46 CFR 56.50-85(a)(8) & (9)	
MI13.5	Verify location of sounding tube closing devices	46 CFR 56.50-90(a)-(e)	

Verifying Officer Guidance:**Inspector's Name:** (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI14 Inspect boiler valves for auxiliary boilers (5 year)

Condition: *During machinery equipment inspection*

Standard: *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances
 2. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 3. Title 46, Code of Federal Regulations Part 63 Automatic Auxiliary Boilers
 4. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2
 5. MI-Steam Course Job Aid 1.5 – Required Valves dated April 5, 2017

Steps		References	Initials
MI14.1	Identify valves subject to inspection	46 CFR 63.15-9 & 61.05-15 MSM II/B.1.G.7 & Table B1-1 JA 1.5; pgs. 1-5-2 & 1-5-3	
MI14.2	Examine seats	46 CFR 61.05-15 MSM II/B.1.G.7 JA 1.5; pg. 1-5-3	
MI14.3	Examine valve assembly	46 CFR 61.05-15 MSM II/B.1.G.7 JA 1.5; pg. 1-5-3	
MI14.4	Examine stem	46 CFR 61.05-15 MSM II/B.1.G.7 JA 1.5; pg. 1-5-3	
MI14.5	Verify material used for replacement valves	46 CFR 56.60-1	
MI14.6	Verify repair methods for discrepancies found	JA 1.5; pg. 1-5-4	

Verifying Officer Guidance: *This card is for fired boilers designed to 46 CFR 52 with Part 62 or 63 control systems. For low pressure steam/hot water boilers (packaged boilers), see MSM II/B.1.G.1.d.*

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)**D, H & I Vessels****Task:** MI-MI15 Inspect boiler mounts for auxiliary boilers (10 year)**Condition:** During machinery equipment inspection**Standard:** In compliance with applicable policies, laws, regulations and standards

- References:**
1. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances
 2. Title 46, Code of Federal Regulations Part 57 Welding & Brazing
 3. Title 46, Code of Federal Regulations Part 59 Repairs to Boilers, Pressure Vessels & Appurtenances
 4. Title 46, Code of Federal Regulations Parts 61 & 63
 5. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2
 6. MI-Steam Course Job Aid 1.6 – Required Mountings and Studs/Bolts and Nuts dated April 5, 2017

Steps		References	Initials
MI15.1	Identify mounts to be removed for inspection	46 CFR 63.15-9 & 61.05-15 MSM II/B.1.G.7, Table B1-1 JA 1.6; pgs.1-6-2 & 1-6-3	
MI15.2	Examine spool piece(s)	46 CFR 61.05-15 MSM II/B.1.G.7 JA 1.6; pgs. 1-6-3 & 1-6-4	
MI15.3	Examine flanges	46 CFR 61.05-15 MSM II/B.1.G.7 JA 1.6; pgs. 1-6-3 & 1-6-4	
MI15.4	Examine piping	46 CFR 61.05-15 MSM II/B.1.G.7 JA 1.6; pgs. 1-6-3 & 1-6-4	
MI15.5	Verify repair methods for discrepancies found	46 CFR 56, 57 & 59 JA 1.6; pg. 1-6-5	

Verifying Officer Guidance: This card is for fired boilers designed to 46 CFR 52 with Part 62 or 63 control systems. For low pressure steam/hot water boilers (packaged boilers), see MSM II/B.1.G.1.d.

Inspector's Name: (Last, First, Initial)

EMPLID:

Verifying Officer's Signature:

Date:

Machinery Equipment Inspection (MI)**D, H & I Vessels****Task:** MI-MI16 Inspect studs, bolts & nuts for auxiliary boilers (10 year)**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances
 2. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 3. Title 46, Code of Federal Regulations Part 63 Automatic Auxiliary Boilers
 4. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2
 5. MI-Steam Course Job Aid 1.6 - Required Mountings and Studs/Bolts and Nuts dated April 5, 2017

Steps		References	Initials
MI16.1	Verify correct material used	46 CFR 63.15-9 & 61.05-15 46 CFR 56.01-2 MSM II/B.1.G.7 / JA 1.6; pg. 1-6-4	
MI16.2	Examine material condition	46 CFR 61.05-15 MSM II/B.1.G.7 JA 1.6; pg. 1-6-4	
MI16.3	Verify repair methods for discrepancies found	JA 1.6; pg. 1-6-5	

Verifying Officer Guidance: *This card is for fired boilers designed to 46 CFR 52 with Part 62 or 63 control systems. For low pressure steam/hot water boilers (packaged boilers), see MSM II/B.1.G.1.d.*

Inspector's Name: (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI17 Witness hydrostatic test of auxiliary boilers

Condition: During machinery equipment inspection

Standard: In compliance with applicable policies, laws, regulations and standards

- References:**
1. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances
 2. Title 46, Code of Federal Regulations Parts 57, 58, 61 & 63
 3. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2
 4. MI-Steam Course Job Aid 1.4 – Hydrostatic Test of the Boiler dated April 5, 2017
 5. Vessel's Boiler Manual
 6. Boiler Dataplate

Steps		References	Initials
MI17.1	Verify Max Allowable Working Pressure (MAWP)	46 CFR 63.15-9 JA 1.4; pg. 1-4-2 Boiler manual	
MI17.2	Verify testing pressure	46 CFR 61.05-10(c) MSM II/B.1.G.2 &.3, JA 1.4; p. 1-4-3 Boiler Dataplate	
MI17.3	Verify water temperature	46 CFR 61.05-5(b) JA 1.4; pg. 1-4-4	
MI17.4	Verify safety valves are gagged	46 CFR 61.05-5(b) JA 1.4; pg. 1-4-4	
MI17.5	Verify that there is no steam on the back side of stop valves	46 CFR 61.05-10(d) JA 1.4, pg. 1-4-4	
MI17.6	Examine internally (furnace/vestibules) for watertube boilers	46 CFR 61.05-10(a) JA 1.4; pg. 1-4-6	
MI17.7	Examine internally (furnace) for firetube boilers	46 CFR 61.05-10(a) JA 1.4; pg. 1-4-6	
MI17.8	Examine externally (drums/headers/vestibules) for watertube boilers	46 CFR 61.05-10(a) JA1.4; pg.1-4-6	
MI17.9	Examine externally (shell) for firetube boilers	46 CFR 61.05-10(a) JA1.4; pg.1-4-6	
MI17.10	Verify repair methods for discrepancies found	46 CFR 56, 57 & 58 JA1.4; pg.1-4-7	

Verifying Officer Guidance: Trainee shall refer to repair tasks in WR 1-5. This card is for fired boilers designed to 46 CFR 52 with Part 62 or 63 control systems. For low pressure steam/hot water boilers (packaged boilers), see MSM II/B.1.G.1.d.

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)**D, H & I Vessels****Task:** MI-MI18 Inspect boiler fireside for auxiliary boilers**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 2. Title 46, Code of Federal Regulations Part 63 Automatic Auxiliary Boilers
 3. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2
 4. MI-Steam Course Job Aid 1.3 – Fireside Examination of a Watertube Boiler dated April 5, 2017

Steps		References	Initials
M18.1	Verify ready for inspection	46 CFR 63.15-9 46 CFR 61.05-15(f) JA 1.3; pg. 1-3-2	
MI18.2	Examine tubes (watertube)	46 CFR 61.05-10 MSM II/B.1.G.3 JA 1.3; pgs. 1-3-4, 1-3-5	
MI18.3	Examine uptake and flue pipe	46 CFR 61.05-10 MSM II/B.1.G.4.c.(2) JA 1.3; pg.1-3-8	
MI18.4	Examine refractory/corbel (water tube)	46 CFR 61.05-10 MSM II/B.1.G.2.c, 3.4 & .4 JA 1.3; pg. 1-3-6	
MI18.5	Examine furnace and tube sheets (fire tube)	46 CFR 61.05-10 MSM II/B.1.G.2.c, 3.4 & .4 JA 1.3; pg. 1-3-6	
MI18.6	Examine material condition of wind box compartment (water tube)	46 CFR 61.05-10 JA 1.3; pg. 1-3-3	
MI18.7	Examine fusible plug (fire tube)	46 CFR 61.05-15(g)	

Verifying Officer Guidance: *This card is for fired boilers designed to 46 CFR 52 with Part 62 or 63 control systems. For low pressure steam/hot water boilers (packaged boilers), see MSM II/B.1.G.1.d.*

Inspector's Name: (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI19 Inspect boiler waterside for auxiliary boilers

Condition: During machinery equipment inspection

Standard: In compliance with applicable policies, laws, regulations and standards

- References:**
1. Title 46, Code of Federal Regulations Parts 52, 56, 61 & 63
 2. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2
 3. MI-Steam Course Job Aid 1.1 – External Examination of a Watertube Boiler dated April 5, 2017
 4. MI-Steam Course Job Aid 1.2 – Waterside Examination of a Watertube Boiler dated July 9, 2020
 5. MI-Steam Course Job Aid 3.3 – Lifting and Reseating of Safety Valves dated April 5, 2017

Steps		References	Initials
MI19.1	Verify ready for inspection	46 CFR 63.15-9 & 61.05-5 JA 1.2; pg. 1-2-2	
MI19.2	Examine external casing/doors	46 CFR 61.05-10 MSM II/B.1.G.2.e, .3.c & .4.c JA 1.1; pgs. 1-1-2 & 1-1-3	
MI19.3	Examine shell/heads (firetube)	46 CFR 61.05-10 MSM II/B.1.G.2.e, .3.c & .4.c JA 1.1; pg. 1-1-2 & 1-1-3	
MI19.4	Examine drum/header internals (watertube)	46 CFR 61.05-10 MSM II/B.1.G.2.f & g, .3.d - .f & .4.c JA 1.2; pgs. 1-2-3 & 1-2-4	
MI19.5	Examine shell/head internals upper/lower (firetube)	46 CFR 61.05-10 MSM II/B.1.G.2.f & g, .3.d - .f & .4.c JA 1.2; pgs. 1-2-2 thru 1-2-4	
MI19.6	Examine blowoff valves/piping	46 CFR 56.50-40, JA 1.1; pg. 1-1-2	
MI19.7	Examine lagging/insulation on piping	46 CFR 56.50-1(k) & -15(h)(3) JA 1.1; p. 1-1-3	
MI19.8	Examine safety relief valve escape piping	46 CFR 56.50-25, MSM II/B.1.G.7.d(2) JA 3.3; pgs. 3-3-2 & 3-3-3	
MI19.9	Verify independent means for checking water level	46 CFR 52.01-110 JA 1.1; pg. 1-1-6	
MI19.10	Examine condition of foundations/sliding feet	46 CFR 52.10-130(a)(2) JA 1.1; pg. 1-1-3	
MI19.11	Verify repair methods for discrepancies found	JA 1.2; pg. 1-2-6	

Verifying Officer Guidance: See VO guidance on previous page.

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)**D, H & I Vessels****Task:** MI-MI20 Inspect boiler gauges for auxiliary boilers**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 2. Title 46, Code of Federal Regulations Part 63 Automatic Auxiliary Boilers
 3. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2
 4. MI-Steam Course Job Aid 3.2 – Steam Gauges dated April 5, 2017

Steps		References	Initials
MI20.1	Verify operation	46 CFR 63.15-9 & 61.05-15(f) MSM II/B.1.G.7.e(4) JA 3.2; pg. 3-2-2	
MI20.2	Verify accuracy	46 CFR 61.05-15(f) MSM II/B.1.G.7.e(4) JA 3.2; pg. 3-2-2	

Verifying Officer Guidance: *This card is for fired boilers designed to 46 CFR 52 with Part 62 or 63 control systems. For low pressure steam/hot water boilers (packaged boilers), see MSM II/B.1.G.1.d.*

Inspector's Name: (Last, First, Initial)

EMPLID:

Verifying Officer's Signature:

Date:

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI21 Inspect feedwater system for auxiliary boilers

Condition: During machinery equipment inspection

Standard: In compliance with applicable policies, laws, regulations and standards

- References:**
1. Title 46, Code of Federal Regulations Part 52 Power Boilers
 2. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances
 3. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 4. COMDTINST M16000.7B Marine Safety Manual Volume II Materiel Inspection Ch-2
 5. MI-Steam Course Job Aid 2.3 – Feedwater Systems dated July 9, 2020

Steps		References	Initials
MI21.1	Examine feedwater pump/piping	46 CFR 56.50-30(a) 46 CFR 56.01-5 & .50-30 MSM II/B.1.H.1 & H.3 JA 2.3; pgs. 2-3-3 & 2-3-4	
MI21.2	Verify operation of feed/relief valves	46 CFR 56.50-30(b) & (c) MSM II/B.1.I.3 JA 2.3; p. 2-3-3, 2-3-5	
MI21.3	Witness operation of feedwater regulators	46 CFR 56.50-30(c) JA 2.3; pg. 2-3-5	
MI21.4	Examine water columns, gage glasses and gage cocks	46 CFR 52.01.110 & 61.05-15(e) MSM II/B.1.G.7 JA 2.3; pg. 2-3-5	
MI21.5	Verify presence and operation of gauges	46 CFR 56.50-10	
MI21.6	Examine make up feed evaporator	JA 2.3; pg. 2-3-6	

Verifying Officer Guidance: *This card is for fired boilers designed to 46 CFR 52 with Part 62 or 63 control systems. For low pressure steam/hot water boilers (packaged boilers), see MSM II/B.1.G.1.d.*

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI22 Inspect lifting and reseating of safety valves for auxiliary boilers

Condition: During machinery equipment inspection

Standard: In compliance with applicable policies, laws, regulations and standards

- References:**
1. Title 46, Code of Federal Regulations Part 52 Power Boilers
 2. Title 46, Code of Federal Regulations Parts 61 & 162
 3. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2
 4. ASME Boiler and Pressure Vessel Code, Section IX, 2001
 5. NVIC 01-71 Repair of Boiler Safety Valves
 6. MI-Steam Course Job Aid 3.3 – Lifting and Reseating of Safety Valves dated April 5, 2017

Steps		References	Initials
MI22.1	Record data from safety relief valves data plate/MISLE	46 CFR 52.01-120(a) ASME Code UG-129 46 CFR 162.018-6 / JA 3.3; pg. 3-3-2	
MI22.2	Verify presence of gags	46 CFR 52.01-120(a)(9) JA 3.3; pg. 3-3-3	
MI22.3	Witness lifting and setting of valve	46 CFR 52.01-120(c) 46 CFR 61.01-1, 05-20 MSM II/B.1.G.7(d) / JA 3.3; pg.3-3-4	
MI22.4	Record lifting and setting pressures	46 CFR 52.01-120(d)(1) ASME Code PG72.3 JA 3.3; pg.3-3-4	
MI22.5	Verify lifting and setting are within range	46 CFR 52.01-120(d)(1) ASME Code PG72.3 JA 3.3; pg.3-3-4	
MI22.6	Witness test of hand relieving gear	46 CFR 52.01-120(d)(2) JA 3.3; pg. 3-3-5	
MI22.7	Verify third party repair facility certificate	NVIC 01-71	

Verifying Officer Guidance: *This card is for fired boilers designed to 46 CFR 52 with Part 62 or 63 control systems. For low pressure steam/hot water boilers (packaged boilers), see MSM II/B.1.G.1.d.*

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI23 Verify operation of automatic auxiliary boiler controls and safety devices

Condition: During machinery equipment inspection

Standard: In compliance with applicable policies, laws, regulations and standards

- References:**
1. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 2. Title 46, Code of Federal Regulations Part 63 Automatic Auxiliary Boilers

Steps		References	Initials
MI23.1	Verify MSC submission/approval of detailed instructions for operational testing and certification reports	46 CFR 63.10-1(a) & (b)	
MI23.2	Verify operation of safety controls	46 CFR 61.35-3(a)(1) 46 CFR 63.15-7(a)	
MI23.3	Verify operation of flame safeguard	46 CFR 61.35-3(a)(2) 46 CFR 63.15-7(a)	
MI23.4	Verify operation of fuel supply controls	46 CFR 61.35-3(a)(3) 46 CFR 63.15-7(a)	
MI23.5	Verify operation of fuel oil pressure limit switch	46 CFR 61.35-3(a)(4) 46 CFR 63.15-7(a) & (d)	
MI23.6	Verify operation of fuel temperature limit control	46 CFR 61.35-3(a)(5) 46 CFR 63.15-7(a) & (d)	
MI23.7	Verify combustion controls	46 CFR 61.35-3(a)(6) 46 CFR 63.15-7(a)	
MI23.8	Verify draft limit controls	46 CFR 61.35-3(a)(7) 46 CFR 63.15-7(a)	
MI23.9	Verify water level controls	46 CFR 61.35-3(a)(9) & (10) 46 CFR 63.15-7(b) & (c)	
MI23.10	Verify low voltage test	46 CFR 61.35-3(a)(11)	
MI23.11	Verify operation of visible shutdown indicator	46 CFR 61.35-3(a)(12) 46 CFR 63.15-7(a) & (b)	
MI23.12	Verify periodically unattended alarm requirements	46 CFR 63.15-7(d)	

Verifying Officer Guidance: See 46 CFR 63.01-3(a)(1) for automatic auxiliary boiler control requirements/applicability. This PQS Card is for fired boilers designed to 46 CFR 52 with a heat input rating < 12,500,000 Btu/hr requiring 46 CFR 63 automatic controls.

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)**D, H & I Vessels****Task:** MI-MI24 Inspect fuel oil service system for auxiliary boilers**Condition:** During machinery equipment inspection**Standard:** In compliance with applicable policies, laws, regulations and standards

- References:**
1. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances
 2. Title 46, Code of Federal Regulations Part 58 Main & Auxiliary Machinery & Related Systems
 3. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 4. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2
 5. MI-Steam Course Job Aid Boiler Fuel Oil Service and Transfer System dated July 9, 2020

Steps		References	Initials
MI24.1	Verify operation of service pumps	46 CFR 56.50-65(b)(2) MSM II/B.1.H.3 JA 2.4; pp. 2-4-2	
MI24.2	Verify service pump relief valves location and 5 year test	46 CFR 61.20-3(a) & 56.50-65(c) MSM II/B.1.I.3 JA 2.4; pp. 2-4-2	
MI24.3	Witness remote shutdown of service pumps	46 CFR 58.01-25 JA 2.4; pp. 2-4-2	
MI24.4	Verify location and markings at remote shutdown station	46 CFR 58.01-25 JA 2.4; pp. 2-4-2	
MI24.5	Verify no non-metallic material installed	46 CFR 56.50-65(a) JA 2.4; p. 2-4-3	
MI24.6	Verify presence and condition of wrap around deflector for fuel piping on burner assembly	46 CFR 56.50-65(c) MSM II/B.1.I.6 JA 2.4; p.2-4-3	
MI24.7	Examine drip pans	46 CFR 56.50-60(k), -65(b)(3) JA 2.4; p. 2-4-5	
MI24.8	Verify repair methods for discrepancies found	JA 2.4; p. 2-4-6	

Verifying Officer Guidance: Ensure trainee understand that class rules may allow for the use of non-metallic material if vessel is ACP.

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI25 Witness testing of Periodic Safety Test Procedures (PSTP)

Condition: *During machinery equipment inspection*

Standard: *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 2. Title 46, Code of Federal Regulations Part 62 Vital System Automation
 3. MI-Steam Course Job Aid 3.4 – Operational Test of Periodic Safety Test Procedures (PSTP) of Steam Propulsion Automation dated XXXXX

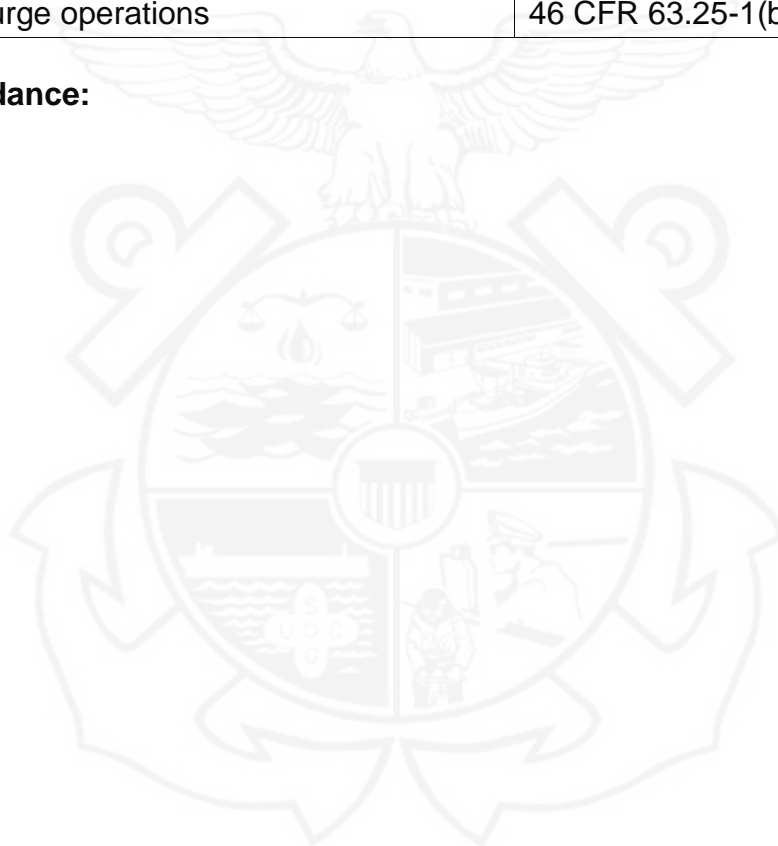
Steps		References	Initials
MI25.1	Verify PSTP is approved and "hard copy" presence	46 CFR 61.40-1(a) 46 CFR 62.25-25 JA 3.4; pg. 3-4-2	
MI25.2	Verify PSTP match equipment installed	46 CFR 61.40-3 JA 3.4; pg.3-4-3	
MI25.3	Verify no manual override devices not approved in test procedures	46 CFR 61.40-6 JA 3.4; pg.3-4-3	
MI25.4	Verify operation of alarms, shutdowns and controls	46 CFR 61.40-6(b) JA 3.4; pg. 3-4-4	
MI25.5	Verify corrections are completed	46 CFR 61.40-10	

Verifying Officer Guidance: *See 46 CFR 63.01-3(a) for automatic auxiliary boiler control requirements/applicability. This PQS Card is for fired auxiliary boilers designed to 46 CFR 52 with a heat input rating equal to or greater than 12,500,000 BTU/hr requiring 46 CFR 62 controls.*

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

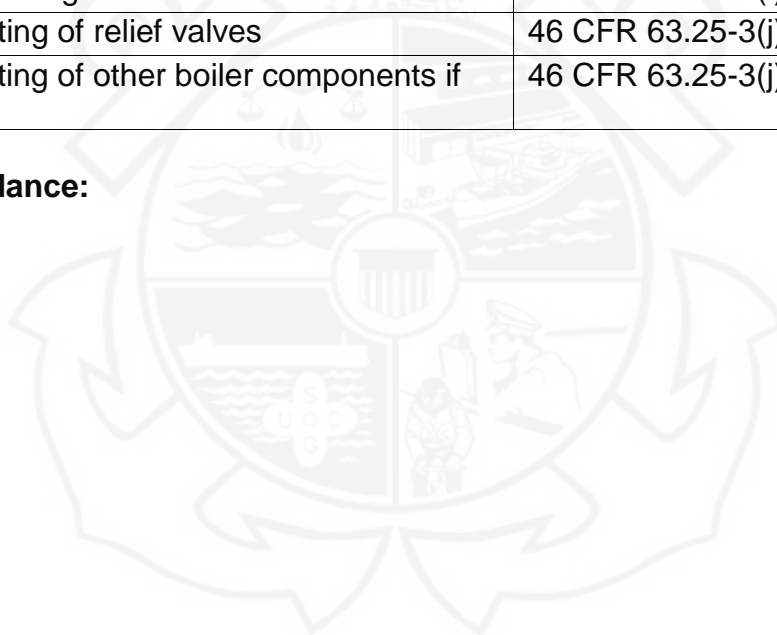
Machinery Equipment Inspection (MI)**D, H & I Vessels****Task:** MI-MI26 Inspect safeties on specific types of small automatic auxiliary boilers**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards***References:** 1. Title 46, Code of Federal Regulations Part 63 Automatic Auxiliary Boilers

Steps		References	Initials
MI26.1	Verify boiler ratings	46 CFR 63.25-1	
MI26.2	Verify operation of low water indicators	46 CFR 63.25-1(a)	
MI26.3	Verify prepurge operations	46 CFR 63.25-1(b)	

Verifying Officer Guidance:**Inspector's Name:** (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Machinery Equipment Inspection (MI)**D, H & I Vessels****Task:** MI-MI27 Inspect electric hotwater heater(s)**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards***References:** 1. Title 46, Code of Federal Regulations Part 63 Automatic Auxiliary Boilers

Steps		References	Initials
MI27.1	Verify pressure and temperature relief valve standards for heater with 120 gallons or less capacity	46 CFR 63.25-3(a)	
MI27.2	Examine heating element regulating device	46 CFR 63.25-3(f)	
MI27.3	Verify independent temperature limiting device	46 CFR 63.25-3(g)	
MI27.4	Verify pressure and temperature relief valve settings	46 CFR 63.25-3(h)	
MI27.5	Examine markings on boiler	46 CFR 63.25-3(i)	
MI27.6	Witness testing of relief valves	46 CFR 63.25-3(j)	
MI27.7	Witness testing of other boiler components if necessary	46 CFR 63.25-3(j)	

Verifying Officer Guidance:**Inspector's Name:** (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Machinery Equipment Inspection (MI)**D, H & I Vessels****Task:** MI-MI28 Inspect fired thermal fluid heaters**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards***References:** 1. Title 46, Code of Federal Regulations Part 63 Automatic Auxiliary Boilers
2. Manufacturer's Operation Manual

Steps		References	Initials
MI28.1	Verify ready for inspection	46 CFR 61.30-5 Operations Manual	
MI28.2	Witness hydrostatic test	46 CFR 61.30-10 Operations Manual	
MI28.3	Examine visually	46 CFR 61.30-15 Operations Manual	
MI28.4	Verify prepurge and burner ignition sequence	46 CFR 61.30-20 Operations Manual	
MI28.5	Verify operation of combustion controls	46 CFR 61.30-20 Operations Manual	
MI28.6	Verify operation of limits, flow and fluid controls	46 CFR 61.30-20 Operations Manual	
MI28.7	Verify operation of high temperature control	46 CFR 61.30-20 Operations Manual	
MI28.8	Verify operation of postpurge control	46 CFR 61.30-20 Operations Manual	
MI28.9	Verify operation of flame safe-guard	46 CFR 61.30-20 Operations Manual	

Verifying Officer Guidance:**Inspector's Name:** (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Machinery Equipment Inspection (MI)

D, H & I Vessels

Task: MI-MI29 Inspect exhaust gas boilers

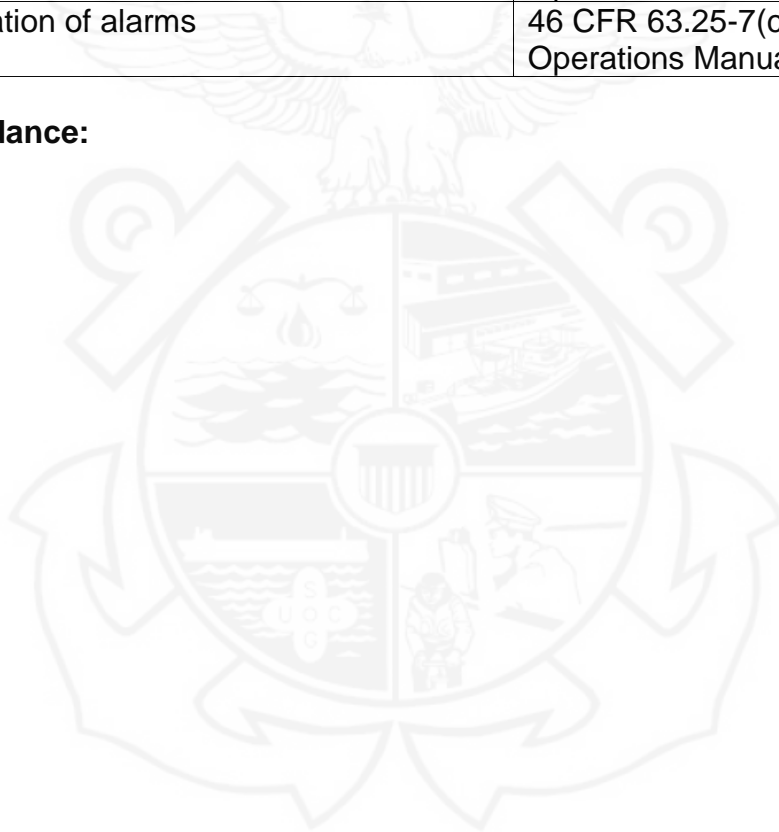
Condition: *During machinery equipment inspection*

Standard: *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 46, Code of Federal Regulations Part 63 Automatic Auxiliary Boilers
 2. Manufacturer's Operation Manual

Steps		References	Initials
MI29.1	Verify operation of feedwater control system	46 CFR 63.25-7(b) Operations Manual	
MI29.2	Verify operation of alarms	46 CFR 63.25-7(c) Operations Manual	

Verifying Officer Guidance:



Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Electrical Systems Inspection (ES)**D, H & I Vessels****Task:** MI-ES01 Inspect switchboard(s)**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 46, Code of Federal Regulations Part 111 Electric Systems General Requirements
 2. IEEE Std 45, Recommended Practice for Electrical Installations on Shipboard, 2002

Steps		References	Initials
ES01.1	Verify presence of dead front (blanks), accessibility and construction	46 CFR 111.30-1 thru -5 IEEE 45-2002 8.3	
ES01.2	Verify and non-conductive handrail(s), matting or deck grating	46 CFR 111.30-11	
ES01.3	Review information on nameplates	46 CFR 111.30-15	
ES01.4	Verify operation of alternating current service switchboard components	46 CFR 111.30-25	
ES01.5	Verify operation of direct current service switchboard components	46 CFR 111.30-27	
ES01.6	Verify operation of emergency switchboard components	46 CFR 111.30-29	

Verifying Officer Guidance: *Trainee shall demonstrate a working knowledge of equipment's components, function and safe operation.*

Inspector's Name: (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Electrical Systems Inspection (ES)

D, H & I Vessels

Task: MI-ES02 Inspect main service and propulsion generator(s) and prime mover(s)

Condition: During machinery equipment inspection while engine(s) is/are running

Standard: In compliance with applicable policies, laws, regulations and standards

- References:**
1. Title 46, Code of Federal Regulations Part 58 Main & Auxiliary Machinery & Related Systems
 2. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections
 3. Title 46, Code of Federal Regulations Part 111 Electric Systems General Requirements
 4. International Convention for the Safety of Life at Sea (SOLAS) 1974, as amended
 5. ABS Rules for Building and Classing Steel Vessels, 2003 Part 4 Vessel Systems and Machinery

Steps		References	Initials
ES02.1	Examine condition of components	46 CFR 61.20-3(a)	
ES02.2	Verify installation of machinery covers and guards	46 CFR 58.01-20 SOLAS 20 II-1/26.1 SOLAS 20 II-2/4.2.2.6.1	
ES02.3	Verify generator(s) nameplates are attached	46 CFR 111.12-5 ABS 4-2-1/1.1 ABS 4-8-3/3.11.8	
ES02.4	Verify set point and operation of prime mover over speed shut-down	46 CFR 111.12-1(b) ABS 4-2-1/7.5.3	
ES02.5	Verify set point and operation of prime mover lube oil shut-down	46 CFR 111.12-1(c)	
ES02.6	Verify power source requirements	46 CFR 111.10 SOLAS 20 II-1/41	
ES02.7	Examine generator protections	46 CFR 111.12-11	
ES02.8	Verify operation of reverse power relays	46 CFR 111.12-11(f)	

Verifying Officer Guidance: Trainee shall demonstrate a working knowledge of equipment's components, function and safe operation. Refer to the appropriate ABS rules are applied based on type/characteristics.

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Electrical Systems Inspection (ES)**D, H & I Vessels****Task:** MI-ES03 Inspect emergency generator(s) and prime mover(s)**Condition:** *During machinery equipment inspection while engine(s) is/are running***Standard:** *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 46, Code of Federal Regulations Part 56 Piping Systems & Appurtenances
 2. Title 46, Code of Federal Regulations Part 58 Main & Auxiliary Machinery & Related Systems
 3. Title 46, Code of Federal Regulations Parts 61, 111 & 112
 4. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2
 5. International Convention for the Safety of Life at Sea (SOLAS) 1974, as amended
 6. ABS Rules for Building and Classing Steel Vessels, 1995 Part 4 Vessel Systems and Machinery

Steps		References	Initials
ES03.1	Verify power source requirement	46 CFR 112.05-05 SOLAS 20 II-1/43.3	
ES03.2	Verify prime mover requirement	46 CFR 58.10-10 & 01-5 46 CFR 111.12-1 46 CFR 112.50-1	
ES03.3	Verify starting requirements	46 CFR 112.50-1(d) SOLAS 20 II-1/44	
ES03.4	Examine starting systems	46 CFR 112.50-1(e) & (k) SOLAS 20 II-1/44.3	
ES03.5	Verify operation of auto-start function	SOLAS 20 II-1/43.3 46 CFR 112.50-1(d) MSM II/B.1.L.2	
ES03.6	Examine condition	46 CFR 61.20-3(a)	
ES03.7	Verify installation of machinery covers and guards	46 CFR 58.01-20	
ES03.8	Verify operation of alarms	46 CFR 112.50-1(h) or (i)	

[Task **MI-ES03** continued on next page]**Inspector's Name:** (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

ES03.9	Verify gauges	ABS 4-2-1/7.17	
ES03.10	Verify marking and operation of remote fuel shutoff valves	46 CFR 56.50-60(c) & (d) SOLAS 20 II-2/4.2.2.3.4	
ES03.11	Verify set point and operation of over speed shut-down	46 CFR 111.12-1(b) & .50-1(g) ABS 4-2-1/7.5.3	
ES03.12	Verify set point and operation of lube oil shut-down	46 CFR 111.12-1(c) 46 CFR 112.50-1(g)	
ES03.13	Verify generator nameplates attached	46 CFR 111.12-5 ABS 4-2-1/1.1 ABS 4-8-3/3.11.8	

Verifying Officer Guidance: Trainee shall demonstrate a working knowledge of equipment's components, function and safe operation. Refer to the appropriate ABS rules that are applied based on vessel type/characteristics.

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Pollution Prevention Inspection (PP)

D, H & I Vessels

Task: MI-PP01 Inspect Oily Water Separator (OWS)

Condition: *During pollution prevention inspection*

Standard: *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 33, Code of Federal Regulations Parts 151 & 155
 2. International Convention for the Prevention of Pollution from Ships (MARPOL) 1973, as amended
 3. IMO Resolution A.1076(28) Amendments to the Survey Guidelines Under the Harmonized System of Survey and Certification (HSSC), 2011
 4. IMO Resolution MEPC.60(33) Guidelines & Specifications for Pollution Prevention Equipment for Machinery Space Bilges of Ships
 5. IMO Resolution MEPC.107(49) Revised Guidelines & Specifications for Pollution Prevention Equipment for Machinery Space Bilges of Ships
 6. Manufacturer's Operation Manual

Steps		References	Initials
PP01.1	Verify approval	33 CFR 155.380(a & (b) MARPOL I/14	
PP01.2	Verify overboard discharge valve is closed	33 CFR 151.10(c) MARPOL I/15	
PP01.3	Witness operation	33 CFR 155.380(e) MARPOL I/14 Operations Manual	
PP01.4	Verify means to retain oily waste	33 CFR 155.330-.370 MARPOL I/14.3-.5 IMO Res A.1076(28) MARPOL I/12	
PP01.5	Verify operation of oil content monitor and performed maintenance	33 CFR 155.380 (f) IMO Res MEPC.60(33) IMO Res MEPC.107(49)	

Verifying Officer Guidance: *Trainee shall demonstrate a working knowledge of equipment components, requirements, function, type approval and operation and how to use the information to verify active compliance.*

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Pollution Prevention Inspection (PP)**D, H & I Vessels****Task:** MI-PP02 Inspect sewage system**Condition:** *During pollution prevention inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 33, Code of Federal Regulations Part 159 Marine Sanitation Devices
 2. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2
 3. Manufacturer's Operation Manual

Steps		References	Initials
PP02.1	Verify presence of manufacturer's instructions	33 CFR 159.57	
PP02.2	Verify operation	33 CFR 159.57 Operations Manual	
PP02.3	Verify Marine Sanitation Device (MSD) approval	33 CFR 159.2 ,.7 & .12 MSM II/B.6.F.4	
PP02.4	Verify capacity	33 CFR 159.57(b)(8)	
PP02.5	Verify piping and wiring	33 CFR 159.97	
PP02.6	Verify instructions and warning placard posted	33 CFR 159.59	

Verifying Officer Guidance: *Trainee shall demonstrate a working knowledge of pollution prevention equipment components, requirements, function and operation. It is important to verify if the capacity of the MSD is adequate for the vessel's crew/personnel complement.*

Inspector's Name: (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Pollution Prevention Inspection (PP)

D, H & I Vessels

Task: MI-PP03 Review fuel oil transfer procedures

Condition: *During pollution prevention inspection*

Standard: *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 33, Code of Federal Regulations Part 155 Oil or Hazardous Material Pollution Prevention Regulations for Vessels
 2. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2

Steps		References	Initials
PP03.1	Verify contents of PIC designation letter	33 CFR 155.700 & 715	
PP03.2	Verify procedure are posted or available	33 CFR 155.720 33 CFR 155.740(c) MSM II B.6.D.16	
PP03.3	Verify contents of procedures	33 CFR 155.750	
PP03.4	Verify amendments to procedures	33 CFR 155.760	

Verifying Officer Guidance:



Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Pollution Prevention Inspection (PP)

D, H & I Vessels

Task: MI-PP04 Inspect incinerator(s)

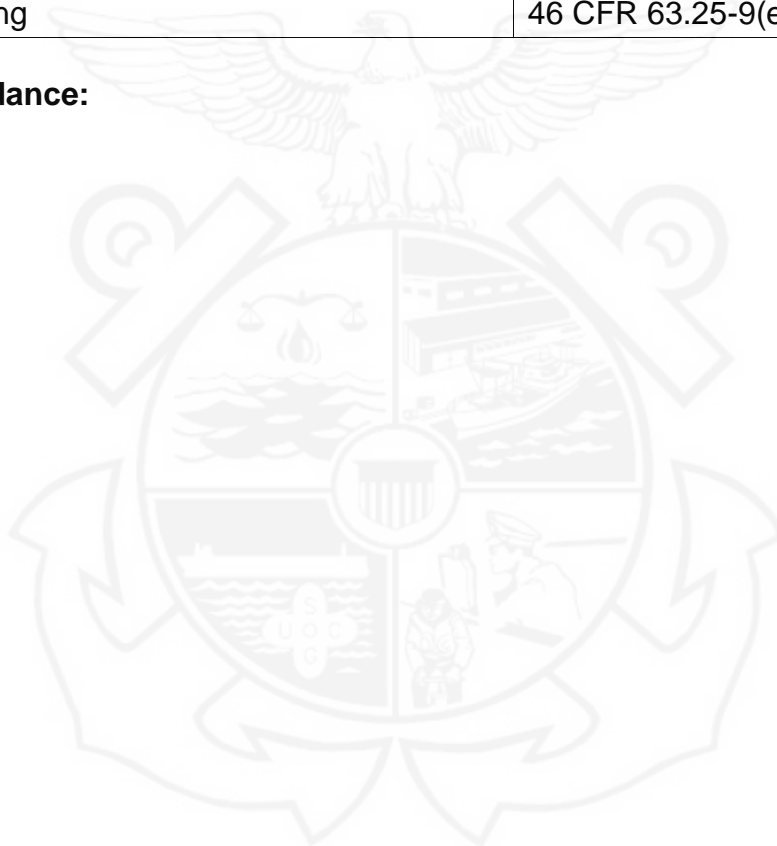
Condition: *During pollution prevention inspection*

Standard: *In compliance with applicable policies, laws, regulations and standards*

References: 1. Title 46, Code of Federal Regulations Part 63 Automatic Auxiliary Boilers

Steps		References	Initials
PP04.1	Verify system approvals	46 CFR 63.25-9(a)	
PP04.2	Verify presence of operation manual	46 CFR 63.25-9(d)	
PP04.3	Verify training	46 CFR 63.25-9(e)	

Verifying Officer Guidance:



Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Pollution Prevention Inspection (PP)**D, H & I Vessels****Task:** MI-PP05 Conduct an IOPP (MARPOL Annex I) survey**Condition:** *During pollution prevention inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards*

- References:**
1. Title 33, Code of Federal Regulations Parts 151 & 153
 2. International Convention for the Prevention of Pollution from Ships (MARPOL) 1973, as amended
 3. IMO MEPC.1/Circ. 736/Rev.2 Guidance for the Recording of Operations in the Oil Record Book P
 4. art I – Machinery Space Operations (All Ships)
 5. IMO A.1120(30) - Survey Guidelines under the Harmonized System of Survey and Certification (HSSC), 2017
 6. IOPP Certificate Supplement or Record of Construction and Equipment
 7. COMDTINST M16000.7B Marine Safety Manual Volume II Material Inspection Ch-2

Steps		References	Initials
PP05.1	Verify standard discharge connection(s)	33 CFR 155.430 MARPOL I/13	
PP05.2	Verify oil record book entries	33 CFR 151.25 MSM /II E1-1 Checklist MARPOL I/17 IMO MEPC.1/Circ. 736/Rev.2	
PP05.3	Witness operational test of equipment	33 CFR 155.330-.380 MARPOL I/14 IMO Res A.1120(30)	
PP05.4	Verify piping and tank configuration	33 CFR 155.330 - .430 MARPOL I/12	
PP05.5	Confirm equipment installation matches international certificate	IMO Res A.1120(30) IOPP Certificate Supplement	

Verifying Officer Guidance:**Inspector's Name:** (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Pollution Prevention Inspection (PP)

D, H & I Vessels

Task: MI-PP06 Conduct an international air pollution prevention (MARPOL Annex VI) survey

Condition: During pollution prevention inspection

Standard: In compliance with applicable policies, laws, regulations and standards

- References:**
1. Title 40, Code of Federal Regulations Part 1043 Control of NOx, SOx & PM Emissions from Marine Engines & Vessels Subject to the MARPOL Protocol
 2. International Convention for the Prevention of Pollution from Ships (MARPOL) 1973, as amended
 3. CG-543 Policy Letter 09-01 Guideline for Ensuring Compliance with Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78; Prevention of Air Pollution from Ships
 4. IMO Resolution A.1076(28) Amendments to the Survey Guidelines Under the Harmonized System of Survey and Certification (HSSC), 2011

Steps		References	Initials
PP06.1	Verify equipment/systems containing chlorofluorocarbons (CFCs), hydro CFCs and volatile organic compounds (VOCs) are on certificate	MARPOL VI/12	
PP06.2	Verify presence of equipment on certificate, approvals and equivalencies	MARPOL VI/4 IMO Res A.1076(28)	
PP06.3	Verify compliance with Emission Control Area (ECA)	MARPOL VI/13 & 14 Appendix VII CG-543 Policy Ltr 09-01	
PP06.4	Review exhaust cleaning systems equivalency documentation	MARPOL VI/4	
PP06.5	Review delivery notes	MARPOL VI/18.5 Appendix V	
PP06.6	Verify samples	MARPOL VI/18.8.1	
PP06.7	Verify compliance with NOx and SOx	MARPOL VI/13 & 14 40 CFR 1043.30 CG-543 Policy Ltr 09-01	
PP06.8	Review notification(s) of fuel oil availability and quality	MARPOL VI/18.2.4	

Verifying Officer Guidance: Trainee shall clearly state how to use the information in all certificates, delivery notes and other documentation in order to verify active compliance.

Inspector's Name: (Last, First, Initial)	EMPLID:
Verifying Officer's Signature:	Date:

Machinery Inspector (MI)**Boiler Repairs****Welding Repair Inspection (WR)****D, H & I Vessels****Task:** MI-WR01 Review structural repair proposal for boilers**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations and standards***References:** 1. Title 46, Code of Federal Regulations Part 59 Repairs to Boilers, Pressure Vessels & Appurtenances

Steps		References	Initials
WR01.1	Evaluate repairs, replacements, or alterations	46 CFR 59.01-5(a) & (e)	
WR01.2	Evaluate repair proposal	46 CFR 59.01-5(c)	
WR01.3	Verify repair materials	46 CFR 59.01-5(c) & (e) 46 CFR 59.10-1	
WR01.4	Verify welding procedures	46 CFR 59.01-5(e)	
WR01.5	Evaluate alternative repair methods for equivalency	46 CFR 59.10-1(d)	

Verifying Officer Guidance: *Trainee shall demonstrate a working knowledge of acceptable structural repair standards, processes, and procedures.***Inspector's Name:** (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Task: MI-WR02 Review welding Procedure Qualification Records (PQR) for boilers**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations, and standards*

- References:**
1. Title 46, Code of Federal Regulations Part 2 Vessel Inspections
 2. Title 46, Code of Federal Regulations Part 57 Welding & Brazing
 3. Title 46, Code of Federal Regulations Part 59 Repairs to Boilers, Pressure Vessels & Appurtenances
 4. ASME Boiler and Pressure Vessel Code, Section IX, 1989

Steps		References	Initials
WR02.1	Confirm need for qualified welding procedure	46 CFR 2.75-70 46 CFR 57.02-2(a)(1) 46 CFR 59.10-1	
WR02.2	Verify variables on PQRs to the Welding Procedure Specification (WPSs)	ASME IX/QW-200.1(b) ASME IX/QW-483	
WR02.3	Verify tests and results	ASME IX/QW-200.2(b)	

Verifying Officer Guidance:**Inspector's Name:** (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Machinery Inspector (MI)**Boiler Repairs****Welding Repair Inspection (WR)****D, H & I Vessels****Task:** MI-WR03 Verify welder is qualified to perform repair work on boilers**Condition:** During machinery equipment inspection**Standard:** In compliance with applicable policies, laws, regulations, and standards

- References:**
1. Title 46, Code of Federal Regulations Part 57 Welding & Brazing
 2. Title 46, Code of Federal Regulations Part 59 Repairs to Boilers, Pressure Vessels & Appurtenances
 3. ASME Boiler and Pressure Vessel Code, Section IX, 1989
 4. ABS Rules for Building and Classing Steel Vessels, 1995 Part 2 Materials and Welding

Steps		References	Initials
WR03.1	Evaluate welder proficiency	46 CFR 59.10-1(a) ABS 2-4-3/11 ASME IX QW-304	
WR03.2	Review qualified welding procedure	46 CFR 57.03-1(a)(1) 46 CFR 57.02-2(a)(1) 46 CFR 59.10-1(a)	
WR03.3	Verify Welder Performance Qualification (WPQ) is valid	ASME IX/QW-322.1	
WR03.4	Verify variables on WPQs	ASME IX/QW-301.4 ASME IX/QW-484(a)	
WR03.5	Verify tests are satisfactory	ASME IX/QW-302.1 ASME IX/QW-484(a)	

Verifying Officer Guidance:**Inspector's Name:** (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

Machinery Inspector (MI)**Boiler Repairs****Welding Repair Inspection (WR)****D, H & I Vessels****Task:** MI-WR04 Inspect fit-up on boilers**Condition:** *During machinery equipment inspection***Standard:** *In compliance with applicable policies, laws, regulations, and standards***References:** 1. Title 46, Code of Federal Regulations Part 59 Repairs to Boilers, Pressure Vessels & Appurtenances

Steps		References	Initials
WR04.1	Examine material and fitted to approved joint detail	46 CFR 59.01-5(a) & (d)	
WR04.2	Verify materials (base, filler, gas)	46 CFR 59.01-5(a)	
WR04.3	Verify welding processes	46 CFR 59.01-5(a) 46 CFR 59.10-1(b)	

Verifying Officer Guidance:

Inspector's Name: (Last, First, Initial)

EMPLID:

Verifying Officer's Signature:

Date:

Machinery Inspector (MI)**Boiler Repairs****Welding Repair Inspection (WR)****D, H & I Vessels****Task:** MI-WR05 Inspect welds on boilers**Condition:** During machinery equipment inspection**Standard:** In compliance with applicable policies, laws, regulations, and standards**References:** 1. Title 46, Code of Federal Regulations Part 59 Repairs to Boilers, Pressure Vessels & Appurtenances

Steps		References	Initials
WR05.1	Verify weld deposit workmanship	46 CFR 59.01-5 46 CFR 59.10 46 CFR 59.15 & .20	
WR05.2	Examine welds for defects (discontinuity)	46 CFR 59.10-1(a)	
WR05.3	Verify weld acceptance criteria (w/NDT)	46 CFR 59.01-5(e) 46 CFR 59.10-5(k) 46 CFR 59.10-10(f)	

Verifying Officer Guidance: Trainee shall demonstrate a working knowledge of structural repair standards, processes, and procedures. If Alternate Compliance Program vessel, then 46 CFR Part 8 applies which incorporates by reference ABS steel vessel rules.

Inspector's Name: (Last, First, Initial)

EMPLID:

Verifying Officer's Signature:

Date:

Follow Up Actions (FU)**D, H & I Vessels****Task:** MI-FU01 Document boiler inspection information in MISLE**Condition:** Upon completion of the inspection**Standard:** In compliance with applicable policies, laws, regulations and standards**References:** 1. Title 46, Code of Federal Regulations Part 61 Marine Engineering - Periodic Tests & Inspections

Steps		References	Initials
FU01.1	Document safety valve setting	46 CFR 61.01-20	
FU01.2	Update safety valve inspection interval	46 CFR 61.05-10(a)	
FU01.3	Update fireside inspection intervals	46 CFR 61.05-10(a)	
FU01.4	Update waterside inspection intervals	46 CFR 61.05-10(a)	
FU01.5	Update bolt and stud inspection intervals	46 CFR 61.05-10(a)	
FU01.6	Update mounting inspection intervals	46 CFR 61.05-10(a)	
FU01.7	Update steam gauge inspection intervals	46 CFR 61.05-10(a)	

Verifying Officer Guidance:**Inspector's Name:** (Last, First, Initial)**EMPLID:****Verifying Officer's Signature:****Date:**

**Performance Qualification Standard and Job Aid Change
Recommendation Form**

From: _____ Date: _____

PQS/Job Aid Title:

Section(s) Affected:

Remark(s)/Comment(s):

Reference(s):

Signature: _____

Submit to MarineSafetyPQS@uscg.mil by clicking the button

External Examination of a Watertube Boiler

MI-STEAM JOB AID 1.1

INSPECT outer casing for bulging, distortion, and gas leaks

Step	Action
1.	<p>INSPECT around doors or removable panels for:</p> <ul style="list-style-type: none"> • Evidence of leakage • Fasteners are intact (studs are in place with proper washer & nut)
2.	<p>ENSURE casing is tight without cracks or broken welds.</p>
3.	<p>ENSURE the casing below the steam drum is examined.</p> <p>Note: Burning or bulging of this casing or distortion of access door frames is usually due to deterioration of brickwork or refractory.</p>
4.	<p>CHECK for hotspots on the casing.</p> <p>Note1: A hot spot on a casing is an indication of brick failure.</p> <p>Note2: Casings are designed to hold about 2psi and maintain an external temperature of at or below 120 Deg F.</p>
5.	<p>ENSURE no water vapor is present.</p> <p>Note: Water vapor leaking from access doors or the casing is an indication of a hand-hole leak or a tube leak.</p>
6.	<p>ENSURE no corrosion is present.</p> <p>Note: If corrosion is present determine if leakage is from equipment, pipe, lines, etc</p>
7.	<p style="text-align: center;">CAUTION</p> <p style="text-align: center;"><i>Never! Hammer test a fitting if under pressure</i></p> <p>ENSURE the blow off piping from the boiler to the overboard is examined.</p> <p>Note 1: If the piping looks corroded it should be hammer tested from the outlet of the boiler isolation valve to the overboard valve.</p> <p>Note 2: Boiler blow off piping is not pressured unless the boiler is being blown down.</p> <p>Reference: 46 CFR 56.50-40</p>

ENSURE hot surfaces are properly insulated

Step	Action
1.	ENSURE any pipe operating over 150° degrees is insulated

INSPECT tank tops below boilers for general wastage and structural integrity

Step	Action
1	ENSURE the foundation of boilers installed directly on the tank tops are checked for wastage. Note: The wastage is normally caused by the corrosive action of bilge water.

VERIFY condition of foundation / sliding feet

Step	Action
1	ENSURE the sliding feet indicate movement and appear lubricated.
2	ENSURE the foundation has no cracks, bends, or broken welds.

INSPECT water level indicators

Step	Action
1	ENSURE the boiler has 2 independent means of indicating water level as per 46 CFR 52.01-110. Note 1: One shall be a gauge lighted by the emergency electrical system which will ensure illumination of the gauges under all normal and emergency conditions. Note 2: The secondary indicator may consist of a gauge glass, or other acceptable device. Where the allowance pressure exceeds 1724 kPa (250 psi), the gage glasses shall be of the flat type instead of the common tubular type.

Waterside Examination of a Watertube Propulsion Boiler

MI-STEAM **JOB AID 1.2**

1-2-1

VERIFY the boiler is properly prepared for inspection

Step	Action
	<p style="text-align: center;"><u>WARNING</u></p> <p style="text-align: center;"><i>Verify confined space is safe for entry.</i></p>
	<p style="text-align: center;"><u>WARNING</u></p> <p style="text-align: center;"><i>Ensure that there is a physical separation between a steaming boiler and one being inspected.</i></p> <p><u>Note:</u> <i>For personnel safety, if one boiler is in operation while testing or inspecting the other boiler, and if there is only one valve separating the boilers, there should be a blank between both boilers as well. If there are two valves, the blank is not needed.</i></p>
	<p style="text-align: center;"><u>WARNING</u></p> <p style="text-align: center;"><i>Prior to entering a boiler it should be cooled and ventilated.</i></p>
1.	<p>VERIFY date of last inspection.</p> <p><u>Note:</u> A water tube boiler requires a waterside exam twice in every five year period with no more than three years elapsing between any two exams.</p>
2.	<p>ENSURE the steam drum, water drum and headers are thoroughly cleaned prior to inspection.</p>
3.	<p>ENSURE a sufficient number of handhold plates are removed from the headers of superheater, economizer, and waterwall tubes to permit a comprehensive examination of these tubes.</p> <p><u>Note1:</u> Generally, removal of 5% of the handhold plates from each header will suffice; however, if internal pitting or an excessive amount of scale is found, it may be necessary to remove all of the handhold plates for a complete examination.</p> <p><u>Note 2:</u> Leaking handhold plates, indicated by chemical staining, should be removed for inspection and gaskets renewed. The gasket seating surface should be examined with the aid of a mirror; chronic leakage is sometimes due to steam cuts across the seating surface.</p>
	<p><u>Note:</u> Refer to MSM, Vol. II for guidance on plugging (how many, where, etc) of tubes in various tube sections (screen, wall, etc). Additional guidance on tube plugging should be in accordance with manufacturer recommendations.</p>

INSPECT steam drum internals

Step	Action
	<p style="text-align: center;"><u>CAUTION</u></p> <p style="text-align: center;"><i>Before entering the steam drum, be sure to empty your pockets of anything small enough to fit down a generating tube that is not needed for the inspection.</i></p> <p><u>Note:</u> All that is needed is an inspection mirror, inspection hammer, and a flashlight.</p>
1.	<p>ENSURE portions of the steam drum internal platform are removed to permit a close examination of the drum interior, tube ends, and tube internal surfaces.</p> <p><u>Note:</u> Steam drum corrosion is most likely to occur at the normal water level, so check for pitting in this area.</p>
2.	<p>In the steam drum, ENSURE the brackets supporting the dry pipe, internal feed lines, and desuperheater are examined to ensure that the securing bolts are tight.</p> <p><u>Note:</u> When the drum is open for inspection, check the condition of the manhole plate and seating surfaces for steam cuts and any other noticeable defects.</p>
3.	<p>ENSURE the tubes are inspected from within the steam drum and determine internal tube surface condition.</p> <p><u>Note:</u> may require the aid of a mirror.</p>
4.	<p>ENSURE dry pipe drains are clean.</p>
5.	<p>INSPECT the outside of the dry pipe is in good condition.</p>
6.	<p>INSPECT the holes or slots in the top of the dry pipe for erosion.</p>
7.	<p>INSPECT internal feed pipe feedwater distribution opening for deterioration/wastage.</p>
8.	<p>TEST the flanged piping connections of the desuperheater and internal feed lines with a hammer and listen carefully to the resulting sound.</p> <p><u>Note:</u> Generally, if the connection is in good condition, it will make a ringing sound when struck. A dull sound is indicative of a cracked or otherwise deteriorated connection that produces a dull sound upon testing should be thoroughly inspected for defects.</p>

Step	Action
9.	<p>CHECK for cracks in the following areas:</p> <ul style="list-style-type: none"> • Longitudinal butt welds in wrapper/tube sheet joint • Circumferential butt welds • Drum penetrations • Interior supports (may crack if installed after stress relief) • Tube sheet ligament areas • Bored openings including feedwater inlet • Desuperheater in and out • Dry pipe outlet and Safety valves

INSPECT water drum internals

Step	Action
1.	<p>ENSURE the tubes are inspected from within the water drum and determine internal tube surface condition.</p> <p>Note 1: May require the aid of a mirror.</p> <p>Note 2: If there is a suspicion that deep corrosion-produced scabs exist in waterside pits, or if any other condition prevents minimum thickness determination, it should be cleaned to bare metal. If pitting is more than isolated in a number of tubes, a sample tube should be cut out of the boiler and sectioned with its minimum thickness determined. MSM Vol II.</p>
2.	<p>ENSURE the inside surface of the water drum is examined for evidence of pitting.</p> <p>Note: This is occasionally seen in boilers that have been out of service for long periods of time.</p>
3.	<p>CHECK for plugged tubes in the water drum.</p> <p>Note: Generally plugged tubes should not account for more than 10% in any one bank. (Record in MISLE narrative)</p>
4.	<p>ENSURE the water drum manhole opening and bottom blow valve connection, are examined</p> <p>Note: In this area, leakage and associated wastage are rarely seen.</p>
5.	<p>TEST the flanged piping connections of the desuperheater. (If installed)</p>

INSPECT superheater

Step	Action
1	INSPECT superheater headers for pitting and grooving. Note: This examination should include the use of mirrors and finger touch, as necessary.
2	ENSURE the tube joints, handhole plates, and drain nipples of the superheater headers are checked for evidence of leakage and external corrosion.
3	INSPECT superheater handhole plates for pitting, cuts at the gasket surface and wastage.
4	INSPECT internal surface of the superheater tubes for deposits, erosion and pitting.
5	INSPECT superheater baffles for wastage, erosion, and corrosion.

INSPECT economizer header

Step	Action
1	INSPECT economizer headers, tubes and handhole plates for waterside deposits, rusting, and corrosion.
2	INSPECT internal condition of economizer tubes.

INSPECT waterwall headers

1.	ENSURE the tube joints, handhole plates, and drain nipples of the waterwall headers are checked for evidence of leakage (indicated by chemical staining) and external corrosion.
2.	INSPECT handhole plates for pitting, cuts at the gasket surface and wastage.
3.	INSPECT internal surface of the tubes for deposits, erosion and pitting.
4.	For vessels with sinuous header boilers (often called straight tube or sectional header boilers): ENSURE the short nipple connections of the transverse junction header (Mud drum) to the front headers and the bottom blow valve connection to this header is checked for leakage; external corrosion of the nipples is sometimes encountered.

DETERMINE repair methods for discrepancies noted

Step	Action
1	<p>ENSURE all repairs comply with the requirements of:</p> <ul style="list-style-type: none"> • 46 CFR Part 56 • 46 CFR Part 57 • 46 CFR Part 59. <p>Common Repairs:</p> <ul style="list-style-type: none"> • Handhold seating surfaces may be repaired by grinding, welding, and resurfacing. • Plugging of tubes may be permitted. See the MSM, Vol. 2 and/or seek manufacturer recommendations. • Pressure vessel/piping repairs shall be IAW ASME Code, Section IX as modified by 46 CFR.

Fireside Examination of a Watertube Boiler

MI - STEAM

JOB AID 1.3

VERIFY the boiler is properly prepared for inspection

Step	Action
	<p style="text-align: center;"><u>WARNING</u></p> <p style="text-align: center;"><i>Verify confined space is safe for entry.</i></p>
	<p style="text-align: center;"><u>WARNING</u></p> <p style="text-align: center;"><i>Ensure that there is a physical separation between a steaming boiler and one being inspected.</i></p> <p><i><u>Note:</u> For personnel safety, if one boiler is in operation while testing or inspecting the other boiler, and if there is only one valve separating the boilers, there should be a blank between both boilers as well. If there are two valves, the blank is not needed.</i></p>
	<p style="text-align: center;"><u>WARNING</u></p> <p style="text-align: center;"><i>Prior to entering a boiler it should be cooled and ventilated.</i></p>
1	<p>VERIFY date of last inspection.</p> <p><u>Note:</u> A water tube boiler requires a fireside exam twice in every five year period with no more than three years elapsing between any two exams.</p>
2	<p>VERIFY all access points are open for inspection of firesides.</p>
3	<p>VERIFY that the firesides of the boiler are cleaned of soot buildup, scale, and loose slag prior to the inspection.</p> <p><u>Note 1:</u> Properly prepared means <u>clean</u>... all the carbon and scale <u>MUST</u> be removed. If not, make them do it the right way. 46 CFR 61.05-5 (a) is the applicable cite to use when encountering a dirty boiler.</p> <p><u>Note 2:</u> There are numerous cleaning methods for boiler preparation including; dry ice blasting, walnut shell blasting and water washing. All methods are acceptable and should be completed prior to inspectors entering the furnace for inspection.</p>

INSPECT inner and outer casing

Step	Action
	Note: Casings are designed to hold about 2psi and maintain an external temperature of at or below 120 Deg F.
1.	INSPECT inner and outer casing for: <ul style="list-style-type: none"> • Broken stays (between inner and outer casing) • Buckling • Tightness • Wastage
2.	INSPECT dead air spaces below furnace, if equipped, for: <ul style="list-style-type: none"> • Accumulation of fuel • Structural defects
3.	INSPECT burner throats. Note 1: Should not be distorted and should appear square to the front furnace wall. Note 2: It is normal to see cracks in the front walls between burner openings in the refractory. Some of the cracks are caused by the expansion of brickwork joints. Note 3: If the crack opening is clean, this indicates that it is probably acceptable since it is closing up when firing. If, however, the opening is penetrated with slag, then the cracks should be repaired.

INSPECT gas baffles

Step	Action
1	VERIFY gas baffles are intact. Note: Particularly where the screen tubes meet the water/steam drums to prevent overheating of the tube sheets.
2	If installed, INSPECT baffles above and below the superheater.

INSPECT water wall, screen, superheater, floor and generating tubes

Step	Action
	<p>Note 1: The external surfaces of tubes are exposed to loss of metal from corrosion by sulfur and vanadium in the oil burned, as well as overheating and slag damage. Deterioration of this type may result in abnormal bends, bulges, blisters, ruptures, and mechanical fatigue cracks that are fairly obvious during visual inspection of the firesides.</p> <p>Note 2: A minor amount of tube distortion is acceptable if the insides of the tubes are clean.</p> <p>Note 3: Severely blistered tubes should be renewed.</p> <p>Note 4: If pitting is more than isolated in a number of tubes, a sample tube should be cut out of the boiler and sectioned with its minimum thickness determined.</p> <p>Note 5: Water-cooled tubes should be repaired to original wall thickness or replaced if reduced to 70% of original. Steam –cooled tubes should be repaired to original wall thickness or replaced if reduced to 85% of original.</p> <p>(Reference: Steam, Its Generation and Use” Edition 41, Babcock and Wilcox, Co. Page 45-14).</p> <p>Note 6: Scale deposits exceeding 1/32" in thickness will seriously impair heat transfer, especially in screen tubes and waterwall tubes, and may result in bulging and distorted tubes. Scale should be removed by mechanical means or by chemical washing. MSM Vol II</p>
1.	<p>INSPECT water wall tubes for the following:</p> <ul style="list-style-type: none"> • Bulges • Blisters • Sagging • Erosion • Corrosion • Pitting • Cracks • Scale • Flame impingement (grooving / bluing) <p>Note 1: Refractory behind water wall tubes should not have more than 1/4”gap.</p> <p>Note 2: The water wall tubes should be examined with the aid of a spotlight for evidence of blistering, bulging, or distortion.</p> <p>Note 3: If there is evidence of tube leakage at the ends of the water wall tubes, sufficient refractory should be removed to expose the waterwall headers so that the leakage can be traced to its source.</p>

	<p>Note 4: Because of the close spacing of the tubes, inspection is usually limited to the outer rows; however, external corrosion of these tubes, due to soot deposits and improper water-washing, is not uncommon.</p>
2	<p>INSPECT screen tubes for the following:</p> <ul style="list-style-type: none"> • Bulges • Blisters • Sagging • Married tubes • Erosion • Corrosion • Flame impingement (grooving / bluing) <p>Note 1: The screen tubes should be examined with the aid of a spotlight for evidence of blistering or distortion.</p> <p>Note 2: Because of the close spacing of the tubes, inspection is usually limited to the outer rows; however, external corrosion of these tubes, due to soot deposits and improper water-washing, is not uncommon.</p> <p>Note 3: Scale deposits exceeding 1/32" in thickness will seriously impair heat transfer, especially in screen tubes and may result in bulging and distorted tubes. Scale should be removed by mechanical means or by chemical washing.</p> <p>Note 4: Married tubes should be checked to ensure there is no active rubbing together (shiny areas where the tubes meet). The concern would be loss of material due to rubbing. Check the married tubes during/after a hydro as the pressure may lessen the issue.</p>
3	<p>INSPECT superheater tubes for the following:</p> <ul style="list-style-type: none"> • Bulges • Blisters • Sagging • Erosion • Corrosion

4.	<p>INSPECT generating tubes for the following:</p> <ul style="list-style-type: none"> • Bulges • Blisters • Sagging • Erosion • Corrosion <p>Note 1: Because of the close spacing of the tubes, inspection is usually limited to the outer rows; however, external corrosion of these tubes, due to soot deposits and improper water-washing, is not uncommon.</p>
5.	<p>INSPECT the tube sheet ligaments, if accessible, for cracks, especially near the furnace area.</p>
6.	<p>INSPECT floor tubes for defects, if accessible.</p> <p>Note 1: Some boilers of this type are fitted with feeder tubes in the furnace floor, which can be examined only when the brickwork is removed.</p> <p>Note 2: The furnace floor should be disturbed only when leakage is suspected or for refractory repairs. Defects in these tubes are rarely encountered.</p>

INSPECT refractory for spalling, sagging or cracking

Step	Action
	<p>Note 1: The furnace refractory is subject to damage from erosion due to direct flame impingement, fusion occurring at high rates of combustion, and destruction of refractory due to improper drainage during water-washing operations.</p> <p>Note 2: The refractory behind plugged waterwall tubes should be carefully examined for further deterioration.</p>
1	<p>INSPECT refractory for spalling, slagging, sagging and cracking to include the following:</p> <ul style="list-style-type: none"> • Corbel is intact and allowing for expansion • Brickwork and mortar is intact • Burner opening is true and in good condition • Bulging of refractory (appears to be pulling away from the casing) • Baffles are intact and in good repair with special attention to superheater support bracketing baffles <p>Note 1: Always investigate the cause of the refractory bulging to ensure that it is not affecting the casing. If the brick work collapses they lose the boiler.</p>

	<p>Note 2: If any brickwork and the mortar are dislodged, loose pieces must be renewed; otherwise they may cause other components to overheat.</p> <p>Note 3: Brickwork should be repaired if deteriorated by more than 1 inch - 1.5 inches.</p> <p>Note 4: Slagging on brickwork should be left alone, as its removal causes more harm.</p> <p>Note 5: Any refractory that is excessively spalled, should be replaced.</p> <p>Note 6: Surface cracks should be patched and any loose pieces should be removed and patched.</p> <p>Note 7: Refractory should be renewed to manufacturer's drawings.</p>
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INSPECT superheater support system

Step	Action
	Note: The superheater and part of its support structure can generally be seen from inside the furnace.
1	INSPECT the superheater headers.
2	<p>INSPECT the superheater element support brackets for erosion or cracking.</p> <p>Note 1: In this area, burned support brackets and badly warped superheater elements are common defects.</p> <p>Note 2: If the brackets are defective, they must be renewed.</p>

INSPECT soot blowers

Step	Action
	Note: Failure of soot blower piping could cause harm to operating personnel.
1	INSPECT condition.
2	<p>INSPECT areas where erosion or corrosion is likely to occur in soot blower piping.</p> <p>Note 1: The most likely area for erosion and corrosion to occur is in the lower areas and elbows.</p> <p>Note 2: Ensure soot blower header drain valves appear to be in good condition.</p>
3	INSPECT each soot blower to ensure that it operates freely.

4	VERIFY alignment. Note: Soot blower element nozzles should not be impinging on the tubes.
5	VERIFY each soot blower's steam connections and packing glands are tight.
6	INSPECT soot blower header piping to see if it is insulated.

INSPECT uptakes (stacks)

Step	Action
1	INSPECT uptakes for: <ul style="list-style-type: none"> • Holes and cracks • Combustion gas leaks • Accumulation of stored combustible material
2	INSPECT air pre-heater tubes. Note: Located inside the uptakes (stacks).
3	VERIFY stacks are insulated.

INSPECT economizers

Step	Action
	Note: A clogged economizer may cause a stack fire.
1	ENSURE the vestibule below the economizer is opened and cleaned. Note: In this area, the generating tubes, at the connections to the bottom of the steam drum, can be seen.
2	INSPECT the tubes and headers of economizers for: <ul style="list-style-type: none"> • external corrosion due to condensation • support plates for excessive soot deposits and corrosion Note: Economizer tubes are susceptible to thin-lipped ruptures, heat blisters, and sagging. In addition, economizer tubes are susceptible to melting, which can result from a serious low-water casualty. If the tube temperature rises high enough, the tubes and fins may actually burn away or melt.

DETERMINE repair methods for discrepancies noted

Step	Action
1	<p>ENSURE all repairs comply with the requirements of:</p> <ul style="list-style-type: none">• 46 CFR Part 56• 46 CFR Part 57• 46 CFR Part 59 <p>Note: In watertube boilers, tube replacement is one of the most frequently encountered repair procedures. Boiler tube life is influenced by such factors as original wall thickness, thermal stresses (due to location within the boiler), waterside corrosion, fireside damage, and service history of the boiler.</p>

Hydrostatic Test of the Boiler

MI - STEAM

JOB AID 1.4

IDENTIFY the maximum allowable working pressure (MAWP) aka design pressure.

Step	Action
	<p style="text-align: center;"><u>WARNING</u></p> <p style="text-align: center;"><i>Verify confined space safe for entry.</i></p>
	<p style="text-align: center;"><u>WARNING</u></p> <p style="text-align: center;"><i>Ensure that there is a physical separation between a steaming boiler and one being inspected.</i></p> <p><u>Note:</u> <i>For personnel safety, if one boiler is in operation while testing or inspecting the other boiler, and if there is only one valve separating the boilers, there should be a blank between both boilers as well. If there are two valves, the blank is not needed.</i></p>
	<p style="text-align: center;"><u>WARNING</u></p> <p style="text-align: center;"><i>Prior to entering a boiler it should be cooled and ventilated.</i></p>
1	<p>VERIFY date of last hydrostatic test.</p> <p><u>Note:</u></p> <ul style="list-style-type: none"> • On a passenger vessel, a water tube boiler requires a hydrostatic test twice in every five year period with no more than three years elapsing between any two exams. • On all other vessels, a water tube boiler requires a hydrostatic test once every 5 years. • The Main Steam piping from the steam drum to the throttle valve and all piping subject to main boiler pressure over 3 inch nominal size is subject to hydrostatic test at the same interval as the boiler.
2	<p>LOCATE the MAWP of a boiler in one of the following locations:</p> <ul style="list-style-type: none"> • Certificate of Inspection • Boiler nameplate • Boiler instruction manual

IDENTIFY the maximum allowable working pressure (MAWP) aka design pressure.

Step	Action
3	<p>CALCULATE the test pressure. (46 CFR 61.05-10) / MSM Vol. II)</p> <p>Note 1:</p> <ul style="list-style-type: none"> • For routine hydrostatic testing, watertube boilers are subjected to a test pressure of 1-1/4 times the MAWP of the boiler. • Following substantial repairs, or if the strength of the boiler is questioned, the test pressure is 1-1/2 times the MAWP (46 CFR 61.05-10c). <p>Note 2: “Maximum Allowable Working Pressure” and “Design Pressure” are interchangeable.</p> <p>Note 3: “Maximum Allowable Working Pressure” IS NOT “Operating Pressure.”</p>

ENSURE furnace thoroughly cooled and cleaned

Step	Action
1.	<p>ENSURE the furnace is open and clean.</p> <p>Note: There are numerous cleaning methods for boiler preparation including; dry ice blasting, walnut shell blasting and water washing. All methods are acceptable and should be completed prior to inspectors entering the furnace for inspection.</p>
2.	<p>ENSURE boiler is cooled.</p>

ENSURE firesides accessible

Step	Action
1	<p>ENSURE all the following are visible when hydrostatic test pressure is applied:</p> <ul style="list-style-type: none"> • casing access points for all boiler tube banks • headers • vestibules • economizers • access to riser tubes, if installed

VERIFY water temperature

Step	Action
1	<p>ENSURE the temperature range of the test water is between 70° and 160° degrees F.</p> <p>Note: Above 70° (prevents damage) and below 160° (prevents flash-off, lower risk to personnel).</p>

VERIFY that safeties are properly gagged

Step	Action
1	<p>CAUTION</p> <p><i>Boiler Safety valves must NEVER, under any circumstances, be lifted by a hydrostatic test.</i></p>
2	<p>ENSURE boiler safety valves are gagged.</p> <p>Note 1: Prevents a valve from lifting under pressure of the hydrostatic test.</p> <p>Note 2: Vessels are required to have safety valve gags on board, see 46 CFR 52.01-120.</p>

VERIFY that there is no steam on back side of stop valves

Step	Action
1.	<p>VERIFY that there is a physical separation between a steaming boiler and one being inspected.</p> <p>WARNING</p> <p><i>For personnel safety, if one boiler is in operation while testing or inspecting the other boiler, and if there is only one valve separating the boilers, there should be a blank between both boilers as well. If there are two valves, the blank is not needed.</i></p> <p>Note: When conducting a hydrostatic test, avoid simultaneously applying hydrostatic pressure on one side and steam on the other side of the main and auxiliary steam stop valves.</p>

VERIFY main steam piping from boiler to throttle valve is tested

Step	Action
1.	VERIFY that the hydrostatic test is applied from the boiler drum to the throttle valve. Reference: 46 CFR 61.15-5a
2.	INSPECT lagging around main steam piping for moisture. Note: If covering of the piping is not removed the test pressure shall be maintained for a period of 10 minutes. Reference: 46 CFR 61.15-5a

VERIFY all piping > 3 inches subject to boiler pressure is hydrostatically tested

Step	Action
1	IDENTIFY all steam piping over 3-inches in diameter subject to boiler pressure.
2	VERIFY hydrostatic test of all steam piping over 3-inches.
3	CONDUCT a visual inspection of piping under hydrostatic test pressure.

VERIFY test pressure

Step	Action
1	VERIFY the test pressure is based on the MAWP and NOT the operating pressure. Note 1: Remember, a hydro test based on 1-1/4 times the MAWP is intended to prove that the boiler is safe for its intended purpose while being operated at its normal operating pressure. Note 2: Sufficient time should be allowed before entering the furnace to see leaks soaking thru the refractory.

INSPECT in furnace for leakage in water wall header, and waterwall tubes, and signs of leakage in tube areas

Step	Action
1	CHECK the area behind the header where the tubes enter the header. Note: Superheater tubes rolled into the header may weep under hydro test pressure-they seal when operating under heat.
2	INSPECT where tubes enter both drums (steam and water).
3	INSPECT all upper and lower walls and corners for moisture in the corbel.
4	CHECK floor, ceilings and walls for moisture.
5	CHECK inside the vestibules where the tubes enter both drums.

INSPECT valve flanges, headers, safety valve drain lines, and piping systems for leaks

Step	Action
1	LISTEN for leaks out of safety valves (confirm by checking drain lines).
2	CHECK for water leaking out of lagging around valves and flanges.
3	CHECK drain lines where they enter the bilge area.
4	CHECK below the boiler for leaks from lower headers.
5	CHECK packing on valves for excessive leakage.
6.	CHECK the steam drum and its accessories. Note: If a hydrostatic pressure test is applied, the nozzles, gaskets, and welded pipe connections should be searched for leakage. MSM VOL II

DETERMINE repair methods for discrepancies noted during a hydrostatic test inspection

Step	Action
1	<p>ENSURE all repairs comply with the requirements of:</p> <ul style="list-style-type: none"> • 46 CFR Part 56 • 46 CFR Part 57 • 46 CFR Part 59
2	<p>Note:</p> <ul style="list-style-type: none"> • Following repairs, watertube boilers should always be hydrostatically tested to 1-1/4 times the MAWP per 46 CFR 61.05-10. • If substantial modifications or repairs have been made, or if the marine inspector has reason to question the strength of the boiler, a watertube boiler should be hydrostatically tested to 1-1/2 times the MAWP. • Substantial repairs are: <ul style="list-style-type: none"> ○ Welding on a header or a drum; ○ Tubes that are welded rather than expanded into headers should be considered substantial repairs; ○ New piping or welded repairs on piping attached to the boiler; or ○ Waterwall or superheater headers newly fabricated and installed would be substantial repairs. • Replacing or plugging tubes is not a substantial repair. • Boiler tubes that have been replaced should be hydrostatically tested to 1-1/4 times the MAWP. • Tubes that have been plugged may be hydrostatically tested to operating pressure. • Questionable boiler strength would be: <ul style="list-style-type: none"> ○ The existence of widespread pitting; ○ Header grooving; ○ A recent history of tube failures; or ○ Sitting idle for a long period of time. • An inspector should have a reasonable level of confidence that the boiler will steam at normal operating pressure without leaking.

Required Valves

MI - STEAM

JOB AID 1.5

VERIFY 5-year valves (mountings) opened and examined

Step	Action
1	<p>VERIFY date of last valves inspection.</p> <p>Note 1: 5-Year "Valves Inspection" is to the boiler mounting valves. The inspection includes removal of the bonnet, inspection of all moving parts, the condition of the valve seating surfaces and body. Commonly referred to as "Mountings Open."</p> <p>Note 2: The inspector should recognize the importance of all connections and piping to the first isolation valve. It should not be necessary to require removal of all first isolation valves to comply with the "mounting" inspection intent. All major valves, which are the first isolation or control of steam or feedwater, should be treated as "mountings" for inspection of the valve and piping toward the boiler. (MSM Vol II)</p> <p>Reference: 46 CFR 61.05-15</p>

IDENTIFY the valves subject to inspection

Step	Action
1.	<p>IDENTIFY to vessel personnel minimum valves required to be inspected.</p>
2.	<p>Note: at a minimum, the following valves are subject to valve and mounting inspection requirements:</p> <ul style="list-style-type: none"> • main steam stop • generator steam stop • auxiliary steam stop • main and auxiliary feed stop • blowdown (surface and bottom) • superheater vent • superheater drain • soot blower stop <p>Note: Most vessels will open all valves that are the first isolation valve from the boiler.</p> <p>Reference: MSM Vol. II</p>

IDENTIFY additional valves to be opened at MI discretion

Step	Action
1.	<p>IDENTIFY to vessel personnel discretionary valves to be inspected.</p> <p>Note 1: May include:</p> <ul style="list-style-type: none"> • Gauge Glass isolation valves • Drum Vent line • Gauge isolation valves • Chemical feed lines • Header blowdowns <p>Note 2: If the valve bonnet is welded, it should not be opened for inspection unless sign/symptoms are present of valve deterioration.</p>

INSPECT valves

Step	Action
1	<p>INSPECT each valve stem for:</p> <ul style="list-style-type: none"> • Deterioration • Corrosion • Defects
2	<p>INSPECT packing gland for:</p> <ul style="list-style-type: none"> • Serviced/repacked • Bolts suitable for continued service
3	<p>INSPECT each valve bonnet and valve body for:</p> <ul style="list-style-type: none"> • Pitting • Corrosion • Bolts/gaskets suitable for continued service
4	<p>INSPECT gate valve (if installed) guides for damage and disc and seats for pitting, steam cuts and erosion.</p>
5	<p>INPECT globe valve seats and discs for pitting, cuts and erosion.</p>

VERIFY replacement valves

Step	Action
1	<p>ENSURE replacement valves are of proper materials grade for the given application.</p> <p>Note 1: For valve construction and replacement requirements see 46 CFR 56.60-1 which refers to ASME/ANSI B16.34</p> <p>Note 2: It is the vessel representative's responsibility to prove a replacement part is acceptable.</p>

DETERMINE repair methods for discrepancies noted during a 5 YEAR valves (mountings) open inspection

Step	Action
1	<p>EVALUATE repair proposal.</p> <p>Note 1: Very often it is more economical to replace the valve rather than repair it.</p> <p>Note 2: Valves and their components can and often are repaired.</p> <ul style="list-style-type: none"> • Valve stems can be machined • Packing glands can be machined; Packing gland bolts can be replaced. • Seats and discs can be replaced. • Pitting on the valve body and bonnet can often be welded. <p>Note 3: If the integrity of the valve seating surface is in question, the valve may be checked by applying bluing to the seat and if necessary, lapping the disc to the seat.</p>
2	ACCEPT/REJECT repair proposal
3	WITNESS tests following repairs, if required
4	DOCUMENT repairs/replacements.

Required Mountings and Studs/Bolts and Nuts

MI - STEAM

JOB AID 1.6

VERIFY 10-year mounting inspection

Step	Action
1	<p>VERIFY date of last mountings inspection.</p> <p>Note 1: 10-year mounting inspection is the inspection of the attachment of all isolation valves to the boiler. In modern construction, that is the welded spool piece between the boiler and first bolted flange of each isolation valve.</p> <p>Note 2: All major valves, which are the first isolation or control of steam or feedwater, should be treated as "mountings" for inspection of the valve and piping toward the boiler.</p> <p>Note 3: Valves should be required to be removed if internal piping and valve conditions cannot be adequately examined from inside the steam drum or other open connections. In most cases, mountings will be removed.</p> <p>Reference: 46 CFR 61.05-15</p>
2	<p>VERIFY 5-year valve (mountings) inspection.</p> <p>Note: The valves are considered as part of the mounting but have a 5-year "open" inspection requirement. See job aid 1-5 for valve inspection.</p>
3	<p>VERIFY date of last studs and bolts inspection.</p> <p>Note: Studs and bolts inspection: Every 10 years.</p> <p>Reference: 46 CFR 61.05-15</p>

IDENTIFY the mountings to be removed for inspection

Step	Action
1	<p>IDENTIFY to vessel personnel, the minimum mountings required to be inspected.</p> <p>Note 1: Valves should be required to be removed if internal piping and valve conditions cannot be adequately examined from inside the steam drum or other open connections. In most cases, mountings valves will be removed.</p> <p>Note2: At a minimum mountings associated with the following valves are subject to inspection:</p> <ul style="list-style-type: none"> • Main steam stop • Generator steam stop • Auxiliary steam stop • Main and auxiliary feed stop • Blowdown (surface and bottom)

	<ul style="list-style-type: none"> • Superheater vent • Superheater drain • Soot blower stop <p>Note 3: While it is usual for the above valves to be removed for 10-year mounting inspection, if a mounting is difficult to access or remove, and its internal piping and mounting studs and bolts can be adequately inspected without removal, the mounting may be left in place.</p> <p>Reference: MSM Vol. II</p>
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IDENTIFY additional mountings to be inspected at MI discretion

Step	Action
1	<p>IDENTIFY to vessel personnel discretionary valves to be inspected.</p> <p>Note: May include:</p> <ul style="list-style-type: none"> • Gauge Glass isolation valves • Drum Vent line • Gauge isolation valves • Chemical feed lines • Header blowdowns

INSPECT Mountings

Step	Action
1	<p>INSPECT spool piece for:</p> <ul style="list-style-type: none"> • Erosion • Corrosion
2	<p>INSPECT flanges for:</p> <ul style="list-style-type: none"> • Steam cutting on faces • Deterioration of the welds connecting the flange to the pipe
3	<p>INSPECT piping from flange to boiler and downstream for:</p> <ul style="list-style-type: none"> • Pitting • Corrosion • Erosion • Evidence of leakage/fractures if it's a welded joint <p>Note: Pitting is most common.</p>

4	<p>If welded in place:</p> <ul style="list-style-type: none"> • Use mirror and light, INSPECT as much of the interior as possible inside the mounting. • If possible, EXAMINE from inside the drum.
	<p>Note 1: When one or more flanged joints intervene between a stop valve and the boiler drum or superheater outlet, such flanged joints need not be opened at the time the valve is removed from its flanged joint. However, studs/bolts in the intervening flanged joints up to and including the first isolation valve do need to be inspected.</p> <p>Note 2: Ensure when flanged valves are removed from the boiler pads for any reason, the condition of the studs or bolts that connect the valves to the pads are determined.</p>

INSPECT Studs/Bolts and Nuts

Step	Action
1.	<p>VERIFY correct studs/bolts & nuts.</p> <ul style="list-style-type: none"> • Manufacturer and markings • Manufactured in accordance with ASME Standard 193 / 194 • Marked on one end with grade and manufacturer's symbol • Proper heat number <p>Note: Common markings:</p> <ul style="list-style-type: none"> • Studs/Bolts: B7 or B16 • Nuts: 2H
2.	<p>INSPECT studs/bolts and nuts for:</p> <ul style="list-style-type: none"> • Cracks • Necking-down • Deterioration • Indications of overheating • Stretching <p>Note 1: If there are signs of overheating, may be indication of an incorrect stud/bolt.</p> <p>Note 2: Not every bolt or stud in a flange needs to be removed in order to determine the condition of the fasteners for that flange. Most flanged connections are of the raised-face type, which allow for adequate examination of most of the fasteners between the flanges. Removal of a representative sample of the fasteners is acceptable.</p>

DETERMINE repair methods for discrepancies noted during a 10-year mounting inspection

Step	Action
1	<p>ENSURE all repairs comply with the requirements of:</p> <ul style="list-style-type: none">• 46 CFR Part 56• 46 CFR Part 57• 46 CFR Part 59 <p>Common Repairs are:</p> <ul style="list-style-type: none">• Replacement of flanges and/or piping.• Replacement of studs/bolts and nuts• Repair of pressure piping.• Testing following repairs.

Main Steam Turbine

MI - STEAM

JOB AID 2.1

DETERMINE condition of foundations

Step	Action
1	INSPECT main turbine foundation bolts for corrosion and deterioration.
2	INSPECT foundations for indication of movement in the foundation (i.e. elongated bolt holes).
3	INSPECT spring bearing foundation bolts for excessive rust.

OBSERVE governor (overspeed) function

Step	Action
	<p>Note 1: All turbines are equipped with a speed limiting governor which is not a positive shutdown device. A speed limiting governor keeps the turbine speed between 110% and 115% of normal RPMs when an overspeed condition exists.</p> <p>Note 2: Some installations have a positive latching mechanism that shuts down steam to the turbine. If the speed exceeds 115% of normal RPM, a reset is required after it is tripped.</p> <p>Note 3: Dockside testing of main turbine governors may not be possible. If this is the case, a CG-835 should be issued to the Chief Engineer to test the governor at sea and log the tests and results.</p>
1.	<p>If equipped, VERIFY the latching mechanism on the governor will positively secure steam to the turbine when RPMs exceed 115% normal operating speed.</p> <p>Note: Once the latch activates the only way to re-admit steam to the turbine is to manually release the latching mechanism.</p>
2.	VERIFY the operation of the speed-limiting governor.

VERIFY operation of turbine lube oil service pumps

Step	Action
	CAUTION <i>As per the MSM, Volume II: Any operational tests of lube oil shutdown controls should not risk shutting off the oil supply to the bearings.</i>
	<p>Note 1: 46 CFR 61.20-3(a) states “at each inspection for certification and periodic inspection, the marine inspector shall conduct such tests and inspections of the main propulsion and auxiliary machinery and of its associated equipment, including fluid control systems, as he feels necessary to check safe operation.”</p> <p>Note 2: Procedures for conducting tests of turbine controls and devices are listed in the main steam turbine instruction book.</p>
1	VERIFY automatic start of both main lube oil service pumps.
2	VERIFY operation of both main lube oil service pumps.
3	<p>VERIFY operation of low lube oil pressure shutdown.</p> <p>References: 46 CFR 56.50-80(g) / 46 CFR 62.35-50, Note 4</p>
4	<p>VERIFY operation low lube oil pressure alarm.</p> <p>Reference: ABS Rules Part 4-9-4/Table 8</p> <p>Note: Some vessels may be additionally equipped with gravity tank - low level alarms or low lube oil sump-level alarms.</p>

WITNESS additional safety/limit controls

Step	Action
	<p>Note: Vessels may be equipped with additional safety limits, controls and alarms depending upon the level of automation.</p> <p>Reference: 46 CFR 62.35-50 refers to ABS Rules Part 4-9-4/Table 8 for the minimum safety trip controls required for specific types of automated vital systems.</p>
1.	<p>VERIFY condition of low pressure turbine sentinel valve.</p> <p>Note: Valve should be tested at yard periods.</p>
2.	VERIFY additional safety/limit controls as detailed in the vessels Periodic Safety Test Procedures.

WITNESS Jacking gear

Step	Action
1	VERIFY the jacking gear indicator lights indicate when the jacking gear is engaged.
2	VERIFY operation of jacking gear interlock. Note: Some installations are designed to prevent the throttle valves from opening while the jacking gear is engaged.

OBSERVE operation of throttles

Step	Action
	Note: Where possible the inspector shall require operational tests to check these devices or mechanisms.
1	VERIFY astern and ahead throttle valves work.
2	VERIFY the linkages move freely and are in proper operating condition.

Main / Auxiliary Condensate and Sea Water Circulating Systems

MI - STEAM

JOB AID 2.2

VERIFY condition of seawater piping, valves, and expansion joints

Step	Action
1	<p>INSPECT the sea water piping from sea-suctions to the condenser and from the condenser to the overboard discharge. Inspect for:</p> <ul style="list-style-type: none">• Secured to prevent vibration and stresses• Leaks• Excessively rusted/corroded bolting• Temporary repairs (patches)• Excessive pitted pipe surface• Sea valves condition, in place
2	<p>EXAMINE <u>non-metallic</u> expansion joints for.</p> <ul style="list-style-type: none">• Installation date• Leaks at the flange• Cracks at base of arch or flange• Ballooned or otherwise deformed arches• Loose outer body fabric• Spongy feeling of the joint body• Hardness and cracking of the cover• Cuts and grooves in the cover <p><u>Note:</u> Non-metallic expansion joint replacement 10 years after installation. Reference: 46 CFR 61.15-12</p>

WITNESS operation of both required means of circulating seawater

Step	Action
	Note: Two main seawater pumps are required.
1	VERIFY operation of both seawater pumps. <ul style="list-style-type: none">• No leaks
2	VERIFY operation of the emergency bilge suction valve (bilge injection).

VERIFY condition of main and auxiliary condensers

Step	Action
1.	INSPECT condenser water boxes externally for: <ul style="list-style-type: none">• Patches• Temporary repairs• Defects• Bolting for excessive rust/corrosion Note: When water box is open and available, internally inspect to verify satisfactory condition.
2.	EXAMINE tube sheets for evidence of: <ul style="list-style-type: none">• Plugged tubes• Cracks• Tube failure Note: The main condenser may contain between 2,000 and 10,000 tubes. While plugging of some tubes is acceptable, the manufacturer's manual should be referenced for the maximum amount of tubes allowed to be plugged.

WITNESS operation of both required main condensate pumps

Step	Action
1	VERIFY operation of main condensate pumps. Note: Two required.
2	INSPECT main condensate pump suction piping to main condenser hotwell.
3	VERIFY main condenser hotwell gauge glass functions and sight glass guards are in place.

WITNESS operation of both required auxiliary condensate pumps

Step	Action
1	VERIFY operation of auxiliary condensate pumps. Note: Two required.
2	INSPECT auxiliary condensate pump suction piping to main condenser hotwell.
3	VERIFY auxiliary condenser hotwell gauge glasses function and sight glass guards are in place.

INSPECT condensate piping

Step	Action
1	INSPECT piping for the following: <ul style="list-style-type: none">• Leaks/drips/weepers• Rust indicative of past leaking• Secure/hangers

WITNESS operation of main and auxiliary air ejectors

Step	Action
1	VERIFY relief valves on each nozzle. Note: Not all air ejectors are fitted with relief valves, check vendors manual for the air ejector to verify size and location of relief valves.
2	VERIFY operation of relief valve located at the outlet of the reducing station supplying the steam to the air ejector.
3	OBSERVE the main and auxiliary air ejectors for condensate and steam leaks.

VERIFY condition of condensate heaters

Step	Action
	Note 1: Condensate heaters are pressure vessels exempt from internal inspection, but are fitted with relief valves. Note 2: Gland exhaust condensers will have only one relief valve on the water side, since the steam side is open to the atmosphere via either a fan or small ejector. Note 3: All other heaters will have relief valves on both the steam and water sides.
1	INSPECT condensate heat exchangers (heaters), including: <ul style="list-style-type: none">• Pressure vessel externals• Relief valves (condensate side & steam side) Note: Hand lifting of relief valves is acceptable. Testing of relief valves is normally conducted when plant is secured.

Feedwater Systems

MI - STEAM JOB AID 2.3

2-3-1

ENSURE De-Aerating Feed Tank (DA) / Direct Contact (DC) Heater is listed on COI as Unfired Pressure Vessel

Step	Action
	<p>Note 1: De-Aerating feed tanks and DC Heaters are both considered unfired pressure vessels. They are required to have relief valves and should be listed on the COI.</p> <p>Note 2: A DC heater heats feedwater, a DA does NOT.</p>

VERIFY condition of DA Feed Tank / DC Heater

Step	Action
	Reference: 46 CFR 61.10-5 (Tests and Inspections of Pressure Vessels)
1.	INSPECT the exterior of the DA Feed Tank/DC Heater.
2.	At each Inspection for Certification, VERIFY operation of relief valve. Note: Valves may be tested in place, may be bench tested, or at a minimum by operating the hand lifting gear.
3.	At each Inspection for Certification, CONDUCT an internal inspection of the DA Feed Tank/DC Heater. (5 year interval). Note 1: Confined space. Note 2: The DA Feed Tank / DC Heater internal inspection is normally conducted in conjunction with the boiler fireside/waterside inspections.
4.	UPDATE MISLE.

VERIFY condition of piping and valves

Step	Action
1	<p>INSPECT feedwater piping for:</p> <ul style="list-style-type: none"> • Leaks • Adequate support (46 CFR 56.01-5) • Insulation

VERIFY condition of feed pumps

Step	Action
	Reference: 46 CFR 56.50-30 Boiler Feed Piping
	Note: There are at least two required, potentially a third depending on configuration. They can be steam driven, electrically driven or a combination of both.
1	VERIFY number of feed pumps.

VERIFY all required pumps operate

Step	Action
1	VERIFY operation of discharge relief valves, if equipped. Note 1: Feed pumps may or may not be fitted with a relief valve, depending upon the shut off head-pressure of the pump. Note 2: Relief valves may be tested in place, may be bench tested, or at a minimum by operating the hand lifting gear. Reference: 46 CFR 56.50-30(a)(3)
2	VERIFY operation of all feed pumps.
3	VERIFY operation of low-lube oil shutdown, if installed.

VERIFY overspeed trips function on turbine driven pumps

Step	Action
1	<p>VERIFY operation of overspeed trip on steam-driven feed pumps.</p> <p>Note 1: Annually, hand-tripped. Reference: MSM VOL II</p> <p>Note 2: At Inspection for Certification:</p> <ul style="list-style-type: none"> • May be verified by the manufacturer who can certify the tripping mechanism is set to overspeed at the proper tripping RPM. (This typically requires bench testing of the mechanism which can cause lengthy delays due to removal of the tripping mechanism from the ship.) • May be tested by a manufacture’s representative on board, providing tripping RPM is known. • May be tested by the ship’s crew, if the marine inspector is satisfied that the crew is capable of conducting the test. Tripping RPM must be known. <p>Reference: 46 CFR 61.20-3(a) “at each inspection for certification and periodic inspection, the marine inspector shall conduct tests and inspections of main propulsion and auxiliary machinery and its associated equipment including fluid control systems as he feels necessary to check safe operation.”</p>

VERIFY condition of third stage heater

Step	Action
	<p>Note 1: Not found on all vessels.</p> <p>Note 2: The third stage heater is a tubular heat exchanger. As such, it is exempt from internal inspection.</p> <p>Reference: 46 CFR 61.10-5</p>
1	INSPECT third stage heater under operating conditions.
2	<p>At each Inspection for Certification, VERIFY operation of relief valve.</p> <p>Note: Valves may be tested in place, may be bench tested, or at a minimum by operating the hand lifting gear.</p>

VERIFY condition of grease extractors (if installed)

Step	Action
1	OBSERVE operation of grease extractors (if installed).
2	VERIFY bypass is installed.

WITNESS operation of feedwater regulators

Step	Action
	Note: May be included in Periodic Safety Test Procedures if automated.
1	WITNESS manual or automatic water regulators in operation.

VERIFY operation of feed stop check valve

Step	Action
	Note: Required valves. Reference: 46 CFR 56.50-30(b)
1	VERIFY reach rods operate main and auxiliary feed stop check valves.

ENSURE that two independent means of determining boiler water levels are operable

Step	Action
1	VERIFY two independent means of indicating boiler water level. Reference: 46 CFR 52.01-110
2	VERIFY the water in the gauge glasses should be “lively” indicating there’s free communication between the boiler water and the gauges. (A dead water level indicates a valve or valves are closed or connections are plugged.)
3	VERIFY gauge glass lighting is operating.

4	VERIFY one gauge glass light is powered by the emergency buss.
5	INSPECT gauge glasses for leaks.

EXAMINE make up feed evaporator

Step	Action
	Reference: 46 CFR 61.10-5 (Tests and Inspections of Pressure Vessels)
1	Annually, INSPECT the exterior of the evaporator.
2	At each Inspection for Certification, VERIFY operation of relief valve. Note: Valves may be tested in place, may be bench tested, or at a minimum by operating the hand lifting gear.
3	At each Inspection for Certification, CONDUCT an internal inspection of the evaporator. Reference: 46 CFR 54.01-10 Note: Confined space.

Boiler Fuel Oil Service and Transfer System

MI - STEAM

JOB AID 2.4

INSPECT required fuel oil service pumps

Step	Action
	References: 46 CFR 56.50-65 and 46 CFR 58.01-25
1	INSPECT foundations.
2	INSPECT for fuel leaks.
3	VERIFY equipped with relief valves.
4	VERIFY service pump relief valves tested every 5 years. References: MSM VOL II and 46 CFR 61.20-3(a)
5	VERIFY operation of both service pumps.
6	VERIFY remote shutdown protected against accidental operation.
7	VERIFY remote shutdowns suitably marked.
8	VERIFY remote shutdowns function as intended.

INSPECT fuel oil service piping

Step	Action
	Reference: 46 CFR 56.50-65
1.	VERIFY location so as to be readily observable.
2.	VERIFY service pump suction and discharge strainers are installed.
3.	VERIFY no non-metallic materials (hose) installed.
4.	VERIFY all bolted flanges between service pumps and burners are equipped with shielding.
5.	INSPECT for: <ul style="list-style-type: none">• Leaks• Condition• Insulation• Hangers

INSPECT fuel oil heaters for boilers (if applicable)

Step	Action
	Reference: 46 CFR 56.50-65
1	VERIFY at least two fuel oil heaters.
2	VERIFY operation of fuel oil heaters.
3	VERIFY fuel oil heater relief valves are tested every 5 years. Note: One on oil side / one on steam side. References: MSM VOL II and 46 CFR 61.20-3(a)
4	VIEW inspection tank through sight glass for oil contamination.

INSPECT fuel oil transfer system pump(s)

Step	Action
	Reference: 46 CFR 56.50-65
1	INSPECT foundations.
2	INSPECT for fuel leaks.
3	VERIFY transfer pumps are equipped with relief valves.
4	VERIFY relief valves are tested every 5 years. References: MSM VOL II and 46 CFR 61.20-3(a)
5	VERIFY operation of all fuel oil transfer pumps.
6	VERIFY remote shutdowns are suitably marked.
7	VERIFY remote shutdowns are protected against accidental operation.

INSPECT remote fuel tank shutoff valves

Step	Action
	Reference: 46 CFR 56.50-1
1	VERIFY remote shutoffs function locally and remotely.
2	If electrically, hydraulically, or pneumatically actuated; VERIFY shutoff valves are labeled and indicate open or closed.
3	If operated by manual reach rod; VERIFY reach rods are adequately protected, if vulnerable to damage.

INSPECT drip pans

Step	Action
	Reference: 46 CFR 56.50-65
1	VERIFY drip pans are installed in required locations, including: <ul style="list-style-type: none">• Boiler front• Fuel oil service pumps• Fuel oil transfer pumps• Fuel oil heaters
2	VERIFY drip pans are clean (fire hazard).

INSPECT torch pots

Step	Action
	Reference: MSM VOL II.
1	VERIFY permanently mounted in vertical position.
2	VERIFY no low flashpoint fuels are used. Note: Normally #2 diesel is used.

DETERMINE repair methods for fuel oil service piping discrepancies

Step	Action
1	VERIFY repairs in accordance with references: 46 CFR 56.50-65 46 CFR 56.97-40
Notes:	<ol style="list-style-type: none">1. Fuel oil service piping is class 12. Piping thickness must be greater than schedule 803. Piping must be seamless4. If valves are replaced and they have threaded bonnets, they must be of the union bonnet type and they must be able to allow re-packing under pressure5. Pipe unions are not allowed in pipe sizes one inch or greater6. Bushings and street ells cannot be used7 Piping from the fuel oil burner front header manifold to the oil gun maybe short lengths of steel, annealed copper nickel, nickel copper or copper pipe and tubing may be used. The wall thickness can't be less than .35" and non metallic materials also can't be used.8. Flexible metallic tubing may be used when approved by MSC.9. If weld repairs are done to fuel oil service piping, it must be hydro tested to 1.5 MAWP but not less than 500 psi.

Operational Test of Forced Draft Fans and Shutdowns

MI - STEAM

JOB AID 3.1

INSPECT components of the forced draft fan

Step	Action
1	ENSURE the linkage and louvers are in good condition.
2	INSPECT motor and fan foundation bolts for: <ul style="list-style-type: none">• Cracks• Broken welds• Excessive rust• Indication of movement
3	VERIFY coupling guards are installed and in good working condition.

VERIFY operation of local control for forced draft fans

Step	Action
1.	WITNESS hand operation of the forced draft fan louvers while the boiler is operating.

VERIFY operation of remote shut down controls for forced draft fans

Step	Action
1	WITNESS operation of remote shut down of forced draft fans.

VERIFY forced draft fan shutdowns are protected against accidental operation

Step	Action
1	ENSURE the forced draft fans stop station is suitably protected from accidental operation. Reference: 46 CFR 58.01-25

VERIFY forced draft fan shutdowns are suitably marked

Step	Action
1	ENSURE remote shutdowns are suitably marked. Reference: 46 CFR 58.01-25

Steam Gauges

MI - STEAM

JOB AID 3.2

VERIFY operation of steam pressure gauge

Step	Action
1	VERIFY operation of each steam gauge for a boiler or a main steam line gauge.

VERIFY the accuracy for steam gauges attached to boilers or main steam lines with a gauge

Step	Action
1.	IDENTIFY a gauge of known accuracy. Note: Alternatives: <ul style="list-style-type: none">• Digital readout from the burner management system• Calibrated spare gauge• Gauge tagged as being tested in shore side facility Reference: 46 CFR 61.05-15(f)
2.	VERIFY gauge of known accuracy matches readings of installed boiler or main steam line pressure gauge.

Lifting and Reseating of Safety Valves

MI - STEAM

JOB AID 3.3

RETRIEVE from MISLE

Step	Action
1	RETRIEVE boiler safety valve data from MISLE prior to going on inspection to include the following: <ul style="list-style-type: none">• Manufacturer• Serial Number• Location• Pressure Setting as stamped on each valve• Date of last boiler safety valve test

IDENTIFY the Maximum Allowable Working Pressure (MAWP)

Step	Action
1.	DETERMINE MAWP of the Boiler. Note: This data is located on the boiler name plate, in the boiler book, on the end of the boiler drum head, and on the COI. Reference: 46 CFR 52.01-140(c)

INSPECT boiler safety valves

Step	Action
	<u>Warning</u> <i>High heat area with potential for release of high temperature steam under pressure.</i>
1	INSPECT each safety valve. Reference: 46 CFR 61.05-10.
2	ENSURE the valve is stamped per Section I of ASME Code. (46 CFR 52.01-120)
3	VERIFY information on the safety valve data plate is consistent with Information retrieved from MISLE.
4	ENSURE the relieving capacity of the valve is shown on the name plate. Note: If there is evidence of a valve replacement, ensure total relieving capacity of all safety valves is equal to or greater than the generating capacity of the boiler.

5	<p>INSPECT escape piping.</p> <ul style="list-style-type: none"> • Not resting on safety valve • Hangers are tight and intact
6	<p>VERIFY drains are installed and tight:</p> <p>Note 1: Safety valves can be checked for leaks by finding the end of the drain pipe. The drain pipes almost always go to the bilge and vapor, or a combination of vapor and water, can be seen going into the bilge</p>

OBSERVE opening and closing of boiler safety valves

Step	Action
	<p>Note: Drum safety valves shall be set to relieve at a pressure not in excess of that allowed by the Certificate of Inspection (MAWP).</p> <p>Reference: 46 CFR 52.01-120(a)(6)</p>
	<p>Note: Boiler safety valve test interval is 2.5 years.</p> <p>Reference: 46 CFR Table 61.05-10</p>
1	<p>ENSURE proper gags are being used.</p> <p>Note: Gag should be installed hand tight as over tightening can distort the valve stem</p>
2	<p>VERIFY pressure at which valve should lift.</p> <p>Note: If necessary the safety valve set pressure information can be found in the boiler book.</p>
3	<p>WITNESS operation of each safety valve.</p> <p>Note: Valves should lift with a distinct pop and reseat with a minimum of simmer, no chatter, and smooth operation while relieving.</p> <p style="text-align: center;">Caution</p> <p style="text-align: center;"><i>MAWP must not be exceeded during the test</i></p>

VERIFY boiler safety valve lift and seating pressures observed during test

Step	Action
1.	<p>RECORD lift and seating pressure of each valve.</p> <p>Note: Guidance on in-service setting of safety valves is in NVIC 1-71 Para. 5.c. and 5.d., ASME Section 1 PG-72.3 and MSM Vol. IV Ch 3.E.2.c. Para. (2) are applicable.</p>
2.	<p>VERIFY the valve lifts within 5% up or down of set pressure stamped on the valve name plate (10% for pressures below 250psi).</p> <p>Note: The spring installed by the manufacturer is designed to allow a given volume of steam (capacity) to pass at a given pressure. If the valve is set outside this + or - 5% range the capacity of the valve changes.</p>
3.	<p>VERIFY all valves operate with the appropriate blowdown between 2% and 4%.</p> <p>Note 1: Blowdown is a required function of boiler safety valves. The minimum 2% is to prevent chattering and the maximum of 4% is to reduce steam loss.</p> <p>Note 2: The 4% blow-down maximum tolerance is optimal; however, this may be exceeded by 1% or 2%. In some cases, efforts to meet the 4% tolerance may be very difficult. However, the 2% minimum blow-down tolerance is not flexible.</p> <p>Note 3: Blowdown should never be allowed to encroach on the plant's operating pressure range.</p>

IDENTIFY the approximate normal load pressure drop across the superheater

Step	Action
	<p>To prevent damage to the superheater, the drum safety valve SHALL be set at a pressure not less than that of the superheater safety valve setting, plus 5psi minimum, plus approximately the normal load pressure drop through the superheater.</p> <p>Note: The normal load pressure drop across the superheater can be found in the vessel's Boiler Book.</p> <p>Reference: 46 CFR 52.01-120(b)(2)</p>

VERIFY superheater safety valve lift pressure

Step	Action
1	<p>WITNESS test of superheater safety valve lift.</p> <p>Note 1: The Boiler Book will list the safety valve lifting pressures at original installation.</p> <p>Note 2: Drum pilot operated superheater safety valves, if fitted, should be set to open before the drum safeties.</p> <p>Reference: 46 CFR 52.01-120(b) (2)</p>

OBSERVE test of hand relieving gear

Step	Action
1.	<p>WITNESS test of safety valve hand relieving gear from the fire room or engineer room floor.</p> <p>Reference: 46 CFR 52.01-120(d)(2)</p>

Operational Test of Periodic Safety Test Procedures (PSTP) of Steam Propulsion Automation

MI - STEAM

JOB AID 3.4

VERIFY vessel has current / approved periodic safety test procedures

Step	Action
1.	VERIFY PSTP status including OCMI approval. Note 1: PSTP require verification during annual inspections unless otherwise prescribed by the OCMI 46 CFR 61.40-6
2	IDENTIFY most current version of the PSTP.

DETERMINE installed system matches approved procedures

Step	Action
1.	ENSURE that the system has not been modified or altered and matches the approved procedures currently in place.
2.	VERIFY that automatic systems have not been bypassed or overridden by manual devices except as noted in the approved test procedures.
3.	VERIFY the automation system using the methods specified by the approved procedures.

VERIFY the automation system function against the approved procedures

Step	Action
	Note: Periodic Safety tests must demonstrate the proper operation of the: <ul style="list-style-type: none">• primary and alternate controls• alarms• power sources• transfer override arrangements• interlocks• safety controls Reference: 46 CFR 61.40-6
1	VERIFY proper operation of all required alarms, shutdowns, controls, and internal communications in accordance with the approved test procedures.

ASSESS if vessel manning remains consistent with regulation / policies

Step	Action
1	VERIFY that the required manning remains consistent with regulations and policies.
2	If there are discrepancies noted, DETERMINE if reduced manning remains valid. Note: If vessel has reduced manning and deemed necessary, increase engine room manning as required.
