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Guidance on Practice for In Service Inspection and Testing of Fired Boilers and Heaters

GP 32-45

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GP 32-45. This Guidance on Practice (GP) is based on parts of heritage documents from the merged BP companies as follows:

British Petroleum

RP 32-4 Inspection & Testing of In-Service Civil and Mechanical Plant -
Technical Guidance – Section B2 - Steam Boilers and Section B8 - Fired
Heaters.

BPOUS RPs

RP 20-4-5 In-Plant Inspection of Existing Boilers.
RP 20-4-6 In-Plant Inspection of Existing Fired Heaters.
RP 20-4-7 In-Plant Inspection of Refractories.

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1. Scope

- a. This GP provides specific guidance for in service inspection and testing of direct fired steam boilers and process heaters.
- b. This GP applies to:
 1. Direct fired steam boilers and process heaters, including essential ancillary equipment, such as damper servo mechanisms, flue gas uptakes, and ducting up to and including stack or isolating spade.
 2. Waste heat boilers or generators using heat of flue gases.
 3. Direct fired incinerators.
- c. Outside scope of this GP are:
 1. Waste heat boilers designed to pressure vessel and heat exchanger codes and using heat of process fluids (refer to GP 32-41 and GP 32-48).
 2. Non integral chimney stacks (refer to GP 32-46).
 3. Deaerators and blowdown vessels (refer to GP 32-41).
 4. Mechanical protective devices (refer to GP 32-47).
 5. Flare tips and appurtenances (refer to GP 32-49).
 6. Selective catalytic reduction equipment.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

BP

GP 32-30	Guidance on Practice for In Service Inspection and Testing of Equipment - Management Principles.
GP 32-40	Guidance on Practice for In Service Inspection and Testing of Equipment - Common Requirements.
GP 32-41	Guidance on Practice for In Service Inspection of Unfired Pressure Vessels.
GP 32-46	Guidance on Practice for In Service Inspection and Testing of Equipment - Onshore Civils and Structures.
GP 32-47	Guidance on Practice for In Service Inspection and Testing of Equipment - Mechanical Protective Devices.
GP 32-48	Guidance on Practice for In Service Inspection and Testing of Heat Exchangers.
GP 32-49	Guidance on Practice for In Service Inspection and Testing of Special and Other Equipment.



NACE International (NACE)

NACE RP0170

Protection of Austenitic Stainless Steels and Other Austenitic Alloys from Polythionic SCC during Shutdown of Refinery Equipment.

3. Symbols and abbreviations

For the purpose of this GP, the following symbols and abbreviations apply:

CUF	Corrosion under fireproofing.
CUI	Corrosion under insulation.
MOC	Management of change.
NDE	Non destructive examination.

4. Terms and definitions

For the purposes of this GP, the following terms and definitions apply:

External Inspection

Visual inspection of external parts of equipment while in or out of service.

Internal Inspection

Combination of visual, non destructive examination (NDE), and testing of internal parts of equipment while out of service and entry to fire box, convection section, breaching, and stack are possible.

Final Inspection

Inspection of work to ensure completeness and adequacy of repair and to verify equipment cleanliness prior to closing.

API RP 573 contains extensive list of commonly used terms and definitions.

5. Site Technical Practices, inspection plans and procedures**5.1. General**

This GP shall be read in conjunction with GP 32-30 and GP 32-40.

5.2. Site Technical Practices

- a. This GP shall be adopted, modified, or supplemented by Sites into a Site Technical Practice (STP).
- b. The STP shall be approved by the Site Engineering Authority and form the basis for the development of equipment specific inspection plans and procedures.

5.3. Inspection plans and procedures

- a. Site equipment specific inspection plans, procedures and for fired heaters and boilers shall:
 1. Cover equipment within scope of this GP.
 2. Identify personnel responsible for specific defined activities.
 3. Comply with applicable regulatory requirements.



4. Be developed for relevant design types
5. Be approved by Site Inspection Authority.
6. Address internal and external components up to and including specification break point for piping or other connected equipment.

Sample inspection checklists for boilers and heaters are in API 573, Appendix A.

Regulatory inspection requirements may not fully meet BP need for longer term integrity forecasting. Additional inspections are usually required. This is particularly relevant to waste heat boilers or superheaters that are part of continuous flow process plant.

7. Include inspection extent, methods, intervals and any special safety precautions.

Several insulating materials are known to be carcinogenic including asbestos and ceramic fibre.

Rope access techniques should be considered when preparing inspection plans and procedures.

- b. Visual inspection, intrusive, and non intrusive NDE shall be used to ensure appropriate level of integrity.
- c. Inspection plans shall use a systematic process to identify potential damage mechanisms and their form, location, and rate.
- d. NDE methods of adequate sensitivity shall be used for detecting, sizing, and characterising potential damage.

A comprehensive list of deterioration mechanisms found in fired boilers and heaters is provided in API 573, Section 6.

Typical deterioration mechanisms, associated inspection techniques, acceptance criteria, and considerations to prevent recurrence are summarised in API 573, Section 9, Table 3.

- e. Normative references, bibliography, and requirements of this GP shall be used to develop inspection plans and procedures.

5.4. External inspection

- a. External inspection may be performed while equipment is in or out of operation.
- b. External inspection procedures shall typically include the following, as applicable:
 1. Ladders, walkways, platforms, and stairways for the following:
 - a) Corroded, bent, broken, or missing structural parts.
 - b) Loose, corroded, or missing bolts.
 - c) Worn stair treads and rungs.
 2. Foundations of heater supports for spalling, cracking, settling, and deterioration.
 3. Heater and boiler walls for corrosion, warping, discoloration, and excessively high surface temperature.

Thermographic scans of exterior shell surfaces may be beneficial identifying possible hot spots caused by refractory failure and inadequate or improper refractory installation. Regular or pre turnaround infrared scans of heater casing provide means to identify and monitor hot spots caused by internal refractory damage.

