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FEDERATION

Guidelines

Pressure Systems

Guidelines for Users and Competent Persons
Steam Boilers where the water space is
inaccessible

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1. Introduction.

The purpose of this document is to provide guidance to Competent Persons when completing examinations on small steam boilers where it is not possible to enter the water space. The guidelines are not to be used as an alternative to water space entry on those boilers where entry does not pose any physical limitations.

Note: Further guidance on the size of inspection openings intended for man entry can be found in PEC 02.

2. Scope.

These Guidelines apply to the out of service examination of small horizontal multi-tubular steam boilers where the size of the boiler and its openings make it unsafe or physically impossible to gain entry to the water space resulting in all examinations having to be completed from the outside. As a general guide boilers falling within in this category have a typical size less than 2.0 metres in diameter and with a capacity of approximately 5000 kg/hr. Most of the boilers are reverse flame design with a few having a traditional reversal chamber with a “wet back”.

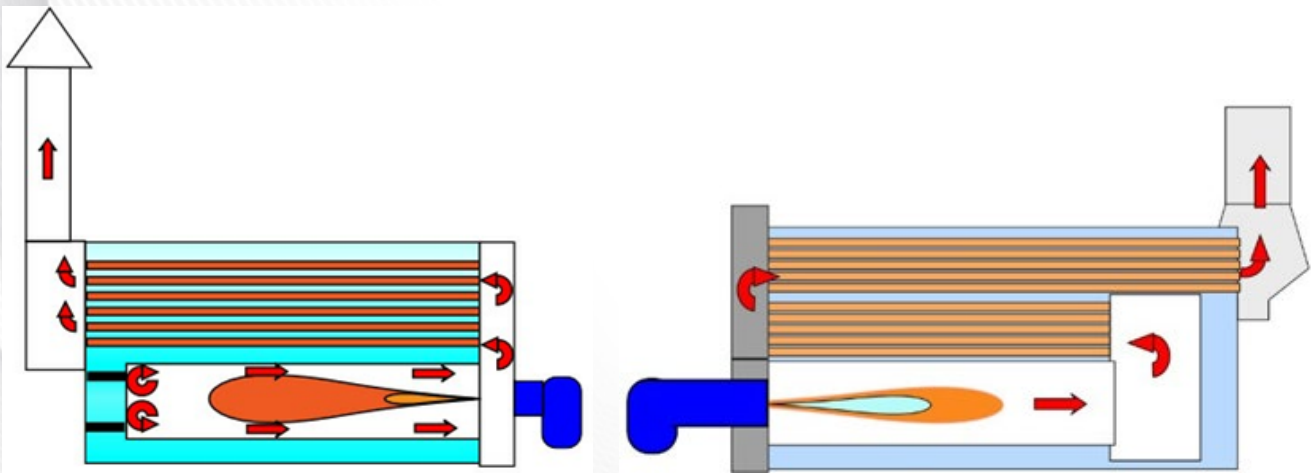


Fig 1 – Typical boiler arrangements

3. Criteria for non-entry to the water space

There is no clear “black and white” criteria that can be applied to determine which boilers should be treated as unsuitable for man entry. This sometimes result in the same boiler being subject to a man entry examination by one Surveyor, then at a future examination from the inspection openings by another Surveyor. This section provides some general guidance on the considerations when formulating a decision not to enter the boiler in order to promote a consistent approach.

3.1. Individual situations need to be assessed on their merits and it is neither possible nor appropriate to provide any quantitative requirements (“go”/“no go”) with respect to man entry. The decision has to be based on the Surveyor’s engineering judgement, whilst taking into account the guidance below and the requirements of PSG 10.

3.2. Assessment for non-access Engineer Surveyors need to:

- assess the size of the access openings
- assess the position of any non-removable internal items that would prevent access
- consider their own physical size and physical ability
- ascertain if a previous Engineer Surveyor has gained access.

4. Damage Mechanisms

Small boilers have the same damage mechanisms and failure modes as the larger boilers, however due to their smaller size the consequences of failure, though still severe, are likely to be less than the larger units. Also as a consequence of their smaller size, they present an additional difficulty in being able to detect some of these damage mechanisms from the manways without the advantage of close inspection or “touch” that is possible from being inside the boiler. The following areas (where accessible) are what would normally be inspected as part of a man entry. An alternative approach for these areas may need to be considered where man entry is not possible:

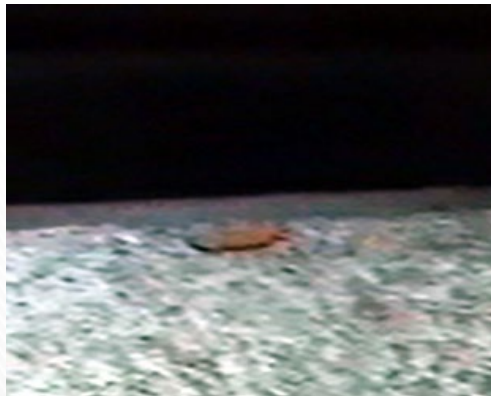
- Shell to endplate/furnace to endplate welds internally – grooving and cracking
- Longitudinal seam weld(s) - cracking
- Furnace tube, stays and smoke tubes – scale formation and corrosion
- Loose scale deposits at the ends of the boiler shell.

5. Alternative methods for examination.

In most cases it may be necessary to supplement the limited visual examination of the water side in order to achieve a similar level of confidence as would be achieved by boiler entry. Possible solutions available to the competent person are outlined below:

- 5.1. Additional lighting in the water space can aid the quality of the inspection from an inspection opening. Other shell openings such as water gauges or other fittings can be utilised for this purpose. The user should be prepared to remove these flanges/connections in order to deploy additional lighting when required to do so by the Competent Person.
- 5.2. In some cases the distance from the inspection openings (upper and lower) can be such that the internal attachments cannot be readily seen. With smaller boilers, being generally shorter, it is normally sufficient to use a large extending mirror to gain improved visual access to the shell to endplate/furnace to endplate welds and the furnace crown and also to identify scale formation.
- 5.3. The use of remote cameras (although still not equivalent to man entry) can further improve the examination. Generally camera capability is almost directly proportional to the cost, though a simple manually operated endoscope device may be sufficiently capable for some short distance applications. Some inspection bodies already provide such simple remote cameras to their Surveyors. However it may be necessary for a more sophisticated unit to be hired from a specialist supplier and this can significantly add to the inspection cost.

5.3.1. The following photographs show typical examples on the variable quality of remote camera images.



Cold Feed, slight scale within distribution pipe.

Reversal Chamber front plate to wrapper plate attachment weld.

Second pass and third pass tubes.



5.3.2. These images illustrate the importance of selecting the right camera for the job and knowing exactly where and how to deploy it. In order to ensure the desired image quality is achieved it is essential that a suitably trained Competent Person is actually viewing the image at the time of the recording. This also allows the Competent Person to decide whether the image quality and coverage is adequate and also if there is a need for additional testing when indications are detected. The Competent Person should not accept a video or images produced without their direct involvement in the operation. The use of a camera has the added advantage in that it can access parts of the boiler which would not normally be accessible through man entry.

Note: whilst it is advantageous to examine shell to endplate/furnace to endplate and shell longitudinal welds from the water side, the SBG1 and SBG2 NDT provide a much more meaningful and thorough examination of these welds. Where there are particular concerns consideration can be given to a shorter interval for the NDT.

5.4. Insulation removal

Removal of insulation would only normally occur where there is concern about its condition and the condition of the underlying surfaces. If it becomes necessary to remove the insulation then consideration should be given to using the opportunity carry out a thickness survey on parts of the shell which are inaccessible internally and also a hydraulic test of the boiler. The test pressure should be the lower of the manufacturer's specified test pressure or 1.5 times the safe operating limit.

6. Summary

This guidance provides general information on additional measures that may be required in order to perform an adequate examination on boilers where man entry is not possible. Individual boilers will need specific consideration on how they can be suitably prepared and where RVI is applied, the type of equipment that needs to be employed. All additional measures should be considered on a case by case basis.