



SAFETY ASSESSMENT
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SAFed approach to use of Remote Visual Inspection on pressure equipment

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INTRODUCTION

Pressure systems present a risk of catastrophic failure from the uncontrolled release of stored energy.

The risks are managed by adequate operation, maintenance and examination as required by the Pressure Systems Safety Regulations. (PSSR) 2000.

Maintenance and examination of certain boilers and pressure vessels requires entry for the purposes of cleaning, repair and do examination of internal surface.

The expectation of the PSSR is that the Competent Person takes all reasonable steps to perform an examination to a sufficient extent that it will detect any defect that could give rise to danger.

Inspection organisations have been gaining entry to vessels for the purpose of carrying out such examinations since the formation of the Manchester Steam Users Association in the mid-nineteenth century. The risks associated with entry into vessels have always been clearly understood by inspection organisations and their safety record in this area over the years has been excellent.

The introduction of The Confined Spaces Regulations (CSR) 1997 has made users and owners of pressure systems more aware of their health and safety obligations with respect to entry into vessels. Unlike sewers, silos and sumps, in most cases the specified risks defined in the CSR can be eliminated for boilers and pressure vessels by adequate preparation for entry coupled with a safe system of work.

Entry into the vessel should be undertaken where:

- The Written Scheme of Examination (WSE) requires internal examination.
- The vessel is designed to facilitate entry.
- The risks can be effectively managed.

Where this cannot be achieved the use of remote visual inspection or other inspection methods can be considered.

Note: when considering the risks associated with vessel entry reference should be made to SAFed Guidelines PSG 10 (Guidelines for the application of a safe system of work for entry in o a confined space).



Remote Visual Inspection (RVI)

RVI equipment is primarily used to perform internal examinations on equipment or critical parts of equipment which would otherwise be inaccessible. It has also been proposed for use on vessels where entry has a perceived risk associated with internal access.

The viability of any alternative approach to the standard practice of visual examination must be given careful consideration to ensure there is no increase in risk of failure to the pressure system under examination.

RVI equipment

Remote visual inspection equipment varies enormously in terms of size, sophistication and cost. It can range from a simple endoscope with entirety manual manipulation to multiple cameras and light sources mounted on a remote-controlled manipulator, capable of taking measurements of observed indications that may constitute defects. Equipment is being continually developed and enhanced but there is no one piece of equipment that is suitable for all applications. Feasibility for RVI needs to be considered on a case-by-case basis, taking into account the RVI equipment which is available.

The following needs to be considered in any RVI feasibility study:

- Is RVI equipment able to access all the relevant areas that would be required to be accessed by vessel entry examination?
- Can the RVI equipment and procedure identify all defects which are likely to occur within the pressure system that would be expected to be detected by visual examination with vessel entry?
- Is the lighting camera manipulation and focus display screen resolution and viewing conditions suitable?
- Will surface conditions affect the inspection capability? e.g. Presence of scale or deposits. highly reflective/absorbent surfaces etc.11
- Is the RVI equipment able to provide sufficient information on a suspected defect to enable its significance to be determined? E.g. Size or grooving, cracks or pitting or can this be determined by further Non Destructive Examination (NDE)?

In cases where there is insufficient information on defects found to determine their significance the competent person would either have to err on the safe side and condemn the equipment or arrange for an entry to take place to permit further evaluation. In cases where the defect is Judged to be unacceptable the equipment would need to be taken out of service unless it was possible for man entry to undertake repair work.

There may be add on benefits that could be taken into consideration when evaluating the overall level of risk control:

- The RVI equipment may be capable of accessing other areas within the pressure equipment that cannot be reached by man entry. This would only be an add on benefit if the area being accessed was likely to be Subject to deterioration that could give rise to danger.
- RVI equipment may be capable of recording the examination for future reference. This would allow indications to be monitored at future examinations and allow other parties to evaluate the findings.

In many cases it may not be possible to carry out a proper evaluation on the suitability of the equipment for a particular application without conducting trials. The trials would not only need to consider access compatibility of the equipment but also the capability of detecting and evaluating the anticipated defects.



Preparation for examination

One possible advantage of RVI is that the extent of preparation required on the pressure equipment can be less than that required for man entry. However, the adequacy of preparation needs to be taken into consideration if this can only be performed from outside of the pressure equipment. Internal surfaces need to be clear of scale and other deposits in order to conduct the examination. Certain pressure equipment requires dismantlement of internal parts to permit examination. These issues need to be addressed if RVI is to be a viable alternative to man entry. It should be noted that the use of RVI will not result in any relaxation of the preparation and examination of protective devices.

Amendments to the examination process

Once a full evaluation has determined that RVI can be employed as an alternative to man entry it is necessary to detail and document the RVI process for incorporation into the WSE. Experience has shown that the time taken to perform RVI to an extent that replicates the same level of internal visual examination is significantly longer than could be achieved through man entry. This needs to be taken into consideration when planning RVI. In addition, the process should address the following areas:

- How the pressure equipment should be prepared for examination, if this is going to change from the current preparation process in the WSE
- The type of RVI equipment that is to be used
- How the equipment is to be deployed and the extent to which the internal surfaces are to be examined
- Whether the results of the examination are to be recorded
- How findings are to be recorded and their significance determined.





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