BEST PRACTICES FOR

PRESSURE VESSEL INSPECTIONS

INTERNAL PRESSURE VESSEL INSPECTIONS

Where construction allows, internally inspect each pressure vessel (except as noted below) **every ten years** (or at time of one-half of the vessel's remaining life, whichever is less).

Properly prepare the pressure vessel for internal inspection by:

- Draining vessel of all contents
- Implementing proper lockout procedures to isolate all sources of energy including electrical, mechanical, gravity, etc.
- Opening vessel by removing all manhole covers, inspection plates, and inspection plugs
- Thoroughly cleaning vessel
- Pre-qualifying the confined space for entry by monitoring air for oxygen concentration, flammable gas concentration, and toxicity levels (i.e., carbon monoxide, hydrogen sulfide, etc.)

Inspection should include:

- **Vessel connections –** threaded connections should be inspected to ensure that an adequate number of threads are engage. Openings should be inspected for obstructions.
- **Vessel closures –** check for proper mating of closure to vessel. Check closure surface for wear and deterioration.
- **Vessel internals –** remove any internals that may hamper inspection. Check vessel shell & heads for signs of corrosion and erosion. This includes pitting and thinning areas. Examine interior welds and their heat affected zones for cracking. Wet fluorescent magnetic particle examinations may be useful in disclosing cracking. Ultrasonic thickness testing may be useful in detecting thinning areas.

General note on pitting - widely scattered pits may be disregarded provided that their depth is no more than one-half of the required thickness of the pressure vessel wall. Areas of concentrated pitting or deep pitting shall be repaired.

General note on thinning – wasted areas that are below the required minimum thickness of the pressure vessel wall should be repaired.

EXTERNAL PRESSURE VESSEL INSPECTIONS

- Review inspection, testing, and maintenance logs for all vessels to be inspected
- Gather information contained on the ASME stamping or nameplate
- Record operating pressure
- Note vessel contents

Assess the overall condition of the vessel (heads, shell, openings, connections, structural attachments, etc.) by inspecting for the following:

- Abrasions – check surfaces for erosion
- Dents – deformations not resulting in vessel thinning. Some cases dents may be removed mechanically.
- Distortion – check for bulging, warping, and general vessel distortion. Check vessel dimensions to determine the extent and seriousness of any distortions
- Cuts or Gouges – depending on severity, cuts & gouges may need to be repaired by welding or patching
- Cracking – inspect the surfaces of shells & heads for possible cracking. Inspect all welded joints and their heat affected zones for possible cracking. Pay particular attention to the skirt and to support attachment and knuckle regions of the heads, as well as to attachment welds – especially air compressor saddle welds to the air receiver, whereby, excessive vibrations can cause cracking.
- Blistering – inspect surfaces of shells & heads for signs of blistering & other signs of deterioration.
- Thinning - ultrasonic thickness testing may be useful in detecting thinning areas.

Each vessel compartment (i.e., shell side, tube side, tube bundle, etc.) shall be protected by a suitable pressure relief valve. Pressure relief valves in hot water service should be of the pressure-temperature relief type. Inspect each pressure relief valve as follows:

- Proper ASME Code symbol stamp – the "UV" symbol. Pressure vessels may also use "V" symbol stamped safety relief valves however Unfired steam boilers (pressure vessels) shall have a "V" symbol stamped safety relief valve.
- Proper set pressure - one or more pressure relief valves must be set at or below the vessel's maximum allowable working pressure. Other pressure relief valves may be set as high as 105% of the vessel's maximum allowable working pressure.
- Sufficient relieving capacity - combined pressure relief valve relieving capacity shall be no less than the maximum generating capacity of the feeding equipment.

For vessels served by a steam pressure reducing station, sufficient relieving capacity shall be provided to relieve the maximum amount of steam that may pass through the reducing station or by-pass, whichever is greater. Supplement 1 of Part 4 of the 2019 Edition of the National Board Inspection Code may be used to estimate this capacity.

- Proper installation – verify that the opening through all pipe & fittings has at least the same crosssectional area as the pressure relief valve inlet. When two or more pressure relief valves are placed on one connection, the inlet internal cross-sectional area of this connection shall be not less than the combined inlet areas of the pressure relief valves connected to it