APPENDIX- IV

REPAIR OF TANK WAGON PRESSURE VESSELS

1. Pressure vessels of tank wagons should only be repaired in nominated workshops having the following facilities:

- Manual welding machine
- Automatic welding machine
- Stress relieving furnace
- X-ray Gamma Ray equipment for taking radiographs of welded joints.
- Pneumatic testing arrangement at pressure given in Table- 10.2.
- Testing for valve.
- Dome fittings with 1t overhead joint.

2. In addition to the equipment mentioned in para 1, the workshops should have qualified staff to operate the above equipment. The welders for repair of the pressure vessels should have the performance qualifications as prescribed in IS 2825, Para 7.2.

3. Repair of fracture

Tank fractures should be repaired by one of the following methods:

- By preparation and welding of the fracture in compliance with interior and exterior reinforcement patch may be applied over repaired area if deemed necessary.
- By removal of defective area and application of welded insert.

4. Welding of fractures

When fractures are to be welded, each end of the cracks must be drilled or chipped out. Dia of drilled holes shall be at least half the plate thickness. If the fracture is not drilled, the chipped groove must be continued at least 25mm beyond each end of the crack and must be tapered towards the plate surface to provide sound weld metal and homogeneous base metal. The metal must be chipped or frame gouged along the fracture on one side of the tank to form a welding groove and then welded. After welding a groove must be back chipped or frame gouged from the opposite side to form a groove deep enough to permit complete weld metal penetration into the weld of the first side. Finished welds may be ground flush on both the sides. Prior to welding all oil, grease, scale, rust or foreign material must be removed from the tank shell around the area of the welding groove. A fracture not exceeding 75mm in length may be repaired by fusion welding without post heat treating or weld except when the fracture is in the knuckle radius of a head in which case it must be heat treated after welding. When several small fractures occur they may be repaired in this manner provided there is space of at least 6 times the plate thickness between any adjacent fractures and

provided the total length does not exceed 600mm for tanks having test pressure of 100 lbs/sq.in above. If reinforcement is to be applied the repaired fracture must be first radiograph to ensure the soundness of the welding. Such reinforcement must be of a thickness at least equal to the original plate thickness and the area must be locally heat treated after welding.

5. Repair of pits and corrosion

Random pits may be chipped or ground to sound metal and welded and then ground flush to original shell thickness, post weld heat treating or radiograph are not required. Where pits are closely grouped or aligned and are deep enough to affect the strength of the metal, the affected area must preferably be removed and an insert applied and locally.

6. Repair of corroded location adjacent to welds

Corrosion in an area adjacent to a weld be repaired by welding. Radiography is not required if the corroded area does not exceed 10mm in width and 5mm in depth irrespective of length. If these dimensions are exceeded the repair weld must be radiograph in its entire length.

7. Repair of deformation and scoring

- Dents or buckles may be repaired provided the procedure by which the areas are restored to contour does not damage the material. If the sharpest radius formed by dents or buckles maybe removed by pressing or jacking to restore the plate to original contour. Excessive heating of the metal shall be avoided. For carbon steel the maximum temperature in 705 Deg.C. If the area formed by dents or buckles is less than 4 times the plate thickness or if the material thickness has been reduced, the affected area must be removed and replaced.
- Scores not exceeding 5mm deep and 10mm wide may be repaired by fusion welding and the surface ground flush. In such scores post weld heat treatment is not required, provided the length of the score does not exceed 300mm and scores are separated by at least 6 times the shell thickness. Scores in excess of above limitations may be repaired by fusion welding but post weld heat treatment must be applied.

8. Repair by means of welded inserts and tank section

On fusion welded tanks, welded insert and tank sections may be applied to any part of the tank shell and head. The inserted material must conform to specification equivalent or superior to the original tank material. The insert or plate must have a double welded butt joint with 25mm minimum corner radius. The insert or plate must be formed to fit the contour of the particular location where it is to be installed. Welded but inserts and tank shell sections must be radio-graphed throughout their entire length.

9. Radiography

- If repaired by butt weld, the entire length of the welded portion must be radiographed.

- When deformation has been removed all weld seams in that area must be radiographed.

10. Post weld heat treatment

- After all welding is complete post weld heat treatment of the tank as a unit or by the double ending method is desirable for carbon steel tanks and mandatory for high alloy steel tanks.

- In lieu of unit post weld heat treatment for carbon steel tanks, local post weld heat treatment may be applied, provided stress relieving equipment such as controlled gas or electric uniform required temperature to an area at least 6 times the plate thickness on each side of weld is used. Local post weld heat treatment by manually held gas torch method must be limited to welds not more than 900mm in length or insert welds not exceeding 1500mm in perimeter. The temperature must be controlled so as to provide protection to adjacent metal to prevent harmful temperature gradient. Post weld heat treatment may be omitted for single or double butt welds not exceeding 25mm in length.

11. Retest

After repairs requiring welding, hot or cold forming to restore tank contour, tanks must be retested as specified in Table-10.2 before return to service.

12. All the repair to the barrel must meet the requirement of IS:2825 and should be done under the guidance of a reputed inspecting agency approved by Chief Controller of Explosives.

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