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GUIDELINES FOR INSPECTION AND REPAIR OF MC-330 AND MC-331 CARGO TANKS

1 Introduction

1.1 The Hazardous Materials Regulations of the Department of Transportation, 173.33 (d)(10)(11), require periodic internal inspection of MC-330 and MC-331 cargo tanks used for anhydrous ammonia. Internal inspection by the wet fluorescent magnetic particle method is required and all cracks and other defects must be repaired. These guidelines were prepared to promote uniformity within the industry among those having the responsibility for the inspection and repair of these tanks.

2 Inspection

2.1 The wet fluorescent magnetic particle method shall be used, and the test procedure shall be in accordance with the applicable portions of Section V of the ASME Code. The alternating current yoke method shall be used.

2.2 The surfaces to be inspected must be cleaned to remove oil, loose scale and rust. All of these materials must be removed from surfaces with sufficient care to clean crevices and corners so that the test solution will flow freely; failure to do this will result in erroneous indications or the masking of indications. Care should be exercised to magnetize each area in directions that would cross any crack regardless of crack orientation. Yokes should be positioned to effectively overlap magnetized areas. Speed of inspection should be slow enough to allow particle buildup at cracks. The continuous method of inspection should be used so that current and test solution are flowing while inspection is being made with the black light. Visible light should be eliminated entirely or held at a level that does not appreciably lessen the fluorescent image. Fluorescent materials should be mixed according to recommendations of the manufacturer and should be agitated frequently during use. Black light output diminishes with use and should be checked periodically with a light meter according to fluorescent material manufacturer's recommendations.

2.3 The wet fluorescent magnetic particle inspection shall include: All welds in or on the interior surface of the tank, and the adjacent base plate extending two inches from either side of such welds; the entire interior surface of tank heads; all interior surfaces at least 2 inches in all directions from exterior welds which are visibly discernible on the interior of the tank. In addition, the entire interior surface of the tank should be visually inspected by eye, and any areas showing evidence of grinding or other repairs or disturbances of plate surface, should be inspected by the wet fluorescent magnetic particle method. If any cracks are found, the entire interior surface shall also be inspected.

3 Repair

3.1 All cracks and other defects, except porosity and slag inclusions in the weld deposit that are acceptable under the ASME Code, shall be removed or repaired in accordance with the repair procedures described in Section VIII, of the edition of the ASME Code under which the tank was built.

3.2. Some minor cracks and other defects may be removed by grinding. In no case shall grinding be done that would reduce the wall thickness below that shown on the dataplate minus .010 inch. Grinding pressure should be light and material should not be overheated. Heavy grinding pressure will produce mechanical work hardening and overheating will induce hard spots and high residual stresses. Material can be prevented from getting too hot either by using a coolant or intermittently grinding and cooling. All ground areas must be properly contoured and feathered to eliminate stress raisers.

3.3 Repairs by welding shall be done only by firms qualified with procedures identical to those required for new construction repairs according to Section VIII of the ASME Code. These firms shall use procedures and welders tested and approved according to Section IX of the ASME Code. All procedures and electrodes used in repairs shall be in accordance with the recommendations of the particular steel producer and electrode supplier. Copy of the manufacturer's data report required by the ASME Code should be obtained if necessary.

3.4 Cracks that are not removable in accordance with the ASME Code by surface grinding shall be removed by acceptable means until no further cracks are revealed by wet fluorescent magnetic particle inspection and the area filled by welding in an approved manner. Preheat area to 100F to 200F to remove moisture and prevent the too rapid cooling that occurs on small welds. The straight stringer-bead technique is suggested for weld metal deposition. This is considered a minor repair.

3.5 In some areas, cracks maybe so numerous that repairing each crack would not be practical. In this case, a section may be removed and a new section installed using the same material and fabrication procedures required by the ASME Code under which the tank was originally constructed. This is considered a major repair.

3.6 After welding, the weld reinforcement should be ground in accordance with the ASME Code, and any undercuts found should either be featherground or weld repaired and ground. Precautions should be taken to avoid overheating and creating coarse surfaces from grinding. Groove weld repairs shall be radiographed wherever practical.

3.7 No postweld heat treatment after minor repair is required. Postweld heat treatment is required after major repairs.

3.8 After welded repairs, the area shall be reinspected by the wet fluorescent magnetic particle method and the tank shall be hydrostatically retested to a pressure at least twice the tank design pressure for quenched and tempered steels and 1-1/2 times the tank design pressure for other than quenched and tempered steels. The repaired area, including the exterior portion of the weld if it penetrates the entire thickness of the material, shall then be reinspected by the wet fluorescent magnetic particle method.

3.9 The need for inspection by an insurance company boiler and pressure vessel inspector should be discussed with the operator since his insurance coverage or local regulations might require this service.

4 Suggested inspection procedure

For the added guidance of those not experienced in the inspection of cargo tanks, the following steps are suggested:

- 4.1 Check tank for vapors. Degas and make safe as required. Remove valves and fittings as required.
- 4.2 Check for surface cleanliness, freedom from oil, loose rust or scale, and residue in bottom. Clean as required with the following suggestions:
 - 4.2.1 Oil: Steam or solvent clean (avoid flammable solvents).
 - 4.2.2 Rust and loose scale: Wire brush or sand blast.
 - 4.2.3 Residue: Scoop out and vacuum.
- 4.3 Visually inspect interior with flood light, marking any areas showing evidence of weld repair of parent metal, manufacturing clips, or disturbances of plate surface.
- 4.4 Mark interior areas corresponding to external structural pad attachments, which must be inspected in accordance with 2.3.
- 4.5 Inspect marked areas, interior of heads, areas up to 2" from all interior welds using wet fluorescent magnetic particle method.
 - 4.5.1 Start on head opposite manhole; work toward manhole.
 - 4.5.2 Work from bottom up.

- 4.5.3 Be equipped with grinder to evaluate findings.
 - 4.5.4 Proceed with inspection of entire interior surface if cracks or defects requiring such inspection are discovered.
 - 4.5.5 Mark and record repair areas.
- 4.6 Determine that proper documentation has been completed, including marking of tank.

Safety precautions to be observed

1. See that tank is adequately purged.
2. Check tank by flammable vapor and oxygen indicator.
3. Maintain ventilation at work area.
4. Work in two-man crews.
5. Avoid excessive contact with inspection fluid. Use protective cream.
6. Ground tank and use only 3-wire grounded electrical system.

5 References

5.1 Department of Transportation, Hazardous Materials Regulations, 49CFR 170-179-for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

5.2 ASME Code, Section V-Nondestructive Examination, Section VIII (Division 1)-Unfired Pressure Vessels, Section IX-Welding Qualifications. All refer to the ASME Boiler and Pressure Vessel Code available from The American Society of Mechanical Engineers, 345 East 47th Street, New York, New York 10017.

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