

## § 180.211 Repair, rebuilding and reheat treatment of DOT-4 series specification cylinders.

(a) *General requirements for repair and rebuilding.* Any repair or rebuilding of a DOT 4-series cylinder must be performed by a person holding an approval as specified in §107.805 of this chapter. A person performing a rebuild function is considered a manufacturer subject to the requirements of §178.2(a)(2) and subpart C of part 178 of this subchapter. The person performing a repair, rebuild, or reheat treatment must record the test results as specified in §180.215. Each cylinder that is successfully repaired or rebuilt must be marked in accordance with §180.213.

(b) *General repair requirements.* Each repair of a DOT 4-series cylinder must be made in accordance with the following conditions:

(1) The repair and the inspection of the work performed must be made in accordance with the requirements of the cylinder specification.

(2) The person performing the repair must use the procedure, equipment, and filler metal or brazing material as authorized by the approval issued under §107.805 of this chapter.

(3) Welding and brazing must be performed on an area free from contaminants.

(4) A weld defect, such as porosity in a pressure retaining seam, must be completely removed before re-welding. Puddling may be used to remove a weld defect only by the tungsten inert gas shielded arc process.

(5) After removal of a non-pressure attachment and before its replacement, the cylinder must be given a visual inspection in accordance with §180.205(f).

(6) Reheat treatment of DOT 4B, 4BA or 4BW specification cylinders after replacement of non-pressure attachments is not required when the total weld material does not exceed 20.3 cm (8 inches). Individual welds must be at least 7.6 cm (3 inches) apart.

(7) After repair of a DOT 4B, 4BA or 4BW cylinder, the weld area must be leak tested at the service pressure of the cylinder.

(8) Repair of weld defects must be free of cracks.

(9) When a non-pressure attachment with the original cylinder specification markings is replaced, all markings must be transferred to the attachment on the repaired cylinder.

(10) Walls, heads or bottoms of cylinders with defects or leaks in base metal may not be repaired, but may be replaced as provided for in paragraph (d) of this section.

(c) *Additional repair requirements for 4L cylinders.* (1) Repairs to a DOT 4L cylinder must be performed in accordance with paragraphs (a) and (b) of this section and are limited to the following:

(i) The removal of either end of the insulation jacket to permit access to the cylinder, piping system, or neck tube.

(ii) The replacement of the neck tube. At least a 13 mm (0.51 inch) piece of the original neck tube must be protruding above the cylinder's top end. The original weld attaching the neck tube to the cylinder must be sound and the replacement neck tube must be welded to this remaining piece of the original neck tube.

(iii) The replacement of material such as, but not limited to, the insulating material and the piping system within the insulation space is authorized. The replacement material must be equivalent to that used at the time of original manufacture.

(iv) Other welding procedures that are permitted by CGA Pamphlet C-3 (IBR, see §171.7 of this subchapter), and not excluded by the definition of "rebuild," are authorized.

(2) After repair, the cylinder must be—

- (i) Pressure tested in accordance with the specifications under which the cylinder was originally manufactured;
  - (ii) Leak tested before and after assembly of the insulation jacket using a mass spectrometer detection system; and
  - (iii) Tested for heat conductivity requirements.
- (d) *General rebuilding requirements.* (1) The rebuilding of a DOT 4-series cylinder must be made in accordance with the following requirements:
- (i) The person rebuilding the cylinder must use the procedures and equipment as authorized by the approval issued under §107.805 of this chapter.
  - (ii) After removal of a non-pressure component and before replacement of any non-pressure component, the cylinder must be visually inspected in accordance with CGA Pamphlet C-6 (IBR, see §171.7 of this subchapter).
  - (iii) The rebuilder may rebuild a DOT 4B, 4BA or 4BW cylinder having a water capacity of 9.07 kg (20 lb) or greater by replacing a head of the cylinder using a circumferential joint. When this weld joint is located at other than an original welded joint, a notation of this modification must be shown on the Manufacturer's Report of Rebuilding in §180.215(c)(2). The weld joint must be on the cylindrical section of the cylinder.
  - (iv) Any welding and the inspection of the rebuilt cylinder must be in accordance with the requirements of the applicable cylinder specification and the following requirements:
    - (A) Rebuilding of any cylinder involving a joint subject to internal pressure may only be performed by fusion welding;
    - (B) Welding must be performed on an area free from contaminants; and
    - (C) A weld defect, such as porosity in a pressure retaining seam, must be completely removed before re-welding. Puddling may be used to remove a weld defect only by using the tungsten inert gas shielded arc process.
- (2) Any rebuilt cylinder must be—
- (i) Heat treated in accordance with paragraph (f) of this section;
  - (ii) Subjected to a volumetric expansion test on each cylinder. The results of the tests must conform to the applicable cylinder specification;
  - (iii) Inspected and have test data reviewed to determine conformance with the applicable cylinder specification; and
  - (iv) Made of material conforming to the specification. Determination of conformance shall include chemical analysis, verification, inspection and tensile testing of the replaced part. Tensile tests must be performed on the replaced part after heat treatment by lots defined in the applicable specification.
- (3) For each rebuilt cylinder, an inspector's report must be prepared to include the information listed in §180.215(c).
- (4) Rebuilding a cylinder with brazed seams is prohibited.
- (5) When an end with the original cylinder specification markings is replaced, all markings must be transferred to the rebuilt cylinder.
- (e) *Additional rebuilding requirements for DOT 4L cylinders.* (1) The rebuilding of a DOT 4L cylinder must be performed in accordance with paragraph (d) of this section. Rebuilding of a DOT 4L cylinder is:
- (i) Substituting or adding material in the insulation space not identical to that used in the original manufacture of that cylinder;

(ii) Making a weld repair not to exceed 150 mm (5.9 inches) in length on the longitudinal seam of the cylinder or 300 mm (11.8 inches) in length on a circumferential weld joint of the cylinder; or

(iii) Replacing the outer jacket.

(2) Reheat treatment of cylinders is prohibited.

(3) After rebuilding, each inner containment vessel must be proof pressure tested at 2 times its service pressure. Each completed assembly must be leak-tested using a mass spectrometer detection system.

(f) *Reheat treatment.* (1) Prior to reheat treatment, each cylinder must be given a visual inspection, internally and externally, in accordance with §180.205(f).

(2) Cylinders must be segregated in lots for reheat treatment. The reheat treatment and visual inspection must be performed in accordance with the specification for the cylinders except as provided in paragraph (f)(4) of this section.

(3) After reheat treatment, each cylinder in the lot must be subjected to a volumetric expansion test and meet the acceptance criteria in the applicable specification or be scrapped.

(4) After all welding and heat treatment, a test of the new weld must be performed as required by the original specification. The test results must be recorded in accordance with §180.215.

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