



NATIONAL PETROCHEMICAL COMPANY
STANDARDS

MATERIAL STANDARD
FOR
FLARE STACK

NPCS-MS-PV-05

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SCOPE

- 1.1 This standard covers the requirements for fabrication, workmanship, inspection, marking, testing and packing of fusion welded self-supported/guyed/structurally supported flare stacks (hereafter referred to as "stacks" for brevity) and is intended to supplement the applicable codes.
- 1.2 For purchase purposes, this standard along with the NPCS-ES-PV-04, shall be complied.
- 1.3 The compliance with this standard does not relieve fabricator from his own responsibilities and guarantees for the soundness of vessel to be delivered.

STANDARDS AND CODES

- ASME Boiler and Pressure Vessel Code, Section VIII. Division 1 and/or 2.
Boiler and Pressure Vessel Code, Section II.
Boiler and Pressure Vessel Code, Section IX.
Boiler and Pressure Vessel Code, Section V.
- BS 4076 Specification for Steel Chimneys.
- All codes referred to, in the above mentioned codes such as ANSI-B 16.5, API-605, ANSI B 16.25, etc.
- AWS/ASME Specification for Welding Electrodes.
- NPCS-ES-PV-01 Pressure Vessels.
- NPCS-SD-PV-17 Tolerances for vertical vessels.
- NPCS-ES-PV-04 Engineering Standard for Flare Stack.

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3 FABRICATION

3.1 GENERAL

3.1.1 When shop working, such as rolling, forming, pressing, etc., can alter the Steel properties and bring them beyond the limits specified by the applicable code, such working shall be followed by a suitable heat treatment, in order to bring such properties back to the prescribed limits.

3.1.2 No hot working is allowed for austenitic Steels with the exception of Stainless Steel forgings.

3.1.3 When low-alloy Steel heads are fabricated with many welded sections, the forming operation shall be carried out in hot condition with particular care as to the finishing temperature or before postweld heat treatment; This applies also for the re-rolling of welded plate courses.

3.1.4 All repairs to defective materials (such as plates, forgings, etc.) are subject to prior approval of purchaser.

3.1.5 Couplings setted on the outside surface of a stack shall be installed cocentric with the holes in the stack wall, within 3 mm. The holes shall be made in the stack wall by drilling or by flame cutting and reaming. If flame cutting and reaming is used instead of drilling, the resulting holes shall be as smooth as a drilled hole and free from all slag and torch undercutting.

3.1.6 Coupling threads must be clean and free from defects, including weld spatter, after installation. Deformed couplings, and those with damaged threads, must be replaced before acceptance.

3.1.7 All stacks shall be furnished complete as what will be shown on stack drawings or as required herein and shall include all necessary bolts, nuts, gaskets, internals and externals as what will be shown.

3.2 MATERIALS

3.2.1 At time of quotation, stack fabricators shall submit, if not already supplied, a detailed material take-off list of all materials and accessories indicated on the individual stack drawing, together with their specified wastage allowance required for plate materials.

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- 3.2.2 Materials of construction shall be as specified to the stack fabricator. All plate material used shall have a mill test certificate.
- 3.2.3 In case of any substitute materials to those specified being used, they must have the prior written approval of purchaser before use.
- 3.3 SHOP FABRICATION
- 3.3.1 Stack and stack ducts shall be shop fabricated to the maximum extent before shipment to site.
- 3.3.2 Stacks including lower conical section, if any, shall be fabricated in horizontal complete circular sections. These shall be as large as possible while conforming to the limits of transportation to site.
- 3.3.3 Where diameter exceeds 4.5 meters, such as in lower conical sections these shall be fabricated in 2 halves suitably braced to facilitate transportation and minimize possible damage during handling.
- 3.3.4 Stack fabricator shall submit detailed plate layout drawings, and other necessary details of stack for approval by purchaser before commencing fabrication. Plates shall be arranged in horizontal courses with staggered vertical joints in accordance with API 650, Clause 3.3.4.
- 3.3.5 Permissible out-of-roundness of any completed stack section shall be in accordance with ASME, Section VIII, paragraph UG-80.
- 3.3.6 Reference measurements of stack dimensions such as diameter and length shall be taken at 7 AM or other agreed early morning hour to eliminate error due to thermal expansion that may occur during the day.
- 3.3.7 The actual diameter measured at all circular sections of cone and cylindrical sections including measurements taken at the vicinity of the welds shall be within 2% of the nominal diameter at that section.
- 3.3.8 Prior to transportation to site each stack section shall be shop matched to each adjacent upper and lower section. This matching shall be witnessed and approved by purchaser's appointed inspector. Out of straightness of edges of adjacent courses shall not be in excess of 3 mm in 3 m.

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- 3.3.9 Conical half sections may be tack welded together for the above procedure. After matching checks are completed tacks shall be removed, surfaces ground smooth and dye penetrant checked.
- 3.3.10 All stack stiffening angles shall be truly round and to same tolerances as the stack plates and welded in place before final shop alignment and matching checks.
- 3.4 PLATE PREPARATION
- 3.4.1 Plates shall be prepared according to plate layout drawing.
- 3.4.2 Preparation shall be in accordance with:
ASME Code Section VIII
- UW-31 For fitting and alignment.
 - UW-32 For cleaning of surfaces to be welded.
- 3.4.3 Plate rolling shall be in accordance with ASME Code Section VIII, Paragraph UG-79 (b).
- 3.5 WELDING
- 3.5.1 Joint Preparation
- 3.5.1.1 Edge preparation shall be in accordance with ASME Code, Section VIII.
- UW-31 For fitting and alignment.
 - UW-32 For cleaning of surfaces to be welded.
- Edges to be welded shall be prepared by machining or by automatic oxy-acetylene cutting, followed by grinding. Shear cutting is allowed only for Carbon Steel sheets thinner than 12 mm. Manual oxy-acetylene cutting is allowed only where nozzles or manholes are to be inserted, provided grinding is subsequently carried out.
- 3.5.1.2 Oxy-acetylene cutting is normally not permitted on Cr-Mo Steel with Chrome content 2% or higher. If it has to be carried out, then a finishing by machining or grinding shall subsequently be made, to remove all hardened areas within the heat affected zone back to the nominal hardness of the parent metal.

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- 3.5.1.3 Grinding of austenitic Steel shall be made *using* wheels of suitable type, and used exclusively for austenitic Steel.
- 3.5.1.4 Before welding, edges shall be checked in order to ascertain the absence of flaking, irregularities or serious defects.
- 3.5.1.5 For low-alloy Steels and for high-strength Steel with thickness above 30 mm, the edges shall be inspected by magnetic particle or liquid penetrant method.
- 3.5.1.6 When thermal cutting is used on austenitic Stainless Steel or other high alloys, the bevel surfaces shall be ground to bright metal. Before welding, the surfaces shall be reasonably smooth and true. Grinding wheels and Stainless Steel wire brushes used on high alloy material shall not have been used on ferrous materials.
- 3.5.1.7 All joints shall *be* full penetration, double welded butt joints. For joints inaccessible from the inside, the fabricator shall submit for approval an alternative method where a full penetration and full fusion weld can be achieved from one side.
- 3.5.1.8 In stacks which are to be 100% radiographed, nozzle to shell welds (Root & Fail run) shall be crack detected by magnetic particle/dye penetrant examination.
- 3.5.1.9 Peening is only permitted to the extent necessary to clean the welds.
- 3.5.2 Welding Procedure & Performance Qualifications
- 3.5.2.1 Welders qualifications shall be in accordance with ASME Code, Section IX. Separate qualifications are required for Carbon Steel, and the different types of low and high alloy Steels.
- 3.5.2.2 Detailed welding procedures as required by the Code for Carbon Steel, low alloy Steel and alloy Steels, including weld preparation and selection *of* electrodes, shall be submitted by vessel fabricator for approval of purchaser before commencement of work.
- 3.5.2.3 Welding on stacks shall be carried out by welders or welding operators previously qualified for the procedure and filler material used by them.
- 3.5.2.4 All welding shall be done by a metal ARC process.

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