

SCOPE

- I 1.1 **This practice** covers the design, fabrication and inspection of steel stacks in non-condensing service. It covers only stacks subject to "low chemical load," as defined in **ASME STS-1**.
- I 1.2 The requirements for flare stacks are not covered by this practice.
- I 1.3 **An asterisk (*)** indicates that a decision by the purchaser is required or that additional information is furnished by the owner.

SUMMARY OF ADDITIONAL REQUIREMENTS

- I 2.1 **Table 1** lists the code and specification which shall be used with this practice.
- I * 2.2 **Table 2** lists the practices which shall be used with this practice as specified by the purchaser.

TABLE 1

CODE AND SPECIFICATION	
ASME Code	
STS-1	Steel Stacks
AISC Specification	Manual of Steel Construction (ASD) - Specification for Structural Steel Buildings

TABLE 2

PRACTICES	
IP 14-1-1	External Insulation
IP 19-3-3	Linings for Fired Heaters

- I 2.3 **Local codes and standards** may be substituted for the ones referenced herein provided the following provisions are met.
The resultant design meets the safety and serviceability criteria attained through this practice.
Substitution is accepted by the authorities, where the facility is to be located by the Owner's Engineer.

DESIGN

- I 3.1 **Design shall be carried out in accordance with ASME STS-1**, with the additions provided in the following paragraphs.
- M 3.2 **Minimum plate thickness**, when new, shall be 3/16 in. (5 mm) for stacks less than 50 ft (15 m) high, and 1/4 in. (6 mm) for stacks 50 ft and higher.
- I * 3.3 **Design wind speed and seismic zone factor** will be specified by the Owner.
Wind loads and earthquake loads shall not be considered to act concurrently.
- R 3.4 **Allowable stresses and safety factors** shall be per **ASME STS-1** except that the limit of proportionality (F_p) shall be taken as 0.7 times the yield stress (F_y) at the design temperature. For self supported cantilever stacks Y, as defined by **ASME STS-1**, shall be assumed to be 1.0.
- R 3.5 **Stress intensification factors** shall be applied as follows:
 - a. A stress intensification factor of 1.5 shall be applied to the stresses in the plate at junctions of cylindrical and conical sections for a distance of 12 in. (300 mm) above and below the junction. One-half the cone apex angle shall not exceed 30 degrees.
 - b. A stress intensification factor of 3.0 shall be applied to the stresses in the plate at the edge of circular or elliptical duct openings cut into the stack. Square and rectangular openings shall be designed per **ASME STS-1**.

R 3.6 **Stresses in butt welds** shall not exceed the following values:

- a. Double V: F_b
 - b. Single V with backing plate: F_b
 - c. Single V with no backing plate: $0.8 F_b$
- where: F_b = Allowable stress

I * 3.7 The need for **insulation and linings** shall be specified by the Owner.

M 3.8 **Corrosion allowance** shall be provided as follows:

STACK METAL TEMPERATURE	CORROSION ALLOWANCE	
	Ferritic Steel	Austenitic Stainless Steel
650°F (345°C) and above	1/8 in. (3 mm)	None
Below 650°F lined unlined	1/16 in. (1.5 mm)	
	1/8 in. (3 mm)	

BOLTED JOINTS

R 3.9 **Permanent splice joints of sectioned stacks** shall be designed for the maximum resultant stresses at the joint, and per the following:

- a. Single fillet welds are not permitted for attaching the flanges.
- b. Flange thickness shall not be less than 1/2 in. (12 mm).
- c. Bolting shall be a minimum of 3/4 in. (20 mm) diameter. Allowable bolt stress shall be $0.75 F_t$ (where F_t is the allowable tensile stress per AISC Specification).
- d. Leakage at joints shall be prevented by exterior seal welding or use of full face, 1/8 in. (3 mm) gaskets or fiber glass tape gasketing.

VIBRATION ANALYSIS

R 3.10 An analysis of **cross wind vibrations** shall be carried out as described in **ASME STS-1**, except the stack shall be considered acceptable if m^1 , as defined by **ASME STS-1**, exceeds 1.1 regardless of the critical windspeed.

R 3.11 **Stacks which are to be lined after erection**, shall be investigated for vibrations under unlined conditions. If necessary, stacks shall be temporarily guyed or braced during these periods.

ACCESSORIES

M 3.12 **Stacks having side entry ducts** shall be provided with a hearth not more than 3 ft (1 m) below the lowest entry duct. A cleanout door shall be provided not less than 2 ft x 2 ft (600 mm x 600 mm) in size. The bottom of the door opening, whenever possible, shall not be more than 2 ft (600 mm) above the hearth.

O 3.13 Size; quantity and location of **instrument connections** will be as specified.

I 3.14 The design requirements and location of **stack dampers and any connecting expansion joints** will be as specified for the individual application.

CASTABLE LININGS

R 4.1 Where specified, **castable refractory** shall be single layer, medium weight as defined in [IP 19-3-3](#).

M 4.2 A **metal cap**, 18 Cr 8 Ni stainless steel, 1/8 in. (3 mm) minimum thickness, **shall be placed at the top of the stack to protect the horizontal surface of the castable from the weather.**