GUYED STEEL STACKS

–Welded Longseam and Spiral Lockseam Construction–

SHEET METAL AND AIR CONDITIONING CONTRACTORS'
NATIONAL ASSOCIATION, INC.
www.smacna.org

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FIRST EDITION – JANUARY, 2011

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FOREWORD

This first edition of *Guyed Steel Stacks – Welded Longseam and Spiral Lockseam Construction –* is intended for use by contractors, fabricators, and designers of heating equipment and industrial process facilities.

The Steel Stack Task Force was formed to develop, organize, review and publish a standard of practices for the design, fabrication and installation of guyed steel stacks. This document is the result of that effort.

SHEET METAL AND AIR CONDITIONING CONTRACTORS'
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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

This publication is devoted exclusively to vertical, uniform diameter guyed stacks either founded at ground level or through-the-roof installations. Tables are provided for stacks of specific height ranging from 20 to 80 feet; for specific wind velocities of 100, 125, and 150 miles per hour; and diameters ranging from 12 to 72 inches. Stacks are listed for either longseam welded or spiral lockseam fabrication. On the list of spiral lockseam stacks some selections are not available for specific combinations of diameter, wind speed and stack height due to a maximum gage limit of 12 gage on the lockforming machinery; and for some of the stack designs requiring 14 gage or 12 gage metal, it may be difficult finding a fabricator capable of handling the required gage. In those cases, a suitable welded longseam alternative may be found in Chapter 2.

RESEARCH NOTE: Prior to the development of stack tables for spiral lockseam duct, SMACNA sponsored research into the behavior of spiral pipe subjected to axial compression and bending moments on statically loaded, full size specimens, followed by finite element modeling of the same type of specimen and loading. The data was developed as an adjunct to extensive prior research (1990's) done on spiral pipe subject to vacuum and internal pressure loads. The new research concluded that while spiral pipe specimens subjected to axial compression could be made to fail as a result of localized buckling due to stress concentration at the load transfer points, between the angle ring intermittent welds and the stack wall, this occurs at loads (11,500 psi) significantly higher than the failure of the spiral lockseam in tension (9300 psi) resulting from bending loads. ***The important conclusion highlighted here is that all other factors being equal, stacks designed for fabrication with spiral lockseam have a significantly lower design stress in tension than those fabricated from longitudinally welded pipe, resulting in equal or heavier gage requirements than longseam.*** *We point this out because for other industrial and HVAC applications the spiral product exhibits a significantly higher strength characteristic, resulting in lighter gage use than longseam.*

1.2 DESIGN LIMITATIONS

This manual is concerned with the design of guyed steel stacks under the following limitations or assumptions:

- The stack will be fabricated of carbon, galvanized or stainless steel with a yield stress of 30 Ksi or higher.
- The width of any breeching or other opening will not exceed two-thirds the diameter of the stack.
- The stack will have a constant diameter from top to bottom and will be unlined (galvanizing excepted).
- The inlet temperature of the gases will not exceed 300°F.

1.3 LOCATION REQUIREMENTS

The location and height of a stack is greatly influenced by the location, size, and configuration of surrounding buildings and topography.

Air flow over a building creates a positive pressure zone on the upstream side of the building and a negative pressure zone (cavity) on the roof and lee side of the building.

Although contour and cavity zones remain relatively unchanged as the wind velocity changes (only the pressures within these zones change), the contour zone and cavity envelopes can often be erratic in shape due to wind turbulence.

Wind flow arround stacks creates negative pressure zones and eddies behind the stack in the same manner as air flow around buildings (Figure 1-1). Low stack discharge velocities permit the effluent to be drawn into the stack eddy zone and may cause down wash. This reduces the effective stack height and may cause the effluent to enter the building cavity, even though the discharge may be well above this cavity. Increasing stack discharge velocity and temperature will increase flume height and thus effective stack height.

The stack-to-wind-velocity ratio should be 1.5 to 1 or higher so that the effluent will break cleanly from the stack, down wash will be eliminated, and the effective stack height will be maximized. In most cases, a stack discharge velocity of 3,000 to 4,000 feet per minute will provide adequate performance.

The designer is cautioned that the Environmental Protection Agency (EPA) and state and local ordinances may dictate the stack height and location. Federal Aviation Agency (FAA) regulations will often restrict the height and location of stacks. Designers should adhere strictly to the requirements of all codes and other government regulations.

NOTE: A stack's location, height, and discharge velocity can be critical in preventing the reentry of stack exhaust into a building's ventilation system. Although