17. SUPPORT DESIGN AND EXTERNAL LOADS

17.1 INTRODUCTION

Supports for heat exchangers and pressure vessels have remained largely beyond the pale of any governing codes. Whereas detailed rules for the design of the pressure parts have been available in the ASME Boiler and Pressure Vessel Codes for several decades [17.1.1-2], support design has received scant attention. Until recently, sizing of supports was generally left to the empirical judgement of the vessel designer. Since stresses due to dead weight, in most situations, amount to only a fraction of pressure-induced stress in the vessel, the effect of dead weight stress was deemed not critical. This situation changed radically with the advent of the commercial nuclear power industry. Equipment supports designed for use in nuclear power plants had to be checked for seismic loads, mechanical loads from attached piping, etc. Increased concerns about equipment reliability have resulted in the spillover of some of the nuclear power industry analysis requirements [17.1.3] into other sectors viz. fossil power, chemical, petrochemical and pharmaceutical industries. This chapter presents some introductory material and design data on sizing pressure vessel supports. Detailed treatment of specific support styles are found in subsequent chapters.

A brief description of common support styles is given in this chapter with some guidelines on their design. In the following sections, a brief account of the types of loadings and required analyses is also presented with special reference to equipment supports. Finally, available methods for evaluation of local stresses are summarized. In what follows, the term pressure vessel is used to indicate all pressure retaining equipment including tubular heat exchangers.

17.2 TYPES OF SUPPORTS—DESIGN DATA

Pressure vessel supports take a variety of forms. The most common styles of supports may be divided into the following categories:

(i) Saddle
(ii) Lug
(iii) Annular ring
(iv) Skirt
(v) Trapeze

(i) Saddle Supports: Saddle supports are the most common means of
supporting horizontal pressure vessels. Two saddles are common (see Photograph 17.a), although three or more have been used in long units (Photographs 17.b) Figure 17.2.1 shows a typical saddle support cross section, along with standard welding symbols.

Tables 17.2.1 and 17.2.2 give typical dimensions for plate and gusset members and for weld dimensions. These dimensions are merely suitable for preliminary design purposes; the final design must be qualified for the external loads acting on the particular unit.

Photograph 17.a. Heat exchanger on two saddle supports.

Photograph 17.b. Heat exchanger on three saddle supports. (Courtesy Joseph Oat Corporation, Camden, N.J.)