types of joints and facings are shown in Fig. A2.18. In Section VIII, Unfired Pressure Vessels, of the ASME Boiler and Pressure Vessel Code, three types of circular flanges are defined, and these are designated as loose-type (Fig. A2.17), integral-type (Fig. A2.16), and optional-type flanges. Under the code, the welds and other details of construction shall satisfy the dimensional requirements stated therein.

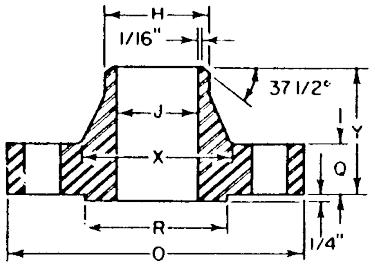

FIGURE A2.16 Typical integral flange (welding neck flange).

Loose-Type Flanges. This (slip-on) type covers those designs in which the flange has no direct connection to the nozzle neck or the vessel or pipe wall and those designs where the method of attachment is not considered to give the mechanical strength equivalent of integral attachment.

Integral-Type Flanges. This type covers designs in which the flange is cast or forged integrally with the nozzle neck or the vessel or pipe wall, butt-welded thereto, or attached by other forms of arc or gas welding of such a nature that the flange

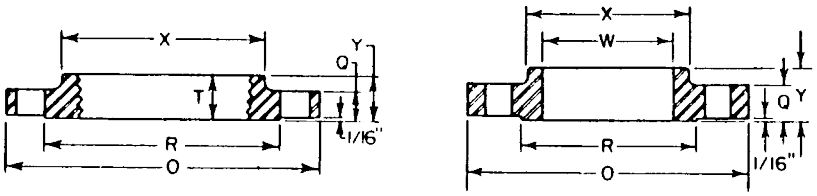

FIGURE A2.17 Typical loose flanges (threaded and slip-on).

and nozzle neck or vessel or pipe wall is considered to be the equivalent of an integral structure. In welded construction, the nozzle neck or the vessel or pipe wall is considered to act as a hub.

Optional-Type Flanges. This type covers designs where the attachment of the flange to the nozzle neck or the vessel or pipe wall is such that the assembly is considered to act as a unit, which shall be calculated as an integral flange, except that for simplicity the designer may calculate the construction as a loose-type flange, provided that stipulated load values are not exceeded.

It is important in flange design to select materials and to proportion dimensions of bolts, flanges, and gaskets to ensure that the necessary compression will be maintained on the joint faces over the expected life of the equipment.

Several distinct phases of the problem are involved: (1) type of flange facing, (2) finish of contact surfaces, (3) gasket type and proportions, (4) bolt load required to secure and maintain a tight joint, and (5) proportions of flange needed to support the bolt load.

Types of Flange Facing. There are numerous types of contact facings for flanges, the simplest of which is the plain face provided with a "smooth tool finish." Class 125 cast-iron flanged fittings are provided with this type of facing. For steel flanges