

WELDED LOAD BEARING ATTACHMENTS TO PRESSURE RETAINING PIPING MATERIALS

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Prepared by

Pipe Fabrication Institute Engineering Committee



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METRIC CONVERSIONS

The conversion of quantities between systems of units involves a determination of significant digits to be retained. All conversions depend upon the intended precision of the original quantity and are rounded to the appropriate accuracy.

Pipe sizes together with applicable wall thicknesses are not shown with metric equivalents.

The SI (metric) values where included with the customary U.S. values in this Standard are the rounded equivalents of the U.S. values and are for reference only.

Metric units were derived utilizing the following conversion factor:

Conversion	Factor	Conversion	Factor
Inches to Millimeters	25.4	Deg. F. to Deg. C.	5/9 (Deg. F. – 32)
Lb/in ² to Kg/cm ²	0.0703		

Preface

Non-integral attachments, such as pipe clamps, are typically recognized as the most practical solution for the support of piping. However, as use of non-integral type attachments is not always feasible for all locations or load conditions, an alternate arrangement becomes necessary. The intent of this standard is to provide procedures to apply for utilization of integral-type support attachments.

1. Scope

- 1.1 This standard covers minimum recommended requirements for materials, design, fabrication and inspection of load bearing attachments, such as, but not limited to, ears, shoes, lugs, fins, rings, skirts, anchors, guides, etc., which are to be fabricated and welded to piping materials that will become part of a pressure retaining piping system. It is not intended to apply to lug or clip attachments whose basic function is to provide support for pipe insulation.

2. Material

- 2.1 All material shall conform to the requirements of one of the acceptable material specifications listed or referenced in the applicable code.
- 2.2 All material shall be of weldable quality and shall be of the same type or of compatible composition with the material to which it is to be welded.

- 2.3 All filler metal shall comply with the requirements of Section II, Part C ASME Boiler and Pressure Vessel Code. A filler metal not incorporated in Section II may be used if a procedure qualification test is first successfully completed in accordance with Section IX requirements.

3. Design

- 3.1 The design temperature to be used for the attachment shall be the same as the design temperature of the piping to which it is to be welded.
- 3.2 The maximum allowable stresses to apply to the attachment shall be those given in the applicable Code for the nominal composition of the attachment material to be used, but in no case greater than the allowable stress for the piping material to which it is to be welded.
- 3.3 The maximum allowable design stresses to apply for filler metal shall be those listed in the applicable Code for the nominal composition, but in no case greater than the allowable stress for the piping material to which it is to be attached.
- 3.4 The allowable supporting loads per linear inch or centimeter of fillet welds shall not exceed those listed in Table I.

|Denotes Revision

- 3.5 To minimize differences in thermal expansion of contact surfaces, the coefficient of thermal expansion of the attachment should be the same or as close as possible to that of the piping material to which it is to be welded.
- 3.6 Each attachment shall be designed for support of all imposed loadings consisting of but not limited to the following:
- a. Static loads as determined by weight balance calculations including weight of the pipe, insulation and the weight of fluid content, cleaning fluid or fluid used for hydrostatic testing, whichever is the greatest.
 - b. All other external loading as specified by the piping design that may be imposed by such conditions as:
 1. Dynamic loading due to safety valve operation, seismic loading or other system operation.
 2. Thermal fatigue loading due to load changes on restraints and anchors.
 3. Additional static loadings imposed by cold pulling during erection.
 4. Eccentric loading conditions during operation.
 5. Any other external loadings such as snow or wind.
- 3.7 Since the character of loadings, amount of loading and attachment location on piping are variables, no uniform or suggested standardized shapes or dimensional proportions are possible. Hence, individual consideration is necessary in the design of each attachment. The typical shapes illustrated by Figures 1 through 7 are not necessarily design recommendations for all applications.

Prime areas of concern are:

- a. Localized stresses induced into the piping component by integral welded attachments on lines operating at elevated temperatures.
- b. The differential expansion stresses between the attached lug and the pipe.
- c. The differential expansion stresses in the attachment lug itself. Very little experimental data has been obtained on the performance of

various lug designs; however, operating experience has shown certain types to be more desirable than others. Figure 5 illustrates a type of integral attachment that is acceptable for low thermal differential stresses. Figure 6 depicts an acceptable design for large thermal differential stresses.

Loading can be distributed over a larger area by use of a pad between the attachment and the pipe as shown in Figure 4. This is useful on light wall pipe subjected to high anchoring stresses, impact loads, or seismic loads.

Impact and shock attachments can be made as shown in Figure 7, by using double shear lugs and a pipe clamp. This method is recommended in place of an integral welded attachment.

Because of the tolerances involved in attaching shear lugs to the pipe and the alignment with the top surface of a riser clamp that is not machined or faced, the following table is recommended for selecting the number of shear lugs:

Pipe Size	Min. No. of Lugs	No. of Lugs Designed to Support Load
6" & under	2	2
8" & larger	4	2

Orientation of lugs are shown in Figure 3.

The effect of external loading on the piping design, together with overall effects resulting from differential thermal conditions of pipe and attachment, shall be the responsibility of the piping designer.

- 3.8 Welding of attachments to arcs of pipe bends and curved sections of fittings should be avoided whenever the alternate choice of welding to straight pipe is a practical option. However, when the optimum design arrangement requires welding to curved pipe or fitting surfaces, the effect on system flexibility, intensification factors and attendant conditions resulting therefrom shall be evaluated by the piping designer prior to use.