vessel wall or within the pad may be credited with a stress value equal to that of the vessel wall or pad, respectively.

(b) The welds that attach elements of compensation, not an integral part of the vessel wall, shall have a strength, \( W \), equal to the load carried by those elements defined as follows:

\[
W = (A - A_1)S_v
\]

where \( A, A_1 \), and \( S_v \) are defined in Figure TD-610.3-2.

(c) When a reinforcing pad is required by the rules of TD-610.3, the welds attaching the nozzle to the pad and shell shall be checked independently to ensure that the loads carried by the individual elements can be transmitted by the attaching welds.

(d) Welds attaching elements of reinforcement need not satisfy the weld strength requirements of (b) and (c) under the following circumstances:

Replace entire paragraph as follows:

(h) Replacing plates and saddles of nozzles attached to the outside of a vessel shall be provided with at least one vent hole [maximum diameter 1.1 mm (7/16 in.)] that may be tapped with straight or tapered threads. These vent holes may be left open or may be plugged when the vessel is in service. If the holes are plugged, the plugging material shall not be capable of sustaining pressure between the reinforcing plate and the vessel wall.

welding. Sufficient welding shall be provided on either side of the line through the center of the opening parallel to the longitudinal axis of the shell to develop the required strength of the reinforcing parts as prescribed in TD-650 through each load-carrying path, in shear or tension, whichever is applicable. See Table TD-650 for example calculations.

(1) The stress correction factors in (g) shall apply.

(2) The strength of fillet welds shall be based on one-half the area subjected to shear, computed on the mean diameter of the weld using the weld leg dimension in the direction under consideration.

(3) The strength of groove welds shall be based on one-half the area subjected to shear or tension, as applicable, computed using the minimum weld depth dimension in the direction under consideration.

(4) Strength calculations for nozzle attachment welds are not required for the following:

(a) Figure TW-140.2-1, sketches (a) through (g), (x-1), (y-1), and (z-1)

(b) openings exempt from the reinforcement requirements by TD-600.3(c)(3)

(g) Stress Values for Weld Metal. The allowable stress values for groove and fillet welds in percentages of stress values for the vessel material are as follows:

1. groove-weld tension, 74%
2. groove-weld shear, 60%
3. fillet-weld shear, 49%

NOTE: These values are obtained by combining the following factors: 87.5% for combined end and side loading, 80% for shear strength, and the applicable joint efficiency factors.

(h) Replacing plates and saddles of nozzles attached to the outside of a vessel shall be provided with at least one telltale hole (maximum size 3/4 in. pipe tap) that may be tapped for a preliminary compressed air and soapsuds test for tightness of welds that seal off the inside of the vessel. These telltale holes may be left open or may be plugged, the plugging material shall not be capable of sustaining pressure between the reinforcing plate on the vessel wall.

TD-660 REINFORCEMENT OF MULTIPLE OPENINGS

NOTE: See TD-630 for multiple openings in flat heads.

(a) When any two openings are spaced at less than two average diameters, so that their limits of reinforcement overlap [see Figure TD-660, sketch (a)], the two openings shall be reinforced in the plane connecting the centers, in accordance with the rules of TD-610, TD-640, and TD-650 with a combined reinforcement within an area not less than the sum of the areas of each opening. No portion of the cross section shall be considered as applying to more than one opening, nor to be considered more than once in a combined area.

1. The overlap area shall be proportioned between the two openings by the ratio of their diameters.

2. If the area of reinforcement between the two openings is less than 50% of the total required for the two openings, the supplemental rules of TD-610.7(g) shall be used.

3. A series of openings, all on the same centerline, shall be treated as successive pairs of openings.

(b) When more than two openings are spaced as in (a) [see Figure TD-660, sketch (b)], and are to be provided with a combined reinforcement, the minimum distance between centers of any two of these openings shall be 17/9 times their average diameter, and the area of reinforcement between any two openings shall be at least equal to 50% of the total required for the two openings. If the distance between centers of two such openings is less than 17/9 times their average diameter, no credit for reinforcement shall be taken for any of the material between these openings. Such openings must be reinforced as described in (c).

(c) Alternatively, any number of adjacent openings, in any arrangement, may be reinforced by using an assumed opening enclosing all such openings. The limits for reinforcement of the assumed opening shall be those given in TD-640(b)(1) and TD-640(c)(1). The nozzle walls of the actual openings shall not be considered to have reinforcing value. When the diameter of the assumed opening exceeds the limits in TD-600.2, the supplemental rules of TD-610.7 shall also be used.