PL-28.4 Corners. If flanged corners are used for the firebox, the minimum inside and outside radii of the mudring shall be as shown in Table PL-28.4-1.

PL-28.5 Washout Plugs. Washout plugs shall be provided at various points above the mudring to allow the removal of sediments. The plugs shall be positioned such that minimal material can collect behind the plug during washing of the boiler. The plugs shall be of large enough diameter to allow foreign material, such as staybolts, to be removed, but not less than NPS 1½ in. (DN 49).

PL-30 STAYBOLTS

Staybolts shall be considered all round attachment bars of any length between the firebox and the shell that are used to support the firebox and flat areas of the shell. Throat braces attached to the lower portion of the boiler barrel and the throat sheet shall be considered braces.

PL-30.1 Staybolts shall be fabricated and installed in accordance with PG-47, PFT-28.2, PFT-28.3, and PFT-29, except that staybolts attached by welding shall have telltale holes conforming to PG-47.1. Full-penetration welded staybolts shall be postweld heat treated in accordance with PW-39 after installation.

PL-30.2 Staybolt stress shall not exceed 7,500 psi (52 MPa) at the smallest cross-sectional area of the staybolt.

PL-30.3 Location, area supported, and spacing of staybolts shall be in accordance with PG-48, PG-49, PFT-23, PFT-25, PFT-26, PFT-27, and PL-27, except that the maximum staybolt stress allowed shall be 7,500 psi (52 MPa).

PL-30.4 Staybolts may be attached by fillet welds provided the following conditions are met.

PL-30.4.1 The stress value for the smallest cross sectional area shall not exceed 7,500 psi (50 MPa).

PL-30.4.2 The weld leg length parallel to the longitudinal axis shall be greater than or equal to 1/4 in. (6.5 mm). The weld shear area parallel to the longitudinal axis shall be no less than 1.25 times the minimum cross-sectional area of the staybolt (minus the cross-sectional area of the telltale hole) as determined by the following equation (see Figure PL-30.4.2-1):

$$d_o \times \pi \times S_{WH} \geq 1.25 \times A_o$$

PL-30.4.3 Staybolt ends directly exposed to the products of combustion shall extend past the fireside of the sheet no more than 3/16 in. (10 mm).

PL-30.4.4 The hole through which the staybolt is inserted shall be 5/64 in. to 1/16 in. (0.4 mm to 1.5 mm) larger than staybolt head diameter. The finished holes shall be true, cleaned of burrs, and nominally coaxial. The staybolt shall be nominally centered in the hole.

PL-30.4.5 Fillet-welded staybolts may be straight cylindrical bars or have a reduced body between the water sides of the sheets. If reduced body fillet-welded staybolts are used, the dimensions in Table PL-30.4.5-1 shall be used. The reduced section may be cylindrical, tapered, or in the form of a radius with the smallest cross sectional area being nominally centered between the water sides of each sheet. If the reduced section consists of two tapered sections and a cylindrical section at the center, the cylindrical section shall be no less than 1/2 in. (13 mm) long.

PL-30.4.6 Fillet-welded stays shall use the same factor $C$ in PG-46 as threaded staybolts.

PL-30.4.7 Welding shall be performed using a method where localized heat input is minimized in order to produce the least distortion practical in the sheets.

PL-30.4.8 PWHT is not required for fillet-welded stays of P-No. 1, Group 1, 2, or 3 materials.

PL-30.4.9 Volumetric examination is not required for fillet-welded stays of P-No. 1, Group 1, 2, or 3 materials.

PL-30.4.10 In staybolts less than 8 in. (200 mm), telltale holes at least 7/16 in. (5 mm) shall be drilled in each end of the staybolt to a depth not less than 1/4 in. (32 mm) or 1/2 in. (13 mm) beyond the inside of the plate or where the reduced section begins for cylindrical reduced sections, whichever is greater. For tapered reduced sections and reduced sections profiled to a radius, telltale holes shall be drilled the full length of the staybolt.

PL-33 CROWN BARS

Crown bars shall be designed in accordance with PFT-30. Crown bars shall stand clear of crown sheet by no less than 1/2 in. (38 mm). See Figure PL-33-1.
Figure PL-30.4.2-1
Fillet-Welded Staybolts

Legend:

- $A_s =$ minimum cross-sectional area of staybolt (minus the cross-sectional area of the telltale hole)
- $d_a =$ nominal bolt diameter on ends of staybolt, maximum $\frac{3}{32}$ in. (3.8 mm) 
- $D_h =$ hole diameter, $\frac{1}{32}$ in. to $\frac{5}{32}$ in. (0.8 mm to 1.5 mm) inclusive, larger than $d_a$
- $D_n =$ smallest diameter of reduced shank of staybolt
- $H_1 =$ $\frac{1}{6}$ in. to $\frac{1}{2}$ in. (3 mm to 13 mm) inclusive
- $H_m =$ maximum height of staybolt on fireside = $\frac{3}{8}$ in. (10 mm)
- $L =$ reduced section, nominally centered, no less than $\frac{1}{2}$ in. (13 mm) long
- $S_{NB} =$ the weld leg length parallel to the longitudinal axis, minimum = $\frac{1}{8}$ in. (3.5 mm), maximum = $\frac{3}{8}$ in. (10 mm) [see PL-30.4.2]
- $T_t =$ $\frac{1}{2}$ in. (13 mm) minimum
- $W =$ weld leg width on sheet, minimum = $\frac{3}{8}$ in. (10 mm)

Table PL-30.4.5-1
Fillet-Welded Staybolt: Examples of Nominal Dimensions Permitted ±0.02 in. (±0.5 mm)

<table>
<thead>
<tr>
<th>Minimum Bolt Diameter at Ends, $d_a$, in. (mm)</th>
<th>Maximum Bolt Diameter at Ends, $d_a$, in. (mm)</th>
<th>Bolt Diameter at Reduced Section, $D_n$, in. (mm)</th>
<th>Minimum Weld Leg, $S_{NB}$, In. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.897 (23)</td>
<td>1.100 (28)</td>
<td>0.709 (18)</td>
<td>0.250 (6.5)</td>
</tr>
<tr>
<td>0.938 (24)</td>
<td>1.125 (29)</td>
<td>0.750 (19)</td>
<td>0.250 (6.5)</td>
</tr>
<tr>
<td>1.000 (25)</td>
<td>1.200 (31)</td>
<td>0.813 (21)</td>
<td>0.250 (6.5)</td>
</tr>
<tr>
<td>1.062 (27)</td>
<td>1.260 (32)</td>
<td>0.875 (22)</td>
<td>0.250 (6.5)</td>
</tr>
<tr>
<td>1.125 (29)</td>
<td>1.330 (34)</td>
<td>0.930 (24)</td>
<td>0.250 (6.5)</td>
</tr>
<tr>
<td>1.220 (31)</td>
<td>1.375 (35)</td>
<td>1.000 (25)</td>
<td>0.250 (6.5)</td>
</tr>
</tbody>
</table>