

## 1.2.7 Joint Efficiency and Quality Factor

### (1) Joint Efficiency

The consideration that must be made is the ratio of the strength of the joint compared to the strength of the base metal. This ratio is called **joint efficiency or joint quality factor**. An efficient joint is one that is just as strong as the base metal.

#### (a) Pressure Vessels

**Table 1.2.7.1 Joint Efficiency (J.E) and Code Reference in ASME Section VIII, Div.1 (2005)**

| Type of joint and radiography   | J.E, %       | Paragraph    |
|---|--------------|--------------|
| Double-welded butt joints (Type 1)  |              | UW-11        |
| Fully radiographed  | 100          | UW-51, UW-35 |
| Spot-radiographed   | 85           | UW-12, UW-52 |
| No radiograph   | 70           | Table UW-12  |
| Single-welded butt joints (backing strip left in place) (Type 2)  |              | UW-52        |
| Fully radiographed  | 90           | UCS-25       |
| Spot-radiographed   | 80           | UW-51        |
| No radiograph   | 65           | UW-52        |
| Single-welded butt joints no backing strip (Type 3) limited to circumferential joints only, not over 5/8 in thick and not over 24-in outside diameter | 60           | Table UW-12  |
| Fillet weld lap joints and single-welded butt circumferential joints  | By component | Table UW-12  |
| Seamless vessel sections or heads (spot-radiographed)   | 100          | UW-12(d)     |
| Seamless vessel sections or heads (no radiography)  | 85           | UW-12(d)     |

#### (b) Weld Joint Quality Factor (Ej) in Piping ; B31.3, para. 302.3.4, K302.3.4, and Table A-1B






##### i) Basic Quality Factors

The  $E_j$  tabulated in B31.3 Table A-1B are basic factors for straight or spiral longitudinal welded joints for pressure retaining components in B31.3 Table 302.3.4.

##### ii) Increased Quality Factors

B31.3 Table 302.3.4 also indicate shigher joint quality factors which may be substituted for those in Table A-1B for certain kinds of welds if additional examination is performed beyond that required by the product specification.

**Table 1.2.7.4 Longitudinal Weld Joint Increased Quality Factor, E<sub>j</sub> (B31.3 Table 302.3.4-2008)**

| No. | Type of Joint  |  | Type of Seam   | Examination  | Factor, E <sub>j</sub>       |
|-----|--|--|--|--|------------------------------|
| 1   | Furnace butt weld, continuous weld                         |   | Straight   | As required by listed specification  | 0.60<br>[Note (1)]           |
| 2   | Electric resistance weld                                   |   | Straight or spiral                                       | As required by listed specification  | 0.85<br>[Note (1)]           |
| 3   | Electric fusion weld                                       |  |  |  |                              |
|     | (a) Single butt weld<br><br>(with or without filler metal) |   | Straight or spiral                                       | As required by listed specification or this Code<br><br>Additionally spot radiographed per para. 341.5.1<br><br>Additionally 100% radiographed per para. 344.5.1 and Table 341.3.2 | 0.80<br><br>0.90<br><br>1.00 |
|     | (b) Double butt weld<br><br>(with or without filler metal) |    | Straight or spiral<br>(except as provided in 4(a) below) | As required by listed specification or this Code<br><br>Additionally spot radiographed per para. 341.5.1<br><br>Additionally 100% radiographed per para. 344.5.1 and Table 341.3.2 | 0.85<br><br>0.90<br><br>1.00 |
| 4   | Per specific specification                                 |  |  |  |                              |
|     | (a) API 5L   | Submerged arc weld (SAW)<br>Gas metal arc weld (GMAW)<br>Combined GMAW, SAW<br> | Straight with one or two seams<br>Spiral                 | As required by specification   | 0.95                         |

NOTE:

(1) It is not permitted to increase the joint quality factor by additional examination for joint 1 or 2.