C. Design Specifications (AISC/LRFD Specification J)

**Bolt Shear:**

\[ \phi R_n = m\phi F_v^b A_b \]  
\[ \text{(J3.6)} \]

where \( m = 1 \) for lap joints (single shear) and \( m = 2 \) for butt joints (double shear), \( A_b \) is the cross-sectional area of the bolts (use \( 0.75A_b \) for N-type bolts) and \( F_v \) is the shear strength of the bolts, which are found in the AISC Tables J3.2 and J3.6 for bearing-type and slip-critical connections, respectively. The resistance factor \( \phi \) is 0.75 for bearing-type and 1.0 for slip-critical case.

**Bearing Capacity:** The design bearing capacity at the holes is \( \phi R_n \), where \( \phi \) is 0.75. The bearing strength should be checked for both bearing and slip-critical type connections. For slip-critical type connections, service load should be checked (without 1.2 and 1.6 factors).

(a) When \( L_e \geq 1.5d \) and \( s \geq 3d \) and there are two or more bolts in line of load:

When deformation around the bolt holes is a design consideration

\[ R_n = 2.4dtF_u \]  
\[ \text{(J3-1a)} \]

When deformation around the bolt holes is not a design consideration, for the bolt nearest edge

\[ R_n = L_e t F_u \leq 3.0dtF_u \]  
\[ \text{(J3-1b)} \]

and for the remaining bolts

\[ R_n = (s - d/2)t F_u \leq 3.0dtF_u \]  
\[ \text{(J3-1c)} \]

(b) When \( L_e < 1.5d \) or \( s < 3d \) or for a single bolt in the line of load:

For a single bolt hole or the bolt hole nearest the edge when there are two or more bolt holes in the line of load

\[ R_n = L_e t F_u \leq 2.4dtF_u \]  
\[ \text{(J3-2a)} \]

For the remaining bolt holes

\[ R_n = (s - d/2)t F_u \leq 2.4dtF_u \]  
\[ \text{(J3-2b)} \]
Bolt Spacing:

(a) Center-to-center spacing (J3.3).

Minimum spacing:

\[ s \geq 2.67d \]

Recommended spacing:

\[ s \geq 3d \]

(b) Edge Spacing (J3.5, J3-10, J3.5)

\[ 1.5d < L_e \leq 12t \leq 6\text{-in} \]

Shear Rupture:

(a) Shear yield + Tension fracture:

\[ \phi P_n = \phi(0.6F_u A_{gy} + F_u A_{nt}) \]  \hspace{1cm} (J4-3a)

(b) Shear fracture + Tension yield:

\[ \phi P_n = \phi(0.6F_u A_{nv} + F_y A_{gt}) \]  \hspace{1cm} (J4-3b)