

APPENDIX A SYMBOLS AND DEFINITIONS

[Table A-1](#) lists the symbols and definitions used in the Manual.

Table A-1 Symbols and Definitions

Symbol	Definition	Section
$2N_f$	Reversals to failure	3.5.3.2
$2N_f$	Reversals to failure	3.5.3.4
$2N_f$	Reversals to failure	3.5.4.1
$2N_f$	Reversals to failure	3.5.4.2
$2N_f$	Reversals to failure	3.5.5.3
$2N_f$	Reversals to failure	3.5.9.2
$2N_f$	Reversals to failure	3.5.9.3
$2N_f$	Reversals to failure	3.5.9.4
$2N_t$	Transition fatigue life	3.5.4.1
α	Reduction factor for area of stiffeners	3.1.2.1.4
α	Angle of arc (in deg.)	3.2.1
α	Angle of arc (in deg.)	3.3.2
β	Material constant	3.5.7.3.1
β	Material constant	3.5.7.3.3.1
δl	Change in gage length	3.5.2
Δe	Change in engineering strain	3.5.2
Δe	Nominal strain range remote from notch	3.5.4.2
ΔK_{eq}	Equivalent stress intensity factor range	3.5.7.3.2
ΔS	Change in engineering stress	3.5.2
ΔS	Nominal stress range remote from notch	3.5.4.2
$\Delta \epsilon$	Local true strain range at the notch root	3.5.4.2
$\Delta \epsilon / 2$	Total strain amplitude	3.5.4.1
$\Delta \epsilon / 2$	Morrow model (total strain amplitude)	3.5.5.3
$\Delta \epsilon_e / 2$	True elastic strain amplitude	3.5.4.1
$\Delta \epsilon_p / 2$	Stable plastic strain amplitude	3.5.4.1
$\Delta \sigma$	Total stress range	3.5.4.1
$\Delta \sigma$	Local true stress range at the notch root	3.5.4.2
$\Delta \sigma / 2$	Stable stress amplitude	3.5.4.1
$\Delta \sigma_{t,max}$	Maximum local notch stress range	3.5.7.3.2
ϕ	Hole diameter	3.1.2.1.1
ϕ	Angle of twist per unit length	3.1.4.1.1
ϵ	Strain rate	2.11
ϵ	True strain	3.5.2
ϵ	Total true strain	3.5.2
ϵ_a	Normal strain amplitude	3.5.8.2
ϵ_a	Strain amplitude	3.5.4.1

Table A-1 (Continued)

Symbol	Definition	Section
ϵ_a	Strain amplitude	3.5.9.4
ϵ_a^e	Elastic strain amplitude	3.5.9.4
ϵ_a^p	Plastic strain amplitude	3.5.9.3
ϵ_a^p	Plastic strain amplitude	3.5.9.4
ϵ_{cu}	Parameter	3.1.3.1.3
ϵ_f	True fracture ductility	3.5.2
ϵ'_f	Fatigue ductility coefficient	3.5.4.1
ϵ'_f	Fatigue ductility coefficient	3.5.4.2
ϵ'_f	Fatigue ductility coefficient	3.5.5.3
ϵ'_f	Fatigue ductility coefficient	3.5.9.3
ϵ'_f	Fatigue ductility coefficient	3.5.9.4
ϵ'_f	Fatigue ductility coefficient	3.5.9.5
ϵ_p	True plastic strain	3.5.2
ϵ_y	Parameter	3.1.3.1.3
γ_a	Shear strain amplitude	3.5.8.2
γ	Parameter	3.3.3
λ	Slenderness factor	3.1.2.1.1
λ	Oil canning buckling parameter	3.3.4
μ_{P_f}	Mean of P_f	3.5.9.1
$\mu_{\epsilon'_f}$	Mean of ϵ'_f	3.5.9.3
$\mu_{\sigma'_f}$	Mean of σ'_f	3.5.9.2
ν	Poisson's ratio	3.1.2.2
ν	Poisson's ratio	3.1.4.1.1
ν	Poisson's ratio	3.3.1.3
ν	Poisson's ratio	3.3.2
ν	Poisson's ratio	3.3.4
%elong.	Percent Elongation	3.5.2
%RA	Percent reduction in area	3.5.2
ρ	Curvature radius of the spot welded notch	3.5.7.3.2
ρ	Reduction factor	3.11.5.4.1
σ	Normal stress	3.5.7.3.3.2
σ	True stress	3.5.2
σ	True stress	3.5.2
$\sigma_{1,3}$	Maximum in-plane principal stress at pt 3	3.5.7.3.3.2
σ_a	True stress amplitude	3.5.3.2
σ_a	True stress amplitude	3.5.3.4
σ_a	Stress amplitude	3.5.7.3.3.3
σ_A	Standard deviation of A	3.5.9.1
σ_a	True stress amplitude	3.5.9.2
$\sigma_{a,R=0}$	Stress amplitude at R=0	3.5.7.3.3.3
σ_{eq}	Von Mises' equivalent stress	3.5.8.2
σ_f	True fracture strength	3.5.2
σ'_f	Fatigue strength coefficient	3.5.3.2
σ'_f	Fatigue strength coefficient	3.5.3.4
σ'_f	Fatigue strength coefficient	3.5.4.1
σ'_f	Fatigue strength coefficient	3.5.4.2

Table A-1 (Continued)

Symbol	Definition	Section
σ'_f	Fatigue strength coefficient	3.5.5.3
σ'_f	Fatigue strength coefficient	3.5.9.2
σ'_f	Fatigue strength coefficient	3.5.9.4
σ'_f	Fatigue strength coefficient	3.5.9.5
$\sigma'_{fR=0}$	Intercepting stress amplitude at one reversal	3.5.7.3.3.3
$\sigma_{\ln(N_f)}$	Standard deviation of $\ln(N_f)$	3.5.9.1
$\sigma_{\ln(P_f)}$	Standard deviation of $\ln(P_f)$	3.5.9.1
σ_m	Mean stress	3.5.3.4
σ_m	Mean stress	3.5.5.3
σ_m	Mean stress	3.5.7.3.3.3
$\sigma_{\max E_a}$	Uniaxial Smith-Watson-Topper parameter	3.5.8.2
σ_{M_x3}	Normal stress due to moment M_x3	3.5.7.3.3.2
σ_{M_y3}	Normal stress due to moment M_y3	3.5.7.3.3.2
σ_{N_z3}	Normal stress due to normal force	3.5.7.3.3.2
σ_r	Radial stress	3.5.7.3.3.1
σ_{r,M_x1}	Radial stress due to moment M_x1	3.5.7.3.3.1
σ_{r,M_x2}	Radial stress due to moment M_x2	3.5.7.3.3.1
σ_{r,M_xi}	Radial stress due to moment M_xi	3.5.7.3.3.1
σ_{r,M_y1}	Radial stress due to moment M_y1	3.5.7.3.3.1
σ_{r,M_y2}	Radial stress due to moment M_y2	3.5.7.3.3.1
σ_{r,M_yi}	Radial stress due to moment M_yi	3.5.7.3.3.1
σ_{r,N_z1}	Radial stress due to normal force N_z1	3.5.7.3.3.1
σ_{r,N_z2}	Radial stress due to normal force N_z2	3.5.7.3.3.1
σ_{r,N_zi}	Radial stress due to normal force N_zi	3.5.7.3.3.1
σ_{r,V_x1}	Radial stress due to lateral force V_x1	3.5.7.3.3.1
σ_{r,V_x2}	Radial stress due to lateral force V_x2	3.5.7.3.3.1
σ_{r,V_xi}	Radial stress due to lateral force V_xi	3.5.7.3.3.1
σ_{r,V_y1}	Radial stress due to lateral force V_y1	3.5.7.3.3.1
σ_{r,V_y2}	Radial stress due to lateral force V_y2	3.5.7.3.3.1
σ_{r,V_yi}	Radial stress due to lateral force V_yi	3.5.7.3.3.1
σ_{r1}	Radial stress at point 1	3.5.7.3.3.1
σ_{r2}	Radial stress at point 2	3.5.7.3.3.1
σ_{\max}	Maximum tangential stress	3.5.7.3.2
σ_1	Principal stress	3.5.8.2
σ_2	Principal stress	3.5.8.2
σ_3	Principal stress	3.5.8.2
θ	Angle	3.1.2.1.3
θ	Angle	3.5.7.3.3.2
θ	Angle around circumference of spot weld	3.5.7.3.3.1
τ	Shear stress	3.5.7.3.3.2
τ_{\max}	Maximum shear stress	3.5.8.2
τ_{V_x3}	Shear stress due to lateral force V_x3	3.5.7.3.3.2
τ_{V_y3}	Shear stress due to lateral force V_y3	3.5.7.3.3.2
θ	Angle of load relative to a line \perp to web	3.1.3.5.1
ψ	Reduction factor	3.1.3.1.2
ψ	Tensile/Compressive stress ratio	3.1.3.1.2

Table A-1 (Continued)

Symbol	Definition	Section
A	Coefficient	2.11
A	Estimated A	3.5.9.1
A	Estimated A	3.5.9.2
A	Estimated A	3.5.9.3
A	Fatigue property of spot welded specimen	3.5.7.3.2
A	Full unreduced xsection area	3.1.2.3
A	Full unreduced xsection area	3.1.2.5
A	Full unreduced xsection area	3.2.1
A	Full unreduced xsection area	3.2.2.1
A	Material constant based on strength	3.5.3.3
A	Material constant based on strength	3.5.3.3
A	Parameter	3.3.4
A	Parameter to determine $(F_y)_{pred}$	2.11
A	Total area of cylindrical tube	3.1.2.2
A'_s	Actual area of lip for a non-simple lip	3.1.2.1.3
A'_s	Actual area of lip for a non-simple lip	3.1.2.1.4
A_e	Effective area	3.1.2.5
A_e	Effective area	3.2.1
A_{ey}	A_e evaluated at stress F_y	3.1.2.5
$(A_e)_1$	Effective cross sectional area, 1	3.6.8
$(A_e)_2$	Effective cross sectional area, 2	3.6.8
A_f	Minimum cross sectional area at fracture	3.5.2
A_{inst}	Instantaneous min. cross sectional area	3.5.2
A_o	Equivalent area	3.1.2.2
A_o	Equivalent area	3.1.2.3
A_o	Equivalent area	3.1.2.5
A_0	Original minimum cross sectional area	3.5.2
A_s	Reduced area of lip	3.1.2.1.3
A_s	Reduced area of lip	3.1.2.1.4
A_s	Stiffener area	3.3.3
a	Area inside tube perimeter	3.1.4.1.1
a	Aspect Ratio (d'/b')	3.6.8
a	Parameter	3.3.4
a	Radius of curvature	3.2.1
a	Radius of curvature	3.2.2.1
a	Radius of curvature of cylindrical plate	3.3.2
a	Radius of curved member	3.2.2.1
a	Spherical radius	3.3.3
a	Spherical radius	3.3.4
a_f	Radius of curvature at flange	3.2.2.1
a_h	Horizontal radius (spherical shell)	3.3.3
a_p	Radius (circular plate)	3.3.1.2
B	Coefficient	2.11
B	Coefficient	3.2.2.1
B	Estimated B	3.5.9.1
B	Estimated B	3.5.9.2

Table A-1 (Continued)

Symbol	Definition	Section
B	Estimated B	3.5.9.3
B	Fatigue property of spot welded specimen	3.5.7.3.2
B	Fatigue strength exponent	3.5.3.2
B	Fatigue strength exponent	3.5.3.4
B	Fatigue strength exponent	3.5.4.1
B	Parameter to determine $(F_y)_{pred}$	2.11
b	Effective width	3.1.2.1.1
b	Effective width	3.1.2.1.2
b	Effective width	3.1.2.1.4
b	Fatigue strength exponent	3.5.4.2
b	Fatigue strength exponent	3.5.5.3
b	Fatigue strength exponent	3.5.7.3.3.3
b	Fatigue strength exponent	3.5.9.2
b	Fatigue strength exponent	3.5.9.4
b	Fatigue strength exponent	3.5.9.5
b	Width	3.1.4.1.1
b	Width of member	3.2.2.1
b'	Effective flange width	3.2.2.1
b ₁	Eff. width near max. comp. stress	3.1.3.1.2
b ₂	Effective width near minimum stress	3.1.3.1.2
b _c	Comp. flange width	3.1.3.1.3
b _c	Comp. flange width (Fig. 3.1.3.1.3-1)	3.1.3.1.3
b _e	Reduced effective width	3.1.2.1.4
b _e	Reduced effective width	3.1.3.1.2
b _f	Flange width beyond web	3.2.2.1
b _i '	Eff. flange width (inner)(Fig. 3.2.2.1-2)	3.2.2.1
b _o	Entire width between webs	3.1.2.1.4
b _o '	Eff. flange width (outer)(Fig. 3.2.2.1-2)	3.2.2.1
b _t	Ten. flange width	3.1.3.1.3
b _t	Ten. flange width (Fig. 3.1.3.1.3-1)	3.1.3.1.3
C	Coefficient	3.3.4
C	Critical loading coefficient	3.3.3
C	Critical slenderness coefficient	3.4.4
C	Fatigue property of spot welded specimen	3.5.7.3.2
C'	Constant	3.3.4
C' _F	High Yield Strength Modifier	3.1.3.5.2
C' _f	Yield Strength Factor	3.1.3.5.1
C' _w	Deflection coeff.(circular plate)	3.3.1.2
C _θ	Parameter	3.1.3.5.1
C ₂	Function of panel geometry	3.3.4
C _{2N_f}	Estimated COV of 2N _f	3.5.9.2
C _{2N_f}	Estimated COV of 2N _f	3.5.9.3
C _b	Bending coefficient	3.1.3.6
C _{e_f}	Estimated COV of e' _f	3.5.9.3
C _F	Parameter	3.1.3.5.1
C _f	Stress coefficient	3.3.1.1

Table A-1 (Continued)

Symbol	Definition	Section
C_h	Parameter	3.1.3.5.1
C_m	Coefficient to modify max. moment	3.1.3.7
C_{mx}	Modifying coefficient along X	3.1.3.7
C_{my}	Modifying coefficient along Y	3.1.3.7
C_{Nf}	Estimated COV of N_f	3.5.9.1
C_{Nf}	Coefficient of variation for N_f	3.5.9.1
C_o	Deflection coefficient-flat plate	3.3.1.2
Cost	Expenditures or resource	3.9.2.4
C_{Pf}	Estimated COV of P_f	3.5.9.1
C_{Pf}	Coefficient of variation for P_f	3.5.9.1
C_R	Parameter	3.1.3.5.1
$C_{s'f}$	Estimated COV of s'_f	3.5.9.2
C_t	Parameter	3.1.3.5.1
C_y	Max. comp. strain permitted/yield strain	3.1.3.1.3
C_w	Deflection coefficient	3.3.1.1
c	Distance to extreme fiber	3.2.1
c	Fatigue ductility exponent	3.5.4.1
c	Fatigue ductility exponent	3.5.4.2
c	Fatigue ductility exponent	3.5.5.3
c	Fatigue ductility exponent	3.5.9.3
c	Fatigue ductility exponent	3.5.9.4
c	Fatigue ductility exponent	3.5.9.5
c_i	Distance from N.A. to inner fiber	3.2.2.1
c_o	Distance from N.A. to outer fiber	3.2.2.1
D	Depth of simple lip	3.1.2.1.3
D	Diameter of largest blank	4.1.6.7
D	Diameter of small rigid circular plate	3.5.7.3.3.1
D	Diameter of small rigid circular plate	3.5.7.3.3.2
D	Diameter of the spot weld nugget	3.5.7.3.2
D	Fatigue property of spot welded specimen	3.5.7.3.2
D	Logarithmic ductility of material	3.5.4.1
D	Outside diameter	3.1.2.2
D	Outside diameter	3.1.3.2
D	Weld nugget diameter	3.5.7.3.1
d	Cup diameter	4.1.6.7
d	Depth along the web	3.1.3.1.3
d	Depth along the web	3.1.3.6
d	Depth of simple lip (flat part)	3.1.2.1.3
d	Nominal dia. of fastener	3.4.2.3.4
d	Nominal diameter	3.4.2.1.1
d	Out-of-straightness after load	3.2.1
d'_s	Actual effective width of lip	3.1.2.1.3
dA	Reduction in area	3.5.4.1
d_o	Original out-of-straightness	3.2.1
D_p	Diameter of larger flexible circular plate	3.5.7.3.3.1
d_s	Effective width of lip	3.1.2.1.3

Table A-1 (Continued)

Symbol	Definition	Section
E	Modulus of elasticity	3.1.2.1.1
E	Modulus of elasticity	3.1.2.1.2
E	Modulus of elasticity	3.1.2.2
E	Modulus of elasticity	3.1.2.3
E	Modulus of elasticity	3.1.2.5
E	Modulus of elasticity	3.1.3.1.2
E	Modulus of elasticity	3.1.3.2
E	Modulus of elasticity	3.1.3.3
E	Modulus of elasticity	3.1.3.6
E	Modulus of elasticity	3.1.3.7
E	Modulus of elasticity	3.1.4.1.1
E	Modulus of elasticity	3.2.1
E	Modulus of elasticity	3.3.1.1
E	Modulus of elasticity	3.3.1.2
E	Modulus of elasticity	3.3.1.3
E	Modulus of elasticity	3.3.2
E	Modulus of elasticity	3.3.3
E	Modulus of elasticity	3.3.4
E	Modulus of elasticity	3.5.2
E	Modulus of elasticity	3.5.4.1
E	Modulus of elasticity	3.5.4.2
E	Modulus of elasticity	3.5.5.3
E	Modulus of elasticity	3.5.9.4
E_t	Tangent modulus of elasticity	3.1.2.3
e	% Strain	4.1.5.3
e	Clear dist. to closest opposite bearing point	3.1.3.5.1
e	Engineering strain	3.5.2
e	Length of moment arm	3.5.7.3.1
e	Length of moment arm	3.5.7.3.2
e_{min}	Minimum distance (hole to part)	3.4.2.3.2
F	Applied force	3.5.7.3.1
F	Applied force	3.5.7.3.2
F	Stress limit	3.1.3.7
F_a	Limiting axial stress	3.1.3.7
F_b	Limiting flexural stress	3.1.3.7
F_{bu}	Ultimate bearing stress	3.4.2.3.3
F_{bwu}	Max. web comp. stress at buckling	3.1.3.1.2
F_{cr}	Critical stress	3.1.2.2
F_{cu}	Ultimate compressive stress	3.1.2.5
F_e	Euler buckling stress	3.1.2.5
F_f	Flange force	3.2.2.1
F_t	UTS at net section	3.4.2.3.4
F_u	Tensile strength of steel	3.1.1
F_u	Tensile strength of steel	3.1.4.2
F_u	Tensile strength of thinnest part	3.4.2.3.2
F_u	Tensile strength of thinnest part	3.4.2.3.3

Table A-1 (Continued)

Symbol	Definition	Section
F_u	Tensile strength of thinnest part	3.4.2.3.4
Function	Function of product, process, etc.	3.9.2.4
F_y	Yield strength	2.11
F_y	Yield strength	3.1.2.1.1
F_y	Yield strength	3.1.2.1.2
F_y	Yield strength	3.1.2.2
F_y	Yield strength	3.1.2.3
F_y	Yield strength	3.1.2.5
F_y	Yield strength	3.1.3.1.2
F_y	Yield strength	3.1.3.1.3
F_y	Yield strength	3.1.3.2
F_y	Yield strength	3.1.3.3
F_y	Yield strength	3.1.3.5.1
F_y	Yield strength	3.1.3.5.2
F_{yd}	Dynamic yield strength	3.3.4
F_{yrs}	Reduced yield strength	3.1.2.1.1
F_{yru}	Reduced yield strength	3.1.2.1.2
$(F_y)_1$	Dynamic Tensile Stress, 1	3.6.8
$(F_y)_2$	Dynamic Tensile Stress, 2	3.6.8
$(F_y)_{pred}$	Predicted dynamic yield strength	2.11
$(F_y)_s$	Static yield strength	2.11
f	Stress in the element	3.1.2.1.1
f	Stress in the element	3.1.2.1.2
f	Stress in the element	3.1.2.3
f_1	Compressive stress	3.1.3.1.2
f_2	Tensile stress	3.1.3.1.2
f_a	Axial stress	3.1.3.7
f_b	Flexural stress	3.1.3.7
f_b	Flexural stress	3.2.2.1
f_{bm}	Maximum stress	3.3.1.1
f_{bmax}	Maximum flexural stress	3.2.2.2
f_{btr}	Transverse bending stress	3.2.2.1
f_{cr}	Critical stress at buckling	3.1.2.2
f_{cr}	Critical stress at buckling	3.3.1.3
f_{cr}	Critical stress at buckling	3.3.2
f_{crc}	Buckling stress of full cylinder	3.1.2.3
f_{crf}	Buckling stress of flat plate	3.1.2.3
f_{crp}	Buckling stress of panel	3.1.2.3
f_m	Membrane stress	3.3.3
f_{max}	Maximum stress	3.2.1
f_r	Radial stress	3.2.2.1
$(f_r)_{r=0}$	Tensile membrane stress($r=0$)	3.3.1.2
$(f_r)_{r=a}$	Tensile membrane stress($r=a$)	3.3.1.2
f_v	Nominal shear stress	3.1.3.3
G	Geometric correction factor	3.5.7.3.3.1
G	Shear modulus of elasticity	3.1.4.1.1

Table A-1 (Continued)

Symbol	Definition	Section
G_i	Geometric correction factor	3.5.7.3.3.1
g	Distortion parameter	3.2.2.2
g	Parameter	3.3.3
H_c	Crown Height	3.3.4
h	Height	3.1.4.1.1
h	Height of member	3.2.2.1
h	Overall height of web	3.1.3.1.2
h	Overall height of web	3.1.3.3
h	Overall height of web	3.1.3.5.1
I	Effective section moment of inertia	3.2.2.2
I	Section moment of inertia	3.2.2.2
I	Section moment of inertia	3.4.4
I_a	I required for full stiffening	3.1.2.1.2
I_a	I required for full stiffening	3.1.2.1.3
I_a	I required for full stiffening	3.1.2.1.4
I_r	Interaction Ratio	3.1.3.4
I_r	Interaction Ratio	3.1.3.5.1
I_r	Interaction Ratio	3.1.3.7
I_r	Interaction Ratio	3.4.4
I_s	I of stiffener	3.1.2.1.3
I_s	Stiffener moment of inertia	3.3.3
I_s/I_a	Ratio of I_s to I_a	3.1.2.1.3
I_s/I_a	Ratio of I_s to I_a	3.1.2.1.4
I_{sf}	I of full area of stiffened element	3.1.2.1.4
I_x	Moment of inertia about X-axis	3.1.3.7
I_{yc}	I of compression portion	3.1.3.6
i	Stress in curved tube/straight tube	3.2.2.2
J	Torsional stiffness constant	3.1.4.1.1
J	Torsional stiffness constant	3.1.4.1.2
j	(Eff. I)/(Full I) of curved tube	3.2.2.2
K	Effective length factor	3.1.2.5
K	Effective length factor	3.4.4
K	Material constant	3.5.8.2
K	Monotonic strength coefficient	3.5.2
K	Theoretical stiffness	3.3.4
K'	Cyclic strength coefficient	3.5.9.5
K_e	Elastic strain concentration factor	3.5.4.2
K_{eq}	Equivalent stress intensity factor	3.5.7.3.2
K_f	Fatigue notch concentration factor	3.5.3.3
K_f	Fatigue stress concentration factor	3.5.4.2
$K_f \cdot dS$	$K_f \cdot dS$	3.5.4.2
K_i	Stress index	3.5.7.3.1
K_i	Stress index	3.5.7.3.1
K_i	Stress index	3.5.7.3.2
$K_{i,max}$	Maximum stress index	3.5.7.3.1
K_{II}	Stress index	3.5.7.3.1

Table A-1 (Continued)

Symbol	Definition	Section
K_{II}	Stress index	3.5.7.3.2
$K_{II,max}$	Maximum stress index	3.5.7.3.1
K_{III}	Stress index	3.5.7.3.2
K_s	Elastic stress concentration factor	3.5.4.2
K_t	Theoretical stress concentration factor	3.5.3.3
K_t	Theoretical stress concentration factor	3.5.4.2
K_x	Effective length factor	3.1.3.7
k	Buckling coefficient	3.1.2.1.1
k	Buckling coefficient	3.1.2.1.3
k	Buckling coefficient	3.1.2.1.4
k	Buckling coefficient	3.1.3.1.2
k	Buckling coefficient	3.3.1.3
k	Constant - see table 3.4.2.1.1-1	3.4.2.1.1
k	Spherical shell factor	3.3.4
L	Eff. unbraced length of comp. flange	3.1.3.6
L	Unbraced length of member	3.1.2.2
L	Unbraced length of member	3.1.2.5
L	Unbraced length of member	3.4.4
L'	Load transmission length	3.4.4
L_1	Shorter plate dimension	3.3.1.1
L_1	Shorter plate dimension	3.3.4
L_1	Smaller rectangular panel dimension	3.3.4
L_2	Larger plate dimension	3.3.1.1
L_2	Larger plate dimension	3.3.4
L_2	Larger rectangular panel dimension	3.3.4
LDR	Limiting drawing ratio	4.1.6.7
L_{eff}	Effective unbraced length	3.2.1
L_x	Actual unbraced L (y-plane bending)	3.1.3.7
l	Length of an element of the cross section	3.1.2.2
l/a	Curvature	3.3.4
l_0	Original gage length	3.5.2
l_1	Initial circle diameter	4.1.5.3
l_2	Final major or minor ellipse diameter	4.1.5.3
l_f	Gage length at fracture	3.5.2
l_{inst}	Instantaneous gage length	3.5.2
limit w/t	Upper bound of w/t ratio	3.1.2.1.1
limit w/t	Upper bound of w/t ratio	3.1.2.1.2
$\ln(2N_f)$	Natural log of $2N_f$	3.5.9.2
$\ln(N_f)$	Natural log of N_f	3.5.9.1
M	Applied bending moment	3.5.7.3.3.1
M	Bending force applied to the weld nugget	3.5.7.3.1
M	Flexural moment	3.1.3.4
M	Flexural moment	3.1.3.5.1
M	Flexural moment	3.2.2.1
M	Flexural moment	3.2.2.2
M	Mean stress sensitivity factor	3.5.7.3.3.3

Table A-1 (Continued)

Symbol	Definition	Section
M_c	Elastic critical moment	3.1.3.6
M_1	Smaller moment at beam end	3.1.3.6
M_1	Smaller moment at beam end	3.1.3.7
M_2	Larger moment at beam end	3.1.3.6
M_2	Larger moment at beam end	3.1.3.7
M_e	Elastic buckling moment	3.1.3.6
M_f	Magnification factor	3.1.3.7
M_p	Plastic moment	3.1.3.2
M_u	Ultimate moment	3.1.3.1.3
M_u	Ultimate moment	3.1.3.2
M_u	Ultimate moment capacity	3.1.3.4
M_u	Ultimate moment capacity	3.1.3.5.1
M_{ux}	Ultimate bending moment along X	3.1.3.7
M_{uy}	Ultimate bending moment along Y	3.1.3.7
M_x	Flexural moment in X-direction	3.1.3.7
M_x	Moment acting on the nugget	3.5.7.3.2
M_{x3}	Applied bending moment at point 3	3.5.7.3.3.2
M_{xi}	Applied bending moment	3.5.7.3.3.1
M_y	Moment acting on the nugget	3.5.7.3.2
M_y	Flexural moment in Y-direction	3.1.3.7
M_y	Yield moment, at first compression yield	3.1.3.6
M_{y3}	Applied bending moment at point 3	3.5.7.3.3.2
M_{yi}	Applied bending moment	3.5.7.3.3.1
M_{yt}	Yield moment, at first tensile yield	3.1.3.6
M_z	Moment acting on the nugget	3.5.7.3.2
m	Fatigue strength exponent	3.5.9.1
N	Applied normal force	3.5.7.3.3.1
N	Bearing length of load or reaction	3.1.3.5.1
N	Bearing length of load or reaction	3.1.3.5.2
N	Monotonic strain hardening exponent	3.5.2
N	Normal force applied to the weld nugget	3.5.7.3.1
N_f	Cycles to failure	3.5.9.1
N_f	Total fatigue life	3.5.7.3.1
N_f	Total fatigue life	3.5.7.3.2
N_f	Total fatigue life	3.5.7.3.3.3
N_z	Out-of-plane normal force on the nugget	3.5.7.3.2
N_{z3}	Applied normal force at point 3	3.5.7.3.3.2
N_{zi}	Applied normal force	3.5.7.3.3.1
n	Number of attachment points	3.4.4
n'	Cyclic strain hardening exponent	3.5.9.5
P	Applied load (tension positive)	3.2.1
P	Axial load	3.1.3.7
P	Applied load	3.5.2
P	Axial load on bolt or stud	3.4.2.1.1
P	Concentrated load on web	3.1.3.5.1
P_a	Load amplitude	3.5.9.1

Table A-1 (Continued)

Symbol	Definition	Section
P_{cb}	Max. concentrated buckling load	3.1.3.5.1
P_{cm}	Reduced value of P_{cy}	3.1.3.5.1
P_{cr}	Critical loading for shell	3.3.3
P_{cr}	Critical oil canning load	3.3.4
P_{cu}	Max. concentrated crippling load	3.1.3.5.1
P_{cu}	Max. concentrated crippling load	3.1.3.5.2
P_{cy}	Max. concentrated load on web	3.1.3.5.1
P_e	Euler buckling load	3.1.3.7
P_e	Euler buckling load	3.2.1
P_{ex}	Euler buckling load along X	3.1.3.7
P_{ex}	X-axis Euler buckling load	3.1.3.7
P_{ey}	Euler buckling load along Y	3.1.3.7
P_f	Applied load at the fracture	3.5.2
P_f	Fatigue strength coefficient	3.5.9.1
P_{max}	Maximum applied load	3.5.2
P_{mean}	Mean crushing load	3.6.8
P_p	Axial force in cover plate	3.4.4
P_u	Axial load capacity	3.1.2.5
P_u	Axial load capacity	3.1.3.7
P_u	Computed ultimate load	3.6.8
P_u	Ultimate strength of stub column	3.6.8
P_y	Axial load at yield strength	3.1.3.6
parameter	Brown and Miller's parameter	3.5.8.2
parameter	Modified Smith-Watson-Topper parameter	3.5.8.2
Q	Moment about section neutral axis	3.4.4
q	Coefficient	3.2.2.2
q	Fatigue notch sensitivity	3.5.3.3
q	Uniform load per unit area	3.3.1.1
q	Uniform load per unit area	3.3.1.2
q	Uniform load per unit area	3.3.3
q_{cr}	Critical loading per unit area	3.3.3
R	Corner bend radius	3.1.3.5.1
R	Radius	3.1.4.1.1
R	Radius of curvature	3.1.2.3
R	Radius of tubular section	3.1.2.2
R	Radius of tubular section	3.1.3.2
R	Radius of tubular section	3.2.2.2
R	Stress ratio	3.5.3.1
R	Stress ratio	3.5.7.3.1
R_1	Radius of curvature - R1	3.3.4
R_2	Radius of curvature - R2	3.3.4
Ratio	Engineered scrap	4.1.8
R_{cr}	Coefficient	3.3.4
r	Curvature radius of the spot welded notch	3.5.7.3.2
r	Force transmitted/tension force	3.4.2.3.4
r	Notch root radius	3.5.3.3

Table A-1 (Continued)

Symbol	Definition	Section
r	Radius of gyration of xsection	3.1.2.5
r	Radius of gyration of xsection	3.2.1
r	Radius of gyration of xsection	3.2.1
r	Radius of gyration of xsection	3.4.4
S	Engineering stress	3.5.2
S	w/t value at which buckling begins	3.1.2.1.1
S	w/t value at which buckling begins	3.1.2.1.2
S	w/t value at which buckling begins	3.1.2.1.3
S	w/t value at which buckling begins	3.1.2.1.4
S _a	Stress amplitude	3.5.3.1
S _a	Stress amplitude for same life as S _{cr}	3.5.3.4
S _a	Stress amplitude at 2x10 ⁶ cycles	3.5.7.3.3.3
S _{a,R=0}	Stress amplitude at R=0 and 2x10 ⁶ cycles	3.5.7.3.3.3
S _c	Effective section modulus	3.1.3.6
S _{cr}	Stress amplitude for R=-1	3.5.3.4
S _f	Section modulus for compressive fiber	3.1.3.6
S _{ft}	Section modulus for tension fiber	3.1.3.6
S _m	Mean stress	3.5.3.1
S _m	Mean stress	3.5.3.4
S _m	Mean stress at 2x10 ⁶ cycles	3.5.7.3.3.3
S _{m,R=0}	Mean stress at R=0 and 2x10 ⁶ cycles	3.5.7.3.3.3
S _{max}	Maximum stress	3.5.3.1
S _{min}	Minimum stress	3.5.3.1
S _r	Stress range	3.5.3.1
S _s	Stiffener spacing	3.3.3
S _u	Ultimate tensile strength	3.5.2
S _u	Ultimate tensile strength	3.5.3.3
S _u	Ultimate tensile strength	3.5.3.4
s	Measured deviation about Y on X	3.5.9.1
s	Measured deviation about Y on X	3.5.9.2
s	Measured deviation about Y on X	3.5.9.3
s	Spacing of attachment points	3.4.4
s	Spacing of bolts	3.4.2.3.4
T	Applied torque	3.1.4.1.1
T	Applied torque	3.1.4.1.2
T	Torque applied to nut	3.4.2.1.1
t	Metal sheet thickness	3.5.7.3.1
t	Thickness of flange or member	3.2.2.1
t	Thickness of flat or curved element	3.1.2.1.1
t	Thickness of flat or curved element	3.1.2.1.2
t	Thickness of flat or curved element	3.1.2.1.3
t	Thickness of flat or curved element	3.1.2.1.4
t	Thickness of flat or curved element	3.1.2.3
t	Thickness of flat or curved element	3.1.2.5
t	Thickness of flat or curved element	3.1.3.1.2
t	Thickness of flat or curved plate	3.1.2.1.3

Table A-1 (Continued)

Symbol	Definition	Section
t	Thickness of flat or curved plate	3.1.3.1.3
t	Thickness of flat or curved plate	3.1.4.1.2
t	Thickness of flat or curved plate	3.3.1.1
t	Thickness of flat or curved plate	3.3.1.2
t	Thickness of flat or curved plate	3.3.1.3
t	Thickness of flat or curved plate	3.3.2
t	Thickness of flat or curved plate	3.3.3
t	Thickness of flat or curved plate	3.3.4
t	Thickness of flat or curved plate	3.4.4
t	Thickness of thinnest part	3.4.2.3.2
t	Thickness of the metal sheet	3.5.7.3.2
t	Thickness of the circular plate	3.5.7.3.3.1
t	Thickness of web	3.1.3.3
t	Thickness of web	3.1.3.5.1
t	Thickness of web	3.1.3.5.2
t	Tube wall thickness	3.1.2.2
t	Tube wall thickness	3.1.3.2
t	Tube wall thickness	3.1.4.1.1
t ₁	Thickness	3.1.4.1.1
t _B	Equivalent bending thickness	3.3.3
t _e	Effective thickness	3.1.2.3
t _f	Flange thickness	3.2.2.1
t _i	Thickness of the circular plate	3.5.7.3.3.1
t _m	Equivalent membrane thickness	3.3.3
t _s	Equivalent thickness	3.1.2.1.4
t _w	Thickness of web	3.2.2.1
t _w	Thickness-see Fig 3.2.2.1-4	3.2.2.1
V	Applied lateral force	3.5.7.3.3.1
V	Shear force applied to the weld nugget	3.5.7.3.1
V	Transverse shear force	3.1.3.3
V	Transverse shear force	3.1.3.4
Value	Function-cost relationship	3.9.2.4
V _m	Max. shear force in beam	3.4.4
V _s	Shear force per attachment point	3.4.4
V _u	Shear force transmitted by bolt	3.4.2.3.2
V _u	Ultimate shear force of web	3.1.3.3
V _u	Ultimate shear force of web	3.1.3.4
V _u	Ultimate shear force of web	3.1.3.5.1
V _x	In-plane shear force acting on the nugget	3.5.7.3.2
V _{x3}	Applied lateral force at point 3	3.5.7.3.3.2
V _{xi}	Lateral force	3.5.7.3.3.1
V _y	In-plane shear force acting on the nugget	3.5.7.3.2
V _{y3}	Applied lateral force at point 3	3.5.7.3.3.2
V _{yi}	Lateral force	3.5.7.3.3.1
v _t	Torsional shear stress	3.1.4.1.1
v _t	Torsional shear stress	3.1.4.1.2

Table A-1 (Continued)

Symbol	Definition	Section
v_{t1}	Torsional shear stress	3.1.4.1.1
W	Denting energy	3.3.4
w	Metal sheet width	3.5.7.3.1
w	Width of flat or curved element	3.1.2.1.1
w	Width of flat or curved element	3.1.2.1.2
w	Width of flat or curved element	3.1.2.1.3
w	Width of flat or curved element	3.1.2.1.4
w	Width of flat or curved element	3.1.2.3
w	Width of flat or curved element	3.1.2.5
w	Width of flat or curved element	3.1.3.1.2
w	Width of flat or curved element	3.3.1.3
w_f	Flange projection of I or C section	3.1.3.1.1
w_f	Half the distance between webs	3.1.3.1.1
w_1	Mass of metal consumed	4.1.8
w_2	Mass of parts produced	4.1.8
w_m	Max. plate deflection	3.3.1.1
w_m	Max. plate deflection	3.3.1.2
w_o	Center deflection	3.3.1.2
y	Distance from centroidal axes	3.2.2.1
y_c	Parameter	3.1.3.1.3
y_{cp}	Parameter	3.1.3.1.3
y_p	Parameter	3.1.3.1.3
y_t	Parameter	3.1.3.1.3
y_{tp}	Parameter	3.1.3.1.3
Z	Sectional property	3.2.2.1

