

BUCKLING AND ULTIMATE STRENGTH ASSESSMENT FOR OFFSHORE STRUCTURES APRIL 2004

NOTICE NO. 1 – November 2011

The following Rule Changes become **EFFECTIVE AS OF 1 NOVEMBER 2011**.

(See <http://www.eagle.org> for the consolidated version of the Guide for Buckling and Ultimate Strength Assessment for Offshore Structures 2004, with all Notices and Corrigenda incorporated.)

Notes - The date in the parentheses means the date that the Rule becomes effective for new construction based on the contract date for construction. (See 1-1-4/3.3 of the ABS Rules for Conditions of Classification – Offshore Units and Structures (Part 1).)

SECTION 3 PLATES, STIFFENED PANELS AND CORRUGATED PANELS

5 Stiffened Panels

(Add new Paragraph 3/5.7, as follows.)

5.7 Overall Buckling State Limit (1 November 2011)

The overall buckling strength of the entire stiffened panels is to satisfy the following equation with respect to the biaxial compression:

$$\left(\frac{\sigma_x}{\eta \sigma_{Gx}} \right)^2 + \left(\frac{\sigma_y}{\eta \sigma_{Gy}} \right)^2 \leq 1$$

where

σ_x = calculated average compressive stress in the longitudinal direction, in N/cm² (kgf/cm², lbf/in²)

σ_y = calculated average compressive stress in the transverse direction, in N/cm² (kgf/cm², lbf/in²)

σ_{Gx} = critical buckling stress for uniaxial compression in the longitudinal direction, in N/cm² (kgf/cm², lbf/in²)

$$= \begin{cases} \sigma_{Ex} & \text{if } \sigma_{Ex} \leq P_r \sigma_0 \\ \sigma_0 \left[1 - P_r (1 - P_r) \frac{\sigma_0}{\sigma_{Ex}} \right] & \text{if } \sigma_{Ex} > P_r \sigma_0 \end{cases}$$

σ_{Gy}	=	critical buckling stress for uniaxial compression in the transverse direction, in N/cm ² (kgf/cm ² , lbf/in ²)
	=	$\begin{cases} \sigma_{Ey} & \text{if } \sigma_{Ey} \leq P_r \sigma_0 \\ \sigma_0 \left[1 - P_r (1 - P_r) \frac{\sigma_0}{\sigma_{Ey}} \right] & \text{if } \sigma_{Ey} > P_r \sigma_0 \end{cases}$
σ_{Ex}	=	elastic buckling stress in the longitudinal direction, in N/cm ² (kgf/cm ² , lbf/in ²)
	=	$k_x \pi^2 (D_x D_y)^{1/2} / (t_x b^2)$
σ_{Ey}	=	elastic buckling stress in the transverse direction, in N/cm ² (kgf/cm ² , lbf/in ²)
	=	$k_y \pi^2 (D_x D_y)^{1/2} / (t_y \ell^2)$
k_x	=	4 for $\ell/b \geq 1$
	=	$\frac{1}{\phi_x^2} + 2\rho + \phi_x^2$ for $\ell/b < 1$
k_y	=	4 for $b/\ell \geq 1$
	=	$\frac{1}{\phi_y^2} + 2\rho + \phi_y^2$ for $b/\ell < 1$
ϕ_x	=	$(\ell/b)(D_y/D_x)^{1/4}$
ϕ_y	=	$(b/\ell)(D_x/D_y)^{1/4}$
D_x	=	$EL_x/s_x(1 - \nu^2)$
D_y	=	$EL_y/s_y(1 - \nu^2)$
	=	$Et^3/12(1 - \nu^2)$ if no stiffener in the transverse direction
ρ	=	$[(I_{px}I_{py})/(I_xI_y)]^{1/2}$
t	=	thickness of the plate, in cm (in.)
ℓ, b	=	length and width of stiffened panel, respectively, in cm (in.)
t_x, t_y	=	equivalent thickness of the plate and stiffener in the longitudinal and transverse direction, respectively, in cm (in.)
	=	$(s_x t + A_{sx})/s_x$ or $(s_y t + A_{sy})/s_y$
s_x, s_y	=	spacing of stiffeners and girders, respectively, in cm (in.)
A_{sx}, A_{sy}	=	sectional area of stiffeners and girders, excluding the associated plate, respectively, in cm (in.)
I_{px}, I_{py}	=	moment of inertia of the effective plate alone about the neutral axis of the combined cross section, including stiffener and plate, in cm ⁴ (in ⁴)
I_x, I_y	=	moment of inertia of the stiffener with effective plate in the longitudinal or transverse direction, respectively, in cm ⁴ (in ⁴). If no stiffener, the moment of inertia is calculated for the plate only.
E	=	modulus of elasticity, 2.06×10^7 N/cm ² (2.1×10^6 kgf/cm ² , 30×10^6 lbf/in ²) for steel
ν	=	Poisson's ratio, 0.3 for steel
P_r	=	proportional linear elastic limit of the structure, which may be taken as 0.6 for steel
σ_0	=	specified minimum yield point of the material, in N/cm ² (kgf/cm ² , lbf/in ²)
η	=	maximum allowable strength utilization factor, as defined in Subsection 1/11 and 3/1.7