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Errata 1

Section 2

Reformatted fractions for the following standard titles:

ASTM E186, *Standard Reference Radiographs for Heavy-Walled (2 to 4$^1/_2$ in. (50.8 to 114 mm)) Steel Castings*
ASTM E280, *Standard Reference Radiographs for Heavy-Walled (4$^1/_2$ to 12 in. (114 to 305 mm)) Steel Castings*

Section 5.4.4.3, Table 4

Changed 0.12 to 0.0012

FPSO	$0.0012 \times (H_{\text{sig}})^2 \geq 0.07$

Section 11.1.5.1

Changed title to “Fracture Toughness of Critical Components”

Section E.2

Removed division slash between E and I variables in fraction denominator:

$$q_1^2 = \frac{F_{\text{buc}}}{E_1 I_1} \qquad \text{(E.8)}$$

$$q_2^2 = \frac{F_{\text{buc}}}{E_2 I_2} \qquad \text{(E.9)}$$

Section F.3

Changes outlined on the following pages.

F.3 Calculation of Wire Rope Design Factors

F.3.1 Load Hoist Rope

The design factor for the main hoist wire rope is calculated using Equation (26) and Equation (27) for running rigging:

$$DF_{W_{gen}} = 3 \leq \frac{10{,}000}{0.004 \times SWLH + 1910} \leq 5.$$

$$DF_{W_{SWLH}} = 2.25 \times C_V \geq DF_{W_{gen}}.$$

From above SWLH = 20,000 lb and $C_v = 2.194$, so:

$$DF_{W_{gen}} = \frac{10{,}000}{0.004 \times 20{,}000 + 1910} = 5.03, \textit{which is greater than } 5, \textit{so } DF_{W_{gen}} = 5.$$

$$DF_{W_{SWLH}} = 2.25 \times 2.194 = 4.94, \textit{which is less than } DF_{W_{gen}}, \textit{so } DF_{W_{SWLH}} = 5.$$

Bearing efficiencies in the rope are calculated using Equation 30:

$$E = \frac{K_b^N - 1}{K_b^S \times N \times (K_b - 1)}$$

where

E is the reeving system efficiency;

K_b is the bearing constant: 1.045 for bronze bushings or 1.02 for roller bearings;

N is the number of line parts; and

S is the total number of sheaves in reeving system.

The main hoist has $N = 2$ parts of line; therefore, it has $S = 2$ sheaves. Assuming it has roller bearings ($K_b = 1.02$), the efficiency can be calculated as:

$$E = \frac{1.02^2 - 1}{1.02^2 \times 2 \times (1.02 - 1)} = 0.971$$

The minimum wire rope breaking strength for the main hoist is calculated using Equation (31):

$$BL_{load} = \frac{W_{SWLH} \times DF_{W_{SWLH}}}{N \times E}$$

where

BL_{load} is the required minimum nominal breaking load for a single wire rope in lb (load line); and

W_{SWLH} is the wire rope load due to (or a function of) SWLH, as defined by 7.2.2.6 in lb.

The wire rope load in this case is the SWLH = 20,000 lb, so the required minimum breaking strength is:

$$BL_{load} = \frac{20{,}000 \times 5}{2 \times 0.971} = 51{,}505\ lb$$

F.3.2 Boom Hoist Rope

Assuming the crane has a cable suspended boom, the running rigging of the boom suspension uses the same DF as the main hoist. For simplicity, this example excludes the effects of wind, offload, and sideload. The boom suspension has $N = 8$ parts of line and $S = 8$ sheaves. Using the geometry of the specific crane and working radius, a factor that relates the load at the boom tip (i.e. on the hook) to a load in the suspension system can be calculated. For this crane, this suspension factor (SF) is 2.6.

The reeving system efficiency is calculated as:

$$E = \frac{1.02^8 - 1}{1.02^8 \times 8 \times (1.02 - 1)} = 0.916$$

The minimum wire rope breaking strength for the boom hoist is calculated using Equation (32):

$$BL_{boom} = \frac{W_{SWLH} \times DF_{W_{SWLH}} + W_{gen} \times DF_{W_{gen}}}{N \times E}$$

where

BL_{boom} is the required minimum nominal breaking load for a single wire rope in lb (boom line); and

W_{gen} is the wire rope load not due to (thus, not a function of) SWLH, as defined by 7.2.2.6 in lb.

The load in the suspension system is a combination of the weight of the boom and the SWLH. The vertical load at the boom point required to support the 25,000 lb boom is 13,700 lb. The resultant wire rope load of each is:

$$W_{SWLH} = SWLH \times SF = 20{,}000 \times 2.6 = 52{,}000\ lb$$

$$W_{gen} = Vertical\ Boom\ Weight \times SF = 13{,}700 \times 2.6 = 35{,}620\ lb$$

The required wire rope breaking strength for the boom hoist rope is:

$$BL_{boom} = \frac{52{,}000 \times 5 + 35{,}620 \times 5}{8 \times 0.916} = 59{,}784\ lb$$

F.3.3 Pendant Lines

This crane also has two static pendant lines that connect the bridle to the boom point. The load in these is the same as the boom suspension. The design factor is calculated using Equation (28) and Equation (29).

$$DF_{W_{gen}} = 3 \leq \frac{10{,}000}{0.0025 \times SWLH + 2444} \leq 4.$$

$$DF_{W_{SWLH}} = 2.0 \times C_V \geq DF_{W_{gen}}.$$

From above, SWLH = 20,000 lb and $C_v = 2.194$, so:

$$DF_{W_{gen}} = \frac{10{,}000}{0.0025 \times 20{,}000 + 2444} = 4.01, which\ is\ greater\ than\ 4, so\ DF_{W_{gen}} = 4.$$

$$DF_{W_{SWLH}} = 2.0 \times 2.194 = 4.39, which\ is\ greater\ than\ DF_{W_{gen}}, so\ DF_{W_{SWLH}} = 4.39.$$

The minimum breaking strength for each pendant is:

$$BL_{pendant} = \frac{52{,}000 \times 4.39 + 35{,}620 \times 4}{2} = 185{,}380\ lb$$