

SECTION F

THERMAL BEHAVIOR OF WIRE-ROPE CABLE INTERMEDIATE RAILINGS

F.1—TEMPERATURE INCREASE VS. PRESTRESS LOAD (SUFFICIENT TO CAUSE LOSS OF 400 lbs. PRESTRESS LOAD)

F.1.1—1/8" WIRE ROPE CABLE

Prestress Force:	$F_{ps} := 400 \cdot \text{lbf}$			
Diameter of Wire Rope:	$D := 0.125 \cdot \text{in}$	Area of Wire Rope:	$A := \frac{\pi \cdot D^2}{4}$	$A = 0.012 \text{ in}^2$
Thermal Expansion Coefficient for Wire Rope Cable:	$\alpha = 9.6 \times 10^{-6} \frac{\text{in}}{\text{in} \cdot ^\circ\text{F}}$			
Temperature Change to Cause Loss of Prestress:	$\Delta T := \frac{F_{ps}}{\alpha \cdot E_{eff} \cdot A}$		$\Delta T = 208.3^\circ\text{F}$	
Effective Thermal Expansion Coefficient (See Section A):	$\alpha_{eff} = 6.35 \times 10^{-6} \frac{\text{in}}{\text{in} \cdot ^\circ\text{F}}$			
Temperature Change to Cause Loss of Prestress:	$\Delta T := \frac{F_{ps}}{\alpha_{eff} \cdot E_{eff} \cdot A}$		$\Delta T = 314.9^\circ\text{F}$	

F.1.2—3/16" WIRE ROPE CABLE

Prestress Force:	$F_{ps} := 400 \cdot \text{lbf}$			
Diameter of Wire Rope:	$D := 0.1875 \cdot \text{in}$	Area of Wire Rope:	$A := \frac{\pi \cdot D^2}{4}$	$A = 0.028 \text{ in}^2$
Thermal Expansion Coefficient for Wire Rope Cable:	$\alpha = 9.6 \times 10^{-6} \frac{\text{in}}{\text{in} \cdot ^\circ\text{F}}$			
Temperature Change to Cause Loss of Prestress:	$\Delta T := \frac{F_{ps}}{\alpha \cdot E_{eff} \cdot A}$		$\Delta T = 92.6^\circ\text{F}$	
Effective Thermal Expansion Coefficient (See Section A):	$\alpha_{eff} = 6.35 \times 10^{-6} \frac{\text{in}}{\text{in} \cdot ^\circ\text{F}}$			
Temperature Change to Cause Loss of Prestress:	$\Delta T := \frac{F_{ps}}{\alpha_{eff} \cdot E_{eff} \cdot A}$		$\Delta T = 140^\circ\text{F}$	

F.1.3—1/4" WIRE ROPE CABLE

Prestress Force:	$F_{ps} := 400 \cdot \text{lbf}$			
Diameter of Wire Rope:	$D := 0.25 \cdot \text{in}$	Area of Wire Rope:	$A := \frac{\pi \cdot D^2}{4}$	$A = 0.049 \text{ in}^2$
Thermal Expansion Coefficient for Wire Rope Cable:	$\alpha = 9.6 \times 10^{-6} \frac{\text{in}}{\text{in} \cdot ^\circ\text{F}}$			
Temperature Change to Cause Loss of Prestress:	$\Delta T := \frac{F_{ps}}{\alpha \cdot E_{\text{eff}} \cdot A}$			$\Delta T = 52.1 \text{ }^\circ\text{F}$
Effective Thermal Expansion Coefficient (See Section A):	$\alpha_{\text{eff}} = 6.35 \times 10^{-6} \frac{\text{in}}{\text{in} \cdot ^\circ\text{F}}$			
Temperature Change to Cause Loss of Prestress:	$\Delta T := \frac{F_{ps}}{\alpha_{\text{eff}} \cdot E_{\text{eff}} \cdot A}$			$\Delta T = 78.7 \text{ }^\circ\text{F}$

F.1.4—5/16" WIRE ROPE CABLE

Prestress Force:	$F_{ps} := 400 \cdot \text{lbf}$			
Diameter of Wire Rope:	$D := 0.3125 \cdot \text{in}$	Area of Wire Rope:	$A := \frac{\pi \cdot D^2}{4}$	$A = 0.077 \text{ in}^2$
Thermal Expansion Coefficient for Wire Rope Cable:	$\alpha = 9.6 \times 10^{-6} \frac{\text{in}}{\text{in} \cdot ^\circ\text{F}}$			
Temperature Change to Cause Loss of Prestress:	$\Delta T := \frac{F_{ps}}{\alpha \cdot E_{\text{eff}} \cdot A}$			$\Delta T = 33.3 \text{ }^\circ\text{F}$
Effective Thermal Expansion Coefficient (See Section A):	$\alpha_{\text{eff}} = 6.35 \times 10^{-6} \frac{\text{in}}{\text{in} \cdot ^\circ\text{F}}$			
Temperature Change to Cause Loss of Prestress:	$\Delta T := \frac{F_{ps}}{\alpha_{\text{eff}} \cdot E_{\text{eff}} \cdot A}$			$\Delta T = 50.4 \text{ }^\circ\text{F}$

F.1.5—3/8" WIRE ROPE CABLE

Prestress Force: $F_{ps} := 400 \cdot \text{lbf}$

Diameter of Wire Rope: $D := 0.375 \cdot \text{in}$

Thermal Expansion Coefficient for Wire Rope Cable: $\alpha = 9.6 \times 10^{-6} \frac{\text{in}}{\text{in} \cdot ^\circ\text{F}}$

Area of Wire Rope: $A := \frac{\pi \cdot D^2}{4}$ $A = 0.11 \text{ in}^2$

Temperature Change to Cause Loss of Prestress: $\Delta T := \frac{F_{ps}}{\alpha \cdot E_{\text{eff}} \cdot A}$ $\Delta T = 23.1 \text{ } ^\circ\text{F}$

Effective Thermal Expansion Coefficient (See Section A): $\alpha_{\text{eff}} = 6.35 \times 10^{-6} \frac{\text{in}}{\text{in} \cdot ^\circ\text{F}}$

Temperature Change to Cause Loss of Prestress: $\Delta T := \frac{F_{ps}}{\alpha_{\text{eff}} \cdot E_{\text{eff}} \cdot A}$ $\Delta T = 35 \text{ } ^\circ\text{F}$