V-Belts

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+ The analysis of V-belts can be consisted in the steps below:

① Find V, L_p, C, ϕ and $\exp(0.5123\phi)$

$$V = \frac{\pi d n}{12} \quad [\text{ft/min}]$$

$$L_p = 2C + \pi(D + d)/2 + (D - d)^2/(4C) \qquad (17\text{–}16a)$$

$$C = 0.25\left\{\left[L_p - \frac{\pi}{2}(D + d)\right] + \sqrt{\left[L_p - \frac{\pi}{2}(D + d)\right]^2 - 2(D - d)^2}\right\} \qquad (17\text{–}16b)$$

$$\phi = \theta_d = \pi - 2\sin^{-1}\frac{(D-d)}{2C}$$

② Find H_d, H_a and N_b

$$H_d = H_{\text{nom}} K_s n_d$$

$$H_a = K_1 K_2 H_{\text{tab}}$$

where H_a = allowable power, per belt
K_1 = angle-of-wrap (ϕ) correction factor, Table 17–13
K_2 = belt length correction factor, Table 17–14

$$N_b \geq \frac{H_d}{H_a} \qquad N_b = 1, 2, 3, \ldots$$

③ Find F_c, ΔF, F_1, F_2, F_i and n_{fs}.

$$F_c = K_c\left(\frac{V}{1000}\right)^2$$

$$F_2 = F_1 - \Delta F$$

$$\Delta F = \frac{63\,025 H_d / N_b}{n(d/2)}$$

$$F_i = \frac{F_1 + F_2}{2} - F_c$$

$$F_1 = F_c + \frac{\Delta F \exp(f\phi)}{\exp(f\phi) - 1}$$

$$n_{fs} = \frac{H_a N_b}{H_{\text{nom}} K_s}$$

④ Find N_p and ϵ if possible

$$N_P = \left[\left(\frac{K}{T_1}\right)^{-b} + \left(\frac{K}{T_2}\right)^{-b}\right]^{-1}$$

$$t = \frac{N_P L_p}{720V}$$

$$T_1 = F_1 + \frac{K_b}{d}$$

$$T_2 = F_1 + \frac{K_b}{D}$$