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Determination of winder sets per reel

Scope

This is a set of equations that can be used by paper mill superintendents and engineers during their day to day operation of the paper machine. The Papermakers Committee would welcome any additions or corrections that will make these calculations more useful.

Safety precautions

Anyone working around winders & reels needs to be well trained in the hazards associated with working in this area. The use of these equations will not cause hazard conditions but collection of data to make some of these calculations, will present situations where expertise in the safety requirements is absolutely necessary.

Content

Calculations

The formula for Calculation Number of sets per Reel for Various Reel and Roll Diameters:

$$S = \frac{[(D_1)^2 - (D_2)^2]}{[(D_3)^2 - (D_4)^2]}$$

where:

- S = No. of Sets Per Reel
- D₁ = Diameter of Total Reel (including reel core)
- D₂ = Diameter of Reel Core
- D₃ = Diameter of Total Core(including roll core)
- D₄ = Diameter of Roll Core

Example 1:

To determine the number of sets of 1270mm (50 in.) diameter rolls with 102mm (4 in.) diameter core that can be wound from a 1829 mm (72 in.) diameter (including reel core) reel with a 406 mm (16 in.) diameter reel core.

Total Reel Diameter (including core)	= 1829 mm (72 in.)
Reel Core Diameter	= 406 mm (16 in.)
Total Roll Diameter (including core)	= 1270 mm (50 in.)
Roll Core Diameter	= 102 mm (4 in.)

$$S = \frac{[(D_1)^2 - (D_2)^2]}{[(D_3)^2 - (D_4)^2]}$$

$$= \frac{[(1829)^2 - (406)^2]}{[(1270)^2 - (102)^2]} \quad \frac{[(72)^2 - (16)^2]}{[(50)^2 - (4)^2]}$$

$$= \frac{[3345241 - 164836]}{[1612900 - 10404]} \quad \frac{[5184 - 256]}{[2500 - 16]}$$

$$= \frac{3180405}{1602496} \quad \frac{4928}{2484}$$

$$= 1.98 \text{ (say 2 sets)}$$

Formula for Calculating the Reel Diameter Required for Various Roll Diameters and Number of Sets:

$$D_1 = \sqrt{S[(D_3)^2 - (D_4)^2] + (D_2)^2}$$

where:

- S = No. of Sets Per Reel
- D₁ = Diameter of Total Reel (including reel core)
- D₂ = Diameter of Reel Core
- D₃ = Diameter of Total Core
- D₄ = Diameter of Roll Core

Example 2:

To determine the reel diameter required, using a 406mm (16 in) diameter reel core, to produce 2 sets of 1270 (50 in.) diameter rolls on a 102 mm (4 in.) roll core.

$$D_1 = \sqrt{S[(D_3)^2 - (D_4)^2] + (D_2)^2}$$

$$= \sqrt{2[(1270)^2 - (102)^2] + (406)^2} \quad \sqrt{2[(50)^2 - (4)^2] + (16)^2}$$

$$= \sqrt{2[(1612900 - 10404)] + 164836} \quad \sqrt{2[(2500 - 16)] + 256}$$

$$= \sqrt{2(1602496) + 164836} \quad \sqrt{2(2484) + 256}$$

$$= \sqrt{3369828} \quad \sqrt{5224}$$

$$= 1836 \text{ mm} \quad 72 \text{ in.}$$