

ROLLER CHAIN DESIGNER GUIDE

Engineering design guide for roller chain drive systems — selection formulas, service factors, and calculation examples.

1. Design Procedure

- 1. Determine required speed and power (or torque) at driven shaft
- 2. Identify driving source and load characteristics
- 3. Select service factor based on application
- 4. Calculate design power = Rated power × Service factor
- 5. Select chain pitch based on speed and design power
- 6. Select sprocket sizes (driver and driven) for required ratio
- 7. Calculate chain length and center distance
- 8. Verify selected chain meets all requirements
- 9. Select lubrication method

2. Service Factors

DRIVEN MACHINE	SMOOTH (ELECTRIC MOTOR)	MODERATE SHOCK	HEAVY SHOCK
Centrifugal pumps/blowers	1.0	1.1	1.3
Conveyors (uniform load)	1.0	1.2	1.4
Conveyors (variable load)	1.2	1.3	1.5
Crushers/mills	1.4	1.5	1.7
Elevators/bucket	1.2	1.4	1.6
Mixers (variable density)	1.3	1.4	1.6

3. Chain Pitch Selection

SPEED (RPM OF SMALL SPROCKET)	MAX RECOMMENDED PITCH
3000+ RPM	#40 (1/2")
2000 – 3000 RPM	#50 (5/8")
1000 – 2000 RPM	#60 (3/4")
500 – 1000 RPM	#80 (1")
200 – 500 RPM	#100 (1-1/4")
100 – 200 RPM	#120 – #140 (1-1/2" – 1-3/4")

Under 100 RPM

#160 (2") or larger

4. Sprocket Size Selection

PARAMETER	GUIDELINE
Min teeth (driver)	17 for smooth operation (12 absolute min)
Preferred driver teeth	21-25 for best chain life
Max ratio (single reduction)	6:1 (use 7:1 max with care)
Max teeth (driven)	120 (larger causes impractical size)

5. Chain Length Calculation

Chain length (pitches) = $(2 \times C / P) + (N1 + N2) / 2 + ((N2 - N1) / (2\pi))^2 \times (P / C)$

C	Center distance (same units as pitch)
P	Chain pitch
N1	Teeth on small (driver) sprocket
N2	Teeth on large (driven) sprocket

Round to the nearest even number of pitches. If the result is odd, round up and use a half-link, or adjust center distance.

6. Center Distance

Preferred center distance = 30 to 50 pitches. Minimum = sprocket OD + sprocket OD + 50mm. Maximum = 80 pitches (beyond this, add idler).

NEED DRIVE DESIGN HELP?

Uniking Canada provides complete chain drive design and engineering.

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