

8.4 Cool Type

8.4.1 Extra High Dm-N Value Ballscrew - Cool Type I



• Cool type I:

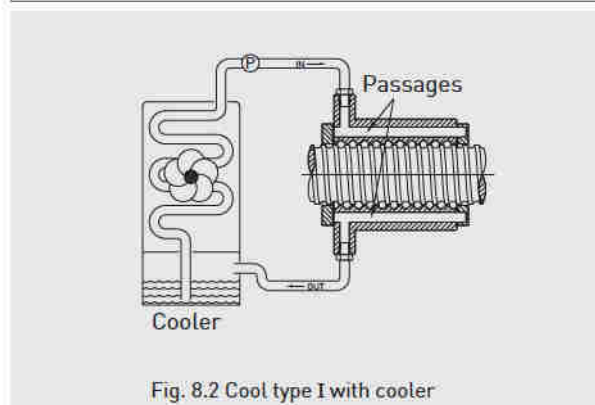
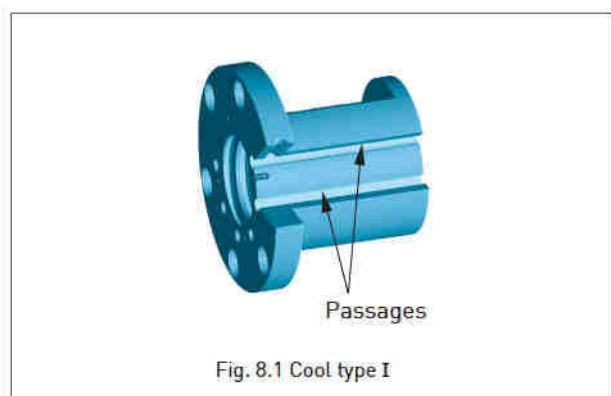
- New era for high speed ballscrew - achieving extra high Dm-N value (up to 200,000) and high positioning accuracy.
- Cool type I and a hollow shaft design.
- High speed machine tools and machining center.

• Design Principle:

The cool type series features forced cooling fluid passing through the nut, to minimize heat generation and thermal expansion during ballscrew operation.

- Cool type I as shown in the Figure 8.1:

Flowing fluids are circulated in passages inside the nut, and exchanges heat with the cooler as shown in the Figure 8.2. In cooperation with the hollow shaft design, it creates high quality thermal control and maintains high accuracy. This combination is most suitable for high-speed machine tools.



• Specification:

1. We recommend shaft a diameter above $\varnothing 32\text{mm}$ for cool type design.
2. Nut type: FSV, FSW, PFDW, OFSW, DFSV, FSH, FSI, etc.
3. Please contact HIWIN with other specifications you need.
4. The cool type I, compared with standard specifications, will cause a minor external dimension change of the nut, please contact HIWIN.

• Specification number:

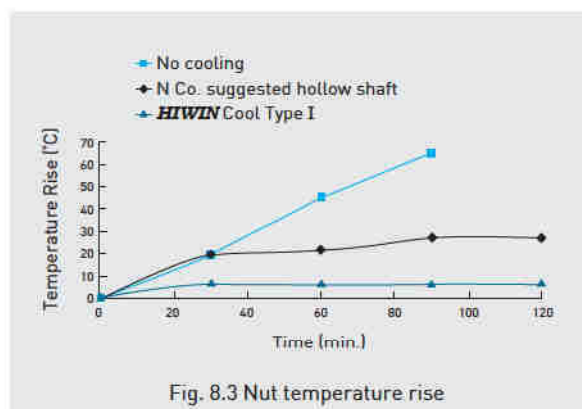
Example: R50 - 30C1 - OFSWC1 - 1180 - 1539 - 0.008

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C1: HIWIN cool type ballscrew for type I

• Performance Comparison:

For high-speed machine tools, the hollow shaft design only is not enough protection against heat generation and thermal expansion, because nut itself is a heat source, as shown in Figure 8.3.

Test condition :
 specification : $\varnothing 50$, lead 30 mm
 speed : 2500 rpm (75 m/min).
 back and forth feed continuously
 acceleration : 9.8 m/sec²
 stroke : 1180 mm
 preload : 205 kgf
 moving weight : 300 kgf
 cooling rate : oil 2.5 liter/min
 inlet temperature : 16°C
 room temperature : 25°C



Cool type I Performance (1)

Specification: $\varnothing 50$, lead 30 mm
 Dm-N value: 150,000
 Acceleration: 9.8 m/sec²

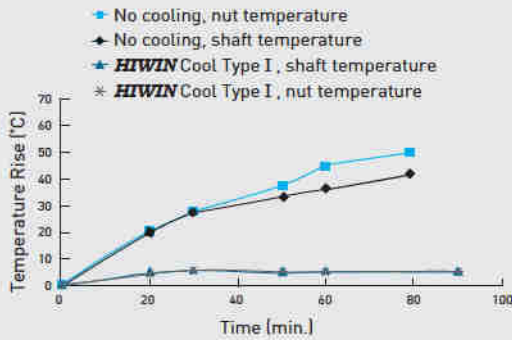


Fig. 8.4 Cool type I: Temperature rise of ballscrew

Cool type I Performance (2)

Specification: $\varnothing 50$, lead 30 mm
 Dm-N value: 200,000
 Acceleration: 9.8 m/sec²

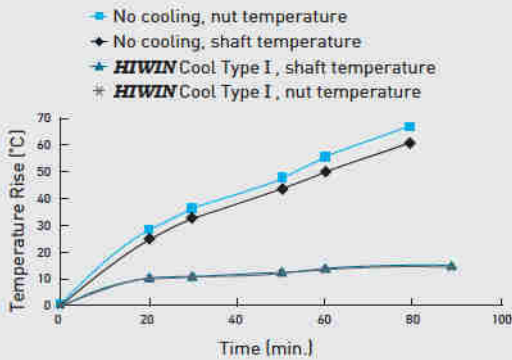


Fig. 8.5 Cool type I: Temperature rise of ballscrew

• Features:

- 1. Optimized design for high reliability:**
Through use of computer simulation and FEM analysis, the cool type ballscrew features excellent thermal protection and high reliability.
- 2. Promote higher speed rotation and extra high Dm-N value (up to 200,000):**
Cool type ballscrews will eliminate high-speed rotation aftereffect, i. e., thermal problems, and promote higher speed rotation.
- 3. Prevent thermal distortion:**
Optimized heat transfer design minimizes heat generation and prevents thermal distortion.
- 4. Strengthen durability:**
When operating repeatedly, friction between balls causes heat generation. That may cause balls to oxidize or decarburize, and shorten the service life. Cool type ballscrews will strengthen durability under a cooling environment.
- 5. Extended lubricant life cycle:**
When using lubrication, minimum heat generation further inhibits deterioration in the quality of lubrication and extends the lubricant life cycle.
- 6. Keep temperature uniform and reduce warm-up time:**
During high-speed operation, nut and shaft cooling effect keeps feed-system temperature constant and reduces warm-up time.
- 7. Higher feeding accuracy:**
Cooling effect of cool type ballscrew will stabilize against thermal expansion and equalize feeding accuracy.

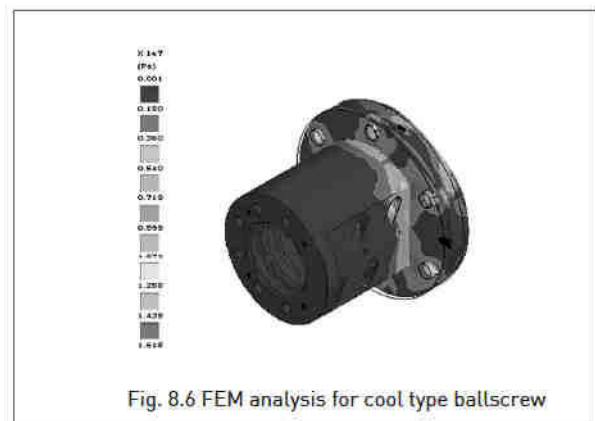


Fig. 8.6 FEM analysis for cool type ballscrew