



Piston Rings - SOP (Standard operating Procedure)

Phase 1: Foundry & Initial Processing

Foundry Shop

Rings are cast from molten iron into rough circular forms. Initial dimensions and surface finishes are significantly different from the final product.

1. Semi-Finish Side Face Grinding

The first "ring plant" process. Rings are ground to establish initial dimensional control.

Target Axial Height: 0.83 mm (± 0.015 mm)

2. Solvent Wash

Rings are cleaned in solvent to remove:

- Rust
 - Dirt
 - Grinding debris
-

3. Heat Treatment

A critical step to alter molecular structure, reduce brittleness, and increase strength.

Process Parameters:

- **Temperature:** 530°C
- **Duration:** 30 minutes
- **Cooling Method:** Air-cooled

Result: The process ensures the ring becomes totally flat.

Phase 2: Precision Machining & Geometry

4. Diskas Machine

Final finish of the side faces. The axial height is brought to precise tolerances.



Target Axial Height: 0.8 mm (-0.01, -0.02 mm)

5. Washing

Second solvent wash to maintain cleanliness and prepare the surface for subsequent operations.

6. Demagnetisation

Removes magnetic properties caused by friction in grinding machines, which prevent rust and dirt from sticking.

Process: Counter-magnetic force applied for several minutes.

7. Cam Turning

Creates the essential oval shape required for piston suitability.

Cam Parameters:

- **Cam %:** 10
 - **E-value:** 7151.95
 - **TSO-dia:** 53.63
 - **D-150-dia:** 53.28
-

8. Gap Cutting

A side cut is made to provide flexibility for liner contact.

Close Gap Calculation: $D + 0.05 (\pm 0.1 \text{ mm})$

9. Solvent Wash

Removal of cutting debris to ensure surface cleanliness.

10. Demagnetization

Magnetic levels reduced to ensure proper surface characteristics.

Maximum Gauss Level: 15 gauss



Phase 3: CNC Work & Edge Profiling

11. Taper Turning (CNC)

Reduces contact surface area to lower friction and save energy.

Controlled Parameters:

- Tool pitch
- Spacer width
- Taper angle
- Radial thickness
- Closed gap

Critical Tolerances:

- **Spacer Width Tolerance:** ± 0.1 mm
- **Taper Angle:** $1^{\circ}55'$
- **Closed Gap:** $(D + 0.2)$

12. OD Gap Edge Chamfer

Performed only if specified on the process card to reduce energy loss during operation.

13. Finish Gap Grinding

Ensures a smooth gap surface. This prevents engine efficiency loss and ensures a proper fit within the piston.

14. ID Gap Edge Chamfering

Similar to OD chamfering; helps reduce energy loss.

Maximum Chamfer: 0.2 mm

15. Washing & Drying



Process:

- Cleaned in solvent
 - Dried using high-pressure air
-

Phase 4: Finishing & Quality Control

16. Beldering (Side Face)

Removes burrs (unwanted edges) from the gap-cutting process.

Purpose:

- Prevents jamming
- Reduces friction

Note

Usually occurs on the inner side and can impact axial height.

17. Straight Honing

Performed on a vertical honing machine using a mandrel, oil, and emery paste.

Specifications:

- **Outer Diameter Finish:** $D + 0.00$
 - **Light Thickness:** 100%
-

18. Final Side Face Grinding

Corrects any height variations or undercuts to achieve the absolute final axial height.

19. Solvent Wash

Final cleaning to remove all residual contaminants.

20. Final Demagnetization

Magnetic properties reduced to final specification.

Maximum Gauss Level: 10 gauss



21. CRI Inspection

The final quality gate where rings are approved for export.

Purpose:

1. Dimensional verification
2. Surface quality assessment
3. Compliance with export standards

Summary

This 21-step manufacturing process transforms rough cast iron rings into precision-engineered piston rings through controlled machining, heat treatment, and rigorous quality control. Each phase builds upon the previous one to achieve the exact dimensional tolerances, surface finishes, and mechanical properties required for optimal engine performance.

Key Process Highlights:

- **Heat Treatment** at 530°C ensures structural integrity
- **Cam Turning** creates the critical oval geometry
- **CNC Taper Turning** optimizes friction and energy efficiency
- **Multiple Demagnetization** steps prevent contamination
- **Final CRI Inspection** guarantees export-ready quality