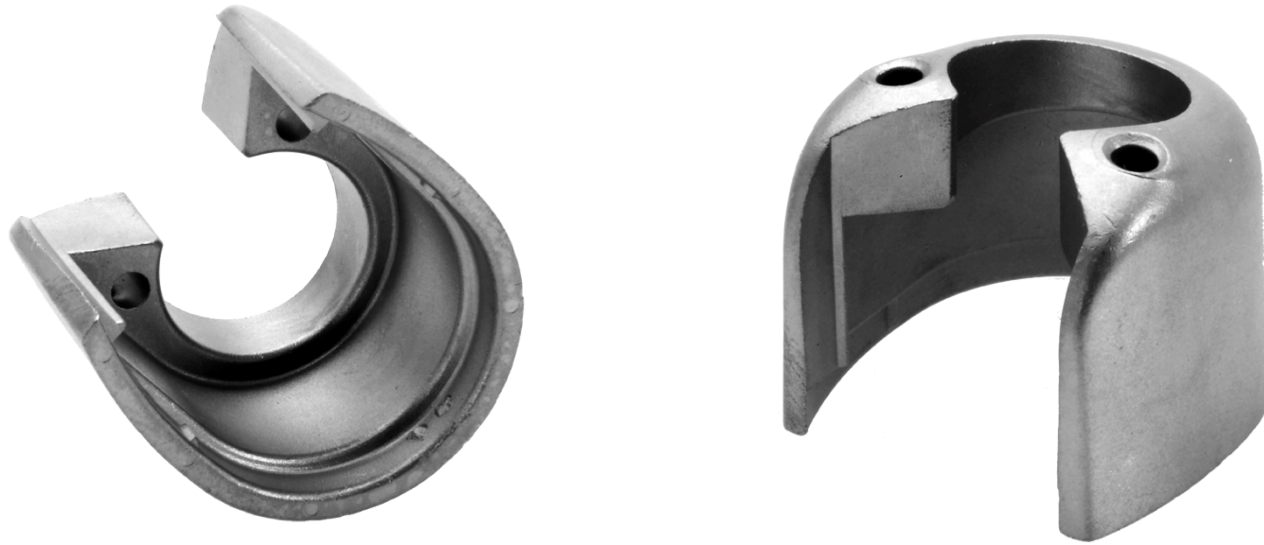


MIM Case Study—End Cap



Application: firearms

Functional requirements: cosmetic; good fit on end of stock

Competing technologies: casting (on a good day)

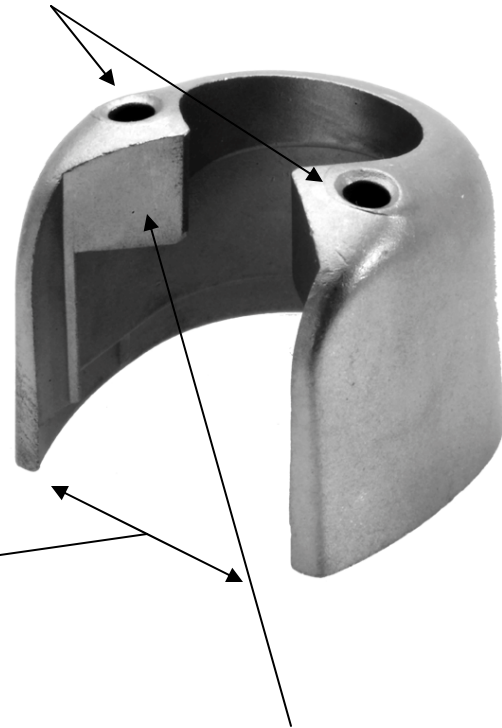
Overall size: L x W x H = 32 mm x 29 mm x 25 mm

Part weight: 42 grams

Material: MIM-4605, as-sintered

Key Characteristics—End Cap

Angled screw holes a challenge for tool design



Outside cosmetic appearance critical; flow lines a problem, good black oxide needed

Side-side distortion

Gravity-induced distortion
(all fall down)

MIM Case Study—End Cap

- Why MIM?
 - Replication of details (curvature, angled holes, small detailed steps) in MIM was excellent
 - Black-oxidized steel was a requirement for a firearms application
 - Cosmetic results of MIM superior to casting
 - Economics of MIM much better than machining

MIM Case Study—End Cap

- MIM Issues
 - Low volume part (5,000 per year)
 - Able to be handled with a one-cavity tool
 - Difficult to recoup engineering costs
 - Distortion
 - A 3-step coining process was needed
 - Parts were processed as-sintered; heat treatment not recommended for this complicated a shape
 - Cosmetics
 - Gate located off critical surfaces
 - Close inspection needed at molding to ensure minimal flow visual marks

MIM Case Study—End Cap

- Economics
 - Marginal for fabricator but a reasonable deal for the customer, even though the tool and up-front engineering was not cheap. They really didn't have many choices other than MIM
 - The coining process was expensive but anticipated and factored into the part cost
- Conclusion
 - Marginal application for MIM
 - Product line ended up discontinued