Custom Zirconia Ceramic Plunger Manufacturer

Y■TZP and Mg■PSZ pump plungers made to your drawing. Engineering review for OEMs, pump manufacturers and industrial buyers — from prototype enquiries to production orders.

Y■TZP + Mg■PSZ	CUSTOM TO DRAWING	PROTOTYPE → PRODUCTION
Grade options to review	Part geometry and requirements	Single parts, pilot and volume RFQs

Need a prototype or a production quotation?

Send your drawing, operating conditions and target quantity. MAC's engineering team reviews manufacturability, material selection, construction, finishing and inspection requirements before quotation.

UPLOAD DRAWING & REQUEST A QUOTE
Prototype, pilot and production enquiries welcome

What this guide helps you specify

MATERIAL	CONSTRUCTION	FINISH & GEOMETRY
Y■TZP or Mg■PSZ candidate grade, based on temperature, media, load and failure mode.	Solid ceramic, shrink-fit sleeve or bonded sleeve; define the ceramic-to-metal interface.	OD, Ra, roundness, straightness, cylindricity, chamfers and packing contact length.

Applications to discuss with engineering

Waterjet and hydroblasting pumps · HPLC and precision dosing pumps · Chemical injection and process pumps · Slurry and oilfield injection systems · Diesel fuel-injection and heavy-duty engine systems

Start your RFQ with three groups of information

PART DEFINITION	OPERATING DUTY	ORDER REQUIREMENTS
2D drawing, 3D model, revision, OD, length, critical features and construction.	Pressure, stroke, speed, media, pH, temperature, abrasives and packing material.	Prototype quantity, pilot quantity, production forecast, inspection and documentation needs.

No finished drawing? Start with a dimensioned sketch and the operating information available. The RFQ review can identify missing inputs before a quotation is prepared.

1. Define the operating duty first

Do not select a zirconia grade from one property number. Share the application conditions and the failure mode you need to control. Exact grade formulation, processing route, component geometry and test basis matter.

INPUT	WHAT TO PROVIDE	WHY IT MATTERS
Pressure	Working, peak and transient pressure; pressure cycle if known.	Stress and cyclic duty.
Motion	Stroke, speed/strokes per minute, duty cycle and start/stop frequency.	Fatigue, wear and heat generation.
Media	Fluid/chemicals, concentration, pH, solids, abrasives and cleaning agents.	Chemical exposure and surface wear.
Temperature	Normal, peak and transient temperature; hot-water/steam exposure.	Aging, fit, bond and thermal stress.
Sealing	Packing/seal material, contact length, lubrication and leakage limits.	Finish and geometry requirements.
Failure history	Cracking, chipping, scoring, leakage, wear location and service hours.	Helps identify the failure mechanism.

2. Discuss the zirconia grade

Y■TZP and Mg■PSZ are candidate material families, not interchangeable grades. Selection must be checked against the exact grade data and actual pump duty.

CANDIDATE	WHEN TO EVALUATE	CHECK BEFORE SPECIFYING
Y■TZP (yttria-stabilized)	Where high strength and fine finishing are important to the design.	Hot-water/steam exposure, hydrothermal aging, service temperature, fatigue and exact grade data.
Mg■PSZ (magnesia-stabilized)	Where the specific formulation and operating conditions support the required toughness/temperature profile.	Strength margin, exact grade properties, temperature range, media compatibility and test basis.

Material data boundary: This guide does not publish third-party competitor datasheets or present generic property ranges as MAC-measured values. Ask MAC to identify the proposed grade and provide applicable material documentation with the quotation.

3. Choose the plunger construction

OPTION	DESCRIPTION	SHOW ON YOUR DRAWING
Solid ceramic	One-piece zirconia component; no metal core or sleeve joint.	Overall length, OD, seat/clamp features, supported faces and edge breaks.
Shrink-fit sleeve	Ceramic sleeve assembled over a metal base using controlled interference.	Sleeve/base dimensions, fit definition, materials, assembly method and operating temperature.
Bonded sleeve	Ceramic sleeve joined to a metal base using an adhesive system.	Bond gap, adhesive specification, media/temperature limits, end sealing and inspection.

Ceramic-to-metal interface

Thermal expansion mismatch can change a fit as temperature changes and create stress at the interface. Engineering review should consider the actual ceramic and metal, geometry, assembly process and operating range. Show the base/crosshead material, load-transfer faces, fit or bond design, alignment/runout requirements and environmental exposure.

4. Make the drawing measurable

The examples below explain what to define; they are not default MAC tolerances or universal recommendations. Use the pump OEM drawing and packing supplier requirements to establish actual limits.

CALLOUT	FUNCTION	WHAT TO DEFINE
Outside diameter	Packing squeeze and clearance.	Nominal OD, tolerance, datum and inspection method.
Surface roughness (Ra)	Seal wear, friction and leakage.	Ra limit, contact length, measurement standard, evaluation length and direction.
Roundness	Circumferential packing contact.	Functional limit and inspection method.
Straightness	Contact through the stroke.	Controlled length and datum/reference.
Cylindricity	Combined form of cylindrical surface.	Tolerance zone and inspection method where required.
Chamfer / edge break	Assembly protection and chip prevention.	Angle/size, edge condition and finish.
Packing contact zone	Defines where finish/form apply.	Mark full contact length and stroke zone.

Surface-finish checklist

- State the required Ra across the full packing-contact length.
- Identify the measurement standard and measurement direction.
- Confirm the finish requirement with the packing supplier; the lowest Ra is not automatically best.
- Consider whether Rz/Rt or other surface-texture parameters are required.
- Confirm the specified finish against the actual part geometry and inspection method.

5. Build a complete RFQ package

INCLUDE	DETAILS
Drawing & model	2D drawing with revision and tolerances; 3D STEP/IGES model where available.
Dimensions	OD, overall length, packing-contact length, end features and critical datums.
Operating conditions	Pressure, stroke, speed, duty cycle, media, pH, temperature and solids/abrasives.
Seal details	Packing material, lubrication, finish requirements and leakage target.
Construction	Solid or sleeved; base material; joint/fit/bond details if known.
Quantity & quality	Prototype, pilot or production quantity; inspection reports, certificates and traceability needs.
Failure evidence	Photos, wear pattern, service hours and description of the current issue.

Prototype, pilot or production order?

Tell MAC the quantity required now and expected demand if the part is approved. Include target delivery date, qualification plan, inspection documents, material traceability and packaging requirements. Price and lead time should be confirmed for the specific RFQ.

MAC capability statements requiring confirmation

The following figures appear in the supplied landing-page copy. They are deliberately not presented here as unconditional guarantees. MAC operations/quality must confirm their scope before they are used as firm capabilities.

SOURCE-PAGE CLAIM	CONFIRM BEFORE PROMISING
OD tolerance down to ±0.002 mm	Applicable features/part sizes, inspection method and capability vs. contractual tolerance.
Lapped finish below 0.05 µm Ra; standard 0.2–0.4 µm Ra	Geometry limits, instrument, standard and reporting method.
1.5 mm to 150+ mm diameter; up to 600+ mm long	Finished-part limits by grade, construction and process route.
DFM review/quotation within 24 business hours; prototype from one piece	Service scope, clock start, exclusions and any setup/engineering charges.

Ready to discuss your zirconia plunger?

Send your drawing, operating duty and target quantity. If you do not have a finished drawing, start with a dimensioned sketch and the application details available.

UPLOAD DRAWING & REQUEST A QUOTE
Prototype enquiries and production-volume RFQs welcome

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This document is an RFQ-preparation aid. It does not certify material properties, approve a design, establish a pressure rating, promise service life or guarantee fitness for a particular application. Final grade, dimensions, tolerances, finish, joint design, inspection and lead time must be agreed in the quotation and controlled drawing.