

# HIP Technology

## Hot Isostatic Pressing

For more than 35 years, Kennametal has been a global leader in Hot Isostatic Pressing technology. Now, because of customer demand, we have extended our capabilities beyond tool HIP to include Powder Metallurgical Steels and Bi-Metallics. We employ a world-renowned flexible production process that enables us to quickly react to changing market needs.

**Our HIP products deliver optimum performance and productivity, no matter how challenging your operations.**

### Technical Data of HIP Units

Units	Diameter (mm)	Length (mm)	Maximum Temp. (°C)	Maximum Pressure (bar)
HIP 1	200	500	2000	1000
	247	700	1450	1000
HIP 2	450	1300	2000	1300
HIP 4	600	1700	1400	1100
HIP 3	900	2700	1400	1400

## HIP Redensification Service

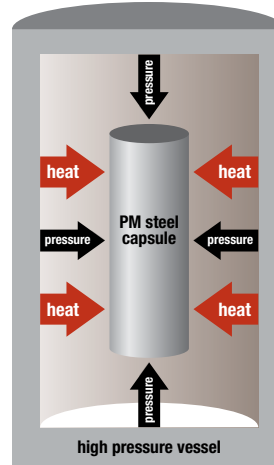
Parts with enclosed porosity can be densified under uniform high pressure and temperature, no encapsulation necessary. Final inspection reveals the increase.



*as casted or sintered*

*after HIP redensification*

Note: Only closed porosity can be totally eliminated.



- Isostatic pressure up to 140 MPa.
- ≤ 2000 °C.

### Kennametal Qualifications

- ISO 9001:2008.
- Norsok M650 Rev. 3 for MDS D44, Rev. 3 (up to 206mm wall thickness).
- Norsok M650 Rev. 4 for MDS D54, Rev. 4 (up to 95mm wall thickness).
- Norsok M650 Rev. 3 for MDS N01, Rev. 3 (up to 186mm wall thickness).
- Redensification qualified from Safran Group, Rolls Royce, and PCC.
- FDA approved.

### General Properties

- Highest possible density.
- Consistent annealed microstructure.
- Exceptionally high static strength (up to 30%).
- Superior dynamic strength (up to 100%).
- Easily polished.
- No new castings required for defective parts.
- No segregation or grain growth.

### Uses

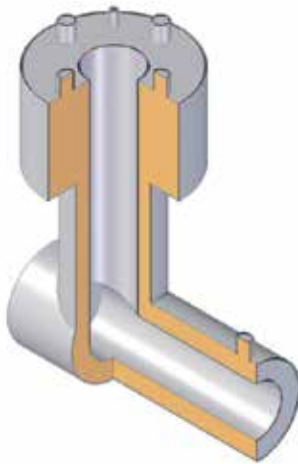
- Hard metals.
- Castings.
- Reannealing.
- Ceramic wear parts.
- Ceramic medical parts.



## Powder Metallurgy

### Near Net Shapes/Solid Powder Metallurgical Steel

Powder must be encapsulated so that gas pressure and heat can be uniformly applied to all surfaces during hot pressing when producing metallurgical parts. After densification, the capsule is stripped. Quality is ensured by ultrasonic measuring and analysis of the polished section. Parts can then be machined to your specifications.



### General Properties

- Maximum abrasion and corrosion resistance.
- High strength (with no porosity).
- Consistent and fine microstructure.
- No phase segregation.



### Materials

- Low carbon steels.
- Tool steels (HSS, etc.).
- Stainless steels (duplex, austenitic, etc.).
- Cobalt- and nickel-based alloys.



### Better Microstructure through HIP



*forged duplex steel*



*HIP duplex steel*

## Bi-Metallics

### Solid/Powder

- Powder and base body encapsulated.
- Pressure and heat uniformly applied to all surfaces.
- Diffusion zone generated.

### Powder/Powder

- Cooling channel could be integrated into body.



### General Properties

- Different material properties combined.
- No phase or zone segregation.
- Uniform microstructure.
- Diffusion bonding.
- Solid coatings thicker than 2mm.
- Special steels and hardfaced layers can be applied.



### Applications

- Plastics and food-extrusion machinery.
- Centrifuges.
- Under-the-sea and off-shore equipment.
- Cutting tools.
- Rolls.
- Valves and pumps.
- Broaches.



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