



Hot Isostatic Pressing (HIP) HIP Services

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Agenda

- What is Hot Isostatic Pressing (HIP)?
- Markets and applications
- Bodycote market position
- Market characteristics
- Barriers to entry
- Summary

What is Hot Isostatic Pressing (HIP)?



A high temperature furnace inside a pressure vessel

Principles of HIP

HOT

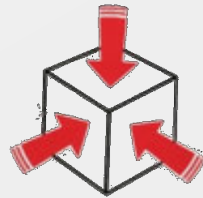
Up to 2300°C

ISOSTATIC

Pascal's Law:

In a fluid, pressure is transmitted equally in all directions.

Fluid = Argon or Nitrogen

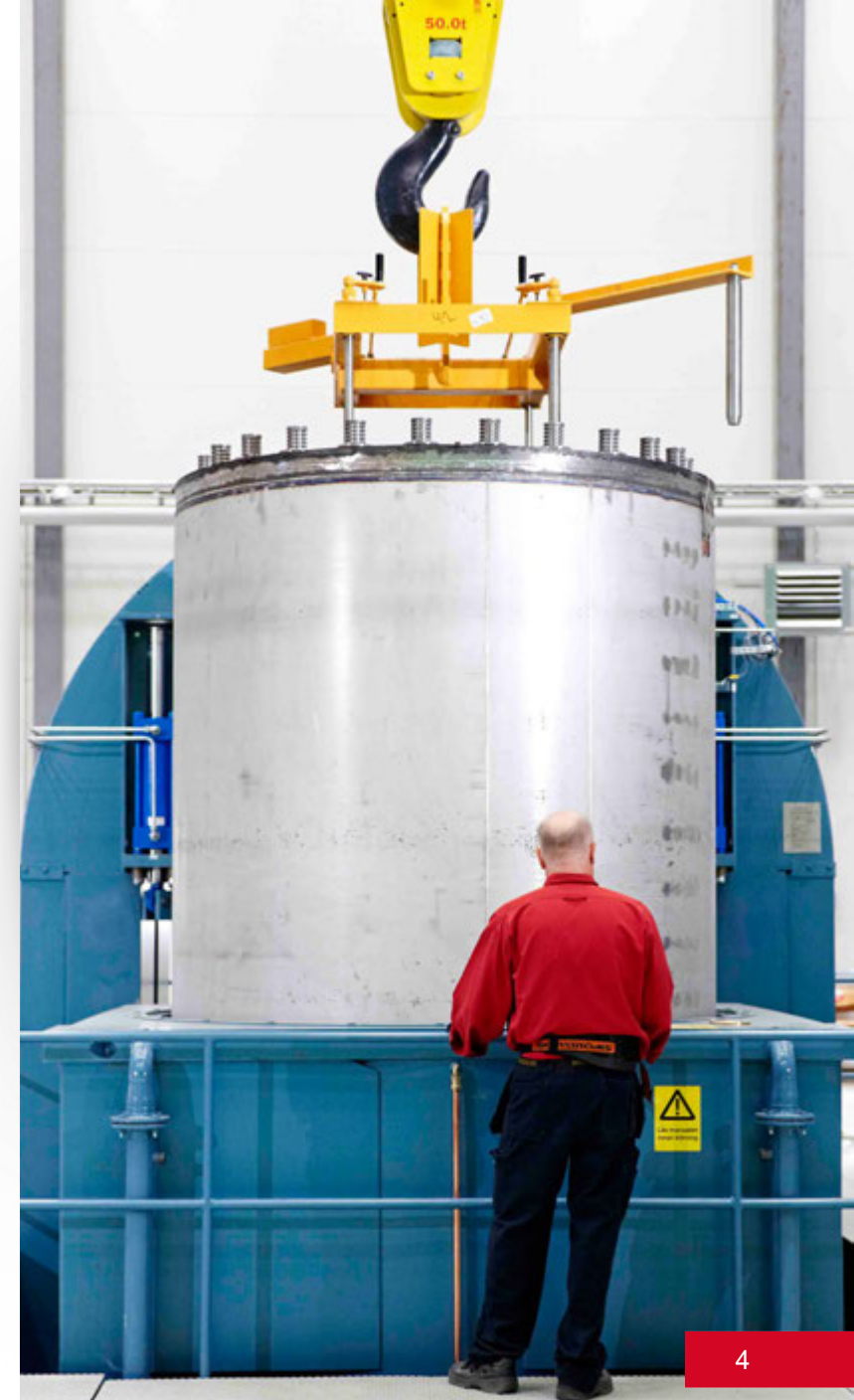


PRESSING

Up to 45,000 psi

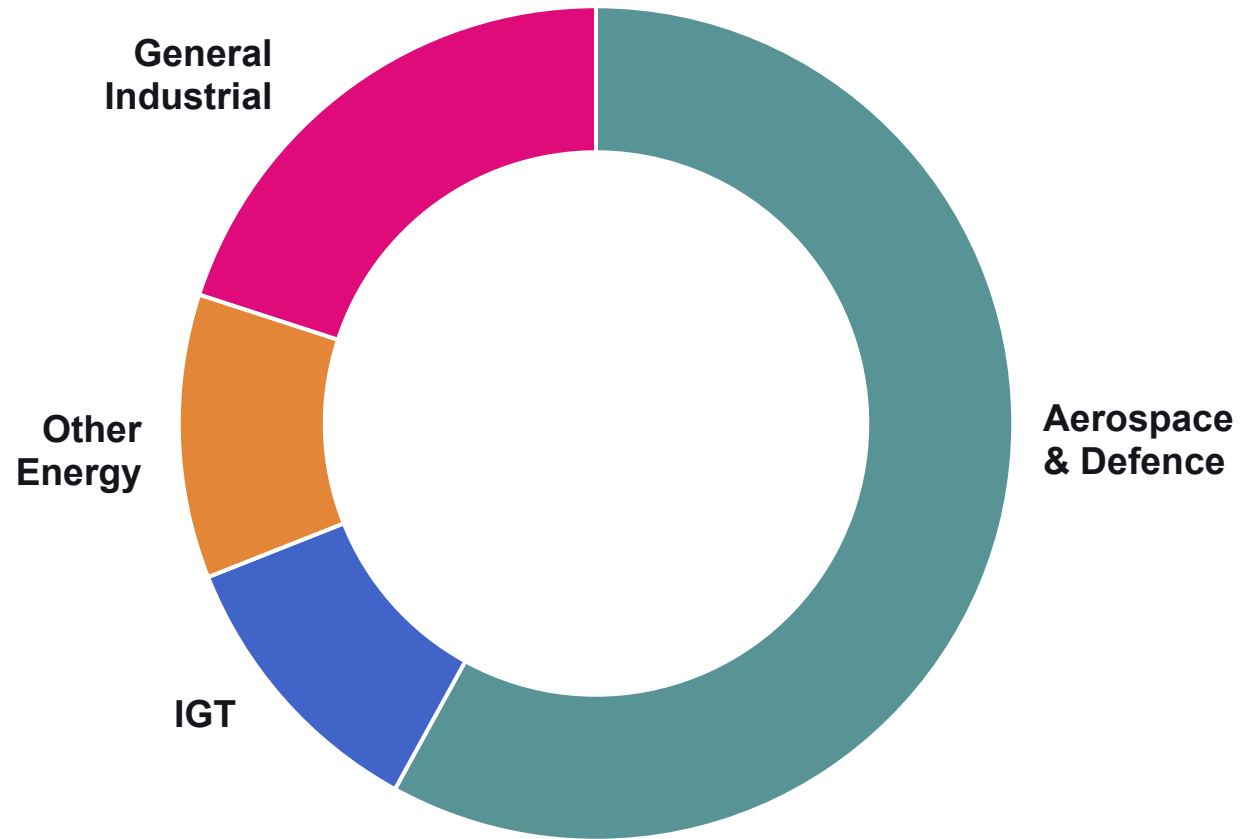
Heals defects in metals

Consolidates material to 100% density

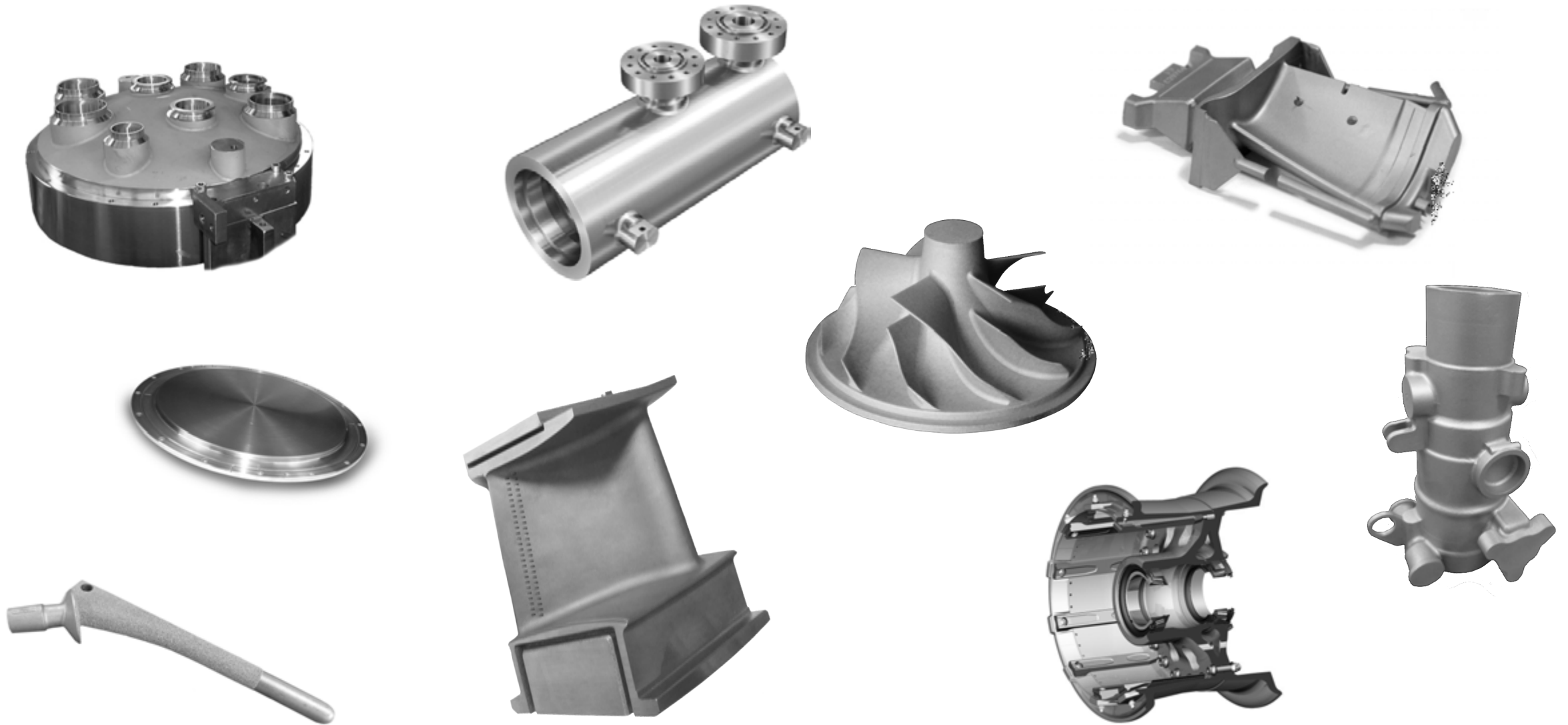




Market sectors



Application examples



Aerospace & Defence

- Strong long-term growth driven by Engine Super Cycle and transition to new materials
- New materials as OEMs strive for higher duty, lighter planes
- Compulsory requirement for severe applications (e.g. turbine blades)

Oil & Gas and Nuclear

- Demand for safety critical components expected to increase over the medium and longer term

General Industry

- Medical implants and surgical tools displays secular growth characteristics
- Increasing demand for high-end electronics

Additive Layer Manufacturing (ALM)

- A compulsory requirement for ALM densification for critical components
- A small but rapidly growing market

Industrial Gas Turbine (IGT)

- No market recovery foreseen in the medium term

Large HIPs

Bodycote's market position



- No need for proximity to customer

Circa 90% of large HIP vessels and circa 90% of global large HIP capacity¹

¹ excluding Japan

Security of supply

Customers require a high level of risk mitigation and safeguarding for their HIP supply chain – HIP vessels are temperamental



01

Long Term Agreement (LTA)

Customers reserve capacity for many years in advance

02

Redundancy

Multiple preapproved and qualified HIPs on a single site

03

Redundancy

Multiple preapproved and qualified sites within an agreed geography

Barriers to entry

Investment

- Large HIP with ancillaries, service and installation costs circa £16m
- Risk mitigation requires at least 2 HIPs, circa £30m
- Spares and maintenance adds circa £1m per annum

Time to market

- 2 years from purchase order to installation and commissioning
- 6 to 12 months pre-production approval process for each component
- Minimum of 3 year sales ramp to maximum processing capacity

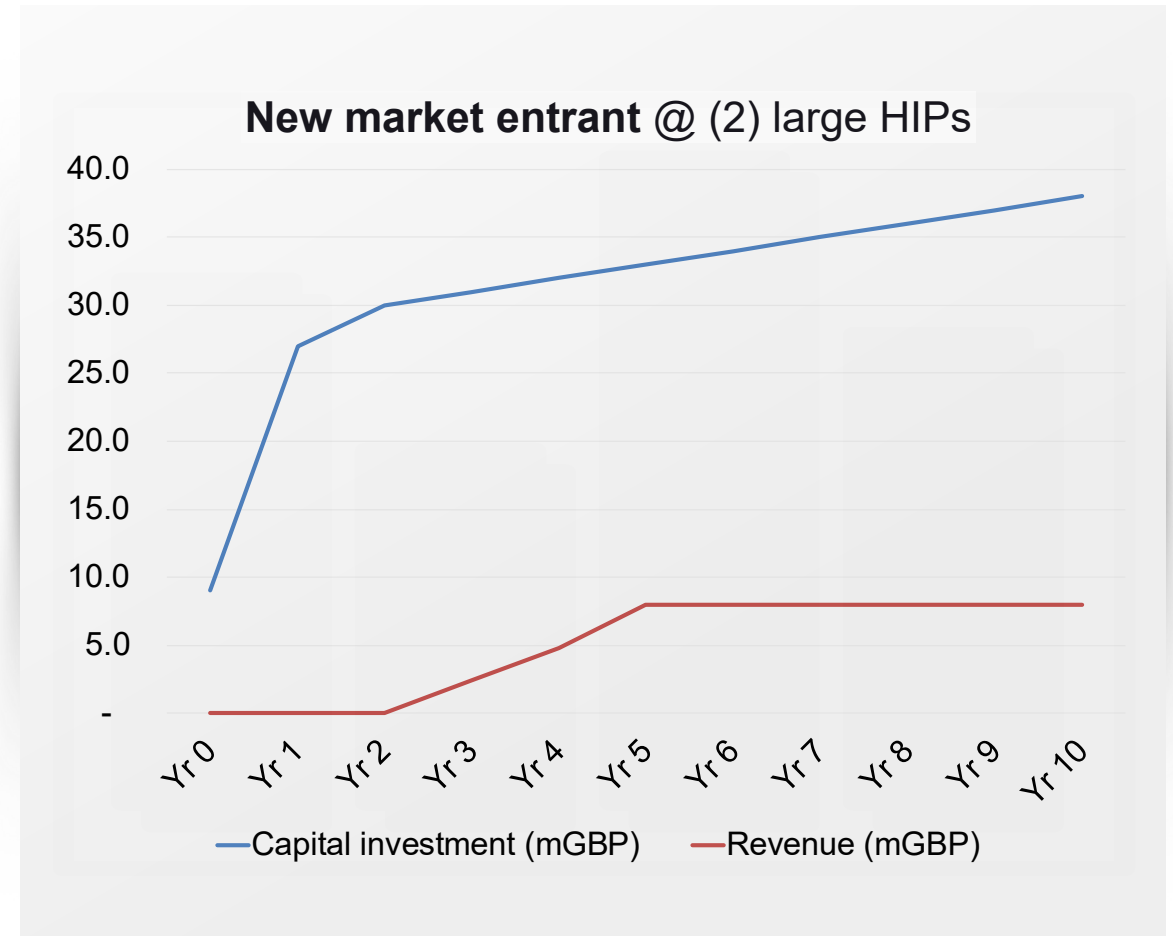


Barriers to entry

Financial hurdles for a **new entrant** today

- £30m up-front investment, plus £1m per annum thereafter from Year 3 of operation
- Capital intensity greater than 4x at current prices (including required redundancy)
- Return on investment below the cost of capital for at least 20 years

Bodycote financial profile is different



Bodycote's competitive advantage



Technology

- Enabler for advanced material requirements

Assets & Diversity

- Global leader in HIP vessel quantity and capacity
- Global leader in HIP vessel's sizes and pressures

Coverage

- Serve key OEMS and tiers in their chosen geographies
- Support civil aviation structural growth

Know-how

- Seasoned professionals in operations and maintenance

CAPITAL MARKETS DAY

2019

