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
A high temperature furnace inside a pressure vessel

What is Hot Isostatic Pressing (HIP)?
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

- Aerospace & Defence
- Other Energy
- IGT
- General Industrial
Application examples
Growth drivers

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 capacity\(^1\)

\(^1\) excluding Japan
Customers require a high level of risk mitigation and safeguarding for their HIP supply chain – HIP vessels are temperamental.

- **Long Term Agreement (LTA)**
  Customers reserve capacity for many years in advance

- **Redundancy**
  Multiple preapproved and qualified HIPs on a single site

- **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