



GRADIENT

SERVICES

**Pyrometallurgy
Components & Monitoring**

**Delivering
Optimal
Engineering
Solutions**

www.gradient.net.au/pyro

OUR CAPABILITY

Design, Manufacture and Monitoring for the **Pyrometallurgical Industry**

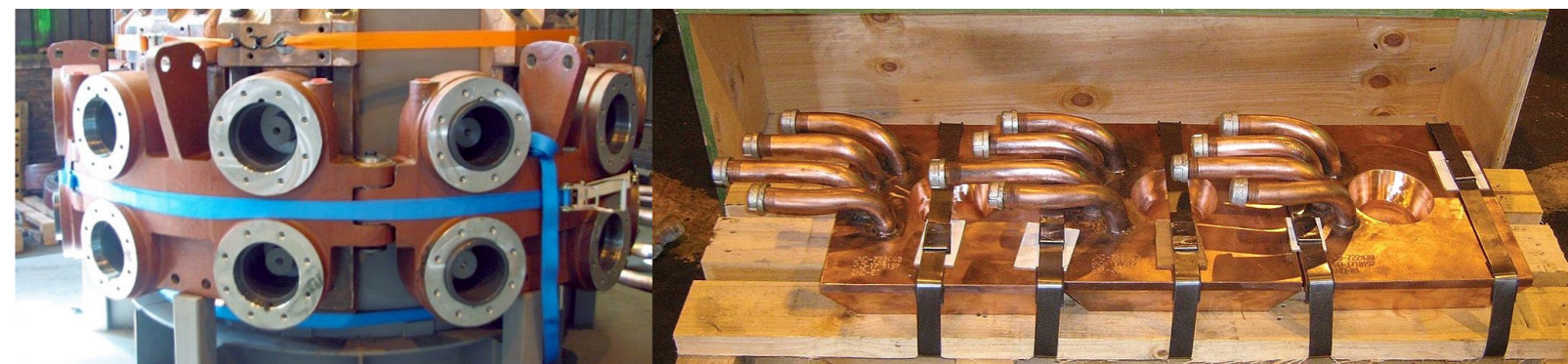
Gradient Services proudly represents **Thos Begbie & Co** and **Saveway Furnace Monitoring Systems**, supplying and supporting the pyrometallurgical industry across the Australia-Pacific region.

What sets us apart is our ability to offer a comprehensive range of solutions, including:

- Ferrous and specialty alloy castings, forgings, and fabrications.
- Non-ferrous castings and fabrications.
- Innovative freezeline solutions for furnaces and launders.
- Maintenance diagnostics to ensure safe and efficient operation under all conditions.
- Engineering services, including operational consulting, material selection and design optimisation.

Our regularly supplied products include:

- Copper water-cooled furnace jackets, charge ports, tapping blocks, and bus bars.
- Ferrous and heat resistant alloy cast and fabricated kiln components.
- Kettles, ladles, and sinter plant machinery.
- Cooled and non-cooled copper and super-alloy launders and launder tips.



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GRADIENT

Casting, Forgings and Fabrication Capabilities



Our Capability

CASTING: Ferrous casting up to 400 tonnes in a single pour

FORGING: Forgings from under 1kg up to 80 tonnes

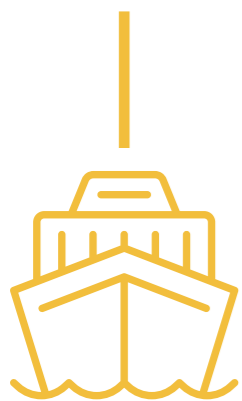
FABRICATION: Certified welders working to international standards

ENGINEERING: Material selection and design optimisation



1,000

Tonnes
Engineered
Products
Supplied
Annually



60

Years Serving
the Australian
Market

Gradient Services has long been a trusted supplier of castings, forgings, and fabrications to lead, zinc, aluminium, and copper smelters, as well as steel mills, across the Australia-Pacific region.

In partnership with Y&J Industries, Gradient offers precision and scale in delivering a complete range of cast, forged, and fabricated furnace and ancillary components. All components undergo rigorous quality assurance testing.

Our track record includes:

- Supply of slipper pads, nose ring segments, tyres, girth gears and trunnion wheels for rotary kilns.
- Supply of refractory-lined rabble arms.
- Supply of cast and fabricated kettles, and sinter plant pallets.
- Supply of cobalt super-alloy launder end segments for copper smelting slag launders.
- Supply of ancillary equipment, including lifting hooks, burner bodies, nozzles, assemblies, and other spares.
- Design and supply of anode clamps for primary aluminium smelters.



THOS BEGBIE & CO

Pyrometallurgical
Copper and Stainless Components



Thos Begbie

Global Leaders in Smelting and Pyrometallurgical Components

Established Heritage and Expertise

Founded in 1887, Thos Begbie has evolved from a foundry in Johannesburg to a global leader in the mining and smelting industries, now operating from Middelburg, South Africa. The company specialises in ferrous and non-ferrous components with a focus on smelting and pyrometallurgical solutions.

Key Offerings and Capabilities

- **Specialised Components**
 - Water-cooled copper walls and roofs for furnaces.
 - Custom castings up to 17 tons in non-ferrous metals.
- **ISO 9001:2015 Certified Manufacturing**
- **State-of-the-Art Facilities**
 - 7,000 m² foundry with advanced testing capabilities.
 - X-ray, ultrasound, and infrared thermal imaging.
 - Metallurgical chemical analysis and mechanical testing.
 - Design and simulation, tooling manufacturing, welding, and fabrication.
- **Operating in 23 countries**, Thos Begbie is the trusted partner for smelting solutions worldwide and has Partnered with Gradient for delivery into the Australia-Pacific region.

Cast Capacity
**up to
17t**



Thos Begbie offers state-of-the-art non-destructive testing (NDT) facilities—an offering that sets it apart globally. The company provides a comprehensive suite of in-house capabilities and services, including:

- Computer-aided design (CAD) and drawing office.
- Solidification and methoding modeling and simulation.
- Pattern shop and tooling manufacture.
- Pipe and tube manipulation and coil fabrication.
- General fabrication and specialty welding.
- Laboratory services with wet-chemistry and metallurgical chemical analysis.
- Modern fettling and sand-blasting facilities.
- Flaw detection using X-ray, ultrasound, and infrared thermal imaging.
- Mechanical property testing and flow-rate analysis.
- Inspection, test planning, and project management.



GRAPHITE FREEZELINE SOLUTIONS

Pyrometallurgical Carbon & Graphite Liners



Graphite Freezeline Solutions (GFS)

Enhanced Furnace Efficiency and Longevity

Specialised Graphite Solutions

Since joining Thos Begbie in 2017, GFS has delivered cutting-edge engineered graphite products whose unique properties enhance furnace performance and durability.

Key Benefits of GFS Products

- **Extended Furnace Lifespan**
 - Graphite freezeline creates a protective accretion layer, reducing corrosion and heat loss.
- **Rapid Performance Optimisation**
 - Minimal curing time ensures immediate cost savings and quick production ramp-up.
- **Low Maintenance**
 - Durable linings require little upkeep during operation.
- **Comprehensive Offerings**
 - Wide range of graphite and carbon grades machined to exact tolerances.
 - Over 20 years' experience with graphite applications to copper coolers.
 - On-site application expertise backed by ISO-certified facilities.



Carbon based linings offer improved
Oxidation and Wear Resistance



SAVEWAY

Pyrometallurgical Furnace Monitoring



Saveway Furnace Monitoring Systems Safety and Innovation in Furnace Monitoring

Since 1992, Saveway has revolutionised furnace safety and monitoring, providing cutting-edge solutions for industries worldwide. Founded by Dr. Manfred Hopf in partnership with the Herrmann family, the company has consistently delivered innovations that enhance furnace reliability and operational safety.

Key Innovations and Technologies

- **SAVEWAY® System (1992):** Real-time visualisation of furnace lining wear, reducing risks of failure and accidents.
- **SAVELINE® System (1996):** Enhanced safety for holding furnaces after a critical runout incident.
- **Industry Expansion (1999):** Adapted technology for steel, ceramic, glass, and smelting industries.

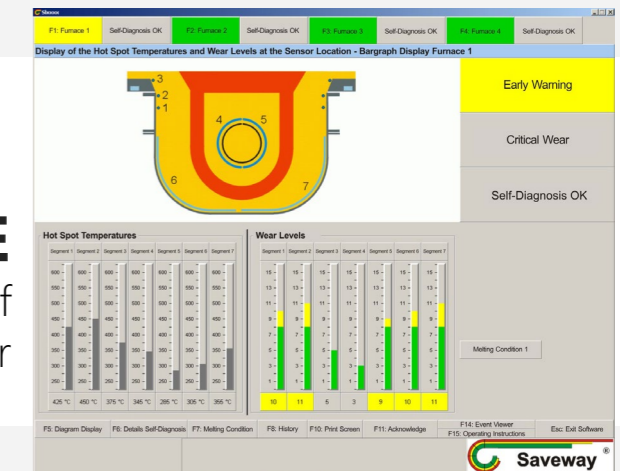
Advanced Monitoring Solutions

- **SAVEDRY® (2005):** Monitors refractory drying and residual moisture to prevent risks.
- **SAVESEARCH® (2008):** Patented selective shunt monitoring for preventive maintenance of induction furnaces.
- **OPTISAVE® (2011):** Advanced temperature measurement for process optimisation and wear monitoring. Features patented linear sensors embedded in water-cooled copper coolers, with five global patents.



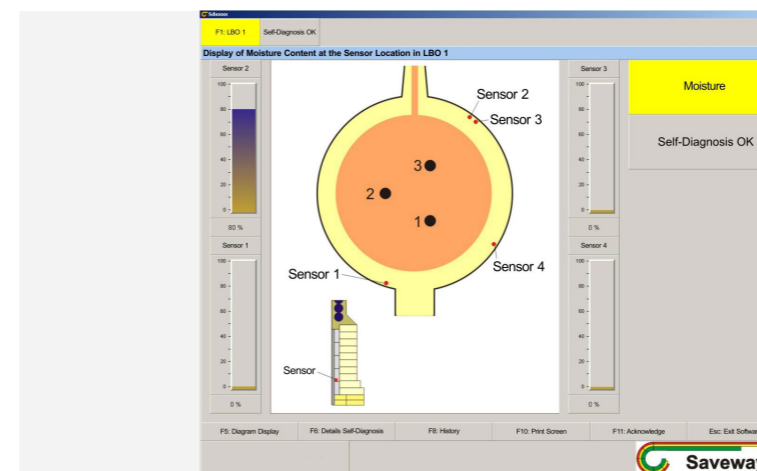
SAVEWAY

Measures remaining wall thickness during operation



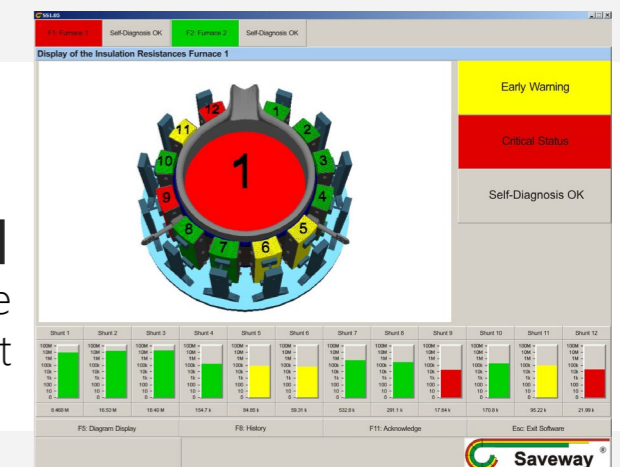
SAVELINE

Comprehensive monitoring of hot spots and wear



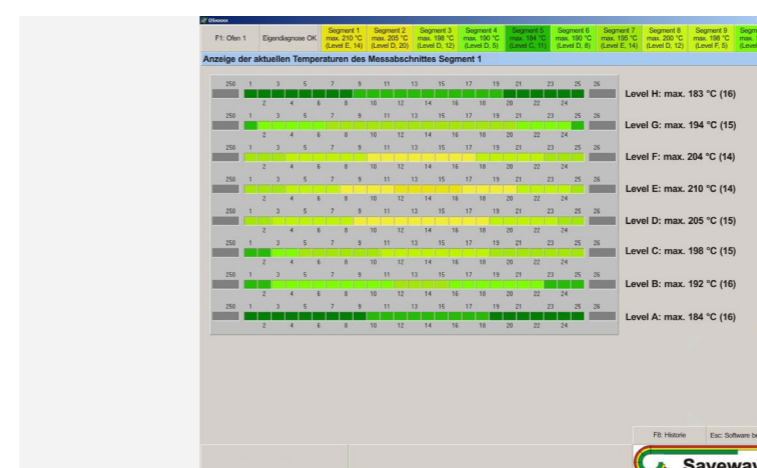
SAVEDRY

Monitors drying and detects leakage



SAVESEARCH

Extensive or selective temperature measurement



OPTISAVE

Selective monitoring of coil shunt insulation

GRADIENT

Why Gradient



Design and Innovation

- Local Engineers & Metallurgists
- Design & Material Improvement
- Reverse Engineering



Processes

- Casting
- Forging
- Machining
- Fabrication
- Finishing Services



Supply Chain

- Key Partner:
- Y&J Industries (Chengdu)
- 200+ Suppliers
- Complete Logistics
- Weekly Updates



Quality

- Dedicated QC team
- Local & International staff
- Comprehensive NDT
- Reporting & Traceability



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