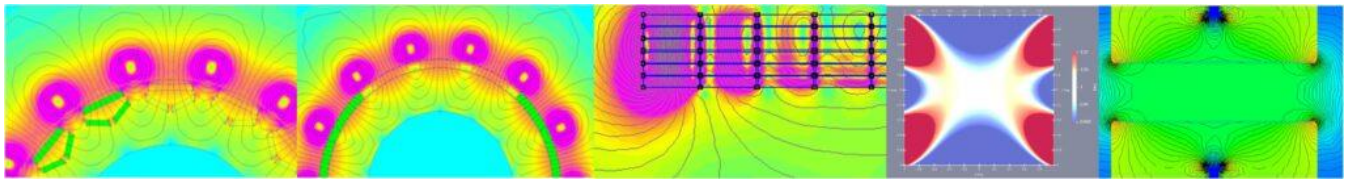
Product Brochure

Custom magnetiser fixtures

Most fixtures are custom including multi-pole axial fixtures (axis of the coil and the magnet are the same) and multi-pole radial designs. The smallest fixtures Hirst have produced magnetise magnets a few millimetres in diameter. The largest Hirst have worked on have been magnet assemblies 5 metres in diameter and requiring specialist lifting equipment. More complex fixture designs are needed when making motor assemblies and the number of poles can be up over 40 as energy needs delivering to individual magnets in an assembly all without demagnetising other parts in the assembly.

Hirst's patented Step and Repeat method can be used where only certain sections of the rotor assembly are magnetised and then the fixture is either moved or different parts of the fixture circuit are switched to achieve a step and repeat function. The Hirst team are experts in making fixtures for all current motor topologies including Interior Permanent Magnet (IPM), Surface Permanent Magnet (SPM) and Axial flux designs. Full state-of-the-art FEA analysis and design optimisation is undertaken by our Magnetic design team when designing a custom fixture – see website for more details.



Our custom-made magnetic solutions have been employed all over the world in a wide array of applications, ranging from automotive industry to aerospace.

To start the process just send us a drawing (.dwg / .dxf / .step) of your magnet assembly including specification of the magnet material and your production cycle time or volume aims and we can tailor a solution for you. Or if the design is at an earlier stage, we can work with you to optimise both production and design.

Key benefits

- **Performance** – get exactly the performance needed with detailed finite element analysis (FEA)
- **Configuration** – Hirst have extensive experience of *axial* or *radial* designs, any pole count from 2 to over 40 poles, single-shot, multi-shot or Hirst step-and-repeat magnetisation. Hirst has experience of advanced designs including skew patterns, Halbach arrays and multiple magnet geometry layouts.
- **Size** – Hirst have experience magnet assemblies from millimetres to metres and from grams to tonnes
- **Cooling** – get the throughput needed for your production, higher power fixtures need liquid cooling
- **Automation** – get the magnet or magnet assemble handling as part of your production line solution, Hirst magnetisers have industry standard automation interfaces such as SCPI, PLC and CANopen.
- **Safety** – interlock and emergency stop, internal protection circuits prevent damage (including temperature on fixture and fixture plugged in, auto energy dump under emergency stop), experience of local health and safety requirements.

Applications

- **Aerospace Sensors** – magnetic calibration of critical aircraft sensors, backup compasses, cockpit oxygen sensors.
- **Audio** –loudspeakers, guitar pickups.
- **Industrial** - Reed relay manufacture, valves and actuators.
- **Consumer** – single magnet assemblies.
- **Electric motors / EVs** - SPM & IPM motors and multi-shot or step and repeat magnetisation of large axial flux motors including skew patterns, Halbach arrays and multiple magnet geometry layouts
- **Recycling and clean energy** - recycling magnets up to two tonnes and very large electric generators for offshore wind applications

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Magnetiser fixture basics

The energy from the magnetiser is delivered to the permanent magnet material via the fixture coil or fixture. The fixture has the precise mechanical dimensions needed to hold the magnet or magnet assembly in place and wound coils needed to deliver the energy to the part being magnetised. Magnetising fixtures are usually made of single or multiple wound coils of wire encased (potted) in a high-performance resin for strength and stability. Sometimes a mechanical clamp is used, or semi-automatic / automatic mechanical handling is integrated into the design.

A large amount of energy is used in the magnetising process and often fixtures are cooled to increase production throughput. In addition, the large magnetic fields used in the magnetising process can be hazardous to health thus guard rails or automated part handling is needed to ensure safe operation. This is vital to stay within guidelines set by Control of Electromagnetic Fields at Work 2016 (HSE). The detailed design process Hirst conducts on each fixture design covers all mechanical handling, production throughput and health and safety requirements.

The number of poles used in a fixture refers to the number of magnetic poles the part being magnetised has. For applications like a single magnet a 2-pole fixture is needed (north and south) and the fixture usually only has one coil to deliver the energy to the magnet to magnetise it. The applications for 2 pole devices are typically in single magnet calibration, sensor parts or navigation compass production.

Custom Fixture design

Most fixtures are custom including multi-pole axial fixtures (axis of the coil and the magnet are the same) and multi-pole radial designs. The smallest fixtures Hirst have produced magnetise magnets a few millimetres in diameter. The largest Hirst have worked on have been magnet assemblies 5 metres in diameter, requiring specialist lifting equipment. More complex fixture designs are needed when making motor assemblies and the number of poles can be over 40 as energy needs delivering to individual magnets in an assembly all without demagnetising other parts in the assembly. Hirst's patented Step and Repeat method can be used where only certain sections of the rotor assembly are magnetised and then the fixture is either moved or different parts of the fixture circuit are switched to achieve a step and repeat function.

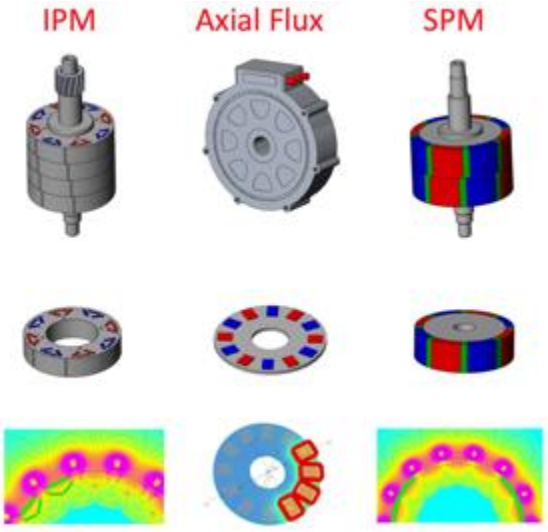
Hirst employ a range of construction techniques to deliver the best solution.

- Iron and Steel based cores for large poles and high fields.
- Non-magnetic former 'air' cores for small poles and axial rotors.
- Resin and glass fibre moulding for mechanical strength and long-term stability.
- Air cooled and water-cooled fixtures.

Electric Motors

Hirst has designed custom fixtures magnetisation of rotors for all motor types including IPM (Interior Permanent Magnet) SPM (Surface Permanent Magnets) and Axial flux rotors.

Hirst has extensive experience of 2 to over 40 poles fixtures, Straight & Skew pole patterns, Halbach arrays and multiple magnet geometry layouts.



The design process for todays advanced electric motors for EV applications are pushing the design of fixtures in terms of number of poles and grades of magnets used to squeeze the efficiency and performance to the maximum.

Most of our designs are developed under non-disclosure agreements so only a few can be show here.

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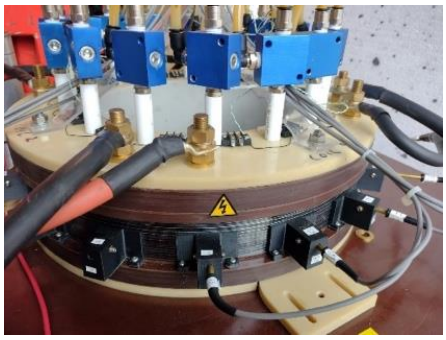
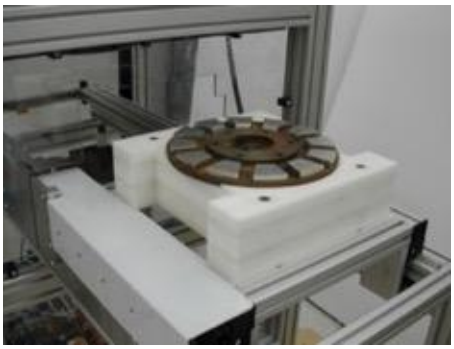
Electric motors - Custom Fixtures



Custom Electric motor fixture - 16 pole fixture IPM configuration for an EV application with multiple Gaussmeter probes embedded into the fixture.



Custom Electric Motor fixture – Axial flux rotor (from 2005) being loaded into a production 24 pole custom fixture in a production tower

Custom 4 pole skew fixture for medium size IPM motor

2 pole custom fixture for SPM motor production

Electric Motors - Application Examples

M3000- 40kJ Magnetiser with custom skewed multipole fixture for IPM motor applications with IFM06 fluxmeter and embedded Gaussmeter feedback.

Above a M12kJ workstation with custom fixture for medium IPM motor production

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Recycling Magnets

Hirst has manufactured custom fixtures for making large ferrite magnets since 2005. These fixtures are over 14 tonnes and are air cooled. They are for 1-2 Tonne magnets used in over-band separators systems for recycling ferrous metals.

Recycling magnets - Custom Fixture

14 tonne custom fixture

Recycling magnets - Application Examples

M800-400kJ Magnetising system with handling equipment and custom 2 pole fixture for magnets used in the recycling industry weighing up to 1 Tonne

A custom 2 pole fixture in use with a M800-400kJ magnetiser for manufacturing 1.4 tonne magnets for use in recycling applications

Loudspeakers

Hirst has manufactured many custom fixtures for production of loudspeakers of all sizes for general audio and premium performance audio applications. Hirst has been making fixtures for this application since the 1950s and Hirst equipment is used in several well know household names. The smaller speaker fixtures are usually air cooled, although larger speaker fixtures are usually water cooled to increase cycle time.

Loudspeakers - Custom Fixtures

A custom axial speaker fixture, water cooled with integrated thermocouple-based temperature monitoring

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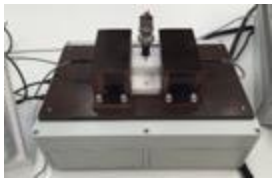
Loudspeaker - Application Examples

M8kJ magnetiser workstation with 2 pole custom fixture for loudspeaker production

Sensors

Hirst has manufactured custom fixtures for precision aerospace sensors magnetic calibration of sensors, critical aircraft sensors, backup compasses, cockpit oxygen sensors these fixtures are often used with the MCSD100J-800J range precision magnetisers, calibrators, setters and demagnetisers. Most sensor fixtures are air cooled.

Sensors - Custom Fixtures



Sensor fixture for compass calibration

Custom 2 pole joystick sensor calibration fixture

Sensor - Application Examples

MCSD-100J Magnetiser with custom fixture for production of critical aircraft sensors with IFM06 Fluxmeter control in a production rack

MCSD200J magnetiser and custom fixture and 2 gaussmeter probes GM08 used for navigation sensor production

Single Magnet Systems

Hirst has manufactured custom fixtures for consumer applications including high volume toys and industrial magnetisation applications for manufacture of reed relays, valves and actuators.

Single magnet systems - Custom Fixtures

Custom 2 pole fixture for single magnet piece manufacture

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Single magnet systems - Application Examples

M4kJ workstation with custom fixture and high throughput conveyor system with 1.2 second duty cycle running 24hrs a day with 4 parallel production lines

MCSD-500J and IFM02 fluxmeter running automated hopper-based sensor magnetiser

Custom benchtop fixture for use for 100mm diameter magnets used in actuators in medical industry fixture us water cooled and features temperature monitoring

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Hirst Magnetic Instruments has been active in providing solutions for 60 years in magnetics and magnetic measurement. Hirst manufactures precision hand-held gaussmeters, Fluxmeters, de-magnetisers, bench top & workstation industrial magnetisers, industrial production-line magnetisers, pulse field magnetometers (PFMs) for developing characterising magnetic materials and many custom projects.

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