

# CRYOGENIC COOLING

CONCEPT • DESIGN • MANUFACTURE • TEST • INSTALL • AFTER SALES

## Liquid nitrogen Cooling System for Tokamak fusion reactor

### Design Challenge

GRE were privileged to win a contract to provide a cooling / temperature control system for an experimental fusion reactor. The requirement was to provide thermal control to a total of TWENTY-SIX separate channels, all independently of one another. Furthermore, the requirement was to bring the system down slowly – at approximately 1K every ten minutes – from ambient temperature to liquid nitrogen temperature (-196°C).

The system must operate as a “black box”, entirely independently of any external control system.

### Solution

GRE designed, manufactured, tested, installed, and commissioned a complete system to deliver temperature control as specified.

Primarily the system will:

- Bringing in liquid nitrogen from a cooling source (storage tank)
- Produce warm gaseous nitrogen from the cold liquid by boiling
- Mix the liquid with the gas in a measured way, in order to produce the smooth ramp down required
- Distribute the gas/liquid nitrogen mix to the experimental fusion reactor
- Stabilise the entire reactor (> 8,000kg, mostly copper) at liquid nitrogen temperature
- Re-establish temperature control and bring back to liquid nitrogen temperature after an experimental energy release has been performed



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