

SCIENCE & TECHNOLOGY FACILITIES COUNCIL  
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# Neutron Cutting Discs for ISIS Instrument LET's Neutron Disc Choppers 1 & 5

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This document provides an outline tender specification for Neutron Cutting Discs for Neutron Disc Choppers 1 and 5 of the ISIS Instrument LET. The information given in this document is subject to a preliminary design review, to be undertaken following placement of the purchase order from this contract.

# **Tender Specification for Neutron Cutting Discs for the use on ISIS**

## **Instrument LET's Neutron Disc Choppers 1 and 5**

### **1. Introduction**

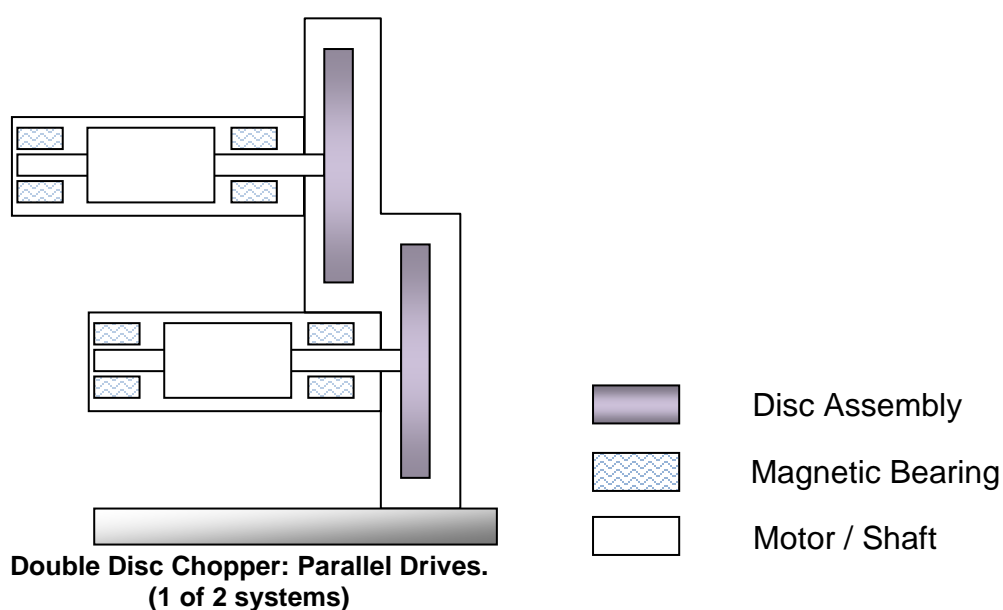
ISIS pulsed neutron and muon source is a world-leading centre for research at the Science & Technology Facilities Council (STFC), Rutherford Appleton Laboratory near Oxford, in the UK. Our suite of neutron and muon instruments give unique insights into the properties of materials on the atomic scale. Neutron choppers are essential components for the majority of the instruments for conditioning the neutron beam to enable a range of scientific techniques to be employed.

Neutron disc choppers are spinning discs that block neutrons except for one or more window sections (openings) where the neutron beam is allowed to pass to the sample under study. ISIS operates different types of disc choppers, and this tender request relates to two existing high speed double disc chopper systems that operate in a vacuum environment at a maximum speed of 18,000rpm. STFC is looking for a supplier of neutron cutting discs that will accommodate the existing choppers' interfaces and meet the operational requirements.

This document provides the outline specification for a total of four chopper discs to be purchased following placement of the contract.

### **2. Scope of Supply**

The scope of supply is for Four Disc Assemblies. Each assembly consist of a Disc, which is based on a STFC – ISIS drawing, a Coupling (hub) including all attachment, securing and alignment components (Fasteners) which interfaces with the specified Spindle Unit (Drive) and a set of results from appropriate Design Studies. Figure 1 shows the configuration of a pair of discs assemblies within one of the double disc choppers.



### ***Figure 1 - Disc Configuration***

## **3. Operational and Drive System Specifications**

- 3.1. The disc assemblies are to operate in a vacuum of  $>1 \times 10^{-3}$  mBar, without outgassing or having any trapped volumes.
- 3.2. The maximum operating speed is 300Hz (18,000 rpm). The disc assembly is to be design to run at this speed for a period of time without any undue vibration or runout. The disc assemblies will also be required to run at the sub-frequencies, from 20Hz to 300Hz in steps of 5Hz, without any undue vibration or runout.
- 3.3. The discs are to be coating in Boron10 in the areas indicated on the ISIS drawings, to give an overall thermal neutron absorption rate of better than  $1e^{-6}$ . The bonding material and the method of adhesion are to be specified and validated in the tender response. Note the Boron10 will be supplied, free of charge, by ISIS. The supplier is to inform ISIS of their estimated quantity of Boron10 required at the Final Design Review. All unused Boron10 is to be returned upon the delivery of the disc assemblies.
- 3.4. The face profile of each disc is to be based on the ISIS drawings. The sectional profile will be specified and validated by the supplier from Finite Element Analysis (FEA) and experience.
- 3.5. To meet these specifications it is expected that the discs will be manufactured from a carbon fibre composite materials. The selection of these materials is to be specified and validated in the tender response.
- 3.6. The coupling of each disc assembly is to interface with the shaft of an SKF Magnetic Bearing Ltd.'s LT450g5 Spindle Unit (ref to SKF drawing 888-0104-101 Rev G, pages 3 & 5). Ideally the coupling will be ridged but if flexible the degree of tilt is to be approved before manufacture.
- 3.7. The design of the coupling and all relative fasteners is part of the contract and must comply with these specification, and be included in the FEA study and report. The material(s) from which the coupling and all fasteners is made, is to be specified by the supplier, but it must be non-corrosive and suitable for use in a vacuum.
- 3.8. The following SKF conditions apply to each disc assembly;
  - 3.8.1. Must not exceed a mass of 10Kg,
  - 3.8.2. Mass/inertia figure must not exceed the limits of the SKF LT450g5 Spindle Unit,
  - 3.8.3. The runout at the rim in respect to the coupling axial contact surface must not exceed 0.5mm in total.
  - 3.8.4. The tilt moment exerted on the Spindle's shaft by the disc assembly must be less than 30N.m when running at the maximum operational speed,
  - 3.8.5. Meet the specification referred to in SKF's documents 892-0114-001 Rev B and 888-0104-101 Rev G. All data listed on 888-0104-101 Rev G, sheet 5, note 4 is to be provided for SKF's approval before manufacture.

- 3.9. Each assembly requires balancing as part of the scope of work and should be done to a level suitable for the high speed spin tests. The fine balancing will be done when the disc assemblies are fitted to their SKF spindle units.
- 3.10. High speed spin tests of each assembly are required, to expose any manufacturing errors. The details of which are to be specified in the tender response, and should include but not limited to; duration, number of accelerations, percentage over maximum operational speed, and whether held at a steady state temperature.

#### **4. Scope of Work**

- 4.1. To provide a schedule showing the minimum following milestones;
  - 4.1.1. Kick off meeting/Preliminary Design Review,
  - 4.1.2. Provision of all design data for SKF's approval,
  - 4.1.3. Final Design Review,
  - 4.1.4. Provision of manufacture and assembly inspection reports,
  - 4.1.5. Provision of all test results and final inspection reports
  - 4.1.6. Delivery of all four assemblies.
- 4.2. Design three Disc Assemblies based on ISIS drawings
  - 4.2.1. SI-8767-307-A,
  - 4.2.2. SI-8767-308-A,
  - 4.2.3. SI-8767-309-A,
  - 4.2.4. Including the Coupling(s) and all Fasteners.
- 4.3. Perform an FEA on all three Assembly designs.
- 4.4. Provide all design data as requested in SKF's document 888-0104-101 Rev G, sheet 5, note 4 for approval.
- 4.5. Hold a Final Design Review of the designs and FEA results.
- 4.6. Manufacture;
  - 4.6.1. 1 x disc based on ISIS drawing SI-8767-307-A,
  - 4.6.2. 1 x disc based on ISIS drawing SI-8767-308-A,
  - 4.6.3. 2 x disc based on ISIS drawing SI-8767-309-A,
  - 4.6.4. 4 x couplings
  - 4.6.5. 4 x set of fasteners
- 4.7. Assemble the four disc and couplings.
- 4.8. Balance the four assemblies.
- 4.9. Perform high speed spin tests of the four assemblies.
- 4.10. Sonar and visual examination for detection of manufacturing errors.
- 4.11. Inspection of design features to relevant ISIS drawings.
- 4.12. Report all results of tests and inspections.

4.13. Securely pack and ship to ISIS.

## **5. Scope of Deliverables**

5.1. Before Final Design Review is signed off by ISIS.

5.1.1. Drawings and 3D models of the disc assemblies.

5.1.2. Design Data for SKF's approval.

5.1.3. Results of the FEA studies, along with any design conditions.

5.2. Four complete Disc Assemblies, plus any unused Boron10 to;

STFC – ISIS,  
Rutherford Appleton Laboratory,  
Chilton, Didcot,  
Oxfordshire, OX11 0QX, UK

5.3. All test and inspection results and reports.

## **6. Warranty**

6.1. A warranty of at least 12 months shall be provided on all items supplied as part of the contract.

6.2. Any warranty provided should commence from start of active use, provided that STFC store the items in accordance with the manufacturer's instructions