

# Fuses for the HV instrumentation of the ITER coils

## Call for Nomination

### **Purpose**

The purpose of this contract is to develop and supply High-Voltage (HV: 40kV DC) fuse elements for protecting the HV instrumentation wires connected to all the ITER superconducting coils.

Two different types of HV fuse are considered: fuses operating under cryogenic conditions and more standard fuses operating at RT.

The HV instrumentation wires are indeed connected to some parts of the coils that could be driven to a HV potential compared to other parts of the coils and to ground. A HV wire short would cause massive fault current to flow through the wire, leading to damage to the wire or even destruction. The role of the fuse is to prevent this situation. Even if the probability of this kind of fault is very low, it may still happen and the caused damage would be fatal for the instrumentation system.

### **Background**

ITER will be the world's largest experimental facility to demonstrate the scientific and technical feasibility of fusion power. The superconducting magnets providing the magnetic fields necessary for the generation and operation of the plasma are provided with an instrumentation system able to monitor and control the main parameters.

The fuses to be developed in the frame of this contract are intended for different operating conditions and applications with a nominal rated current below 100mA, and for operation in DC mode whereas standard HV fuses are generally used to protect AC electrical power transmission systems from fault conditions and have a rated current over 100A. This is the reason why the development of a new fuse is required.

The fuses, subject of the present contract, are part of the investment protection system for the instrumentation of the ITER superconducting magnets. All HV wires which will be connected to the magnet superconductors will be series-connected through these fuses. Therefore the fuses will be installed close to the voltage taps inside the cryostat. They will thus affect the quench detection electronics as the line impedance between the voltage tap and the quench detector input. The fuse is a critical component as one malfunction can provoke false outputs, which would be a very serious problem in a superconducting magnet system.

### **Scope of work**

The scope of this specification is to describe the design, qualification, manufacturing, testing and delivery requirements for the HV cryogenic and room temperature (RT) fuses needed for protecting the HV instrumentation wires connected to all the ITER superconducting coils.

**Table 1: Amount of fuses to be delivered**

HV Instrumentation	Cryo-fuses	RT-fuses	
	In Cryostat	CTB Current Leads	*Coils (optional)
# fuses	4000	450	4000

\*Coils (optional): more fuse components can be added after Phase I development condition.

**Phase I: Prototypes and qualification**

It includes the design, work plans, manufacture, testing, and qualification and reporting for:

- 20 HV cryo-fuse prototypes, among which 10 tested + 10 not tested;
- 20 HV RT fuse prototypes, among which 10 tested + 10 not tested.

**Phase II: Pre-series and series production**

It includes the procurement of materials, manufacturing, testing, delivery and the manufacturing dossier for:

- 3 pre-series prototype HV cryo-fuse units;
- 3 pre-series prototype HV RT fuse units;
- The amount of HV cryo-fuse units defined in Table1
- The amount of HV RT fuse units defined in Table1.

**Timetable**

The tentative timetable is as follows:

Tender submission	March	2014
Tender Evaluation	April	2014
Contract placement	July	2014
Completion of Phase 1	July	2015
Completion of Phase 2	July	2016

The total duration of the contract is 2 years broken down as follows:

- one year (12 months) from the contract signature for Phase I
- one year (12 months) from the end of Phase I for Phase II

There shall be a holding point between Phases I & II in order to review the results of Phase I. In case Phase I results do not fulfil the requirements, this contract may be terminated or modified.

**Experience**

The contractor and its personnel shall have adequate experience in HV fuse development and manufacturing.

- R&D in HV fuse technology over 20kV AC
- Design and Manufacture of HV fuse over 20kV AC.
- Sale of HV fuses (>20kV AC) over 10k unit per year.
- HV test facility.
- Experience in HV insulations under vacuum would be an advantage

**Candidature**

Participation is open to all legal persons participating either individually or in a grouping (consortium) which is established in an ITER Member State. A legal person cannot participate individually or as a consortium partner in more than one application or tender. A consortium may be a permanent, legally-established grouping or a grouping, which has been constituted informally for a specific tender procedure. All members of a consortium (i.e. the leader and all other members) are jointly and severally liable to the ITER Organization.

The consortium groupings shall be presented at the pre-qualification stage. The tenderer's composition cannot be modified without the approval of the ITER Organization after the pre-qualification.

Legal entities belonging to the same legal grouping are allowed to participate separately if they are able to demonstrate independent technical and financial capacities. Candidates (individual or consortium) must comply with the selection criteria. The IO reserves the right to disregard duplicated reference projects and may exclude such legal entities from the pre-qualification procedure.