Magnet Control Cubicle production and delivery

Call for Nomination

1 Purpose

This call for nomination is associated with the manufacturing and delivery to the ITER site of the Control Cubicles of the ITER Magnet system.

2 Introduction

ITER is a joint international research and development project that aims to demonstrate the scientific and technical feasibility of fusion power. The partners in the project are the People´s Republic of China, the European Union, India, Japan, the Republic of Korea, the Russian Federation and the USA. ITER is being constructed at Cadarache in the South of France (for details see **www.iter.org**).

The ITER Magnets of are cooled by a forced flow of super-critical helium at a temperature of approximately 4 K. This helium is supplied to the magnets via cryolines grouped into 29 separate feeders. The feeders contain all the necessary valves and instrumentation to control and monitor the various helium gas flows, pressures and temperatures and the quench detection signals involved in the Magnet protection functions.

Control Cubicles are required to control and protect the Magnet operation.

All these Control Cubicles are installed in protected area and therefore are not exposed to any specific environmental constraints. Standard industrial environmental requirements apply only.

All these Control Cubicles are made of Off the Shelf components, there is no R&D activity in this procurement contract but layout and cabling design only. The cubicles shall be delivered as ready to install component to the ITER site. The installation work is out of scope of the contract.

The cubicles shall be mounted and tested in supplier premises located close to the ITER site to facilitate the shipment of equipment in both directions and allow the ITER staff to attend easily the cubicle tests.

A total of 88 cubicles shall be produced and supplied from this contract which is split in 3 phases for manufacturing 24, 24 and 40 cubicles respectively.

Figure 1: Illustration of a Magnet control cubicle

3 Scope of work

The contract scope of work is made of the following tasks:

Cubicle layout drawings production

From cubicle configurations specification, cubicle equipment technical specifications and user manual and mounting and cabling requirements provided by IO, the contractor shall produce a proposal of cubicle layout drawing showing the expected distribution of the equipment within the cubicle and meeting the contract requirements.

There is one cubicle layout drawing for each manufactured cubicle.

Cubicle internal cabling and cable routing drawings production

The cubicle internal cabling drawing is the drawing of all electrical and optical connections of any cubicle equipment and parts to each other for signals, networks, field-buses, ground and power cables.

IO will provide the cabling requirements which shall be used by the contractor for producing the cabling and cable routing drawings.

The cubicle internal cabling drawings shall be produced with the See Electrical Expert tool (SEE).

There is one cubicle internal cabling drawing and one cable routing drawing for each manufactured cubicle.

The Contractor shall ensure that all designs, CAD data and drawings delivered to IO comply with the Specification for CAD data Production in ITER direct contracts (P7Q3J7.

Cubicle internal power distribution and grounding schemes production

Many equipment installed within the cubicles are active equipment and shall be supplied in AC and DC power.

The contractor shall provide the cubicle power distribution and grounding schemes and solutions. These schemes and solutions shall meet the relevant specific requirements given in these technical specifications and shall comply with the IEC-61000 standard and EU applicable rules in this area.

Cubicle Bill of Material production

The cubicle Bill of Material (BOM) is the list of all equipment required for the cubicle manufacture.

There is one BOM for each manufactured cubicle.

Cubicle internal cooling analysis

The cubicles are all air cooled in open loop by a fan installed at the bottom of the cubicle on the cubicle rear panel for pushing the building air in the cubicle.

It is requested to the contractor to perform the proper cubicle cooling analysis for optimizing the cooling of the equipment installed in the cubicle. The inputs required to perform this cooling analysis as the local air conditions in temperature and humidity and the equipment heat loads will be provided to the contractor by IO.

There is one generic cubicle internal cooling analysis for each batch of manufactured cubicle with similar hardware configurations.

Cubicle part procurement

The cubicle parts have different procurement schemes depending on the considered part:

- ✓ Some parts have been already selected by IO from the industry production but shall be procured by the contractor using the strategic agreements already placed by IO to the industry.
- ✓ Some parts have been already procured by IO through separate contracts and shall be delivered by IO to the contractor along the progress of the cubicle assembly.
- ✓ The remaining parts shall be selected and procured by the contractor after IO approval on the part selection.

The table below provides the schemes to consider by the contractor for procuring all parts and equipment required to execute this contract

Cubicle equipment/part	**Equipment/part procurement scheme**			
	IO selection	**IO procured**	**Contractor selection**	**Contractor procured**
Cubicle equipment				
Cubicle enclosure	X			X
Cubicle fan and filters			X	X
Cubicle monitoring system.	X			X
Cubicle power supply distribution and earthing devices			X	X
Cubicle internal cable trays			X	X
Top plate cable glands.			X	X
Controllers				
Conventional slow controller CPU and RI/O chassis.	X			X
Interlock controller CPU chassis and RI/O chassis.	X			X
Fast controller CPU chassis	X			X
CRIO chassis for EQDD	X			X
Cabling interfaces and signal conditioning				
Signal terminal blocks.			X	X
LV T sensor conditioner	X	X		X*
LV strain gage and displacement conditioner	X	X		X*
Optical FBG signal conditioner	X	X		X*
Optical FP signal conditioner	X	X		
Vacuum gauge controllers	X	X		
Serial optical interface	X	X		
AC/DC 12 V 24 V power supplies			X	X
Valve positioner rack	X	X		X*
DLIB and NI9350/DLIB interface	X	X		
Network interfaces				
PON/TCN switch.	X			X
Profinet switch	X			X
Profinet/Profibus gateway and DP/PA coupler	X			X
Magnet specific equipment				
HTSCL heater power supply	X	X		

* To be procured by the contractor as a complement of already procured IO procurements

Cubicle production

The cubicle production is the assembly of the cubicle enclosure, the mechanical installation of all internal equipment and parts and the cabling and routing of all cubicle internal cables.

The production shall be arranged by cubicle type by the contractor.

IO shall be able to access the production and testing premises for inspection purpose after having announced the inspection to the contractor.

The cubicle MIP shall be applied at cubicle production and a MIP report is delivered for each cubicle.

Cubicle testing

The cubicles shall be tested by the contractor as part of the production factory acceptance tests.

The proper operation of all active equipment shall be determined from a test application software proposed and developed by the contractor and approved by IO for testing the right operation of the controllers, the connectivity of the network interfaces and switches and the controller signal interfaces. This test application software and the display equipment and software shall be delivered to IO.

The proper connection of the signal cables from the terminal blocks to the controller signal interfaces shall be checked by simulation of the signals at the level of the cubicle terminal blocks. There is no functional test performed on the signal conditioners, even not for the data communication with the controllers; only the power status light shall be checked.

There is one cubicle test report for each manufactured cubicle.

Cubicle delivery

After successful testing of the cubicles the cubicles shall be shipped by the supplier to IO.

4 Tentative time table

A tentative timetable is as follows

Call for nomination	April 2019
Pre-qualification	May-June 2019
Call for tender	July 2019
Tender submissions	September-October 2019
Contract awarding	November-December 2019

5 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 cannot be modified later without the approval of the ITER Organization.

6 Experience and key competencies

The Candidates will need to demonstrate that they have the capabilities to successfully perform the entire scope of work mentioned above and in particular:

- ✓ Strong experience Siemens PLC S7-1500 technlogy.
- ✓ Strong experience in National Instrument cRIO technology.
- ✓ Strong experience in control cubicle design, manufacture and tests.
- ✓ Strong experience in instrumentation signal handling and EMC.

7 QA requirements

The organization conducting these activities should have an ITER approved QA Program or an ISO 9001 accredited quality system.

Prior to the commencement of the task, a Quality Plan must be submitted for IO approval giving evidence of the accredited quality system and describing the organization of this task, the skill of workers involved in the study, any anticipated sub-contractors and giving details of who will be the independent checker of the activities.

Prior to commencement of any manufacturing, a Manufacturing Inspection Plan (MIP) must be approved by ITER who will mark up any planned interventions.

8 Safety

This section is not relevant for this contract since these is no Safety component in the Control Cubicles targeted by this contract

9 Applicable document and references

Applicable Documents

[1] Electrical Design Handbook (EDH Part 1: Introduction (ITER_D_2F7HD2)

[2] Plant Control Design Handbook (ITER_D_27LH2V)

[3] ITER catalogue for I&C produc–s - Cubicles (35LXVZ)

[4] ITER catalogue for I&C produc–s - Slow controllers PLC (333J63)

[5] Requirements for Preparing and Implementing a Manufacturing and Inspection Plan (ITER_D_22MDZD)

[6] Procedure on procurement documentation exchange between IO, DAs and contractors (35BVQR)

[7] ITER Procurement Quality Requirements (ITER_D_22MFG4)

Reference Documents

[8] DDD11-9: Instrumentation (2F2B53)

[9] DDD11-10: Magnet Controls (JF2N9W)

[10] Magnet control cubicle configuration for procurement (WWEZCG)

[11] Magnet controller configuration (UMC55X)

10 Definitions

BOM	Bill of Material
CAD	Computer Aided Design
CMM	Configuration Management Model
CODAC	Control, Data Access and Communication
DAN	Data Archiving network
DDD	Design Description Document
EQDD	Electronic Quench Detection Device
FO	Fibre Optic
HP	Hold Point
HIPOT	High (electric) Potential
HW	Hardware
ICD	Interface Control Document
IDM	ITER Document Management
IO	ITER Organization
I/O	Input / Output signals
ISO	International Organization for Standardization
I&C	Instrumentation and Control
KOM	Kick Off Meeting
MIP	Manufacturing and Inspection Plan
MQP	Management and Quality Program
NA	Non Applicable
NCR	Non Conformity Report
NI	National Instrument
NP	Notification Point
PBS	Plant Breakdown Structure
P&ID	Process and Instrumentation Diagram
PLC	Programmable Logic Controller
PON	Plant Operation Network
PRM	Contract Progress Meeting
QA	Quality Assurance
QCR	Quality Control Review
QP	Quality Plan
RO	Responsible Officer
R&D	Research and Development
SDN	Synchronous Databus Network
TCN	Time Communication Network