

Technical Specifications (In-Cash Procurement)

Call for Nomination: Pressure transducer and Pressure switch racks for the Magnet system

Technical specification summary for the call for Nomination by DA of the procurement contract for the pressure transducer and pressure switch racks

Pressure transducer and switch racks 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 pressure transducer and switch racks 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 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. They also contain all the cryogenic safety devices (relief valves, cryogenic quench valves and burst discs) required to protect the coils, busbars, 80 K helium shield circuit, 50 K helium current lead circuit and feeder vacuum boxes.

Pressure transducers are required to get the pressure and flow measurements needed to control the Magnet cooling. Pressure switches are required in addition to implement some Safety functions.

All these pressure transducer and pressure switch components are operated at room temperature and in the atmosphere.

All these pressure transducer and pressure switch components comply with the environmental conditions they are installed and then shall be qualified accordingly.

All these pressure transducer and pressure switch components shall be installed in racks ready to install and connect to the Magnet systems. The rack frame shall be compliant with the seismic requirements.

Pressure transducers, differential pressure transducers and pressure switches shall use proven technologies with references.

3 Scope of work

The contract scope of work is made of the following:

- ✓ Select and qualify the pressure transducer and pressure switch product meeting the technical requirements. See the specs summary in performance and connecting configuration below.
- ✓ Qualify the selected products to the a Magnetic field of 100 mT in steady state.
- ✓ Design the stainless steel rack support (316L material to be used) able to support the pressure transducers and pressure switches. There are **30 racks to deliver**. A few pressure transducers and switches shall be delivered as separate components. The contractor shall propose to ITER the arrangement on the rack support for the pressure sensors including the routing of the capillaries between sensors and the defined interface area and the electrical connection to a rack junction box. Before manufacturing and assembly of pressure sensors rack supports, the arrangement shall be compatible with the space allocation and validated by ITER. An illustration of such a rack is given in the Figure 1.
- ✓ Manufacture the racks, install the pressure transducers and pressure switches, piping and cabling.
- ✓ Perform factory acceptance tests including at least leak tests, pressure tests and functional tests. The pressure tests shall performed 3.0 MPa after assembly and connection to pressure sensors. The leak tightness of the pressure sensors including manifold and all capillary tube

connections on the rack support shall be better than $10^{-9} \text{ Pa.m}^3.\text{s}^{-1}$ ($10^{-8} \text{ mbar.l.s}^{-1}$) at the maximum operating pressure 3.0MPa.

- ✓ Deliver to ITER site.

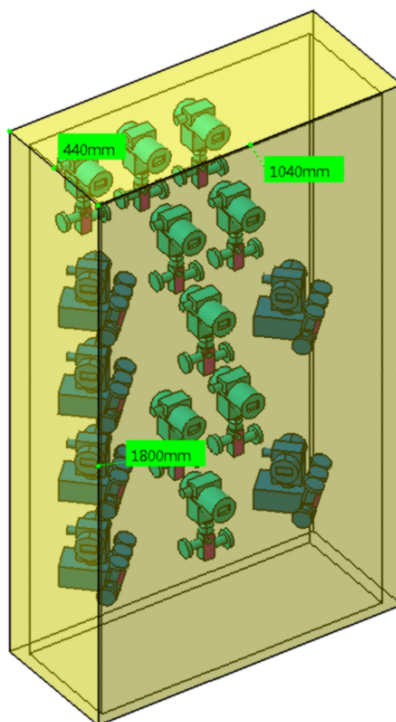


Figure 1: Illustration of a pressure transducer and pressure switch rack

Main specifications for the absolute pressure transducers

515 absolute pressure transducers shall be delivered with the following main requirements:

Requirements	Values
Range of measure	0 – 3.0MPa absolute
Max allowable pressure	> 3.0 MPa
Min allowable pressure	Vacuum
Accuracy	< 0.1% of the full scale (to be maintained even under magnetic field)
Fluid operation	Helium gas
Temperature	Room Temperature (15°C-30°C)
Type	Pressure transducer
Calibration	Calibrated between 0-3.0MPa absolute with calibration certificates
Standards	CE mark including PED 97/23/EC

All absolute pressure transmitters shall be equipped with 2 manifold valves in order to facilitate maintenance and calibration. Stainless steel (316L) shall be used as main material for valves, manifolds and connections.

Main specifications for the differential pressure transducers

275 differential pressure transducers shall be delivered with the following main requirements:

Requirements	Values
Range of measure	0 – 0.020 MPa differential pressure
Max allowable pressure	> 3.0 MPa (also in differential pressure in both direction)
Min allowable pressure	Vacuum
Accuracy	< 0.1% of the full scale (to be maintained even under magnetic field)
Fluid operation	Helium gas
Temperature	Room Temperature (15°C-30°C)
Type	Differential Pressure transducer
Calibration	Calibrated between 0-0.025MPa differential pressure with calibration certificates
Standards	CE mark including PED 97/23/EC

All differential pressure transducers shall be equipped with manifold valves in order to facilitate maintenance and calibration. Stainless steel (316L) shall be used as main material for valves, manifolds and connections.

Main specifications for differential pressure switches

40 differential pressure switches shall be delivered with the following main requirements:

Requirements	Values
Range of operation	0.1 MPa / - 0.1MPa
Max allowable pressure	> 3.0 MPa (also in differential pressure in both direction)
Min allowable pressure	Vacuum
Accuracy	< 1% of the full scale (to be maintained even in magnetic field environment)
Stability	< 1% of the full scale (to be maintained even in magnetic field environment)
Fluid operation	Helium gas
Temperature	Room Temperature (15°C-30°C)
Type	Differential Pressure switches
Calibration	Calibrated and tested with certificates
Standards	CE mark including PED 97/23/EC
Safety requirement	SIC-2 component: A dedicated qualification test campaign has to be organised by the contractor in magnetic field with the full measure chain including the cables to ensure the performance. IO shall be involved in test program definition and shall witness the qualification test. A dedicated manufacturing dossier shall be provided for each component with all inspection and test performed.

Main specifications for the pressure safety switches

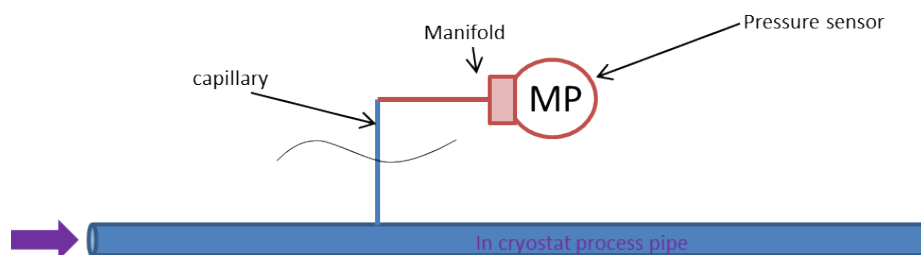
64 pressure Safety switches shall be delivered with the following main requirements:

Requirements	Values
Range of operation	atm / vacuum
Max allowable pressure	> 1.0 MPa
Min allowable pressure	Vacuum
Accuracy	< 1% of the full scale (to be maintained even in magnetic field environment)
Stability	< 1% of the full scale (to be maintained even in magnetic field environment)
Fluid operation	Helium/Air
Temperature	Room Temperature (15°C-30°C)
Type	Relative Pressure switches
Calibration	Calibrated and tested with certificates
Standards	CE mark including PED 97/23/EC
Safety requirement	SIC-2 component: A dedicated qualification test campaign has to be organised by the contractor in magnetic field with the full measure chain including the cables to ensure the performance. IO shall be involved in test program definition and shall witness the qualification test. A dedicated manufacturing dossier shall be provided for each component with all inspection and test performed.

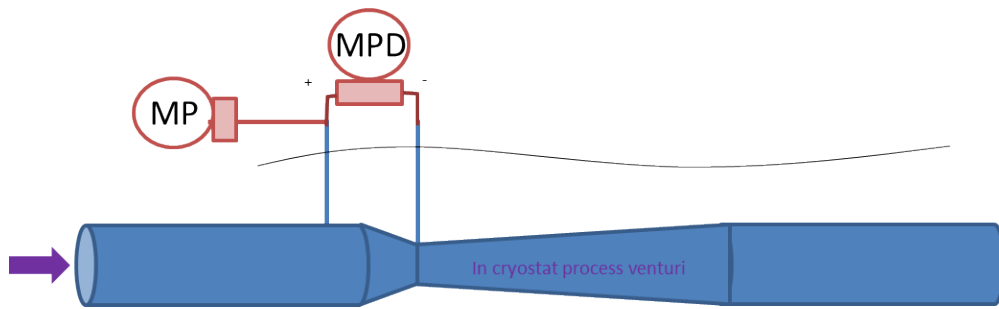
Pressure measurement configurations:

The pressure transducers and switches targeted by this contract will be involved in the following pressure measurement configurations. Only the red part is part of the contract scope.

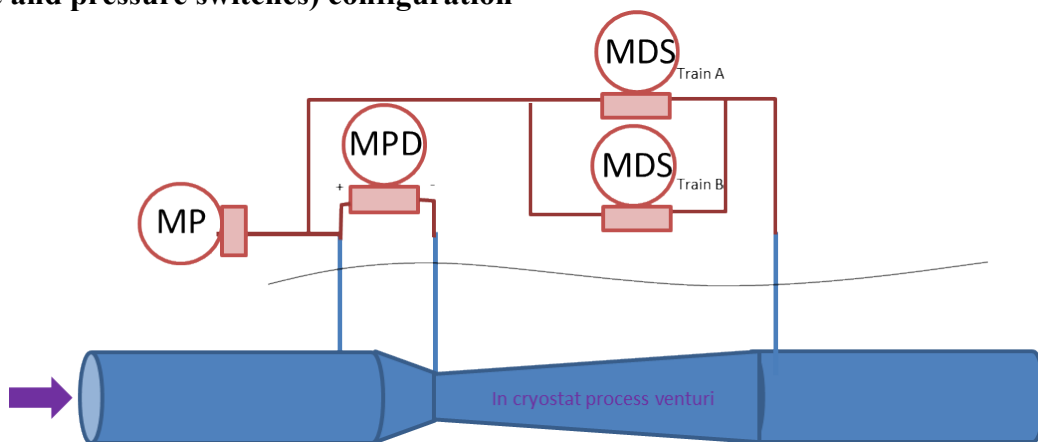
Single absolute pressure measurement configuration



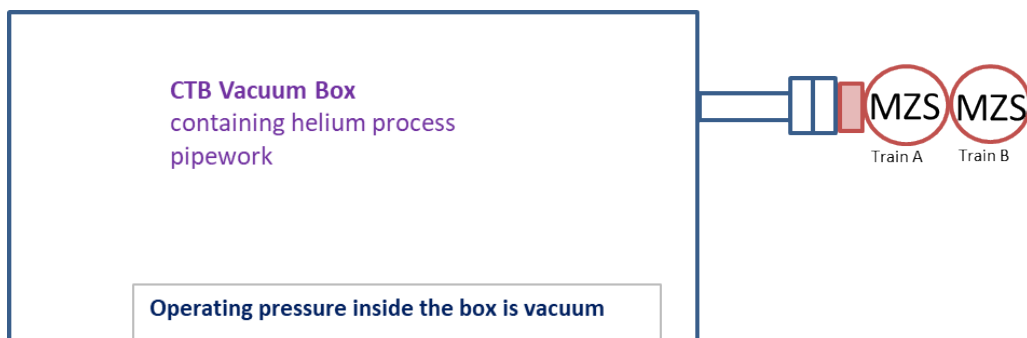
Venturi Mass flowmeter measurement (Absolute pressure and differential pressure) configuration



Venturi Mass flowmeter measurement for TF feeders (Absolute pressure, differential pressure and pressure switches) configuration



CTB vacuum safety pressure switches configuration



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:

- ✓ Experience and proven solutions in industrial pressure measurements and Safety pressure switches.
- ✓ Experience and capability to perform magnetic field tests.
- ✓ Experience in designing steel frame structures and modelling for checking the seismic loads requirements.
- ✓ Experience in high quality piping and instrumentation signal cabling and wiring.
- ✓ Capability to perform qualification tests at its premises (i.e. Helium leak tests, Pneumatic and Hydrostatic pressure tests...)

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

ITER is a Nuclear Facility identified in France by the number INB-174 (“Installation Nucléaire de Base”). For Protection Important Components (PIC) and in particular Safety Important Class components (SIC), the French Nuclear Regulation must be observed, in application of the Article 14 of the *ITER Agreement*:

- ✓ The *Order 7th February 2012* applies to all the components important for the protection (PIC) and the activities important for the protection (PIA).
- ✓ The compliance with the INB-order must be demonstrated in the chain of external contractors.
- ✓ In application of article II.2.5.4 of the *Order 7th February 2012*, contracted activities for supervision purposes are also subject to a supervision done by the Nuclear Operator.

For all Protection Important Components, structures and systems of the nuclear facility and Protection Important Activities (PIA), the Candidates shall ensure that a specific management system is implemented for his own activities and for the activities done by any subcontractor following the requirements of the *Order 7th February 2012*.

9 Applicable document and references

- [1] ITER cryogenic handbook [ITER_D_2LJS3K](#)
- [2] ITER vacuum handbook [ITER_D_2EZ9UM](#)
- [3] ITER Abbreviations [ITER_D_2MU6W5](#)
- [4] ITER Procurement Quality Requirements [ITER_D_22MFG4](#)
- [5] Qualification guidelines [ITER_D_WGFF3G](#)
- [6] List of ITER-INB Protections Important Activities, [ITER_D_PSTTZL](#)
- [7] Provisions for Implementation of the Generic Safety Requirements by the external interveners [ITER_D_SBSTBM](#)

10 Definitions

CTB	Coil Termination Box
IO	ITER Organisation
He	Helium
SIC	Safety Important Class
PIC	Protection Important Component
TF	Toroidal Field
CC	Correction Coil
PF	Poloidal Field
STR	Structures
CS	Central Solenoid
MP	Pressure sensor
MPD	Differential pressure sensor
MDS	Pressure switch
MZD	Pressure safety switch
MIP	Manufacturing and Inspection Plan