Contract for the Centralized Procurement and Preassembly of Piping Systems for ITER

ADDENDUM 2

Summary for the Test Blanket Modules

Purpose

The purpose of this Contract is the Centralized Procurement and Preassembly of Piping Systems for ITER. Addendum 2 gives the details of the piping required for the Test Blanket Modules (TBMs) to be included in this contract.

Background

The Connection Pipes for the Test Blanket Systems:

A tritium breeding blanket ensuring tritium self-sufficiency is a compulsory component for DEMO although is not present in ITER. Mock-ups of DEMO breeding blankets, called Test Blanket Modules (TBMs), inserted and tested in ITER in three dedicated equatorial ports directly facing the plasma, are the principal means by which ITER will provide the first experimental answers on the correct performance of the breeding blankets, which remains an open issue on the path to commercial fusion power. These activities correspond to the so-called “TBM Program”.

The TBM Program plans to test mock-ups of (prototypical) complete DEMO breeding blanket systems in ITER, which means that the breeding blanket mock-ups (i.e. the Test Blanket Modules, TBMs) are connected with several ancillary systems (e.g. cooling systems, tritium extraction systems, coolant purification systems, maintenance systems, and measuring and control systems). TBMs and associated systems are called Test Blanket Systems (TBSs).

The TBMs will be installed in 3 dedicated equatorial ports of ITER (ports #2, #18, and #16) directly facing the plasma. TBMs are inserted in 20 cm-thick water-cooled steel frames that act as the unique interface with shield modules and Vacuum Vessel (thermal, mechanical and neutronic interfaces). Each port can host 2 TBMs, and therefore 6 TBMs and associated independent systems shall be simultaneously tested in ITER. The overview of the six Test Blankets Systems and their location within the Tokamak Complex are shown in Fig. A1.

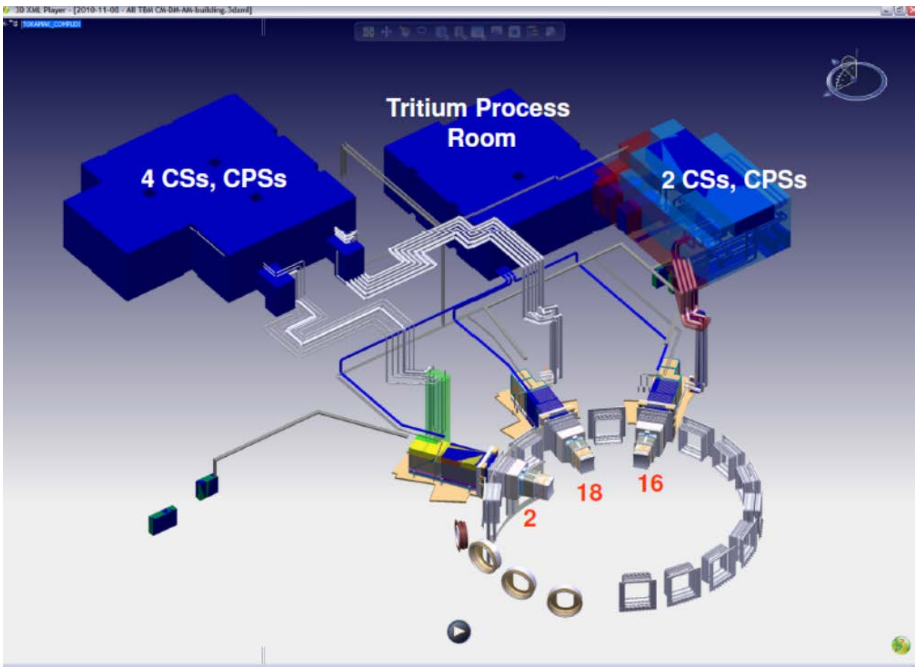

Fig. A1: View of the CATIA Model of the TBM Ancillary Circuits from Port Cells (#2, #18 and #16 to TWCS Vault Annex, CVCS area and to L2 of the Tritium Building

A connection pipe is defined as a pipe going from one room of a building to another room of the same or of another building through wall penetrations and/or shafts and/or corridors. The connection with each specific component in the room is not included. Therefore, when a system is entirely located in the same room, no connection pipes are involved.

Some details of the TBS Connection Pipes are given in Fig. A2 and Fig. A3.

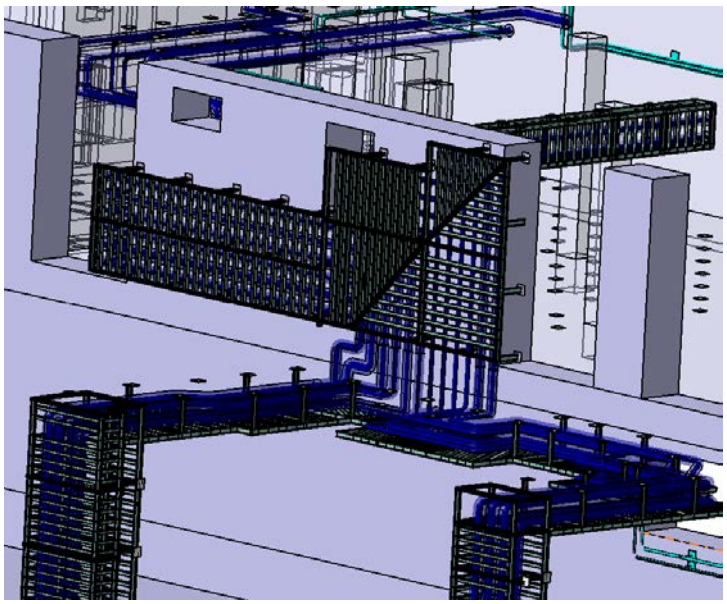

Fig. A2: View of TBS connection pipes in Level 3 and 4 of the Tokamak building (the models of pipes supports and protection grids are also shown).

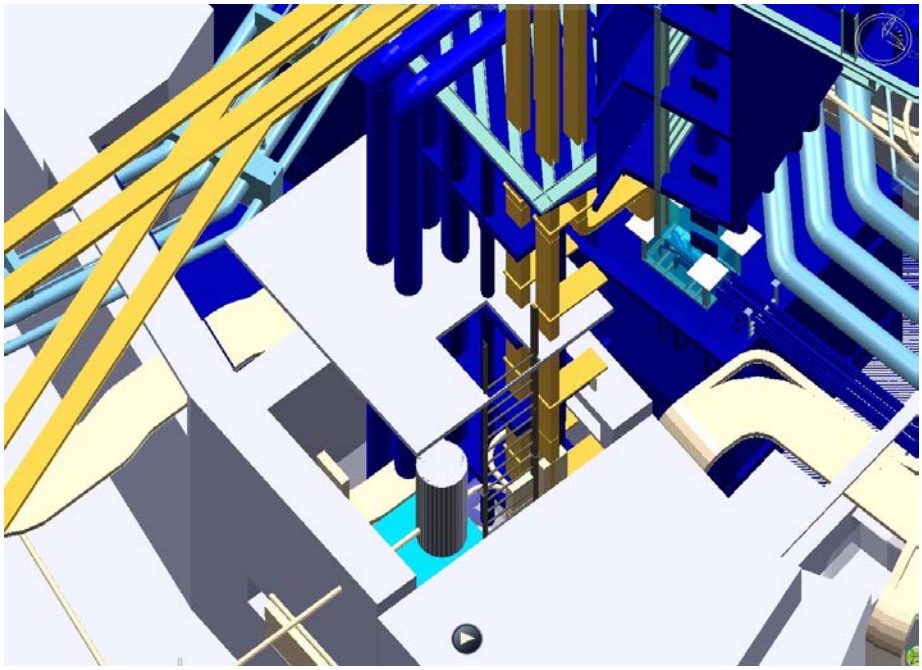

Fig. A3: Details of TBS Connection Pipes and supports with the Shaft #18.

The Tables in Annex A1 define the preliminary specifications for the TBS Connection Pipes. In particular, in Annex 5 there are 3 Tables: Table A1-1 for the Connection Pipes for the TBS cooling circuits, Table A1-2 for the Connection Pipes for the TBS Tritium Circuits and Table A1-3 for the Connection Pipes for the TBS coolant purification systems.

The main Connection Pipe technical specifications are the following:

- The Connection Pipe structural material (e.g., SS-316L or equivalent grade for EN standard) will be used.
- Only one type of thermal insulator will be used.
- Only one design code will be used (e.g., RCC-MR)
- Connection Pipe diameters and schedules given in Annex 5 (and thermal insulator thickness) are preliminary and will be optimized taking into account the following data:
    - Operating and design pressure
    - Operating and design temperatures
    - Maximum expected flow-rates
    - Maximum acceptable pressure drops
    - Composition and mass of the fluids
    - Standardization of the pipe characteristics will be applied (i.e. same characteristics for same functions).

The procurement will include also pipes supports and pipes protective grids. One valve per each pipe will also be necessary (characteristics to be defined).

The Tenderer, awarded and having signed the Contract shall be denominated as the Contractor.

Scope of work

The contractor shall execute the following activities, in compliance with the French Quality Order of 7 February 2012, in compliance with the applicable ESP-ESPN classification and conformity requirements, and under the direct supervision of the selected NB or ANB, where applicable:

1. propose solutions to optimize the piping design introducing modularity and prefabrication, using spools, skids, protection grids, support structures and thermal insulator, as driven by the IO assembly requirements;
2. apply best value for money criteria to evaluate subtier suppliers and manufacturers of piping materials and components and to submit a list to IO for approval;
3. procure the piping, fitting, protection grids and valves according to the IO Technical Specifications and selected codes & standards (ASME and/or RCC-MR), based on quantity estimates provided by IO. ;
4. procure the thermal insulator according to the IO Technical Specifications;
5. execute the prefabrication or pre-assembly of the piping in skids or spools with supporting structures as proposed by the Contractors and accepted by IO following the IO assembly schedule
6. execute piping examination and testing, NDE inspections and hydrotestings according to the selected codes & standards (ASME and/or RCC-MR);
7. provide packaging, temporary storage and shipping of piping materials and preassembled spools from workshops to ITER site at Cadarache;
8. provide the necessary certification of conformity.

Estimated Duration and Timetable

The duration of the Contract will be approximately 5 years from the date of the signature.

The tentative timetable of the applicable to Addendum 2 for the Call for Tender procedure is as follows:

- Call for Nominations October 2013
- Call for Pre-qualification November 2013
- Call for Tender January 2014
- Tender submission March 2014
- Award of contract May 2014
- Task Order for TBS connection pipes Dec 2015
- The final input data for TBS connection pipes will be available in July 2015.

Experience

The potential tenderers shall have proven experience in the following areas:

- Design of large and complex cooling systems for Nuclear Power Stations according to ASME codes & standards and in compliance with the French regulations (QO 1984, ESP/ESPN for Pressure Equipment);
- Supply of piping systems and piping supports for nuclear island and/or for auxiliary circuits according to ASME and/or RCC-MR codes & standards and in compliance with the French regulations (QO 1984, ESP/ESPN for Pressure Equipments). Pre-fabrication and fabrication of piping systems, modules, spools, skids, and supporting structures in qualified workshops in compliance with the French regulation (QO 1984, ESP-ESPN for Pressure Equipments) and under the control of NB and ANB

Particular interest shall be paid to the Tenderers that have or plan to have workshop nearby or in close proximity (< 50 km) to IO site at Cadarache.

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.

Annex A1

Present characteristics of the 6 TBS Connection Pipes (i.e. pre-conceptual design)

(Note: these data might evolve during the progress of the pipes design and, therefore, are given here as "preliminary"; they do not represent any commitment for IO)

Within the six Test Blanket Systems (A1, A2, B3, B4, C5, C6), the subsystems requiring connection pipes (including thermal insulator) and their identification are the following (data to be confirmed for the Conceptual Design):

- 56-A1-HE: Helium-coolant system : operating temperature and pressure: 500ºC, 8 MPa.
- 56-A1-HP : Helium-coolant purification system : operating temperature and pressure: 500ºC, 8 MPa.
- 56-A1-TR : Tritium Removal system : operating temperature and pressure: RT, 0.4 MPa.
- 56-A2-HE : Helium-coolant system : operating temperature and pressure: 500ºC, 8 MPa.
- 56-A2-HP : Helium-coolant purification system : operating temperature and pressure: 500ºC, 8 MPa.
- 56-A2-TE : Tritium Extraction System : operating temperature and pressure: RT, 0.4 MPa.
- 56-B3-WA : Water-coolant system : operating temperature and pressure: 325ºC, 15.5 MPa.
- 56-B3-TE : Tritium Extraction System : operating temperature and pressure: RT, 0.1 MPa.
- 56-B4-HE : Helium-coolant system: operating temperature and pressure: 500ºC, 8 MPa.
- 56-B4-HP : Helium-coolant purification system : operating temperature and pressure: 500ºC, 8 MPa.
- 56-B4-TE : Tritium Extraction System : operating temperature and pressure: RT, 0.1 MPa.
- 56-B4-LH : Extra-Connection Pipes : operating temperature and pressure: 500ºC, 8 MPa.
- 56-C5-HE : Helium-coolant system: operating temperature and pressure: 500ºC, 8 MPa.

- 56-C5-HP : Helium-coolant purification system : operating temperature and pressure: 500ºC, 8 MPa.
- 56-C5-TE : Tritium Extraction System : operating temperature and pressure: RT, 0.1 MPa.
- 56-C6-HE : First Wall (FW) Helium-coolant system: operating temperature and pressure: 500ºC, 8 MPa.
- 56-C6-TE : Tritium Extraction System : operating temperature and pressure: RT, 0.1 MPa.
- 56-C6-LH : LiPb Helium-coolant System (secondary coolant): operating temperature and pressure: 500ºC, 8 MPa.
- 56-C6-LP : LiPb cover gas sub-system: operating temperature and pressure: RT, 0.1 MPa.
- 56-00-W1 : CCWS-1 distribution network for PBS-56: same characteristics as the CCWS-1 loop.

The TBS Connection Pipes are defined by the following parameters:

- Operating and design temperatures
- Operating and design pressures
- Maximum allowable pressure and temperature
- Pipe numbers and materials
- Pipe diameters and schedule
- Thermal insulator material and thickness (if any)
- Classifications : Safety, ESP/ESPN, Quality Class

Note:

Each connection pipes will terminate on both side with a flange (and, possibly, a control system for applying inert gas) in order to be able to connect the remaining part of the circuit several years later.

Table A1-1: Connection Pipes for the TBSs Cooling Circuits

Sub-system	Function	Start	End	DN/Schedule	O.Diameter / Thickness (mm)	Length (m)	Nb of bends	Material	Linear Density (kg/m)	Total weight (tons)	ESP/ESPN	Safety	Quality Class
56.A1.HE	Inlet	11-L1-C16	11-L3-02E	DN150/80s	168.3/10.97	34.9	11	SS-316L	43.2	1.51	II/no	SIC-2	QC1
56.A1.HE	Outlet	11-L1-C16	11-L3-02E	DN150/80s	168.3/10.97	33.9	11	SS-316L	43.2	1.46	II/no	SIC-2	QC1
56.A2.HE	Inlet	11-L1-C16	11-L3-02E	DN150/80s	168.3/10.97	34.9	11	SS-316L	43.2	1.51	II/no	SIC-2	QC1
56.A2.HE	Outlet	11-L1-C16	11-L3-02E	DN150/80s	168.3/10.97	34.9	11	SS-316L	43.2	1.51	II/no	SIC-2	QC1
56.B3.WA	Inlet	11-L1-C18	14-L4-20	DN80/160s	88.9/11.13	65.6	22	SS-316L	21.7	1.42	II/N2	SIC-2	QC1
56.B3.WA	Outlet	11-L1-C18	14-L4-20	DN80/160s	88.9/11.13	64.3	22	SS-316L	21.7	1.39	II/N2	SIC-2	QC1
56.B4.HE	Inlet	11-L1-C18	14-L4-20	DN80/80s	88.9/7.62	60.5	16	SS-316L	15.6	0.94	II/no	SIC-2	QC1
56.B4.HE	Outlet	11-L1-C18	14-L4-20	DN80/80s	88.9/7.62	61.6	16	SS-316L	15.6	0.96	II/no	SIC-2	QC1
56.B4.LH	Inlet	11-L1-C18	14-L4-20	DN125/40s	141.3/6.55	59.5	15	SS-316L	22.1	1.31	II/no	SIC-2	QC1
56.B4.LH	Outlet	11-L1-C18	14-L4-20	DN125/40s	141.3/6.55	57.6	17	SS-316L	22.1	1.27	II/no	SIC-2	QC1
56.C5.HE	Inlet	11-L1-C02	14-L4-20	DN150/80s	168.3/10.97	76.0	26	SS-316L	43.2	3.28	II/no	SIC-2	QC1
56.C5.HE	Outlet	11-L1-C02	14-L4-20	DN150/80s	168.3/10.97	74.3	22	SS-316L	43.2	3.20	II/no	SIC-2	QC1
56.C6.HE	Inlet	11-L1-C02	14-L4-20	DN100/120s	114.3/11.13	71.0	23	SS-316L	21.4	1.52	I/no	SIC-2	QC2
56.C6.HE	Outlet	11-L1-C02	14-L4-20	DN100/120s	114.3/11.13	72.6	21	SS-316L	21.4	1.55	I/no	SIC-2	QC2
56.C6.LH	Inlet	11-L1-C02	14-L4-20	DN80/120s	88.9/11.13	74.0	22	SS-316L	21.4	1.58	I/no	SIC-2	QC2
56.C6.LH	Outlet	11-L1-C02	14-L4-20	DN80/120s	88.9/11.13	73.4	21	SS-316L	21.4	1.57	I/no	SIC-2	QC2
Total	-	-	-	-	-	**936.5**	-	-	-	**25.5**	-	-	-

Table A1-2: Connection Pipes for the TBSs Coolant Purification Circuits (for Accountancy)

Sub-system	Function	Start	End	DN/Schedule	O.Diameter/ Tkh (mm)	Length (m)	Nb of bends	Material	LD (kg/m)	Tot Wt (tons)	ESP/ESPN	Safety	Quality Class
56.A1.HP	Outlet	11-L3-02E	14-L2-24	DN25/40s	33.7/3.4	67.3	26	SS-316L	2.6	0.17	0/N3	SIC-2	QC1
56.A2.HP	Outlet	11-L3-02E	14-L2-24	DN25/40s	33.7/3.4	63.6	26	SS-316L	2.6	0.16	0/N3	SIC-2	QC1
56.B4.HP	Outlet	14-L4-20	14-L2-24	DN25/10s	33.7/2.8	88.0	26	SS-316L	2.1	0.19	0/N3	SIC-2	QC1
56.C5.HP	Outlet	14-L4-20	14-L2-24	DN25/10s	33.7/2.8	92.0	29	SS-316L	2.1	0.20	0/N3	SIC-2	QC1
56.C6.HP	Outlet	14-L4-20	14-L2-24	DN25/10s	33.7/2.8	128	33	SS-316L	2.1	0.27	SEP/no	SIC-2	QC2
Total	-	-	-	-	-	**438.9**	-	-	-	**1.0**	-	-	-

Table A1-3: Connection Pipes for the TBSs Tritium Circuits and for LiPb cover gas (if any)

Sub-system	Function	Start	End	DN/Schedule	O.Diameter/ Tkh (mm)	Length (m)	Nb of bends	Material	LD (kg/m)	T Wt (tons)	ESP/ESPN	Safety	Quality Class
56.A1.TR	Inlet	11-L1-C16	14-L2-24	DN15/40s	21.3/2.8	50.0	15	SS-316L	1.3	0.07	0/N3	SIC-2	QC1
56.A1.TR	Outlet	11-L1-C16	14-L2-24	DN15/40s	21.3/2.8	49.5	15	SS-316L	1.3	0.06	0/N3	SIC-2	QC1
56.A2.TE	Inlet	11-L1-C16	14-L2-24	DN20/10s	26.7/2.1	55.6	15	SS-316L	1.9	0.11	0/N3	SIC-2	QC1
56.A2.TE	Inlet nb2	11-L1-C16	14-L2-24	DN20/10s	26.7/2.1	55.6	15	SS-316L	1.9	0.11	0/N3	SIC-2	QC1
56.A2.TE	Outlet	11-L1-C16	14-L2-24	DN20/10s	26.7/2.1	55.7	15	SS-316L	1.9	0.11	0/N3	SIC-2	QC1
56.B3.TE	Inlet	11-L1-C18	14-L2-24	DN15/10s	21.3/2.1	41.0	15	SS-316L	1.9	0.08	0/N2	SIC-2	QC2
56.B3.TE	Inlet nb2	11-L1-C18	14-L2-24	DN15/10s	21.3/2.1	41.0	15	SS-316L	1.9	0.08	0/N2	SIC-2	QC2
56.B3.TE	Outlet	11-L1-C18	14-L2-24	DN15/10s	21.3/2.1	41.5	15	SS-316L	1.9	0.08	0/N2	SIC-2	QC2
56.B3.TE	Outlet nb2	11-L1-C18	14-L2-24	DN15/10s	21.3/2.1	41.5	15	SS-316L	1.9	0.08	0/N2	SIC-2	QC2
56.B4.TE	Inlet	11-L1-C18	14-L2-24	DN40/10s	48.3/2.8	44.8	15	SS-316L	3.2	0.14	0/N3	SIC-2	QC1
56.B4.TE	Outlet	11-L1-C18	14-L2-24	DN40/10s	48.3/2.8	45.0	15	SS-316L	3.2	0.14	0/N3	SIC-2	QC1
56.C5.TE	Inlet	11-L1-C02	14-L2-24	DN40/10s	48.3/2.8	71.5	16	SS-316L	3.2	0.23	0/N3	SIC-2	QC1
56.C5.TE	Outlet	11-L1-C02	14-L2-24	DN40/10s	48.3/2.8	71.0	16	SS-316L	3.2	0.23	0/N3	SIC-2	QC1
56.C6.TE	Inlet	11-L1-C02	14-L2-24	DN15/40s	21.3/2.8	75.0	15	SS-316L	1.3	0.10	SEP/no	SIC-2	QC2
56.C6.TE	Outlet	11-L1-C02	14-L2-24	DN15/40s	21.3/2.8	75.3	15	SS-316L	1.3	0.10	SEP/no	SIC-2	QC2
56.C6.TE	Outlet nb2	11-L1-C02	14-L2-24	DN15/40s	21.3/2.8	75.8	15	SS-316L	1.3	0.10	SEP/no	SIC-2	QC2
56.C6.LP	Inlet cg	11-L1-C02	14-L2-24	DN25/40s	33.4/2.8	75.8	15	SS-316L	1.9	0.11	0/no	SIC-2	QC1
56.C6.LP	Outlet cg	11-L1-C02	14-L2-24	DN25/40s	33.4/2.8	75.8	15	SS-316L	1.9	0.11	0/no	SIC-2	QC1
Total	-	-	-	-	-	**1041.4**	-	-	-	**2.0**	-	-	-