

Design and manufacturing of the VV PHTS and Drying System FILTERS

Call for Nomination

Purpose

The purpose of this Contract is to design and manufacture 2 filters for Vacuum Vessel Primary Heat Transfer System (VV PHTS) and 4 filters for the Drying system (DYS) of Tokamak Cooling Water System (TCWS).

The VV PHTS filters shall be compliant with the French Order dated 30 December 2015 on Nuclear Pressure Equipment (ESPN) and the 2014/068 EU directive. The VV PHTS filters named 26PHVV-FI-1001/1002 are classified as ESPN equipment level N3.

The DYS filters shall be compliant with the Pressure equipment 2014/068 EU directive. The DYS filters named 26DY00-FI-1001/1002/1003/1004 are classified as pressure equipment category IV.

The ITER Organization will act as Equipment Manufacturer of the VV PHTS filters as it pertains to the ESPN, which is the legal entity which assumes responsibility for the design, manufacture and inspection of a product to be marketed under its name as an item of pressure equipment, nuclear pressure equipment, or a nuclear pressure assembly. ITER will liaise with the Agreed Notified Body for the ESPN compliance assessment.

The supplier will act as Equipment Manufacturer for the 4 DYS filters unless different arrangement is agreed by the IO.

The supplier will be responsible of drafting the Nuclear Pressure Equipment (ESPN) and the 2014/068 EU directive required documentation, such as hazards and risk analysis, design notes and drawings, design notes justifying correct equipment behaviour for each possibility of damage from the different cases of load combinations, instruction manual as well as any other document that can be used to show compliance to the essential safety requirements.

The main design parameters of the VV PHTS filters are the following:

Table A-1. Nominal Performance and Design Conditions – Cartridge Filter Housing

Parameter	Value
Fluid type	Demineralized water ⁽¹⁾
Min/max mass flow, kg/s	1.5/10 ⁽²⁾
Max. Operating temperature, °C	90-155 ⁽²⁾
Max. Operating pressure, MPa	1.6 ⁽⁵⁾
Design pressure, MPa	2.6 ⁽³⁾
Design temperature, °C	220 ⁽³⁾

*Nozzles ⁽⁴⁾		
<i>Service</i>	<i>ID</i>	<i>DN / Schedule</i>
Filter Inlet	N1	65 / 40S
Filter Outlet	N2	65 / 40S
Rupture Disk	N3	20 / 40S

* All nozzles are welded connection.

Table A-2. Nominal Performance and Design Conditions – Cartridge Filter Elements

Parameter	Value
Fluid type	Demineralized Water ⁽¹⁾
Min/max mass flowrate, kg/s	1.5/10 ⁽²⁾
Min/max volumetric flowrate, L/min at operating conditions	93/658
Max. Operating temperature, °C	90-155 ⁽²⁾
Max. Operating pressure, MPa	1.6 ⁽⁵⁾
Allowable pressure drop at 5 kg/s flowrate, MPa	0.24 ⁽²⁾
Filter element pore size (absolute), µm	5.0
Filtration efficiency, %	98

The main design parameters of the DYS filters are the following:

Table A-1. Nominal Performance and Design Conditions – Cartridge Filter Housing

Parameter	Value
Fluid type	Humid nitrogen ⁽¹⁾
Mass flow, kg/s	7 ⁽²⁾
Operating temperature, °C	40 ⁽²⁾
Operating pressure, MPa	1.3 ⁽²⁾
Maximum pressure drop (dirty filter, at 7 kg/s), MPa	0.07 ⁽²⁾
Design pressure, MPa	4.8 ⁽³⁾
Design temperature, °C	100 ⁽³⁾

Nozzles ⁽⁴⁾		
<i>Service</i>	<i>ID</i>	<i>DN / Schedule</i>
Filter Inlet	N1	65 / 40S
Filter Inlet	N1	65 / 40S
Filter Outlet	N2	65 / 40S
Filter Outlet	N2	65 / 40S
Drain	N4	25 / 40S
Drain	N4	25 / 40S
<i>Service</i>	<i>ID</i>	<i>Parameters</i>
Level Switch	MLS 9105	¾" (*)
Level Switch	MLS 9106	¾" (*)

* All threaded connections shall be made with Swagelok Two-Ferrule, mechanical grip design tube fittings or

Table A-2. Nominal Performance and Design Conditions – Cartridge Filter Elements

Parameter	Value
Fluid type	Humid Nitrogen ⁽¹⁾
Mass flow, kg/s	7 ⁽²⁾
Operating temperature, °C	40 ⁽²⁾
Operating pressure, MPa	1.3 ⁽²⁾
Allowable pressure drop (dirty filter, at 7 kg/s), MPa	0.07 ⁽²⁾
Filter element pore size (absolute), µm*	500
Filtration efficiency, %	100
End cap configuration	SOE, 2-222 O-ring with spear end-cap

Background

The Tokamak Cooling Water System (TCWS) is the primary coolant system of ITER machine having the aim to remove the power generated by the plasma and transferred to dedicated components of the machine and to release it to the secondary coolant system.

The TCWS is based on three Primary Heat Transfer Systems (PHTSs): VV PHTS for cooling the Vacuum Vessel, IBED PHTS for cooling the in-vessel components and NBI PHTS for cooling the Neutral Beam Injectors.

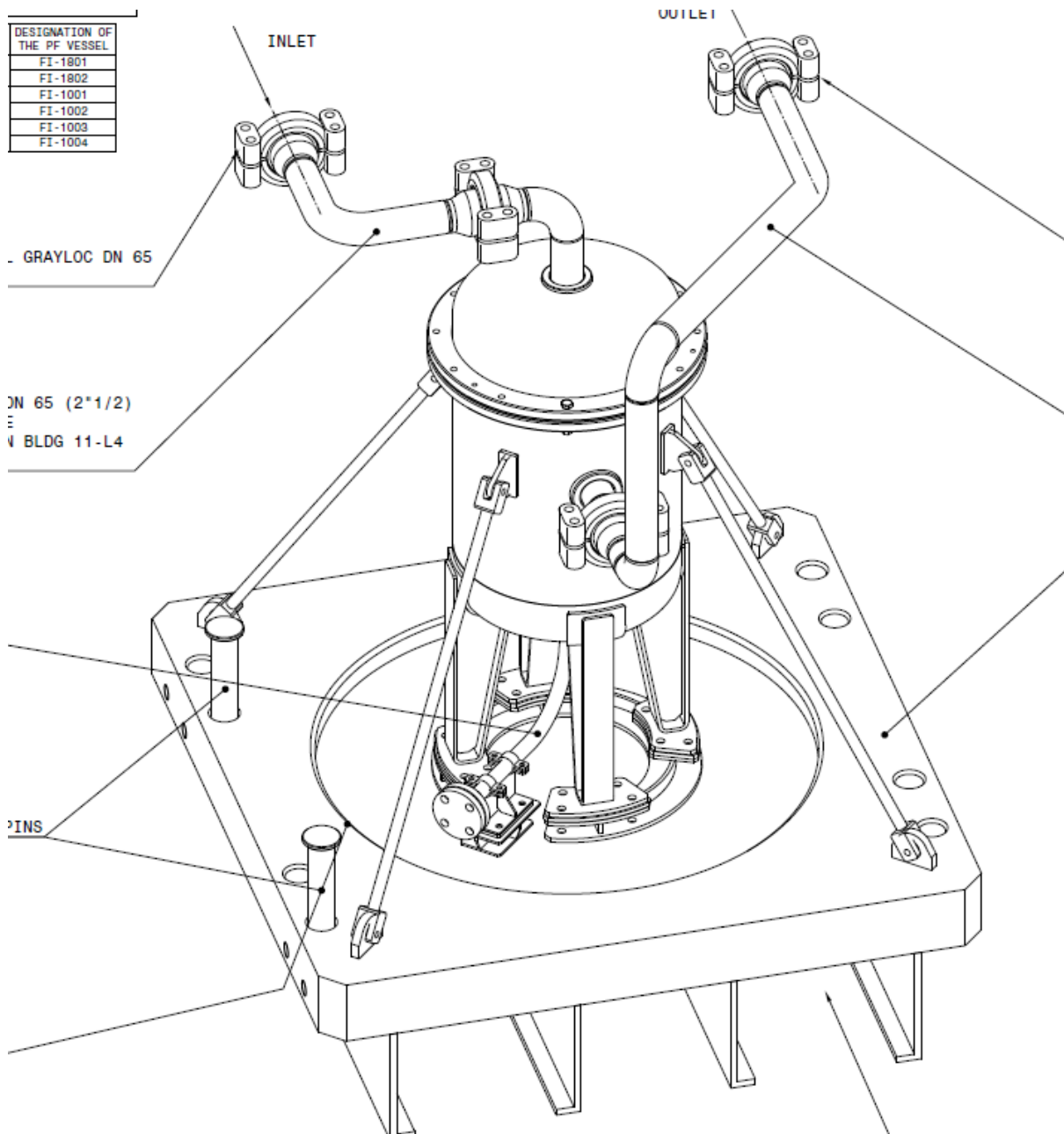
The TCWS includes auxiliary systems as the Chemical and Volume Control System (CVCS), Draining and Refilling System (DRS), and Drying System (DYS).

The TCWS is designed to reject all the heat generated in the plasma and transmitted to the in-vessel components to the intermediate closed loop CCWS-1 (Component Cooling Water System 1) and then to the environment via the HRS (Heat Rejection System). TCWS release heat also to the Chilled Water System (CHWS).

In the ITER Plant Breakdown Structure (PBS), the Cooling Water System consisting of TCWS, CCWS, CHWS and HRS, is represented by the PBS 26. The level 2 and 3 of PBS 26 and the sub-systems belonging to TCWS are reported in Table 2.1.

The Vacuum Vessel Primary Heat Transfer System (VV PHTS) provides cooling and baking services by supplying demineralized water to the main channels of the vacuum vessel, field joints, port extensions and port stub extension field joints at the lower ports, and the neutral beam port extensions. The VV PHTS is designed to provide the primary confinement for Activated Corrosion Products and tritium entrained in the cooling water outside the Vacuum Vessel and maintains leak tight integrity during all operating modes. As part of the function to maintain chemistry, the VV PHTS has a separate loop that includes two vertical mechanical water filters (each of them hereinafter is referred to as VV PHTS Filter) to remove insoluble containments and species from VV PHTS water. Each VV PHTS Filter shall consist of a filter housing, a set of filter elements, nozzles, bolts, supports, handling and lifting lugs, and gaskets.

The Drying System (DYS) provides removal of water from TCWS that cannot be gravity drained and gas baking of divertor cassettes. The DHS should be capable to dry the in-vessel components of the client systems in preparation for periodic leak testing, maintenance or component replacement; able to blow-out (where required) and dry IBED PHTS and DHS loops to meet operational requirements; able to provide hot nitrogen for gas baking of the divertor cassettes; capable to provide the primary confinement for small amounts of activated corrosion products and tritium during drying operations. Four DHS Filters (In case, Two Filters each 50% operation) retain particulate matter that may be contained in nitrogen-water mixture. Each DHS Filter shall consist of filter housing, a set of filter elements, nozzles, bolts, supports, handling and lifting lugs, and gaskets.



Scope of work

The contract will include design, fabrication, inspection, examination, testing, certification, packaging, and shipping of the 6 filters described above (including cartridges and supporting frame).

Timetable

The tentative timetable is as follows:

Tender submission

May 2020

Contract placement	July	2020
Completion of Contract	January	2022

Experience

The contractor and its personnel shall have adequate experience in manufacturing of stainless steel pressure filters in compliance with the 2014/068 EU directive and American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PV) Section VIII, Division 2—2017 Edition or equivalent codes. Experience in Nuclear waste handling would be beneficial.

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.