ITER Torus & Cryostat CRYOPUMPS (OPE-0966)
PRELIMINARY CONTRACT SCOPE AND DESCRIPTION

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(information presented here may be subject to changes)
The Design of Torus Cryopump is driven by the fact that to sustain fusion, the plasma must be continuously pumped:

- Only a few % of the fuel is burned in the plasma and turns into He ashes.
- Divertor configuration allows exhaust of excess fuel, ashes and impurities.
- Continuous pumping and fueling are necessary to maintain core fuel density.

Pumps in the divertor ports pump the neutral gas containing fuel, impurities and helium ash.
System Scope

6 Torus Cryopumping Systems
- 1 Torus Cryopump
- Vacuum Instrumentation
- 1 Actuator Control System
- 1 Helium Inerting System
- 1 Control cubicle
- 4 Pneumatic enclosures
- Cabling

2 Cryostat Cryopumping Systems
- 1 Cryostat Cryopump
- Vacuum Instrumentation
- 1 Actuator Control System
- 1 Control cubicle
- 2 Pneumatic enclosures
- Cabling

Final Design level

6x

2x
Contract Scope

F4E preliminary contract scope and description

- 6 Torus Cryopumping Systems
  - 1 Torus Cryopump
  - Vacuum Instrumentation
  - 1 Actuator Control System
  - 1 Helium Inerting System
  - 1 Control cubicle
  - 4 Pneumatic enclosures
  - Cabling

- TCCS

- 2 Cryostat Cryopumping Systems
  - 1 Cryostat Cryopump
  - Vacuum Instrumentation
  - 1 Actuator Control System
  - 1 Control cubicle
  - 2 Pneumatic enclosures
  - Cabling

Final Design Level
Final Design Level

Supplier scope

- Manufacturing Design + Manufacturing Readiness Review
- Procurement of raw material and off-the-shelf components for eight cryopumps and their related systems
- Machining, manufacturing
- Assembly of all subcomponents into eight cryopumps + peripheral systems
- Factory Acceptance Tests
- Packing and shipping to ITER site

Out of scope

- Final Design
- Site Acceptance Tests
- Installation, testing, commissioning
- Manufacture of Johnston Couplings
- Control/conditioning of instrumentation
Overall scope

- 6 Torus Cryopumping Systems
- 2 Cryostat Cryopumping Systems
The cryopumps (Torus and Cryostat)

- Charcoal coated cryopanels
- Pump casing
- Johnston couplings
- Pump plug
- Pneumatic actuator
- Valve head
- Double bellows assembly
- Thermal radiation shield
- Valve stem
- Valve shaft
The cryopumps (Torus and Cryostat)

- Cryopanels
- Thermal radiation shield
- Pump casing
- Valve assembly
- Other components integrated in the cryopumps:
  - Temperature sensors + cabling
  - 2 electrical feedthroughs
  - Valve double bellows
  - Pneumatic actuator
  - 7 DN65 + 1 DN150 flanges
  - 4 Johnston Couplings
  - Seals, bolts, nuts
  - Transport and storage frame
**Main components:**
- Pressure gauges (Pirani + cold cathode + membrane)
- Pressure switches (membrane)
- Residual Gas Analyzer
- Connecting pipes + supports + flanges
- Double containment feature
- Valves
- Cabling + connectors
- Conditioning electronics

*Note: still to be decided if instruments will be free-issued to the contractor and only installation will be part of the scope.*
**Scope: Actuator control system**

**Main components:**
- Cubicle/enclosure
- Valves
- PIC valves
- Pneumatic connections
Main components:
- 2 gas Helium tanks
- Valves
- SIC valves
- Burst disks
- Injection line
Technical requirements

Some of the technologies included in the scope:
- Hydroforming
- Charcoal coating
- Electropolishing
- Hard chrome plating
- Copper electrodeposition of temperature sensors
- Complex pipe fitting
- Blackening
- Electron beam welding

Some of the materials/components included in the scope:
- Mainly 1.4307 austenitic stainless steel
- Some of the components with limitation on Co, Ta, Nb
- Some of the components are ESR (valve stem)
- Instruments based on off-the-shelf / catalogue components
- Single items based on off-the-shelf components (seals, washers)
Special technologies

Hydroforming
Charcoal coating

Vacuum and Tritium compatible, radiation hard ceramic glue

Charcoal adhered in the glue
Tendering phase

Invitation to participate:
Nov-Dec 2018

Selection of candidates based on eligibility/exclusion and selection criteria

Launch invitation to tender

Submission of Requests to Participate

Submission of Preliminary tenders

Evaluation of tenders

Negotiation phase – possible intermediate tender submissions

Contract signed:
Before November 2019
Contract schedule outline

Contract signed: November 2019

Manufacturing design

Manufacturing Readiness Review (Hold Point)

Manufacturing & testing

Delivery of 1st cryopump: March 2022

Delivery of last cryopump: November 2022
Thank you for your attention

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