
TECHNICAL NOTE

RELATED TO THE OPE-1405 MARKET SURVEY ON

INTEGRATION OF JT-60SA ACTIVELY COOLED DIVERTOR



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1 INTRODUCTION TO JT-60SA AND THE ACTIVELY COOLED DIVERTOR

The Tokamak JT-60SA, which is currently under construction in Japan, is a nuclear fusion experiment aimed to research the technical and physical basis of future fusion power plants. Large superconducting magnets create a toroidal magnetic field, thus confining the high temperature plasma in a ring like shape. The plasma can reach temperatures of up to 200 million degrees Celsius (20keV) at its centre. At these temperatures, nuclei of hydrogen isotopes have a high probability of fusing to helium nuclei.

All components exposed to the plasma inside the tokamak vessel (i.e. in-vessel components), must be able to withstand extreme heat fluxes (up to 10MW/m²). Moreover, some specific components must act as a collector for the hot ashes coming from the plasma (i.e. the Divertor). The Divertor must be protected by a series of heat resistant elements (i.e. high heat flux elements), made of carbon-based material attached to an actively cooled metallic heat sink.

➤ JT-60SA ACTIVELY COOLED DIVERTOR

The role of the Divertor is to absorb the stray particles and heat radiation escaping the plasma, diverting this high energy to the in vessel cooling system. The divertor is made of 36 identical cassettes (Figure 1), equipped with several plasma facing components installed on a stainless steel cassette frame, and cooled by pressurized water through a network of stainless steel pipes. The divertor units are also equipped with several diagnostics to diagnose the plasma and the divertor operation itself.

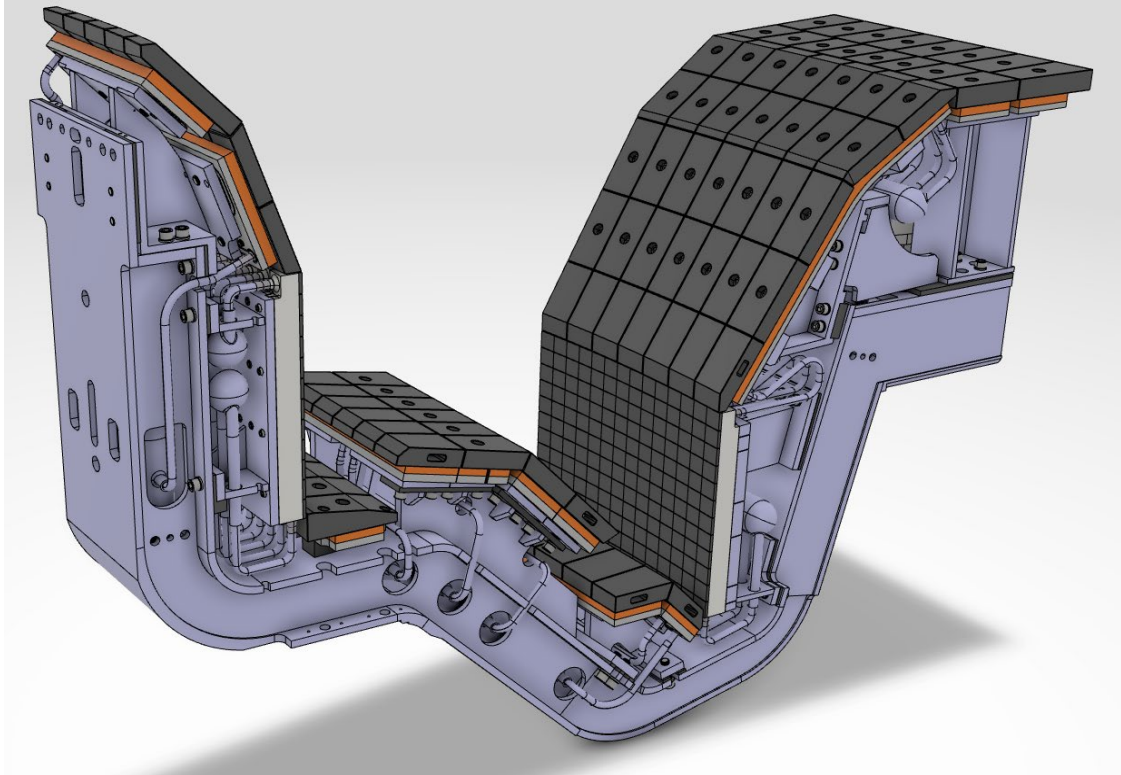


Figure 1 - Divertor cassette

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2 SCOPE OF WORK

The scope of this contract is the procurement of the hardware of the divertor diagnostics and the provision of integration, customization, testing, packing and shipment services for the integration of the divertor units.

The hardware to be provided consists of:

- Langmuir probes (made of machined solid tantalum, including insulated ceramic bushing, mica insulating sheets, cables and sheaths)
- Rogowski coils (made of mineral insulated cables, wound into specific shapes and complete with terminals and leads)
- Thermocouples (type-K, with stainless steel sheath and cables)
- Gas injection pipes (stainless steel, 10/12 mm diameter, bent to final shape)

The services to be provided for the integration of the plasma facing components and the diagnostics to the divertor units consist of:

- Precise assembly
- Mechanical connections (bolting, fitting)
- Welding (orbital welding, hand TIG welding, in-bore welding)
- Metrology (laser or optical metrology)
- Testing (pressure, hot leak test at 200C in a vacuum oven)
- Packing and shipment to Japan

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3 EXPECTED SKILLS/EXPERIENCE

The successful tenderer is expected to have, either internally or by its sub-contractors, the following skills/experience:

- Precise assembly assisted by custom made templates and/or metrology
- Optical and laser metrology in support of the assembly and positioning of the plasma facing components on the divertor units.
- Orbital welding of small stainless steel pipes in tight spaces. Ideally experience in design of custom orbital welding heads for such applications (e.g. for pipe bundles, heat exchangers, steam generators, etc.)
- In Bore TIG Welding of stainless steel pipes for the connection of the inner vertical target main pipes.
- Hand TIG welding of stainless steel pipes
- Non-destructive examination of welded joints in stainless steel pipes (e.g. visual, penetrant and ultrasonic testing)
- Precision machining of stainless steel, copper alloys and graphite to perform minute customizations of parts during the integration process
- Pressure testing with third party inspection
- Hot leak testing of large (>1 m longest dimension) components in a vacuum oven at >200C
- Well-developed quality control system, under an international quality standard (e.g. ISO9001)

4 MARKET SURVEY

To establish an optimum contract strategy, F4E needs to develop its understanding of the market with a comprehensive list of possible interested EU suppliers.

In the frame of the Market Survey, interested suppliers are invited to submit information. This information will be visible to F4E only and will not be communicated to other parties, except if agreed upon by the respondent(s).

Please answer the Market Survey by clicking on this [LINK](#).

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