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Technical Specifications (In-Cash Procurement)

Technical specification for supply of lifting hoist and monorail for handling of baskets with specimens of ITER Corrosion Monitoring Chambers.

The purpose of this technical specification is to describe the requirements for the design and procurement of a lifting hoist and monorail for handling of baskets with specimens of ITER Corrosion Monitoring Chambers.

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1 Preamble

This Technical Specification is to be read in combination with the General Management Specification for Service and Supply (GM3S) – [AD1] that constitutes a full part of the technical requirements.

In case of conflict, the content of the Technical Specification supersedes the content of [AD1].

2 Purpose

The purpose of this technical specification is to describe the requirements for the design and procurement of a lifting hoist and monorail for handling of baskets with specimens of ITER Corrosion Monitoring Chambers.

3 Acronyms & Definitions

3.1 Acronyms

The following acronyms are the main one relevant to this document.

Abbreviation	Description
GM3S	General Management Specification for Service and Supply
IO	ITER Organization
ISI	In-Service Inspection System
CMC	Corrosion Monitoring Chambers
PPE	Personal Protection Equipment
LTM	Long Term Maintenance
NPE	Nuclear Pressure Equipment
VV	Vacuum Vessel
SIC	Safety Important Class
PIC	Protection Important Class
SR	Safety Relevant
NSR	Non-Safety Related
ESP	Équipements Sous Pression (Pressure Equipment)
ESPN	Équipement Sous Pression Nucléaire (Nuclear Pressure Equipment)
FAT	Factory Acceptance Test

4 Applicable Documents & Codes and standards

4.1 Applicable Documents

This is the responsibility of the Supplier to identify and request for any documents that would not have been transmitted by IO, including the below list of reference documents.

Upon notification of any revision of the applicable document transmitted officially to the Supplier, the Supplier shall advise within 4 weeks of any impact on the execution of the contract. Without any response after this period, no impact will be considered.

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Ref	Title	IDM Doc ID	Version
[AD1]	General Management Specification for Service and Supply (GM3S)	82MXQK	1.4
[AD2]	ITER_D_SMP384 - Arrêté du 30 décembre 2015 modifié relatif aux équipements sous pression nucléaires - (TRANSLATION-EN)	SMP384	v2.5

4.2 Reference Documents

Ref	Title	IDM Doc ID	Version
1	FN7YXY_v2-TOC_WPL_P62_20505-TOC_WPL_P62_20505 - TO#08 - Manufacturing drawing (PN) - Manufacturing drawing - Type 1' and type 2 metallic corbels and beam - TOC_WPL_P62_20505-B1	FN7YXY	2.0
2	ITER_D_CC9CEV - TOC_LDN_P62_00007 - Calculation note for specific corbels and beam B11-L4-04 (TO#08)	CC9CEV	1.1
3	5X9GL5_v5-209369-0000-DE00-GAD-0012-209369-0000-DE00-GAD-0012 - CMC Vessel layout drawing-05	5X9GL5	5.0
4	04/25-20-4-0/1/2/3/4 - VV ISI CMC Basket lifting adaptor	DFGJNTH	01
5	LST-0001,RPT-0001 - Baseframe Manufacturing Drawing-02	7V4SKB	02
6	62MBV4_v6-W50-ITERFBUK-035331-EQ-EQD-W50-ITERFBUK-035331-EQ-EQD - VV ISI CMC Basket and Sub-baskets layout drawing-06	62MBV4	06
7	YWEJXE_v4-055832-055832 - VV_ISI_CMS_GA---C	YWEJXE	04

5 VV ISI CMC System Description

5.1 VV In-Service Inspection Corrosion Monitoring Chambers overview

The primary purpose of the Vacuum Vessel In-Service Inspection Corrosion Monitoring Chambers is to monitor the evolution of corrosion in Vacuum Vessel material samples during the life of the ITER machine. The VV ISI CMC is in the Tokamak building, and is connected to the VV Primary Heat Transfer System (PHTS) downstream of the VV.

The VV ISI CMC will be used by the ITER Organization for performing periodic inspection and periodic requalification of the VV NPE, as required by the ESPN – [AD2]. ESPN and Équipements Sous Pression (ESP) stipulate the Operator (ITER Organization) is responsible for the maintenance, monitoring, and repairs required for the safe operation of the equipment.

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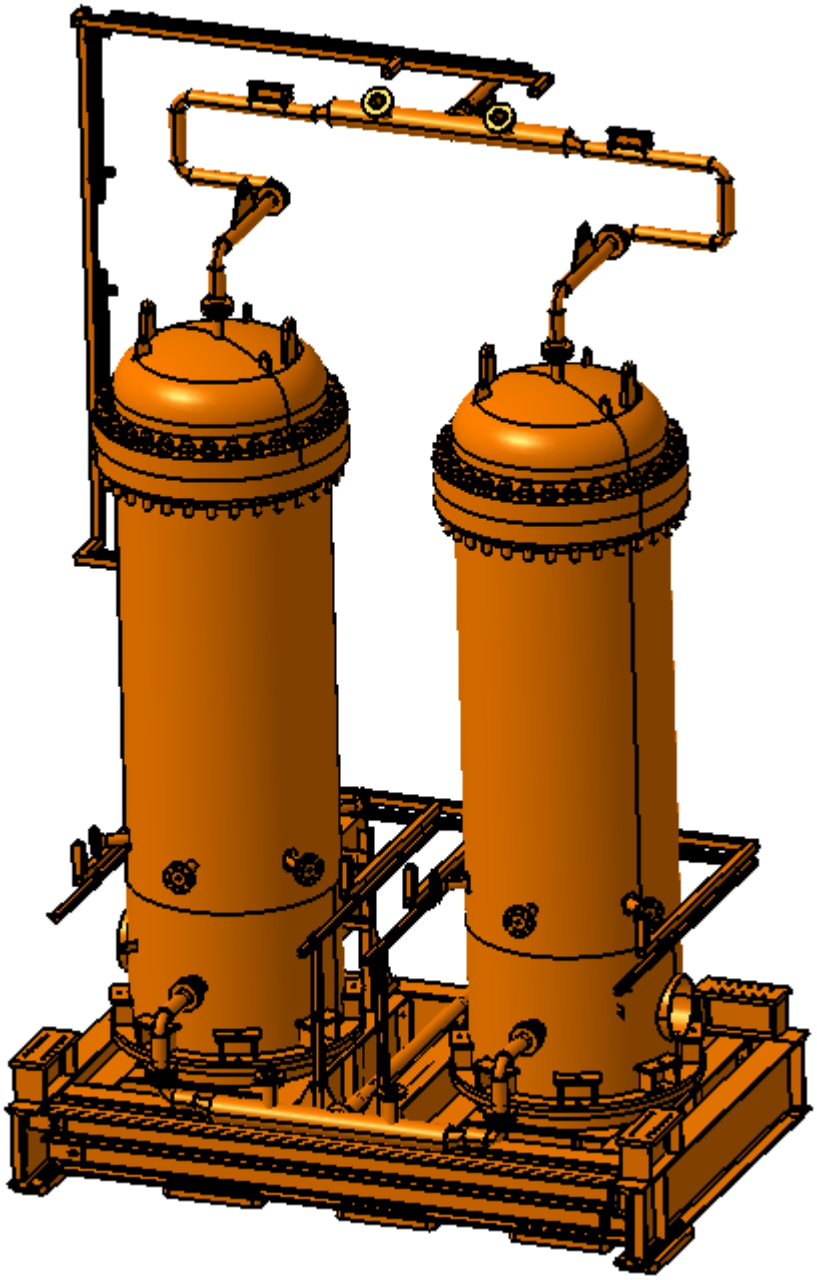

Figure 1 Corrosion Monitoring Chambers System

The VV ISI CMC shown in Figure 1 comprises:

- 2 Pressure Vessels
- Pipework for single point connection with the VV primary heat transfer system inlet & outlet, draining and venting
- Fixtures to hold the samples in baskets which can be removed to enable specimen inspection within the pressure vessels
- Flanges for interface, assembly, and maintenance
- Instrumentation for temperature and electrochemical potential monitoring within VV ISI CMC
- Silver/silver chloride reference electrode and platinum electrode in each CMC vessel, installed through 100mm flanged ports below the internal main basket containing the specimens
- Pressure gauges on each CMC

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- Data loggers to record operation data and associated shielded box to house them
- Thermal insulation to limit heat release to the room
- Structural supports for the pressure vessels and their pipework.

Drawings of these components can be found in the references [3] – [7] in the section 4.2 of this technical specification.

The component classification of the VV ISI CMC system is highlighted in the below Table 1, where the last two rows represent current scope of work.

Table 1: Components classification

VV ISI CMC Components	Safety class	Quality Class	Seismic class	ESP / ESPN category
Vessel	PIC/SIC-2	QC1	SC1(S)	IV/N3
Vessel lid	PIC/SIC-2	QC1	SC1(S)	IV/N3
Base Frame	NON-PIC / SR	QC1	SC1(S)	N/A
Pipework Upper	PIC/SIC-2	QC1	SC1(S)	IV/N3
Pipework Lower	PIC/SIC-2	QC1	SC1(S)	IV/N3
Electronic instrumentation equipment	NON-PIC / SR	QC1	SC1(S)	N/A
Basket	NON-PIC / SR	QC1	SC1(S)	N/A
Specimens	PIC/SIC-2	QC1	SC1(S)	N/A
Spool of pipe to connect to VV water cooling	PIC/SIC-2	QC1	SC1(S)	IV/N3
Human Access Platform	NON-PIC/ SR	QC1	SC1(S)	N/A
Corbel #1	NON-PIC/ NSR	QC1	SC1(S)	N/A
Corbel #2	NON-PIC/ NSR	QC1	SC1(S)	N/A
Cross-beam	NON-PIC/ NSR	QC1	SC1(S)	N/A
Monorail	NON-PIC/ NSR	QC1	SC1(S)	N/A
Lifting Hoist	NON-PIC/ NSR	QC1	SC1(S)	N/A

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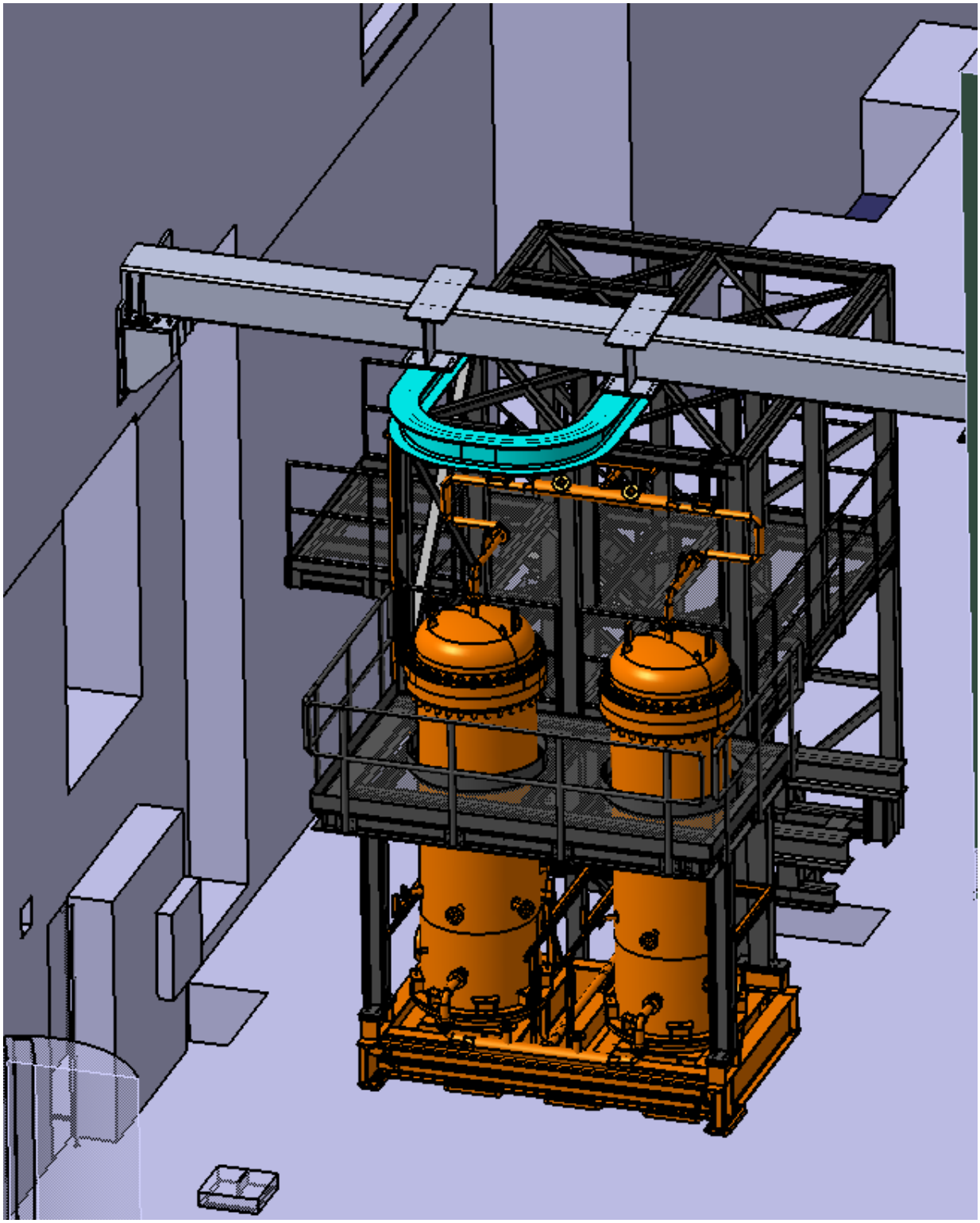

Figure 2. VV In-Service Inspection System Corrosion Monitoring Chambers is shown in the building with human access platforms and with supporting structure for the monorail.

The VV ISI CMC is a passive monitoring system, and as such it remains “in-service” throughout the plasma operation mode and the short-term maintenance mode. During the Long-Term Maintenance (LTM) mode the VV ISI CMC may perform these tasks:

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- Inspection of the specimens within the CMC (specimens/jigs will be removed c/w basket and sub-baskets to the Hot Workshop at L3 of Hot Cell Complex for inspection to be performed into an external Laboratory)
- Maintenance of the VV ISI CMC system itself.

5.2 Supporting structure for the lifting hoist

Corbel#1 and Corbel#2 as well as Cross-beam serve as supporting structure for the lifting hoist. Cross-beam has 2 welded pads with holes to bolt the counter plates of monorail.

Preinstalled supporting structure implies following requirements on the operability of monorail:

1. Monorail design tolerances referred to ISO 12488
2. Maximum lifting load (configuration "LTM"): 5 tons (assuming lifting hoist weight 0.3 tons, monorail weight to be considered), recommendations for the design of monorail are included in the calculation note [2];
3. Maximum beam displacement 5 mm, max. beam rotation 2.5 mrad for monorail operability with maximum lifting hoist load: 5 tons,
4. Recommended cross-section for the monorail: HEB300

5.3 Equipment, which needs to be lifted and handled

During long term maintenance the lifting hoist should lift and handle the upper lids of CMC vessels, should extract and handle the baskets with specimens along the U-shape monorail.

The two Corrosion Monitoring Chambers (Code of Construction ASME VIII, dv.2-2015) in stainless steel 316/316L provide an internal volume of approximately 3 m^3 to house the main basket with sub-baskets / specimens / jigs, with a vessel wall thickness (shell and heads) of 20 mm.

The vessels have a domed end at top and bottom, with the top head being a removable head assembly to allow access to the main basket and sub-baskets/specimens/jigs within. The compression on the gasket (Spiral Wound with 316L windings and graphite filler, c/w 316L inner and outer rings) is ensured by 44 studs to provide a good sealing joint.

The chambers themselves are mounted on skirts that sit on the base frame ring through a bolted connection.

5.3.1 Upper Piping

Upper Piping at one point is connected to the Vacuum Vessel cooling water system and at 2 other points it's connected to Vessel #1 and Vessel 2. The Valve on the piping shall be closed before starting the maintenance and piping duct shall be drained and vented. The workers standing on the human access platform shall disconnect the piping. Upper piping consists of several pipes, connected with flanges (figure 3), all are from Stainless steel 316L. Total weight including lagging is around 30 kg. This equipment can be handled either manually or using lifting hoist. After disconnection and handling piping can be kept on the floor during maintenance and does not require transportation to the Hot Cell building.

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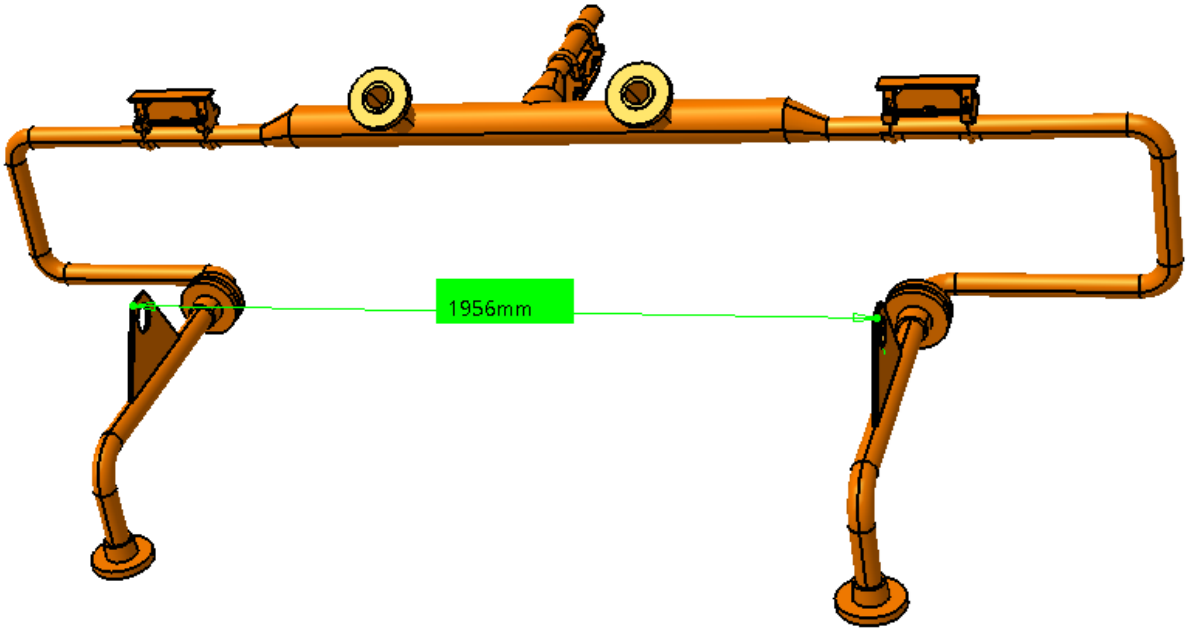

Figure 3 Upper piping

5.3.2 Vessel lid

Vessel lid is a top cover of CMC Vessel. Diameter is 1355 mm and overall weight including bolting is around 1 ton. Vessel lid is equipped with several lifting lugs which shall be used during lifting and handling.

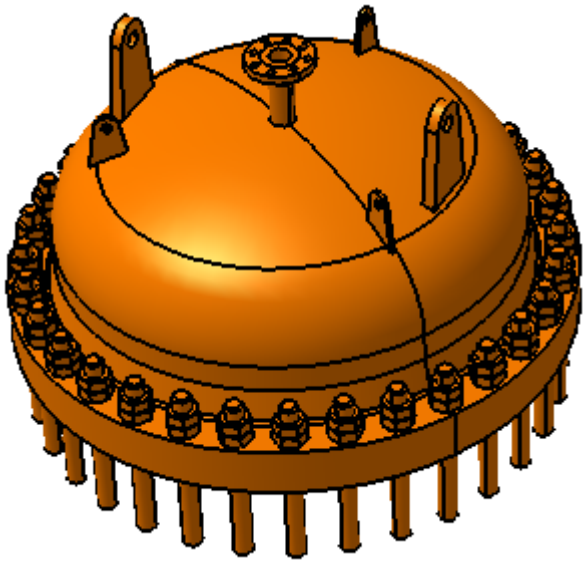

Figure 4 Vessel lid

5.3.3 Removable basket assembly

The main basket and sub-baskets maximize the available space within the Corrosion Monitoring Chamber to accommodate all the specimens and consider the limited headroom above the CMC vessel to allow for a lifting device and the main baskets removal from the system. The main basket, in stainless steel 316/316L is composed by an external structure with a top flange to be positioned on the CMC vessel ledge, three internal channels used to facilitate the installation of the 6-off sub-baskets (Figure 5 and 6). Each one of the 6-off sub-baskets (stacked on top of each

other), in stainless steel 316/316L contains internally a “boxed” structure directly welded to the bottom flange of the sub-basket to house the different specimens with jigs and mesh walls mounted on the external perimeter of the component providing protection against loose items in the Corrosion Monitoring Chamber migrating into the VV PHTS.

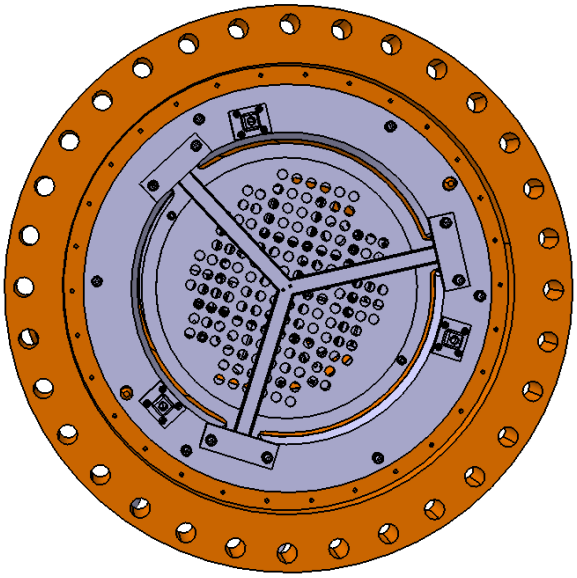

Figure 5 Main basket in the Vessel, top view

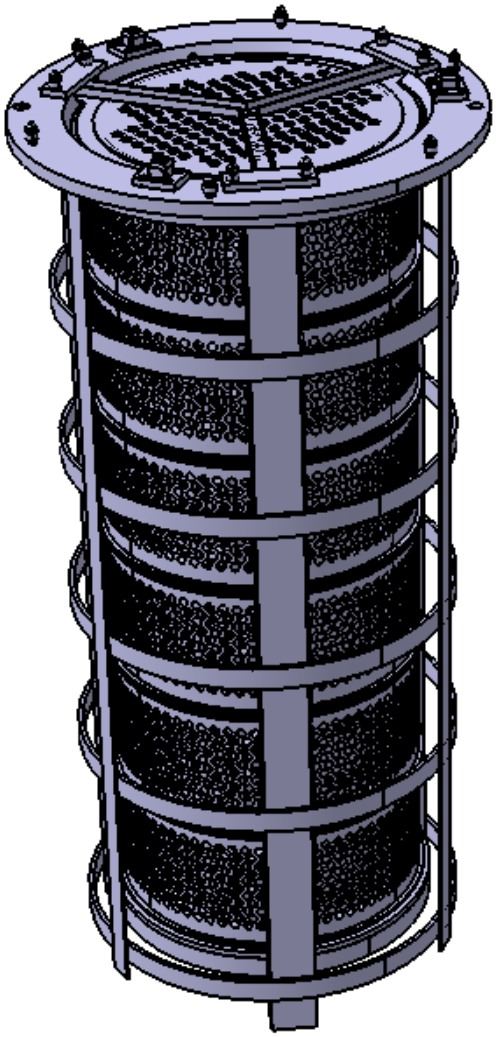

Figure 6 Main basket extracted from vessel

Lifting hoist in the scope of this contract should be capable to extract and handle the main basket as a whole structure and lower it up to the floor level. The entire main basket will be placed in the transportation canister and shall be transported to the Hot Cell building.

Removable basket characteristics:

Main basket weight (empty): ~239 kg

Weight (full): ~1330 kg (including sub-baskets and specimens)

Main basket dimensions: h 2030 mm x Φ 980 mm

Service life: 20 years

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6 Lifting Hoist in the Scope of Supply

6.1 Main Lifting Tasks

The lifting hoist shall perform following tasks during each Long Term Maintenance and during initial assembly of WP7 In-Service Inspection System:

- Removal and installation of the upper piping spool;
- Removal and installation of the vessel lid;
- Removal and installation of the baskets with specimens.

For more details refer to Section 7.

6.2 Preconditions for Performing Lifting Tasks

Lifting hoist will be used when human access to this area is allowed and these operations are considered human assisted.

Before opening the vessels, the volume inside will be vented and drained to minimize the presence of corrosion products adhering to the corrosion specimens, jigs and basket assemblies.

6.3 Hardware in the Scope of Supply

Lifting hoist in the scope of this supply contract consists, but is not limited to, the following hardware:

- Curved U-shape monorail with its welded or bolted attachments to the preinstalled cross-beam;
- Lifting device (electrically handled hoist on the monorail);
- Control unit.

6.4 Software in the Scope of Supply

If applicable, the software shall be provided as required by the design of the lifting hoist.

6.5 Main Activities in the Scope of Supply

Main activities in the scope of supply of this contract include:

- Design and fabrication of the U-shape monorail considering the interfacing data and quality requirements provided by ITER.
- Investigation of the market and selection of suitable off-the shelf electrical chain hoist certified as per applicable EU Directives and European Norms (EN), e.g. Machinery Directive 2006/42/EC, Low Voltage Directive 2006/95/EC, EMC Directive 2004/108/EC.
- Demonstration that selected Manufacturer has proven experience in delivering of lifting equipment for nuclear facilities.
- Demonstration that safety-related functions are integrated in the hoist design thanks to rugged and proven electronic controls in comparison with conventional controls (e.g. performance Level C and Category 2 to EN ISO 13849-1 are satisfied as minimum requirements for the safety-related functions specified in DIN EN 14492-2).
- In addition, the following strengths of the selected chain hoist shall be targeted:
    - Individual customer solutions offered by the Manufacturer (to fit better to the ITER environment and needs).
    - Versatile and fully equipped as standard.
    - Proven technology.

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- Tough and reliable.
- High level of safety and reliability and long service life.
- Simple commissioning.
- Ergonomic operation.
- Minimum maintenance requirement and easy to service.

7 Lifting and Handling Operations

Lifting and handling operations will be implemented when human access in this area is allowed. For human access to the upper pipe spool the access platform with stairs is permanently installed. Human access platform can house up to 2 workers with minimum set of PPE (AS + TyvekL + simple mask).

Operations listed in the below table 2 will be implemented during each long term maintenance and foreseen 40 LTMs during 20 years of ITER operation.

During each long term maintenance, it is required to open 1 CMC Vessel and extract 1 main basket. Whereas during next LTM the opposite CMC Vessel shall be opened and corresponding main basket shall be extracted.

Main basket will be packed in the transportation canister and transported to Hot Cell building, where the specimens will be extracted, packed and to be sent to laboratory for analysis.

Whereas new specimens shall be installed in the main basket in the Hot Cell building and transported back to the Tokamak building. In the

Tokamak building the main basket shall be placed back in the dedicated CMC vessel using the lifting hoist.

The anticipation is for 10 working cycles during 1 working day.

Table 2: Lifting and handling tasks description

Task Description
To remove the top lid of the CMC Vessel, to handle it along the monorail, to lower it up to floor level, where it could be grabbed by workers and positioned on the floor.
To engage the lifting adaptor with the main basket lifting lugs, to lift the main basket containing sub-baskets with all the corrosion specimens from the CMC, to handle it along the monorail to position the basket in the canister.
Using lifting hoist, to lift the lid from the lay down area, to handle it along the monorail and to place it on top of CMC Vessel

Room layout is show in the figure 2. Lifting and handling space overall dimensions are in the below figures 7 and 8.

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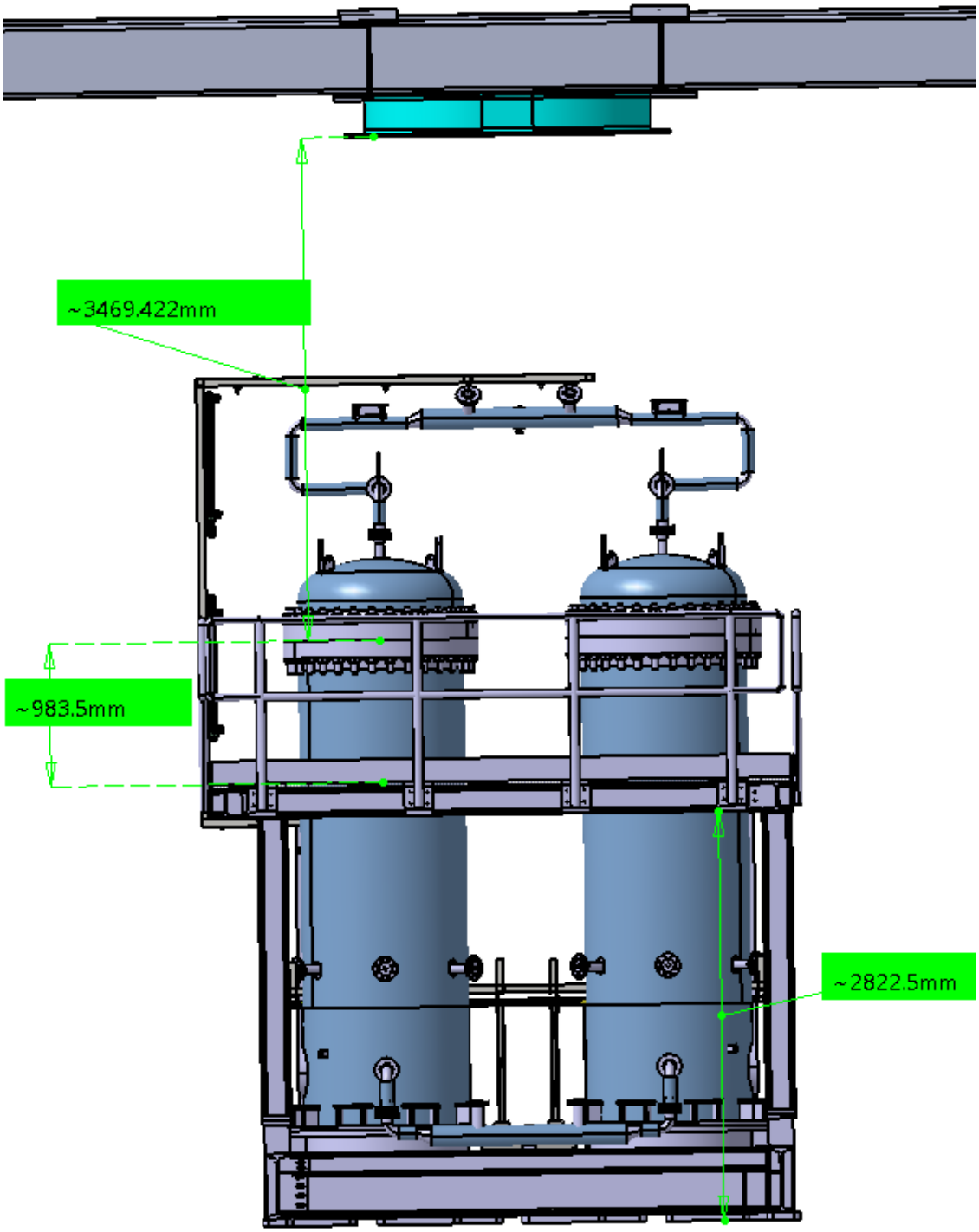

Figure 7 Lifting space layout, front view.

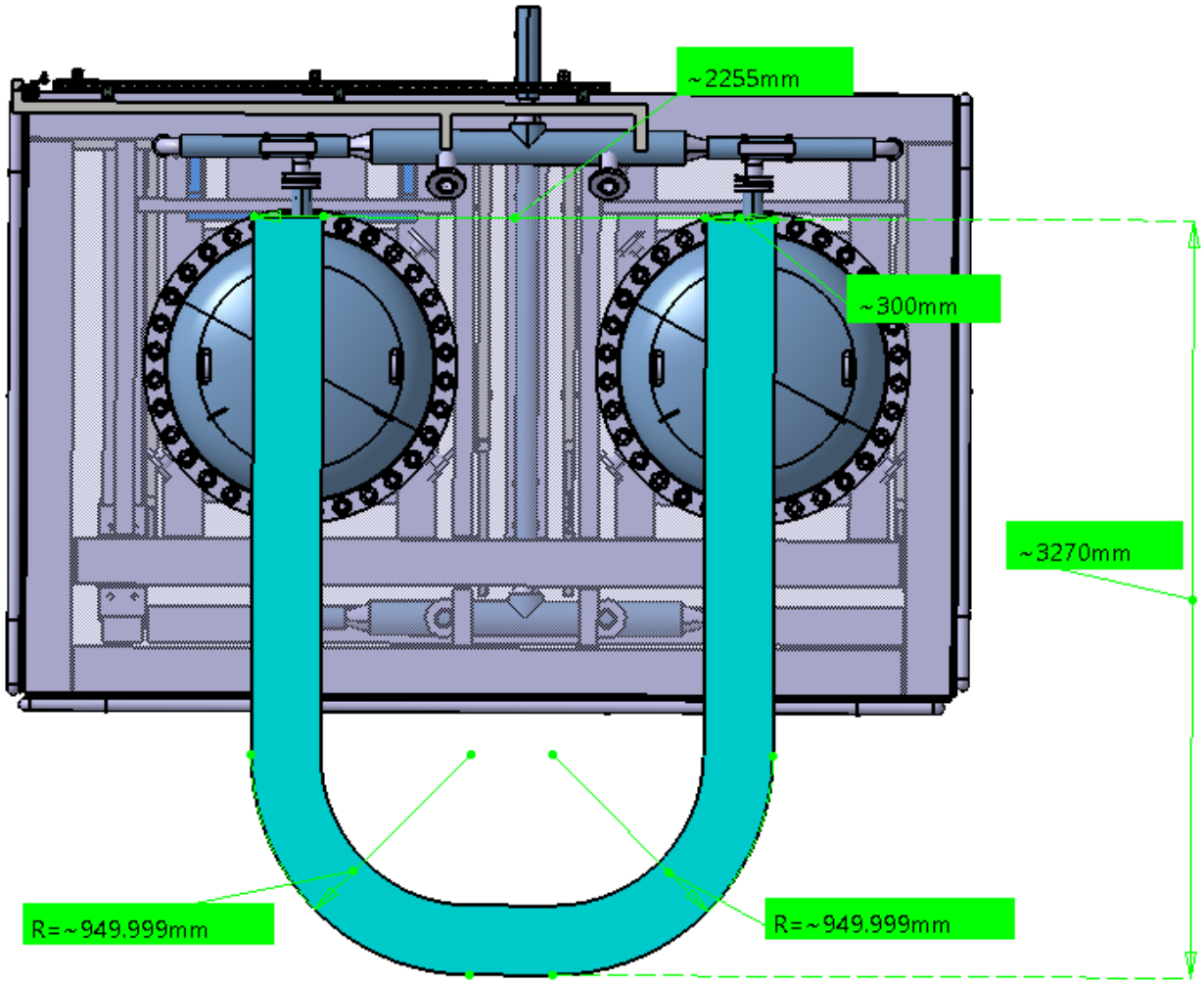

Figure 8 Handling space, top view, cross-beam not shown

8 Location for Scope of Work Execution

ALL the works in the scope of this contract are performed at supplier premises or supplier's subcontractors (off-site work).

9 IO Documents & IO Free issue items

As input data for the contract ITER will provide the 3D models and drawings of interfacing systems, including VV ISI CMC System, Corbels and cross-beam, human access platforms. ITER will also provide the calculation note for the corbels and cross-beam.

10 Deliverables and Schedule Milestones

10.1.1 Tentative Schedule

Schedule Milestones	Description	Is Contract Gate? (Y/N)	Expected Timing (T0+x) *

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#1	Manufacturing Design	Y	T0+6 months
#2	Manufacturing Readiness Review	Y	T0+8 months
#3	Factory Acceptance Test	Y	T0+15months
#4	Delivery	N	T0+18months

* TO = KOM date.

** Expected list of delivered documents is given in Appendix 1 (minimum but not limited to).

Delivery Conditions: The goods shall be delivered on the basis of Incoterms 2020 DAP (excluding customs duties and VAT) to the following address:

ITER Site located on the Route de Vinon-Sur-Verdon, CS 90046,
13067, Saint-Paul-lez-Durance,
France.

Installation of monorail and lifting hoist shall be done by assembly subcontractor and it is out of this contract scope.

11 Quality Assurance requirements

The Quality class under this contract is QC1, [AD1] GM3S section 8 applies in line with the defined Quality Class.

12 Safety requirements

The applicable standard for monorail and lifting hoist is EN 13001. Part EN 13001-2 of the standard states the applicable loads for design. Since the lifting and handling system in the scope of this contract has a planned interaction with PIC components, a specific additional safety factor shall be considered.

The most severe load combination considered is self-weight + seismic (Ex, Ey, Ez).

The calculation note [2] recommends following safety factors:

- The partial safety factor for fatigue loading: $\boldsymbol{\gamma Ff}$ = 1
- The partial safety factor for fatigue strength: γMf = 1.35

Monorail and lifting hoist are NON-PIC, QC1.

12.1 Seismic class

Components in the scope of this supply are seismic class: SC1(S).

13 Special Management requirements

Requirement for [AD1] GM3S section 6 applies in full.

13.1 CAD design requirements

This contract includes CAD works for the design of monorail and its interface to the cross-beam. This contract shall use the assynchronous CAD collaboration scheme, which include the following approach:

- ITER will provide the 3D Models of interfacing systems in the CATIA or in .stp format.
- Supplier must develop 3D models and manufacturing drawings of monorail in the scope of this contract and provide to ITER for approval before starting of manufacturing.

Appendix I – List of Documents Deliverables

This list outlines the key documents to be delivered. However, the deliverables are not limited to only listed hereunder: the rule to be considered is “as appropriate / as needed”:

1. Quality Plan.
2. 3D Models and Drawings.
3. Assembly Plan.
4. Operation Plan.
5. Maintenance Plan.
6. Manufacturing Inspection Plan (MIP).
7. Operation Manual.
8. Certificate of conformity.
9. End of Manufacturing Report (EMR);