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EXTERNAL REFERENCE / VERSION

Technical Specifications (In-Cash Procurement)

Technical Specification for CC Feeder Ring Rail System

This is the Technical Specification for CC Feeder Ring Rail System, to be attached under PF5 Coil, used for installation of Feeder Rings and Support Frames

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Definitions

Abbreviation	Definition
BCC	Bottom Correction Coils
CDR	Concept Design Review
CE	Conformité Européene
FAT	Factory Acceptance Test
FDR	Final Design Review
IO	ITER Organization
MD	Manufacturing Dossier
MIP	Manufacturing and Inspection Plan
NDT	Non-Destructive Testing
PNI	ITER Part Number
QA	Quality Activity
QC	Quality Class (1, 2, 3, or 4)
SAT	Site Acceptance Test
SCC	Side Correction Coils
TB	Transition Box (BCC Feeder Rings)
WLL	Working Load Limit
WPS	Welding Procedure Specification

For a complete list of ITER abbreviations see ref ITER Abbreviations (2MU6W5)

Throughout this document, the following terminology shall apply:

- “shall” is used wherever a provision is mandatory (it is a requirement). The IO RO shall be informed of any deviation.
- “should” is used wherever it is necessary to express recommended or preferred provisions, deviations are allowed but they shall be justified to the IO RO.
- “may” is used to expressed allowed provisions or potentialities.

Tooling Classifications	Class
Safety Classification	Non-SIC
Protection Classification	Non-PIC
Vacuum Classification	VQC N/A
Quality Classification	QC-1
Seismic Classification	SC-2

1 Introduction

This document is a Technical Specification for the procurement of a support structure for lifting and positioning tools called “Lower CC Feeder Ring Rail System”, for use in the clean area of the tokamak pit. Various lifting and positioning trolleys / tools will be attached to the Rail System and rolled along it. Some bracing tools will also be attached to the Rail System.

This tooling is classified as a Support Structure. It will be attached to the PF5 coil and used for installation of B2 Permanent Support Frames and B2 Feeder Rings.

Figure 1 shows the Rail System (green ring, in 18 segments) with some example tools attached. ONLY the Rail System is included in the scope of this technical specification. All trolleys and other tools are out of this scope.

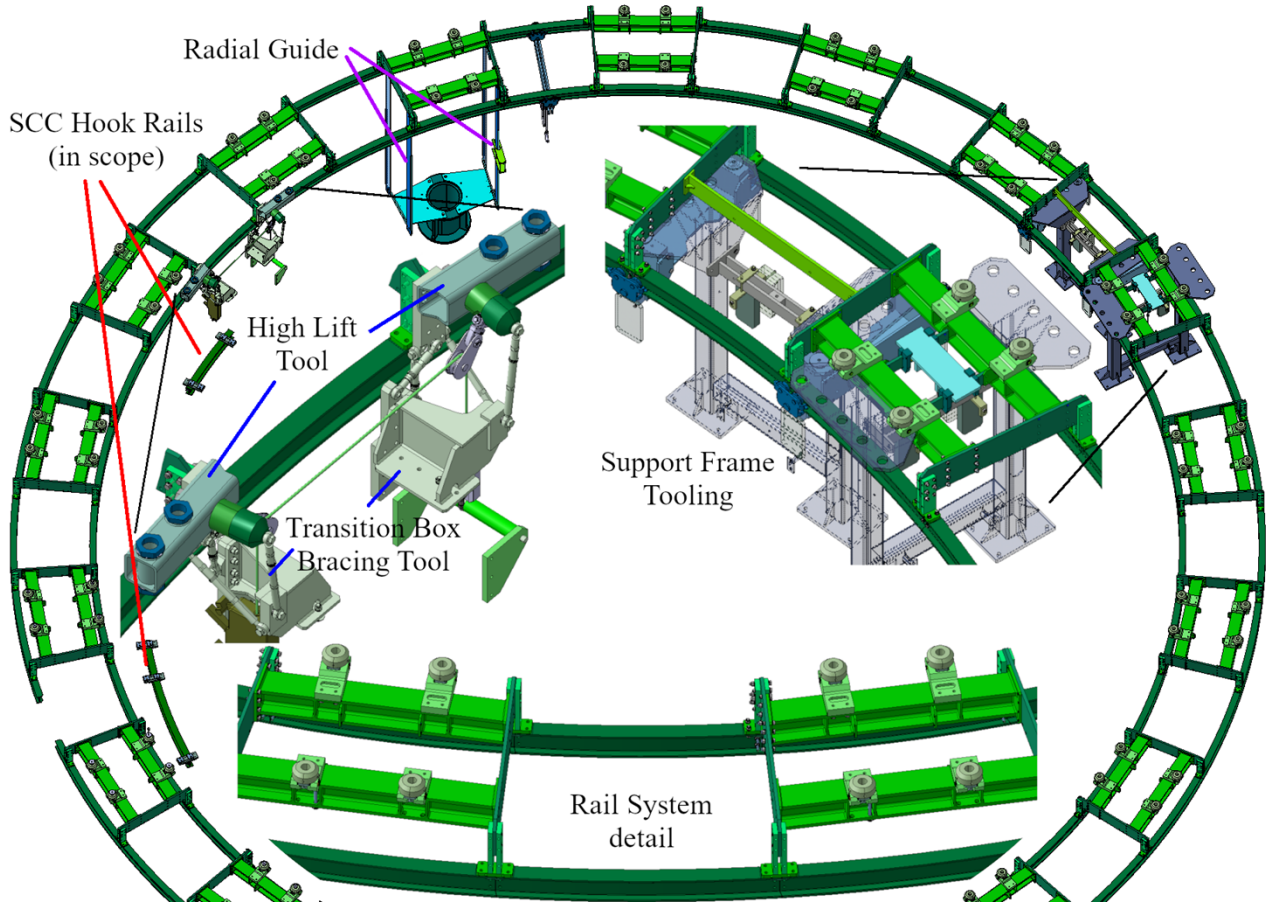

Figure 1: Rail System with Attached Tool Examples

The Rail System includes extra rails, with associated clamps, for SCC Feeder Ring Hook support. These attach under TF Coil Transition Boxes (not shown). They are used for a short time (a few months) during the Feeder Ring installation process. The main Rail System will remain in place for about two years.

The final delivery also includes extra (contingency) un-machined rails with inner and outer radii and about 10cm more length for machining to compensate tolerance accumulation if necessary.

Figure 2 shows the Rail System attached under the PF5 coil (light brown), with components to be installed (blue). One of 18 B2 Permanent Support Frames is shown riding along the rails. The

Feeder Rings to be lifted and positioned using the Rail System are shown in blue, and temporary support tooling shown in brown.

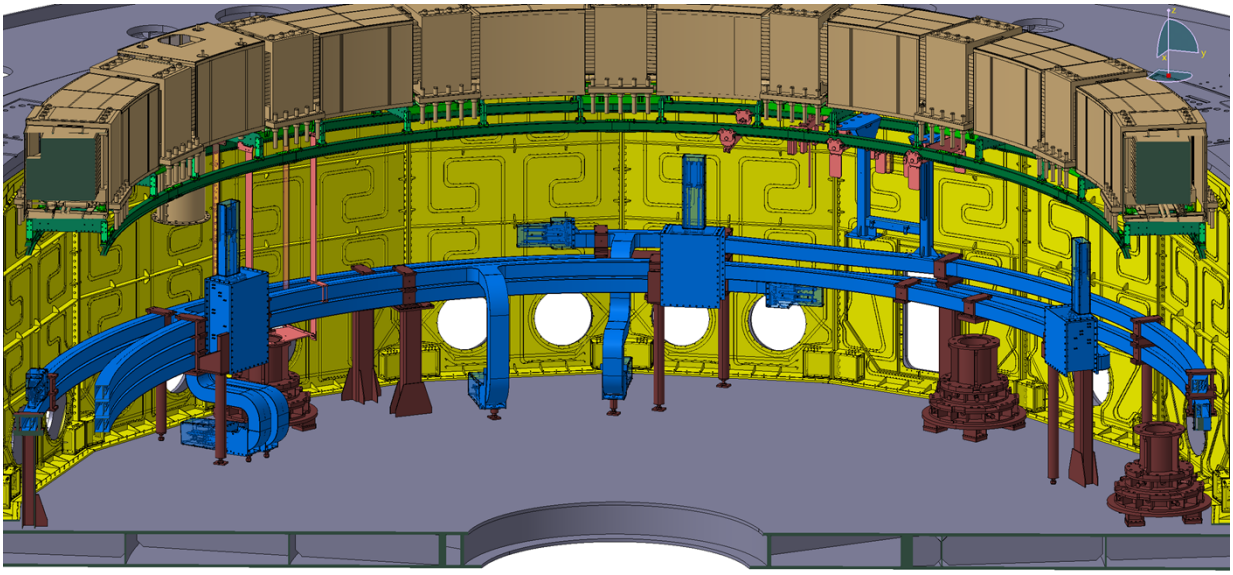

Figure 2: Rail System on PF5 with Components to be Installed in Context

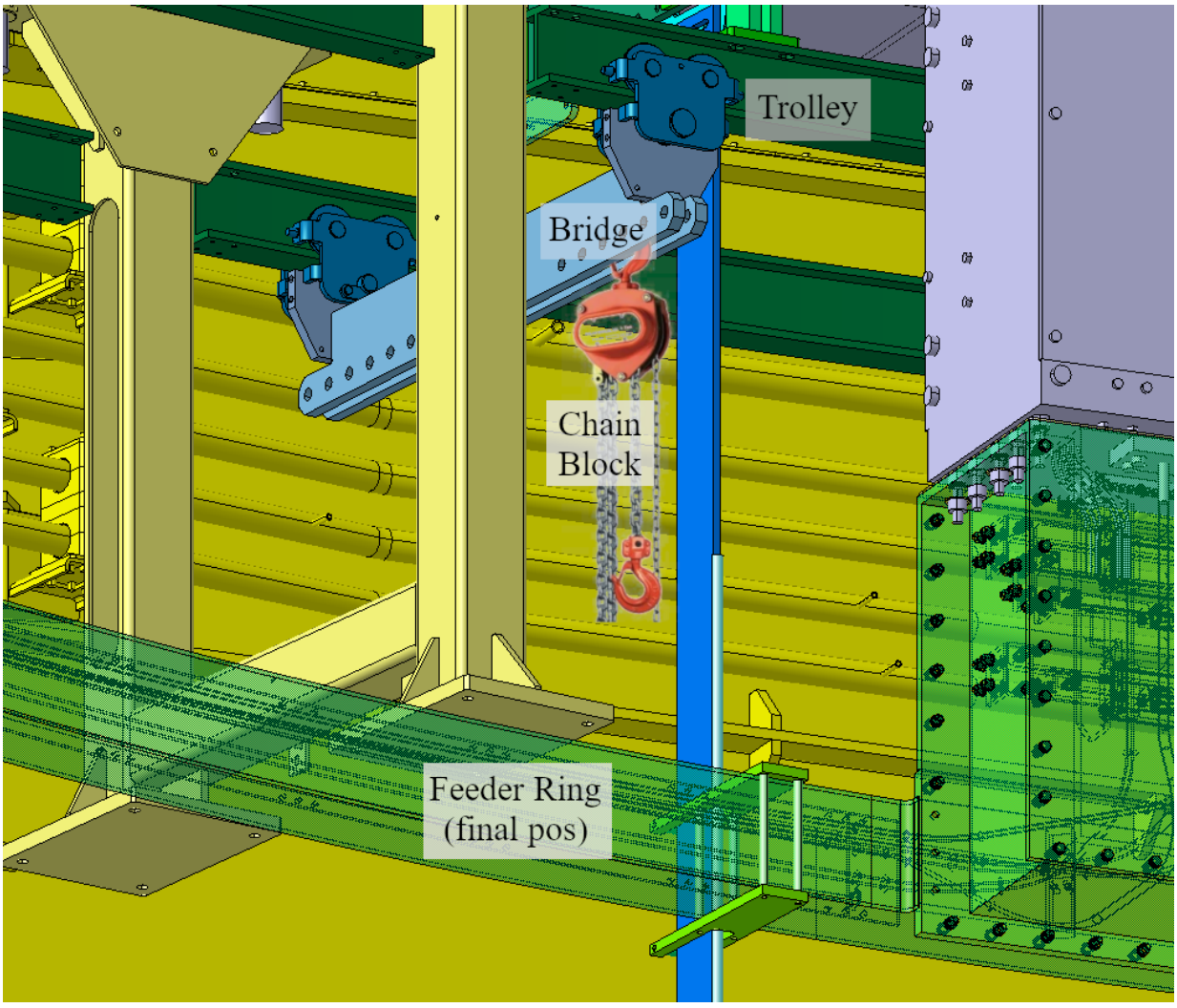

Figure 3: Lifting Means Example, Chain Block on Trolley

Figure 3 Shows an example of lifting means; chain block on trolleys spanning both inner and outer rails. In many lift locations the lifting means will hang directly from a single trolley on one rail. The example trolley shown is Powertex PPT-S2 or PGT-S2. The rail shall be compatible with this and similar models. (All lifting equipment out of scope of this technical specification.)

2 Scope

2.1 In the scope of supply

The contractor is responsible for;

- Verification of the design, as required for conformance to applicable norms and standards, including French health and safety regulations, Machinery Directive, etc. of tooling specified in models, drawing and BoM ([R1] and [R2]). See also Section 5.
- Verification / assessment of the design for contractor's manufacturing processes, quality, safety during handling / assembly / disassembly and cost optimization. Any changes suggested or required to be submitted to IO through a Deviation Request (DR) as soon as they are identified, and DR agreed and closed prior to manufacturing.
- The manufacture, testing and CE certification of tooling.
- Raw material procurement, with material certificates. Procurement of aluminium extrusion rails is considered raw material (subcontracting allowed up to 30% of contract value excluding raw material).
- Submitting and respecting the Schedule, Manufacturing plan, inspection / quality plan. These shall be updated as required during contract execution.
- Providing Maintenance / Test / Inspection procedure for tooling as required. Any testing and inspection required before delivery is in scope of supply. Any maintenance, testing or inspection included in the procedure to be performed after delivery is out of scope.
- Providing as built data for final acceptance.
- Identification of parts with PNI, Serial Number and tag. Contractor's own identification system can be included. An updated BoM based on design updates and contractor's identification shall be provided.
- Part finishing, primarily galvanization or painting with anti-rust primer and colour for steel parts, and anodizing of aluminium parts. Lubrication of specified features with Molykote D-321 R lubricant.
- Packaging and protection for shipping and storage. Packaging design is in the supplier's scope.
- Shipment of hardware to the IO site.

The equipment provided – as well as its design, documentation and custom tooling / fixtures used to manufacture it – will become the property of the IO upon delivery. Tooling and fixtures shall be stored and maintained by the contractor.

2.2 Schedule: Test Segments and Full Tool

The Supplier shall produce a detailed Schedule showing all phases of the Contract and showing how the overall IO Schedule will be complied with. This detailed Schedule shall be submitted to the IO for approval/acceptance, before starting any work in relation to the Contract. This tooling procurement will be divided into two batches;

1) Test segments. Three test frame segments, plus rails in between, will be ordered for delivery in early 2024. These segments are for testing at IO of the rail system and tooling attached to it, and will be used for the final tool (assuming they test successfully). These tests are out of scope of supply.
2) Remaining tool segments and other pieces. These will be ordered separately for delivery at a later date. This date is not yet established, but is estimated in September 2027, subject to change based on schedule progress.

2.3 List of Deliverables and Due Dates

ID	Deliverable	Deadline
	Contract Signature	
	- Batch 1, Firm Part	
D1	Kick Off Meeting 1 (T0)	
D2	Final Design Review	T0 + 6 weeks
D3	Manufacturing Readiness Review	T0 + 10 weeks
D4	Shipment Documentation Delivery	T0 + 20 weeks
D5	Delivery	T0 + 22 weeks
	- Batch 2, Optional Part	
	Option release signed by the IO (T1)	
D6	Kick Off Meeting 2	T1 + 1 week
D7	Manufacturing Readiness Review	T1 + 4 weeks
D8	Shipment Documentation Delivery	T1 + 20 weeks
D9	Delivery	T1 + 22 weeks

Table 1 List of Deliverables and Due Dates

T0 = Date of Kick off Meeting

T1 = Date of Option Release by the IO

2.4 Out of the scope of supply

The contractor is not responsible for:

- Performing integrated structural analysis, considering the tool + the environment for the seismic calculation,
- The maintenance of the equipment on IO site,
- Any on site works other than the ones necessary as part of the delivery and warranty,

- SAT: Site Acceptance Test.

3 Design Reviews and Documentation

The design of the CC Feeder Ring Rail System tooling is functionally complete. However, as described in scope of work, the contractor shall verify the design for CE certification and compliance with French and European norms, safety, etc. 3D models and 2D drawings defining tolerances of parts and assemblies are provided (see references [R1] and [R2]).

During the bidding phase, the contractor may propose opportunities for cost and design optimization. Once the contract is placed and process agreed, variations will be accepted if duly justified technically via the Deviation Request process.

The contract is divided into two phases; final design and manufacturing.

- Final design phase: The contract starts with a Kick off Meeting shortly after contract signature, with some preliminary documentation presented, to start the Final Design phase. The contractor will evaluate the IO provided design and may propose changes to meet health and safety, certification, or structural requirements. Changes shall be presented as soon as they are identified in regular progress meetings, and formalized through the Deviation Request process. The final design phase will terminate with a successful Final Design Review, presenting the completed design and supporting documentation, after which manufacturing phase will begin.
- Manufacturing phase: The contractor shall finalize manufacturing documentation, order material, and produce hardware. The manufacturing of parts will start only after a successful Manufacturing Readiness Review. Some material purchasing and manufacturing activities may be advanced based on schedule requirements and with IO agreement.

During the design review “chits” may be issued: A chit is a description of an issue found in the design that must be resolved. Chits are divided into two categories. For a Category 1 chit, the issue needs to be resolved immediately before that phase of the design can be accepted. A Category 2 chit can be resolved during the next phase.

3.1 Kick off Meeting

The required documentation for the Kick off Meeting:

- **Kick off Meeting Required Documentation** — **Maturity**
- Quality Plan — Preliminary
- Compliance Matrix — Preliminary
- Work Plan and Schedule — Complete (subject to change)
    - Schedule shall carefully address material procurement lead time given current market conditions.

3.2 Final Design Review (FDR)

At the end of the final design phase, the tool design shall have been evaluated to demonstrate;

- that it meets the requirements for safety and CE certification,
- that any deviations from the requirements or schedule have been identified,

- it is achievable at an acceptable risk and cost, with any design changes proposed.

Sufficient information shall be provided in order for the IO to make a full assessment of the Supplier's proposals in terms of safety, functionality, and operability.

The minimum required documentation for the Final Design Review:

FDR Required Documentation	**Maturity**
Hazard analysis and mitigation plan	Complete
Engineering Analysis Report for CE Certification	Complete
3D models and 2D drawing updates (as required)	Complete
Quality Plan	Complete
Bill of Materials	Preliminary
Welding Procedure Specification (WPS)	Preliminary
Manufacturing and Inspection Plan	Preliminary
Test Plan and Report Template	Preliminary

- Hazard analysis and mitigation plan
    - Contractor shall provide a hazard analysis. Mitigation plan will be addressed by IO unless specifically in contractor's scope.

3.3 Manufacturing Readiness Review (MRR)

The required documentation for the Manufacturing Readiness Review:

MRR Required Documentation	**Maturity**
3D models and 2D drawings updated (if necessary)	Complete
Bill of Materials (including serial numbers)	Complete
Welding Procedure Specification (WPS)	Complete
Manufacturing and Inspection Plan	Complete
Test Plan and Report Template	Complete
Maintenance and Periodic Inspection Plan	Complete
Cleaning and Packaging Procedure	Complete
Manufacturing Dossier	Preliminary

- Manufacturing Dossier
    - Including Material Certificates and/or Declarations of conformity for raw materials and hardware, welder and NDT inspection personnel qualification / certification.

3.4 Deliverables Required for Shipment

The contractor shall submit the following documentation prior to shipping:

- Packing List
- Contractor Release Note
- Preservation Plan (any humidity or temperature limits during shipping and storage, rust prevention measures, periodic inspection requirements, etc.)
- Manufacturing Dossier (MD)

The MD shall have a table of contents listing all sections and attachments. The MD shall be organized in the following manner:

Section 1 – Fabrication Documents, including:

- Material and Inspection Certificates, Type 3.1 in accordance with EN 10204
- NDT Examination Reports
- Dimensional Inspection Reports, As-built Drawings, Documents, and Data as necessary
- CE Certificate

Section 2 – Qualifications and Procedures

- Manufacturing and Inspection Plan (MIP)
- Welding Procedure and Operator Qualification Records
- Welding Procedure Specifications
- NDT/Inspection Personnel Certifications
- Packing and Shipping Procedures
- Records of approved Non-Conformances (NCR) and Deviation Requests (DR)
- Codes and Standards conformity certificates

Release Note;

The Release Note shall be submitted along with the MD prior to shipment. The above test reports shall show that the structural and non-structural material satisfies the intent of this specification and shall be submitted with a Release Note according to [R6]. The Release Note shall attest to completeness, accuracy and compliance with this specification.

IO reserves the right to verify the validity of the Certificate of Compliance during the performance of audits of the Contractor or by independent inspection of the item(s).

4 Tool Usage and Loads

This section provides supplementary details about the tool usage to find the required load ratings. It is not necessary to understand it fully to manufacture the tool. The key points are load specifications;

- Inner rail rated for vertical load of 2t every 20°, not uniform (total load ~14t)
- Outer rail rated for vertical load of 1t every 20°, not uniform (total load ~4t)
    - Positions of inner and outer rail loads could coincide for worst case tool loading.
- Lateral loads at any lift point, plus lateral loads on any frame interface up to 0.5t.
- Cantilevered rails rated for 500kg vertical load.
- SCC Feeder Ring Hook Support Rails rated for 600kg vertical load at any position along rail.

The system is subject to seismic loads, with most significant seismic load coming from the Seismic Braces attached to the Rail System Interfaces. Seismic load compatibility will be assessed and confirmed by the IO.

The rail system has three main uses;

- Section 4.1; Lift and rotate BCC Bundle
- Section 4.2; Rotate Feeder Ring Permanent Support Frames
- Section 4.3; Lift and rotate SCC and BCC Feeder Rings

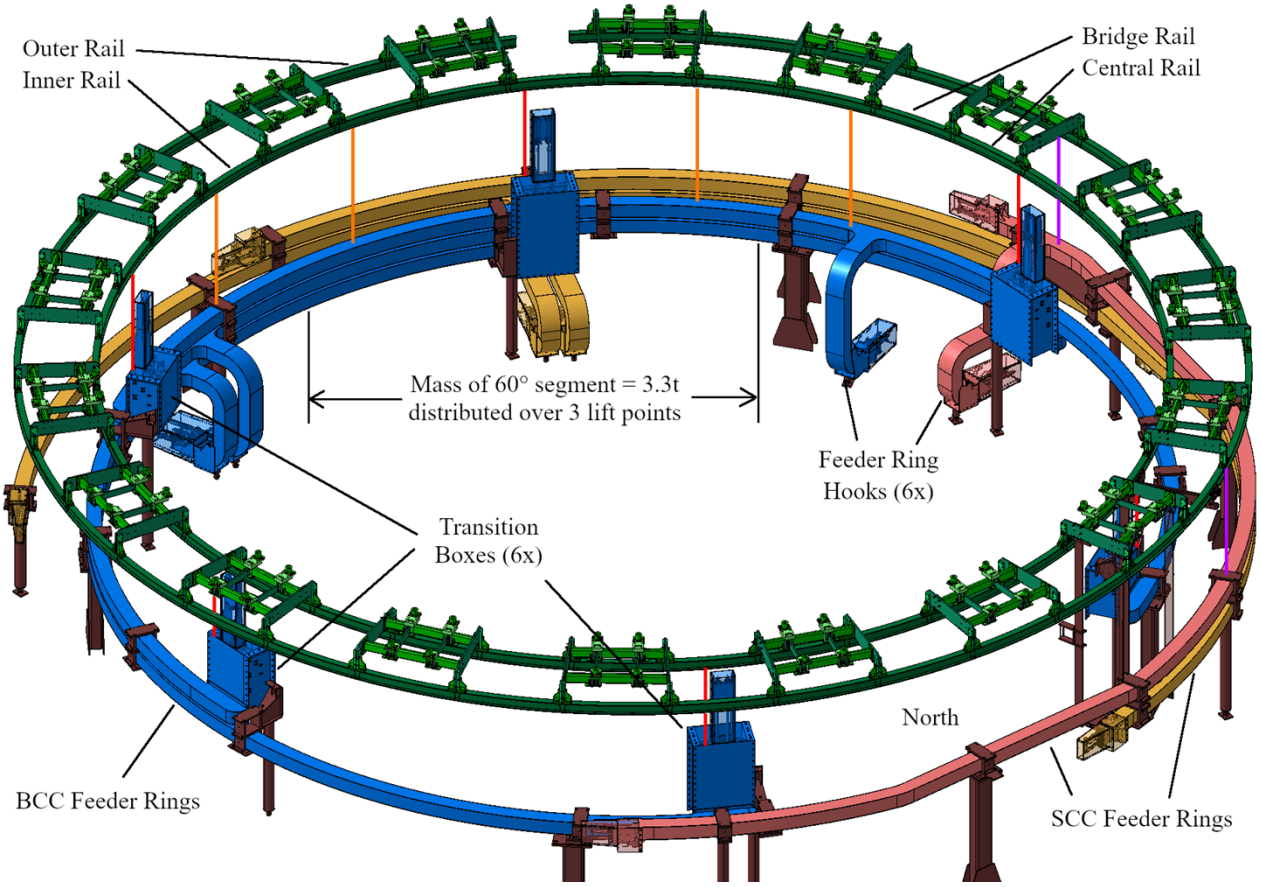

Figure 4: Rail System and Components to be Installed

4.1 Lift and rotate BCC Bundle

This operation includes a high lift, nominally 500mm above final position and 1200mm above temporary position, for PF5 ICF placement. This is the heaviest and highest lift calculated at 13.1t total, all on the inner rail. Load is not uniform; calculated values for Transition Boxes (TBs) are 1.1t each at end TBs, 2.2t each for TBs where there are two Feeder Rings, and 3.3t each where there are three Feeder Rings. TBs are spaced 60° apart, and additional lifting points will be added to ensure no Rail System segment is overloaded. See Figure 4.

An auxiliary high lift system will be used (out of scope) on the BCC Transition Boxes for the 1200mm lift. This is required both to achieve the full 1200mm lift height (rail to Transition Box at this height is not adequate for chain block, for example), and as a safety backup to prevent overloading of the rail system.

The BCC Feeder Ring Bundle will be braced at this position for seismic loads (also out of scope of supply). The Seismic Brace will link the Rail System and High Lift System for added strength. The link will be made at 12 of 36 positions, in pairs.. Seismic load is taken primarily by the Auxiliary High Lift interfaces. See Figure 5 for conceptual design of Auxiliary High Lift System and Seismic Brace at heaviest load positions.

Figure 5 also shows the interfaces available for attachment of any other tooling; 8x M16 threaded holes. The Seismic Brace tool is the main tool identified for use of this interface. Other uses could

include temporary lifting and bracing tools for other components and tooling, lashing points, etc. Any working loads applied to these interfaces will be compatible with load ratings in section 4.4.

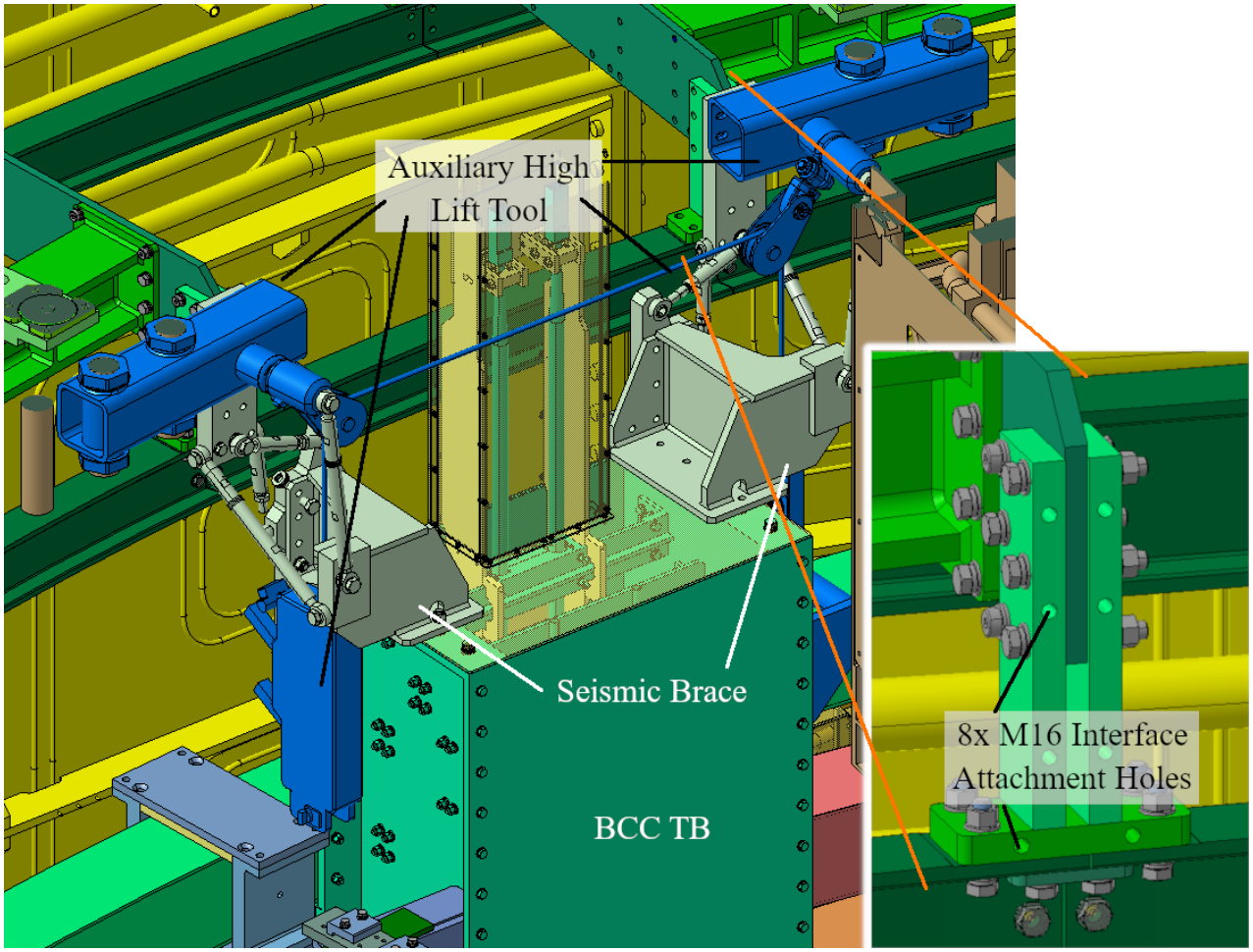

Figure 5: Seismic Brace and Auxiliary High Lift Tool (out of scope), Rail System Interface

BCC Bundle rotation is also the largest rotation of the Feeder Rings; 21.5° total clockwise, split 1.5° near floor, lift 1200mm, lower back to floor, and rotate 20° near floor. Note that the high lift system is not compatible with rotation, so it is only used for the vertical 1200mm lift. For the final rotation, the top SCC Feeder Ring must be lifted to allow a part of the BCC Bundle to pass it. This represents the largest total load on any Rail System segment; 2t for BCC Bundle on inner rail plus up to 1t on same segment on outer rail.

4.2 Rotate Feeder Ring Permanent Support Frames

Support Frames will be lifted at North, and rotated both directions to final location. There are 18 Support Frames, with total mass including tooling about 1t each. The Central Rail segments (inner and outer) must be removed to lift the Support Frames to the final installation position. These rail segments will be left off afterwards.

4.3 Lift and rotate SCC and BCC Feeder Rings

For final installation, Feeder Rings are lifted one by one, first BCC Rings and then SCC Rings. BCC Feeder Rings are nominally at final rotation at this point, so only small rotations for final position adjustments will be required. SCC Feeder Rings will be lifted partially, rotated (3.5° or 6.5°), and then lifted to final height. Loads will be below specification, probably not exceeding 1t per segment

for any of these lifts. The BCC lifts involve primarily the inner rail, although some lift trolleys may bridge inner and outer rails with counterweight mass (<300kg) reacting on outer rail. SCC lifts involve primarily the outer rail.

Additional rail segments, attached under TF Coil Transition Boxes will be used to aid the SCC Feeder Ring Hook lifts. These are shown in Figure 1, labelled "SCC Hook Rails".

The outer rail includes two short (~300mm long) cantilevered rails at PF5 Coil Transition Box. Cantilevered rails are subject to 500kg vertical load up to end stops. The cantilevered rails are included in scope of batch 1.

4.4 Loading Specification

The Rail System shall be specified for vertical loads up to 2t every 20° on the inner rail, plus 1t every 20° on the outer rail. These could be dynamic (rolling) loads or static. Relative position of loads on inner and outer rails is not restricted.

The distance between inner rail loads can be reduced for lighter loads based on the formula;

- $d_{min} = 20° * [1 – 0.5 * (2t – L_{max})]$.
- d_{min} = minimum angle between loading points.
- L_{max} = larger of the two loads

For example, with largest load 1.5t of two neighbouring loads, the space between loads can be 15°. The minimum space to any 2t load is always 20°.

The same formula shall be used for outer rail load spacing, except multiply L_{max} by 2; 1t at 20°, 0.75t at 15°, 0.5t at 10°, etc. Outer rail limit is based on simultaneous loading of inner and outer rails, but since SCC Feeder Rings are only lifted one by one, no higher load rating is necessary when used alone.

5 Codes and Standards

The equipment designed, manufactured and tested shall be in accordance with the latest applicable codes and standards and regulations. The applicable version of the codes and standards and regulations shall be defined at the start of the contract.

As part of the CE marking process, the Supplier shall provide the list of the applied codes and standards used in the design.

Examples of standards that may be applicable to the equipment to be procured within the scope of this Technical Specification are:

- Eurocode 0 - Basis of Design: NF EN 1990
- Eurocode 3 - Design of Steel Structures: NF EN 1993
- Supporting Structure – EN 1090-3 (Execution of steel structures and aluminium structures - Part 3 : technical requirements for aluminium structures), which in turn applies the Eurocode 9: design of aluminium structures (EN 1999-1-1 General structural rules).
- Safety of machinery - General principles for design - Risk assessment and risk reduction: NF EN ISO 12100

- NF A50-630-2, NF EN 755-2 of 2016-04-23 Aluminium and aluminium alloys - Extruded rod/bar, tube and profiles - Part 2 : Mechanical properties

For welds, NDT and qualification of welders the following shall be applied:

- EN 15614 - Specification and qualification of welding procedures for metallic materials, welding procedure test, arc and gas welding of steels and arc welding of nickel and nickel alloys
- EN 287 - Qualification test of welders. Fusion welding. Steels
- EN ISO 9712 - Non-destructive testing - Qualification and certification of NDT personnel General principles
- EN ISO 5817 - Level of imperfections in welded joints (equal or superior to level C)

6 Requirements

Any ambiguity or conflict between requirements is to be resolved by mutual agreement of contractor and IO as early as possible.

6.1 Planning, Processes and Management

[Req.1] Project planning, milestones and hold points shall be defined and agreed at the start of the contract, based on the preliminary plan below and planning provided in the offer. A summary of steps and milestones is listed below;

- Tender,
- Contract signature,
- Kick off Meeting – held at IO or remotely to launch work on contract,
- Weekly written reporting, highlighting progress and difficulties encountered,
- Technical and managerial progress meetings, generally by video conference,
- Final Design Review – formal review of the final design, ready for manufacturing. FDR to be held at IO site,
- Manufacturing Readiness Review,
- Manufacture,
- Factory Acceptance Testing,
- Delivery to IO,
- Warranty.

[Req.2] Design reviews, organized and led by contractor, will generally be held over a period of 1 day at the IO site. Design reviews shall be held in English. All requirements shall be reviewed in sufficient detail to show how they are met.

[Req.3] The Supplier shall provide the design documentation approximately 2 weeks prior the design review.

[Req.4] The contractor shall coordinate regular technical and management meetings (combined or separate as required) with IO, generally via video conference. Frequency shall be

approximately monthly, and probably more frequently at start of contract and near major milestones. The meetings shall include project planning and progress updates, documenting progress and achievements, any problems or unforeseen events, and demonstrating fulfilment of project scope, constraints, and on time delivery including corrective actions if necessary.

[Req.5] Data generated during execution of the contract for submission to IO shall be uploaded electronically into the ITER IDM system, following a structure to be defined by or agreed with IO.

[Req.6] All documentation shall be in English, unless explicitly agreed otherwise.

[Req.7] The Contractor shall establish the list of code and standards applicable to the supply and submit it for approval by IO, taking into account sections 4 and 5 in particular.

[Req.8] The Documentation produced in the scope of work on this technical specification shall be retained by the Supplier for a minimum of 5 years after contract close-out.

[Req.9] CAD data shall be provided for all models developed and/or modified by the contactor. IO uses CATIA V5 R31, and native data is preferable. However, the contractor is not required to work in the same system, but only required to provide accurate data that can be read into IO systems.

[Req.10] All documentation listed in section 3 above shall be completed according to the design phase and approved by IO in IDM.

[Req.11] All requirements of this Technical Specification and subsequent changes proposed by the Contractor during the course of execution of this contract shall be recorded using the Deviation Request process [R10] and Non-Conformity Report [R11].
Other information needed shall be through official Request for Information (RFI), via email or verbally with email confirmation. The contractor shall maintain RFI exchanges, DRs and NCRs to be included in final Manufacturing Dossier.

[Req.12] The Supplier shall ensure that access rights are granted to IO personnel at all locations where ITER work is being performed. The IO reserves the right to perform unscheduled inspections. Planned and documented audits may be performed by the IO and regulatory body representatives in France, to verify compliance with the technical and quality requirements contained in this Technical Specification. Moreover the IO reserves the right to obtain or take photographs of the ITER equipment during the different phases of its preparation.

6.2 Loads and Test Requirements

[Req.13] The manufacturer shall confirm that Rail System tooling design and manufacturing are adequate to meet load requirements defined in section 4 (including seismic loads), and adequate for conformance to French and European norms and CE certification as support structure. An Engineering Analysis Report confirming suitability of design to be submitted for FDR.

[Req.14] The manufacturer shall confirm that Rail System tooling can be safely assembled overhead. The manufacture may suggest additional lifting holes for implementation with mutual agreement.

[Req.15] Working Load Limit (WLL): A margin of 20% shall be added to nominal loads for all load cases (excluding seismic loads).

[Req.16] Load testing, of parts and/or assemblies, shall be defined and conducted by the contractor in agreement with IO. The safety factor shall be determined by the code applied for the design; applying EN 1991-3, all pieces shall be tested to 125% WLL without permanent deformation and after removal of the force there shall be no visible defects. Seismic load cases are excluded from load testing requirements.

[Req.17] Load testing shall be in compliance with all applicable French and European regulations, ensure fit for function, and performed to ensure complete assembly will pass site acceptance testing (SAT). This includes at least; sample testing of load bearing welds, and sample testing of threaded parts. Part deflection under load should be included as necessary. Preliminary Test Plan shall be submitted for FDR, and complete plan by MRR.

[Req.18] IO Representatives shall witness all testing performed, unless explicitly agreed otherwise.

6.3 Manufacturing Requirements

[Req.19] Prior to the start of manufacturing activities, all design issues shall be resolved, and it shall be verified that the equipment can be manufactured based on the final version of design approved by the IO.

[Req.20] Material compatibility is required based on usage of part and contact with machine components. In particular, the tool shall not cause transfer of the following materials;

1. Sulphur and sulphur compounds
2. Pb, Hg, P, Zn, Cd, Sn, Sb, Bi, As, Cu, rare earth elements
3. Halides

The parts “Mounting Stud”, are interfaces with Tokamak machine components, therefore they are made of Stainless Steel, with lubricated threads. Other materials listed above shall be avoided in all parts, processing and finishing. Zinc plating is accepted for bolts and load bearing nuts to avoid galling. Other nuts, and flat washers and lock washers, shall be Stainless Steel.

[Req.21] The tool material shall be certified according to EN 10204 type 3.1 (paragraph 4.1). Fasteners shall be certified according to EM 10204 type 2.1 (paragraph 3.1).

[Req.22] The design of the machine assembly tools shall comply with the applicable Codes, Standards and Regulations which are defined in Ref. [R5].

[Req.23] Parts shall be made with materials specified in BoM. Specifically, rails are made from a custom aluminium extrusion, Interface cylinders (called “Mounting Stud”) from 304L stainless steel, and all other parts carbon steel typically from S235 or S355 if needed for higher yield strength. Specific materials may be modified by mutual agreement.

[Req.24] The following welding documentation shall be retained by the Contractor and available for IO review;

- Procedures for the control of the welding program, which includes qualification of Welding Procedure Specifications, qualification and assignment of welders, filler metal control, control of welding work, specification of workmanship requirements, and other information related to the administrative control of welding.
- NDT procedures and inspector qualifications (can be subcontracted).
- Records of Welder Performance Qualification and updates/renewal of qualification for the welders who will be assigned to the work.
- Forms to document the production welding activities.
- Drawing(s) depicting examination surface configuration and the surface finish for pressure retaining and integrally attached welds and adjacent base material subject to volumetric examination shall be provided by the Contractor.

[Req.25] Manufacturing of sample test segments and full tool shall be considered. Any tooling, for example rail extrusion die, required in full for test segments shall be itemized in offer. If any material must be procured for full tool before manufacture of test segments, this advanced material purchase shall also be itemized separately in offer. Such tooling and/or material shall be considered IO property in the event that it needs to be transferred to another supplier after test segment manufacturing.

[Req.26] Parts should generally be interchangeable with tolerances applied to parts and/or assemblies as specified in drawing [R1]. Parts may be matched if necessary to meet assembly tolerances, with serial numbers and tag numbers applied to individual parts according to matched assembly requirements.

[Req.27] Threads shall be formed / rolled, not cut, unless otherwise agreed for specific threads.

[Req.28] Extra pieces shall be supplied to ensure minimal risk of downtime. This applies primarily to, but is not limited to, fastening hardware. Spare quantities shall be agreed by FDR. One spare rail of each inner and outer radius, un-machined and with extra length ~10cm, is required. Suggested spares for machined parts are as follows; 1 for parts with quantity 36, 2 for quantity 72 and 4 for quantity 144 (quantities are total batch 1 plus batch 2). Spare fastening hardware to be provided for both batches 1 and 2. Other spare parts to be provided only for batch 2.

[Req.29] Painting, galvanizing or other protective coating will be required. Specifications and/or colour to be agreed with IO to meet tool schedule needs. Break sharp edges and corners, burrs, etc. before painting. Painting shall be according to C3 system of ACQPA (association pour la certification et la qualification des peintures anticorrosives) or similar.

[Req.30] Parts shall be delivered free of any dirt, oil, cutting fluids, etc. Excessive weld spatter shall be removed before painting. Supplier shall provide cleaning procedure, ensuring no transfer of material listed in [Req.20] to the ITER machine. Cleaning based on EN 12300 standard is recommended.

[Req.31] Parts shall be identified with the following information;

1. ITER part number (PNI), as specified in BoM.
2. Tag number, as specified on drawing.
3. Serial number.
4. Parts may include a manufacturer part number also.

Identification shall be engraved preferentially, when possible, or using a label otherwise, particularly for painted parts. Identification shall be visible after assembly from below generally. Letters shall be approximately 1cm tall.

[Req.32] The Manufacturing Dossier, defined in section 3.4, shall be submitted before shipment.

[Req.33] Packaging shall be appropriate for storage outdoors subject to all weather conditions at ITER site throughout the year. Any storage limits shall be noted in Preservation Plan.

[Req.34] Packaging size, weight and handling shall be defined and agreed with IO by FDR. Time required to unpack and setup from storage and disassemble and repack for storage shall be considered in packaging design.

[Req.35] All shipments shall be accompanied by Bill or Materials, Packing List, and any other documentation necessary for delivery to IO Site.

6.4 Quality Assurance

[Req.36] The Supplier shall make sure that suitably qualified and experienced people are working on the design, manufacture and test of the equipment supplied under this technical specification.

[Req.37] A Quality Plan shall be produced by the contractor, including subcontractors' Quality Plans, at the start of the contract, and submitted to the IO for approval before FDR. Refer to reference [R8] for further details.

[Req.38] Prior to the start of manufacturing, a Manufacturing and Inspection Plan (MIP) shall be produced by the contractor, including subcontractors' scope, and approved by IO, who will mark up any intended intervention point. The level of detail in the MIP shall be such as to prevent the possibility of bypassing any quality activity and to enable adequate planning, monitoring and verification of operations.

The right of IO to intervene or witness any point in the MIP shall apply in relation to any subcontractor via the main contractor. The oversight of any quality control operation by the IO shall not release the supplier of their responsibility in meeting any and all aspects of this technical specification.

See reference [R9] for an example template for the MIP.

[Req.39] The supplier shall warranty all hardware supplied in the scope of this technical specification for all defined load cases for five years from the date of delivery to the IO site.

[Req.40] The equipment shall be handed over to the IO only after the supplier has demonstrated its full compliance with the requirements included in this Technical Specification and other contractual requirements: all the related documentation has been accepted by IO, the equipment has satisfactorily passed all tests and commissioning. A Certificate of Acceptance shall be signed by both IO and the Contractor formalizing acceptance of the above.

Appendix 1: Figures

Appendix 2: References

[R1] 063516 - BCC_SCC_FEEDER-RING_RAIL-UNITS (729KUX).
- 3D model reference (enovia ID RFFK2N latest revision, at time of writing --J)

[R2] Lower CC Feeder ICF Rail System - Bill of materials (7JDKYH)
- Purchasing BoM in attachment to be provided for tool quote and manufacturing.

[R3] ITER Procurement Quality Requirements (22MFG4)

[R4] Design Review Procedure (2832CF)

[R5] Applicable Codes, Standards and Regulations for the Design of the Machine Assembly Tools (D3Q5XP v2.1)

[R6] Release Note Template (QVEKNQ)

[R7] Package & Packing List Template (XBZLNG)

[R8] Requirements for Producing a Quality Plan (22MFMW)

[R9] Inspection Plan (IP) Template (QV7GQF)

[R10] Deviation Request Template (2LRNQP)

[R11] NCR Database - Introduction & How to (SM2JWP)

[R12] Inspection Plan (IP) Template (QV7GQF)