
Request for Proposals

for the
Design, Production, Testing and Delivery of
Beta Gallery Support Structure for the ESS

Abstract

This Request for Proposals (RFP) is for the design, production, testing and delivery of components for the RF distribution system of the European Spallation Source (ESS) in Lund. These are the Gallery Support Structures for 15 Units in the ESS. These will be used to support waveguide system from a separate tender.

1. SCOPE OF SUPPLY

1.1 Introduction to ESS

ESS ERIC is a Swedish limited liability company jointly owned by the Swedish and Danish Governments. The core business of the company is to design, plan, construct, commission, operate and decommission the European Spallation Source (ESS). ESS ERIC is located in Lund, Sweden, co-hosted by Sweden and Denmark and has more than 22 Partner Countries, including the UK. The UK contribution is coordinated by STFC. The facility will deliver its first neutrons in 2019 and is expected to be fully operational by 2025.

The European Spallation Source (ESS) will be one of the largest infrastructures in Europe and will be used for materials research. It will use a long pulsed superconducting linac and accelerate a 62.5 mA proton beam current to the energy of 2000 MeV. Peak beam power to the target will be 125 MW, 7 times more than the highest power existing facility. The layout of the accelerator is shown in Figure 1-1.

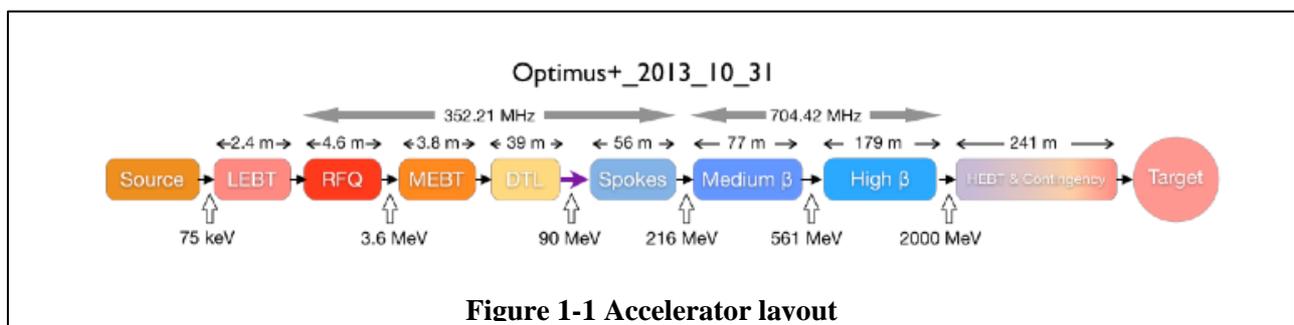


Figure 1-1 Accelerator layout

STFC are providing a number of goods and services on behalf of the ESS. This tender is for the procurement of the support structure to mount the RF distribution system on.

The Headquarters of the ESS are currently located at:

European Spallation Source ERIC
Tunavagen 24,
Lund,
Sweden

1.2 List of acronyms

EIA	- Electronic Industries Alliance
ESS	- European Spallation Source
HB/MB	- High Beta/Medium Beta elliptical cavities
ISO	- International Organization for Standardization
RFDS	- Radio Frequency Distribution System
RFP	- Request For Proposals
RoHS	- Restriction of Hazardous Substances
STFC	- Science and Technology Facilities Council

1.3 Objective

A series of large steel supporting structures are required to provide overhead support for the RF waveguide runs, loads, circulators and water cooling pipework in the 15 Beta galleries, located at the European Spallation source in Lund, Sweden.

1.3.1 *Items included in the supply*

The supply shall comprise the components shown in Table 1-1. The details can be found in section 4.

Table 1-1 Components of the RFDS included in this tender

Item Area	Component	Number required	Drawing No.
MB/HB	Gallery support structure (including fixtures and fittings kit)	7 or 15*	289-10713

*To be determined at the design review

The Bidder is to provide the prices for both 7 and 15 Support structures. The quantity of 15 support structures will be evaluated against only, with the final quantity to be confirmed at the design review

Tenders should be made for all the components in Table 1-1.

A fixtures and fittings kit should be included with each support structure. The kit should contain the relevant nuts, bolts and washers to allow the gallery support structures to be fully assembled and suitable anchor rods to enable it to be fastened securely to the concrete foundations (§ for details, see 4.2). Each kit should be labelled and packaged in a plastic bag. These items should be delivered with the relevant support structure following the scheduled laid out in Table 1-2.

Factory acceptance testing (FAT) must be made at the Suppliers or at the sub-Suppliers premises. Please refer to section 6.2 for more information.

Site acceptance testing (SAT) will be performed for the support structures following delivery at the ESS, Lund, Sweden. If any of the support structures are deemed not to meet the specification, they will be replaced; the supplier will bear all costs.

1.3.2 *Items not included in the supply*

The following products and services are not included in the supply:

1. Pedestals;
2. Support structures for Spoke units;
3. Support structures for Tunnel units;
4. Installation at ESS site, including lifting equipment and tooling;
5. Waveguides;
6. Fixtures and fittings to mount waveguides, loads, circulators and pipework

1.3.3 Items supplied by STFC

None.

1.4 Delivery

The delivery schedule is shown in Table 1-2. The first column in Table 1-2 is the week number in which a delivery must take place, where week one is w/c Jan 2nd 2017. For each week number, the number of support structures for the MB/HB that must be delivered are given. Proposals to combine deliveries can be discussed at the design review meeting (see Section 2.2.5), but all the required support structure and fixtures and fittings must be available during or before the specified week. The cost of delivery should be included in the tender using DAP as defined in Incoterms 2010.

Table 1-2 Delivery schedule

Week	UNIT ID.	Support structure QTY
		MB/HB
03/2018	160, 170, 180	3
09/2018	190, 200, 210	3
15/2018	220, 230, 240	3
21/2018	250, 260, 270	3
27/2018	280, 290, 300	3
Totals		15

If required by the ESS, STFC reserves the right to delay delivery by up to three months to be compatible with ESS operations, with one month's notice. There shall be no extra charge to STFC for this. See section 4 for more information.

1.5 Warranty

The equipment shall be warranted for at least two years from the date of site acceptance (usually within one month of delivery) or from three months after delivery if site acceptance is delayed.

2. GENERAL REQUIREMENTS

2.1 Supplier's responsibilities

The Supplier is solely responsible for meeting all the requirements of this Request for Proposals (RFP) and for all aspects of the performance of the device: mechanical, electrical, thermal, as well as safety aspects, including testing and certification.

The Supplier will be responsible for the final design, the production methods and the correct performance of all the items supplied, irrespective of whether they have been chosen by the Supplier or suggested by STFC. Any approval or acceptance by STFC of the design and components does not release the Supplier from their responsibilities in this respect.

The Supplier will be required to work in close contact with the Project Manager at STFC at all stages of the contract, in order to resolve any technical issues or problems that arise in the timeliest and efficient manner. All contact with STFC referred to below should also take place with the Project Manager.

2.2 Contract management

2.2.1 Contract engineer

The Supplier shall assign an engineer to be responsible for the technical execution of the Contract and its follow-up, including all contacts with STFC, throughout the duration of the Contract.

2.2.2 Time schedule and progress reports

A written progress report shall be sent to STFC every month during the contract. This report must contain as a minimum a list of activities and milestones achieved since the previous report, any delay or technical issues which are likely to affect the performance or the schedule and any proposals to address these slippages or technical issues and an updated schedule and/or milestone list.

The Supplier will inform STFC immediately in writing where a delay of more than two weeks against any milestone in the agreed programme is anticipated. The Supplier shall make available evidence of all corrective actions being undertaken to mitigate the impact on the contract deliverables.

Throughout the project the Supplier shall report any risks or concerns that specifications cannot be met as soon as possible, with a full explanation of why they cannot be met. Submitting such reports shall not result in the Supplier being released of their responsibility for meeting their contractual liabilities under the contract.

2.2.3 Factory access and inspections

STFC reserves the right to carry out regular and/or spot inspections at the Supplier's premises and where deemed necessary that of its sub Suppliers. Contract inspections concern all contract compliance issues including schedule and quality performance.

STFC and the ESS reserve the right to be present to witness any tests carried out at the Supplier's or any sub-contractor's premises.

2.2.4 Design report and production

A detailed design report shall be submitted to STFC for approval within two weeks after notification of the contract. STFC will give its approval or refusal, in writing, within two weeks following the date of the design review meeting. This design report shall include:

1. A drawing of the mechanical layout;
2. A hazard analysis report;
3. Complete list of parts;
4. Where relevant, data sheets of the main components and subsystems, including the performance;
5. Demonstration that the components will meet the specifications;
6. A detailed Gantt chart, showing the schedule for the procurement of materials, manufacturing, factory acceptance testing and delivery

2.2.5 Technical and progress meetings

2.2.5.1 Design review meeting

Within two weeks of the submission of the design report, a Design review meeting shall be held with the Supplier either at STFC Daresbury or ESS Lund. At this review, the Supplier will present in detail their plan for the execution of the contract, a Quality Assurance plan and the proposed design solution. STFC and the Supplier must agree that the solution proposed is suitable and can proceed for manufacturing. The design report shall be updated according to the decisions agreed on, during this meeting.

During Design review, the Supplier shall provide STFC with the risk register for the design and construction of the equipment. The required mitigations shall also be provided. A hazard analysis must also be included.

A set of minutes will be produced by the Supplier following the meeting, accurately recording the agreements and actions, and sent to STFC for approval.

2.2.5.2 Progress meetings

A programme of technical and progress meetings will be agreed between the Supplier and STFC during the Design review meeting. These should take place at least every month and may take place via a remote connection.

2.2.6 Design approval prior to manufacture

Unless otherwise agreed in writing, STFC must approve the final design report before the Supplier proceeds to ordering of any materials, components or equipment required to fulfil this contract and equipment manufacture shall not start without STFC's written prior agreement on the design.

2.2.7 Deviations

If, after the Contract is placed, the Supplier discovers that they have misinterpreted this RFP, this will not be accepted as an excuse for deviation from it and the Supplier shall deliver equipment in conformity with this RFP at no extra cost.

During execution of the Contract, any and all deviations proposed by the Supplier from this RFP, contract or any other subsequent contractual agreement, shall be submitted to STFC in writing. STFC reserves the right to reject or accept such proposals without justification.

STFC reserves the right to modify this RFP during execution of the Contract. Such modifications shall be mutually agreed between STFC and the Supplier.

No acceptance or approval by STFC of any procedure or test shall release the Supplier from their responsibility in fulfilling the terms of the contract.

3. ENGINEERING STANDARDS AND MANUFACTURING SPECIFICATIONS

3.1 Materials and workmanship

3.1.1 Metric system

The design, systems, parts and components shall be in accordance with the metric system.

3.2 Design principles

Unless stated otherwise in this RFP, the following design principles shall apply.

3.2.1 Reliability and lifetime

ESS attaches great importance to a design which is extremely reliable and requires a minimum of maintenance.

It is expected that the operational lifetime of the components which will be supported on the gallery support structures is higher than 20 years. Therefore, the gallery support structures should have an operational life of 20 years.

3.3 Applicable directives, regulations and standards

The following directives, regulations and standards are applicable for the execution of the Contract.

3.3.1 European standards and regulations

European directives and regulations applicable for the design and manufacture of the gallery support structure include, but are not necessarily limited to, those listed in the table below. The table also references standards harmonized with the European directives and regulations list.

Table 3-1: Table listing of European Directives and Regulations applicable for the components

Subject of Directive / Regulation	Reference / link to Directive & Regulation)	E.g. of products	Reference / link to harmonized standards ¹⁾
Restriction of the use of certain hazardous substances (RoHS)	2011/65/EU	RF Distribution components	RoHS
Design of Steel Structures	Eurocode 3	Gallery support structures	EN 1993-1-1:2005 (E)
Design of Steel Structures	Eurocode 3	Design of support joints	EN 1993-1-8:2005 (E)
Execution of steel structure	Eurocode 3		BS EN 1090-1:2009
<p>1 Harmonized standards are technical specifications of products meeting essential requirements set out by European Directives and Regulations. These standards are usually used as means to demonstrate compliance with European Directives and Regulations.</p>			

3.3.2 Other international standards

Unless noted otherwise in this specification, all equipment and drawings should comply with the relevant I.E.C. standards, recommendations and reports including the latest revision.

3.4 Documentation

All documentation, information and drawings shall be produced in MS Word, .pdf and .dxf formats. All documentation, including “as built” drawings, certificates, manuals, etc, shall be written in English.

A complete set of “as-built” documentation shall be supplied to STFC in digital format for each component before delivery starts.

Where deviations from the information, electrical schematics, mechanical drawings or components are authorized by STFC during manufacture, the Supplier must note the changes. The set of “as-built” documentation shall reflect all the changes and updates.

3.4.1 Technical documentation

3.4.1.1 Assembly instructions

An assembly manual of the support structures shall be provided in electronic format and one in hardcopy.

The manual shall include a detailed outline of the erection method; including a sequence for erecting the structure, positions of temporary bracing or other restraints needed to provide stability to members during the build, details of how each part is connected and the relevant torque values for the fasteners, details of any design features which would affect the construction sequence, or which may create an unusual hazard during construction. In addition, markers should be placed on each part for reference on how the structure is assembled and this detailed in the manual.

Required size of lay down areas should be included in the manual to ensure that sufficient room in the gallery is available to provide temporary storage of structural members and other materials during the build. See Section 5 for more information on space constraints.

3.4.1.2 Manufacturing drawings

A complete set of drawings shall be provided in electronic format. The drawings shall be prepared in accordance with ISO 8015:2011 or BS 8888:2017. A complete set includes:

- Detailed mechanical construction drawings;
- Detailed electrical circuit diagrams, if appropriate;
- Complete mechanical assembly in 3D (.dxf or STEP format);
- Wiring diagrams, if appropriate;
- Complete list of parts including details of all components, manufacturer, type number and, whenever applicable, datasheets.

4. TECHNICAL REQUIREMENTS

This section describes the technical requirements for all the RF distribution gallery support structures for this tender.

4.1 General data

The reliability of the structures should be at least 20 years, so that the operation of the accelerator is not compromised by degradation of a support structure.

4.1.1 Materials

It is recommended that the gallery support structure is made from structural steel, grade 275 for the plates and grade S355 for the beams and columns. Fixtures and fittings (nuts and bolts) should be property class 8.8 carbon steel. STFC reserves the right to accept or reject any other material selected by the supplier without giving justification. Alternative materials will only be considered during the design review if the supplier can prove (via calculations and FEA) that an alternative column or beam will not affect the overall design or reduce the strength and integrity of the support.

4.1.2 Welding

Welds should be carried out in accordance with BS EN 1011-1 or an equivalent welding specification

4.1.3 Surface finish

The gallery support structure should be free from burrs or sharp edges.

4.1.4 Surface cleaning, treatment and painting

The support structure is contained within a building and protected from external elements, however condensation may occur inside the gallery during or after installation. BS EN ISO 12944-2 identifies the corrosivity of this environment as class C2. Therefore, the supplier must use a suitable cleaning and painting system that provides class C2 corrosivity protection during its expected operational lifetime.

Colour of structure to be grey RAL 7011 or similar, to be confirmed during the design review.

4.1.5 Mechanical tolerances

Structural members should be fabricated using suitable tolerances that ensure that the assembled structure conforms to the tolerances provided in the assembly drawing 289-10713.

4.1.6 Naming, Information and documentation

All the support structure's components shall be marked with the respective drawing number

When delivered, each support structure needs to be accompanied with a report indicating:

1. Unit I.D.
2. Respective drawing number;
3. Measured mechanical dimensions;
4. Deviation from the specifications (within the tolerances);
5. Components total weight;
6. Packing list of included components;
7. Certificate of load bearing capacity;

A copy of these documents shall be sent to STFC prior to shipping.

4.1.7 Packing and delivery

The Supplier is responsible for the packing and the transport to the build site in Sweden, to the following address:

European Spallation Source ERIC

Östra, Odarslövsvägen 113

225 92 Lund

The support structures should arrive on site without being damaged. Should any damage occur during transport, the supplier is responsible for repairing this. The crates should have tiltwatch and shockwatch indicators or equivalent.

To prevent possible damage during transit, susceptible components or their features (mating faces) may need to be covered or protected. This will ensure the support frames will be able to be assembled onsite, without any re-work.

The fixtures and fittings kit should be bagged to enable easy assembly of the support structures. If specialist lifting jigs or other handling tools are required to transport the units to site, then these shall be provided by the Supplier.

The following must be clearly displayed on the outside of the container(s):

- a. Contact name;
- b. Delivery address;
- c. The STFC contract number;
- d. The weight of each loaded container;
- e. Support points for transport and lifting;
- f. Unique identifiers of the contents

A detailed delivery schedule will be given by STFC during the Design review as access to the ESS site is given in 2 hour slots.

4.2 Gallery support structure

4.2.1 Design

The design of the support structure is largely constrained by the amount of free space inside the gallery and the size and location of the equipment that is suspended from it. The limited amount of space that can be utilised for the supporting structure is provided in the space envelope drawing specified in Annex 1. Excluding the baseplates at floor level, all members must strictly observe the space constraint provided.

To ensure that the structure provides the appropriate supporting features in which to suspend the equipment, without clashing with the equipment, a drawing detailing the relative location of each member is provided in Annex 1 (289-10713).

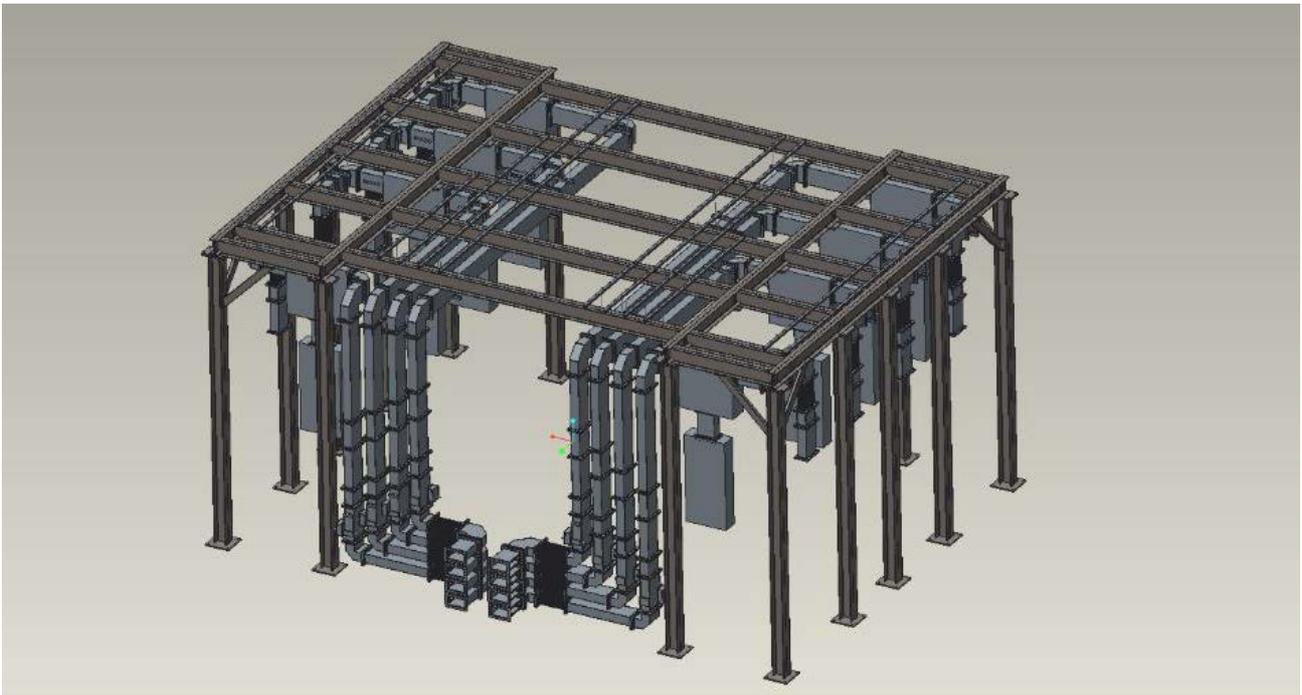


Figure 4-1 Preliminary design with waveguides, loads & circulators suspended (pipework not shown)

The provided positions of the members must be observed, however the design of the gallery support structure given in the Annex is only provided as a guideline for the supplier. Final designs of the structure and any additional components, including connection types, must be derived by the supplier. However, it is recommended that the supplier utilises the following main structural beams and columns: UKC 203mm x 203mm x 45 and UKB 254mm x 146mm x 37 respectively. Suitable alternatives will only be considered during the design review if the supplier can prove (via calculations and FEA) that the alternative column or beam will not affect the overall design, exceed the space envelope or reduce the strength and integrity of the support.

4.2.1 Support structure assembly

Space inside the gallery is limited (see section 5.1.3) and there is no overhead crane to facilitate lifting operations. Any lifting will be carried out by forklift or temporary lifting equipment with a capacity of 2000kg. This limits the size and weight of the largest assembly that can be lifted into position. Therefore, to try and prevent any major installation issues at ESS, the overhead structure should be designed so that it is a bolted assembly, thus providing flexibility in the lifting and installation process.

Welding of any parts onsite is not permitted.

The parts shall be pre-drilled. Detailed information regarding the nuts-bolts and the required torque shall be provided.

4.2.2 Baseplates

To prevent interference with surrounding equipment and access areas, the position of the baseplates relative to the columns are shown in the assembly drawing 289-10713. The baseplates should be no larger than 400mm x 400mm and each baseplate must not apply a concentrated floor load greater than 2.5 N/mm².

4.2.3 Bracing, column stiffeners

Bracing and column stiffeners should be included where deemed necessary.

4.2.4 Load bearing zones

The support structure in the gallery is approximately 10.1m wide x 6.3m deep x 5m high. It is to provide overhead support for RF equipment which is located predominantly inside the framework's space envelope. The structure also must be able to support water cooling pipework mounted at certain locations on the top and sides. Note; side loading cantilevers are not a required deliverable and are listed here only as an illustration of the likely loading area. This loading is symmetrical about the centre of the frame.

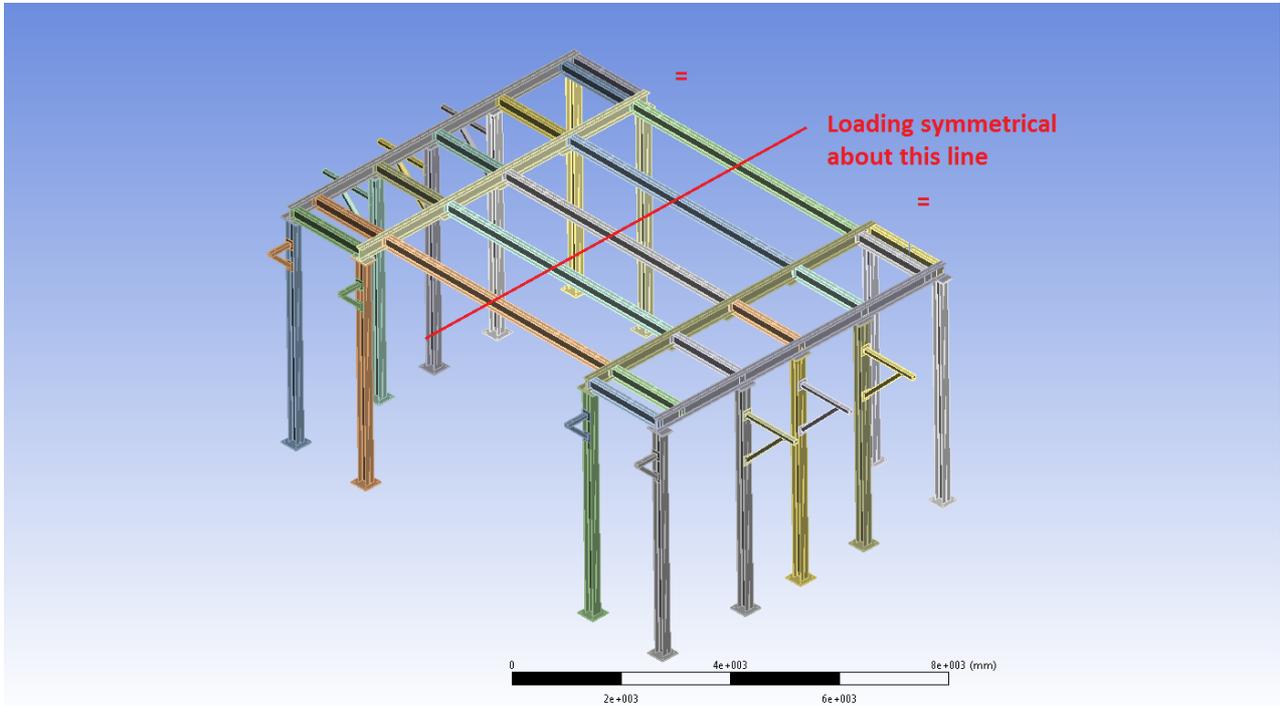


Figure 4-2 Loads applied symmetrically

To define the loading requirements, the loads have been grouped into zones to illustrate their location and amount. The approximate location of the loads is shown in the following diagrams, however exact positions of the localized loads from the waveguide support hangers (zone-1) can be found in the drawing 289-10712. The loads that the structure shall be able to support (excluding the appropriate safety factors) are shown in Table 4-1.

Table 4-1 Gallery structure load bearing zones

Zone #	Description	Load Type	Load kg
1	RF equipment (waveguides, loads and circulators)	Distributed	5000
2	Pipework A (on top)	Distributed	1600
3	Pipework B (side mounted on 1m cantilever arm)	Distributed	2600
4	Pipework C (end mounted on 0.4m cantilever arm)	Distributed	1600
Total			10800

The supplier must include detailed calculations to validate the load bearing capacity of the support structure. The loads are specified in Table 4-1 and the areas in which the loads are supported are shown in Figure 4-2 and Figure 4-3.

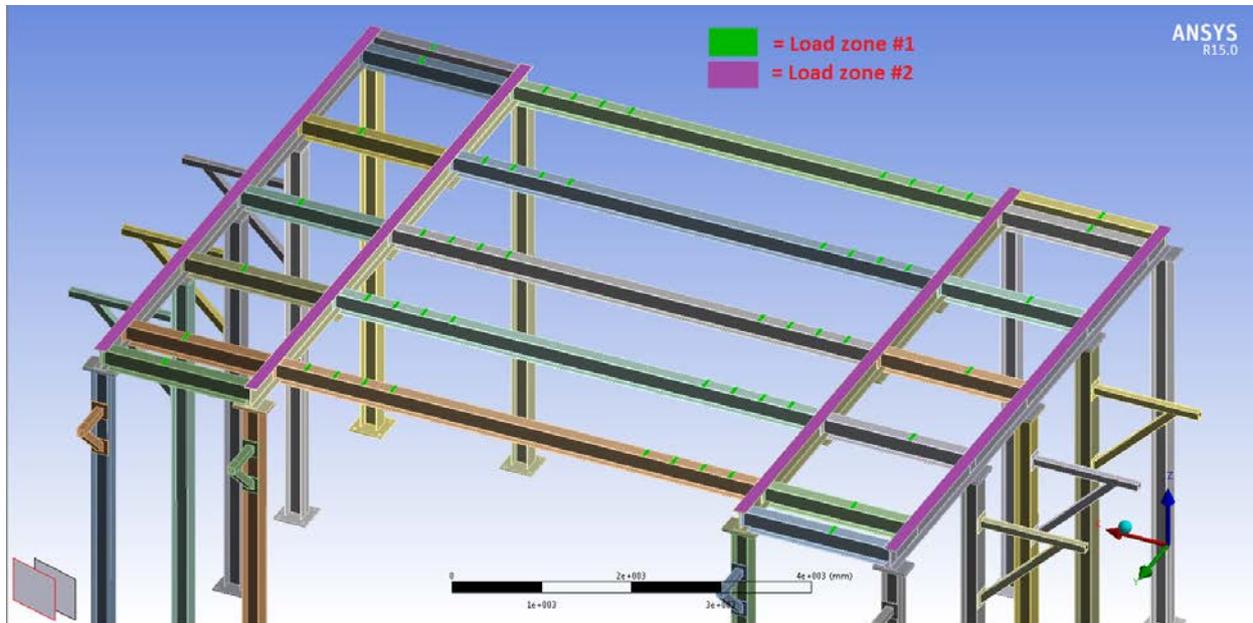


Figure 4-3 Load zones 1 and 2 on top of support for the waveguide hangers and pipework A

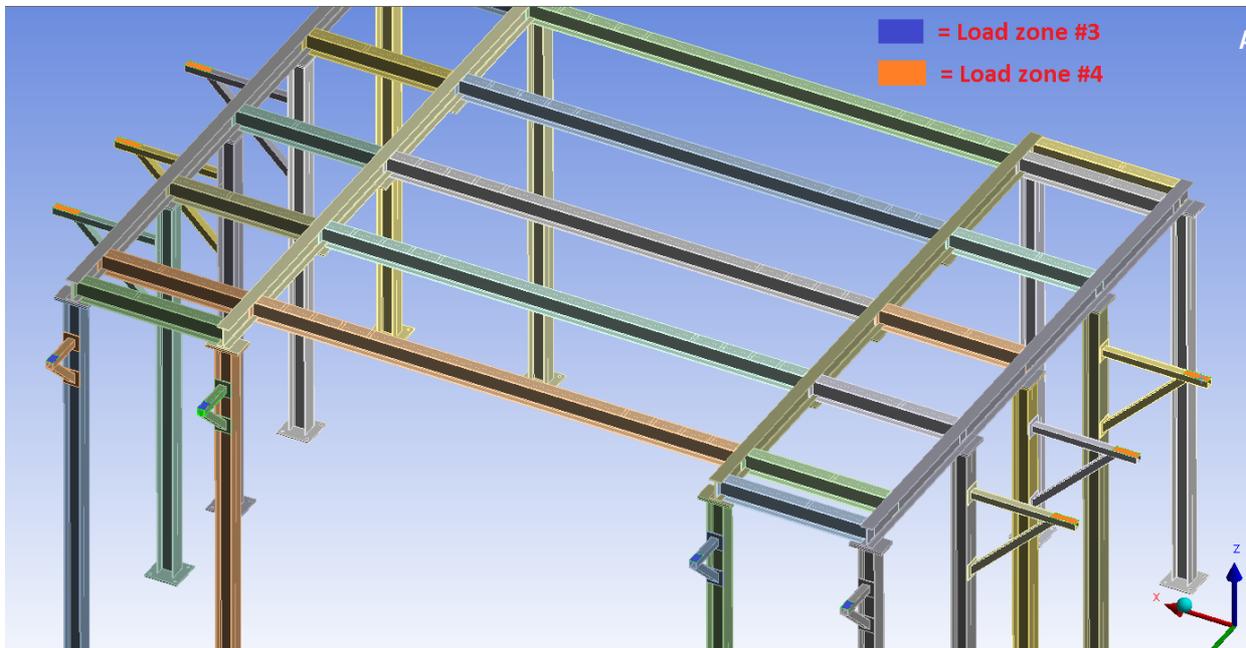


Figure 4-4 – Load zones 3 and 4 on cantilever arms mounted 600mm down from the top of the structure for pipework C and D respectively

4.2.5 Proof load testing

The first manufactured structure must be fully assembled and load tested to support a test load of 200kN. Proof load test certification is required for support structure to prove that the design is safe, fit for purpose. STFC and the ESS reserve the right to be present to witness any load tests carried out at the Supplier's or any sub-contractor's premises.

4.2.6 Baseplate fixtures

The support structure's baseplates will be fixed directly to the concrete foundation. The supplier must include suitable anchor rod fixtures for each support structure to secure the baseplates to the concrete foundation. Details of the floor mounting method should be considered and discussed in the Design review.

5. INFORMATION ABOUT ESS REQUIREMENTS

5.1.1 Safety

All equipment shall be designed for safe operation.

5.1.2 Gallery temperature

The temperature in the RF Gallery is expected to be maintained at $22.5^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for operation, however for testing in the test halls and for maintenance periods, the support structures shall be capable of being used in an ambient temperature of $22.5^{\circ}\text{C} \pm 10^{\circ}\text{C}$ but such that there will be no long term condensation on components.

5.1.3 Mechanical construction, layout and lifting equipment

Space inside the gallery is limited and there is no overhead crane to facilitate lifting operations.

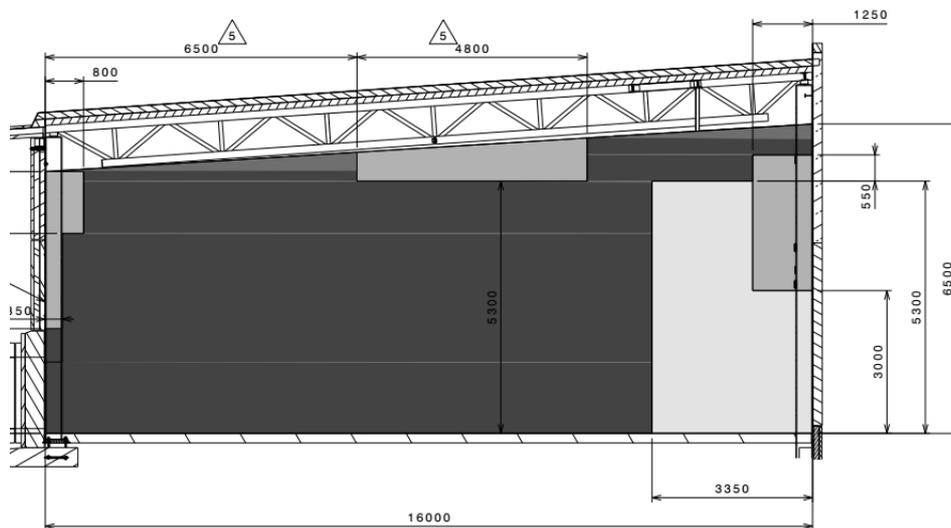


Figure 5-1 Section through the gallery area shows overhead height limit of 5.3m (ESS-0006000.1)

Therefore, the supplier must ensure that the structure is designed as such that it can be safely erected inside the building using temporary lifting equipment that fits inside the available space, such as a forklift or portable gantry. Any lifting equipment required for assembly should be detailed in the design process. Lifting points should be made available to aid with assembly of the support structures.

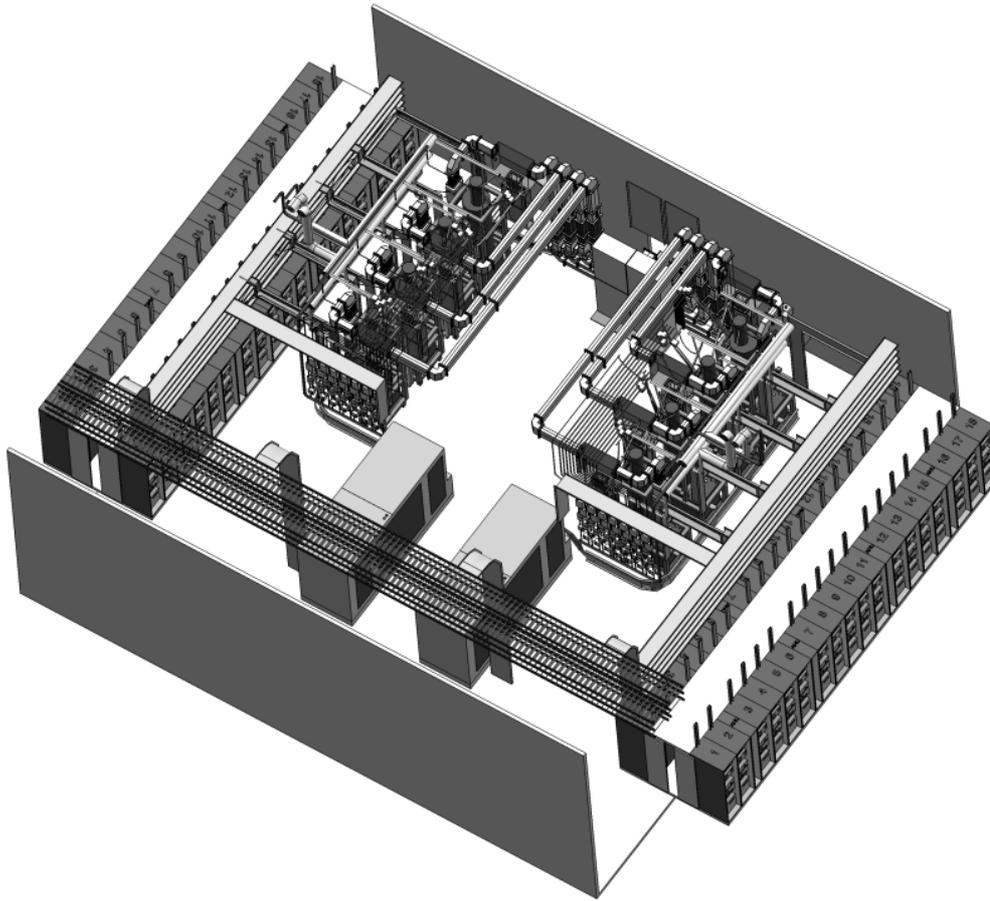


Figure 5-2 Gallery walls and equipment that is installed after the support structure (ESS-0006436.7)

6. FACTORY TESTS AND DELIVERY

The factory tests shall establish that the support frames completely fulfil this RFP. If the tests show that any part of the specification is not met, then it shall be corrected and the tests shall be repeated by the Supplier at no extra cost to STFC. The support frames shall be fully tested in the factory, but ESS reserves the right to repeat any of the tests.

6.1 General arrangements for tests

The test at the factory must establish that all items of the equipment completely meet the performance requirements described in this RFP.

Testing shall always conform with local safety codes. In the event of marginal design or performance, STFC reserves the right to require additional or more extensive testing to be conducted at no extra cost to STFC

6.2 Factory tests

The factory and site acceptance testing will include any or all of the tests specified in the preceding sections of this specification and shall serve to demonstrate compliance with all requirements of this RFP. The plans for Factory Testing should be specified in the tender.

Following tests shall be performed at the Factory for all the components to ensure they meet the requirements:

1. Visual inspection, to ensure uniformity of the surface, absence of penetration of welding material inside the components, cleanliness etc.
2. Verification of the dimensions, finish and quality criteria;
3. 2 gallery support structures should be fully assembled and verification performed of the assembled dimensions to the space envelope.

6.3 Approval before delivery

The results of all FAT must be recorded on test certificates in English (including weld inspection check sheets) and sent to STFC before delivery of the tested components to the ESS. Delivery of these components shall not commence until successful completion of all the tests and after written authorisation by STFC.

6.4 Site acceptance tests

Acceptance tests will be carried out at ESS or ESS approved site in Sweden on selected items to establish that the support structures meet the specification and that no damage has occurred during transport. These tests will be performed on support structures in crates for which the tiltwatch or shockwatch indicators have triggered. They will also be performed on selected equipment at random. These tests will be performed within four weeks of arrival at the ESS.

Site acceptance will be given by STFC only after all items have been delivered in accordance with the conditions of the contract, all tests specified have been successfully completed, all other documents and certificates have been supplied to STFC.

In the event of any errors being found during the site acceptance tests, the Supplier shall replace them immediately at their cost.

7. QUALITY ASSURANCE AND GUARANTEES

The Supplier shall maintain and apply a quality assurance program compliant with ISO-9001 or equivalent for the design, manufacture and testing of all systems and equipment provided by them.

CE marking or equivalent of equipment should be applied wherever required.

All support structures shall be designed and constructed with an expected operational lifetime of greater than 20 years. It is understood that maintenance may be required during this period. Subassemblies should be designed for repair rather than replacement.

Systems shall be designed and constructed for continuous use with minimal maintenance, no more often than twice per year for periods not exceeding 10 days. Maintenance outside of these periods should not be required.

ANNEX I

289-10712: Rev B - Gallery Support Frame GA - HB/MB RF Gallery Cell 160-290

289-10713: Rev B - Gallery Support Frame Assembly - HB/MB RF Gallery Cell 160-290

Space envelope layouts MB drawing ESS-0011433.2

RF Cells in Medium Beta (Cell 160-190) drawing ESS-0006436.7

ACCSYS Active envelopes ESS-00060000.1