NUCLEAR PHYSICS INSTITUTE CAS
public research institution

MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

EUROPEAN SPALLATION SOURCE

INSTRUMENT SHUTTER FOR THE BEER INSTRUMENT AT ESS

TECHNICAL SPECIFICATIONS AND REQUIREMENTS

Status: Draft
Revision: 1.4
Date: 21/12/2021

Annexes:

Annex 1 - BEER Instrument Shutter – Design description

CONTENT

1. TERMS OF REFERENCE

1.1. Scope of this document

This document in conjunction with referenced annexes establishes the requirements for the tendering, procurement, manufacturing, delivery and installation of the BEER Instrument Shutter to be installed at the European Spallation Source in Lund, Sweden.

1.2. Terms

Herein, the term '*Contractor*' shall refer to the parties responsible for providing the scope of work defined below. The term '*Customer*' shall refer to the purchaser and its representatives, including the ESS.

The *Contractor* is responsible for fabrication, inspection, testing, packaging, shipping, and other stipulated services in accordance with the requirements of this specification.

The terms '*System*' or '*Shutter*' refer to the whole *BEER Instrument Shutter* as described in Section 3. (scope of work). For historical reasons, the term '*Safety Shutter*' is equivalently used in some of the referenced documents.

Requirement level interpretation

The key words "*must*", "*shall*" and "*should*" in this document are to be interpreted as follows:

1. "*must*" or "*shall*" is an absolute requirement of the specification.
2. "*should*" means that there may exist valid reasons in certain circumstances to ignore a particular item or ease a requirement, but the full implications should be understood and carefully weighed, and mutually agreed, before choosing a different course.

1.3. Exceptions

Any exceptions to the specifications in this document shall be clearly noted as such in the *Contractor*'s proposal documentation. If the *Contractor* proposes exceptions from this specification, alternative solutions shall be presented. The *Customer* shall form a validation team to examine the feasibility of the proposed alternatives. Conditions for design modifications are described in Section 4.4..

1.4. Applicable documents

The delivered assembly, including accessories, shall follow:

- European directives
- Swedish laws and standards
- Relevant Europeans and ISO standards
- ESS standards and regulations

The list of applicable documents is provided in Section 11..

2. INFORMATION

2.1. Introduction to the European Spallation Source

The European Spallation Source ERIC (ESS) is a European Research Infrastructure Consortium (ERIC), a multi-disciplinary research facility based on the world's most powerful neutron source with a vision to enable scientific breakthroughs in research related to materials, energy, health and the environment, and address some of the most important societal challenges of our time. The initial suite of neutron instruments will consist of 15 instruments and a test beam line with further integration of instruments following to complete the projected suite of 22 instruments. Instruments will include hardware and software necessary to conduct neutron scattering experiments, to collect data and to distribute to users and archive all necessary information related to the experiments. Specific experimental conditions or preparations that may be required by the experimental programs will be supported by ESS laboratories or other partner laboratories.

Details about the project can be found under:

https://europeanspallationsource.se/ess-mandate

The facility will host several neutron beamlines that are being constructed by so-called in-kind partner institutes. The Nuclear Physics Institute of the CAS, V. V. I. (NPI) from the Czech Republic participates in the design and construction of the BEER instrument, together with Helmholtz-Zentrum Hereon in Geesthacht, Germany.

2.2. Introduction to the BEER instrument

The BEER project (Beamline for European Engineering Materials Research) is realized as a part of multidisciplinary complex of international research centre ESS – European Spallation Source constructed in Lund in Sweden. 17 partner European countries participate in its construction mainly in form of in-kind contribution, thus the development and supplement of individual scientific and technological units.

The diffractometer BEER is an experimental device focused on research of advanced materials for wide field of applications - i.e. research in engineering materials with various degrees of complexity as for example in-situ and in-operando experiments for material characterization, thermo-mechanical processing or joining of materials. The continuous development of advanced structural materials and novel manufacturing processes are key for European manufacturing industry to stay competitive and ensure clean transport and clean energy generation. This includes the development of sustainable material and processing solutions protecting natural resources. More about BEER instrument can be found here:

https://europeanspallationsource.se/instruments/beer

Please refer to BEER – System Design Description [ESS-1138650] and BEER - Concept of Operation [ESS-0124310] for further information.

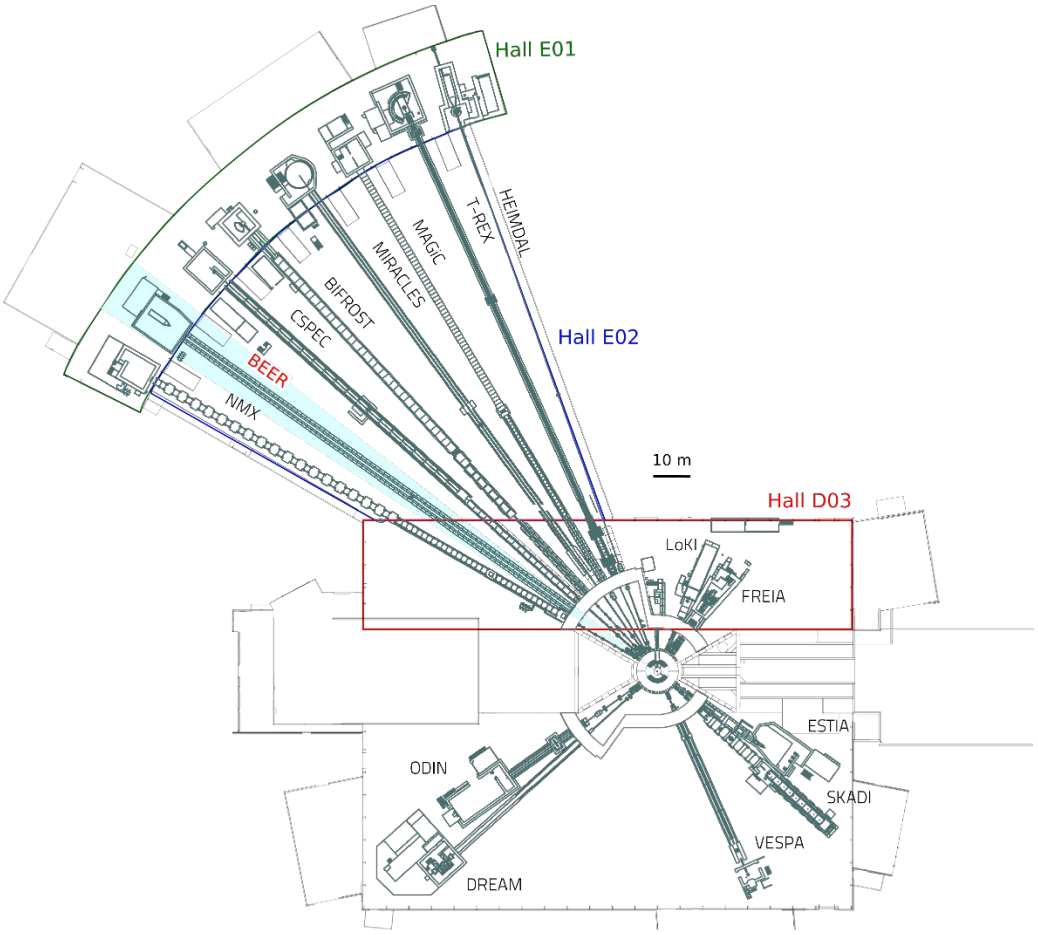

Figure 1. Layout of ESS instruments with highlighted BEER sector.

2.3. Introduction to the Instrument Shutter

To enable experiment preparation, sample exchange during standard ESS operation periods, and also a safe personal access, an Instrument Shutter is needed at a position after the first DLS (Direct Line of Sight) closure. This shutter closes the thermal neutron beam and shields also other radiation propagating downstream, especially high energy neutrons, in order to secure radiation safety in the experimental cave. The shutter will also enable safe maintenance of downstream equipment including the neutron guides and the chopper placed in the guide hall E02. The Instrument Shutter is designed as a radiation safety component which interacts with the Personal Safety System (PSS).

The Instrument Shutter system (see Figure 2) consists of a block of shielding material (mostly Cu, combined with borated PE and B4C layers) and a neutron guide segment. Both the shielding and neutron guide are mounted on an inverse pendulum mechanism, which allows to switch between two operation positions: (i) **closed**, when the shielding block is centred at the neutron bam, and (ii) **open**, when the neutron guide is aligned with the neutron beam and neutron optics elements before and after the shutter. For safety reasons, the mechanism must move the System in the closed position in a case of failure (lost electricity or compressed air). This is achieved automatically by action of gravity.

NOTE: the neutron beam guide is not part of the shutter delivery. The shutter system only includes a mounting platform for it.

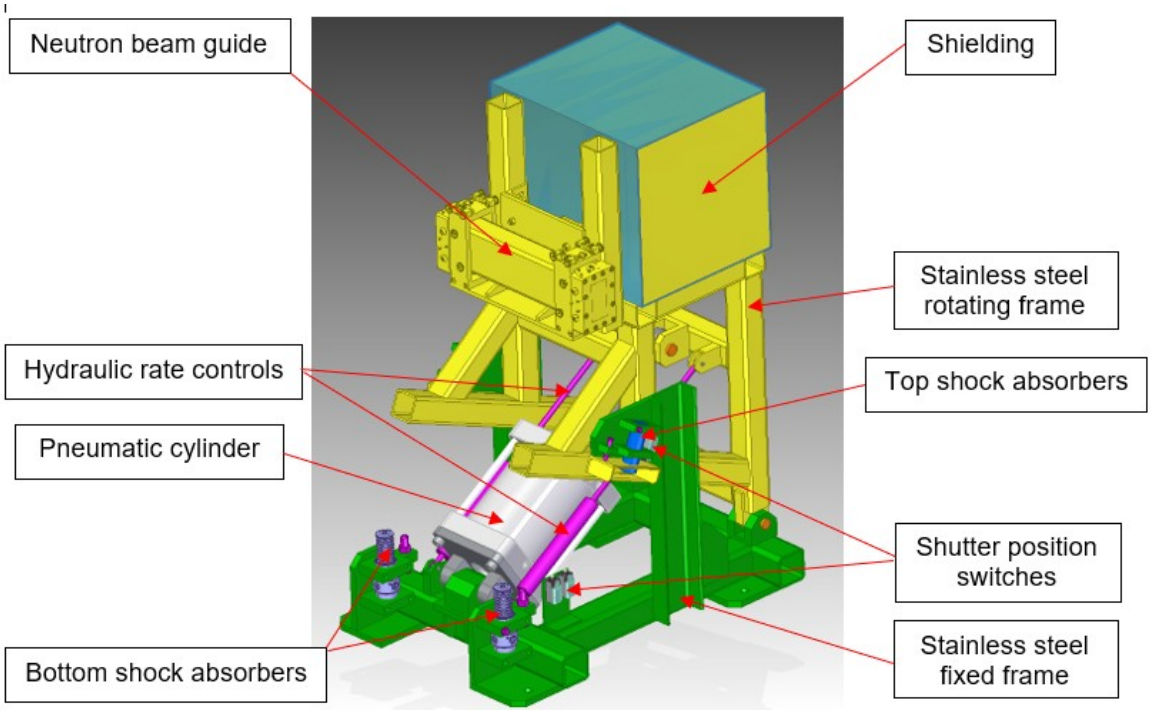

Figure 2: 3D view of the Instrument Shutter for the BEER instrument.

The Instrument Shutter will be installed in a shielding pit just after the bunker wall at 28 m from the source in D03 hall (see Figure 3).

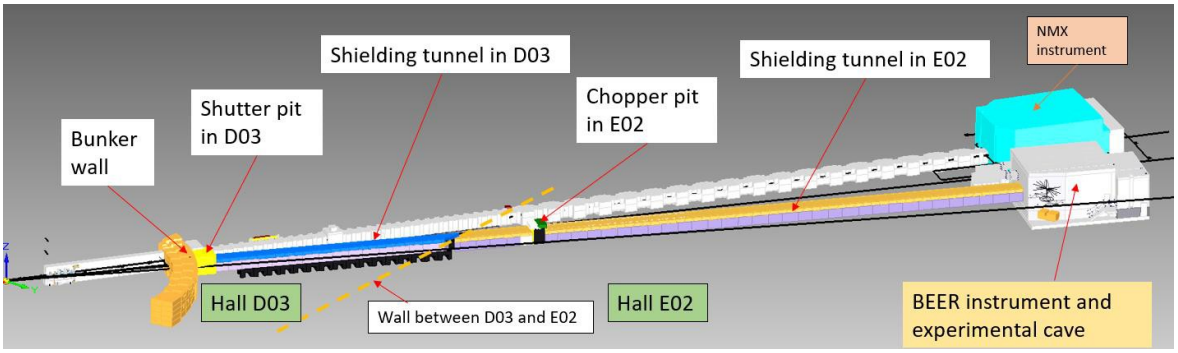

Figure 3: Scheme of beamline shielding of the BEER instrument.

2.4. Construction phases and review process

The ESS instrument construction is divided into three phases, which are concluded by acceptance process called Tollgate reviews (TG):

Phase 2 – Detailed Design (TG3)

Phase 3 - Manufacturing and procurement (TG4)

Phase 4 - Installation and integration (TG5)

This contract concerns finalization of Phase 2 and execution of Phases 3 and 4 for the Instrument Shutter.

2.5. Current status and options for modifications

The BEER instrument is in the design phase, except of the neutron optics system (neutron guides), which is already in production. The detailed design documentation for the Shutter has been finished and evaluated by ESS within the TG3 review. The Contractor may propose modifications or alternative solutions in the offer under the conditions described on Section 4.4..

3. SCOPE OF WORK

The Contractor shall be responsible for the procurements, manufacturing, delivery, installation, integration and commissioning of the complete *Instrument Shutter* to ESS. The following deliverables and services are expected to be delivered with the Instrument Shutter system:

Physical deliverables

- The Instrument Shutter system as described in the Annex 1, including pneumatic actuator and flow control valves (Annex 1, Figure 20, red box).
- Material samples for the copper and steel components supposed to be exposed to the neutron beam during operation.

Services

- Update and verification of the design according to the design specification.
- Preparation of design documents for CDR
- Factory acceptance tests (FAT)
- Delivery to ESS storage facility
- Transport to ESS site, installation and alignment
- Cold commissioning of the Shutter at ESS facility (SAT)
- Training of operating staff at ESS premises

Documentation

- Documentation as described in Section 5..

Excluded parts

Following components are explicitly excluded from the scope of work:

- The neutron guide segment with its vacuum housing and alignment features
- The pneumatic control (valves and pressure control) as described in Annex 1, Figure 20 (green box).
- Electrical signalling switches for MCA and PSS, see Annex 1, Sect. 2.7.2.10
- Electric control of the pneumatic system including the connection boxes for switches, see Annex 1, Sect. 2.7.2.11.
- Compressed air supply

4. SPECIFICATIONS

4.1. General requirements

The System has to be designed and manufactured according to ESS and European standards. A selection of documents describing ESS standards and requirements which are relevant for this contract is given in Section BEER project documents 11.1. and ESS Guidelines and regulations 11.2.. These documents will be provided to the Contractor on request. In case of uncertainty or need of additional information, the Contractor shall contact the Customer and/or representatives of the relevant ESS technical groups.

The delivered sub-systems have to comply with European standards (see Section 11.3.). EU declaration of conformity will be required as a part of the final System documentation.

4.2. System requirements

The list of System requirements and compliance matrix for the current design are provided in Annex 1, Section 7.

4.3. Detailed description of the Instrument Shutter system

The detailed technical description with drawings, material specifications and interface description is provided in the **Annex 1** (*BEER Instrument Shutter – Design description*), which makes an integral part of the System specifications.

4.4. Design changes

Modifications of the design details given in Annex 1 are possible under following conditions:

Before CDR:

The Contractor may propose modifications or alternative solutions provided that they comply with the System requirements (Section 4.2.). In such a case, the Contractor shall describe the concept of the proposed modifications in a technical report as a part of the offer documents. The level of details of this description must allow to evaluate feasibility and compliance of the proposed modifications with the System requirements. If accepted, the Contractor shall implement these modifications in the detailed design documents to be submitted for CDR in the first stage of the project. These documents must proof that the modifications do not negatively affect the functional and safety properties of the System.

In particular, changes of the dimensions and material composition of the shielding block should be avoided. If necessary for technical, safety or economic reasons, such design modification must be accompanied by radiation safety analysis proving that the modified design meets the radiation safety requirements for the whole instrument. An updated Bill of Materials for Activation Inventory must be provided.

Specific component types proposed in the design specification (Annex 1) can be replaced by other types with equivalent parameters, unless this option is explicitly excluded

After CDR:

Any changes are possible only through the formal procedure starting with submission of a 'Design Changes Request' with reasoning and analysis of consequences for costing, performance and safety and compatibility (interfaces) with other sub-systems. The proposed changes must be evaluated and approved by both the Customer and by ESS prior any further steps in their implementation are taken. The changes are only possible if necessary due to (i) physical constraints (ii) conflicts with interfaces to other sub-systems (iii) ESS safety and operational requirements or (iv) on request of the Customer.

4.5. Requested design modifications

On top of the design changes proposed by the Contractor as described in Section 4.3., the Client requests following modifications with respect to the detailed design described in Annex 1.

1. Propose paths and mounting for electric connections, compressed air pipes and the vacuum pipe for the shutter guide so that the performance of the shutter is not affected.

2. Implement *modified shape of support pads* which fix the shutter to the floor. The requirement is keeping safe distance from the support block edges (see drawing).
3. During normal operation or guide alignment, the shutter has to be kept open precisely at the end position by the air pressure. However, the shutter is required to close automatically in a case of air or electricity supply failure. *Implementation of manual locking* for maintenance or alignment of the shutter in open position is therefore necessary to ensure personal safety in the confinement space of the shutter pit.
4. Increase of the number of cycles without heavy maintenance from 10 000 to at least 40 000 should be considered (see requirement R15 in Section 7 of Annex 1)
5. *Verify and adapt* the holding brackets for the PSS and MCA switches (provided by ESS/in-kind partner) with respect to the design presented in Section 2.7.2.10 of Annex 1, propose placement of the connection boxes (provided by ESS/in-kind partner) as an interface towards MCA and PSS switches.

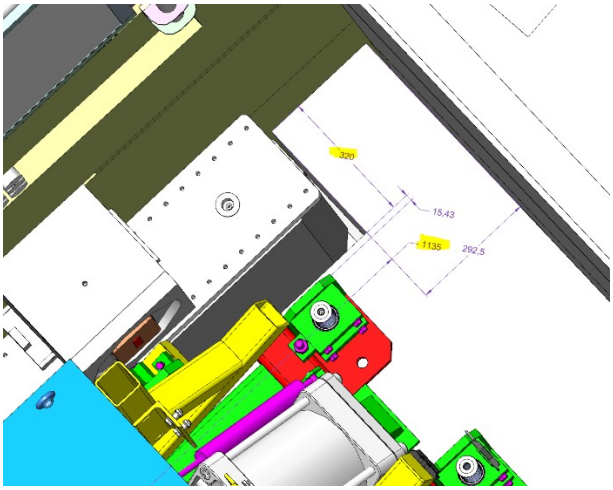

Figure 4. In red: proposed modification of support pad for fixing the shutter on the floor. The purpose is to avoid interference with the cut-out in the floor on the to-left side of the figure.

5. DOCUMENTATION REQUIREMENTS

5.1. Documentation in the tender response

Following information shall be provided by the Contractor as part of the offer in the tender response:

- Technical report describing the offered system. The report shall describe any proposed modifications and alternative solutions with respect to the System description in Annex 1 (see Section 4.4.). The level of details of the report should be sufficient to assess the compliance of the offer with tender requirements.
- Costing of all items, services and documentation described in this document.
- Project schedule.
- Previous documented history of delivering similar systems (especially systems involving pneumatic motion systems of similar payload and accuracy).

5.2. Design and manufacturing documentation

The present detailed design documentation (see Annex 1) with drawings will be provided by the Customer. The Contractor is expected to implement any changes to this design (see 4.4.) and provide:

- 3D model in .stp or CATIA v6 format

- Detailed production drawings in .pdf
- Updated Bill of Materials for Activation Inventory

5.3. System documentation

- Detailed design description
- Interface description
- System integration and verification plan, including
    - FAT and SAT procedures description
    - Installation plan
    - Requirements on resources (heavy equipment, special tools, staff etc.) required for installation, integration and verification of the System.
- System Operation & Maintenance Manual, including, but not limited to:
    - Maintenance periods and lifetime assessment
    - List of recommended spare parts
    - Specifications for utilities (compressed air, electricity), tools and other systems required for operation and maintenance, including process schemes
    - Required test equipment
    - Requirements for storage, transportation, handling and packaging

5.4. Shipment documents

See Section 8.6.. for details

5.5. Project documents

- Project Quality Plan (PQP)
- FAT reports, including measurements qualifying key dimensions, and functionality.
- Non-conformance and deviation reports
- Welding processes qualification/documentation
    - ISO 3834-2 certification for the welding company
    - ISO 15614 welding procedure qualification for all welding
    - Welders qualification acc. to ISO 9606 / ISO 14732 / certificates of welders
    - Welding Procedures Specification
    - Welds Test Schedule
    - Welding inspection reports
- Surface treatment certificates
- Materials certificates/data sheets and traceability reports
- Dimensional report
- Inspection certificates for friction grip joints
- Visual inspection report
- Certificates/data sheets for included components if applicable (e.g. pneumatic control and electrical components)
- Risk assessment and Method Statement (RAMS)
- EU declaration of conformity for CE marking according to DIN EN ISO/IEC 17050-1

6. QUALITY ASSURANCE REQUIREMENTS

6.1. Quality Management System

The contractor must maintain and apply a quality management system compliant with ISO-9001 for all processes and services needed to make the product.

6.2. Project Quality Plan (PQP)

The contractor must create and apply a PQP. The PQP lists, in the correct order, all critical task, processes, inspections, and tests of the phases 'manufacturing' and 'assembly'. The PQP must be released at the CDR with defined witness points, hold points, and report indications. A template for a PQP is shown in ESS Template for Project Quality Plan [ESS-0037830].

6.3. Declaration of conformity

The Contractor shall provide EU declaration of conformity for CE marking according to DIN EN ISO/IEC 17050-1.

6.4. Sub-contractors and/or suppliers

The contractor must apply the same project management and quality assurance requirements of this requirements specification for its sub-contractors and suppliers. The Customer reserves the right to visit the supplier's or sub-supplier's premises upon prior notice to perform an audit or review the progress of the contractual agreed deliverables.

7. PROJECT MANAGEMENT

7.1. Project stages and milestones

The execution of the contract scope of work is expected in following stages:

Stage 1: Design: Verification and (if necessary) update of the detailed design documentation described in Annex 1. Presentation of the detailed design at the Critical Design Review (CDR) at ESS. The documentation and CDR shall cover all modifications with respect to the existing Instrument Shutter design. Transition to the Stage 2 is subject to the ESS approval of manufacturing readiness (RFM).

Stage 2: Production: Manufacturing and assembly of the Shutter components at the Contractor's premises. The production phase is completed by FAT and delivery to the ESS site. Transition to the Stage 3 is subject to the ESS approval of installation readiness (RFI).

Stage 3: Installation: The Shutter system shall be installed, aligned with the neutron optics system and cold commissioned in accordance with the installation plan for the Neutron Scattering Systems (NSS) of the ESS. The project is completed by site acceptance tests (SAT).

Completion of one stage and transition to another one is conditioned by ESS approval through the review procedures as indicated in the list above. Close cooperation between the Contractor, the Customer and ESS teams is therefore necessary for successful and timely completion of the project.

7.2. Project schedule

The contractor must set up a project schedule and this shall be set before the contract is signed. The project schedule starts with the kick-off meeting and ends with the final acceptance. The planning must indicate:

- All defined milestones

- Delivery dates for review documents to the Customer.
- Time needed to approve review documents by the Customer (approx. 10 working days)
- Dates of Customer's deliverables to contractor's site (if applicable)
- All main tasks
- Actual timeline
- Delivery dates of the ordered products/batches to ESS
- FAT and SAT dates

7.3. Acceptance tests and reviews

The reviews are organized as meetings or carried out by email communication. The form and location of the reviews may be changed in mutual agreement. The list o expected reviews is given in Table 2.

The Contractor should provide all necessary documentation for each review at least 2 weeks before the review date. For details about the reviews and tests, see Section 8..

Table 2: Review meetings approvals and tests to be performed

ID	Name of Meeting / Review	Form
KOM	Kick-off Meeting	meeting
CDR	Critical Design Review	meeting
RFM	Ready for Manufacturing	e-mail
FAT	Factory Acceptance Test	meeting
RFD	Ready for Delivery	e-mail
SAI	Site arrival inspection	e-mail
RFI	Ready for Installation	meeting
SAT	Site Acceptance Test	meeting

7.4. Communication

The delivery of relevant data between the Contractor and Customer, such as review documents, data files or open issues must be formally transferred via email and should be done by the persons defined for communication.

The Contractor shall inform the Customer about the project progress and issues of concern at least once per month in progress reports.

Meetings can be held on-line via videoconference tools if agreed by both parties. The inviting party shall prepare an agenda and meeting minutes. The actions resulting from these meetings shall be clearly defined and distributed, along with the minutes themselves, to all responsible persons. Open issues shall be recorded in an open issue list maintained by the Contractor.

All communication, drawings, material certificates, and related documentation must be in English.

The Contractor should provide, where possible, recommendations and design optimizations where these can offer a reduction in costs and risks, or improve the performance.

7.4.1. Point of contact

The principal point of contact for the project execution and coordination between the Contractor and ESS is the Lead Instrument Scientist for BEER nominated by the Customer:

Premysl Beran (Premysl.Beran@ess.eu), tel. +46721792504, ESS Technical Directorate, Instrument Scientists Group

The Customer can nominate other contacts for communication for particular project stages or tasks.

8. EXECUTION OF THE PROJECT

8.1. Kick-off Meeting (KOM)

The 'project kick-off meeting' should be held within 2 weeks after the contract is signed. The list below summarises the minimum that shall be discussed:

- Project Schedule
- Communication Strategy
- Requirements for design modifications and CDR

8.2. Critical Design Review (CDR)

All modifications of the detailed design implemented by the Contractor shall be reviewed by the Customer and by ESS representatives at the CDR. For this review, the Contractor shall provide

- Production version of the Detailed Technical Design (DTD), as specified in section 5.2.
- Preliminary version of the System integration and verification plan as specified in section 5.3.

8.3. Ready for manufacturing (RFM)

Manufacturing readiness shall be approved by ESS and confirmed by the Customer on the basis of CDR output. The approved CDR documentation and released Project Quality Plan are required for the RFM review.

8.4. Factory Acceptance Test (FAT)

Representatives of the Customer and ESS (if required) shall be present during the FAT. The Contractor shall inform the Customer team at least 20 working days before the tests. At the end of the tests, a report shall be sent to the Customer for validation.

The content of the FAT and required equipment shall be described in the Quality Plan (Section 6.2.). The FAT shall include, but is not limited to:

- Measurement of critical dimensions
- Test of the pneumatic control unit
- Test of the Shutter motion speed between operation positions (on/off)
- Test of the signals from end switches
- Measurements of end positions accuracy
- Measurements of end positions repeatability
- Test of safety functions (closing on air/electricity supply failure)

The Contractor shall provide measurement tools and media (electric and compressed air supplies) required for FAT. A mock-up of the shutter neutron guide is required for testing.

8.5. Ready for Delivery (RFD)

Readiness for delivery must be approved by the ESS and confirmed by the Customer. Necessary documents to be provided by the Contractor include:

- Approved FAT protocol (see 8.4.).
- Design documentation in "as manufactured" state (see 5.2.)
- Materials and components certificates/data sheets (see 5.5.)
- Shipment documents (see 5.3.)
- Detailed installation and alignment plan
- Requirements for resources required for handling and storage

8.6. Delivery

All tangible deliverables shall be delivered in accordance with DAP (2010 Incoterms), at the ESS premises in Lund, Sweden or such other final destination defined by ESS.

All deliveries shall be pre-advised 48h prior to the arrival at destination via email to logistics@esss.se, a confirmation with slot time for unloading will follow to the sender of the pre-advice.

All deliverables shall be executed in accordance with the Logistics Guidelines [ESS-0042559] (i.e. technical guideline regarding transportation further specifying: delivery notice time, minimum packaging specs, delivery notes, opening hours of receiving at ESS ERIC or warehouse, time of storage at Partner premises without charge after FAT, etc.)

All deliveries shall also be accompanied by an appropriate pro-forma invoice (evidencing the replacement value of the delivered equipment) and such other delivery documentation to enable ESS ERIC to properly store and insure the equipment.

For goods/material/equipment purchased by ESS ERIC and delivered to the Supplier for use in execution of this scope of work, that are expected to be returned to ESS ERIC, the Supplier shall consult the ESS ERIC procedure for the Off-site Lending of Hardware [ESS-0048868]. The procedure describes the responsibilities, routines and processes in regards to lending of equipment.

8.6.1. Delivery address

Site location: Transportgatan 5 F03 / Gate E, 225 92 Lund, Sweden
Site owner: European Spallation Source ERIC, Address: Box 176, S-221 00 Lund, Sweden.

8.6.2. Shipment

The start of the shipment will be communicated to ESS by email at least **14 days** prior to shipment and confirmed once the shipment is sent.

Prior to shipment, the Contractor must inform ESS about the delivery dates, quantity, size and weight of the packaging, resources required for unloading and storage, as well as requirements for safe handling and storage of all packages.

No shipment can be made without previous agreement by ESS.

The components delivered to ESS must be accompanied by

- Parts list for all replaceable parts with appropriate identification and specifications
- Materials certificates/data sheets (if not included in FAT)

8.6.3. Handling and packing

- The packing must have means to use classical handling tools. The packed parts must be protected during transport and storage against possible harms such as weather elements, mechanical shocks, strain, and rubbing which can damage surfaces.
- Packing-cases must be of a stout and robust nature suitable for lifting and transportation without damage using a forklift truck or crane.
- The contractor must inform ESS about the amount and size of packages.
- Each package must contain a packing list, indicating at least:
    - Serial number
    - Item description
    - Quantity ordered
    - Quantity shipped
    - Packed in sub-package number
- The package must be marked with:
    - The Customer's and ESS contact email addresses and phone numbers
    - Weight of the package
    - Support points for transport and lifting

ESS will supply the local handling tools for unloading the goods at ESS.

8.6.4. Identification and Marking of Components

In order to provide traceability of the components, any loose or pre-assembled component should have an identification marking. Where this is not feasible, exceptions shall be communicated and agreed. The marking should be permanently fixed on an exposed surface showing, at least:

- Weight of the element,
- ESS Identifier (provided by the Customer)
- Part number
- Drawing number

8.7. Site Arrival Inspection (SAI)

Upon arrival at the ESS site, staff appointed by the Customer shall inspect the Shutter elements to ensure the integrity of the transport. The inspection should include at minimum the document control, visual inspection and metrology on critical parts. If the SAI fulfils the requirements, the Customer shall accept provisional reception.

8.8. Ready for Installation (RFI)

For the RFI to be concluded, the Contractor shall provide detailed installation and alignment plan including:

- Clear assembly plans
- Updated installation schedule
- Risk assessments and method statements (RAMS)
- Information on any temporary services needed

8.9. Installation

Installation works at ESS site will be coordinated by the Installation Package Leader appointed by the Customer. ESS shall be responsible for the operation of the forklift or crane but the Contractor is responsible for the delivery, integration, and commissioning of the final assembly. Any external

resources (services, personnel, tools) required by the Contractor from the Customer or ESS must be specified and agreed in advance (see RFI).

For the activities performed by the Contractor's staff at the ESS site, the Contractor must fill in the RAMS (Risk assessment and Method Statement) according to the ESS template [ESS-2071941]. The staff of the Contractor working on site is subject to ESS regulations [ESS-0093892]. The Contractor is responsible for necessary work permits and training of its staff.

The anticipated requirements for mounting of the shutter and step-by-step installation procedure are provided in Annex 1.

8.10. Site Acceptance Test (SAT)

The preliminary plan for SAT is described in the BEER System Integration and Verification Plan [ESS-0432367]. The SAT shall include, but is not limited to:

- Check that all shutter components are installed on site according to documentation package.
- Visual check of main components and their finishing.
- Test of the adjustment operation of the neutron beam guide (including mechanical hard stops) fixed to the shutter by operator (operator access, accuracy, time required).
- Test of opening/closing of shutter with normal operation (repeated number of cycles), including
    - Accuracy and repeatability
    - Clearances to avoid any risks of clashes
    - Sensors signals
    - Time required to open/close the shutter
- Test of maintainability (considering space limitation in shutter pit)
- Test of access to components during inspection of the shutter.
- Test of access to components around shutter (bunker window, fixed neutron guide).
- Test of the shutter fail safe function in case of air/electric supply loss
- Training of operators

8.11. Final project acceptance

The project shall be deemed complete upon signing of the SAT report and all final documentation, including:

- As built technical drawings (electrical, mechanical, pneumatic & process schemes).
- Performed FAT Protocol.
- Recommended spare parts list.
- Materials certificates/data sheets.
- Main equipment data sheets.
- Instruments calibration certificates.
- Welding Processes qualification/documentation
- Maintenance and User's manual.
- Certificate of compliance with the requirements
- EU declaration of conformity

9. WARRANTY

The warranty on workmanship and stability of the Shutter components shall be 5 years from the SAT. Rights to request services under the warranty period shall be transferred to the ESS.

10. SUGGESTED MILESTONES AND PAYMENTS

The main milestones with tentative completion dates and proposed payments are given in the following table:

Table 3. Tentative milestones, schedule and payments.

ID	Milestone	Tentative date	Payment
WP01.2.2	Procurement contract signed	D	5%
WP01.2.3	Detailed design approved (RFM)	D + 3 month	25%
WP01.2.4	Delivered to site (SAI)	D + 10 months	55%
WP01.2.5	Start of installation (RFI)	D + 10.5 months	--
WP01.2.6	Installed (SAT)	D + 11 months	15%

The time schedule shall be studied so that it is compatible with the installation of the bunker insert and the E02 neutron transport guide.

11. REFERENCES

The documents marked as *ESS-xxxxxxx* are documents from the ESS repository. Their current versions can be found at the ESS CHESS repository. If the Contractor does not have access rights for this repository, the Customer will provide necessary documents on request.

11.1. BEER project documents

Design	
BEER - System Design Description	ESS-1138650
BEER – Concept of Operation	ESS-0124310
BEER - Sub-System Design Description – Beam Transport and Conditioning	ESS-0432123
BEER - Interface Description	ESS-0432366
BEER - Radiation Safety Analysis	ESS-0432365
BEER - Complete 3D Model of the instrument	ESS-0432373
BEER - Material inventory for activation analysis	ESS-1416976
Quality management	
BEER - System Validation Plan	ESS-0432370
BEER - System integration and verification plan	ESS-0432367
BEER - System Operations and Maintenance Manual	ESS-0432372
BEER - Instrument Hazard Analysis	ESS-0432364
BEER - Project Quality Plan	ESS-0432363

11.2. ESS Guidelines and regulations

Design and construction	
Main coordinate systems at the ESS	ESS-0035090
ESS Instrument Technical Interfaces	ESS-0403282
MCA Components Standard	ESS-0439471
ESS Generic Requirements for Documentation of Technical Systems	ESS-0094092
Engineering Drawing Standards Manual	ESS-0002955
Neutron Instrument Design and Construction - Phase 2 Technical Data Package Specification	ESS-0099059
Neutron Instrument Design and Construction - Phase 3 Technical Data Package Specification (to be published)	ESS-0099060
Neutron Instrument Design and Construction - Phase 4 Technical Data Package Specification (to be published)	ESS-0099061
Safety requirements	
ESS Guideline for Instrument Hazard Analysis	ESS-0047810
Template for Instrument Hazard Analysis	ESS-0100583
Machine Protection Risk Management Plan	ESS-0320782
ESS rule for identification and classification of safety important components	ESS-0016468
Activation Study of Various Alloys in the Beam Extraction Area	ESS-0185932
Fire Protection - Semi Detailed Requirements on Radiation Safety & Protection of Property	ESS-0002642
Risk assessment and Method Statement (RAMS)	ESS-2071941
Project management	
ESS Procedure for Change Control of ESS Facility	ESS-0001879
Guideline for Shipping	ESS-0042559
ESS ERIC procedure for the Off-site Lending of Hardware	ESS-0048868
Information to contractors working on site	ESS-0093892
Quality management	
ESS Template for Project Quality Plan	ESS-0037830
ESS Guideline for Factory Acceptance Test (FAT) and Site Acceptance Test (SAT)	ESS-0094204
ESS Rules for CE marking	ESS-0127031

EU Declaration of Incorporation	ESS-0145023

11.3. EU Directives, Standards and Regulations

Norm	Description
2006/42/EC	Machine Directive
EN 1993 EUROCODE 3	Design of steel structures
ISO 129-1	Technical product documentation (TPD) – Presentation of dimensions and tolerances – Part 1: General principles
EN ISO 1101	Geometrical product specifications (GPS) — Geometrical tolerancing
EN 61355	Classification and designation of documents for plants, systems and equipment
EN 60617	Graphical symbols for diagrams
ISO 5725-1	Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions
EN ISO 12100	Safety of machinery. General principles for design. Risk assessment and risk reduction
EN ISO 13857	Safety of machinery. Safety distances to prevent hazard zones being reached by upper and lower limbs
EN ISO 13850	Safety of machinery. Emergency stop function. Principles for design
EN ISO 9606-1	Qualification testing of welders — Fusion welding — Part 1: Steels
EN ISO 14731	Welding coordination – Tasks and responsibilities
EN ISO 14732	Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials
EN ISO 9712	Non-destructive testing — Qualification and certification of NDT personnel
EN ISO 9001	Quality management systems — Requirements
ISO 10005	Quality management – Guidelines for quality plans
EN 1090	Execution of Steel Structures and Aluminium Structures
EN 10029	Hot-rolled steel plates 3 mm thick or above - Tolerances on dimensions and shape
EN ISO 898	Mechanical properties of fasteners made of carbon steel and alloy steel -
EN 10204	Metallic products - Types of inspection documents
EN 10025	Hot rolled products of structural steels
EN 10163	Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections
EN 10021	General technical delivery conditions for steel products.

12. GLOSSARY

Name	Explanation
CDR	Critical Design Review
ESS	European Spallation Source ERIC
FAT	Factory acceptance test

KOM	Kick-off meeting
MCA	Motion Control and Automation
PQP	Project quality plan
PSS	Personal Safety System
RAMS	Risk assessment and Method Statement
RFD	Ready for delivery
RFI	Ready for installation
RFM	Ready for manufacturing
SAI	Site acceptance inspection
SAT	Site acceptance test
TGn	Tollgate review *n*