Purchase Contract

entered into pursuant to Section 2079 et seq. of Act No. 89/2012 Coll., the Civil Code (hereinafter the "**Civil Code**")

I. CONTRACTUAL PARTIES:

1. **Buyer:**

Fyzikální ústav AV ČR, v. v. i.
(Institute of Physics of the Czech Academy of Sciences, public research institution)
with its registered office at Na Slovance 2, ZIP 182 21 Praha 8
represented by: RNDr. Michael Prouza, Ph.D. - Director
registered in the register of public research institutions of the Ministry of Education, Youth and Sports of the Czech Republic
Id. No.: 68378271
(hereinafter the "**Buyer**")

and

2. **ALCA TECHNOLOGY S.R.L.**
with its registered office at Schio (VI), Via Logo di Garda, 130 CAP 36015
represented by: Fabrizio Anselmi, Administrator
Id. No.: 02793000247

(Hereinafter the "**Seller**"; the Buyer and the Seller are hereinafter jointly referred to as the "**Parties**" and each of them individually as a "**Party**").

enter, on the present day, month and year, into this Purchase Contract (hereinafter the "**Contract**").

II. INTRODUCTORY PROVISIONS:

The Seller has been selected as the winner of a public contract awarding procedure announced by the Buyer for the public contract called "**TP22-20 Vacuum Chambers for Hall E1**" (hereafter the "**Tender Procedure**").

The public contract is funded from the Operational Programme Research, Development and Education managed by the Czech Ministry of Education, Youth and Sports.

III. SUBJECT-MATTER OF THE CONTRACT:

The Seller shall in return for the purchase price stipulated below design (the final production design based on the detailed technical concept provided by the Buyer), manufacture, final clean, assemble, test and deliver to the Buyer three vacuum chambers titled as BPC-MAC chamber, chamber CH12 and chamber CH12 specified in detail herein (including all relating required services) (hereafter individually the "**MAC Chamber**", the "**Chamber CH12**" and the "**Chamber CH13**", together as the "**Chambers**" and any of the Chambers as the "**Chamber**") and the Buyer shall take over the Chambers, all in accordance with the terms and conditions of this Contract.

The MAC Chamber and required related services to it shall comply with the Requirements Specification Document titled "Experimental BPC-MAC chamber for technology in hall E1 TP22_020b" that forms part of Annex No 1 hereto Technical Specification.

Chamber CH12 and Chamber CH13 and required related services to them shall comply with the Requirements Specification Document titled "CH12 and CH13 chambers for beam transport in hall E1 TP22_020a" that forms part of Annex No 1 hereto Technical Specification.

IV. OWNERSHIP TITLE:

The ownership right to the Chambers passes to the Buyer upon execution of the Acceptance protocol for each Chamber separately by the Buyer.

V. DEADLINES, PARTIES´ DUTIES:

1. The Seller shall perform this Contract in individual deliverables and within deadlines stipulated in Annex No 2 hereto Deliverables and Payments.
2. Where anything in this Contract is subject to approval of the Buyer, the Buyer shall not refuse its approval without stipulating technically justified grounds for the refusal. No approval provided by the Buyer under this Contract releases the Seller from the liability for compliance of the Chambers with this Contract.
3. The Buyer is entitled to require in advance that its representatives take part in any test or manufacturing step in the Seller´s premises. The Seller shall in such case invite the Buyer 10 days in advance if practically possible. The participation of the Buyer´s representatives is subject to all rules applicable in Seller´s premises.

VI. PURCHASE PRICE AND PAYMENT TERMS

1. Purchase prices of the individual Chambers and the total purchase price of all Chambers (hereinafter the "**Purchase Price**") are stipulated in Annex No 3 hereto Prices.
2. The value added tax shall be paid according to the applicable law or international agreements.
3. The Purchase Price is the maximum price for performing this Contract that cannot be exceeded. The Purchase Price includes all costs related to the performance of the Contract, including the cost of transport of the Chambers to the place of delivery, customs (if applicable), licenses and fees, etc. The Purchase Price is fixed and shall not change, unless this Contract or applicable law states otherwise, regardless of the changes of subsuplier prices or changes in the foreign exchange rates. The Purchase price may be modified only in compliance with the public procurement legal rules.
4. The Purchase Price shall be paid by the Buyer in instalments stipulated in Annex No 2 hereto Deliverables and Payments. The Seller is entitled to invoice any payment only after due completion of any deliverable.
5. If this Contract is being performed in line herewith without substantial breaches hereof by the Seller and if it might ease or speed up performance of this Contract by the Seller and if the Seller will present plan of performance of activities that are to come to deliver any of the yet undelivered Chambers the Buyer reserves the right to provide the Seller with Purchase Price or any portion of it sooner than set out in Annex No 2 hereto. If the conditions stipulated above are met, the Buyer is

entitled to modify the payment schedule in favor of the Supplier and to provide it with any prepayment.

6. The Purchase Price instalments shall be paid on the basis of tax documents – invoices, to the account of the Seller specified in the invoice. The invoices shall have only the electronic form and shall be submitted to the email address: efaktury@fzu.cz.

7. The invoiced amount is due in thirty (30) days of the date of delivery of the invoice to the Buyer. If the invoice stipulates different due period such period is deemed irrelevant and the period stipulated herein applies. Payment of the invoiced amount means the date of its remitting to the Seller's account. Any invoice shall have the properties of a tax document under the applicable Czech laws. The Buyer shall advice the Seller on the proper contents of the invoice in advance if needed. Furthermore, the invoice shall state the following:

   - the registration number of this Contract, which the Buyer shall communicate to the Seller at his request before the invoice is issued
   - declaration that the taxable performance was provided for the purposes of "Advanced Research Using High Intensity Laser Produced Photons and Particles" project, reg. No. CZ.02.1.01/0.0/0.0/16_019/0000789 or any other project in accordance with instructions provided by the Buyer in advance

   and must also comply with any double taxation treaties applicable to the given case.

VII. PLACE OF DELIVERY

The place of delivery is the ELI Beamlines research centre, Za Radnicí 836, ZIP 252 41, Dolní Břežany, the Czech Republic.

VIII. FINAL ACCEPTANCE OF THE CHAMBERS

1. Each Chamber shall be accepted by the Buyer in the place of delivery on the basis of an acceptance protocol (Final acceptance) if the Chamber complies with this Contract, all required activities are completed and all required documentation and information is provided by the Seller.

2. The acceptance protocol shall contain the following information:

   - identification of the Seller
   - identification of the Chamber
   - a list of defects and deficiencies of the Chamber, if there are any, and the deadlines for their removal, if the Buyer decides to accept the Chamber despite having defects
   - the signature of the Buyer and the date of acceptance

   (hereinafter the "**Acceptance protocol**").

3. The Buyer may but is not obliged to accept any Chamber with defects or deficiencies, particularly if the defects or deficiencies do not prevent the Buyer from using the Chamber for intended use. Should the Buyer accept the Chamber with defects or deficiencies, the Buyer shall list these in the Acceptance protocol, including the manner and agreed deadline for their removal. Should the Parties

not agree on the deadline for the removal of any defect or deficiency in the Acceptance protocol, then those must be removed within 60 days from the date of the acceptance.

IX. WARRANTY

1. The Seller hereby provides the warranty of quality for the Chambers of 2 years from the date of acceptance of any of the Chambers. Should any documentation related to a Chamber provided by the Seller indicate any longer warranty of the Chamber or any its part, such longer warranty applies.
2. The warranty period shall commence on the date of the execution of the Acceptance protocol. However, if the Chamber is taken over with defects or deficiencies, the warranty period shall commence on the date of the removal of the last defect or deficiency by the Seller.
3. The Buyer shall raise a claim for removal of a defect of a Chamber without undue delay after detecting the defect, but not later than on the last day of the warranty period, by means of a written notice to the Seller's email address for claims notification set out herein (hereinafter the „**Warranty claim**"). Warranty claim sent by the Buyer on the last day of the warranty period shall be deemed to have been made in time.
4. In the Warranty claim, the Buyer shall describe the defect and suggest the manner in which the defect is to be removed. The Buyer is entitled after consultation with the Seller to decide on the manner of removal of the defect by the following means:
   - the removal of a defect by the delivery of a substitute Chamber or any its part, or
   - the repair of the defect, or
   - provision of an appropriate discount on the Purchase Price (especially in case of minor or irremovable defects).

   The Buyer shall not require the removal of a defect by the delivery of a substitute Chamber or any its part in case of defects removable by repair unless the same defect occurs more than once.
5. The Seller agrees to remove defects of the Chambers free of charge. If the removal of a defect of a Chamber requires transport of the Chamber to the Seller´s place, the Seller shall pay the transport costs there and back.
6. Defects must be removed within the period of 30 days from the date, on which the Warranty claim was notified to the Seller unless the Buyer and the Seller agree on another term. The Buyer shall agree on a longer term if the Seller proves that the period of 30 days is unfeasible for reasons not given on the side of the Seller (e.g. the subsupliers´ delivery terms).
7. The Seller shall remove defects of the Chambers within periods stated in the Contract also in the instances when the Seller is of the opinion that it is not liable for such defects. In case the Seller will not accept any defect and the Buyer will not agree with such conclusion, the validity of the Warranty claim shall be ascertained by an expert, which is to be selected by the Buyer but on which the Seller also must agree. In the event the expert declares the Warranty claim as justified, the Seller shall bear

the costs of the expert's assessment. If the Warranty claim is raised unjustly (according to expert's assessment), the Buyer shall reimburse the Seller all reasonably incurred costs associated with removing the defect.

8. The Parties shall execute a record on the removal of any defect, in which they shall confirm that the defect was removed. The warranty period of the respective Chamber shall extend by the time that expires from the date of exercising the Warranty claim until a defect is removed if the defect prevented the Buyer from using the Chamber for intended use.
9. In case the Seller fails to remove a defect within the time period set out in the Contract, or within other period as may be agreed by the Parties, or in case the Seller refuses to remedy the defect, the Buyer shall be entitled to have the defect removed at its own cost by a third party, and the Seller shall be obliged to compensate the Buyer for all reasonably incurred costs associated with removing the defect within 30 days of the Buyer's request to do so. Under the condition that the repair was professionally done, the scope and length of the warranty remains unaffected by the defect removal by the third party.
10. The warranty shall not cover defects caused by unprofessional handling, non-compliance with the Seller's written instructions for operation and maintenance of the Chambers. The warranty shall also not apply to defects caused by intentional conduct.
11. This email address info@alcatechnology.com serves as a defect notification address.

X. CONTRACTUAL PENALTIES

1. If the Seller is in delay with due completion of deliverable T5 regarding any of the Chambers, the Seller shall pay to the Buyer contractual penalty in the amount of 0.1% of the price of the relevant delayed Chamber (as stipulated in Annex No 3 hereto) without VAT for each, even commenced day of delay.
2. Total amount of the contractual penalty for delay with the completion of Deliverable T5 regarding any Chamber shall not exceed 10% of the purchase price of the relevant delayed Chamber. I.e. the total amount of the contractual penalty for delay under this Contract shall not exceed 10% of the Purchase Price.
3. If the Seller fails to remove a defect within the periods stipulated in the Contract, the Seller shall pay to the Buyer a contractual penalty in the amount of 15 EUR for each defect and for each day of delay.
4. No delay penalty may be requested by the Buyer if a delay on the side of the Seller is caused by documented impact(s) of the covid-19 pandemic or of the war in Ukraine on the Seller and the respective obstacle could have been overcome only with unreasonable costs or efforts.
5. If the Buyer fails to pay the Purchase Price within the deadlines set out in this Contract, the Buyer shall pay the Seller interest on delay in the amount set forth by the applicable law for each day of delay.

6. The obliged Party must pay any contractual penalties/ interests to the entitled Party not later than within 15 calendar days of the date of receipt of the relevant claim from the entitled party.

XI. TERMINATION OF THE CONTRACT, VIS MAJOR

1. This Contract may be terminated by agreement of the Parties or by withdrawal from the Contract on the grounds stipulated by law or by the Contract.
2. The Buyer is entitled to withdraw from the Contract without any penalty if any of the following events occur:
    i) the Seller has materially breached the obligations imposed on it by the Contract, especially a) by being in delay with meeting any deadline hereof for more than 2 months, b) any Chamber is defective and such defect is not removed within 3 months from notifying the Seller of such fact – the withdrawal takes effect only in relation to design and manufacture of the defective Chamber, or c) the same defect that prevents the Buyer from using the Chamber for intended use occurs more than two times – the withdrawal takes effect only in relation to design and manufacture of the defective Chamber;
    ii) insolvency proceedings are initiated against the Seller's assets,
    iii) should it become apparent that the Seller provided information or documents in the Seller's bid, which are not true and which could have influenced the award of this Contract to the Seller.
3. The Seller is entitled to withdraw from the Contract in the event of material breach of the Contract by the Buyer, especially by delay with due payment of any instalment of the Purchase Price longer than 2 months.

Vis major circumstances

4. Circumstances constituting vis major shall be constituted by such circumstances / obstacles which arose independently of the will of the obliged Party, and which prevent fulfilment of that Party's obligation, provided that it could not be reasonably expected that the obliged Party could overcome or avert this obstacle or its consequences, and furthermore that such Party could foresee such obstacle when it entered into the respective covenants. Vis major shall not be constituted by obstacles that arose only after the obliged Party was in default with fulfilment of its obligations, or which arose in connection with its economic situation.

    Any particular effects or impacts on the Seller or his performance under this Contract of the Covid-19 epidemic or of the war in Ukraine that meet the conditions above will be considered as a vis major cases despite the fact of the existence of the epidemic and the war on the date of the signature of this Contract.

5. Should a situation occur, which a Party could reasonably consider to constitute vis major, and which could affect fulfilment of its obligations hereunder, such Party shall as soon as possible notify the other Party and attempt to continue in its performance hereunder in a reasonable degree.

Simultaneously, such Party shall inform the other of any and all its proposals, including alternative modes of performance, however, without consent of the other Party, it shall not proceed to effect such alternative performance.

6. If a situation constituting vis major occurs, the deadlines imposed hereunder shall be extended by the period of the documented duration of the said vis major. The obliged Party shall properly document to the other Party the start and the finish of the vis major period.

XII. REPRESENTATIVES OF THE PARTIES

1. The Buyer has appointed the following authorised representative for communication with the Seller in relation to this Contract:

   Ing. Lukáš Brabec, DPhil., email: Lukas.Brabec@eli-beams.eu, +420 266 051 247

2. The Seller has appointed the following authorised representative for communication with the Buyer in relation to this Contract:

   ANDREA LANARO, email: andrea.lanaro@alcatechnology.com, Phone: 0039445500064

XIII. CHOICE OF LAW

1. This Contract and all the legal relationships arising out of it shall be governed by the laws of the Czech Republic.
2. Any disputes arising out of this Contract or legal relationships connected with the Contract shall be resolved by the Parties amicably. In the event that a dispute cannot be resolved amicably within sixty (60) days, the dispute shall be resolved by the competent court in the Czech Republic based on an action filed by any of the Parties.

XIV. SOCIAL, ECOLOGICAL AND INNOVATIVE ASPECTS

The Buyer aims to conclude contracts with Sellers that take into account and implement the principles of social responsibility, ecological sustainability and innovation. Therefore, the Seller shall ensure that:

a) this Contract is performed only by persons that are employed in accordance with the applicable legal regulations (no illegal or child workers);

b) while performing this Contract, all applicable health and safety regulations and rules at work place are observed;

c) all persons performing this Contract are employed under fair and non-discriminatory working conditions;

d) if presented with different manners of fulfilling this Contract, the Seller shall select the solution/process that is in accordance with the principles governing nature conservation and nature protection, ecological sustainability and ecological waste management; and

e) if presented with different manners of fulfilling this Contract, the Seller shall select the solution/process that is the most innovative.

XV. ASSIGNEMENT

1. The Seller shall not be entitled to assign any rights or obligations arising in connection herewith to a third party.
2. The Buyer makes the Seller aware that the Buyer is going with anticipated effect as of 1.1.2023 to transfer the ELI Beamlines research facility (now owned and operated by the Buyer) for construction and operation of which is the supply under this Contract being agreed to to The Extreme Light Infrastructure ERIC (ELI ERIC). The ELI ERIC is a legal person set up under Regulation (EC) No 723/2009 and it is the future long term owner and operator of the ELI Beamlines facility. The Seller by entering this Contract agrees to the assignment of all rights and obligations from this Contract by the Buyer to ELI ERIC. The Buyer shall inform the Seller on the completed assignment without undue delay and the assignment shall become effective at the moment of its notification to the Seller. The supply supplied under this Contract will be used exclusively in the ELI Beamlines facility.

XVI. RESERVED CHANGES IN OBLIGATION

Material costs development

Should the actual price of the identified categories of the raw material at the moment of purchase increase or decrease by more than 10 % with respect to their price considered in the bid submitted by the Seller within the Tender Procedure (hereinafter the "**Bid**"), the Seller and the Buyer shall proceed in compliance with the below-stated rules.

The Seller shall make all reasonable efforts to secure as low as possible price made possible by the overall behaviour of the market for designated raw material.

Regarding the categories of stainless steel and/ or aluminium alloy as specified in the Bid, the Seller shall inform the Buyer, without undue delay, on selection of the suppliers (sub-contractors) for each purchase, with justification of the selection. The justification shall be based on a competitive tender (documented especially by relevant price enquiries sent to more suppliers), and shall use the criterion of the most economically advantageous tender to select the supplier (sub-contractor).

Price increase

Should the actual unit price of the identified categories of raw materials, as mentioned above, and for the maximum total extent specified in the Bid, at the moment of purchase for fulfilment of this Contract increase by more than 10 % with respect to their price considered in the Bid, the Seller is entitled to ask the Buyer for compensation of the extra costs incurred, in the amount above the price level considered in the Bid.

Should the following conditions:

a) the increased price is documented by the outputs of the competitive tender;

and

b) the difference between the unit price in the bid and the actual purchase price is consistent with the overall behaviour of the market for the respective material in the relevant timeframe (using the indexes published by the London Metal Exchange (https://www.lme.com/);

be met, the Buyer shall agree with the Seller on corresponding increase of the prices of the raw material in the Contract.

Due to the budgetary limitations of the Buyer, the total permitted price increase of the raw materials under this clause is limited to 50 000 EUR (or to an equivalent of this amount in the currency of the actual purchase).

Should the Buyer have doubts regarding the cost figures of the raw materials presented by the Seller, it is entitled to refuse any such price increase.

Price decrease

Should, based on the competitive tender, the actual unit price of the identified categories of raw materials, as mentioned above, and for the total expected extent specified in the Bid, decrease by more than 10 % with respect to their price considered in the Bid, the Purchase Price shall be decreased by the corresponding amount (in the amount with respect to the price level considered in the bid).

The Purchase Price invoiced by the Supplier shall in such case be decreased by the financial amount saved (by decreasing invoiced Payments for the corresponding contractual deliverables).

Joint provisions

Agreements or understandings between the Parties needed to implement the reserved changes in obligation above shall be made in written, however, they do not need to take the form of an amendment to this Contract.

XVII. FINAL PROVISIONS

1. The Contract with all annexes represents the entire and complete agreement between the Buyer and the Seller.
2. The Buyer is entitled to set off any even yet undue of its financial claims towards the Seller against any financial claim of the Seller (e.g. the claim for the Purchase Price payment).
3. In the event that any of the provisions of this contract shall later be shown or determined to be invalid, putative, ineffective or unenforceable, then such invalidity, putativeness, ineffectiveness or unenforceability shall not cause invalidity, putativeness, ineffectiveness or unenforceability of the Contract as a whole. In such event the Parties undertake without undue delay to subsequently clarify any such provision or to replace after mutual agreement such invalid, putative, ineffective or unenforceable provision of the Contract by a new provision, that in the extent permitted by the laws and regulations of the Czech Republic, relates as closely as possible to the intentions of the Parties to the Contract at the time of entering hereto.
4. This Contract is subject to mandatory publication according to the applicable Czech law.
5. This Contract becomes valid as of the day of its execution by the authorised persons of both Parties.
6. This Contract may be changed or supplemented solely in writing.

7. The following Annexes form an integral part of the Contract:

   Annex No. 1: Technical Specification

   Annex No. 2: Deliverables and Payments

   Annex No. 3: Prices

   Annex No. 4: Qualification Prerequisites

   In case of any discrepancies between this Contract and its Annex 1, the provisions of this Contract shall prevail.

8. The Parties, manifesting their consent with the entire the Contract, affix their signatures below.

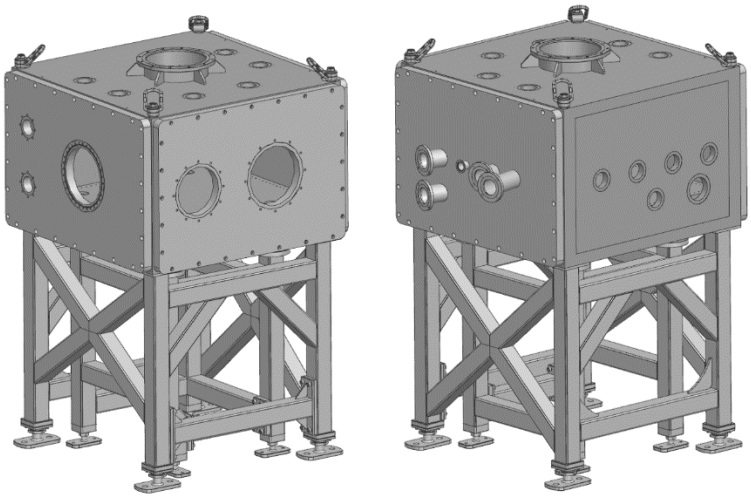
Seller:	Buyer:
_____	_____
Name: Fabrizio Anselmi	Name: RNDr. Michael Prouza, Ph.D.
Position: Administrator	Position: Director

Annex 1 Technical Specification

Confidentiality Level	*PU - Publish*	**TC ID / Revision**	00331860/C
Document Status	*Document Released*	**Document No.**	N/A
OBS code	*88*		
PBS code	*SE.BDS.BT.BTL1.L1E1.9.3*		
Project branch	*Engineering & Scientific documents (E&S)*		
Document Type	*Specification (SP)*		

[RSD product category C]

Experimental BPC-MAC chamber for technology in hall E1 TP22_020b



Keywords

Chamber and components, vacuum, design, manufacturing, requirements

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Reviewed By			
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FZU Institute of Physics of the Czech Academy of Sciences
EUROPEAN UNION
European Structural and Investing Funds
Operational Programme Research, Development and Education
MINISTRY OF EDUCATION YOUTH AND SPORTS

Content

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MINISTRY OF EDUCATION YOUTH AND SPORTS

1. Introduction

1.1. Purpose

The Contracting Authority (CA), Fyzikální ústav AV ČR, v.v.i. (FZU), is undertaking the ELI Beamlines project in the Czech Republic with the objective of building a facility using cutting-edge laser technologies and implementing research and application projects in the field of laser-matter interaction using ultra-short laser pulses at high repetition rates and/or with high energy.

The part of the project realization is a rectangular vacuum chamber for experimental technology, which will be located in the experiment hall E1 in front of the existing MAC Chamber. The Location of the new BPC MAC Chamber is shown in Figure 1 below.

The detailed technical concept of the delivery system has been developed by the CA. This system will be implemented in-house using components manufactured by specialized suppliers.

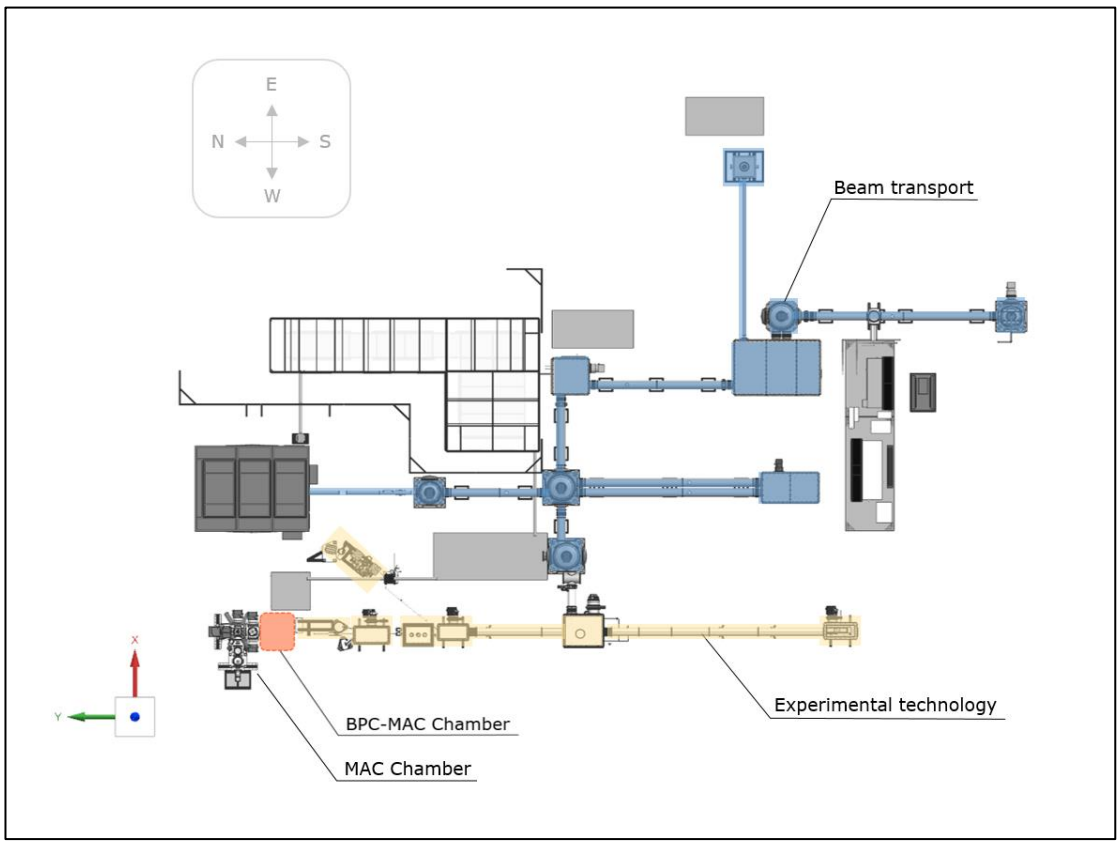

Figure 1: Location of BPC MAC Chamber in hall E1.

The chamber will house the laser optomechanics and optics under vacuum. The optomechanics and optics are not parts of this contract. A design for the PBC MAC chamber is shown in Figure 2.

1.2. Scope

This RSD contains all of the technical requirements: design, functional, performance, delivery, safety and quality requirements for the following products *(tender number - TP22_020b)*: **Chamber BPC-MAC for experimental technology in hall E1** (further referred to as "**Chamber**").

The Chamber is an integral part of the local vacuum system located in the E1 hall. This Chamber is registered in the PBS database under the following PBS code: *SE.BDS.BT.BTL1.L1E1.9.3*.

1.3. Terms, Definitions and Abbreviations

For the purpose of this document, the following abbreviations apply:

Abbreviation	Meaning
A	Analysis (as a Verification method)
CA	Contracting Authority (Institute of Physics CAS)
CDRR	Critical Design Review Report
ELI	Extreme Light Infrastructure
FEA	Finite Element Analysis
FEM	Finite Element Method
FTR	Factory Test Report
I	Inspection (as a verification method)
NCR	Nonconformity Report
NVR	Non-Volatile Residue
OFHC	Oxygen-free High Conductivity copper
R	Review of design or documentation (as a verification method)
RD	Reference Document
RGA	Residual Gas Analysis
RSD	Requirements Specification Document
T	Test (as a verification method)
TMP	Turbomolecular Pump
UHV /HV	Ultra High Vacuum / High Vacuum
VCD	Verification Control Document

1.4. Reference documents

Refer. No	Title of Document/File
RD-01	00331862-A_RD-01 3D Model and Drawings - Chamber_BPC_MAC in E1.rar
RD-02	00331861-A_VCD_Chamber_BPC_MAC in E1_TP22_020.rar

Detailed list of drawings included within **RD-01 archive**:

No.	Drawing No./Rev.	Drawing (3D model) Name	Sheets	File format
1	00328259/00	E1_BPC_MAC	1	PDF
2	00328259/00		1	STP

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1.5. References to standards

If this document or RD-01 include references to standards or standardized/ standardizing technical documents the CA allows/permits also another equivalent solution to be offered.

1.6. Overall view of the chamber and Scope of Work

The scope of work includes detailed design, manufacture, verification and transport to ELI-Beamlines of the vacuum chamber and the chamber support (see Figure 2 below).

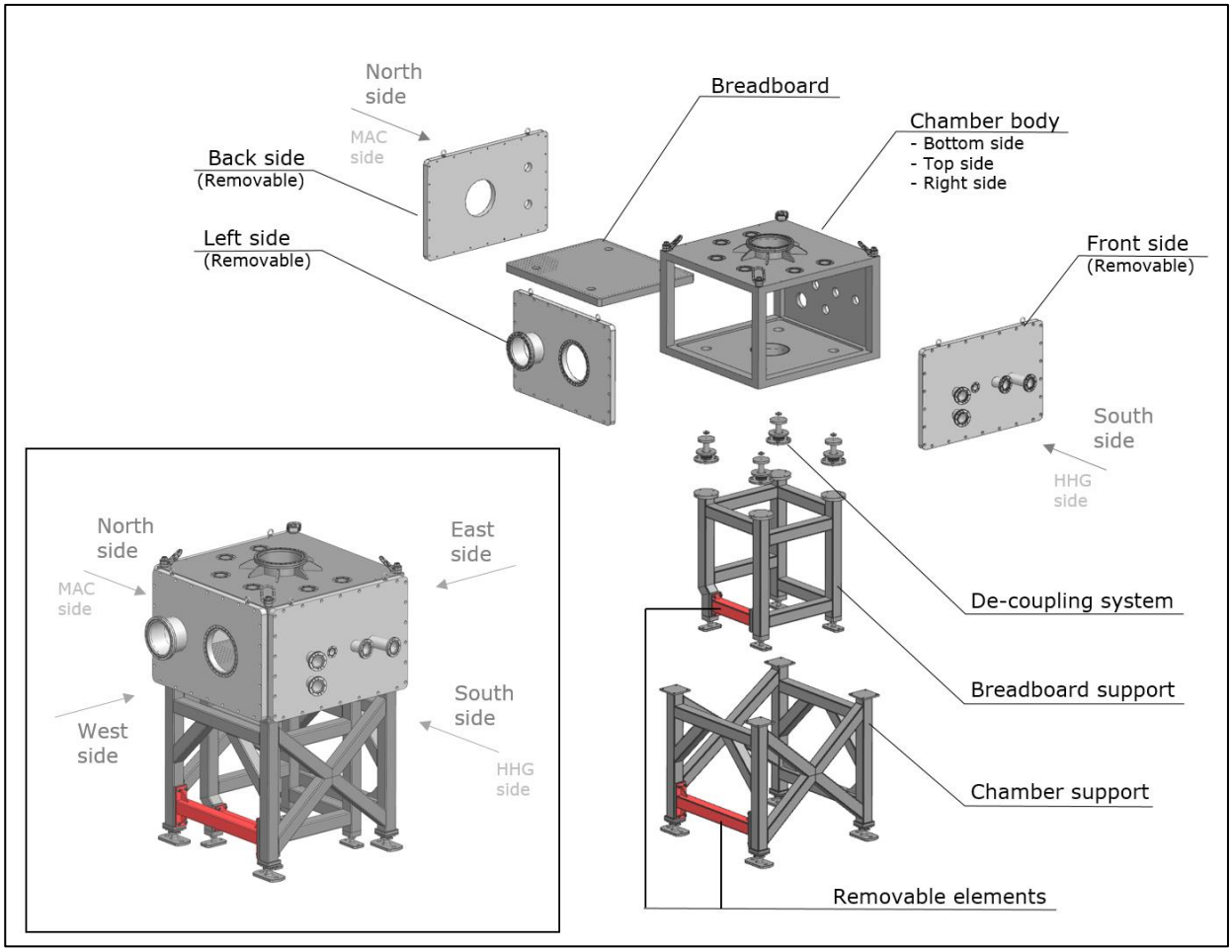

Figure 2: Rectangular design for Chamber BPC MAC

1.6.1. BPC MAC Chamber

The chamber shall be designed and manufactured for operation at vacuum level better than $1x10^{-6}$ mbar. The chamber is composed of the following components:

- Welded stainless steel body guaranteeing the strength stability of the chamber;
- Removable walls for easy handling and access to the chamber;
- Lifting features ensuring easy handling by overhead crane;

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Each individually removable wall shall also be equipped with lifting features (e.g. Lifting points, bosses for screw-in lifting eyes) to enable its handling by overhead crane.

An Interface control document (ICD) will be created in cooperation with the supplier and the CA during the detailed design phase. The individual interfaces of the chamber with ELI Beamlines technologies (TMPs, Gauges, pipes etc.) will be specified and verified in the ICD.

1.6.2. Chamber support

The frame for the vacuum chamber shall ensure safe use and connection of the chamber to the floor. The frame will be anchored to the floor. The frame shall be designed to withstand torque in the event of a pump failure. The supplier is obliged to document the FEM-stress analysis of the frame. The construction and anchoring of the frame shall respect the current installation space in the hall E1. The restriction area (see Figure 3 below) shall remain empty. The frame shall be height-adjustable within the range of 20 mm of the nominal value anchored in the drawing.

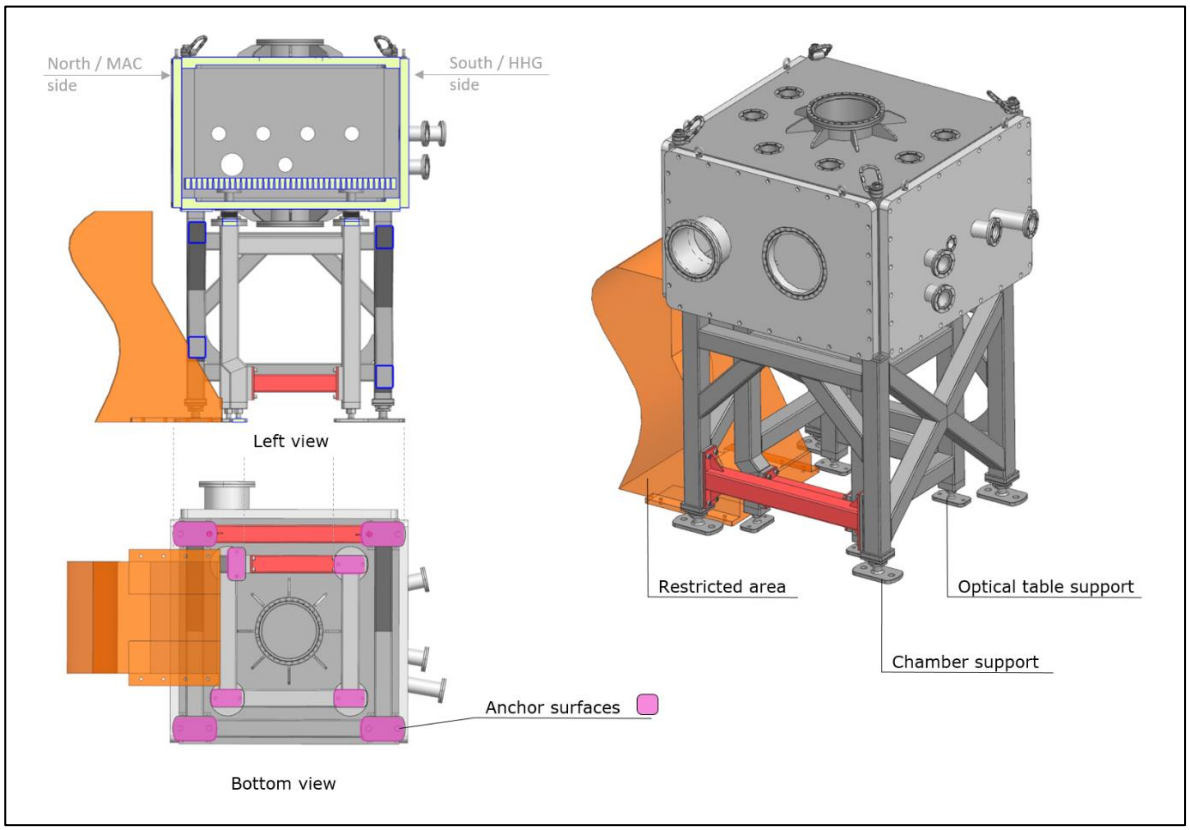

Figure 3: Installation space for BPC MAC

The frame shall allow assembly and service of selected TMP mounted on the bottom side. For this reason, it shall contain a removable element. The final design of the frame shall be approved by the CA.

The TMP mounting direction is indicated in the figure below. The minimum dimensions ''X_A'', ''Z_A'' of the assembly area ''A'' shall be approved by the CA.

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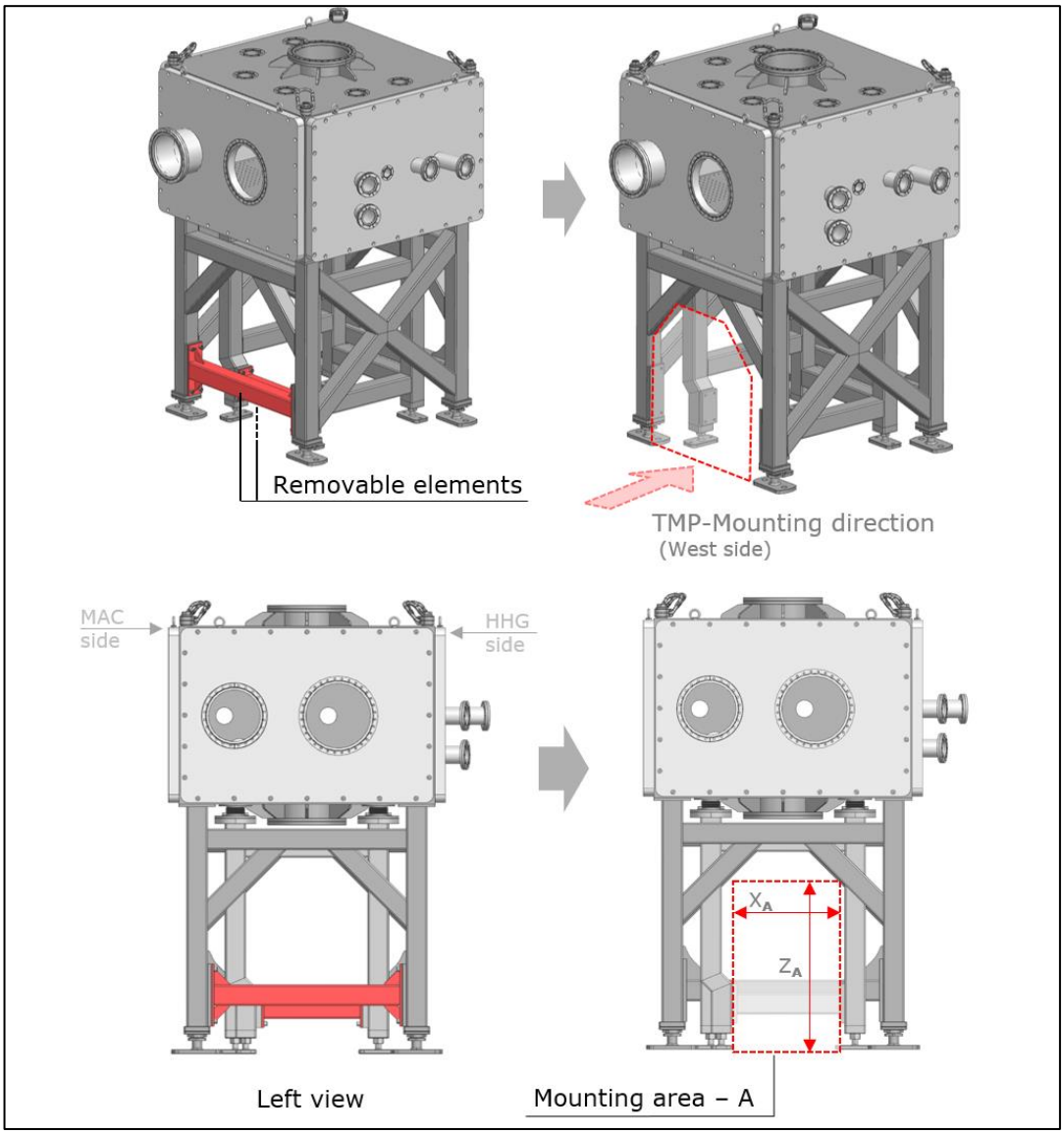

Figure 4: Mounting area and removable elements of Supports

1.6.3. Internal Breadboard and the Support

The Breadboard is included in the delivery and shall be placed in a chamber with a separate frame (Breadboard support) for the reasons to isolate the breadboard from the chamber. The breadboard support shall be equipped with fine height setting.

The material of the breadboard shall be aluminium alloy EN AW 5083 (equivalent to ČSN 42 4415, equivalent to ANSI AA5083), or equivalent.

The breadboard shall be made from high-flatness prefabricated panels, cast and free of any defects and/or inhomogeneity. The Supplier shall optimize the supporting chassis and shall perform the FEM-structural and modal simulations. The simulation results will be submitted to the CA for review and approval. The natural frequency of the breadboard Assembly (breadboard support, breadboard, De-coupling system) shall be greater than 50 Hz.

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The breadboard will be designed by the supplier and the minimum dimensions from the drawings shall be observed during the design.

The construction and anchoring of the frame shall respect the current installation space in the hall E1. The restriction area (see Figure 3 above) shall remain empty.

The frame shall be height-adjustable within the range of 20 mm of the nominal value anchored in the drawing.

The frame shall allow assembly and service of selected TMP mounted on the bottom side. For this reason, it shall contain a removable element.

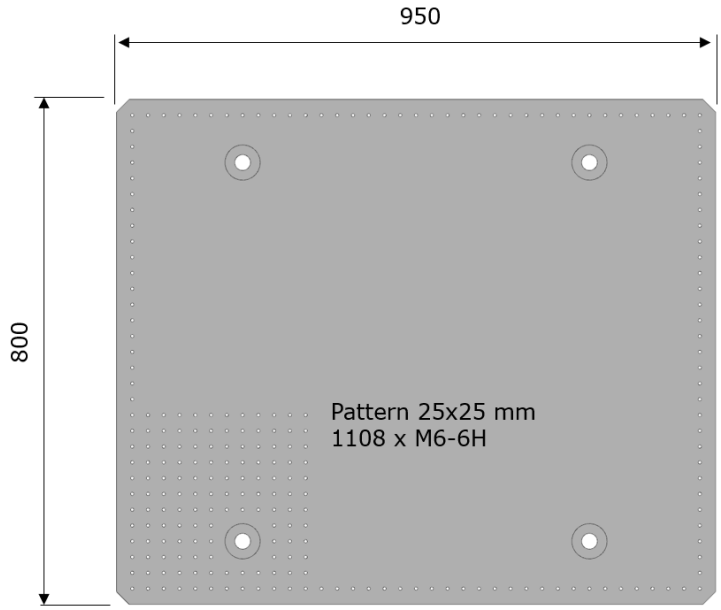

Figure 5: Minimum dimensions of the breadboard for chamber BPC MAC

1.6.4. De-coupling system

The structure consists of below providing full isolation of the force on the flange used for the leg, arising from the pressure difference between outer atmospheric pressure and the chamber vacuum.

Overview of the de-coupling system requirements (for more details see section 2):

- Each of the four de-coupling elements will be connected to the frame by at least four screws;
- The contact area with the frame shall be precisely defined and ensure maximum system stability;
- The Decoupling system shall allow positioning in the vertical direction within the range ±1 mm.

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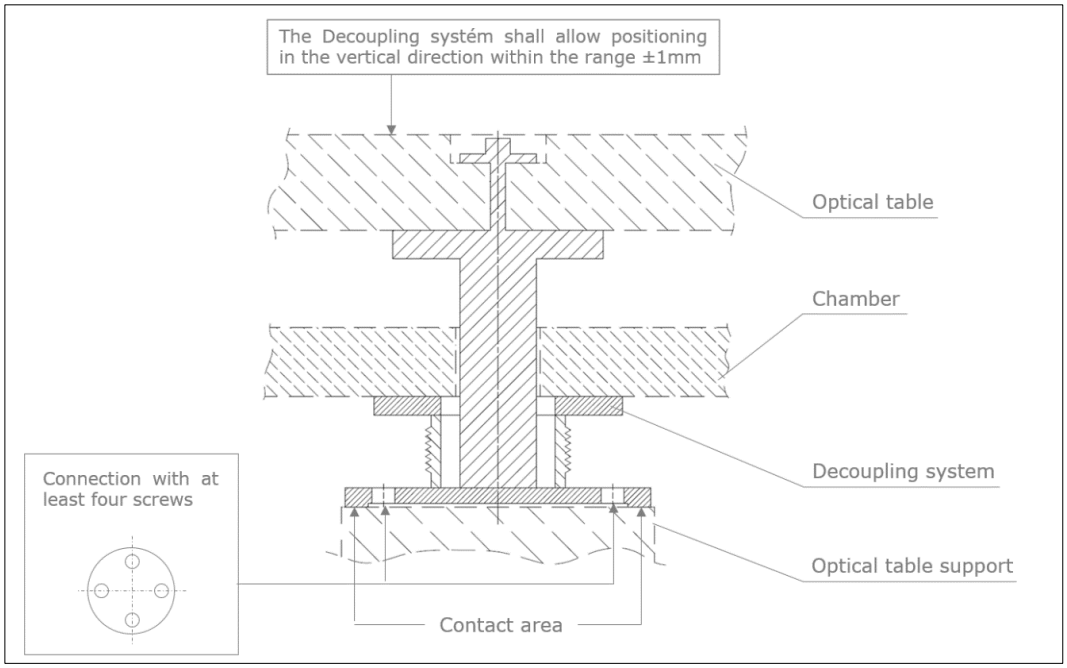

Figure 6: Scheme of De-coupling system

1.6.5. Vacuum Flange layout

All circular flanges and ports shall be dimensioned according to ISO 3669 (2020 revision), or equivalent, corresponding to ISO-CF implementation.

The flanges for the De-coupling system shall be dimensioned according to ISO 1609 (2020 revision), or equivalent, corresponding to ISO-F implementation.

For works vacuum testing by the supplier, all ports except those used for pumping and for vacuum gauges are required to be blanked by corresponding vacuum flanges. Vacuum flanges are included in the delivery.

For delivery of the chamber to ELI Beamlines, all ports shall be blanked. The table below describes the intent for using these ports.

Table 1: Circular port Tolerance Grade

Port tolerance Grade	Tolerance Specification
A	Co-axial tolerance of ±1 mm or better and angular tolerance of ±0.5 degrees or better with respect to their ideal axis
B	Co-axial tolerance of ±3 mm or better and angular tolerance of ±2.0 degrees or better with respect to their ideal axis

Table 2: Overview of ports-BPC MAC Chamber

Port	Type	Dimension	Position	Purpose	Load [Nm]	Tolerance
F1	ISO-CF*	DN250	Bottom side	TMP	M_T**= 52 000	B
F2	ISO-CF*	DN250	Top side	TMP	M_T**= 52 000	B
F3	ISO-CF*	DN63	Top side	Gauge		B
F4	ISO-CF*	DN63	Top side	Gauge		B

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F5	ISO-CF*	DN63	Top side	Gauge		B
F6	ISO-CF*	DN63	Top side	Gauge		B
F7	ISO-CF*	DN63	Top side	Gauge		B
F8	ISO-CF*	DN63	Top side	Gauge		B
F9	ISO-CF*	DN200	Left side	Gauge		B
F10	ISO-CF*	DN250	Left side	Gauge		B
F11	ISO-CF*	DN250	Back side	Gate valve		A
F12	ISO-CF*	DN63	Back side	Gauge		A
F13	ISO-CF*	DN63	Back side	Gauge		A
F14	ISO-CF*	DN63	Front side	Beam transport		A
F15	ISO-CF*	DN63	Front side	Beam transport		A
F16	ISO-CF*	DN40	Front side	Beam transport		A
F17	ISO-CF*	DN63	Front side	Beam transport		A
F18	ISO-CF*	DN63	Front side	Beam transport		A
F19	ISO-CF*	DN63	Right side	Gauge		A
F20	ISO-CF*	DN63	Right side	Gauge		A
F21	ISO-CF*	DN63	Right side	Gauge		A
F22	ISO-CF*	DN63	Right side	Gauge		A
F23	ISO-CF*	DN63	Right side	Gauge		A
F24	ISO-CF*	DN100	Right side	Gauge		A

* or equivalent technical solution

** $\mathbf{M_T}$ = Torque

2. Design, Functional and Performance requirements

Following sections of this specification provide a summary of the contractual requirements. The total scope of the contract also comprises all the requirements stated or implied in the foregoing text, whether or not included in the summaries.

2.1. General requirements

REQ-034242/A

The Supplier shall manufacture and deliver the BPC-MAC chamber shown in Drawings **00328259** (see **RD-01**; section 1.5) with dimensions and parameters defined in this document and in the associated drawing and 3D model.
NOTE: Design changes are possible if it is necessary. All changes must be coordinated and approved by the CA.

Verification method: I – inspection

REQ-034243/A

The detailed design shall include full coordination with the interfaces of adjacent systems, especially turbomolecular pumps, vacuum gauges, coolants cooling water, etc., and with the ELI-Beamlines building, according to the information provided by the CA.

Verification method: R – review

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REQ-034244/A

The contract shall cover the supply of all materials, preparation of manufacturing drawings, manufacture, inspection, cleaning, testing, assembly, packing and subsequent delivery to the CA's facility located in Dolni Břežany.
NOTE: As manufacturing drawings will be required drawings of all components with tolerance, surface descriptions, drawings of all assemblies/subassemblies and welding drawings with weld descriptions. Each production parameter shall be recorded on the manufacturing drawings.

Verification method: R – review

REQ-034245/A

The completed assembly of the chamber must be supplied with a full set of blanking flanges.
NOTE: Material of blanking flanges shall be Stainless Steel class 1.4429 (equivalent to AISI 316LN).

Verification method: R – review, I – inspection

REQ-034246/A

The Chamber detailed design shall make all necessary allowance for transport of the chamber to its working location. This shall include the provision of designated lifting points and jacking points and positions to support the chamber on rollers for lateral movement. The lid shall also be equipped with lifting features (e.g. bosses for screw-in lifting eyes) to enable its handling by overhead crane.

Verification method: R – review, I – inspection

REQ-034247/A

The Supplier shall perform structural analysis of the final design of the Chamber and Frame to proof strength and allowable deformations. Allowable values of deformations of individual walls are defined in the drawings (see **RD-01**; section 1.5). All Analysis shall be approved by the CA.
NOTE: The structural analysis shall be performed by the FEM method, by a qualified designer experienced in the field of Pressure Vessels and Steel Structures. The Calculation of chamber shall meet the standard according to EN 13445-3 Annex C - Method based on stress categories, or technically and qualitatively equivalent. Structural analysis of frames shall meet the standard according to Eurocode - Design of steel structures, or technically and qualitatively equivalent.

Verification method: R – review, A – analysis (approved by the CA)

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REQ-034248/A

The Supplier shall design a dimension of the vacuum chamber and frames to withstand the load prescribed by the TMP in the event of a crash of the pump.
NOTE: The strength of welds at areas of connections nozzle/flange and nozzle/chamber wall shall be performed by calculation according to EN 13445-3, or technically and qualitatively equivalent. The maximum load is listed in Table 2.

Verification method: R – review, A – analysis (approved by the CA)

REQ-034249/A

The Vacuum chamber body shall be delivered with alignment reference holes according to Reference drawings 00328259
- DRILLING TYP A (see **RD-01**; section 1.5).
NOTE: Flat contact surface of 28 mm diameter shall be available around the hole.

Verification method: I – inspection

REQ-034250/A

The Supports (Chamber support, Breadboard support) shall be height-adjustable within the range of 20 mm of the nominal value anchored in the drawing. The final design of the supports must be approved by the CA.

Verification method: R – review

REQ-034270/A

The Supports shall allow assembly and service of selected TMP mounted on the bottom side. The final design of frames must be approved by the CA.

Verification method: R – review

2.2. Manufacturing drawings

REQ-034251/A

The Supplier shall prepare and supply manufacturing drawings in **.pdf* format and one of the following file formats:

- *.dwg;
- Native data for NX *.prt (Version 1934 or later)
- Native data for Autodesk Inventor *.idw (Version 2021 or late).

Verification method: R – review

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REQ-034252/A

The Supplier shall prepare and supply an updated 3D model of the supplied Assy. BPC MAC chamber in one of the following formats:

- Universal format: Parasolid *.*x_t*, or *.*stp*
- Native data for NX *.*prt* (Version 1934 or later)
- Native data for Autodesk Inventor *.*idw* (Version 2021 or late).

Verification method: R – review

REQ-034253/A

Any dimensional or design modifications that may arise as part of the detailed manufacturing design shall be consulted with and approved by the CA.

Verification method: R – review

REQ-034254/A

The final manufacturing drawing and detailed 3D model for manufacture shall be approved by the CA (see section 6.4.1).

Verification method: R – review

REQ-034255/A

If at any stage of the design or manufacturing it is clear to the Supplier that an advantage could be gained by a modification of the original then the Supplier is encouraged to bring it to the attention of the CA.

Verification method: Not To Be Tracked within VCD

2.3. Raw material requirements

REQ-034256/A

The Chamber body shall be manufactured from stainless steel class 1.4404 (equivalent to ČSN 17 349, equivalent to AISI 316L), or equivalent. Good manufacturing practices for stainless steel welding shall be followed.

Verification method: R – review

REQ-034257/A

The Chamber panels shall be manufactured from stainless steel class 1.4404 (equivalent to ČSN 17 349, equivalent to AISI 316L), or equivalent. Good manufacturing practices for stainless steel welding shall be followed.

Verification method: R – review

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REQ-034258/A

The breadboard shall be manufactured from stress relieved cast aluminium slab made from high-flatness (equal or better than 0.2 mm /1000 mm) prefabricated panels.

Verification method: R – review

REQ-034259/A

The Breadboard frame shall be manufactured from stainless steel class 1.4307 (equivalent to ČSN 17249, equivalent to AISI 304L), or equivalent. Good manufacturing practices for stainless steel welding shall be followed.
NOTE: Material change is possible if agreed by the CA.

Verification method: R – review

REQ-034260/A

The Chamber frame shall be manufactured from stainless steel class 1.4307 (equivalent to ČSN 17249, equivalent to AISI 304L), or equivalent. Good manufacturing practices for stainless steel welding shall be followed.
NOTE: Material change is possible if agreed by the CA.

Verification method: R – review

2.4. Manufacture and machining requirements

REQ-034261/A

The manufacturing design and the selection of all components inside the vacuum envelope of the Chamber shall follow best practices to avoid any trapped volumes of air, e.g. the mounting holes shall not be blind tapped.

Verification method: R – review

REQ-034262/A

The Breadboard shall be able to be positioned with precision better than ±1 mm.

Verification method: R – review

REQ-034263/A

The Breadboard shall be machined with an array of M6 tapped mounting holes on a 25 mm square grid over the entire surface.

Verification method: R – review, I – inspection

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REQ-034264/A

All mounting holes of the breadboard shall be drilled right through and parallel tapped from the top face to a depth of at least 15 mm.

Verification method: R – review, I – inspection

REQ-034265/A

All threads shall be cut and tapped.
NOTE: It is not allowed to make threads by forming.

Verification method: R – review, I – inspection

REQ-034266/A

The Supplier shall check all major dimensions of the manufactured Chamber, as defined in the manufacturing drawings approved by the CA. The result shall be provided in the form of the Factory Test Report (see REQ-034337/A).

Verification method: R – review, T – test

REQ-034267/A

The Supplier shall verify all dimensions of the manufactured pieces of the supporting frame and breadboard, as defined in the manufacturing drawings. The results of tests shall be submitted in the form of Factory Test Report (see REQ-034337/A).

Verification method: R – review, T – test

REQ-034268/A

The Supplier shall test the Chamber for deformations due to the atmospheric pressure differential. The measured deformations shall not exceed the defined parameters from the drawing. The result shall be provided in the form of the Factory Test Report.

Verification method: R – review, T – test

REQ-034426/A

All threads (on the Chamber, Breadboard, Frames, Lifting features) shall be metric.

Verification method: R – review, I – inspection

REQ-034427/A

All manufactured parts shall be free of sharp edges.

Verification method: I - inspection

REQ-034428/A

All manufactured parts shall be burr free.

Verification method: I - inspection

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2.5. Vacuum components manufacture

REQ-034271/A

The assembly must be designed and manufactured for operation at vacuum level better than 1E-6 mbar.

Verification method: R – review, T – test

REQ-034272/A

All vacuum components shall be high vacuum compatible to comply with REQ-034271/A and shall be manufactured using materials and procedures that will guarantee low outgassing rate (including seal and weld integrity) as might be reasonably expected for such vacuum components.

Verification method: R – review

REQ-034273/A

Assembly of vacuum parts shall take place under controlled conditions in a cleanroom environment of Class 7 according to ČSN EN ISO 14644 (equivalent to EN ISO 14644), or equivalent.
NOTE: The ISO 14644 certification of the Supplier's cleanrooms are not required in lieu of an inspection by the CA.

Verification method: I – inspection

REQ-034274/A

All cutting fluids, greases etc. used for manufacturing shall be capable of being removed entirely by subsequent cleaning operations.

Verification method: I – inspection

2.6. Vacuum flanges and seals

REQ-034275/A

The flanges shall be compatible with

- ISO 3669:2020 - Vacuum technology — Dimensions of knife-edge flanges
- ISO 1609:2020 - Vacuum technology - Flange dimensions

Verification method: R – review, I – inspection

REQ-034276/A

Sealing for removable panels and de-coupling system shall be made of fluoroelastomer polymer material.

Verification method: R – review (specification sheet and part number of sealing included in final technical reports)

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REQ-034277/A

Hardness of O-rings (fluoroelastomer polymer) shall be 60-70 HRC unless agreed otherwise with the CA.

Verification method: R – review (specification sheet and part number of sealing included in final technical reports)

REQ-034429/A

Copper gasket shall be made of OFHC (Oxygen-Free) material.

Verification method: R – review (specification sheet and part number of sealing included in final technical report for chamber)

2.7. Surfaces

REQ-034278/A

The surface finish shall be as specified in the documents supplied by the CA. Where this is not specified:

- The Inner surface (vacuum side) roughness shall be better than Ra 0,8 μm.
- The Outer surface finish shall be uniform (blasting with glass beads / Vibratory Grinding)

NOTE: Other finish technologies are possible if agreed with the CA.

Verification method: R – review, I – inspection

REQ-034279/A

The surface quality of the breadboard shall be compatible with the required vacuum 1E-6 mbar. Surface roughness shall be better than Ra 0,8 μm.

Verification method: R – review, I – inspection

REQ-034280/A

The surface of seal faces shall be compatible with the requirements of the ISO-CF, ISO-F seals used.

Verification method: R – review, I – inspection

REQ-034281/A

Sealing surfaces shall be in particular free of radial scratches or dents.

Verification method: I – inspection

REQ-034282/A

Seal faces shall be suitably protected immediately after final machining to minimize the risk of damage.

NOTE: This protection should only be removed for the purposes of cleaning and inspection, prior to final assembly.

Verification method: Not To Be Tracked within VCD

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REQ-034283/A

All Frames require treatment of surfaces prior to painting to avoid any corrosion.

Verification method: R – review

REQ-034284/A

All outside of the vacuum surfaces shall be compatible for the cleanroom environment of Class 7 according to ČSN EN ISO 14644 (equivalent to EN ISO 14644), or equivalent.
NOTE: This requirement is also valid for all support structures, which have to be painted such that the performance of the Class 7 cleanroom of the experimental halls will not be degraded after adequate DI water/detergent cleanroom wiping of these structures.

Verification method: R – review, I – inspection

2.8. Cleaning of vacuum components

REQ-034286/A

Cleaning procedure shall remove contaminants that adhere to the surface such as oils, greases, dirt, swarf, corrosion products, or fingerprints. The cleaning procedure shall include at minimum the following steps:

1. General pre-clean, removal of gross contamination, fluxes etc. by wiping/scraping;
2. Degrease with solvent by rinsing, swabbing or immersion.
3. Washing with domestic water and detergent;
4. Vapor degrease or soak cleaning;
5. Degrease with solvent;
6. Small and complex items are immersed and ultrasonically agitated;
7. Wash with domestic water;
8. Wash with demineralized water;
9. Drying (dry air);
10. Immediate packaging (in cleanroom conditions Class 7).

Verification method: R – review

REQ-034287/A

The Supplier shall perform mass-spectrometer RGA (Residual Gas Analyzer) test on the chamber. The RGA shall have a range of at least 200 AMU (Atomic Mass Unit) and shall contain Secondary Electron Multiplier (SEM). The chamber shall be pumped by a dry vacuum pump and a turbomolecular pump to a pressure of 10-6 mbar for at least 12 hours before activating the RGA. The RGA filament shall be on for at least 4 hours before recording the final scan. The resulting RGA spectrum shall conform to the following criteria:

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a) all peaks above AMU 45 shall be lower than 1/100 of AMU 44;
b) the AMU 45 peak shall be lower than 1/10 of AMU 44.

NOTE: The recommended cleaning procedure to achieve the required RGA values can be provided by the CA to the supplier upon request.

Verification method: R – review, T – test, I – inspection

REQ-034288/A

The Supplier shall give the CA the description of the cleaning procedure for vacuum components.

Verification method: R – review

REQ-034289/A

Clean components shall be handled wearing clean, dry, lint-free gloves.

Verification method: R – review

REQ-034290/A

Chemical used in the cleaning process shall not affect the material properties or cause color change, corrosion or other damage.

Verification method: R – review

REQ-034291/A

All O-rings shall be made from fluoroelastomer and vacuum baked in a clean oven at temperature of 120 °C for 48 hours prior to use. After the bake-out, the O-rings shall not come in contact with isopropyl alcohol or any grease.

Verification method: R – review, I – inspection

2.9. Welding

REQ-034292/A

All welds shall meet acceptance criteria Class B according to ČSN EN ISO 5817 (equivalent to EN ISO 5817).

Verification method: I – inspection

REQ-034293/A

The parts to be welded shall be thoroughly cleaned and degreased.

Verification method: Not To Be Tracked within VCD

REQ-034294/A

Shielding gases shall be used during welding to minimize oxidation.

Verification method: I – inspection

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REQ-034295/A

All welds on the Chamber shall be visually inspected, and the Protocol for the chamber shall be issued.

Verification method: R – review, I – inspection

REQ-034296/A

All internal welds of the Chamber shall be examined by Penetration or ultrasonic testing, and protocol for the chamber shall be issued.

Verification method: R – review, T – test, I – inspection

2.10. Vacuum leak test

REQ-034297/A

The Supplier shall perform vacuum leak test using a helium leak detector. The measured single leak rate of any flange shall be less than 1.0E-8 mbar·l/sec. The total leakage rate of the chamber shall be 1.0E-4 mbar·l/sec or less. The results shall be provided in the form of the Factory Test Report (see REQ-034337/A).
NOTE: It is recommended that single flange test (helium spray) is performed according to ČSN EN 1779 (equivalent to EN 1779), method A.3, and the test of total leakage according to ČSN EN 1779 (equivalent to EN 1779), method D.2.

Verification method: R – review, T – test

3. Delivery requirements

3.1. General requirements

REQ-034298/A

The transportation to the ELI Beamlines facility in Dolní Břežany of the Chamber shall be conducted by the Supplier.
NOTE: The bid price will be considered by the CA as the final price, including transportation costs and insurance.

Verification method: I – inspection

REQ-034299/A

Part of delivery shall be a helium leak detection test report for the BPC MAC chamber (see REQ-034297/A).

Verification method: I – inspection

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REQ-034300/A

Part of delivery shall be support frames for the BPC MAC chamber.

Verification method: I – inspection

REQ-034301/A

The crates shall be labelled with the contents of the crate, i.e. with all part numbers of the contained components.

Verification method: I – inspection

3.2. Packaging requirements

REQ-034302/A

The Supplier shall invite the CA representative to inspect the vacuum cleanliness of the chamber placed in Class 7 cleanroom according to ČSN EN ISO 14644 (equivalent to EN ISO 14644), or equivalent, (or better cleanliness class), before starting the packaging of these components for transport.

Verification method: R – review, I – inspection

REQ-034303/A

The chamber shall be prepared for transport with the lids and doors fitted and all circular flanges sealed by metal blanks cleaned to the same standard as the chamber itself.

Verification method: I – inspection

REQ-034304/A

The vacuum chamber, the internal support frames, and the breadboard shall be packed separately for transport.

Verification method: I – inspection

REQ-034305/A

The cleaned chamber and all components shall be wrapped in two layers of ultra-low outgassing polyethylene film (as sheet or bags) with thickness of at least 100 µm, with NVR (non-volatile residue) better than 0.15 µg/cm2 and very low particle generation. Alternatively, UHV compatible aluminium foil approved by CA can be used. The clean conditions wrapping shall be further enclosed in robust outer packaging and transport crates as necessary for protection and handling during shipping to the ELI-Beamlines site.
NOTE: The CA can recommend to the Supplier appropriate low-outgassing polyethylene-based foil brands if necessary.

Verification method: R – review, I – inspection

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3.3. Transportation requirements

REQ-034306/A

The Supplier shall transport the completed and tested components to the ELI Beamlines site.

Verification method: R – review, I – inspection

REQ-034307/A

The Supplier shall allow supervising the activities related to the transportation by the CA if requested.
NOTE: Any acts of supervision shall not mean that the CA assumes the additional liability of any king exceeding its liabilities according to the contract.

Verification method: Not To Be Tracked within VCD

REQ-034308/A

The transportation procedure shall be reviewed and agreed by the CA.

Verification method: R – review

REQ-034309/A

The flanges of the chamber shall remain sealed during transport.

Verification method: R – review, I – inspection

4. Safety Requirements

REQ-034310/A

The Supplier shall supply a Declaration of Conformity for each product type if the appropriate legislation determines the Supplier's obligation to have a Declaration of Conformity for the purposes of a Device sale in the Czech Republic. In such a case the Declaration of Conformity shall comply with:

- Act No. 90/2016 Coll., as amended
- Act No. 22/1997 Coll., as amended
- The equivalent legal regulation of another EU member state so that the conditions for the sale of the product in the Czech Republic are met, and/or
- the relevant EU/EC regulation

NOTE: The compliance with these obligations will be demonstrated by the (EU) Declaration of conformity, other relevant documents and the CE marking if required by the relevant regulations. If a delivered product is not required to assess conformity according to specific

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legislation, the supplier declares, in written form, by concluding the contract that the product complies with the general safety requirement of EU Directive 2001/95/EC on general product safety and that the Supplier duly complies their obligations under this Regulation.

Verification method: I – inspection

5. Quality Requirements

5.1. Documentation and data control

REQ-034311/A

The Supplier shall provide the **Product User Manual** as part of the delivered system. The Manual shall include the instructions and descriptions regarding the following procedures:

- transport, handling, storage;
- installation, alignment and cleaning;
- safe operation and maintenance procedures.

Verification method: R - review, I – inspection

REQ-034312/A

The Supplier shall supply the following relevant manufacturing documents:

- all manufacturing **drawings**, **3D models** (if available) and **design supporting documentation** (i.e. technical documentation, see REQ-034334/A) approved by the CA;
- all "**requests for deviation/wavier** from requirements described herein" (see REQ-034320/A) approved by the CA.

Verification method: I – inspection

REQ-034313/A

All documentation shall be supplied in either English or Czech language.

Verification method: Not To Be Tracked within VCD

REQ-034314/A

The Supplier shall provide documentation showing that material specifications required by the CA and the manufacturing drawings have been used (e.g. material delivery notes or catalogue part numbers).

Verification method: R – review

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REQ-034315/A

The manufacturing documents shall include the **accuracy of the manufacturing process**. This accuracy shall be also included in the corresponding **Factory test report** (see REQ-034337/A).
NOTE: The Supplier will specify the maximal difference between specified parameters (in section 3) and the parameters of the manufactured Chamber.

Verification method: R – review

REQ-034316/A

The Supplier shall use following data formats:

- *.JPG, *.PNG, *.TIFF, *.PDF/A, *.HTML
- CAD 2D: *.dwg
- CAD 3D: *.stp; *.ste; *.step or other 3D CAD formats agreed with the CA
- text processors: *.doc, *.docx, OpenDocument Format
- spreadsheet processors: *.xls, *.xlsx, OpenDocument Format
- presentations: *.ppt, *.pptx; OpenDocument Format

Verification method: Not To Be Tracked within VCD

5.2. Marking

REQ-034317/A

The BPC MAC chamber shall be marked on the outside with the following information:

- Assembly Name;
- Assembly Number;
- Assembly Manufacturer;
- Manufacture date.

Text size, format and position of the mark shall be approved by the CA.

Verification method: I – inspection

REQ-034318/A

Each removable component of the Chamber shall be marked on the outside with the following information:

- Component Name;
- Component Number;
- Component Weight.

Text size, format and position of the mark shall be approved by the CA.

Verification method: I – inspection

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REQ-034319/A

Form of the mark shall comply the conditions of the cleanroom environment of Class 7 according to ČSN EN ISO 14644 (equivalent to EN ISO 14644), or equivalent.

Verification method: I – inspection

5.3. Nonconformity Control System

REQ-034320/A

The Supplier shall establish and maintain a nonconformity control system compatible with ČSN EN ISO 9001 (equivalent to EN ISO 9001) or equivalent.

Verification method: Not To Be Tracked within VCD

5.4. Specific Quality Requirements

REQ-034321/A

In case of a warranty repair of the Camber by the Supplier, the Supplier shall redo necessary parts of the verification procedure (see section 6). The results of this process shall be provided to the CA.

Verification method: Not To Be Tracked within VCD

6. Verification requirements for the Supplier

The verification process will be performed by the Supplier to demonstrate that the chamber meets the specified requirements of the CA.

6.1. General requirements

REQ-034322/A

The verification process shall be performed by the Supplier to demonstrate that the delivered Chamber meets the specified requirements of the CA. The verification process consists of:

1. **Verification planning** (via VCD, see section 6.3);
2. **Verification execution and reporting** (see sections 6.3 and 6.4);
3. **Verification control and close-out** (see section 6.5).

Verification method: Not To Be Tracked within VCD

REQ-034323/A

The Supplier shall assign clear responsibility for the implementation of the verification process including all activities defined in the REQ-034322/A.

Verification method: R - review

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6.2. Verification Documentation

REQ-034324/A

The Supplier shall establish and maintain the system of verification process documentation.

Verification method: Not To Be Tracked within VCD

REQ-034325/A

Verification documentation shall consist of the following basic types of documents:

- **Verification Reports**, including CDR Report, Tests and Analyses reports (see section 6.4);
- **VCD, Verification Control Document** (see section 6.3).

Verification method: Not To Be Tracked within VCD

REQ-034326/A

The verification reports shall be submitted to the CA for review as agreed with the CA after corresponding verification activity completion, within the time frame agreed with the CA in the **VCD**.
NOTE: Verification activity can be design review, test, analysis or inspection of the Chamber (see REQ-034332*/A).*

Verification method: Not To Be Tracked within VCD

6.3. Verification planning and reporting

The Verification Control Document (VCD) shall list the selected method(s) of verification, overall verification result (pass/fail) and reference to the relevant report, where necessary for each requirement. The VCD is a living (versioned) document and provides an overview of the mutually agreed Verification methods during the contract execution and overview of the verification results at the contract end to support the acceptance of the Chamber. The **VCD** represents a formal tool of communication between the Supplier and the CA (formal record, reporting tool). The **VCD** will be provided by the CA and it can be accommodated to the Supplier's needs.

REQ-034327/A

The Supplier shall provide a Verification Control Document (**VCD**) in coordination with and having approval from the CA.

NOTE 1: Guidelines for VCD preparation see in RD-02 (section 1.5).
NOTE 2: The form of VCD will be agreed between the CA and the Supplier based on the best commercial praxis used by the Supplier.

Verification method: R - review

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REQ-034328/A

In the **VCD**, the Supplier shall describe **HOW** and **WHEN** each of the technical requirements is to be verified.

Verification method: R – review

REQ-034329/A

The verification approach shall be defined by the Supplier in the **VCD** prior to its implementation.
NOTE: Since some requirements are to be verified through a review of the design, the VCD shall be prepared by the Supplier and agreed with the CA before starting the Design Review.

Verification method: R - review

REQ-034330/A

The Supplier shall provide regular progress reports to the CA in the form of the VCD execution according to the time frames agreed with the CA in the **VCD** (see REQ-034328/A and REQ-034329/A).

Verification method: R - review

6.4. Verification execution

REQ-034331/A

The verification execution process shall consist of the following stages according to the phasing of the contract execution:

- **Critical design review** (CDR);
- **Verification of all components of the Chamber** (testing and inspection at Supplier's site);
- **Final acceptance after the delivery**.

NOTE 1: The CDR is intended to verify that the design meets corresponding requirements (could be accepted) and/or identify required corrective actions needed to accept the design and start the manufacturing phase of the contract.
NOTE 2: Verification of all elements of the Chamber is executed at the end of each corresponding manufacturing phase by inspection and tests. The purpose of this verification is to check the product readiness for shipment to the ELI Beamlines.
NOTE 3: In the final acceptance stage, the verification shall demonstrate that the Chamber is free of fabrication defects and is ready for the intended operational use.

Verification method: Not To Be Tracked within VCD

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REQ-034332/A

Verification shall be accomplished by the Supplier through one or more of the following verification methods:

1. **Review of design**; Verification via Review (**R**) shall consist of using approved records (examples of such approved records are design documents and reports, technical descriptions, engineering drawings, manuals and accompanying operation documentation) or evidence that unambiguously shows that the requirement is met.
2. **Inspection**; Verification via Inspection (**I**) shall consist of visual determination of physical characteristics.
3. **Test** (including functional demonstration); Verification via Test (**T**) shall consist of measuring product performance and functions under the defined operating conditions.
4. **Analysis**; Verification by Analysis (**A**) shall consist of performing theoretical or empirical evaluations using methods defined in the VCD.

Verification method: Not To Be Tracked within VCD

REQ-034333/A

The results of the analysis shall be documented by the corresponding Analysis Report (e.g. FEA/FEM report) and tracked in the VCD (see section 6.3).

Verification method: R – review

REQ-034334/A

The results of a review of the design shall be documented in the Critical Design Review Report (**CDRR**) and tracked in the VCD (see section 6.3).
NOTE: The CA can provide the Supplier with the template of the CDRR.

Verification method: R - review

REQ-034335/A

The final manufacturing drawings, the Interface Control Document (ICD) and the parts of the VCD related to the Design of the Chamber shall be accepted by the CA before the commencement of manufacturing.
NOTE: The ICD will be created by the Supplier in cooperation with the CA during the detailed design phase and the document should specify the interface of the chamber with ELI Beamlines technologies (TMP, Gauges, pipes etc.).

Verification method: R - review

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REQ-034336/A

The results of the inspection shall be documented in the Inspection protocol (e.g. welding inspection protocol) and tracked in the VCD.

Verification method: R - review

REQ-034337/A

The results of the tests (e.g. dimensions, vacuum, cleanliness, etc.) shall be documented in the appropriate Factory Test Report (**FTR**) and tracked in the VCD (see section 6.3).

Verification method: R - review

REQ-034338/A

With the support of the CA, the Supplier shall carry out the final verification of requirements according to the VCD and record the results in the final VCD issue after the approval of the last report and before starting the Final Acceptance phase (see REQ-034339/A).

Verification method: R - review

6.5. Verification close out (Acceptance)

Acceptance will be carried out by the CA after the successful completion of each of the following verification phases:

- Critical Design Review (CDR) and approval of all final manufacturing drawings before manufacturing;
- Factory verification and acceptance of the manufactured, assembled, cleaned and properly packaged Chamber;
- Final verification after delivery (Final Acceptance).

Upon the success of each acceptance phase, the CA will provide to the Supplier a signed acceptance protocol. In case of unsuccessful acceptance, the CA will provide to the Supplier a Nonconformity Report (NCR) and the Supplier will be obliged to address the nonconformance.

REQ-034339/A

The Final Acceptance phase shall demonstrate the following:

- The Chamber has been successfully verified by the Supplier and the results of this process have been documented in an appropriate way through verification reports (see section 6.4) and VCD (see section 6.3);
- All detected nonconformities have been solved in accordance with REQ-034320/A;
- The delivered Chamber is free of fabrication errors and is ready for the intended operational use.

Verification method: Not To Be Tracked within VCD

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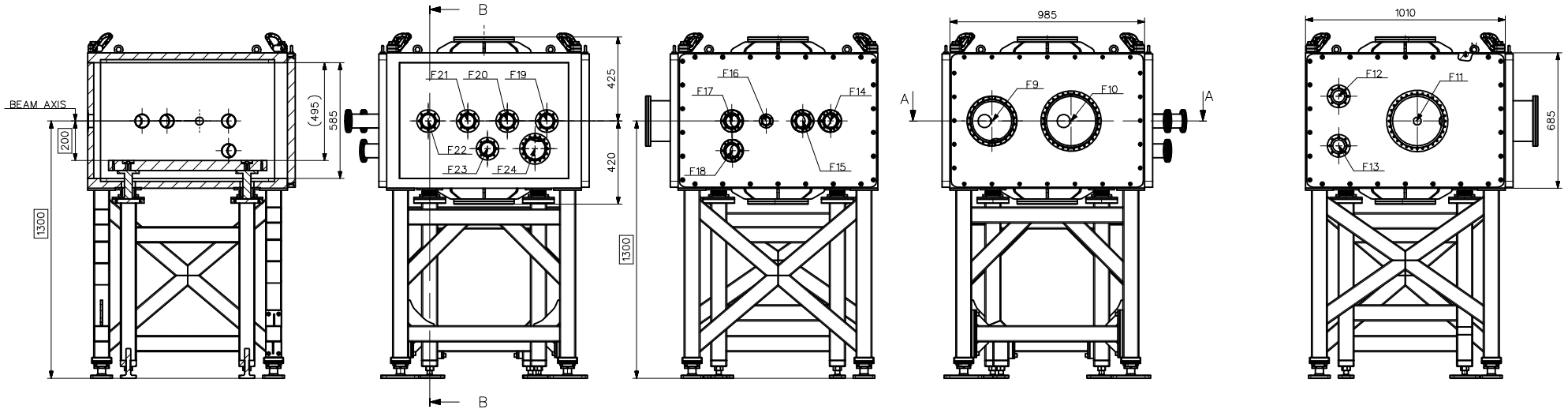


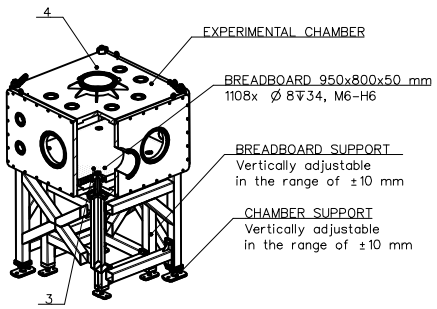
SECTION B-B
SCALE 1:10

RIGHT VIEW
SCALE 1:10

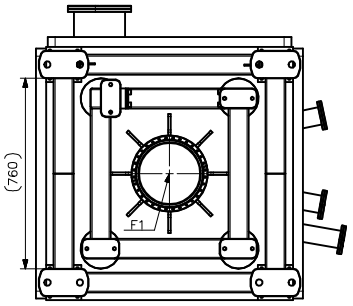
FRONT VIEW
SCALE 1:10

LEFT VIEW
SCALE 1:10

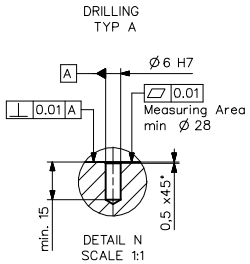
BACK VIEW
SCALE 1:10



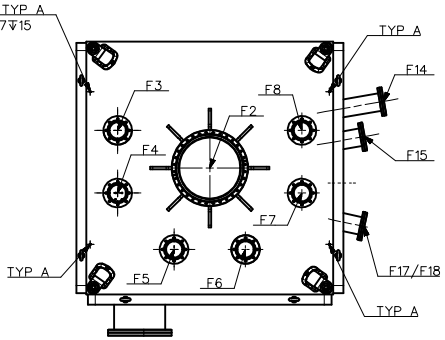
VIEW L
SCALE 1:20



BOTTOM VIEW
SCALE 1:10



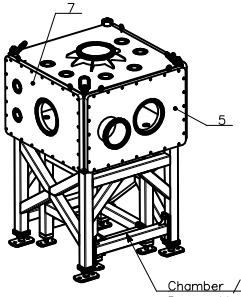
DETAIL N
SCALE 1:1



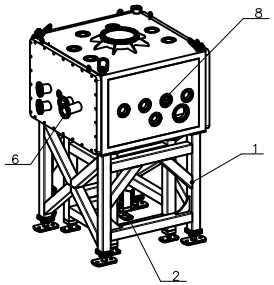
TOP VIEW
SCALE 1:10

POS.	Part Name	Material
1	Chamber support	AISI304L
2	Breadboard support	AISI304L
3	Breadboard	ANSI AA5083
4	Chamber – Body	AISI316L
5	Chamber – Left wall	AISI316L
6	Chamber – Front wall	AISI316L
7	Chamber – Back wall	AISI316L
8	Chamber – Right wall	AISI316L

POS.	DIMENSION CONNECTION	STANDARD	SECTION
F1	DN250 / Gate valve	ISO 3669	G7
F2	DN250 / Gate valve	ISO 3669	F11
F3	DN63	ISO 3669	F10
F4	DN63	ISO 3669	G10
F5	DN63	ISO 3669	G11
F6	DN63	ISO 3669	H11
F7	DN63	ISO 3669	G11
F8	DN63	ISO 3669	F11
F9	DN200	ISO 3669	B10
F10	DN250	ISO 3669	B11
F11	DN250/ Gate valve	ISO 3669	B15
F12	DN63	ISO 3669	B14
F13	DN63	ISO 3669	C14
F14	DN63 / Bellow	ISO 3669	B9
F15	DN63 / Bellow	ISO 3669	B9
F16	DN40 / Bellow	ISO 3669	B8
F17	DN63 / Bellow	ISO 3669	B8
F18	DN63 / Bellow	ISO 3669	C8
F19	DN63	ISO 3669	B6
F20	DN63	ISO 3669	B5
F21	DN63	ISO 3669	B5
F22	DN63	ISO 3669	B5
F23	DN63	ISO 3669	B5
F24	DN100	ISO 3669	B6

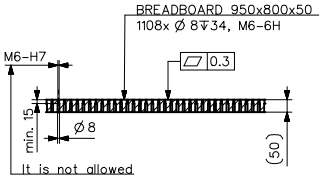


ISOMETRIC FRONT
SCALE 1:20



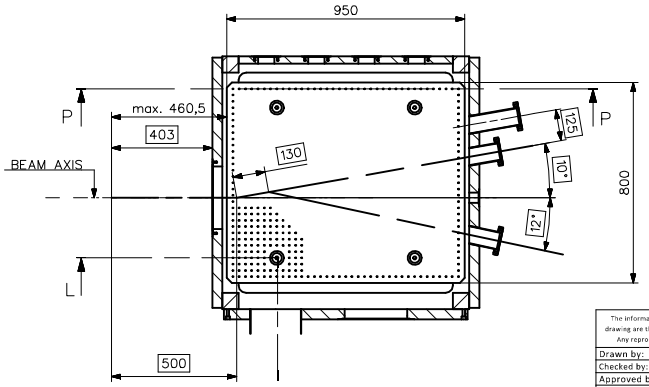
ISOMETRIC BACK
SCALE 1:20

Chamber / Breadboard support
Removable elements from this direction.
The frame design must allow the
turbopump assembly and servis



It is not allowed
to make threads
by forming.

SECTION P–P



SECTION A–A
SCALE 1:10

Permissible Chamber deformation from vacuum
shall by less than 2 mm

Project on	eli beamlines	FZU Institute of Physics of the Czech Academy of Sciences	
Drawn by: libor.pospisil	Date: 25-May-2022	Scale 1:1	Dwg. title E1_BPC_MAC
Checked by:	Date:		
Approved by:	Date:		
Weight[Kg]: -	All dimensions in mm		Dwg. no. - TC ID/Rev. 00328259/00
Material:	Tolerance: ISO2768-mK		Sheet Size A1
Raw mat.: -			Sheet 1 of 1

Confidentiality Level	*PU - Publish*	**TC ID / Revision**	00329583/C
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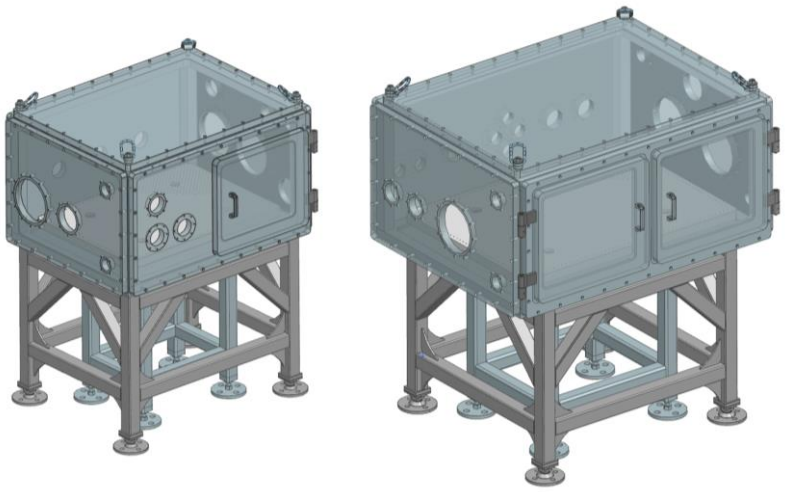
PBS code	*SE.BDS.BT.BTL1.L1E1.9.1, SE.BDS.BT.BTL1.L1E1.9.2*		
Project branch	*Engineering & Scientific documents (E&S)*		
Document Type	*Specification (SP)*		

[RSD product category C]

CH12 and CH13 chambers for beam transport in hall E1

TP22_020a



Keywords

Chambers and components, vacuum, design, manufacturing, requirements

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RSS TC ID/revision	RSS - Date of Creation	*RSS - Date of Last Modification*	*Systems Engineer*
023776/A.001	08.04.2022	08.04.2022	A. Kuzmenko
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023776/A.003	03.05.2022	03.05.2022	A. Kuzmenko

Reviewed By

Name (Reviewer)	*Position*	*Date*	*Signature*
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Approved by

Name (Approver)	*Position*	*Date*	*Signature*
Jakob Andreasson	Head of department of Structural Dynamics		

Revision History / Change Log

Change No.	*Made by*	*Date*	*Change description, Pages, Chapters*	*TC rev.*
1	L. Pospíšil	04.04.2022	RSD draft creation	A
2	L. Pospíšil, A. Kuzmenko	13.04.2022	RSD update; version for review	B
3	L. Pospíšil, A. Kuzmenko	03.05.2022	RSD update; final version	C

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Content

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1. Introduction

1.1. Purpose

The Contracting Authority (CA), Fyzikální ústav AV ČR, v.v.i. (FZU), is undertaking the ELI Beamlines project in the Czech Republic with the objective of building a facility using cutting-edge laser technologies and to implement research and application projects in the field of laser-matter interaction using ultra-short laser pulses at high repetition rates and/or with energy.

The parts of the project realization are two rectangles chambers for beam transport, which will be located in the experiment hall E1 as replacements for existing solutions. The existing solution is shown in Figure 1 below.

The detailed technical concept of the delivery system has been developed by the CA. This system will be implemented in-house using components manufactured by specialized suppliers.

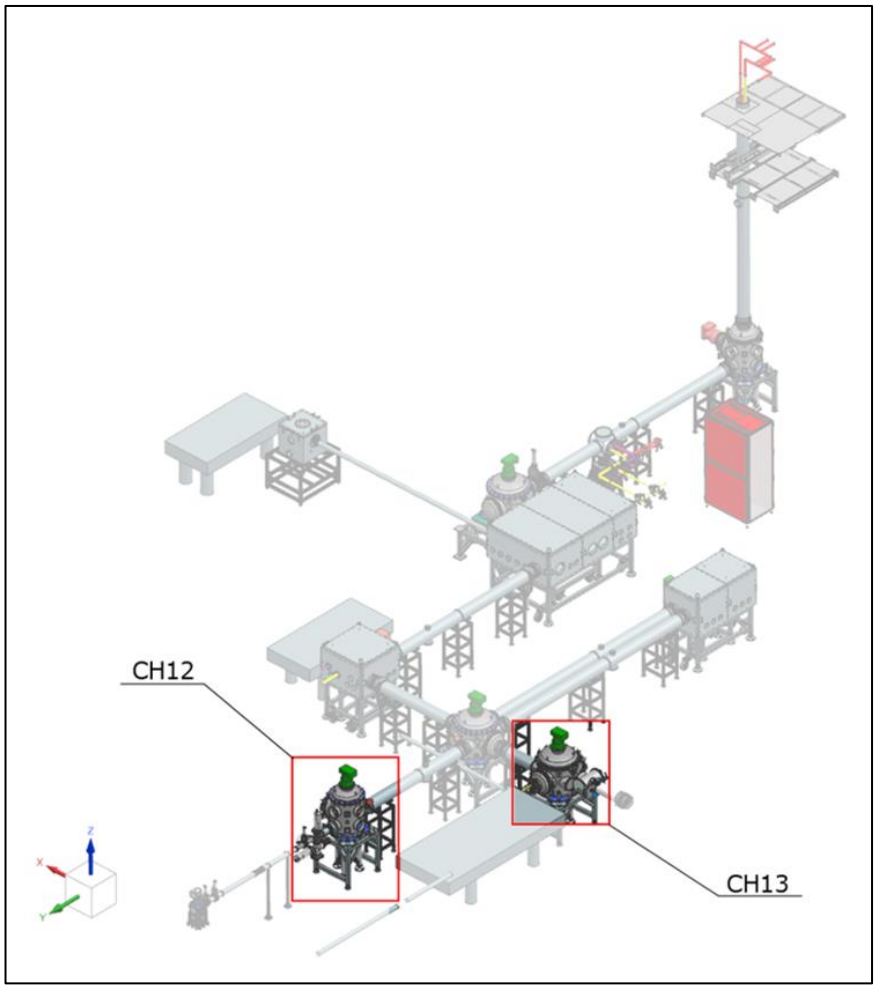

Figure 1: Existing chambers solutions CH12-CH13 in hall E1.

The chambers are house the laser optomechanics under vacuum. The optomechanics is not part of this contract. A new Rectangular design for both chambers is shown in Figure 2 below.

1.2. Scope

This RSD contains all of the technical requirements: design, functional, performance, delivery, safety and quality requirements for the following products *(tender number - TP22_020)*: **Chambers CH12 and CH13 for beam transport in hall E1** (further referred to as "**CH12 or CH13 Chamber**" or "**Chambers**" in plural).

The Chambers are integral parts of the local vacuum beam transport system located in the E1 hall. These Chambers are registered in the PBS database under the following PBS codes: *SE.BDS.BT.BTL1.L1E1.9.1 (CH12) and SE.BDS.BT.BTL1.L1E1.9.2 (CH13)*.

1.3. Terms, Definitions and Abbreviations

For the purpose of this document, the following abbreviations apply:

Abbreviation	Meaning
A	Analysis (as a Verification method)
CA	Contracting Authority (Institute of Physics CAS)
CDRR	Critical Design Review Report
ELI	Extreme Light Infrastructure
FEA	Finite Element Analysis
FEM	Finite Element Method
FTR	Factory Test Report
HV	High Vacuum
I	Inspection (as a verification method)
ICD	Interface Control Document
NCR	Nonconformity Report
NVR	Non-Volatile Residue
R	Review of design or documentation (as a verification method)
RD	Reference Document
RGA	Residual Gas Analysis
RSD	Requirements Specification Document
T	Test (as a verification method)
TMP	Turbomolecular Pump
UHV	Ultra High Vacuum
VCD	Verification Control Document

1.4. Reference documents

Number of doc.	Title of Document/File
RD-01	00329614-A_RD-01_3D Model and Drawings-Chambers CH12 and CH13 in E1.rar
RD-02	00329615-A_VCD_Chambers CH12 and CH13 for BT in E1_TP22_020.rar

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Detailed list of drawings included within **RD-01 archive**:

No.	Drawing No./Rev.	Drawing (3D model) Name	Sheets	File format
1	00327375/00	Vacuum Assy. Ch12	1	PDF
2			-	STP
3	00327502/00	Vacuum Assy. Ch13	1	PDF
4			-	STP

1.5. References to standards

If this document or RD-01 include references to standards or standardized/ standardizing technical documents the CA allows/permits also another equivalent solution to be offered.

1.6. Overall view of the two chambers and Scope of Work

The scope of work includes detailed design, manufacture, verification and transport to ELI-Beamlines of the two vacuum chambers (see Figure 2 below).

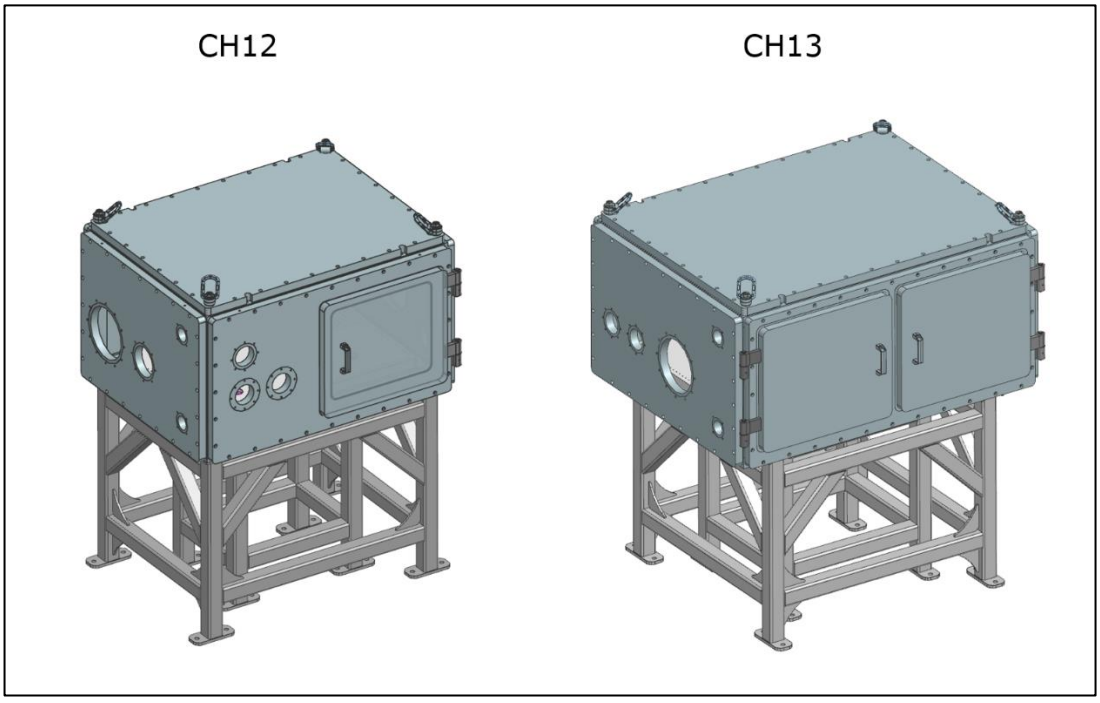

Figure 2: A new Rectangular design for Chamber-CH12/CH13

1.6.1. Chambers CH12-CH13

The chambers must be designed and manufactured for operation at vacuum level better than $1x10^{-6}$ mbar. The chambers are composed of the following components:

- Removable lightweight aluminum walls for easy handling and access to the chambers;
- Welded stainless steel cage guaranteeing the strength stability of the chambers;

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- Doors, allowing easy and quick access to the chamber from the front side;
- The chambers must contain lifting points. Each individual removable wall shall also be equipped with lifting features (e.g. bosses for screw-in lifting eyes) to enable its handling by overhead crane.

An Interface control document (ICD) will be created in cooperation with the supplier and the CA during the detailed design phase. The individual interfaces of the chambers with ELI Beamlines technologies (TMPs, Gauges, pipes etc.) will be specified and verified in the ICD.

1.6.2. Chamber support

The frames for the vacuum chambers must ensure safe use and connection of the chamber to the floor. The frames will be anchored to the floor. The Supplier shall optimize the supporting chassis and shall perform the FEM simulations. The frames must be designed to withstand a torque in the event of a pump failure. The supplier is obliged to document the FEM-stress analysis of the frame.

1.6.3. Internal Breadboards and the Support

Breadboards are included in the delivery and they must be placed in a chamber with a separate frame (Breadboard support) for the reasons to isolate the breadboards from the chamber. The breadboard supports shall be equipped with a fine height setting.

The material of the breadboards shall be aluminium alloy EN AW 5083 (equivalent to ČSN 42 4415, equivalent to ANSI AA5083), or equivalent.

The breadboards shall be made from high-flatness prefabricated panels, cast and free of any defects and/or inhomogeneity. The Supplier shall optimize the supporting chassis and shall perform the FEM-structural and modal simulations. The simulation results will be submitted to the CA for review and approval. The natural frequency of the breadboard Assembly (Breadboard support, Breadboard, De-coupling system) shall be greater than 50 Hz.

The Breadboards will be designed by the supplier and the minimum dimensions from the drawings must be observed during the design.

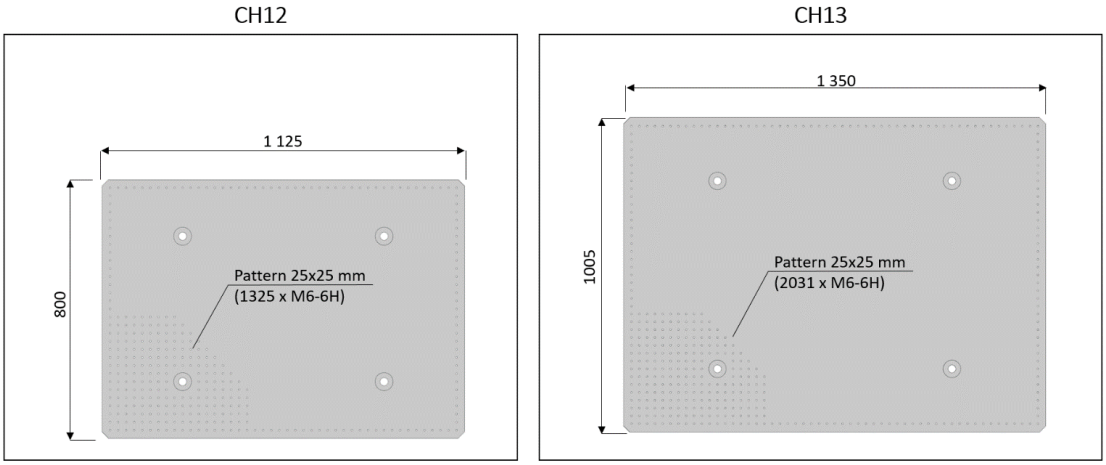

Figure 3: Minimum dimensions of breadboards for chambers CH12 and CH13

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1.6.4. De-coupling system

The structure consists of bellow providing full isolation of the force on the flange used for the leg, arising from pressure difference between outer atmospheric pressure and the chamber vacuum.

Overview of the de-coupling system requirements (for more details see section 2):

- Each of the four de-coupling elements will be connected to the frame by at least four screws;
- The contact area with the frame must be precisely defined and ensure maximum system stability;
- The Decoupling system shall allow positioning in the vertical direction within the range ±1 mm.

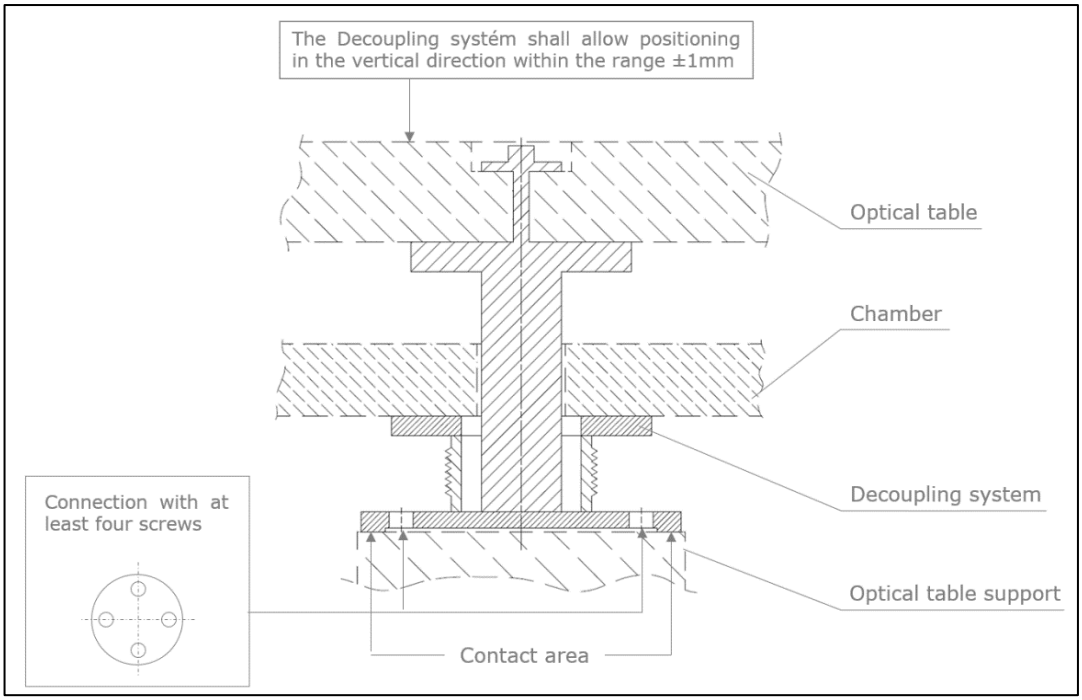

Figure 4: Scheme of De-coupling system

1.6.5. Vacuum Flange Schedule

All circular flanges shall be dimensioned according to ISO 1609 (2020 revision), or equivalent, corresponding to ISO-K or ISO-F implementation.

For works vacuum testing by the supplier, all flanges except those used for pumping and for vacuum gauges are required to be blanked by corresponding vacuum flanges. Vacuum flanges are included in the delivery.

For delivery of the chamber to ELI-Beamlines, all flanges shall be blanked.

The table below describes the intent for using these ports. The ports equipped with a Turbopump (TMP) must withstand the load when the pump is destroyed. The load values are listed in the table below using the Bending moment M_B and torque M_T values.

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Table 1: Circular Flange Tolerance Grade

Flange tolerance Grade	Tolerance Specification
A	Co-axial tolerance of ±1 mm or better and angular tolerance of ±0.5 degrees or better with respect to their ideal axis
B	Co-axial tolerance of ±3 mm or better and angular tolerance of ±2.0 degrees or better with respect to their ideal axis

Table 2: Overview of flanges-Chamber 12

Flange	Type	Dimension	Position	Purpose	Load [Nm]	Tolerance
F1	ISO-F*	DN160	Left side	Beam transport output		A
F2	ISO-F*	DN250	Left side	Beam transport output		A
F3	ISO-F*	DN63	Left side	Gauge		B
F4	ISO-F*	DN63	Left side	Gauge		B
F5	ISO-F*	DN100	Front side	Gauge		B
F6	ISO-F*	DN100	Front side	Gauge/ Viewports		B
F7	ISO-F*	DN100	Front side	Gauge/ Viewports		B
F8	ISO-F*	DN250	Right side	Beam transport input		A
F9	ISO-F*	DN250	Right side	Beam transport input		A
F10	ISO-F*	DN160	Right side	TMP – case_1	M_T**= 6 500	A
F11	ISO-F*	DN63	Right side	Gauge		B
F12	ISO-F*	DN63	Right side	Gauge		B
F13	ISO-F*	DN100	Right side	Valve		B
F14	ISO-F*	DN100	Back side	Cable Gland		A
F15	ISO-F*	DN100	Back side	Cable Gland		A
F16	ISO-F*	DN160	Back side	Cable Gland		A
F17	ISO-F*	DN160	Bottom side	TMP – case_2	M_T**= 6 500	A

* or equivalent technical solution

** $\mathbf{M_T}$ = Torque

Table 3: Overview of flanges-Chamber 13

Flange	Type	Dimension	Position	Purpose	Load [Nm]	Tolerance
F1	ISO-F*	DN250	Right side	Beam transport input		A
F2	ISO-F*	DN250	Right side	TMP – case_2	M_T**= 52 000 M_B**= 35 000	B
F3	ISO-F*	DN160	Right side	Gauge		B
F4	ISO-F*	DN63	Right side	Valve		B
F5	ISO-F*	DN63	Right side	Gauge		B
F6	ISO-F*	DN63	Right side	Gauge		B
F7	ISO-F*	DN63	Right side	Gauge		B
F8	ISO-F*	DN250	Left side	Beam transport output		A
F9	ISO-F*	DN63	Left side	Gauge		B
F10	ISO-F*	DN63	Left side	Gauge		B
F11	ISO-F*	DN100	Left side	Cable Gland		B
F12	ISO-F*	DN100	Left side	Cable Gland		B

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Flange	Type	Dimension	Position	Purpose	Load [Nm]	Tolerance
F13	ISO-F*	DN63	Back side	Beam dump		A
F14	ISO-F*	DN63	Back side	Beam dump		A
F15	ISO-F*	DN100	Back side	Cable Gland		B
F16	ISO-F*	DN63	Back side	Viewports		A
F17	ISO-F*	DN63	Back side	Viewports		A
F18	ISO-F*	DN63	Back side	Viewports		A
F19	ISO-F*	DN63	Back side	Viewports		A
F20	ISO-F*	DN100	Back side	Cable Gland		B
F21	ISO-F*	DN100	Back side	Cable Gland		B
F22	ISO-F*	DN250	Bottom side	TMP – case_1	M_T**= 52 000 M_B**= 35 000	A

* or equivalent technical solution;

** $\mathbf{M_T}$ = Torque and $\mathbf{M_B}$ = Bending moment.

2. Design, Functional and Performance requirements

The following sections of this specification provide a summary of the contractual requirements. The total scope of the contract also comprises all the requirements stated or implied in the foregoing text, whether or not included in the summaries.

2.1. General requirements

REQ-034055/A

The Supplier shall manufacture and deliver the CH12 and CH13 chambers shown in Drawings **00327502** and **00327375** (see **RD-01**; section 1.5) with dimensions and parameters defined in this document and in associated drawings and 3D models.
NOTE: Design changes are possible if it is necessary. All changes must be coordinated with and approved by the CA.

Verification method: I – inspection

REQ-034056/A

The detailed design shall include full coordination with the interfaces of adjacent systems, especially turbomolecular pumps, vacuum gauges, coolants cooling water, etc., and with the ELI-Beamlines building, according to the information provided by the CA.

Verification method: R – review

REQ-034057/A

The contract shall cover the supply of all materials, preparation of manufacturing drawings, analyses, manufacture, inspection, cleaning, testing, assembly, packing and subsequent delivery to the CA's facility located in Dolni Břežany.
NOTE: As manufacturing drawings will be required drawings of all components with tolerance, surface descriptions, drawings of all

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assemblies/subassemblies and welding drawings with weld descriptions. Each production parameter shall be recorded on the manufacturing drawings.

Verification method: R – review, I – inspection

REQ-034058/A

The Supplier shall develop the design of door hinges with double pivot arrangement to avoid crushing the O-rings when closing the door.

Verification method: R – review

REQ-034059/A

The completed assembly of the chambers must be supplied with a full set of blanking flanges.
NOTE: Material of blanking flanges shall by Stainless Steel class *1.4301 (equivalent to AISI 304).*

Verification method: R – review, I – inspection

REQ-034060/A

The Chambers detailed design shall make all necessary allowance for transport of the chamber to its working location. This shall include the provision of designated lifting points and jacking points and positions to support the chamber on rollers for lateral movement. The lid shall also be equipped with lifting features (e.g. bosses for screw-in lifting eyes) to enable its handling by overhead crane.

Verification method: R – review, I – inspection

REQ-034061/A

The Supplier shall perform structural analysis of the final design of the Chamber and Frame to proof strength and allowable deformations. Allowable values of deformations of individual walls are defined in the drawings (see **RD-01**; section 1.5). All Analysis shall be approved by the CA.
NOTE: The structural analysis shall be performed by the FEM method, by a qualified designer experienced in the field of Pressure Vessels and Steel Structures. The Calculation of chamber shall meet the standard according to EN 13445-3 Annex C - Method based on stress categories, or technically and qualitatively equivalent. Structural analysis of frames shall meet the standard according to Eurocode - Design of steel structures, or technically and qualitatively equivalent.

Verification method: R – review, A – analysis (approved by the CA)

REQ-034062/A

The Supplier shall design a dimension of the vacuum chamber and frames to withstand the load prescribed by the TMP in the event of a crash of the pump.

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NOTE: The strength of welds at areas of connections nozzle/flange and nozzle/chamber wall shall be performed by calculation according to EN 13445-3, or technically and qualitatively equivalent. The maximum load is listed in Tables 2 and 3.

Verification method: R – review, A – analysis (approved by the CA)

REQ-034155/A

The Vacuum chambers bodies shall be delivered with alignment reference holes according to Reference drawings 00327375, 00327502 - DRILLING TYP A (see **RD-01**; section 1.5).
NOTE: Flat contact surface of 28 mm diameter shall be available around the hole.

Verification method: I – inspection

2.2. Manufacturing drawings

REQ-034063/A

The Supplier shall prepare and supply manufacturing drawings in **.pdf* format and one of the following file formats:

- *.dwg;
- Native data for NX *.prt (Version 1934 or later)
- Native data for Autodesk Inventor *.idw (Version 2021 or late).

Verification method: R – review

REQ-034064/A

The Supplier shall prepare and supply an updated 3D model of the supplied Assy. CH12 and CH13 chambers in one of the following formats:

- Universal format: Parasolid **.x_t*, or **.stp*
- Native data for NX **.prt* (Version 1934 or later)
- Native data for Autodesk Inventor **.idw* (Version 2021 or late).

Verification method: R – review

REQ-034065/A

Any dimensional or design modifications that may arise as part of detailed manufacturing design must be consulted with and approved by the CA.

Verification method: R – review

REQ-034066/A

The final manufacturing drawings and detailed 3D models for manufacture shall be approved by the CA (see section 6.4.1).

Verification method: R – review

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REQ-034067/A

If at any stage of the design or manufacturing it is clear to the Supplier that an advantage could be gained by a modification of the original then the Supplier is encouraged to bring it to the attention of the CA.

Verification method: Not To Be Tracked within VCD

2.3. Raw material requirements

REQ-034068/A

The Chambers body shall be manufactured from stainless steel class 1.4307 (equivalent to ČSN 17249, equivalent to AISI 304L), or equivalent. Good manufacturing practices for stainless steel welding shall be followed.

Verification method: R – review

REQ-034069/A

The principal material of the Chambers Walls and Doors shall be aluminium alloy EN AW 5083 (equivalent to ČSN 42 4415, equivalent to ANSI AA5083), or equivalent, without internal stress, free of residual cavities.

Verification method: R – review

REQ-034070/A

The Breadbords shall be manufactured from stress relieved cast aluminium slab made from high-flatness (equal or better than 0.2 mm /1000 mm) prefabricated panels.

Verification method: R – review

REQ-034071/A

The Breadboard frame shall be manufactured from ISO EN S235JR (W.Nr. 1.0037), or equivalent.
NOTE: Material change is possible if agreed by the CA.

Verification method: R – review

REQ-034072/A

The Chambers frames shall be manufactured from ISO EN S235JR (W.Nr. 1.0037), or equivalent.
NOTE: Material change is possible if agreed by the CA.

Verification method: R – review

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2.4. Manufacture and machining requirements

REQ-034073/A

The manufacturing design and the selection of all components inside the vacuum envelope of the Chambers shall follow best practice to avoid any trapped volumes of air, e.g. the mounting holes shall not be blind tapped.

Verification method: R – review

REQ-034074/A

The Breadboards shall be able to be positioned with a precision better than ±1 mm.

Verification method: R – review

REQ-034075/A

The Breadboards shall be machined with an array of M6 tapped mounting holes on a 25 mm square grid over the entire surface.

Verification method: R – review, I – inspection

REQ-034076/A

All mounting holes of the breadboard shall be drilled right through and parallel tapped from the top face to a depth of at least 15 mm.

Verification method: R – review, I – inspection

REQ-034077/A

All threads shall be cut tapped.
NOTE: It is not allowed to make threads by forming.

Verification method: R – review, I – inspection

REQ-034078/A

The Supplier shall check all major dimensions of the manufactured Chambers, as defined in the manufacturing drawings approved by the CA. The result shall be provided in the form of the Factory Test Report (see REQ-034147/A).

Verification method: R – review, T – test

REQ-034079/A

The Supplier shall verify all dimensions of the manufactured pieces of the supporting frames and breadboards, defined in the manufacturing drawings. The results of tests shall be submitted in the form of Factory Test Report (see REQ-034147/A).

Verification method: R – review, T – test

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REQ-034080/A

The Supplier shall test the Chambers for deformations due to the atmospheric pressure differential. The measured deformations shall not exceed the defined parameters from the drawings. The result shall be provided in the form of the Factory Test Report.

Verification method: R – review, T – test

REQ-034213/A

The door shall include a quick-closing system, which allows quick access to the chamber. The final solution of the closing systems for both chambers shall be approved by the CA.

Verification method: R – review

REQ-034214/A

The frames shall allow assembly and service of selected Turbopumps mounted on the chamber. The final frame design shall be approved by the CA.
NOTE: The type of the Turbopumps will be specified by the CA during the chamber production.

Verification method: R – review

REQ-034430/A

All threads (on the Chamber, Breadboard, Frames, Lifting features) shall be metric.

Verification method: R – review, I – inspection

REQ-034431/A

All manufactured parts shall be free of sharp edges.

Verification method: I - inspection

REQ-034432/A

All manufactured parts shall be burr free.

Verification method: I – inspection

2.5. Vacuum components manufacture

REQ-034081/A

The assembly must be designed and manufactured for operation at a vacuum level better than 1E-6 mbar.

Verification method: R – review, T – test

REQ-034082/A

All vacuum components must be high vacuum compatible to comply with REQ-034081/A and must be manufactured using materials and procedures that will guarantee a low outgassing rate (including seal

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and weld integrity) as might be reasonably expected for such vacuum components.

Verification method: R – review

REQ-034083/A

Assembly of vacuum parts must take place under controlled conditions in a cleanroom environment of Class 7 according to ČSN EN ISO 14644 (equivalent to EN ISO 14644), or equivalent.
NOTE: The ISO 14644 certification of the Supplier's cleanrooms is not required in lieu of an inspection by the CA.

Verification method: I – inspection

REQ-034084/A

All cutting fluids, greases etc. used for manufacturing shall be capable of being removed entirely by subsequent cleaning operations.

Verification method: I – inspection

2.6. Vacuum flanges and seals

REQ-034085/A

The flanges shall be compatible with

- ISO 1609:2020 - Vacuum technology - Flange dimensions
- ISO 2861:2020 - Vacuum technology — Dimensions of clamped-type quick-release couplings.

Verification method: R – review, I – inspection

REQ-034086/A

Sealing shall be made of fluoroelastomer polymer material.

Verification method: R – review (specification sheet and part number of sealing included in final technical reports for both chambers)

REQ-034087/A

Hardness of O-rings shall be 60-70 HRC unless agreed otherwise with the CA.

Verification method: R – review (specification sheet and part number of sealing included in final technical reports for both chambers)

2.7. Surfaces

REQ-034088/A

The surface finish shall be as specified in the documents supplied by the CA. Where this is not specified:

- The Inner surface (vacuum side) roughness shall be better than Ra 0,8 µm.

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- The Outer surface finish shall be uniform (blasting with glass beads / Vibratory Grinding)

NOTE: Other finish technologies are possible if agreed with the CA.

Verification method: R – review, I – inspection

REQ-034089/A

The surface quality of the Breadboard shall be compatible with the required vacuum 1E-6 mbar. Surface roughness shall be better than Ra 0,8 μm.

Verification method: R – review, I – inspection

REQ-034090/A

The surface of seal faces shall be compatible with the requirements of the ISO-K, ISO-F seals used.

Verification method: R – review, I – inspection

REQ-034091/A

Sealing surfaces shall be in particular free of radial scratches or dents.

Verification method: I – inspection

REQ-034092/A

Seal faces shall be suitably protected immediately after final machining to minimize the risk of damage.
NOTE: This protection should only be removed for the purposes of cleaning and inspection, prior to final assembly.

Verification method: Not To Be Tracked within VCD

REQ-034093/A

All Frames shall be painted with non-outgassing paint compatible with the cleanroom environment of Class 7 according to ČSN EN ISO 14644 (equivalent to EN ISO 14644), or equivalent. The paint color shall be approved by the CA.

Verification method: R – review

REQ-034094/A

All Frames require treatment of surfaces prior to painting to avoid any corrosion.

Verification method: R – review

REQ-034095/A

All outside of the vacuum surfaces shall be compatible with the cleanroom environment of Class 7 according to ČSN EN ISO 14644 (equivalent to EN ISO 14644), or equivalent.
NOTE: This requirement is also valid for all support structures, which have to be painted such that the performance of the Class 7 cleanroom

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of the experimental halls will not be degraded after adequate DI water/detergent cleanroom wiping of these structures.

Verification method: R – review, I – inspection

2.8. Cleaning of vacuum components

REQ-034096/A

Cleaning procedure shall remove contaminants that adhere to the surface such as oils, greases, dirt, swarf, corrosion products, or finger prints. The cleaning procedure shall include at minimum the following steps:

1. General pre-clean, removal of gross contamination, fluxes etc. by wiping/scraping;
2. Degrease with solvent by rinsing, swabbing or immersion.
3. Washing with domestic water and detergent;
4. Vapor degrease or soak cleaning;
5. Degrease with solvent;
6. Small and complex items are immersed and ultrasonically agitated;
7. Wash with domestic water;
8. Wash with demineralized water;
9. Drying (dry air);
10. Immediate packaging (in clean room conditions Class 7).

Verification method: R – review

REQ-034097/A

The Supplier shall perform mass-spectrometer RGA (Residual Gas Analyzer) test on each chamber. The RGA shall have a range of at least 200 AMU (Atomic Mass Unit) and shall contain Secondary Electron Multiplier (SEM). The chambers shall be pumped by a dry vacuum pump and a turbomolecular pump to a pressure of 10-6 mbar for at least 12 hours before activating the RGA. The RGA filament shall be on for at least 4 hours before recording the final scan. The resulting RGA spectrum shall conform to the following criteria:

a) all peaks above AMU 45 shall be lower than 1/100 of AMU 44;
b) the AMU 45 peak shall be lower than 1/10 of AMU 44.

NOTE: The recommended cleaning procedure to achieve the required RGA values can be provided by the CA to the supplier upon request.

Verification method: R – review, T – test, I – inspection

REQ-034098/A

The Supplier shall give the CA the description of the cleaning procedure for vacuum components.

Verification method: R – review

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REQ-034099/A

Clean components shall be handled wearing clean, dry, lint-free gloves.

Verification method: R – review

REQ-034100/A

Chemical used in the cleaning process must not affect the material properties or cause color change, corrosion or other damage.

Verification method: R – review

REQ-034215/A

All O-rings shall be made from fluoroelastomer and vacuum baked in a clean oven at temperature of 120 °C for 48 hours prior to use. After the bake-out, the O-rings shall not come in contact with isopropyl alcohol or any grease.

Verification method: R – review, I – inspection

2.9. Welding

REQ-034101/A

All welds shall meet acceptance criteria Class B according to ČSN EN ISO 5817 (equivalent to EN ISO 5817).

Verification method: I – inspection

REQ-034102/A

The parts to be welded shall be thoroughly cleaned and degreased.

Verification method: Not To Be Tracked within VCD

REQ-034103/A

Shielding gases shall be used during welding to minimize oxidation.

Verification method: I – inspection

REQ-034104/A

All welds on the Chambers and frames shall be visually inspected, and the Protocol for each chamber shall be issued.

Verification method: R – review, I – inspection

REQ-034105/A

All internal welds of the Chambers shall be examined by Penetration or ultrasonic testing, and protocol for each chamber shall be issued.

Verification method: R – review, T – test, I – inspection

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2.10. Vacuum leak test

REQ-034106/A

The Supplier shall perform vacuum leak test using a helium leak detector. The measured single leak rate of any flange shall be less than 1.0E-8 mbar·l/sec. The total leakage rate of each chamber shall be 1.0E-4 mbar·l/sec or less. The results shall be provided in the form of the Factory Test Report (see REQ-034147/A).
NOTE: It is recommended that a single flange test (helium spray) is performed according to ČSN EN 1779 (equivalent to EN 1779), method A.3, and the test of total leakage according to ČSN EN 1779 (equivalent to EN 1779), method D.2.

Verification method: R – review, T – test

3. Delivery requirements

3.1. General requirements

REQ-034107/A

The transportation to the ELI Beamlines facility in Dolní Břežany of the Chambers shall be conducted by the Supplier.
NOTE: The bid price will be considered by the CA as the final price, including transportation costs and insurance.

Verification method: I – inspection

REQ-034108/A

Part of delivery shall be a helium leak detection test report for both CH12 and CH13 chambers (see REQ-034106/A).

Verification method: I – inspection

REQ-034109/A

Part of delivery shall be support frames for both CH12 and CH13 chambers.

Verification method: I – inspection

REQ-034110/A

The crates shall be labelled with the contents of the crate, i.e. with all part numbers of the contained components.

Verification method: I – inspection

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3.2. Packaging requirements

REQ-034112/A

The Supplier shall invite the CA representative to inspect the vacuum cleanliness of the chambers placed in Class 7 cleanroom according to ČSN EN ISO 14644 (equivalent to EN ISO 14644), or equivalent, (or better cleanliness class), before starting the packaging of these components for transport.

Verification method: R – review, I – inspection

REQ-034113/A

The chambers shall be prepared for transport with the lids and doors fitted and all circular flanges sealed by metal blanks cleaned to the same standard as the chamber itself.

Verification method: I – inspection

REQ-034114/A

The vacuum chambers, the internal support frames, and the breadboards shall be packed separately for transport.

Verification method: I – inspection

REQ-034115/A

The cleaned chambers and all components shall be wrapped in two layers of ultra-low outgassing polyethylene film (as sheet or bags) with thickness of at least 100 µm, with NVR (non-volatile residue) better than 0.15 µg/cm2 and very low particle generation. Alternatively, UHV compatible aluminium foil approved by CA can be used. The clean conditions wrapping shall be further enclosed in robust outer packaging and transport crates as necessary for protection and handling during shipping to the ELI-Beamlines site.
NOTE: The CA can recommend to the Supplier appropriate low-outgassing polyethylene-based foils brands if necessary.

Verification method: R – review, I – inspection

3.3. Transportation requirements

REQ-034116/A

The Supplier shall transport the completed and tested components to the ELI Beamlines site.

Verification method: R – review, I – inspection

REQ-034117/A

The Supplier shall allow supervising the activities related to the transportation by the CA if requested.

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NOTE: Any acts of supervision shall not mean that the CA assumes the additional liability of any king exceeding its liabilities according to the contract.

Verification method: Not To Be Tracked within VCD

REQ-034118/A

The transportation procedure shall be reviewed and agreed by the CA.

Verification method: R – review

REQ-034119/A

The flanges of the chamber shall remain sealed during transport.

Verification method: R – review, I – inspection

4. Safety Requirements

REQ-034120/A

The Supplier shall supply a Declaration of Conformity for each product type if the appropriate legislation determines the Supplier's obligation to have a Declaration of Conformity for the purposes of a Device sale in the Czech Republic. In such a case the Declaration of Conformity shall comply with:

- Act No. 90/2016 Coll., as amended
- Act No. 22/1997 Coll., as amended
- The equivalent legal regulation of another EU member state so that the conditions for the sale of the product in the Czech Republic are met, and/or
- the relevant EU/EC regulation

NOTE: The compliance with these obligations will be demonstrated by the (EU) Declaration of conformity, other relevant documents and the CE marking if required by the relevant regulations. If a delivered product is not required to assess conformity according to specific legislation, the supplier declares, in written form, by concluding the contract that the product complies with the general safety requirement of EU Directive 2001/95/EC on general product safety and that the Supplier duly complies their obligations under this Regulation.

Verification method: I – inspection

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5. Quality Requirements

5.1. Documentation and data control

REQ-034121/A

The Supplier shall provide the **Product User Manual** as part of the delivered system. The Manual shall include the instructions and descriptions regarding the following procedures:

- transport, handling, storage;
- installation, alignment and cleaning;
- safe operation and maintenance procedures.

Verification method: R - review, I – inspection

REQ-034122/A

The Supplier shall supply the following relevant manufacturing documents:

- all manufacturing **drawings**, **3D models** (if available) and **design supporting documentation** (i.e. technical documentation, see REQ-034144/A) approved by the CA;
- all "**requests for deviation/wavier** from requirements described herein" (see REQ-034130/A) approved by the CA.

Verification method: I – inspection

REQ-034123/A

All documentation shall be supplied in either English or Czech language.

Verification method: Not To Be Tracked within VCD

REQ-034124/A

The Supplier shall provide documentation showing that material specifications required by the CA and the manufacturing drawings have been used (e.g. material delivery notes or catalogue part numbers).

Verification method: R – review

REQ-034125/A

The manufacturing documents shall include the **accuracy of the manufacturing process**. This accuracy shall be also included in the corresponding **Factory test report** (see REQ-034147/A).

NOTE: The Supplier will specify the maximal difference between specified parameters (in section 3) and the parameters of the manufactured Chambers.

Verification method: R – review

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REQ-034126/A

The Supplier shall use following data formats:

- *.JPG, *.PNG, *.TIFF, *.PDF/A, *.HTML
- CAD 2D: *.dwg
- CAD 3D: *.stp; *.ste; *.step or other 3D CAD formats agreed with the CA
- text processors: *.doc, *.docx, OpenDocument Format
- spreadsheet processors: *.xls, *.xlsx, OpenDocument Format
- presentations: *.ppt, *.pptx; OpenDocument Format

Verification method: Not To Be Tracked within VCD

5.2. Marking

REQ-034127/A

The CH12-CH13 chambers shall be marked on the outside with the following information:

- Assembly Name;
- Assembly Number;
- Assembly Manufacturer;
- Manufacture date.

Text size, format and position of the mark shall be approved by the CA.

Verification method: I – inspection

REQ-034128/A

Each removable component of the Chambers shall be marked on the outside with the following information:

- Component Name;
- Component Number;
- Component Weight.

Text size, format and position of the mark shall be approved by the CA.

Verification method: I – inspection

REQ-034129/A

The form of the mark must comply with the conditions of the cleanroom environment of Class 7 according to ČSN EN ISO 14644 (equivalent to EN ISO 14644), or equivalent.

Verification method: I – inspection

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5.3. Nonconformity Control System

REQ-034130/A

The Supplier shall establish and maintain a nonconformity control system compatible with ČSN EN ISO 9001 (equivalent to EN ISO 9001) or equivalent.

Verification method: Not To Be Tracked within VCD

5.4. Specific Quality Requirements

REQ-034131/A

In case of a warranty repair of the Cambers by the Supplier, the Supplier shall redo necessary parts of the verification procedure (see section 6). The results of this process shall be provided to the CA.

Verification method: Not To Be Tracked within VCD

6. Verification requirements for the Supplier

The verification process will be performed by the Supplier to demonstrate that the chambers meet the specified requirements of the CA.

6.1. General requirements

REQ-034132/A

The verification process shall be performed by the Supplier to demonstrate that the delivered Chambers meet the specified requirements of the CA. The verification process consists of:

1. **Verification planning** (via VCD, see section 6.3);
2. **Verification execution and reporting** (see sections 6.3 and 6.4);
3. **Verification control and close-out** (see section 6.5).

Verification method: Not To Be Tracked within VCD

REQ-034133/A

The Supplier shall assign clear responsibility for the implementation of the verification process including all activities defined in the REQ-034132/A.

Verification method: R - review

6.2. Verification Documentation

REQ-034134/A

The Supplier shall establish and maintain the system of verification process documentation.

Verification method: Not To Be Tracked within VCD

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REQ-034135/A

Verification documentation shall consist of the following basic types of documents:

- **Verification Reports**, including CDR Report, Tests and Analyses reports (see section 6.4);
- **VCD, Verification Control Document** (see section 6.3).

Verification method: Not To Be Tracked within VCD

REQ-034136/A

The verification reports shall be submitted to the CA for the review as agreed with the CA after corresponding verification activity completion, within the time frame agreed with the CA in the **VCD**.
NOTE: Verification activity can be design review, test, analysis or inspection of the Chambers (see REQ-034142/A).

Verification method: Not To Be Tracked within VCD

6.3. Verification planning and reporting

The Verification Control Document (VCD) shall list the selected method(s) of verification, overall verification result (pass/fail) and reference to the relevant report, where necessary for each requirement. The VCD is a living (versioned) document and provides an overview of the mutually agreed Verification methods during the contract execution and an overview of the verification results at the contract end to support the acceptance of the Chambers. The **VCD** represents a formal tool of communication between the Supplier and the CA (formal record, reporting tool). The **VCD** will be provided by the CA and it can be accommodated to the Supplier's needs.

REQ-034137/A

The Supplier shall provide a Verification Control Document (**VCD**) in coordination with and having approval from the CA.

NOTE 1: Guidelines for VCD preparation see in RD-02 (section 1.5).
NOTE 2: The form of VCD will be agreed between the CA and the Supplier based on the best commercial praxis used by the Supplier.

Verification method: R - review

REQ-034138/A

In the **VCD**, the Supplier shall describe **HOW** and **WHEN** each of the technical requirements is to be verified.

Verification method: R – review

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REQ-034139/A

The verification approach shall be defined by the Supplier in the **VCD** prior to its implementation.
NOTE: Since some requirements are to be verified through a review of the design, the VCD shall be prepared by the Supplier and agreed with the CA before starting the Design Review.

Verification method: R - review

REQ-034140/A

The Supplier shall provide regular progress reports to the CA in the form of the VCD execution according to the time frames agreed with the CA in the **VCD** (see REQ-034138/A and REQ-034139/A).

Verification method: R - review

6.4. Verification execution

REQ-034141/A

The verification execution process shall consist of following stages according to the phasing of the contract execution:

- **Critical design review** (CDR);
- **Verification of all components of the Chambers** (testing and inspection at Supplier's site);
- **Final acceptance after the delivery**.

NOTE 1: The CDR is intended to verify that the design meets corresponding requirements (could be accepted) and/or identify required corrective actions needed to accept the design and start manufacturing phase of the contract.
NOTE 2: Verification of all elements of the Chambers is executed at the end of each corresponding manufacturing phase by inspection and tests. The purpose of this verification is checking the product readiness for shipment to the ELI Beamlines.
NOTE 3: In the final acceptance stage, the verification shall demonstrate that the Chambers are free of fabrication defects and is ready for the intended operational use.

Verification method: Not To Be Tracked within VCD

REQ-034142/A

Verification shall be accomplished by the Supplier through one or more of the following verification methods:

1. **Review of design**; Verification via Review (**R**) shall consist of using approved records (examples of such approved records are design documents and reports, technical descriptions, and engineering drawings, manuals and accompanying operation documentation) or evidence that unambiguously shows that the requirement is met.

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2. **Inspection**; Verification via Inspection (**I**) shall consist of visual determination of physical characteristics.
3. **Test** (including functional demonstration); Verification via Test (**T**) shall consist of measuring product performance and functions under the defined operating conditions.
4. **Analysis**; Verification by Analysis (**A**) shall consist of performing theoretical or empirical evaluations using methods defined in the VCD.

Verification method: Not To Be Tracked within VCD

REQ-034143/A

The results of the analysis shall be documented by the corresponding Analysis Report (e.g. FEA/FEM report) and tracked in the VCD (see section 6.3).

Verification method: R – review

REQ-034144/A

The results of a review of the design shall be documented in the Critical Design Review Report (**CDRR**) and tracked in the VCD (see section 6.3).
NOTE: The CA can provide to the Supplier the template of the CDRR.

Verification method: R - review

REQ-034145/A

The final manufacturing drawings, the Interface Control Document (**ICD**) and the parts of the VCD related to the Design of the Chambers shall be accepted by the CA before the commencement of manufacturing.
NOTE: The ICD will be created by the Supplier in cooperation with the CA during the detailed design phase and the document should specify the individual interfaces of the chambers with ELI Beamlines technologies (TMPs, Gauges, pipes etc.).

Verification method: R - review

REQ-034146/A

The results of the inspection shall be documented in the Inspection protocol (e.g. welding inspection protocol) and tracked in the VCD.

Verification method: R - review

REQ-034147/A

The results of the tests (e.g. dimensions, vacuum, cleanliness, etc.) shall be documented in the appropriate Factory Test Report (**FTR**) and tracked in the VCD (see section 6.3).

Verification method: R - review

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REQ-034148/A

With the support of the CA, the Supplier shall carry out the final verification of requirements according to the VCD and record the results in the final VCD issue after the approval of the last report and before starting the Final Acceptance phase (see REQ-034149/A).

Verification method: R - review

6.5. Verification close out (Acceptance)

Acceptance will be carried out by the CA after the successful completion of each of the following verification phases:

- Critical Design Review (CDR) and approval of all final manufacturing drawings before manufacturing;
- Factory verification and acceptance of the manufactured, assembled, cleaned and properly packaged Chambers;
- Final verification after delivery (Final Acceptance).

Upon the success of each acceptance phase, the CA will provide a signed acceptance protocol to the Supplier. In case of unsuccessful acceptance, the CA will provide to the Supplier a Nonconformity Report (NCR) and the Supplier will be obliged to address the nonconformance.

REQ-034149/A

The Final Acceptance phase shall demonstrate the following:

- The Chambers have been successfully verified by the Supplier and the results of this process have been documented in an appropriate way through verification reports (see section 6.4) and VCD (see section 6.3);
- All detected nonconformities have been solved in accordance with REQ-034131/A;
- The delivered Chambers are free of fabrication errors and are ready for the intended operational use.

Verification method: Not To Be Tracked within VCD

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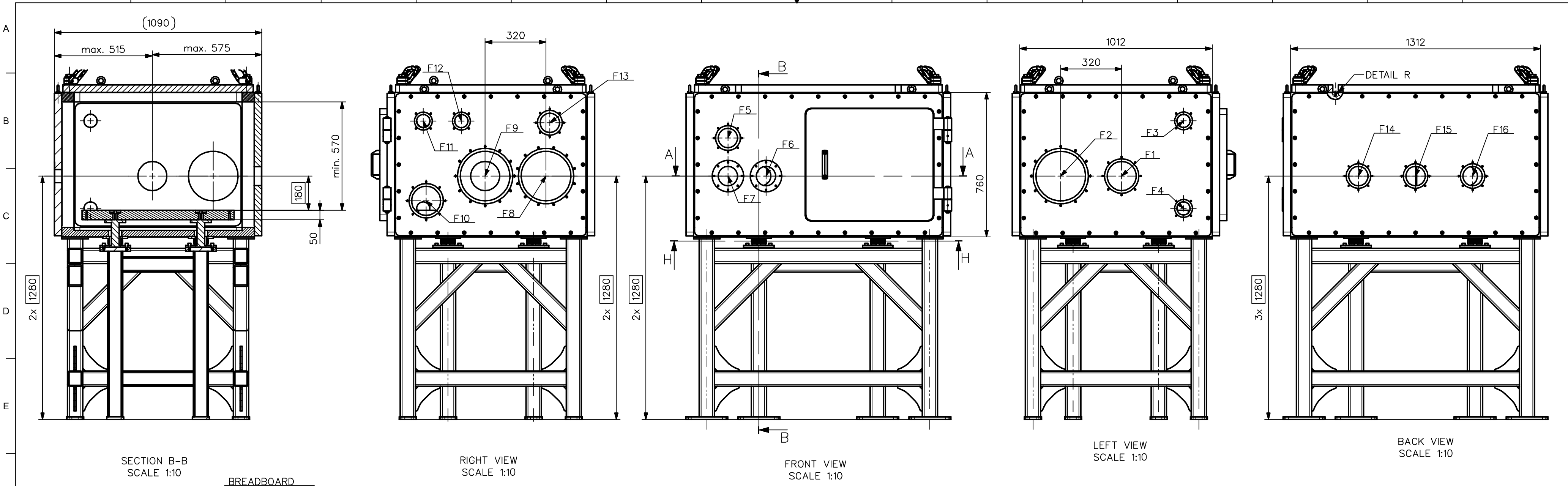
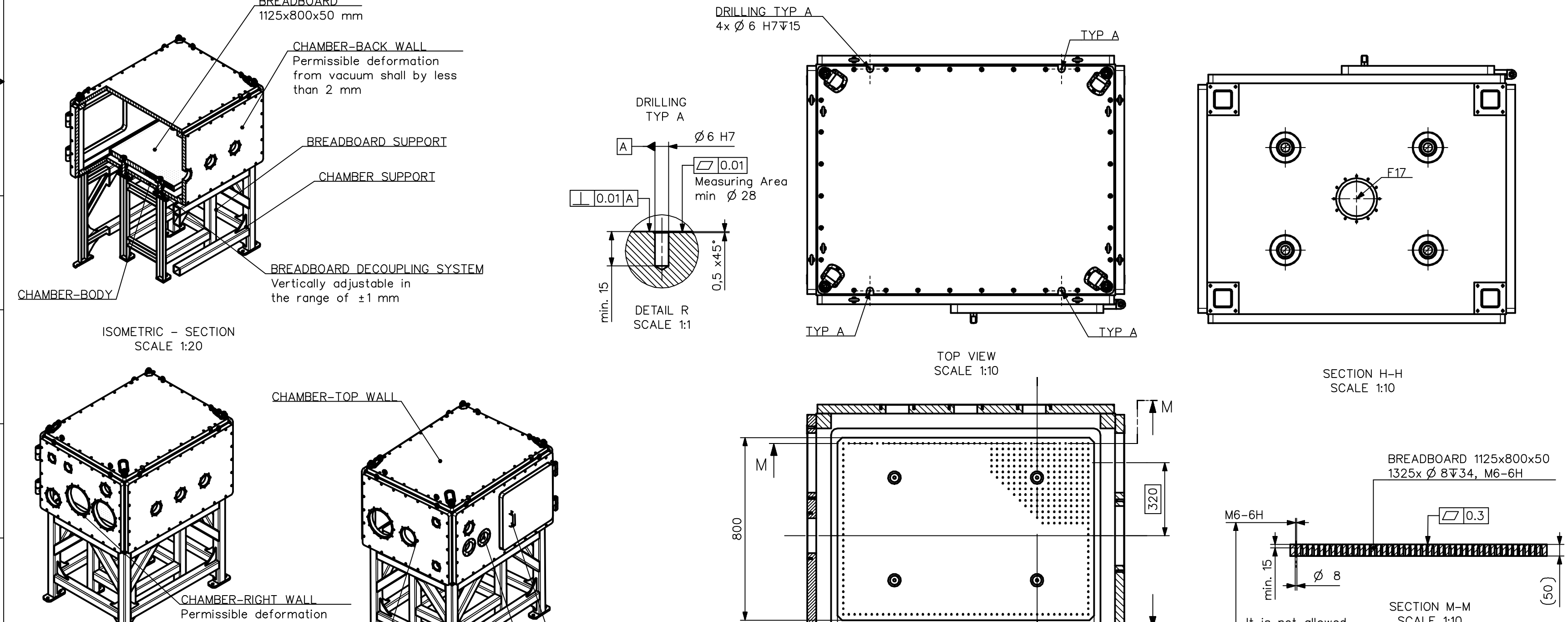
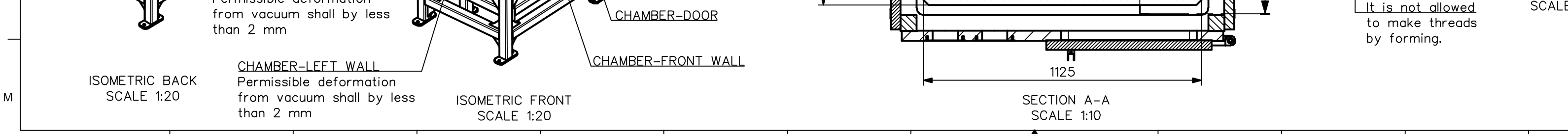






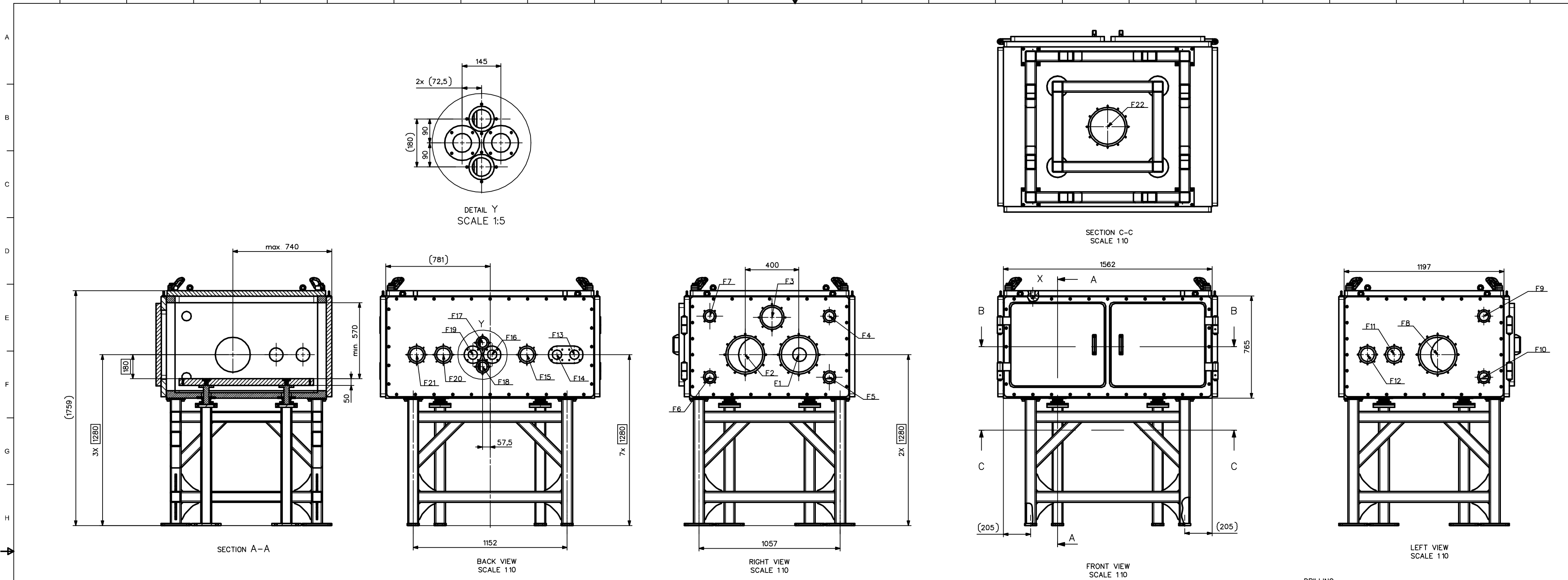
POS.	Part Name	Material
1	Chamber support	S235JR
2	Breadboard support	S235JR
3	Breadboard	ANSI AA5083
4	Chamber - Body	AISI304L
5	Chamber - Front wall	ANSI AA5083
6	Chamber - Right wall	ANSI AA5083
7	Chamber - Left wall	ANSI AA5083
8	Chamber - Back wall	ANSI AA5083
9	Chamber - TOP wall	ANSI AA5083
10	Chamber - Door	ANSI AA5083

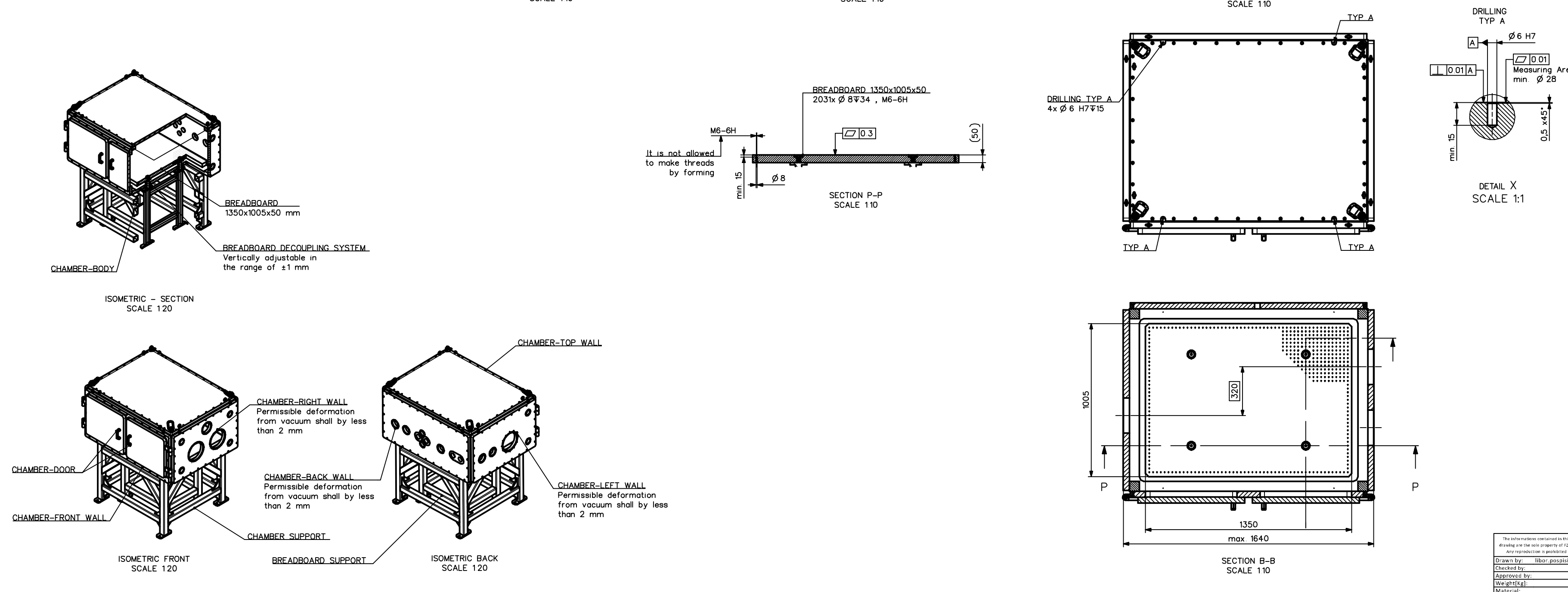
POS.	DIMENSION CONNECTION	STANDARD	SECTION
F1	DN160	ISO 1609	C12
F2	DN250	ISO 1609	B11
F3	DN63	ISO 1609	B12
F4	DN63	ISO 1609	C12
F5	DN100	ISO 1609	B7
F6	DN100/Viewport	ISO 1609	B7
F7	DN100/Viewport	ISO 1609	C7
F8	DN250	ISO 1609	C6
F9	DN250	ISO 1609	C5
F10	DN160/TMP	ISO 1609	C4
F11	DN63	ISO 1609	B5
F12	DN63	ISO 1609	B6
F13	DN100	ISO 1609	A7
F14	DN100	ISO 1609	B15
F15	DN100	ISO 1609	B15
F16	DN160	ISO 1609	B16
F17	DN160 / (TMP)	ISO 1609	H13

Projection

FZU Institute of Physics of the Czech Academy of Sciences

Drawn by: libor.pospisil	Date: 27-May-2022	Scale 1:10	Dwg. title **Vacuum Assy. Ch12**
Checked by:	Date:		
Approved by:	Date:		
Weight[Kg]: -	All dimensions in mm	Dwg. no. - TC ID/Rev. **00327375/00**	Sheet Size A1
Material:	Tolerance: ISO2768-mK		Sheet 1 of 1
Raw mat.: -			





POS.	Part Name	Material
1	Chamber support	S235JR
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7	Chamber - Left wall	ANSI AA5083
8	Chamber - Back wall	ANSI AA5083
9	Chamber - TOP wall	ANSI AA5083
10	Chamber - Door	ANSI AA5083

POS.	DIMENSION CONNECTION	STANDARD	SECTION
F1	DN250	ISO 1609	E12
F2	DN250	ISO 1609	E11
F3	DN160	ISO 1609	D12
F4	DN63	ISO 1609	E13
F5	DN63	ISO 1609	E13
F6	DN63	ISO 1609	F11
F7	DN63	ISO 1609	F11
F8	DN250	ISO 1609	E22
F9	DN63	ISO 1609	E23
F10	DN63	ISO 1609	F23
F11	DN100	ISO 1609	F21
F12	DN100	ISO 1609	F21
F13	DN63	ISO 1609	E9
F14	DN63	ISO 1609	E9
F15	DN100	ISO 1609	E9
F16	DN63	ISO 1609	E8
F17	DN63	ISO 1609	E8
F18	DN63	ISO 1609	E8
F19	DN63	ISO 1609	E8
F20	DN100	ISO 1609	E7
F21	DN100	ISO 1609	F6
F22	DN250 / TMP	ISO 1609	B17

Projection

FZU Institute of Physics of the Czech Academy of Sciences

Drawn by: libor.pospisil	Date: 27-May-2022	Scale 1:1	Dwg. title: Vacuum Assy. Ch13
Checked by:	Date:		
Approved by:	Date:		
Weight[Kg]:	All dimensions in mm	Dwg. no. - TC ID/Rev.: 00327502/00	Sheet Size A0
Material:	Tolerance: ISO2768-mK		Sheet 1 of 1
Raw mat.: -			

Annex 2 Deliverables and Payments

No.	Deliverable	Limit	Responsibility	Payments
T0	Contract signature			
T1	Detailed technical concept handover of all Chambers	**T0 + 1 week**	Buyer	
T2	Manufacturing drawings and updated detailed 3D model delivery (All chambers)	**T0 + 12 weeks**	Seller	
T3	Manufacturing drawings review (Critical Design Review) and final acceptance of manufacturing drawings (All chambers)	**T0 + 14 weeks**	Seller + Buyer	50% of Purchase Price
T4	Factory verification (Factory test reports, etc.) and acceptance of manufactured, assembled, cleaned and properly packaged chambers (components) (All chambersr)	**T0 + 36 weeks**	Seller	25% of Purchase Price
T5	Delivery to the place of delivery / handover (All chambers)	**T0 + 46 weeks**	Supplier	
T6	Acceptance (All chambers)	**T0 + 47 weeks**	Buyer	25% of Purchase Price

Annex 3 Prices

Item	Price in EUR excl. VAT
MAC Chamber Price	[redacted]
Chamber CH12 Price	[redacted]
Chamber CH13 Price	[redacted]
Total Bid Price:	**225 250,00**

Annex 4 Qualification prerequisites

The Seller shall use the following persons it identified within its Bid submitted within the Tender Procedure while carrying out all the relevant activities hereunder:

- [redacted], vacuum designer
- [redacted], vacuum designer

The Seller is allowed to use other persons only if it proves that such persons meet the requirements for the team members stated in the procurement documentation issued within the Tender Procedure.