

act for Work

" TP14\_143 Vacuum components branch from L1 to E1 including supporting frames (TP14\_143  
Vakuové komponenty z L1 do E1 včetně podpůrných konstrukcí)"

concluded in accordance with Section 2586 *et seq* of Act No. 89/2012 Coll., Civil Code  
(hereinafter the "Civil Code") (hereinafter the "Contract").

## I. Contractual Parties:

### 1. Client:

Fyzikální ústav AV ČR, v. v. i.,  
With its seat at: Na Slovance 2  
Post code 182 21 Praha 8  
Represented by: prof. Jan Řídký, DrSc. - Director

Registered in the public research institutions registry maintained by the Ministry of  
Education, Youth and Sports of the Czech Republic,

Banking details:  
Československá obchodní banka, a.s.,  
Account No.: 2106551053/2700

ID No.: 68378271  
VAT No.: CZ68378271  
(hereinafter the "Client" or "Contracting Authority" or the "Customer")  
and

### 2. Contractor:

Pfeiffer Vacuum Austria GmbH  
with its registered office at: *Diefenbachgasse 35, AT 1150 Wien, Austria*  
registered in *Industrial Court of Vienna • FN 125744 v*,  
represented by *Ing. Reinhard Schnitzler*, function/acting as *director*,  
Bank: *UniCredit Bank Austria AG, Swift/BIC: BKAUATWW, bank code: 11000, Account:*  
*09604401100, IBAN: AT971100009604401100*

Account number registered with the tax administrator (only applicable if Seller is domiciled in  
CZ): -----

Id. No.: *FN 125744 v*

Tax Id. No.: *ATU15088508*

(Hereinafter the "Contractor" or the "Supplier"; the Client and the Contractor may be  
referred to herein jointly as the "Contractual Parties" or with respect to each individually as  
the "Contractual Party").

## II. FUNDAMENTAL PROVISIONS:

1. The Client is the recipient of funding provided by the Ministry of Education, Youth and Sports of the Czech Republic for the Project “ELI: Extreme Light Infrastructure”, Reg. No. CZ.1.05/1.1.00/02.0061, granted within the framework of the Operational Program Research and Development for Innovation (“OP RDI”), Priority Axis I European Centers of Excellence, Area of Intervention 1.1. European Centers of Excellence (hereinafter the “ELI-Beamlines Project”).
2. The aim of the ELI-Beamlines Project is to construct and operate an international research laboratory (research facility) using the latest generation of laser Technology and to subsequently implement a number of future projects in basic and applied research. The objectives, extent and aims of the ELI-Beamlines Project are given in more detail in the European Commission Decision dated 20.4.2011, Ref. No. C(2011) 2753 on major project “ELI: Extreme Light Infrastructure” and in the decision of the Ministry of Education, Youth and Sports of the Czech Republic dated 2.8.2011, Ref. No. 26310/2009-45 and in the documents related to these decisions. At the same time, the ELI-Beamlines Project forms an integral part of the Czech roadmap of large infrastructures for research, development and innovations, approved by the Government of the Czech Republic.
3. The ELI-Beamlines Project is one of the pillars within the so-called ESFRI Roadmap created by the European Strategy Forum on Research Infrastructures which was formed at the behest of the European Commission to establish a network of pan-European research centres at the most advanced scientific levels whose aim is to facilitate, within the framework of specific scientific focus of each such research centre, a fully open access into these facilities to scientific workers exclusively on the basis of their scientific excellence (i.e. without regard to the legal or commercial status of institutions or corporations they may come from).
4. In order to successfully implement the ELI-Beamlines Project it will be necessary to execute certain work according to this Contract. The executed work shall form an integral part of the infrastructure for research, development and innovations of ELI-Beamlines in Dolní Břežany (hereinafter the “ELI-Beamlines Infrastructure” or “ELI-Beamlines research centre”) and shall be further used to implement research projects in the area of interaction of highly intensive laser radiation with materials.
5. The Contractor was selected as the winner of a public procurement procedure announced by the Client in accordance with Sec. 27 Act No. 137/2006 Coll., on Public Procurement, as amended, for the public contract called “**TP14\_143 Vacuum components branch from L1 to E1 including supporting frames (TP14\_143 Vakuové komponenty z L1 do E1 včetně podpůrných konstrukcí)**” (hereinafter the “Procurement Procedure”) and preliminary published (preliminary information notice) in the Official Journal of the European Union under the evidence number of the Procurement Procedure 7501021097023.
6. The Contractor acknowledges that the Client considers the Contractor’s participation in the Procedure, provided that the Contractor complies with all qualification requirements, as the confirmation of the fact that the Contractor is capable, within the meaning of Sec 5(1) of the Civil Code, of providing performance under the Contract with such knowledge, diligence and care that is associated and expected of the Contractor’s profession, and that the Contractor’s

potential performance lacking such professional care would give rise to corresponding liability on the Contractor's part. The Contractor is prohibited from misusing his qualities as the expert or his economic position in order to create or exploit dependency of the weaker party or to establish an unjustified imbalance in the mutual rights and obligation of the parties.

7. The Contractor acknowledges that the Client is not, in connection to the subject of this Contract, an entrepreneur, and also that the subject of this Contract is not related to any business activities of the Client.
8. The documentation necessary for the execution of work consists of following annexes:
  - a) Scope of Work, which forms an integral Annex No. 1 hereof and contains the detailed description of the subject of delivery pursuant hereof (hereinafter the "Annex 1" or the "Scope of Work") including a set of partial deliverables of the Work (hereinafter individually the "Deliverable") and its parts (hereinafter each separately „part of Deliverable“);
  - b) Technical specifications for the Contract form an integral part hereof as its Annex No. 2 (hereinafter the "Annex 2" or "Technical specification" or "RSD") and the part of Technical specification containing conceptual design of Devices hereof as the "Conceptual design". This Technical specification also formed a part of the tender documentation for the Procurement Procedure in the form of Annex No.3;
  - c) Schedule of Deliverables, which forms an integral Annex No. 3 hereof (hereinafter the "Annex 3" or the "Schedule of Deliverables") and contains the schedule of delivery of Deliverables and its parts hereof;
  - d) The Contractor's bid submitted for the Procurement Procedure in its parts which describes the work in technical detail (hereinafter the "Contractor's Bid"); the Contractor's Bid forms Annex No. 4 (hereinafter the "Annex 4") to this Contract and an integral part hereof.
  - e) Verification plans of Devices pursuant to Art. V par. 4 hereof, which becomes integral Annex No. 5 hereto (hereinafter the "Annex 5" or the "Verification plan");
  - f) The breakdown of the Price of Work and Payments Schedule, which forms an integral Annex No. 6 hereof (hereinafter the "Annex 6" or "The breakdown of the Price of Work and Payments Schedule") and contains the price of individual performances hereof.
9. The Contractor declares that he possesses all professional qualifications to execute the work therefore he is authorized to carry out activities foreseen hereunder, and—there are no obstacles on his part that would prevent him from executing the work contracted hereunder.
10. The Contractor is fully aware that the deadlines for the execution of the work or its parts—are vital for the Client with regard to the EU-Beamlines Project—Thus, damages may arise to the

Client if the mentioned execution of works or parts of the work fail to meet the delivery deadlines that are tied into ELI overall project schedule. The Client has notified the Contractor what are the tie-in projects' deadlines specified hereunder in connection with the ELI-Beamlines Project deadlines – see [www.eli-beams.eu](http://www.eli-beams.eu).

11. The Contractor declares that he accepts the “risk of changed circumstances” within the meaning of Sec 1765(2) of the Civil Code.

### **III. WORK SUBJECT – MATTER; WORK SCOPE**

1. The subject-matter hereof is namely:

A. the obligation of the Contractor to perform for the Client duly and on time, in accordance with the terms hereof, on its own account and liability, and within the deadlines agreed upon herein, design, manufacture, assemble, test and deliver to the Client in the place of delivery hereof devices specified in integral Annex 1 para 1 hereto and reaching parameters stated in Technical specification and Contractor's Bid (hereinafter each device individually as the “Device” and all devices collectively as the “Devices”); The Devices and the other parts of the work hereof are hereinafter also referred to as the “Work”,

and

(B) the obligation of the Client to pay the Contractor, under the terms and conditions hereof, the agreed upon price for the execution of the Work.

2. The Contractor is bound to perform the Work in parts described in the Scope of Work and designated as Deliverable or its part.
3. The subject-matter of the Work, included in the Price of the Work hereof, are also changes in the extent specified in the Annex 1 par. 3 hereto, which the Contractor is obliged to perform.
4. The Contractor's obligations hereunder, performance of which has been included in the Price of the Work, shall also include:
  - i. Training of persons designated by the Client, in the extent of minimum 1 training day (a training day shall be understood a working day), in such a way that these persons (after training) will be able to safely operate, manage, maintain, assemble and disassemble the Device, and know the essential information that every owner and user should know.

#### **IV. EQUIPMENT REQUIRED TO EXECUTE WORK:**

The Contractor shall secure such equipment that may be required to execute the Work defined hereunder, unless this Contract stipulates otherwise.

#### **V. RECORDING THE RESULTS OF THE WORK:**

1. The outcome of Deliverables D2 i), D3 i), D4 i) and D5 i) shall be **technical reports** containing preliminary design of Device including all its parts, which shall contain, in particular:
  - a. the drawings of parts of Device including 3 CAD models of Device;
  - b. Bill of Materials (relevant only for Deliverable 5 hereof);
  - c. FEM Device analysis as stipulated in Technical specification (relevant only for Deliverable 5 hereof);
  - d. Surface cleaning procedure proposal for the Device;
  - e. Proposal of the verification plan of each Device as stipulated below (hereinafter the **"Proposal of verification plan of Device"**);
  - f. Verification matrix of each Device as stipulated below (hereinafter the **"VM"**);
  - g. Interface Control Document of each Device as stipulated below (hereinafter the **"ICD"**);

(hereinafter the **"preliminary design of Device"**).
2. **Proposal of verification plan of Device** shall contain especially the overall verification approach, the model philosophy, the product matrix, the verification strategies for the Client's requirements (the interrelation between different methods and levels of verification to be used to demonstrate status of compliance to requirements), the test, inspection, analysis and review-of-design programme with the relevant activity sheets and planning, the verification tools, the verification control methodology, the involved documentation, the verification management and organization and must also fulfil at least the Client's requirements listed in the Technical specification. **VM** shall contain for each requirement of the Client the corresponding verification method at the applicable verification level. **ICD** shall define and describe all external interface aspects of the Device (Electrical/Mechanical/Thermal/Optical), including physical, functional, performance and operational constraints.
3. The outcome of Deliverables D1 i), D2 ii), D3 ii), D4 ii) and D5 ii) shall be **technical reports** containing detailed plan of Device including all its parts, which shall contain, in particular:
  - a) Final drawings of all parts of Device (as a whole) including 3D design;
  - b) Manufacturing drawings of individual parts of Device;
  - c) Verification plan for Device (including the update of the Proposal of verification plan of Device);
  - d) Verification control document for Device as stipulated below (hereinafter the **"VCD"**);
  - e) drafts of all manuals, analysis and procedures and specified in Technical specification (e.g. for transport, installation, handling, manipulation, operating procedures manual and so on)

(hereinafter the **"detailed plan of Device"**).

4. The Client shall comment on each verification plan for the Device (pursuant Art. V par 3 letter c) hereof) within thirty (30) days from the date on which it was delivered. If the Client shall not make any comments or suggestions in the above mentioned time limit, nor in the above mentioned time limit confirms in writing its consent to the verification plan of Device, it shall be deemed that the Client consents to it and the verification plan for each Device shall be attached as **Annex 5** to this Contract ("**Verification plan**"). If the Client for any justified reason does not agree with the verification plan of Device, the Contractor shall modify it according to the Client's instructions and after its modification by the Contractor it shall become integral part of this Contract as Annex 5 as mentioned above.
5. VCD shall be in the form of matrix. For each requirement of the Client concerning the Device VCD shall contain especially i) requirement identifier pursuant Technical specification, ii) requirement revision, iii) requirement text, iv) HW/SW code – identifier according the Contractor technical documentation, iv) verification methods, v) close-out status (no –open/yes –closed), v) link to the relevant section of the Verification plan and any planning document, vi) references to any documentation that demonstrates compliance to the Client's technical requirements.
6. The outcome of Deliverables D1 ii), D2 iii), D3 iii), D4 iii) and D5 iii) shall be **protocols on testing of Devices at the Contractor's place/Reports on the process of Testing** (as stated in Art. VI par. 3 hereof). Protocols on testing of Devices hereof shall contain at least: i) the Client's and the Contractor's information, ii) description of the Device, iii) confirmation of the performed tests pursuant to the Verification plan and analysis of results achieved, as defined in the Technical specification, iv) updated version of ICD hereof, v) updated version of VCD and vi) date of execution by the Contractual Parties (hereinafter the "**Protocol on testing of Device**"). This provision shall apply adequately also on the extent of all Reports on the process of Testing and Protocols on testing of Devices at the research center ELI-Beamlines as stated below.
7. The outcome of each Deliverable D1 iii), D2 iv), D3 iv), D4 iv) and D5 iv) , shall be delivered and tested Device in place of performance documented by **Protocols on testing of Devices at the research center ELI-Beamlines**, as stated in Art. VI par. 3 hereof and **protocols on the handover of Device/s**.
8. All submitted documents executed pursuant hereof shall be well-structured and provided in such level of detail so that a professional in the given area shall be able to assess the correctness of the Contractor's approach in solutions used for the Work or its part and the possibility of achieving the required technical parameters defined in this Contract by the methods used. Furthermore, the documents must contain all the facts required by this Contract and its annexes. All submitted documents executed pursuant hereof shall be prepared for the Client in Czech and English language.

## **VI. ACCEPTANCE PROCEDURE AND FULFILMENT OF COVENANTS:**

### **1. Verification Control Board:**

The Client shall set up a v Verification Control Board to carry out preliminary and final

assessment of the results of the Contractor's activities hereunder (hereinafter the "Verification Control Board"); the Client shall notify the Contractor of the panel's composition. The Verification Control Board reviews and assesses the execution of the Work from its technical perspective.

2. Acceptance procedure of technical reports as outputs of Deliverables or their parts, as stated in Art. V hereof:

a) Preliminary assessment

- i. In order to preliminarily assess the technical reports as outputs of Deliverables hereof or their parts, the Contractor undertakes to provide the Client with the draft of technical report relating to the respective individual deliverable or its part, and corresponding to mid- and final stages of the progress in execution of each particular Deliverable or its part.
- ii. The Client shall provide the Contractor with his comments to the submitted draft reports or draft proposals which the Contractor shall be obliged to take into account, i.e. the Contractor shall accept all justified and materially correct comments and requirements made by the Client. Should the Contractor consider some of the comments or requirements made by the Client as materially incorrect or unacceptable, the Contractor shall specify his reasons for refusing to accept such in writing. In the case that the Client will not provide the Contractor with its comments within this deadline; it shall be deemed that the Client has no comments and that he is obliged to issue the acceptance protocol within the meaning of letter b) of this Art VI. par. 2 of this Contract.
- iii. Should the Client reach a conclusion that a personal meeting with the Contractor is required in order to properly execute any Deliverable or its part, the Client shall invite the Contractor to attend such a meeting at the Client's registered offices. The Contractor shall be obliged to attend such meeting at the Client's registered offices, at least once in connection with execution of each Order and at least once in connection with execution of each Deliverable or its part hereof. Upon Contractor's request the meeting may be replaced by videoteleconference. The Contractual Parties shall prepare a protocol documenting every such meeting. Should the protocol contain comments, the Contractor shall be obliged to follow procedure outlined in point ii. above.

b) Acceptance Certificate

Should the technical reports comply with requirements of the Client and contain essentials as set forth herein, the Client shall issue to the Contractor, without undue delay, a confirmation attesting to their acceptance (hereinafter the "Report Acceptance Certificate").

The Contractor's obligation arising on the basis of technical report Deliverable or its part as specified in Art. V hereof shall be deemed to have been fulfilled by the issue of the Report Acceptance Certificate confirming the completeness of the technical report prepared pursuant to this Contract.

3. Acceptance procedure of Protocol on testing of Devices at Contractor's place/Report on the process of testing at Contractor's place/Protocol on testing of Device at the research center ELI-Beamlines, as outputs of deliverables or its parts, as stated in Art. V hereof:

a) Testing of Devices

- i. The Contractor shall invite sufficiently in advance the Client to participate at the testing of Device, at least ten (10) working days prior to the testing pursuant to the Verification plan.
  - i. During testing the compliance of the Devices with the Technical specification and Contractor's Bid, and inspections and tests of Devices shall be verified in accordance with the Verification plan.
  - ii. The process of testing and its results shall be documented by the Contractor in a **Protocol on testing of Devices at the Contractor's place/at the research center ELI-Beamlines**, which shall be signed by both Contractual Parties. Should the Protocol on testing of Devices contain any comments of the Client on the results of the testing, the Contractor shall respond to such comments, i.e. the Contractor shall accept all materially correct and legitimate comments or requirements of the Client. Should the Contractor some of the comments or requirements consider materially incorrect or unacceptable the Contractor must specify reasons for their refusal in writing.
  - iii. In the case of Deliverables D1 ii), D2 iii), D3 iii), D4 iii) and D5 iii) the Client is not obliged to be present during the testing; in such a case the Contractor shall prepare a report on the process of testing and its results (hereinafter the „**Report on the process of testing**“) and hand it over to the Client. In such a case the provisions of Art. VI par. 2 letter a) point ii) and iii) and letter b) of this Contract shall analogically apply on the evaluation and acceptance of the Report on the process of testing.
- b) If the output of part of Deliverable hereof is the Report on the process of testing/Protocol on testing of Devices at the Contractor's place, the Client shall issue to the Contractor, without undue delay, a confirmation on the proper execution of Deliverable or its part (hereinafter the “**Acceptance Certificate on testing of Devices at the Contractor's place**“), if the results of testing of Device are in accordance with the Verification plan and the results of testing presented in the Report on the process of testing/Protocol on the testing of Devices at the Contractor's place show that Devices fulfil in every aspect the requirements of the Client stipulated in the Technical specification and in the Contractor's Bid.
- c) In the case of parts of Deliverables, whose output is the Protocol on testing of Devices at the research centre ELI – Beamlines, the Client shall issue to the Contractor, without undue delay, a confirmation on the proper execution of such partial performance (hereinafter the “**Acceptance Certificate on testing of Devices at the Research centre ELI-Beamlines**“) provided that the following conditions have been simultaneously satisfied:
- i. The Contractor shall deliver relevant devices to the Client without defects or unfinished works, about which was between Contractual parties executed the handover protocol on handover and takeover of these devices by the Client (hereinafter the “**Handover Protocol**“);



- ii. the results of testing of these devices pursuant to the Verification plan demonstrate that these devices fulfil in every aspect the requirements of the Client specified in the Technical specification and reach required technical parameters;
- iii. the Contractor handed over to the Client the filled VCD concerning relevant devices;
- iv. the Contractor handed over to the Client a declaration that these device complies with the applicable legal regulations of EU or Czech Republic, technical norms, Technical specification and Contractor's Bid;
- v. the Contractor delivered to the Client the operating procedures manual for the operations of these devices in accordance with this Contract; The Contractor fulfilled all requirements of the Client stipulated in Technical specification and this Contract;
- vi. And only in the case of Deliverable D5 iv) hereof the Contractor realised the training of persons designated by the Client pursuant hereto.

If the Contractor does not deliver to the Client all the above listed documents, the Deliverable shall not be duly completed and eligible for handover.

d) The fulfilment of obligations

Deliverable, whose output is the Protocol on testing of Devices at the Contractor's place/Report on the process of testing/Protocol on testing of Devices at the research centre ELI – Beamlines, shall be considered as complete by issuing the Acceptance Certificate on testing of Devices at the Contractor's place / Acceptance Certificate on testing of Devices at the research centre ELI – Beamlines by the Client.

4. Joint provisions for the acceptance procedure and fulfilment of obligations:

- a) The Client shall not be obliged, during the course of the acceptance procedure, to verify the correctness of any calculations or details of the proposed technical solutions.
- b) The assessment and subsequent acceptance of the individual parts of Work/ Deliverables does not release the Contractor from his liability for the correctness and completeness of the entire Work.
- c) Should it be necessary to modify any part of the already accepted Deliverable of the Work in order to meet the parameters expected of the completed Work, the Contractor undertakes to perform such modifications and accepts that the costs related thereto are included in the Price as agreed in Art. X par. 1 hereof.
- d) The Contractual Parties may replace meetings in person by other forms of communication (e.g. videoconference), as long as they agree on such in writing.
- e) Each Contractual Party shall bear its expenditures related to their participation in meetings at the other Contractual party's registered offices; costs which would however arise due to error, faulty performance or breach of contractual provisions of the Contractual Parties shall be borne by that Contractual Party which caused such breach.

VII. TERM – TIME SCHEDULING

The Contractor undertakes to perform the Work and its part in terms stated in the integral Schedule of Deliverables .

### VIII. PLACE OF DELIVERY:

Unless the Contract stipulates otherwise, the place of handover and takeover of the Work or its part hereof shall be (by Client's choice) the address of the planned ELI-Beamlines research centre in Dolní Břežany or another address in Central Bohemia Region; the Client shall notify to the Contractor the specific place of delivery hereof sufficiently in advance before the date of performance hereof. In the event that the Client will not do it sufficiently in advance before the term stated in the Schedule of Deliverables, the Contractor is obliged to ask the Client for the statement in writing about the exact place of delivery.

### IX. TRANSFER OF OWNERSHIP RIGHTS

The ownership rights to the Work or its parts shall pass to the Client upon the physical handover of each respective performance (Device or its part) by the Contractor. The risk of damage shall not pass to the Client before the ownership rights.

### X. PRICE OF WORK; INVOICING; PAYMENT:

1. The total (maximum) price of Work has been set forth on the basis of the Contractor's bid in the amount not exceeding the maximum possible amount of EUR 355 557,00 excluding VAT, in words: **threehundredfiftyfivethousandfivehundredfiftyseven** EUR, excluding VAT (hereinafter the "Price of the Work"). *The Contractor is obliged to fill in this Art. X para 1 as the Price of the Work the sum of all Deliverables D1 to D5 as stipulated in Annex 6 para 1 hereof.*
2. The price of Deliverables is stated for the purposes of this Contract in integral Annex 6 hereto (The breakdown of the Price of Work and Payments Schedule).
3. The Price of the Work shall cover any and all performance provided by the Contractor in order to fulfil all of the Client's requirements to properly execute and deliver the Work hereunder, and includes all costs accrued by the Contractor during the execution of the Work and its handover at the registered offices of the Client incl. all fees, customs duties and insurance as well, etc.
4. Contractual Parties have agreed that the Contractor shall be authorized to invoice the Price of the Work in accordance with Annex 6 hereto.
5. VAT shall be imposed on top of all payments made hereunder according to valid legislation, if applicable.
6. The due date of all invoices issued hereunder shall be thirty (30) days from the date of their delivery to the Client (hereinafter the "Due Date"). A payment of the amounts invoiced shall be understood to be effected on the day such are remitted to the bank account of the Contractor. The tax documents – invoices issued by the Contractor

hereunder shall in compliance with all applicable legal regulations of the Czech Republic include especially the following data:

- a) Commercial name and seat of the Client,
- b) Tax identification number of the Client,
- c) Commercial name and seat of the Contractor,
- d) Tax identification number of the Contractor,
- e) Number of the tax document – invoice,
- f) Quantity (extent) and nature of performance supplied or services rendered,
- g) The date of issue of the tax document – invoice,
- h) The day of the supply of goods or services or the date of the payment on account, whichever comes sooner, in so far as they differ from the date of issue of the tax document – invoice,
- i) Due Date,
- j) The price,
- k) Statement that the performance is provided in connection with the “ELI: EXTREME LIGHT INFRASTRUCTURE” Project, Reg. No. CZ.1.05/1.1.00/02.0061,
- l) registered number of the Contract, which the Client shall communicate to the Contractor based on the Contractor’s request before the issuance of the invoice

and, furthermore, the tax documents – invoices shall also be in compliance with agreements on avoidance of double taxation, if applicable in particular cases.

7. The Contractor is obliged to issue invoice stipulated herein without delay, after all requirements are met. The last invoice of each calendar year must be delivered by the Contractor to the Client’s mail room no later than on December 15 of that calendar year. Should a tax document – invoice not be issued in compliance with payment terms defined herein or should it not meet the statutory requirements, or if it should not be delivered to the Client by deadlines set hereunder, the Client is entitled to return the tax document -invoice back to the Contractor as incomplete, or incorrectly issued, for its correction, or re-issue, within five (5) business days from the date of its delivery to the Client. In such a case, the Client shall not be in default with the remittance of the Price of the Work or any portion thereof, and the Contractor shall issue a corrected invoice with a new identical due date which shall commence to run on the day of delivery of the corrected or re-issued tax document - invoice to the Client.
8. The Client’s invoicing details are given in Art. I hereof.

#### **XI. WARRANTY, WARRANTY AND OUT-OF-WARRANTY SERVICE:**

1. The Work shall be deemed to be defective if its implementation or its parts fail to correspond to the results defined herein.
2. The Contractor shall be liable for any defects on the Work or any of its parts at the time of its handover and acceptance, as well as for defects that may be discovered on the Work or its parts during the entire warranty period (quality guarantee).

3. The Contractor shall provide quality warranty of the Device for a period of 24 months.
4. The warranty period shall commence on the date of execution of the Handover Protocol on handover and takeover of the Device by the Client pursuant hereof.
5. Any requests to remove defects on the Work or its part during the warranty period shall be exercised in writing by the Client against the Contractor without undue delay after such were discovered, no later than on the last day of the warranty period (hereinafter the "Warranty Claim"). Warranty Claim transmitted by the Client even on the last day of the warranty period shall be deemed to have been exercised on time.
6. The Contractor shall review all submitted Warranty Claims, notify the Client whether he recognizes the claim, and inform the Client in writing on the deadline for the removal of the defect within one week of the date on which the claim was delivered to him by the Client.
7. The Contractor undertakes to remedy any claimed defects on the Work or its parts free of charge and without undue delay.
8. Unless the Parties agree otherwise (in writing), the maximum period for removal of a defect shall be 15 (fifteen) business days from the date the Warranty Claim was submitted to the Contractor.
9. The Contractor shall be obliged to remove defects on the Work also in instances when the Contractor is of the opinion that he is not liable for such defects.
10. Cost accrued in connection with the removal of defects in these disputable cases shall be borne by the Contractor until such dispute is resolved.
11. Removal/remedy of claimed defect shall be subject to a protocol in which the Contractual Parties confirm the defect's removal. The warranty period shall extend by any period that passed between the claim notification and removal of the defect.
12. Acts of the Contractual Parties shall constitute claims under this Article if made in writing or by electronic means of communication by one of the representatives of the Contractual Parties pursuant to Art. XVII par. 1 and 2 hereof and delivered to the address of the other Contractual Party pursuant to Art. I or Art. XVII. par. 1 or 2 hereof.

## XII. INTELLECTUAL PROPERTY RIGHTS

1. The Contractor, while performing the work in the accordance herewith shall not act in a breach of the rights of third parties, arising to such third parties from intellectual property rights, namely author's rights pursuant to Act. No. 121/2000 Coll., on Copyrights, Rights Related to Copyright and on amendment of certain other Acts, as amended (hereinafter referred to as the "Copyright Act") and from industrial rights pursuant to dedicated legislation of the Czech Republic and of other states as well as from International treaties on intellectual property rights protection.
2. In the event that in the connection with the execution of this Contract the Work as a whole or its part shall constitute a copyrighted work within the meaning of the Copyright Act, the Contractor grants to the Client by signing of this Contract a nonexclusive, royalty-free licence to use the copyrighted work (or any of its parts), to which the Contractor undertook on the basis thereof and which is or will be protected by the Copyright Act, in the unlimited extent and for all manners of use specified in Section 12 of Copyright Act on the territory of the whole word. The Contractor explicitly acknowledges that he grants to the Client a nonexclusive, royal-free licence to use all designs of Devices, as results of performance hereof, for the manufacture of an unlimited number of such devices, and for the period of duration of proprietary rights to such parts of Work .
3. Copyrighted work (Art. XII par. 2) and industrial rights (Art. XII par. 3) are jointly referred to, for the purposes hereof, as intellectual property rights. In the event that the execution of this Contract will result into Work or any part thereof, which the Contractor is entitled to register through any form of industrial rights (i.e. trademark, patent or invention, utility or industrial design etc.) protected according to the valid legal regulation in the Czech Republic or in another country, or international or supra-national body, the Contractor shall grant the Client a royalty-free license to use the Work for the purposes of the ELI-Beamlines Project for the duration of the protection period granted to that particular intellectual property right, and for the purposes of further use of the Work in research and educational activities, as well as for the purposes of this Contract on the territory of the entire World.
4. The Contractor hereby grants to the Client the consent with provision of rights constituting a licence hereof on need to know basis to a third party, i.e. a sub-licence with respect to its main scope of activities and/or the operation of ELI-Beamlines centre.
5. The intellectual property rights according to Art. XII shall pass to the legal successor of the Client or operator of the ELI-Beamlines Infrastructure.

## XIII. PUBLICATION ACTIVITIES

1. The Contractor shall refer all publications arising as a direct result of this Contract to the Client, at least 20 (twenty) calendar days before the publication is submitted to scientific

journal, proceedings or other periodicals. Client and Contractor will agree that comments or amendments suggested by the Client will be added to the text of such publication.

2. The Contractor shall acknowledge in the publications this Contract and the ELI-Beamlines Project as the source of funding supporting the work reported, in the Acknowledgments section of the publication.
3. The Contractor shall observe any applicable regulations governing publicity arising from the binding documentations under OP RD1.

#### **XIV. RIGHTS AND OBLIGATIONS OF THE CONTRACTUAL PARTIES**

1. The Contractor shall fulfil all of its covenants entered into hereunder with professional care, at its own cost and risk, and to observe the deadlines imposed in Art. VII hereof and in the Schedule of Deliverables , for the Price of the Work set forth in Art. X. hereof.
2. The Client shall deliver to the Contractor any and all source documents, materials or other information, which are necessary for the execution of the Work and which the Contractor can reasonably request from the Client under the condition that the Contractor raised any such requirements with sufficient advance ensuring fulfilment of the deadlines for delivery of the Work as defined herein.
3. The Contractor shall be obliged to take into account, in the execution of the Work hereunder, all requirements of the Client that are aimed at achieving the highest quality of the objectives hereof, unless such are contrary to the law.
4. The Contractor shall be obliged to inform the Client on the progress achieved in the Work's execution, at least once a month, in the form of an e-mail report.
5. Under the terms and conditions of this Contract and in the accordance with instructions issued by the Client, the Contractor, using all necessary professional care, shall:
  - i. duly archive all written material prepared in connection with the execution of the Work hereunder and to provide access to the Client to these archived documents until 2021. The Client shall be entitled to take possession of these documents after ten years from the completion of the Work hereunder from the Contractor free of charge;
  - ii. cooperate during financial inspections carried out in accordance with Act No. 320/2001 Coll., on Financial Inspections, as amended, i.e. to allow the Managing Authority of the Operational Program Research and Development for Innovation (hereinafter the "Sponsor") to access also those portions of the tender (bid) submitted within the Procurement Procedure, the Contract, Orders and related documents which may be protected by special legal regulation, given that all requirements set forth by legal regulation with respect to the manner of executing such inspections will have been observed; the Contractor shall bind any of its sub-contractors to comply with this obligation accordingly.

6. The Contractor undertakes to fulfil all the Client's requirements stipulated in this Contract.
7. The Contractor is fully responsible for damage caused by his subcontractors to the Client.

#### **XV. LIABILITY, SANCTIONS**

1. In the case where the Contractor shall be in delay with any of the part of Deliverables D1 i), D 2 ii), D3 ii), D4 ii) and D5 ii) , the Contractor is obliged to pay to the Client contractual penalty in the amount of 0,1% from the price of Deliverable pursuant to par. 1 of Annex 6 hereto, with which is in delay, and for each case of breach of such obligation and for each day of delay.
2. In the case where the Contractor shall be in delay with any of the part of Deliverables D1 iii), D 2 iv), D3 iv), D4 iv) and D5 iv), the Contractor is obliged to pay to the Client contractual penalty in the amount of 0,2% from the price of Deliverable pursuant to par. 1 of Annex 6 hereto, with which is in delay, and for each case of breach of such obligation and for each day of delay.
3. In the case where the Contractor shall a) fail to remove the warranty-claimed defects of the Device within the period stipulated by Art. XI par. 8, and/or b) fail to send the Client the report on progress achieved in the Work's execution pursuant to Art. XIV par. 4 hereof, and/or refuse to attend any meeting pursuant Art VI hereof, the Contractor shall be obliged to pay contractual penalty in the amount of 200 EUR for each case of breach of such obligation for each day of delay.
4. The Client is entitled to offset any of its claims to contractual penalty in accordance with this Art. XV hereof against any claims of the Contractor to payment of any part of the price in accordance herewith.
5. The Parties exclude use of Sec. 2050 of the Civil Code. By the payment of contractual penalty in accordance with this Art XV hereof, no claim of the Client to damage compensation shall be excluded, neither affected.

#### **XVI. TERMINATION OF THE CONTRACT, VIS MAJOR:**

1. This Contract may be terminated by its fulfilment / completion, by agreement of the Contractual Parties or by withdrawal from the Contract for reasons specified in law or in this Contract.
2. The Client shall be entitled to withdraw from the Contract without sanction should any of the below specified events occur:
  - a) any expenditure or any part thereof, which may arise on basis of this Contract, are declared by the Sponsor or other controlling body to be ineligible, or

- b) the Client's financial support (aid) provided toward implementation of the ELI-Beamlines Projects is withdrawn;
  - c) The Contractor at least two times breached any conditions stated by this Contract; or
  - d) The Device during acceptance procedure pursuant to Art. VI par. 3 hereof within the testing phase does not fulfil requirements of the Client on the Device defined in the Technical specification, even after three repetitions.
3. In case of termination of the Contract due to reasons given in par. 2 of this Article, the Contractor shall be eligible for payment for the actually executed part of the Work delivered to the Client, if such had been executed in accordance with the terms and conditions hereof.
  4. In the event of termination of this Contract by the Client for other reasons than for the reasons of a breach of obligations on the part of the Contractor, the Contractor shall have the right to payment of the part of the Price representing the costs which he accrued in connection with the fulfilment of his obligations hereunder prior to the Contract termination by the Client, and which could demonstrably not be cancelled in time and if such costs accrued by the Contractor are not covered from other external sources.
  5. Things, rights and any other values, whose price was paid for by the Client to the Contractor according to par. 4 of this Article, shall pass, by payment, into the ownership of the Client and the Contractor shall be obliged to allow the Client to dispose with such accordingly. The risk of damage shall pass to the Client upon handover.
  6. The act of withdrawal from the Contract shall become effective on the day of delivery of the notification in writing from one Contractual Party to the other with consequences of the Contract termination effective in the "ex nunc" regime.
  7. Circumstances precluding liability shall be deemed to have been constituted by such circumstances / obstacles which arose independently of the will of the obliged Contractual Party, and which prevent fulfilment of that Contractual Party's obligation, provided that it could not be reasonably expected that the obliged Contractual Party could overcome or avert this obstacle or its consequences, and furthermore that such Contractual Party could foresee such obstacle when it entered into the respective covenants (hereinafter "Vis major"). Liability cannot be precluded by obstacles that arose only after the obliged Contractual Party was in default with fulfilment of its obligations, or which arose in connection with its economic situation. The effects precluding liability shall be limited to the period during which the obstacles causing these effects persist.
  8. Should a situation occur, which a Contractual Party could reasonably consider to constitute Vis major, and which could affect fulfilment of its obligations hereunder, such Contractual Party shall immediately notify the other Contractual party and attempt to continue in its performance hereunder in a reasonable degree. Simultaneously, such Contractual Party



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

9. If a situation constituting Vis major occurs, the deadlines imposed hereunder shall be extended by the period of the duration of the said Vis major event.

#### **XVII. REPRESENTATIVES, NOTICES:**

1. The Contractor has appointed the following representatives responsible for the management and performance of the Work hereunder and communication with the Client:

In technical matters:

**RNDr. Jiří Drbohlav, PhD.**

E-mail: [jiri.drbohlav@pfeiffer-vacuum.cz](mailto:jiri.drbohlav@pfeiffer-vacuum.cz)

Tel.: 00420 257 923 888

In contractual matters:

**Dr. Ing. Radan Salomonovič**

E-mail: [radan.salomonovic@pfeiffer-vacuum.cz](mailto:radan.salomonovic@pfeiffer-vacuum.cz)

Tel.: 00420 257 923 888

2. The Client has appointed the following representatives responsible for communication with the Contractor for the purposes of realization of the Work:

In technical matters:

**Ing. Pavel Korouš**

E-mail: [Pavel.Korous@eli-beams.eu](mailto:Pavel.Korous@eli-beams.eu)

Tel.: + 420 702 004 85

In contractual matters:

**prof. Jan Řídký, DrSc.**

Tel: +420 266 052 121,

Email: [ridky@fzu.cz](mailto:ridky@fzu.cz)

3. Any and all notices transmitted between the Contractual Parties hereunder must be made in writing and delivered to the other Contractual Party by an internationally recognized courier service (Federal Express, DHL, etc.), delivered in person (with a written confirmation of receipt), by a registered letter or in the form of electronic communication carrying electronic signature sent to [epodatelna@fzu.cz](mailto:epodatelna@fzu.cz) for the Client and to [office@pfeiffer-vacuum.cz](mailto:office@pfeiffer-vacuum.cz) for the Contractor.
4. In expert or technical matters (matters related to preliminary assessment of the delivery of Work, Warranty Claims, etc.) electronic communication will be acceptable between the appointed representatives for technical matters to e-mail addresses as provided in par. 2 here above.

## **XVIII. DISPUTES:**

1. This Contract and any and all legal relations arising herefrom shall be governed by the laws and regulations of the Czech Republic.
2. The Contractual Parties acknowledge and recognize that areas not explicitly regulated hereby shall be regulated by the respective provisions of the Civil Code (Czech Act. No. 89/2012 Coll.).
3. Any and all disputes arising in connection herewith shall be resolved by the Contractual Parties by negotiations. In cases where a dispute cannot be resolved by negotiation within sixty (60) days, such a dispute shall be decided upon a motion of one of the Contractual Parties by a competent court in the Czech Republic.

## **XIX. INSURANCE:**

1. The Contractor declares that he is adequately insured for any liability in respect of compensation for damages in connection with the performance of this Contract, for 2500000 EUR, to the amount of the Price of Work. The Contractor shall maintain in force insurance contracts, as stated in first sentence hereof from the date of implementation of the Work and for at least four (4) years after its completion. The Contractor shall submit to the Client the insurance contract at his request. Failure to submit an insurance contract is a material breach of the Contract and the Client is entitled to cancel the contract.

## **XX. CONCLUDING AND OTHER COVENANTS:**

1. This Contract with all annexes represents a complete agreement between the Client and the Contractor.
2. 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 the invalidity, putativeness, ineffectiveness, or unenforceability of the Contract as a whole. In such event the Contractual Parties undertake without any undue delay to subsequently clarify any such provision using Sec 553 (2) of the Civil Code, 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 Contractual Parties to the Contract at the time of creation hereof.
3. This Contract becomes valid and comes into force on the date of its signature by the authorized representatives of both Contractual Parties.

4. This Contract may be amended or modified exclusively in the form of written and numbered amendments specifying the time and place thereof, and signed by the authorized representatives of the Contractual Parties. The Contractual parties expressly reject, within the bounds of Sec 564 of the Civil Code, modification of the Contract in any other manner.
5. This Contract was made out in four (4) counterparts, each having the force of original. Each Contractual Party shall receive two (2) counterparts.
6. The Annexes listed below form an integral part of this Contract:

Annex 1: Scope of Work

Annex 2: Technical specification

Annex 3 : Schedule of Deliverables

Annex 4: the Contractor's Bid

Annex5: Verification plan (shall be attached pursuant to Art. V par. 4 hereof after signing of the Contract)

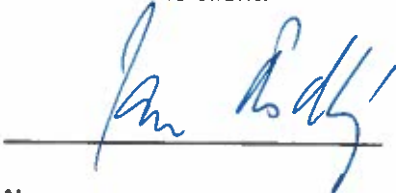
Annex 6: The breakdown of the Price of Work and Payments Schedule

7. By attaching their signature hereto the Contractual Parties express their consent with the content hereof in its entirety.

In Prague on 9. 6., 2016

In Vienna on 15. 06. 2016

In behalf of the Client:



Name:

In behalf of the Contractor:

**PFEIFFER VACUUM**

Pfeiffer Vacuum Austria GmbH

Diefenbachgasse 35 • 1150 Vienna • Austria

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Dipl.-Ing. Reinhard Schnitzler

Pfeiffer Vacuum Austria GmbH - director

## Annex 1 – Scope of Work

The detailed description of the subject matter of the Contract:

1. According to the Contract and for the Price of Work the Contractor shall design, manufacture, assemble, test and deliver in the place of delivery stipulated in the Contract following Devices that fulfill the requirements of the Technical specification of the Client, this Contract and the Contractor's Bid:

Item	Dwg title	Dwg no	QTY – pcs	
1	Bellows	Bellows_DN250_230	00104221	20
2	Pipes	L1E1_P01_CH2-3	00104267	1
		L1E1_P02_CH2-3	00104268	1
		L1E1_P03_CH3-5	00104269	1
		L1E1_P05_CH3-5	00104281	1
		L1E1_P06_CH3-5	00104282	1
		L1E1_P12_CH8-9	00104289	1
		L1E1_P13_CH8-9	00104290	1
		L1E1_P14_CH9-10	00104292	1
		L1E1_P15_CH9-10	00104293	1
		L1E1_P16_CH10-12	00104294	1
		L1E1_P18_CH10-12	00104296	1
		L1E1_P19_CH10-11	00104297	1
		L1E1_P20_CH10-11	00104298	1
		L1E1_P21_CH10-11	00104301	1
		L1E1_P22_CH10-11	00104302	1
		L1E1_P23_CH10-13	00104303	1
		L1E1_P24_CH13-HHG	00110952	1
L1E1_P25_CH12-PSX	00110962	1		
3	Support frames for pipes	L1E1_F4	00110881	3
		L1E1_F5	00101717	12
		L1E1_F6	00104392	1
4	Support frames for chambers	L1E1_F2	00109283	2
		L1E1_F3	00109230	2
5	Chambers	L1E1_CH8	00090530	1
		L1E1_CH9	00090538	1
		L1E1_CH11	00090540	1

2. The Work according to the Contract shall consist of following Deliverables and their parts as are listed below in the table designated as "The description of

the subject matter of the Contract”, which the Contractor undertakes to perform:

The description of the subject matter of the Contract

Deliverable	The description of the parts of Deliverable
<p><b>D1:</b> The Contractor shall design, manufacture, assemble, test and deliver to the Client 20 pcs of bellows specified under items 1 above (hereinafter the “Deliverable D1”)</p>	<p>Within this Deliverable 1 the Contractor shall:</p> <ul style="list-style-type: none"> <li>a) develop the Conceptual design of the bellow into detailed plan of this Device (hereinafter “Deliverable D1 i”);</li> <li>b) manufacture and assemble 20 pcs of bellows in accordance with the detailed plan of this Device approved by the Client within Deliverable 1 i) and shall test these devices pursuant to the Verification plan at the Contractor’s premises (hereinafter “Deliverable D1 ii”);</li> <li>c) deliver 20 pcs of above mentioned bellows and test them pursuant to the Verification plan in the Research center ELI-Beamlines (hereinafter “Deliverable D1 iii”).</li> </ul>
<p><b>D2:</b> The Contractor shall design, manufacture, assemble, test and deliver to the Client 18 pcs of vacuum pipes specified in the table above under items 2 above (hereinafter “Deliverable D2”).</p>	<p>Within this Deliverable 2 the Contractor shall:</p> <ul style="list-style-type: none"> <li>a) develop the Conceptual design of all vacuum pipes presented by the Client so, that the preliminary designs of these devices are created (hereinafter “Deliverable D2 i”);</li> <li>b) develop preliminary designs of these devices approved by the Client in Deliverable 2 i) into detailed plans of these devices (hereinafter “Deliverable D2 ii”);</li> <li>c) manufacture and assemble all vacuum pipes pursuant hereof in accordance with the detailed plan of these devices approved by the Client within Deliverable 2 ii) and shall test these devices pursuant to the Verification plan at the Contractor’s premises (hereinafter “Deliverable D2 iii”);</li> <li>d) deliver 18 pcs of above mentioned vacuum pipes and test them pursuant to the Verification plan in the Research center ELI-Beamlines (hereinafter “Deliverable D2 iv”).</li> </ul>
<p><b>D3:</b> The Contractor shall design, manufacture, assemble, test and deliver to the Client 16 pcs of frames for vacuum pipes specified in the table above under item 3 above (hereinafter “Deliverable D3”).</p>	<p>Within this Deliverable 3 the Contractor shall:</p> <ul style="list-style-type: none"> <li>a) develop the Conceptual design of all frames for vacuum pipes presented by the Client so, that the preliminary designs of these devices are created (hereinafter “Deliverable D3 i”);</li> <li>b) develop preliminary designs of these devices approved by the Client in Deliverable 3 i) into detailed plans of these devices (hereinafter</li> </ul>

	<p>"Deliverable D3 ii)");</p> <p>c) manufacture and assemble all frames for vacuum pipes pursuant hereof in accordance with the detailed plan of these devices approved by the Client within Deliverable 3 ii) and shall test these devices pursuant to the Verification plan at the Contractor's premises (hereinafter "Deliverable D3 iii)");</p> <p>d) deliver 16 pcs of above mentioned frames for vacuum pipes and test them pursuant to the Verification plan in the Research center ELI-Beamlines (hereinafter "Deliverable D3 iv)").</p>
<p>The Contractor shall design, manufacture, assemble, test and deliver to the Client 4 pcs of frames for chambers specified in the table above under item 4 above (hereinafter "Deliverable 4").</p>	<p>Within this Deliverable 4 the Contractor shall:</p> <p>a) develop the Conceptual design of all frames for chambers presented by the Client so, that the preliminary designs of these devices are created (hereinafter "Deliverable 4 i)");</p> <p>b) develop preliminary designs of these devices approved by the Client in Deliverable 4 i) into detailed plans of these devices (hereinafter "Deliverable 4ii)");</p> <p>c) manufacture and assemble all frames for chambers pursuant hereof in accordance with the detailed plan of these devices approved by the Client within Deliverable 4 ii) and shall test these devices pursuant to the Verification plan at the Contractor's premises (hereinafter "Deliverable 4 iii)");</p> <p>d) deliver 4 pcs of above mentioned frames for chambers and test them pursuant to the Verification plan in the Research center ELI-Beamlines (hereinafter "Deliverable 4 iv)").</p>
<p>The Contractor shall design, manufacture, assemble, test and deliver to the Client 3 pcs of vacuum chambers specified in the table above under item 5 above (hereinafter "Deliverable 5").</p>	<p>Within this Deliverable 5 the Contractor shall:</p> <p>a) develop the Conceptual design of all vacuum chambers presented by the Client so, that the preliminary designs of these devices are created (hereinafter "Deliverable 5 i)");</p> <p>b) develop preliminary designs of these devices approved by the Client in Deliverable 5 i) into detailed plans of these devices (hereinafter "Deliverable 5 ii)");</p> <p>c) manufacture and assemble all vacuum chambers pursuant hereof in accordance with the detailed plan of these devices approved by the Client within Deliverable 5 ii) and shall test these devices pursuant to the Verification plan at the Contractor's premises (hereinafter "Deliverable 5 iii)");</p>

2/2

	d) deliver 3 pcs of above mentioned vacuum chambers and test them pursuant to the Verification plan in the Research center ELI-Beamlines (hereinafter "Deliverable 5 iv").
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3. In accordance with Art. III par. 3 of the Contract the Client is entitled until the term for delivery of detailed manufacturing plan of each Device (as stated in in Annex 3 hereof ) to ask the Contractor to modify the Work that shall be included in the Price of Work as follows:
- a. In the case of all vacuum pipes hereof the pipe length can be changed  $\pm 10\%$ ;
  - b. In the case of all vacuum chambers the number of flanges in the height of the optical table can be increased by 20 flanges and the number of flanges in the bottom of the vacuum chamber can be increased by 6 flanges.

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<i>Requirements Specification Document (RSD)</i>			
<p><b>Vacuum components branch L1-E1          including supporting frames          TP14_143</b></p>			
<p><b>Keywords</b>          N/A</p>			
	<b>Position</b>	<b>Name</b>	
<b>Responsible person</b>	Chief Engineer		
<b>Prepared by</b>	Group Leader of Vacuum and Cryogenics		





EVROPSKÁ UNIE  
EVROPSKÝ FOND PRO REGIONÁLNÍ ROZVOJ  
INVESTICE DO VAŠÍ BUDOUCNOSTI



OP Výzkum a vývoj  
pro inovace

Annex No. 3 –  
Technical specifications (Requirements Specification Document + Verification Control  
Document)  
TP14\_143 Vacuum components branch L1-E1 including supporting frames II  
(attached as a separate file)

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# 1. Introduction

## 1.1. Purpose

This Requirements Specification Document (RSD) lists the technical requirements and constraints on system applying in RA1 of ELI project. This leads to the identification of interfaces with the ELI laser systems and ELI building facility. This RSD also acts as the parent document for the technical requirements that need to be addressed in lower level design description documents.

## 1.2. Scope

This RSD contains all of the top level functional, performance, safety, operational, design and quality requirements for the **components of vacuum distribution L1 – E1**. In addition to the requirements specified in this RSD, this system shall comply completely with the requirements given in the Reference documents [*chapter 1.4*].

## 1.3. Terms, Definitions and Abbreviations

For the purpose of this document, the following abbreviated terms apply:

Abbreviation	Meaning
ELI	Extreme Light Infrastructure
RA1	Research activity 1
HHG	High Harmonic Generation
E1	Experimental hall 1
ESD	Electrostatic discharge
L1	Laser Hall 1
RSD	Requirement Specification Document
BT	Beam Transport
RC	Rectangular Chambers
CC	Cylindrical Chambers
CVC	Central Vacuum Control
TMP	Turbo Molecular Pump
R	Review of Design
FD	Functional Demonstration
T	Test
A	Analysis
I	Inspection
L x W x H	Length x width x height
N/A	Not Applicable
VP	Verification Plan

VCD	Verification Control Document
TRPT	Test report
ARPT	Analysis report
IRPT	Inspection report
VRPT	Verification report
TRR	Test Readiness Review
TSPE	Test specifications
PTR	Post Test Review
TPRO	Test procedures
CM	Compliance Matrix
VM	Verification Matrix
FPM	Fluorelastomer Polymer
CVS	Central vacuum system
ICD	Interface Control Document
RCS	Reference Coordinate System
RMS	Reference Mechanical System
FEM	Finite Element Method

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

- Positioning: placing of component without high precision (no special equipment needed);
- Adjustment: Placing of component with using special equipment (e.g. screws, actuators) to achieve high precision.

## 1.4. Reference documents

Number of document	Title of document
RD-01	TC#(00111980/A) - L1 to E1 Vacuum BT Drawings for tender
RD-02	TC#(00112523/A) - E1 Room datasheet

Detailed list of drawings including within RD-01:

Drawing File [PDF format]
00111980-A_P21_00104301_00.pdf
00111980-A_P22_00104302_00.pdf
00111980-A_P02_00104268_00.pdf
00111980-A_P05_00104281_00.pdf
00111980-A_P13_00104290_00.pdf
00111980-A_P16_00104294_00.pdf
00111980-A_L1E1_CH8_00090530_03.pdf

00111980-A_L1E1_CH9_00090538_02.pdf
00111980-A_L1E1_CH11_00090540_03.pdf
00111980-A_L1E1_F2_00109283_00.pdf
00111980-A_L1E1_F3_00109230_00.pdf
00111980-A_L1E1_F4_00110881_00.pdf
00111980-A_L1E1_F5_00101717_00.pdf
00111980-A_L1E1_F6_00104392_00.pdf
00111980-A_Pipes_length_DN250.pdf
00111980-A_Pipe_DN250.pdf

## 2. General system requirements

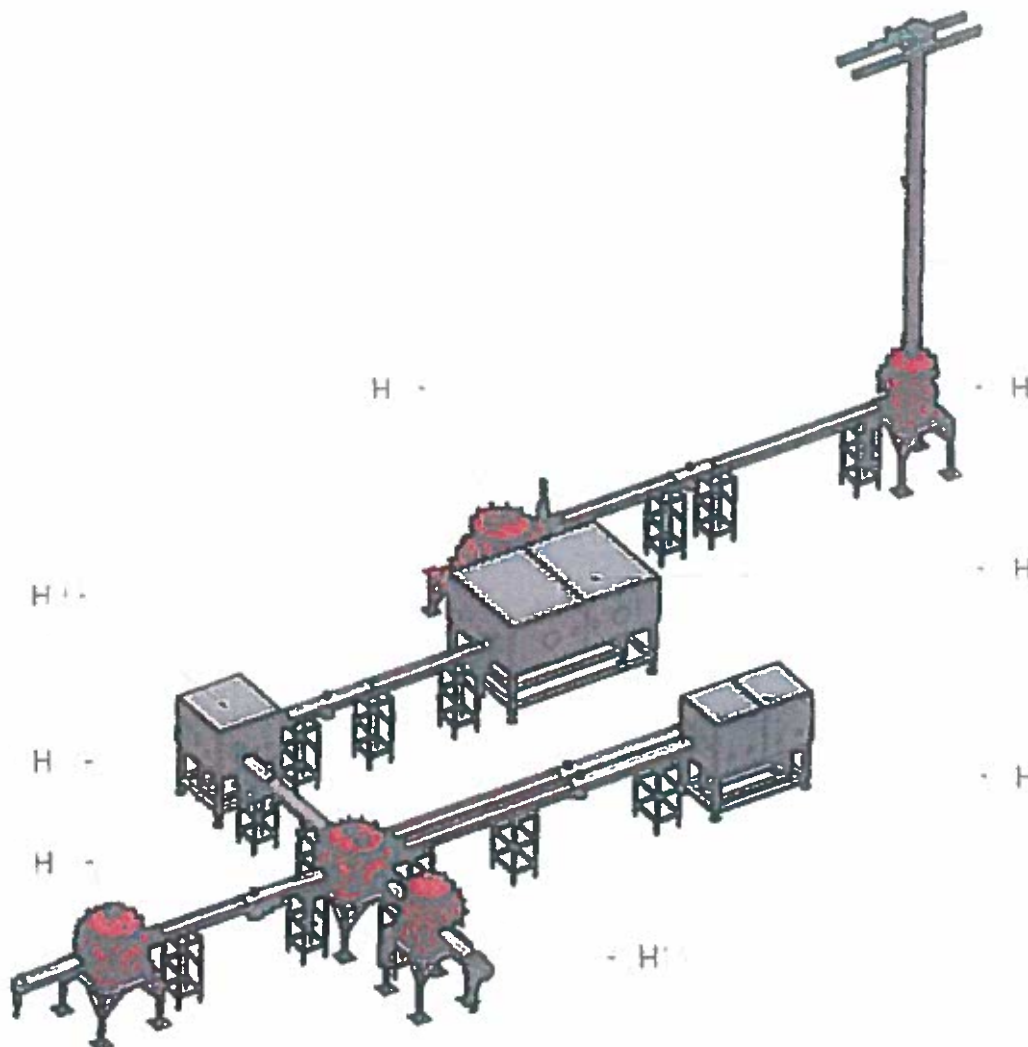
The part of the vacuum distribution consists mainly of vacuum chambers, pipes, bellows, supportive frames and fittings. Components of the vacuum distribution and verified components of the vacuum distribution are included in the delivery. Supplier is responsible for the delivery of the vacuum components specified in further chapters.

### 2.1. System Configuration

The beam distribution L1 - E1 ensures propagation of the laser L1 from the room L1 to the room E1 to the final experiments. The beam distribution provides sealed, clean and dry environment of pumped-down volume with the particular level of vacuum (specified further in the requirements). This volume is enclosed by vacuum chambers, pipes and bellows (Figure 1). The volume is pumped-down with the roughing pump and subsequently with TMPs. Other components as vacuum gauges and vacuum valves are also part of the distribution. Primary pumps (backing and roughing pump), vacuum valves, gauges and TMPs are not included in this contract.

The laser beam L1 is propagated further to the final experiments, by use of mirrors and other optomechanic components which are also part of the distribution (placed inside the chambers). Mirrors and other optomechanic components are not included in this contract.

### 2.1.1. Figure 1 Isometric view of the beam transport L1 – E1



**Figure 1 Isometric view of the beam transport L1 – E1**  
(Red marked components will be delivered by Contracting Authority.)

## 2.2. Interface requirements

The beam distribution starts with the electropneumatic gate valve DN250 ISO-F just before the chamber CH2 in the room L1 (CH2 is out of the scope of this RSD). The valve connects the beam distribution with the laser L1.

- The first end of the beam distribution is the electropneumatic gate valve DN250 ISO-F just behind the chamber CH13 in the room E1. The valve connects the beam distribution with the experiment HHG.

- The second end of the beam distribution is the electropneumatic gate valve DN250 ISO-F just behind the chamber CH12 in the room E1. The valve connects the beam distribution with the experiment PXS.
- Connection to the CVS is ensured with connection DN160 ISO-K (Roughing).
- The system is designed for generation of high vacuum with TMPs ATH 2303M and ATH 1603M which are connected to flanges DN250 ISO-F (safety requirements will be provided to the Supplier).
- Vacuum gauges are connected to the system with the flanges DN25 ISO-KF.
- Venting of the system is ensured with electropneumatic valves with interface DN25 ISO-KF.

### 3. Functional and Performance Requirements

REQ-007906/A

Vacuum components of L1 – E1 system shall be designed for vacuum level  $10^{-6}$  mbar.

Verification method: T - test

REQ-008117/A

Vacuum vessels shall allow vacuum pumping and venting.

Verification method: FD - functional demonstration

### 4. Design requirements

#### 4.1. General design requirements

REQ-008273/A

Enclosed drawings shall be taken into account as inputs for preliminary design.

Verification method: R - review

REQ-008323/A

All relevant components (RC Vacuum Chambers including chassis, pipe support structures, CC Vacuum Vessel chassis) shall be designed to accommodate laser beam axis 1300 mm above floor level.

Verification method: R - review

REQ-007914/A

All Vacuum chamber parts heavier than 15 kg shall be equipped with lifting eyes interfaces.

NOTE: Final design of the interfaces will be part of detailed design.

Verification method: R - review



REQ-007923/A

All openings of delivered components shall be closed as follows:

- Vacuum chambers by aluminium alloy or stainless steel blank flanges;
- Vacuum pipes and bellows by plastic caps.

Verification method: I - inspection

REQ-007981/A

Outer surface finish shall be uniform Ballotini (blasting with glass beads). Other finish technologies are possible if agreed with the Contracting Authority.

Verification method: I - inspection

REQ-007982/A

Precautions shall be taken in design and assembly of all vacuum components to avoid trapped volumes in vacuum spaces which could result in virtual leaks and these spaces shall be suitably vented.

Verification method: I - inspection

REQ-007999/A

Maximum dimensions of used components and their non-dismountable sub-components shall be 1,9 x 2,9 x 2,4 m.

Verification method: R - review

REQ-008000/A

Design shall have grounding and ESD.

Verification method: R - review

REQ-008001/A

All opened profiles in frames constructions shall be covered with end caps.

Verification method: I - inspection

REQ-008010/A

Supplier shall provide final information regarding BT L1-E1 weight and weight distribution of BT L1-E1 components.

Verification method: R - review

REQ-007919/A

Vacuum Vessels shall be equipped with inlet and outlet flanges according to the listed standards:

- ISO 1609:1986 - Vacuum technology - Flange dimension;
- ISO 2861:2013 - Vacuum technology - Dimensions of clamped - type quick-release couplings).

Verification method: R - review

REQ-008284/A

Single leak rate for each relevant component (vacuum pipes, bellows) shall be lower than  $1 \cdot 10^{-9}$  mbar·l/s per component.

Verification method: T - test

REQ-008315/A

Total leak rate for each relevant component (vacuum vessels) shall be lower than  $5 \cdot 10^{-4}$  mbar·l/s per component.

Verification method: T - test

### 4.1.1. Cylindrical Chambers (CC)

Following chapter is defining the term of cylindrical chamber of CC type.

#### 4.1.1.1. CC Vacuum Vessels (N/A)

#### 4.1.1.2. CC Vacuum Vessel Chassis

Following chapter is defining the term of vacuum vessel chassis of CC type.

REQ-007993/A

CC Vacuum Vessel Chassis shall be made of stainless steel.

Verification method: R - review

REQ-008118/A

CC chassis shall allow for floor fixing.

NOTE: For further information see the document "E1 room datasheet" (RD-02).

Selected values mentioned in E1 room datasheet are:

- Max. load for floors of experimental halls is 25 kN on surface with dimensions 20x20 cm;
- Anything exceeding these values should be checked and approved by Contracting Authority.

Verification method: R - review

REQ-007997/A

Design of CC Vacuum Vessel Chassis shall allow positioning in x, y direction (horizontal plane) when fixed to floor.

NOTE: Requirement defining interfaces (e.g. bracket with holes) needed for positioning.

Verification method: R - review

REQ-007998/A

Range of CC Vacuum Vessel Chassis adjustment shall be:

- in z direction 30 mm

Verification method: R - review, FD - functional demonstration

REQ-007994/A

CC Vacuum Vessel Chassis shall allow x, y, z vessels adjustment.

Verification method: R - review

REQ-007995/A

Range of CC Vacuum Vessel adjustment shall be (see REQ-007994/A):

- in x direction 20 mm
- in y direction 20 mm
- in z direction 20 mm

Verification method: R - review, FD - functional demonstration

REQ-008008/A

Design solution using screws for adjustment shall be used (see Figure 2).

Verification method: R - review

#### 4.1.1.2.1. Figure 2

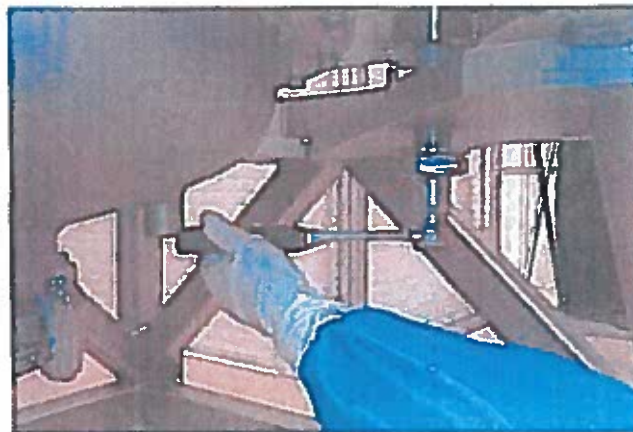


Figure 2

(In relation to verification method of REQ-008008/A)

REQ-007996/A

CC Vacuum Vessel Chassis shall allow clash free installation of Turbomolecular pumps (TMP).

Verification method: R - review

## 4.1.2. Rectangular Chambers (RC)

Rectangular Vacuum Chambers are requested for larger optical set up. More complex optical layout needs more frequent opening of these rectangular chambers.

### 4.1.2.1. General

REQ-008316/A

RC Vacuum Chambers shall provide for the following mechanical interfaces:

- TMP's (Turbo Molecular Pumps);
- Gauges;
- Feedthroughs;
- Diagnostics;
- Remote control;
- Central Vacuum System (CVS);
- Beam Transport (BT);
- Vacuum Gate Valves;
- Vacuum Venting Valves.

Verification method: R - review

REQ-008324/A

RC Vacuum Chambers shall be a modular units allowing extension in longitudinal direction (see Figure 3).

Verification method: R - review

#### 4.1.2.1.1. Figure 3

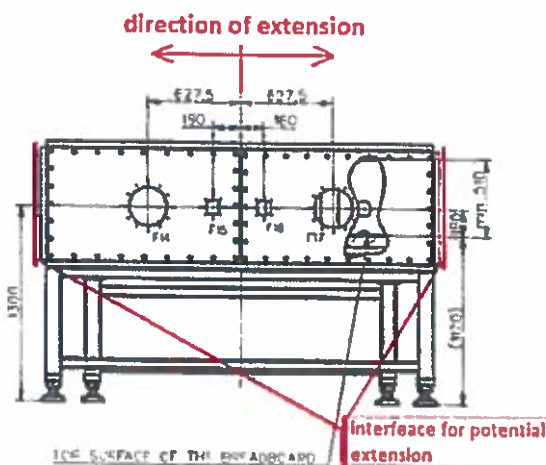


Figure 3 direction of extension  
(In relation to requirement n° REQ-008324/A)

REQ-008321/A

The supplier shall define the Reference Coordinate System (RCS) of the RC Chambers which shall allow positioning these RC Chambers in Contracting Authority's experimental hall according to Reference Mechanical System of the hall (RMS).

Verification method: R - review

REQ-008322/A

RCS and its relation to the RMS shall be set up together with supplier during the preliminary design phase.

Verification method: R - review

REQ-008005/A

RC Breadboard and RC Vacuum Vessel shall allow for decoupling.

Verification method: R - review

REQ-008006/A

Decoupling of RC breadboard and vacuum vessel shall be made by using edge welded bellows.

Verification method: R - review

REQ-008007/A

Double bellows decoupling system shall be applied on RC breadboard chassis (see Figure 4).

Verification method: R - review

#### 4.1.2.1.2. Figure 4

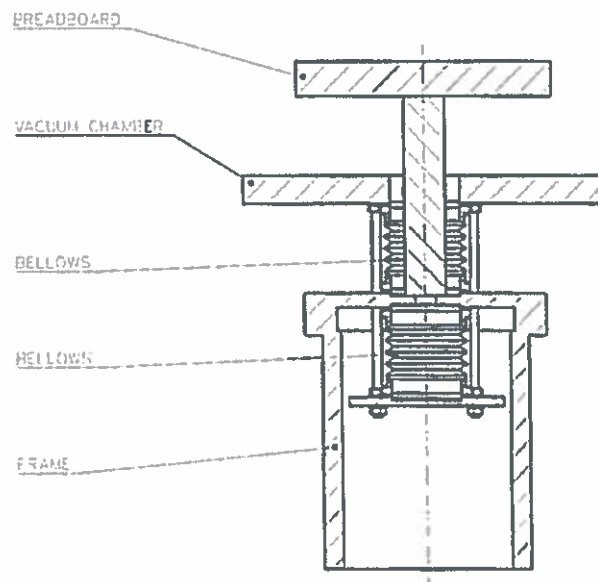


Figure 4

(In relation to requirement n° REQ-008007/A)

REQ-008276/A

All RC Vacuum Vessels and Vacuum Vessel Chassis shall allow installation of Turbomolecular pumps (TMP) as follows:

- Vacuum Vessel – ISO F interface Vacuum Vessel versus TMP;
- Vacuum Vessels Chassis – possibility to dismount the Chassis.

NOTE: Preferable position of TMP's is from the bottom part of Vacuum Vessel.

Verification method: R - review

#### 4.1.2.2. RC Vacuum Vessels

REQ-007913/A

RC frame shall be made of stainless steel.

Verification method: R - review

REQ-007916/A

RC shall be equipped with roughing inlet flange (DN160 ISO –K/F).

Verification method: R - review

REQ-008274/A

RC panels and blank flanges shall be made of stainless steel or aluminium alloy following types:

- Aluminium alloy:
  - EN AW-2219
  - EN AW-3003
  - EN AW-5083
  - EN AW-6082
  - EN AW-2090
  - EN AW-2219
  - EN AW-7005
- Stainless steel
  - AISI 304
  - AISI 304L

Verification method: R - review

REQ-008275/A

Final choice of RC panel material shall be made in preliminary design phase.

Verification method: R - review

REQ-008004/A

RC Vessel panels shall be designed as a modular system.

*Technical note: Modular system = unification of panel dimensions.*

Verification method: R - review

REQ-008320/A

Maximal deformations of RC Vacuum Vessel panels under vacuum shall be lower than 3 mm in comparison to the vented status.

Verification method: T - test

REQ-007915/A

All RC removable panels shall be equipped with guiding pins for closing procedure.

Verification method: R - review

REQ-007912/A

Blind holes with thread depth  $2.5d$  shall be prepared in RC covers/panels for all designed flanges.

Verification method: R - review

REQ-007924/A

Stainless steel screws with Allen heads shall be used on RC Chamber panels.

Verification method: R - review

#### 4.1.2.3. RC Vacuum Vessel Chassis

REQ-008325/A

RC Vacuum Vessel Chassis shall allow z (vertical) adjustment.

Verification method: R - review

REQ-008326/A

Range of RC Vacuum Vessel Chassis adjustment in z (vertical) direction shall be 20 mm.

Verification method: R - review

REQ-008002/A

RC Vacuum Vessel Chassis shall be made of stainless steel or extruded aluminium alloy profiles.

Verification method: R - review

REQ-008285/A

Design of RC Vacuum Vessel Chassis shall allow positioning in x, y direction (horizontal plane) when fixed to floor.

NOTE: Requirement defining interfaces (e.g. bracket with holes) needed for positioning.

Verification method: R - review

REQ-008327/A

RC Vacuum Vessel Chassis shall allow installation of Turbomolecular pumps (TMP).

Verification method: R - review

REQ-008328/A

RC Vacuum Vessel Chassis shall allow for floor fixing.

NOTE: For further information see the document "E1 room datasheet" (RD-02).

Selected values mentioned in E1 room datasheet are:

- Max. load for floors of experimental halls is 25 kN on surface with dimensions 20x20 cm;
- Anything exceeding these values should be checked and approved by Contracting Authority.

Verification method: R - review

REQ-008329/A

Each RC Vacuum Vessel Chassis shall be equipped with removable transportation wheels.

Verification method: R - review

#### 4.1.2.4. RC Optical Tables

##### 4.1.2.4.1. General

REQ-008330/A

Supplier shall provide static **FEM** analysis and vibration study according to Contracting Authority Inputs.

*Technical note: The latest results of building vibration measurement and simplified optical layout will be provided by Contracting Authority after contract signature.*

Verification method: A - analysis

##### 4.1.2.4.2. Optical Table design

REQ-008331/A

RC Optical Tables shall have threaded holes pattern with 25 mm spacing.

Verification method: R - review

REQ-008332/A

Threaded holes of RC Optical Table shall be **M6** size.

Verification method: R - review



REQ-008333/A

RC Optical Table shall be made of aluminium alloy following types:

- EN AW-2219
- EN AW-3003
- EN AW-5083
- EN AW-6082
- EN AW-7005 (must not be baked out)

The parts must not be anodized.

Verification method: R - review

REQ-008334/A

Final choice of RC Optical Table material shall be made in preliminary design phase.

Verification method: R - review

REQ-008335/A

Minimum thickness of RC Optical Table plate shall be 50 mm as a starting value. Based on FEM analysis and vibration study (REQ-008330/A) modification of this value is acceptable.

Verification method: R - review

REQ-008658/A

Maximum static deformation of RC Optical Table shall be  $\leq 1$  mm.

Verification method: A - analysis

REQ-008659/A

Natural frequencies of RC Optical Table shall be  $\geq 20$  Hz.

Verification method: A - analysis

#### 4.1.2.5. RC Optical Table Chassis

REQ-008336/A

RC Optical Table Chassis shall allow z (vertical) adjustment.

Verification method: R - review

REQ-008337/A

Range of RC Optical Table Chassis adjustment in z (vertical) direction shall be 20 mm.

Verification method: R - review

REQ-008611/A

Design of RC Optical Table Chassis shall allow positioning in x, y direction (horizontal plane) together with Vacuum Vessel Chassis.

NOTE: Requirement defining interfaces (e.g. bracket with holes) needed for positioning. Temporary connection between two chassis is also mentioned in this requirement.

Verification method: R - review

REQ-008760/A

RC Optical Table Chassis shall allow x, y, z adjustment of RC Optical Table.

Verification method: R - review

REQ-008761/A

RC Optical Table adjustment shall be (see REQ-008760/A):

- in x direction 15 mm
- in y direction 15 mm
- in z direction 15 mm

Verification method: R - review

REQ-008338/A

RC Optical Table Chassis shall be made of stainless steel or aluminium alloy extruded profiles (unified with RC Vacuum Vessel Chassis).

Verification method: R - review

REQ-008339/A

RC Optical Table Chassis shall allow installation of TMP's.

Verification method: R - review

REQ-008340/A

RC Optical Table Chassis shall allow floor fixing.

Verification method: R - review

REQ-008341/A

RC Optical Table Chassis shall be equipped with removable transportation wheels.

Verification method: R - review

### 4.1.3. Sealing

REQ-007925/A

Sealing used for BT L1-E1 system shall be made of fluorelastomer polymer (FPM) material.

NOTE: RC chambers applicable.

Verification method: R - review

REQ-007926/A

Hardness of **BT L1-E1** sealing o-rings shall be 60 or 70 HSC (Shore).

NOTE: RC chambers applicable.

Verification method: R - review

REQ-007978/A

Sealing surfaces must be in particular free of scratches or dents.

Verification method: I - inspection

REQ-007979/A

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

Verification method: I - inspection

REQ-007980/A

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

Verification method: R - review

## 4.2. Operational design requirements

REQ-008281/A

Vacuum vessels shall comply with frequency of opening/closing 2-times a day.

NOTE: Based on engineering demands on operational and maintenance procedures.

Verification method: R - review, A - analysis

## 4.3. L1-E1 Vacuum Chambers

### 4.3.1. Vacuum Chamber CH3

CH3 Vacuum Vessel will be supplied by Contracting Authority. CH3 Vacuum Vessel Chassis is in contract scope.

#### 4.3.1.1. CH3 Vacuum Vessel (N/A)

### 4.3.1.2. CH3 Chassis

See drawing 00109230/00.

REQ-008314/A

**CH3 Chassis** shall be designed as **CC** type.  
Verification method: R - review

REQ-007977/A

**CH3 Chassis** shall have an interface for fixation to the floor and wall.  
Verification method: R - review

REQ-008313/A

**CH3 Chassis** shall be compatible with **CH3 Vacuum Vessel** interface (see Annex I).  
Verification method: R - review

### 4.3.2. Vacuum Chamber CH5

**CH5 Vacuum Vessel** will be fully supplied by Contracting Authority.

### 4.3.3. Vacuum Chamber CH8

**CH8 Vacuum chamber** will be delivered by supplier including vacuum vessel, vacuum vessel chassis, optical table and optical table chassis. See drawing 00090530/03.

REQ-008609/A

**Vacuum Chamber CH8** shall be designed as **RC** type (see Chapter 4.1.2).  
Verification method: R - review

### 4.3.4. Vacuum Chamber CH9

**CH9 Vacuum chamber** will be delivered by supplier including vacuum vessel, vacuum vessel chassis, optical table and optical table chassis. See drawing 00090538/02.

REQ-008610/A

**Vacuum Chamber CH9** shall be designed as **RC** type (see Chapter 4.1.2).  
Verification method: R - review

### 4.3.5. Vacuum Chamber CH10

**CH10** Vacuum Vessel will be supplied by Contracting Authority. **CH10** Vacuum Vessel Chassis is in contract scope.

#### 4.3.5.1. CH10 Vacuum Vessel (N/A)

#### 4.3.5.2. CH10 Chassis

See drawing 00109283/00.

REQ-008344/A

**CH10** Chassis shall be designed as **CC** type.  
Verification method: R - review

REQ-008345/A

**CH10** Chassis shall be compatible with **CH10** Vacuum Vessel interface (see Annex I).  
Verification method: R - review

### 4.3.6. Vacuum Chamber CH11

**CH11** Vacuum chamber will be delivered by supplier including vacuum vessel, vacuum vessel chassis, optical table and optical table chassis. See drawing 00090540/03.

REQ-008011/A

Vacuum Chamber **CH11** shall be designed as **RC** type (see Chapter 4.1.2).  
Verification method: R - review

### 4.3.7. Vacuum Chamber CH12

**CH12** Vacuum Vessel will be supplied by Contracting Authority. **CH12** Vacuum Vessel Chassis is in contract scope.

#### 4.3.7.1. CH12 Vacuum Vessel (N/A)

### 4.3.7.2. CH12 Chassis

See drawing 00109283/00.

REQ-008346/A

**CH12** Chassis shall be designed as **CC** type.  
Verification method: R - review

REQ-008347/A

**CH12** Chassis shall be compatible with **CH12** Vacuum Vessel interface (see Annex I).  
Verification method: R - review

### 4.3.8. Vacuum Chamber CH13

**CH13** Vacuum Vessel will be supplied by Contracting Authority. **CH13** Vacuum Vessel Chassis is in contract scope.

#### 4.3.8.1. CH13 Vacuum Vessel (N/A)

#### 4.3.8.2. CH13 Chassis

See drawing 00109230/00.

REQ-008348/A

**CH13** Chassis shall be designed as **CC** type.  
Verification method: R - review

REQ-008349/A

**CH13** Chassis shall be compatible with **CH13** Vacuum Vessel interface (see Annex I).  
Verification method: R - review

### 4.4. Edge welded bellows

REQ-007908/A

Edge welded bellows shall be equipped with guiding rods for axial movement fixation.  
Verification method: I - inspection

REQ-008282/A

Each edge welded bellows shall undergo a helium leak test confirmed with output protocol.

Verification method: T - test

REQ-008283/A

Each edge welded bellows shall be manufactured according to Table 1.

Verification method: T - test

Edge welded bellows with guiding rods - DN250		
Type of flanges	ISO-K (ISO 1609)	
Inside pressure	$10^6$ mbar	
Outside pressure	1 bar (atmospheric pressure)	
Leak rate	$10^{-9}$ mbar·l/s	
Temperature	$20 \pm 3^\circ\text{C}$	
Material	AISI 304, AISI 316	
Lifetime	min. 10 000 cycles	
Movement absorption	Axial	$\pm 15$ mm
	Lateral	$\pm 5$ mm
	Angular	$\pm 2^\circ$
Minimal inner diameter	258 mm	
Length free	230 mm	
Space for mounting (between flanges) without centering	237,8 mm	

Table 1 Technical specification of edge welded bellows.

## 4.5. Pipes

See drawings: 00104267/00; 00104268/00; 00104269/00; 00104281/00; 00104282/00; 00104289/00; 00104290/00; 00104292/00; 00104293/00; 00104294/00; 00104296/00; 00104297/00; 00104298/00; 00104301/00; 00104302/00; 00104303/00; 00110952/00; 00110962/00.

REQ-007907/A

Pipes shall be designed with respect to standard ISO 1609:1986 - Vacuum technology - Flange dimension.

Verification method: R - review

REQ-008009/A

Vacuum pipes shall be clearly identified and labelled for assembly purpose

Verification method: R - review

### 4.5.1. Pipes support structures

See drawings: 00110881/00, 00101717/00, 00104392/00

REQ-008652/A

Pipes support structures shall be positioned in **x, y** direction.  
Note: requirement describes positioning with relation to building resp. E1 experimental hall.  
Verification method: R - review

REQ-008653/A

Pipes support structures shall allow **z** (vertical) adjustment. Exception is support structure for horizontal pipe (see drawing number 00104392/00).  
Verification method: R - review

REQ-008655/A

Range of Pipes support structures adjustment in **z** (vertical) direction shall be 30 mm.  
Verification method: R - review

REQ-008654/A

Pipes support structures shall be made of stainless steel or extruded aluminium alloy profiles.  
Verification method: R - review

### 4.6. Vacuum Fittings

REQ-007904/A

The clamps shall be of suitable design and use material that prevents permanent clamp deformation after multiple use.  
Verification method: R - review

REQ-007905/A

The clamps shall be of suitable design and use material that prevents damaging of the clamp slots on flanges.  
Verification method: R - review

REQ-007909/A

Fittings shall be designed with respect to the listed standards:

- ISO 1609:1986 - Vacuum technology - Flange dimension;
- ISO 2861:2013 - Vacuum technology - Dimensions of clamped - type quick-release couplings).

Verification method: R - review



REQ-007910/A

Centering ring with outer ring shall be used for connection between fitting and chamber.

Verification method: R - review

## 4.7. Cleaning

REQ-007983/A

Cleaning procedure shall remove contaminants that adhere to the surface such as oils, greases, dirt, swarf, corrosion products, or finger prints.

Verification method: I - inspection

REQ-007984/A

Any assemblies shall be made up from pre-cleaned components where possible.

Verification method: R - review

REQ-007985/A

Cleanliness shall be taken into account at all stages from detailed design to installation.

Verification method: R - review

REQ-007986/A

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

Verification method: R - review

REQ-007987/A

Supplier shall provide cleaning procedure compatible with High Vacuum ( $10^{-6}$  mbar) and using in cleanroom ISO7.

Verification method: R - review

REQ-008319/A

The cleaning procedure shall be included at minimum the following steps:

- General pre-clean, removal of gross contamination, fluxes etc. by wiping/scraping;
- Degrease with solvent by rinsing, swabbing or immersion;
- Wash with domestic water and detergent;
- Vapor degrease or soak cleaning;
- Degrease with solvent. Small and complex items shall be immersed and ultrasonically agitated;
- Wash with domestic water;
- Wash with demineralised water;
- Drying (dry air);
- Immediate packaging.

Verification method: R - review

## 4.8. Manufacturing

REQ-007988/A

Vacuum sealing welds made externally must have full penetration leaving a smooth surface on the vacuum side.

Verification method: R - review

REQ-007989/A

Supplier shall apply cleaning and degreased procedure. This procedure shall be provided by Supplier.

Verification method: R - review

REQ-007990/A

Shielding gases shall be used to minimise oxidation.

Verification method: R - review

REQ-007991/A

Tools used during manufacture shall not contaminate the vacuum surface.

Verification method: I - inspection

REQ-007992/A

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

Verification method: R - review

## 4.9. Electrical design requirements

N/A

## 4.10. EMC/EMP

REQ-008656/A

All conductive parts must be designed according to following Czech applicable standards:

- ČSN 33 2000-4-41;
- ČSN 33 2000-5-54.

Verification method: R - review

## 5. Transportation requirements

Supplier will provide transportation path to final destination for RC chambers during preliminary design phase (approximately transportation path is 100 meters).  
For further information see the document "E1 room datasheet" (RD-02).

### 5.1. General requirements

REQ-008012/A

The transportation personnel shall follow the Contracting Authority's facility regulations.

NOTE: These regulations shall be defined by Contracting Authority and provided to the supplier after contract signature and before detailed design contract phase.

Verification method: R - review

REQ-008013/A

The technologies and instruments shall be delivered in protective package preventing damage and contamination and a minimum of two plies separate clean packaging. The technologies shall be cleaned and packaged in clean environment of ISO class 7.

Verification method: R - review, I - inspection

REQ-008014/A

All transportation tools and equipment entering the clean rooms shall be cleaned and reviewed by the Contracting Authority's approved methods.

NOTE: Some tools can be provided by the Contracting Authority upon agreement.

Verification method: I - inspection

REQ-008015/A

The transportation to the final destination of the technologies and the instruments shall be conducted by the supplier.

Verification method: R - review

REQ-008016/A

The transportation procedures shall be discussed and reviewed by the Contracting Authority's installation officer and shall be compliant with the Contracting Authority's installation regulations.

NOTE: These regulations shall be defined by Contracting Authority and provided to the supplier after contract signature and before detailed design contract phase.

Verification method: R - review

REQ-008017/A

The main parts of the mechanical structure shall be equipped with positioning/alignment marks for industrial 3D-measurements/survey. The specific type of the positioning/alignment marks, their number and location shall be agreed with the Contracting Authority.  
Verification method: R - review, I - inspection

## 6. General Safety Requirements

REQ-008018/A

System or its relevant components shall comply with all applicable EU and Czech legislative requirements and where applicable shall have CE marking and Certificate of Compliance.  
Verification method: R - review

REQ-008019/A

Supplier shall perform hazard identification and risk assessment of system prior to design.  
NOTE: Relevant for chamber design - RC chambers.  
Verification method: R - review, A - analysis

REQ-008020/A

System or its relevant components shall be delivered with technical documentation where supplied specifies modes of operation: conditions for safe operation, installation and maintenance of system.  
Verification method: R - review

## 7. Quality Requirements

### 7.1. Quality Management

#### 7.1.1. Quality organization and responsibilities

##### 7.1.1.1. Organization

REQ-008021/A

The supplier shall identify the personnel responsible (project Quality Manager) for Quality Controls disciplines.

Verification method: Not To Be Tracked within VCD

REQ-008024/A

The project Quality Manager shall act as the primary contact person within the project concerning Quality matters.

Verification method: Not To Be Tracked within VCD

REQ-008025/A

The supplier shall apply International recognized standards or best practice where applicable for quality assurance programme.

Verification method: Not To Be Tracked within VCD

##### 7.1.1.2. Responsibility and authority

REQ-008028/A

When the supplier's Quality organization delegates quality assurance tasks to another organization it shall be done in a documented and controlled way monitored by the Quality organization.

Verification method: Not To Be Tracked within VCD

REQ-008773/A

Quality workmanship procedure shall be provided by supplier and agreed by Contracting Authority.

Verification method: R - review

## 7.1.2. Documentation and data control

### 7.1.2.1. Documentation

REQ-008031/A

The supplier shall supply the following relevant manufacturing documents (extent as stipulated in contract): Operating manual (including step-by-step aligning procedure), maintenance manual, breakdown list as built, Declarations of Conformity and relevant CE markings where required by EU legislation.

Verification method: I - Inspection

### 7.1.2.2. Formats for data exchange

REQ-008033/A

Documentation shall be supplied in all following formats: hardcopy and PDF/A.

Verification method: Not To Be Tracked within VCD

REQ-008034/A

The supplier shall provide following type of documents:

- 3D model;
- 2D drawings;
- Printable format for text documents.

Verification method: Not To Be Tracked within VCD

REQ-008035/A

The Supplier shall use following data formats.

- \*.JPG;
- \*.PDF/A;
- CAD 2D: \*.dwg;
- CAD 3D: STEP type files (\*.stp;\*.step);
- text processors \*.doc, \*.docx, OpenDocument Format;
- spreadsheet processors \*.xls, \*.xlsx, OpenDocument Format;
- presentations \*.ppt, \*.pptx; OpenDocument Format;
- \*.HTML

Verification method: Not To Be Tracked within VCD

## 8. Communication during contract execution

### 8.1. Interface management

REQ-008657/A

All interfaces of delivered components relevant for **L1 to E1** system integration shall be identified and captured on drawings.  
Verification method: R - review

REQ-008762/A

All interfaces identified, captured on drawings shall be agreed by Contracting Authority.  
Verification method: R - review

## 9. Verification process requirements

### 9.1. General

REQ-008350/A

The verification process shall demonstrate that the deliverable product meets the specified ELI (further Contracting Authority) requirements and is capable of sustaining its operational role through:

1. Verification planning;
2. Verification execution and reporting.

Verification method: Not To Be Tracked within VCD

REQ-008359/A

The technical consultation between supplier and the Contracting Authority shall involve agreement on the methods, levels of verification, and verification tools to be used for verifying individual requirements.  
Verification method: Not To Be Tracked within VCD

## 9.2. Verification methods

### 9.2.1. General

REQ-008351/A

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

1. review;
2. inspection;
3. test;
4. functional demonstration;
5. analysis.

Verification method: Not To Be Tracked within VCD

### 9.2.2. Review

Verification by Review (R) shall consist in using approved records or evidence that unambiguously shows that the requirement is met.

NOTE: Examples of such approved records are design documents and reports, technical descriptions, and engineering drawings, manuals and accompanying operation documentation.

REQ-008763/A

A review of design programme shall be defined in the Verification Plan (VP), see chapter 9.3.

Verification method: Not To Be Tracked within VCD

REQ-008764/A

A review of design programme shall only be applicable in stages (phases) before starting the manufacturing.

Verification method: Not To Be Tracked within VCD

REQ-008765/A

The results of review shall be documented in approved record and by VCD (see chapter 9.4).

Verification method: R - review



### 9.2.3. Inspection

Verification by Inspection (I) shall consist of visual determination of physical characteristics.

NOTE: Physical characteristics include constructional features, hardware conformance to document drawing or workmanship requirements, physical conditions, software source code conformance with coding standards.

REQ-008353/A

The inspection results recorded in an inspection report referred in VCD.

NOTE: concerning VCD see chapter 9.3 and 9.4.

Verification method: R - review

REQ-008766/A

An inspection programme shall be defined in the Verification Plan (VP), see chapter 9.3.

Verification method: Not To Be Tracked within VCD

### 9.2.4. Test

Verification by Test (T) shall consist of measuring product performance and functions under representative simulated environments.

REQ-008354/A

The measurement results shall be recorded in a Test report.

Verification method: R - review

REQ-008767/A

The analysis of data derived from testing shall be an integral part of the test and the results included in the test report.

Verification method: Not To Be Tracked within VCD

REQ-008768/A

The protocol of the measurement shall be made and approved.

Verification method: R - review

REQ-008769/A

A test programme shall be prepared for each product in conformance with Verification Plan.

Verification method: Not To Be Tracked within VCD

REQ-008770/A

The test programme shall be defined in the specific chapter of the Verification Plan.

Verification method: Not To Be Tracked within VCD

REQ-008771/A

Test Programme shall be approved by the Contracting Authority.  
Verification method: R - review

### 9.2.5. Functional demonstration

Verification via Functional demonstration (FD) is either test of the system's response to a subject of requirement, or demonstration of qualitative operational performance consistent with the requirement.

REQ-008355/A

The execution of functional demonstration shall be observed and results recorded in a Functional demonstration report.  
Verification method: R - review

REQ-008356/A

All safety critical functions shall be identified and verified by functional demonstration.  
Verification method: Not To Be Tracked within VCD

### 9.2.6. Analysis

Verification by Analysis (A) shall consist of performing theoretical or empirical evaluation using techniques agreed with the Contracting Authority.

NOTE: Techniques comprise systematic, statistical and qualitative design analysis, modelling and computational simulation.

REQ-008357/A

The results of analysis shall be recorded in an Analysis report.  
Verification method: R - review

REQ-008772/A

An analysis programme shall be defined in the Verification Plan (VP), see chapter 9.3.  
Verification method: Not To Be Tracked within VCD

### 9.3. Verification Control Document (VCD)

The Verification Control Document (VCD) lists for each requirement the selected method(s) of verification, overall verification result (pass/fail) and reference to relevant report where necessary. The VCD is a living (versioned) document and provides an overview of the mutually agreed verification methods during the project execution and overview of the results at the contract end to support the acceptance of all deliverables.

The verification approach shall be defined by the supplier in the Verification Plan (VP) for approval by the Contracting Authority prior to implementation.

The supplier shall define the verification approach by conducting the following steps:

REQ-008774/A

Identify and agree with the Contracting Authority the set of requirements to be subject of the verification process at supplier site and at Contracting Authority site.

Verification method: Not To Be Tracked within VCD

REQ-008775/A

Select verification tools for defined methods of verification.

Verification method: Not To Be Tracked within VCD

REQ-008776/A

Identify the stages and events of the contract realization in which the verification is implemented.

Verification method: Not To Be Tracked within VCD

REQ-008358/A

The contents of the initial issue of the Verification Control Document (VCD) shall be prepared by the Contracting Authority based on technical consultations with the supplier and agreed with the supplier within the time limit specified in table 3.

Verification method: Not To Be Tracked within VCD

REQ-008362/A

Based on the agreed methods of verification and the VP proposal how the verifications should be grouped together, the supplier shall include in the VP the list of the Test reports, Analysis reports, Inspections reports, and Functional demonstration reports that the supplier proposes to be prepared as part of verification of the requirements.

(agreement by Contracting Authority)

Verification method: R - review

REQ-008363/A

The supplier shall carry out factory verification of requirements according to the VP and according to the updated VCD and record the results in the VCD before shipping the system out of factory.

(agreement by Contracting Authority)

Verification method: R - review

REQ-008364/A

The supplier shall carry out with support from the Contracting Authority the final verification of requirements at ELI facility according to the VP and VCD and record the results in the final VCD.

(agreement by Contracting Authority)

Verification method: R - review

## 9.4. Acceptance

REQ-008365/A

In the acceptance stage the verification shall demonstrate that the product is free of fabrication errors and is ready for the intended operational use.

Verification method: Not To Be Tracked within VCD

REQ-008366/A

Acceptance shall be carried out on the final hardware.

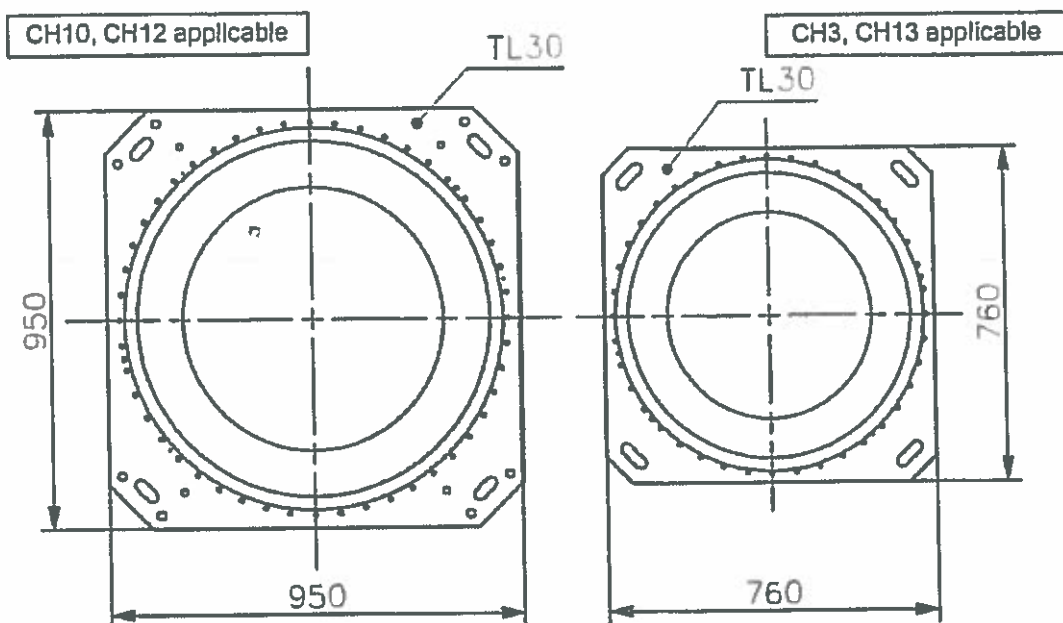
Verification method: Not To Be Tracked within VCD

REQ-008367/A

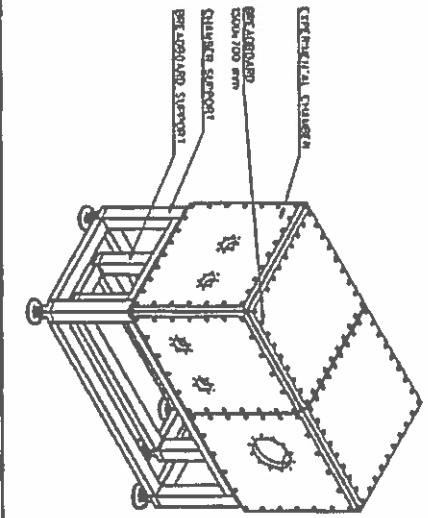
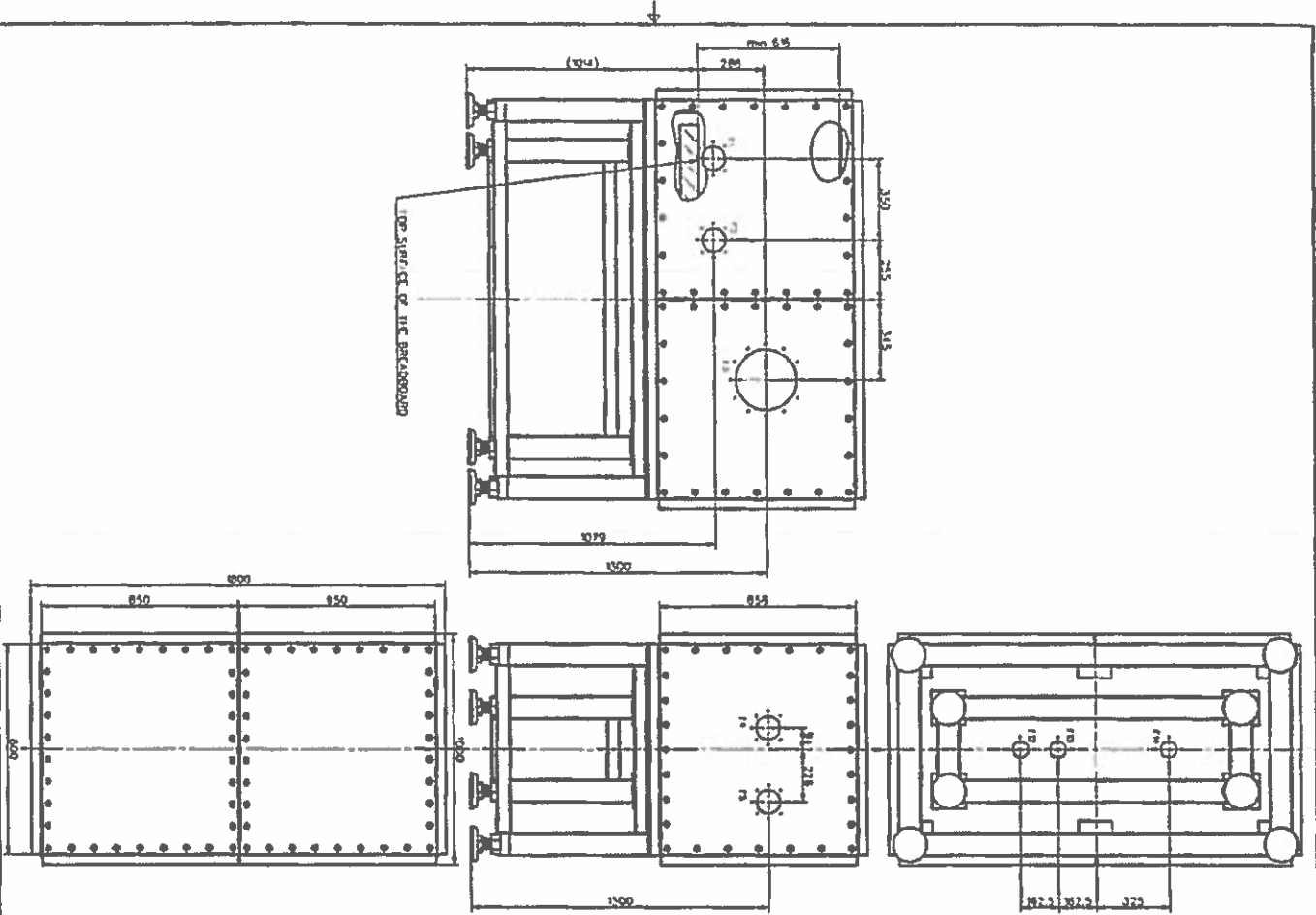
The basis for acceptance shall be completed Verification Control Document (Chapter 9.3) summarizing the overall verification results together with relevant reports supporting the verification.

Verification method: R - review

## 10. Annex I

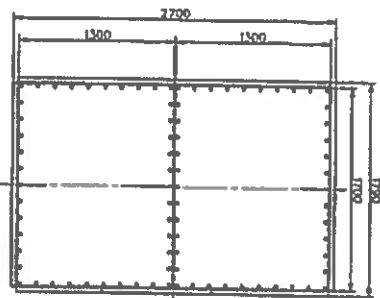
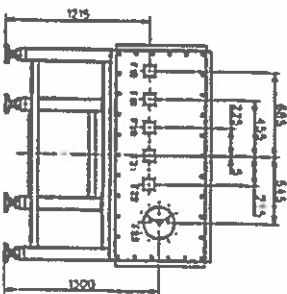
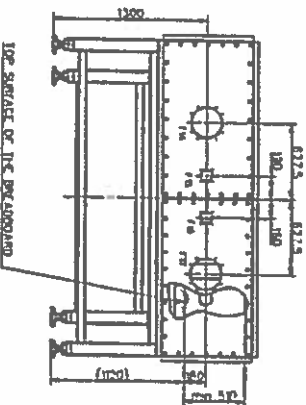
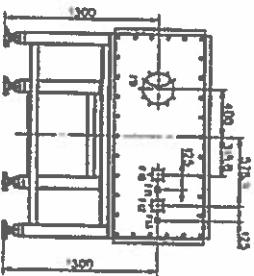
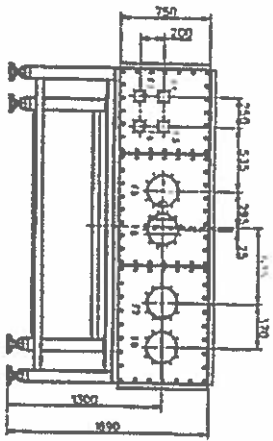
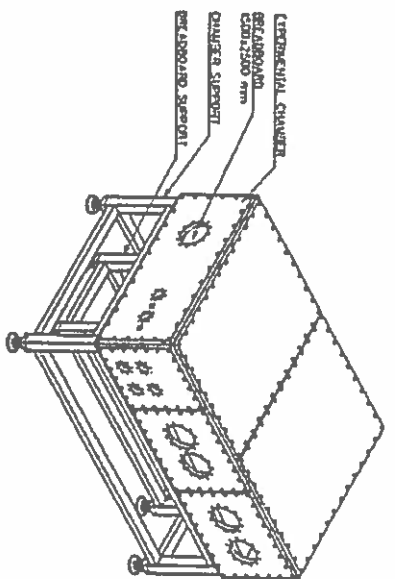
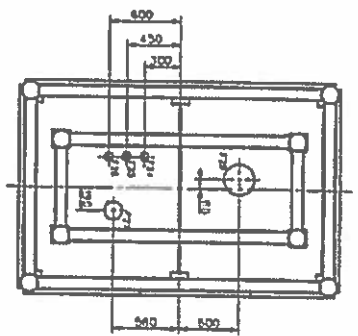






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1.3	DRUM	ISO 8400
1.4	DRUM	ISO 8400
1.5	DRUM	ISO 8400
1.6	DRUM	ISO 8400
1.7	DRUM	ISO 8400
1.8	DRUM	ISO 8400
1.9	DRUM	ISO 8400
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1.11	DRUM	ISO 8400
1.12	DRUM	ISO 8400
1.13	DRUM	ISO 8400
1.14	DRUM	ISO 8400

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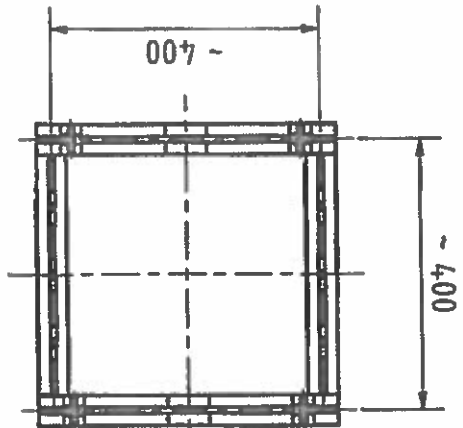
TOP SURFACE OF THE PERIPHERAL

Item No.	Material/Component	Standard
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3	CH100	ГОСТ 8099
4	CH100	ГОСТ 8099
5	CH100	ГОСТ 8099
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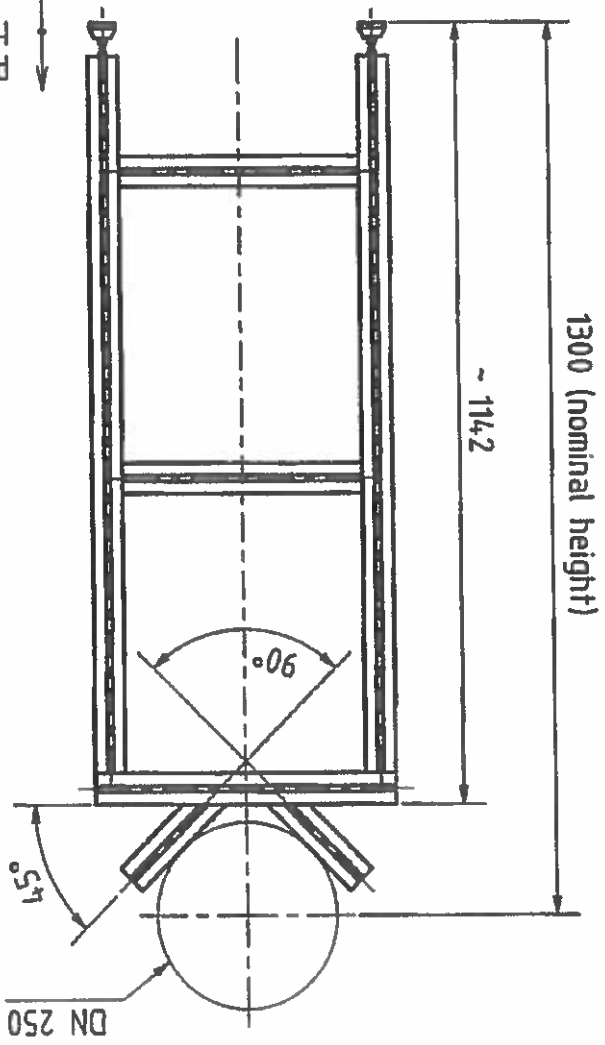
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 Design: **1:20**  
 Date: **1.11.19**  
 Project: **00090530/03**  
 Design: **1.11.19**

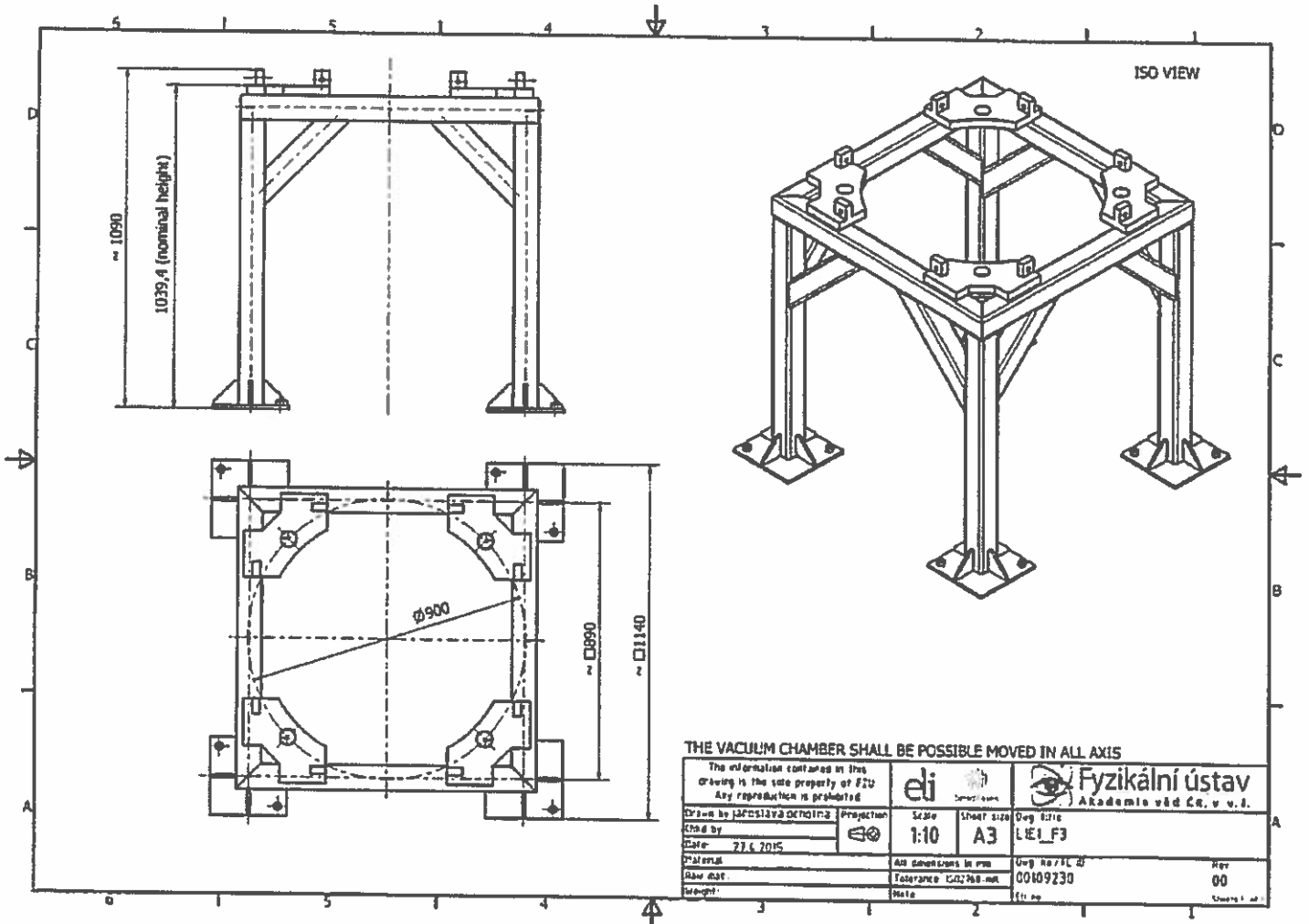


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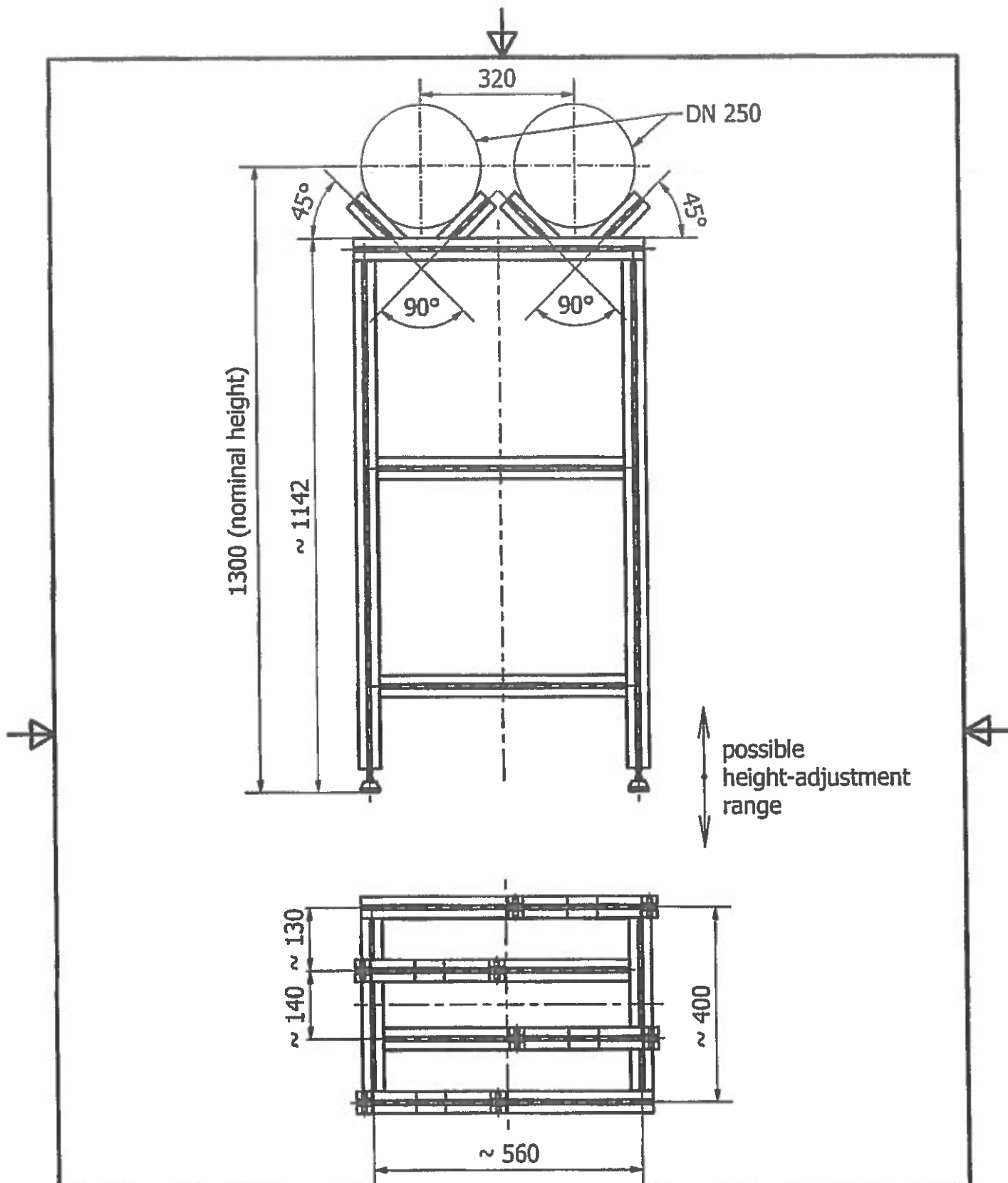
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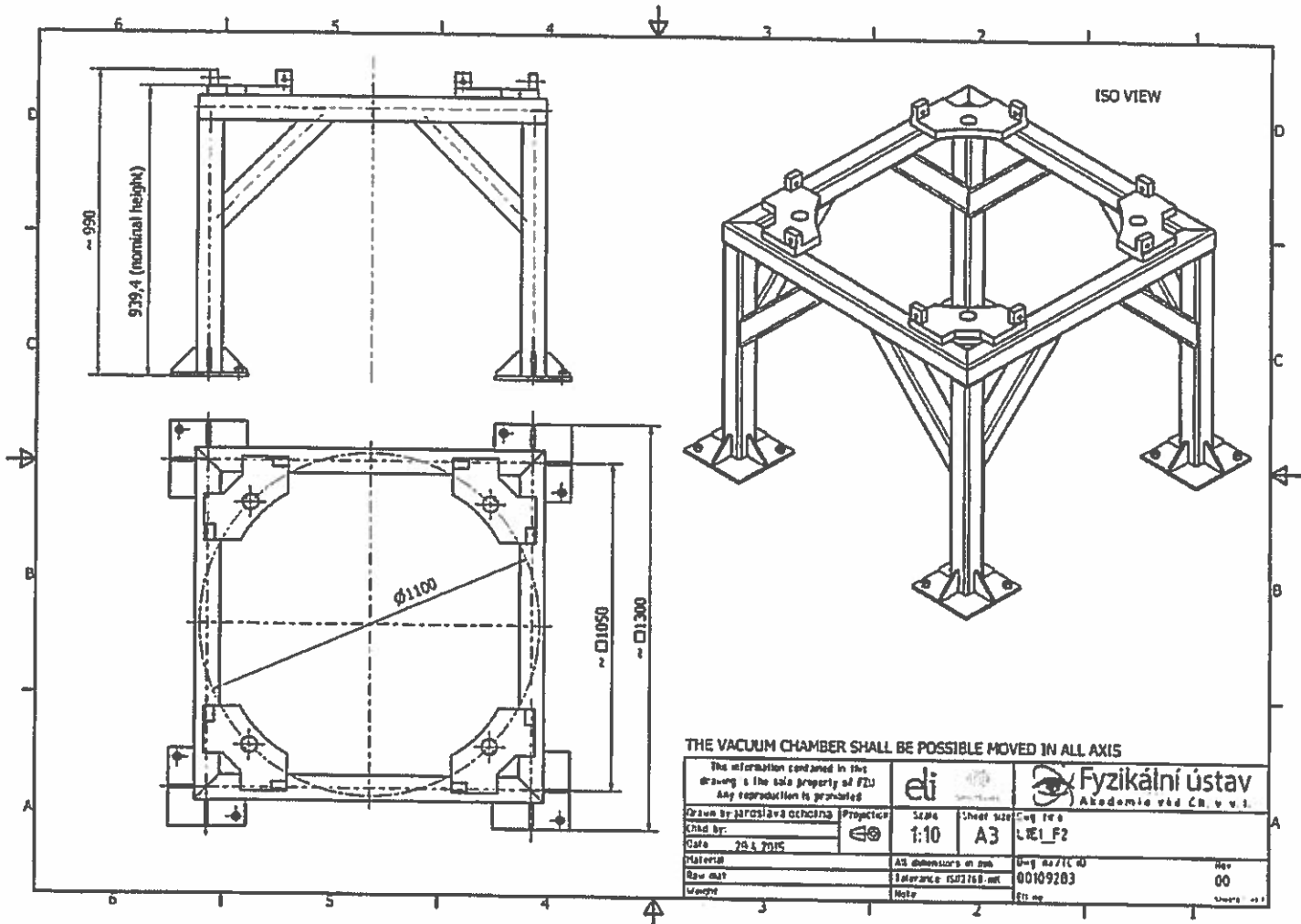


THE VACUUM CHAMBER SHALL BE POSSIBLE MOVED IN ALL AXIS

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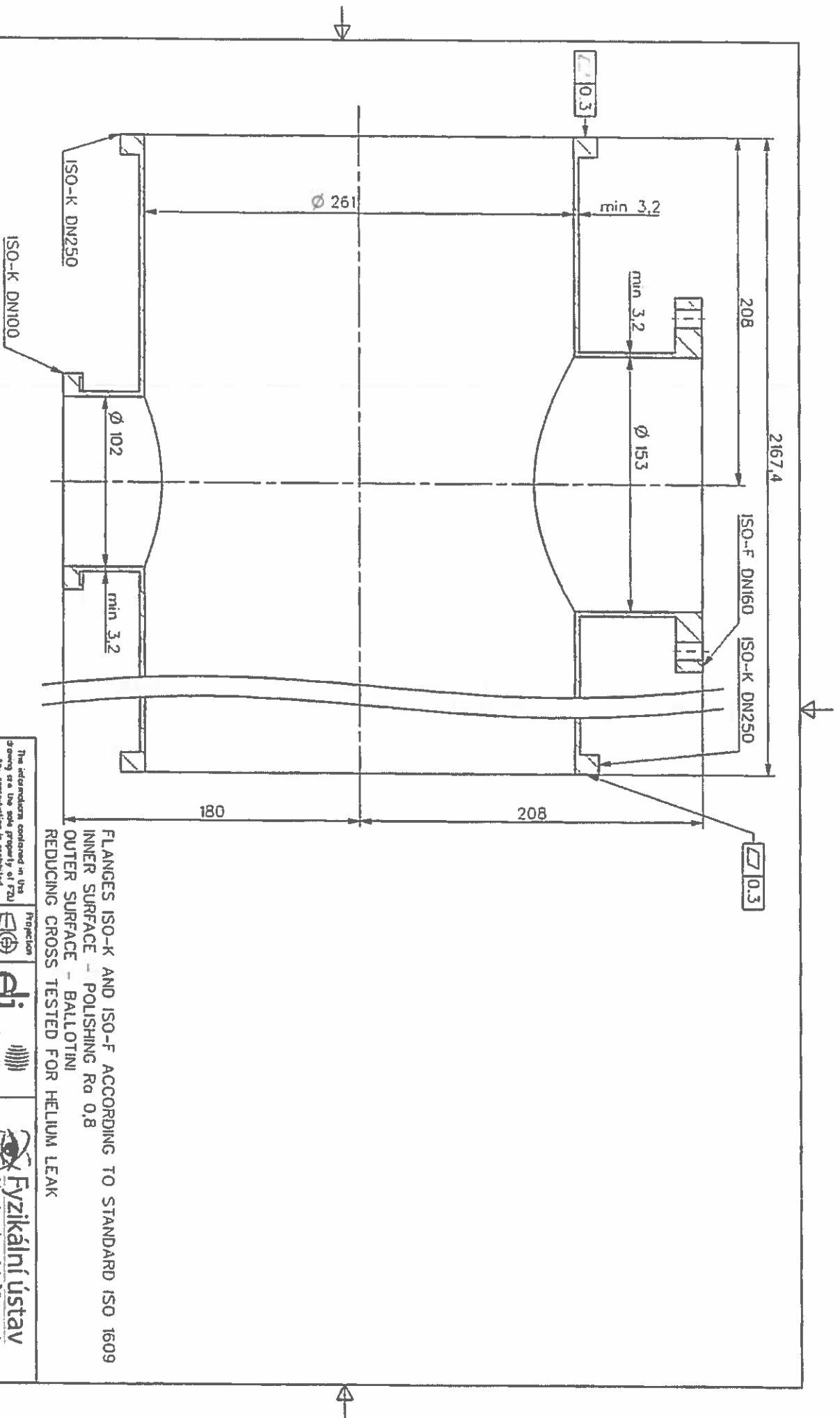


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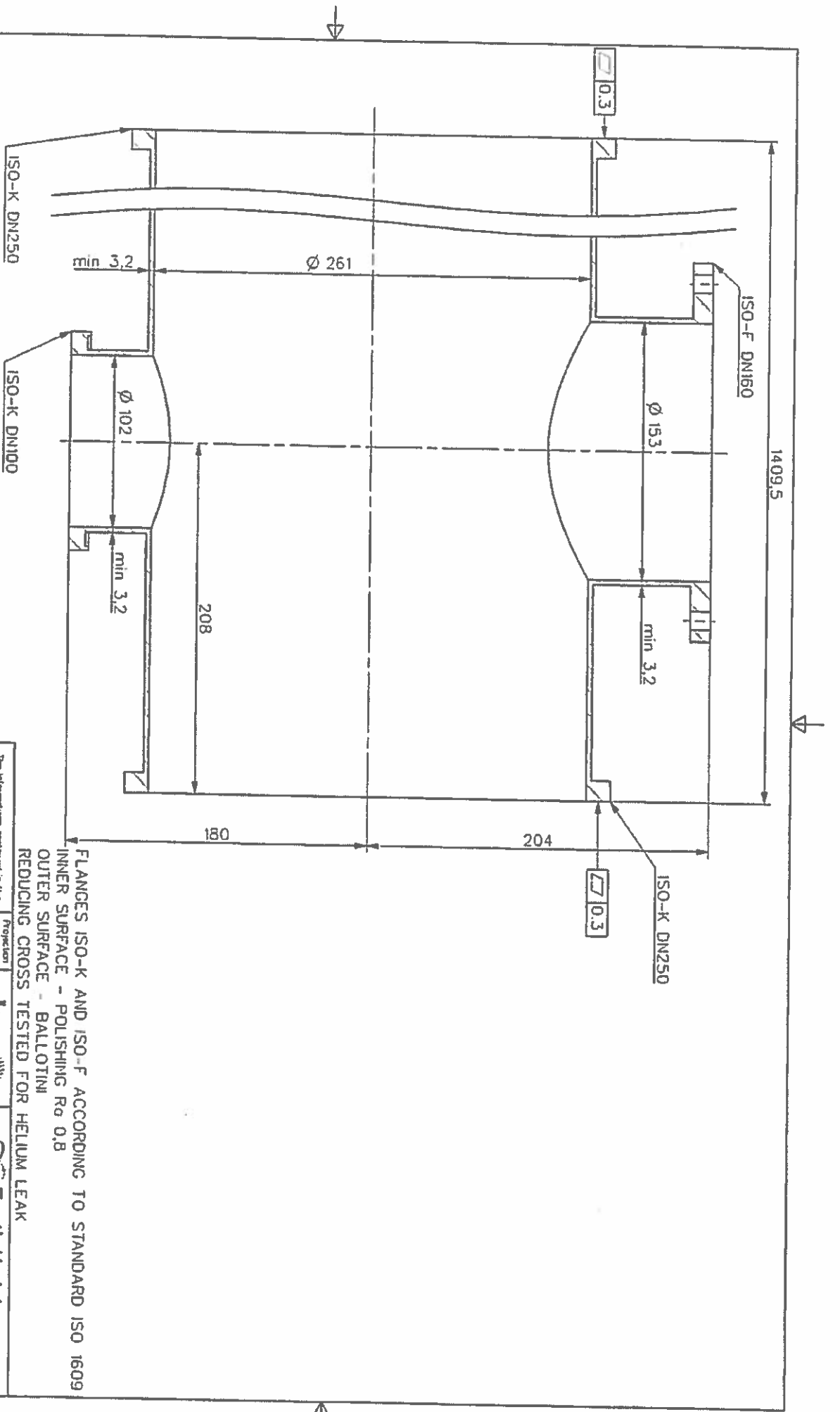
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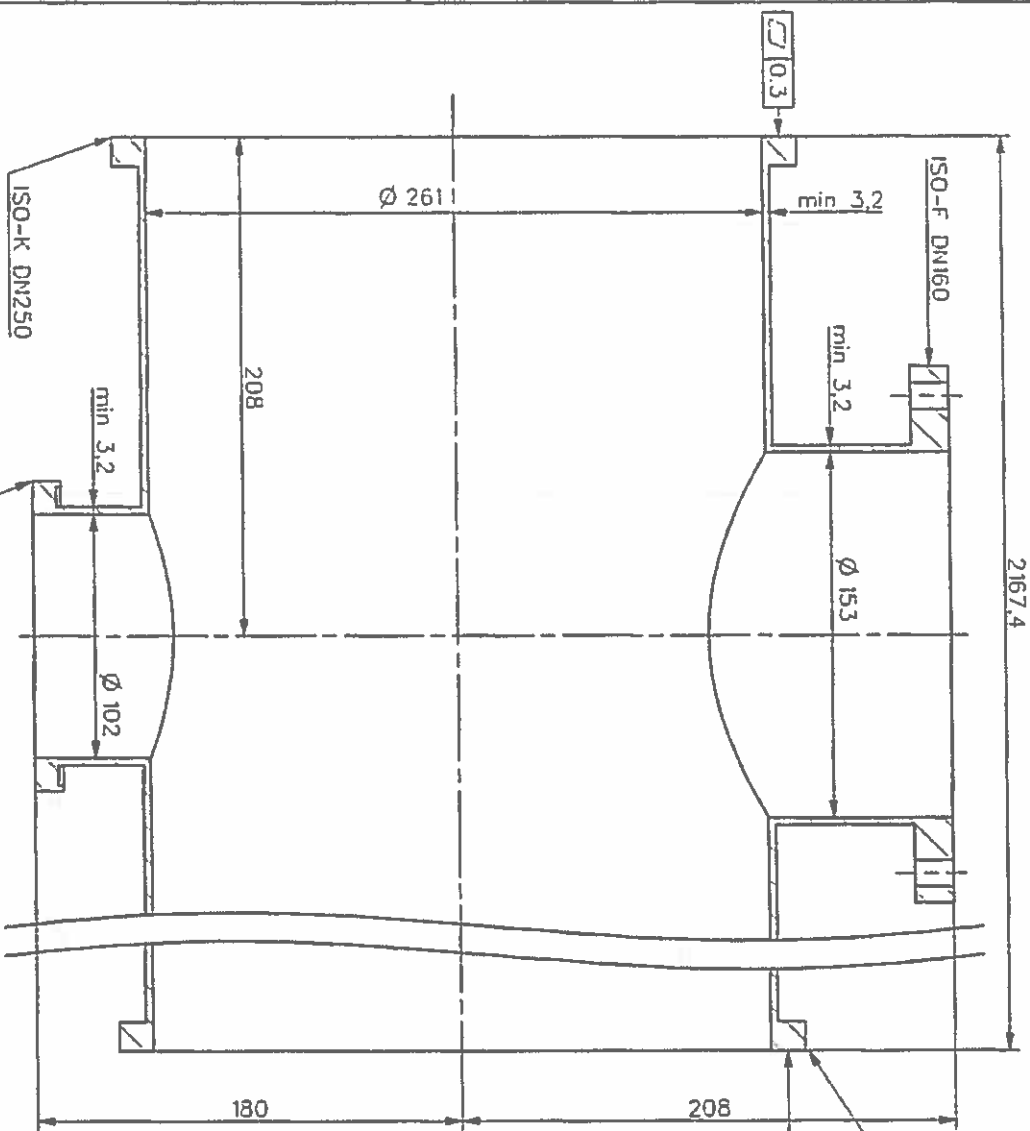
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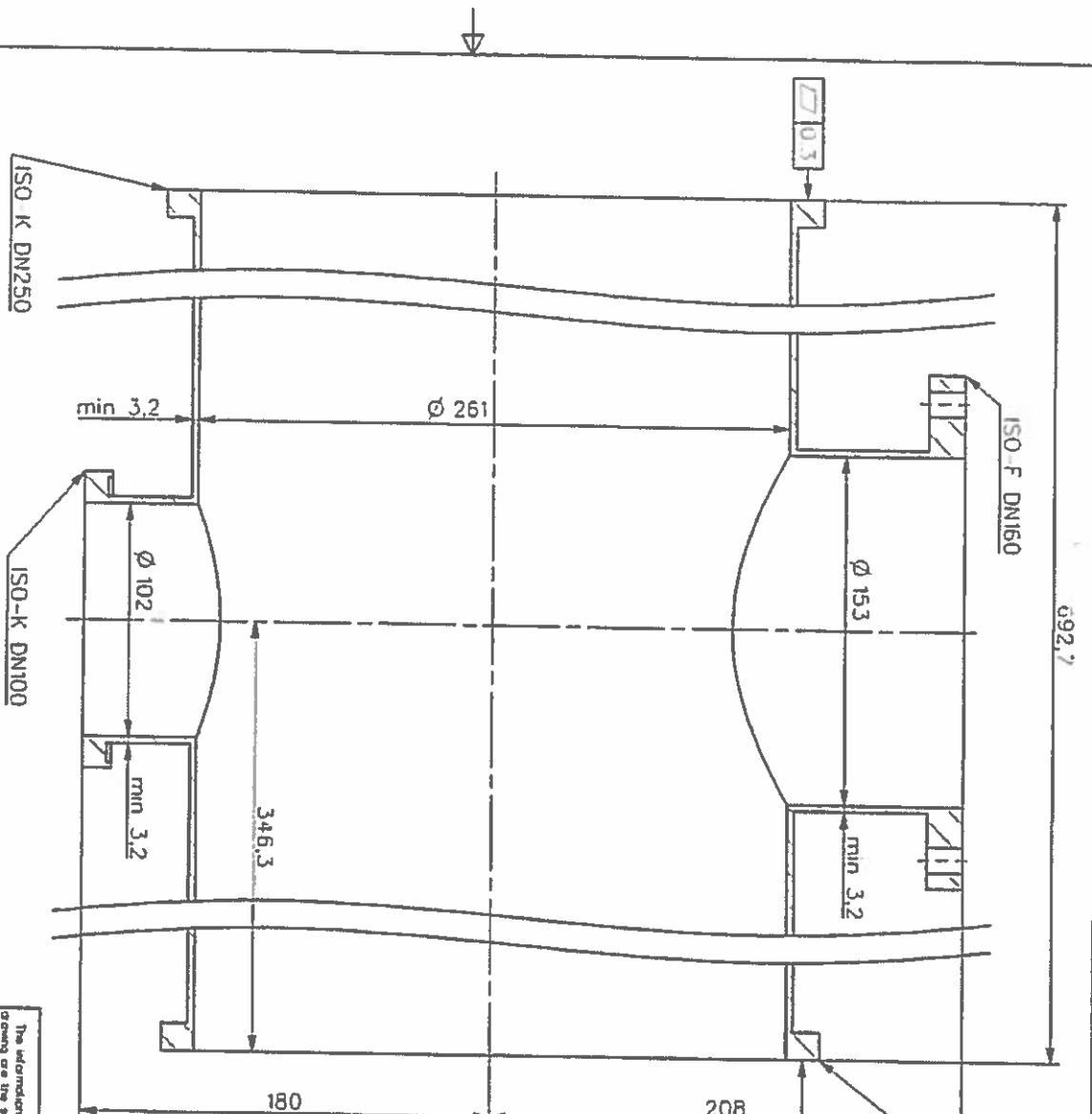
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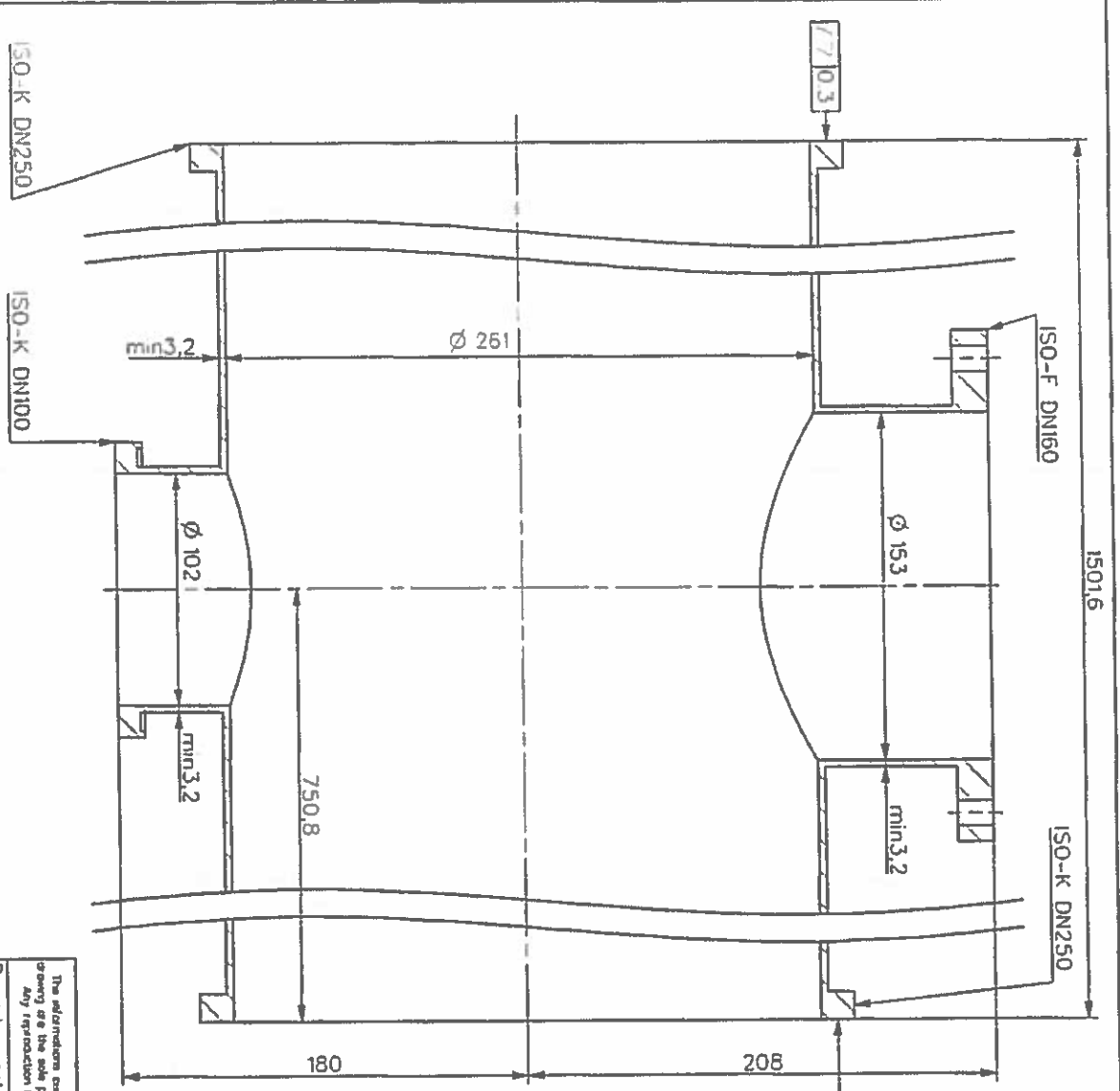
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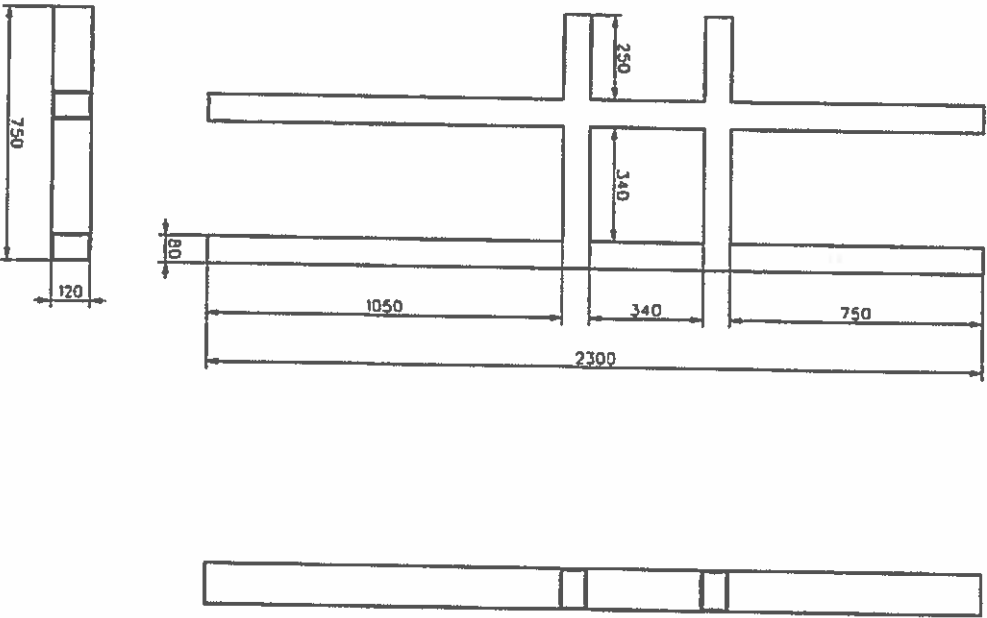
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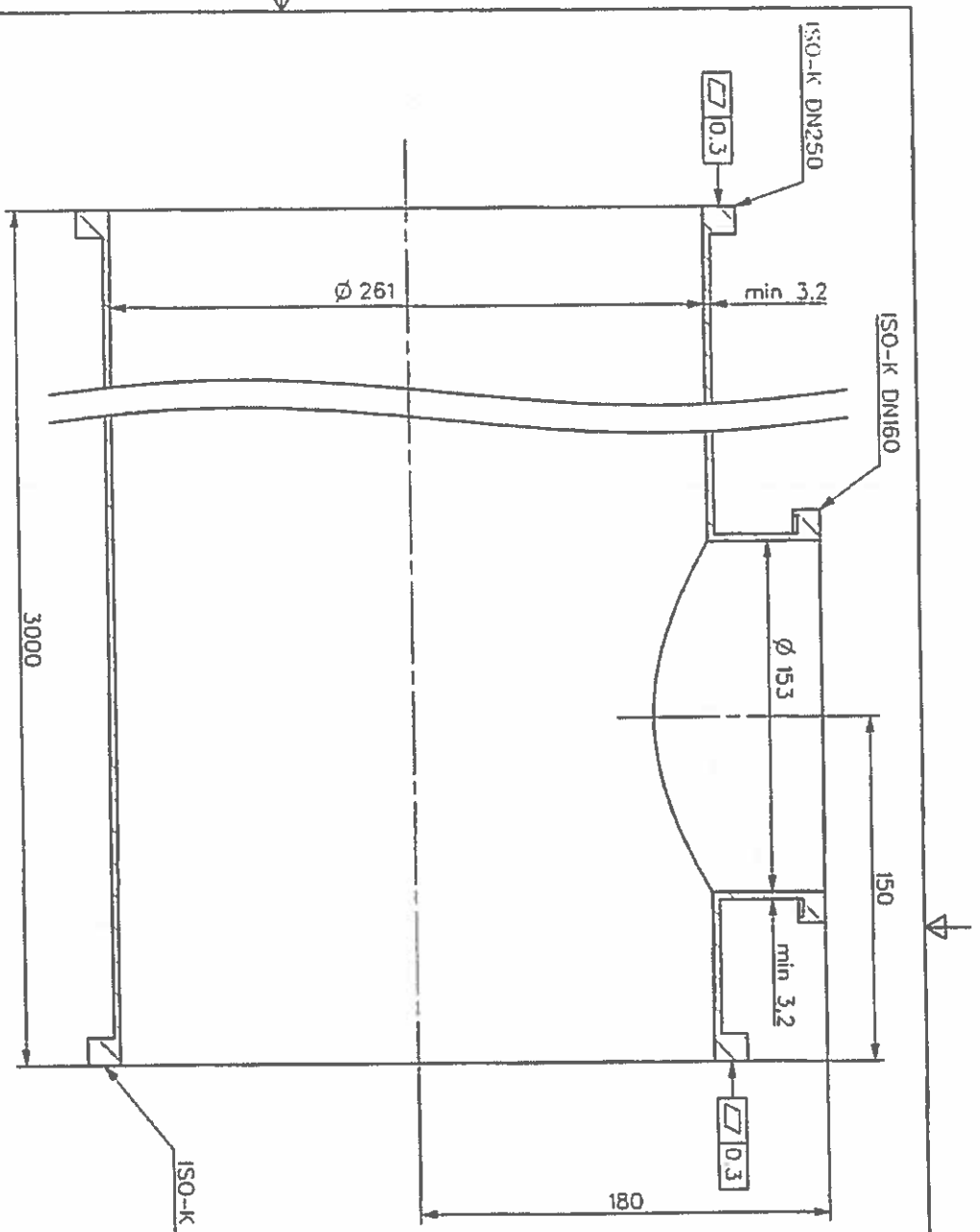


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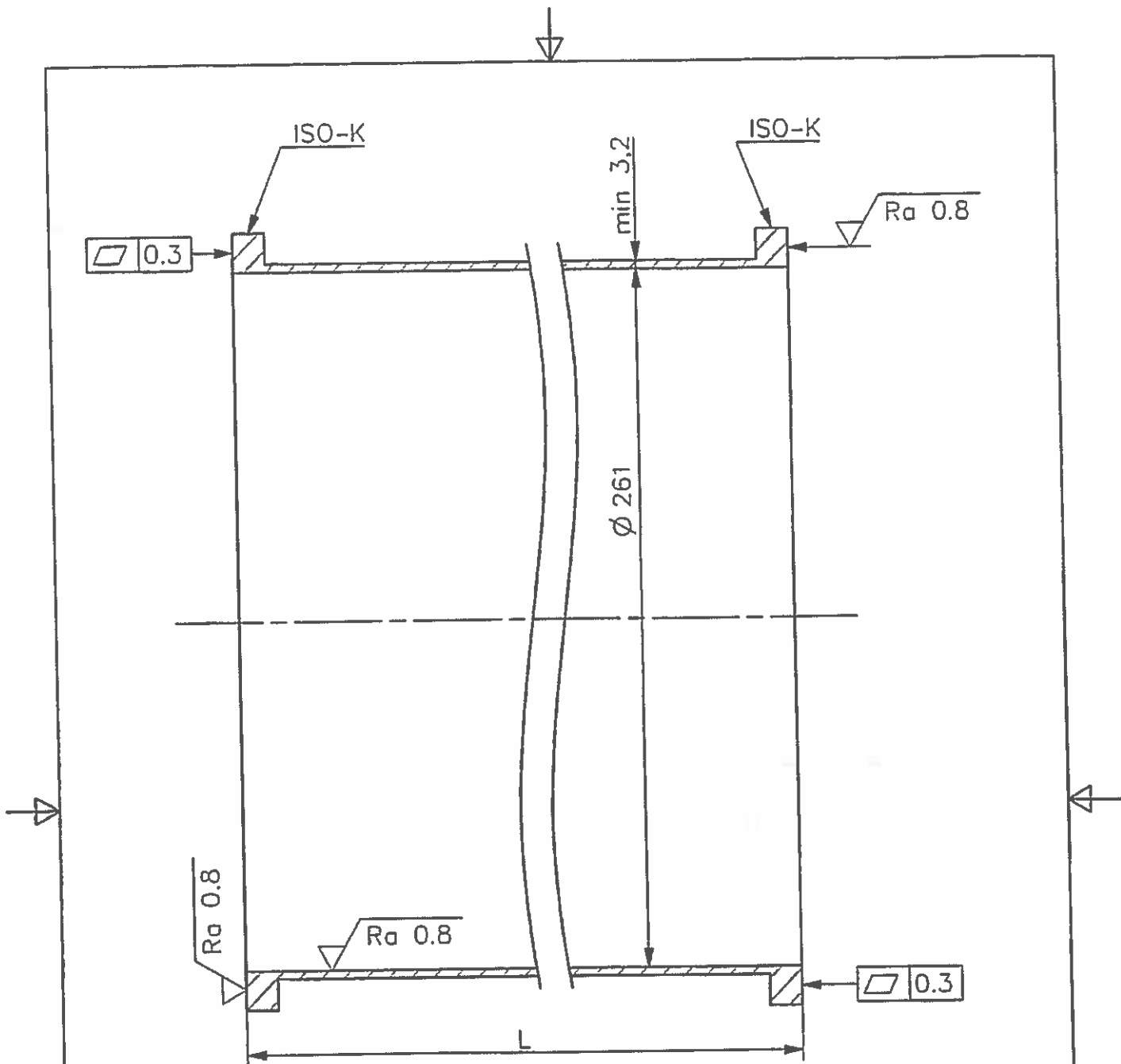


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Date:	15.5.2015						
Material:	AISI 304	All dimensions in mm					
Weight:		Tolerance: ISO2768-mS					
		Application					

<b>Dwg no. PIPE DN250</b>			
<b>Name</b>	<b>Length "L"</b>	<b>Between chambers</b>	<b>Dwg no.</b>
L1E1_P01_CH2-3	2481,7 mm	Room L1 - CH3	00104267
L1E1_P03_CH3-5	3000 mm	CH3 - CH5	00104269
L1E1_P06_CH3-5	2000 mm	CH3 - CH5	00104282
L1E1_P12_CH8-9	2000 mm	CH8 - CH9	00104289
L1E1_P14_CH9-10	684,7 mm	CH9 - CH10	00104292
L1E1_P15_CH9-10	1500 mm	CH9 - CH10	00104293
L1E1_P18_CH10-12	1500 mm	CH10 - CH12	00104296
L1E1_P19_CH10-11	3000 mm	CH10 - CH11	00104297
L1E1_P20_CH10-11	3000 mm	CH10 - CH11	00104298
L1E1_P23_CH10-13	638,3 mm	CH10 - CH13	00104303
L1E1_P24_CH13_HHG	779,4 mm	CH13-HHG	00110952
L1E1_P25_CH12_PXS	1000 mm	CH12-PXS	00110962

**SEE: Dwg no. PIPE DN250**



FLANGES ISO-K ACCORDING TO STANDARD ISO 1609  
 INNER SURFACE - POLISHING Ra 0,8  
 OUTER SURFACE - BALLOTINI  
 PIPE TESTED FOR HELIUM LEAK

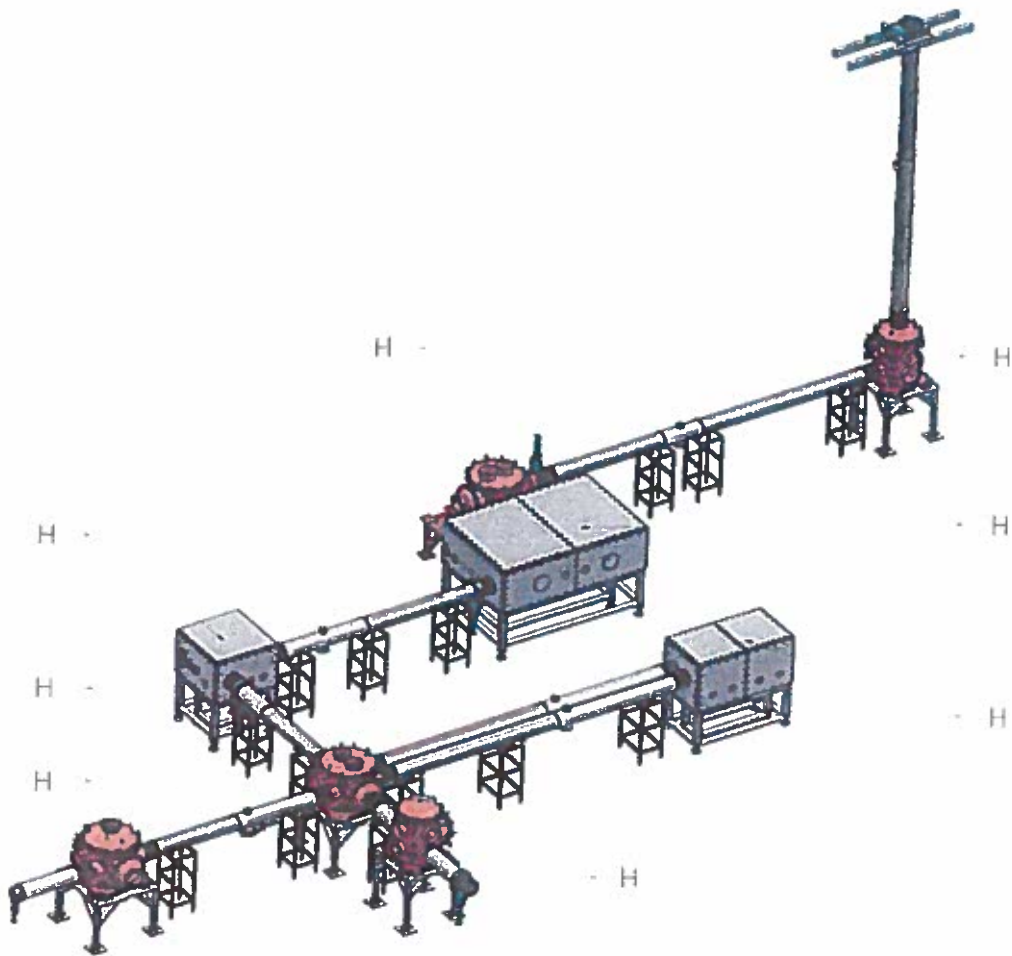
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Checked by:		1:2	PIPE DN250
Date:			
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Raw mat.:	Tolerance: ISO2768-mk	ELI B. Nr.	
Weight:	Application		

### Annex 3 – Schedule of Deliverables

Deliverable, its part	Step	Result	Deadline
D1 i)	Provide detailed plan of all bellows hereof	Technical report	3 months from contract signature
D1 ii)	Manufacture, assemble and test all bellows by the Contractor	Protocol on testing of Devices at Contractor's place/Report on testing at Contractor's place	5 months from contract signature
D1 iii)	Deliver, assemble and test all bellows	Protocol on testing of Device at the research center ELI-Beamlines	6 months from contract signature
D2 i)	Provide preliminary design of all vacuum pipes	Technical report	1 month from contract signature
D2 ii)	Provide detailed plan of all vacuum pipes	Technical report	3 months from contract signature
D2 iii)	Manufacture, assemble and test all vacuum pipes by the Contractor	Protocol on testing of Devices at Contractor's place/Report on testing at Contractor's place	5 months from contract signature
D2 iv)	Deliver, assemble and test all vacuum pipes by the Client	Protocol on testing of Device at the research center ELI-Beamlines	6 months from contract signature
D3 i)	Provide preliminary design of all frames for vacuum pipes	Technical report	1 month from contract signature
D3 ii)	Provide detailed plan of all frames for vacuum pipes	Technical report	3 months from contract signature
D3 iii)	Manufacture, assemble and test all frames for vacuum pipes by the Contractor	Protocol on testing of Devices at Contractor's place/Report on testing at Contractor's place	5 months from contract signature
D3 iv)	Deliver, assemble and test all frames for vacuum pipes by the Client	Protocol on testing of Device at the research center ELI-Beamlines	6 months from contract signature
D4 i)	Provide preliminary design	Technical report	1 month from contract signature

*[Handwritten signature]*

	of all frames for vacuum chambers		
D4 ii)	Provide detailed plan of all frames for vacuum chambers	Technical report	3 months from contract signature
D4 iii)	Manufacture, assemble and test all frames for vacuum chambers by the Contractor	Protocol on testing of Devices at Contractor's place/Report on testing at Contractor's place	5 months from contract signature
D4 iv)	Deliver, assemble and test all frames for vacuum chambers by the Client	Protocol on testing of Device at the research center ELI-Beamlines	6 months from contract signature
D5 i)	Provide preliminary design of all vacuum chambers	Technical report	1.5 month from contract signature
D5 ii)	Provide detailed plan of all vacuum chambers	Technical report	3 months from contract signature
D5 iii)	Manufacture, assemble and test all vacuum chambers by the Contractor	Protocol on testing of Devices at Contractor's place/Report on testing at Contractor's place	9 months from contract signature
D5 iv)	Deliver, assemble and test Device by the Client	Protocol on testing of Device at the research center ELI-Beamlines	10 months from contract signature



# Technical Concept Document

ELI Prague

Vacuum components branch L1-E1 including supporting frames

TP14\_143



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## 1. This document

This "Technical Concept Document" is based on the tender ELI Prague TP14\_143, Vacuum components branch L1-E1 including supporting frames

Document TC ID / Revision 00111983 / C

WBS code 4.3 - Beam transport

PBS code SE.BDS.BT - 4.3 Beam Transport

Submission Deadline January 19<sup>th</sup>, 2016

This document contains comments and details of the planned realization by Trinos Vakuum-Systeme GmbH, Göttingen - Pfeiffer Vacuum Group.

The Specification: TC#00111983/C - RSD Vacuum components branch L1-E1 including supporting frames TP14\_143 is fulfilled if not mentioned otherwise.

### 1.1 Scope of Work

- 20 Bellows
- 18 Pipes
- 16 Support frames for pipes
- 4 Support frames for chambers
- 3 Rectangular Chambers incl. support frames

Following parts are not included:

- Cylindrical Chambers
- Pumps
- Gate Valves

The Schedule of Deliverables as attached to this document will be fulfilled.

### 1.2 Language

Project Language for Communication and Documentation is English

### 1.3 Transfer to Third Party

This Document is for the purpose of the Tender only and must not be published or transferred to third parties without written permission of Trinos Vacuum Systems.

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## 2. Mechanical Components

The mechanical setup is similar to all other projects which were realized by Trinos Vacuum Systems.

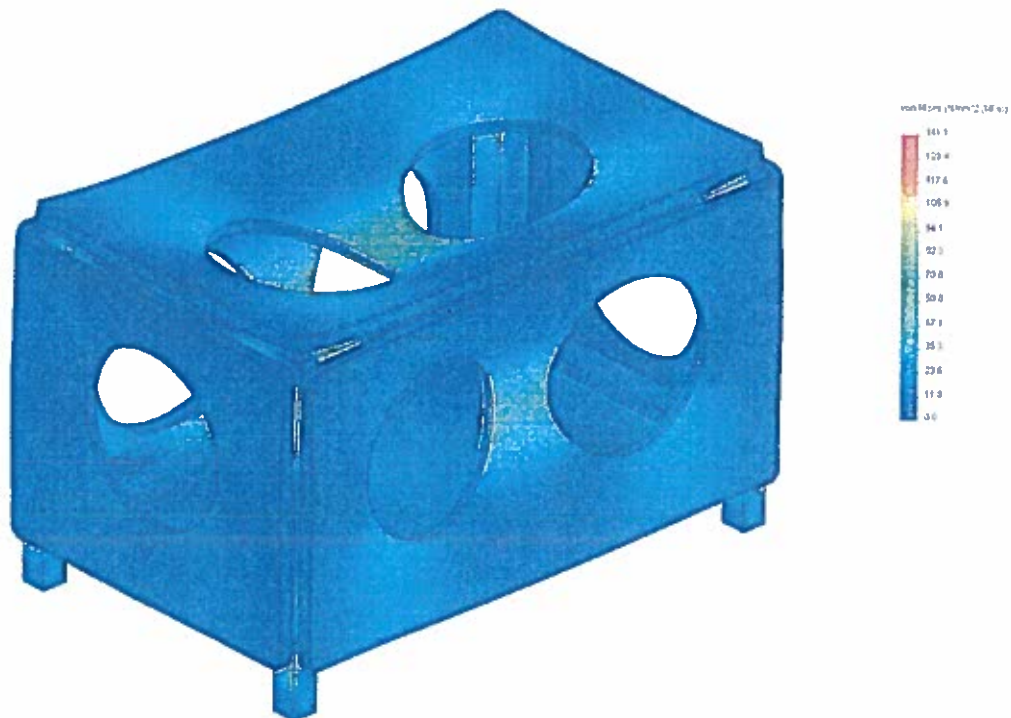
### General information:

- Trinos provides a 3D-Model 3 month after award of contract.  
Step-Files and 2D-Drawings are used for communication with the customer.  
2D-drawings will be checked and approved by the customer prior to start with the production.
- Protocol of the test for Helium-Tightness:  
Tightness  $< 1 \cdot 10^{-10} \text{ Pa} \cdot \text{m}^3/\text{s}$  ( $< 1 \cdot 10^{-9} \text{ mbar} \cdot \text{l/s}$ ), excl. Gas-Permeation (local)  
Tightness  $< 5 \cdot 10^{-5} \text{ Pa} \cdot \text{m}^3/\text{s}$  ( $< 1 \cdot 10^{-4} \text{ mbar} \cdot \text{l/s}$ ) integral for each component
- Tolerances (unless otherwise specified):
  - General Tolerances: ISO 2768-1 m
  - General Tolerances for welded constructions: EN ISO 13920 B
- Material (unless otherwise specified):
  - Stainless Steel 1.4301 (304) or higher
  - Covers made from EN AW 5083 or higher
  - Gaskets: FKM
- Breadboards will be made from EN AW 5083 with a thickness of 80 mm
- Support frames for pipes made from Aluminum
- Support frames for chambers will be fabricated from stainless steel (1.4301 (304))
- Surface Stainless Steel pipes:
  - inside: surface roughness  $\leq \text{Ra } 0,8 \mu\text{m}$
  - outside: glass beads blasted
- Surface Aluminum covers:
  - inside: milled with surface roughness  $\leq \text{Ra } 0,8 \mu\text{m}$
  - outside: milled with surface roughness  $\leq \text{Ra } 1,6 \mu\text{m}$
- Edges: Laser- or water-cut
- All ports blanked off
- Operating pressure: 0 hPa (mbar) to atmosphere
- Operating Temperature: Room temperature  
max. Temp for FKM gaskets:  $(-15)^\circ\text{C}$  to  $150^\circ\text{C}$
- Magnetic Permeability not specified
- A rating plate will be fixed to the chamber, please let us know if you prefer a particular position

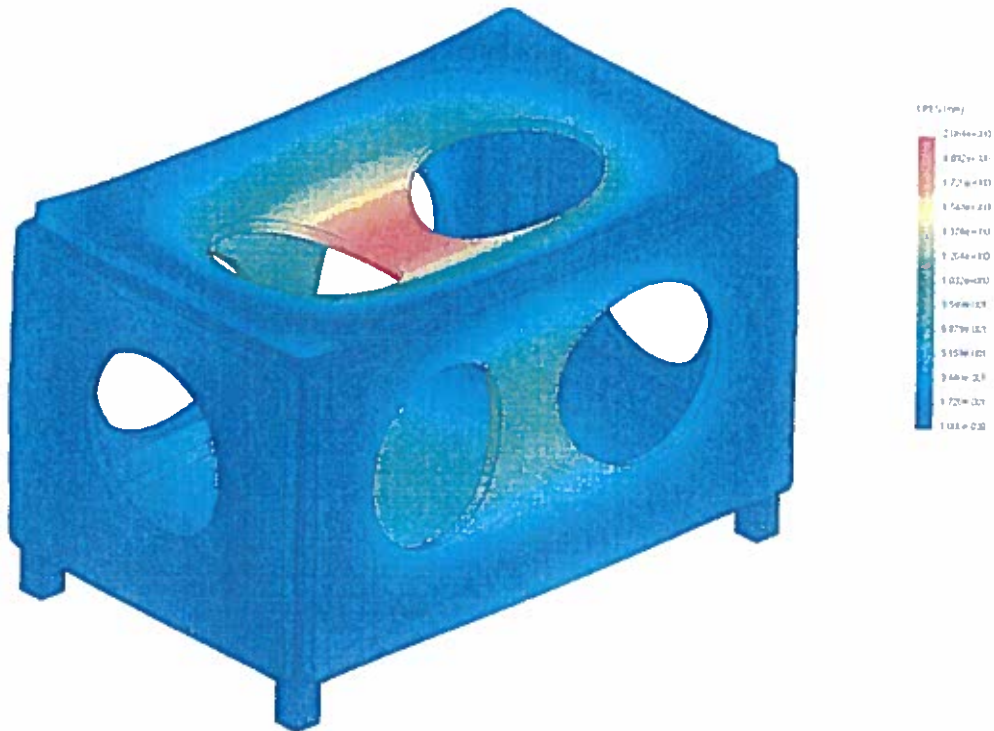
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- Weld connections: TIG; in special cases Laser-welded with high penetration depth (3000 W, up to 8 mm).
- FEM-Analyses of the chambers.  
For complex structures the static mechanical load can be simulated by FEM-Analysis. For large areas a bending of the plain chamber walls up to 1 mm due to atmospheric pressure is possible.  
Due to the de-coupling of the breadboard from the chamber, this movement is not transferred to the optical setup.

*Image: FEM Simulation of a rectangular chamber; Static load due to atmosphere pressure*



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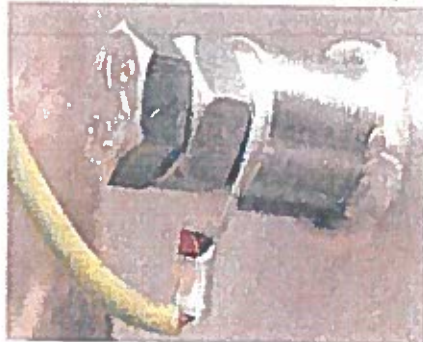
- Turbo pumps may cause extreme forces in case of mechanical crash of the rotor. Flanges for Turbo Pumps must be provided by the customer. The flanges will be checked and reinforced if necessary. Pfeiffer Vacuum has many experiences in the construction and the layout of Turbo Flanges.

### 3. Electrical Grounding (EMC/EMP)

(REQ-008656/A)

Each Trinos chambers are equipped with a connection point for equipotential bonding. The position and number of grounding points can be discussed with the customer. The customer can connect a grounding cable from these points to the local earth circuit connector of the building.

*Image: Equipotential ground terminal connector, thread: M8*



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The vacuum system forms a closed metallic cover of the included volume and works like a Faraday cage. The electrical interaction between the inside and the outside should be low. However, the influence of the laser radiation inside the volume should be part of the customer's know-how or customers experiment. Trinos cannot give any statement according to the EMC-/ EMP-performance of the setup.

The Czech standards of *REQ-008656/A* (ČSN 33 2000-4-41 and ČSN 33 2000-5-54) are unknown to Trinos and are not part of this quote.

#### **4. Cleanroom Setup**

REQ-008013/A

Trinos is equipped with a clean room ISO class 7. Final cleaning and packaging will be performed under this condition. Trinos is experienced in mounting under ISO-7-condition.

#### **5. Reference coordinate system and position adjustment**

The Reference Coordinate System (RCS) will be defined in accordance to the Reference Mechanical System of the hall (RMS) for the rectangular chambers.  
Trinos assumes that the customer provides a reliable system for the positioning of pipes and chambers.

#### **6. Factory Acceptance Test**

All parts will be mounted and tested at Trinos prior to shipping. A protocol of all test results will be delivered before installation at customer site.

#### **7. Installation**

During the setup, pipes and chambers will be connected to chambers and gate valves which are delivered by the customer. Connection and adjustment will be skipped for the components which are not present at the time of installation.

Delivery of pipes, bellows and support frames will be 6 month after award of contract, chambers will be delivered 9 month after award of the contract.

Pumps are not part of the tender. Mounting, setup and putting into service of pumps is not part of this quote.

#### **8. General Safety Requirements**

A risk assessment will be part of the Trinos Construction Process.

Please note that CE marking is not applicable for vacuum chambers, pipes and supporting frames of this tender.

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## 9. Vibration Study

For an evaluation of vibration performances, Trinos will work together with the Company ERAS, located in Göttingen. ERAS has a lot of experience in vibration analyses and will give his expertise and support regarding the vibration situation.

Trinos will take the results into account during the construction phase. If the customer asks for changes due to the vibration study, they can be only be considered as long as they are neutral to the calculated costs. If the range of changes exceeds the calculated costs, Trinos will be free to add the additional costs to the final price.

Here is a description of the ERAS scope of work:

ERAS GmbH in Göttingen is an expert for analysis of both structural and system dynamics. Furthermore ERAS has been focusing on design and realization of customized vibration control solutions in nearly every branch and application for over 20 years. In the niche market of systems for active vibration control ERAS is one of only few global players. The ERAS VibraLock® technology can reference numerous field-proven installations on a high-professional level. ERAS is partner to the optical and laser industry for over 10 years now. Both vibration-related beam control solutions as well as engineering services covering system and structure optimizations are part of their business. As a partner to TRINOS Vacuum Systems ERAS will join this tender in the role of a subcontractor. ERAS will take over the work package Vibration Study as described in the tender for quotes. Based on an initial review of the beamline infrastructure layout and design, ERAS will decide on appropriate tools and measures for analyzing the beamline infrastructure dynamics. Most probably, a FE model will be set up of selected or even the entire beamline infrastructure (depending on what will be considered as being most promising from a customers' benefit perspective). Depending on kind and quality of input data provided by contracting authority ERAS will perform studies of influences on relevant beamline parameters in frequency and/or time domain. A typical outcome could be a prediction of estimated beam deviation distribution at defined beam extraction points. Work will be performed and results will be presented as paperwork. ERAS will be glad to assist the contracting authority in determining relevant input data for vibration study purposes if desired. All work and expenses needed to generate results as described above are covered by the total budget given. In case that additional services or solutions would be required (like further analyses or consulting on site etc.) ERAS will then provide separate fixed-price-quotes targeting on the specific customers' needs. In case that either vibration study results or observations during initial operation should indicate need for extended vibration control measures the contracting authority can instantly fall back and rely on ERAS' VibraLock® technology. The VibraLock® system tool box features various application-proven components and approaches for both structural dynamics improvement and beamline manipulation. VibraLock® systems can guarantee for most effective and highly professional vibration compensation or isolation as well as for application-tailored actuation of beamline components like lenses or deflection mirrors.

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## 10. Contact Person at Trinos

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**Annex 5 – Verification plan - shall be attached to the Contract pursuant Art. V par 4 of the Contract after signature of the Contract.**

Following table is not the Verification plan but only tamplate for future Verification plan.

Program: [4.3 - Beam transport]

Subject: [Vacuum beam transport L1 to E1 (Vacuum hardware)]. Verification Control Document (VCD)

Specification: [TC0011943/E - RSD Vacuum components branch L1-E1 including supporting frames TP14\_143]

Requirement TC ID	Revision	Requirement text	Level	Verification Method	Close-out		VFD Verification Planning Document	VRD Verification Record Document	Comments
					Yes	No			
REQ-007906	A	Vacuum components of L1 - E1 system shall be designed for vacuum level 10-6 mbar.		T - test					
REQ-008117	A	Vacuum vessels shall allow vacuum pumping and venting.		FD-functional demonstration					
REQ-008273	A	Enclosed drawings shall be taken into account as inputs for preliminary design.		R - review					
REQ-008323	A	All relevant components (RC Vacuum Chambers including chassis, pipe support structures, CC Vacuum Vessel chassis) shall be designed to accommodate laser beam exit, 1300 mm above floor level.		R - review					
REQ-007914	A	All Vacuum chamber parts heavier than 15 kg shall be equipped with lifting eyes interfaces. NOTE: Final design of the interfaces will be part of detailed design.		R - review					
REQ-007923	A	All openings of detented components shall be closed as follows: Vacuum chambers by aluminum alloy or stainless steel blank flanges; Vacuum pipes and bellows by plastic caps.		I - inspection					
REQ-007981	A	Outer surface finish shall be uniform Balaban (blasting with glass beads). Other finish technologies are possible if agreed with the Contracting Authority.		I - inspection					
REQ-007982	A	Precautions shall be taken in design and assembly of all vacuum components to avoid trapped volumes in vacuum spaces which could result in virtual leaks and these spaces shall be suitably vented.		I - inspection					
REQ-007999	A	Maximum dimensions of used components and their non-dismountable sub-components shall be 1,9 x 2,9 x 2,4 m.		R - review					
REQ-008001	A	Design shall have grounding and ESD.		R - review					
REQ-008010	A	All opened profiles in frames constructions shall be covered with end caps.		I - inspection					
REQ-007919	A	Supplier shall provide final information regarding BT L1-E1 weight and weight distribution of BT L1-E1 components.		R - review					
REQ-008284	A	Vacuum Vessels shall be equipped with inlet and outlet flanges according to the listed standards: ISO 1609-1988 - Vacuum technology - Flange dimension; ISO 2861-2013 - Vacuum technology - Dimensions of clamped - type quick-release couplings.		R - review					
REQ-008315	A	Single leak rate for each relevant component (vacuum pipes, bellows) shall be lower than 1 10-9 mbar l/s per component.		T - test					
REQ-007993	A	Total leak rate for each relevant component (vacuum vessels) shall be lower than 5 10-4 mbar l/s per component. CC Vacuum Vessel Chassis shall be made of stainless steel.		T - test					
REQ-007993	A	CC Vacuum Vessel Chassis shall be made of stainless steel.		R - review					

Program: [4.3 - Beam transport]

Subject: [Vacuum beam transport L1 to E1 (Vacuum hardware)]. Verification Control Document (VCD)

Specification: [TC906111983/E - BSD Vacuum components branch L1-E1 including supporting frames TP14\_143]

Requirement TC ID	Revision	Requirement text	Level	Verification Method	Close-out		VCD Verification Planning Document	VCD Verification Record Document	Comments
					Yes	No			
REQ-008110	A	CC Chassis shall allow for floor fixing. NOTE: For further information see the document "E1 room datasheet" (RD-02). Selected values mentioned in E1 room datasheet are: Max. load for floors of experimental halls is 25 kN on surface with dimensions 20x20 cm. Anything exceeding these values should be checked and approved by Contracting Authority.		R - review					
REQ-007097	A	Design of CC Vacuum Vessel Chassis shall allow positioning in x, y direction (horizontal plane) when fixed to floor. NOTE: Requirement defining interfaces (e.g. bracket with holes) needed for positioning.		R - review					
REQ-007998	A	Range of CC Vacuum Vessel Chassis adjustment shall be in a z direction 30 mm		R - review, FD - functional demonstration					
REQ-007994	A	CC Vacuum Vessel Chassis shall allow x, y, z vessels adjustment.		R - review					
REQ-007995	A	Range of CC Vacuum Vessel adjustment shall be (see REQ-007994(A) in x direction 20 mm in y direction 20 mm in z direction 20 mm.		R - review, FD - functional demonstration					
REQ-008006	A	Design solution using screws for adjustment shall be used (see Figure 2)		R - review					
REQ-007990	A	CC Vacuum Vessel Chassis shall allow clash free installation of Turbomolecular pumps (TMP).		R - review					
REQ-008310	A	RC Vacuum Chambers shall provide for the following mechanical interfaces: TMP's (Turbo Molecular Pumps); Gauges; Feedthroughs; Diagnostics; Remote control; Central Vacuum System (CVS); Beam Transport (BT); Vacuum Gate Valves; Vacuum Venting Valves.		R - review					
REQ-008323	A	RC Vacuum Chambers shall be a modular units allowing extension in longitudinal direction (see Figure 3)		R - review					
REQ-008321	A	The supplier shall define the Reference Coordinate System (RCS) of the RC Chambers which shall allow positioning these RC Chambers in Contracting Authority's experimental hall according to Reference Mechanical System of the hall (RMS)		R - review					
REQ-008322	A	RCS and its relation to the RMS shall be set up together with supplier during the preliminary design phase.		R - review					
REQ-008005	A	RC Breadboard and RC Vacuum Vessel shall allow for decoupling.		R - review					
REQ-008006	A	Decoupling of RC breadboard and vacuum vessel shall be made by using elastic welded balljoint		R - review					
REQ-008007	A	Double ball joint decoupling system shall be applied on RC breadboard chassis (see Figure 4).		R - review					
REQ-008276	A	All RC Vacuum Vessels and Vacuum Vessel Chassis shall allow installation of Turbomolecular pumps (TMP) as follows: Vacuum Vessel - ISO F Interface Vacuum Vessel versus TMP; Vacuum Vessels Chassis - possibility to dismount the Chassis. NOTE: Preferable position of TMP's is from the bottom part of Vacuum Vessel		R - review					
REQ-	A	RC frame shall be made of stainless steel.		R - review					

Program: [4.3 - Beam transport]

Subject: [Vacuum beam transport L1 to E1 (Vacuum hardware)]. Verification Control Document (VCD)

Specification: [TCR0011983/E - RSD Vacuum components branch L1-E1 including supporting frames TP14\_143]

Requirement TC ID	Revision	Requirement text	Level	Verification Method	Close-out		VFD Verification Planning Document	VFD Verification Record Document	Comments
					Yes	No			
REQ-007916	A	RC shall be equipped with roughing side flanges (DN160 SO - ICF).		R - review					
REQ-008274	A	RC flanges and blank flanges shall be made of stainless steel or aluminum alloy (following types: Aluminum alloy: EN AW-2219 EN AW-3003 EN AW-5083 EN AW-5082 EN AW-2090 EN AW-2218 EN AW-7003 Stainless steel(AISI) 304, AISI 304L).		R - review					
REQ-008275	A	Final choice of RC panel material shall be made in preliminary design phase.		R - review					
REQ-008004	A	RC Vessel panels shall be designed as a modular system. Technical note: Modular system = indication of panel dimensions.		R - review					
REQ-008020	A	Maximal deformations of RC Vacuum Vessel panels under vacuum shall be lower than 3 mm in comparison to the vended sheets.		T - test					
REQ-007915	A	All RC removable panels shall be equipped with guiding pins for closing procedure.		R - review					
REQ-007912	A	Blind holes with thread depth 2.5d shall be prepared in RC covers/panels for all designed flanges.		R - review					
REQ-007924	A	Stainless steel screws with Allen heads shall be used on RC Chamber panels.		R - review					
REQ-008325	A	RC Vacuum Vessel Chassis shall allow z (vertical) adjustment.		R - review					
REQ-008326	A	Range of RC Vacuum Vessel Chassis adjustment in z (vertical) direction shall be 20 mm.		R - review					
REQ-008002	A	RC Vacuum Vessel Chassis shall be made of stainless steel or enstated aluminium alloy profiles.		R - review					
REQ-008285	A	Design of RC Vacuum Vessel Chassis shall allow positioning in x, y direction (horizontal plane) when fixed to floor. NOTE: Requirement defining interfaces (e.g. bracket with holes) needed for positioning.		R - review					
REQ-008327	A	RC Vacuum Vessel Chassis shall allow installation of Turbomolecular pumps (TMP).		R - review					
REQ-008328	A	RC Vacuum Vessel Chassis shall allow for floor fixing. NOTE: For further information see the document "E1 room date sheet" (RD-02). Selected values mentioned in E1 room date sheet are: Max. load for floors of experimental halls is 25 kN on surface with dimensions 20x20 cm. Anything exceeding these values should be checked and approved by Contracting Authority.		R - review					
REQ-008320	A	Each RC Vacuum Vessel Chassis shall be equipped with removable transportation wheels.		R - review					
REQ-008330	A	Supplier shall provide static FEM analysis and vibration study according to Contracting Authority inputs. Technical note: The latest results of building vibration measurement and simplified optical layout will be provided by Contracting Authority after contract signature.		A - analysis					
REQ-008331	A	RC Optical Tables shall have threaded holes pattern with 26 mm spacing.		R - review					
REQ-008332	A	Threaded holes of RC Optical Table shall be M8 x 1.5.		R - review					

Program: [4.3 - Beam transport]

Subject: [Vacuum beam transport L1 to E1 (Vacuum hardware)]. Verification Control Document (VCD)

Specification: [TC00011963/E - RSD Vacuum components branch L1-E1 including supporting frames TP14\_143]

Requirement TC ID	Revision	Requirement text	Level	Verification Method	Close-out		VCD Verification Planning Document	VCD Verification Record Document	Comments
					Yes	No			
REQ-008333	A	RC Optical Table shall be made of aluminum alloy following types: EN AW-2219EN AW-3003EN AW-5052EN AW-6062EN AW-7005 (must not be baked out)The parts must not be anodized.		R - review					
REQ-008334	A	Final choice of RC Optical Table material shall be made in preliminary design phase.		R - review					
REQ-004315	A	Minimum thickness of RC Optical Table plate shall be 50 mm as a starting value. Based on FEM analysis and vibration study (REQ-008330/A) modification of this value is acceptable.		R - review					
REQ-008656	A	Maximum static deformation of RC Optical Table shall be $\leq$ 1 mm.		A - analysis					
REQ-008326	A	Natural frequencies of RC Optical Table shall be $\geq$ 20 Hz.		A - analysis					
REQ-008337	A	RC Optical Table Chassis shall allow z (vertical) adjustment.		R - review					
REQ-008611	A	Range of RC Optical Table Chassis adjustment in z (vertical) direction shall be 20 mm. Design of RC Optical Table Chassis shall allow positioning in x, y direction (horizontal plane) together with Vacuum Vessel Chassis (NOTE: Requirement defining interfaces (e.g. bracket with holes) needed for positioning. Temporary connection between two chassis is also mentioned in this requirement).		R - review					
REQ-008760	A	RC Optical Table Chassis shall allow x, y, z adjustment of RC Optical Table.		R - review					
REQ-008761	A	RC Optical Table adjustment shall be (see REQ-008760/A) in x direction 15 mm in y direction 15 mm in z direction 15 mm		R - review					
REQ-008536	A	RC Optical Table Chassis shall be made of stainless steel or aluminum alloy extruded profiles (united with RC Vacuum Vessel Chassis).		R - review					
REQ-008339	A	RC Optical Table Chassis shall allow installation of TMP's.		R - review					
REQ-008341	A	RC Optical Table Chassis shall allow floor fixing.		R - review					
REQ-007825	A	RC Optical Table Chassis shall be equipped with removable transportation wheels.		R - review					
REQ-007826	A	Sealing used for BT L1-E1 system shall be made of fluoropolymer polymer (FPM) material. NOTE: RC chambers applicable.		R - review					
REQ-007978	A	Hardness of BT L1-E1 sealing o-rings shall be 50 or 70 HSC (Shore) NOTE: RC chambers applicable.		R - review					
REQ-007879	A	Sealing surfaces must be in particular free of scratches or dents.		I - inspection					
REQ-007880	A	Seal faces shall be suitably protected immediately after final machining to minimize the risk of damage. This protection shall only be removed for the purposes of cleaning and inspection, prior to final assembly. The surface finish of seal faces shall be compatible with the requirements of the ISO-K (1999) ISO-F seals listed		I - inspection					
REQ-007978	A			R - review					

Program: [4.3 - Beam transport]

Subject: [Vacuum beam transport L1 to E1 (Vacuum hardware)]. Verification Control Document (VCD)

Specification: [TCR00111993/E - R5D Vacuum components branch L1-E1 including supporting frames TP14\_143]

003965A; Vacuum beam transport L1 to E1 (Vacuum hardware)

Requirement ID	Revises	Requirement text	Level	Verification Method	Close-out		VCD Verification Based Document	Comments
					Yes	No		
REQ-008281	A	Vacuum vessels shall comply with frequency of opening/closing 2 times a day. NOTE: Based on engineering demands on operational and maintenance procedures.		R - review, A - analysis				
REQ-007977	A	CH3 Chassis shall be designed as CC type.		R - review				
REQ-009313	A	CH3 Chassis shall have an interface for fusion to the floor and wall.		R - review				
REQ-009609	A	CH3 Chassis shall be compatible with CH13 Vacuum Vessel Interface (see Annex II)		R - review				
REQ-008810	A	Vacuum Chamber CH4 shall be designed as RC type (see Chapter 4.1.2)		R - review				
REQ-0095345	A	Vacuum Chamber CH9 shall be designed as RC type (see Chapter 4.1.2)		R - review				
REQ-008011	A	CH10 Chassis shall be designed as CC type.		R - review				
REQ-008347	A	CH10 Chassis shall be compatible with CH10 Vacuum Vessel Interface (see Annex II)		R - review				
REQ-008349	A	Vacuum Chamber CH11 shall be designed as RC type (see Chapter 4.1.2)		R - review				
REQ-007908	A	CH12 Chassis shall be designed as CC type.		R - review				
REQ-008282	A	CH12 Chassis shall be compatible with CH12 Vacuum Vessel Interface (see Annex II)		R - review				
REQ-008349	A	CH13 Chassis shall be designed as CC type.		R - review				
REQ-007908	A	CH13 Chassis shall be compatible with CH13 Vacuum Vessel Interface (see Annex II)		R - review				
REQ-008282	A	Edge welded bellows shall be equipped with guiding rods for axial movement function.		I - inspection				
REQ-008282	A	Each edge welded bellows shall undergo a helium leak test confirmed with output protocol.		T - test				
REQ-008283	A	Each edge welded bellows shall be manufactured according to Table 1. Edge welded bellows with guiding rods DN2501 type of flanges ISO-K (ISO 1609) inside pressure 10-6 mbar/Outside pressure 1 bar (atmospheric pressure), leak rate 10-9 mbar/L/absemin, 10 000 cycles/Movement absorption fluid 15 mm/Lateral: 5 mm/Axial: 27°/Maximal inner diameter 230 mm/Length from 230 mm/Space for moulding (between flanges) without centering 237.8 mm/ Table 1 Technical specification of edge welded bellows.		T - test				
REQ-007987	A	Pipes shall be designed with respect to standard ISO 1609-1986 - Vacuum technology - Flange dimension.		R - review				
REQ-008069	A	Vacuum pipes shall be clearly identified and labeled for assembly purpose.		R - review				
REQ-008652	A	Pipe support structures shall be positioned in x, y direction/Note: requirement describes positioning with relation to building resp. E1 as perpendicular/In all		R - review				
REQ-008653	A	Pipes support structures shall allow 2 (vertical) adjustment. Exception to support structure for horizontal pipe (see drawing number 00104392/00)		R - review				

Program: [4.3 - Beam transport]

Subject: [Vacuum beam transport L1 to E1 (Vacuum hardware)]. Verification Control Document (VCD)

Specification: [TC00111983/E - RSD Vacuum components branch L1-E1 including supporting frames TP14\_143]

001965A: Vacuum beam transport L1 to E1 (Vacuum hardware)

Requirement ID	Revision	Requirement text	Level	Verification Method	Close-out		VCD Verification Document	VCD Verification Record Document	Comments
					Yes	No			
REQ-007955	A	Range of Poles support structures adjustment in z (vertical) direction shall be 30 mm.		R - review					
REQ-008154	A	Poles support structures shall be made of stainless steel or anodized aluminum alloy profiles.		R - review					
REQ-007904	A	The clamps shall be of suitable design and use material that prevents permanent clamp deformation after multiple use.		R - review					
REQ-007905	A	The clamps shall be of suitable design and use material that prevents damaging of the clamp slots on flanges.		R - review					
REQ-007909	A	Flange shall be designed with respect to the ISO standards: ISO 1609:1986 - Vacuum technology - Flange dimension; ISO 2461:2013 - Vacuum technology - Dimensions of clamped - type quick-release couplings.		R - review					
REQ-007910	A	Centering ring with outer ring shall be used for connection between flange and chamber.		R - review					
REQ-007983	A	Cleaning procedure shall remove contaminants that adhere to the surface such as oils, greases, dirt, sweat, corrosion products, or finger prints.		I - inspection					
REQ-007984	A	Any assemblies shall be made up from pre-cleaned components where possible.		R - review					
REQ-007985	A	Cleanliness shall be taken into account at all stages from detailed design to installation.		R - review					
REQ-007986	A	Clean components shall be handled wearing clean, dry, lint-free gloves.		R - review					
REQ-007987	A	Supplier shall provide cleaning procedure compatible with High Vacuum (10 <sup>-6</sup> mbar) and using in cleanroom ISO7.		R - review					
REQ-008319	A	The cleaning procedure shall be included at minimum the following steps: General pre-clean, removal of gross contamination, flushes etc. by wiping/scrubbing; Degrease with solvent by rinsing, swabbing or immersion; Wash with domestic water and detergent; Vapor degrease or soak cleaning; Degrease with solvent. Small and complex items shall be immersed and ultrasonically agitated; Wash with domestic water; Wash with demineralized water; Drying (dry air); immediate packaging.		R - review					
REQ-007898	A	Vacuum sealing welds made externally must have full penetration leaving a smooth surface on the vacuum side.		R - review					
REQ-007989	A	Supplier shall apply cleaning and degreasing procedure. This procedure shall be provided by Supplier.		R - review					
REQ-007991	A	Swabbing gases shall be used to remove oxidation.		I - inspection					
REQ-007992	A	Tools used during manufacture shall not contaminate the vacuum surfaces.		R - review					
REQ-008050	A	All cutting fluids, greases etc. used during manufacture shall be capable of being removed entirely by subsequent cleaning operations. All conductive parts must be designed according to following Czech applicable standards CSN 33 2000-4-1; CSN 33 2000-5-64		R - review					

Program: [4.3 - Beam transport]

Subject: [Vacuum beam transport L1 to E1 (Vacuum hardware)], Verification Control Document (VCD)

Specification: [TC00011983/E - NSD Vacuum components branch L1-E1 including supporting frames TP14\_143]

0019657A:Vacuum beam transport L1 to E1 (Vacuum hardware)

Requirement TC ID	Revision	Requirement text	Level	Verification Method	Close-out		VPR Validation Planning Document	VMD Verification Record Document	Comments
					Yes	No			
REQ-008012	A	The transportation personnel shall follow the Contracting Authority's safety regulations. NOTE: These regulations shall be defined by Contracting Authority and provided to the supplier after contract signature and before detailed design contract phase. The technologies and instruments shall be delivered in protective package preventing damage and contamination and a minimum of two sets separate clean packaging. The technologies shall be cleaned and packaged in clean environment of ISO class 7. All transportation tools and equipment entering the clean rooms shall be cleaned and reviewed by the Contracting Authority's approved methods. NOTE: Some tools can be provided by the Contracting Authority upon agreement. The transportation to the final destination of the technologies and the instruments shall be conducted by the supplier.		R - review					
REQ-008013	A	All transportation tools and equipment entering the clean rooms shall be cleaned and reviewed by the Contracting Authority's approved methods. NOTE: Some tools can be provided by the Contracting Authority upon agreement. The transportation to the final destination of the technologies and the instruments shall be conducted by the supplier.		R - review, I - inspection					
REQ-008014	A	All transportation tools and equipment entering the clean rooms shall be cleaned and reviewed by the Contracting Authority's approved methods. NOTE: Some tools can be provided by the Contracting Authority upon agreement. The transportation to the final destination of the technologies and the instruments shall be conducted by the supplier.		I - inspection					
REQ-008015	A	The transportation procedures shall be discussed and reviewed by the Contracting Authority's installation officer and shall be compliant with the Contracting Authority's installation regulations. NOTE: These regulations shall be defined by Contracting Authority and provided to the supplier after contract signature and before detailed design contract phase.		R - review					
REQ-008016	A	The main parts of the mechanical structure shall be equipped with positioning/alignment marks for industrial 3D measurement/survey. The specific type of the positioning/alignment marks, their number and location shall be agreed with the Contracting Authority. System or its relevant components that comply with all applicable EU and Czech legislative requirements and where applicable shall have CE marking and Certificate of Compliance.		R - review, I - inspection					
REQ-008018	A	System or its relevant components that comply with all applicable EU and Czech legislative requirements and where applicable shall have CE marking and Certificate of Compliance.		R - review					
REQ-008019	A	Supplier shall perform hazard identification and risk assessment of system prior to design. NOTE: Relevant for chamber design - RC chambers. System or its relevant components shall be delivered with technical documentation where supplied specifies modes of operation, conditions for safe operation, installation and maintenance of system.		R - review, A - analysis					
REQ-008020	A	Supplier shall supply the following relevant manufacturing documents (extent as specified in contract): Operating manual (including step-by-step assembly procedure), maintenance manual, breakdown list as built, Declarations of Conformity and relevant CE markings where required by EU legislation.		R - review					
REQ-008031	A	All interfaces of derived components relevant for L1 to E1 system integration shall be identified and captured on drawings.		I - inspection					
REQ-008657	A			R - review					



Program: (4.3 - Beam Transport)

Subject: (Vacuum beam transport L1 to EI (Vacuum hardware)): Verification Control Document (VCD)

Specification: (TCR0011933/E - RSD Vacuum components branch L1-EI including supporting frames TPI4\_143)

003965A:Vacuum beam transport L1 to EI (Vacuum hardware)

Requirement TC ID	Revision	Requirement text	Level	Verification Method	Close-out		VFD Verification Planning Document	VFD Verification Record Document	Comments
					Yes	No			
REQ-008162	A	All interfaces identified, captured on drawings shall be signed by Contracting Authority.		R - review					
REQ-008165	A	The results of review shall be documented in approved record and by VCD (see chapter 9.4).		R - review					
REQ-008353	A	The inspection results recorded in an inspection report referred in VCD/NOTE concerning VCD see chapter 9.3 and 9.4.		R - review					
REQ-008354	A	The measurement results shall be recorded in a Test report.		R - review					
REQ-008789	A	The protocol of the measurement shall be made and approved.		R - review					
REQ-008771	A	Test Programs shall be approved by the Contracting Authority.		R - review					
REQ-008355	A	The execution of functional demonstration shall be observed and results recorded in a Functional demonstration report.		R - review					
REQ-008357	A	The results of analysis shall be recorded in an Analysis report.		R - review					
REQ-008362	A	Based on the agreed methods of verification and the VP proposal how the verifications should be grouped together, the supplier shall include in the VP the list of the Test reports, Analysis reports, inspections reports, and Functional demonstration reports that the supplier proposes to be prepared as part of verification of the requirements. (agreement by Contracting Authority)		R - review					
REQ-008363	A	The supplier shall carry out factory verification of requirements according to the VP and according to the updated VCD and record the results in the VCD before shipping the system out of factory. (agreement by Contracting Authority)		R - review					
REQ-008364	A	The supplier shall carry out with support from the Contracting Authority the final verification of requirements of E1I tasks according to the VP and VCD and record the results in the final VCD (agreement by Contracting Authority)		R - review					
REQ-008367	A	The basis for acceptance shall be completed Verification Control Document (Chapter 9.3) summarizing the overall verification results together with relevant reports supporting the verification		R - review					

**Annex 6 -The breakdown of the Price of the Work and the Payment Schedule**

**1. Price of Deliverables hereof**

Deliverable	Price of Deliverable excl. VAT - EUR	VAT in % EUR	Price of Deliverable incl. VAT - EUR
D1	21420,00 EUR	4498,20	25 918,20
D2	37618,00 EUR	7899,78	45 517,78
D3	34520,00 EUR	7249,20	41 769,20
D4	18924,00 EUR	3974,04	22 898,04
D5	243 075,00 EUR	51045,75	294 120,75
The total Price of the Work (e.g. for all Deliverables D1 to D5)	355 557,00 EUR	74666,97	430 223,97

**2. Contractual Parties have agreed that the Contractor shall be authorized to invoice the Price of the Work as follows:**

Deliverable	Invoicing (invoice issue)
D1	10% of the Price of D1 after the signature hereof, 20% of the Price of D1 after fulfillment of the partial deliverable D1 i), 40% of the Price of D1 after fulfillment of the partial deliverable D1 ii), 30% of the Price of D1 after fulfillment of the partial deliverable D1 iii).
D2	10% of the Price of D2 after the signature hereof, 20% of the Price of D2 after fulfillment of the partial deliverable D2 i), 25% of the Price of D2 after fulfillment of the partial deliverable D2 ii), 25% of the Price of D2 after fulfillment of the partial deliverable D2 iii), 20% of the Price of D2 after fulfillment of the partial deliverable D2 iv).
D3	10% of the Price of D3 after the signature hereof,

	<p>20% of the Price of D3 after fulfillment of the partial deliverable D3 i),</p> <p>25% of the Price of D3 after fulfillment of the partial deliverable D3 ii),</p> <p>25% of the Price of D3 after fulfillment of the partial deliverable D3 iii),</p> <p>20% of the Price of D3 after fulfillment of the partial deliverable D3 iv).</p>
D4	<p>10% of the Price of D4 after the signature hereof,</p> <p>20% of the Price of D4 after fulfillment of the partial deliverable D4 i),</p> <p>25% of the Price of D4 after fulfillment of the partial deliverable D4 ii),</p> <p>25% of the Price of D4 after fulfillment of the partial deliverable D4 iii),</p> <p>20% of the Price of D4 after fulfillment of the partial deliverable D4 iv).</p>
D5	<p>10% of the Price of D5 after the signature hereof,</p> <p>20% of the Price of D5 after fulfillment of the partial deliverable D5 i),</p> <p>25% of the Price of D5 after fulfillment of the partial deliverable D5 ii),</p> <p>25% of the Price of D5 after fulfillment of the partial deliverable D5 iii),</p> <p>20% of the Price of D5 after fulfillment of the partial deliverable D5 iv).</p>

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