

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

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This Document is for the purpose of the Tender only and must not be published or transferred to third parties without written permission of Trinos Vacuum Systems.

2. Mechanical Components

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

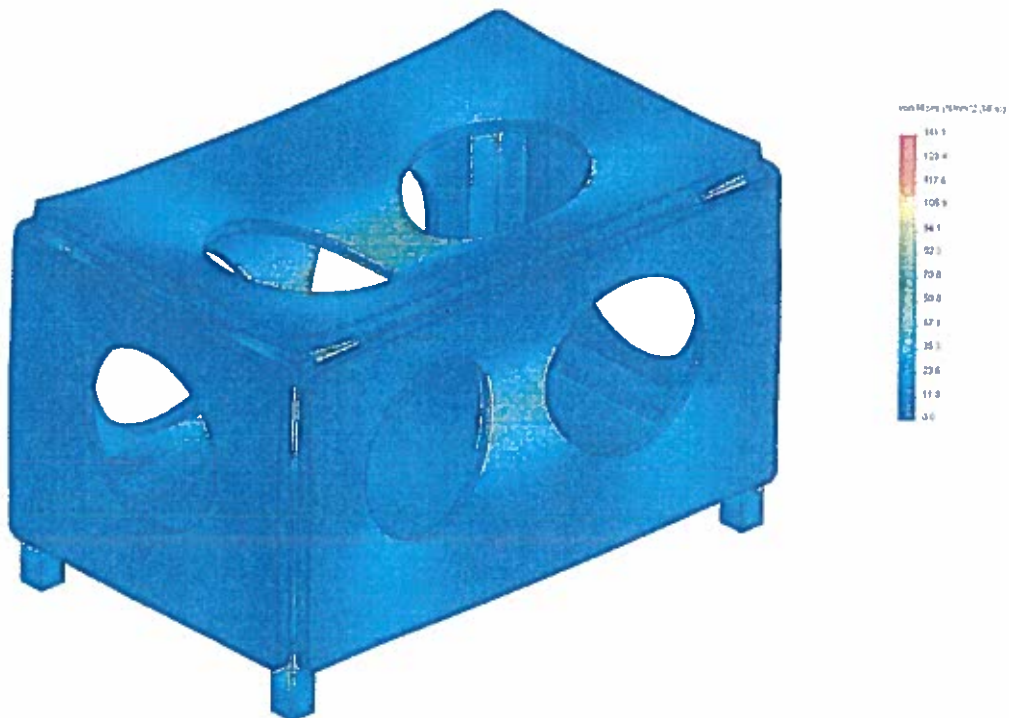
General information:

- 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°C
- Magnetic Permeability not specified
- A rating plate will be fixed to the chamber, please let us know if you prefer a particular position

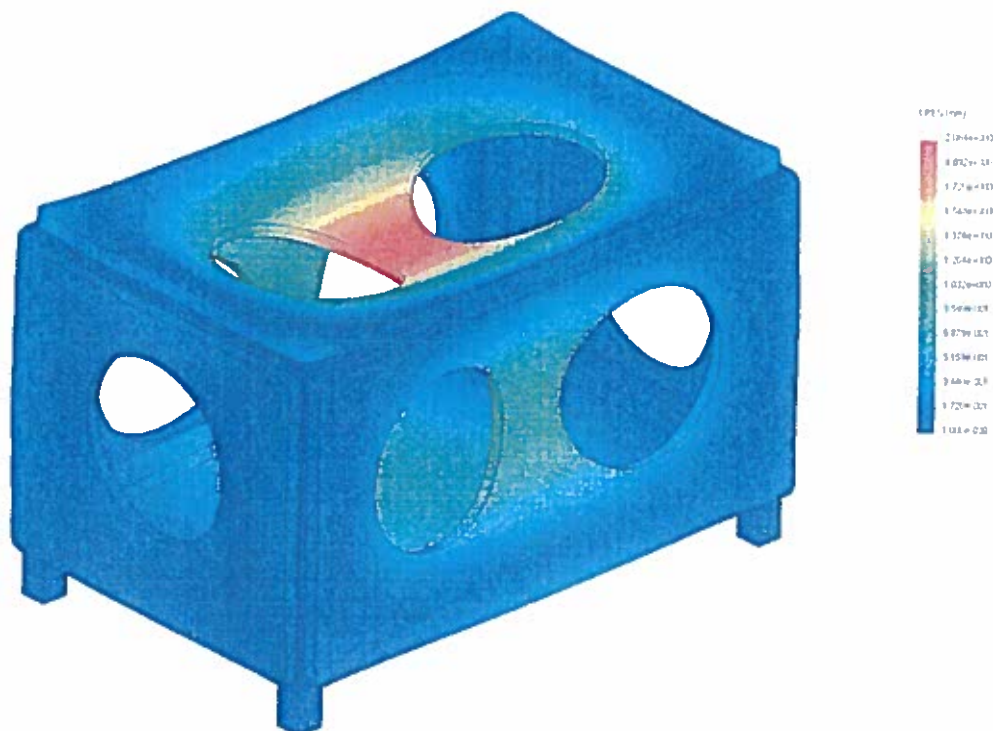
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- Weld connections: TIG; in special cases Laser-welded with high penetration depth (3000 W, up to 8 mm).
- FEM-Analyses of the chambers.
For complex structures the static mechanical load can be simulated by FEM-Analysis. For large areas a bending of 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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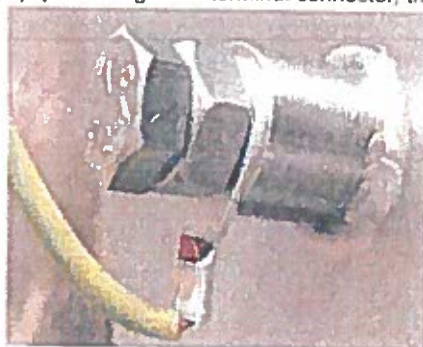
- Turbo pumps may cause extreme forces in case of mechanical crash of the rotor. Flanges for Turbo Pumps must be provided by the customer. The flanges will be checked and reinforced if necessary. Pfeiffer Vacuum has many experiences in the construction and the layout of Turbo Flanges.

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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