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G1 and G4 diffraction grating mounts for L4 10PW compressor

TP19_018

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1. Introduction

1.1. Purpose

This Requirements Specification Document (RSD) lists the technical requirements and constraints on a product related to the RA1 programme of the ELI Beamlines project. This can lead to identification of the product interfaces with the ELI Beamlines science-based technology and ELI Beamlines building facility. This RSD also acts as the parent document for technical requirements that are addressed in lower level design description documents (see chapter 1.4).

1.2. Scope of work

This Requirements Specification Document (RSD) states and describes the technical requirements for fabrication of G1 and G4 diffraction grating mounts for the L4 10 PW compressor. These mounts are an integral part of the overall L4 laser system of ELI-Beamlines and are registered in the PBS database under the following PBS codes: RA1.L4.CMP1.10PW.OM.G1.MT and RA1.L4.CMP1.10PW.OM.G4.MT.

This RSD contains all of the technical requirements: functional, performance and design, delivery, safety and quality requirements for the following products (tender number: TP19_018): G1 and G4 Diffraction Grating Mounts for L4 10PW Compressor ("Mounts" in further text). In addition to the requirements specified hereinafter, all parts of the mounts shall fully comply with the drawings provided in the Reference Documents (see below RD-01, chapter 1.4).

The G1 and G4 grating mounts will be located inside the L4 10PW compressor vacuum chamber and will provide a support structure for large and heavy diffraction gratings. The optomechanical mounts will enable the gratings to be held in a precisely defined position and to be remotely steered, with very high precision and stability, whilst operating under high vacuum (10^{-7} mbar) within the compressor chamber.

Required part of the supply is development of manufacturing documentation for the G1 and G4 mounts, manufacture, functional testing including the motorized actuators, and delivery to ELI-Beamlines of two mounts, one for G1 and one for G4. The mounts have identical principal design but their layouts are arranged symmetrically with respect to the axis parallel to the axial translation (see below).

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

1.3. Terms, Definitions and Abbreviations

For the purpose of this document, the following abbreviated terms are applied:

Abbreviation	Meaning
CA	Contracting Authority
ELI	Extreme Light Infrastructure
FZÚ	Institute of Physics AS CR, v. v. i., in Czech Fyzikální ústav AVČR. v. v. i.
L4	Identification of laser system
L4c	Identification code of hall
L x W x H	Length x Width x Height

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Abbreviation	Meaning
MCTR	Motion Control System
N/A	Not Applicable
PBS	Product Breakdown Structure (CA internal term)
RA1	Research Activity 1
RGA	Residual Gas Analyzer
RSD	Requirements Specification Document
TC ID	Team Center IDentifier (unique identifier number)
VCD	Verification Control Document

1.4. Reference Documents

Number of document	TC ID	Title of Document/ File
RD-01	00236527/A	Drawing_package-G1_and_G4_difraction_grating_mounts_for_L4

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

Drawing TC No	Filename	Sheets	File format
00236057	G1-G4 Sestava (G1-G4 assembly)	1	PDF
00236096	Plovoucí základna (Air cushion baseplate)	1	PDF
00236087	Pojízdná základna (Linear translation baseplate)	1	PDF
00236010	Základní deska (Tripod baseplate)	1	PDF
00236018	Spodní deska (Bottom baseplate)	1	PDF
00236073	Opěra L (L shaped rib)	1	PDF
00236106	Frame optics	1	PDF

1.5. References to standards

If this document includes references to standards or standardized/ standardizing technical documents the CA allows/permits also another equal solution to be offered. If a supplier offers another equal solution the CA shall not reject its bid, once the supplier by appropriate means in the bid proves that the offered supplies, services or works meet in an equivalent manner the requirements including references to standards or technical documents.

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2. Technical description

2.1. Gratings and their configuration in the L4 pulse compressor

The diffraction gratings are not part of the supply but are described for better understanding. The gratings G1 and G4 are identical and their size is 850 x 700 x 100 mm, see Figure 1. The gratings are made from fused silica and their weight is approximately 130 kg.

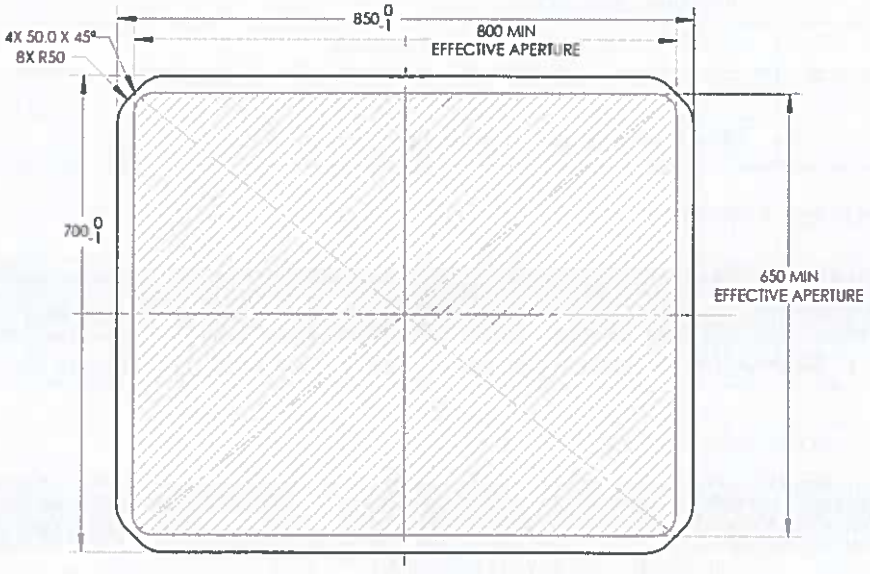

Figure 1: Dimensions of the diffraction gratings G1 and G4. The gratings are 100(+0/-1) mm thick.

The gratings G1 and G4 will be arranged in the L4 compressor symmetrically according to the vertical plane of symmetry, as represented in Figure 2. The G1 and G4 mounts, although of identical design, will therefore have mirror-like symmetry.

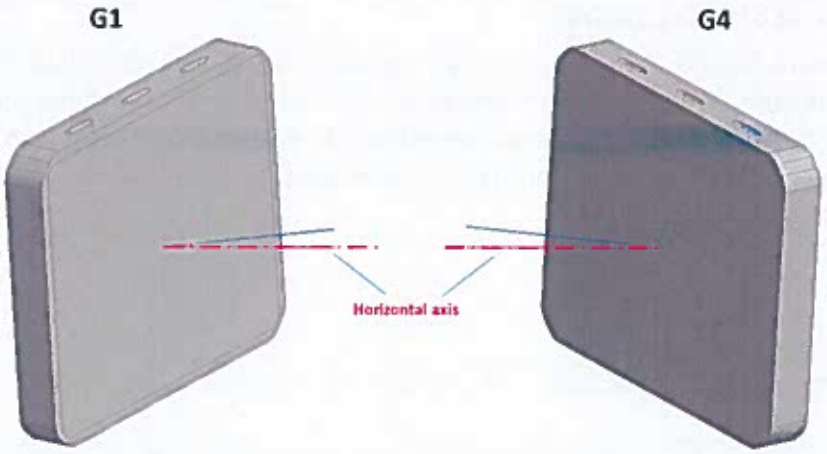

Figure 2: Spatial configuration of the gratings G1 and G4 in the L4 compressor: the gratings and their mounts are arranged symmetrically to each other. The gratings are oriented in space so that the front surface is rotated in yaw by 37.1 degrees with respect to the horizontal axis, and are inclined vertically (in pitch) by 4.07 degrees with respect to the horizontal axis. The required horizontal translation (see below) is in the direction of the horizontal axis.

2.2. Grating Mounts

The optomechanical mount design for the support of grating 4 (G4) is shown in Figure 3. The mount is equipped with a tripod mechanism making it possible rotation of the grating around 3 axes (roll, pitch, yaw). The tripod legs have flexure joints at each end making it possible the desired angular displacements. The tripod is designed to provide the point of rotation of the mounted grating, for all axes, on the centre of the front surface of the grating, with an accuracy of approximately 1 mm. Movement of the flexure joint unit is motorized using high-resolution vacuum-rated actuators (type Newport VHRU -10V9; travel range 10 mm, resolution 50 nm, absolute accuracy 2 µm, load capacity 500 N). CA will provide these actuators along with the encoders (Renishaw type) to the Supplier for their integration into the mounts.

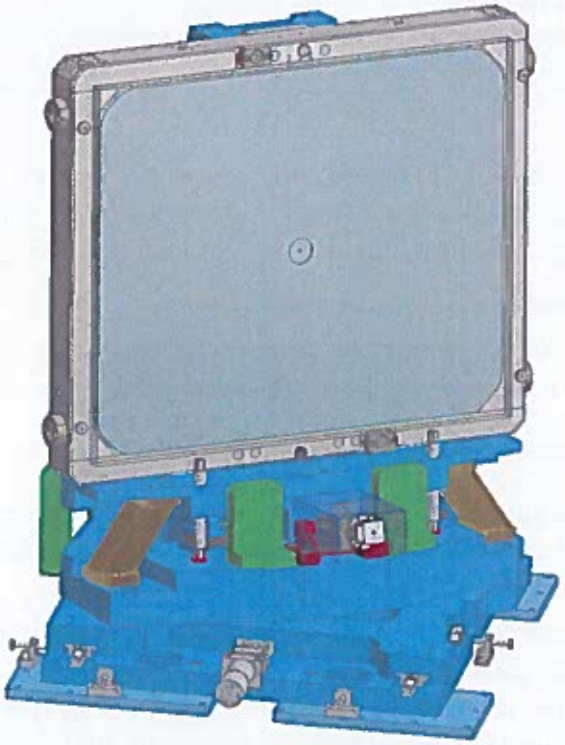

Figure 3: Assembly of the optomechanical mount G4. The three legs providing the three-axis rotation, equipped by flexure joints, are shown in dark yellow. The body of the mount is represented in dark blue, while brackets serving to fix the upper movable part during transport and installation are shown in green. The motorized stepper actuator serving for translational movement is seen in front near the mount base plate.

The mounts have also translation stage providing movement along the optical axis (see also Figure 2). The stage uses high vacuum actuators (type Phytron VSS coupled to vacuum planetary gearbox VGPL), which will be provided to the Supplier by CA.

The required range of motion in each axis is given in Table 1.

The mounts will be sitting on the internal chassis of the L4 compressor, and the baseplate of the mounts is equipped by mounting brackets that allow affixing the mounts to the chassis. During installation, the mounts will be pre-positioned on the chassis using air cushion, see drawing package in Section 8 and the full 3D model that will be provided on award of the contract.

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Table 1: Required parameters of individual movements of the G1 and G4 mounts.

Movement	Range	Resolution [1]	Accuracy [2]	Actuator type	Encoder
Yaw	±0.3°	0.5 µrad	1 µrad equivalent [3]	Stepper	Yes
Pitch	±0.3°	0.5 µrad	1 µrad equivalent [3]	Stepper	Yes
Roll	±0.3°	0.5 µrad	1 µrad equivalent [3]	Stepper	Yes
Axial translation	±50 mm	5 µm	10 µm	Stepper + ball screw	Yes

[1] *One incremental step of motorized actuator; one graduation of fine adjustment scale for micrometric screw*
[2] *Absolute position knowledge by encoder readout, bidirectional repeatability for motions without encoder*
[3] *Obtained by calculation from readout of encoders providing data along non-parallel direction*

Yaw: rotation around the vertical axis
Pitch: rotation around the horizontal axis parallel to the mirror surface
Roll: rotation around the horizontal axis perpendicular to the mirror surface

The principal material of the mounts will be aluminium alloy (e.g. EN AW 5083), free of internal stress. The CA will provide the Supplier with the raw material of aluminium alloy for manufacture of all parts of the mounts. All machined components will be machined from solid with no welding and then bolted together.

All fixings (bolts, nuts, washers) shall be from stainless steel.

The mounts will be operating in high-cleanliness vacuum, at nominal pressure 10^{-7} mbar. All holes made in the mounts have therefore to be vented, as indicated in the drawings.

2.3. Grating Supporting Bezels (Frames)

The optomechanical mounts are designed to accommodate the gratings within bezels (frames) as shown in the drawings in Section 8 - Drawing Package. Fully detailed 3D model of the grating support bezels will be provided on award of contract.

The above described units (translation stage and 3-axis tripod positioner) for optomechanical positioning of the gratings provide sufficient margin, as well as design flexibility, for attaching grating bezels to the optomechanical mount and to allow keeping the centre of rotation of the grating on the grating front surface centre. The design also provides space for implementation of grating protection covers, as indicated in Section 8 - Drawing Package and also in the 3D model that will be provided on award of the contract.

Attached to the bezels are 6 mounting points consisting of boss with a precisely toleranced ø6 hole suitable for mounting a corner cube reflector for laser scanning. Design of these mounting points is included in Section 8 - Drawing Package and in the 3D model that will be provided on award of the contract.

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2.4. Interface Requirements

The mounts will be installed on the internal optical chassis of the compressor. Mechanical requirements are detailed in Section 3. Detailed 3D model of the internal optical chassis will be provided on award of the contract.

The gratings will be first mounted into the bezels (frames) and will be protected by covers. These bezels will serve for handling of the gratings and for mounting on top of the positioning unit of the mount. The bezels shall therefore be equipped with removable lifting eyes for their manipulation.

The optomechanical mounts shall provide an interface to the lifting equipment used to position the mounts inside the compressor. The mounts shall be equipped with appropriately dimensioned lifting eyes making possible safe manipulation, with the entire mounts including the bezels with installed gratings (protected by covers), for their installation inside the compressor.

The mounts shall also have an interface with the L4 compressor Motion Control System (MCTR) for the function of grating positioning and readout of status signals. The control system and cabling between the mounts and the controller is being designed and built under a separate contract. Within the scope of this contract only the wiring connections are required from various actuators and sensors to the respective connector array and/or junction box on the mount.

Each mounts shall integrate the following elements of motorized positioning and of status (or environment) readout:

a) Tripod angular movements (roll, pitch, yaw)
   3x Newport VHRU stepper actuator with integrated limit switches
   3x Renishaw linear encoder to measure displacement of the actuators
   3x Renishaw linear encoder to measure displacement of the grating support plate

b) Axial linear translation
   1x Phytron stepper actuator + gearbox
   1x Renishaw encoder to measure linear displacement
   2x Limit switch

c) Environment monitoring
   3x Temperature sensor
   1x Accelerometer

Actuators along with the encoders, temperature sensors and accelerometers will be provided to the Supplier for their integration into the mounts by the CA.

2.5. List of CA supplied equipment

- Actuators (including gearbox for axial translation) according to Table 1
- Encoders
- Temperature sensors and accelerometers
- Retro reflecting corner cubes
- Raw material for machined aluminium components

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2.6. General Requirements for Manufacture, Testing, and Packaging

2.6.1. Cleaning Procedure for Machined Parts

1. Physical pre-cleaning
   a. Prior to cleaning, all machined components and fixings shall be examined.
   b. All surfaces shall be inspected one by one and shall be free of scratches, rolling, cracks, scale, or other defects.
   c. All swarf, burrs, etc. from the machined surfaces shall be physically removed. The procedures may include high pressure air blasting, water jet, scraping, swabbing etc.
   d. Gross contaminations from the manufacturing process shall be removed by washing or rinsing with suitable general purpose solvent.

2. Cleaning / washing
   a. All components shall be cleaned separately. Cleaning of assembled components and systems is not allowed.
   b. All components to be cleaned shall be thoroughly inspected. Areas or re-entrant volumes which may trap cleaning agents or may have deposits from the fabrication process shall be identified and closely followed during the whole cleaning process.
   c. Degrease using detergent and town water, using a mild alkaline non-etch environment with a pH <11. If local regulation permits it is advised to use as an alternative trichloroethylene or perchloroethylene. Allowed procedures include rinsing, immersion and swabbing. Use of high pressure hot water jet (>100 bar), using 2% solution of Brulin 1990GD at 65-70°C is recommended.
   d. Application of vapour degreasing process additionally to c) is recommended.
   e. Immediately after c), without letting the surface dry, wash thoroughly with town water, without detergent. Recommended is use of high pressure hot water jet at temperatures around 80° C or higher. Pay particular attention to any trapped volumes.
   f. Wash with clean demineralised water (minimum resistivity = 10^6 Ohm/cm). Allowed procedures include immersion and rinsing; use of high pressure hot water jet (temperature 60-80° C) is recommended.
   g. Step f) should be ideally done by using ultrasonic bath. Use of ultrasonic bath for all small to medium size components and complex-shape components in step f) is mandatory.
   h. All bolts shall be cleaned in ultrasonic bath with 2% solution of Brulin 816GD. Subsequently the bolts shall be cleaned by ultrasonic bath of clean acetone or isopropyl.
   i. As far as practicable all components should be baked out at temperatures 200 to 300° C in a vacuum oven at a pressure <1 mbar, to achieve vacuum surfaces low in hydrocarbons.

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2.6.2. General rules for assembling

- Any use of grease shall be avoided unless absolutely necessary.
- The only UHV compatible approved lubricants are Krytox™ LVP and Braycote Micronic 601EF
- The mounts shall be assembled in clean space with cleanliness Class 5 according to ČSN EN ISO 14644 standard (equivalent to ISO 14644), or better.
- All care should be taken to preserve the cleanliness of CA supplied equipment.

2.6.3. Testing and inspection

- The assembled mounts shall be tested in clean space or clean flowbox with cleanliness Class 5 according to ČSN EN ISO 14644 standard (equivalent to ISO 14644), or better.
- The mounts shall be thoroughly tested at works for functionality (resolution / range / accuracy / encoder readings / integration with the electronic controller) with mass simulators corresponding to the aggregated mass of the corresponding mirror and its frame.

2.6.4. Packaging

- Each movement or movable part of the optomechanical mounts shall be firmly locked before packaging to avoid damage during transport, by means of a securing bracket.
- Each mount shall be packed separately.
- A multi-layer wrapping protocol shall be applied to preserve Class 5 level of cleanliness (according to ČSN EN ISO 14644 standard (equivalent to ISO 14644), or better) during shipping.
- The interior of the package container shall be filled with clean dry air or nitrogen.
- Each mount shall be triple bagged, with two layers of polyethylene cleanroom film (e.g. UltraLOPlus™ or equivalent) and then one layer of a vapour barrier material such as foil. Seams shall be taped or heat sealed. Excess air between wrappings shall be evacuated and the bags sealed with desiccant packs inside.

3. Functional, Performance and Design requirements

3.1. General Design and Manufacturing Requirements

REQ-027527/A

R1-01 - The mounts shall be manufactured in accordance with the attached reference drawings (see Section 8) and the fully detailed 3D model that will be provided following award of contract.

NOTE: The manufacturing of the mounts shall be started only after approval of the manufacturing design by the CA (see R1-09 - REQ-027535/A).

Verification method: R – Review

REQ-027528/A

R1-02 – Any principal documentation shall be in English language.

Verification method: R – Review

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REQ-027529/A

R1-03 – The principal material of the mounts shall be aluminium and/or stainless steel.

Verification method: R – Review, I – Inspection

REQ-027530/A

R1-04 – The mounts shall feature integration of electrical actuator including wiring for actuators and electrical devices to the connector array and/or junction box attached to the mount.

Verification method: R – Review, I – Inspection

REQ-027531/A

R1-05 – The manufacturing design of the mounts shall avoid any trapped volumes of air, e.g. the mounting holes shall not be blind tapped.

Verification method: R - Review, I – Inspection

REQ-027532/A

R1-06 – The mounts shall be attachable to the optical chassis and shall be able to be pre-positioned (without engaging the actuators) by activating the in-built system of air cushions (see drawings in Section 8), with precision of ±1 mm.

Verification method: R – Review, I – Inspection

REQ-027533/A

R1-07 – The manufacturing design will include position encoders for each movement according to Table I, allowing reading out absolute position with a precision of at least of the indicated resolution. The encoders must allow absolute position readout after switching the encoder on, without homing the movement.

Verification method: R – Review, I – Inspection

REQ-027534/A

R1-08 – Each mount (minus grating) shall be supplied with a means of lifting that ensures the base of the mount is horizontal in both axes when the mount is lifted from a single point of suspension.

Verification method: R – Review, I – Inspection

REQ-027535/A

R1-09 – The manufacturing design, i.e. 3D model and drawing, shall be approved by CA before production.

Verification method: R – Review

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REQ-027536/A

R1-10 – All edges of the mounts shall be chamfered 0.5x45°, unless stated otherwise on the corresponding drawings.

Verification method: R – Review, I – Inspection

REQ-027537/A

R1-11 – All outer surfaces of the mounts shall be machined resulting in surface quality of Ra 0.8 µm or better.

Verification method: R – Review, I – Inspection

REQ-027538/A

R1-12 – All internal surfaces or internal poorly accessible surfaces of the mounts shall be machined to provide surface quality of Ra 3.2 µm or better.

Verification method: R – Review, I – Inspection

3.2. Requirements for manufacture

REQ-027539/A

R2-01 – Only new materials and equipment shall be used. Recycled material and reused equipment shall not be acceptable.

Verification method: R – Review

REQ-027540/A

R2-02 – No parts of the mounts shall exhibit any visible surface defects, such as scratches, digs, bumps (from clamping in the manufacturing process), etc.

Verification method: I – Inspection

REQ-027541/A

R2-03 – The surface of all parts of the mounts shall be milled. Grinding, polishing, sand blasting or any other surface treatment is not allowed.

Verification method: I – Inspection

REQ-027542/A

R2-04 – The manufactured parts, including all holes, shall be completely free of machining chips.

Verification method: I – Inspection

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REQ-027543/A

R2-05 – Each grating bezel (frame) shall be supplied with a removable grating cover made from stainless steel.

Verification method: I – Inspection

REQ-027544/A

R2-06 - Best practice shall be followed in the implementation of the vacuum electrical cables and of connector arrays and/or junction boxes.

Verification method: Not To Be Tracked within VCD

REQ-027648/A

R2-07 - The suppler shall coordinate with the CA on the selection and construction details for the vacuum electrical cables, connector arrays and/or junction boxes, in order to ensure sufficient EMP resistance, vacuum cleanliness, compatibility with the long cable runs and interface compliance to the L4 compressor Motion Control System (MCTR).

Note: The long electrical cable runs interconnecting G1 and G4 with the MCTR controller are not part of the supply.

Verification method: Not To Be Tracked within VCD

3.3. Actuators and Electronic Elements Integration Requirements

REQ-027545/A

R3-01 – The stepper motors Newport VHRU and Phytron VSS (supplied by CA) electrical actuators shall be integrated into the mounts (see also Table I).

Verification method: I – Inspection

REQ-027546/A

R3-02 – Vacuum compatible (10^{-7} mbar) electrical wiring shall be supplied from the actuators, position encoders up to connector array and/or junction box attached to the mount.

Verification method: R – Review, I – Inspection

REQ-027547/A

R3-03 – Vacuum compatible (10^{-7} mbar) limit switches shall be used.

Verification method: R – Review, I – Inspection

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4. Cleaning, Testing, Packaging and Delivery Requirements

REQ-027548/A

R4-01 - The mounts shall be cleaned and tested at the manufacturer's works prior to acceptance by CA before transport to ELI-Beamlines. The cleaning procedure shall follow the steps detailed in Section 2.6

NOTE: The Supplier shall announce well in advance that the mounts are cleaned and tested and are ready for the CA acceptance before transport.

NOTE: CA will carry out its own spot check tests to confirm vacuum cleanliness of the mounts using its own test method.

Verification method: T – Test

REQ-027549/A

R4-02 – All finished parts shall be degreased by thorough cleaning, paying attention to each hole, by water high-pressure (>100 bar) washer, using 2% solution of Brulin 1990GD at 65-70°C. Immediately after, without letting the surface dry, the parts shall be rinsed with demineralized water and dried clean with a clean room cloth to avoid leaving traces of water drops.

NOTE: The CA permits also another equivalent degreasing solution and /or cleaning procedure to be offered, however this must be approved in written by the CA.

Verification method: I – Inspection

REQ-027550/A

R4-03 – The Supplier shall allow the CA to witness the activities related to the cleaning, testing, packaging and transportation.

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

Verification method: Not To Be Tracked within VCD

REQ-027551/A

R4-04 – Achieved parameters of the individual movements, i.e. range, resolution and accuracy shall correspond to those specified in Table I.

Verification method: M – Measuring

REQ-027552/A

R4-05 – The transportation to ELI-Beamlines of the mounts shall be conducted by the Supplier.

Verification method: Not To Be Tracked within VCD

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5. Safety Requirements

REQ-027553/A

R5-01 – The Supplier shall supply a Declaration of Conformity or any other equivalent document legally recognized and accepted in the Czech Republic for each product type if the appropriate legislation determines the Supplier's obligation to have a Declaration of Conformity (or the equivalent document) for the purposes of a Product sale in the Czech Republic to fulfil the requirements of 2001/95/EC directive or applicable Czech law.

Verification method: R - Review

6. Quality requirements

6.1. Documentation and data control

REQ-027554/A

The Supplier shall supply the following relevant manufacturing documents:

- all manufacturing design, 3D model and design supporting documentation approved by the CA (see REQ-027560/A);
- full technical documentation on the delivered Product (e.g. installation, safe operation and maintenance instructions);
- all "requests for deviation/waiver from requirements described herein" approved by the CA (see REQ-027557/A).

Verification method: R – Review, I - Inspection

REQ-027555/A

The Supplier shall use following data formats:

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

Verification method: Not To Be Tracked within VCD

REQ-027556/A

Documentation (e.g. reports, protocols, certificates, instructions, manuals, etc.) shall be supplied in PDF format.

Verification method: Not To Be Tracked within VCD

6.2. Nonconformity control system

REQ-027557/A

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

Verification method: Not To Be Tracked within VCD

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7. Verification requirements for the Supplier

The verification process will be performed mostly by the Supplier. The VCD draft provided by CA will specify exactly what is required to be verified by whom as well as the CA proposal how.

The VCD serves for gradual recording of executed verifications by the Supplier during the Contract realization. The records usually consist of date (time) when the verification was executed, by whom, the result (OK/NOK) and usually also reference to the related document as evidence of the result of verification.

7.1. Verification Control Document (VCD)

The CA requires that the Supplier will use the VCD document provided by the CA. Supplier can extend and adapt the VCD document for better reflection to the real condition and fulfillment of the basic purpose of the VCD – to document and demonstrate the verification of fulfillment of CA requirements

REQ-027558/A

The Supplier shall gradually execute the verification as required within this RSD as well as within the VCD draft provided by CA and record the results in to the VCD.

NOTE: Phases of delivery are called Deliverables in the Purchase contract.

Verification method: R - Review

7.2. Recommended verification methods

The verification process shall be accomplished by the Supplier through one or more of the following verification methods recommended by the CA:

1. Test – real verification that the subject of delivery fulfills required parameters usually carried out under controlled conditions, as close as possible to real operation. The Test protocols with test results or the complete Test report usually serve as the documented evidence. (Test - T) e.g.:
   a. Test at the Supplier (Factory Acceptance Test – FAT);
   b. Test at the CA (Site Acceptance Test – SAT);
   c. Functional Demonstration at the Supplier or at the CA but always with CA attendance (Functional Demonstration – FD);
   d. Measuring – specific type of Test - physical verification that the real measured value complies with the required value in the same units and standardized measuring conditions. The measurement protocol or report can serve as the documented evidence. The CA can also ask for the calibration protocol of used gauge or similar documentation. (Measuring – M).
2. Review – verification that the Documentation meet the requirements or the Documentation demonstrate the requirements fulfillment (Review – R).
3. Inspection – visual check or evaluation physical characteristics of the subject whether meet the requirements (Inspection – I).
4. Analysis - performing of theoretical or empirical evaluations of meeting the requirements by using defined methods (Analysis - A).

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7.3. Approval of detailed engineering documentation

This chapter describes summary of what has to be provided by the Supplier in terms of documentation (detailed engineering documentation including technical documentation, manufacturing drawings and design supporting documentation) before starting the manufacturing.

Output of this phase is **Final set of detailed engineering documentation, approved by the CA.**

REQ-027559/A

Before completion of the detailed engineering documentation phase the Supplier shall provide following information that shall be agreed by the CA:

- structure and content of the Test protocols, Analysis reports, Review reports etc. (if applicable);
- structure and content of the VCD if it was modified by the Supplier.

NOTE: Phases of delivery are called Deliverables in the Purchase contract.

Verification method: R - Review.

REQ-027560/A

Before completion of the detailed engineering documentation phase the Supplier and the CA shall agree on:

- final detailed engineering drawings provided by the Supplier;
- detailed procedures related to the testing, cleaning and packaging during Manufacturing phase;
- common nonconformity control system (see REQ-027557/A).

NOTE: Phases of delivery are called Deliverables in the Purchase contract.

Verification method: R - Review.

7.4. Manufacturing and delivery

The goal is to demonstrate that the manufactured part of the mounts meet all requirements specified herein.

Output of this phase is the **Verified and Delivered mounts.**

REQ-027561/A

The results of the Manufacturing phase of verification shall be recorded by the Supplier (including review of documentation/reports and inspection of the mounts) in the VCD (see section 7.1).

NOTE: Phases of delivery are called Deliverables in the Purchase contract.

Verification method: R - Review

REQ-027562/A

The final issue of the VCD shall be submitted to the CA after the approval of the last report before delivery.

Verification method: R – Review

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7.5. Acceptance

Acceptance will be carried out by the CA upon completion of each Phase of delivery. In case of successful acceptance phase the CA will provide to the Supplier signed acceptance protocol for each Phase of delivery. In case of unsuccessful acceptance stage the CA will provide to the Supplier Nonconformity Report (NCR) and process in accordance with REQ-027557/A shall be applied.

The final acceptance will be executed by the CA by verifying all criteria stated in REQ- 027563/A

The Acceptance phase shall demonstrate the following:

- The final product has been successfully verified and this process has been documented in an appropriate way;
- All detected nonconformities have been solved in accordance with REQ-027557/A;
- The final product is free of fabrication errors, is not damaged during transport and is ready for the intended operational use.

REQ-027563/A

The Acceptance phase shall demonstrate the following:

- All finished parts of the grating mounts have been successfully verified by the Supplier and the results of this process have been documented in VCD (The completed VCD is submitted);
- All previous Phases of delivery were accepted by CA and confirmed by the related Acceptance protocol (All the Acceptance protocols are submitted);
- All detected nonconformities have been solved in accordance with REQ-027557/A;

Verification method: Final CA verification

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8. Drawing package

The drawings of the assembly of G1 and G4 diffraction grating mounts for L4 Compressor and their parts, included within the **RD-01** archive (see chapter 1.4), are shown below.

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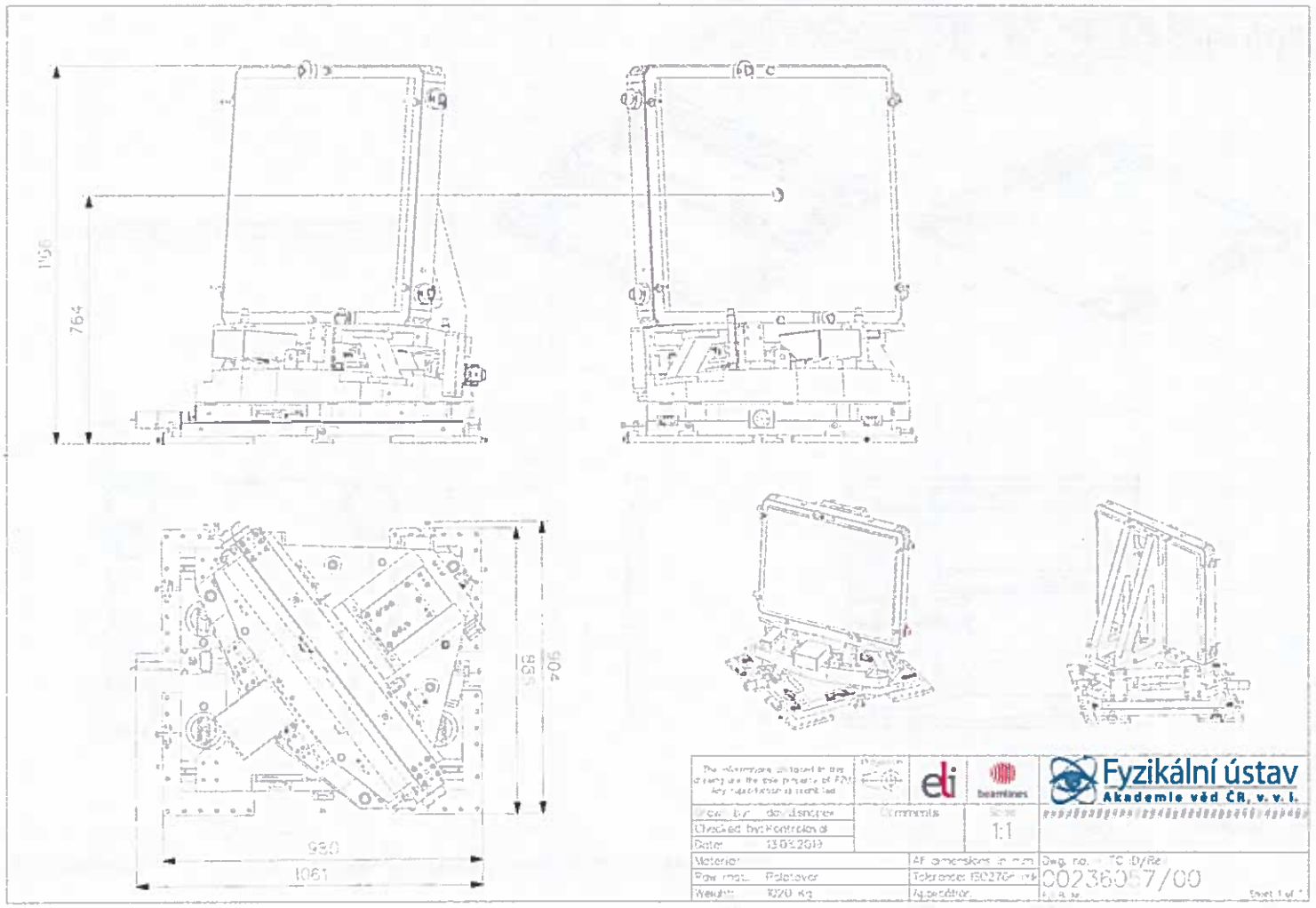
8.1. Assembly of G1 and G4 grating mounts (Drawing No 023-60-57 Rev. 01)



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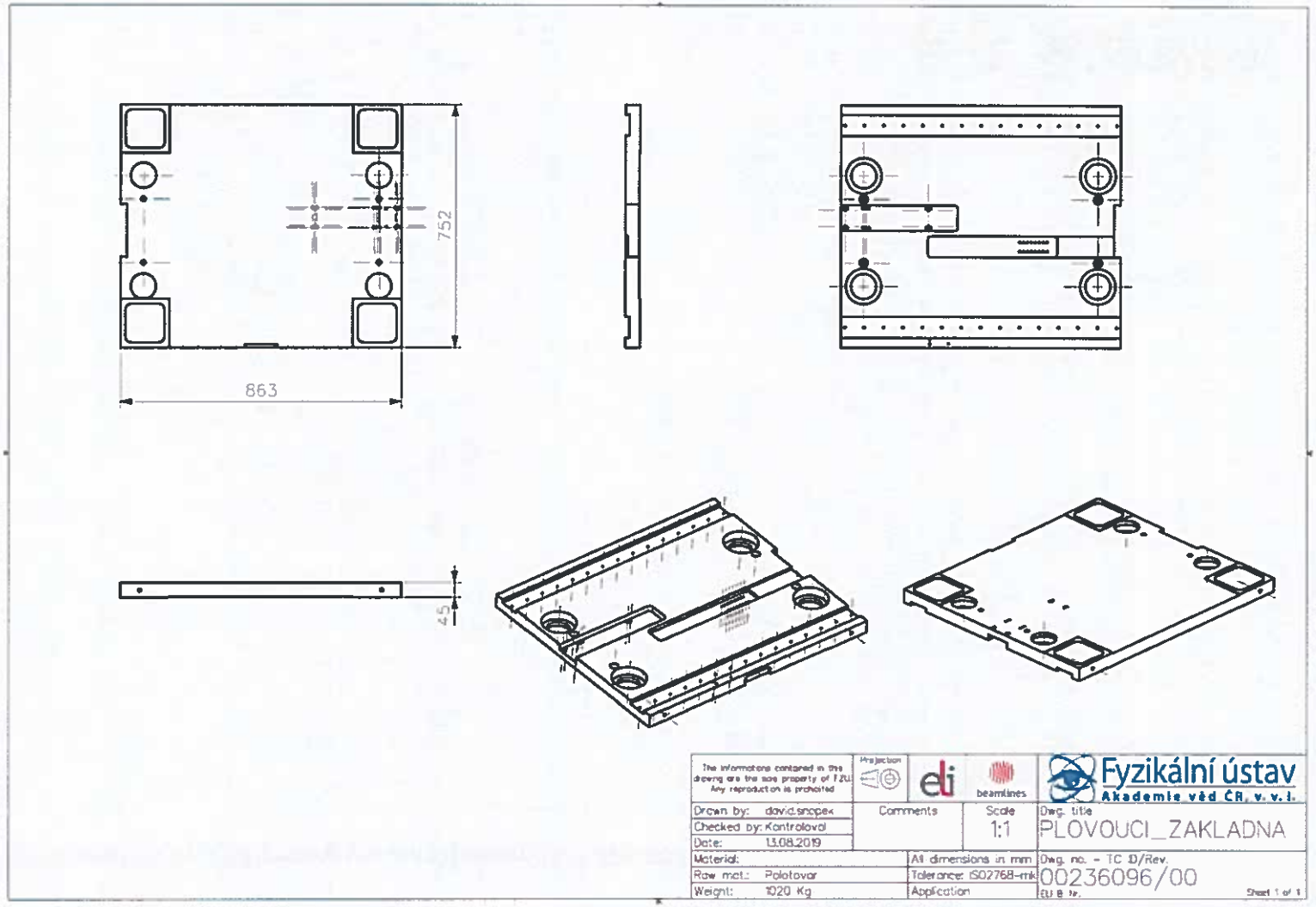
8.2. Baseplate with air cushion pockets (Drawing No 023-60-96 Rev. 01)



The informations contained in this drawing are the sole property of FZU. Any reproduction is prohibited	Projection	beamlines	Fyzikální ústav Akademie věd ČR, v. v. i.
Drawn by: david.snopek	Comments	Scale 1:1	Dwg. title PLOVOUCI_ZAKLADNA
Checked by: Kontrolovol			
Date: 13.08.2019			
Material:		All dimensions in mm	Dwg. no. - TC ID/Rev. 00236096/00
Raw mat.: Polotovar		Tolerance: ISO2768-mK	
Weight: 1020 Kg		Application	EU 8 hr. Sheet 1 of 1

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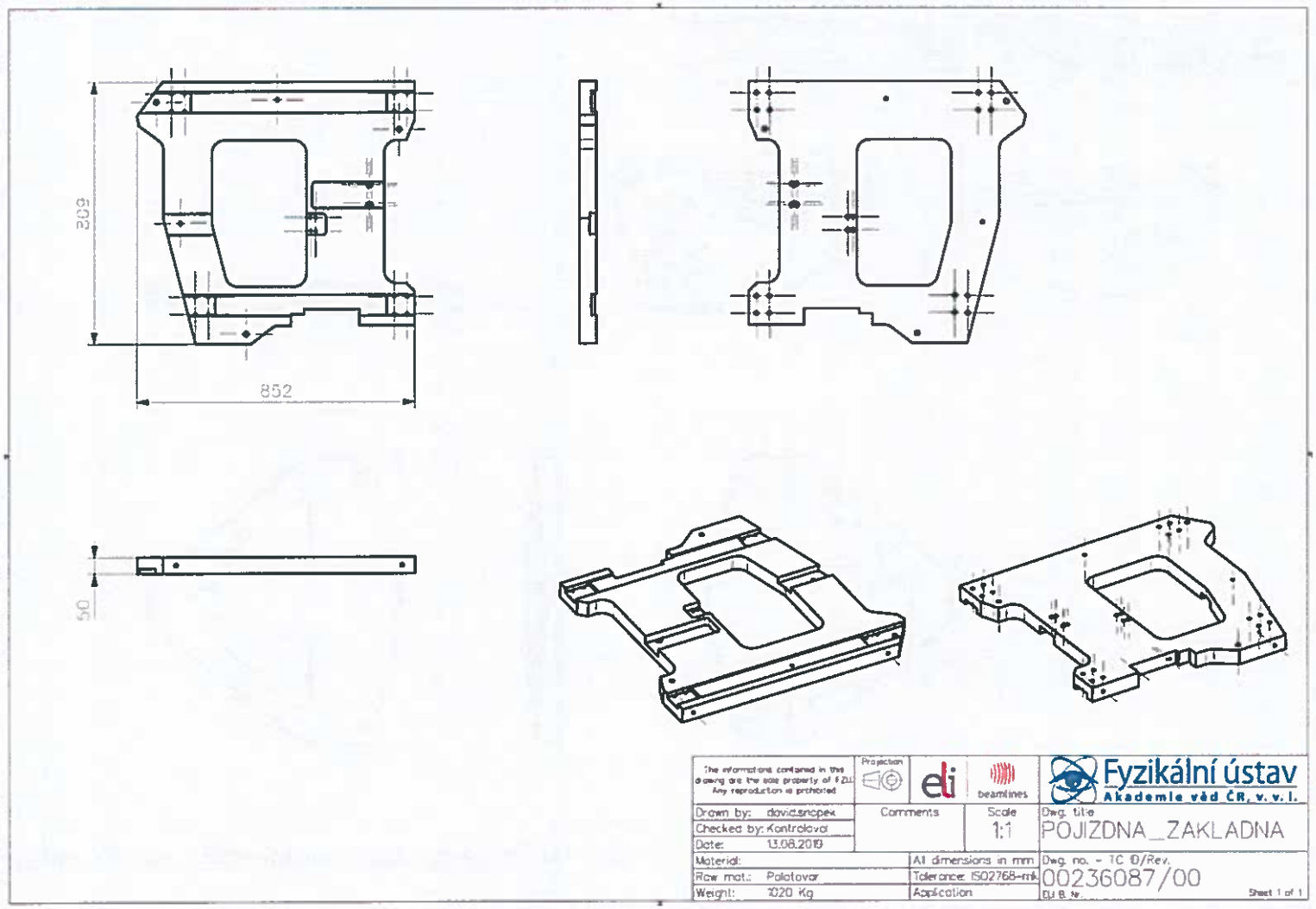
8.3. Linear translation baseplate (Drawing No 023-60-87 Rev. 01)



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Drawn by: dovicsnopek	Comments	Scale 1:1	Dwg. title: POJIZDNA_ZAKLADNA
Checked by: Kontrolovat			
Date: 13.08.2019			
Material:		All dimensions in mm	Dwg. no. - TC ID/Rev.: 00236087/00
Raw mat.: Palotovar		Tolerance: ISO2768-mK	
Weight: 1020 Kg		Application	EU B. Nr. Sheet 1 of 1

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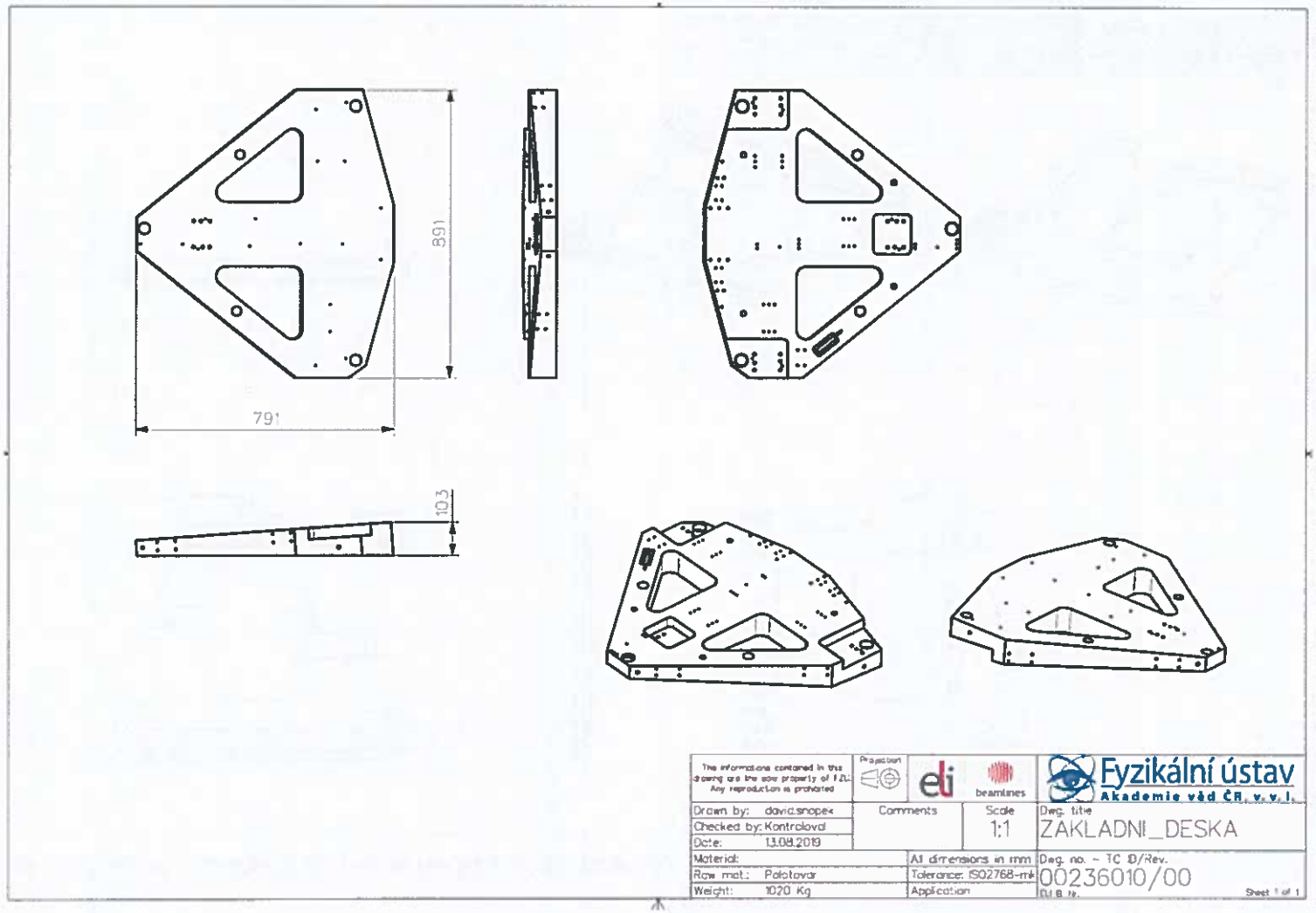
8.4. Baseplate of the tripod (Drawing No 023-60-10 Rev. 01)



The informations contained in this drawing are the sole property of FZU. Any reproduction is prohibited	Projection		Fyzikální ústav Akademie věd ČR, v. v. i.
Drawn by: david.snopek	Comments	Scale 1:1	Dwg. title ZAKLADNI_DESKA
Checked by: Kontrolová			
Date: 13.09.2019			
Material:		All dimensions in mm	Dwg. no. - TC ID/Rev. 00236010/00
Raw mat.: Pelotovar		Tolerance: ISO2768-mK	
Weight: 1020 Kg		Application	Sheet 1 of 1

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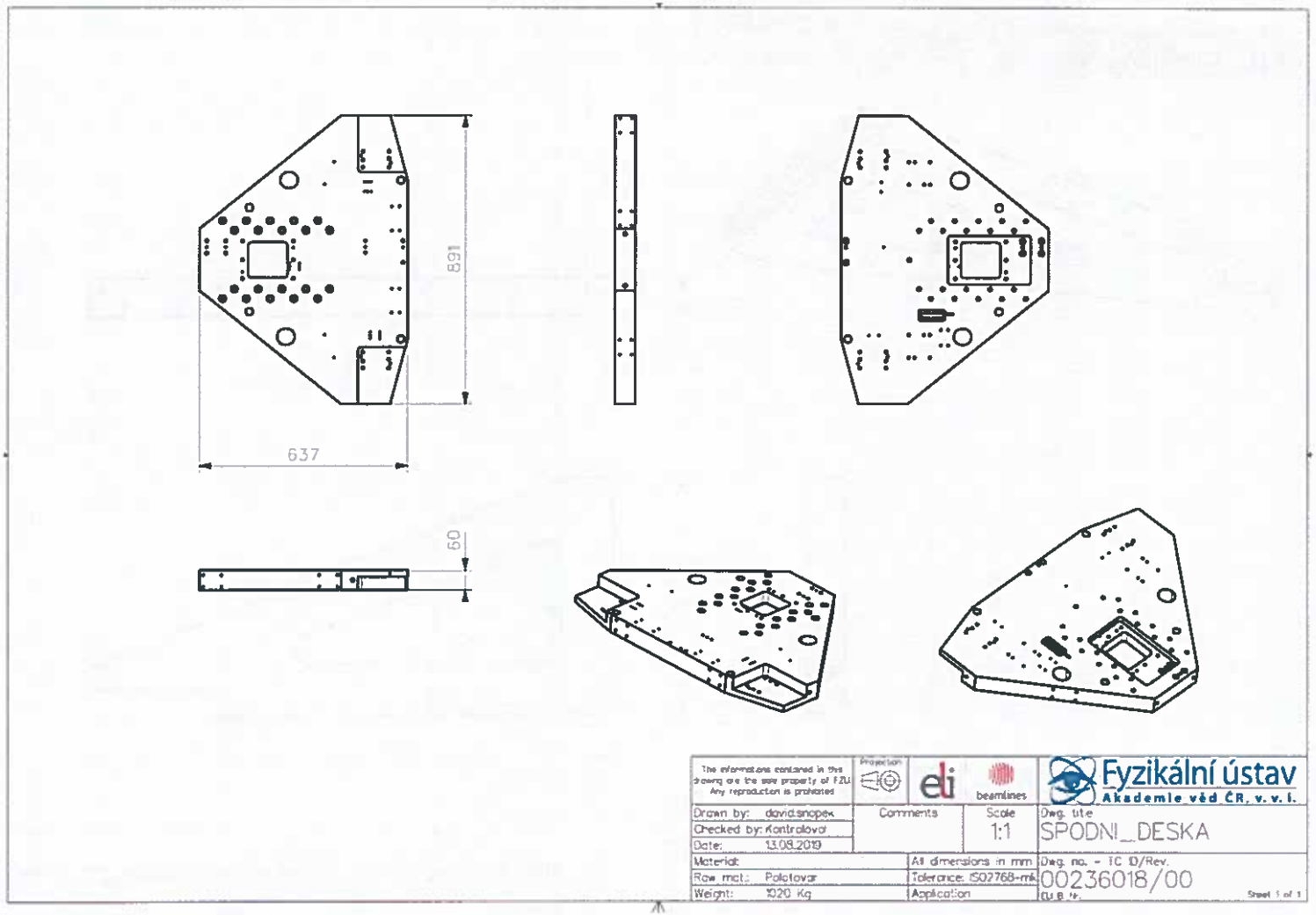
8.5. Bottom plate (Drawing No 023-60-18 Rev. 01)



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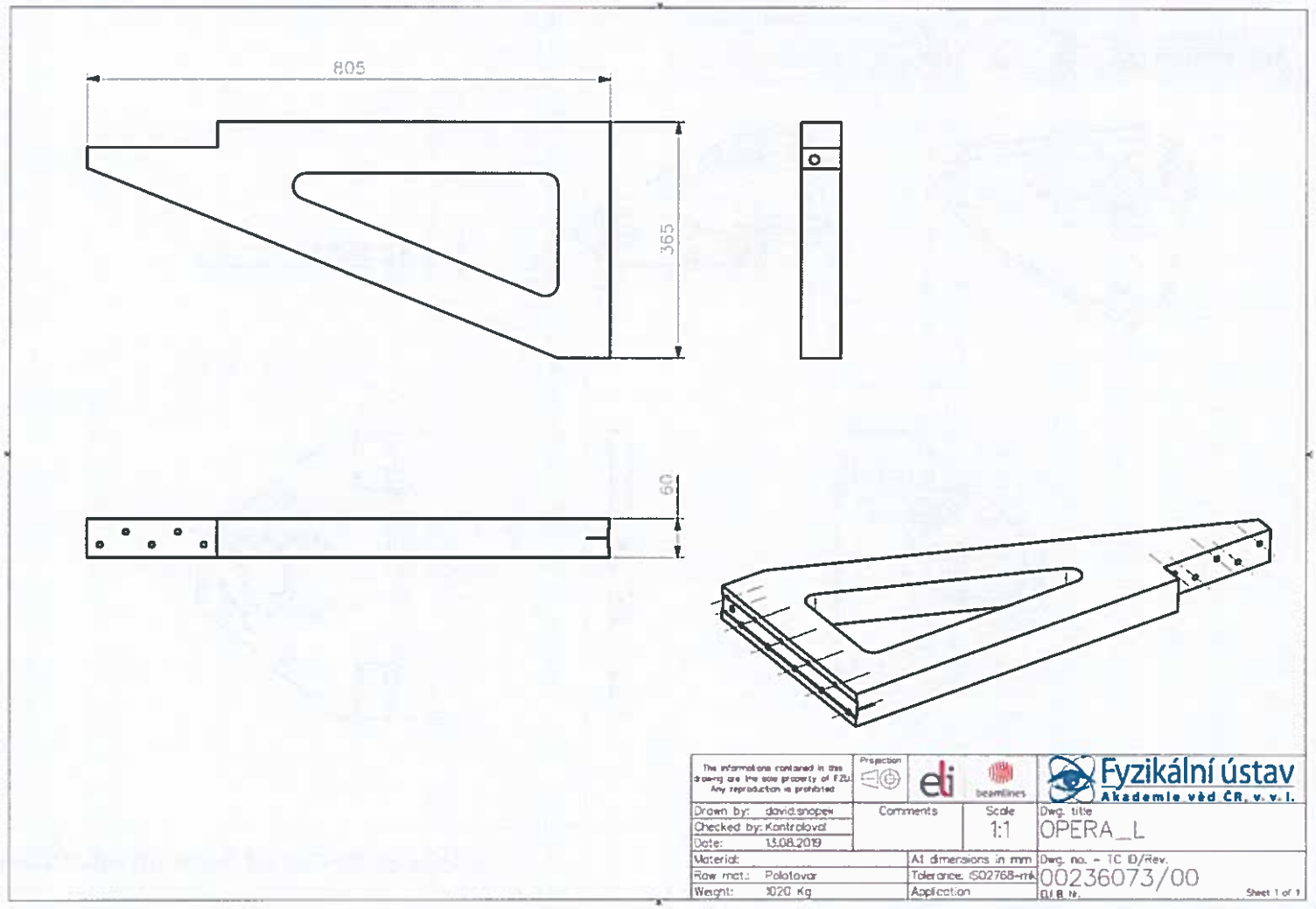
8.6. L-shape Stiffening Rib (Drawing No 023-60-73 Rev. 01)



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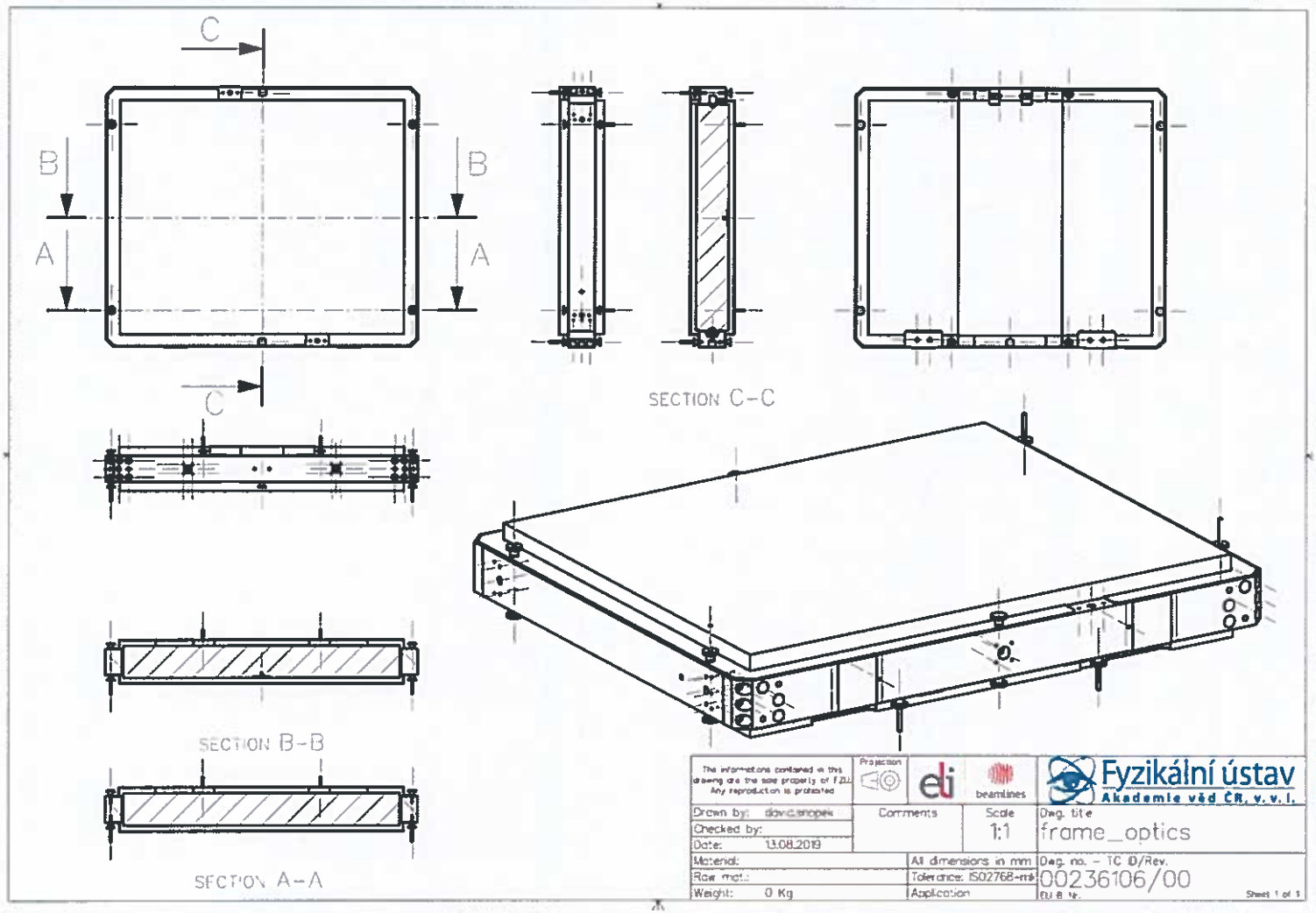
8.7. Grating Bezel / Frame (Drawing No 023-61-06 Rev. 01)



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