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[RSD Product Category B]

Uncoated Mirror Substrates TM-45
for 30 J, 30 fs @ 810 nm petawatt laser L3 Beam Transport
[TP20_004]



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1. Introduction

1.1. Purpose

This Requirements Specification Document (RSD) lists the technical requirements and constraints on products applying in RA2 program of ELI project. This leads to the identification of interfaces with the ELI science-based technology. This RSD also acts as the parent document for the technical requirements that need to be addressed in lower-level design description documents (see chapter 1.4).

1.2. Scope

This RSD contains all of the technical requirements: functional, performance and design, delivery, safety and quality requirements for the following product (tender number – TP20_004): **Uncoated Turning Mirror Substrates for ELI L3 laser** (further referred to as “**Mirror substrate**” or “**Mirror substrates**” in plural).

The products will be located in the E2 and E5 experimental halls after coating. These Mirror substrates are registered in the BPS software under the following PBS code: *E.E2.BETA.BT.2*.

1.3. Terms, Definitions and Abbreviations

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

Abbreviation	Meaning
CA	Contracting Authority (Institute of Physics AV CR, v. v. i.)
ELI	Extreme Light Infrastructure
L4n	Long Pulse beam from ATON L4 laser
NCR	Nonconformity Report
QR	Quality Report
RA2	Research activity 2
RD	Reference Document
RMS	Root Mean Square
RSD	Requirements Specification Document

1.4. Reference documents

Number of doc.	Title of Document/File
RD-01	00265452-B_L3BT TM45 uncoated substrate revB.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.

2. Functional, Performance and Design requirements

Functional, performance and design requirements for the **mirror substrates** are summarized within reference drawing **RD-01** (see chapter 1.4).

2.1. General requirements

REQ-029537/A

The Supplier shall produce **5 pcs** of the **mirror substrates** for E2 beam transport in accordance with the requirements given in the reference drawing **RD-01** (see chapter 1.4) and up to 8 the **mirror substrates on request**.

REQ-029538/A

The parameters of each **mirror substrate** shall correspond to the requirements given in the reference drawing **RD-01** (see chapter 1.4).

REQ-029539/A

Specific Quality Report: I, II, III, IV (see REQ-029545/A)

The material used for the **mirror substrates** shall correspond to the requirement from the reference drawing **RD-01** (see chapter 1.4) so that no bubbles are present close to the S1 surface. Any other material shall be approved in advance by the CA.

REQ-029540/A

Specific Quality Report: V (see REQ-029545/A)

2 pcs 2" diameter coating damage witness samples for damage testing and metrology purpose of the coating run shall be provided by the Supplier.

NOTE 1: There is no specification for the surface flatness. However, the quality of the polish should be 20/10 scratch/dig - exactly the same polishing procedure as the main mirror substrates.

NOTE 2: The witness shall use the same material as the main pieces. Specifications of the leak mirror coating, S- and P-polarization.

2.2. Marking

REQ-029541/A

The **mirror substrates** shall be marked with bead blasting or by laser engraving according to the reference drawing **RD-01** (see chapter 1.4) with character size at least 8 mm. The first part number of this contract shall start with number **48**.

3. Packaging and transport requirements

3.1. General requirements

REQ-029542/A

All the mirror substrates shall be cleaned and packaged in the clean environment of class 6 according to ČSN EN ISO 14644 (equivalent to EN ISO 14644) or cleaner.

REQ-029543/A

Each mirror substrate shall be placed in a separate PET-G container preventing damage, degradation and contamination. The PET-G containers shall be packed in a minimum of two plies separate clean packaging and placed in a sufficiently padded box for transport.

3.2. Transport

REQ-029544/A

The Supplier shall cooperate with the CA to facilitate the transportation arrangement, namely should communicate to the CA the weight and sizes of crates.

4. Quality control

4.1. Quality Reports (QRs)

REQ-029545/A

For each mirror substrates, the Supplier shall perform the following tests of product quality and provide corresponding **specific quality reports (I - V)**:

- I. An interferometric report of the full clear aperture. Sub-aperture measurement is acceptable for spatial periods below 6 mm. At least 2 measurement locations are required for the sub-aperture measurement;
 - II. S-D report listing the main defects and their locations;
 - III. Microroughness report from the centre of clear aperture. Witness sample processed in the same way can be used too;
 - IV. Dimensional report listing the main dimensions;
 - V. Material report showing the Fused Silica class, batch number and producer.
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4.2. Documentation and data control

REQ-029546/A

For each mirror substrates, the Supplier shall provide a Declaration of Conformity (or the equivalent document) with technical requirements defined by the product RSD and ensure completeness of the products.

REQ-029547/A

For each mirror substrates, the Supplier shall provide the interferometric data from the quality report I (see REQ-029545/A) in a digital form readable by Zygo MX software. Data format shall be agreed with the CA.

4.3. Nonconformity Control System

REQ-029548/A

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

4.4. Phasing of the delivery

This chapter is intended to briefly summarize basic milestones of the Contract delivery. These milestones represent gates (checkpoints) where the quality of the delivery is to be evaluated.

Delivery shall not proceed past these gates unless their satisfactory accomplishment is approved by the CA.

Delivery lifecycle shall contain at least the following phases (**quality gates**):

- **Manufacturing;**
- **Acceptance.**

4.4.1. Manufacturing

The goal is to demonstrate that the manufactured products meet the specified technical requirements (RSD) of the CA.

This quality gate concerns primarily:

- **Testing at the Supplier's site** (factory testing);
- **Packaging.**

The output of this phase is a **Verified Final Product**.

REQ-029549/A

The results of the Manufacturing phase of verification shall be recorded by the Supplier in corresponding QRs (see REQ-029545/A) and provided to the CA for approval (see chapter 4.4.2).

4.4.2. Acceptance

The Acceptance phase shall demonstrate the following:

- Final products have been successfully verified and this process has been documented in an appropriate way through QRs (see REQ-029545/A);
- All detected nonconformities have been solved in accordance with REQ-029548/A;
- Final products are free of fabrication errors.

The output of this phase is an **Accepted Final Product**.

In case of successful acceptance phase, the CA shall provide to the Supplier signed acceptance protocol. In case of unsuccessful acceptance stage, the CA shall provide to the Supplier Nonconformity Report (NCR) and process in accordance with REQ-029548/A shall be applied.

REQ-029550/A

Verification process shall be carried out by the Supplier and it is successfully completed when the final products comply with all specifications and the results of this process are documented in an appropriate way through QRs (see REQ-029545/A).

NOTE: Acceptance will be carried out by the CA (or if required, representatives/contractors appointed by the CA) on the final products at the Supplier's site.
