

Serial number: 001

NuMI Low Energy Target
(in-line documentation)

Serial number: 001
Date of Manufacture: 01/15/2003

1. Pertinent Process Information

The process of the construction of the target is described in the document “NuMI Low Energy Target Specification”, last revision from 01/31/2003. The conformance certification of the each constructed part to the requirements of appropriate drawing was carried out by engineering inspection divisions of the IHEP, Protvino and IPPE, Obninsk workshops.

To provide the nonflatness tolerance of the target core equal to 0.2 mm, as specified in the drawing 7589-01-50-00, cross section B-B, the special soldering furnace for the assembly of the target core was built (Figure 1).

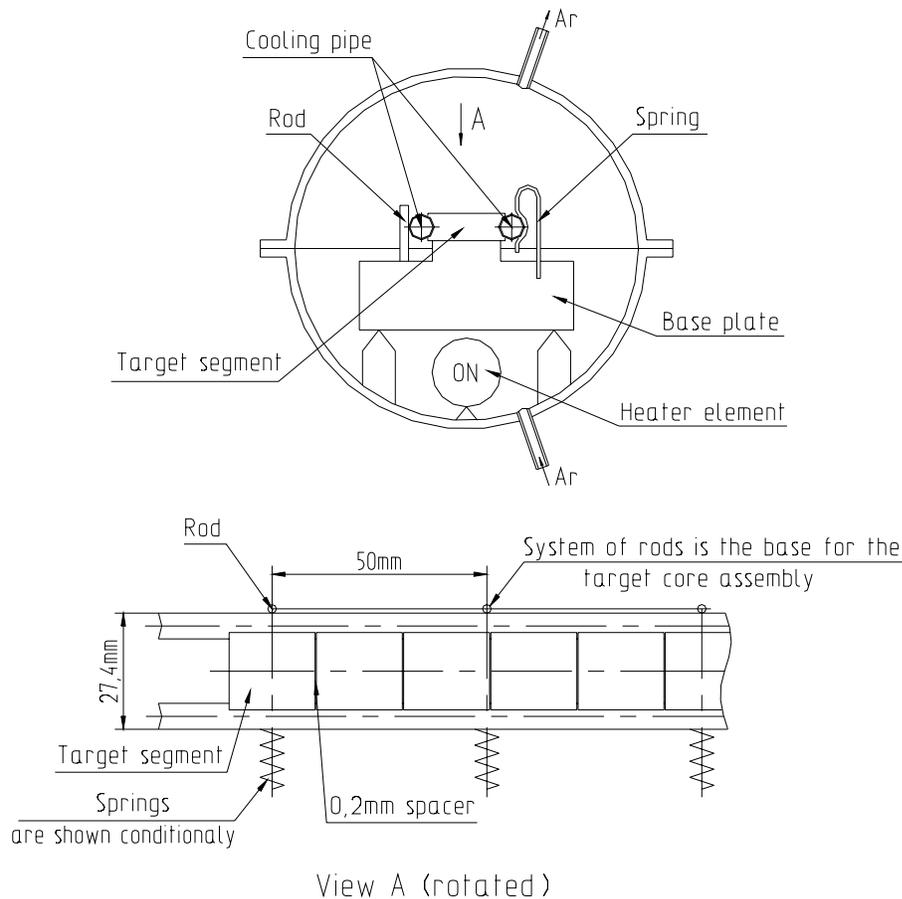


Figure 1. The assembly of the target core in the soldering furnace during the process of soldering.

The base plate and holes for rods were machined by the coordinate boring machine (the accuracy to within 10 μm). Target segments are placed on the precise smooth surface of the base plate machined by the grinding machine. The transverse size of this surface is a few millimeters less than the height of the graphite segment. It provides sliding of target segments during the soldering process. The

assembly of cooling pipes and target segments are pressed to the rods by springs, uniformly spaced along the target core length. Soldering of this assembly is carried out in the argon environment. The low heating rate equal to $10^{\circ}\text{C}/5$ min minimizes the warpage of the base plate, as well as that of the target core assembly. To prevent the warpage of the target core with soldered cooling pipes during cooling process the steel weight with precise grinding surface is placed on the graphite core as it is shown in Figure 2.

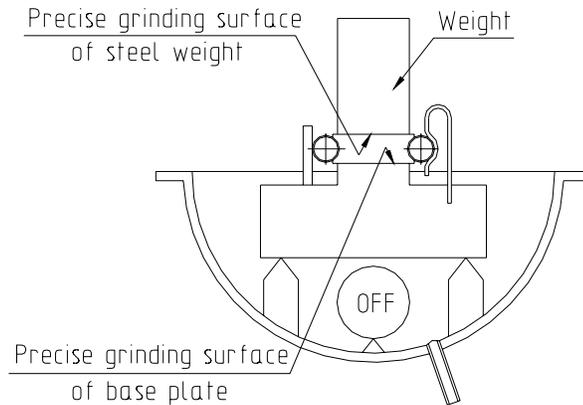


Figure 2. The assembly for cooling process of the soldered target core.

2. Required Mechanical Dimensions

Measured dimensions compared to the specified in appropriate Engineering Drawings are given in Table 1.

Dimension	Specified, mm	Measured, mm
The length of the graphite core	953.8 $_{-2.3}$	952 \pm 0.1
The height clearance of the target core with soldered cooling pipes	27.4	27.4 \pm 0.01
The distance between the downstream plane of mounting flange and the first target segment	32.2	34 \pm 0.1

Table 1. Measured mechanical dimensions compared to the specified in appropriate Engineering Drawings.

The measured position of the cross with respect to the center of the compensation ring of the beryllium window is shown in Figure 3. Measurements were carried out with help of the theodolite–level.

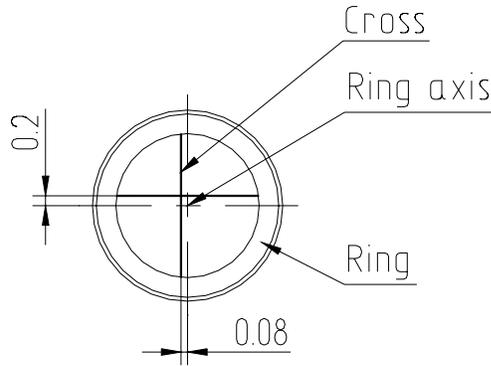


Figure 3. Measured position (mm) of the cross with respect to the ring center.

3. Required Electric Check

Required electric check involving measurements of resistances between different parts of the target at 100 V, were carried out by the E6-13 teraohm-meter. Results of measurements are given in Table 2.

The target core and ground (mounting flange)	$>10^{11}$
The target core and target casing	1×10^{10}
The vertical monitoring graphite plate and ground	3×10^{10}

Table 2. Measured resistances (Ohm) between different parts of the target.

4. Required Vacuum Test

Vacuum tests were carried out at vacuum 10^{-3} Torr by the PTI – 10 helium leak detector with sensitivity of 10^{-10} Torr \times l/s. Three types of vacuum tests were carried out at the stage of the construction of the target as specified in appropriate Engineering Drawings and “NuMI Low Energy Target Specification”:

- each of welded or brazed joints. In case of the leakage the joint is repaired until the vacuum tightness of the joint was reached and the leak reduced below 10^{-7} Torr \times l/s;
- each of separate assembly or sub-assembly. No leakage was detected;
- the final assembly of the target. No leakage was detected.

5. Required Hydraulic Tests

Two types of hydraulic tests of the target cooling system were carried out at the stage of the construction of the target as specified in appropriate Engineering Drawings and “NuMI Low Energy Target Specification”:

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- the static test at the water pressure equal to 0.3 MPa during 30 min. No leakage was detected;
- the test of the water flow rate at a pressure drop equal to 0.0981 MPa. As measurements showed the water flow rate at this pressure drop was equal to $3.5^{+0.2}$ l/min.