

Specifications for Lead Tungstate Crystals (Nov 2018)

The following are the domains for the specification, defining the acceptance tests and procedures:

- check of visual properties;
- geometry;
- optical properties.

1. Visual Properties

Some parameters of the crystal quality such as possible coloring, cracks or any sort can easily be seen by eyes and a check list will allow to immediately reject crystals presenting such obvious defects. The list of the visual properties includes:

- The manufacturer label number should be on the front face of the crystal;
- No visible cracks, chips or scratches, missing material, surface flaws;
- No visible veil or core defect;
- Transparent and colorless;
- All faces polished.

2. Geometry

Each crystal module will have simple rectangular shape with the size of 21.5x21.5x180.0 mm³ (see Fig. 1)

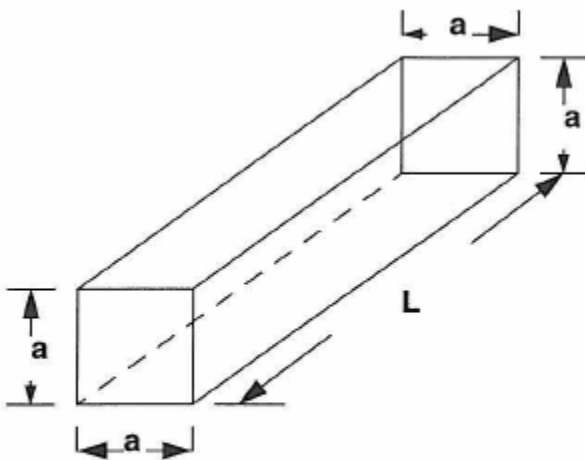


Fig. 1

The dimensions of each crystal are shown in Fig 1 and are specified in the following Table:

	Length (mm)	Tolerance (mm)
a	21.5	+0.0 -0.1
L	180.0	+0.3 -0.0

Tolerances for dimensions:

- All transversal dimensions should be within +0.0 mm, -0.1 mm except for the length of the crystal;
- The longitudinal dimensions should be within +0.3 mm, -0.0 mm

Planarity:

- Planarity for all faces should be kept within 0.020 mm for all faces.

Angular tolerances:

- All angular tolerances should be kept within 0.050 mm across a length of 25 mm, except for the back face, which is specified below.

Perpendicularity:

- On the back face (opposite to the front face where the manufacturer number is labeled), we will attach a PMT with the length of 80 mm. Therefore we have a special requirement for this face. The Perpendicularity for this face should be kept within 0.20 mm across the length of the crystal 180 mm.

Chamfers:

- Chamfers should be made on all 12 edges, with the cut to the limit of 0.3-0.7mm x 45°. The surface finish of chamfers can be left at a roughness of 0.5 μm (lapping)

Surface Finish:

- Surface finish for all faces should be "Polished Finish" with the Roughness less than 0.020 μm . It should be done on a polishing machine equipped with a special polishing cloth and using diamond abrasive of grain 3 μm in emulsion. From the surface finish provided by the previous operation (lapping), about 10 minutes are necessary to reach the required surface finish.

3. Optical Properties

Longitudinal transmission (absolute values):

- ≥20% at 360 nm;
- ≥55 % at 420 nm;
- ≥65% at 620 nm

Transversal transmission:

- The non-uniformity of the transversal transmission $\delta\lambda$ at the transmission value of 50% should be $\delta\lambda \leq 6$ nm for 5 measurements every 3 cm, starting at 1.5 cm from front face.

Scintillation Light yield:

- Light Yield ≥ 12 photoelectrons/MeV, measured at T=18° C and in a 100 ns gate, with ^{60}Co source at 3 cm from PWO front face, with a Phillips XP2262B photomultiplier covering all rear face, with a n=1.5 silicon coupling grease, wrapped on 4 sides and face in 1 layer of Tyvek.

Decay time:

- LY(100 ns)/LY(1000 ns) > 90% at T=18° C.
- Afterglow $\leq 0.5\%$ of peak amplitude with a ^{60}Co counting rate of MHz.