

1. Cosmetic Requirements

- a. All exposed surfaces are to be completely free of cosmetic imperfections; no nicks, chips, scratches, rounded corners or pitting will be permitted. Lines or scratches due to sanding or polishing paper are not acceptable.
- b. All signs of tooling marks are to be removed. Tooling marks are referred to as marks that occur during the machining of the part (e.g. the swirl marks made by a shell mill).
- c. All burrs and sharp edges are to be removed.
- d. All surfaces require machining; stock material showing any signs of extrusion/die marks is not permitted.
- e. All parts are to be delivered free of grease and clean; free of grease or dirt and with no signs of corrosion, oxidation marks, grinding dust or chips and must be received in a dry condition with no water marks or residue. Only if material is subject to corrosion or rust, a light coating of oil or grease may be used.
- f. Parts are to be made of to the material specified on the drawing. Prior written approval from Thorlabs is required if a substitute material will be used. In such a case, where an approved material has been substituted, the components should be segregated and shipped in separate boxes with the material type specified on the box or attached note. An approved Thorlabs deviation form shall accompany all such product deliveries.

2. Tumbling Requirements

- a. All aluminum components should be tumbled prior to anodizing to achieve a uniform matte finish and to break all sharp edges.
- b. Machined parts may have to be polished lightly on a fine emery paper or cloth (320 grit) to remove tool marks, surface scratches or other imperfections in the material prior to tumbling. Verify that no scratches are introduced from polishing and that they are completely removed and not visible after tumbling.
- c. Suggested tumbling process for Thorlabs machined components:
 - i. Degrease all machined components prior to tumbling process.
 - ii. Tumble all machined components for approximately *20-60 minutes or until a uniform matte finish is achieved prior to plating.
 - iii. After tumbling, rinse parts thoroughly in clean warm water and dry completely ensuring that there are no water marks or residue on the dry parts.
 - iv. Refer to mechanical drawings for specifications on anodizing or other plating/finishing processes required.

Note: All surface scratches, tooling marks, and imperfections in the material need to be removed prior to anodizing. The anodizing process will highlight any material imperfections, surface scratches, tooling marks, inadequate matte finish or tumbling.

*Applications may vary depending on circumstances.

Materials needed for tumbling:

- 1) Tub tumbler, Bowl tumbler
- 2) XV Triangles (1-1/4 x 5/8 x 7/8") and Cones (3/4") (Plastic media)
 - a. Supplier, Vibra Finish
 - b. Supplier, Almco Inc., Tel # 507-377-2102
- 3) 506RD Rust Inhibitor Liquid Compound
 - a. Supplier, Almco Inc., Tel # 507-377-2102
- 4) H-10 Anti-Foam
 - a. Supplier, Almco Inc., Tel # 507-377-2102

3. Anodizing Requirements

- a. Anodize build-up in threads must not exceed the point where the threads are out of specification. Threads must meet all applicable specs associated with max/min major, minor, and pitch diameters.
- b. Anodizing can affect dimensions. Parts are to meet drawing specifications AFTER all finishing requirements. Dimensional allowances for plating may need to be made during machining of the components. Coordination with the plater may be required to assure compatibility.
- c. All finishes (colored or clear anodizing, black oxide, etc.) should be consistent in color, uniform matte finish, and appearance regardless of when the parts were produced. Contact Thorlabs for acceptable samples of color and finish.

4. Dimensional Requirements

- a. All dimensions expressed on mechanical drawings should be measured as complete, AFTER all finishing processes. Some allowances for finishing may have to be made.
- b. All holes are to have uniform chamfers for ease of assembly (0.010" x 45° over major diameter for threaded holes and 0.010" x 45° for unthreaded holes, unless specified otherwise).
- c. External threads are to be chamfered 0.010" x 45° under minor diameter, unless specified otherwise.
- d. Edges are to have a minimum 0.005" chamfer not exceeding a 0.010" chamfer unless otherwise specified.
- e. All chamfers are to have +/- 0.003" uniformity.
- f. A minimum undercut is required for mating parts to seat flush. Internal/external thread undercuts should be held from 1 to 1-1/2 threads. Internal holes calling for a minimum undercut should be 0.020" long, unless otherwise specified.
- g. Geometric tolerances (unless otherwise specified):
 - i. Flatness 0.002"
 - ii. Parallel 0.002"
 - iii. Straightness 0.001"
 - iv. Positional 0.002"
 - v. Concentricity 0.002"
 - vi. Perpendicularity 0.002"
 - vii. Angular +/-30'
- h. Linear Tolerances (unless specified otherwise):
 - i. +/- 0.010" for two place decimal dimensions

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- ii. $\pm 0.005''$ for three place decimal dimensions
 - i. Surface finish is to be 32 micro-inches or better before tumbling
 - j. Delivery of any parts not meeting specification must be accompanied with an approved written Thorlabs Deviation form clearly included with each shipment of parts.

5. Gauging Techniques

- a. When checking a part using a GO pin gauge, the procedure is to jiggle or twist (one turn) the gauge to get started into the hole then pushed forward. If gauge doesn't go completely through the hole, then hole is too small.
- b. When checking a part using a NO-GO pin gauge, the procedure is to jiggle or twist the gauge to get started but the gauge should not go into hole.
- c. When inspecting using a THREADED PLUG GAUGE or THREADED RING GAUGE use the following procedure:
 - i. GO side — carefully thread gauge onto part. Gauge must spin freely with no sign of resistance.
 - ii. NO-GO side — carefully thread onto part (gauge is allowed up to 3 complete turns). If gauge threads more than 3 turns it is cause for rejection.