

**1015.2. con't.**

- d. Technology for the "production" of aromatic polyamide fibres;
- e. Technology for the installation, maintenance or repair of materials controlled by 1013.1.;

- f. Technology for the repair of "composite" structures, laminates or materials controlled by 1011.2., 1013.7.c. or 1013.7.d.

**Note:**

*1015.2.f. does not control technology for the repair of "civil aircraft" structures using carbon "fibrous or filamentary materials" and epoxy resins, contained in aircraft manufacturers' manuals.*

## Category 1020: Materials Processing

### 1021. Systems, Equipment and Components

**N.B.:**

*For quiet running bearings, see Item 2009 on the Munitions List.*

1. Anti-friction bearings and bearing systems, as follows, and components therefor:

**Note:**

*1021.1. does not control balls with tolerances specified by the manufacturer in accordance with ISO 3290 as grade 5 or worse.*

- a. Ball bearings and solid roller bearings having tolerances specified by the manufacturer in accordance with ABEC 7, ABEC 7P, ABEC 7T or ISO Standard Class 4 or better (or national equivalents), and having rings, balls or rollers made from monel or beryllium;

**Note:**

*1021.1.a. does not control tapered roller bearings.*

- b. Other ball bearings and solid roller bearings having tolerances specified by the manufacturer in accordance with ABEC 9, ABEC 9P or ISO Standard Class 2 or better (or national equivalents);

**Note:**

*1021.1.b. does not control tapered roller bearings.*

- c. Active magnetic bearing systems using any of the following:
  1. Materials with flux densities of 2.0 T or greater and yield strengths greater than 414 MPa;
  2. All-electromagnetic 3D homopolar bias designs for actuators; or
  3. High temperature (450 K (177°C) and above) position sensors.

1. Machine tools, as follows, and any combination thereof, for removing or cutting metals, ceramics or composites, which, according to the manufacturer's technical specification, can be equipped with electronic devices for "numerical control":

- a. Machine tools for turning, having all of the following characteristics :

1. Positioning accuracy with all compensations available of less (better) than 6 µm along any linear axis (overall positioning); and
2. Two or more axes which can be coordinated simultaneously for "contouring control";

**Note:**

*1022.1.a. does not control turning machines specially designed for the production of contact lenses.*

- b. Machine tools for milling, having any of the following characteristics :

1. a) Positioning accuracies with all compensations available of less (better) than 6 µm along any linear axis (overall positioning); and
- b) Three linear axes plus one rotary axis which can be coordinated simultaneously for "contouring control";

2. Five or more axis which can be coordinated simultaneously for "contouring control"; or

3. A positioning accuracy for jig boring machines with all compensations available, of less (better) than 4 µm along any linear axis (overall positioning);

- c. Machine tools for grinding, having any of the following characteristics:

1. a) Positioning accuracy with all compensations available of less (better) than 4 µm along any linear axis (overall positioning); and
- b) Three or more axes which can be coordinated simultaneously for "contouring control"; or
2. Five or more axis which can be coordinated simultaneously for "contouring control";

**Notes:**

*1022.1.c. does not control grinding machines, as follows:*

1. Cylindrical external, internal, and external-internal grinding machines having all the following characteristics:
  - a. Limited to cylindrical grinding; and
  - b. Limited to a maximum workpiece capacity of 150 mm outside diameter or length;
2. Machines designed specifically as jig grinders having any of the following characteristics:
  - a. The c-axis is used to maintain the grinding wheel normal to the work surface; or
  - b. The a-axis is configured to grind barrel cams;
3. Tool or cutter grinding machines shipped as complete systems with "software" specially designed for the production of tools or cutters;
4. Crank shaft or cam shaft grinding machines;
5. Surface grinders.

### 1022. Test, Inspection and Production Equipment

**Technical Notes:**

1. Secondary parallel contouring axes, (e.g., the w-axis on horizontal boring mills or a secondary rotary axis the centre line of which is parallel to the primary rotary axis) are not counted in the total number of contouring axes.
- N.B.:
 

Rotary axes need not rotate over 360°. A rotary axis can be driven by a linear device (e.g., a screw or a rack-and-pinion).
2. Axis nomenclature shall be in accordance with International Standard ISO 841, 'Numerical Control Machines - Axis and Motion Nomenclature'.
3. For the purposes of this Category a "tilting spindle" is counted as a rotary axis.
4. Guaranteed positioning accuracy levels instead of individual test protocols may be used for each machine tool model using the agreed ISO test procedure.
5. The positioning accuracy of "numerically controlled" machine tools is to be determined and presented in accordance with ISO 230/2.