

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 therefore:

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 all tolerances specified by the manufacturer in accordance with ISO 492 Tolerance Class 4 (or ANSI/ABMA Std 20 Tolerance Class ABEC-7 or RBEC-7, or other national equivalents), or better, and having both rings and rolling elements (ISO 5593) made from monel or beryllium;

Note:

1021.1.a. does not control tapered roller bearings.

- b. Other ball bearings and solid roller bearings having all tolerances specified by the manufacturer in accordance with ISO 492 Tolerance Class 2 (or ANSI/ABMA Std 20 Tolerance Class ABEC-9 or RBEC-9, or other national equivalents), or better;

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.

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. 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. For the purposes of 1022., the number of axes which can be co-ordinated simultaneously for "contouring control" is the number of axes which affect relative movement between any one workpiece and a tool, cutting head or grinding wheel which is cutting or removing material from the workpiece. This does not include any additional axes which affect other relative movement within the machine. Such axes include:
 - a. Wheel-dressing systems in grinding machines;
 - b. Parallel rotary axes designed for mounting of separate workpieces;
 - c. Co-linear rotary axes designed for manipulating the same workpiece by holding it in a chuck from different ends.
3. Axis nomenclature shall be in accordance with International Standard ISO 841, 'Numerical Control Machines - Axis and Motion Nomenclature'.
4. For the purposes of this Category a "tilting spindle" is counted as a rotary axis.
5. Stated positioning accuracy levels derived from measurements made according to ISO 230/2 (1997) or national equivalents may be used for each machine tool model instead of individual machine tests. Stated positioning accuracy means the accuracy value provided to national licensing authorities as representative of the accuracy of a machine model.

Determination of Stated Values:

- a. Select five machines of a model to be evaluated;
- b. Measure the linear axis accuracies according to ISO 230/2 (1997);
- c. Determine the A-values for each axis of each machine. The method of calculating the A-value is described in the ISO standard;
- d. Determine the mean value of the A-value of each axis. This mean value \bar{A} becomes the stated value of each axis for the model ($\bar{A}_x, \bar{A}_y, \dots$);
- e. Since the Category 1020 list refers to each linear axis there will be as many stated values as there are linear axes;
- f. If any axis of a machine model not controlled by 1022.1.a. to c. has a stated accuracy \bar{A} of 5 microns for grinding machines and 6.5 microns for milling and turning machines or better, the builder should be required to reaffirm the accuracy level once every eighteen months.

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":

Note 1

1022.1. does not control special purpose machine tools limited to the manufacture of gears. For such machines, see Item 1022.3.

Note 2

1022.1. does not control special purpose machine tools limited to the manufacture of any of the following parts:

- a. Crank shafts or cam shafts;
- b. Tools or cutters;
- c. Extruder worms;
- d. Engraved or faceted jewelry parts;

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

1. Positioning accuracy with "all compensations available" equal to or less (better) than 4.5 μm according to ISO 230/2 (1997) or national equivalents along any linear axis; **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 :

Having all of the following:

1. a. Positioning accuracy with "all compensations available" equal to or less (better) than 4.5 μm according to ISO 230/2 (1997) or national equivalents along any linear axis; **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", equal to or less (better) than 3.0 μm according to ISO 230/2 (1997) or national equivalents along any linear axis;
4. Fly cutting machines, having all of the following characteristics:
 - a. Spindle "run-out" and "camming" less (better) than 0.0004 mm TIR; **and**
 - b. Angular deviation of slide movement (yaw, pitch and roll) less (better) than 2 seconds of arc, TIR, over 300 mm of travel.

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

1. Having all of the following: