

f. Custom integrated circuits for which either the function is unknown, or the control status of the equipment in which the integrated circuits will be used is unknown to the manufacturer, having any of the following:

- f.1. More than 144 terminals; *or*
- f.2. A typical "basic propagation delay time" of less than 0.4 ns.
- g. Traveling wave tubes, pulsed or continuous wave, as follows:
  - g.1. Coupled cavity tubes, or derivatives thereof;
  - g.2. Helix tubes, or derivatives thereof, with any of the following:
    - g.2.a. An "instantaneous bandwidth" of half an octave or more; *and*
    - g.2.b. The product of the rated average output power (expressed in kW) and the maximum operating frequency (expressed in GHz) of more than 0.2;
    - g.2.c. An "instantaneous bandwidth" of less than half an octave; *and*
    - g.2.d. The product of the rated average output power (expressed in kW) and the maximum operating frequency (expressed in GHz) of more than 0.4;
  - h. Flexible waveguides designed for use at frequencies exceeding 40 GHz;
  - i. Surface acoustic wave and surface skimming (shallow bulk) acoustic wave devices (*i.e.*, "signal processing" devices employing elastic waves in materials), having either of the following:
    - i.1. A carrier frequency exceeding 1 GHz; *or*
    - i.2. A carrier frequency of 1 GHz or less; *and*
      - i.2.a. A frequency side-lobe rejection exceeding 55 Db;
      - i.2.b. A product of the maximum delay time and bandwidth (time in microseconds and bandwidth in MHz) of more than 100; *or*
      - i.2.c. A dispersive delay of more than 10 microseconds.
  - j. Batteries, as follows:

**Note:** 3A991.j does not control batteries with volumes equal to or less than 27 cm<sup>3</sup> (*e.g.*, standard C-cells or UM-2 batteries).

- j.1. Primary cells and batteries having an energy density exceeding 350 Wh/kg and rated for operation in the temperature range from below 243 K (−30°C) to above 343 K (70°C);
- j.2. Rechargeable cells and batteries having an energy density exceeding 150 Wh/kg after 75 charge/discharge cycles at a discharge current equal to C/5 hours © being the nominal capacity in ampere hours) when operating in the temperature range from below 253 K (−20°C) to above 333 K (60°C);

**Technical Note:** Energy density is obtained by multiplying the average power in watts (average voltage in volts times average current in amperes) by the duration of the discharge in hours to 75 percent of the open circuit voltage divided by the total mass of the cell (or battery) in kg.

k. "Superconductive" electromagnets or solenoids specially designed to be fully charged or discharged in less than one minute, having all of the following:

**Note:** 3A991.k does not control "superconductive" electromagnets or solenoids designed for Magnetic Resonance Imaging (MRI) medical equipment.

- k.1. Maximum energy delivered during the discharge divided by the duration of the discharge of more than 500 kJ per minute;
- k.2. Inner diameter of the current carrying windings of more than 250 mm; *and*
- k.3. Rated for a magnetic induction of more than 8T or "overall current density" in the winding of more than 300 A/mm<sup>2</sup>.
- l. Circuits or systems for electromagnetic energy storage, containing components manufactured from "superconductive" materials specially designed for operation at temperatures below the "critical temperature" of at least one of their "superconductive" constituents, having all of the following:
  - l.1. Resonant operating frequencies exceeding 1 MHz;
  - l.2. A stored energy density of 1 MJ/M<sup>3</sup> or more; *and*
  - l.3. A discharge time of less than 1 ms;
  - m. Hydrogen/hydrogen-isotope thytrons of ceramic-metal construction and rate for a peak current of 500 A or more;
  - n. Digital integrated circuits based on any compound semiconductor having an equivalent gate count of more than 300 (2 input gates).

■ 15. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3—Electronics, Export Control Classification Number (ECCN) 3B001 is amended by revising the "items" paragraph in the List of Items Controlled section, to read as follows:

**3B001 Equipment for the manufacturing of semiconductor devices or materials, as follows (see List of Items Controlled), and specially designed components and accessories therefor.**

\* \* \* \* \*

#### List of Items Controlled

*Unit:* \* \* \*

*Related Controls:* \* \* \*

*Related Definitions:* \* \* \*

*Items:*

- a. "Stored program controlled" equipment designed for epitaxial growth, as follows:
  - a.1. Equipment capable of producing a layer thickness uniform to less than ±2.5% across a distance of 75 mm or more;
  - a.2. Metal organic chemical vapor deposition (MOCVD) reactors specially designed for compound semiconductor crystal growth by the chemical reaction between materials controlled by 3C003 or 3C004;
  - a.3. Molecular beam epitaxial growth equipment using gas or solid sources;
  - b. "Stored program controlled" equipment designed for ion implantation, having any of the following:
    - b.1. A beam energy (accelerating voltage) exceeding 1MeV;
    - b.2. Being specially designed and optimized to operate at a beam energy (accelerating voltage of less than 2 keV;

b.3. Direct write capability; *or*  
b.4. Being capable of high energy oxygen implant into a heated semiconductor material "substrate";

c. "Stored program controlled" anisotropic plasma dry etching equipment, as follows:

- c.1. Equipment with cassette-to-cassette operation and load-locks, and having any of the following:
    - c.1.a. Designed or optimized to produce critical dimensions of 0.3 μm or less with ±5% 3 sigma precision; *or*
    - c.1.b. Designed for generating less than 0.04 particles/cm<sup>2</sup> with a measurable particle size greater than 0.1 μm in diameter;
    - c.2. Equipment specially designed for equipment controlled by 3B001.e. and having any of the following:
      - c.2.a. Designed or optimized to produce critical dimensions of 0.3 μm or less with ±5% 3 sigma precision; *or*
      - c.2.b. Designed for generating less than 0.04 particles/cm<sup>2</sup> with a measurable particle size greater than 0.1 μm in diameter;
    - d. "Stored program controlled" plasma enhanced CVD equipment, as follows:
      - d.1. Equipment with cassette-to-cassette operation and load-locks, and having any of the following:
        - d.1.a. Designed or optimized to produce critical dimensions of 0.3 μm or less with ±5% 3 sigma precision; *or*
        - d.1.b. Designed for generating less than 0.04 particles/cm<sup>2</sup> with a measurable particle size greater than 0.1 μm in diameter;
      - d.2. Equipment specially designed for equipment controlled by 3B001.e. and having any of the following:
        - d.2.a. Designed or optimized to produce critical dimensions of 0.3 μm or less with ±5% 3 sigma precision; *or*
        - d.2.b. Designed for generating less than 0.04 particles/cm<sup>2</sup> with a measurable particle size greater than 0.1 μm in diameter;
      - e. "Stored program controlled" automatic loading multi-chamber central wafer handling systems, having all of the following:
        - e.1. Interfaces for wafer input and output, to which more than two pieces of semiconductor processing equipment are to be connected; *and*
        - e.2. Designed to form an integrated system in a vacuum environment for sequential multiple wafer processing;
- Note:** 3B001.e. does not control automatic robotic wafer handling systems not designed to operate in a vacuum environment.
- f. "Stored program controlled" lithography equipment, as follows:
- f.1. Align and expose step and repeat (direct step on wafer) or step and scan (scanner) equipment for wafer processing using photo-optical or X-ray methods, having any of the following:
    - f.1.a. A light source wavelength shorter than 350 nm; *or*
    - f.1.b. Capable of producing a pattern with a minimum resolvable feature size of 0.35 μm or less;
- Technical Note:** The minimum resolvable feature size is calculated by the following formula: