

such individuals and in which at least 75 percent of the voting interest is owned or controlled by persons who are citizens of the United States or of one of its possessions.

“*Usable in or Capable of*”. (MTCR context)—Equipment, parts, components or “software” that are suitable for a particular purpose. There is no need for the equipment, parts, components or “software” to have been configured, modified or specified for the particular purpose. For example, any military specification memory circuit would be “capable of” operation in a guidance system.

“*Use*”. (All categories and General Technology Note)—Operation, installation (including on-site installation), maintenance (checking), repair, overhaul and refurbishing.

“*User-accessible programmability*”. (Cat 4, 5, and 6)—The facility allowing a user to insert, modify, or replace “programs” by means other than:

- (a) A physical change in wiring or interconnections; or
- (b) The setting of function controls including entry of parameters.

*Utilization facility*. (a) As defined by 10 CFR 110.2 of the Nuclear Regulatory Commission Regulations, utilization facility means a nuclear reactor, other than one that is a production facility, any of the following major components of a nuclear reactor: Pressure vessels designed to contain the core of a nuclear reactor, other than one that is a production facility, and the following major components of a nuclear reactor:

- (1) Primary coolant pumps;
- (2) Fuel charging or discharging machines; and
- (3) Control rods.

(b) Utilization facility does not include the steam turbine generator portion of a nuclear power plant.

“*Vacuum Atomization*”. (Cat 1)—A process to reduce a molten stream of metal to droplets of a diameter of 500 micrometer or less by the rapid evolution of a dissolved gas upon exposure to a vacuum.

“*Variable geometry airfoils*”. (Cat 7)—Use trailing edge flaps or tabs, or leading edge slats or pivoted nose droop, the position of which can be controlled in flight.

“*Vector Rate*”. (Cat 4)—See: “Two dimensional Vector Rate”; “Three dimensional Vector Rate”.

*You*. Any person, including a natural person, including a citizen of the United States or any foreign country; any firm; any government, government agency, government department, or government commission; any labor union; any fraternal or social organization; and any other association or organization whether or not organized for profit.

[61 FR 12925, Mar. 25, 1996, as amended at 61 FR 68586, Dec. 30, 1996; 62 FR 6686, Feb. 12, 1997; 62 FR 25470, May 9, 1997; 63 FR 50525, Sept. 22, 1998; 63 FR 72166, Dec. 31, 1998; 64 FR 1122, Jan. 8, 1999; 64 FR 5932, Feb. 8, 1999; 64 FR 13339, Mar. 18, 1999; 64 FR 27146, May 18, 1999; 65 FR 2501, Jan. 14, 2000; 65 FR 34075, May 26, 2000; 65 FR 42573, July 10, 2000; 65 FR 43133, July 12, 2000; 65 FR 62609, Oct. 19, 2000; 66 FR 18402, Apr. 9, 2001; 66 FR 36683, July 12, 2001; 66 FR 36910, July 16, 2001; 66 FR 461, Jan. 3, 2002; 67 FR 38869, June 6, 2002; 67 FR 54953, Aug. 27, 2002; 67 FR 55599, Aug. 29, 2002; 68 FR 10591, Mar. 5, 2003; 68 FR 34195, June 6, 2003; 68 FR 50474, Aug. 21, 2003; 68 FR 54656, Sept. 18, 2003; 68 FR 60289, Oct. 22, 2003; 68 FR 68980, Dec. 10, 2003]

EDITORIAL NOTE: At 66 FR 36910, July 16, 2001, §772.1 was amended by revising the phrase “Cat. 1 and 7” to read “All Categories” in the definition for “*Production*”. However, this phrase does not exist in this definition in the 2001 edition of the volume.

## PART 774—THE COMMERCE CONTROL LIST

Sec.

774.1 Introduction.

774.2 [Reserved]

SUPPLEMENT NO. 1 TO PART 774—THE COMMERCE CONTROL LIST

SUPPLEMENT NO. 2 TO PART 774—GENERAL TECHNOLOGY AND SOFTWARE NOTES

SUPPLEMENT NO. 3 TO PART 774—STATEMENT OF UNDERSTANDING

SOURCE: 61 FR 12937, Mar. 25, 1996, unless otherwise noted.

AUTHORITY: 50 U.S.C. app. 2401 *et seq.*; 50 U.S.C. 1701 *et seq.*; 10 U.S.C. 7420; 10 U.S.C. 7430(e); 18 U.S.C. 2510 *et seq.*; 22 U.S.C. 287c, 22 U.S.C. 3201 *et seq.*, 22 U.S.C. 6004; 30 U.S.C. 185(s), 185(u); 42 U.S.C. 2139a; 42 U.S.C. 6212; 43 U.S.C. 1354; 46 U.S.C. app. 466c; 50 U.S.C. app. 5; Sec. 901-911, Pub. L. 106-387; Sec. 221, Pub. L. 107-56; E.O. 13026, 61 FR 58767, 3 CFR, 1996 Comp., p. 228; E.O. 13222, 66 FR 44025, 3 CFR, 2001 Comp., p. 783; Notice of August 7, 2003, 68 FR 47833, August 11, 2003.

§ 774.1

§ 774.1 Introduction.

In this part, references to the EAR are references to 15 CFR chapter VII, subchapter C. The Bureau of Industry and Security (BIS) maintains the Commerce Control List (CCL) that includes items (commodities, software, and technology) subject to the authority of BIS. The CCL does not include those items exclusively controlled for export by another department or agency of the U.S. Government. In instances where other agencies administer controls over related items, entries in the CCL will contain a reference to these controls. Those items subject to the EAR but not specified on the CCL are identified by the designator “EAR99”. See § 734.2(a) of the EAR for items that are “subject to the EAR”. You should consult part 738 of the EAR for an explanation of the organization of the CCL and its relationship to the Country Chart.

The CCL is contained in Supplement No. 1 to this part, and Supplement No. 2 to this part contains the General Technology and Software Notes relevant to entries contained in the CCL.

§ 774.2 [Reserved]

SUPPLEMENT NO. 1 TO PART 774—THE COMMERCE CONTROL LIST

CATEGORY 0—NUCLEAR MATERIALS, FACILITIES, AND EQUIPMENT [AND MISCELLANEOUS ITEMS]

A. SYSTEMS, EQUIPMENT AND COMPONENTS

**0A001 “Nuclear reactors”, i.e., reactors capable of operation so as to maintain a controlled, self-sustaining fission chain reaction, and equipment and components specially designed or prepared for use in connection with a “nuclear reactor”, including (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:*

*Control(s):* Items described in 0A001 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110)

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A.  
*Related Controls:* N/A  
*Related Definitions:* N/A

*Items:* a. Pressure vessels, i.e. metal vessels as complete units or X parts therefor, which are specially designed or prepared to contain the core of a “nuclear reactor” and are capable of withstanding the operating pressure of the primary coolant, including the top plate for a reactor pressure vessel;

b. Fuel element handling equipment, including reactor fuel charging and discharging machines;

c. Control rods specially designed or prepared for the control of the reaction rate in a “nuclear reactor”, including the neutron absorbing part and the support or suspension structures therefore, and control rod guide tubes;

d. Electronic controls for controlling the power levels in “nuclear reactors”, including reactor control rod drive mechanisms and radiation detection and measuring instruments to determine neutron flux levels;

e. Pressure tubes specially designed or prepared to contain fuel elements and the primary coolant in a “nuclear reactor” at an operating pressure in excess of 5.1 MPa;

f. Tubes or assemblies of tubes, made from zirconium metal or alloy in which the ratio of hafnium to zirconium is less than 1:500 parts by weight, specially designed or prepared for use in a “nuclear reactor”;

g. Coolant pumps specially designed or prepared for circulating the primary coolant of “nuclear reactors”;

h. Internal components specially designed or prepared for the operation of a “nuclear reactor”, including core support structures, thermal shields, baffles, core grid plates and diffuser plates;

i. Heat exchangers.

**0A002 Power generating or propulsion equipment specially designed for use with space, marine or mobile “nuclear reactors”. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**0A018 Items on the International Munitions List.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT, UN.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
AT applies to entire entry .....	AT Column 1.
UN applies to entire entry .....	Rwanda.

LICENSE EXCEPTIONS

LVS: \$5000 for 0A018.a and .b, \$3000 for 0A018.c, \$1500 for 0A018.d through .f, \$0 for Rwanda  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

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*Unit:* 0A018.a, .b, and .c in \$ value; 0A018.d, .e, and .f in number.

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* a. Power controlled searchlights and control units therefor, designed for military use, and equipment mounting such units; and specially designed parts and accessories therefor;

b. Construction equipment built to military specifications, specially designed for airborne transport; and specially designed parts and accessories therefor;

c. Specially designed components and parts for ammunition, except cartridge cases, powder bags, bullets, jackets, cores, shells, projectiles, boosters, fuses and components, primers, and other detonating devices and ammunition belting and linking machines (all of which are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (See 22 CFR parts 120 through 130.)

d. Bayonets;

e. Muzzle-loading (black powder) firearms; NOTE: Antique small arms dating prior to 1890 and their reproductions are not controlled by this ECCN 0A018.

f. Military helmets, except:

f.1. Conventional steel helmets other than those described by 0A018.f.2 of this entry.

f.2. Helmets, made of any material, equipped with communications hardware, optional sights, slewing devices or mechanisms to protect against thermal flash or lasers.

NOTE: Helmets described in 0A018.f.1 are controlled by 0A988. Helmets described in 0A018.f.2 are controlled by the U.S. Department of State, Office of Defense Trade Controls (See 22 CFR part 121, Category X).

**0A978 Saps.**

LICENSE REQUIREMENTS

*Reason for Control:* CC

*Control(s)* *Country Chart*

CC applies to entire entry ..... CC Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**0A979 Police helmets and shields; and parts, n.e.s.**

LICENSE REQUIREMENTS

*Reason for Control:* CC

*Control(s)*

*Country Chart*

CC applies to entire entry ..... CC Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**0A980 Horses by sea.**

LICENSE REQUIREMENTS

*Reason for Control:* SS

*Control(s):* SS applies to entire entry. For licensing requirements (and possible License Exceptions) proceed directly to part 754 of the EAR. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for SS reasons

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**0A982 Restraint devices, including thumbcuffs, leg irons, shackles, and handcuffs; straight jackets, plastic handcuffs; and parts and accessories, n.e.s.**

LICENSE REQUIREMENTS

*Reason for Control:* CC

*Control(s)*

CC applies to entire entry. A license is required for ALL destinations, except Canada, regardless of end-use. Accordingly, a column specific to this control does not appear on the Commerce Country Chart. (See part 742 of the EAR for additional information.)

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**0A983 Specially designed implements of torture and thumbscrews; and parts and accessories, n.e.s.**

LICENSE REQUIREMENTS

*Reason for Control:* CC

*Control(s):* CC applies to entire entry. A license is required for ALL destinations, regardless of end-use. Accordingly, a column

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specific to this control does not appear on the Commerce Country Chart. (See part 742 of the EAR for additional information.)

**LICENSE EXCEPTIONS**

LVS: N/A

GBS: N/A

CIV: N/A

**LIST OF ITEMS CONTROLLED**

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**0A984 Shotguns, barrel length 18 inches (45.72 cm) inches or over; buckshot shotgun shells; except equipment used exclusively to treat or tranquilize animals, and except arms designed solely for signal, flare, or saluting use; and parts, n.e.s.**

**LICENSE REQUIREMENTS**

*Reason for Control:* CC, FC, UN.

Control(s)	Country chart
FC applies to entire entry .....	FC Column 1.
CC applies to shotguns with a barrel length greater than or equal to 18 in. (45.72 cm), but less than 24 in. (60.96 cm) or buckshot shotgun shells controlled by this entry, regardless of end-user.	CC Column 1.
CC applies to shotguns with a barrel length greater than or equal to 24 in. (60.96 cm), regardless of end-user.	CC Column 2.
CC applies to shotguns with a barrel length greater than or equal to 24 in. (60.96 cm) if for sale or resale to police or law enforcement.	CC Column 3.
UN applies to entire entry .....	Rwanda.

**LICENSE EXCEPTIONS**

LVS: N/A

GBS: N/A

CIV: N/A

**LIST OF ITEMS CONTROLLED**

*Unit:* \$ value.

*Related Controls:* This entry does not control shotguns with a barrel length of less than 18 inches (45.72 cm). (See 22 CFR part 121.) These items are subject to the export licensing authority of the Department of State, Office of Defense Trade Controls.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**0A985 Discharge type arms (for example, stun guns, shock batons, electric cattle prods, immobilization guns and projectiles) except equipment used exclusively to treat or tranquilize animals, and except arms designed solely for signal, flare, or saluting use; and parts, n.e.s.**

**LICENSE REQUIREMENTS**

*Reason for Control:* CC, UN.

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Control(s)	
CC applies to entire entry. A license is required for ALL destinations, except Canada, regardless of end-use. Accordingly, a column specific to this control does not appear on the Commerce Country Chart. (See part 742 of the EAR for additional information.)	
UN applies to entire entry .....	Rwanda.

**LICENSE EXCEPTIONS**

LVS: N/A

GBS: N/A

CIV: N/A

**LIST OF ITEMS CONTROLLED**

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**0A986 Shotgun shells, except buckshot shotgun shells, and parts.**

**LICENSE REQUIREMENTS**

*Reason for Control:* AT, FC, UN.

Control(s)	Country chart
AT applies to entire entry. A license is required for items controlled by this entry to North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine AT licensing requirements for this entry. See § 742.19 of the EAR for additional information.	
FC applies to entire entry .....	FC Column 1.
UN applies to entire entry. A license is required for items controlled by this entry to Rwanda. The Commerce Country Chart is not designed to determine licensing requirements for this entry. See part 746 of the EAR for additional information.	

**LICENSE EXCEPTIONS**

LVS: N/A

GBS: N/A

CIV: N/A

**LIST OF ITEMS CONTROLLED**

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**0A987 Optical sighting devices for firearms (including shotguns controlled by 0A984); and parts, n.e.s.**

**LICENSE REQUIREMENTS**

*Reason for Control:* FC, CC, UN.

Control(s)	Country chart
FC applies to optical sights for firearms, including shotguns described in ECCN 0A984, and related parts.	FC Column 1.
CC applies to entire entry .....	CC Column 1.
UN applies to entire entry .....	Rwanda.

**0A988 Conventional military steel helmets as described by 0A018.f.1; and machetes.**

## LICENSE REQUIREMENTS

*Reason for Control:* UN.

*Control(s):* UN applies to entire entry. A license is required for conventional military steel helmets as described by 0A018.f.1 to Rwanda. A license is required for machetes to Rwanda. The Commerce Country Chart is not designed to determine licensing requirements for this entry. See part 746 of the EAR for additional information.

NOTE: Exports from the U.S. and transshipments to *Iran* must be licensed by the Department of Treasury, Office of Foreign Assets Control. (See §746.7 of the EAR for additional information on this requirement.)

## LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

## LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**0A999 Specific Processing Equipment, as Follows (See List of Items Controlled).**

## LICENSE REQUIREMENTS

*Reason for Control:* AT.

*Control(s):*

*Country Chart.*

AT applies to entire entry. A license is required for items controlled by this entry to North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine AT licensing requirements for this entry. See §742.19 of the EAR for additional information.

## LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

## LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* N/A.

*Related Definitions:* N/A.

*Items:*

- a. Ring Magnets;
- b. Reserved.

B. TEST, INSPECTION AND PRODUCTION EQUIPMENT

**0B001 Plant for the separation of isotopes of “natural uranium” and “depleted uranium”, “special fissile materials” and “other fissile materials”, and specially designed or prepared equipment and components therefor, as follows (see List of Items Controlled).**

## LICENSE REQUIREMENTS

*Reason for Control:*

*Control(s):* Items described in 0B001 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

## LICENSE EXCEPTIONS,

LVS: N/A

GBS: N/A

CIV: N/A

## LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* “Materials resistant to corrosion by UF<sub>6</sub>” may be copper, stainless steel, aluminum, aluminum oxide, aluminum alloys, nickel or alloy containing 60 weight percent or more nickel and UF<sub>6</sub>-resistant fluorinated hydrocarbon polymers, as appropriate for the type of separation process.

*Items:* a. Plant specially designed for separating isotopes of “natural uranium” and “depleted uranium”, “special fissile materials” and “other fissile materials”, as follows:

- a.1. Gaseous diffusion separation plant;
- a.2. Gas centrifuge separation plant;
- a.3. Aerodynamic separation plant;
- a.4. Chemical exchange separation plant;
- a.5. Ion-exchange separation plant;
- a.6. Atomic vapor “laser” isotopic separation plant;
- a.7. Molecular “laser” isotopic separation plant;
- a.8. Plasma separation plant;
- a.9. Electro magnetic separation plant;
- b. Equipment and components, specially designed or prepared for gaseous diffusion separation process, as follows:
  - b.1. Bellow valves made of or protected by materials resistant to UF<sub>6</sub> (e.g., aluminum, aluminum alloys, nickel or alloy containing 60 weight percent or more nickel), with a diameter of 40 mm to 1500 mm;
    - b.2.a. Compressors (positive displacement, centrifugal and axial flowtypes) or gas blowers with a suction volume capacity of 1 m<sup>3</sup>/min or more of UF<sub>6</sub>, and discharge pressure up to 666.7 kPa, made of or protected by materials resistant to UF<sub>6</sub> (e.g., aluminum, aluminum alloys, nickel or alloy containing 60 weight percent or more nickel);
    - b.2.b. Rotary shaft seals for compressors or blowers specified in 0B001.b.2.a. and designed for a buffer gas in-leakage rate of less than 1,000 cm<sup>3</sup>/min.;
  - b.3. Gaseous diffusion barriers made of porous metallic, polymer or ceramic materials resistant to corrosion by UF<sub>6</sub> with a pore size of 10 to 100 nm, a thickness of 5 mm or less, and, for tubular forms, a diameter of 25 mm or less;

b.4. Gaseous diffuser housings made of or protected by materials resistant to corrosion by UF<sub>6</sub>;

b.5. Heat exchangers made of aluminum, copper, nickel, or alloys containing more than 60 weight percent nickel, or combinations of these metals as clad tubes, designed to operate at sub-atmospheric pressure with a leak rate that limits the pressure rise to less than 10 Pa per hour under a pressure differential of 100 kPa;

c. Equipment and components, specially designed or prepared for gas centrifuge separation process, as follows:

c.1. Gas centrifuges;

c.2. Complete rotor assemblies consisting of one or more rotor tube cylinders;

c.3. Rotor tube cylinders with a thickness of 12 mm or less, a diameter of between 75 mm and 400 mm, made from any of the following high strength-to-density ratio materials:

c.3.a. Maraging steel capable of an ultimate tensile strength of 2,050 MPa or more;

c.3.b. Aluminum alloys capable of an ultimate tensile strength of 460 MPa or more; *or*

c.3.c. "Fibrous or filamentary materials" with a "specific modulus" of more than  $3.18 \times 10^6$  m and a "specific tensile strength" greater than  $76.2 \times 10^3$  m;

c.4. Magnetic suspension bearings consisting of an annular magnet suspended within a housing made of UF<sub>6</sub> resistant materials (e.g. aluminum, aluminum alloys, nickel or alloy containing 60 weight percent or more nickel) containing a damping medium and having the magnet coupling with a pole piece or second magnet fitted to the top cap of the rotor;

c.5. Specially prepared bearings comprising a pivot-cup assembly mounted on a damper;

c.6. Rings or bellows with a wall thickness of 3 mm or less and a diameter of between 75 mm and 400 mm and designed to give local support to a rotor tube or to join a number together, made from any of the following high strength-to-density ratio materials;

c.6.a. Maraging steel capable of an ultimate tensile strength of 2050 MPa or more;

c.6.b. Aluminum alloys capable of an ultimate tensile strength of 460 MPa or more; *or*

c.6.c. "Fibrous or filamentary materials" with a "specific modulus" of more than  $3.18 \times 10^6$  m and a "specific tensile strength" greater than  $76.2 \times 10^3$  m;".

c.7. Baffles of between 75 mm and 400 mm diameter for mounting inside a rotor tube, made from any of the following high strength-to-density ratio materials:

c.7.a. Maraging steel capable of an ultimate tensile strength of 2050 MPa or more;

c.7.b. Aluminum alloys capable of an ultimate tensile strength of 460 MPa or more; *or*

c.7.c. "Fibrous or filamentary materials" with a "specific modulus" of more than  $3.18 \times 10^6$  m and a "specific tensile strength" greater than  $76.2 \times 10^3$  m;".

c.8. Top and bottom caps of between 75 mm and 400 mm diameter to fit the ends of a rotor tube, made from any of the following high strength-to-density ratio materials:

c.8.a. Maraging steel capable of an ultimate tensile strength of 2050 MPa or more; *or*

c.8.b. Aluminum alloys capable of an ultimate tensile strength of 460 MPa or more;

c.8.c. "Fibrous or filamentary materials" with a "specific modulus" of more than  $3.18 \times 10^6$  m and a "specific tensile strength" greater than  $76.2 \times 10^3$  m.

c.9. Molecular pumps comprised of cylinders having internally machined or extruded helical grooves and internally machined bores;

c.10. Ring-shaped motor stators for multiphase AC hysteresis (or reluctance) motors for synchronous operation within a vacuum in the frequency range of 600 to 2,000 Hz and a power range of 50 to 1,000 Volt-Amps;

c.11. Frequency changers (converters or inverters) specially designed or prepared to supply motor stators for gas centrifuge enrichment, having all of the following characteristics, and specially designed components therefor:

c.11.a. Multiphase output of 600 to 2000 Hz;

c.11.b. Frequency control better than 0.1%;

c.11.c. Harmonic distortion of less than 2%; *and*

c.11.d. An efficiency greater than 80%;

c.12. Centrifuge housing/recipients to contain the rotor tube assembly of a gas centrifuge, consisting of a rigid cylinder of wall thickness up to 30 mm with precision machined ends and made of or protected by UF<sub>6</sub> resistant materials;

c.13. Scoops consisting of tubes of up to 12 mm internal diameter for the extraction of UF<sub>6</sub> gas from within a centrifuge rotor tube by a Pitot tube action, made of or protected by UF<sub>6</sub> resistant materials;

d. Equipment and components, specially designed or prepared for aerodynamic separation process, as follows:

d.1. Separation nozzles consisting of slit-shaped, curved channels having a radius of curvature less than 1 mm and having a knife-edge contained within the nozzle which separates the gas flowing through the nozzle into two streams;

d.2. Tangential inlet flow-driven cylindrical or conical tubes (vortex tubes), made of or protected by UF<sub>6</sub> resistant materials with a diameter of between 0.5 cm and 4 cm and a length to diameter ratio of 20:1 or less and with one or more tangential inlets;

d.3. Compressors (positive displacement, centrifugal and axial flow types) or gas blowers with a suction volume capacity of 2 m<sup>3</sup>/min, made of or protected by materials resistant to UF<sub>6</sub> (e.g., aluminum, aluminum alloys, nickel or alloy containing 60 weight percent or more nickel), and rotary shaft seals therefor;

d.4. Aerodynamic separation element housings, made of or protected by materials resistant to  $UF_6$  to contain vortex tubes or separation nozzles;

d.5. Heat exchangers made of aluminum, copper, nickel, or alloy containing more than 60 weight percent nickel, or combinations of these metals as clad tubes, designed to operate at pressures of 600 kPa or less;

d.6. Bellows valves made of or protected by  $UF_6$  resistant materials with a diameter of 40 to 1500 mm;

d.7. Process systems for separating  $UF_6$  from carrier gas (hydrogen or helium) to 1 ppm  $UF_6$  content or less, including:

d.7.a. Cryogenic heat exchangers and cryoseparators capable of temperatures of  $-120^\circ C$  or less;

d.7.b. Cryogenic refrigeration units capable of temperatures of  $-120^\circ C$  or less;

d.7.c. Separation nozzle or vortex tube units for the separation of  $UF_6$  from carrier gas;

d.7.d.  $UF_6$  cold traps capable of temperatures of  $-20^\circ C$  or less;

e. Equipment and components, specially designed or prepared for chemical exchange separation process, as follows:

e.1. Fast-exchange liquid-liquid centrifugal contactors with stage residence time of 30 seconds or less and resistant to concentrated hydrochloric acid (e.g., made of or lined with suitable plastic materials such as fluorocarbon polymers or lined with glass);

e.2. Fast-exchange liquid-liquid pulse columns with stage residence time of 30 seconds or less and resistant to concentrated hydrochloric acid (e.g., made of or lined with suitable plastic materials such as fluorocarbon polymers or lined with glass);

e.3. Electrochemical reduction cells designed to reduce uranium from one valence state to another;

e.4. Electrochemical reduction cells feed equipment to take  $U^{+4}$  from the organic stream and, for those parts in contact with the process stream, made of or protected by suitable materials (e.g., glass, fluorocarbon polymers, polyphenyl sulphate, polyether sulfone and resin-impregnated graphite);

e.5. Feed preparation systems for producing high purity uranium chloride solution consisting of dissolution, solvent extraction and/or ion exchange equipment for purification and electrolytic cells for reducing the uranium  $U^{+6}$  or  $U^{+4}$  to  $U^{+3}$ ;

e.6. Uranium oxidation systems for oxidation of  $U^{+3}$  to  $U^{+4}$ ;

f. Equipment and components, specially designed or prepared for ion-exchange separation process, as follows:

f.1. Fast reacting ion-exchange resins, pellicular or porous macro-reticulated resins in which the active chemical exchange groups are limited to a coating on the surface of an inactive porous support structure, and other composite structures in any suit-

able form, including particles or fibers, with diameters of 0.2 mm or less, resistant to concentrated hydrochloric acid and designed to have an exchange rate half-time of less than 10 seconds and capable of operating at temperatures in the range of  $100^\circ C$  to  $200^\circ C$ ;

f.2. Ion exchange columns (cylindrical) with a diameter greater than 1000 mm, made of or protected by materials resistant to concentrated hydrochloric acid (e.g., titanium or fluorocarbon plastics) and capable of operating at temperatures in the range of  $100^\circ C$  to  $200^\circ C$  and pressures above 0.7 MPa;

f.3. Ion exchange reflux systems (chemical or electrochemical oxidation or reduction systems) for regeneration of the chemical reducing or oxidizing agents used in ion exchange enrichment cascades;

g. Equipment and components, specially designed or prepared for atomic vapor "laser" isotopic separation process, as follows:

g.1. High power electron beam guns with total power of more than 50 kW and strip or scanning electron beam guns with a delivered power of more than 2.5 kW/cm for use in uranium vaporization systems;

g.2. Trough shaped crucibles and cooling equipment made of or protected by materials resistant to heat and corrosion of molten uranium or uranium alloy's (e.g., tantalum, yttria-coated graphite, graphite coated with other rare earth oxides or mixtures thereof);  
N.B: See also 2A225.

g.3. Product and tails collector systems made of or lined with materials resistant to the heat and corrosion of uranium vapor, such as yttria-coated graphite or tantalum;

g.4. Separator module housings (cylindrical or rectangular vessels) for containing the uranium metal vapor source, the electron beam gun and the product and tails collectors;

g.5. "Lasers" or "laser" systems for the separation of uranium isotopes with a spectrum frequency stabilizer for operation over extended periods of time;

N.B.: See also 6A005 and 6A205.

h. Equipment and components, specially designed or prepared for molecular "laser" isotopic separation process, as follows:

h.1. Supersonic expansion nozzles for cooling mixtures of  $UF_6$  and carrier gas to 150 K or less and made from  $UF_6$  resistant materials;

h.2. Uranium fluoride ( $UF_5$ ) product collectors consisting of filter, impact, or cyclone-type collectors or combinations thereof, and made of  $UF_5/UF_6$  resistant materials (e.g. aluminum, aluminum alloys, nickel or alloys containing 60 weight percent of nickel and  $UF_6$  resistant fully fluorinated hydrocarbon polymers);

h.3. Equipment for fluorinating  $UF_5$  to  $UF_6$ ;

h.4. Compressors made of or protected by materials resistant to  $UF_6$  (e.g., aluminum,

aluminum alloys, nickel or alloy containing 60 weight percent or more nickel), and rotary shaft seals therefor;

h.5. Process systems for separating UF<sub>6</sub> from carrier gas (e.g., nitrogen or argon) including:

h.5.a. Cryogenic heat exchangers and cryoseparators capable of temperatures of -120 °C or less;

h.5.b. Cryogenic refrigeration units capable of temperatures of -120 °C or less;

h.5.c. UF<sub>6</sub> cold traps capable of temperatures of -20 °C or less;

h.6. "Lasers" or "laser" systems for the separation of uranium isotopes with a spectrum frequency stabilizer for operation over extended periods of time;

N.B.: See also 6A005 and 6A205.

i. Equipment and components, specially designed or prepared for plasma separation process, as follows:

i.1. Product and tails collectors made of or protected by materials resistant to the heat and corrosion of uranium vapor such as yttria-coated graphite or tantalum;

i.2. Radio frequency ion excitation coils for frequencies of more than 100 kHz and capable of handling more than 40 kW mean power;

i.3. Microwave power sources and antennae for producing or accelerating ions, with an output frequency greater than 30 GHz and mean power output greater than 50 kW;

i.4. Uranium plasma generation systems;

i.5. Liquid uranium metal handling systems consisting of crucibles, made of or protected by suitable corrosion and heat resistant materials (e.g., tantalum, yttria-coated graphite, graphite coated with other rare earth oxides or mixtures thereof), and cooling equipment for the crucibles;

N.B.: See also 2A225.

i.6. Separator module housings (cylindrical) for containing the uranium plasma source, radio-frequency drive coil and the product and tails collectors and made of a suitable non-magnetic material (e.g. stainless steel);

j. Equipment and components, specially designed or prepared for electromagnetic separation process, as follows:

j.1. Ion sources, single or multiple, consisting of a vapor source, ionizer, and beam accelerator made of suitable materials (e.g., graphite, stainless steel, or copper) and capable of providing a total ion beam current of 50 mA or greater;

j.2. Ion collector plates for collection of enriched or depleted uranium ion beams, consisting of two or more slits and pockets and made of suitable non-magnetic materials (e.g., graphite or stainless steel);

j.3. Vacuum housings for uranium electromagnetic separators made of non-magnetic materials (e.g. graphite or stainless steel) and designed to operate at pressures of 0.1 Pa or lower;

j.4. Magnet pole pieces with a diameter greater than 2 m;

j.5. High voltage power supplies for ion sources, having all of the following characteristics:

j.5.a. Capable of continuous operation;

j.5.b. Output voltage of 20,000 V or greater;

j.5.c. Output current of 1 A or greater;

j.5.d. Voltage regulation of better than 0.01% over a period of 8 hours;

N.B.: See also 3A227.

j.6. Magnet power supplies (high power, direct current) having all of the following characteristics:

j.6.a. Capable of continuous operation with a current output of 500 A or greater at a voltage of 100 V or greater;

j.6.b. Current or voltage regulation better than 0.01% over a period of 8 hours.

N.B.: See also 3A226.

**0B002 Specially designed or prepared auxiliary systems, equipment and components, as follows, (see List of Items Controlled) for isotope separation plant specified in 0B001, made of or protected by UF<sub>6</sub> resistant materials.**

#### LICENSE REQUIREMENTS

##### *Reason for Control:*

*Control(s):* Items described in 0B002 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110)

#### LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

#### LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* a. Feed autoclaves, ovens or systems used for passing UF<sub>6</sub> to the enrichment process;

b. Desublimers or cold traps, used to remove UF<sub>6</sub> from the enrichment process for subsequent transfer upon heating;

c. Product and tails stations for transferring UF<sub>6</sub> into containers;

d. Liquefaction or solidification stations used to remove UF<sub>6</sub> from the enrichment process by compressing and converting UF<sub>6</sub> to a liquid or solid form;

e. Piping systems and header systems specially designed for handling UF<sub>6</sub> within gaseous diffusion, centrifuge or aerodynamic cascades made of or protected by UF<sub>6</sub> resistant materials;

f.1. Vacuum manifolds or vacuum headers having a suction capacity of 5 m<sup>3</sup>/minute or more; *or*

f.2. Vacuum pumps specially designed for use in UF<sub>6</sub> bearing atmospheres;

g. UF<sub>6</sub> mass spectrometers/ion sources specially designed or prepared for taking on-line

samples of feed, product or tails from UF<sub>6</sub> gas streams and having all of the following characteristics:

- g.1. Unit resolution for mass of more than 320 amu;
- g.2. Ion sources constructed of or lined with nichrome or monel, or nickel plated;
- g.3. Electron bombardment ionization sources; and
- g.4. Collector system suitable for isotopic analysis.

**0B003 Plant for the conversion of uranium and equipment specially designed or prepared therefor, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control Control(s)*

Items described in 0B003 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit: N/A*

*Related Controls: N/A*

*Related Definitions: N/A*

*Items:*

- a. Systems for the conversion of uranium ore concentrates to UO<sub>3</sub>;
- b. Systems for the conversion of UO<sub>3</sub> to UF<sub>6</sub>;
- c. Systems for the conversion of UO<sub>3</sub> to UO<sub>2</sub>;
- d. Systems for the conversion of UO<sub>2</sub> to UF<sub>4</sub>;
- e. Systems for the conversion of UF<sub>4</sub> to UF<sub>6</sub>;
- f. Systems for the conversion of UF<sub>4</sub> to uranium metal;
- g. Systems for the conversion of UF<sub>6</sub> to UO<sub>2</sub>;
- h. Systems for the conversion of UF<sub>6</sub> to UF<sub>4</sub>;
- i. Systems for the conversion of UO<sub>2</sub> to UCl<sub>4</sub>.

**0B004 Plant for the production of heavy water, deuterium or deuterium compounds, and specially designed or prepared equipment and components therefor, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:*

*Control(s):* Items described in 0B004 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110)

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit: N/A*

*Related Controls: N/A*

*Related Definitions: N/A*

*Items:* a. Plant for the production of heavy water, deuterium or deuterium compounds, as follows:

- a.1. Hydrogen sulphide-water exchange plants;
- a.2. Ammonia-hydrogen exchange plants;
- a.3. Hydrogen distillation plants;
- b. Equipment and components, as follows, designed for:
  - b.1. Hydrogen sulphide-water exchange process:
    - b.1.a. Tray exchange towers;
    - b.1.b. Hydrogen sulphide gas compressors;
  - b.2. Ammonia-hydrogen exchange process:
    - b.2.a. High-pressure ammonia-hydrogen exchange towers;
    - b.2.b. High-efficiency stage contactors;
    - b.2.c. Submersible stage recirculation pumps;
    - b.2.d. Ammonia crackers designed for pressures of more than 3 MPa;
  - b.3. Hydrogen distillation process:
    - b.3.a. Hydrogen cryogenic distillation towers and cold boxes designed for operation below 35 K (–238° C);
    - b.3.b. Turboexpanders or turboexpander-compressor sets designed for operation below 35 K (–238° C);
    - b.3.c. Heavy water concentration process to reactor grade level (99.75 weight percent deuterium oxide):
      - b.3.c.a. Water distillation towers containing specially designed packings;
      - b.3.c.b. Ammonia distillation towers containing specially designed packings;
      - b.3.c.c. Catalytic burners for conversion of fully enriched deuterium to heavy water;
      - b.3.c.d. Infrared absorption analyzers capable of on-line hydrogen-deuterium ratio analysis where deuterium concentrations are equal to or more than 90 weight percent.

**0B005 Plant specially designed for the fabrication of “nuclear reactor” fuel elements and specially designed equipment therefor.**

LICENSE REQUIREMENTS

*Reason for Control:*

*Control(s):* Items described in 0B005 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110)

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit: N/A*

*Related Controls:* N/A

*Related Definitions:* A plant for the fabrication of "nuclear reactor" fuel elements includes equipment which: (a) Normally comes into direct contact with or directly processes or controls the production flow of nuclear materials; (b) Seals the nuclear materials within the cladding; (c) Checks the integrity of the cladding or the seal; and (d) Checks the finish treatment of the solid fuel

*Items:* The List of Items Controlled is contained in the ECCN heading

**0B006 Plant for the reprocessing of irradiated "nuclear reactor" fuel elements, and specially designed or prepared equipment and components therefor, including (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:*

*Control(s):* Items described in 0B006 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110)

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* a. Fuel element chopping or shredding machines, i.e. remotely operated equipment to cut, chop, shred or shear irradiated "nuclear reactor" fuel assemblies, bundles or rods;

b. Dissolvers, critically safe tanks (e.g. small diameter, annular or slab tanks) specially designed or prepared for the dissolution of irradiated "nuclear reactor" fuel, which are capable of withstanding hot, highly corrosive liquids, and which can be remotely loaded and maintained;

c. Counter-current solvent extractors and ion-exchange processing equipment specially designed or prepared for use in a plant for the reprocessing of irradiated "natural uranium", "depleted uranium" or "special fissile materials" and "other fissile materials";

d. Process control instrumentation specially designed or prepared for monitoring or controlling the reprocessing of irradiated "natural uranium", "depleted uranium" or "special fissile materials" and "other fissile materials";

e. Holding or storage vessels specially designed to be critically safe and resistant to the corrosive effects of nitric acid;

NOTE: Critically safe tanks may have the following features:

1. Walls or internal structures with a boron equivalent of at least two percent;

2. A maximum diameter or 175 mm for cylindrical vessels; or

3. A maximum width of 75 mm for either a slab or annular vessel.

f. Complete systems specially designed or prepared for the conversion of plutonium nitrate to plutonium oxide;

g. Complete systems specially designed or prepared for the production of plutonium metal.

NOTE: Plant for the reprocessing of irradiated "nuclear reactor" fuel elements includes equipment and components which normally come into direct contact with and directly control the irradiated fuel and the major nuclear material and fission product processing streams.

**0B986 Equipment specially designed for manufacturing shotgun shells; and ammunition hand-loading equipment for both cartridges and shotgun shells.**

LICENSE REQUIREMENTS

*Reason for Control:* AT, UN.

*Control(s):* AT applies to entire entry. A license is required for items controlled by this entry to North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine AT licensing requirements for this entry. See §742.19 of the EAR for additional information.

UN applies to entire entry. A license is required for items controlled by this entry to Rwanda. The Commerce Country Chart is not designed to determine licensing requirements for this entry. See part 746 of the EAR for additional information.

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**0B999 Specific Processing Equipment, as Follows (See List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* AT.

*Control(s):*

*Country Chart.*

AT applies to entire entry. A license is required for items controlled by this entry to North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine AT licensing requirements for

this entry. See §742.19 of the EAR for additional information.

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* N/A.

*Related Definitions:* N/A.

*Items:*

- a. Hot cells;
- b. Glove boxes suitable for use with radioactive materials.

C. MATERIALS

**0C001 “Natural uranium” or “depleted uranium” or thorium in the form of metal, alloy, chemical compound or concentrate and any other material containing one or more of the foregoing.**

LICENSE REQUIREMENTS

*Reason for Control:*

*Control(s):* Items described in 0C001 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110)

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* (1) See also 1A290. (2) This entry does not control: (a) Four grams or less of “natural uranium” or “depleted uranium” when contained in a sensing component in instruments (see 10 CFR part 110); or (b) “Depleted uranium” specially fabricated for the following civil non-nuclear applications: Shielding; Packaging; Ballasts; or Counter-weights

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**0C002 “Special fissile materials” and “other fissile materials”; except, four “effective grams” or less when contained in a sensing component in instruments.**

LICENSE REQUIREMENTS

*Reason for Control:*

*Control(s):* Items described in 0C002 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110)

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The List of Items Controlled is Contained in the ECCN heading

**0C004 Deuterium, heavy water, deuterated paraffins and other compounds of deuterium, and mixtures and solutions containing deuterium, in which the isotopic ratio of deuterium to hydrogen exceeds 1:5000.**

LICENSE REQUIREMENTS

*Reason for Control:*

*Control(s):* Items described in 0C004 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110)

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**0C005 Graphite, nuclear-grade, having a purity level of less than 5 parts per million “boron equivalent” and with a density greater than 1.5 g/cm<sup>3</sup>.**

LICENSE REQUIREMENTS

*Reason for Control:*

*Control(s):* Items described in 0C005 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110)

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**0C006 Nickel powder or porous nickel metal, specially prepared for the manufacture of gaseous diffusion barriers, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:*

*Control(s):* Items described in 0C006 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110)

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: N/A

Related Controls: See also 1C240

Related Definitions: N/A

*Items:* a. Powder with a nickel purity content of 99.9 weight percent or more and a mean particle size of less than 10 micrometers measured by American Society for Testing and Materials (ASTM) B330 standard and a high degree of particle size uniformity; or

b. Porous nickel metal produced from materials specified in 0C006.a.

**0C201 Specially prepared compounds or powders, other than nickel, resistant to corrosion by UF<sub>6</sub> (e.g. aluminum oxide and fully fluorinated hydrocarbon polymers), for the manufacture of gaseous diffusion barriers, having a purity of 99.9 weight percent or more and a mean particle size of less than 10 micrometers measured by American Society for Testing and Materials (ASTM) B330 standard and a high degree of particle size uniformity.**

LICENSE REQUIREMENTS

*Reason for Control:*

*Control(s):* Items described in 0C201 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110)

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: N/A

Related Controls: N/A

Related Definitions: N/A

*Items:* The list of items controlled is contained in the ECCN heading

## D. SOFTWARE

**0D001 "Software" specially designed or modified for the "development", "production", or "use" of items described in 0A001, 0A002, 0B (except 0B986 and 0B999), or 0C.**

LICENSE REQUIREMENTS

*Reason for Control**Control(s)*

"Software" for items described in 0A001, 0B001, 0B002, 0B003, 0B004, 0B005, 0B006, 0C001, 0C002, 0C004, 0C005, 0C006, or 0C201 is subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

"Software" for items described in 0A002 is subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (see 22 CFR part 121).

*License Exceptions*

CIV: N/A

TSR: N/A

*List of Items Controlled*

Unit: N/A

Related Controls: N/A

Related Definitions: N/A

*Items:* The List of Items Controlled is contained in the ECCN heading.

**0D999 Specific Software, as Follows (See List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* AT.*Control(s).**Country Chart.*

AT applies to entire entry. A license is required for items controlled by this entry to North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine AT licensing requirements for this entry. See §742.19 of the EAR for additional information.

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value.

Related Controls: N/A.

Related Definitions: N/A.

*Items:*

- a. Software for neutronic calculations/modeling;
- b. Software for radiation transport calculations/modeling;
- c. Software for hydrodynamic calculations/modeling.

## E. TECHNOLOGY

**0E001 "Technology," according to the Nuclear Technology Note, for the "development", "production", or "use" of items described in 0A001, 0A002, 0B (except 0B986 and 0B999), 0C, or 0D001.**

LICENSE REQUIREMENTS

*Reason for Control**Control(s)*

"Technology" for items described in 0A001, 0B001, 0B002, 0B003, 0B004, 0B005, 0B006, 0C001, 0C002, 0C004, 0C005, 0C006, 0C201, or 0D001 (applies to "software" in 0D001 for all items except those described in 0A002) is subject to the export licensing authority of the Department of Energy (see 10 CFR part 810).

"Technology" for items described in 0A002 and 0D001 (applies to "software" in 0D001 for items described in 0A002 only) is subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (see 22 CFR part 121).

*License Exceptions*

CIV: N/A

TSR: N/A

*List of Items Controlled*

Unit: N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The List of Items Controlled is contained in the ECCN heading.

**0E018 “Technology” for the “development”, “production”, or “use” of items controlled by 0A018.b through 0A018.e.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, UN, AT.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
UN applies to entire entry .....	Rwanda.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes, except N/A for Rwanda

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**0E982 “Technology” exclusively for the “development” or “production” of equipment controlled by 0A982 or 0A985.**

LICENSE REQUIREMENTS

*Reason for Control:* CC

*Control(s)*

CC applies to “technology” for items controlled by 0A982 or 0A985. A license is required for ALL destinations, except Canada, regardless of end-use. Accordingly, a column specific to this control does not appear on the Commerce Country Chart. (See part 742 of the EAR for additional information.)

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**0E984 “Technology” for the “development” or “production” of shotguns controlled by 0A984 and buckshot shotgun shells.**

LICENSE REQUIREMENTS

*Reason for Control:* CC, UN.

Control(s)	Country chart
CC applies to “technology” for shotguns with a barrel length over 18 in. (45.72 cm) but less than 24 in. (60.96 cm) and shotgun shells, regardless of end-user.	CC Column 1.

Control(s)	Country chart
CC applies to “technology” for shotguns with a barrel length over 24 in. (60.96 cm), regardless of end-user.	CC Column 2.
CC applies to “technology” for shotguns with a barrel length over 24 in. (60.96 cm) if for sale or resale to police or law enforcement.	CC Column 3.
UN applies to entire entry .....	Rwanda.

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**EAR99 Items subject to the EAR that are not elsewhere specified in this CCL Category or in any other category in the CCL are designated by the number EAR99.**

*Category 1—Materials, Chemicals, “Microorganisms” & “Toxins”*

A. SYSTEMS, EQUIPMENT AND COMPONENTS

**1A001 Components made from fluorinated compounds, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$5000

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms.

*Related Controls:* Items specially designed or modified for missiles or for items on the U.S. Munitions List are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (see 22 CFR part 121.)

*Related Definitions:* N/A.

*Items:*

a. Seals, gaskets, sealants or fuel bladders specially designed for “aircraft” or aerospace use made from more than 50% by weight of any of the materials controlled by 1C009.b or 1C009.c;

b. Piezoelectric polymers and copolymers made from vinylidene fluoride materials controlled by 1C009.a:

b.1. In sheet or film form; *and*

b.2. With a thickness exceeding 200 µm

c. Seals, gaskets, valve seats, bladders or diaphragms made from fluoroelastomers containing at least one vinyl ether group as a constitutional unit, specially designed for "aircraft", aerospace or missile use.

**1A002 "Composite" structures or laminates, having any of the following (see List of Items Controlled).**

LICENSE REQUIREMENTS  
Reason for Control: NS, NP, AT.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 2.
NP applies to 1A002.b.1 in the form of tubes with an inside diameter between 75 mm and 400 mm.	NP Column 1.
1 AT applies to entire entry .....	AT Column 1.

License Requirement Notes:  
See § 743.1 of the EAR for reporting requirements for exports under License Exceptions.

*License Exceptions*

LVS: \$1,500; N/A for NP; N/A for "composite" structures or laminates controlled by 1A002.a, having an organic "matrix" and made from materials controlled by 1C010.c or 1C010.d.

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Kilograms.

*Related Controls:* (1) See ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry. (2) Also see ECCNs 1A202, 1C010, 1C210, 9A010, and 9A110. (3) "Composite" structures specially designed for missile applications (including specially designed subsystems and components) are controlled by ECCN 9A110. (4) "Composite" structures or laminates specially designed or prepared for use in separating uranium isotopes are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A.

*Items:*

a. An organic "matrix" and made from materials controlled by 1C010.c, 1C010.d or 1C010.e; or

NOTE: 1A002.a does not control finished or semifinished items specially designed for purely civilian applications as follows:

- a. Sporting goods;
- b. Automotive industry;
- c. Machine tool industry; and
- d. Medical applications.

b. A metal or carbon "matrix" and made from:

b.1. Carbon "fibrous or filamentary materials" with:

b.1.a. A "specific modulus" exceeding  $10.15 \times 10^6$  m; and

b.1.b. A "specific tensile strength" exceeding  $17.7 \times 10^4$  m; or

b.2. Materials controlled by 1C010.c.

NOTE: 1A002.b does not control finished or semifinished items specially designed for purely civilian applications as follows:

- a. Sporting goods;
- b. Automotive industry;
- c. Machine tool industry; and
- d. Medical applications.

TECHNICAL NOTES: (1) Specific modulus: Young's modulus in pascals, equivalent to  $N/m^2$  divided by specific weight in  $N/m^3$ , measured at a temperature of  $(296 \pm 2)$  K ( $(23 \pm 2)$  °C) and a relative humidity of  $(50 \pm 5)\%$ . (2) Specific tensile strength: ultimate tensile strength in pascals, equivalent to  $N/m^2$  divided by specific weight in  $N/m^3$ , measured at a temperature of  $(296 \pm 2)$  K ( $(23 \pm 2)$  °C) and a relative humidity of  $(50 \pm 5)\%$ .

NOTE: 1A002 does not control composite structures or laminates made from epoxy resin impregnated carbon "fibrous or filamentary materials" for the repair of aircraft structures of laminates, provided that the size does not exceed one square meter ( $1 m^2$ ).

**1A003 Manufactures of non-fluorinated polymeric substances controlled by 1C008.a.3 in film, sheet, tape or ribbon form with either of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$200

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Kilograms

*Related Controls:* This entry does not control manufactures when coated or laminated with copper and designed for the production of electronic printed circuit boards

*Related Definitions:* N/A

*Items:* a. With a thickness exceeding 0.254 mm; or

b. Coated or laminated with carbon, graphite, metals or magnetic substances

**1A004 Protective and detection equipment and components, not specially designed for military use. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**1A005 Body armor, and specially designed components therefor, not manufactured to military standards or specifications, nor to their equivalents in performance.**

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LICENSE REQUIREMENTS  
Reason for Control: NS, UN, AT.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 2.
UN applies to entire entry .....	Rwanda.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS  
LVS: N/A  
GBS: Yes, except UN  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

**Related Controls:** (1) Bulletproof and bullet resistant vests (body armor) NIJ levels III and IV, are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (See 22 CFR part 121.) (2) This entry does not control individual suits of body armor and accessories therefor, when accompanying their users for his/her own personal protection. (3) This entry does not control body armor designed to provide frontal protection only from both fragment and blast from non-military explosive devices

**Related Definitions:** N/A

**Items:** The list of items controlled is contained in the ECCN heading

**1A101 Devices for reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures, for applications usable in “missiles” and their subsystems.**

LICENSE REQUIREMENTS  
Reason for Control: MT, AT

Control(s)	Country Chart
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

**Related Controls:** See also 1C101. For commodities that meet the definition of defense articles under 22 CFR 120.3 of the International Traffic in Arms Regulations (ITAR), see also 22 CFR 121.16, Item 17-Category II of the (ITAR), which describes similar commodities under the jurisdiction of the Department of State, Directorate of Defense Trade Control.

**Related Definitions:** N/A

**Items:** The list of items controlled is contained in the ECCN heading.

**1A102 Resaturated pyrolyzed carbon-carbon components designed for “missiles”. (These items are subject to the export licensing authority of the U.S. Department**

**of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)**

**1A202 Composite structures, other than those controlled by 1A002, in the form of tubes and having both of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS  
Reason for Control: NP, AT

Control(s)	Country Chart
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Kilograms

**Related Controls:** (1) See ECCNs 1E201 (“use”) and 1E202 (“development” and “production”) for technology for items controlled by this entry. (2) Also see ECCNs 1A002, 1C010, 1C210, 9A010, and 9A110. (3) “Composite” structures specially designed or prepared for use in separating uranium isotopes are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

**Related Definitions:** N/A

**Items:**

- a. An inside diameter of between 75 mm and 400 mm; and
- b. Made with any of the “fibrous or filamentary materials” specified in 1C010.a or .b or 1C210.a or with carbon prepreg materials specified in 1C210.c.

**1A225 Platinized catalysts specially designed or prepared for promoting the hydrogen isotope exchange reaction between hydrogen and water for the recovery of tritium from heavy water or for the production of heavy water.**

LICENSE REQUIREMENTS  
Reason for Control: NP, AT

Control(s)	Country Chart
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Kilograms

**Related Controls:** (1) See ECCNs 1E201 (“use”) and 1E202 (“development” and “production”) for technology for items controlled by this entry. (2) Equipment specially designed or prepared for the production of

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heavy water is subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1A226 Specialized packings, which may be used in separating heavy water from ordinary water, having both of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) See ECCNs 1E201 ("use") and 1E202 ("development" and "production") for technology for items controlled by this entry. (2) Equipment specially designed or prepared for the production of heavy water is subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*Items:*

- a. Made of phosphor bronze mesh chemically treated to improve wettability; and
- b. Designed to be used in vacuum distillation towers.

**1A227 High-density (lead glass or other) radiation shielding windows, having all of the following characteristics (see List of Items Controlled), and specially designed frames therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) See ECCNs 1E201 ("use") and 1E202 ("development" and "production") for technology for items controlled by this entry. (2) Equipment specially designed or prepared for nuclear reactors and reprocessing facilities is subject to the ex-

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port licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* In 1A227.a, the term "cold area" means the viewing area of the window exposed to the lowest level of radiation in the design application.

*Items:*

- a. A "cold area" greater than 0.09 m<sup>2</sup>;
- b. A density greater than 3 g/cm<sup>3</sup>; and
- c. A thickness of 100 mm or greater.

**1A290 Depleted uranium (any uranium containing less than 0.711% of the isotope U-235) in shipments of more than 1,000 kilograms in the form of shielding contained in X-ray units, radiographic exposure or teletherapy devices, radioactive thermoelectric generators, or packaging for the transportation of radioactive materials.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* (1) This entry does not control depleted uranium in fabricated forms for use in munitions. See 22 CFR part 121 for depleted uranium subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (2) Depleted uranium that is not fabricated for use in munitions or fabricated into commodities solely to take advantage of its high density (e.g., aircraft, ship, or other counterweights) or in the forms listed in this entry are subject to the export licensing authority of the Nuclear Regulatory Commission. (See 10 CFR part 110.) (3) See also 0C001

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**1A984 Chemical agents, including tear gas formulation containing 1 percent or less of orthochlorobenzalmalononitrile (CS), or 1 percent or less of chloroacetophenone (CN), except in individual containers with a net weight of 20 grams or less; smoke bombs; non-irritant smoke flares, canisters, grenades and charges; and other pyrotechnic articles having dual military and commercial use.**

LICENSE REQUIREMENTS

*Reason for Control:* CC

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*Control(s)* *Country Chart*  
 CC applies to entire entry ..... CC Column 1  
 LICENSE EXCEPTIONS  
 LVS: N/A  
 GBS: N/A  
 CIV: N/A  
 LIST OF ITEMS CONTROLLED  
*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**1A985 Fingerprinting powders, dyes, and inks.**

LICENSE REQUIREMENTS  
*Reason for Control:* CC  
*Control(s)* *Country Chart*  
 CC applies to entire entry ..... CC Column 1  
 LICENSE EXCEPTIONS  
 LVS: N/A  
 GBS: N/A  
 CIV: N/A  
 LIST OF ITEMS CONTROLLED  
*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**1A999 Specific Processing Equipment, n.e.s., as Follows (See List of Items Controlled).**

LICENSE REQUIREMENTS  
*Reason for Control:* AT.  
*Control(s).*  
*Country Chart.*  
 AT applies to entire entry. A license is required for items controlled by this entry to North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine AT licensing requirements for this entry. See §742.19 of the EAR for additional information.  
 LICENSE EXCEPTIONS  
 LVS: N/A.  
 GBS: N/A.  
 CIV: N/A.  
 LIST OF ITEMS CONTROLLED  
*Unit:* \$ value.  
*Related Controls:* N/A.  
*Related Definitions:* N/A.  
*Items:*  
 a. Radiation detection, monitoring and measurement equipment, n.e.s.;  
 b. Radiographic detection equipment such as x-ray converters, and storage phosphor image plates.

B. TEST, INSPECTION AND PRODUCTION EQUIPMENT

**1B001 Equipment for the production of fibers, prepregs, preforms or “composites” controlled by 1A002 or 1C010, and specially designed components and accessories therefor.**

LICENSE REQUIREMENTS  
*Reason for Control:* NS, MT, NP, AT

*Control(s)* *Country Chart*  
 NS applies to entire entry ..... NS Column 2  
 MT applies to entire entry, except 1B001.d.4 and .f. MT Column 1  
 NP applies to filament winding machines described in 1B001.a that are capable of winding cylindrical rotors having a diameter between 75 mm (3 in) and 400 mm (16 in) and lengths of 600 mm (24 in) or greater; and coordinating and programming controls and precision mandrels for these filament winding machines. NP Column 1  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS  
 LVS: N/A for MT and for 1B001.a; \$5,000 for all other items  
 GBS: N/A  
 CIV: N/A  
 LIST OF ITEMS CONTROLLED  
*Unit:* \$ value  
*Related Controls:* (1) See ECCN 1D001 for software for items controlled by this entry and see ECCNs 1E001 (“development” and “production”) and 1E101 (“use”) for technology for items controlled by this entry. (2) Also see ECCNs 1B101 and 1B201.  
*Related Definitions:* N/A

*Items:*  
 a. Filament winding machines of which the motions for positioning, wrapping and winding fibers are coordinated and programmed in three or more axes, specially designed for the manufacture of “composite” structures or laminates from “fibrous or filamentary materials”;  
 b. Tape-laying or tow-placement machines of which the motions for positioning and laying tape, tows or sheets are coordinated and programmed in two or more axes, specially designed for the manufacture of “composite” airframe or “missile” structures;  
 c. Multidirectional, multidimensional weaving machines or interlacing machines, including adapters and modification kits, for weaving, interlacing or braiding fibers to manufacture “composite” structures;  
 TECHNICAL NOTE: For the purposes of 1B001.c the technique of interlacing includes knitting.  
 NOTE: 1B001.c does not control textile machinery not modified for the above end-uses.

d. Equipment specially designed or adapted for the production of reinforcement fibers, as follows:

d.1. Equipment for converting polymeric fibers (such as polyacrylonitrile, rayon, pitch or polycarbosilane) into carbon fibers or silicon carbide fibers, including special equipment to strain the fiber during heating;

d.2. Equipment for the chemical vapor deposition of elements or compounds on heated filamentary substrates to manufacture silicon carbide fibers;

d.3. Equipment for the wet-spinning of refractory ceramics (such as aluminum oxide);

d.4. Equipment for converting aluminum containing precursor fibers into alumina fibers by heat treatment;

e. Equipment for producing prepregs controlled by 1C010.e by the hot melt method;

f. Non-destructive inspection equipment capable of inspecting defects three dimensionally, using ultrasonic or X-ray tomography and specially designed for "composite" materials.

**1B002 Equipment for Producing Metal Alloys, Metal Alloy Powder or Alloyed Materials, Specially Designed to Avoid Contamination and Specially Designed for Use in One of the Processes Specified in 1C002.c.2**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$5000

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

**1B003 Tools, dies, molds or fixtures, for "superplastic forming" or "diffusion bonding" titanium or aluminum or their alloys, specially designed for the manufacture of (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$5000

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number; components in \$ value

Related Controls: For specially designed production equipment of systems, sub-systems and components controlled by 9A005 to 9A009, 9A011, 9A101, 9A105 to 9A109, 9A111, and 9A116 to 9A120 usable in "missiles", see 9B115.

Related Definitions: N/A

Items: a. Airframe or aerospace structures;

b. "Aircraft" or aerospace engines; or

c. Specially designed components for those structures or engines.

**1B018 Equipment on the International Munitions List.**

LICENSE REQUIREMENTS

Reason for Control: NS, MT, RS, AT, UN

<i>Control(s)</i>	<i>Country chart</i>
NS applies to entire entry .....	NS Column 1.
MT applies to equipment for the "production" of rocket propellants.	MT Column 1.
RS applies to 1B018.a .....	RS Column 2.
AT applies to entire entry .....	AT Column 1.
UN applies to entire entry .....	Rwanda.

LICENSE EXCEPTIONS

LVS: \$3000 for 1B018.a for countries WITHOUT an "X" in RS Column 2 on the Country Chart contained in Supplement No. 1 to part 738 of the EAR; \$5000 for 1B018.b; N/A for Rwanda.

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number; parts and accessories in \$ value

Related Controls: N/A

Related Definitions: N/A

Items: a. Equipment for the "production" of military explosives and solid propellants.

a.1. Complete installations;

a.2. Specialized components (for example, dehydration presses; extrusion presses for the extrusion of small arms, cannon and rocket propellants; cutting machines for the sizing of extruded propellants; sweetie barrels (tumblers) 6 feet and over in diameter and having over 500 pounds product capacity; and continuous mixers for solid propellants); or

a.3. Nitrators, continuous types; and

a.4. Specially designed parts and accessories therefor.

b. Environmental chambers capable of pressures below (10<sup>-4</sup>) Torr, and specially designed components therefor.

**1B101 Equipment, other than that controlled by 1B001, for the "production" of structural composites, fibers, prepregs or preforms as follows (see List of Items**

**Controlled); and specially designed components and accessories therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, NP, AT

Control(s)	Country Chart
MT applies to entire entry ..... NP applies to filament winding machines described in 1B101.a that are capable of winding cylindrical rotors having a diameter between 75 mm (3 in.) and 400 mm (16 in.) and lengths of 600 mm (24 in.) or greater AND to coordinating and programming controls and precision mandrels for these filament winding machines.	MT Column 1. NP Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See ECCN 1D101 for software for items controlled by this entry and see ECCNs 1E001 (“development” and “production”) and 1E101 (“use”) for technology for items controlled by this entry. Also see 1B201.

*Related Definitions:* Examples of components and accessories for the machines controlled by this entry are molds, mandrels, dies, fixtures and tooling for the preform pressing, curing, casting, sintering or bonding of composite structures, laminates and manufactures thereof.

*Items:* a. Filament winding machines of which the motions for positioning, wrapping and winding fibers can be coordinated and programmed in three or more axes, designed to fabricate composite structures or laminates from fibrous or filamentary materials, and coordinating and programming controls;

b. Tape-laying machines of which the motions for positioning and laying tape and sheets can be coordinated and programmed in two or more axes, designed for the manufacture of composite airframe and “missile” structures;

c. Equipment designed or modified for the “production” of “fibrous or filamentary materials” as follows:

c.1. Equipment for converting polymeric fibers (such as polyacrylonitrile, rayon or polycarbosilane) including special provision to strain the fiber during heating;

c.2. Equipment for the vapor deposition of elements or compounds on heated filament substrates; and

c.3. Equipment for the wet-spinning of refractory ceramics (such as aluminum oxide);

d. Equipment designed or modified for special fiber surface treatment or for producing preforms and preforms controlled by 9A110.

NOTE: Equipment covered in 1B101.d includes but is not limited to, rollers, tension stretchers, coating equipment, cutting equipment and clicker dies.

**1B102 Metal powder “production equipment,” other than that specified in 1B002, and components as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

Control(s)	Country Chart
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; components in \$ value

*Related Controls:* 1.) See also 1B115.b.

*Related Definitions:* N/A

*Items:*

a. Metal power “production equipment usable for the “production,” in a controlled environment, of spherical or atomized materials specified in 1C011.a, 1C011.b, 1C111.a.1, 1C111.a.2, or on the U.S. Munitions List.

b. Specially designed components for “production equipment” specified in 1B002 or 1B102.a.

NOTE: 1B102 includes:

a. Plasma generators (high frequency arc-jet) usable for obtaining sputtered or spherical metallic powders with organization of the process in an argon-water environment;

b. Electrobust equipment usable for obtaining sputtered or spherical metallic powders with organization of the process in an argon-water environment;

c. Equipment usable for the “production” of spherical aluminum powders by powdering a melt in an inert medium (e.g., nitrogen).

**1B115 “Equipment, other than that controlled in 1B002 or 1B102, for the “production” of propellant or propellant constituents, and specially designed components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

Control(s)	Country Chart
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; components in \$ value

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*Related Controls:* For the control of batch mixers, continuous mixers and fluid energy mills, see 1B117, 1B118 and 1B119.

*Related Definitions:* N/A

*Items:*

a. "Production equipment" for the "production", handling or acceptance testing of liquid propellants or propellant constituents controlled by 1C011.a, 1C011.b, 1C111 or on the U.S. Munitions List;

b. "Production equipment," for the production, handling, mixing, curing, casting, pressing, machining, extruding or acceptance testing of solid propellants or propellant constituents described in 1C011.a, 1C011.b or 1C111, or on the U.S. Munitions List.

NOTE: 1B115.b does not control batch mixers, continuous mixers or fluid energy mills. For the control of batch mixers, continuous mixers and fluid energy mills see 1B117, 1B118, and 1B119.

NOTE 1: [Reserved]

NOTE 2: 1B115 does not control equipment for the "production," handling and acceptance testing of boron carbide.

**1B116 Specially designed nozzles for producing pyrolytically derived materials formed on a mold, mandrel or other substrate from precursor gases which decompose in the 1,573 K (1,300 °C) to 3,173 K (2,900 °C) temperature range at pressures of 130 Pa to 20 kPa.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

Control(s)	Country Chart
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**1B117 "Batch mixers with provision for mixing under vacuum in the range from zero to 13.326 kPa and with temperature control capability of the mixing chamber and having all of the following characteristics (see List of Items Controlled), and specially designed components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT.

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1.

Control(s)	Country chart
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; components in \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

a. A total volumetric capacity of 110 liters (30 gallons) or more; and

b. At least one mixing/kneading shaft mounted off center.

**1B118 Continuous mixers with provision for mixing under vacuum in the range from zero to 13.326 kPa and with temperature control capability of the mixing chamber and having all of the following characteristics (see List of Items Controlled), and specially designed components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; components in \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

a. Two or more mixing/kneading shafts; and

b. Capability to open the mixing chamber.

**1B119 Fluid energy mills usable for grinding or milling propellant or propellant constituents specified in 1C011.a, 1C011.b or 1C111, or on the U.S. Munitions List, and specially designed components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

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LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; components in \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1B201 Filament winding machines, other than those controlled by ECCN 1B001 or 1B101, and related equipment, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See ECCN 1D201 for software for items controlled by this entry and see ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry. Also see ECCN 1E203 for technology for the "development" of software controlled by ECCN 1D201.

*Related Definitions:* N/A

*Items:*

- a. Filament winding machines having all of the following characteristics:
  - a.1. Having motions for positioning, wrapping, and winding fibers coordinated and programmed in two or more axes;
  - a.2. Specially designed to fabricate composite structures or laminates from "fibrous or filamentary materials"; and
  - a.3. Capable of winding cylindrical rotors of diameter between 75 mm (3 in.) and 400 mm (16 in.) and lengths of 600 mm (24 in.) or greater;
- b. Coordinating and programming controls for filament winding machines controlled by 1B201.a;
- c. Precision mandrels for filament winding machines controlled by 1B201.a.

**1B225 Electrolytic cells for fluorine production with a production capacity greater than 250 g of fluorine per hour.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1B226 Electromagnetic isotope separators designed for, or equipped with, single or multiple ion sources capable of providing a total ion beam current of 50 mA or greater.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) Electromagnetic isotope separators specially designed or prepared for use in separating uranium isotopes are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110). (2) See ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry.

*Related Definitions:* N/A

*ECCN Controls:* This entry includes separators capable of enriching stable isotopes and separators with the ion sources and collectors both in the magnetic field and those configurations in which they are external to the field.

*Items:* The list of items controlled is contained in the ECCN heading.

**1B227 Ammonia synthesis converters or ammonia synthesis units in which the synthesis gas (nitrogen and hydrogen) is withdrawn from an ammonia/hydrogen high-pressure exchange column and the synthesized ammonia is returned to that column.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

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GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) Equipment specially designed or prepared for the production of heavy water is subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110). (2) See ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1B228 Hydrogen-cryogenic distillation columns having all of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) Equipment specially designed or prepared for the production of heavy water is subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110). (2) See ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry.

*Related Definitions:* "Fine-grain stainless steels" in this entry are defined to be fine-grain austenitic stainless steels with an ASTM (or equivalent standard) grain size number of 5 or greater

*Items:* a. Designed to operate with internal temperatures of 35 K (-238 °C) or less;

b. Designed to operate at an internal pressure of 0.5 to 5 MPa (5 to 50 atmospheres);

c. Constructed of "fine-grain stainless steels" of the 300 series with low sulphur content or equivalent cryogenic and H<sub>2</sub>-compatible materials; *and*

d. With internal diameters of 1 m or greater and effective lengths of 5 m or greater.

**1B229 Water-hydrogen sulphide exchange tray columns and "internal contactors", as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1

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<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) Equipment specially designed or prepared for the production of heavy water is subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110). (2) See ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry.

*Related Definitions:* The "internal contactors" controlled by 1B229.b are segmented trays that have an effective assembled diameter of 1.8 m (6 ft.) or greater, are designed to facilitate countercurrent contacting, and are constructed of stainless steels with a carbon content of 0.03% or less. These may be sieve trays, valve trays, bubble cap trays, or turbogrid trays.

*Items:*

a. Water-hydrogen sulphide exchange tray columns, having all of the following characteristics:

a.1. Can operate at pressures of 2 MPa or greater;

a.2. Constructed of carbon steel having an austenitic ASTM (or equivalent standard) grain size number of 5 or greater; *and*

a.3. With a diameter of 1.8 m (6 ft.) or greater;

b. "Internal contactors" for the water-hydrogen sulphide exchange tray columns controlled by 1B229.a.

**1B230 Pumps capable of circulating solutions of concentrated or dilute potassium amide catalyst in liquid ammonia (KNH<sub>2</sub>/NH<sub>3</sub>), having all of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) Equipment specially designed or prepared for the production of heavy water is subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110). (2) See

ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry.

*Related Definitions:* N/A  
*Items:*

- a. Airtight (i.e., hermetically sealed);
- b. A capacity greater than 8.5 m<sup>3</sup>/h; *and*
- c. Either of the following characteristics:
  - c.1. For concentrated potassium amide solutions (1% or greater), an operating pressure of 1.5 to 60 MPa (15-600 atmospheres); *or*
  - c.2. For dilute potassium amide solutions (less than 1%), an operating pressure of 20 to 60 MPa (200-600 atmospheres).

**1B231 Tritium facilities or plants, and equipment therefor, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS  
*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED  
*Unit:* \$ value

*Related Controls:* (1) Tritium, tritium compounds, and mixtures containing tritium are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110). (2) See ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry.

- Related Definitions:* N/A  
*Items:* a. Facilities or plant for the production, recovery, extraction, concentration, or handling of tritium;
- b. Equipment for tritium facilities or plant, as follows:
    - b.1. Hydrogen or helium refrigeration units capable of cooling to 23 K (-250 C) or less, with heat removal capacity greater than 150 watts; *or*
    - b.2. Hydrogen isotope storage and purification systems using metal hydrides as the storage, or purification medium.

**1B232 Turboexpanders or turboexpander-compressor sets having both of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS  
*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A  
LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* (1) Equipment specially designed or prepared for the production of heavy water is subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110). (2) See ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry.

*Related Definitions:* N/A  
*Items:*

- a. Designed for operation with an outlet temperature of 35 K (-238 °C) or less; *and*
- b. Designed for a throughput of hydrogen gas of 1,000 kg/h or greater.

**1B233 Lithium isotope separation facilities or plants, and equipment therefor, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS  
*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
Facilities and plants described in 1B233.a are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).	
NP applies to 1B233.b .....	NP Column 1.
AT applies to 1B233.b .....	AT Column 1.

LICENSE EXCEPTIONS  
LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED  
*Unit:* \$ value  
*Related Controls:* See ECCN 1E001 ("development" and "production") and ECCN 1E201 ("use") for technology for items described in this entry.  
*Related Definitions:* N/A

- Items:*
- a. Facilities or plants for the separation of lithium isotopes;
  - b. Equipment for the separation of lithium isotopes, as follows:
    - b.1. Packed liquid-liquid exchange columns specially designed for lithium amalgams;
    - b.2. Mercury and/or lithium amalgam pumps;
    - b.3. Lithium amalgam electrolysis cells;
    - b.4. Evaporators for concentrated lithium hydroxide solution.

**1B999 Specific Processing Equipment, n.e.s., as Follows (See List of Items Controlled).**

LICENSE REQUIREMENTS  
*Reason for Control:* AT.  
*Control(s).*  
*Country Chart.*

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AT applies to entire entry. A license is required for items controlled by this entry to North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine AT licensing requirements for this entry. See §742.19 of the EAR for additional information.

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value.

Related Controls: See also 1B001, 1B101, 1B201, 1B225 and 1D999.

Related Definitions: N/A.

Items:

- a. Electrolytic cells for flourine production, n.e.s.;
- b. Particle accelerators;
- c. Industrial process control hardware/systems designed for power industries, n.e.s.;
- d. Freon and chilled water cooling systems capable of continuous cooling duties of 100,000 BTU/hr (29.3 kW) or greater;
- e. Equipment for the production of structural composites, fibers, prepregs and preforms, n.e.s.

C. MATERIALS

TECHNICAL NOTE: Metals and alloys: Unless provision to the contrary is made, the words "metals" and "alloys" in 1C001 to 1C012 cover crude and semi-fabricated forms, as follows:

Crude forms: Anodes, balls, bars (including notched bars and wire bars), billets, blocks, blooms, bricks, cakes, cathodes, crystals, cubes, dice, grains, granules, ingots, lumps, pellets, pigs, powder, rondelles, shot, slabs, slugs, sponge, sticks;

Semi-fabricated forms (whether or not coated, plated, drilled or punched):

a. Wrought or worked materials fabricated by rolling, drawing, extruding, forging, impact extruding, pressing, graining, atomizing, and grinding, i.e.: angles, channels, circles, discs, dust, flakes, foils and leaf, forging, plate, powder, pressings and stampings, ribbons, rings, rods (including bare welding rods, wire rods, and rolled wire), sections, shapes, sheets, strip, pipe and tubes (including tube rounds, squares, and hollows), drawn or extruded wire;

b. Cast material produced by casting in sand, die, metal, plaster or other types of molds, including high pressure castings, sintered forms, and forms made by powder metallurgy.

The object of the control should not be defeated by the export of non-listed forms alleged to be finished products but representing in reality crude forms or semi-fabricated forms.

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**1C001 Materials specially designed for use as absorbers of electromagnetic waves, or intrinsically conductive polymers, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Kilograms.

Related Controls: See also 1C101.

Related Definitions: N/A.

Items:

a. Materials for absorbing frequencies exceeding  $2 \times 10^8$  Hz but less than  $3 \times 10^{12}$  Hz.

NOTE 1: 1C001.a does not control:

a. Hair type absorbers, constructed of natural or synthetic fibers, with non-magnetic loading to provide absorption;

b. Absorbers having no magnetic loss and whose incident surface is non-planar in shape, including pyramids, cones, wedges and convoluted surfaces;

c. Planar absorbers, having all of the following characteristics:

1. Made from any of the following:

a. Plastic foam materials (flexible or non-flexible) with carbon-loading, or organic materials, including binders, providing more than 5% echo compared with metal over a bandwidth exceeding  $\pm 15\%$  of the center frequency of the incident energy, and not capable of withstanding temperatures exceeding 450 K (177 °C); or

b. Ceramic materials providing more than 20% echo compared with metal over a bandwidth exceeding  $\pm 15\%$  of the center frequency of the incident energy, and not capable of withstanding temperatures exceeding 800 K (527 °C);

TECHNICAL NOTE: Absorption test samples for 1C001.a. Note 1.c.1 should be a square at least 5 wavelengths of the center frequency on a side and positioned in the far field of the radiating element.

2. Tensile strength less than  $7 \times 10^6$  N/m<sup>2</sup>;

and

3. Compressive strength less than  $14 \times 10^6$  N/m<sup>2</sup>;

d. Planar absorbers made of sintered ferrite, having:

1. A specific gravity exceeding 4.4; and

2. A maximum operating temperature of 548 K (275 °C).

NOTE 2: Nothing in Note 1 releases magnetic materials to provide absorption when contained in paint.

b. Materials for absorbing frequencies exceeding  $1.5 \times 10^{14}$  Hz but less than  $3.7 \times 10^{14}$  Hz and not transparent to visible light;

c. Intrinsically conductive polymeric materials with a bulk electrical conductivity exceeding 10,000 S/m (Siemens per meter) or a sheet (surface) resistivity of less than 100 ohms/square, based on any of the following polymers:

- c.1. Polyaniline;
- c.2. Polypyrrole;
- c.3. Polythiophene;
- c.4. Poly phenylene-vinylene; or
- c.5. Poly thienylene-vinylene.

TECHNICAL NOTE: Bulk electrical conductivity and sheet (surface) resistivity should be determined using ASTM D-257 or national equivalents.

**1C002 Metal alloys, metal alloy powder and alloyed materials, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NS, NP, AT.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 2.
NP applies to 1C002.b.3 or b.4 if they exceed the parameters stated in 1C202.	NP Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: \$3,000; N/A for NP  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Kilograms.

Related Controls: (1) See ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry. (2) Also see ECCN 1C202. (3) Aluminum alloys and titanium alloys in physical forms and finished products specially designed or prepared for use in separating uranium isotopes are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

Related Definition: N/A.

Items:

NOTE: 1C002 does not control metal alloys, metal alloy powder or alloyed materials for coating substrates.

TECHNICAL NOTE 1: The metal alloys in 1C002 are those containing a higher percentage by weight of the stated metal than of any other element.

TECHNICAL NOTE 2: Stress-rupture life should be measured in accordance with ASTM standard E-139 or national equivalents.

TECHNICAL NOTE 3: Low cycle fatigue life should be measured in accordance with ASTM Standard E-606 "Recommended Practice for Constant-Amplitude Low-Cycle Fa-

tigue Testing" or national equivalents. Testing should be axial with an average stress ratio equal to 1 and a stress-concentration factor ( $K_f$ ) equal to 1. The average stress is defined as maximum stress minus minimum stress divided by maximum stress.

a. Aluminides, as follows:

a.1. Nickel aluminides containing a minimum of 15 weight percent aluminum, a maximum of 38 weight percent aluminum and at least one additional alloying element;

a.2. Titanium aluminides containing 10 weight percent or more aluminum and at least one additional alloying element;

b. Metal alloys, as follows, made from material controlled by 1C002.c:

b.1. Nickel alloys with:

b.1.a. A stress-rupture life of 10,000 hours or longer at 923 K (650 °C) at a stress of 676 MPa; or

b.1.b. A low cycle fatigue life of 10,000 cycles or more at 823 K (550 °C) at a maximum stress of 1,095 MPa;

b.2. Niobium alloys with:

b.2.a. A stress-rupture life of 10,000 hours or longer at 1,073 K (800 °C) at a stress of 400 MPa; or

b.2.b. A low cycle fatigue life of 10,000 cycles or more at 973 K (700 °C) at a maximum stress of 700 MPa;

b.3. Titanium alloys with:

b.3.a. A stress-rupture life of 10,000 hours or longer at 723 K (450 °C) at a stress of 200 MPa; or

b.3.b. A low cycle fatigue life of 10,000 cycles or more at 723 K (450 °C) at a maximum stress of 400 MPa;

b.4. Aluminum alloys with a tensile strength of:

b.4.a. 240 MPa or more at 473 K (200 °C); or

b.4.b. 415 MPa or more at 298 K (25 °C);

b.5. Magnesium alloys with:

b.5.a. A tensile strength of 345 MPa or more; and

b.5.b. A corrosion rate of less than 1 mm/year in 3% sodium chloride aqueous solution measured in accordance with ASTM standard G-31 or national equivalents;

c. Metal alloy powder or particulate material, having all of the following characteristics:

c.1. Made from any of the following composition systems:

TECHNICAL NOTE: X in the following equals one or more alloying elements.

c.1.a. Nickel alloys (Ni-Al-X, Ni-X-Al) qualified for turbine engine parts or components, i.e. with less than 3 non-metallic particles (introduced during the manufacturing process) larger than  $100 \mu$  in  $10^9$  alloy particles;

c.1.b. Niobium alloys (Nb-Al-X or Nb-X-Al, Nb-Si-X or Nb-X-Si, Nb-Ti-X or Nb-X-Ti);

c.1.c. Titanium alloys (Ti-Al-X or Ti-X-Al);

c.1.d. Aluminum alloys (Al-Mg-X or Al-X-Mg, Al-Zn-X or Al-X-Zn, Al-Fe-X or Al-X-Fe); or

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- c.1.e. Magnesium alloys (Mg-Al-X or Mg-X-Al); and
- c.2. Made in a controlled environment by any of the following processes:
  - c.2.a. "Vacuum atomization";
  - c.2.b. "Gas atomization";
  - c.2.c. "Rotary atomization";
  - c.2.d. "Splat quenching";
  - c.2.e. "Melt spinning" and "comminution";
  - c.2.f. "Melt extraction" and "comminution"; or
  - c.2.g. "Mechanical alloying";
- d. Alloyed materials, having all the following characteristics:
  - d.1. Made from any of the composition systems specified in 1C002.c.1;
  - d.2. In the form of uncomminuted flakes, ribbons or thin rods; *and*
  - d.3. Produced in a controlled environment by any of the following:
    - d.3.a. "Splat quenching";
    - d.3.b. "Melt spinning"; or
    - d.3.c. "Melt extraction".

**1C003 Magnetic metals, of all types and of whatever form, having any of the characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$3000  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* a. Initial relative permeability of 120,000 or more and a thickness of 0.05 mm or less;

TECHNICAL NOTE: Measurement of initial permeability must be performed on fully annealed materials.

b. Magnetostrictive alloys, having any of the following characteristics:

b.1. A saturation magnetostriction of more than  $5 \times 10^{-4}$ ; *or*

b.2. A magnetomechanical coupling factor (k) of more than 0.8; *or*

c. Amorphous or nanocrystalline alloy strips, having all of the following characteristics:

c.1. A composition having a minimum of 75 weight percent of iron, cobalt or nickel;

c.2. A saturation magnetic induction (B<sub>s</sub>) of 1.6 T or more; *and*

c.3. Any of the following:  
c.3.a. A strip thickness of 0.02 mm or less; *or*

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c.3.b. An electrical resistivity of  $2 \times 10^{-4}$ ; ohm cm or more.

TECHNICAL NOTE: Nanocrystalline materials in 1C003.c are those materials having a crystal grain size of 50 nm or less, as determined by X-ray diffraction.

**1C004 Uranium titanium alloys or tungsten alloys with a "matrix" based on iron, nickel or copper, having all of the characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$3000  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

a. A density exceeding 17.5 g/cm<sup>3</sup>;

b. An elastic limit exceeding 880 MPa;

c. An ultimate tensile strength exceeding 1,270 MPa; *and*

d. An elongation exceeding 8%.

**1C005 "Superconductive" "composite" conductors in lengths exceeding 100 m or with a mass exceeding 100 g, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$1500  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* a. Multifilamentary "superconductive" "composite" conductors containing one or more niobium-titanium filaments:

a.1. Embedded in a "matrix" other than a copper or copper-based mixed "matrix"; *or*

a.2. Having a cross-section area less than  $0.28 \times 10^{-4}$  mm<sup>2</sup> (6 μm in diameter for circular filaments);

b. "Superconductive" "composite" conductors consisting of one or more "superconductive" filaments other than niobium-titanium, having all of the following:

b.1. A "critical temperature" at zero magnetic induction exceeding 9.85 K ( $-263.31^{\circ}\text{C}$ ) but less than 24 K ( $-249.16^{\circ}\text{C}$ );

b.2. A cross-section area less than  $0.28 \times 10^{-4} \text{ mm}^2$ ; and

b.3. Remaining in the "superconductive" state at a temperature of 4.2 K ( $-268.96^{\circ}\text{C}$ ) when exposed to a magnetic field corresponding to a magnetic induction of 12 T.

**1C006 Fluids and lubricating materials, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$3000

GBS: Yes for 1C006.d

CIV: Yes for 1C006.d

LIST OF ITEMS CONTROLLED

*Unit:* Barrels (55 U.S. gallons/209 liters).

*Related Controls:* N/A.

*Related Definitions:* N/A.

*Items:*

a. Hydraulic fluids containing, as their principal ingredients, any of the following compounds or materials:

a.1. Synthetic silahydrocarbon oils, having all of the following:

TECHNICAL NOTE: For the purpose of 1C006.a.1, silahydrocarbon oils contain exclusively silicon, hydrogen and carbon.

a.1.a. A flash point exceeding 477 K ( $204^{\circ}\text{C}$ );

a.1.b. A pour point at 239 K ( $&-34^{\circ}\text{C}$ ) or less;

a.1.c. A viscosity index of 75 or more; and

a.1.d. A thermal stability at 616 K ( $343^{\circ}\text{C}$ ); or

a.2. Chlorofluorocarbons, having all of the following:

TECHNICAL NOTE: For the purpose of 1C006.a.2, chlorofluorocarbons contain exclusively carbon, fluorine and chlorine.

a.2.a. No flash point;

a.2.b. An autogenous ignition temperature exceeding 977 K ( $704^{\circ}\text{C}$ );

a.2.c. A pour point at 219 K ( $-54^{\circ}\text{C}$ ) or less;

a.2.d. A viscosity index of 80 or more; and

a.2.e. A boiling point at 473 K ( $200^{\circ}\text{C}$ ) or higher;

b. Lubricating materials containing, as their principal ingredients, any of the following compounds or materials:

b.1. Phenylene or alkylphenylene ethers or thio-ethers, or their mixtures, containing more than two ether or thio-ether functions or mixtures thereof; or

b.2. Fluorinated silicone fluids with a kinematic viscosity of less than  $5,000 \text{ mm}^2/\text{s}$  (5,000 centistokes) measured at 298 K ( $25^{\circ}\text{C}$ );

c. Damping or flotation fluids with a purity exceeding 99.8%, containing less than 25 particles of  $200 \mu\text{m}$  or larger in size per 100 ml and made from at least 85% of any of the following compounds or materials:

c.1. Dibromotetrafluoroethane;

c.2. Polychlorotrifluoroethylene (oily and waxy modifications only); or

c.3. Polybromotrifluoroethylene;

d. Fluorocarbon electronic cooling fluids, having all of the following characteristics:

d.1. Containing 85% by weight or more of any of the following, or mixtures thereof:

d.1.a. Monomeric forms of perfluoropolyalkylether-triazines or perfluoroaliphatic-ethers;

d.1.b. Perfluoroalkylamines;

d.1.c. Perfluorocycloalkanes; or

d.1.d. Perfluoroalkanes;

d.2. Density at 298 K ( $25^{\circ}\text{C}$ ) of 1.5 g/ml or more;

d.3. In a liquid state at 273 K ( $0^{\circ}\text{C}$ ); and

d.4. Containing 60% or more by weight of fluorine.

TECHNICAL NOTE: For the purpose of 1C006:

a. Flash point is determined using the Cleveland Open Cup Method described in ASTM D-92 or national equivalents;

b. Pour point is determined using the method described in ASTM D-97 or national equivalents;

c. Viscosity index is determined using the method describe in ASTM D-2270 or national equivalents;

d. Thermal stability is determined by the following test procedure or national equivalents:

Twenty ml of the fluid under test is placed in a 46 ml type 317 stainless steel chamber containing one each of 12.5 mm (nominal) diameter balls of M-10 tool steel, 52100 steel and naval bronze (60% Cu, 39% Zn, 0.75% Sn);

The chamber is purged with nitrogen, sealed at atmospheric pressure and the temperature raised to and maintained at  $644 \pm 6 \text{ K}$  ( $371 \pm 6^{\circ}\text{C}$ ) for six hours;

The specimen will be considered thermally stable if, on completion of the above procedure, all of the following conditions are met:

1. The loss in weight of each ball is less than  $10 \text{ mg}/\text{mm}^2$  of ball surface;

2. The change in original viscosity as determined at 311 K ( $38^{\circ}\text{C}$ ) is less than 25%; and

3. The total acid or base number is less than 0.40;

e. Autogenous ignition temperature is determined using the method described in ASTM E-659 or national equivalents.

**1C007 Ceramic base materials, non-"composite" ceramic materials, ceramic-"matrix" "composite" materials and precursor materials, as follows (see List of Items Controlled).**

## LICENSE REQUIREMENTS

Reason for Control: NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2.
MT applies to items in 1C007.d and .f when the dielectric constant is less than 6 at frequencies from 100 Hz to 10,000 MHz for use in missile radomes.	MT Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

## LICENSE EXCEPTIONS

LVS: \$5000, except N/A for MT and for 1C007.e  
GBS: N/A  
CIV: N/A

## LIST OF ITEMS CONTROLLED

Unit: Kilograms.

Related Controls: See also 1C107.

Related Definitions: N/A.

## Items:

a. Base materials of single or complex borides of titanium having total metallic impurities, excluding intentional additions, of less than 5,000 ppm, an average particle size equal to or less than 5  $\mu\text{m}$  and no more than 10% of the particles larger than 10  $\mu\text{m}$ ;

b. Non-“composite” ceramic materials in crude or semi-fabricated form, composed of borides of titanium with a density of 98% or more of the theoretical density;

NOTE: 1C007.b does not control abrasives.

c. Ceramic-ceramic “composite” materials with a glass or oxide-“matrix” and reinforced with fibers having all the following:

c.1 Made from any of the following materials:

- c.1.a. Si-N;
- c.1.b. Si-C;
- c.1.c. Si-Al-O-N; or
- c.1.d. Si-O-N; and

c.2. Having a “specific tensile strength” exceeding  $12.7 \times 10^3$  m;

d. Ceramic-ceramic “composite” materials, with or without a continuous metallic phase, incorporating particles, whiskers or fibers, where carbides or nitrides of silicon, zirconium or boron form the “matrix”;

e. Precursor materials (i.e., special purpose polymeric or metallo-organic materials) for producing any phase or phases of the materials controlled by 1C007.c, as follows:

e.1. Polydiorganosilanes (for producing silicon carbide);

e.2. Polysilazanes (for producing silicon nitride);

e.3. Polycarbosilazanes (for producing ceramics with silicon, carbon and nitrogen components);

f. Ceramic-ceramic “composite” materials with an oxide or glass “matrix” reinforced with continuous fibers from any of the following systems:

f.1.  $\text{Al}_2\text{O}_3$ ; or

f.2. Si-C-N.

NOTE: 1C007.f does not control “composites” containing fibers from these systems with a fiber tensile strength of less than 700 MPa at 1,273 K (1,000 °C) or fiber tensile creep resistance of more than 1% creep strain at 100 MPa load and 1,273 K (1,000 °C) for 100 hours.

**1C008 Non-fluorinated polymeric substances, as follows (see List of Items Controlled).**

## LICENSE REQUIREMENTS

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

## LICENSE EXCEPTIONS

LVS: \$200

GBS: N/A

CIV: N/A

## LIST OF ITEMS CONTROLLED

Unit: Kilograms

Related Controls: N/A

Related Definitions: N/A

Items: a. Non-fluorinated polymeric substances, as follows:

- a.1. Bismaleimides;
- a.2. Aromatic polyamide-imides;
- a.3. Aromatic polyimides;
- a.4. Aromatic polyetherimides having a glass transition temperature ( $T_g$ ) exceeding 513 K (240° C) determined using the dry method described in ASTM D 3418;

NOTE: 1C008.a does not control non-fusible compression molding powders or molded forms.

b. Thermoplastic liquid crystal copolymers having a heat distortion temperature exceeding 523 K (250° C) measured according to ASTM D-648, method A, or national equivalents, with a load of 1.82 N/mm<sup>2</sup> and composed of:

- b.1. Any of the following:
  - b.1.a. Phenylene, biphenylene or naphthalene; or
  - b.1.b. Methyl, tertiary-butyl or phenyl substituted phenylene, biphenylene or naphthalene; *and*
  - b.2. Any of the following acids:
    - b.2.a. Terephthalic acid;
    - b.2.b. 6-hydroxy-2 naphthoic acid; *or*
    - b.2.c. 4-hydroxybenzoic acid;
- c. Polyarylene ether ketones, as follows:
  - c.1. Polyether ether ketone (PEEK)
  - c.2. Polyether ketone ketone (PEKK);
  - c.3. Polyether ketone (PEK);
  - c.4. Polyether ketone ether ketone ketone (PEKEKK);
- d. Polyarylene ketones;

- e. Polyarylene sulphides, where the aryl-ene group is biphenylene, triphenylene or combinations thereof;
- f. Polybiphenylenethersulphone.

TECHNICAL NOTE: The glass transition temperature ( $T_g$ ) for 1C008 materials is determined using the method described in ASTM D 3418 using the dry method.

**1C009 Unprocessed fluorinated compounds, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$5000

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Kilograms

Related Controls: N/A

Related Definitions: N/A

- Items: a. Copolymers of vinylidene fluoride having 75% or more beta crystalline structure without stretching;
- b. Fluorinated polyimides containing 10% by weight or more of combined fluorine;
- c. Fluorinated phosphazene elastomers containing 30% by weight or more of combined fluorine.

**1C010 "Fibrous or filamentary materials" which may be used in organic "matrix", metallic "matrix" or carbon "matrix" "composite" structures or laminates, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NS, NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
NP applies to 1C010.a (aramid "fibrous or filamentary materials", .b (carbon "fibrous and filamentary materials"), and e.1 for "fibrous and filamentary materials" that meet or exceed the control criteria of ECCN 1C210.	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

LVS: \$1500, N/A for NP

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Kilograms

Related Controls: (1) See ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry. (2) Also see ECCNs 1C210 and 1C990. (3) See also 9C110 for material not controlled by 1C010.e, as defined by notes 1 or 2.

Related Definitions: (1) Specific modulus: Young's modulus in pascals, equivalent to N/m<sup>2</sup> divided by specific weight in N/m<sup>3</sup>, measured at a temperature of (296±2) K ((23+2) C) and a relative humidity of (50±5)%. (2) Specific tensile strength: ultimate tensile strength in pascals, equivalent to N/m<sup>2</sup> divided by specific weight in N/m<sup>3</sup>, measured at a temperature of (296±2) K ((23±2) C) and a relative humidity of (50±5)%

Items: a. Organic "fibrous or filamentary materials", having all of the following:

- a.1. A specific modulus exceeding  $12.7 \times 10^6$  m; and
- a.2. A specific tensile strength exceeding  $23.5 \times 10^4$  m;

NOTE: 1C010.a does not control polyethylene.

b. Carbon "fibrous or filamentary materials", having all of the following:

- b.1. A specific modulus exceeding  $12.7 \times 10^6$  m; and
- b.2. A specific tensile strength exceeding  $23.5 \times 10^4$  m;

TECHNICAL NOTE: Properties for materials described in 1C010.b should be determined using SACMA recommended methods SRM 12 to 17, or national equivalent tow tests, such as Japanese Industrial Standard JIS-R-7601, Paragraph 6.6.2, and based on lot average.

NOTE: 1C010.b does not control fabric made from "fibrous or filamentary materials" for the repair of aircraft structures or laminates, in which the size of individual sheets does not exceed 50 cm × 90 cm.

c. Inorganic "fibrous or filamentary materials", having all of the following:

- c.1. A specific modulus exceeding  $2.54 \times 10^6$  m; and
- c.2. A melting, softening, decomposition or sublimation point exceeding 1,922 K (1,649 °C) in an inert environment;

NOTE: 1C010.c does not control:

- 1. Discontinuous, multiphase, polycrystalline alumina fibers in chopped fiber or random mat form, containing 3 weight percent or more silica, with a specific modulus of less than  $10 \times 10^6$  m;
- 2. Molybdenum and molybdenum alloy fibers;
- 3. Boron fibers;
- 4. Discontinuous ceramic fibers with a melting, softening, decomposition or sublimation point lower than 2,043 K (1,770 °C) in an inert environment.
- d. "Fibrous or filamentary materials":
  - d.1. Composed of any of the following:

d.1.a. Polyetherimides controlled by 1C008.a; *or*

d.1.b. Materials controlled by 1C008.b to 1C008.f; *or*

d.2. Composed of materials controlled by 1C010.d.1.a or 1C010.d.1.b and "commingled" with other fibers controlled by 1C010.a, 1C010.b or 1C010.c;

e. Resin-impregnated or pitch-impregnated fibers (prepregs), metal or carbon-coated fibers (preforms) or "carbon fiber preforms", as follows:

e.1. Made from "fibrous or filamentary materials" controlled by 1C010.a, 1C010.b or 1C010.c;

e.2. Made from organic or carbon "fibrous or filamentary materials":

e.2.a. With a "specific tensile strength" exceeding  $17.7 \times 10^4$  m;

e.2.b. With a "specific modulus" exceeding  $10.15 \times 10^6$  m;

e.2.c. Not controlled by 1C010.a or 1C010.b; *and*

e.2.d. When impregnated with materials controlled by 1C008 or 1C009.b, having a glass transition temperature ( $T_g$ ) exceeding 383 K (110 °C) or with phenolic or epoxy resins, having a glass transition temperature ( $T_g$ ) equal to or exceeding 418 K (145 °C).

NOTES: 1C010.e does not control:

1. Epoxy resin "matrix" impregnated carbon "fibrous or filamentary materials" (prepregs) for the repair of aircraft structures or laminates, in which the size of individual sheets of prepreg does not exceed 50 cm x 90 cm;

2. Prepregs when impregnated with phenolic or epoxy resins having a glass transition temperature ( $T_g$ ) less than 433 K (160 °C) and a cure temperature lower than the glass transition temperature.

TECHNICAL NOTE: The glass transition temperature ( $T_g$ ) for 1C010.e materials is determined using the method described in ASTM D 3418 using the dry method. The glass transition temperature for phenolic and epoxy resins is determined using the method described in ASTM D 4065 at a frequency of 1 Hz and a heating rate of 2 K per minute using the dry method.

**1C011 Metals and compounds, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to 1C011.a and .b .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A.

*Related Controls:* 1.) See also 1C111. 2.) Items controlled by 1C011.a, and metal fuels in particle form, whether spherical, atomized, spheroidal, flaked or ground, manufactured from material consisting of 99 percent or more of items controlled by 1C011.b. are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (see 22 CFR part 121).  
*Related Definitions:* N/A.

*Items:*

a. Metals in particle sizes of less than 60  $\mu$ m whether spherical, atomized, spheroidal, flaked or ground, manufactured from material consisting of 99% or more of zirconium, magnesium and alloys of these;

TECHNICAL NOTE: The natural content of hafnium in the zirconium (typically 2% to 7%) is counted with the zirconium.

NOTE: The metals or alloys listed in 1C011.a are controlled whether or not the metals or alloys are encapsulated in aluminum, magnesium, zirconium or beryllium.

b. Boron or boron carbide of 85% purity or higher and a particle size of 60  $\mu$ m or less;

NOTE: The metals or alloys listed in 1C011.b are controlled whether or not the metals or alloys are encapsulated in aluminum, magnesium, zirconium or beryllium.

c. Guanidine nitrate;

d. Nitroguanidine (NQ) (CAS 556-88-7).

**1C012 Materials, as Follows (See List of Items Controlled)**

LICENSE REQUIREMENTS

*Reason for Control:*

*Control(s):* Items described in 1C012 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110)

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A.

*Related Controls:* N/A.

*Related Definitions:* These materials are typically used for nuclear heat sources.

*Items:*

a. Plutonium in any form with a plutonium isotopic assay of plutonium-238 of more than 50% by weight;

NOTE: 1C012.a does not control:

1. Shipments with a plutonium content of 1 g or less;

2. Shipments of 3 "effective grams" or less when contained in a sensing component in instruments.

b. Previously separated neptunium-237 in any form.

NOTE: 1C012.b does not control shipments with a neptunium-237 content of 1 g or less.

**1C018 Commercial charges and devices containing energetic materials on the International Munitions List.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT, UN.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
AT applies to entire entry .....	AT Column 1.
UN applies to entire entry .....	Rwanda.

LICENSE EXCEPTIONS

LVS: \$3000, except N/A for Rwanda

GBS: Yes for items listed in Advisory Note to 1C018, except N/A for Rwanda

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Number.

*Related Controls:* (1) Explosive devices or charges that utilize USML controlled energetic materials (See 22 CFR 121.1, Category V) are subject to the licensing authority of the U.S. Department of State, Office of Defense Trade Controls if they have been specifically designed, developed, configured, adapted, or modified for a military application. (2) With the exception of slurries, cutters and severing tools, if the USML controlled materials utilized in devices and charges controlled by this entry can be easily extracted without destroying the device or charge, then they are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (3) Commercial prefabricated slurries and emulsions containing greater than 35% of USML controlled energetic materials are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Control. (4) The individual USML controlled energetic materials, even when compounded with other materials, remain subject to the export licensing authority of the Department of State when not incorporated into explosive devices or charges controlled by this entry or 1C992. (5) See also ECCNs 1C011, 1C111, and 1C239 for additional controlled energetic materials.

*Related Definitions:* (1) For purposes of this entry, the term "controlled materials" means controlled energetic materials (see ECCNs 1C011, 1C111, 1C239 and 22 CFR 121.1, Category V). (2) For purposes of this entry, the mass of aluminum powder, potassium perchlorate, and any of the substances listed in the note to the USML (see 22 CFR Part 121.12) (such as ammonium pictrate, black powder, etc.) contained in commercial explosive devices and in the charges are omitted when determining the total mass of controlled material.

*Items:*

a. Shaped charges specially designed for oil well operations, utilizing one charge func-

tioning along a single axis, that upon detonation produce a hole; and

- a.1. Contain any controlled materials;
- a.2. Have a uniform shaped conical liner with an included angle of 90 degrees or less;
- a.3. Have more than 0.090 kg but not more than 2.0 kg of controlled materials; and
- a.4. Have a diameter not exceeding 4.5 inches.

b. Detonating cord or shock tubes containing greater than 0.064 kg per meter (300 grains per foot), but not more than 0.1 kg per meter (470 grains per foot) of controlled materials;

c. Cartridge power devices containing greater than 0.70 kg, but not more than 1.0 kg of controlled materials;

d. Detonators (electric or nonelectric) and assemblies thereof containing greater than 0.01 kg, but not more than 0.1 kg of controlled materials;

e. Igniters containing greater than 0.01 kg, but not more than 0.1 kg of controlled materials;

f. Oil well cartridges containing greater than 0.015 kg, but not more than 0.1 kg of controlled materials;

g. Commercial cast or pressed boosters containing greater than 1.0 kg, but not more than 5.0 kg of controlled materials;

h. Commercial prefabricated slurries and emulsions containing greater than 10 kg and less than or equal to thirty-five percent by weight of USML controlled materials;

i. Cutters and severing tools containing greater than 3.5 kg, but not more than 10 kg of controlled materials;

j. Pyrotechnic devices when designed exclusively for commercial purposes (e.g., theatrical stages, motion picture special effects, and fireworks displays), and containing greater than 3.0 kg, but not more than 5.0 kg of controlled materials; or

k. Other commercial explosive devices and charges, not controlled by 1C018.a through g above, when used for commercial applications and containing greater than 1.0 kg but not more than 5.0 kg of controlled materials.

**1C101 Materials for reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures (i.e., stealth technology), other than those controlled by 1C001, for applications usable in "missiles" and their subsystems.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

Control(s)	Country Chart
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) Materials controlled by this entry include structural materials and coatings (including paints), specially designed for reduced or tailored reflectivity or emissivity in the microwave, infrared or ultraviolet spectra. (2) This entry does not control coatings (including paints) when specially used for the thermal control of satellites. (3) For commodities that meet the definition of defense articles under 22 CFR 120.3 of the International Traffic in Arms Regulations (ITAR), see 22 CFR 121.16, Item 17-Category II of the (ITAR), which describes similar commodities under the jurisdiction of the Department of State, Directorate of Defense Trade Control.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1C102 Resaturated pyrolyzed carbon-carbon materials designed for space launch vehicles specified in 9A004 or sounding rockets specified in 9A104. (These items are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)**

**1C107 Graphite and ceramic materials, other than those controlled by 1C007, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT.

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Kilograms

*Related Controls:* (1) See also OC005 and 1C004. (2) For commodities that meet the definition of defense articles under 22 CFR 120.3 of the ITAR, see 22 CFR 121.16, Item 8-Category II of the International Traffic in Arms Regulations (ITAR), which describes similar commodities under the jurisdiction of the Department of State, Directorate of Defense Trade Control.

*Related Definitions:* N/A

*Items:*

a. Fine grain recrystallized bulk graphites with a bulk density of 1.72 g/cm<sup>3</sup> or greater, measured at 288 K (15 °C), and having a particle size of 100 micrometers or less, usable for rocket nozzles and reentry vehicle nose tips as follows:

- a.1. Cylinders having a diameter of 120 mm or greater and a length of 50 mm or greater;
- a.2. Tubes having an inner diameter of 65 mm or greater and a wall thickness of 25 mm or greater and a length of 50 mm or greater;
- a.3. Blocks having a size of 120 mm x 120 mm x 50 mm or greater.
- b. Pyrolytic or fibrous reinforced graphites, usable for rocket nozzles and reentry vehicle nose tips;
- c. Ceramic composite materials (dielectric constant less than 6 at frequencies from 100 Hz to 10 GHz), for use in "missile" radomes; and
- d. Bulk machinable silicon-carbide reinforced unfired ceramic, usable for nose tips.

**1C111 Propellants and constituent chemicals for propellants, other than those specified in 1C011, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Kilograms.

*Related Controls:* Butacene as defined by 1C111.c.1 is subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (See 22 CFR 121.12.b(6), other ferrocene derivatives)

*Related Definitions:* N/A.

*Items:* a. Propulsive substances:

a.1. Spherical aluminum powder, other than that specified on the U.S. Munitions List, with particles of uniform diameter of less than 200 micrometer and an aluminum content of 97% by weight or more, if at least 10 percent of the total weight is made up of particles of less than 63 micrometer, according to ISO 2591:1988 or national equivalents such as JIS Z8820.

*Technical Note:* A particle size of 63 micrometer (ISO R-565) corresponds to 250 mesh (Tyler) or 230 mesh (ASTM standard E-11).

a.2. Metal fuels, other than that controlled by the U.S. Munitions List, in particle sizes of less than  $z60 \times 10^{-6}$  m (60 micrometers), whether spherical, atomized, spheroidal, flaked or ground, consisting 97% by weight or more of any of the following:

- a.2.a Zirconium;
- a.2.b Beryllium;
- a.2.c Magnesium; or
- a.2.d Alloys of the metals specified by a.2.a to a.2.c above.

*Technical Note:* The natural content of hafnium in the zirconium (typically 2% to 7%) is counted with the zirconium.

- a.3. Liquid oxidizers, as follows:
  - a.3.a. Dinitrogen trioxide;
  - a.3.b. Nitrogen dioxide/dinitrogen tetroxide;
  - a.3.c. Dinitrogen pentoxide;
  - a.3.d. Mixed Oxides of Nitrogen (MON)

*Technical Note:* Mixed Oxides of Nitrogen (MON) are solutions of Nitric Oxide (NO) in Dinitrogen Tetroxide/Nitrogen Dioxide (N<sub>2</sub>O<sub>4</sub>/NO<sub>2</sub>) that can be used in missile systems. There are a range of compositions that can be denoted as MON<sub>i</sub> or MON<sub>ij</sub>, where i and j are integers representing the percentage of Nitric Oxide in the mixture (e.g., MON<sub>3</sub> contains 3% Nitric Oxide, MON<sub>25</sub> 25% Nitric Oxide. An upper limit is MON<sub>40</sub>, 40% by weight).

- b. Polymeric substances:
  - b.1. Carboxy-terminated polybutadiene (CTPB);
  - b.2. Hydroxy-terminated polybutadiene (HTPB), other than that controlled by the U.S. Munitions List;
  - b.3. Polybutadiene-acrylic acid (PBAA);
  - b.4. Polybutadiene-acrylic acid-acrylonitrile (PBAN);
- c. Other propellant additives and agents:
  - c.1. Butacene ;
  - c.2. Triethylene glycol dinitrate (TEGDN);
  - c.3. 2-Nitrodiphenylamine;
  - c.4. Trimethylolethane trinitrate (TMETN);
  - c.5. Diethylene glycol dinitrate (DEGDN).

**1C116 Maraging steels (steels generally characterized by high nickel, very low carbon content and the use of substitutional elements or precipitates to produce age-hardening) having an ultimate tensile strength of 1,500 MPa or greater, measured at 293 K (20° C), in the form of sheet, plate or tubing with a wall or plate thickness equal to or less than 5 mm.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
NP applies to items that meet or exceed the parameters of 1C216.	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* (1) See ECCNs 1E001 ("development" and "production") and 1E101 ("use") for technology for items controlled

by this entry. (2) Also see ECCN 1C216. (3) Maraging steel, in physical forms and finished products and specially designed or prepared for use in separating uranium isotopes, is subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1C117 Tungsten, molybdenum and alloys of these metals in the form of uniform, spherical or atomized particles of 500 micrometer diameter or less with a purity of 97% or greater for fabrication of rocket motor components, i.e., heat shields, nozzle substrates, nozzle throats and thrust vector control surfaces.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1C118 Titanium-stabilized duplex stainless steel (Ti-DSS), having all of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

Control(s)	Country chart
MT applies to entire entry. ....	MT Column 1.
1AT applies to entire entry. ....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms.

*Related Controls:* N/A.

*Related Definitions:* N/A.

*Items:*

- a. Having all of the following characteristics:
  - a.1. Containing 17.0-23.0 weight percent chromium and 4.5-7.0 weight percent nickel;
  - a.2. Having a titanium content of greater than 0.10 weight percent; *and*

a.3. A ferritic-austenitic microstructure (also referred to as a two-phase microstructure) of which at least 10 percent is austenite by volume (according to ASTM E-1181-87 or national equivalents), *and*

- b. Having any of the following forms:
  - b.1. Ingots or bars having a size of 100 mm or more in each dimension;
  - b.2. Sheets having a width of 600 mm or more and a thickness of 3 mm or less; *or*
  - b.3. Tubes having an outer diameter of 600 mm or more and a wall thickness of 3 mm or less.

**1C202 Alloys, other than those controlled by 1C002.a.2.c or .d, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS  
Reason for Control: NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms  
*Related Controls:* (1) See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry. (2) Also see ECCN 1C002. (3) Aluminum alloys and titanium alloys, in physical forms and finished products and specially designed or prepared for use in separating uranium isotopes, are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* The phrase “capable of” refers to aluminum alloys and titanium alloys either before or after heat treatment.  
*Items:*

- a. Aluminum alloys having both of the following characteristics:
  - a.1. “Capable of” an ultimate tensile strength of 460 MPa or more at 293 K (20 °C); *and*
  - a.2. In the form of tubes or cylindrical solid forms (including forgings) with an outside diameter of more than 75 mm;
- b. Titanium alloys having both of the following characteristics:
  - b.1. “Capable of” an ultimate tensile strength of 900 MPa or more at 293 K (20 °C); *and*
  - b.2. In the form of tubes or cylindrical solid forms (including forgings) with an outside diameter of more than 75 mm.

**1C210 “Fibrous or filamentary materials” or prepregs, other than those controlled by**

**1C010.a, .b or .e, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS  
Reason for Control: NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms  
*Related Controls:* (1) See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry. (2) Also see ECCNs 1C010 and 1C990.

*Related Definitions:* For the purpose of this entry, the term “fibrous or filamentary materials” is restricted to continuous “monofilaments”, “yarns”, “rovings”, “tows”, or “tapes”. Definitions for other terms used in this entry:

*Filament or Monofilament* is the smallest increment of fiber, usually several μm in diameter.

*Strand* is a bundle of filaments (typically over 200) arranged approximately parallel.

*Roving* is a bundle (typically 12-120) of approximately parallel strands.

*Yarn* is a bundle of twisted strands.

*Tow* is a bundle of filaments, usually approximately parallel.

*Tape* is a material constructed of interlaced or unidirectional filaments, strands, rovings, tows, or yarns, etc., usually preimpregnated with resin.

*Specific modulus* is the Young’s modulus in N/m<sup>2</sup> divided by the specific weight in N/m<sup>3</sup>, measured at a temperature of (296 ± 2) K ((23 ± 2) °C) and a relative humidity of 50 ± 5 percent.

*Specific tensile strength* is the ultimate tensile strength in N/m<sup>2</sup> divided by specific weight in N/m<sup>3</sup>, measured at a temperature of (296 ± 2) K ((23 ± 2) °C) and a relative humidity of 50 ± 5 percent.

*Items:* a. Carbon or aramid “fibrous or filamentary materials” having a “specific modulus” of 12.7 × 10<sup>6</sup> m or greater or a “specific tensile strength” of 235 × 10<sup>3</sup> m or greater *except* Aramid “fibrous or filamentary materials” having 0.25 percent or more by weight of an ester based fiber surface modifier;

b. Glass “fibrous or filamentary materials” having a “specific modulus” of 3.18 × 10<sup>6</sup> m or greater and a “specific tensile strength” of 76.2 × 10<sup>3</sup> m or greater; *or*

c. Thermoset resin impregnated continuous “yarns”, “rovings”, “tows” or “tapes” with a width no greater than 15 mm

(prepregs), made from carbon or glass “fibrous or filamentary materials” controlled by 1C210.a or .b.

TECHNICAL NOTE: The resin forms the matrix of the composite.

**1C216 Maraging steel, other than that controlled by 1C116, “capable of” an ultimate tensile strength of 2,050 MPa or more, at 293 K (20 °C).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT.

Control(s)	Country chart
NP applies to entire entry .....	NP Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* (1) See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry. (2) Also see ECCN 1C116. (3) Maraging steel, in physical form and finished products specially designed or prepared for use in separating uranium isotopes, is subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* The phrase “capable of” in the ECCN heading refers to maraging steel either before or after heat treatment.

*ECCN Controls:* This entry does not control forms in which all linear dimensions are 75 mm or less.

*Items:* The list of items controlled is contained in the ECCN heading.

**1C225 Boron enriched in the boron-10 (<sup>10</sup>B) isotope to greater than its natural isotopic abundance, as follows: elemental boron, compounds, mixtures containing boron, manufactures thereof, waste or scrap of any of the foregoing.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

Control(s)	Country Chart
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”)

for technology for items controlled by this entry.

*Related Definitions:* In this entry, mixtures containing boron include boron-loaded materials.

*Items:*

*Technical Note:* The natural isotopic abundance of boron-10 is approximately 18.5 weight percent (20 atom percent).

The list of items controlled is contained in the ECCN heading.

**1C226 Tungsten, tungsten carbide, and alloys containing more than 90% tungsten by weight, having both of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

Control(s)	Country Chart
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry.

*Related Definitions:* N/A

*ECCN Controls:* This entry does not control manufactures specially designed as weights or gamma-ray collimators.

*Items:*

- a. In forms with a hollow cylindrical symmetry (including cylinder segments) with an inside diameter between 100 and 300 mm; and
- b. A mass greater than 20 kg.

**1C227 Calcium having both of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

Control(s)	Country Chart
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry.

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*Related Definitions:* N/A

*Items:*

- a. Containing less than 1,000 parts per million by weight of metallic impurities other than magnesium; *and*
- b. Containing less than 10 parts per million by weight of boron.

**1C228 Magnesium having both of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilogram

*Related Controls:* See ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry.

*Related Definitions:* N/A

*Items:*

- a. Containing less than 200 parts per million by weight of metallic impurities other than calcium; *and*
- b. Containing less than 10 parts per million by weight of boron.

**1C229 Bismuth having both of the following characteristics (see List of Items Controlled)**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* See ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry.

*Related Definitions:* N/A

*Items:*

- a. A purity of 99.99% or greater by weight; *and*
- b. Containing less than 10 parts per million by weight of silver.

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**1C230 Beryllium metal, alloys containing more than 50% beryllium by weight, beryllium compounds, manufactures thereof, and waste or scrap of any of the foregoing.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* See ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry.

*Related Definitions:* N/A

*ECCN Controls:* This entry does not control the following:

- a. Metal windows for X-ray machines, or for bore-hole logging devices;
- b. Oxide shapes in fabricated or semi-fabricated forms specially designed for electronic component parts or as substrates for electronic circuits;
- c. Beryl (silicate of beryllium and aluminum) in the form of emeralds or aquamarines.

*Items:* The list of items controlled is contained in the ECCN heading.

**1C231 Hafnium metal, hafnium alloys and compounds containing more than 60% hafnium by weight, manufactures thereof, and waste or scrap of any of the foregoing.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* See ECCNs 1E001 ("development" and "production") and 1E201 ("use") for technology for items controlled by this entry.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1C232 Helium-3 (<sup>3</sup>He), mixtures containing helium-3, and products or devices containing any of the foregoing.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Liters  
*Related Controls:* See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry.

*Related Definitions:* N/A

*ECCN Controls:* This entry does not control a product or device containing less than 1 g of helium-3.

*Items:* The list of items controlled is contained in the ECCN heading.

**1C233 Lithium enriched in the lithium-6 (<sup>6</sup>Li) isotope to greater than its natural isotopic abundance, and products or devices containing enriched lithium, as follows: elemental lithium, alloys, compounds, mixtures containing lithium, manufactures thereof, and waste or scrap of any of the foregoing.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms  
*Related Controls:* (1) See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry. (2) Facilities or plants specially designed or prepared for the separation of lithium isotopes are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* The natural isotopic abundance of lithium-6 is approximately 6.5 weight percent (7.5 atom percent).

*ECCN Controls:* This entry does not control thermoluminescent dosimeters.

*Items:* The list of items controlled is contained in the ECCN heading.

**1C234 Zirconium with a hafnium content of less than 1 part hafnium to 500 parts zirconium by weight, as follows: metal, alloys containing more than 50% zirconium by weight, compounds, manufactures thereof, and waste or scrap of any of the foregoing.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms  
*Related Controls:* (1) See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry. (2) Zirconium metal and alloys in the form of tubes or assemblies of tubes, specially designed or prepared for use in a reactor, are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*ECCN Controls:* This entry does not control zirconium in the form of foil having a thickness of 0.10 mm (0.004 in.) or less.

*Items:* The list of items controlled is contained in the ECCN heading.

**1C235 Tritium, tritium compounds, mixtures containing tritium in which the ratio of tritium to hydrogen atoms exceeds 1 part in 1,000, and products or devices containing any of the foregoing.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

Control(s)	Country chart
NP applies to entire entry .....	NP Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms  
*Related Controls:* (1) See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry. (2) Also see ECCN 1B231. (3) Tritium that is byproduct material (e.g., produced in a nuclear reactor) is subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*ECCN Controls:* (1) This entry does not control tritium, tritium compounds, and mixtures that are byproduct material (e.g., produced in a nuclear reactor)—such materials are subject to the licensing jurisdiction of the Nuclear Regulatory Commission (see Related Controls paragraph for this entry). (2) This entry does not control a product or device containing less than  $1.48 \times 10^3$  GBq (40 Ci) of tritium.

*Items:* The list of items controlled is contained in the ECCN heading.

**1C236 Alpha-emitting radionuclides having an alpha half-life of 10 days or greater, but less than 200 years, in the following forms (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Gigabecquerels

*Related Controls:* (1) See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry. (2) Certain alpha-emitting radionuclides are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*ECCN Controls:* This entry does not control a product or device containing less than 3.7 GBq (100 millicuries) of alpha activity.

*Items:*

- a. Elemental;
- b. Compounds having a total alpha activity of 37 GBq/kg (1 Ci/kg) or greater;
- c. Mixtures having a total alpha activity of 37 GBq/kg (1 Ci/kg) or greater;
- d. Products or devices containing any of the items in 1C236.a, .b., or .c.

**1C237 Radium-226 (<sup>226</sup>Ra), radium-226 alloys, radium-226 compounds, mixtures containing radium-226, manufactures thereof, and products or devices containing any of the foregoing.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Gigabecquerels

*Related Controls:* See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry.

*Related Definitions:* N/A

*ECCN Controls:* This entry does not control the following:

- a. Medical applicators;
- b. A product or device containing less than 0.37 GBq (10 millicuries) of radium-226.

*Items:* The list of items controlled is contained in the ECCN heading.

**1C238 Chlorine trifluoride (ClF<sub>3</sub>).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1C239 High explosives, other than those controlled by the U.S. Munitions List, or substances or mixtures containing more than 2% by weight thereof, with a crystal density greater than 1.8 g/cm<sup>3</sup> and having a detonation velocity greater than 8,000 m/s.**

LICENSE REQUIREMENTS

*Reason for Control:*

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* (1) See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry. (2) High explosives for military use are subject to the export licensing authority of the U.S. Department of State,

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Office of Defense Trade Controls (see 22 CFR part 121.12).

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1C240 Nickel powder or porous nickel metal, other than those described in 0C006, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:*

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms

*Related Controls:* (1) See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry. (2) Nickel powder and porous nickel metal, specially designed or prepared for use in separating uranium isotopes, are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*ECCN Controls:* This entry does not control the following:

- a. Filamentary nickel powders;
- b. Single porous nickel sheets with an area of 1,000 cm<sup>2</sup> per sheet or less.

*Items:*

- a. Nickel powder having both of the following characteristics:
  - a.1. A nickel purity content of 99.0% or greater by weight; and
  - a.2. A mean particle size of less than 10 micrometers measured by American Society for Testing and Materials (ASTM) B330 standard;
- b. Porous nickel metal produced from materials controlled by 1C240.a.

TECHNICAL NOTE: 1C240.b refers to porous metal formed by compacting and sintering the materials in 1C240.a to form a metal material with fine pores interconnected throughout the structure.

**1C350 Chemicals that may be used as precursors for toxic chemical agents.**

LICENSE REQUIREMENTS

*Reason for Control:* CB, CW, AT

<i>Control(s)</i>	<i>Country Chart</i>
CB applies to entire entry .....	CB Column 2

CW applies to 1C350.a, .b, and .c. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for CW reasons. A license is required, for CW reasons, to export or reexport Schedule 1 chemicals and mixtures identified in 1C350.a to all destinations, including Canada. A license is required, for CW reasons, to export or reexport Schedule 2 chemicals and mixtures identified in 1C350.b to States not Party to the CWC (destinations *not* listed in Supplement No. 2 to part 745 of the EAR). A license is required, for CW reasons, to export Schedule 3 chemicals and mixtures identified in 1C350.c to States not Party to the CWC, unless an End-Use Certificate issued by the government of the importing country has been obtained by the exporter prior to export. A license is required, for CW reasons, to reexport Schedule 3 chemicals and mixtures identified in 1C350.c from a State not Party to the CWC to any other State not Party to the CWC. (See §742.18 of the EAR for license requirements and policies for toxic and precursor chemicals controlled for CW reasons. See §745.2 of the EAR for End-Use Certificate requirements that apply to exports of Schedule 3 chemicals to countries not listed in Supplement No. 2 to part 745 of the EAR.) AT applies to entire entry. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for AT reasons in 1C350. A license is required, for AT reasons, to export or reexport items controlled by 1C350 to Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria. (See Part 742 of the EAR for additional information on the AT controls that apply to Iran, North Korea, Sudan, and Syria. See Part 746 of the EAR for additional information on the comprehensive trade sanctions that apply to Cuba, Iran, Iraq, and Libya.)

*License Requirement Notes:*

1. *SAMPLE SHIPMENTS:* Subject to the following requirements and restrictions, a license is not required for sample shipments when the cumulative total of these shipments does not exceed a 55-gallon container or 200 kg of a single chemical to any one consignee during a calendar year. A consignee that receives a sample shipment under this exclusion may not resell, transfer, or reexport the sample shipment, but may use the sample shipment for any other legal purpose unrelated to chemical weapons.

a. *Chemicals Not Eligible:*

A. *CWC Schedule 1 chemicals (all destinations).* The CWC Schedule 1 chemicals and mixtures identified in 1C350.a are *not* eligible for sample shipment to any destination without a license.

B. *CWC Schedule 2 chemicals (States not Party to the CWC).* No CWC Schedule 2 chemical or mixture identified in 1C350.b is eligible for sample shipment to *States not Party to*

the CWC (destinations *not* listed in Supplement No. 2 to part 745 of the EAR) without a license.

b. *Countries Not Eligible:* The following countries are *not* eligible to receive sample shipments of any chemicals controlled by this ECCN without a license: Cuba, Iran, Iraq, Libya, North Korea, Sudan, Syria.

c. *Sample shipments that require an End-Use Certificate for CW reasons:* No CWC Schedule 3 chemical or mixture identified in 1C350.c is eligible for sample shipment to States not Party to the CWC (destinations *not* listed in Supplement No. 2 to Part 745 of the EAR) without a license, unless an End-Use Certificate issued by the government of the importing country is obtained by the exporter prior to export (see §745.2 of the EAR for End-Use Certificate requirements).

d. *Sample shipments that require a license for reasons set forth elsewhere in the EAR:* Sample shipments, as described in this Note 1, may require a license for reasons set forth elsewhere in the EAR. See, in particular, the end-use/end-user restrictions in Part 744 of the EAR, and the restrictions that apply to embargoed countries in Part 746 of the EAR.

e. *Quarterly report requirement.* The exporter is required to submit a quarterly written report for shipments of samples made under this Note 1. The report must be on company letterhead stationery (titled "Report of Sample Shipments of Chemical Precursors" at the top of the first page) and identify the chemical(s), Chemical Abstract Service Registry (C.A.S.) number(s), quantity(ies), the ultimate consignee's name and address, and the date exported. The report must be sent to the U.S. Department of Commerce, Bureau of Industry and Security, P.O. Box 273, Washington, DC 20044, Attn: "Report of Sample Shipments of Chemical Precursors".

#### 2. MIXTURES:

a. Mixtures that contain precursor chemicals identified in ECCN 1C350, in concentrations that are below the levels indicated in 1C350.a through .d, are controlled by ECCN 1C395 or 1C995 and are subject to the license requirements specified in those ECCNs.

b. A license is not required for mixtures controlled under this ECCN when the controlled chemical in the mixture is a normal ingredient in consumer goods packaged for retail sale for personal use. Such consumer goods are classified as EAR99.

c. A license is not required for mixtures containing less than 0.5% aggregate quantities, by weight, of the CWC Schedule 1 chemicals controlled by 1C350.a as unavoidable by-products or impurities. Such mixtures are classified as EAR99. All other mixtures containing these Schedule 1 chemicals are controlled by ECCN 1C350.a.

NOTE TO MIXTURES: Calculation of concentrations of controlled chemicals:

a. Exclusion. No chemical may be added to the mixture (solution) for the sole purpose of circumventing the Export Administration Regulations;

b. Percent Weight Calculation. When calculating the percentage, by weight, of components in a chemical mixture, include all components of the mixture, including those that act as solvents.

3. *COMPOUNDS:* Compounds created with any chemicals identified in this ECCN 1C350 may be shipped NLR (No License Required), without obtaining an End-Use Certificate, unless those compounds are also identified in this entry or require a license for reasons set forth elsewhere in the EAR.

4. *TESTING KITS:* Certain medical, analytical, diagnostic, and food testing kits containing small quantities of chemicals identified in this ECCN 1C350, except chemicals identified as Schedule 1 chemicals under the CWC, are excluded from the scope of this ECCN and are controlled under ECCN 1C395 or ECCN 1C995. (Note that replacement reagents for such kits are controlled by this ECCN 1C350 if the reagents contain at least one of the precursor chemicals identified in 1C350 in concentrations equal to or greater than the control levels for mixtures indicated in 1C350.)

TECHNICAL NOTES: 1. For purposes of this entry, a "mixture" is defined as a solid, liquid or gaseous product made up of two or more components that do not react together under normal storage conditions.

2. The scope of this control applicable to Hydrogen Fluoride (see 1C350.d.7 in the List of Items Controlled) includes its liquid, gaseous, and aqueous phases, and hydrates.

#### LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

#### LIST OF ITEMS CONTROLLED

*Unit:* Liters or kilograms, as appropriate.

*Related Controls:* 1C350.a controls certain CWC Schedule 1 chemicals (see §742.18 of the EAR). The U.S. Government must provide advance notification and annual reports to the OPCW of all exports of Schedule 1 chemicals. See §§742.18 and 745.1 of the EAR for notification and annual report requirements. See 22 CFR part 121, Category XIV and §121.7 for additional CWC Schedule 1 chemicals controlled by the Department of State. Also see ECCNs 1C355, 1C395, and 1C995.

*Related Definitions:* See §770.2(k) of the EAR for synonyms for the chemicals listed in this entry.

#### *Items:*

a. Australia Group-controlled precursor chemicals also identified as Schedule 1 chemicals under the CWC, as follows, and

mixtures containing any amount of the following chemicals, except mixtures that contain less than 0.5% aggregate quantities (by weight) of these chemicals as unavoidable by-products or impurities (*i.e.*, the Schedule 1 chemicals are not intentionally produced or added):

- a.1. (C.A.S. #57856-11-8) 0-Ethyl-2-diisopropylaminoethyl methyl phosphonite (QL);
- a.2. (C.A.S. #753-98-0) Ethyl phosphonyl difluoride;
- a.3. (C.A.S. #676-99-3) Methyl phosphonyl difluoride.
- b. Australia Group-controlled precursor chemicals also identified as Schedule 2 chemicals under the CWC, as follows, and mixtures in which at least one of the following chemicals constitutes 30 percent or more of the weight of the mixture:
  - b.1. (C.A.S. #7784-34-1) Arsenic trichloride;
  - b.2. (C.A.S. #76-93-7) Benzilic acid;
  - b.3. (C.A.S. #78-38-6) Diethyl ethylphosphonate;
  - b.4. (C.A.S. #15715-41-0) Diethyl methylphosphonite;
  - b.5. (C.A.S. #2404-03-7) Diethyl-N,N-dimethylphosphoroamidate;
  - b.6. (C.A.S. #5842-07-9) N,N-Diisopropyl-beta-aminoethane thiol;
  - b.7. (C.A.S. #4261-68-1) N,N-Diisopropyl-beta-aminoethyl chloride hydrochloride;
  - b.8. (C.A.S. #96-80-0) N,N-Diisopropyl-beta-aminoethanol;
  - b.9. (C.A.S. #96-79-7), N,N-Diisopropyl-beta-aminoethyl chloride;
  - b.10. (C.A.S. #6163-75-3) Dimethyl ethylphosphonate;
  - b.11. (C.A.S. #756-79-6) Dimethyl methylphosphonate;
  - b.12. (C.A.S. #1498-40-4) Ethyl phosphonous dichloride [Ethyl phosphinyl dichloride];
  - b.13. (C.A.S. #430-78-4) Ethyl phosphonous difluoride [Ethyl phosphinyl difluoride];
  - b.14. (C.A.S. #1066-50-8) Ethyl phosphonyl dichloride;
  - b.15. (C.A.S. #676-83-5) Methyl phosphonous dichloride [Methyl phosphinyl dichloride];
  - b.16. (C.A.S. #753-59-3) Methyl phosphonous difluoride [Methyl phosphinyl difluoride];
  - b.17. (C.A.S. #676-97-1) Methyl phosphonyl dichloride;
  - b.18. (C.A.S. #464-07-3) Pinacolyl alcohol;
  - b.19. (C.A.S. #1619-34-7) 3-Quinuclidinol;
  - b.20. (C.A.S. #111-48-8) Thiodiglycol.
- c. Australia Group-controlled precursor chemicals also identified as Schedule 3 chemicals under the CWC, as follows, and mixtures in which at least one of the following chemicals constitutes 30 percent or more of the weight of the mixture:
  - c.1. (C.A.S. #762-04-9) Diethyl phosphite;
  - c.2. (C.A.S. #868-85-9) Dimethyl phosphite (dimethyl hydrogen phosphite);
  - c.3. (C.A.S. #10025-87-3) Phosphorus oxychloride;

- c.4. (C.A.S. #10026-13-8) Phosphorus pentachloride;
- c.5. (C.A.S. #7719-12-2) Phosphorus trichloride;
- c.6. (C.A.S. #10025-67-9) Sulfur monochloride;
- c.7. (C.A.S. #10545-99-0) Sulfur dichloride;
- c.8. (C.A.S. #7719-09-7) Thionyl chloride;
- c.9. (C.A.S. #102-71-6) Triethanolamine;
- c.10. (C.A.S. #122-52-1) Triethyl phosphite;
- c.11. (C.A.S. #121-45-9) Trimethyl phosphite.
- d. Other Australia Group-controlled precursor chemicals not also identified as Schedule 1, 2, or 3 chemicals under the CWC, as follows, and mixtures in which at least one of the following chemicals constitutes 30 percent or more of the weight of the mixture:
  - d.1. (C.A.S. #1341-49-7) Ammonium hydroxide fluoride;
  - d.2. (C.A.S. #107-07-3) 2-Chloroethanol;
  - d.3. (C.A.S. #100-37-8) N,N-Diethylaminoethanol;
  - d.4. (C.A.S. #108-18-9) Di-isopropylamine;
  - d.5. (C.A.S. #124-40-3) Dimethylamine;
  - d.6. (C.A.S. #506-59-2) Dimethylamine hydrochloride;
  - d.7. (C.A.S. #7664-39-3) Hydrogen fluoride;
  - d.8. (C.A.S. #3554-74-3) 3-Hydroxyl-1-methylpiperidine;
  - d.9. (C.A.S. #76-89-1) Methyl benzilate;
  - d.10. (C.A.S. #1314-80-3) Phosphorus pentasulfide;
  - d.11. (C.A.S. #75-97-8) Pinacolone;
  - d.12. (C.A.S. #151-50-8) Potassium cyanide;
  - d.13. (C.A.S. #7789-23-3) Potassium fluoride;
  - d.14. (C.A.S. #7789-29-9) Potassium bifluoride;
  - d.15. (C.A.S. #3731-38-2) 3-Quinuclidone;
  - d.16. (C.A.S. #1333-83-1) Sodium bifluoride;
  - d.17. (C.A.S. #143-33-9) Sodium cyanide;
  - d.18. (C.A.S. #7681-49-4) Sodium fluoride;
  - d.19. (C.A.S. #1313-82-2) Sodium sulfide;
  - d.20. (C.A.S. #637-39-8) Triethanolamine hydrochloride.

**1C351 Human and zoonotic pathogens and “toxins”, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: CB, CW, AT

Control(s)	Country chart
CB applies to entire entry .....	CB Column 1

CW applies to 1C351.d.5 and d.6 and a license is required for CW reasons for all destinations, including Canada, as follows: CW applies to 1C351.d.5 for ricin in the form of (1) Ricinus Communis Agglutinin<sub>II</sub> (RCA<sub>II</sub>), also known as ricin D or Ricinus Communis Lectin<sub>III</sub> (RCL<sub>III</sub>); and (2) Ricinus Communis Lectin<sub>IV</sub> (RCL<sub>IV</sub>), also known as ricin E. CW applies to 1C351d.6 for saxitoxin identified by C.A.S. #35523-89-8. See §742.18 of the EAR for

licensing information pertaining to chemicals subject to restriction pursuant to the Chemical Weapons Convention (CWC). The Commerce Country Chart is not designed to determine licensing requirements for items controlled for CW reasons.

AT applies to en- AT Column 1  
tire entry.

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Value.

**Related Controls:** Certain forms of ricin and saxitoxin in 1C351.d.5. and d.6 are CWC Schedule 1 chemicals (see §742.18 of the EAR). The U.S. Government must provide advance notification and annual reports to the OPCW of all exports of Schedule 1 chemicals. see §745.1 of the EAR for notification procedures. see 22 CFR part 121, Category XIV and §121.7 for additional CWC Schedule 1 chemicals controlled by the Department of State. All vaccines and "immunotoxins" are excluded from the scope of this entry. Certain medical products and diagnostic and food testing kits that contain biological toxins controlled under paragraph (d) of this entry, with the exception of toxins controlled for CW reasons under d.5 and d.6, are excluded from the scope of this entry. Vaccines, "immunotoxins", certain medical products, and diagnostic and food testing kits excluded from the scope of this entry are controlled under ECCN 1C991. For the purposes of this entry, only saxitoxin is controlled under paragraph d.6; other members of the paralytic shellfish poison family (e.g. neosaxitoxin) are classified as EAR99.

**Related Definitions:** 1. For the purposes of this entry "immunotoxin" is defined as an antibody-toxin conjugate intended to destroy specific target cells (e.g., tumor cells) that bear antigens homologous to the antibody. 2. For the purposes of this entry "subunit" is defined as a portion of the "toxin".

Items:

- a. Viruses, as follows:
  - a.1. Chikungunya virus;
  - a.2. Congo-Crimean haemorrhagic fever virus;
  - a.3. Dengue fever virus;
  - a.4. Eastern equine encephalitis virus;
  - a.5. Ebola virus;
  - a.6. Hantaan virus;
  - a.7. Japanese encephalitis virus;
  - a.8. Junin virus;
  - a.9. Lassa fever virus
  - a.10. Lymphocytic choriomeningitis virus;
  - a.11. Machupo virus;
  - a.12. Marburg virus;
  - a.13. Monkey pox virus;
  - a.14. Rift Valley fever virus;

- a.15. Tick-borne encephalitis virus (Russian Spring-Summer encephalitis virus);
- a.16. Variola virus;
- a.17. Venezuelan equine encephalitis virus;
- a.18. Western equine encephalitis virus;
- a.19. White pox; or
- a.20. Yellow fever virus.
- b. Rickettsiae, as follows:
  - b.1. Bartonella quintana (Rochalimea quintana, Rickettsia quintana);
  - b.2. Coxiella burnetii;
  - b.3. Rickettsia prowasecki; or
  - b.4. Rickettsia rickettsii.
- c. Bacteria, as follows:
  - c.1. Bacillus anthracis;
  - c.2. Brucella abortus;
  - c.3. Brucella melitensis;
  - c.4. Brucella suis;
  - c.5. Burkholderia mallei (Pseudomonas mallei);
  - c.6. Burkholderia pseudomallei (Pseudomonas pseudomallei);
  - c.7. Chlamydia psittaci;
  - c.8. Clostridium botulinum;
  - c.9. Francisella tularensis;
  - c.10. Salmonella typhi;
  - c.11. Shigella dysenteriae;
  - c.12. Vibrio cholerae; or
  - c.13. Yersinia pestis.
- d. "Toxins", as follows, and "subunits" thereof:
  - d.1. Botulinum toxins;
  - d.2. Clostridium perfringens toxins;
  - d.3. Conotoxin;
  - d.4. Microcystin (Cyanginosin);
  - d.5. Ricin;
  - d.6. Saxitoxin;
  - d.7. Shiga toxin;
  - d.8. Staphylococcus aureus toxins;
  - d.9. Tetrodotoxin;
  - d.10. Verotoxin;
  - d.11. Aflatoxins;
  - d.12. Abrin;
  - d.13. Cholera toxin;
  - d.14. Diacetoxyscirpenol toxin;
  - d.15. T-2 toxin;
  - d.16. HT-2 toxin;
  - d.17. Modeccin toxin;
  - d.18. Volkensin toxin; or
  - d.19. Viscum Album Lectin 1 (Viscumin).

**1C352 Animal pathogens, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: CB, AT

Control(s)	Country Chart
CB applies to entire entry .....	CB Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* All vaccines are excluded from the scope of this entry. See also 1C991.

*Related Definition:* N/A

*Items:* a. Viruses, as follows:

- a.1. African swine fever virus;
- a.2. Avian influenza virus that are:
  - a.2.a. Defined in EC Directive 92/40/EC (O.J. L.16 23.1.92 p.19) as having high pathogenicity, as follows:
    - a.2.a.1. Type A viruses with an IVPI (intravenous pathogenicity index) in 6 week old chickens of greater than 1.2; *or*
    - a.2.a.2. Type A viruses H5 or H7 subtype for which nucleotide sequencing has demonstrated multiple basic amino acids at the cleavage site of haemagglutinin;
  - a.3. Bluetongue virus;
  - a.4. Foot and mouth disease virus;
  - a.5. Goat pox virus;
  - a.6. Porcine herpes virus (Aujeszky's disease);
  - a.7. Swine fever virus (Hog cholera virus);
  - a.8. Lyssa virus;
  - a.9. Newcastle disease virus;
  - a.10. Peste des petits ruminants virus;
  - a.11. Porcine enterovirus type 9 (swine vesicular disease virus);
  - a.12. Rinderpest virus;
  - a.13. Sheep pox virus;
  - a.14. Teschen disease virus;
  - a.15. Vesicular stomatitis virus;
  - b. Bacteria, as follows:
    - b.1. *Mycoplasma mycoides*.
    - b.2. Reserved.

**1C353 Genetic elements and genetically modified organisms, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* CB, AT

<i>Control(s)</i>	<i>Country Chart</i>
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CB applies to entire entry .....	CB Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* Vaccines that contain genetic elements or genetically modified organisms identified in this entry are controlled by ECCN 1C991.

*Related Definitions:* N/A.

*Items:*

- a. Genetic elements, as follows:
  - a.1. Genetic elements that contain nucleic acid sequences associated with the pathogenicity of microorganisms controlled by 1C351.a. to .c, 1C352, or 1C354;
  - a.2. Genetic elements that contain nucleic acid sequences coding for any of the "toxins"

controlled by 1C351.d or "subunits of toxins" thereof.

TECHNICAL NOTE: Genetic elements include, *inter alia*, chromosomes, genomes, plasmids, transposons, and vectors, whether genetically modified or unmodified.

b. Genetically modified organisms, as follows:

- b.1. Genetically modified organisms that contain nucleic acid sequences associated with the pathogenicity of microorganisms controlled by 1C351.a. to .c, 1C352, or 1C354;

- b.2. Genetically modified organisms that contain nucleic acid sequences coding for any of the "toxins" controlled by 1C351.d or "subunits of toxins" thereof.

**1C354 Plant pathogens, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* CB, AT

<i>Control(s)</i>	<i>Country Chart</i>
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CB applies to entire entry .....	CB Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* All vaccines are excluded from the scope of this entry. See also 1C991

*Related Definitions:* N/A

*Items:* a. Bacteria, as follows:

- a.1. *Xanthomonas albilineans*;
- a.2. *Xanthomonas campestris* pv. *citri* including strains referred to as *Xanthomonas campestris* pv. *citri* types A,B,C,D,E or otherwise classified as *Xanthomonas citri*, *Xanthomonas campestris* pv. *aurantifolia* or *Xanthomonas campestris* pv. *citrumelo*;
- b. Fungi, as follows:
  - b.1. *Colletotrichum coffeanum* var. *virulans* (*Colletotrichum kahawae*);
  - b.2. *Cochliobolus miyabeanus* (*Helminthosporium oryzae*);
  - b.3. *Microcyclus ulei* (syn. *Dothidella ulei*);
  - b.4. *Puccinia graminis* (syn. *Puccinia graminis* f. sp. *tritici*);
  - b.5. *Puccinia striiformis* (syn. *Puccinia glumarum*);
  - b.6. *Magnaporthe grisea* (*pyricularia grisea*/*pyricularia oryzae*).

**1C355 Chemical Weapons Convention (CWC) Schedule 2 and 3 chemicals and families of chemicals not controlled by ECCN 1C350 or by the Department of State under the ITAR.**

LICENSE REQUIREMENTS

*Reason for Control:* CW, AT  
*Control(s)*

CW applies to entire entry. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for CW reasons. A license is required to export or reexport CWC Schedule 2 chemicals and mixtures identified in 1C355.a to States not Party to the CWC (destinations *not* listed in Supplement No. 2 to part 745). A license is required to export CWC Schedule 3 chemicals and mixtures identified in 1C355.b to States not Party to the CWC, unless an End-Use Certificate issued by the government of the importing country is obtained by the exporter, prior to export. A license is required to reexport CWC Schedule 3 chemicals and mixtures identified in 1C355.b from a State not Party to the CWC to any other State not Party to the CWC. (See §742.18 of the EAR for license requirements and policies for toxic and precursor chemicals controlled for CW reasons.)

AT applies to entire entry. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for AT reasons in 1C355. A license is required, for AT reasons, to export or reexport items controlled by 1C355 to Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria. (See Part 742 of the EAR for additional information on the AT controls that apply to Iran, North Korea, Sudan, and Syria. See Part 746 of the EAR for additional information on the comprehensive trade sanctions that apply to Cuba, Iran, Iraq, and Libya.)

*License Requirements Notes:*

1. **MIXTURES:**

a. Mixtures containing toxic and precursor chemicals identified in ECCN 1C355, in concentrations that are below the control levels indicated in 1C355.a and .b, are controlled by ECCN 1C995 and are subject to the license requirements specified in that ECCN.

b. Mixtures containing chemicals identified in this entry are not controlled by ECCN 1C355 when the controlled chemical is a normal ingredient in consumer goods packaged for retail sale for personal use or packaged for individual use. Such consumer goods are classified as EAR99.

**NOTE TO MIXTURES:** Calculation of concentrations of CW-controlled chemicals:

a. **Exclusion.** No chemical may be added to the mixture (solution) for the sole purpose of circumventing the Export Administration Regulations;

b. **Percent Weight Calculation.** When calculating the percentage, by weight, of components in a chemical mixture, include all components of the mixture, including those that act as solvents.

2. **COMPOUNDS:** Compounds created with any chemicals identified in this ECCN 1C355 may be shipped NLR (No License Required), without obtaining an End-Use Certificate, unless those compounds are also identified in this entry or require a license for reasons set forth elsewhere in the EAR.

**TECHNICAL NOTES:** For purposes of this entry, a "mixture" is defined as a solid, liquid, or gaseous product made up of two or more components that do not react together under normal storage conditions.

**LICENSE EXCEPTIONS**

*LVS:* N/A.

*GBS:* N/A.

*CIV:* N/A.

**LIST OF ITEMS CONTROLLED**

*Unit:* Liters or kilograms, as appropriate.

*Related Controls:* See also ECCNs 1C350, 1C351, 1C395, and 1C995. See §§742.18 and 745.2 of the EAR for End-Use Certification requirements. See 22 CFR part 121, Category XIV and §121.7 for chloropicrin (trichloronitromethane) (C.A.S. 76-06-2) (Schedule 3). Mixtures containing chloropicrin (trichloronitromethane) that have been transferred to the Department of Commerce from the Department of State through a commodity jurisdiction determination are controlled under this entry.

*Related Definitions:* N/A.

*Items:*

a. CWC Schedule 2 chemicals and mixtures containing Schedule 2 chemicals:

a.1. Toxic chemicals, as follows, and mixtures containing toxic chemicals:

a.1.a. PFIB: 1,1,3,3,3-Pentafluoro-2-(trifluoromethyl)-1-propene (C.A.S. 382-21-8) and mixtures in which PFIB constitutes more than 1 percent of the weight of the mixture;

a.1.b. [Reserved].

a.2. Precursor chemicals, as follows, and mixtures in which at least one of the following precursor chemicals constitutes more than 10 percent of the weight of the mixture:

a.2.a. **FAMILY:** Chemicals except for those listed in Schedule 1, containing a phosphorus atom to which is bonded one methyl, ethyl, or propyl (normal or iso) group with no additional carbon atoms in the structure;

**NOTE:** 1C355.a.2.a does not control Fonofos: O-Ethyl S-phenyl ethylphosphonothiolothionate (C.A.S. 944-22-9).

a.2.b. **FAMILY:** N,N-Dialkyl (Me, Et, n-Pr or i-Pr) phosphoramidic dihalides;

a.2.c. **FAMILY:** Dialkyl (Me, Et, n-Pr or i-Pr) N,N-dialkyl (Me, Et, n-Pr, or i-Pr)-phosphoramidates;

a.2.d. **FAMILY:** N,N-Dialkyl (Me, Et, n-Pr or i-Pr) aminoethyl-2-chlorides and corresponding protonated salts;

a.2.e. **FAMILY:** N,N-Dialkyl (Me, Et, n-Pr or i-Pr) aminoethane-2-ols and corresponding protonated salts;

**NOTE:** 1C355.a.2.e. does not control N,N-Dimethylaminoethanol and corresponding protonated salts (C.A.S. 108-01-0) or N,N-Diethylaminoethanol and corresponding protonated salts (C.A.S. 100-37-8).

a.2.f. FAMILY: N,N-Dialkyl (Me, Et, n-Pr or i-Pr) aminoethane-2-thiols and corresponding protonated salts.

b. CWC Schedule 3 chemicals and mixtures containing Schedule 3 chemicals:

b.1. Toxic chemicals, as follows, and mixtures in which at least one of the following toxic chemicals constitutes 30 percent or more of the weight of the mixture:

b.1.a. Phosgene: Carbonyl dichloride (C.A.S. 75-44-5);

b.1.b. Cyanogen chloride (C.A.S. 506-77-4);

b.1.c. Hydrogen cyanide (C.A.S. 74-90-8).

b.2. Precursor chemicals, as follows, and mixtures in which at least one of the following precursor chemicals constitutes 30 percent or more of the weight of the mixture:

b.2.a. Ethyldiethanolamine (C.A.S. 139-87-7);

b.2.b. Methyldiethanolamine (C.A.S. 105-59-9).

b.3. Mixtures containing chloropicrin (trichloronitromethane)(C.A.S. 76-06-2), transferred from the Department of State (see Related Controls).

**1C395 Mixtures and Medical, Analytical, Diagnostic, and Food Testing Kits Not Controlled by ECCN 1C350, as follows (See List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: CB, CW, AT

Control(s) Country Chart

CB applies to entire entry. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for CB reasons in 1C395. A license is required, for CB reasons, to export or reexport mixtures controlled by 1C395.a and test kits controlled by 1C395.b to States not Party to the CWC (destinations *not* listed in Supplement No. 2 to part 745 of the EAR).

CW applies to entire entry. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for CW reasons. A license is required for CW reasons, as follows, to States not Party to the CWC (destinations *not* listed in Supplement No. 2 to Part 745 of the EAR): (1) Exports and reexports of mixtures controlled by 1C395.a, (2) exports and reexports of test kits controlled by 1C395.b that contain CWC Schedule 2 chemicals controlled by ECCN 1C350, (3) exports of test kits controlled by 1C395.b that contain CWC Schedule 3 chemicals controlled by ECCN 1C350, except that a license is not required, for CW reasons, to export test kits containing CWC Schedule 3 chemicals if an End-Use Certificate issued by the government of the importing country is obtained by the exporter prior to export, and

(4) reexports from States not Party to the CWC of test kits controlled by 1C395.b that contain CWC Schedule 3 chemicals. (See §742.18 of the EAR for license requirements and policies for toxic and precursor chemicals controlled for CW reasons.)

AT applies to entire entry. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for AT reasons in 1C395. A license is required, for AT reasons, to export or reexport items controlled by 1C395 to Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria. (See Part 742 of the EAR for additional information on the AT controls that apply to Iran, North Korea, Sudan, and Syria. See Part 746 of the EAR for additional information on the comprehensive trade sanctions that apply to Cuba, Iran, Iraq, and Libya.)

License Requirement Notes:

1. 1C395.b does not control mixtures that contain precursor chemicals identified in ECCN 1C350.b or .c in concentrations below the control levels for mixtures indicated in 1C350.b or .c. 1C395.a and 1C995.a.1 and a.2.a control such mixtures, unless they are consumer goods as described in License Requirements Note 2 of this ECCN.

2. This ECCN does not control mixtures when the controlled chemicals are normal ingredients in consumer goods packaged for retail sale for personal use. Such consumer goods are classified as EAR99.

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: 1. ECCN 1C350 controls mixtures containing 30 percent or higher concentrations, by weight, of any single CWC Schedule 2 chemical identified in ECCN 1C350.b; ECCN 1C995 controls such mixtures containing concentrations of 10 percent or less. 2. ECCN 1C995 controls "medical, analytical, diagnostic, and food testing kits" (as defined in the Related Definitions paragraph of this ECCN) that contain precursor chemicals listed in 1C350.d. ECCN 1C350 controls any such kits that contain CWC Schedule 1 chemicals listed in 1C350.a or testing kits in which the amount of any single chemical listed in 1C350.b, .c, or .d exceeds 300 grams by weight.

Related Definitions: For the purpose of this entry, "medical, analytical, diagnostic, and food testing kits" are pre-packaged materials of defined composition that are specifically developed, packaged and marketed for medical, analytical, diagnostic, or public health purposes. Replacement reagents for medical, analytical, diagnostic, and food

testing kits described in 1C395.b are controlled by ECCN 1C350 if the reagents contain at least one of the precursor chemicals identified in that ECCN in concentrations equal to or greater than the control levels for mixtures indicated in 1C350.b. or .c.

*Items:*

a. Mixtures containing more than 10 percent, but less than 30 percent, by weight of any single CWC Schedule 2 chemical identified in ECCN 1C350.b (For controls on other mixtures containing these chemicals, see Note 1 in the Related Controls paragraph of this ECCN.)

b. "Medical, analytical, diagnostic, and food testing kits" (as defined in the Related Definitions for this ECCN) that contain CWC Schedule 2 or 3 chemicals controlled by ECCN 1C350.b or .c in an amount *not* exceeding 300 grams per chemical. (For controls on other such test kits containing these and other controlled chemicals, see Note 2 in the Related Controls paragraph of this ECCN.)

**1C980 Inorganic chemicals listed in Supplement No. 1 to part 754 of the EAR that were produced or derived from the Naval Petroleum Reserves (NPR) or became available for export as a result of an exchange of any NPR produced or derived commodities.**

LICENSE REQUIREMENTS

*Reason for Control:* SS

*Control(s):* SS applies to entire entry. For licensing requirements (and possible License Exceptions) proceed directly to part 754 of the EAR. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for SS reasons

LIST OF ITEMS CONTROLLED

*Unit:* Barrels/Liters

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1C981 Crude petroleum including reconstituted crude petroleum, tar sands & crude shale oil listed in Supplement No. 1 to part 754 of the EAR.**

LICENSE REQUIREMENTS

*Reason for Control:* SS

*Control(s):* SS applies to entire entry. For licensing requirements (and possible License Exceptions) proceed directly to part 754 of the EAR. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for SS reasons

LIST OF ITEMS CONTROLLED

*Unit:* Barrels/Liters

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**1C982 Other petroleum products listed in Supplement No. 1 to part 754 of the EAR that were produced or derived from the Naval Petroleum Reserves (NPR) or became available for export as a result of an exchange of any NPR produced or derived commodities.**

LICENSE REQUIREMENTS

*Reason for Control:* SS

*Control(s):* SS applies to entire entry. For licensing requirements (and possible License Exceptions) proceed directly to part 754 of the EAR. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for SS reasons

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**1C983 Natural gas liquids and other natural gas derivatives listed in Supplement No. 1 to part 754 of the EAR that were produced or derived from the Naval Petroleum Reserves (NPR) or became available for export as a result of an exchange of any NPR produced or derived commodities.**

LICENSE REQUIREMENTS

*Reason for Control:* SS

*Control(s):* SS applies to entire entry. For licensing requirements (and possible License Exceptions) proceed directly to part 754 of the EAR. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for SS reasons.

LIST OF ITEMS CONTROLLED

*Unit:* Barrels/Liters

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**1C984 Manufactured gas and synthetic natural gas (except when commingled with natural gas and thus subject to export authorization from the Department of Energy) listed in Supplement No. 1 to part 754 of the EAR that were produced or derived from the Naval Petroleum Reserves (NPR) or became available for export as a result of an exchange of any NPR produced or derived commodities.**

LICENSE REQUIREMENTS

*Reason for Control:* SS

*Control(s):* SS applies to entire entry. For licensing requirements (and possible License

Exceptions) proceed directly to part 754 of the EAR. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for SS reasons

LIST OF ITEMS CONTROLLED

*Unit:* Millions of cubic feet  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading

**1C988 Western red cedar (*Thuja plicata*), logs and timber, and rough, dressed and worked lumber containing wane listed in Supplement No. 2 to part 754 of the EAR.**

LICENSE REQUIREMENTS

*Reason for Control:* SS  
*Control(s):* SS applies to entire entry. For licensing requirements (and possible License Exceptions) proceed directly to part 754 of the EAR. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for SS reasons

LIST OF ITEMS CONTROLLED

*Unit:* Million board feet scribner  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading

**1C990 Fibrous and filamentary materials, not controlled by 1C010 or 1C210, for use in "composite" structures and with a specific modulus of  $3.18 \times 10^6$  m or greater and a specific tensile strength of  $7.62 \times 10^4$  m or greater.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading

**1C991 Vaccines, immunotoxins, medical products, diagnostic and food testing kits, as follows (see List of Items controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* CB, AT.

Control(s)	Country Chart
CB applies to 1C991.d .....	CB Column 3
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.  
*Related Controls:* Medical products containing ricin or saxitoxin, as follows, are controlled for CW reasons under ECCN 1C351:  
 (1) Ricinus Communis Agglutinin<sub>II</sub> (RCA<sub>II</sub>), also known as ricin D, or Ricinus Communis Lectin<sub>III</sub> (RCL<sub>III</sub>);  
 (2) Ricinus Communis Lectin<sub>IV</sub> (RCL<sub>IV</sub>), also known as ricin E; or  
 (3) Saxitoxin identified by C.A.S. #35523-89-8.

*Related Definitions:* For the purpose of this entry, "immunotoxin" is defined as an antibody-toxin conjugate intended to destroy specific target cells (e.g., tumor cells) that bear antigens homologous to the antibody. For the purpose of this entry, "medical products" are: (1) pharmaceutical formulations designed for human administration in the treatment of medical conditions, (2) prepackaged for distribution as medical products, and (3) approved by the U.S. Food and Drug Administration to be marketed as medical products. For the purpose of this entry, "diagnostic and food testing kits" are specifically developed, packaged and marketed for diagnostic or public health purposes. Biological toxins in any other configuration, including bulk shipments, or for any other end-uses are controlled by ECCN 1C351. For the purpose of this entry, "vaccine" is defined as a medicinal (or veterinary) product in a pharmaceutical formulation, approved by the U.S. Food and Drug Administration or the U.S. Department of Agriculture to be marketed as a medical (or veterinary) product or for use in clinical trials, that is intended to stimulate a protective immunological response in humans or animals in order to prevent disease in those to whom or to which it is administered.

*Items:*

- a. Vaccines against items controlled by ECCN 1C351, 1C352, 1C353, or 1C354;
- b. Immunotoxins containing items controlled by 1C351.d;
- c. Medical products containing botulinum toxins controlled by ECCN 1C351.d.1;
- d. Medical products containing items controlled by ECCN 1C351.d, except botulinum toxins controlled by ECCN 1C351.d.1 and items controlled for CW reasons under 1C351.d.5 or .d.6; and
- e. Diagnostic and food testing kits containing items controlled by ECCN 1C351.d.

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except items controlled for CW reasons under ECCN 1C351.d.5 or .d.6.

**1C992 Commercial charges and devices containing energetic materials, n.e.s.**

LICENSE REQUIREMENTS

*Reason for Control:* AT.

Control(s)	Country chart
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* Commercial charges and devices containing USML controlled energetic materials that exceed the quantities noted or that are not covered by this entry are controlled under 1C018.

*Related Definitions:* (1) Items controlled by this entry 1C992 are those materials not subject to the licensing authority of the U.S. Department of State, Office of Defense Trade Controls (see 22 CFR part 121) or controlled by ECCN 1C018. (2) For purposes of this entry, the term "controlled materials" means controlled energetic materials (see ECCNs 1C011, 1C111, 1C239 and 22 CFR 121.1, Category V). (3) The individual USML controlled energetic materials, even when compounded with other materials, remain subject to the export licensing authority of the Department of State when not incorporated into explosive devices or charges controlled by this entry. (4) Commercial prefabricated slurries and emulsions containing greater than 35% of USML controlled energetic materials are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Control. (5) For purposes of this entry, the mass of aluminum powder, potassium perchlorate, and any of the substances listed in the note to the USML (see 22 CFR 121.12) (such as ammonium pictrate, black powder, etc.) contained in commercial explosive devices and in the charges are omitted when determining the total mass of controlled material.

*Items:*

a. Shaped charges specially designed for oil well operations, utilizing one charge functioning along a single axis, that upon detonation produce a hole, and

a.1. Contain any formulation of controlled materials;

a.2. Have only a uniform shaped conical liner with an included angle of 90 degrees or less;

a.3. Contain more than 0.010 kg but less than or equal to 0.090 kg of controlled materials; and

a.4. Have a diameter not exceeding 4.5 inches;

b. Shaped charges specially designed for oil well operations containing less than or equal to 0.010 kg of controlled materials;

c. Detonation cord or shock tubes containing less than or equal to 0.064 kg per meter (300 grains per foot) of controlled materials;

d. Cartridge power devices, that contain less than or equal to 0.70 kg of controlled materials in the deflagration material;

e. Detonators (electric or nonelectric) and assemblies thereof, that contain less than or equal to 0.01 kg of controlled materials;

f. Igniters, that contain less than or equal to 0.01 kg of controlled materials;

g. Oil well cartridges, that contain less than or equal to 0.015 kg of controlled energetic materials;

h. Commercial cast or pressed boosters containing less than or equal to 1.0 kg of controlled materials;

i. Commercial prefabricated slurries and emulsions containing less than or equal to 10.0 kg and less than or equal to thirty-five percent by weight of USML controlled materials;

j. Cutters and severing tools containing less than or equal to 3.5 kg of controlled materials;

k. Pyrotechnic devices when designed exclusively for commercial purposes (e.g., theatrical stages, motion picture special effects, and fireworks displays) and containing less than or equal to 3.0 kg of controlled materials; or

l. Other commercial explosive devices and charges not controlled by 1C992.a through .k containing less than or equal to 1.0 kg of controlled materials.

NOTE: 1C992.l includes automotive safety devices; extinguishing systems; cartridges for riveting guns; explosive charges for agricultural, oil and gas operations, sporting goods, commercial mining, or public works purposes; and delay tubes used in the assembly of commercial explosive devices.

**1C995 Mixtures not controlled by ECCN 1C350, ECCN 1C355 or ECCN 1C395 that contain chemicals controlled by ECCN 1C350 or ECCN 1C355 and medical, analytical, diagnostic, and food testing kits not controlled by ECCN 1C350 or ECCN 1C395 that contain chemicals controlled by ECCN 1C350.d, as follows (see List of Items controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* AT

*Control(s)*                      *Country Chart*

AT applies to entire entry. The Commerce Country Chart is not designed to determine licensing requirements for items controlled

for AT reasons in 1C995. A license is required, for AT reasons, to export or reexport items controlled by 1C995 to Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria. (See Part 742 of the EAR for additional information on the AT controls that apply to Iran, North Korea, Sudan, and Syria. See Part 746 of the EAR for additional information on the comprehensive trade sanctions that apply to Cuba, Iran, Iraq, and Libya.)

*License Requirement Notes:*

1. This ECCN does not control mixtures containing less than 0.5% of any single toxic or precursor chemical controlled by ECCN 1C350.b, .c, or .d or ECCN 1C355 as unavoidable by-products or impurities. Such mixtures are classified as EAR99.

2. 1C995.c does not control mixtures that contain precursor chemicals identified in 1C350.d in concentrations below the control levels for mixtures indicated in 1C350.d. 1C995.a.2.b controls such mixtures, unless they are consumer goods as described in License Requirements Note 3 of this ECCN.

3. This ECCN does not control mixtures when the controlled chemicals are normal ingredients in consumer goods packaged for retail sale for personal use. Such consumer goods are classified as EAR99.

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* 1. ECCN 1C350 controls mixtures containing 30 percent or higher concentrations of any single CWC Schedule 2 chemical identified in ECCN 1C350.b. ECCN 1C395 controls mixtures containing concentrations of more than 10 percent, but less than 30 percent, of any single CWC Schedule 2 chemical identified in ECCN 1C350.b. 2. ECCN 1C350 controls mixtures containing chemicals identified in ECCN 1C350.c or .d that exceed the concentration levels indicated in 1C995.a.2. 3. ECCN 1C355 controls mixtures containing chemicals identified in ECCN 1C355 that exceed the concentration levels indicated in 1C995.b. 4. ECCN 1C395 controls "medical, analytical, diagnostic, and food testing kits" (as defined in the Related Definitions paragraph of this ECCN) that contain CWC Schedule 2 or 3 chemicals listed in 1C350.b or .c. ECCN 1C350 controls any such kits that contain CWC Schedule 1 chemicals listed in 1C350.a or testing kits in which the amount of any single chemical listed in 1C350.b, .c, or .d exceeds 300 grams by weight.

*Related Definitions:* For the purpose of this entry, "medical, analytical, diagnostic, and food testing kits" are pre-packaged materials of defined composition that are specifi-

cally developed, packaged and marketed for medical, analytical, diagnostic, or public health purposes. Replacement reagents for medical, analytical, diagnostic, and food testing kits described in 1C995.c are controlled by ECCN 1C350 if the reagents contain at least one of the precursor chemicals identified in that ECCN in concentrations equal to or greater than the control levels for mixtures indicated in 1C350.d.

*Items:*

a. Mixtures containing the following concentrations of precursor chemicals controlled by ECCN 1C350 (For controls on other mixtures containing these chemicals, see Notes 1 and 2 in the Related Controls paragraph of this ECCN.):

a.1. Mixtures containing 10 percent or less, by weight, of any single CWC Schedule 2 chemical controlled by ECCN 1C350.b;

a.2. Mixtures containing less than 30 percent, by weight, of:

a.2.a. Any single CWC Schedule 3 chemical controlled by ECCN 1C350.c; or

a.2.b. Any single precursor chemical controlled by ECCN 1C350.d.

b. Mixtures containing the following concentrations of toxic or precursor chemicals controlled by ECCN 1C355 (For controls on other mixtures containing these chemicals, see Note 3 in the Related Controls paragraph of this ECCN.):

b.1. Mixtures containing the following concentrations of CWC Schedule 2 chemicals controlled by ECCN 1C355.a:

b.1.a. Mixtures containing 1 percent or less, by weight, of any single CWC Schedule 2 chemical controlled by ECCN 1C355.a.1 (i.e., mixtures containing PFIB); or

b.1.b. Mixtures containing 10 percent or less, by weight, of any single CWC Schedule 2 chemical controlled by 1C355.a.2;

b.2. Mixtures containing less than 30 percent, by weight, of any single CWC Schedule 3 chemical controlled by ECCN 1C355.b.

c. "Medical, analytical, diagnostic, and food testing kits" (as defined in the Related Definitions for this ECCN) that contain precursor chemicals controlled by ECCN 1C350.d in an amount *not* exceeding 300 grams per chemical. (For controls on other such test kits containing these and other controlled chemicals, see Note 4 in the Related Controls paragraph of this ECCN.)

**1C996 Hydraulic fluids containing synthetic hydrocarbon oils, having all the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* AT

*Control(s)* Country Chart

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

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GBS: N/A  
 CIV: N/A  
 LIST OF ITEMS CONTROLLED  
*Unit:* Barrels (55 U.S. gallons/209 liters)  
*Related Controls:* N/A  
*Related Definitions:* N/A

- Items:*
- a. A flash point exceeding 477 K (204° C);
  - b. A pour point at 239 K (-34° C) or less;
  - c. A viscosity index of 75 or more; *and*
  - d. A thermal stability at 616 K (343° C).

**1C997 Ammonium Nitrate, Including Fertilizers and Fertilizer Blends Containing More Than 15% by Weight Ammonium Nitrate, Except Liquid Fertilizers (Containing Any Amount of Ammonium Nitrate) or Dry Fertilizers Containing Less Than 15% by Weight Ammonium Nitrate**

LICENSE REQUIREMENTS  
*Reason for Control:* AT.

Control(s)	Country chart
AT applies to entire entry .....	AT Column 1 and Iraq

**License Exceptions**

LVS: N/A.  
 GBS: N/A.  
 CIV: N/A.

LIST OF ITEMS CONTROLLED  
*Unit:* Kilograms.  
*Related Controls:* N/A.  
*Related Definitions:* N/A.

*Items:* The list of items controlled is contained in the ECCN heading.

**1C999 Specific Materials, n.e.s., as Follows (See List of Items Controlled).**

LICENSE REQUIREMENTS  
*Reason for Control:* AT.  
*Control(s).*

*Country Chart.*  
 AT applies to entire entry. A license is required for items controlled by this entry to North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine AT licensing requirements for this entry. See §742.19 of the EAR for additional information.

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.  
*Related Controls:* See also 1C236.  
*Related Definitions:* N/A.

- Items:*
- a. Hardened steel and tungsten carbide precision ball bearings (3mm or greater diameter);
  - b. 304 and 316 stainless steel plate, n.e.s.;
  - c. Monel plate;
  - d. Tributyl phosphate;

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- e. Nitric acid in concentrations of 20 weight percent or greater;
- f. Flourine;
- g. Alpha-emitting radionuclides, n.e.s.

**1D001 “Software” specially designed or modified for the “development”, “production” or “use” of equipment controlled by 1B001 to 1B003.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, NP, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 1
MT applies to “software” for the “development”, “production”, or “use” of items controlled by 1B001 for MT reasons.	MT Column 1
NP applies to “software” for the “development”, “production” or “use” of items controlled by 1B001 for NP reasons.	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: Yes, except N/A for MT  
 TSR: Yes, except N/A for MT

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* (1) See ECCNs 1E101 (“use”) and 1E102 (“development” and “production”) for technology for items controlled by this entry. (2) Also see ECCNs 1D101 and 1D102.  
*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1D002 “Software” for the “development” of organic “matrix”, metal “matrix” or carbon “matrix” laminates or “composites”.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under Exceptions.

LICENSE EXCEPTIONS

CIV: Yes  
 TSR: Yes

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* “Software” for items controlled by 1A102 are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (see 22 CFR part 121).  
*Related Definitions:* N/A

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*Items:* The list of items controlled is contained in the ECCN heading

**1D018 “Software” specially designed or modified for the “development”, “production”, or “use” of items controlled by 1B018.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT, UN.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
MT applies to “software” for the “development”, “production”, or “use” of items controlled by 1B018 for MT reasons.	MT Column 1.
AT applies to entire entry .....	AT Column 1.
UN applies to entire entry .....	Rwanda.

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**1D101 “Software” specially designed or modified for the “use” of commodities controlled by 1B101, 1B102, 1B115, 1B117, 1B118, or 1B119.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, NP, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1.
NP applies to “software” for the “use” of items controlled by 1B101.a.	NP Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See ECCNs 1E101 (“use”) and 1E102 (“development” and “production”) for technology for items controlled by this entry.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1D103 “Software” specially designed for reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures, for applications usable in “missiles” or their subsystems.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

*Control(s)*

*Country Chart*

MT applies to entire entry ..... MT Column 1

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) This entry includes “software” specially designed for analysis of signature reduction. (2) For software that meets the definition of defense articles under 22 CFR 120.3 of the International Traffic in Arms Regulations (ITAR), see 22 CFR 121.16, Item 17-Category II of the (ITAR), which describes similar software that are under the jurisdiction of the Department of State, Directorate of Defense Trade Control.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**1D201 “Software” specially designed or modified for the “use” of items controlled by 1B201.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

*Control(s)*

*Country Chart*

NP applies to entire entry ..... NP Column 1

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See ECCNs 1E201 (“use”) and 1E203 (“development” and “production”) for technology for items controlled by this entry.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1D390 “Software” for process control that is specifically configured to control or initiate “production” of chemicals controlled by 1C350.**

LICENSE REQUIREMENTS

*Reason for Control:* CB, AT

*Control(s)*

*Country Chart*

CB applies to entire entry ..... CB Column 2

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

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*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**1D993 “Software” specially designed for the “development”, “production”, or “use” of equipment or materials controlled by 1C210.b or 1C990.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
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AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**1D999 Specific Software, n.e.s., as Follows (See List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* AT.

*Control(s).*

*Country Chart.*

AT applies to entire entry. A license is required for items controlled by this entry to North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine AT licensing requirements for this entry. See §742.19 of the EAR for additional information.

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* See also 1B999.

*Related Definitions:* N/A.

*Items:*

a. Software specially designed for industrial process control hardware/systems controlled by 1B999, n.e.s.;

b. Software specially designed for equipment for the production of structural composites, fibers, prepregs and preforms controlled by 1B999, n.e.s.

**E. TECHNOLOGY**

**1E001 “Technology” according to the General Technology Note for the “development” or “production” of items controlled by 1A001.b, 1A001.c, 1A002, 1A003, 1A005, 1A101, 1B, or 1C (except 1C355, 1C980 to 1C984, 1C988, 1C990, 1C991, 1C992, and 1C995).**

LICENSE REQUIREMENTS

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*Reason for Control:* NS, MT, NP, CB, AT

<i>Control(s)</i>	<i>Country chart</i>
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NS applies to “technology” for items controlled by 1A001.b and .c, 1A002, 1A003, 1A005, 1B001 to 1B003, 1B018, 1C001 to 1C010, or 1C018.

NS Column 1

MT applies to “technology” 1 for items controlled by 1A101, 1B001, 1B101, 1B102, 1B115 to 1B119, 1C001, 1C007, 1C011, 1C101, 1C102, 1C107, 1C111, 1C116, 1C117, or 1C118 for MT reasons.

MT Column

NP applies to “technology” for items controlled by 1A002, 1B001, 1B101, 1B201, 1B225 to 1B233, 1C002, 1C010, 1C116, 1C202, 1C210, 1C216, 1C225 to 1C240 for NP reasons.

NP Column 1

CB applies to “technology” for items controlled by 1C351, 1C352, 1C353, or 1C354.

CB Column 1

CB applies to “technology” for materials controlled by 1C350.

CB Column 2

AT applies to entire entry ..... AT Column 1

LICENSE REQUIREMENTS NOTE: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes, except for the following:

- (1) Items controlled for MT reasons; or
- (2) Exports and reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of “technology” for the “development” or “production” of the following:

- (a) Items controlled by 1C001; or
- (b) Items controlled by 1A002.a which are composite structures or laminates having an organic “matrix” and being made from materials listed under 1C010.c or 1C010.d.

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* (1) Also see ECCNs 1E101, 1E201, and 1E202. (2) “Technology” for lithium isotope separation (see related ECCN 1B233) and “technology” for items described in ECCN 1C012 are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110). (3) “Technology” for items described in ECCN 1A102 is subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (see 22 CFR part 121).

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1E002 Other “technology”, as follows (see List of Items Controlled).**

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LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to 1E002.e .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes, except for 1E002.e

LIST OF ITEMS CONTROLLED

*Unit:* N/A.

*Related Controls:* See also 1E102, 1E202, and 1E101 for "technology" related to 1E002.e.

*Related Definitions:* N/A.

*Items:*

a. "Technology" for the "development" or "production" of polybenzothiazoles or polybenzoxazoles;

b. "Technology" for the "development" or "production" of fluoroelastomer compounds containing at least one vinyl ether monomer;

c. "Technology" for the design or "production" of the following base materials or non-"composite" ceramic materials:

c.1. Base materials having all of the following characteristics:

c.1.a. Any of the following compositions:

c.1.a.1. Single or complex oxides of zirconium and complex oxides of silicon or aluminum;

c.1.a.2. Single nitrides of boron (cubic crystalline forms);

c.1.a.3. Single or complex carbides of silicon or boron; *or*

c.1.a.4. Single or complex nitrides of silicon;

c.1.b. Total metallic impurities, excluding intentional additions, of less than:

c.1.b.1. 1,000 ppm for single oxides or carbides; *or*

c.1.b.2. 5,000 ppm for complex compounds or single nitrides; *and*

c.1.c. Being any of the following:

c.1.c.1. Zirconia with an average particle size equal to or less than 1 µm and no more than 10% of the particles larger than 5 µm;

c.1.c.2. Other base materials with an average particle size equal to or less than 5 µm and no more than 10% of the particles larger than 10 µm; *or*

c.1.c.3. Having all of the following:

c.1.c.3.a. Platelets with a length to thickness ratio exceeding 5;

c.1.c.3.b. Whiskers with a length to diameter ratio exceeding 10 for diameters less than 2 µm; *and*

c.1.c.3.c. Continuous or chopped fibers less than 10 µm in diameter;

c.2. Non-"composite" ceramic materials composed of the materials described in 1E002.c.1;

NOTE: 1E002.c.2 does not control technology for the design or production of abrasives.

d. "Technology" for the "production" of aromatic polyamide fibers;

e. "Technology" for the installation, maintenance or repair of materials controlled by 1C001;

f. "Technology" for the repair of "composite" structures, laminates or materials controlled by 1A002, 1C007.c or 1C007.d.

NOTE: 1E002.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.

**1E101 "Technology", in accordance with the General Technology Note, for the "use" of commodities and software controlled by 1A101, 1A102, 1B001, 1B101, 1B102, 1B115 to 1B119, 1C001, 1C007, 1C011, 1C101, 1C107, 1C111, 1C116, 1C117, 1C118, 1D001, 1D101, or 1D103.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, NP, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1.
NP applies to "technology" for items controlled by 1B001, 1B101, 1C116, 1D001, and 1D101 for NP reasons.	NP Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* "Technology" for items controlled by 1A102 are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (see 22 CFR part 121).

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1E102 "Technology" according to the General Technology Note for the "development" of software controlled by 1D001, 1D101 or 1D103.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, NP, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1.
NP applies to "technology" for items controlled by 1D001 and 1D101 for NP reasons.	NP Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

CIV: N/A

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TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: N/A

*Related Controls:* This entry includes databases specially designed for analysis of signature reduction.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1E103 “Technical data” (including processing conditions) and procedures for the regulation of temperature, pressure or atmosphere in autoclaves or hydroclaves, when used for the “production” of “composites” or partially processed “composites”, usable for equipment or materials specified in 1C007, 1C102, 1C107, 1C116, 1C117, 1C118, 9A110, and 9C110.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
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MT applies to entire entry ..... MT Column 1

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: N/A

*Related Controls:* See also 1E203

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1E104 “Technology” for the “production” of pyrolytically derived materials formed on a mold, mandrel or other substrate from precursor gases which decompose in the 1,573 K (1,300 °C) to 3,173 K (2,900 °C) temperature range at pressures of 130 Pa (1 mm Hg) to 20 kPa (150 mm Hg), including “technology” for the composition of precursor gases, flow-rates and process control schedules and parameters.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
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MT applies to entire entry ..... MT Column 1

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

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**1E201 “Technology” according to the General Technology Note for the “use” of items controlled by 1A002, 1A202, 1A225 to 1A227, 1B201, 1B225 to 1B232, 1B233.b, 1C002.a.2.c or .d, 1C010.a, 1C010.b, 1C010.e.1, 1C202, 1C210, 1C216, 1C225 to 1C240 or 1D201.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NP applies to entire entry ..... NP Column 1

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1E202 “Technology” according to the General Technology Note for the “development” or “production” of goods controlled by 1A202 or 1A225 to 1A227.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NP applies to entire entry ..... NP Column 1

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1E203 “Technology” according to the General Technology Note for the “development” or “production” of “software” controlled by 1D201.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NP applies to entire entry ..... NP Column 1

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: N/A

*Related Controls:* N/A

*Related Definitions:* N/A

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*Items:* The list of items controlled is contained in the ECCN heading.

**1E350 “Technology” according to the “General Technology Note” for facilities designed or intended to produce chemicals controlled by 1C350.**

LICENSE REQUIREMENTS

*Reason for Control:* CB, AT

<i>Control(s)</i>	<i>Country Chart</i>
CB applies to entire entry .....	CB Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1E351 “Technology” according to the “General Technology Note” for the disposal of chemicals or microbiological materials controlled by 1C350, 1C351, 1C352, 1C353, or 1C354.**

LICENSE REQUIREMENTS

*Reason for Control:* CB, AT

<i>Control(s)</i>	<i>Country Chart</i>
CB applies to “technology” for the disposal of items controlled by 1C351, 1C352, 1C353, or 1C354.	CB Column 1
CB applies to “technology” for the disposal of items controlled by 1C350.	CB Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**1E355 Technology for the production of Chemical Weapons Convention (CWC) Schedule 2 and 3 chemicals, as follows (see List of Items Controlled):**

LICENSE REQUIREMENTS

*Reason for Control:* CW, AT.

*Control(s)*

*Country Chart*

CW applies to entire entry. A license is required for CW reasons to CWC non-States Parties (destinations not listed in Supplement No. 2 to part 745), except for Israel and Taiwan. See §742.18 of the EAR. The Commerce Country Chart is not designed to determine licensing requirements for items controlled for CW reasons.

AT applies to the entire entry AT Column 1

LICENSE EXCEPTIONS

TSR: N/A.

CIV: N/A.

LIST OF ITEMS CONTROLLED

*Unit:* N/A.

*Related Controls:* N/A.

*Related Definitions:* N/A.

*Items:*

a. Technology for the production of the following CWC Schedule 2 toxic chemicals:

a.1. PFIB: 1,1,3,3,3-Pentafluoro-2-(trifluoromethyl)-1-propene (382-21-8);

a.2. [Reserved]

b. Technology for the production of the following CWC Schedule 3 toxic chemicals CWC:

b.1. Phosgene: Carbonyl dichloride (75-44-5);

b.2. Cyanogen chloride (506-77-4);

b.3. Hydrogen cyanide (74-90-8).

**1E994 “Technology” for the “development”, “production”, or “use” of fibrous and filamentary materials controlled by 1C990.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**EAR99 Items subject to the EAR that are not elsewhere controlled by this CCL Category or in any other category in the CCL are designated by the number EAR99.**

*Category 2—Materials Processing*

NOTE: For quiet running bearings, see the U.S. Munitions List.

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A. SYSTEMS, EQUIPMENT AND COMPONENTS

**2A001 Anti-friction bearings and bearing systems, as follows, (see List of Items Controlled) and components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$3000  
 GBS: Yes, for 2A001.a and 2A001.b  
 CIV: Yes, for 2A001.a and 2A001.b

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* (1) See also 2A991. (2) Quiet running bearings are subject to the export licensing authority of the Department of State, Office of Defense Trade Controls. (See 22 CFR part 121.)

*Related Definitions:* Annular Bearing Engineers Committee (ABEC).

*Items:*

NOTE: 2A001 does not control balls with tolerance 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: 2A001.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: 2A001.b does not control tapered roller bearings.

c. Active magnetic bearing systems using any of the following:

c.1. Materials with flux densities of 2.0 T or greater and yield strengths greater than 414 MPa;

c.2. All-electromagnetic 3D homopolar bias designs for actuators; *or*

c.3. High temperature (450 K (177°C) and above) position sensors.

**2A225 Crucibles made of materials resistant to liquid actinide metals, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

*Control(s)* *Country Chart*

NP applies to entire entry ..... NP Column 1  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E201 ("use") for technology for items controlled under this entry.

*Related Definitions:* N/A

*Items:*

a. Crucibles having both of the following characteristics:

a.1. A volume of between 150 cm<sup>3</sup> and 8,000 cm<sup>3</sup>; and

a.2. Made of or coated with any of the following materials, having a purity of 98% or greater by weight:

a.2.a. Calcium fluoride (CaF<sub>2</sub>);  
 a.2.b. Calcium zirconate (metazirconate) (CaZrO<sub>3</sub>);

a.2.c. Cerium sulphide (Ce<sub>2</sub>S<sub>3</sub>);

a.2.d. Erbium oxide (erbia) (Er<sub>2</sub>O<sub>3</sub>);

a.2.e. Hafnium oxide (hafnia) (HfO<sub>2</sub>);

a.2.f. Magnesium oxide (MgO);

a.2.g. Nitrided niobium-titanium-tungsten alloy (approximately 50% Nb, 30% Ti, 20% W);

a.2.h. Yttrium oxide (yttria) (Y<sub>2</sub>O<sub>3</sub>); *or*

a.2.i. Zirconium oxide (zirconia) (ZrO<sub>2</sub>);

b. Crucibles having both of the following characteristics:

b.1. A volume of between 50 cm<sup>3</sup> and 2,000 cm<sup>3</sup>; and

b.2. Made of or lined with tantalum, having a purity of 99.9% or greater by weight;

c. Crucibles having all of the following characteristics:

c.1. A volume of between 50 cm<sup>3</sup> and 2,000 cm<sup>3</sup>;

c.2. Made of or lined with tantalum, having a purity of 98% or greater by weight; and

c.3. Coated with tantalum carbide, nitride, boride, or any combination thereof.

**2A226 Valves having all of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, CB, AT

<i>Control(s)</i>	<i>Country chart</i>
NP applies to entire entry .....	NP Column 1.
CB applies to valves that also meet or exceed the technical parameters in 2B350.g.	CB Column 3.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A

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GBS: N/A  
CIV: N/A

**LIST OF ITEMS CONTROLLED**

*Unit:* \$ value

*Related Controls:* (1) See ECCNs 2E001 (“development”), 2E002 (“production”), and 2E201 (“use”) for technology for items controlled under this entry. (2) Also see ECCNs 2A292 and 2B350.g. (3) Valves specially designed or prepared for certain nuclear uses are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* For valves with different inlet and outlet diameters, the “nominal size” in 2A226 refers to the smallest diameter.

*Items:*

- a. A “nominal size” of 5 mm or greater;
- b. Having a bellows seal; *and*
- c. Wholly made of or lined with aluminum, aluminum alloy, nickel, or nickel alloy containing more than 60% nickel by weight.

**2A290 Generators and other equipment specially designed, prepared, or intended for use with nuclear plants.**

**LICENSE REQUIREMENTS**

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 2
AT applies to entire entry .....	AT Column 1

**LICENSE EXCEPTIONS**

LVS: N/A  
GBS: N/A  
CIV: N/A

**LIST OF ITEMS CONTROLLED**

*Unit:* \$ value

*Related Controls:* (1) See ECCN 2D290 for software for items controlled under this entry. (2) See ECCNs 2E001 (“development”), 2E002 (“production”), and 2E290 (“use”) for technology for items controlled under this entry. (3) Also see ECCN 2A291. (4) Certain nuclear equipment specially designed or prepared for use in nuclear plants is subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*Items:*

- a. Generators, turbine-generator sets, steam turbines, heat exchangers, and heat exchanger type condensers designed or intended for use in a nuclear reactor;
- b. Process control systems intended for use with the equipment controlled by 2A290.a.

**2A291 Equipment, except items controlled by 2A290, related to nuclear material handling and processing and to nuclear reactors.**

**LICENSE REQUIREMENTS**

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 2
AT applies to entire entry .....	AT Column 1

**LICENSE EXCEPTIONS**

LVS: N/A  
GBS: N/A  
CIV: N/A

**LIST OF ITEMS CONTROLLED**

*Unit:* Equipment in number; parts and accessories in \$ value

*Related Controls:* (1) See ECCN 2D290 for software for items controlled under this entry. (2) See ECCNs 2E001 (“development”), 2E002 (“production”), and 2E290 (“use”) for technology for items controlled under this entry. (3) Also see ECCN 2A290. (4) Certain equipment specially designed or prepared for use in a nuclear reactor or in nuclear material handling is subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110). (5) Nuclear radiation detection and measurement devices specially designed or modified for military purposes are subject to the export licensing authority of the Department of State (see 22 CFR parts 120 through 130).

*Related Definitions:* N/A

*Items:*

- a. Process control systems intended for use with nuclear reactors.
- b. Simulators specially designed for “nuclear reactors”.
- c. Casks that are specially designed for transportation of high-level radioactive material and that weigh more than 1,000 kg.
- d. Commodities, parts and accessories specially designed or prepared for use with nuclear plants (e.g., snubbers, airlocks, pumps, reactor fuel charging and discharging equipment, containment equipment such as hydrogen recombiner and penetration seals, and reactor and fuel inspection equipment, including ultrasonic or eddy current test equipment).
- e. Radiation detectors and monitors specially designed for detecting or measuring “special nuclear material” (as defined in 10 CFR part 110) or for nuclear reactors.

*Technical Notes:* 1. 2A291.e does not control neutron flux detectors and monitors. These are subject to the export licensing authority of the Nuclear Regulatory Commission, pursuant to 10 CFR part 110.

2. 2A291.e does not control general purpose radiation detection equipment, such as geiger counters and dosimeters. These items are controlled by ECCN 1A999.

**2A292 Piping, fittings and valves made of, or lined with, stainless steel, copper-nickel**

**alloy or other alloy steel containing 10% or more nickel and/or chromium.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, CB, AT

Control(s)	Country chart
NP applies to entire entry .....	NP Column 2.
CB applies to valves that meet or exceed the technical parameters described in 2B350.g.	CB Column 3.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Pressure tubes, pipes, and fittings in kilograms; valves in number; parts and accessories in \$ value

*Related Controls:* (1) See ECCN 2D290 for software for items controlled under this entry. (2) See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E290 ("use") for technology for items controlled under this entry. (3) Also see ECCN 2A226. (4) Piping, fittings, and valves specially designed or prepared for certain nuclear uses are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*Items:*

- a. Pressure tube, pipe, and fittings of 200 mm (8 in.) or more inside diameter, and suitable for operation at pressures of 3.4 MPa (500 psi) or greater;
- b. Pipe valves having all of the following characteristics:
  - b.1. A pipe size connection of 200 mm (8 in.) or more inside diameter; *and*
  - b.2. Rated at 10.3 MPa (1,500 psi) or more.

**2A293 Pumps designed to move molten metals by electromagnetic forces.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

Control(s)	Country Chart
NP applies to entire entry .....	NP Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number

*Related Controls:* (1) See ECCN 2D290 for software for items controlled under this entry. (2) See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E290 ("use") for technology for items controlled under this

entry. (3) Pumps for use in liquid-metal-cooled reactors are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**2A983 Explosives or detonator detection equipment, both bulk and trace based, consisting of an automated device, or combination of devices for automated decision making to detect the presence of different types of explosives, explosive residue, or detonators; and parts and components, n.e.s.**

LICENSE REQUIREMENTS

*Reason for Control:* RS, AT

Control(s)	Country chart
RS applies to entire entry	RS Column 2
AT applies to entire entry	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number

*Related Controls:* N/A

*Related Definitions:* (1) For the purpose of this entry, automated decision making is the ability of the equipment to detect explosives or detonators at the design or operator-selected level of sensitivity and provide an automated alarm when explosives or detonators at or above the sensitivity level are detected. This entry does not control equipment that depends on operator interpretation of indicators such as inorganic/organic color mapping of the items(s) being scanned.

(2) Explosives and detonators include commercial charges and devices controlled by 1C018 and 1C992 and energetic materials controlled by ECCNs 1C011, 1C111, 1C239 and 22 CFR 121.1 Category V.

*Items:*

NOTE: Explosives or detonation detection equipment in 2A983 includes equipment for screening people, documents, baggage, other personal effects, cargo and/or mail.

- a. Explosives detection equipment for automated decision making to detect and identify bulk explosives utilizing, but not limited to, x-ray (e.g., computed tomography, dual energy, or coherent scattering), nuclear (e.g., thermal neutron analysis, pulse fast neutron analysis, pulse fast neutron transmission spectroscopy, and gamma resonance absorption), or electromagnetic techniques (e.g., quadropole resonance and dielectrometry).
- b. Explosives detection equipment for automated decision making to detect and

identify the presence of explosive residues utilizing, but not limited to, explosives trace detection techniques (e.g., chemiluminescence, ion mobility spectroscopy and mass spectroscopy).

c. Detonator detection equipment for automated decision making to detect and identify initiation devices (e.g. detonators, blasting caps) utilizing, but not limited to, x-ray (e.g. dual energy or computed tomography) or electromagnetic techniques.

**2A991 Bearings and bearing systems not controlled by 2A001.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
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AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) This entry does not control balls with tolerance specified by the manufacturer in accordance with ISO 3290 as grade 5 or worse. (2) Quiet running bearings are subject to the export licensing authority of the Department of State, Office of Defense Trade Controls. (See 22 CFR part 121)

*Related Definitions:* (1) (a) DN is the product of the bearing bore diameter in mm and the bearing rotational velocity in rpm. (b) Operating temperatures include those temperatures obtained when a gas turbine engine has stopped after operation. (2) Annular Bearing Engineers Committee (ABEC); American National Standards Institute (ANSI); Anti-Friction Bearing Manufacturers Association (AFBMA)

*Items:* a. Ball bearings or Solid ball bearings (except tapered roller bearings), having tolerances specified by the manufacturer in accordance with ABEC 7, ABEC 7P, or ABEC 7T or ISO Standard Class 4 or better (or equivalents) and having any of the following characteristics.

a.1. Manufactured for use at operating temperatures above 573 K (300° C) either by using special materials or by special heat treatment; *or*

a.2. With lubricating elements or component modifications that, according to the manufacturer's specifications, are specially designed to enable the bearings to operate at speeds exceeding 2.3 million DN.

b. Solid tapered roller bearings, having tolerances specified by the manufacturer in accordance with ANSI/AFBMA Class 00 (inch) or Class A (metric) or better (or equivalents)

and having either of the following characteristics.

b.1. With lubricating elements or component modifications that, according to the manufacturer's specifications, are specially designed to enable the bearings to operate at speeds exceeding 2.3 million DN; *or*

b.2. Manufactured for use at operating temperatures below 219 K (-54° C) or above 423 K (150° C).

c. Gas-lubricated foil bearing manufactured for use at operating temperatures of 561 K (288° C) or higher and a unit load capacity exceeding 1 MPa.

d. Active magnetic bearing systems.

e. Fabric-lined self-aligning or fabric-lined journal sliding bearings manufactured for use at operating temperatures below 219 K (-54° C) or above 423 K (150° C).

**2A994 Portable electric generators and specially designed parts.**

LICENSE REQUIREMENTS

*Reason for Control:* AT.

*Control(s).*

AT applies to entire entry. A license is required for items controlled by this entry to Cuba, Iran, Libya, and North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine licensing requirements for this entry. See part 746 of the EAR for additional information on Cuba, Iran, and Libya. See §742.19 of the EAR for additional information on North Korea.

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

B. TEST, INSPECTION AND PRODUCTION EQUIPMENT

NOTES FOR CATEGORY 2B: 1. Secondary parallel contouring axes, (e.g., the w-axis on horizontal boring mills or a secondary rotary axis the center 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. Axis nomenclature shall be in accordance with International Standard ISO 841, "Numerical Control Machines—Axis and Motion Nomenclature".

3. For the purposes of 2B001 to 2B009 a "tilting spindle" is counted as a rotary axis.

4. Guaranteed positioning accuracy levels instead of individual test protocols may be

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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 (1988).

**2A999 Specific Processing Equipment, n.e.s., as Follows (See List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* AT.

*Control(s):*

*Country Chart.*

AT applies to entire entry. A license is required for items controlled by this entry to North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine AT licensing requirements for this entry. See §742.19 of the EAR for additional information.

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* See also 2A226, 2B350.

*Related Definitions:* N/A.

*Items:*

- a. Bellows sealed valves;
- b. Reserved.

**B. Test, Inspection and Production Equipment**

Technical Notes for 2B001 to 2B009:

1. Secondary parallel contouring axes, (e.g., the w-axis on horizontal boring mills or a secondary rotary axis the center 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. The number of axes which can be coordinated 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:

- 2.a. Wheel-dressing systems in grinding machines;
- 2.b. Parallel rotary axes designed for mounting of separate workpieces;
- 2.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. A "tilting spindle" is counted as a rotary axis.

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5. Guaranteed "positioning accuracy" levels instead of individual test protocols may be used for each machine tool model using the agreed ISO test procedure.

6. The positioning accuracy of "numerically controlled" machine tools is to be determined and presented in accordance with ISO 230/2 (1988).

**2B001 Machine tools (see List of Items Controlled) 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".**

LICENSE REQUIREMENTS

*Reason for Control:* NS, NP, AT

*Control(s)*

*Country Chart*

NS applies to entire entry ..... NS Column 2  
 NP applies to 2B001.a,b,c, and d, NP Column 1

EXCEPT:(1) turning machines under 2B001.a with a capacity equal to or less than 35 mm diameter; (2) bar machines (Swissturn), limited to machining only bar feed through, if maximum bar diameter is equal to or less than 42 mm and there is no capability of mounting chucks. (Machines may have drilling and/or milling capabilities for machining parts with diameters less than 42 mm); or (3) milling machines under 2B001.b. with x-axis travel greater than two meters and overall "positioning accuracy" on the x-axis more (worse) than 0.030 mm.

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value.

*Related Controls:* (1) See ECCNs 2D001 and 2D002 for software for items controlled under this entry. (2) See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E201 ("use") for technology for items controlled under this entry. (3) Also see ECCNs 2B201, 2B290, and 2B991.

*Related Definitions:* N/A.

*Items:*

NOTE 1: 2B001 does not control special purpose machine tools limited to the manufacture of gears. For such machines, see 2B003.

NOTE 2: 2B001 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 jewellery parts.*

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

a.1. Positioning accuracy with "all compensations available" of less (better) than 6 µm along any linear axis; *and*

a.2. Two or more axes which can be coordinated simultaneously for "contouring control";

NOTE: 2B001.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:

b.1. Having all of the following:

b.1.a. Positioning accuracy with "all compensations available" of less (better) than 6 µm along any linear axis; *and*

b.1.b. Three linear axes plus one rotary axis which can be coordinated simultaneously for "contouring control";

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

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

b.4. Fly cutting machines, having all of the following characteristics:

b.4.a. Spindle "run-out" and "camming" less (better) than 0.0004 mm TIR; *and*

b.4.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: c.1. Having all of the following:

c.1.a. Positioning accuracy with "all compensations available" of less (better) than 4 µm along any linear axis; *and*

c.1.b. Three or more axes which can be coordinated simultaneously for "contouring control"; *or*

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

NOTES: 2B001.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 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. Surface grinders.

d. Electrical discharge machines (EDM) of the non-wire type which have two or more rotary axes which can be coordinated simultaneously for "contouring control";

e. Machine tools for removing metals, ceramics or "composites" having all of the following characteristics:

e.1. Removing material by means of any of the following:

e.1.a. Water or other liquid jets, including those employing abrasive additives;

e.1.b. Electron beam; *or*

e.1.c. "Laser" beam; *and*

e.2. Having two or more rotary axes which:

e.2.a. Can be coordinated simultaneously for "contouring control"; *and*

e.2.b. Have a positioning accuracy of less (better) than 0.003°;

f. Deep-hole-drilling machines and turning machines modified for deep-hole-drilling, having a maximum depth-of-bore capability exceeding 5,000 mm and specially designed components therefor.

**2B003 "Numerically controlled" or manual machine tools, and specially designed components, controls and accessories therefor, specially designed for the shaving, finishing, grinding or honing of hardened ( $R_c = 40$  or more) spur, helical and double-helical gears with a pitch diameter exceeding 1,250 mm and a face width of 15% of pitch diameter or larger finished to a quality of AGMA 14 or better (equivalent to ISO 1328 class 3).**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

<i>Control(s)</i>	<i>County Chart</i>
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NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

LVS: \$5000

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value

*Related Controls:* See also 2B993

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**2B004 Hot "isostatic presses", having all of the characteristics described in the List of Items Controlled, and specially designed components and accessories therefor.**

LICENSE REQUIREMENTS

Reason for Control: NS, MT NP, AT

Control(s)	Country chart
NS applies to entire entry .....	NS Column 2.
MT applies to entire entry .....	MT Column 1.

Control(s)	Country chart
NP applies to entire entry, except 2B004.b.3 and presses with maximum working pressures below 69 MPa.	NP Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number; parts and accessories in \$ value

*Related Controls:* (1) See ECCN 2D001 for software for items controlled under this entry. (2) See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E101 ("use") for technology for items controlled under this entry. (3) For specially designed dies, molds and tooling, see ECCNs 1B003 and 9B009 and ML18 (22 CFR part 121). (4) For additional controls on dies, molds and tooling, see ECCNs 1B101.d, 2B104 and 2B204. (5) Also see ECCN 2B117.

*Related Definitions:* N/A

Items:

- a. A controlled thermal environment within the closed cavity and possessing a chamber cavity with an inside diameter of 406 mm or more; *and*
- b. Any of the following:
  - b.1. A maximum working pressure exceeding 207 MPa;
  - b.2. A controlled thermal environment exceeding 1,773 K (1,500° C); *or*
  - b.3. A facility for hydrocarbon impregnation and removal of resultant gaseous degradation products.

TECHNICAL NOTE: The inside chamber dimension is that of the chamber in which both the working temperature and the working pressure are achieved and does not include fixtures. That dimension will be the smaller of either the inside diameter of the pressure chamber or the inside diameter of the insulated furnace chamber, depending on which of the two chambers is located inside the other.

**2B005 Equipment specially designed for the deposition, processing and in-process control of inorganic overlays, coatings and surface modifications, as follows, for non-electronic substrates, by processes shown in the Table and associated Notes following 2E003.f, and specially designed automated handling, positioning, manipulation and control components therefor.**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$1000  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) This entry does not control chemical vapor deposition, cathodic arc, sputter deposition, ion plating or ion implantation equipment specially designed for cutting or machining tools. (2) Vapor deposition equipment for the production of filamentary materials are controlled by 1B001 or 1B101. (3) Chemical Vapor Deposition furnaces designed or modified for densification of carbon-carbon composites are controlled by 2B104.

*Related Definitions:* N/A

Items:

- a. "Stored program controlled" chemical vapor deposition (CVD) production equipment having all of the following:
  - a.1. Process modified for one of the following:
    - a.1.a. Pulsating CVD;
    - a.1.b. Controlled nucleation thermal deposition (CNTD); *or*
    - a.1.c. Plasma enhanced or plasma assisted CVD; *and*
  - a.2. Any of the following:
    - a.2.a. Incorporating high vacuum (equal to or less than 0.01 Pa) rotating seals; *or*
    - a.2.b. Incorporating *in situ* coating thickness control;
  - b. "Stored program controlled" ion implantation production equipment having beam currents of 5 mA or more;
  - c. "Stored program controlled" electron beam physical vapor (EB-PVD) production equipment incorporating power systems rated for over 80 kW, having any of the following:
    - c.1. A liquid pool level "laser" control system which regulates precisely the ingots feed rate; *or*
    - c.2. A computer controlled rate monitor operating on the principle of photo-luminescence of the ionized atoms in the evaporant stream to control the deposition rate of a coating containing two or more elements;
  - d. "Stored program controlled" plasma spraying production equipment having any of the following characteristics:
    - d.1. Operating at reduced pressure controlled atmosphere (equal or less than 10 kPa measured above and within 300 mm of the gun nozzle exit) in a vacuum chamber capable of evacuation down to 0.01 Pa prior to the spraying process; *or*
    - d.2. Incorporating *in situ* coating thickness control;
  - e. "Stored program controlled" sputter deposition production equipment capable of current densities of 0.1 mA/mm<sup>2</sup> or higher at a deposition rate 15 μm/h or more;
  - f. "Stored program controlled" cathodic arc deposition equipment incorporating a

grid of electromagnets for steering control of the arc spot on the cathode;

g. "Stored program controlled" ion plating production equipment allowing for the *in situ* measurement of any of the following:

- g.1. Coating thickness on the substrate and rate control; or
- g.2. Optical characteristics.

**2B006 Dimensional inspection or measuring systems and equipment, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
NP applies to 2B006.a and .b .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number

*Related Controls:* (1) See ECCNs 2D001 and 2D002 for "software" for items controlled under this entry. (2) See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E201 ("use") for technology for items controlled under this entry. (3) Also see ECCNs 2B206 and 2B996.

*Related Definitions:* N/A

*Items:*

a. Computer controlled, "numerically controlled" or "stored program controlled" coordinate measuring machines (CMM), having a three dimensional length (volumetric) maximum permissible error of indication (MPE<sub>E</sub>) at any point within the operating range of the machine (*i.e.*, within the length of axes) equal to or less (better) than (1.7 + L/1,000) μm (L is the measured length in mm) tested according to ISO 10360-2 (2001);

b. Linear and angular displacement measuring instruments, as follows:

b.1. Linear displacement measuring instruments having any of the following:

TECHNICAL NOTE: For the purpose of 2B006.b.1 "linear displacement" means the change of distance between the measuring probe and the measured object.

b.1.a. Non-contact type measuring systems with a "resolution" equal to or less (better) than 0.2 μm within a measuring range up to 0.2 mm;

b.1.b. Linear voltage differential transformer systems having all of the following characteristics:

b.1.b.1. "Linearity" equal to or less (better) than 0.1% within a measuring range up to 5 mm; *and*

b.1.b.2. Drift equal to or less (better) than 0.1% per day at a standard ambient test room temperature ± 1 K; *or*

b.1.c. Measuring systems having all of the following: b.1.c.1. Containing a "laser"; *and*

b.1.c.2. Maintaining, for at least 12 hours, over a temperature range of ± 1 K around a standard temperature and at a standard pressure, all of the following:

b.1.c.2.a. A "resolution" over their full scale of 0.1 μm or less (better); *and*

b.1.c.2.b. A "measurement uncertainty" equal to or less (better) than (0.2 + L/2,000) μm (L is the measured length in mm);

NOTE: 2B006.b.1 does not control measuring interferometer systems, without closed or open loop feedback, containing a "laser" to measure slide movement errors of machine-tools, dimensional inspection machines or similar equipment.

b.2. Angular displacement measuring instruments having an "angular position deviation" equal to or less (better) than 0.00025°;

NOTE: 2B006.b.2 does not control optical instruments, such as autocollimators, using collimated light to detect angular displacement of a mirror.

c. Equipment for measuring surface irregularities, by measuring optical scatter as a function of angle, with a sensitivity of 0.5 nm or less (better).

NOTE: Machine tools that can be used as measuring machines are controlled by this entry if they meet or exceed the criteria specified for the machine tool function or the measuring machine function.

**2B007 "Robots" having any of the following characteristics described in the List of Items Controlled and specially designed controllers and "end-effectors" therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, NP, AT

Control(s)	Country chart
NS applies to entire entry .....	NS Column 2.
NP applies to 2B007.b and 2B007.c and to specially designed controllers and "end-effectors" therefor.	NP Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: \$5000, except 2B007.b and .c  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) See ECCN 2D001 for "software" for items controlled under this entry. (2) See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E201 ("use") for technology for items controlled under this entry. (3) Also see ECCNs 2B207, 2B225 and 2B997.

*Related Definitions:* N/A

*Items:*

a. Capable in real time of full three-dimensional image processing or full three-dimensional "scene analysis" to generate or modify "programs" or to generate or modify numerical program data;

*Technical Note:* The "scene analysis" limitation does not include approximation of the third dimension by viewing at a given angle, or limited grey scale interpretation for the perception of depth or texture for the approved tasks (2½ D).

b. Specially designed to comply with national safety standards applicable to explosive munitions environments;

c. Specially designed or rated as radiation-hardened to withstand a total radiation dose greater than  $5 \times 10^3$  Gy (silicon) without operational degradation; or

*Technical Note:* The term Gy (silicon) refers to the energy in Joules per kilogram absorbed by an unshielded silicon sample when exposed to ionizing radiation.

d. Specially designed to operate at altitudes exceeding 30,000m.

**2B008 Assemblies or Units, Specially Designed for Machine Tools, or Dimensional Inspection or Measuring Systems and Equipment, as Follows (See List of Items Controlled)**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.  
*Related Controls:* See also 2B998.  
*Related Definition:* N/A.

*Items:*  
 a. Linear position feedback units (e.g., inductive type devices, graduated scales, infrared systems or "laser" systems) having an overall "accuracy" less (better) than  $(800 + (600 \times L \times 10^{-3}))$  nm (L equals the effective length in mm);

N.B.: For "laser" systems see also Note to 2B006.b.1.

b. Rotary position feedback units (e.g., inductive type devices, graduated scales, infrared systems or "laser" systems) having an "accuracy" less (better) than 0.00025°;

N.B.: For "laser" systems see also Note to 2B006.b.1.

c. "Compound rotary tables" and "tilting spindles", capable of upgrading, according to the manufacturer's specifications, machine tools to or above the levels controlled by 2B001 to 2B009.

**2B009 Spin-forming machines and flow-forming machines, which, according to the manufacturer's technical specifications, can be equipped with "numerical control" units or a computer control and having all of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, NP, AT

Control(s)	Country chart
NS applies to entire entry .....	NS Column 2
MT applies to: spin-forming machines combining the functions of spin-forming and flow-forming; and flow-forming machines that meet or exceed the parameters of 2B009.a and 2B109.	MT Column 1
NP applies to flow-forming machines, and spin-forming machines capable of flow-forming functions, that meet or exceed the parameters of 2B209.	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* (1) See ECCN 2D001 for "software" for items controlled under this entry. (2) See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E101 ("use") for technology for items controlled under this entry. (3) Also see ECCNs 2B109 and 2B209 for additional flow-forming machines for MT and NP reasons.

*Related Definitions:* Machines combining the function of spin-forming and flow-forming are for the purpose of 2B009 regarded as flow-forming machines.

*Items:* a. Two or more controlled axes of which at least two can be coordinated simultaneously for "contouring control"; and

b. A roller force more than 60 kN.

*Technical Note:* Machines combining the function of spin-forming and flow-forming are for the purpose of 2B009 regarded as flow-forming machines.

**2B018 Equipment on the International Munitions List.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, RS, AT, UN.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.

Control(s)	Country chart
MT applies to specialized machinery, equipment, and gear for producing rocket systems (including ballistic missile systems, space launch vehicles, and sounding rockets) and unmanned air vehicle systems (including cruise missile systems, target drones, and reconnaissance drones) usable in systems that are controlled for MT reasons including their propulsion systems and components, and pyrolytic deposition and densification equipment.	MT Column 1.
RS applies to entire entry .....	RS Column 2.
AT applies to entire entry .....	AT Column 1.
UN applies to entire entry .....	Rwanda.

LICENSE EXCEPTIONS

LVS: \$3000, except N/A for Rwanda  
 GBS: Yes for Advisory Note in this entry to 2B018, except N/A for Rwanda  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number; parts and accessories in \$ value

Related Controls: N/A

Related Definitions: N/A

Items: Specialized machinery, equipment, gear, and specially designed parts and accessories therefor, including but not limited to the following, that are specially designed for the examination, manufacture, testing, and checking of arms, appliances, machines, and implements of war: a. Armor plate drilling machines, other than radial drilling machines;

- b. Armor plate planing machines;
- c. Armor plate quenching presses;
- d. Centrifugal casting machines capable of casting tubes 6 feet (183 cm) or more in length, with a wall thickness of 2 inches (5 cm) and over;
- e. Gun barrel rifling and broaching machines, and tools therefor;
- f. Gun barrel rifling machines;
- g. Gun barrel trepanning machines;
- h. Gun boring and turning machines;
- i. Gun honing machines of 6 feet (183 cm) stroke or more;
- j. Gun jump screw lathes;
- k. Gun rifling machines;
- l. Gun straightening presses;
- m. Induction hardening machines for tank turret rings and sprockets;
- n. Jigs and fixtures and other metal-working implements or accessories of the kinds exclusively designed for use in the manufacture of firearms, ordnance, and other stores and appliances for land, sea, or aerial warfare;
- o. Small arms chambering machines;
- p. Small arms deep hole drilling machines and drills therefor;
- q. Small arms rifling machines;
- r. Small arms spill boring machines;
- s. Tank turret bearing grinding machines.

ADVISORY NOTE: Licenses are likely to be approved, as administrative exceptions, for export and reexport to Country Group D:1 of equipment used to determine the safety data of explosives, as required by the International Convention on the Transport of Dangerous Goods (C.I.M.) articles 3 and 4 in Annex 1 RID, provided that such equipment will be used only by the railway authorities of current C.I.M. members, or by the Government-accredited testing facilities in those countries, for the testing of explosives to transport safety standards, of the following description:

- a. Equipment for determining the ignition and deflagration temperatures;
- b. Equipment for steel-shell tests;
- c. Drophammers not exceeding 20 kg in weight for determining the sensitivity of explosives to shock;
- d. Equipment for determining the friction sensitivity of explosives when exposed to charges not exceeding 36 kg in weight.

**2B104 "Isostatic presses", other than those controlled by 2B004, having all of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: MT, NP, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1.
NP applies to entire entry .....	NP Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number

Related Controls: (1) See ECCN 2D101 for "software" for items controlled under this entry. (2) See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E101 ("use") for technology for items controlled under this entry. (3) Also see ECCNs 2B004, 2B204, and 2B117.

Related Definitions: The inside chamber dimension is that of the chamber in which both the working temperature and the working pressure are achieved and does not include fixtures. That dimension will be the smaller of either the inside diameter of the pressure chamber or the inside diameter of the insulated chamber, depending on which of the two chambers is located inside the other.

Items:

- a. Maximum working pressure of 69 MPa or greater;
- b. Designed to achieve and maintain a controlled thermal environment of 873 K (600 °C) or greater; and

c. Possessing a chamber cavity with an inside diameter of 254 mm or greater.

**2B105 Chemical vapor deposition (CVD) furnaces, other than those controlled by 2B005.a, designed or modified for the densification of carbon-carbon composites.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1.
AT applies to entire entry .....	AT Column 1.

*License Exceptions*

LVS: N/A  
 GBS: N/A  
 CIV: N/A

*List of Items Controlled*

*Unit:* Equipment in number

*Related Controls:* (1) See ECCN 2D101 for "software" for items controlled under this entry. (2) See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E101 ("use") for technology for items controlled under this entry. (3) Also see ECCNs 2B005 and 2B117.

*Related Definitions:* N/A

*Items:* The list of items controlled in contained in the ECCN heading.

**2B109 Flow-forming machines, other than those controlled by 2B009, and specially designed components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, NP, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1.
NP applies to items controlled by this entry that meet or exceed the technical parameters in 2B209.	NP Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; components in \$ value

*Related Controls:* (1) See ECCN 2D101 for "software" for items controlled under this entry. (2) See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E101 ("use") for technology for items controlled under this entry. (3) Also see ECCNs 2B009 and 2B209.

*Related Definitions:* N/A

*Items:*

- a. Flow-forming machines having all of the following:
  - a.1. According to the manufacturer's technical specification, can be equipped with

"numerical control" units or a computer control, even when not equipped with such units at delivery; *and*

- a.2. Have more than two axes which can be coordinated simultaneously for "contouring control."

- b. Specially designed components for flow-forming machines controlled in 2B009 or 2B109.a.

TECHNICAL NOTES: 1. Machines combining the function of spin-forming and flow-forming are for the purpose of 2B109 regarded as flow-forming machines.

2. 2B109 does not control machines that are not usable in the "production" of propulsion components and equipment (e.g. motor cases) for systems in 9A005, 9A007.a, or 9A105.a.

**2B116 Vibration test systems, equipment and components therefor, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* MT, NP, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1.
NP applies to electrodynamic vibration test systems in 2B116.a and to all items in 2B116.b, .c, and .d.	NP Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) See ECCN 2D101 for "software" for items controlled under this entry. (2) See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E101 ("use") for technology for items controlled under this entry. (3) Also see ECCN 9B990.

*Related Definitions:* Vibration test systems incorporating a digital controller are those systems, the functions of which are, partly or entirely, automatically controlled by stored and digitally coded electrical signals.

*Items:*

- a. Vibration test systems employing feedback or closed loop techniques and incorporating a digital controller, capable of vibrating a system at 10 g RMS or more over the entire range 20 Hz to 2,000 Hz and imparting forces of 50 kN (11,250 lbs.), measured "bare table", or greater;
  - b. Digital controllers, combined with specially designed vibration test "software", with a real-time bandwidth greater than 5 kHz and designed for use with vibration test systems described in 2B116.a;
  - c. Vibration thrusters (shaker units), with or without associated amplifiers, capable of

imparting a force of 50 kN (11,250 lbs.), measured 'bare table', or greater, and usable in vibration test systems described in 2B116.a;

d. Test piece support structures and electronic units designed to combine multiple shaker units into a complete shaker system capable of providing an effective combined force of 50 kN, measured 'bare table', or greater, and usable in vibration test systems described in 2B116.a.

TECHNICAL NOTE: 'bare table' means a flat table, or surface, with no fixture or fitting.

**2B117 Equipment and process controls, other than those controlled by 2B004, 2B005.a, 2B104 or 2B105, designed or modified for the densification and pyrolysis of structural composite rocket nozzles and re-entry vehicle nose tips.**

LICENSE REQUIREMENTS

Reason for Control: MT, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number

Related Controls: (1) See ECCN 2D101 for "software" for items controlled under this entry. (2) See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E101 ("use") for technology for items controlled under this entry. (3) Also see ECCN s 2B004, 2B005, 2B104, 2B105, and 2B204.

Related Definitions: N/A

Items: The list of items controlled in contained in the ECCN heading.

**2B119 Balancing machines and related equipment, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: MT, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: See also 2B219, 7B101.

Related Definitions: N/A

Items:

a. Balancing machines having all the following characteristics:

a.1. Not capable of balancing rotors/assemblies having a mass greater than 3 kg;

a.2. Capable of balancing rotors/assemblies at speeds greater than 12,500 rpm;

a.3. Capable of correcting unbalance in two planes or more; and

a.4. Capable of balancing to a residual specific unbalance of 0.2 g mm per kg of rotor mass.

NOTE: 2B119.a. does not control balancing machines designed or modified for dental or other medical equipment.

b. Indicator heads designed or modified for use with machines specified in 2B119.a.

NOTE: Indicator heads are sometimes known as balancing instrumentation.

**2B120 Motion simulators or rate tables (equipment capable of simulating motion), having all of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: MT, AT

Control(s)	Country chart
MT applies to entire entry .....	MT column 1
AT applies to entire entry .....	AT column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: (1) Rate tables not controlled by 2B120 and providing the characteristics of a positioning table are to be evaluated according to 2B121. (2) Equipment that has the characteristics specified in 2B121, which also meets the characteristics of 2B120 will be treated as equipment specified in 2B120. (3) See also 2B008, 2B121, 7B101 and 7B994.

Related Definitions: N/A

Items:

a. Two axes or more;  
b. Slip rigs capable of transmitting electrical power and/or signal information; and  
c. Having any of the following characteristics:

c.1. For any single axis having all of the following:

c.1.a. Capable of rates of rotation of 400 degrees/s or more, or 30 degrees/s or less, and

c.1.b. A rate resolution equal to or less than 6 degrees/s and an accuracy equal to or less than 0.6 degrees/s; or

c.2. Having a worst-case rate stability equal to or better (less) than plus or minus 0.05% averaged over 10 degrees or more; or

c.3. A positioning accuracy equal to or better than 5 arc-second.

NOTE: 2B120 does not control rotary tables designed or modified for machine tools or for medical equipment. For controls on machine tool rotary tables see 2B008.

**2B121 Positioning tables (equipment capable of precise rotary position in any axis), other than those controlled in 2B120, having all the following characteristics (See List of Items Controlled).**

LICENSE REQUIREMENTS  
Reason for Control: MT, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

*License Exceptions*

LVS: N/A  
GBS: N/A  
CIV: N/A

*List of Items Controlled*

Unit: \$ value

*Related Controls:* (1) Equipment that has the characteristics specified in 2B121, which also meets the characteristics of 2B120 will be treated as equipment specified in 2B120. (2) See also 2B008, 2B120, 7B101 and 7B994.

*Related Definitions:* N/A

*Items:*

- a. Two axes or more; *and*
- b. A positioning accuracy equal to or better than 5 arc-second.

NOTE: 2B121 does not control rotary tables designed or modified for machine tools or for medical equipment. For controls on machine tool rotary tables see 2B008.

**2B122 Centrifuges capable of imparting accelerations above 100 g and having slip rings capable of transmitting electrical power and signal information.**

LICENSE REQUIREMENTS  
Reason for Control: MT, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* See also 7B101.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**2B201 Machine tools, other than those controlled by 2B001, for removing or cutting metals, ceramics or “composites”, which, according to the manufacturer’s technical specifications, can be equipped with electronic devices for simultaneous “contouring control” in two or more axes.**

LICENSE REQUIREMENTS

Reason for Control: NP, AT

Control(s)	Country Chart
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number; parts and accessories in \$ value

*Related Controls:* (1) See ECCNs 2D002 and 2D202 for “software” for items controlled by this entry. “Numerical control” units are controlled by their associated “software”. (2) See ECCNs 2E001 (“development”), 2E002 (“production”), and 2E201 (“use”) for technology for items controlled under this entry. (3) Also see ECCNs 2B001, 2B290, and 2B991.

*Related Definitions:* N/A

*Items:*

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

a.1. Positioning accuracies with “all compensations available” equal to or less (better) than 6 µm along any linear axis (overall positioning); *or*

a.2. Two or more contouring rotary axes.  
NOTE: 2B201.a does not control milling machines having the following characteristics:

a. X-axis travel greater than 2 m; *and*

b. Overall positioning accuracy on the x-axis more (worse) than 30 µm.

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

b.1. Positioning accuracies with “all compensations available” equal to or less (better) than 4 µm along any linear axis (overall positioning); *or*

b.2. Two or more contouring rotary axes.  
NOTE: 2B201.b does not control the following grinding machines:

a. Cylindrical external, internal, and external-internal grinding machines having all of the following characteristics:

1. Limited to cylindrical grinding;

2. A maximum workpiece outside diameter or length of 150 mm;

3. Not more than two axes that can be coordinated simultaneously for “contouring control”; *and*

4. No contouring c-axis.

b. Jig grinders with axes limited to x, y, c and a where c axis is used to maintain the grinding wheel normal to the work surface, and the a axis is configured to grind barrel cams;

c. Tool or cutter grinding machines with “software” specially designed for the production of tools or cutters; *or*

d. Crankshaft or camshaft grinding machines.

**2B204 “Isostatic presses”, other than those controlled by 2B004 or 2B104, and related equipment, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number

*Related Controls:* (1) See ECCN 2D201 for “software” for items controlled under this entry. (2) See ECCNs 2E001 (“development”), 2E002 (“production”), and 2E201 (“use”) for technology for items controlled under this entry. (3) Also see ECCNs 2B004 and 2B104.

*Related Definitions:* The inside chamber dimension is that of the chamber in which both the working temperature and working pressure are achieved and does not include fixtures. That dimension will be the smaller of either the inside diameter of the pressure chamber or the inside diameter of the insulated chamber, depending on which of the two chambers is located inside the other.

*Items:*

- a. “Isostatic presses” having both of the following characteristics:
  - a.1. Capable of achieving a maximum working pressure of 69 MPa or greater; and
  - a.2. A chamber cavity with an inside diameter in excess of 152 mm;
- b. Dies, molds and controls, specially designed for “isostatic presses” controlled by 2B204.a.

**2B206 Dimensional inspection machines, instruments or systems, other than those described in 2B006, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number; parts and accessories in \$ value

*Related Controls:* (1) See ECCNs 2D002 and 2D201 for “software” for items controlled

under this entry. (2) See ECCNs 2E001 (“development”), 2E002 (“production”), and 2E201 (“use”) for technology for items controlled under this entry. (3) Also see ECCNs 2B006 and 2B996.

*Related Definitions:* N/A

*ECCN Controls:* (1) Machine tools that can be used as measuring machines are controlled by this entry if they meet or exceed the criteria specified for the machine tool function or the measuring machine function. (2) A machine described in this entry is controlled if it exceeds the control threshold anywhere within its operating range.

*Items:*

- a. Computer controlled or numerically controlled dimensional inspection machines having both of the following characteristics:
  - a.1. Two or more axes; and
  - a.2. A one-dimensional length “measurement uncertainty” equal to or less (better) than  $(1.25 + L/1000) \mu\text{m}$  tested with a probe of an “accuracy” of less (better) than  $0.2 \mu\text{m}$  (L is the measured length in millimeters) (Ref.: VDI/VDE 2617 Parts 1 and 2);
- b. Systems for simultaneously linear-angular inspection of hemishells, having both of the following characteristics:
  - b.1. “Measurement uncertainty” along any linear axis equal to or less (better) than 3.5  $\mu\text{m}$  per 5 mm; and
  - b.2. “Angular position deviation” equal to or less than  $0.02^\circ$ .

*Technical Notes:* (1) The probe used in determining the measurement uncertainty of a dimensional inspection system shall be described in VDI/VDE 2617 parts 2, 3 and 4. (2) All parameters of measurement values in this entry represent plus/minus, i.e., not total band.

**2B207 “Robots”, “end-effectors” and control units, other than those controlled by 2B007, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) See ECCN 2D201 for “software” for items controlled under this entry. (2) See ECCNs 2E001 (“development”), 2E002 (“production”), and 2E201 (“use”) for technology for items controlled

under this entry. (3) *Also see* ECCNs 2B007, 2B225, and 2B997.

*Related Definitions:* N/A

*ECCN Controls:* This entry does not control "robots" specially designed for non-nuclear industrial applications, such as automobile paint-spraying booths.

*Items:*

a. "Robots" or "end-effectors" specially designed to comply with national safety standards applicable to handling high explosives (for example, meeting electrical code ratings for high explosives);

b. Control units specially designed for any of the "robots" or "end-effectors" controlled by 2B207.a.

**2B209 Flow forming machines, spin forming machines capable of flow forming functions, other than those controlled by 2B009 or 2B109, and mandrels, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value

*Related Controls:* (1) *See* ECCN 2D201 for "software" for items controlled under this entry. (2) *See* ECCNs 2E001 ("development"), 2E002 ("production"), and 2E201 ("use") for technology for items controlled under this entry. (3) *Also see* ECCNs 2B009 and 2B109.

*Related Definitions:* N/A

*Items:*

a. Machines having both of the following characteristics:

a.1. Three or more rollers (active or guiding); *and*

a.2. According to the manufacturer's technical specifications, can be equipped with "numerical control" units or a computer control;

NOTE: 2B209.a includes machines that have only a single roller designed to deform metal, plus two auxiliary rollers that support the mandrel, but do not participate directly in the deformation process.

b. Rotor-forming mandrels designed to form cylindrical rotors of inside diameter between 75 mm and 400 mm.

**2B225 Remote manipulators that can be used to provide remote actions in radiochemical separation operations or**

**hot cells, having either of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) *See* ECCNs 2E001 ("development"), 2E002 ("production"), and 2E201 ("use") for technology for items controlled under this entry. (2) *Also see* ECCNs 2B007 and 2B207. (3) Remote manipulators specially designed or prepared for use in fuel reprocessing or for use in a reactor are subject to the export licensing authority of the Nuclear Regulatory Commission (*see* 10 CFR part 110).

*Related Definitions:* N/A

*Items:*

a. A capability of penetrating 0.6 m or more of hot cell wall (through-the-wall operation); *or*

b. A capability of bridging over the top of a hot cell wall with a thickness of 0.6 m or more (over-the-wall operation).

*Technical Note:* Remote manipulators provide translation of human operator actions to a remote operating arm and terminal fixture. They may be of "master/slave" type or operated by joystick or keypad.

**2B226 Controlled atmosphere (vacuum or inert gas) induction furnaces, and power supplies therefor, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) *See* ECCNs 2E001 ("development"), 2E002 ("production"), and 2E201 ("use") for technology for items controlled under this entry. (2) *Also see* ECCN 2B227 and Category 3B.

*Related Definitions:* N/A

*ECCN Controls:* 2B226.a does not control furnaces designed for the processing of semiconductor wafers.

*Items:*

- a. Furnaces having all of the following characteristics:
  - a.1. Capable of operation above 1,123 K (850 °C);
  - a.2. Induction coils 600 mm or less in diameter; *and*
  - a.3. Designed for power inputs of 5 kW or more;
- b. Power supplies, with a specified power output of 5 kW or more, specially designed for furnaces controlled by 2B226.a.

**2B227 Vacuum or other controlled atmosphere metallurgical melting and casting furnaces and related equipment, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) See ECCN 2D201 for "software" for items controlled under this entry. (2) See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E201 ("use") for technology for items controlled under this entry. (2) Also see ECCN 2B226.

*Related Definitions:* N/A

*Items:*

- a. Arc remelt and casting furnaces having both of the following characteristics:
  - a.1. Consumable electrode capabilities between 1,000 cm<sup>3</sup> and 20,000 cm<sup>3</sup>; *and*
  - a.2. Capable of operating with melting temperatures above 1,973 K (1,700 °C);
- b. Electron beam melting furnaces and plasma atomization and melting furnaces, having both of the following characteristics:
  - b.1. A power of 50 kW or greater; *and*
  - b.2. Capable of operating with melting temperatures above 1,473 K (1,200 °C);
- c. Computer control and monitoring systems specially configured for any of the furnaces controlled by 2B227.a or .b.

**2B228 Rotor fabrication and assembly equipment, rotor straightening equipment, bellows-forming mandrels and dies, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E201 ("use") for technology for items controlled under this entry.

*Related Definitions:* N/A

*Items:*

- a. Rotor assembly equipment for assembly of gas centrifuge rotor tube sections, baffles, and end-caps;
  - NOTE: 2B228.a includes precision mandrels, clamps, and shrink fit machines.

- b. Rotor straightening equipment for alignment of gas centrifuge rotor tube sections to a common axis;

*Technical Note:* The rotor straightening equipment in 2B228.b normally consists of precision measuring probes linked to a computer that subsequently controls the action of, for example, pneumatic rams used for aligning the rotor tube sections.

- c. Bellows-forming mandrels and dies for producing single-convolution bellows.

*Technical Note:* In 2B228.c, the bellows have all of the following characteristics:

1. Inside diameter between 75 mm and 400 mm;
2. Length equal to or greater than 12.7 mm;
3. Single convolution depth greater than 2 mm; *and*
4. Made of high-strength aluminum alloys, maraging steel or high strength "fibrous or filamentary materials".

**2B229 Centrifugal multiplane balancing machines, fixed or portable, horizontal or vertical, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) See ECCN 2D201 for "software" for items controlled under this entry. (2) See ECCNs 2E001 ("development"), 2E002 ("production"), and 2E201

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(“use”) for technology for items controlled under this entry.

*Related Definitions:* N/A

*Items:*

a. Centrifugal balancing machines designed for balancing flexible rotors having a length of 600 mm or more and having all of the following characteristics:

a.1. Swing or journal diameter greater than 75 mm;

a.2. Mass capability of from 0.9 to 23 kg; *and*

a.3. Capable of balancing speed of revolution greater than 5,000 r.p.m.;

b. Centrifugal balancing machines designed for balancing hollow cylindrical rotor components and having all of the following characteristics:

b.1. Journal diameter greater than 75 mm;

b.2. Mass capability of from 0.9 to 23 kg;

b.3. Capable of balancing to a residual imbalance equal to or less than 0.01 kg × mm/kg per plane; *and*

b.4. Belt drive type.

**2B230 “Pressure transducers” capable of measuring absolute pressures at any point in the range 0 to 13 kPa and having both of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See ECCNs 2E001 (“development”), 2E002 (“production”), and 2E201 (“use”) for technology for items controlled under this entry.

*Related Definitions:* (1) Pressure transducers are devices that convert pressure measurements into an electrical signal. (2) For purposes of this entry, “accuracy” includes non-linearity, hysteresis and repeatability at ambient temperature.

*Items:*

a. Pressure sensing elements made of or protected by aluminum, aluminum alloy, nickel or nickel alloy with more than 60% nickel by weight; *and*

b. Having either of the following characteristics:

b.1. A full scale of less than 13 kPa and an “accuracy” of better than ± 1% of full-scale; *or*

b.2. A full scale of 13 kPa or greater and an “accuracy” of better than ± 130 Pa.

**2B231 Vacuum pumps having all of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) See ECCNs 2E001 (“development”), 2E002 (“production”), and 2E201 (“use”) for technology for items controlled under this entry. (2) Vacuum pumps specially designed or prepared for the separation of uranium isotopes are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* (1) The pumping speed is determined at the measurement point with nitrogen gas or air. (2) The ultimate vacuum is determined at the input of the pump with the input of the pump blocked off.

*Items:*

a. Input throat size equal to or greater than 380 mm;

b. Pumping speed equal to or greater than 15 m<sup>3</sup>/s; *and*

c. Capable of producing an ultimate vacuum better than 13.3 mPa.

**2B232 Multistage light gas guns or other high-velocity gun systems (coil, electromagnetic, and electrothermal types, and other advanced systems) capable of accelerating projectiles to 2 km/s or greater.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See ECCNs 2E001 (“development”), 2E002 (“production”), and 2E201 (“use”) for technology for items controlled under this entry.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**2B290 “Numerically controlled” machine tools not controlled by 2B001 or 2B201.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value

*Related Controls:* (1) See ECCNs 2D002 and 2D290 for “software” for items controlled under this entry. (2) See ECCNs 2E001 (“development”), 2E002 (“production”), and 2E290 (“use”) for technology for items controlled under this entry. (3) Also see ECCNs 2B001, 2B201, and 2B991.

*Related Definition:* N/A

*Items:* a. Turning machines or combination turning/milling machines that are capable of machining diameters greater than 2.5 meters.

b. Reserved.

**2B350 Chemical manufacturing facilities and equipment, except valves controlled by 2A226 or 2A292, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* CB, AT

<i>Control(s)</i>	<i>Country Chart</i>
CB applies to entire entry .....	CB Column 3
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number.

*Related Controls:* The controls in this entry do not apply to equipment that is: (a) Specially designed for use in civil applications (e.g., food processing, pulp and paper processing, or water purification); AND (b) inappropriate, by the nature of its design, for use in storing, processing, producing or conducting and controlling the flow of chemical weapons precursors controlled by 1C350.

*Related Definitions:* For purposes of this entry the term “chemical warfare agents” are those agents subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (See 22 CFR part 121)

*Items:*

a. Reaction vessels or reactors, with or without agitators, with total internal (geometric) volume greater than 0.1 m<sup>3</sup> (100 liters) and less than 20 m<sup>3</sup> (20,000 liters), where all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:

- a.1. Alloys with more than 25% nickel and 20% chromium by weight;
- a.2. Fluoropolymers;
- a.3. Glass (including vitrified or enameled coating or glass lining);
- a.4. Nickel or alloys with more than 40% nickel by weight;
- a.5. Tantalum or tantalum alloys;
- a.6. Titanium or titanium alloys; *or*
- a.7. Zirconium or zirconium alloys.

b. Agitators for use in reaction vessels or reactors described in 2B350.a, and impellers, blades or shafts designed for such agitators, where all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:

- b.1. Alloys with more than 25% nickel and 20% chromium by weight;
- b.2. Fluoropolymers;
- b.3. Glass (including vitrified or enameled coatings or glass lining);
- b.4. Nickel or alloys with more than 40% nickel by weight;
- b.5. Tantalum or tantalum alloys;
- b.6. Titanium or titanium alloys; *or*
- b.7. Zirconium or zirconium alloys.

c. Storage tanks, containers or receivers with a total internal (geometric) volume greater than 0.1 m<sup>3</sup> (100 liters) where all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:

- c.1. Alloys with more than 25% nickel and 20% chromium by weight;
- c.2. Fluoropolymers;
- c.3. Glass (including vitrified or enameled coatings or glass lining);

c.4. Nickel or alloys with more than 40% nickel by weight;

- c.5. Tantalum or tantalum alloys;
- c.6. Titanium or titanium alloys; *or*
- c.7. Zirconium or zirconium alloys.

d. Heat exchangers or condensers with a heat transfer surface area of less than 20 m<sup>2</sup>, but greater than 0.15 m<sup>2</sup>, and tubes, plates, coils or blocks (cores) designed for such heat exchangers or condensers, where all surfaces that come in direct contact with the chemical(s) being processed are made from any of the following materials:

- d.1. Alloys with more than 25% nickel and 20% chromium by weight;
- d.2. Fluoropolymers;
- d.3. Glass (including vitrified or enameled coatings or glass lining);
- d.4. Graphite or carbon-graphite;

- d.5. Nickel or alloys with more than 40% nickel by weight;
- d.6. Silicon carbide;
- d.7. Tantalum or tantalum alloys;
- d.8. Titanium or titanium alloys;
- d.9. Titanium carbide; *or*
- d.10. Zirconium or zirconium alloys.
- e. Distillation or absorption columns of internal diameter greater than 0.1 m, and liquid distributors, vapor distributors or liquid collectors designed for such distillation or absorption columns, where all surfaces that come in direct contact with the chemical(s) being processed are made from any of the following materials:
  - e.1. Alloys with more than 25% nickel and 20% chromium by weight;
  - e.2. Fluoropolymers;
  - e.3. Glass (including vitrified or enameled coatings or glass lining);
  - e.4. Graphite or carbon-graphite;
  - e.5. Nickel or alloys with more than 40% nickel by weight;
  - e.6. Tantalum or tantalum alloys;
  - e.7. Titanium or titanium alloys; *or*
  - e.8. Zirconium or zirconium alloys.
- f. Remotely operated filling equipment in which all surfaces that come in direct contact with the chemical(s) being processed are made from any of the following materials:
  - f.1. Alloys with more than 25% nickel and 20% chromium by weight; *or*
  - f.2. Nickel or alloys with more than 40% nickel by weight.
- g. Valves with nominal sizes greater than 1.0 cm (3/8in.), and casings (valve bodies) or preformed casing liners designed for such valves, in which all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:
  - g.1. Nickel or alloys with more than 40% nickel by weight;
  - g.2. Alloys with more than 25% nickel and 20% chromium by weight;
  - g.3. Fluoropolymers;
  - g.4. Glass or glass lined (including vitrified or enameled coatings);
  - g.5. Tantalum or tantalum alloys;
  - g.6. Titanium or titanium alloys; *or*
  - g.7. Zirconium or zirconium alloys.
- h. Multi-walled piping incorporating a leak detection port, in which all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:
  - h.1. Alloys with more than 25% nickel and 20% chromium by weight;
  - h.2. Fluoropolymers;
  - h.3. Glass (including vitrified or enameled coatings or glass lining);
  - h.4. Graphite or carbon-graphite;
  - h.5. Nickel or alloys with more than 40% nickel by weight;
  - h.6. Tantalum or tantalum alloys;
  - h.7. Titanium or titanium alloys; *or*
  - h.8. Zirconium or zirconium alloys.

- i. Multiple-seal, canned drive, magnetic drive, bellows or diaphragm pumps, with manufacturer's specified maximum flow-rate greater than 0.6 m<sup>3</sup>/hour, or vacuum pumps with manufacturer's specified maximum flow-rate greater than 5 m<sup>3</sup>/hour (under standard temperature (273 K (0 °C)) and pressure (101.3 kPa) conditions), and casings (pump bodies), preformed casing liners, impellers, rotors or jet pump nozzles designed for such pumps, in which all surfaces that come into direct contact with the chemical(s) being processed are made from any of the of the following materials:
  - i.1. Alloys with more than 25% nickel and 20% chromium by weight;
  - i.2. Ceramics;
  - i.3. Ferrosilicon;
  - i.4. Fluoropolymers;
  - i.5. Glass (including vitrified or enameled coatings or glass lining);
  - i.6. Graphite or carbon-graphite;
  - i.7. Nickel or alloys with more than 40% nickel by weight;
  - i.8. Tantalum or tantalum alloys;
  - i.9. Titanium or titanium alloys, *or*
  - i.10. Zirconium or zirconium alloys.
- j. Incinerators designed to destroy chemical warfare agents, chemical weapons precursors controlled by 1C350, or chemical munitions having specially designed waste supply systems, special handling facilities and an average combustion chamber temperature greater than 1000 °C in which all surfaces in the waste supply system that come into direct contact with the waste products are made from or lined with any of the following materials:
  - j.1. Alloys with more than 25% nickel and 20% chromium by weight;
  - j.2. Ceramics; *or*
  - j.3. Nickel or alloys with more than 40% nickel by weight.

TECHNICAL NOTE: Carbon-graphite is a composition consisting primarily of graphite and amorphous carbon, in which the graphite is 8 percent or more by weight of the composition.

**2B351 Toxic gas monitoring systems that operate on-line and dedicated detectors therefor.**

LICENSE REQUIREMENTS

Reason for Control: CB, AT.

<i>Control(s)</i>	<i>Country Chart</i>
CB applies to entire entry .....	CB Column 3
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number.  
*Related Controls:* N/A.

*Related Definitions:* For the purposes of this entry, the term "continuous operation" describes the capability of the equipment to operate on line without human intervention. The intent of this entry is to control toxic gas monitoring systems capable of collection and detection of samples in environments such as chemical plants, rather than those used for batch-mode operation in laboratories.

*Items:*

a. Designed for continuous operation and usable for the detection of chemical warfare agents or chemicals controlled by 1C350 at concentrations of less than 0.3mg/m<sup>3</sup> (see technical note below); *or*

b. Designed for the detection of cholinesterase-inhibiting activity.

TECHNICAL NOTE: Toxic Gas Monitoring Systems, controlled under 2B351.a., include those with detection capability for chemicals containing phosphorus, sulfur, fluorine or chlorine, other than those specified in 1C350.

**2B352 Equipment capable of use in handling biological materials, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* CB, AT

<i>Control(s)</i>	<i>Country Chart</i>
CB applies to entire entry .....	CB Column 3
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number

*Related Controls:* N/A

*Related Definitions:* For purposes of this entry, isolators include flexible isolators, dry boxes, anaerobic chambers and glove boxes.

*Items:*

a. Complete containment facilities at P3 or P4 containment level.

TECHNICAL NOTE: P3 or P4 (BL3, BL4, L3, L4) containment levels are as specified in the WHO Laboratory Biosafety Manual (Geneva, 1983).

b. Fermenters capable of cultivation of pathogenic microorganisms, viruses, or for toxin production, without the propagation of aerosols, having a capacity equal to or greater than 20 liters.

TECHNICAL NOTE: Fermenters include bioreactors, chemostats, and continuous-flow systems.

c. Centrifugal separators capable of the continuous separation of pathogenic microorganisms, without the propagation of aerosols, and having all of the following characteristics:

c.1. One or more sealing joints within the steam containment area;

c.2. A flow rate greater than 100 liters per hour;

c.3. Components of polished stainless steel or titanium; *and*

c.4. Capable of in-situ steam sterilization in a closed state.

TECHNICAL NOTE: Centrifugal separators include decanters.

d. Cross (tangential) flow filtration equipment and accessories, as follows:

d.1. Cross (tangential) flow filtration equipment capable of separation of pathogenic microorganisms, viruses, toxins or cell cultures, without the propagation of aerosols, having all of the following characteristics:

d.1.a. A total filtration area equal to or greater than 1 square meter (1 m<sup>2</sup>); *and*

d.1.b. Capable of being sterilized or disinfected in-situ.

N.B.: 2B352.d.1 does not control reverse osmosis equipment, as specified by the manufacturer.

d.2. Cross (tangential) flow filtration components (*e.g.*, modules, elements, cassettes, cartridges, units or plates) with filtration area equal to or greater than 0.2 square meters (0.2 m<sup>2</sup>) for each component and designed for use in cross (tangential) flow filtration equipment controlled by 2B352.d.1.

TECHNICAL NOTE: In this ECCN, "sterilized" denotes the elimination of all viable microbes from the equipment through the use of either physical (*e.g.*, steam) or chemical agents. "Disinfected" denotes the destruction of potential microbial infectivity in the equipment through the use of chemical agents with a germicidal effect. "Disinfection" and "sterilization" are distinct from "sanitization", the latter referring to cleaning procedures designed to lower the microbial content of equipment without necessarily achieving elimination of all microbial infectivity or viability.

e. Steam sterilizable freeze-drying equipment with a condenser capacity of 10 kgs of ice or greater in 24 hours, but less than 1,000 kgs of ice in 24 hours.

f. Protective and containment equipment, as follows:

f.1. Protective full or half suits, or hoods dependant upon a tethered external air supply and operating under positive pressure;

TECHNICAL NOTE: This entry does not control suits designed to be worn with self-contained breathing apparatus.

f.2. Class III biological safety cabinets or isolators with similar performance standards, *e.g.*, flexible isolators, dry boxes, anaerobic chambers, glove boxes or laminar flow hoods (closed with vertical flow).

g. Chambers designed for aerosol challenge testing with microorganisms, viruses, or toxins and having a capacity of 1 m<sup>3</sup> or greater.

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**2B991 Numerical control units for machine tools and “numerically controlled” machine tools, n.e.s.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

*Control(s)* *Country Chart*  
AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number  
*Related Controls:* Also see ECCNs 2B001, 2B201, and 2B290.

*Related Definitions:* N/A

*Items:* a. “Numerical control” units for machine tools:

a.1. Having four interpolating axes that can be coordinated simultaneously for “contouring control”; or

a.2. Having two or more axes that can be coordinated simultaneously for “contouring control” and a minimum programmable increment better (less) than 0.001 mm;

a.3. “Numerical control” units for machine tools having two, three or four interpolating axes that can be coordinated simultaneously for “contouring control”, and capable of receiving directly (on-line) and processing computer-aided-design (CAD) data for internal preparation of machine instructions; or

b. “Motion control boards” specially designed for machine tools and having any of the following characteristics:

b.1. Interpolation in more than four axes;  
b.2. Capable of “real time processing” of data to modify tool path, feed rate and spindle data, during the machining operation, by any of the following:

b.2.a. Automatic calculation and modification of part program data for machining in two or more axes by means of measuring cycles and access to source data; or

b.2.b. “Adaptive control” with more than one physical variable measured and processed by means of a computing model (strategy) to change one or more machining instructions to optimize the process.

b.3. Capable of receiving and processing CAD data for internal preparation of machine instructions; or

c. “Numerically controlled” machine tools that, according to the manufacturer’s technical specifications, can be equipped with electronic devices for simultaneous “contouring control” in two or more axes and that have both of the following characteristics:

c.1. Two or more axes that can be coordinated simultaneously for contouring control; and

c.2. “Positioning accuracies”, with all compensations available:

c.2.a. Better than 0.020 mm along any linear axis (overall positioning) for grinding machines;

c.2.b. Better than 0.020 mm along any linear axis (overall positioning) for milling machines; or

c.2.c. Better than 0.020 mm along any linear axis (overall positioning) for turning machines; or

d. Machine tools, as follows, for removing or cutting metals, ceramics or composites, that, according to the manufacturer’s technical specifications, can be equipped with electronic devices for simultaneous “contouring control” in two or more axes:

d.1. Machine tools for turning, grinding, milling or any combination thereof, having two or more axes that can be coordinated simultaneously for “contouring control” and having any of the following characteristics:

d.1.a. One or more contouring “tilting spindles”;

NOTE: 2B991.d.1.a. applies to machine tools for grinding or milling only.

d.1.b. “Camming” (axial displacement) in one revolution of the spindle less (better) than 0.0006 mm total indicator reading (TIR);

NOTE: 2B991.d.1.b. applies to machine tools for turning only.

d.1.c. “Run out” (out-of-true running) in one revolution of the spindle less (better) than 0.0006 mm total indicator reading (TIR);

d.1.d. The “positioning accuracies”, with all compensations available, are less (better) than: 0.001° on any rotary axis;

d.2. Electrical discharge machines (EDM) of the wire feed type that have five or more axes that can be coordinated simultaneously for “contouring control”.

**2B992 Non-“numerically controlled” machine tools for generating optical quality surfaces, and specially designed components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

*Control(s)* *Country Chart*  
AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* a. Turning machines using a single point cutting tool and having all of the following characteristics:

a.1. Slide positioning accuracy less (better) than 0.0005 mm per 300 mm of travel;

a.2. Bidirectional slide positioning repeatability less (better) than 0.00025 mm per 300 mm of travel;

a.3. Spindle "run out" and "camming" less (better) than 0.0004 mm total indicator reading (TIR);

a.4. Angular deviation of the slide movement (yaw, pitch and roll) less (better) than 2 seconds of arc, TIR, over full travel; *and*

a.5. Slide perpendicularity less (better) than 0.001 mm per 300 mm of travel;

TECHNICAL NOTE: The bidirectional slide positioning repeatability (R) of an axis is the maximum value of the repeatability of positioning at any position along or around the axis determined using the procedure and under the conditions specified in part 2.11 of ISO 230/2: 1988.

b. Fly cutting machines having all of the following characteristics:

b.1. Spindle "run out" and "camming" less (better) than 0.0004 mm TIR; *and*

b.2. Angular deviation of slide movement (yaw, pitch and roll) less (better) than 2 seconds of arc, TIR, over full travel.

**2B993 Gearmaking and/or finishing machinery not controlled by 2B003 capable of producing gears to a quality level of better than AGMA 11.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

*Control(s)* *Country Chart*

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**2B996 Dimensional inspection or measuring systems or equipment not controlled by 2B006.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

*Control(s)* *Country Chart*

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* a. Manual dimensional inspection machines, having both of the following characteristics:

a.1. Two or more axes; *and*

a.2. A measurement uncertainty equal to or less (better) than  $(3 + L/300)$  micrometer in any axes (L measured length in mm).

**2B997 "Robots" not controlled by 2B007 or 2B207 that are capable of employing feedback information in real-time processing from one or more sensors to generate or modify "programs" or to generate or modify numerical program data.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

*Control(s)* *Country Chart*

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**2B998 Assemblies, units or inserts specially designed for machine tools controlled by 2B991, or for equipment controlled by 2B993, 2B996 or 2B997.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

*Control(s)* *Country Chart*

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* This entry does not control measuring interferometer systems, without closed or open loop feedback, containing a laser to measure slide movement errors of machine-tools, dimensional inspection machines or similar equipment.

*Related Definition:* N/A

*Items:* a. Spindle assemblies, consisting of spindles and bearings as a minimal assembly, with radial ("run out") or axial ("camming") axis motion in one revolution of the spindle less (better) than 0.0006 mm total indicator reading (TIR);

b. Single point diamond cutting tool inserts, having all of the following characteristics:

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- b.1. Flawless and chip-free cutting edge when magnified 400 times in any direction;
- b.2. Cutting radius from 0.1 to 5 mm inclusive; *and*
- b.3. Cutting radius out-of-roundness less (better) than 0.002 mm TIR.
- c. Specially designed printed circuit boards with mounted components capable of upgrading, according to the manufacturer's specifications, "numerical control" units, machine tools or feedback devices to or above the levels specified in ECCNs 2B991, 2B993, 2B996, 2B997, or 2B998.

**2B999 Specific Processing Equipment, n.e.s., as Follows (See List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* AT.

*Control(s):*

*Country Chart.*

AT applies to entire entry. A license is required for items controlled by this entry to North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine AT licensing requirements for this entry. See §742.19 of the EAR for additional information.

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* See also 0B001, 0B002, 0B004, 1B233, 2A293, 2B001.f, 2B004, 2B009, 2B104, 1B109, 2B204, 2B209, 2B228, 2B229, 2B231, 2B350.

*Related Definitions:* N/A.

*Items:*

- a. Isostatic presses, n.e.s.;
- b. Bellows manufacturing equipment, including hydraulic forming equipment and bellows forming dies;
- c. Laser welding machines;
- d. MIG welders;
- e. E-beam welders;
- f. Monel equipment, including valves, piping, tanks and vessels;
- g. 304 and 316 stainless steel valves, piping, tanks and vessels;
- h. Mining and drilling equipment, as follows:
  - h.1. Large boring equipment capable of drilling holes greater than two feet in diameter;
  - h.2. Large earth-moving equipment used in the mining industry;
  - i. Electroplating equipment designed for coating parts with nickel or aluminum;
  - j. Pumps designed for industrial service and for use with an electrical motor of 5 HP or greater;
  - k. Vacuum valves, piping, flanges, gaskets and related equipment specially designed for use in high-vacuum service, n.e.s.;

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- l. Spin forming and flow forming machines, n.e.s.;
- m. Centrifugal multiplane balancing machines, n.e.s.;
- n. Austenitic stainless steel plate, valves, piping, tanks and vessels.

C. MATERIALS [RESERVED]

D. SOFTWARE

**2D001 "Software", other than that controlled by 2D002, specially designed or modified for the "development", "production" or "use" of equipment controlled by 2A001 or 2B001 to 2B009.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, NP, AT

*Control(s)*

*Country Chart*

NS applies to entire entry ..... NS Column 1

MT applies to "software" for equipment controlled by 2B004 and 2B009 for MT reasons.

NP applies to specially designed or modified "software" for equipment controlled by 2B001 for NP reasons, and to specially designed "software" for equipment controlled by 2B004, 2B006, 2B007, or 2B009 for NP reasons.

AT applies to entire entry ..... AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes, except N/A for MT

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) See ECCNs 2E001 ("development") and 2E101 ("use") for technology for "software" controlled under this entry. (2) Also see ECCNs 2D101 and 2D201.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**2D002 "Software" for Electronic Devices, Even When Residing in an Electronic Device or System, Enabling Such Devices or Systems to Function as a "Numerical Control" Unit, Capable of Coordinating Simultaneously More Than 4 Axes for "Contouring Control"**

LICENSE REQUIREMENTS

*Reason for Control:* NS, NP, AT.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
NP applies to entire entry .....	NP Column 1.
AT applies to entire entry .....	AT Column 1.

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LICENSE EXCEPTIONS

CIV: N/A  
TSR: Yes

LIST OF ITEMS CONTROLLED

Unit: \$ value.

*Related Controls:* (1) See ECCNs 2E001 (“development”) and 2E201 (“use”) for technology for “software” controlled under this entry. (2) Also see ECCN 2D202.

*Related Definitions:* N/A.

*Items:*

NOTE: 2D002 does not control “software” specially designed or modified for the operation of machine tools not controlled by Category 2.

The list of items controlled is contained in the ECCN heading.

**2D018 “Software” for the “development”, “production” or “use” of equipment controlled by 2B018.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT, UN.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
MT applies to “software” for equipment controlled by 2B018 for MT reasons.	MT Column 1.
AT applies to entire entry .....	AT Column 1.
UN applies to entire entry .....	Rwanda.

LICENSE EXCEPTIONS

CIV: N/A  
TSR: Yes, except N/A for Rwanda

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**2D101 “Software” specially designed or modified for the “use” of equipment controlled by 2B104, 2B105, 2B109, 2B116, 2B117, or 2B119 to 2B122.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, NP, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1.
NP applies to “software” specially designed for the use” of items controlled by 2B104, 2B109, or 2B116 for NP reasons.	NP Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) See ECCNs 2E001 (“development”) and 2E101 (“use”) for technology

for “software” controlled under this entry. (2) Also see ECCN 9D004.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**2D201 “Software” specially designed for the “use” of equipment controlled by 2B204, 2B206, 2B207, 2B209, 2B227 or 2B229.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

Control(s) Country Chart

NP applies to entire entry ..... NP Column 1

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) See ECCNs 2E001 (“development”) and 2E201 (“use”) for technology for “software” controlled under this entry. (2) Also see ECCNs 2D002 and 2D202.

*Related Definitions:* N/A

*ECCN Controls:* “Software” specially designed for systems controlled by 2B206.b includes software for simultaneous measurements of wall thickness and contour.

*Items:* The list of items controlled is contained in the ECCN heading.

**2D202 “Software” specially designed or modified for the “development”, “production” or “use” of equipment controlled by 2B201.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

Control(s) Country Chart

NP applies to entire entry ..... NP Column 1

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**2D290 “Software” specially designed or modified for the “development”, “production” or “use” of items controlled by 2A290, 2A291, 2A292, 2A293, or 2B290.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

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<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 2
AT applies to entire entry .....	AT Column 1
LICENSE EXCEPTIONS	
CIV: N/A	
TSR: N/A	
LIST OF ITEMS CONTROLLED	
<i>Unit:</i> \$ value	
<i>Related Controls:</i> See ECCN 2E001 (“development”) for technology for “software” controlled under this entry.	
<i>Related Definitions:</i> N/A	
<i>Items:</i> The list of items controlled is contained in the ECCN heading.	

**2D983 “Software” specially designed or modified for the “development”, “production” or “use” of equipment controlled by 2A983.**

LICENSE REQUIREMENTS  
*Reason for Control:* RS, AT

<i>Control(s)</i>	<i>Country chart</i>
RS applies to entire entry	RS Column 2
AT applies to entire entry	AT Column 1

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: N/A  
 LIST OF ITEMS CONTROLLED  
*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**2D991 “Software” specially designed for the “development”, “production”, or “use” of equipment controlled by 2B991, 2B993, or 2B996, 2B997, and 2B998.**

LICENSE REQUIREMENTS  
*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: N/A  
 LIST OF ITEMS CONTROLLED  
*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**2D992 Specific “software”, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS  
*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1
LICENSE EXCEPTIONS	
CIV: N/A	
TSR: N/A	
LIST OF ITEMS CONTROLLED	
<i>Unit:</i> \$ value	
<i>Related Controls:</i> N/A	
<i>Related Definitions:</i> N/A	
<i>Items:</i> a. “Software” to provide “adaptive control” and having both of the following characteristics:	
a.1. For “flexible manufacturing units” (FMUs) which consist at least of equipment described in b.1 and b.2 of the definition of “flexible manufacturing unit” contained in part 772 of the EAR; <i>and</i>	
a.2. Capable of generating or modifying, in “real time processing”, programs or data by using the signals obtained simultaneously by means of at least two detection techniques, such as:	
a.2.a. Machine vision (optical ranging);	
a.2.b. Infrared imaging;	
a.2.c. Acoustical imaging (acoustical ranging);	
a.2.d. Tactile measurement;	
a.2.e. Inertial positioning;	
a.2.f. Force measurement; <i>and</i>	
a.2.g. Torque measurement.	
NOTE: 2D992.a does not control “software” which only provides rescheduling of functionally identical equipment within “flexible manufacturing units” using pre-stored part programs and a pre-stored strategy for the distribution of the part programs.	
b. Reserved.	

**2D994 “Software” specially designed for the “development” or “production” of portable electric generators controlled by 2A994.**

LICENSE REQUIREMENTS  
*Reason for Control:* AT.  
*Control(s).*  
 AT applies to entire entry. A license is required for items controlled by this entry to Cuba, Iran, Libya, and North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine licensing requirements for this entry. See part 746 of the EAR for additional information on Cuba, Iran, and Libya. See §742.19 of the EAR for additional information on North Korea.

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: N/A  
 LIST OF ITEMS CONTROLLED  
*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

E. TECHNOLOGY

**2E001 “Technology according to the General Technology Note for the “development” of equipment or “software” controlled by 2A (except 2A983, 2A991, or 2A994), 2B (except 2B991, 2B993, 2B996 2B997 or 2B998), or 2D (except 2D983, 2D991, 2D992, or 2D994).**

LICENSE REQUIREMENTS

Reason for Control: NS, MT, NP, CB, AT

Control(s)	Country chart
NS applies to “technology” for items controlled by 2A001, 2B001 to 2B009, 2D001 or 2D002.	NS Column 1
MT applies to “technology” for items controlled by 2B004, 2B009, 2B018, 2B104, 2B105, 2B109, 2B116, 2B117, 2B119 to 2B122, 2D001 or 2D101 for MT reasons.	MT Column 1
NP applies to “technology” for items controlled by 2A225, 2A226, 2B001, 2B004, 2B006, 2B007, 2B009, 2B104, 2B109, 2B116, 2B201, 2B204, 2B206, 2B207, 2B209, 2B225 to 2B232, 2D001, 2D002, 2D101, 2D201 or 2D202 for NP reasons.	NP Column 1
NP applies to “technology” for items controlled by 2A290 to 2A293, 2B290, or 2D290 for NP reasons.	NP Column 2
CB applies to “technology” for equipment controlled by 2B350 to 2B352 and for valves controlled by 2A226 or 2A292 having the characteristics of those controlled by 2B350.g.	CB Column 3
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes, except N/A for MT

LIST OF ITEMS CONTROLLED

Unit: N/A

Related Controls: See also 2E101, 2E201, and 2E301

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

**2E002 “Technology” according to the General Technology Note for the “production” of equipment controlled by 2A (except 2A983, 2A991, or 2A994) or 2B (except 2B991, 2B993, 2B996, 2B997, or 2B998).**

LICENSE REQUIREMENTS

Reason for Control: NS, MT, NP, CB, AT

Control(s)	Country chart
NS applies to “technology” for equipment controlled by 2A001, 2B001 to 2B009.	NS Column 1
MT applies to “technology” for equipment controlled by 2B004, 2B009, 2B018, 2B104, 2B105, 2B109, 2B116, 2B117, or 2B119 to 2B122 for MT reasons.	MT Column 1
NP applies to “technology” for equipment controlled by 2A225, 2A226, 2B001, 2B004, 2B006, 2B007, 2B009, 2B104, 2B109, 2B116, 2B201, 2B204, 2B206, 2B207, 2B209, 2B225 to 2B232 for NP reasons.	NP Column 1
NP applies to “technology” for equipment controlled by 2A290 to 2A293, 2B290 for NP reasons.	NP Column 2
CB applies to “technology” for equipment controlled by 2B350 to 2B352 and for valves controlled by 2A226 or 2A292 having the characteristics of those controlled by 2B350.g.	CB Column 3
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes, except N/A for MT

LIST OF ITEMS CONTROLLED

Unit: N/A

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

**2E003 Other “technology”, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes, except 2E003.a, .b, .e and .f

LIST OF ITEMS CONTROLLED

Unit: N/A

Related Controls: See 2E001, 2E002, and 2E101 for “development” and “use” technology for equipment that are designed or modified for densification of carbon-carbon composites, structural composite rocket nozzles and reentry vehicle nose tips.

Related Definitions: N/A

Items:

a. “Technology” for the “development” of interactive graphics as an integrated part in “numerical control” units for preparation or modification of part programs;

b. "Technology" for metal-working manufacturing processes, as follows:

b.1. "Technology" for the design of tools, dies or fixtures specially designed for any of the following processes:

b.1.a. "Superplastic forming";

b.1.b. "Diffusion bonding"; *or*

b.1.c. "Direct-acting hydraulic pressing";

b.2. Technical data consisting of process methods or parameters as listed below used to control:

b.2.a. "Superplastic forming" of aluminum alloys, titanium alloys or "superalloys":

b.2.a.1. Surface preparation;

b.2.a.2. Strain rate;

b.2.a.3. Temperature;

b.2.a.4. Pressure;

b.2.b. "Diffusion bonding" of "superalloys" or titanium alloys:

b.2.b.1. Surface preparation;

b.2.b.2. Temperature;

b.2.b.3. Pressure;

b.2.c. "Direct-acting hydraulic pressing" of aluminum alloys or titanium alloys:

b.2.c.1. Pressure;

b.2.c.2. Cycle time;

b.2.d. "Hot isostatic densification" of titanium alloys, aluminum alloys or "superalloys":

b.2.d.1. Temperature;

b.2.d.2. Pressure;

b.2.d.3. Cycle time;

c. "Technology" for the "development" or "production" of hydraulic stretch-forming machines and dies therefor, for the manufacture of airframe structures;

d. "Technology" for the "development" of generators of machine tool instructions (e.g., part programs) from design data residing inside "numerical control" units;

e. "Technology for the development" of integration "software" for incorporation of expert systems for advanced decision support of shop floor operations into "numerical control" units;

f. "Technology" for the application of inorganic overlay coatings or inorganic surface modification coatings (specified in column 3 of the following table) to non-electronic substrates (specified in column 2 of the following table), by processes specified in column 1 of the following table and defined in the Technical Note.

*N.B.* This table should be read to control the technology of a particular 'Coating Process' only when the 'Resultant Coating' in column 3 is in a paragraph directly across from the relevant 'Substrate' under column 2. For example, Chemical Vapor Deposition (CVD) coating process technical data are controlled for the application of 'silicides' to 'Carbon-carbon, Ceramic and Metal "matrix" "composites" substrates, but are not controlled for the application of 'silicides' to 'Cemented tungsten carbide (16), Silicon carbide (18)' substrates. In the second case, the 'Resultant Coating' is not listed in the paragraph under column 3 directly across from the paragraph under column 2 listing 'Cemented tungsten carbide (16), Silicon carbide (18)'.

CATEGORY 2E—MATERIALS PROCESSING TABLE; DEPOSITION TECHNIQUES

1. Coating process (1) <sup>1</sup>	2. Substrate	3. Resultant coating
A. Chemical Vapor Deposition (CVD)	"Superalloys" ..... Ceramics (19) and Low-expansion glasses (14).  Carbon-carbon, Ceramic, and Metal "matrix" "composites".  Cemented tungsten carbide (16), Silicon Carbide (18).  Molybdenum and Molybdenum alloys ..... Beryllium and Beryllium alloys .....	Aluminides for internal passages Silicides Carbides Dielectric layers (15) Diamond Diamond-like carbon (17) Silicides Carbides Refractory metals, Mixtures thereof (4) Dielectric layers (15) Aluminides Alloyed aluminides (2) Boron nitride Carbides Tungsten Mixtures thereof (4) Dielectric layers (15) Dielectric Players (15) Dielectric layers (15) Diamond Diamond-like carbon (17) Dielectric layers (15) Diamond Diamond-like carbon (17)
B. Thermal Evaporation Physical Vapor 1. Physical Vapor Deposition (PVD); Deposition (TE-PVD) Electron- Beam (EB-PVD).	"Superalloys" .....	Alloyed silicides Alloyed aluminides (2) McrAlX (5) Modified zirconia (12) Silicides Aluminides Mixtures thereof (4)

CATEGORY 2E—MATERIALS PROCESSING TABLE; DEPOSITION TECHNIQUES—Continued

1. Coating process (1) <sup>1</sup>	2. Substrate	3. Resultant coating		
	Ceramics (19) and Low-expansion glasses (14).	Dielectric layers (15)		
	Corrosion resistant steel (7) .....	MCrAlX (5) Modified zirconia (12) Mixtures thereof (4)		
	Carbon-carbon, Ceramic and Metal "matrix" "composites".	Silicides Carbides Refractory metals Mixtures thereof (4) Dielectric layers (15) Boron nitride		
	Cemented tungsten carbide (16), Silicon carbide (18).	Carbides Tungsten Mixtures thereof (4) Dielectric layers (15)		
	Molybdenum and Molybdenum alloys .....	Dielectric layers (15)		
	Beryllium and Beryllium alloys .....	Dielectric layers (15) Borides Beryllium		
	Sensor window materials (9) .....	Dielectric layers (15)		
	Titanium alloys (13) .....	Borides Nitrides		
	2. Ion assisted resistive heating, Physical Vapor Deposition (PVD) (Ion Plating).	Ceramics (19) and Low-expansion glasses (14).	Dielectric layers (15) Diamond-like carbon (17)	
		Carbon-carbon, Ceramic and Metal "matrix" "composites".	Dielectric layers (15)	
Cemented tungsten carbide (16), Silicon carbide.		Dielectric layers (15)		
Molybdenum and Molybdenum alloys .....		Dielectric layers (15)		
Beryllium and Beryllium alloys .....		Dielectric layers (15)		
Sensor window materials (9) .....		Dielectric layers (15) Diamond-like carbon (17)		
3. Physical Vapor Deposition (PVD): "Laser" Vaporization.		Ceramics (19) and Low-expansion glasses (14).	Silicides Dielectric layers (15) Diamond-like carbon (17)	
		Carbon-carbon, Ceramic and Metal "matrix" "composites".	Dielectric layers (15)	
		Cemented tungsten carbide (16), Silicon carbide.	Dielectric layers (15)	
		Molybdenum and Molybdenum alloys .....	Dielectric layers (15)	
	Beryllium and Beryllium alloys .....	Dielectric layers (15)		
	Sensor window materials (9) .....	Dielectric layers (15) Diamond-like carbon		
	4. Physical Vapor Deposition (PVD): Cathodic Arc Discharge.	"Superalloys" .....	Alloyed silicides Alloyed Aluminides (2) MCrAlX (5) Borides Carbides Nitrides Diamond-like carbon (17)	
		Polymers (11) and Organic "matrix" "composites".		
		C. Pack cementation (see A above for out-of-pack cementation) (10).	Carbon-carbon, Ceramic and Metal "matrix" "composites".	Silicides Carbides Mixtures thereof (4)
			Titanium alloys (13) .....	Silicides Aluminides Alloyed aluminides (2)
Refractory metals and alloys (8) .....			Silicides Oxides	
D. Plasma spraying .....			"Superalloys" .....	MCrAlX (5) Modified zirconia (12) Mixtures thereof (4) Abradable Nickel-Graphite Abradable materials containing Ni-Cr-Al Abradable Al-Si-Polyester Alloyed aluminides (2) MCrAlX (5) Modified zirconia (12) Silicides Mixtures thereof (4)
			Aluminum alloys (6) .....	

CATEGORY 2E—MATERIALS PROCESSING TABLE; DEPOSITION TECHNIQUES—Continued

1. Coating process (1) <sup>1</sup>	2. Substrate	3. Resultant coating
	Refractory metals and alloys (8), Carbides, Corrosion resistant steel (7).	Aluminides Silicides MCrAlX (5) Modified zirconia (12) Mixtures thereof (4)
	Titanium alloys (13) .....	Carbides Aluminides Silicides Alloyed aluminides (2)
E. Slurry Deposition .....	Abradable, Nickel-Graphite .....	Abradable materials containing Ni-Cr-Al Abradable Al-Si-Polyester
	Refractory metals and alloys (8) .....	Fused silicides Fused aluminides except for resistance heating elements
	Carbon-carbon, Ceramic and Metal "matrix" "composites".	Silicides Carbides Mixtures thereof (4)
F. Sputter Deposition .....	"Superalloys" .....	Alloyed silicides Alloyed aluminides (2) Noble metal modified aluminides (3) McrAlX (5) Modified zirconia (12) Platinum Mixtures thereof (4)
	Ceramics and Low-expansion glasses (14).	Silicides Platinum Mixtures thereof (4) Dielectric layers (15) Diamond-like carbon (17)
	Titanium alloys (13) .....	Borides Nitrides Oxides Silicides Aluminides Alloyed aluminides (2) Carbides
	Carbon-carbon, Ceramic and Metal "matrix" "Composites".	Silicides Carbides Refractory metals Mixtures thereof (4) Dielectric layers (15) Boron nitride
	Cemented tungsten carbide (16), Silicon carbide (18).	Carbides Tungsten Mixtures thereof (4) Dielectric layers (15) Boron nitride
	Molybdenum and Molybdenum alloys .....	Dielectric layers (15)
	Beryllium and Beryllium alloys .....	Borides Dielectric layers (15) Beryllium
	Sensor window materials (9) .....	Dielectric layers (15) Diamond-like carbon (17)
	Refractory metals and alloys (8) .....	Aluminides Silicides Oxides Carbides
G. Ion Implantation .....	High temperature bearing steels .....	Additions of Chromium, Tantalum, or Niobium (Columbium)
	Titanium alloys (13) .....	Borides Nitrides
	Beryllium and Beryllium alloys .....	Borides Carbides
	Cemented tungsten carbide (16) .....	Carbides Nitrides

<sup>1</sup> The numbers in parenthesis refer to the Notes following this Table.

## NOTES TO TABLE ON DEPOSITION TECHNIQUES

1. The term 'coating process' includes coating repair and refurbishing as well as original coating.

2. The term 'alloyed aluminide coating' includes single or multiple-step coatings in which an element or elements are deposited prior to or during application of the aluminide coating, even if these elements are deposited by another coating process. It does not, however, include the multiple use of single-step pack cementation processes to achieve alloyed aluminides.

3. The term 'noble metal modified aluminide' coating includes multiple-step coatings in which the noble metal or noble metals are laid down by some other coating process prior to application of the aluminide coating.

4. The term 'mixtures thereof' includes infiltrated material, graded compositions, co-deposits and multilayer deposits and are obtained by one or more of the coating processes specified in the Table.

5. MCrAlX refers to a coating alloy where M equals cobalt, iron, nickel or combinations thereof and X equals hafnium, yttrium, silicon, tantalum in any amount or other intentional additions over 0.01 weight percent in various proportions and combinations, except:

a. CoCrAlY coatings which contain less than 22 weight percent of chromium, less than 7 weight percent of aluminum and less than 2 weight percent of yttrium;

b. CoCrAlY coatings which contain 22 to 24 weight percent of chromium, 10 to 12 weight percent of aluminum and 0.5 to 0.7 weight percent of yttrium; *or*

c. NiCrAlY coatings which contain 21 to 23 weight percent of chromium, 10 to 12 weight percent of aluminum and 0.9 to 1.1 weight percent of yttrium.

6. The term 'aluminum alloys' refers to alloys having an ultimate tensile strength of 190 MPa or more measured at 293 K (20° C).

7. The term 'corrosion resistant steel' refers to AISI (American Iron and Steel Institute) 300 series or equivalent national standard steels.

8. 'Refractory metals and alloys' include the following metals and their alloys: niobium (columbium), molybdenum, tungsten and tantalum.

9. 'Sensor window materials', as follows: alumina, silicon, germanium, zinc sulphide, zinc selenide, gallium arsenide, diamond, gallium phosphide, sapphire and the following metal halides: sensor window materials of more than 40 mm diameter for zirconium fluoride and hafnium fluoride.

10. "Technology" for single-step pack cementation of solid airfoils is not controlled by this Category.

11. 'Polymers', as follows: polyimide, polyester, polysulfide, polycarbonates and polyurethanes.

12. 'Modified zirconia' refers to additions of other metal oxides, (e.g., calcia, magnesia, yttria, hafnia, rare earth oxides) to zirconia in order to stabilize certain crystallographic phases and phase compositions. Thermal barrier coatings made of zirconia, modified with calcia or magnesia by mixing or fusion, are not controlled.

13. 'Titanium alloys' refers only to aerospace alloys having an ultimate tensile strength of 900 MPa or more measured at 293 K (20° C).

14. 'Low-expansion glasses' refers to glasses which have a coefficient of thermal expansion of  $1 \times 10^{-7} \text{ K}^{-1}$  or less measured at 293 K (20° C).

15. 'Dielectric layers' coatings constructed of multi-layers of insulator materials in which the interference properties of a design composed of materials of various refractive indices are used to reflect, transmit or absorb various wavelength bands. Dielectric layers refers to more than four dielectric layers or dielectric/metal "composite" layers.

16. 'Cemented tungsten carbide' does not include cutting and forming tool materials consisting of tungsten carbide/(cobalt, nickel), titanium carbide/(cobalt, nickel), chromium carbide/nickel-chromium and chromium carbide/nickel.

17. "Technology" specially designed to deposit diamond-like carbon on any of the following is not controlled: magnetic disk drives and heads, equipment for the manufacture of disposables valves for faucets, acoustic diaphragms for speakers, engine parts for automobiles, cutting tools, punching-pressing dies, office automation equipment, microphones or medical devices.

18. 'Silicon carbide' does not include cutting and forming tool materials.

19. Ceramic substrates, as used in this entry, does not include ceramic materials containing 5% by weight, or greater, clay or cement content, either as separate constituents or in combination.

TECHNICAL NOTE TO TABLE ON DEPOSITION TECHNIQUES: Processes specified in Column 1 of the Table are defined as follows:

a. Chemical Vapor Deposition (CVD) is an overlay coating or surface modification coating process wherein a metal, alloy, "composite", dielectric or ceramic is deposited upon a heated substrate. Gaseous reactants are decomposed or combined in the vicinity of a substrate resulting in the deposition of the desired elemental, alloy or compound material on the substrate. Energy for this decomposition or chemical reaction process may be provided by the heat of the substrate, a glow discharge plasma, or "laser" irradiation.

NOTE 1: CVD includes the following processes: directed gas flow out-of-pack deposition, pulsating CVD, controlled nucleation thermal decomposition (CNTD), plasma enhanced or plasma assisted CVD processes.

NOTE 2: Pack denotes a substrate immersed in a powder mixture.

NOTE 3: The gaseous reactants used in the out-of-pack process are produced using the same basic reactions and parameters as the pack cementation process, except that the substrate to be coated is not in contact with the powder mixture.

b. Thermal Evaporation-Physical Vapor Deposition (TE-PVD) is an overlay coating process conducted in a vacuum with a pressure less than 0.1 Pa wherein a source of thermal energy is used to vaporize the coating material. This process results in the condensation, or deposition, of the evaporated species onto appropriately positioned substrates. The addition of gases to the vacuum chamber during the coating process to synthesize compound coatings is an ordinary modification of the process. The use of ion or electron beams, or plasma, to activate or assist the coating's deposition is also a common modification in this technique. The use of monitors to provide in-process measurement of optical characteristics and thickness of coatings can be a feature of these processes. Specific TE-PVD processes are as follows:

1. Electron Beam PVD uses an electron beam to heat and evaporate the material which forms the coating;
2. Ion Assisted Resistive Heating PVD employs electrically resistive heating sources in combination with impinging ion beam(s) to produce a controlled and uniform flux of evaporated coating species;
3. "Laser" Vaporization uses either pulsed or continuous wave "laser" beams to vaporize the material which forms the coating;
4. Cathodic Arc Deposition employs a consumable cathode of the material which forms the coating and has an arc discharge established on the surface by a momentary contact of a ground trigger. Controlled motion of arcing erodes the cathode surface creating a highly ionized plasma. The anode can be either a cone attached to the periphery of the cathode, through an insulator, or the chamber. Substrate biasing is used for non line-of-sight deposition.

NOTE: This definition does not include random cathodic arc deposition with non-biased substrates.

5. Ion Plating is a special modification of a general TE-PVD process in which a plasma or an ion source is used to ionize the species to be deposited, and a negative bias is applied to the substrate in order to facilitate the extraction of the species from the plasma. The introduction of reactive species, evaporation of solids within the process

chamber, and the use of monitors to provide in-process measurement of optical characteristics and thicknesses of coatings are ordinary modifications of the process.

c. Pack Cementation is a surface modification coating or overlay coating process wherein a substrate is immersed in a powder mixture (a pack), that consists of:

1. The metallic powders that are to be deposited (usually aluminum, chromium, silicon or combinations thereof);
  2. An activator (normally a halide salt);
- and
3. An inert powder, most frequently alumina.

NOTE: The substrate and powder mixture is contained within a retort which is heated to between 1,030 K (757 °C) to 1,375 K (1,102 °C) for sufficient time to deposit the coating.

d. Plasma Spraying is an overlay coating process wherein a gun (spray torch) which produces and controls a plasma accepts powder or wire coating materials, melts them and propels them towards a substrate, whereon an integrally bonded coating is formed. Plasma spraying constitutes either low pressure plasma spraying or high velocity plasma spraying.

NOTE 1: Low pressure means less than ambient atmospheric pressure.

NOTE 2: High velocity refers to nozzle-exit gas velocity exceeding 750 m/s calculated at 293 K (20 °C) at 0.1 MPa.

e. Slurry Deposition is a surface modification coating or overlay coating process wherein a metallic or ceramic powder with an organic binder is suspended in a liquid and is applied to a substrate by either spraying, dipping or painting, subsequent air or oven drying, and heat treatment to obtain the desired coating.

f. Sputter Deposition is an overlay coating process based on a momentum transfer phenomenon, wherein positive ions are accelerated by an electric field towards the surface of a target (coating material). The kinetic energy of the impacting ions is sufficient to cause target surface atoms to be released and deposited on an appropriately positioned substrate.

NOTE 1: The Table refers only to triode, magnetron or reactive sputter deposition which is used to increase adhesion of the coating and rate of deposition and to radio frequency (RF) augmented sputter deposition used to permit vaporization of non-metallic coating materials.

NOTE 2: Low-energy ion beams (less than 5 keV) can be used to activate the deposition.

g. Ion Implantation is a surface modification coating process in which the element to be alloyed is ionized, accelerated through a potential gradient and implanted into the surface region of the substrate. This includes

processes in which ion implantation is performed simultaneously with electron beam physical vapor deposition or sputter deposition.

ACCOMPANYING TECHNICAL INFORMATION TO  
TABLE ON DEPOSITION TECHNIQUES:

1. "Technology" for pretreatments of the substrates listed in the Table, as follows:

a. Chemical stripping and cleaning bath cycle parameters, as follows:

1. Bath composition;

a. For the removal of old or defective coatings corrosion product or foreign deposits;

b. For preparation of virgin substrates;

2. Time in bath;

3. Temperature of bath;

4. Number and sequences of wash cycles;

b. Visual and macroscopic criteria for acceptance of the cleaned part;

c. Heat treatment cycle parameters, as follows:

1. Atmosphere parameters, as follows:

a. Composition of the atmosphere;

b. Pressure of the atmosphere;

2. Temperature for heat treatment;

3. Time of heat treatment;

d. Substrate surface preparation parameters, as follows:

1. Grit blasting parameters, as follows:

a. Grit composition;

b. Grit size and shape;

c. Grit velocity;

2. Time and sequence of cleaning cycle after grit blast;

3. Surface finish parameters;

4. Application of binders to promote adhesion;

e. Masking technique parameters, as follows:

1. Material of mask;

2. Location of mask;

2. "Technology" for in situ quality assurance techniques for evaluation of the coating processes listed in the Table, as follows:

a. Atmosphere parameters, as follows:

1. Composition of the atmosphere;

2. Pressure of the atmosphere;

b. Time parameters;

c. Temperature parameters;

d. Thickness parameters;

e. Index of refraction parameters;

f. Control of composition;

3. "Technology" for post deposition treatments of the coated substrates listed in the Table, as follows:

a. Shot peening parameters, as follows:

1. Shot composition;

2. Shot size;

3. Shot velocity;

b. Post shot peening cleaning parameters;

c. Heat treatment cycle parameters, as follows:

1. Atmosphere parameters, as follows:

a. Composition of the atmosphere;

b. Pressure of the atmosphere;

2. Time-temperature cycles;

d. Post heat treatment visual and macroscopic criteria for acceptance of the coated substrates;

4. "Technology" for quality assurance techniques for the evaluation of the coated substrates listed in the Table, as follows:

a. Statistical sampling criteria;

b. Microscopic criteria for:

1. Magnification;

2. Coating thickness, uniformity;

3. Coating integrity;

4. Coating composition;

5. Coating and substrates bonding;

6. Microstructural uniformity.

c. Criteria for optical properties assessment (measured as a function of wavelength):

1. Reflectance;

2. Transmission;

3. Absorption;

4. Scatter;

5. "Technology" and parameters related to specific coating and surface modification processes listed in the Table, as follows:

a. For Chemical Vapor Deposition (CVD):

1. Coating source composition and formulation;

2. Carrier gas composition;

3. Substrate temperature;

4. Time-temperature-pressure cycles;

5. Gas control and part manipulation;

b. For Thermal Evaporation-Physical Vapor Deposition (PVD):

1. Ingot or coating material source composition;

2. Substrate temperature;

3. Reactive gas composition;

4. Ingot feed rate or material vaporization rate;

5. Time-temperature-pressure cycles;

6. Beam and part manipulation;

7. "Laser" parameters, as follows:

a. Wave length;

b. Power density;

c. Pulse length;

d. Repetition ratio;

e. Source;

c. For Pack Cementation:

1. Pack composition and formulation;

2. Carrier gas composition;

3. Time-temperature-pressure cycles;

d. For Plasma Spraying:

1. Powder composition, preparation and size distributions;

2. Feed gas composition and parameters;

3. Substrate temperature;

4. Gun power parameters;

5. Spray distance;

6. Spray angle;

7. Cover gas composition, pressure and flow rates;

8. Gun control and part manipulation;

e. For Sputter Deposition:

1. Target composition and fabrication;

2. Geometrical positioning of part and target;

3. Reactive gas composition;

- 4. Electrical bias;
- 5. Time-temperature-pressure cycles;
- 6. Triode power;
- 7. Part manipulation;
- f. For Ion Implantation:
  - 1. Beam control and part manipulation;
  - 2. Ion source design details;
  - 3. Control techniques for ion beam and deposition rate parameters;
  - 4. Time-temperature-pressure cycles.
- g. For Ion Plating:
  - 1. Beam control and part manipulation;
  - 2. Ion source design details;
  - 3. Control techniques for ion beam and deposition rate parameters;
  - 4. Time-temperature-pressure cycles;
  - 5. Coating material feed rate and vaporization rate;
  - 6. Substrate temperature;
  - 7. Substrate bias parameters.

**2E018 “Technology” for the “use” of equipment controlled by 2B018.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT, UN.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
MT applies to “technology” for equipment controlled by 2B018 for MT reasons.	MT Column 1.
AT applies to entire entry .....	AT Column 1.
UN applies to entire entry .....	Rwanda.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes, except N/A for Rwanda

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**2E101 “Technology” according to the General Technology Note for the “use” of equipment or “software” controlled by 2B004, 2B009, 2B104, 2B105, 2B109, 2B116, 2B117, 2B119 to 2B122, 2D001, 2D002 or 2D101.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, NP, AT

Control(s)	Country chart
MT applies to “technology” for items controlled by 2B004, 2B009, 2B104, 2B105, 2B109, 2B116, 2B117, 2B119 to 2B122, 2D001, or 2D101 for MT reasons.	MT Column 1
NP applies to “technology” for items controlled by 2B004, 2B009, 2B104, 2B109, 2B116, 2D001, 2D002 or 2D101 for NP reasons.	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* (1) This entry controls only “technology” for 2B009 and 2B109 for spin forming machines combining the functions of spin forming and flow forming, and flow forming machines.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**2E201 “Technology” according to the General Technology Note for the “use” of equipment or “software” controlled by 2A225, 2A226, 2B001, 2B006, 2B007.b, 2B007.c, 2B008, 2B201, 2B204, 2B206, 2B207, 2B209, 2B225 to 2B232, 2D002, 2D201 or 2D202.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, CB, AT

Control(s)	Country chart
NP applies to entire entry, except 2B008.	NP Column 1.
CB applies to “technology” for valves controlled by 2A226 that meet or exceed the technical parameters in 2B350.g.	CB Column 3.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**2E290 “Technology” according to the General Technology Note for the “use” of equipment controlled by 2A290, 2A291, 2A292, 2A293, or 2B290.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, CB, AT

Control(s)	Country chart
NP applies to entire entry .....	NP Column 2.
CB applies to “technology” for valves controlled by 2A292 that meet or exceed the technical parameters in 2B350.g.	CB Column 3.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

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*Items:* The list of items controlled is contained in the ECCN heading.

**2E301 “Technology” according to the “General Technology Note” for “use” of items controlled by 2B350, 2B351 and 2B352.**

LICENSE REQUIREMENTS  
*Reason for Control:* CB, AT

<i>Control(s)</i>	<i>Country Chart</i>
CB applies to entire entry .....	CB Column 3
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The lists of items controlled are contained in the ECCN headings.

**2E983 “Technology” specially designed or modified for the “development”, “production” or “use” of equipment controlled by 2A983, or the “development” of software controlled by 2D983.**

LICENSE REQUIREMENTS  
*Reason for Control:* RS, AT

<i>Control(s)</i>	<i>Country chart</i>
RS applies to entire entry	RS Column 2
AT applies to entire entry	AT Column 1

LICENSE EXCEPTIONS  
CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**2E991 “Technology” for the “use” of equipment controlled by 2B991, 2B993, 2B996, or 2B997.**

LICENSE REQUIREMENTS  
*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A  
*Related Controls:* N/A.  
*Related Definitions:* N/A.  
*Items:* The list of items controlled is contained in the ECCN heading.

**2E994 “Technology” for the “use” of portable electric generators controlled by 2A994.**

LICENSE REQUIREMENTS

*Reason for Control:* AT  
*Control(s):*

AT applies to entire entry. A license is required for items controlled by this entry to Cuba, Iran, Libya, and North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine licensing requirements for this entry. See part 746 of the EAR for additional information on Cuba, Iran, and Libya. See §742.19 of the EAR for additional information on North Korea.

NOTE: Exports from the U.S. and transshipments to Iran must be licensed by the Department of Treasury, Office of Foreign Assets Control. (See §742.8 and §746.7 of the EAR for additional information on this requirement.)

LICENSE EXCEPTIONS

CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A  
*Related Controls:* N/A.  
*Related Definitions:* N/A.

*Items:* The list of items controlled is contained in the ECCN heading.

**EAR99 Items subject to the EAR that are not elsewhere controlled by this CCL Category or in any other category in the CCL are designated by the number EAR99.**

*Category 3—Electronics*

A. SYSTEMS, EQUIPMENT AND COMPONENTS

NOTE 1: The control status of equipment and components described in 3A001 or 3A002, other than those described in 3A001.a.3 to 3A001.a.10 or 3A001.a.12, which are specially designed for or which have the same functional characteristics as other equipment is determined by the control status of the other equipment.

NOTE 2: The control status of integrated circuits described in 3A001.a.3 to 3A001.a.9 or 3A001.a.12 that are unalterably programmed or designed for a specific function for other equipment is determined by the control status of the other equipment.

N.B.: When the manufacturer or applicant cannot determine the control status of the other equipment, the control status of the integrated circuits is determined in 3A001.a.3 to 3A001.a.9 and 3A001.a.12. If the integrated circuit is a silicon-based “microcomputer microcircuit” or microcontroller microcircuit described in 3A001.a.3 having an operand (data) word length of 8 bit or less, the control status of the integrated circuit is determined in 3A001.a.3.

**3A001 Electronic components, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, NP, AT

Control(s)	Country chart
NS applies to entire entry .....	NS Column 2
MT applies to 3A001.a.1.a when usable in "missiles"; and to 3A001.a.5.a when "designed or modified" for military use, hermetically sealed and rated for operation in the temperature range from below -54 °C to above +125 °C.	MT Column 1
NP applies to pulse discharge capacitors in 3A001.e.2 and superconducting solenoidal electromagnets in 3A001.e.3 that meet or exceed the technical parameters in 3A201.a and 3A201.b, respectively.	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A for MT or NP

Yes for:

- \$1500: 3A001.c
- \$3000: 3A001.b.1, b.2, b.3, .d, .e and .f
- \$5000: 3A001.a, and .b.4 to b.7
- GBS: Yes for 3A001.a.1.b, a.2 to a.12, b.2, and b.8 (except for TWTAs exceeding 18 GHz).
- CIV: Yes for 3A001.a.3.b, a.3.c, a.4, a.7, and a.11.

LIST OF ITEMS CONTROLLED

*Unit:* Number.

*Related Controls:* (1.) The following commodities are under the export licensing authority of the Department of State, Office of Defense

Trade Controls (22 CFR part 121) when "space qualified" and operating at frequencies higher than 31 GHz: helix tubes (traveling wave tubes (TWT)) defined in 3A001.b.1.a.4.c; microwave solid state amplifiers defined in 3A001.b.4.b; microwave "assemblies" defined in 3A001.b.6; traveling wave tube amplifiers (TWTA) defined in 3A001.b.8; and derivatives thereof; 2.) "Space qualified" and radiation hardened photovoltaic arrays, as defined in 3A001.e.1.c, having silicon cells or having single, dual or triple junction solar cells that have gallium arsenide as one of the junctions, are subject to the export licensing authority of the Department of Commerce. All other "space qualified" and radiation hardened photovoltaic arrays defined in 3A001.e.1.c and spacecraft/satellite concentrators and batteries are under the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121). See also 3A101, 3A201, and 3A991

*Related Definitions:* For the purposes of integrated circuits in 3A001.a.1,  $5 \times 10^3$  Gy(Si) =  $5 \times 10^5$  Rads (Si);  $5 \times 10^6$  Gy (Si)/s =  $5 \times 10^8$  Rads (Si)/s. For purposes of photovoltaic arrays in 3A001.e.1.c, an array predomi-

nately consists of: a substrate; solar cells having silicon cells or having single, dual, and or triple junction solar cells that have gallium arsenide as one of the junctions; coverglass; ultra-violet coating(s); and bonding agent(s). Spacecraft/satellite: solar concentrators, power conditioners and or controllers, bearing and power transfer assembly, and or deployment hardware/systems are controlled under the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121).

*Items:*

a. General purpose integrated circuits, as follows:

NOTE 1: The control status of wafers (finished or unfinished), in which the function has been determined, is to be evaluated against the parameters of 3A001.a.

NOTE 2: Integrated circuits include the following types:

- "Monolithic integrated circuits";
- "Hybrid integrated circuits";
- "Multichip integrated circuits";
- "Film type integrated circuits", including silicon-on-sapphire integrated circuits;
- "Optical integrated circuits".

a.1. Integrated circuits, designed or rated as radiation hardened to withstand any of the following:

- a.1.a. A total dose of  $5 \times 10^3$  Gy (Si), or higher;
- a.1.b. A dose rate upset of  $5 \times 10^6$  Gy (Si)/s, or higher; *or*
- a.1.c. A fluence (integrated flux) of neutrons (1 MeV equivalent) of  $5 \times 10^{13}$  n/cm<sup>2</sup> or higher on silicon, or its equivalent for other materials;

NOTE: 3A001.a.1.c does not apply to Metal Insulator Semiconductors (MIS).

a.2. "Microprocessor microcircuits", "microcomputer microcircuits", microcontroller microcircuits, storage integrated circuits manufactured from a compound semiconductor, analog-to-digital converters, digital-to-analog converters, electro-optical or "optical integrated circuits" designed for "signal processing", field programmable logic devices, neural network integrated circuits, custom integrated circuits for which either the function is unknown or the control status of the equipment in which the integrated circuit will be used is unknown, Fast Fourier Transform (FFT) processors, electrical erasable programmable read-only memories (EEPROMs), flash memories or static random-access memories (SRAMs), having any of the following:

- a.2.a. Rated for operation at an ambient temperature above 398 K (125 °C);
- a.2.b. Rated for operation at an ambient temperature below 218 K (-55 °C); *or*
- a.2.c. Rated for operation over the entire ambient temperature range from 218 K (-55 °C) to 398 K (125 °C);

NOTE: 3A001.a.2 does not apply to integrated circuits for civil automobile or railway train applications.

a.3. "Microprocessor microcircuits", "micro-computer microcircuits" and micro-controller microcircuits, having any of the following characteristics:

NOTE: 3A001.a.3 includes digital signal processors, digital array processors and digital coprocessors.

a.3.a. [Reserved]

a.3.b. Manufactured from a compound semiconductor and operating at a clock frequency exceeding 40 MHz; *or*

a.3.c. More than one data or instruction bus or serial communication port that provides a direct external interconnection between parallel "microprocessor microcircuits" with a transfer rate exceeding 150 Mbyte/s;

a.4. Storage integrated circuits manufactured from a compound semiconductor;

a.5. Analog-to-digital and digital-to-analog converter integrated circuits, as follows:

a.5.a. Analog-to-digital converters having any of the following:

a.5.a.1. A resolution of 8 bit or more, but less than 12 bit, with a total conversion time of less than 5 ns;

a.5.a.2. A resolution of 12 bit with a total conversion time of less than 20 ns;

a.5.a.3. A resolution of more than 12 bit but equal to or less than 14 bit with a total conversion time of less than 200 ns; *or*

a.5.a.4. A resolution of more than 14 bit with a total conversion time of less than 1  $\mu$ s;

a.5.b. Digital-to-analog converters with a resolution of 12 bit or more, and a "settling time" of less than 10 ns;

TECHNICAL NOTE: 1. A resolution of  $n$  bit corresponds to a quantization of  $2^n$  levels.

2. Total conversion time is the inverse of the sample rate.

a.6. Electro-optical and "optical integrated circuits" designed for "signal processing" having all of the following:

a.6.a. One or more than one internal "laser" diode;

a.6.b. One or more than one internal light detecting element; *and*

a.6.c. Optical waveguides;

a.7. Field programmable logic devices having any of the following:

a.7.a. An equivalent usable gate count of more than 30,000 (2 input gates);

a.7.b. A typical "basic gate propagation delay time" of less than 0.1 ns; *or*

a.7.c. A toggle frequency exceeding 133 MHz;

NOTE: 3A001.a.7 includes: Simple Programmable Logic Devices (SPLDs), Complex Programmable Logic Devices (CPLDs), Field Programmable Gate Arrays (FPGAs), Field Programmable Logic Arrays (FPLAs), and Field Programmable Interconnects (FPICs).

*N.B.:* Field programmable logic devices are also known as field programmable gate or field programmable logic arrays.

a.8. [Reserved]

a.9. Neural network integrated circuits;

a.10. Custom integrated circuits for which 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:

a.10.a. More than 1,000 terminals;

a.10.b. A typical "basic gate propagation delay time" of less than 0.1 ns; *or*

a.10.c. An operating frequency exceeding 3 GHz;

a.11. Digital integrated circuits, other than those described in 3A001.a.3 to 3A001.a.10 and 3A001.a.12, based upon any compound semiconductor and having any of the following:

a.11.a. An equivalent gate count of more than 3,000 (2 input gates); *or*

a.11.b. A toggle frequency exceeding 1.2 GHz;

a.12. Fast Fourier Transform (FFT) processors having a rated execution time for an  $N$ -point complex FFT of less than  $(N \log_2 N)/20,480$  ms, where  $N$  is the number of points;

TECHNICAL NOTE: When  $N$  is equal to 1,024 points, the formula in 3A001.a.12 gives an execution time of 500  $\mu$ s.

b. Microwave or millimeter wave components, as follows:

b.1. Electronic vacuum tubes and cathodes, as follows:

NOTE 1: 3A001.b.1 does not control tubes designed or rated for operation in any frequency band which meets all of the following characteristics:

(a) Does not exceed 31 GHz; and

(b) Is "allocated by the ITU" for radio-communications services, but not for radio-determination.

NOTE 2: 3A001.b.1 does not control non-"space-qualified" tubes which meet all the following characteristics:

(a) An average output power equal to or less than 50 W; *and*

(b) Designed or rated for operation in any frequency band which meets all of the following characteristics:

(1) Exceeds 31 GHz but does not exceed 43.5 GHz; *and*

(2) Is "allocated by the ITU" for radio-communications services, but not for radio-determination.

b.1.a. Traveling wave tubes, pulsed or continuous wave, as follows:

b.1.a.1. Operating at frequencies exceeding 31 GHz;

b.1.a.2. Having a cathode heater element with a turn on time to rated RF power of less than 3 seconds;

b.1.a.3. Coupled cavity tubes, or derivatives thereof, with a "fractional bandwidth" of more than 7% or a peak power exceeding 2.5 kW;

b.1.a.4. Helix tubes, or derivatives thereof, with any of the following characteristics:

b.1.a.4.a. An "instantaneous bandwidth" of more than one octave, and average power (expressed in kW) times frequency (expressed in GHz) of more than 0.5;

b.1.a.4.b. An "instantaneous bandwidth" of one octave or less, and average power (expressed in kW) times frequency (expressed in GHz) of more than 1; *or*

b.1.a.4.c. Being "space qualified";

b.1.b. Crossed-field amplifier tubes with a gain of more than 17 dB;

b.1.c. Impregnated cathodes designed for electronic tubes producing a continuous emission current density at rated operating conditions exceeding 5 A/cm<sup>2</sup>;

b.2. Microwave integrated circuits or modules having all of the following:

b.2.a. Containing "monolithic integrated circuits" having one or more active circuit elements; *and*

b.2.b. Operating at frequencies above 3 GHz;

NOTE 1: 3A001.b.2 does not control circuits or modules for equipment designed or rated to operate in any frequency band which meets all of the following characteristics:

(a) Does not exceed 31 GHz; *and*

(b) Is "allocated by the ITU" for radio-communications services, but not for radio-determination.

NOTE 2: 3A001.b.2 does not control broadcast satellite equipment designed or rated to operate in the frequency range of 40.5 to 42.5 GHz.

b.3. Microwave transistors rated for operation at frequencies exceeding 31 GHz;

b.4. Microwave solid state amplifiers, having any of the following:

b.4.a. Operating frequencies exceeding 10.5 GHz and an "instantaneous bandwidth" of more than half an octave; *or*

b.4.b. Operating frequencies exceeding 31 GHz;

b.5. Electronically or magnetically tunable band-pass or band-stop filters having more than 5 tunable resonators capable of tuning across a 1.5:1 frequency band ( $f_{\max}/f_{\min}$ ) in less than 10  $\mu$ s having any of the following:

b.5.a. A band-pass bandwidth of more than 0.5% of center frequency; *or*

b.5.b. A band-stop bandwidth of less than 0.5% of center frequency;

b.6. Microwave "assemblies" capable of operating at frequencies exceeding 31 GHz;

b.7. Mixers and converters designed to extend the frequency range of equipment described in 3A002.c, 3A002.e or 3A002.f beyond the limits stated therein;

b.8. Microwave power amplifiers containing tubes controlled by 3A001.b and having all of the following:

b.8.a. Operating frequencies above 3 GHz;

b.8.b. An average output power density exceeding 80 W/kg; *and*

b.8.c. A volume of less than 400 cm<sup>3</sup>;

NOTE: 3A001.b.8 does not control equipment designed or rated for operation in any frequency band which is "allocated by the ITU" for radio-communications services, but not for radio-determination.

c. Acoustic wave devices, as follows, and specially designed components therefor:

c.1. Surface acoustic wave and surface skimming (shallow bulk) acoustic wave devices (*i.e.*, "signal processing" devices employing elastic waves in materials), having any of the following:

c.1.a. A carrier frequency exceeding 2.5 GHz;

c.1.b. A carrier frequency exceeding 1 GHz, but not exceeding 2.5 GHz, and having any of the following:

c.1.b.1. A frequency side-lobe rejection exceeding 55 dB;

c.1.b.2. A product of the maximum delay time and the bandwidth (time in  $\mu$ s and bandwidth in MHz) of more than 100;

c.1.b.3. A bandwidth greater than 250 MHz;

*or*

c.1.b.4. A dispersive delay of more than 10  $\mu$ s; *or*

c.1.c. A carrier frequency of 1 GHz or less, having any of the following:

c.1.c.1. A product of the maximum delay time and the bandwidth (time in  $\mu$ s and bandwidth in MHz) of more than 100;

c.1.c.2. A dispersive delay of more than 10  $\mu$ s; *or*

c.1.c.3. A frequency side-lobe rejection exceeding 55 dB and a bandwidth greater than 50 MHz;

c.2. Bulk (volume) acoustic wave devices (*i.e.*, "signal processing" devices employing elastic waves) that permit the direct processing of signals at frequencies exceeding 1 GHz;

c.3. Acoustic-optic "signal processing" devices employing interaction between acoustic waves (bulk wave or surface wave) and light waves that permit the direct processing of signals or images, including spectral analysis, correlation or convolution;

d. Electronic devices and circuits containing components, manufactured from "superconductive" materials specially designed for operation at temperatures below the "critical temperature" of at least one of the "superconductive" constituents, with any of the following:

d.1. Current switching for digital circuits using "superconductive" gates with a product of delay time per gate (in seconds) and power dissipation per gate (in watts) of less than 10<sup>-14</sup> J; *or*

d.2. Frequency selection at all frequencies using resonant circuits with Q-values exceeding 10,000;

e. High energy devices, as follows:

e.1. Batteries and photovoltaic arrays, as follows:

NOTE: 3A001.e.1 does not control batteries with volumes equal to or less than 27 cm<sup>3</sup> (e.g., standard C-cells or R14 batteries).

e.1.a. Primary cells and batteries having an energy density exceeding 480 Wh/kg and rated for operation in the temperature range from below 243 K (-30 °C) to above 343 K (70 °C);

e.1.b. 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 (C 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% of the open circuit voltage divided by the total mass of the cell (or battery) in kg.

e.1.c. "Space qualified" and radiation hardened photovoltaic arrays with a specific power exceeding 160 W/m<sup>2</sup> at an operating temperature of 301 K (28 °C) under a tungsten illumination of 1 kW/m<sup>2</sup> at 2,800 K (2,527 °C);

e.2. High energy storage capacitors, as follows:

e.2.a. Capacitors with a repetition rate of less than 10 Hz (single shot capacitors) having all of the following:

e.2.a.1. A voltage rating equal to or more than 5 kV;

e.2.a.2. An energy density equal to or more than 250 J/kg; *and*

e.2.a.3. A total energy equal to or more than 25 kJ;

e.2.b. Capacitors with a repetition rate of 10 Hz or more (repetition rated capacitors) having all of the following:

e.2.b.1. A voltage rating equal to or more than 5 kV;

e.2.b.2. An energy density equal to or more than 50 J/kg;

e.2.b.3. A total energy equal to or more than 100 J; *and*

e.2.b.4. A charge/discharge cycle life equal to or more than 10,000;

e.3. "Superconductive" electromagnets and solenoids specially designed to be fully charged or discharged in less than one second, having all of the following:

NOTE: 3A001.e.3 does not control "superconductive" electromagnets or solenoids specially designed for Magnetic Resonance Imaging (MRI) medical equipment.

e.3.a. Energy delivered during the discharge exceeding 10 kJ in the first second;

e.3.b. Inner diameter of the current carrying windings of more than 250 mm; *and*

e.3.c. Rated for a magnetic induction of more than 8 T or "overall current density" in the winding of more than 300 A/mm<sup>2</sup>;

f. Rotary input type shaft absolute position encoders having any of the following:

f.1. A resolution of better than 1 part in 265,000 (18 bit resolution) of full scale; *or*

f.2. An accuracy better than ± 2.5 seconds of arc.

**3A002 General purpose electronic equipment, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

LVS: \$3000: 3A002.a, .e, .f, .g; \$5000: 3A002.b to .d

GBS: Yes for 3A002.a.1.; 3A002.b (synthesized output frequency of 2.6 GHz or less and a "frequency switching time" of 0.3 ms or more); and 3A002.d (synthesized output frequency of 2.6 GHz or less and a "frequency switching time" of 0.3 ms or more)

CIV: Yes for 3A002.a.1 (provided all of the following conditions are met: (1) Bandwidths do not exceed: 4 MHz per track and have up to 28 tracks or 2 MHz per track and have up to 42 tracks; (2) Tape speed does not exceed 6.1 m/s; (3) They are not designed for underwater use; (4) They are not ruggedized for military use; *and* (5) Recording density does not exceed 653.2 magnetic flux sine waves per mm); 3A002.b (synthesized output frequency of 2.6 GHz or less; and a "frequency switching time" of 0.3 ms or more), 3A002.d (synthesized output frequency of 2.6 GHz or less; and a "frequency switching time" of 0.3 ms or more).

LIST OF ITEMS CONTROLLED

*Unit:* Number.

*Related Controls:* "Space qualified" atomic frequency standards defined in 3A002.g.2 are subject to the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121). See also 3A292 and 3A992.

*Related Definitions:* Constant percentage bandwidth filters are also known as octave or fractional octave filters.

*Items:*

a. Recording equipment, as follows, and specially designed test tape therefor:

a.1. Analog instrumentation magnetic tape recorders, including those permitting the recording of digital signals (e.g., using a high density digital recording (HDDR) module), having any of the following:

a.1.a. A bandwidth exceeding 4 MHz per electronic channel or track;

a.1.b. A bandwidth exceeding 2 MHz per electronic channel or track and having more than 42 tracks; *or*

a.1.c. A time displacement (base) error, measured in accordance with applicable IRIG or EIA documents, of less than  $\pm 0.1 \mu\text{s}$ ;

NOTE: Analog magnetic tape recorders specially designed for civilian video purposes are not considered to be instrumentation tape recorders.

a.2. Digital video magnetic tape recorders having a maximum digital interface transfer rate exceeding 360 Mbit/s;

NOTE: 3A002.a.2 does not control digital video magnetic tape recorders specially designed for television recording using a signal format, which may include a compressed signal format, standardized or recommended by the ITU, the IEC, the SMPTE, the EBU, the ETSI, or the IEEE for civil television applications.

a.3. Digital instrumentation magnetic tape data recorders employing helical scan techniques or fixed head techniques, having any of the following:

a.3.a. A maximum digital interface transfer rate exceeding 175 Mbit/s; *or*

a.3.b. Being "space qualified";

NOTE: 3A002.a.3 does not control analog magnetic tape recorders equipped with HDDR conversion electronics and configured to record only digital data.

a.4. Equipment, having a maximum digital interface transfer rate exceeding 175 Mbit/s, designed to convert digital video magnetic tape recorders for use as digital instrumentation data recorders;

a.5. Waveform digitizers and transient recorders having all of the following:

*N.B.: See also 3A292.*

a.5.a. Digitizing rates equal to or more than 200 million samples per second and a resolution of 10 bits or more; *and*

a.5.b. A continuous throughput of 2 Gbit/s or more;

TECHNICAL NOTE: For those instruments with a parallel bus architecture, the continuous throughput rate is the highest word rate multiplied by the number of bits in a word. Continuous throughput is the fastest data rate the instrument can output to mass storage without the loss of any information while sustaining the sampling rate and analog-to-digital conversion.

a.6. Digital instrumentation data recorders, using magnetic disk storage technique, having all of the following:

a.6.a. Digitizing rate equal to or more than 100 million samples per second and a resolution of 8 bits or more; *and*

a.6.b. A continuous throughput of 1 Gbit/s or more;

b. "Frequency synthesizer", "electronic assemblies" having a "frequency switching time" from one selected frequency to another of less than 1 ms;

c. Radio frequency "signal analyzers", as follows:

c.1. "Signal analyzers" capable of analyzing frequencies exceeding 31.8 GHz but less than 37.5 GHz or exceeding 43.5 GHz;

c.2. "Dynamic signal analyzers" having a "real-time bandwidth" exceeding 500 kHz;

NOTE: 3A002.c.2 does not control those "dynamic signal analyzers" using only constant percentage bandwidth filters (also known as octave or fractional octave filters).

d. Frequency synthesized signal generators producing output frequencies, the accuracy and short term and long term stability of which are controlled, derived from or disciplined by the internal master frequency, and having any of the following:

d.1. A maximum synthesized frequency exceeding 31.8 GHz;

d.2. A "frequency switching time" from one selected frequency to another of less than 1 ms; *or*

d.3. A single sideband (SSB) phase noise better than  $-(126 + 20 \log_{10} F - 20 \log_{10} f)$  in dBc/Hz, where F is the off-set from the operating frequency in Hz and f is the operating frequency in MHz;

NOTE: 3A002.d does not control equipment in which the output frequency is either produced by the addition or subtraction of two or more crystal oscillator frequencies, or by an addition or subtraction followed by a multiplication of the result.

e. Network analyzers with a maximum operating frequency exceeding 43.5 GHz;

f. Microwave test receivers having all of the following:

f.1. A maximum operating frequency exceeding 43.5 GHz; *and*

f.2. Being capable of measuring amplitude and phase simultaneously;

g. Atomic frequency standards having any of the following:

g.1. Long-term stability (aging) less (better) than  $1 \times 10^{-11}$ /month; *or*

g.2. Being "space qualified".

NOTE: 3A002.g.1 does not control non-"space qualified" rubidium standards.

**3A101 Electronic equipment, devices and components, other than those controlled by 3A001, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Number

*Related Controls:* Items controlled in 3A101.a are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (See 22 CFR part 121).

*Related Definitions:* N/A

*Items:*

a. Analog-to-digital converters, usable in "missiles", designed to meet military specifications for ruggedized equipment;

b. Accelerators capable of delivering electromagnetic radiation produced by bremsstrahlung from accelerated electrons of 2 MeV or greater, and systems containing those accelerators, usable for the "missiles" or the subsystems of "missiles".

NOTE: 3A101.b above does not include equipment specially designed for medical purposes.

**3A201 Electronic components, other than those controlled by 3A001, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Number

*Related Controls:* (1) See ECCNs 3E001 ("development" and "production") and 3E201 ("use") for technology for items controlled under this entry. (2) Also see 3A001.e.2 (capacitors) and 3A001.e.3 (superconducting electromagnets). (3) Superconducting electromagnets specially designed or prepared for use in separating uranium isotopes are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*Items:*

a. Pulse discharge capacitors having either of the following sets of characteristics:

a.1. Voltage rating greater than 1.4 kV, energy storage greater than 10 J, capacitance greater than 0.5 μF, and series inductance less than 50 nH; or

a.2. Voltage rating greater than 750 V, capacitance greater than 0.25 μF, and series inductance less than 10 nH;

b. Superconducting solenoidal electromagnets having all of the following characteristics:

b.1. Capable of creating magnetic fields greater than 2 T;

b.2. A ratio of length to inner diameter greater than 2;

b.3. Inner diameter greater than 300 mm; and

b.4. Magnetic field uniform to better than 1% over the central 50% of the inner volume;

NOTE: 3A201.b does not control magnets specially designed for and exported "as parts of" medical nuclear magnetic resonance (NMR) imaging systems. The phrase "as part of" does not necessarily mean physical part in the same shipment; separate shipments from different sources are allowed, provided the related export documents clearly specify that the shipments are dispatched "as part of" the imaging systems.

c. Flash X-ray generators or pulsed electron accelerators having either of the following sets of characteristics:

c.1. An accelerator peak electron energy of 500 keV or greater, but less than 25 MeV, and with a "figure of merit" (K) of 0.25 or greater; or

c.2. An accelerator peak electron energy of 25 MeV or greater, and a "peak power" greater than 50 MW;

NOTE: 3A201.c does not control accelerators that are component parts of devices designed for purposes other than electron beam or X-ray radiation (electron microscopy, for example) nor those designed for medical purposes.

*Technical Notes:* (1) The "figure of merit" K is defined as:  $K = 1.7 \times 10^3 V^{2.65} Q$ . V is the peak electron energy in million electron volts. If the accelerator beam pulse duration is less than or equal to 1 μs, then Q is the total accelerated charge in Coulombs. If the accelerator beam pulse duration is greater than 1 μs, then Q is the maximum accelerated charge in 1 μs. Q equals the integral of i with respect to t, over the lesser of 1 μs or the time duration of the beam pulse  $Q = \int i dt$ , where i is beam current in amperes and t is time in seconds.

(2) "Peak power" = (peak potential in volts) × (peak beam current in amperes).

(3) In machines based on microwave accelerating cavities, the time duration of the beam pulse is the lesser of 1 μs or the duration of the bunched beam packet resulting from one microwave modulator pulse.

(4) In machines based on microwave accelerating cavities, the peak beam current is the average current in the time duration of a bunched beam packet.

**3A225 Frequency changers (also known as converters or inverters) or generators, other than those described in 0B001.c.11, having all of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Number

*Related Controls:* (1) See ECCNs 3E001 (“development” and “production”) and 3E201 (“use”) for technology for items controlled under this entry. (2) Frequency changers (also known as converters or inverters) specially designed or prepared for use in separating uranium isotopes are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

- Items:* a. A multiphase output capable of providing a power of 40 W or more;  
 b. Capable of operating in the frequency range between 600 and 2000 Hz;  
 c. Total harmonic distortion below 10%;  
 and  
 d. Frequency control better than 0.1%.

**3A226 High-power direct current power supplies, other than those described in 0B001.j.6, having both of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) See ECCNs 3E001 (“development” and “production”) and 3E201 (“use”) for technology for items controlled under this entry. (2) Also see ECCN 3A227. (3) Direct current power supplies specially designed or prepared for use in separating uranium isotopes are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*Items:*

- a. Capable of continuously producing, over a time period of 8 hours, 100 V or greater with current output of 500 A or greater; and  
 b. Current or voltage stability better than 0.1% over a time period of 8 hours.

**3A227 High-voltage direct current power supplies, other than those described in 0B001.j.5, having both of the following**

**characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) See ECCNs 3E001 (“development” and “production”) and 3E201 (“use”) for technology for items controlled under this entry. (2) Also see ECCN 3A226. (3) Direct current power supplies specially designed or prepared for use in separating uranium isotopes are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*Items:*

- a. Capable of continuously producing, over a time period of 8 hours, 20 kV or greater with current output of 1 A or greater; and  
 b. Current or voltage stability better than 0.1% over a time period of 8 hours.

**3A228 Switching devices, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Number

*Related Controls:* (1) See ECCNs 3E001 (“development” and “production”) and 3E201 (“use”) for technology for items controlled under this entry.

(2) Also see ECCN 3A991.k.

*Related Definitions:* N/A

*Items:*

- a. Cold-cathode tubes, whether gas filled or not, operating similarly to a spark gap, having all of the following characteristics:  
 a.1. Containing three or more electrodes;  
 a.2. Anode peak voltage rating of 2.5 kV or more;  
 a.3. Anode peak current rating of 100 A or more; and  
 a.4. Anode delay time of 10 μs or less.

*Technical Note:* 3A228.a includes gas krytron tubes and vacuum spraytron tubes.

b. Triggered spark-gaps having both of the following characteristics:

b.1. An anode delay time of 15  $\mu$ s or less; *and*

b.2. Rated for a peak current of 500 A or more.

c. Modules or assemblies with a fast switching function having all of the following characteristics:

c.1. Anode peak voltage rating greater than 2 kV;

c.2. Anode peak current rating of 500 A or more; *and*

c.3. Turn-on time of 1  $\mu$ s or less.

**3A229 Firing sets and equivalent high-current pulse generators (for detonators controlled by 3A232), as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Number

*Related Controls:* (1) See ECCNs 3E001 (“development” and “production”) and 3E201 (“use”) for technology for items controlled under this entry. (2) High explosives and related equipment for military use are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (see 22 CFR part 121).

*Related Definitions:* In 3A229.b.5, “rise time” is defined as the time interval from 10% to 90% current amplitude when driving a resistive load.

*ECCN Controls:* 3A229.b includes xenon flash-lamp drivers.

*Items:*

a. Explosive detonator firing sets designed to drive multiple controlled detonators controlled by 3A232;

b. Modular electrical pulse generators (pulsers) having all of the following characteristics:

b.1. Designed for portable, mobile, or ruggedized use;

b.2. Enclosed in a dust-tight enclosure;

b.3. Capable of delivering their energy in less than 15  $\mu$ s;

b.4. Having an output greater than 100 A;

b.5. Having a “rise time” of less than 10  $\mu$ s into loads of less than 40 ohms;

b.6. No dimension greater than 254 mm;

b.7. Weight less than 25 kg; *and*

b.8. Specified for use over an extended temperature range 223 K (–50 °C) to 373 K (100 °C) or specified as suitable for aerospace applications.

**3A230 High-speed pulse generators having both of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Number

*Related Controls:* See ECCNs 3E001 (“development” and “production”) and 3E201 (“use”) for technology for items controlled under this entry.

*Related Definitions:* In 3A230.b, “pulse transition time” is defined as the time interval between 10% and 90% voltage amplitude.

*Items:*

a. Output voltage greater than 6 V into a resistive load of less than 55 ohms; *and*

b. “Pulse transition time” less than 500 ps.

**3A231 Neutron generator systems, including tubes, having both of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Number; parts and accessories in \$ value

*Related Controls:* See ECCNs 3E001 (“development” and “production”) and 3E201 (“use”) for technology for items controlled under this entry.

*Related Definitions:* N/A

*Items:*

a. Designed for operation without an external vacuum system; *and*

b. Utilizing electrostatic acceleration to induce a tritium-deuterium nuclear reaction.

**3A232 Detonators and multipoint initiation systems, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS  
Reason for Control: NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Number  
*Related Controls:* (1) See ECCNs 3E001 (“development” and “production”) and 3E201 (“use”) for technology for items controlled under this entry. (2) High explosives and related equipment for military use are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (see 22 CFR part 121).

*Related Definitions:* N/A  
*ECCN Controls:* This entry does not control detonators using only primary explosives, such as lead azide.

- Items:*
- a. Electrically driven explosive detonators, as follows:
    - a.1. Exploding bridge (EB);
    - a.2. Exploding bridge wire (EBW);
    - a.3. Slapper;
    - a.4. Exploding foil initiators (EFI);
  - b. Arrangements using single or multiple detonators designed to nearly simultaneously initiate an explosive surface over an area greater than 5,000 mm<sup>2</sup> from a single firing signal with an initiation timing spread over the surface of less than 2.5 μs.

*Technical Note:* The detonators controlled by this entry all utilize a small electrical conductor (bridge, bridge wire or foil) that explosively vaporizes when a fast, high-current electrical pulse is passed through it. In nonslapper types, the exploding conductor starts a chemical detonation in a contacting high-explosive material, such as PETN (Pentaerythritol tetranitrate). In slapper detonators, the explosive vaporization of the electrical conductor drives a flyer or slapper across a gap and the impact of the slapper on an explosive starts a chemical detonation. The slapper in some designs is driven by a magnetic force. The term exploding foil detonator may refer to either a EB or a slapper-type detonator. Also, the word initiator is sometimes used in place of the word detonator.

**3A233 Mass spectrometers, other than those described in 0B002.g, capable of measuring ions of 230 atomic mass units or greater and having a resolution of better**

**than 2 parts in 230, and ion sources therefor.**

LICENSE REQUIREMENTS  
Reason for Control: NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Number  
*Related Controls:* (1) See ECCNs 3E001 (“development” and “production”) and 3E201 (“use”) for technology for items controlled under this entry. (2) Mass spectrometers specially designed or prepared for analyzing on-line samples of UF<sub>6</sub> gas streams are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A  
*Items:*

- a. Inductively coupled plasma mass spectrometers (ICP/MS);
- b. Glow discharge mass spectrometers (GDMS);
- c. Thermal ionization mass spectrometers (TIMS);
- d. Electron bombardment mass spectrometers that have a source chamber constructed from, lined with or plated with materials resistant to UF<sub>6</sub>;
- e. Molecular beam mass spectrometers having either of the following characteristics:
  - e.1. A source chamber constructed from, lined with or plated with stainless steel or molybdenum and equipped with a cold trap capable of cooling to 193 K (–80 °C) or less;
  - or
  - e.2. A source chamber constructed from, lined with or plated with materials resistant to UF<sub>6</sub>;
- f. Mass spectrometers equipped with a microfluorination ion source designed for actinides or actinide fluorides.

**3A292 Oscilloscopes and transient recorders other than those controlled by 3A002.a.5, and specially designed components therefor.**

LICENSE REQUIREMENTS  
Reason for Control: NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Number

Related Controls: See ECCN 3E292 ("development", "production", and "use") for technology for items controlled under this entry.

Related Definitions: "Bandwidth" is defined as the band of frequencies over which the deflection on the cathode ray tube does not fall below 70.7% of that at the maximum point measured with a constant input voltage to the oscilloscope amplifier.

Items: a. Non-modular analog oscilloscopes having a bandwidth of 1 GHz or greater;

b. Modular analog oscilloscope systems having either of the following characteristics:

b.1. A mainframe with a bandwidth of 1 GHz or greater; or

b.2. Plug-in modules with an individual bandwidth of 4 GHz or greater;

c. Analog sampling oscilloscopes for the analysis of recurring phenomena with an effective bandwidth greater than 4 GHz;

d. Digital oscilloscopes and transient recorders, using analog-to-digital conversion techniques, capable of storing transients by sequentially sampling single-shot inputs at successive intervals of less than 1 ns (greater than 1 giga-sample per second), digitizing to 8 bits or greater resolution and storing 256 or more samples.

NOTE: Specially designed components controlled by this item are the following, for analog oscilloscopes:

1. Plug-in units;
2. External amplifiers;
3. Pre-amplifiers;
4. Sampling devices;
5. Cathode ray tubes.

**3A980 Voice print identification and analysis equipment and parts, n.e.s.**

LICENSE REQUIREMENTS

Reason for Control: CC

Control(s) Country Chart

CC applies to entire entry ..... CC Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

**3A981 Polygraphs (except biomedical recorders designed for use in medical facilities for monitoring biological and**

**neurophysical responses); fingerprint analyzers, cameras and equipment, n.e.s.; automated fingerprint and identification retrieval systems, n.e.s.; psychological stress analysis equipment; electronic monitoring restraint devices; and specially designed parts and accessories, n.e.s.**

LICENSE REQUIREMENTS

Reason for Control: CC

Control(s) Country Chart

CC applies to entire entry ..... CC Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

**3A991 Electronic devices and components not controlled by 3A001.**

LICENSE REQUIREMENTS

Reason for Control: AT.

Control(s)	Country chart
AT applies to entire entry .....	AT Column 1

License Requirements Notes

1. Microprocessors with a CTP below 550 MTOPS listed in paragraphs (a)(2) or (a)(3) of this entry may be shipped NLR (No License Required) when destined to North Korea, provided restrictions set forth in other sections of the EAR (e.g., end-use restrictions), do not apply.

2. See 744.17 of the EAR for additional license requirements for commodities classified as 3A991.a.1.

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number.

Related Controls: N/A.

Related Definitions: N/A.

Items:

a. "Microprocessor microcircuits", "microcomputer microcircuits", and microcontroller microcircuits having any of the following:

a.1. A "composite theoretical performance" ("CTP") of 6,500 million theoretical operations per second (MTOPS) or more and an arithmetic logic unit with an access width of 32 bit or more;

a.2. A clock frequency rate exceeding 25 MHz; *or*

a.3. More than one data or instruction bus or serial communication port that provides a direct external interconnection between parallel "microprocessor microcircuits" with a transfer rate of 2.5 Mbyte/s.

b. Storage integrated circuits, as follows:

b.1. Electrical erasable programmable read-only memories (EEPROMs) with a storage capacity:

b.1.a. Exceeding 16 Mbits per package for flash memory types; *or*

b.1.b. Exceeding either of the following limits for all other EEPROM types:

b.1.b.1. Exceeding 1 Mbit per package; *or*

b.1.b.2. Exceeding 256 kbit per package and a maximum access time of less than 80 ns;

b.2. Static random access memories (SRAMs) with a storage capacity:

b.2.a. Exceeding 1 Mbit per package; *or*

b.2.b. Exceeding 256 kbit per package and a maximum access time of less than 25 ns;

c. Analog-to-digital converters having any of the following:

c.1. A resolution of 8 bit or more, but less than 12 bit, with a total conversion time of less than 10 ns;

c.2. A resolution of 12 bit with a total conversion time of less than 200 ns;

c.3. A resolution of more than 12 bit but equal to or less than 14 bit with a total conversion time of less than 2  $\mu$ s; *or*

c.4. A resolution of more than 14 bit with a total conversion time of less than 2  $\mu$ s;

d. Field programmable logic devices having either of the following:

d.1. An equivalent gate count of more than 5000 (2 input gates); *or*

d.2. A toggle frequency exceeding 100 MHz;

e. Fast Fourier Transform (FFT) processors having a rated execution time for a 1,024 point complex FFT of less than 1 ms.

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 (C 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:

- 1.1. Resonant operating frequencies exceeding 1 MHz;
- 1.2. A stored energy density of 1 MJ/M<sup>3</sup> or more; *and*
- 1.3. A discharge time of less than 1 ms;
- m. Hydrogen/hydrogen-isotope thyratrons 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).

**3A992 General purpose electronic equipment not controlled by 3A002.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

*Control(s)*                      *Country Chart*

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: \$1000 for Syria for .a only

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* a. Electronic test equipment, n.e.s.

b. Digital instrumentation magnetic tape data recorders having any of the following characteristics;

b.1. A maximum digital interface transfer rate exceeding 60 Mbit/s and employing helical scan techniques;

b.2. A maximum digital interface transfer rate exceeding 120 Mbit/s and employing fixed head techniques; or

b.3. "Space qualified";

c. Equipment, with a maximum digital interface transfer rate exceeding 60 Mbit/s, designed to convert digital video magnetic tape recorders for use as digital instrumentation data recorders;

**3A999 Specific Processing Equipment, n.e.s., as Follows (See List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* AT.

*Control(s).*

*Country Chart.*

AT applies to entire entry. A license is required for items controlled by this entry to North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine AT licensing requirements for this entry. See §742.19 of the EAR for additional information.

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* See also 0B002, 3A225 (for frequency changes capable of operating in the frequency range of 600 Hz and above), 3A233.

*Related Definitions:* N/A.

*Items:*

a. Frequency changers capable of operating in the frequency range from 300 up to 600 Hz, n.e.s.;

b. Mass spectrometers n.e.s.;

c. All flash x-ray machines, and components of pulsed power systems designed thereof, including Marx generators, high power pulse shaping networks, high voltage capacitors, and triggers;

d. Pulse amplifiers, n.e.s.;

e. Electronic equipment for time delay generation or time interval measurement, as follows:

e.1. Digital time delay generators with a resolution of 50 nanoseconds or less over time intervals of 1 microsecond or greater; *or*

e.2. Multi-channel (three or more) or modular time interval meter and chronometry equipment with resolution of 50 nanoseconds or less over time intervals of 1 microsecond or greater;

f. Chromatography and spectrometry analytical instruments.

B. TEST, INSPECTION AND PRODUCTION EQUIPMENT

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

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

*Control(s)*                      *Country Chart*

NS applies to entire entry ..... NS Column 2

AT applies to entire entry ..... AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

LVS: \$500

GBS: "Yes, except 3B001. a.2 (metal organic chemical vapor deposition reactors), a.3 (molecular beam epitaxial growth equipment using gas sources), e (automatic loading multi-chamber central wafer handling systems *only* if connected to equipment controlled by 3B001.a.2 and a.3, and f), or f (lithography equipment).

CIV: Yes for equipment controlled by 3B001.a.1

LIST OF ITEMS CONTROLLED

*Unit:* Number.

*Related Controls:* See also 3B991.

*Related Definitions:* N/A.

*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  $\pm 2.5\%$  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  $\mu\text{m}$  or less with  $\pm 5\%$  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  $\mu\text{m}$  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  $\mu\text{m}$  or less with  $\pm 5\%$  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  $\mu\text{m}$  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  $\mu\text{m}$  or less with  $\pm 5\%$  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  $\mu\text{m}$  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  $\mu\text{m}$  or less with  $\pm 5\%$  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  $\mu\text{m}$  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  $\mu\text{m}$  or less;

TECHNICAL NOTE: The minimum resolvable feature size is calculated by the following formula:

$$\text{MRF} = \frac{(\text{an exposure light source wavelength in } \mu\text{m}) \times (\text{K factor})}{\text{numerical aperture}}$$

Where the K factor = 0.7.

MRF = minimum resolvable feature size.

f.2. Equipment specially designed for mask making or semiconductor device processing using deflected focused electron beam, ion beam or “laser” beam, having any of the following:

f.2.a. A spot size smaller than 0.2  $\mu\text{m}$ ;

f.2.b. Being capable of producing a pattern with a feature size of less than 1  $\mu\text{m}$ ; *or*

f.2.c. An overlay accuracy of better than  $\pm 0.20 \mu\text{m}$  (3 sigma);

g. Masks and reticles designed for integrated circuits controlled by 3A001;

h. Multi-layer masks with a phase shift layer.

**3B002 “Stored Program Controlled” Test Equipment, Specially Designed for Testing Finished or Unfinished Semiconductor Devices, As Follows (See List of**

**Items Controlled), and Specially Designed Components and Accessories Therefor**

## LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

## LICENSE EXCEPTIONS

LVS: \$500

GBS: Yes

CIV: N/A

## LIST OF ITEMS CONTROLLED

*Unit:* Number.*Related Controls:* See also 3B992.*Related Definitions:* N/A.*Items:*

a. For testing S-parameters of transistor devices at frequencies exceeding 31 GHz;

b. For testing integrated circuits capable of performing functional (truth table) testing at a pattern rate of more than 333 MHz;

NOTE: 3B002.b does not control test equipment specially designed for testing:

1. "Electronic assemblies" or a class of "electronic assemblies" for home or entertainment applications;

2. Uncontrolled electronic components, "electronic assemblies" or integrated circuits;

3. Memories.

TECHNICAL NOTE: For purposes of 3B002.b, pattern rate is defined as the maximum frequency of digital operation of a tester. It is therefore equivalent to the highest data rate that a tester can provide in non-multiplexed mode. It is also referred to as test speed, maximum digital frequency or maximum digital speed.

c. For testing microwave integrated circuits controlled by 3A001.b.2.

**3B991 Equipment not controlled by 3B001 for the manufacture of electronic components and materials, and specially designed components and accessories therefor.**

## LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

## LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

## LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number.*Related Controls:* N/A.

*Related Definitions:* 'Sputtering' is an overlay coating process wherein positively charged ions are accelerated by an electric field towards the surface of a target (coating ma-

terial). The kinetic energy of the impacting ions is sufficient to cause target surface atoms to be released and deposited on the substrate. (**Note:** Triode, magnetron or radio frequency sputtering to increase adhesion of coating and rate of deposition are ordinary modifications of the process.)

*Items:* a. Equipment specially designed for the manufacture of electron tubes, optical elements and specially designed components therefor controlled by 3A001 or 3A991;

b. Equipment specially designed for the manufacture of semiconductor devices, integrated circuits and "electronic assemblies", as follows, and systems incorporating or having the characteristics of such equipment:

NOTE: 3B991.b also controls equipment used or modified for use in the manufacture of other devices, such as imaging devices, electro-optical devices, acoustic-wave devices.

b.1. Equipment for the processing of materials for the manufacture of devices and components as specified in the heading of 3B991.b, as follows:

NOTE: 3B991 does not control quartz furnace tubes, furnace liners, paddles, boats (except specially designed caged boats), bubblers, cassettes or crucibles specially designed for the processing equipment controlled by 3B991.b.1.

b.1.a. Equipment for producing polycrystalline silicon and materials controlled by 3C001;

b.1.b. Equipment specially designed for purifying or processing III/V and II/VI semiconductor materials controlled by 3C001, 3C002, 3C003, or 3C004, except crystal pullers, for which see 3B991.b.1.c below;

b.1.c. Crystal pullers and furnaces, as follows:

NOTE: 3B991.b.1.c does not control diffusion and oxidation furnaces.

b.1.c.1. Annealing or recrystallizing equipment other than constant temperature furnaces employing high rates of energy transfer capable of processing wafers at a rate exceeding 0.005 m<sup>2</sup> per minute;

b.1.c.2. "Stored program controlled" crystal pullers having any of the following characteristics:

b.1.c.2.a. Rechargeable without replacing the crucible container;

b.1.c.2.b. Capable of operation at pressures above 2.5x10<sup>5</sup> Pa; *or*

b.1.c.2.c. Capable of pulling crystals of a diameter exceeding 100 mm;

b.1.d. "Stored program controlled" equipment for epitaxial growth having any of the following characteristics:

b.1.d.1. Capable of producing a layer thickness uniformity across the wafer of equal to or better than +3.5%; *or*

b.1.d.2. Rotation of individual wafers during processing;

b.1.e. Molecular beam epitaxial growth equipment;

b.1.f. Magnetically enhanced ‘sputtering’ equipment with specially designed integral load locks capable of transferring wafers in an isolated vacuum environment;

b.1.g. Equipment specially designed for ion implantation, ion-enhanced or photo-enhanced diffusion, having any of the following characteristics:

b.1.g.1. Patterning capability;  
b.1.g.2. Beam energy (accelerating voltage) exceeding 200 keV;

b.1.g.3. Optimized to operate at a beam energy (accelerating voltage) of less than 10 keV; *or*

b.1.g.4. Capable of high energy oxygen implant into a heated “substrate”;

b.1.h. “Stored program controlled” equipment for the selective removal (etching) by means of anisotropic dry methods (*e.g.*, plasma), as follows:

b.1.h.1. Batch types having either of the following:

b.1.h.1.a. End-point detection, other than optical emission spectroscopy types; *or*

b.1.h.1.b. Reactor operational (etching) pressure of 26.66 Pa or less;

b.1.h.2. Single wafer types having any of the following:

b.1.h.2.a. End-point detection, other than optical emission spectroscopy types;

b.1.h.2.b. Reactor operational (etching) pressure of 26.66 Pa or less; *or*

b.1.h.2.c. Cassette-to-cassette and load locks wafer handling;

NOTES: 1. “Batch types” refers to machines not specially designed for production processing of single wafers. Such machines can process two or more wafers simultaneously with common process parameters, *e.g.*, RF power, temperature, etch gas species, flow rates.

2. “Single wafer types” refers to machines specially designed for production processing of single wafers. These machines may use automatic wafer handling techniques to load a single wafer into the equipment for processing. The definition includes equipment that can load and process several wafers but where the etching parameters, *e.g.*, RF power or end point, can be independently determined for each individual wafer.

b.1.i. “Chemical vapor deposition” (CVD) equipment, *e.g.*, plasma-enhanced CVD (PECVD) or photo-enhanced CVD, for semiconductor device manufacturing, having either of the following capabilities, for deposition of oxides, nitrides, metals or polysilicon:

b.1.i.1. “Chemical vapor deposition” equipment operating below  $10^5$  Pa; *or*

b.1.i.2. PECVD equipment operating either below 60 Pa (450 millitorr) or having automatic cassette-to-cassette and load lock wafer handling;

NOTE: 3B991.b.1.i does not control low pressure “chemical vapor deposition” (LPCVD) systems or reactive “sputtering” equipment.

b.1.j. Electron beam systems specially designed or modified for mask making or semiconductor device processing having any of the following characteristics:

b.1.j.1. Electrostatic beam deflection;

b.1.j.2. Shaped, non-Gaussian beam profile;

b.1.j.3. Digital-to-analog conversion rate exceeding 3 MHz;

b.1.j.4. Digital-to-analog conversion accuracy exceeding 12 bit; *or*

b.1.j.5. Target-to-beam position feedback control precision of 1 micrometer or finer;

NOTE: 3B991.b.1.j does not control electron beam deposition systems or general purpose scanning electron microscopes.

b.1.k. Surface finishing equipment for the processing of semiconductor wafers as follows:

b.1.k.1. Specially designed equipment for backside processing of wafers thinner than 100 micrometer and the subsequent separation thereof; *or*

b.1.k.2. Specially designed equipment for achieving a surface roughness of the active surface of a processed wafer with a two-sigma value of 2 micrometer or less, total indicator reading (TIR);

NOTE: 3B991.b.1.k does not control single-side lapping and polishing equipment for wafer surface finishing.

b.1.l. Interconnection equipment which includes common single or multiple vacuum chambers specially designed to permit the integration of any equipment controlled by 3B991 into a complete system;

b.1.m. “Stored program controlled” equipment using “lasers” for the repair or trimming of “monolithic integrated circuits” with either of the following characteristics:

b.1.m.1. Positioning accuracy less than  $\pm 1$  micrometer; *or*

b.1.m.2. Spot size (kerf width) less than 3 micrometer.

b.2. Masks, mask “substrates”, mask-making equipment and image transfer equipment for the manufacture of devices and components as specified in the heading of 3B991, as follows:

NOTE: The term “masks” refers to those used in electron beam lithography, X-ray lithography, and ultraviolet lithography, as well as the usual ultraviolet and visible photo-lithography.

b.2.a. Finished masks, reticles and designs therefor, except:

b.2.a.1. Finished masks or reticles for the production of unembargoed integrated circuits; *or*

b.2.a.2. Masks or reticles, having both of the following characteristics:

b.2.a.2.a. Their design is based on geometries of 2.5 micrometer or more; *and*

b.2.a.2.b. The design does not include special features to alter the intended use by means of production equipment or “software”;

b.2.b. Mask “substrates” as follows:

b.2.b.1. Hard surface (e.g., chromium, silicon, molybdenum) coated "substrates" (e.g., glass, quartz, sapphire) for the preparation of masks having dimensions exceeding 125 mm x 125 mm; *or*

b.2.b.2. "Substrates" specially designed for X-ray masks;

b.2.c. Equipment, other than general purpose computers, specially designed for computer aided design (CAD) of semiconductor devices or integrated circuits;

b.2.d. Equipment or machines, as follows, for mask or reticle fabrication:

b.2.d.1. Photo-optical step and repeat cameras capable of producing arrays larger than 100 mm x 100 mm, or capable of producing a single exposure larger than 6 mm x 6 mm in the image (i.e., focal) plane, or capable of producing line widths of less than 2.5 micrometer in the photoresist on the "substrate";

b.2.d.2. Mask or reticle fabrication equipment using ion or "laser" beam lithography capable of producing line widths of less than 2.5 micrometer; *or*

b.2.d.3. Equipment or holders for altering masks or reticles or adding pellicles to remove defects;

NOTE: 3B991.b.2.d.1 and b.2.d.2 do not control mask fabrication equipment using photo-optical methods which was either commercially available before the 1st January, 1980, or has a performance no better than such equipment.

b.2.e. "Stored program controlled" equipment for the inspection of masks, reticles or pellicles with:

b.2.e.1. A resolution of 0.25 micrometer or finer; *and*

b.2.e.2. A precision of 0.75 micrometer or finer over a distance in one or two coordinates of 63.5 mm or more;

NOTE: 3B991.b.2.e does not control general purpose scanning electron microscopes except when specially designed and instrumented for automatic pattern inspection.

b.2.f. Align and expose equipment for wafer production using photo-optical or X-ray methods, including both projection image transfer equipment and step and repeat (direct step on wafer) or step and scan (scanner) equipment, capable of performing any of the following functions:

NOTE: 3B991.b.2.f does not control photo-optical contact and proximity mask align and expose equipment or contact image transfer equipment.

b.2.f.1. Production of a pattern size of less than 2.5 micrometer;

b.2.f.2. Alignment with a precision finer than  $\pm 0.25$  micrometer (3 sigma);

b.2.f.3. Machine-to-machine overlay no better than  $\pm 0.3$  micrometer; *or*

b.2.f.4. A light source wavelength shorter than 400 nm;

b.2.g. Electron beam, ion beam or X-ray equipment for projection image transfer capable of producing patterns less than 2.5 micrometer;

NOTE: For focused, deflected-beam systems (direct write systems), see 3B991.b.1.j or b.10.

b.2.h. Equipment using "lasers" for direct write on wafers capable of producing patterns less than 2.5 micrometer.

b.3. Equipment for the assembly of integrated circuits, as follows:

b.3.a. "Stored program controlled" die bonders having all of the following characteristics:

b.3.a.1. Specially designed for "hybrid integrated circuits";

b.3.a.2. X-Y stage positioning travel exceeding 37.5 x 37.5 mm; *and*

b.3.a.3. Placement accuracy in the X-Y plane of finer than  $\pm 10$  micrometer;

b.3.b. "Stored program controlled" equipment for producing multiple bonds in a single operation (e.g., beam lead bonders, chip carrier bonders, tape bonders);

b.3.c. Semi-automatic or automatic hot cap sealers, in which the cap is heated locally to a higher temperature than the body of the package, specially designed for ceramic microcircuit packages controlled by 3A001 and that have a throughput equal to or more than one package per minute.

NOTE: 3B991.b.3 does not control general purpose resistance type spot welders.

b.4. Filters for clean rooms capable of providing an air environment of 10 or less particles of 0.3 micrometer or smaller per 0.02832 m<sup>3</sup> and filter materials therefor.

**3B992 Equipment not controlled by 3B002 for the inspection or testing of electronic components and materials, and specially designed components and accessories therefor;**

LICENSE REQUIREMENTS

Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart</i>
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AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number.

Related Controls: N/A.

Related Definitions: N/A.

Items:

a. Equipment specially designed for the inspection or testing of electron tubes, optical elements and specially designed components therefor controlled by 3A001 or 3A991;

b. Equipment specially designed for the inspection or testing of semiconductor devices, integrated circuits and "electronic assemblies", as follows, and systems incorporating

or having the characteristics of such equipment:

NOTE: 3B992.b also controls equipment used or modified for use in the inspection or testing of other devices, such as imaging devices, electro-optical devices, acoustic-wave devices.

b.1. "Stored program controlled" inspection equipment for the automatic detection of defects, errors or contaminants of 0.6 micrometer or less in or on processed wafers, "substrates", other than printed circuit boards or chips, using optical image acquisition techniques for pattern comparison;

NOTE: 3B992.b.1 does not control general purpose scanning electron microscopes, except when specially designed and instrumented for automatic pattern inspection.

b.2. Specially designed "stored program controlled" measuring and analysis equipment, as follows:

b.2.a. Specially designed for the measurement of oxygen or carbon content in semiconductor materials;

b.2.b. Equipment for line width measurement with a resolution of 1 micrometer or finer;

b.2.c. Specially designed flatness measurement instruments capable of measuring deviations from flatness of 10 micrometer or less with a resolution of 1 micrometer or finer.

b.3. "Stored program controlled" wafer probing equipment having any of the following characteristics:

b.3.a. Positioning accuracy finer than 3.5 micrometer;

b.3.b. Capable of testing devices having more than 68 terminals; or

b.3.c. Capable of testing at a frequency exceeding 1 GHz;

b.4. Test equipment as follows:

b.4.a. "Stored program controlled" equipment specially designed for testing discrete semiconductor devices and unencapsulated dice, capable of testing at frequencies exceeding 18 GHz;

TECHNICAL NOTE: Discrete semiconductor devices include photocells and solar cells.

b.4.b. "Stored program controlled" equipment specially designed for testing integrated circuits and "electronic assemblies" thereof, capable of functional testing:

b.4.b.1. At a pattern rate exceeding 20 MHz; or

b.4.b.2. At a pattern rate exceeding 10 MHz but not exceeding 20 MHz and capable of testing packages of more than 68 terminals;

NOTE: 3B992.b.4.b does not control equipment specially designed for testing integrated circuits not controlled by 3A001 or 3A991.

NOTES: 1. 3B992.b.4.b does not control test equipment specially designed for testing "assemblies" or a class of "electronic assemblies" for home and entertainment applications.

2. 3B992.b.4.b does not control test equipment specially designed for testing electronic components, "assemblies" and integrated circuits not controlled by 3A001 or 3A991 provided such test equipment does not incorporate computing facilities with "user accessible programmability".

b.4.c. Equipment specially designed for determining the performance of focal-plane arrays at wavelengths of more than 1,200 nm, using "stored program controlled" measurements or computer aided evaluation and having any of the following characteristics:

b.4.c.1. Using scanning light spot diameters of less than 0.12 mm;

b.4.c.2. Designed for measuring photosensitive performance parameters and for evaluating frequency response, modulation transfer function, uniformity of responsivity or noise; or

b.4.c.3. Designed for evaluating arrays capable of creating images with more than  $32 \times 32$  line elements;

b.5. Electron beam test systems designed for operation at 3 keV or below, or "laser" beam systems, for non-contactive probing of powered-up semiconductor devices having any of the following:

b.5.a. Stroboscopic capability with either beam blanking or detector strobing;

b.5.b. An electron spectrometer for voltage measurements with a resolution of less than 0.5 V; or

b.5.c. Electrical tests fixtures for performance analysis of integrated circuits;

NOTE: 3B992.b.5 does not control scanning electron microscopes, except when specially designed and instrumented for non-contactive probing of a powered-up semiconductor device.

b.6. "Stored program controlled" multifunctional focused ion beam systems specially designed for manufacturing, repairing, physical layout analysis and testing of masks or semiconductor devices and having either of the following characteristics:

b.6.a. Target-to-beam position feedback control precision of 1 micrometer or finer; or

b.6.b. Digital-to-analog conversion accuracy exceeding 12 bit;

b.7. Particle measuring systems employing "lasers" designed for measuring particle size and concentration in air having both of the following characteristics:

b.7.a. Capable of measuring particle sizes of 0.2 micrometer or less at a flow rate of  $0.02832 \text{ m}^3$  per minute or more; and

b.7.b. Capable of characterizing Class 10 clean air or better.

#### C. MATERIALS

**3C001 Hetero-epitaxial materials consisting of a "substrate" having stacked epitaxially grown multiple layers of any**

of the following (see List of Items Controlled).

## LICENSE REQUIREMENTS

Reason for Control: NS, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

## LICENSE EXCEPTIONS

LVS: \$3000

GBS: N/A

CIV: N/A

## LIST OF ITEMS CONTROLLED

Unit: \$ value.

**Related Controls:** This entry does not control equipment or material whose functionality has been unalterably disabled are not controlled.

**Related Definitions:** III/V compounds are polycrystalline or binary or complex monocrystalline products consisting of elements of groups IIIA and VA of Mendeleev's periodic classification table (e.g., gallium arsenide, gallium-aluminum arsenide, indium phosphide).

**Items:**

- a. Silicon;
- b. Germanium;
- c. Silicon Carbide; or
- d. III/V compounds of gallium or indium.

**3C002 Resist material and "substrates" coated with controlled resists.**

## LICENSE REQUIREMENTS

Reason for Control: NS, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

## LICENSE EXCEPTIONS

LVS: \$3000

GBS: Yes for positive resists not optimized for photolithography at a wavelength of less than 365 nm, provided that they are not controlled by 3C002.b through .d.

CIV: Yes for positive resists not optimized for photolithography at a wavelength of less than 365 nm, provided that they are not controlled by 3C002.b through .d.

## LIST OF ITEMS CONTROLLED

Unit: \$ value

**Related Controls:** N/A

**Related Definitions:** Silylation techniques are defined as processes incorporating oxidation of the resist surface to enhance performance for both wet and dry developing.

**Items:**

- a. Positive resists designed for semiconductor lithography specially adjusted (optimized) for use at wavelengths below 350 nm;
- b. All resists designed for use with electron beams or ion beams, with a sensitivity of 0.01  $\mu\text{coulomb}/\text{mm}^2$  or better;

c. All resists designed for use with X-rays, with a sensitivity of 2.5  $\text{mJ}/\text{mm}^2$  or better;

d. All resists optimized for surface imaging technologies, including silylated resists.

**3C003 Organo-inorganic compounds, as follows (see List of Items Controlled).**

## LICENSE REQUIREMENTS

Reason for Control: NS, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

## LICENSE EXCEPTIONS

LVS: \$3000

GBS: N/A

CIV: N/A

## LIST OF ITEMS CONTROLLED

Unit: \$ value

**Related Controls:** This entry controls only compounds whose metallic, partly metallic or non-metallic element is directly linked to carbon in the organic part of the molecule.

**Related Definition:** N/A

**Items:** a. Organo-metallic compounds of aluminum, gallium or indium having a purity (metal basis) better than 99.999%;

b. Organo-arsenic, organo-antimony and organo-phosphorus compounds having a purity (inorganic element basis) better than 99.999%.

**3C004 Hydrides of phosphorus, arsenic or antimony, having a purity better than 99.999%, even diluted in inert gases or hydrogen.**

## LICENSE REQUIREMENTS

Reason for Control: NS, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

## LICENSE EXCEPTIONS

LVS: \$3000

GBS: N/A

CIV: N/A

## LIST OF ITEMS CONTROLLED

Unit: \$ value

**Related Controls:** N/A

**Related Definition:** N/A

**Items:**

The list of items controlled is contained in the ECCN heading.

NOTE: This entry does not control hydrides containing 20% molar or more of inert gases or hydrogen.

**3C992 Positive resists designed for semiconductor lithography specially adjusted (optimized) for use at wavelengths between 370 and 350 nm.**

LICENSE REQUIREMENTS  
Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
LVS: N/A  
GBS: N/A  
CIV: N/A  
LIST OF ITEMS CONTROLLED  
Unit: \$ value  
Related Controls: N/A  
Related Definitions: N/A  
Items:

The list of items controlled is contained in the ECCN heading.

D. SOFTWARE

**3D001 “Software” specially designed for the “development” or “production” of equipment controlled by 3A001.b to 3A002.g or 3B (except 3B991 and 3B992).**

LICENSE REQUIREMENTS  
Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to “software” for equipment controlled by 3A001.b to 3A001.f, 3A002, and 3B.	NS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS  
CIV: N/A  
TSR: Yes, except for “software” specially designed for the “development” or “production” of Traveling Wave Tube Amplifiers described in 3A001.b.8 having operating frequencies exceeding 18 GHz.

LIST OF ITEMS CONTROLLED  
Unit: \$ value.  
Related Controls: “Software” specially designed for the “development” or “production” of the following equipment is under the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121): (a) When operating at frequencies higher than 31 GHz and “space qualified”: Helix tubes (traveling wave tubes (TWT)) defined in 3A001.b.1.a.4.c; microwave solid state amplifiers defined in 3A001.b.4.b; microwave “assemblies” defined in 3A001.b.6; and traveling wave tube amplifiers (TWTAs) defined in 3A001.b.8; (b) “Space qualified” and radiation hardened photovoltaic arrays defined in 3A001.e.1.c (i.e., not having silicon cells or single, dual or triple junction solar cells that have gallium arsenide as one of the junctions), spacecraft/satellite solar concentrators and batteries; and (c) “Space

qualified” atomic frequency standards defined in 3A002.g.2. See also 3D101

Related Definitions: For purposes of photovoltaic arrays in 3A001.e.1.c, an array predominately consists of: a substrate; solar cells having silicon cells or having single, dual, and or triple junction solar cells that have gallium arsenide as one of the junctions; coverglass; ultra-violet coating(s); and bonding agent(s). Spacecraft/satellite: solar concentrators, power conditioners and or controllers, bearing and power transfer assembly, and or deployment hardware/systems are controlled under the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121).

Items: The list of items controlled is contained in the ECCN heading.

**3D002 “Software” specially designed for the “use” of “stored program controlled” equipment controlled by 3B (except 3B991 and 3B992).**

LICENSE REQUIREMENTS  
Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
CIV: N/A  
TSR: Yes  
LIST OF ITEMS CONTROLLED  
Unit: \$ value  
Related Controls: N/A  
Related Definitions: N/A  
Items: The list of items controlled is contained in the ECCN heading.

**3D003 Computer-Aided-Design (CAD) “Software”, Having all of the Following (See List of Items Controlled)**

LICENSE REQUIREMENTS  
Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
CIV: N/A  
TSR: Yes  
LIST OF ITEMS CONTROLLED  
Unit: \$ value.  
Related Controls: 3D003 does not control “software” specially designed for schematic entry, logic simulation, placing and routing, layout verification or pattern generation tape.  
Related Definitions: (1.) Libraries, design attributes or associated data for the design of semiconductor devices or integrated circuits are considered as “technology”. (2.) A

lithographic processing simulator is a "software" package used in the design phase to define the sequence of lithographic, etching and deposition steps for translating masking patterns into specific topographical patterns in conductors, dielectrics or semiconductor material.

*Items:*

- a. Designed for the "development" of semiconductor devices or integrated circuits; and
- b. Designed to perform or use any of the following:
  - b.1. Design rules or circuit verification rules;
  - b.2. Simulation of the physically laid out circuits; or
  - b.3. Lithographic processing simulators for design.

**3D101 "Software" specially designed or modified for the "use" of equipment controlled by 3A101.b.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
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MT applies to entire entry ..... MT Column 1  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**3D980 "Software" specially designed for the "development", "production", or "use" of items controlled by 3A980 and 3A981.**

LICENSE REQUIREMENTS

*Reason for Control:* CC, AT

<i>Control(s)</i>	<i>Country Chart</i>
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CC applies to entire entry ..... CC Column 1  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**3D991 "Software" specially designed for the "development", "production", or "use" of electronic devices or components controlled by 3A991, general purpose electronic equipment controlled by 3A992, or**

**manufacturing and test equipment controlled by 3B991 and 3B992.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
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AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

E. TECHNOLOGY

**3E001 "Technology" according to the General Technology Note for the "development" or "production" of equipment or materials controlled by 3A (except 3A292, 3A980, 3A981, 3A991 or 3A992), 3B (except 3B991 or 3B992) or 3C.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, NP, AT

Control(s)	Country chart
NS applies to "technology" for items controlled by 3A001, 3A002, 3B001, 3B002, or 3C001 to 3C004.	NS Column 1.
MT applies to "technology" for equipment controlled by 3A001 or 3A101 for MT reasons.	MT Column 1.
NP applies to "technology" for equipment controlled by 3A001, 3A201, or 3A225 to 3A233 for NP reasons.	NP Column 1.
AT applies to entire entry .....	AT Column 1.

*License Requirement Note:* See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A  
 TSR: Yes, except N/A for MT, and "technology" specially designed for the "development" or "production" of Traveling Wave Tube Amplifiers described in 3A001.b.8 having operating frequencies exceeding 18 GHz.

LIST OF ITEMS CONTROLLED

*Unit:* N/A  
*Related Controls:* (1.) See also 3E101 and 3E201. (2.) 3E001 does not control "technology" for the "development" or "production" of: (a) Microwave transistors operating at frequencies below 31 GHz; (b) Integrated circuits controlled by 3A001.a.3 to a.12, having all of the following: 1. Using "technology" of 0.7 micrometer or more, AND 2. Not incorporating multi-layer

structures. (3.) The term multi-layer structures in this entry does not include devices incorporating a maximum of two metal layers and two polysilicon layers. (4.) "Technology" according to the General Technology Note for the "development" or "production" of the following commodities is under the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121): (a) When operating at frequencies higher than 31 GHz and "space qualified": helix tubes (traveling wave tubes (TWT)) defined in 3A001.b.1.a.4.c; microwave solid state amplifiers defined in 3A001.b.4.b; microwave "assemblies" defined in 3A001.b.6; or traveling wave tube amplifiers (TWTA) defined in 3A001.b.8; (b) "Space qualified" and radiation hardened photovoltaic arrays defined in 3A001.e.1.c (*i.e.*, not having silicon cells or single, dual or triple junction solar cells that have gallium arsenide as one of the junctions), and spacecraft/satellite solar concentrators and batteries; and (b) "Space qualified" atomic frequency standards defined in 3A002.g.2.

**Related Definition:** For purposes of photovoltaic arrays in 3A001.e.1.c, an array predominately consists of: a substrate; solar cells having silicon cells or having single, dual, and or triple junction solar cells that have gallium arsenide as one of the junctions; coverglass; ultra-violet coating(s); and bonding agent(s). Spacecraft/satellite: solar concentrators, power conditioners and or controllers, bearing and power transfer assembly, and or deployment hardware/systems are controlled under the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121).

**Items:**  
The list of items controlled is contained in the ECCN heading.

**NOTE:** 3E001 does not control "technology" for the "development" or "production" of:

(a) Microwave transistors operating at frequencies below 31 GHz;

(b) Integrated circuits controlled by 3A001.a.3 to a.12, having all of the following:

(b.1) Using "technology" of 0.5 μm or more;

and  
(b.2) Not incorporating multi-layer structures.

**TECHNICAL NOTE:** The term multi-layer structures in Note b.2 does not include devices incorporating a maximum of three metal layers and three polysilicon layers.

**3E002 "Technology" according to the General Technology Note other than that controlled in 3E001 for the "development" or "production" of "microprocessor microcircuits", "micro-computer microcircuits" and microcontroller microcircuits having a "composite theoretical performance" ("CTP") of 530 million theo-**

**retical operations per second (MTOPI) or more and an arithmetic logic unit with an access width of 32 bits or more.**

**LICENSE REQUIREMENTS**  
*Reason for Control:* NS, AT.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
AT applies to entire entry .....	AT Column 1.

**LICENSE EXCEPTIONS**

*CTV:* N/A.

*TSR:* Yes.

**LIST OF ITEMS CONTROLLED**

*Unit:* N/A.

*Related Controls:* N/A.

*Related Definitions:* N/A.

**Items:**

The list of items controlled is contained in the ECCN heading.

**NOTE:** 3E002 does not control "technology" for the "development" or "production" of:

(a) Microwave transistors operating at frequencies below 31 GHz;

(b) Integrated circuits controlled by 3A001.a.3 to a.12, having all of the following:

(b.1) Using "technology" of 0.5 μm or more;

and  
(b.2) Not incorporating multi-layer structures.

**TECHNICAL NOTE:** The term multi-layer structures in Note b.2 does not include devices incorporating a maximum of three metal layers and three polysilicon layers.

**3E003 Other "Technology" for the "Development" or "Production" of Items Described in the List of Items Controlled**

**LICENSE REQUIREMENTS**  
*Reason for Control:* NS, AT.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
AT applies to entire entry .....	AT Column 1.

**LICENSE EXCEPTIONS**

*CTV:* N/A.

*TSR:* Yes, except .f. and .g

**LIST OF ITEMS CONTROLLED**

*Unit:* N/A.

*Related Controls:* (1) Technology for the "development" or "production" of "space qualified" electronic vacuum tubes operating at frequencies of 31 GHz or higher, described in 3E003.g, is under the export license authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121);

(2) See 3E001 for silicon-on-insulation (SOI) technology for the "development" or "production" related to radiation hardening of integrated circuits.

*Related Definitions:* N/A.

**Items:**

- a. Vacuum microelectronic devices;
- b. Hetero-structure semiconductor devices such as high electron mobility transistors (HEMT), hetero-bipolar transistors (HBT), quantum well and super lattice devices;
- c. "Superconductive" electronic devices;
- d. Substrates of films of diamond for electronic components;
- e. Substrates of silicon-on-insulator (SOI) for integrated circuits in which the insulator is silicon dioxide;
- f. Substrates of silicon carbide for electronic components;
- g. Electronic vacuum tubes operating at frequencies of 31 GHz or higher.

**3E101 "Technology" according to the General Technology Note for the "use" of equipment or "software" controlled by 3A001.a.1 or .2, 3A101, or 3D101.**

LICENSE REQUIREMENTS  
Reason for Control: MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
CIV: N/A  
TSR: N/A  
LIST OF ITEMS CONTROLLED  
Unit: N/A  
Related Controls: N/A  
Related Definitions: N/A  
Items: The list of items controlled is contained in the ECCN heading.

**3E102 "Technology" according to the General Technology Note for the "development" of "software" controlled by 3D101.**

LICENSE REQUIREMENTS  
Reason for Control: MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
CIV: N/A  
TSR: N/A  
LIST OF ITEMS CONTROLLED  
Unit: N/A  
Related Controls: N/A  
Related Definitions: N/A  
Items: The list of items controlled is contained in the ECCN heading.

**3E201 "Technology" according to the General Technology Note for the "use" of equipment controlled by 3A001.e.2 or .e.3, 3A201 or 3A225 to 3A233.**

LICENSE REQUIREMENTS  
Reason for Control: NP, AT

Control(s)	Country chart
NP applies to "technology" for equipment controlled by 3A001.e.2, or .e.3, 3A201 or 3A225 to 3A233 for NP reasons.	NP Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS  
CIV: N/A  
TSR: N/A  
LIST OF ITEMS CONTROLLED  
Unit: N/A  
Related Controls: N/A  
Related Definitions: N/A  
Items: The list of items controlled is contained in the ECCN heading.

**3E292 "Technology" according to the General Technology Note for the "development", "production", or "use" of equipment controlled by 3A292.**

LICENSE REQUIREMENTS  
Reason for Control: NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
CIV: N/A  
TSR: N/A  
LIST OF ITEMS CONTROLLED  
Unit: N/A  
Related Controls: N/A  
Related Definitions: N/A  
Items: The list of items controlled is contained in the ECCN heading.

**3E980 "Technology" specially designed for "development", "production", or "use" of items controlled by 3A980 and 3A981.**

LICENSE REQUIREMENTS  
Reason for Control: CC, AT

<i>Control(s)</i>	<i>Country Chart</i>
CC applies to entire entry .....	CC Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
CIV: N/A  
TSR: N/A  
LIST OF ITEMS CONTROLLED  
Unit: N/A  
Related Controls: N/A  
Related Definitions: N/A  
Items: The list of items controlled is contained in the ECCN heading.

**3E991 "Technology" for the "development", "production", or "use" of electronic devices or components controlled by 3A991, general purpose electronic equipment controlled by 3A992, or manufacturing**

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**and test equipment controlled by 3B991 or 3B992.**

**LICENSE REQUIREMENTS**

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

**LICENSE EXCEPTIONS**

CIV: N/A

TSR: N/A

**LIST OF ITEMS CONTROLLED**

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**EAR99 Items subject to the EAR that are not elsewhere specified in this CCL Category or in any other category in the CCL are designated by the number EAR99.**

*Category 4—Computers*

NOTE 1: Computers, related equipment and “software” performing telecommunications or “local area network” functions must also be evaluated against the performance characteristics of Category 5, Part 1 (Telecommunications).

NOTE 2: Control units that directly interconnect the buses or channels of central processing units, “main storage” or disk controllers are not regarded as telecommunications equipment described in Category 5, Part 1 (Telecommunications).

N.B: For the control status of “software” specially designed for packet switching, see ECCN 5D001. (Telecommunications).

NOTE 3: Computers, related equipment and “software” performing cryptographic, cryptanalytic, certifiable multi-level security or certifiable user isolation functions, or that limit electromagnetic compatibility (EMC), must also be evaluated against the performance characteristics in Category 5, Part 2 (“Information Security”).

**A. SYSTEMS, EQUIPMENT AND COMPONENTS**

**4A001 Electronic computers and related equipment, and “electronic assemblies” and specially designed components therefor.**

**LICENSE REQUIREMENTS**

*Reason for Control:* NS, MT, AT, NP, XP

<i>Control(s)</i>	<i>Country chart</i>
NS applies to entire entry .....	NS Column 2.
MT applies to items in 4A001.a when the parameters in 4A101 are met or exceeded.	MT Column 1.

<i>Control(s)</i>	<i>Country chart</i>
AT applies to entire entry .....	AT Column 1.

NP applies, unless a License Exception is available. See §742.3(b) of the EAR for information on applicable licensing review policies.

XP applies to electronic computers with a CTP greater than 28,000 MTOPS, unless a License Exception is available. XP controls vary according to destination and end-user and end-use; however, XP does not apply to Canada. See §742.12 of the EAR for additional information.

**LICENSE REQUIREMENT NOTES:** See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

**LICENSE EXCEPTIONS**

LVS: \$5000 for 4A001.a; N/A for MT and 4A001.b

GBS: N/A

CIV: N/A

**LIST OF ITEMS CONTROLLED**

*Unit:* Equipment in number; parts and accessories in \$ value

*Related Controls:* See also 4A101 and 4A994. Equipment designed or rated for transient ionizing radiation is subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (See 22 CFR part 121.)

*Related Definitions:* For the purposes of integrated circuits in 4A001.a.2,  $5 \times 10^3$  Gy(Si) =  $5 \times 10^5$  Rads (Si);  $5 \times 10^6$  Gy (Si)/s =  $5 \times 10^8$  Rads (Si)/s.

*Items:*

a. Specially designed to have either of the following characteristics:

a.1. Rated for operation at an ambient temperature below 228 K (–45 °C) or above 358 K (85 °C);

NOTE: 4A001.a.1. does not apply to computers specially designed for civil automobile or railway train applications.

a.2. Radiation hardened to exceed any of the following specifications:

a.2.a. A total dose of  $5 \times 10^3$  Gy (Si);

a.2.b. A dose rate upset of  $5 \times 10^6$  Gy (Si)/s; or

a.2.c. Single Event Upset of  $1 \times 10^{-7}$  Error/bit/day;

b. Having characteristics or performing functions exceeding the limits in Category 5, Part 2 (“Information Security”).

**4A002 “Hybrid computers” and “electronic assemblies” and specially designed components therefor.**

**LICENSE REQUIREMENTS**

*Reason for Control:* NS, MT, AT, NP, XP

<i>Control(s)</i>	<i>Country chart</i>
NS applies to entire entry .....	NS Column 2.

Control(s)	Country chart
MT applies to hybrid computers combined with specially designed "software", for modeling, simulation, or design integration of complete rocket systems and unmanned air vehicle systems that are usable in systems controlled for MT reasons.	MT Column 1.
AT applies to entire entry .....	AT Column 1.

Control(s)	Country chart
CC applies to "digital computers" for computerized finger-print equipment.	CC Column 1.
AT applies to entire entry (refer to 4A994 for controls on "digital computers" with a CTP ≥ 6 but ≤ 190,000 MTOPS).	AT Column 1.

NP applies, unless a License Exception is available. See §742.3(b) of the EAR for information on applicable licensing review policies.

XP applies to hybrid computers with a CTP greater than 28,000 MTOPS, unless a License Exception is available. XP controls vary according to destination and end-user and end-use; however, XP does not apply to Canada. See §742.12 of the EAR for additional information.

LICENSE EXCEPTIONS

LVS: \$5000; N/A for MT

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number; parts and accessories in \$ value

Related Controls: See also 4A102 and 4A994

Related Definitions: N/A

Items:

- a. Containing "digital computers" controlled by 4A003;
- b. Containing analog-to-digital converters having all of the following characteristics:
  - b.1. 32 channels or more; and
  - b.2. A resolution of 14 bit (plus sign bit) or more with a conversion rate of 200,000 conversions/s or more.

**4A003 "Digital computers", "electronic assemblies", and related equipment therefor, as follows, and specially designed components therefor.**

LICENSE REQUIREMENTS

Reason for Control: NS, MT, CC, AT, NP, XP

Control(s)	Country chart
NS applies to 4A003.b and .c .....	NS Column 1.
NS applies to 4A003.a, .e, and .g .....	NS Column 2.
MT applies to digital computers used as ancillary equipment for test facilities and equipment that are controlled by 9B005 or 9B006.	MT Column 1.

NP applies, unless a License Exception is available. See §742.3(b) of the EAR for information on applicable licensing review policies.

XP applies to "digital computers" with a CTP greater than 190,000 MTOPS, unless a License Exception is available. XP controls vary according to destination and end-user and end-use; however, XP does not apply to Canada. See §742.12 of the EAR for additional information.

NOTE: For all destinations, except Cuba, Iran, Iraq, Libya, North Korea, Sudan, Syria, no license is required (NLR) for computers with a CTP not greater than 190,000 MTOPS and for "electronic assemblies" described in 4A003.c that are not capable of exceeding a CTP greater than 190,000 MTOPS in aggregation. Computers controlled in this entry for MT reasons are not eligible for NLR.

LICENSE EXCEPTIONS

LVS: \$5000; N/A for MT, b. and .c.

GBS: Yes, for 4A003.e, and .g and specially designed components therefor, exported separately or as part of a system.

CTP: Yes, for computers controlled by 4A003.a or .b, and "electronic assemblies" controlled by 4A003.c, to the exclusion of other technical parameters, with the exception of parameters specified as controlled for Missile Technology (MT) concerns and 4A003.e (equipment performing analog-to-digital conversions exceeding the limits of 3A001.a.5.a). See §740.7 of the EAR.

CIV: Yes, for .e, and .g.

LIST OF ITEMS CONTROLLED

Unit: Equipment in number; parts and accessories in \$ value

Related Controls: See also 4A994 and 4A980

Related Definitions: N/A

Items:

- NOTE 1: 4A003 includes the following:
- a. Vector processors;
  - b. Array processors;
  - c. Digital signal processors;
  - d. Logic processors;
  - e. Equipment designed for "image enhancement";
  - f. Equipment designed for "signal processing".

NOTE 2: The control status of the "digital computers" and related equipment described

in 4A003 is determined by the control status of other equipment or systems provided:

a. The "digital computers" or related equipment are essential for the operation of the other equipment or systems;

b. The "digital computers" or related equipment are not a "principal element" of the other equipment or systems and

*N.B. 1:* The control status of "signal processing" or "image enhancement" equipment specially designed for other equipment with functions limited to those required for the other equipment is determined by the control status of the other equipment even if it exceeds the "principal element" criterion.

*N.B. 2:* For the control status of "digital computers" or related equipment for telecommunications equipment, see Category 5, Part 1 (Telecommunications).

c. The "technology" for the "digital computers" and related equipment is determined by 4E.

a. Designed or modified for "fault tolerance";

NOTE: FOR THE PURPOSES OF 4A003.A., "DIGITAL COMPUTERS" AND RELATED EQUIPMENT ARE NOT CONSIDERED TO BE DESIGNED OR MODIFIED FOR "FAULT TOLERANCE" IF THEY UTILIZE ANY OF THE FOLLOWING:

1. Error detection or correction algorithms in "main storage";

2. The interconnection of two "digital computers" so that, if the active central processing unit fails, an idling but mirroring central processing unit can continue the system's functioning;

3. The interconnection of two central processing units by data channels or by use of shared storage to permit one central processing unit to perform other work until the second central processing unit fails, at which time the first central processing unit takes over in order to continue the system's functioning; or

4. The synchronization of two central processing units by "software" so that one central processing unit recognizes when the other central processing unit fails and recovers tasks from the failing unit.

b. "Digital computers" having a "composite theoretical performance" ("CTP") exceeding 190,000 million theoretical operations per second (MTOPS);

c. "Electronic assemblies" specially designed or modified to be capable of enhancing performance by aggregation of "computing elements" ("CEs") so that the "CTP" of the aggregation exceeds the limit in 4A003.b.;

NOTE 1: 4A003.c applies only to "electronic assemblies" and programmable interconnections not exceeding the limit in 4A003.b. when shipped as unintegrated "electronic assemblies". It does not apply to "electronic assemblies" inherently limited by nature of their design for use as related equipment controlled by 4A003.d. or 4A003.e.

NOTE 2: 4A003.c does not control "electronic assemblies" specially designed for a product or family of products whose maximum configuration does not exceed the limit of 4A003.b.

d. [Reserved]

e. Equipment performing analog-to-digital conversions exceeding the limits in 3A001.a.5;

f. [Reserved]

g. Equipment specially designed to provide external interconnection of "digital computers" or associated equipment that allows communications at data rates exceeding 1.25 Gbyte/s.

NOTE: 4A003.g does not control internal interconnection equipment (e.g., backplanes, buses) passive interconnection equipment, "network access controllers" or "communication channel controllers".

**4A004 Computers, as follows (see List of Items Controlled) and specially designed related equipment, "electronic assemblies" and components therefor.**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$5000

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* a. "Systolic array computers";

b. "Neural computers";

c. "Optical computers".

**4A101 Analog computers, "digital computers" or digital differential analyzers, other than those controlled by 4A001 designed or modified for use in "missiles", having any of the following (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* a. Rated for continuous operation at temperatures from below 228 K (-45° C) to above 328 K (+55° C); or

b. Designed as ruggedized or "radiation hardened".

**4A102 "Hybrid computers" specially designed for modelling, simulation or design integration of "missiles". (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**4A980 Computers for fingerprint equipment, n.e.s.**

LICENSE REQUIREMENTS

*Reason for Control:* CC, AT

<i>Control(s)</i>	<i>Country Chart</i>
CC applies to entire entry .....	CC Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**4A994 Computers, "electronic assemblies", and related equipment not controlled by 4A001, 4A002, or 4A003, and specially designed components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value

*Related Controls:* N/A

*Related Definitions:* "Two dimensional vector rate" is the number vectors generated per second that have 10 pixel poly line vectors, clip tested, randomly oriented, with either integer or floating point X-Y coordinate values (whichever produces the maximum rate) (see paragraph (g) of this ECCN).

*Items:*

a. Electronic computers and related equipment, and "electronic assemblies" and spe-

cially designed components therefor, rated for operation at an ambient temperature above 343 K (70 °C);

b. "Digital computers" having a "composite theoretical performance" ("CTP") equal to or greater than 6 million theoretical operations per second (MTOPS);

c. "Electronic assemblies" that are specially designed or modified to enhance performance by aggregation of "computing elements" ("CEs"), as follows:

c.1. Designed to be capable of aggregation in configurations of 16 or more "computing elements" ("CEs"); or

c.2. Having a sum of maximum data rates on all channels available for connection to associated processors exceeding 40 million Byte/s;

NOTE 1: 4A994.c applies only to "electronic assemblies" and programmable interconnections with a "CTP" not exceeding the limits in 4A994.b, when shipped as unintegrated "electronic assemblies". It does not apply to "electronic assemblies" inherently limited by nature of their design for use as related equipment controlled by 4A994.

NOTE 2: 4A994.c does not control any "electronic assembly" specially designed for a product or family of products whose maximum configuration does not exceed the limits of 4A994.b.

d. Disk drives and solid state storage equipment:

d.1. Magnetic, erasable optical or magneto-optical disk drives with a "maximum bit transfer rate" exceeding 25 million bit/s;

d.2. Solid state storage equipment, other than "main storage" (also known as solid state disks or RAM disks), with a "maximum bit transfer rate" exceeding 36 million bit/s;

e. Input/output control units designed for use with equipment controlled by 4A994.d;

f. Equipment for "signal processing" or "image enhancement" having a "composite theoretical performance" ("CTP") exceeding 8.5 million theoretical operations per second (MTOPS);

g. Graphics accelerators or graphics coprocessors that exceed a "three dimensional vector rate" of 400,000 or, if supported by 2-D vectors only, a "two dimensional vector rate" of 600,000;

NOTE: The provisions of 4A994.g do not apply to work stations designed for and limited to:

a. Graphic arts (e.g., printing, publishing); and

b. The display of two-dimensional vectors.

h. Color displays or monitors having more than 120 resolvable elements per cm in the direction of the maximum pixel density;

NOTE 1: 4A994.h does not control displays or monitors not specially designed for electronic computers.

NOTE 2: Displays specially designed for air traffic control (ATC) systems are treated as

specially designed components for ATC systems under Category 6.

i. Equipment containing "terminal interface equipment" exceeding the limits in 5A991.

NOTE: For the purposes of 4A994.i, "terminal interface equipment" includes "local area network" interfaces, modems and other communications interfaces. "Local area network" interfaces are evaluated as "network access controllers".

j. Equipment specially designed to provide external interconnection of "digital computers" or associated equipment that allows communications at data rates exceeding 80 Mbyte/s.

NOTE: 4A994.j does not control internal interconnection equipment (e.g., backplanes, buses) passive interconnection equipment, "network access controllers" or "communication channel controllers".

B. TEST, INSPECTION AND PRODUCTION EQUIPMENT

**4B994 Equipment for the "development" and "production" of magnetic and optical storage equipment.**

LICENSE REQUIREMENTS

Reason for Control: AT

Control(s) Country Chart

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: This entry does not control general-purpose sputtering equipment.

Related Definition: N/A

Items: a. Equipment specially designed for the application of magnetic coating to controlled non-flexible (rigid) magnetic or magneto-optical media;

b. "Stored program controlled" equipment specially designed for monitoring, grading, exercising or testing controlled rigid magnetic media;

c. Equipment specially designed for the "production" or alignment of heads or head/disk assemblies for controlled rigid magnetic and magneto-optical storage, and electro-mechanical or optical components therefor.

C. MATERIALS

**4C994 Materials specially formulated for and required for the fabrication of head/disk assemblies for controlled magnetic and magneto-optical hard disk drives.**

LICENSE REQUIREMENTS

Reason for Control: AT

Control(s) Country Chart

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

D. SOFTWARE

NOTE: The control status of "software" for the "development", "production", or "use" of equipment described in other Categories is dealt with in the appropriate Category. The control status of "software" for equipment described in this Category is dealt with herein.

**4D001 "Software" specially designed or modified for the "development", "production" or "use" of equipment or "software" controlled by 4A001 to 4A004, or 4D (except 4D980, 4D993 or 4D994), and other specified software, see List of Items Controlled.**

LICENSE REQUIREMENTS

Reason for Control: NS, CC, AT, NP, XP.

Control(s)	Country chart
NS applies to "software" for commodities or software controlled by 4A001 to 4A004, 4D001 to 4D003.	NS Column 1.
CC applies to "software" for computerized finger-print equipment controlled by 4A003 for CC reasons.	CC Column 1.
AT applies to entire entry .....	AT Column 1.

NP applies, unless a License Exception is available. See §742.3(b) of the EAR for information on applicable licensing review policies.

XP applies to "software" for computers with a CTP greater than 190,000 MTOPS, unless a License Exception is available. XP controls vary according to destination and end-user and end-use; however, XP does not apply to Canada. See §742.12 of the EAR for additional information.

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A

TSR: (a) N/A for:

- (1) "Software" for equipment or "software" requiring a license; or
- (2) "Software" described by TSR paragraph (b)(1)(ii) of this License Exception section, when exported or reexported to a destination not included in TSR paragraph (b)(1)(i) of this License Exception section.
  - (b) Yes for:
    - (1) "Software":
      - (i) Exported or reexported to Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, or the United Kingdom; and
      - (ii) Specially designed for the "development" or "production" of any of the following:
        - (A) "Digital" computers controlled by 4A003.b and having a CTP exceeding than 33,000 MTOPS; or
        - (B) "Electronic assemblies" controlled by 4A003.c and capable of enhancing performance by aggregation of "computing elements" so that the CTP of the aggregation exceeds 33,000 MTOPS; and
    - (2) All other "software" not described in TSR paragraphs (a) or (b)(1) of this License Exception section.

LIST OF ITEMS CONTROLLED

Unit: \$ value  
 Related Controls: N/A  
 Related Definitions: N/A  
 Items:

- a. "Software" specially designed or modified for the "development", "production" or "use" of equipment or "software" controlled by 4A001 to 4A004, or 4D (except 4D980, 4D993 or 4D994).
- b. "Software", other than that controlled by the heading, specially designed or modified for the "development" or "production" of:
  - b.1. "Digital computers" having a "composite theoretical performance" ("CTP") exceeding 28,000 MTOPS; or
  - b.2. "Electronic assemblies" specially designed or modified for enhancing performance by aggregation of "computing elements" ("CEs") so that the "CTP" of the aggregation exceeds the limit in 4D001.b.1.

**4D002 "Software" specially designed or modified to support "technology" controlled by 4E (except 4E980, 4E992, and 4E993).**

LICENSE REQUIREMENTS  
 Reason for Control: NS, AT, NP, XP

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1
AT applies to entire entry .....	AT Column 1

NP applies, unless a License Exception is available. See §742.3(b) of the EAR for information on applicable licensing review policies.

XP applies to "software" for computers with a CTP greater than 28,000 MTOPS, unless a License Exception is available. XP controls vary according to destination and end-user and end-use; however, XP does not apply to Canada. See §742.12 of the EAR for additional information.

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: Yes, except N/A for "software" specifically designed or modified to support "technology" for computers requiring a license.

LIST OF ITEMS CONTROLLED

Unit: \$ value  
 Related Controls: N/A  
 Related Definitions: N/A  
 Items: The list of items controlled is contained in the ECCN heading.

**4D003 Specific "software", as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS  
 Reason for Control: NS, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: Yes, except 4D003.c

LIST OF ITEMS CONTROLLED

Unit: \$ value.  
 Related Controls: N/A.  
 Related Definitions: N/A.  
 Items:
 

- a. Operating system "software", "software" development tools and compilers specially designed for "multi-data-stream processing" equipment, in "source code";
- b. [Reserved]
- c. "Software" having characteristics or performing functions exceeding the limits in Category 5, Part 2 ("Information Security").

**4D980 "Software" specially designed for the "development", "production", or "use" of items controlled by 4A980.**

LICENSE REQUIREMENTS  
 Reason for Control: CC, AT

Control(s)	Country Chart
CC applies to entire entry .....	CC Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

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*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**4D993 “Program” proof and validation “software”, “software” allowing the automatic generation of “source codes”, and operating system “software” not controlled by 4D003 that are specially designed for real time processing equipment.**

LICENSE REQUIREMENTS  
*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* “Global interrupt latency time” is the time taken by the computer system to recognize an interrupt due to the event, service the interrupt and perform a context switch to an alternate memory-resident task waiting on the interrupt.

- Items:*
- a. “Program” proof and validation “software” using mathematical and analytical techniques and designed or modified for “programs” having more than 500,000 “source code” instructions;
  - b. “Software” allowing the automatic generation of “source codes” from data acquired on line from external sensors described in the Commerce Control List;
  - c. Operating system “software” specially designed for “real time processing” equipment that guarantees a “global interrupt latency time” of less than 20 microseconds.

**4D994 “Software” other than that controlled in 4D001 specially designed or modified for the “development”, “production”, or “use” of equipment controlled by 4A101, 4A994, 4B994, and materials controlled by 4C994.**

LICENSE REQUIREMENTS  
*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* N/A

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*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

E. TECHNOLOGY

**4E001 “Technology” according to the General Technology Note, for the “development”, “production” or “use” of equipment or “software” controlled by 4A (except 4A980, 4A993 or 4A994) or 4D (except 4D980, 4D993, 4D994), and other specified technology, see List of Items Controlled.**

LICENSE REQUIREMENTS  
*Reason for Control:* NS, MT, CC, AT, NP, XP.

Control(s)	Country chart
NS applies to “technology” for commodities or software controlled by 4A001 to 4A004, 4D001 to 4D003.	NS Column 1.
MT applies to “technology” for items controlled by 4A001.a and 4A101 for MT reasons.	MT Column 1.
CC applies to “technology” for computerized fingerprint equipment controlled by 4A003 for CC reasons.	CC Column 1.
AT applies to entire entry .....	AT Column 1.

NP applies, unless a License Exception is available. See §742.3(b) of the EAR for information on applicable licensing review policies.

XP applies to “technology” for computers with a CTP greater than 190,000 MTOPS, unless a License Exception is available. XP controls vary according to destination and end-user and end-use; however, XP does not apply to Canada. See §742.12 of the EAR for additional information.

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

- CIV:* N/A  
*TSR:* (a) N/A for:
- (1) “Technology” controlled for MT reasons; or
  - (2) “Technology” described by TSR paragraph (b)(2)(ii) of this License Exception, when exported or reexported to a destination not included in TSR paragraph (b)(2)(i) of this License Exception.
- (b) Yes for:
- (1) “Technology” directly related to hardware eligible for export or reexport under a License Exception;
  - (2) “Technology”:
- (i) Exported or reexported to Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal,

- Spain, Sweden, Switzerland, Turkey, or the United Kingdom; and
- (ii) For the "development" or "production" of any of the following:
    - (A) "Digital" computers controlled by 4A003.b and having a CTP exceeding 33,000 MTOPS;
    - (B) "Electronic assemblies" controlled by 4A003.c and capable of enhancing performance by aggregation of "computing elements" so that the CTP of the aggregation exceeds 33,000 MTOPS; or
    - (C) "Software" controlled by 4D001 and specially designed for the "development" or "production" of equipment listed in TSR paragraphs (b)(2)(ii)(A) or (b)(2)(ii)(B) of this License Exception section; and
  - (3) All other "technology" not described in TSR paragraphs (a), (b)(1), or (b)(2) of this License Exception section.

LIST OF ITEMS CONTROLLED

Unit: N/A  
 Related Controls: N/A  
 Related Definitions: N/A  
 Items:

- a. "Technology" according to the General Technology Note, for the "development," "production," or "use" of equipment or "software" controlled by 4A (except 4A980, 4A993 or 4A994) or 4D (except 4D980, 4D993, 4D994).
- b. "Technology", other than that controlled by 4E001.a, specially designed or modified for the "development" or "production" of:
  - b.1. "Digital computers" having a "composite theoretical performance" ("CTP") exceeding 28,000 MTOPS; or
  - b.2. "Electronic assemblies" specially designed or modified for enhancing performance by aggregation of "computing elements" ("CEs") so that the "CTP" of the aggregation exceeds the limit in 4E001.b.1.

**4E980 "Technology" for the "development", "production", or "use" of items controlled by 4A980.**

LICENSE REQUIREMENTS  
 Reason for Control: CC, AT

<i>Control(s)</i>	<i>Country Chart</i>
CC applies to entire entry .....	CC Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: N/A  
 LIST OF ITEMS CONTROLLED  
 Unit: N/A  
 Related Controls: N/A  
 Related Definitions: N/A  
 Items: The list of items controlled is contained in the ECCN heading.

**4E992 "Technology" other than that controlled in 4E001 for the "development", "production", or "use" of equipment controlled by 4A994 and 4B994, materials controlled by 4C994, or "software" controlled by 4D993 or 4D994.**

LICENSE REQUIREMENTS  
 Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: N/A  
 LIST OF ITEMS CONTROLLED  
 Unit: N/A  
 Related Controls: See also 4E994  
 Related Definitions: N/A  
 Items: The list of items controlled is contained in the ECCN heading.

**4E993 Other "Technology" for the "development" or "production" of graphics accelerators or equipment designed for "multi-data-stream processing" and "technology" "required" for the "development" or "production" of magnetic hard disk drives.**

LICENSE REQUIREMENTS  
 Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: N/A  
 LIST OF ITEMS CONTROLLED  
 Unit: N/A  
 Related Controls: N/A  
 Related Definitions: N/A  
 Items: a. "Technology" for the "development" or "production" of graphics accelerators;

- b. "Technology", for the "development" or "production" of equipment designed for "multi-data-stream processing";
- c. "Technology", "required" for the "development" or "production" of magnetic hard disk drives with a "maximum bit transfer rate" ("MBTR") exceeding 11 Mbit/s.

**EAR99 Items subject to the EAR that are not elsewhere specified in this CCL Category or in any other category in the CCL are designated by the number EAR99.**

Information on How to Calculate "Composite Theoretical Performance" ("CTP")  
 TECHNICAL NOTE: "COMPOSITE THEORETICAL PERFORMANCE" ("CTP")  
 Abbreviations used in this Technical Note

“CE”	“computing element” (typically an arithmetic logical unit)
FP	floating point
XP	fixed point
t	execution time
XOR	exclusive OR
CPU	central processing unit
TP	theoretical performance (of a single “CE”)
“CTP”	“composite theoretical performance” (multiple “CEs”)
R	effective calculating rate
WL	word length
L	word length adjustment
*	multiply

Execution time t is expressed in microseconds, TP and “CTP” are expressed in millions of theoretical operations per second (Mtops) and WL is expressed in bits.

*Outline of “CTP” calculation method*

“CTP” is a measure of computational performance given in Mtops. In calculating the “CTP” of an aggregation of “CEs” the following three steps are required:

1. Calculate the effective calculating rate R for each “CE”;
2. Apply the word length adjustment (L) to the effective calculating rate (R), resulting in a Theoretical Performance (TP) for each “CE”;
3. If there is more than one “CE”, combine the TPs, resulting in a “CTP” for the aggregation.

Details for these steps are given in the following sections.

NOTE 1: For aggregations of multiple “CEs” that have both shared and unshared memory subsystems, the calculation of “CTP” is completed hierarchically, in two steps: first, aggregate the groups of “CEs” sharing memory; second, calculate the “CTP” of the groups using the calculation method for multiple “CEs” not sharing memory.

NOTE 2: “CEs” that are limited to input/output and peripheral functions (e.g., disk drive, communication and video display controllers) are not aggregated into the “CTP” calculation.

The following table shows the method of calculating the Effective Calculating Rate R for each “CE”:

Step 1: The effective calculating rate R



<p>For simple logic processors not implementing any of the specified arithmetic operations.</p>	<p>1 ----- <math>3 * t_{log}</math> Where <math>t_{log}</math> is the execute time of the XOR, or for logic hardware not implementing the XOR, the fastest simple logic operation. See Notes X &amp; Z</p>
<p>For special logic processors not using any of the specified arithmetic or logic operations.</p>	<p><math>R = R' * WL/64</math> Where R' is the number of results per second, WL is the number of <u>bits</u> upon which the logic operation occurs, and 64 is a factor to normalize to a 64 bit operation.</p>

NOTE W: For a pipelined "CE" capable of executing up to one arithmetic or logic operation every clock cycle after the pipeline is full, a pipelined rate can be established. The effective calculating rate (R) for such a "CE" is the faster of the pipelined rate or non-pipelined execution rate.

NOTE X: For a "CE" that performs multiple operations of a specific type in a single cycle (e.g., two additions per cycle or two identical logic operations per cycle), the execution time t is given by:

**cycle time**

$$t = \text{-----}$$

**the number of identical operations per machine cycle**

"CEs" that perform different types of arithmetic or logic operations in a single machine cycle are to be treated as multiple separate "CEs" performing simultaneously (e.g., a "CE" performing an addition and a multiplication in one cycle is to be treated as two "CEs", the first performing an addition in one cycle and the second performing

a multiplication in one cycle). If a single "CE" has both scalar function and vector function, use the shorter execution time value.

NOTE Y: For the "CE" that does not implement FP add or FP multiply, but that performs FP divide:

1

$$R_{fp} = \frac{1}{t_{fpdivide}}$$

If the "CE" implements FP reciprocal but not FP add, FP multiply or FP divide, then

1

$$R_{fp} = \frac{1}{t_{fpreciprocal}}$$

If none of the specified instructions is implemented, the effective FP rate is 0.

NOTE Z: In simple logic operations, a single instruction performs a single logic manipulation of no more than two operands of given lengths. In complex logic operations, a single instruction performs multiple logic manipulations to produce one or more results from two or more operands.

Rates should be calculated for all supported operand lengths considering both pipelined operations (if supported), and non-pipelined operations using the fastest executing instruction for each operand length based on:

1. Pipelined or register-to-register operations. Exclude extraordinarily short execution times generated for operations on a predetermined operand or operands (for example, multiplication by 0 or 1). If no register-to-register operations are implemented, continue with (2).

2. The faster of register-to-memory or memory-to-register operations; if these also do not exist, then continue with (3).

3. Memory-to-memory.

In each case above, use the shortest execution time certified by the manufacturer.

Step 2: *TP for each supported operand length WL*

Adjust the effective rate R (or R) by the word length adjustment L as follows:  
 $P = R * L$ , where  $L = (1/3 + WL/96)$

NOTE: The word length WL used in these calculations is the operand length in bits. (If an operation uses operands of different lengths, select the largest word length.) The combination of a mantissa ALU and an expo-

nent ALU of a floating point processor or unit is considered to be one "CE" with a Word Length (WL) equal to the number of bits in the data representation (typically 32 or 64) for purposes of the "CTP" calculation.

This adjustment is not applied to specialized logic processors that do not use XOR instructions. In this case  $TP = R$ .

Select the maximum resulting value of TP for:

- Each XP-only "CE" ( $R_{xp}$ );
- Each FP-only "CE" ( $R_{fp}$ );
- Each combined FP and XP "CE" (R);

Each simple logic processor not implementing any of the specified arithmetic operations; *and*

Each special logic processor not using any of the specified arithmetic or logic operations.

Step 3: *"CTP" for aggregations of "CEs", including CPUs.*

For a CPU with a single "CE", "CTP" = TP (for "CEs" performing both fixed and floating point operations  $TP = \max(TP_{fp}, TP_{xp})$ )

"CTP" for aggregations of multiple "CEs" operating simultaneously is calculated as follows:

NOTE 1: For aggregations that do not allow all of the "CEs" to run simultaneously, the possible combination of "CEs" that provides the largest "CTP" should be used. The TP of each contributing "CE" is to be calculated at its maximum value theoretically possible before the "CTP" of the combination is derived.

N.B.: To determine the possible combinations of simultaneously operating "CEs",

generate an instruction sequence that initiates operations in multiple "CEs", beginning with the slowest "CE" (the one needing the largest number of cycles to complete its operation) and ending with the fastest "CE". At each cycle of the sequence, the combination of "CEs" that are in operation during that cycle is a possible combination. The instruction sequence must take into account all hardware and/or architectural constraints on overlapping operations.

NOTE 2: A single integrated circuit chip or board assembly may contain multiple "CEs".

NOTE 3: Simultaneous operations are assumed to exist when the computer manufacturer claims concurrent, parallel or simultaneous operation or execution in a manual or brochure for the computer.

NOTE 4: "CTP" values are not to be aggregated for "CE" combinations (inter)connected by "Local Area Networks", Wide Area Networks, I/O shared connections/devices, I/O controllers and any communication interconnection implemented by "software".

NOTE 5: "CTP" values must be aggregated for multiple "CEs" specially designed to enhance performance by aggregation, operating simultaneously and sharing memory, or multiple memory/"CE"-combinations operating simultaneously utilizing specially designed hardware.

This aggregation does not apply to "electronic assemblies" described by 4A003.c.

$$CTP = TP_1 + C_2 * TP_2 + \dots + C_n * TP_n$$

Where the TPs are ordered by value, with TP<sub>1</sub> being the highest, TP<sub>2</sub> being the second highest, ..., and TP<sub>n</sub> being the lowest. C<sub>i</sub> is a coefficient determined by the strength of the interconnection between "CEs", as follows:

For multiple "CEs" operating simultaneously and sharing memory:

$$C_2 = C_3 = C_4 = \dots = C_n = 0.75$$

NOTE 1: When the "CTP" calculated by the above method does not exceed 194 Mtops, the following formula may be used to calculate C<sub>i</sub>:

0.75

$$C_i = \frac{0.75}{\sqrt{m}}$$

$$(i = 2, \dots, n)$$

$\sqrt{m}$

Where m=the number of "CEs" or groups of "CEs" sharing access.

provided:

1. The TP<sub>1</sub> of each "CE" or group of "CEs" does not exceed 30 Mtops;

2. The "CEs" or groups of "CEs" share access to main memory (excluding cache memory) over a single channel; and

3. Only one "CE" or group of "CEs" can have use of the channel at any given time.

N.B.: This does not apply to items controlled under Category 3.

NOTE 2: "CEs" share memory if they access a common segment of solid state memory. This memory may include cache memory, main memory or other internal memory. Peripheral memory devices such as disk drives, tape drives or RAM disks are not included.

For Multiple "CEs" or groups of "CEs" not sharing memory, interconnected by one or more data channels:

$$C_i = 0.75 * k_i \quad (i=2, \dots, 32) \text{ (see Note below)}$$

$$= 0.60 * k_i \quad (i=33, \dots, 64)$$

$$= 0.45 * k_i \quad (i=65, \dots, 256)$$

$$= 0.30 * k_i \quad (i > 256)$$

The value of C<sub>i</sub> is based on the number of "CE"s, not the number of nodes.

Where k<sub>i</sub>=min (S<sub>i</sub>/K<sub>i</sub>, 1), and

K<sub>i</sub>=normalizing factor of 20 MByte/s.

S<sub>i</sub> = sum of the maximum data rates (in units of MByte/s) for all data channels connected to the i<sup>th</sup> "CE" or group of "CEs" sharing memory.

When calculating a C<sub>i</sub> for a group of "CEs", the number of the first "CE" in a group determines the proper limit for C<sub>i</sub>. For example, in an aggregation of groups consisting of 3 "CEs" each, the 22nd group will contain "CE"<sub>64</sub>, "CE"<sub>65</sub> and "CE"<sub>66</sub>. The proper limit for C<sub>i</sub> for this group is 0.60.

Aggregation (of "CEs" or groups of "CEs") should be from the fastest-to-slowest; i.e.: TP<sub>1</sub> ≥ TP<sub>2</sub> ≥ ... ≥ TP<sub>n</sub>, and

in the case of TP<sub>i</sub> = TP<sub>i+1</sub>, from the largest to smallest; i.e.: C<sub>i</sub> ≥ C<sub>i+1</sub>

NOTE: The k<sub>i</sub> factor is not to be applied to "CEs" 2 to 12 if the TP<sub>i</sub> of the "CE" or group of "CEs" is more than 50 Mtops; i.e., C<sub>i</sub> for "CEs" 2 to 12 is 0.75.

Category 5—Telecommunications and  
“Information Security”

I. TELECOMMUNICATIONS

NOTES: 1. The control status of components, “lasers”, test and “production” equipment and “software” therefor which are specially designed for telecommunications equipment or systems is determined in Category 5, Part I.

2. “Digital computers”, related equipment or “software”, when essential for the operation and support of telecommunications equipment described in this Category, are regarded as specially designed components, provided they are the standard models customarily supplied by the manufacturer. This includes operation, administration, maintenance, engineering or billing computer systems.

A. SYSTEMS, EQUIPMENT AND COMPONENTS

**5A001 Telecommunications systems, equipment, and components.**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to 5A001.a .....	NS Column 1
NS applies to 5A001.b, .c. or .d ..	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

LVS: N/A for 5A001.a and b.5 \$5000 for 5A001b.1, b.2, b.3, b.6, and .d \$3000 for 5A001.c

GBS: Yes, except 5A001.a and b.5

CIV: Yes, except 5A001.a, b.3 and b.5

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; cable and fiber in meters/feet, components and accessories in \$ value.

*Related Controls:* Telecommunications equipment defined in 5A001.a.1 through 5A001.a.3 for use on board satellites is subject to the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121). See also 5A101 and 5A991.

*Related Definitions:* N/A

*Items:*

a. Any type of telecommunications equipment having any of the following characteristics, functions or features:

a.1. Specially designed to withstand transitory electronic effects or electromagnetic pulse effects, both arising from a nuclear explosion;

a.2. Specially hardened to withstand gamma, neutron or ion radiation; or

a.3. Specially designed to operate outside the temperature range from 218 K (-55 °C) to 397 K (124 °C).

NOTE: 5A001.a.3 applies only to electronic equipment.

NOTE: 5A001.a.2 and 5A001.a.3 do not apply to equipment on board satellites.

b. Telecommunication transmission equipment and systems, and specially designed components and accessories therefor, having any of the following characteristics, functions or features:

b.1 Being underwater communications systems having any of the following characteristics:

b.1.a. An acoustic carrier frequency outside the range from 20 kHz to 60 kHz;

b.1.b. Using an electromagnetic carrier frequency below 30 kHz; or

b.1.c. Using electronic beam steering techniques;

b.2. Being radio equipment operating in the 1.5 MHz to 87.5 MHz band and having any of the following characteristics:

b.2.a. Incorporating adaptive techniques providing more than 15 dB suppression of an interfering signal; or

b.2.b. Having all of the following:

b.2.b.1. Automatically predicting and selecting frequencies and “total digital transfer rates” per channel to optimize the transmission; and

b.2.b.2. Incorporating a linear power amplifier configuration having a capability to support multiple signals simultaneously at an output power of 1 kW or more in the frequency range of 1.5 MHz or more but less than 30 MHz, or 250 W or more in the frequency range of 30 MHz or more but not exceeding 87.5 MHz, over an “instantaneous bandwidth” of one octave or more and with an output harmonic and distortion content of better than -80 dB;

b.3. Being radio equipment employing “spread spectrum” techniques, including “frequency hopping” techniques, having any of the following characteristics:

b.3.a. User programmable spreading codes; or

b.3.b. A total transmitted bandwidth which is 100 or more times the bandwidth of any one information channel and in excess of 50 kHz;

NOTE: 5A001.b.3.b does not control radio equipment specially designed for use with civil cellular radio-communications systems.

NOTE: 5A001.b.3 does not control equipment operating at an output power of 1.0 Watt or less.

b.4 Being radio equipment employing “time-modulated ultra-wideband” techniques, having user programmable channelizing or scrambling codes;

b.5 Being digitally controlled radio receivers having all of the following:

b.5.a. More than 1,000 channels;

b.5.b. A "frequency switching time" of less than 1 ms;

b.5.c. Automatic searching or scanning of a part of the electromagnetic spectrum; *and*

b.5.d. Identification of the received signals or the type of transmitter; *or*

NOTE: 5A001.b.5 does not control radio equipment specially designed for use with civil cellular radio-communications systems.

b.6. Employing functions of digital "signal processing" to provide voice coding output at rates of less than 2,400 bit/s.

TECHNICAL NOTE: For variable rate voice coding, 5A001.b.6 applies to the voice coding output of continuous speech.

c. Optical fiber communication cables, optical fibers and accessories, as follows:

c.1. Optical fibers of more than 500 m in length specified by the manufacturer as being capable of withstanding a proof test tensile stress of  $2 \times 10^9$  N/m<sup>2</sup> or more;

TECHNICAL NOTE: Proof Test: on-line or off-line production screen testing that dynamically applies a prescribed tensile stress over a 0.5 to 3 m length of fiber at a running rate of 2 to 5 m/s while passing between capstans approximately 150 mm in diameter. The ambient temperature is a nominal 293 K (20 °C) and relative humidity 40%. Equivalent national standards may be used for executing the proof test.

c.2. Optical fiber cables and accessories designed for underwater use.

NOTE: 5A001.c.2 does not control standard civil telecommunication cables and accessories.

N.B. 1: For underwater umbilical cables, and connectors thereof, see 8A002.a.3.

N.B. 2: For fiber-optic hull penetrators or connectors, see 8A002.c.

d. "Electronically steerable phased array antennae" operating above 31 GHz.

NOTE: 5A001.d does not control "electronically steerable phased array antennae" for landing systems with instruments meeting ICAO standards covering microwave landing systems (MLS).

**5A101 Telemetry and telecontrol equipment as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS  
Reason for Control: MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
LVS: N/A  
GBS: N/A  
CIV: N/A  
LIST OF ITEMS CONTROLLED  
*Unit:* Number  
*Related Controls:* N/A  
*Related Definitions:* N/A

*Items:*

- a. Usable for unmanned air vehicles or rocket systems; *and*
- b. Usable for "missiles."

NOTE: 5A101 does not control telecontrol equipment specially designed to be used for remote control of recreational model planes, boats or vehicles and having an electric field strength of not more than 200 microvolts per meter at a distance of 500 meters.

**5A980 Communications intercepting devices; and parts and accessories therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* Controls on equipment described in this entry are maintained in accordance with the Omnibus Crime Control and Safe Streets Act of 1968 (Public Law 90-351). A license is required for ALL destinations, regardless of end-use. Accordingly, a column specific to this control does not appear on the Commerce Country Chart. (See §742.13 of the EAR for additional information on the scope of this control.)

NOTE: These items are subject to the United Nations Security Council arms embargo against Rwanda described in §746.8 of the EAR.

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**5A991 Telecommunication equipment, not controlled by 5A001.**

LICENSE REQUIREMENTS  
*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
LVS: N/A  
GBS: N/A  
CIV: N/A  
LIST OF ITEMS CONTROLLED  
*Unit:* \$ value.  
*Related Controls:* Telecommunication equipment defined in 5A991 for use on board satellites is subject to the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121). *See also* 5E101 and 5E991.  
*Related Definitions:* (1) 'Bandwidth of one voice channel' is data communication equipment designed to operate in one voice channel of

3,100 Hz, as defined in CCITT Recommendation G.151. (2) *'Communications channel controller'* is the physical interface that controls the flow of synchronous or asynchronous digital information. It is an assembly that can be integrated into computer or telecommunications equipment to provide communications access. (3) *'Datagram'* is a self-contained, independent entity of data carrying sufficient information to be routed from the source to the destination data terminal equipment without reliance on earlier exchanges between this source and destination data terminal equipment and the transporting network. (4) *'Fast select'* is a facility applicable to virtual calls that allows data terminal equipment to expand the possibility to transmit data in call set-up and clearing 'packets' beyond the basic capabilities of a virtual call. (5) *'Gateway'* is the function, realized by any combination of equipment and "software", to carry out the conversion of conventions for representing, processing or communicating information used on one system into the corresponding, but different conventions used in another system. (6) *'Integrated Services Digital Network'* (ISDN) is a unified end-to-end digital network, in which data originating from all types of communication (e.g., voice, text, data, still and moving pictures) are transmitted from one port (terminal) in the exchange (switch) over one access line to and from the subscriber. (7) *'Packet'* is a group of binary digits including data and call control signals that is switched as a composite whole. The data, call control signals, and possible error control information are arranged in a specified format.

**Items:**

a. Any type of telecommunications equipment, not controlled by 5A001.a, specially designed to operate outside the temperature range from 219 K (-54 °C) to 397 K (124 °C).

b. Telecommunication transmission equipment and systems, and specially designed components and accessories therefor, having any of the following characteristics, functions or features:

NOTE: Telecommunication transmission equipment:

a. Categorized as follows, or combinations thereof:

1. Radio equipment (e.g., transmitters, receivers and transceivers);
2. Line terminating equipment;
3. Intermediate amplifier equipment;
4. Repeater equipment;
5. Regenerator equipment;
6. Translation encoders (transcoders);
7. Multiplex equipment (statistical multiplex included);
8. Modulators/demodulators (modems);
9. Transmultiplex equipment (see CCITT Rec. G701);

10. "Stored program controlled" digital crossconnection equipment;

11. "Gateways" and bridges;
12. "Media access units"; and

b. Designed for use in single or multi-channel communication via any of the following:

1. Wire (line);
2. Coaxial cable;
3. Optical fiber cable;
4. Electromagnetic radiation; or
5. Underwater acoustic wave propagation.

b.1. Employing digital techniques, including digital processing of analog signals, and designed to operate at a "digital transfer rate" at the highest multiplex level exceeding 45 Mbit/s or a "total digital transfer rate" exceeding 90 Mbit/s;

NOTE: 5A991.b.1 does not control equipment specially designed to be integrated and operated in any satellite system for civil use.

b.2. Modems using the "bandwidth of one voice channel" with a "data signaling rate" exceeding 9,600 bits per second;

b.3. Being "stored program controlled" digital cross connect equipment with "digital transfer rate" exceeding 8.5 Mbit/s per port.

b.4. Being equipment containing any of the following:

b.4.a. "Network access controllers" and their related common medium having a "digital transfer rate" exceeding 33 Mbit/s;

or

b.4.b. "Communication channel controllers" with a digital output having a "data signaling rate" exceeding 64,000 bit/s per channel;

NOTE: If any uncontrolled equipment contains a "network access controller", it cannot have any type of telecommunications interface, except those described in, but not controlled by 5A991.b.4.

b.5. Employing a "laser" and having any of the following characteristics:

b.5.a. A transmission wavelength exceeding 1,000 nm; or

b.5.b. Employing analog techniques and having a bandwidth exceeding 45 MHz;

NOTE: 5A991.b.5.b does not control commercial TV systems.

b.5.c. Employing coherent optical transmission or coherent optical detection techniques (also called optical heterodyne or homodyne techniques);

b.5.d. Employing wavelength division multiplexing techniques; or

b.5.e. Performing "optical amplification"

b.6. Radio equipment operating at input or output frequencies exceeding:

b.6.a. 31 GHz for satellite-earth station applications; or

b.6.b. 26.5 GHz for other applications;

NOTE: 5A991.b.6. does not control equipment for civil use when conforming with an International Telecommunications Union (ITU) allocated band between 26.5 GHz and 31 GHz.

b.7. Being radio equipment employing any of the following:

b.7.a. Quadrature-amplitude-modulation (QAM) techniques above level 4 if the “total digital transfer rate” exceeds 8.5 Mbit/s;

b.7.b. QAM techniques above level 16 if the “total digital transfer rate” is equal to or less than 8.5 Mbit/s; *or*

b.7.c. Other digital modulation techniques and having a “spectral efficiency” exceeding 3 bit/s/Hz;

NOTES: 1. 5A991.b.7 does not control equipment specially designed to be integrated and operated in any satellite system for civil use.

2. 5A991.b.7 does not control radio relay equipment for operation in an ITU allocated band:

a. Having any of the following:

a.1. Not exceeding 960 MHz; *or*

a.2. With a “total digital transfer rate” not exceeding 8.5 Mbit/s; and

b. Having a “spectral efficiency” not exceeding 4 bit/s/Hz.

b.8. Providing functions of digital “signal processing” as follows:

b.8.a. Voice coding at rates less than 2,400 bit/s;

b.8.b. Employing circuitry that incorporates “user-accessible programmability” of digital “signal processing” circuits exceeding the limits of 4A003.b.

c. “Stored program controlled” switching equipment and related signaling systems, having any of the following characteristics, functions or features, and specially designed components and accessories therefor:

NOTE: Statistical multiplexers with digital input and digital output which provide switching are treated as “stored program controlled” switches.

c.1. “Data (message) switching” equipment or systems designed for “packet-mode operation” and assemblies and components therefor, *n.e.s.*

c.2. Containing “Integrated Services Digital Network” (ISDN) functions and having any of the following:

c.2.a. Switch-terminal (*e.g.*, subscriber line) interfaces with a “digital transfer rate” at the highest multiplex level exceeding 192,000 bit/s, including the associated signaling channel (*e.g.*, 2B+D); *or*

c.2.b. The capability that a signaling message received by a switch on a given channel that is related to a communication on another channel may be passed through to another switch.

NOTE: 5A991.c does not preclude the evaluation and appropriate actions taken by the receiving switch or unrelated user message traffic on a D channel of ISDN.

c.3. Routing or switching of “datagram” packets;

c.4. Routing or switching of “fast select” packets;

NOTE: The restrictions in 5A991.c.3 and c.4 do not apply to networks restricted to using only “network access controllers” or to “network access controllers” themselves.

c.5. Multi-level priority and pre-emption for circuit switching;

NOTE: 5A991.c.5 does not control single-level call preemption.

c.6. Designed for automatic hand-off of cellular radio calls to other cellular switches or automatic connection to a centralized subscriber data base common to more than one switch;

c.7. Containing “stored program controlled” digital cross connect equipment with “digital transfer rate” exceeding 8.5 Mbit/s per port.

c.8. “Common channel signaling” operating in either non-associated or quasi-associated mode of operation;

c.9. “Dynamic adaptive routing”

NOTE: 5A991.c.10 does not control packet switches or routers with ports or lines not exceeding the limits in 5A991.c.10.

c.10. Being packet switches, circuit switches and routers with ports or lines exceeding any of the following:

c.10.a. A “data signaling rate” of 64,000 bit/s per channel for a “communications channel controller” *or*

NOTE: 5A991.c.10.a does not control multiplex composite links composed only of communication channels not individually controlled by 5A991.b.1.

c.10.b. A “digital transfer rate” of 33 Mbit/s for a “network access controller” and related common media;

c.11. “Optical switching”;

c.12. Employing “Asynchronous Transfer Mode (‘ATM’) techniques.

d. Optical fibers and optical fiber cables of more than 50 m in length designed for single mode operation;

e. Centralized network control having all of the following characteristics:

e.1. Receives data from the nodes; *and*

e.2. Process these data in order to provide control of traffic not requiring operator decisions, and thereby performing “dynamic adaptive routing”;

NOTE: 5A991.e does not preclude control of traffic as a function of predictable statistical traffic conditions.

f. Phased array antennae, operating above 10.5 GHz, containing active elements and distributed components, and designed to permit electronic control of beam shaping and pointing, except for landing systems with instruments meeting International Civil Aviation Organization (ICAO) standards (microwave landing systems (MLS)).

g. Mobile communications equipment, *n.e.s.*, and assemblies and components therefor; *or*

h. Radio relay communications equipment designed for use at frequencies equal to or

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exceeding 19.7 GHz and assemblies and components therefor, n.e.s.

**B. TEST, INSPECTION AND PRODUCTION EQUIPMENT**

**5B001 Telecommunication test, inspection and production equipment, as follows (See List of Items Controlled).**

LICENSE REQUIREMENTS  
*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

License Requirement Notes: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

LVS: \$5000

GBS: Yes

CIV: Yes

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value.

*Related Controls:* See also 5B991.

*Related Definition:* N/A.

*Items:*

a. Equipment and specially designed components or accessories therefor, specially designed for the "development", "production" or "use" of equipment, functions or features controlled by 5A001, 5D001 or 5E001.

NOTE: 5B001.a. does not control optical fiber characterization equipment.

b. Equipment and specially designed components or accessories therefor, specially designed for the "development" of any of the following telecommunication transmission or "stored program controlled" switching equipment:

b.1. Equipment employing digital techniques, including "Asynchronous Transfer Mode" ("ATM"), designed to operate at a "total digital transfer rate" exceeding 1.5 Gbit/s;

b.2. Equipment employing a "laser" and having any of the following:

b.2.a. A transmission wavelength exceeding 1750 nm;

b.2.b. Performing "optical amplification"

b.2.c. Employing coherent optical transmission or coherent optical detection techniques (also called optical heterodyne or homodyne techniques); *or*

b.2.d. Employing analog techniques and having a bandwidth exceeding 2.5 GHz;

NOTE: 5B001.b.2.d. does not include equipment specially designed for the "development" of commercial TV systems.

b.3. Equipment employing "optical switching"

b.4. Radio equipment employing quadrature-amplitude-modulation (QAM) techniques above level 256; *or*

b.5. Equipment employing "common channel signaling" operating in non-associated mode of operation.

**5C991 Preforms of glass or of any other material optimized for the manufacture of optical fibers controlled by 5A991.**

LICENSE REQUIREMENTS  
*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

The list of items controlled is contained in the ECCN heading.

**D. SOFTWARE**

**5D001 "Software", as described in the List of Items Controlled.**

LICENSE REQUIREMENTS  
*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: Yes, except for "software" controlled by 5D001.a and specially designed for the "development" or "production" of items controlled by 5A001.b.5  
TSR: Yes, except for exports and reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "software" controlled by 5D001.a and specially designed for items controlled by 5A001.b.5.

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* See also 5D991.

*Related Definitions:* N/A.

*Items:*

a. "Software" specially designed or modified for the "development", "production" or "use" of equipment, functions or features controlled by 5A001 or 5B001.

b. "Software" specially designed or modified to support "technology" controlled by 5E001.

c. Specific "software" as follows:

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c.1. "Software" specially designed or modified to provide characteristics, functions or features of equipment controlled by 5A001 or 5B001;

c.2. [Reserved];

c.3. "Software", other than in machine-executable form, specially designed for "dynamic adaptive routing".

d. "Software" specially designed or modified for the "development" of any of the following telecommunication transmission or "stored program controlled" switching equipment:

d.1. Equipment employing digital techniques, including "Asynchronous Transfer Mode" ("ATM"), designed to operate at a "total digital transfer rate" exceeding 1.5 Gbit/s;

d.2. Equipment employing a "laser" and having any of the following:

d.2.a. A transmission wavelength exceeding 1750 nm; or

d.2.b. Employing analog techniques and having a bandwidth exceeding 2.5 GHz;

NOTE: 5D001.d.2.b. does not control "software" specially designed or modified for the "development" of commercial TV systems.

d.3. Equipment employing "optical switching"; or

d.4. Radio equipment employing quadrature-amplitude-modulation (QAM) techniques above level 256.

5D101 "Software" specially designed or modified for the "use" of items controlled by 5A101.

LICENSE REQUIREMENTS

Reason for Control: MT, AT

Control(s) Country Chart

MT applies to entire entry ..... MT Column 1

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

5D991 "Software" specially designed or modified for the "development", "production", or "use" of equipment controlled by 5A991 and 5B991.

LICENSE REQUIREMENTS

Reason for Control: AT

Control(s) Country Chart

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

E. TECHNOLOGY

5E001 "Technology", (see List of Items Controlled).

LICENSE REQUIREMENTS

Reason for Control: NS, AT

Control(s) Country Chart

NS applies to entire entry ..... NS Column 1

AT applies to entire entry ..... AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes, except for exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "technology" controlled by 5E001.a for the "development" or "production" of the following:

(1) Items controlled by 5A001.b.5; or

(2) "Software" controlled by 5D001.a that is specially designed for the "development" or "production" of equipment, functions or features controlled by 5A001.b.5.

LIST OF ITEMS CONTROLLED

Unit: \$ value.

Related Controls: Technology defined in 5E001.b.1, 5E001.b.2, 5E001.b.4, or 5E001.c for use on board satellites is subject to the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121). See also 5E101 and 5E991

Related Definitions: N/A.

Items:

a. "Technology" according to the General Technology Note for the "development", "production" or "use" (excluding operation) of equipment, functions or features or "software" controlled by 5A001, 5B001 or 5D001.

b. Specific "technologies", as follows:

b.1. "Required" "technology" for the "development" or "production" of telecommunications equipment specially designed to be used on board satellites;

b.2. "Technology" for the "development" or "use" of "laser" communication techniques with the capability of automatically acquiring and tracking signals and maintaining communications through exoatmosphere or sub-surface (water) media;

b.3. "Technology" for the "development" of digital cellular radio base station receiving equipment whose reception capabilities that allow multi-band, multi-channel, multi-mode, multi-coding algorithm or multi-protocol operation can be modified by changes in "software";

b.4. "Technology" for the "development" of "spread spectrum" techniques, including "frequency hopping" techniques.

c. "Technology" according to the General Technology Note for the "development" or "production" of any of the following telecommunication transmission or "stored program controlled" switching equipment, functions or features:

c.1. Equipment employing digital techniques, including "Asynchronous Transfer Mode" ("ATM"), designed to operate at a "total digital transfer rate" exceeding 1.5 Gbit/s;

c.2. Equipment employing a "laser" and having any of the following:

c.2.a. A transmission wavelength exceeding 1750 nm;

c.2.b. Performing "optical amplification" using praseodymium-doped fluoride fiber amplifiers (PDFFA);

c.2.c. Employing coherent optical transmission or coherent optical detection techniques (also called optical heterodyne or homodyne techniques);

c.2.d. Employing wavelength division multiplexing techniques exceeding 8 optical carriers in a single optical window; *or*

c.2.e. Employing analog techniques and having a bandwidth exceeding 2.5 GHz;

NOTE: 5E001.c.2.e. does not control "technology" for the "development" or "production" of commercial TV systems.

c.3. Equipment employing "optical switching";

c.4. Radio equipment having any of the following:

c.4.a. Quadrature-amplitude-modulation (QAM) techniques above level 256; *or*

c.4.b. Operating at input or output frequencies exceeding 31 GHz; *or*

NOTE: 5E001.c.4.b. does not control "technology" for the "development" or "production" of equipment designed or modified for operation in any frequency band which is "allocated by the ITU" for radio-communications services, but not for radio-determination.

c.5. Equipment employing "common channel signaling" operating in non-associated mode of operation.

**5E101 "Technology" according to the General Technology Note for the "development," "production" or "use" of equipment or software controlled by 5A101 or 5D101.**

LICENSE REQUIREMENTS  
Reason for Control: MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

**5E991 "Technology" for the "Development," "Production" or "Use" of Equipment Controlled by 5A991 or 5B991, or "Software" Controlled by 5D991, and Other "Technologies" as Follows (see List of Items Controlled)**

LICENSE REQUIREMENTS

Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value.

Related Controls: N/A.

Related Definitions: (1) "Synchronous digital hierarchy" (SDH) is a digital hierarchy providing a means to manage, multiplex, and access various forms of digital traffic using a synchronous transmission format on different types of media. The format is based on the Synchronous Transport Module (STM) that is defined by CCITT Recommendation G.703, G.707, G.708, G.709 and others yet to be published. The first level rate of 'SDH' is 155.52 Mbits/s. (2) 'Synchronous optical network' (SONET) is a network providing a means to manage, multiplex and access various forms of digital traffic using a synchronous transmission format on fiber optics. The format is the North America version of 'SDH' and also uses the Synchronous Transport Module (STM). However, it uses the Synchronous Transport Signal (STS) as the basic transport module with a first level rate of 51.81 Mbits/s. The SONET standards are being integrated into those of 'SDH'.

Items:

a. Specific "technologies" as follows:

a.1. "Technology" for the processing and application of coatings to optical fiber specially designed to make it suitable for underwater use;

a.2. "Technology" for the "development" of equipment employing 'Synchronous Digital Hierarchy' ('SDH') or 'Synchronous Optical Network' ('SONET') techniques.

**EAR99 Items subject to the EAR that are not elsewhere specified in this CCL Category or in any other category in the CCL are designated by the number EAR99.**

II. "INFORMATION SECURITY"

NOTE 1: The control status of "information security" equipment, "software", systems, application specific "electronic assemblies", modules, integrated circuits, components, or functions is determined in Category 5, Part 2 even if they are components or "electronic assemblies" of other equipment.

N.B. TO NOTE 1: Commodities and software specially designed for medical end-use that incorporate an item in Category 5, part 2 are not classified in any ECCN in Category 5, part 2.

NOTE 2: Category 5, part 2, encryption products, when accompanying their user for the user's personal use or as tools of trade, are eligible for License Exceptions TMP or BAG, subject to the terms and conditions of these License Exceptions.

NOTE 3: Cryptography Note: ECCNs 5A002 and 5D002 do not control items that meet all of the following:

a. Generally available to the public by being sold, without restriction, from stock at retail selling points by means of any of the following:

1. Over-the-counter transactions;
2. Mail order transactions;
3. Electronic transactions; or
4. Telephone call transactions;

b. The cryptographic functionality cannot be easily changed by the user;

c. Designed for installation by the user without further substantial support by the supplier; and

d. When necessary, details of the items are accessible and will be provided, upon request, to the appropriate authority in the exporter's country in order to ascertain compliance with conditions described in paragraphs (a) through (c) of this note.

N.B. TO CRYPTOGRAPHY NOTE: Mass market encryption commodities and software eligible for the Cryptography Note are subject to the notification or review requirements described in §742.15(b)(1) and (b)(2) of the EAR, unless specifically excluded from these requirements by §742.15(b)(3) of the EAR. Mass market commodities and software employing a key length greater than 64 bits for the symmetric algorithm must be reviewed in accordance with the requirements of §742.15(b)(2) of the EAR in order to be released from the "EI" and "NS" controls of ECCN 5A002 or 5D002. All other mass market commodities and software eligible for the Cryptography Note are controlled under ECCN 5A992 or 5D992 (without review) and may be exported or reexported to most destinations without a license, following notifi-

cation, in accordance with the requirements of §742.15(b)(1) of the EAR.

A. SYSTEMS, EQUIPMENT AND COMPONENTS

**5A002 Systems, equipment, application specific "electronic assemblies", modules and integrated circuits for "information security", as follows (see List of Items Controlled), and other specially designed components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT, EI

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1.
AT applies to entire entry .....	AT Column 1.

EI applies to encryption items transferred from the U.S. Munitions List to the Commerce Control List consistent with E.O. 13026 of November 15, 1996 (61 FR 58767) and pursuant to the Presidential Memorandum of that date. Refer to §742.15 of this subchapter.

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports of commodities controlled under 5A002 and exported under License Exceptions LVS or GOV.

LICENSE EXCEPTIONS

LVS: Yes: \$500 for components and spare parts only. N/A for equipment.

GBS: N/A

CIV: N/A

List of Items Controlled

*Unit:* \$ value.

*Related Controls:* 5A002 does not control the items listed in paragraphs (a) through (f) in the Note in the items paragraph of this entry. These items are instead controlled under ECCN 5A992.

*Related Definitions:* N/A

*Items:*

NOTE: 5A002 does not control the following. However, these items are instead controlled under 5A992:

(a) "Personalized smart cards":

(1) Where the cryptographic capability is restricted for use in equipment or systems excluded from control paragraphs (b) through (f) of this Note; or

(2) For general public-use applications where the cryptographic capability is not user-accessible and it is specially designed and limited to allow protection of personal data stored within.

N.B.: If a "personalized smart card" has multiple functions, the control status of each function is assessed individually.

(b) Receiving equipment for radio broadcast, pay television or similar restricted audience broadcast of the consumer type, without digital encryption except that exclusively used for sending the billing or program-related information back to the broadcast providers.

(c) Equipment where the cryptographic capability is not user-accessible and which is specially designed and limited to allow any of the following:

- (1) Execution of copy-protected "software";
- (2) Access to any of the following:

(a) Copy-protected contents stored on read-only media; or

(b) Information stored in encrypted form on media (e.g., in connection with the protection of intellectual property rights) where the media is offered for sale in identical sets to the public; or

(3) Copying control of copyright protected audio/video data.

(d) Cryptographic equipment specially designed and limited for banking use or money transactions;

(e) Portable or mobile radiotelephones for civil use (e.g., for use with commercial civil cellular radio communications systems) that are not capable of end-to-end encryption.

*N.B.:* The term "money transactions" includes the collection and settlement of fares or credit functions.

(f) Cordless telephone equipment not capable of end-to-end encryption where the maximum effective range of unboosted cordless operation (e.g., a single, unrelayed hop between terminal and home basestation) is less than 400 meters according to the manufacturer's specifications.

TECHNICAL NOTE: Parity bits are not included in the key length.

a. Systems, equipment, application specific "electronic assemblies", modules and integrated circuits for "information security", as follows, and other specially designed components therefor:

*N.B.:* For the control of global navigation satellite systems receiving equipment containing or employing decryption (e.g., GPS or GLONASS) see 7A005.

a.1. Designed or modified to use "cryptography" employing digital techniques performing any cryptographic function other than authentication or digital signature having any of the following:

TECHNICAL NOTES:

1. Authentication and digital signature functions include their associated key management function.

2. Authentication includes all aspects of access control where there is no encryption of files or text except as directly related to the protection of passwords, Personal Identification Numbers (PINs) or similar data to prevent unauthorized access.

3. "Cryptography" does not include "fixed" data compression or coding techniques.

NOTE: 5A002.a.1 includes equipment designed or modified to use "cryptography" employing analog principles when implemented with digital techniques.

a.1.a. A "symmetric algorithm" employing a key length in excess of 56-bits; or

a.1.b. An "asymmetric algorithm" where the security of the algorithm is based on any of the following:

a.1.b.1. Factorization of integers in excess of 512 bits (e.g., RSA);

a.1.b.2. Computation of discrete logarithms in a multiplicative group of a finite field of size greater than 512 bits (e.g., Diffie-Hellman over  $Z/pZ$ ); or

a.1.b.3. Discrete logarithms in a group other than mentioned in 5A002.a.1.b.2 in excess of 112 bits (e.g., Diffie-Hellman over an elliptic curve);

a.2. Designed or modified to perform cryptanalytic functions;

a.3. [Reserved]

a.4. Specially designed or modified to reduce the compromising emanations of information-bearing signals beyond what is necessary for health, safety or electromagnetic interference standards;

a.5. Designed or modified to use cryptographic techniques to generate the spreading code for "spread spectrum" systems, including the hopping code for "frequency hopping" systems;

a.6. Designed or modified to use cryptographic techniques to generate channelizing or scrambling codes for "time-modulated ultra-wideband" systems;

a.7. Designed or modified to provide certified or certifiable "multilevel security" or user isolation at a level exceeding Class B2 of the Trusted Computer System Evaluation Criteria (TCSEC) or equivalent;

a.8. Communications cable systems designed or modified using mechanical, electrical or electronic means to detect surreptitious intrusion.

PART 2—INFORMATION SECURITY

**5A992 Equipment not controlled by 5A002.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to 5A992.a .....	AT Column 1
AT applies to 5A992.b .....	AT Column 2

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

Items:

a. Telecommunications and other information security equipment containing encryption.

b. "Information security" equipment, n.e.s., (e.g., cryptographic, cryptanalytic, and cryptologic equipment, n.e.s.) and components therefor.

**5B002 Information Security—test, inspection and "production" equipment.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry.	NS Column 1
AT applies to entire entry.	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* a. Equipment specially designed for:

a.1. The "development" of equipment or functions controlled by 5A002, 5B002, 5D002 or 5E002, including measuring or test equipment;

a.2. The "production" of equipment or functions controlled by 5A002, 5B002, 5D002, or 5E002, including measuring, test, repair or production equipment;

b. Measuring equipment specially designed to evaluate and validate the "information security" functions controlled by 5A002 or 5D002.

C. MATERIALS [RESERVED]

D. SOFTWARE

**5D002 Information Security—"Software"**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT, EI

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
AT applies to entire entry .....	AT Column 1.

"EI" applies to encryption items transferred from the U.S. Munitions List to the Commerce Control List consistent with Executive Order 13026 of November 15, 1996 (3 CFR, 1996 Comp., p.228) and pursuant to the Presidential Memorandum of that date. Refer to §742.15 of the EAR.

NOTE: Encryption software is controlled because of its functional capacity, and not

because of any informational value of such software; such software is not accorded the same treatment under the EAR as other "software"; and for export licensing purposes, encryption software is treated under the EAR in the same manner as a commodity included in ECCN 5A002.

NOTE: Encryption software controlled for "EI" reasons under this entry remains subject to the EAR even when made publicly available in accordance with part 734 of the EAR. See §740.13(e) of the EAR for information on releasing certain source code (and corresponding object code) which would be considered publicly available from "EI" controls.

NOTE: After notification to BIS, 56-bit encryption items (including key management products not exceeding 512 bits) and up to (and including) 64-bit mass market encryption commodities and software are released from "EI" and "NS" controls. After a review by BIS, all other mass market encryption commodities and software eligible for the Cryptography Note also may be released from "EI" and "NS" controls. See §742.15(b)(1) and (b)(2) of the EAR.

License Exceptions

*CIV:* N/A

*TSR:* N/A

List of Items Controlled

*Unit:* \$ value.

*Related Controls:* This entry does not control "software" "required" for the "use" of equipment excluded from control under the Related Controls paragraph or the Technical Notes in ECCN 5A002 or "software" providing any of the functions of equipment excluded from control under ECCN 5A002. These items are controlled under ECCN 5D992.

*Related Definitions:* 5D002.a controls "software" designed or modified to use "cryptography" employing digital or analog techniques to ensure "information security".

*Items:*

a. "Software" specially designed or modified for the "development", "production", or "use" of equipment or "software" controlled by 5A002, 5B002, or 5D002.

b. "Software" specially designed or modified to support "technology" controlled by 5E002.

c. Specific "software" as follows:

c.1. "Software" having the characteristics, or performing or simulating the functions of the equipment controlled by 5A002 or 5B002;

c.2. "Software" to certify "software" controlled by 5D002.c.1.

**5D992 "Information Security" "software" not controlled by 5D002.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to 5D992.a.1 and .b.1 ..	AT Column 1

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*Control(s)*                      *Country Chart*

AT applies to 5D992.a.2, b.2 and c    AT Column 2

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED  
*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* 1

    a. "Software", as follows:  
     a.1 "Software" specially designed or modified for the "development", "production", or "use" of telecommunications and other information security equipment containing encryption (e.g., equipment controlled by 5A992.a);  
     a.2 "Software" specially designed or modified for the "development", "production, or "use" of information security or cryptologic equipment (e.g., equipment controlled by 5A992.b).

    b. "Software", as follows:  
     b.1. "Software" having the characteristics, or performing or simulating the functions of the equipment controlled by 5A992.a.  
     b.2. "Software" having the characteristics, or performing or simulating the functions of the equipment controlled by 5A992.b.  
     c. "Software" designed or modified to protect against malicious computer damage, e.g., viruses.

**E. TECHNOLOGY**

**5E002 "Technology" according to the General Technology Note for the "development", "production" or "use" of equipment controlled by 5A002 or 5B002 or "software" controlled by 5D002.**

LICENSE REQUIREMENTS  
*Reason for Control:* NS, AT, EI

*Control(s)*                      *Country Chart*

NS applies to entire entry .....    NS Column 1  
 AT applies to entire entry .....    AT Column 1

EI applies to encryption items transferred from the U.S. Munitions List to the Commerce Control List consistent with E.O. 13026 of November 15, 1996 (61 FR 58767) and pursuant to the Presidential Memorandum of that date.

Refer to §742.15 of the EAR

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED  
*Unit:* N/A  
*Related Controls:* See also 5E992  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**5E992 "Information Security" "technology", not controlled by 5E002.**

LICENSE REQUIREMENTS  
*Reason for Control:* AT

*CONTROL(S)*                      *Country Chart*

AT applies to 5E992.a .....    AT Column 1  
 AT applies to 5E992.b .....    AT Column 2

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED  
*Unit:* N/A  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:*

    a. "Technology" n.e.s., for the "development", "production" or "use" of telecommunications equipment and other information security and containing encryption (e.g., equipment controlled by 5A992.a) or "software" controlled by 5D992.a.1 or b.1.  
     b. "Technology", n.e.s., for the "development", "production" or "use" of "information security" or cryptologic equipment (e.g., equipment controlled by 5A992.b), or "software" controlled by 5D992.a.2, b.2, or c.

**EAR99 Items subject to the EAR that are not elsewhere specified in this CCL Category or in any other category in the CCL are designated by the number EAR99.**

*Category 6—Sensors and Lasers*

**A. SYSTEMS, EQUIPMENT AND COMPONENTS**

**6A001 Acoustics.**

LICENSE REQUIREMENTS  
*Reason for Control:* NS, ATO

*Control(s)*                      *Country Chart*

NS applies to entire entry .....    NS Column 2  
 AT applies to entire entry .....    AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS  
 LVS: \$3000; N/A for 6A001.a.1.b.1 object detection and location systems having a transmitting frequency below 5 kHz or a sound pressure level exceeding 210 dB (reference 1 µ Pa at 1 m) for equipment with an operating frequency in the band from 30 kHz to 2 kHz inclusive; 6A001.a.2.a.1, a.2.a.2, a.2.a.4, a.2.a.5, 6A001.a.2.b; processing equipment controlled by 6A001.a.2.c, and specially designed for real time application with towed acoustic hydrophone arrays; a.2.e.1, a.2.e.2; and bottom or bay cable systems controlled by 6A001.a.2.f and having processing equipment specially designed

for real time application with bottom or bay cable systems.

GBS: Yes for 6A001.a.1.b.4.

CIV: Yes for 6A001.a.1.b.4.

LIST OF ITEMS CONTROLLED

Unit: \$ value.

Related Controls: See also 6A991.

Related Definitions: N/A.

Items:

a. Marine acoustic systems, equipment and specially designed components therefor, as follows:

a.1. Active (transmitting or transmitting-and-receiving) systems, equipment and specially designed components therefor, as follows:

NOTE: 6A001.a.1 does not control:

a. Depth sounders operating vertically below the apparatus, not including a scanning function exceeding  $\pm 20^\circ$ , and limited to measuring the depth of water, the distance of submerged or buried objects or fish finding;

b. Acoustic beacons, as follows:

1. Acoustic emergency beacons;

2. Pingers specially designed for relocating or returning to an underwater position.

a.1.a. Wide-swath bathymetric survey systems designed for sea bed topographic mapping, having all of the following:

a.1.a.1. Being designed to take measurements at an angle exceeding  $20^\circ$  from the vertical;

a.1.a.2. Being designed to measure depths exceeding 600 m below the water surface; *and*

a.1.a.3. Being designed to provide any of the following:

a.1.a.3.a. Incorporation of multiple beams any of which is less than  $1.9^\circ$ ; *or*

a.1.a.3.b. Data accuracies of better than 0.3% of water depth across the swath averaged over the individual measurements within the swath;

a.1.b. Object detection or location systems having any of the following:

a.1.b.1. A transmitting frequency below 10 kHz;

a.1.b.2. Sound pressure level exceeding 224dB (reference  $1 \mu\text{Pa}$  at 1 m) for equipment with an operating frequency in the band from 10 kHz to 24 kHz inclusive;

a.1.b.3. Sound pressure level exceeding 235 dB (reference  $1 \mu\text{Pa}$  at 1 m) for equipment with an operating frequency in the band between 24 kHz and 30 kHz;

a.1.b.4. Forming beams of less than  $1^\circ$  on any axis and having an operating frequency of less than 100 kHz;

a.1.b.5. Designed to operate with an unambiguous display range exceeding 5,120 m; *or*

a.1.b.6. Designed to withstand pressure during normal operation at depths exceeding 1,000 m and having transducers with any of the following:

a.1.b.6.a. Dynamic compensation for pressure; *or*

a.1.b.6.b. Incorporating other than lead zirconate titanate as the transduction element;

a.1.c. Acoustic projectors, including transducers, incorporating piezoelectric, magnetostrictive, electrostrictive, electrodynamic or hydraulic elements operating individually or in a designed combination, having any of the following:

NOTES: 1. The control status of acoustic projectors, including transducers, specially designed for other equipment is determined by the control status of the other equipment.

2. 6A001.a.1.c does not control electronic sources that direct the sound vertically only, or mechanical (e.g., air gun or vapor-shock gun) or chemical (e.g., explosive) sources.

a.1.c.1. An instantaneous radiated acoustic power density exceeding  $0.01 \text{ mW/mm}^2/\text{Hz}$  for devices operating at frequencies below 10 kHz;

a.1.c.2. A continuously radiated acoustic power density exceeding  $0.001 \text{ Mw/mm}^2/\text{Hz}$  for devices operating at frequencies below 10 kHz; *or*

TECHNICAL NOTE: Acoustic power density is obtained by dividing the output acoustic power by the product of the area of the radiating surface and the frequency of operation.

a.1.c.3. Side-lobe suppression exceeding 22 dB;

a.1.d. Acoustic systems, equipment and specially designed components for determining the position of surface vessels or underwater vehicles designed to operate at a range exceeding 1,000 m with a positioning accuracy of less than 10 m rms (root mean square) when measured at a range of 1,000 m;

NOTE: 6A001.a.1.d includes:

a. Equipment using coherent "signal processing" between two or more beacons and the hydrophone unit carried by the surface vessel or underwater vehicle;

b. Equipment capable of automatically correcting speed-of-sound propagation errors for calculation of a point.

a.2. Passive (receiving, whether or not related in normal application to separate active equipment) systems, equipment and specially designed components therefor, as follows:

a.2.a. Hydrophones having any of the following characteristics:

NOTE: The control status of hydrophones specially designed for other equipment is determined by the control status of the other equipment.

a.2.a.1. Incorporating continuous flexible sensors or assemblies of discrete sensor elements with either a diameter or length less than 20 mm and with a separation between elements of less than 20 mm;

a.2.a.2. Having any of the following sensing elements:

a.2.a.2.a. Optical fibers; *or*

a.2.a.2.b. Flexible piezoelectric ceramic materials;

a.2.a.3. A hydrophone sensitivity better than -180dB at any depth with no acceleration compensation;

a.2.a.4. When designed to operate at depths exceeding 35 m with acceleration compensation; *or*

a.2.a.5. Designed for operation at depths exceeding 1,000 m;

TECHNICAL NOTE: Hydrophone sensitivity is defined as twenty times the logarithm to the base 10 of the ratio of rms output voltage to a 1 V rms reference, when the hydrophone sensor, without a pre-amplifier, is placed in a plane wave acoustic field with an rms pressure of 1  $\mu$ Pa. For example, a hydrophone of -160 dB (reference 1 V per  $\mu$ Pa) would yield an output voltage of  $10^{-8}$  V in such a field, while one of -180 dB sensitivity would yield only  $10^{-9}$  V output. Thus, -160 dB is better than -180 dB.

a.2.b. Towed acoustic hydrophone arrays having any of the following:

a.2.b.1. Hydrophone group spacing of less than 12.5 m;

a.2.b.2. Designed or "able to be modified" to operate at depths exceeding 35m;

TECHNICAL NOTE: "Able to be modified" in 6A001.a.2.b.2 means having provisions to allow a change of the wiring or interconnections to alter hydrophone group spacing or operating depth limits. These provisions are: spare wiring exceeding 10% of the number of wires, hydrophone group spacing adjustment blocks or internal depth limiting devices that are adjustable or that control more than one hydrophone group.

a.2.b.3. Heading sensors controlled by 6A001.a.2.d;

a.2.b.4. Longitudinally reinforced array hoses;

a.2.b.5. An assembled array of less than 40 mm in diameter;

a.2.b.6. Multiplexed hydrophone group signals designed to operate at depths exceeding 35 m or having an adjustable or removable depth sensing device in order to operate at depths exceeding 35 m; *or*

a.2.b.7. Hydrophone characteristics controlled by 6A001.a.2.a;

a.2.c. Processing equipment, specially designed for towed acoustic hydrophone arrays, having "user accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;

a.2.d. Heading sensors having all of the following:

a.2.d.1. An accuracy of better than  $\pm 0.5^\circ$ ; *and*

a.2.d.2. Designed to operate at depths exceeding 35 m or having an adjustable or removable depth sensing device in order to operate at depths exceeding 35 m;

a.2.e. Bottom or bay cable systems having any of the following:

a.2.e.1. Incorporating hydrophones controlled by 6A001.a.2.a; *or*

a.2.e.2. Incorporating multiplexed hydrophone group signal modules having all of the following characteristics:

a.2.e.2.a. Designed to operate at depths exceeding 35 m or having an adjustable or removal depth sensing device in order to operate at depths exceeding 35 m; *and*

a.2.e.2.b. Capable of being operationally interchanged with towed acoustic hydrophone array modules;

a.2.f. Processing equipment, specially designed for bottom or bay cable systems, having "user accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;

b. Correlation-velocity sonar log equipment designed to measure the horizontal speed of the equipment carrier relative to the sea bed at distances between the carrier and the sea bed exceeding 500 m.

**6A002 Optical sensors.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, CC, RS, AT, UN.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 2
MT applies to optical detectors in 6A002.a.1, a.3, or .e that are specially designed or modified to protect "missiles" against nuclear effects ( <i>e.g.</i> , Electromagnetic Pulse (EMP), X-rays, combined blast and thermal effects), and usable for "missiles".	MT Column 1
RS applies to 6A002.a.1, a.2, a.3, .c, and .e.	RS Column 1
CC applies to police-model infrared viewers in 6A002.c.	CC Column 1
AT applies to entire entry .....	AT Column 1
UN applies to 6A002.a.1, a.2 a.3 and c.	Rwanda.

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

LVS: \$3000, *except* N/A for MT and for 6A002.a.1, a.2, a.3, .c, and .e

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value.

*Related Controls:* The following commodities are subject to the export licensing authority of U.S. Department of State, Office of Defense Trade Controls (22 CFR part 121): 1.) "Image intensifiers" defined in 6A002.a.2 and "focal plane arrays" defined in 6A002.a.3 specially designed, modified, or configured for military use and not part of civil equipment; 2.) "Space qualified"

solid-state detectors defined in 6A002.a.1, “space qualified” imaging sensors (e.g., “monospectral imaging sensors” and “multispectral imaging sensors”) defined in 6A002.b.2.b.1, and “space qualified” cryocoolers defined in 6A002.d.1, unless, on or after September 23, 2002, the Department of State issues a commodity jurisdiction determination assigning the export licensing authority to the Department of Commerce, Bureau of Industry and Security. See also 6A102, 6A202, and 6A992

NOTE: Exporters may apply for a commodity jurisdiction request with the Department of State, Office of Defense Trade Controls for “space qualified” solid-state detectors defined in 6A002.a.1 and imaging sensors (e.g., “monospectral imaging sensors” and “multispectral imaging sensors”) defined in 6A002.b.2.b.1 that may have predominant civil application(s).

*Related Definitions:* N/A

*Items:*

a. Optical detectors, as follows:  
NOTE: 6A002.a does not control germanium or silicon photodevices.

a.1. “Space-qualified” solid-state detectors, as follows:

a.1.a. “Space-qualified” solid-state detectors, having all of the following:

a.1.a.1. A peak response in the wavelength range exceeding 10 nm but not exceeding 300 nm; *and*

a.1.a.2. A response of less than 0.1% relative to the peak response at a wavelength exceeding 400 nm;

a.1.b. “Space-qualified” solid-state detectors, having all of the following:

a.1.b.1. A peak response in the wavelength range exceeding 900 nm but not exceeding 1,200 nm; *and*

a.1.b.2. A response “time constant” of 95 ns or less;

a.1.c. “Space-qualified” solid-state detectors having a peak response in the wavelength range exceeding 1,200 nm but not exceeding 30,000 nm;

a.2. Image intensifier tubes and specially designed components therefor, as follows:

a.2.a. Image intensifier tubes having all of the following:

a.2.a.1. A peak response in the wavelength range exceeding 400 nm but not exceeding 1,050 nm;

a.2.a.2. A microchannel plate for electron image amplification with a hole pitch (center-to-center spacing) of 12  $\mu$ m or less; *and*

a.2.a.3. Any of the following photocathodes:

a.2.a.3.a. S-20, S-25 or multialkali photocathodes with a luminous sensitivity exceeding 350  $\mu$ A/lm;

a.2.a.3.b. GaAs or GaInAs photocathodes; *or*

a.2.a.3.c. Other III-V compound semiconductor photocathodes;

NOTE: 6A002.a.2.a.3.c does not apply to compound semiconductor photocathodes with a

maximum radiant sensitivity of 10 mA/W or less.

a.2.b. Specially designed components, as follows:

a.2.b.1. Microchannel plates having a hole pitch (center-to-center spacing) of 12  $\mu$ m or less;

a.2.b.2. GaAs or GaInAs photocathodes;

a.2.b.3. Other III-V compound semiconductor photocathodes;

NOTE: 6A002.a.2.b.3 does not control compound semiconductor photocathodes with a maximum radiant sensitivity of 10 mA/W or less.

a.3. Non-“space-qualified” “focal plane arrays”, as follows:

TECHNICAL NOTES:

1. Linear or two-dimensional multi-element detector arrays are referred to as “focal plane arrays”.

2. For the purposes of 6A002.a.3. “cross scan direction” is defined as the axis parallel to the linear array of detector elements and the “scan direction” is defined as the axis perpendicular to the linear array of detector elements.

NOTE 1: 6A002.a.3 includes photoconductive arrays and photovoltaic arrays.

NOTE 2: 6A002.a.3 does not control:

a. Silicon “focal plane arrays”;

b. Multi-element (not to exceed 16 elements) encapsulated photoconductive cells using either lead sulphide or lead selenide;

c. Pyroelectric detectors using any of the following:

c.1. Triglycine sulphate and variants;

c.2. Lead-lanthanum-zirconium titanate and variants;

c.3. Lithium tantalate;

c.4. Polyvinylidene fluoride and variants; *or*

c.5. Strontium barium niobate and variants.

a.3.a. Non-“space-qualified” “focal plane arrays”, having all of the following:

a.3.a.1. Individual elements with a peak response within the wavelength range exceeding 900 nm but not exceeding 1,050 nm; *and*

a.3.a.2. A response “time constant” of less than 0.5 ns;

a.3.b. Non-“space-qualified” “focal plane arrays”, having all of the following:

a.3.b.1. Individual elements with a peak response in the wavelength range exceeding 1,050 nm but not exceeding 1,200 nm; *and*

a.3.b.2. A response “time constant” of 95 ns or less;

a.3.c. Non-“space-qualified” non-linear (2-dimensional) “focal plane arrays”, having individual elements with a peak response in the wavelength range exceeding 1,200 nm but not exceeding 30,000 nm;

a.3.d. Non-“space-qualified” linear (1-dimensional) “focal plane arrays”, having all of the following:

a.3.d.1. Individual elements with a peak response in the wavelength range exceeding 1,200 nm but not exceeding 2,500 nm; and

a.3.d.2. Any of the following:

a.3.d.2.a. A ratio of scan direction dimension of the detector element to the cross-scan direction dimension of the detector element of less than 3.8; or

a.3.d.2.b. Signal processing in the element (SPRITE);

a.3.e. Non-“space-qualified” linear (1-dimensional) “focal plane arrays”, having individual elements with a peak response in the wavelength range exceeding 2,500 nm but not exceeding 30,000 nm.

b. “Monospectral imaging sensors” and “multispectral imaging sensors” designed for remote sensing applications, having any of the following:

b.1. An Instantaneous-Field-Of-View (IFOV) of less than 200 μrad (microradians); or

b.2. Being specified for operation in the wavelength range exceeding 400 nm but not exceeding 30,000 nm and having all the following:

b.2.a. Providing output imaging data in digital format; and

b.2.b. Being any of the following:

b.2.b.1. “Space-qualified”; or

b.2.b.2. Designed for airborne operation, using other than silicon detectors, and having an IFOV of less than 2.5 mrad (milliradians).

c. Direct view imaging equipment operating in the visible or infrared spectrum, incorporating any of the following:

c.1. Image intensifier tubes having the characteristics listed in 6A002.a.2.a; or

c.2. “Focal plane arrays” having the characteristics listed in 6A002.a.3.

TECHNICAL NOTE: “Direct view” refers to imaging equipment, operating in the visible or infrared spectrum, that presents a visual image to a human observer without converting the image into an electronic signal for television display, and that cannot record or store the image photographically, electronically or by any other means.

NOTE: 6A002.c does not control the following equipment incorporating other than GaAs or GaInAs photocathodes:

a. Industrial or civilian intrusion alarm, traffic or industrial movement control or counting systems;

b. Medical equipment;

c. Industrial equipment used for inspection, sorting or analysis of the properties of materials;

d. Flame detectors for industrial furnaces;

e. Equipment specially designed for laboratory use.

d. Special support components for optical sensors, as follows:

d.1. “Space-qualified” cryocoolers;

d.2. Non-“space-qualified” cryocoolers, having a cooling source temperature below 218 K (−55 °C), as follows:

d.2.a. Closed cycle type with a specified Mean-Time-To-Failure (MTTF), or Mean-Time-Between-Failures (MTBF), exceeding 2,500 hours;

d.2.b. Joule-Thomson (JT) self-regulating minicoolers having bore (outside) diameters of less than 8 mm;

d.3. Optical sensing fibers specially fabricated either compositionally or structurally, or modified by coating, to be acoustically, thermally, inertially, electromagnetically or nuclear radiation sensitive.

e. “Space qualified” “focal plane arrays” having more than 2,048 elements per array and having a peak response in the wavelength range exceeding 300 nm but not exceeding 900 nm.

**6A003 Cameras.**

LICENSE REQUIREMENTS

Reason for Control: NS, NP, RS, AT, UN.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 2.
NP applies to items controlled in paragraphs 6A003.a.2, a.3 and a.4.	NP Column 1.
RS applies to items controlled in 6A003.b.3 and b.4.	RS Column 1.
AT applies to entire entry .....	AT Column 1.
UN applies to items controlled in 6A003.b.3 and b.4.	Rwanda.

LICENSE EXCEPTIONS

LVS: \$1500, except N/A for 6A003.a.2 through a.6, b.1, b.3 and b.4.

GBS: Yes for 6A003.a.1.

CIV: Yes for 6A003.a.1.

LIST OF ITEMS CONTROLLED

Unit: Number.

Related Controls: (1) See ECCNs 6E001 (“development”), 6E002 (“production”), and 6E201 (“use”) for technology for items controlled under this entry. (2) Also see ECCN 6A203. (3) See ECCN 8A002.d and .e for cameras specially designed or modified for underwater use.

Related Definitions: N/A.

Items:

a. Instrumentation cameras and specially designed components therefor, as follows:

NOTE: Instrumentation cameras, controlled by 6A003.a.3 to 6A003.a.5, with modular structures should be evaluated by their maximum capability, using plug-ins available according to the camera manufacturer’s specifications.

a.1. High-speed cinema recording cameras using any film format from 8 mm to 16 mm inclusive, in which the film is continuously advanced throughout the recording period, and that are capable of recording at framing rates exceeding 13,150 frames/s;

NOTE: 6A003.a.1 does not control cinema recording cameras designed for civil purposes.

a.2. Mechanical high speed cameras, in which the film does not move, capable of recording at rates exceeding 1,000,000 frames/s for the full framing height of 35 mm film, or at proportionately higher rates for lesser frame heights, or at proportionately lower rates for greater frame heights;

a.3. Mechanical or electronic streak cameras having writing speeds exceeding 10 mm/ $\mu$ s;

a.4. Electronic framing cameras having a speed exceeding 1,000,000 frames/s;

a.5. Electronic cameras, having all of the following:

a.5.a. An electronic shutter speed (gating capability) of less than 1  $\mu$ s per full frame; *and*

a.5.b. A read out time allowing a framing rate of more than 125 full frames per second.

a.6. Plug-ins, having all of the following characteristics:

a.6.a. Specially designed for instrumentation cameras which have modular structures and that are controlled by 6A003.a; *and*

a.6.b. Enabling these cameras to meet the characteristics specified in 6A003.a.3, 6A003.a.4 or 6A003.a.5, according to the manufacturer's specifications.

b. Imaging cameras, as follows:

NOTE: 6A003.b does not control television or video cameras specially designed for television broadcasting.

b.1. Video cameras incorporating solid state sensors, having a peak response in the wavelength range exceeding 10nm, but not exceeding 30,000 nm and any of the following:

b.1.a. More than  $4 \times 10^6$  "active pixels" per solid state array for monochrome (black and white) cameras;

b.1.b. More than  $4 \times 10^6$  "active pixels" per solid state array for color cameras incorporating three solid state arrays; *or*

b.1.c. More than  $12 \times 10^6$  "active pixels" for solid state array color cameras incorporating one solid state array;

TECHNICAL NOTE: For the purposes of this entry, digital video cameras should be evaluated by the maximum number of "active pixels" used for capturing moving images.

b.2. Scanning cameras and scanning camera systems, having all of the following:

b.2.a. A peak response in the wavelength range exceeding 10 nm, but not exceeding 30,000 nm;

b.2.b. Linear detector arrays with more than 8,192 elements per array; *and*

b.2.c. Mechanical scanning in one direction;

b.3. Imaging cameras incorporating image intensifier tubes having the characteristics listed in 6A002.a.2.a;

b.4. Imaging cameras incorporating "focal plane arrays" having the characteristics listed in 6A002.a.3.

NOTE: 6A003.b.4 does not control imaging cameras incorporating linear "focal plane arrays" with twelve elements or fewer, not

employing time-delay-and-integration within the element, designed for any of the following:

a. Industrial or civilian intrusion alarm, traffic or industrial movement control or counting systems;

b. Industrial equipment used for inspection or monitoring of heat flows in buildings, equipment or industrial processes;

c. Industrial equipment used for inspection, sorting or analysis of the properties of materials;

d. Equipment specially designed for laboratory use; *or*

e. Medical equipment.

#### 6A004 Optics.

##### LICENSE REQUIREMENTS

*Reason for Control:* NS, AT.

##### Control(s)

##### Country Chart

NS applies to entire entry ..... NS Column 2.

AT applies to entire entry ..... AT Column 1.

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

##### LICENSE EXCEPTIONS

LVS: \$3000

GBS: Yes for 6A004.a.1, a.2, a.4, b, d.2, and d.4

CIV: Yes for 6A004.a.1, a.2, a.4, b, d.2, and d.4

##### LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; cable in meters/feet; components in \$ value.

*Related Controls:* "Space qualified" components for optical systems defined in 6A004.c and optical control equipment defined in 6A004.d.1 are subject to the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121). See also 6A994

*Related Definitions:* N/A.

##### Items:

a. Optical mirrors (reflectors), as follows:

a.1. "Deformable mirrors" having either continuous or multi-element surfaces, and specially designed components therefor, capable of dynamically repositioning portions of the surface of the mirror at rates exceeding 100 Hz;

a.2. Lightweight monolithic mirrors having an average "equivalent density" of less than 30 kg/m<sup>2</sup> and a total mass exceeding 10 kg;

a.3. Lightweight "composite" or foam mirror structures having an average "equivalent density" of less than 30 kg/m<sup>2</sup> and a total mass exceeding 2 kg;

a.4. Beam steering mirrors more than 100 mm in diameter or length of major axis, that maintain a flatness of  $\lambda/2$  or better ( $\lambda$  is equal to 633 nm) having a control bandwidth exceeding 100 Hz.

b. Optical components made from zinc selenide (ZnSe) or zinc sulphide (ZnS) with

transmission in the wavelength range exceeding 3,000 nm but not exceeding 25,000 nm and having any of the following:

- b.1. Exceeding 100 cm<sup>3</sup> in volume; *or*
- b.2. Exceeding 80 mm in diameter or length of major axis and 20 mm in thickness (depth).
- c. "Space-qualified" components for optical systems, as follows:
  - c.1. Lightweighted to less than 20% "equivalent density" compared with a solid blank of the same aperture and thickness;
  - c.2. Substrates, substrates having surface coatings (single-layer or multi-layer, metallic or dielectric, conducting, semiconducting or insulating) or having protective films;
  - c.3. Segments or assemblies of mirrors designed to be assembled in space into an optical system with a collecting aperture equivalent to or larger than a single optic 1 m in diameter;
  - c.4. Manufactured from "composite" materials having a coefficient of linear thermal expansion equal to or less than  $5 \times 10^{-6}$  in any coordinate direction.
- d. Optical control equipment, as follows:
  - d.1. Specially designed to maintain the surface figure or orientation of the "space-qualified" components controlled by 6A004.c.1 or 6A004.c.3;
  - d.2. Having steering, tracking, stabilization or resonator alignment bandwidths equal to or more than 100 Hz and an accuracy of 10  $\mu$ rad (microradians) or less;
  - d.3. Gimbals having all of the following:
    - d.3.a. A maximum slew exceeding 5°;
    - d.3.b. A bandwidth of 100 Hz or more;
    - d.3.c. Angular pointing errors of 200  $\mu$ rad (microradians) or less; *and*
    - d.3.d. Having any of the following:
      - d.3.d.1. Exceeding 0.15 m but not exceeding 1 m in diameter or major axis length and capable of angular accelerations exceeding 2 rad (radians)/s<sup>2</sup>; *or*
      - d.3.d.2. Exceeding 1 m in diameter or major axis length and capable of angular accelerations exceeding 0.5 rad (radians)/s<sup>2</sup>;
    - d.4. Specially designed to maintain the alignment of phased array or phased segment mirror systems consisting of mirrors with a segment diameter or major axis length of 1 m or more.
  - e. Aspheric optical elements having all of the following characteristics:
    - e.1. The largest dimension of the optical-aperture is greater than 400 mm;
    - e.2. The surface roughness is less than 1 nm (rms) for sampling lengths equal to or greater than 1 mm; *and*
    - e.3. The coefficient of linear thermal expansion's absolute magnitude is less than  $3 \times 10^{-6}$ /K at 25 °C;

TECHNICAL NOTES: 1. An "aspheric optical element" is any element used in an optical system whose imaging surface or surfaces are designed to depart from the shape of an ideal sphere.

2. Manufacturers are not required to measure the surface roughness listed in 6A004.e.2 unless the optical element was designed or manufactured with the intent to meet, or exceed, the control parameter.

NOTE: 6A004.e does not control aspheric optical elements having any of the following:

- a. A largest optical-aperture dimension less than 1 m and a focal length to aperture ratio equal to or greater than 4.5:1;
- b. A largest optical-aperture dimension equal to or greater than 1 m and a focal length to aperture ratio equal to or greater than 7:1;
- c. Being designed as Fresnel, flyeye, stripe, prism or diffractive optical elements;
- d. Being fabricated from borosilicate glass having a coefficient of linear thermal expansion greater than  $2.5 \times 10^{-6}$ /K at 25 °C; *or*
- e. Being an x-ray optical element having inner mirror capabilities (*e.g.*, tube-type mirrors).

N.B.: For aspheric optical elements specially designed for lithographic equipment, see 3B001.

**6A005 "Lasers" (other than those described in 0B001.g.5 or .h.6), components and optical equipment, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS  
Reason for Control: NS, NP, AT

Control(s)	Country chart
NS applies to entire entry .....	NS Column 2.
NP applies to "lasers" controlled by 6A005.a.1.c, a.2.a, a.4.c., a.6, c.1.b, c.2.b.2.a, c.2.b.2.b, c.2.c.2, or d.2.c, as described in the following License Requirements Note.	NP Column 1.
AT applies to entire entry .....	AT Column 1.

License Requirements Note: NP controls apply to the following "lasers" controlled by 6A005:

- (a) Pulsed excimer "lasers" controlled by 6A005.a.1.c having all of the following characteristics:
  - (1) Operating at wavelengths between 240 and 360 nm;
  - (2) A repetition rate > 250 Hz; *and*
  - (3) An average output power > 500 W;
- (b) Copper vapor "lasers" controlled by 6A005.a.2.a having all of the following characteristics:
  - (1) Operating at wavelengths between 500 and 600 nm; *and*
  - (2) An average output power  $\geq$  40 W;
- (c) Pulsed carbon dioxide "lasers" controlled by 6A005.a.4.c (except industrial CO<sub>2</sub> lasers used in applications such as cutting and welding) having all of the following characteristics:
  - (1) Operating at wavelengths between 9,000 and 11,000 nm;
  - (2) A repetition rate > 250 Hz;
  - (3) An average output power > 500 W; *and*

(4) A pulse width < 200 ns;  
 (d) Argon ion "lasers" controlled by 6A005.a.6 having all of the following characteristics:

(1) Operating at wavelengths between 400 and 515 nm; *and*

(2) An average output power > 40 W;

(e) Alexandrite "lasers" controlled by 6A005.c.1.b having all of the following characteristics:

(1) Operating at wavelengths between 720 and 800 nm;

(2) A bandwidth  $\leq 0.005$  nm;

(3) A repetition rate > 125 Hz; *and*

(4) Average output power > 30 W;

(f) Single-transverse mode output neodymium-doped (other than glass) "lasers" controlled by 6A005.c.2.b.2.a with an average output power > 40 W;

(g) Multiple-transverse mode output neodymium-doped (other than glass) "lasers" controlled by 6A005.c.2.b.2.b with an average output power > 50 W;

(h) Neodymium-doped (other than glass) "lasers" controlled by 6A005.c.2.c.2 having all of the following characteristics:

(1) Incorporating frequency doubling for output wavelength between 500 and 550 nm; *and*

(2) Average output power > 40 W;

(i) Tunable pulsed single-mode dye "lasers" controlled by 6A005.d.2.c operating at wavelengths between 300 and 800 nm.

#### LICENSE EXCEPTIONS

*LVS:* N/A for NP items. \$3000 for all other items.

*GBS:* Yes, for 6A005.d (except d.2.c), CO<sub>2</sub> or CO/CO<sub>2</sub> "lasers" having an output wavelength in the range from 9,000 to 11,000 nm and having a pulsed output not exceeding 2 J per pulse and a maximum rated average single or multimode output power not exceeding 5 kW; CO "lasers" having a CW maximum rated single or multimode output power not exceeding 10 kW; CO<sub>2</sub> "lasers" controlled by 6A005.a.4 that operate in CW multiple-transverse mode; and having a CW output power not exceeding 15 kW; Neodymium-doped (other than glass), pulse-excited, "Q-switched lasers" controlled by 6A005.c.2.b.2.b having a pulse duration equal to or more than 1 ns; and a multiple-transverse mode output with a "peak power" not exceeding 400 MW; Neodymium-doped (other than glass) "lasers" controlled by 6A005.c.2.b.3.b or 6A005.c.2.b.4.b that have an output wavelength exceeding 1,000 nm, but not exceeding 1,100 nm; and an average or CW output power not exceeding 2 kW; and operate in a pulse-excited, non-"Q-switched" multiple-transverse mode; or in a continuously excited, multiple-transverse mode; and 6A005.f.1.

*CVI:* Yes, for 6A005.d (except d.2.c), CO<sub>2</sub> or CO/CO<sub>2</sub> "lasers" having an output wavelength in the range from 9,000 to 11,000 nm

and having a pulsed output not exceeding 2 J per pulse and a maximum rated average single or multimode output power not exceeding 5 kW; CO "lasers" having a CW maximum rated single or multimode output power not exceeding 10 kW; CO<sub>2</sub> "lasers" controlled by 6A005.a.4 that operate in CW multiple-transverse mode; and having a CW output power not exceeding 15 kW; Neodymium-doped (other than glass), pulse-excited, "Q-switched lasers" controlled by 6A005.c.2.b.2.b having a pulse duration equal to or more than 1 ns; and a multiple-transverse mode output with a "peak power" not exceeding 400 MW; Neodymium-doped (other than glass) "lasers" controlled by 6A005.c.2.b.3.b or 6A005.c.2.b.4.b that have an output wavelength exceeding 1,000 nm, but not exceeding 1,100 nm; and an average or CW output power not exceeding 2 kW; and operate in a pulse-excited, non-"Q-switched" multiple-transverse mode; or in a continuously excited, multiple-transverse mode; and 6A005.f.1.

#### LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; components and accessories in \$ value.

*Related Controls:* (1) See ECCN 6D001 for "software" for items controlled under this entry. (2) See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry. (3) Also see ECCNs 6A205 and 6A995. (4) See ECCN 3B001 for excimer "lasers" specially designed for lithography equipment. (5) "Lasers" specially designed or prepared for use in isotope separation are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110). (6) Shared aperture optical elements, capable of operating in "super-high power laser" applications, are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (see 22 CFR part 121).

*Related Definitions:* (1.) Pulsed "lasers" include those that run in a continuous wave (CW) mode with pulses superimposed. (2.) Pulse-excited "lasers" include those that run in a continuously excited mode with pulse excitation superimposed. (3.) The control status of Raman "lasers" is determined by the parameters of the pumping source "lasers". The pumping source "lasers" can be any of the "lasers" described as follows:

#### Items:

a. Gas "lasers", as follows:

a.1. Excimer "lasers", having any of the following:

a.1.a. An output wavelength not exceeding 150 nm and having any of the following:

a.1.a.1. An output energy exceeding 50 mJ per pulse; *or*

a.1.a.2. An average output power exceeding 1 W;

a.1.b. An output wavelength exceeding 150 nm but not exceeding 190 nm and having any of the following:

a.1.b.1. An output energy exceeding 1.5 J per pulse; *or*

a.1.b.2. An average output power exceeding 120 W;

a.1.c. An output wavelength exceeding 190 nm but not exceeding 360 nm and having any of the following:

a.1.c.1. An output energy exceeding 10 J per pulse; *or*

a.1.c.2. An average output power exceeding 500 W; *or*

a.1.d. An output wavelength exceeding 360 nm and having any of the following:

a.1.d.1. An output energy exceeding 1.5 J per pulse; *or*

a.1.d.2. An average output power exceeding 30 W;

*N.B.* For excimer "lasers" specially designed for lithography equipment, see 3B001.

a.2. Metal vapor "lasers", as follows:

a.2.a. Copper (Cu) "lasers" having an average output power exceeding 20 W;

a.2.b. Gold (Au) "lasers" having an average output power exceeding 5 W;

a.2.c. Sodium (Na) "lasers" having an output power exceeding 5 W;

a.2.d. Barium (Ba) "lasers" having an average output power exceeding 2 W;

a.3. Carbon monoxide (CO) "lasers" having any of the following:

a.3.a. An output energy exceeding 2 J per pulse and a pulsed "peak power" exceeding 5 kW; *or*

a.3.b. An average or CW output power exceeding 5 kW;

a.4. Carbon dioxide (CO<sub>2</sub>) "lasers" having any of the following:

a.4.a. A CW output power exceeding 15 kW;

a.4.b. A pulsed output having a "pulse duration" exceeding 10 μs and having any of the following:

a.4.b.1. An average output power exceeding 10 kW; *or*

a.4.b.2. A pulsed "peak power" exceeding 100 kW; *or*

a.4.c. A pulsed output having a "pulse duration" equal to or less than 10 μs; and having any of the following:

a.4.c.1. A pulse energy exceeding 5 J per pulse; *or*

a.4.c.2. An average output power exceeding 2.5 kW;

a.5. "Chemical lasers", as follows:

a.5.a. Hydrogen Fluoride (HF) "lasers";

a.5.b. Deuterium Fluoride (DF) "lasers";

a.5.c. "Transfer lasers", as follows:

a.5.c.1. Oxygen Iodine (O<sub>2</sub>-I) "lasers";

a.5.c.2. Deuterium Fluoride-Carbon dioxide (DF-CO<sub>2</sub>) "lasers";

a.6. Krypton ion or argon ion "lasers" having any of the following:

a.6.a. An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 50 W; *or*

a.6.b. An average or CW output power exceeding 50 W;

a.7. Other gas "lasers", having any of the following:

NOTE: 6A005.a.7 does not control nitrogen "lasers".

a.7.a. An output wavelength not exceeding 150 nm and having any of the following:

a.7.a.1. An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; *or*

a.7.a.2. An average or CW output power exceeding 1 W;

a.7.b. An output wavelength exceeding 150 nm but not exceeding 800 nm and having any of the following:

a.7.b.1. An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 30 W; *or*

a.7.b.2. An average or CW output power exceeding 30 W;

a.7.c. An output wavelength exceeding 800 nm but not exceeding 1,400 nm and having any of the following:

a.7.c.1. An output energy exceeding 0.25 J per pulse and a pulsed "peak power" exceeding 10 W; *or*

a.7.c.2. An average or CW output power exceeding 10 W; *or*

a.7.d. An output wavelength exceeding 1,400 nm and an average or CW output power exceeding 1 W.

b. Semiconductor "lasers", as follows:

b.1. Individual single-transverse mode semiconductor "lasers" having any of the following:

b.1.a. A wavelength equal to or less than 1510 nm, and having an average or CW output power exceeding 1.5 W; *or*

b.1.b. A wavelength greater than 1510 nm, and having an average or CW output power exceeding 500 mW;

b.2. Individual, multiple-transverse mode semiconductor "lasers" having all of the following:

b.2.a. A wavelength of less than 950 nm or more than 2000 nm; *and*

b.2.b. An average or CW output power exceeding 10 W.

b.3. Individual arrays of individual semiconductor "lasers", having any of the following:

b.3.a. A wavelength of less than 950 nm and an average or CW output power exceeding 60 W; *or*

b.3.b. A wavelength equal to or greater than 2000 nm and an average or CW output power exceeding 10 W;

TECHNICAL NOTE: Semiconductor "lasers" are commonly called "laser" diodes.

NOTE 1: 6A005.b includes semiconductor "lasers" having optical output connectors (e.g. fiber optic pigtails).

NOTE 2: The control status of semiconductor "lasers" specially designed for other equipment is determined by the control status of the other equipment.

- c. Solid state “lasers”, as follows:
- c.1. “Tunable” “lasers” having any of the following:
- NOTE: 6A005.c.1 includes titanium—sapphire (Ti: Al<sub>2</sub>O<sub>3</sub>), thulium—YAG (Tm: YAG), thulium—YSGG (Tm: YSGG), alexandrite (Cr: BeAl<sub>2</sub>O<sub>4</sub>) and color center “lasers”.
- c.1.a. An output wavelength less than 600 nm and having any of the following:
- c.1.a.1. An output energy exceeding 50 mJ per pulse and a pulsed “peak power” exceeding 1 W; *or*
- c.1.a.2. An average or CW output power exceeding 1 W;
- c.1.b. An output wavelength of 600 nm or more but not exceeding 1,400 nm and having any of the following:
- c.1.b.1. An output energy exceeding 1 J per pulse and a pulsed “peak power” exceeding 20 W; *or*
- c.1.b.2. An average or CW output power exceeding 20 W; *or*
- c.1.c. An output wavelength exceeding 1,400 nm and having any of the following:
- c.1.c.1. An output energy exceeding 50 mJ per pulse and a pulsed “peak power” exceeding 1 W; *or*
- c.1.c.2. An average or CW output power exceeding 1 W;
- c.2. Non-“tunable” “lasers”, as follows:
- NOTE: 6A005.c.2 includes atomic transition solid state “lasers”.
- c.2.a. Neodymium glass “lasers”, as follows:
- c.2.a.1. “Q-switched lasers” having any of the following:
- c.2.a.1.a. An output energy exceeding 20 J but not exceeding 50 J per pulse and an average output power exceeding 10 W; *or*
- c.2.a.1.b. An output energy exceeding 50 J per pulse;
- c.2.a.2. Non-“Q-switched lasers” having any of the following:
- c.2.a.2.a. An output energy exceeding 50 J but not exceeding 100 J per pulse and an average output power exceeding 20 W; *or*
- c.2.a.2.b. An output energy exceeding 100 J per pulse;
- c.2.b. Neodymium-doped (other than glass) “lasers”, having an output wavelength exceeding 1,000 nm but not exceeding 1,100 nm, as follows:
- N.B.:* For neodymium-doped (other than glass) “lasers” having an output wavelength not exceeding 1,000 nm or exceeding 1,100 nm, see 6A005.c.2.
- c.2.b.1. Pulse-excited, mode-locked, “Q-switched lasers” having a “pulse duration” of less than 1 ns and having any of the following:
- c.2.b.1.a. A “peak power” exceeding 5 GW;
- c.2.b.1.b. An average output power exceeding 10 W; *or*
- c.2.b.1.c. A pulsed energy exceeding 0.1 J;
- c.2.b.2. Pulse-excited, “Q-switched lasers” having a pulse duration equal to or more than 1 ns, and having any of the following:

- c.2.b.2.a. A single-transverse mode output having:
- c.2.b.2.a.1. A “peak power” exceeding 100 MW;
- c.2.b.2.a.2. An average output power exceeding 20 W; *or*
- c.2.b.2.a.3. A pulsed energy exceeding 2 J; *or*
- c.2.b.2.b. A multiple-transverse mode output having:
- c.2.b.2.b.1. A “peak power” exceeding 400 MW;
- c.2.b.2.b.2. An average output power exceeding 2 kW; *or*
- c.2.b.2.b.3. A pulsed energy exceeding 2 J;
- c.2.b.3. Pulse-excited, non-“Q-switched lasers”, having:
- c.2.b.3.a. A single-transverse mode output having:
- c.2.b.3.a.1. A “peak power” exceeding 500 kW; *or*
- c.2.b.3.a.2. An average output power exceeding 150 W; *or*
- c.2.b.3.b. A multiple-transverse mode output having:
- c.2.b.3.b.1. A “peak power” exceeding 1 MW; *or*
- c.2.b.3.b.2. An average power exceeding 2 kW;
- c.2.b.4. Continuously excited “lasers” having:
- c.2.b.4.a. A single-transverse mode output having:
- c.2.b.4.a.1. A “peak power” exceeding 500 kW; *or*
- c.2.b.4.a.2. An average or CW output power exceeding 150 W; *or*
- c.2.b.4.b. A multiple-transverse mode output having:
- c.2.b.4.b.1. A “peak power” exceeding 1 MW; *or*
- c.2.b.4.b.2. An average or CW output power exceeding 2 kW;
- c.2.c. Other non-“tunable” “lasers”, having any of the following:
- c.2.c.1. A wavelength less than 150 nm and having any of the following:
- c.2.c.1.a. An output energy exceeding 50 mJ per pulse and a pulsed “peak power” exceeding 1 W; *or*
- c.2.c.1.b. An average or CW output power exceeding 1 W;
- c.2.c.2. A wavelength of 150 nm or more but not exceeding 800 nm and having any of the following:
- c.2.c.2.a. An output energy exceeding 1.5 J per pulse and a pulsed “peak power” exceeding 30 W; *or*
- c.2.c.2.b. An average or CW output power exceeding 30 W;
- c.2.c.3. A wavelength exceeding 800 nm but not exceeding 1,400 nm, as follows:
- c.2.c.3.a. “Q-switched lasers” having:
- c.2.c.3.a.1. An output energy exceeding 0.5 J per pulse and a pulsed “peak power” exceeding 50 W; *or*

- c.2.c.3.a.2. An average output power exceeding:
  - c.2.c.3.a.2.a. 10 W for single-mode "lasers";
  - c.2.c.3.a.2.b. 30 W for multimode "lasers";
  - c.2.c.3.b. Non-"Q-switched lasers" having:
    - c.2.c.3.b.1. An output energy exceeding 2 J per pulse and a pulsed "peak power" exceeding 50 W; *or*
    - c.2.c.3.b.2. An average or CW output power exceeding 50 W; *or*
  - c.2.c.4. A wavelength exceeding 1,400 nm *and* having any of the following:
    - c.2.c.4.a. An output energy exceeding 100 mJ per pulse and a pulsed "peak power" exceeding 1 W; *or*
    - c.2.c.4.b. An average or CW output power exceeding 1 W;
  - d. Dye and other liquid "lasers", having any of the following:
    - d.1. A wavelength less than 150 nm and:
      - d.1.a. An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; *or*
      - d.1.b. An average or CW output power exceeding 1 W;
    - d.2. A wavelength of 150 nm or more but not exceeding 800 nm and having any of the following:
      - d.2.a. An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 20 W;
      - d.2.b. An average or CW output power exceeding 20 W; *or*
      - d.2.c. A pulsed single longitudinal mode oscillator having an average output power exceeding 1 W and a repetition rate exceeding 1 kHz if the "pulse duration" is less than 100 ns;
      - d.3. A wavelength exceeding 800 nm but not exceeding 1,400 nm and having any of the following:
        - d.3.a. An output energy exceeding 0.5 J per pulse and a pulsed "peak power" exceeding 10 W; *or*
        - d.3.b. An average or CW output power exceeding 10 W; *or*
        - d.4. A wavelength exceeding 1,400 nm and having any of the following:
          - d.4.a. An output energy exceeding 100 mJ per pulse and a pulsed "peak power" exceeding 1 W; *or*
          - d.4.b. An average or CW output power exceeding 1 W;
    - e. Components, as follows:
      - e.1. Mirrors cooled either by active cooling or by heat pipe cooling;
 

TECHNICAL NOTE: Active cooling is a cooling technique for optical components using flowing fluids within the subsurface (nominally less than 1 mm below the optical surface) of the optical component to remove heat from the optic.
      - e.2. Optical mirrors or transmissive or partially transmissive optical or electro-optical components specially designed for use with controlled "lasers";
      - f. Optical equipment, as follows:

- N.B. For shared aperture optical elements, capable of operating in "Super-High Power Laser" ("SHPL") applications, see the U.S. Munitions List (22 CFR part 121).
  - f.1. Dynamic wavefront (phase) measuring equipment capable of mapping at least 50 positions on a beam wavefront having any the following:
    - f.1.a. Frame rates equal to or more than 100 Hz and phase discrimination of at least 5% of the beam's wavelength; *or*
    - f.1.b. Frame rates equal to or more than 1,000 Hz and phase discrimination of at least 20% of the beam's wavelength;
  - f.2. "Laser" diagnostic equipment capable of measuring "SHPL" system angular beam steering errors of equal to or less than 10  $\mu$ rad;
  - f.3. Optical equipment and components specially designed for a phased-array "SHPL" system for coherent beam combination to an accuracy of  $\lambda/10$  at the designed wavelength, or 0.1  $\mu$ m, whichever is the smaller;
  - f.4. Projection telescopes specially designed for use with "SHPL" systems.

**6A006 "Magnetometers", "magnetic gradiometers", "intrinsic magnetic gradiometers" and compensation systems, and specially designed components therefor, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS  
*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

LVS: \$1500  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See also 6A996. This entry does not control instruments specially designed for biomagnetic measurements for medical diagnostics.

*Related Definitions:* N/A

- Items:* a. "Magnetometers" using "superconductive", optically pumped or nuclear precession (proton/Overhauser) "technology" having a "noise level" (sensitivity) lower (better) than 0.05 nT rms per square root Hz;
- b. Induction coil "magnetometers" having a "noise level" (sensitivity) lower (better) than any of the following:
  - b.1. 0.05 nT rms/square root Hz at frequencies of less than 1 Hz;

- b.2.  $1 \times 10^{-3}$  nT rms/square root Hz at frequencies of 1 Hz or more but not exceeding 10 Hz; or
- b.3.  $1 \times 10^{-4}$  nT rms/square root Hz at frequencies exceeding 10 Hz;
- c. Fiber optic "magnetometers" having a "noise level" (sensitivity) lower (better) than 1 nT rms per square root Hz;
- d. "Magnetic gradiometers" using multiple "magnetometers" controlled by 6A006.a, 6A006.b or 6A006.c;
- e. Fiber optic "intrinsic magnetic gradiometers" having a magnetic gradient field "noise level" (sensitivity) lower (better) than 0.3 nT/m rms per square root Hz;
- f. "Intrinsic magnetic gradiometers", using "technology" other than fiber-optic "technology", having a magnetic gradient field "noise level" (sensitivity) lower (better) than 0.015 nT/m rms per square root Hz;
- g. Magnetic compensation systems for magnetic sensors designed for operation on mobile platforms;
- h. "Superconductive" electromagnetic sensors, components manufactured from "superconductive" materials:
  - h.1. Designed for operation at temperatures below the "critical temperature" of at least one of their "superconductive" constituents (including Josephson effect devices or "superconductive" quantum interference devices (SQUIDS));
  - h.2. Designed for sensing electromagnetic field variations at frequencies of 1 KHz or less; and
  - h.3. Having any of the following characteristics:
    - h.3.a. Incorporating thin-film SQUIDS with a minimum feature size of less than 2  $\mu$ m and with associated input and output coupling circuits;
    - h.3.b. Designed to operate with a magnetic field slew rate exceeding  $1 \times 10^6$  magnetic flux quanta per second;
    - h.3.c. Designed to function without magnetic shielding in the earth's ambient magnetic field; or
    - h.3.d. Having a temperature coefficient less (smaller) than 0.1 magnetic flux quantum/K.

**6A007 Gravity meters (gravimeters) and gravity gradiometers, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NS, MT, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 2
MT applies to 6A007.b and .c when the accuracies in 6A007.b.1 and b.2 are met or exceeded.	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$3000; N/A for MT  
GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: See also 6A107 and 6A997

Related Definitions: N/A

Items: a. Gravity meters designed or modified for ground use having a static accuracy of less (better) than 10  $\mu$ gal;

NOTE: 6A007.a does not control ground gravity meters of the quartz element (Worden) type.

b. Gravity meters designed for mobile platforms for ground, marine, submersible, space or airborne use, having all of the following:

b.1. A static accuracy of less (better) than 0.7 mgal; and

b.2. An in-service (operational) accuracy of less (better) than 0.7 mgal having a time-to-steady-state registration of less than 2 minutes under any combination of attendant corrective compensations and motional influences;

c. Gravity gradiometers.

**6A008 Radar systems, equipment and assemblies having any of the following characteristics (see List of Items Controlled), and specially designed components therefor.**

LICENSE REQUIREMENTS

Reason for Control: NS, MT, RS, AT.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 2.
MT applies to items that are designed for airborne applications and that are usable in systems controlled for MT reasons.	MT Column 1.
RS applies to 6A008.j.1 .....	RS Column 1.
AT applies to entire entry .....	AT Column 1.

License Requirement Notes: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

LVS: \$5000; N/A for MT and for 6A008.j.1 and 6A008.1.3

GBS: Yes, for 6A008.b, .c, and l.1 only.

CIV: Yes, for 6A008.b, .c, and l.1 only.

LIST OF ITEMS CONTROLLED

Unit: \$ value.

Related Controls: This entry does not control: Secondary surveillance radar (SSR); Car radar designed for collision prevention; Displays or monitors used for Air Traffic Control (ATC) having no more than 12 resolvable elements per mm; Meteorological (weather) radar. See also 6A108 and 6A998. ECCN 6A998 controls, *inter alia*, the LIDAR equipment excluded by the note to paragraph j of this ECCN (6A008).

Related Definitions: N/A.

Items:

a. Operating at frequencies from 40 GHz to 230 GHz and having an average output power exceeding 100 mW;

b. Having a tunable bandwidth exceeding  $\pm 6.25\%$  of the center operating frequency;

TECHNICAL NOTE: The center operating frequency equals one half of the sum of the highest plus the lowest specified operating frequencies.

c. Capable of operating simultaneously on more than two carrier frequencies;

d. Capable of operating in synthetic aperture (SAR), inverse synthetic aperture (ISAR) radar mode, or sidelooking airborne (SLAR) radar mode;

e. Incorporating "electronically steerable phased array antennae";

f. Capable of heightfinding non-cooperative targets;

NOTE: 6A008.f does not control precision approach radar (PAR) equipment conforming to ICAO standards.

g. Specially designed for airborne (balloon or airframe mounted) operation and having Doppler "signal processing" for the detection of moving targets;

h. Employing processing of radar signals using any of the following:

h.1. "Radar spread spectrum" techniques; *or*

h.2. "Radar frequency agility" techniques;

i. Providing ground-based operation with a maximum "instrumented range" exceeding 185 km;

NOTE: 6A008.i does not control:

a. Fishing ground surveillance radar;

b. Ground radar equipment specially designed for en route air traffic control, provided that all the following conditions are met:

1. It has a maximum "instrumented range" of 500 km or less;

2. It is configured so that radar target data can be transmitted only one way from the radar site to one or more civil ATC centers;

3. It contains no provisions for remote control of the radar scan rate from the en route ATC center; and

4. It is to be permanently installed;

c. Weather balloon tracking radars.

j. Being "laser" radar or Light Detection and Ranging (LIDAR) equipment, having any of the following:

j.1. "Space-qualified"; *or*

j.2. Employing coherent heterodyne or homodyne detection techniques and having an angular resolution of less (better) than 20  $\mu$ rad (microradians);

NOTE: 6A008.j does not control LIDAR equipment specially designed for surveying or for meteorological observation.

k. Having "signal processing" sub-systems using "pulse compression", with any of the following:

k.1. A "pulse compression" ratio exceeding 150; *or*

k.2. A pulse width of less than 200 ns; *or*

l. Having data processing sub-systems with any of the following:

l.1. "Automatic target tracking" providing, at any antenna rotation, the predicted target position beyond the time of the next antenna beam passage;

NOTE: 6A008.l.1 does not control conflict alert capability in ATC systems, or marine or harbor radar.

l.2. Calculation of target velocity from primary radar having non-periodic (variable) scanning rates;

l.3. Processing for automatic pattern recognition (feature extraction) and comparison with target characteristic data bases (waveforms or imagery) to identify or classify targets; *or*

l.4. Superposition and correlation, or fusion, of target data from two or more "geographically dispersed" and "interconnected radar sensors" to enhance and discriminate targets.

NOTE: 6A008.l.4 does not control systems, equipment and assemblies designed for marine traffic control.

**6A018 Magnetic, pressure, and acoustic underwater detection devices specially designed for military purposes and controls and components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT, UN.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
AT applies to entire entry .....	AT Column 1.
UN applies to entire entry .....	Rwanda.

LICENSE EXCEPTIONS

LVS: \$5000, except N/A for Rwanda

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; components in \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**6A102 Radiation hardened detectors, other than those controlled by 6A002, specially designed or modified for protecting against nuclear effects (e.g., Electromagnetic Pulse (EMP), X-rays, combined blast and thermal effects) and usable for "missiles," designed or rated to withstand radiation levels which meet or exceed a total irradiation dose of  $5 \times 10^5$  rads (silicon).**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

*Control(s)* *Country Chart*  
 MT applies to entire entry ..... MT Column 1  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Components in number

*Related Controls:* N/A

*Related Definitions:* In this entry, a detector is defined as a mechanical, electrical, optical or chemical device that automatically identifies and records, or registers a stimulus such as an environmental change in pressure or temperature, an electrical or electromagnetic signal or radiation from a radioactive material.

*Items:* The list of items controlled is contained in the ECCN heading.

**6A103 Radomes designed to withstand a combined thermal shock greater than 100 cal/sq cm accompanied by a peak over pressure of greater than 50 kPa, usable in protecting “missiles” against nuclear effects (e.g., Electromagnetic Pulse (EMP), X-rays, combined blast and thermal effects), and usable for “missiles.” (These items are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)**

**6A107 Gravity meters (gravimeters) and specially designed components for gravity meters and gravity gradiometers, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

*Control(s)* *Country Chart*  
 MT applies to entire entry ..... MT Column 1  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

- a. Gravity meters (gravimeters), other than those controlled by 6A007.b, designed or modified for airborne or marine use, and having a static or operational accuracy of  $7 \times 10^{-6}$  m/s<sup>2</sup> (0.7 milligal) or better, and having a time to steady-state registration of two minutes or less, usable for “missiles”;
- b. Specially designed components for gravity meters controlled in 6A007. b or 6A107.a

and gravity gradiometers controlled in 6A007.c.

**6A108 Radar systems and tracking systems, other than those controlled by 6A008, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

*Control(s)* *Country Chart*  
 MT applies to entire entry ..... MT Column 1  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) This entry does not control airborne civil weather radar conforming to international standards for civil weather radars provided that they do not incorporate any of the following: (a) Phased array antennas; (b) Frequency agility; (c) Spread spectrum; or (d) Signal processing specially designed for the tracking of vehicles. (2) Items in 6A108.a that are specially designed or modified for “missiles” or for items on the U.S. Munitions List are subject to the export licensing authority of the U.S. Department of State, Defense Trade Controls (see 22 CFR part 121).

*Related Definitions:* Laser radar systems are defined as those that embody specialized transmission, scanning, receiving and signal processing techniques for utilization of lasers for echo ranging, direction finding and discrimination of targets by location, radial speed and body reflection characteristics.

*Items:*

- a. Radar and laser radar systems designed or modified for use in “missiles”;  
 NOTE: 6A108.a includes the following:
  - a. Terrain contour mapping equipment;
  - b. Imaging sensor equipment;
  - c. Scene mapping and correlation (both digital and analog) equipment;
  - d. Doppler navigation radar equipment.
- b. Precision tracking systems, usable for “missiles”, as follows:
  - b.1. Tracking systems which use a code translator installed on the rocket or unmanned air vehicle in conjunction with either surface or airborne references or navigation satellite systems to provide real-time measurements of in-flight position and velocity;
  - b.2. Range instrumentation radars including associated optical/infrared trackers with all of the following capabilities:
    - b.2.a. Angular resolution better than 3 milliradians (0.5 mils);
    - b.2.b. Range of 30 km or greater with a range resolution better than 10 m rms;

b.2.c. Velocity resolution better than 3 m/s.

**6A202 Photomultiplier tubes having both of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NP, AT

Control(s)	Country Chart
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Number

Related Controls: See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry.

Related Definitions: N/A

Items:

- a. Photocathode area of greater than 20 cm<sup>2</sup>; and
- b. Anode pulse rise time of less than 1 ns.

**6A203 Cameras and components, other than those controlled by 6A003, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NP, AT

Control(s)	Country Chart
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment and components in number; parts and accessories in \$ value

Related Controls: (1) See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry. (2) Also see ECCN 6A003.a.2, a.3, and a.4.

Related Definitions: N/A

Items:

a. Mechanical rotating mirror cameras, as follows, and specially designed components therefor:

- a.1. Framing cameras with recording rates greater than 225,000 frames per second;
- a.2. Streak cameras with writing speeds greater than 0.5 mm per microsecond;

NOTE: Components of cameras controlled by 6A203.a include their synchronizing electronics units and rotor assemblies consisting of turbines, mirrors and bearings.

b. Electronic streak cameras, electronic framing cameras, tubes and devices, as follows:

b.1. Electronic streak cameras capable of 50 ns or less time resolution;

b.2. Streak tubes for cameras controlled by 6A203.b.1;

b.3. Electronic (or electronically shuttered) framing cameras capable of 50 ns or less frame exposure time;

b.4. Framing tubes and solid-state imaging devices for use with cameras controlled by 6A203.b.3, as follows:

b.4.a. Proximity focused image intensifier tubes having the photocathode deposited on a transparent conductive coating to decrease photocathode sheet resistance;

b.4.b. Gated silicon intensifier target (SIT) vidicon tubes, where a fast system allows gating the photoelectrons from the photocathode before they impinge on the SIT plate;

b.4.c. Kerr or Pockels cell electro-optical shuttering;

b.4.d. Other framing tubes and solid-state imaging devices having a fast-image gating time of less than 50 ns specially designed for cameras controlled by 6A203.b.3.

c. Radiation-hardened TV cameras, or lenses therefor, specially designed or rated as radiation hardened to withstand a total radiation dose greater than 50 × 10<sup>3</sup> Gy (silicon) (5 × 10<sup>6</sup> rad (silicon)) without operational degradation.

Technical Note: The term Gy (silicon) refers to the energy in Joules per kilogram absorbed by an unshielded silicon sample when exposed to ionizing radiation.

**6A205 "Lasers", "laser" amplifiers and oscillators, other than those controlled by 6A005 or described in 0B001.g.5 or h.6, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NP, AT

Control(s)	Country Chart
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number; parts and accessories in \$ value

Related Controls: (1) See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry. (2) Also see ECCNs 6A005 and 6A995. (3) "Lasers" specially designed or prepared for use in isotope separation are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*Items:*

- a. Argon ion "lasers" having both of the following characteristics:
    - a.1. Operating at wavelengths between 400 nm and 515 nm; *and*
    - a.2. An average output power greater than 40 W;
  - b. Tunable pulsed single-mode dye laser oscillators having all of the following characteristics:
    - b.1. Operating at wavelengths between 300 nm and 800 nm;
    - b.2. An average output power greater than 1 W;
    - b.3. A repetition rate greater than 1 kHz;*and*
    - b.4. Pulse width less than 100 ns;
  - c. Tunable pulsed dye laser amplifiers and oscillators having all of the following characteristics:
    - c.1. Operating at wavelengths between 300 nm and 800 nm;
    - c.2. An average output power greater than 30 W;
    - c.3. A repetition rate greater than 1 kHz;*and*
    - c.4. Pulse width less than 100 ns;
- NOTE: 6A205.c does not control single mode oscillators.
- d. Pulsed carbon dioxide "lasers" having all of the following characteristics:
    - d.1. Operating at wavelengths between 9,000 nm and 11,000 nm;
    - d.2. A repetition rate greater than 250 Hz;
    - d.3. An average output power greater than 500 W; *and*
    - d.4. Pulse width of less than 200 ns;
  - e. Para-hydrogen Raman shifters designed to operate at 16 micrometer output wavelength and at a repetition rate greater than 250 Hz;
  - f. Pulse-excited, Q-switched neodymium-doped (other than glass) "lasers" having all of the following characteristics:
    - f.1. An output wavelength exceeding 1,000 nm, but not exceeding 1,100 nm;
    - f.2. A pulse duration equal to or more than 1 ns; *and*
    - f.3. A multiple-transverse mode output having an average power exceeding 50 W.

**6A225 Velocity interferometers for measuring velocities exceeding 1 km/s during time intervals of less than 10 microseconds.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value

*Related Controls:* See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry.

*Related Definitions:* N/A

*ECCN Controls:* 6A225 includes velocity interferometers, such as VISARs (Velocity interferometer systems for any reflector) and DLLs (Doppler laser interferometers).

*Items:* The list of items controlled is contained in the ECCN heading.

**6A226 Pressure sensors, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country Chart</i>
NP applies to entire entry .....	NP Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value

*Related Controls:* See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry.

*Related Definitions:* N/A

- Items:* a. Manganin gauges for pressures greater than 100 kilobars; *or*
- b. Quartz pressure transducers for pressures greater than 100 kilobars.

**6A991 Marine or terrestrial acoustic equipment, n.e.s., capable of detecting or locating underwater objects or features or positioning surface vessels or underwater vehicles; and specially designed components, n.e.s.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 2

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**6A992 Optical Sensors, not controlled by 6A002.**

LICENSE REQUIREMENTS  
Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED  
Unit: Equipment in number; parts and accessories in \$ value  
Related Controls: N/A  
Related Definitions: N/A  
Items:

- a. Image intensifier tubes and specially designed components therefor, as follows:
  - a.1. Image intensifier tubes having all the following:
    - a.1.a. A peak response in wavelength range exceeding 400 nm, but not exceeding 1,050 nm;
    - a.1.b. A microchannel plate for electron image amplification with a hole pitch (center-to-center spacing) of less than 25 micrometers; and
      - a.1.c. Having any of the following:
        - a.1.c.1. An S-20, S-25 or multialkali photocathode; or
        - a.1.c.2. A GaAs or GaInAs photocathode;
    - a.2. Specially designed microchannel plates having both of the following characteristics:
      - a.2.a. 15,000 or more hollow tubes per plate; and
      - a.2.b. Hole pitch (center-to-center spacing) of less than 25 micrometers.
  - b. Direct view imaging equipment operating in the visible or infrared spectrum, incorporating image intensifier tubes having the characteristics listed in 6A992.a.1.

**6A994 Optics, not controlled by 6A004.**

LICENSE REQUIREMENTS  
Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED  
Unit: Equipment in number; parts and accessories in \$ value  
Related Controls: N/A  
Related Definitions: N/A  
Items: a. Optical filters:

- a.1. For wavelengths longer than 250 nm, comprised of multi-layer optical coatings and having either of the following:

- a.1.a. Bandwidths equal to or less than 1 nm Full Width Half Intensity (FWHI) and peak transmission of 90% or more; or
- a.1.b. Bandwidths equal to or less than 0.1 nm FWHI and peak transmission of 50% or more;

NOTE: 6A994 does not control optical filters with fixed air gaps or Lyot-type filters.

- a.2. For wavelengths longer than 250 nm, and having all of the following:
  - a.2.a. Tunable over a spectral range of 500 nm or more;
  - a.2.b. Instantaneous optical bandpass of 1.25 nm or less;
  - a.2.c. Wavelength resettable within 0.1 ms to an accuracy of 1 nm or better within the tunable spectral range; and
  - a.2.d. A single peak transmission of 91% or more;
- a.3. Optical opacity switches (filters) with a field of view of 30° or wider and a response time equal to or less than 1 ns;
  - b. "Fluoride fiber" cable, or optical fibers therefor, having an attenuation of less than 4 dB/km in the wavelength range exceeding 1,000 nm but not exceeding 3,000 nm.

**6A995 "Lasers", not controlled by 6A005 or 6A205.**

LICENSE REQUIREMENTS  
Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED  
Unit: Equipment in number; parts and accessories in \$ value.  
Related Controls: N/A.  
Related Definitions: N/A.  
Items:

- a. Carbon dioxide (CO<sub>2</sub>) "lasers" having any of the following:
  - a.1. A CW output power exceeding 10 kW;
  - a.2. A pulsed output with a "pulse duration" exceeding 10 microseconds; and
    - a.2.a. An average output power exceeding 10 kW; or
    - a.2.b. A pulsed "peak power" exceeding 100 kW; or
    - a.3. A pulsed output with a "pulse duration" equal to or less than 10 microseconds; and
      - a.3.a. A pulse energy exceeding 5 J per pulse and "peak power" exceeding 2.5 kW; or
      - a.3.b. An average output power exceeding 2.5 kW;
  - b. Semiconductor lasers, as follows:
    - b.1. Individual, single-transverse mode semiconductor "lasers" having:

b.1.a. An average output power exceeding 100 mW; or  
 b.1.b. A wavelength exceeding 1,050 nm;  
 b.2. Individual, multiple-transverse mode semiconductor "lasers", or arrays of individual semiconductor "lasers", having a wavelength exceeding 1,050 nm;  
 c. Solid state, non-"tunable" "lasers", as follows:  
 c.1. Ruby "lasers" having an output energy exceeding 20 J per pulse;  
 c.2. Neodymium-doped (other than glass) "lasers", as follows, with an output wavelength exceeding 1,000 nm but not exceeding 1,100 nm:  
 c.2.a. Pulse-excited, "Q-switched lasers", with a pulse duration equal to or more than 1 ns, and a multiple-transverse mode output with any of the following:  
 c.2.a.1. A "peak power" exceeding 200 MW; or  
 c.2.a.2. An average output power exceeding 50 W;  
 c.2.b. Pulse-excited, non-"Q-switched lasers", having a multiple-transverse mode output with an average power exceeding 500 W; or  
 c.2.c. Continuously excited "lasers" having a multiple-transverse mode output with an average or CW output power exceeding 500 W;  
 d. Free electron "lasers".

**6A996 "Magnetometers", n.e.s., having a "noise level" (sensitivity) lower (better) than 1.0 nT rms per square root Hz.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
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AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**6A997 Gravity meters (gravimeters) for ground use, n.e.s.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
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AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* a. Having a static accuracy of less (better) than 100 microgal; or

b. Being of the quartz element (Worden) type.

**6A998 Radar Systems, Equipment and Assemblies, n.e.s., (See List of Items Controlled), and Specially Designed Components Therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* RS, AT

Control(s)	Country chart
RS applies to paragraph .b .....	RS Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.  
*Related Controls:* N/A.  
*Related Definitions:* N/A.  
*Items:*

a. Airborne radar equipment, n.e.s., and specially designed components therefor.

b. "Space-qualified" "laser" radar or Light Detection and Ranging (LIDAR) equipment specially designed for surveying or for meteorological observation.

**6A999 Specific Processing Equipment, as Follows (See List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* AT.

*Control(s).*

*Country Chart.*

AT applies to entire entry. A license is required for items controlled by this entry to North Korea for anti-terrorism reasons. The Commerce Country Chart is not designed to determine AT licensing requirements for this entry. See §742.19 of the EAR for additional information.

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.  
*Related Controls:* See also 6A203.  
*Related Definitions:* N/A.

*Items:*

- a. Seismic detection equipment;
- b. Radiation hardened TV cameras, n.e.s.

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B. TEST, INSPECTION AND PRODUCTION EQUIPMENT

**6B004 Optical equipment, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$5000

GBS: Yes for 6B004.b

CIV: Yes for 6B004.b

LIST OF ITEMS CONTROLLED

Unit: Number

Related Controls: This entry does not control microscopes.

Related Definitions: N/A

Items: a. Equipment for measuring absolute reflectance to an accuracy of  $\pm 0.1\%$  of the reflectance value;

b. Equipment other than optical surface scattering measurement equipment, having an unobscured aperture of more than 10 cm, specially designed for the non-contact optical measurement of a non-planar optical surface figure (profile) to an "accuracy" of 2 nm or less (better) against the required profile.

**6B007 Equipment to produce, align and calibrate land-based gravity meters with a static accuracy of better than 0.1 mgal.**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$5000

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Number

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

**6B008 Pulse radar cross-section measurement systems having transmit pulse widths of 100 ns or less and specially designed components therefor.**

LICENSE REQUIREMENTS

Reason for Control: NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
MT applies to entire entry .....	MT Column 1

*Control(s)*

*Country Chart*

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Number

Related Controls: See also 6B108

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

**6B108 Systems, other than those controlled by 6B008, specially designed for radar cross section measurement usable for "missiles" and their subsystems.**

LICENSE REQUIREMENTS

Reason for Control: MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: r

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

**6B995 Specially designed or modified equipment, including tools, dies, fixtures or gauges, and other specially designed components and accessories therefor:**

LICENSE REQUIREMENTS

Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number; parts and accessories in \$ value

Related Controls: N/A

Related Definitions: N/A

Items: a. For the manufacture or inspection of:

a.1. Free electron "laser" magnet wigglers;

a.2. Free electron "laser" photo injectors;

b. For the adjustment, to required tolerances, of the longitudinal magnetic field of free electron "lasers".

## C. MATERIALS

**6C002 Optical sensor materials, as follows (see List of Items Controlled).**

## LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

## LICENSE EXCEPTIONS

LVS: \$3000

GBS: N/A

CIV: N/A

## LIST OF ITEMS CONTROLLED

*Unit:* Number.*Related Controls:* See also 6C992.*Related Definitions:* N/A.*Items:*

- a. Elemental tellurium (Te) of purity levels of 99.9995% or more;
- b. Single crystals (including epitaxial wafers) of any of the following:
  - b.1. Cadmium zinc telluride (CdZnTe), with zinc content less than 6% by mole fraction;
  - b.2. Cadmium telluride (CdTe) of any purity level; *or*
  - b.3. Mercury cadmium telluride (HgCdTe) of any purity level.

TECHNICAL NOTE: Mole fraction is defined as the ratio of moles of ZnTe to the sum of the moles of CdTe and ZnTe present in the crystal.

**6C004 Optical materials, as follows (see List of Items Controlled).**

## LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

## LICENSE EXCEPTIONS

LVS: \$1500

GBS: Yes for 6C004.a and .e

CIV: Yes for 6C004.a and .e

## LIST OF ITEMS CONTROLLED

*Unit:* \$ value*Related Controls:* See also 6C994*Related Definitions:* N/A

*Items:* a. Zinc selenide (ZnSe) and zinc sulphide (ZnS) "substrate blanks" produced by the chemical vapor deposition process, having any of the following:

- a.1. A volume greater than 100 cm<sup>3</sup>; or
- a.2. A diameter greater than 80 mm having a thickness of 20 mm or more;
- b. Boules of the following electro-optic materials:
  - b.1. Potassium titanyl arsenate (KTA);
  - b.2. Silver gallium selenide (AgGaSe<sub>2</sub>);

b.3. Thallium arsenic selenide (Tl<sub>3</sub>AsSe<sub>3</sub>, also known as TAS;

c. Non-linear optical materials, having all of the following:

c.1. Third order susceptibility ( $\chi^3$ ) of 10<sup>-6</sup> m<sup>2</sup>/V<sup>2</sup> or more; and

c.2. A response time of less than 1 ms;

d. "Substrate blanks" of silicon carbide or beryllium beryllium (Be/Be) deposited materials exceeding 300 mm in diameter or major axis length;

e. Glass, including fused silica, phosphate glass, fluorophosphate glass, zirconium fluoride (ZrF<sub>4</sub>) and hafnium fluoride (HfF<sub>4</sub>), having all of the following:

e.1. A hydroxyl ion (OH<sup>-</sup>) concentration of less than 5 ppm;

e.2. Integrated metallic purity levels of less than 1 ppm; and

e.3. High homogeneity (index of refraction variance) less than 5 × 10<sup>-6</sup>;

f. Synthetically produced diamond material with an absorption of less than 10<sup>-5</sup> cm<sup>-1</sup> for wavelengths exceeding 200 nm but not exceeding 14,000 nm.

**6C005 Synthetic crystalline "laser" host material in unfinished form, as follows (see List of Items Controlled).**

## LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

## LICENSE EXCEPTIONS

LVS: \$1500

GBS: N/A

CIV: N/A

## LIST OF ITEMS CONTROLLED

*Unit:* Kilograms*Related Controls:* N/A*Related Definitions:* N/A*Items:* a. Titanium doped sapphire;

b. Alexandrite.

**6C992 Optical sensing fibers not controlled by 6A002.d.3 which are modified structurally to have a 'beat length' of less than 500 mm (high birefringence) or optical sensor materials not described in 6C002.b and having a zinc content of equal to or more than 6% by 'mole fraction'.**

## LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

## LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value.

*Related Controls:* N/A.

*Related Definitions:* (1) 'Mole fraction' is defined as the ratio of moles of ZnTe to the sum of the moles of CdTe and ZnTe present in the crystal. (2) 'Beat length' is the distance over which two orthogonally polarized signals, initially in phase, must pass in order to achieve a 2 Pi radian(s) phase difference.

*Items:*

The list of items controlled is contained in the ECCN heading.

**6C994 Optical materials.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
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AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value

*Related Controls:* N/A

*Related Definitions:* (1) 'Fluoride fibers' are fibers manufactured from bulk fluoride compounds. (2) 'Optical fiber preforms' are bars, ingots, or rods of glass, plastic or other materials that have been specially processed for use in fabricating optical fibers. The characteristics of the preform determine the basic parameters of the resultant drawn optical fibers.

*Items:*

a. Low optical absorption materials, as follows:

a.1. Bulk fluoride compounds containing ingredients with a purity of 99.999% or better; or

NOTE: 6C994.a.1 controls fluorides of zirconium or aluminum and variants.

a.2. Bulk fluoride glass made from compounds controlled by 6C004.e.1;

b. 'Optical fiber preforms' made from bulk fluoride compounds containing ingredients with a purity of 99.999% or better, specially designed for the manufacture of 'fluoride fibers' controlled by 6A994.b.

D. SOFTWARE

**6D001 "Software" Specially Designed for the "Development" or "Production" of Equipment Controlled by 6A004, 6A005, 6A008, or 6B008.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, NP, RS, AT.

Control(s)	Country chart
NS applies to "software" for equipment controlled by 6A004, 6A005, 6A008 or 6B008.	NS Column 1.
MT applies to "software" for equipment controlled by 6A008 or 6B008 for MT reasons.	MT Column 1.
NP applies to "software" for equipment controlled by 6A005 for NP reasons.	NP Column 1.
RS applies to "software" for equipment controlled by 6A008.j.1.	RS Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes, except for the following:

(1) Items controlled for MT reasons;  
 (2) "Software" specially designed for the "development" or "production" of "space qualified" "laser" radar or Light Detection and Ranging (LIDAR) equipment defined in 6A008.j.1; or

(3) Exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "software" specially designed for the "development" or "production" of equipment controlled by 6A008.1.3 or 6B008.

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* "Software" specially designed for the "development" or "production" of "space qualified" components for optical systems defined in 6A004.c and "space qualified" optical control equipment defined in 6A004.d.1 is subject to the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121). See also 6D991, and ECCNs 6E001 ("development") and 6E102 ("use") for "technology" for items controlled under this entry.

*Related Definitions:* N/A.

*Items:*

The list of items controlled is contained in the ECCN heading.

**6D002 "Software" specially designed for the "use" of equipment controlled by 6A002.b, 6A008, or 6B008.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, RS, AT

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
MT applies to "software" for equipment controlled by 6A008 or 6B008 for MT reasons.	MT Column 1.

Control(s)	Country chart
RS applies to "software" for equipment controlled by 6A008.j.1.	RS Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes, except N/A for the following

- (1) Items controlled for MT reasons; or
- (2) "Software" specially designed for the "use" of "space qualified" "laser" radar or Light Detection and Ranging (LIDAR) equipment defined in 6A008.j.1.

LIST OF ITEMS CONTROLLED

Unit: \$ value.

**Related Controls:** "Software" specially designed for the "use" of "space qualified" imaging sensors (e.g., "monospectral imaging sensors" and "multispectral imaging sensors") defined in 6A002.b.2.b.1 is subject to the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121), unless, on or after September 23, 2002, the Department of State issues a commodity jurisdiction determination assigning the export licensing authority to the Department of Commerce, Bureau of Industry and Security. "Software" specially designed for the "use" of "space qualified" LIDAR equipment specially designed for surveying or for meteorological observation, released from control under the note in 6A008.j, is controlled in 6D991. See also 6D102, 6D991, and 6D992

**Related Definitions:** N/A.

**Items:**

The list of items controlled is contained in the ECCN heading.

**6D003 Other "software", as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

**Reason for Control:** NS, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: Yes for 6D003.h.1

TSR: Yes, except for the following:

- (1) Items controlled for MT reasons; or
- (2) Exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "software" for items controlled by 6D003.a.

LIST OF ITEMS CONTROLLED

Unit: \$ value

**Related Controls:** See also 6D103 and 6D993

**Related Definitions:** N/A

**Items:**

- a. Acoustics "software", as follows:
    - a.1. "Software" specially designed for acoustic beam forming for the "real time processing" of acoustic data for passive reception using towed hydrophone arrays;
    - a.2. "Source code" for the "real time processing" of acoustic data for passive reception using towed hydrophone arrays;
    - a.3. "Software" specially designed for acoustic beam forming for the "real time processing" of acoustic data for passive reception using bottom or bay cable systems;
    - a.4. "Source code" for the "real time processing" of acoustic data for passive reception using bottom or bay cable systems;
  - b. Optical sensors. None.
  - c. Cameras. None.
  - d. Optics. None.
  - e. Lasers. None.
  - f. Magnetometers.
    - f.1. "Software" specially designed for magnetic compensation systems for magnetic sensors designed to operate on mobile platforms;
    - f.2. "Software" specially designed for magnetic anomaly detection on mobile platforms;
  - g. Gravimeters. "Software" specially designed to correct motional influences of gravity meters or gravity gradiometers;
  - h. Radar "software", as follows:
    - h.1. Air Traffic Control "software" application "programs" hosted on general purpose computers located at Air Traffic Control centers and capable of any of the following:
      - h.1.a. Processing and displaying more than 150 simultaneous "system tracks"; or
      - h.1.b. Accepting radar target data from more than four primary radars;
    - h.2. "Software" for the design or "production" of radomes which:
      - h.2.a. Are specially designed to protect the "electronically steerable phased array antennae" controlled by 6A008.e.; and
      - h.2.b. Result in an antenna pattern having an "average side lobe level" more than 40 dB below the peak of the main beam level.
- TECHNICAL NOTE: "Average side lobe level" in 6D003.h.2.b is measured over the entire array excluding the angular extent of the main beam and the first two side lobes on either side of the main beam.
- 6D102 "Software" specially designed or modified for the "use" of goods controlled by 6A108.**

LICENSE REQUIREMENTS

**Reason for Control:** MT, AT

Control(s)	Country Chart
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

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CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

**6D103 Software” that processes post-flight, recorded data, enabling determination of vehicle position throughout its flight path, specially designed or modified for “missiles”.**

LICENSE REQUIREMENTS

Reason for Control: MT, AT

Control(s)	Country Chart
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

The list of items controlled is contained in the ECCN heading.

**6D991 “Software” Specially Designed for the “Development”, “Production”, or “Use” of Equipment Controlled by 6A002.e, 6A991, 6A996, 6A997, or 6A998.**

LICENSE REQUIREMENTS

Reason for Control: RS, AT

Control(s)	Country chart
RS applies to “software” for equipment controlled by 6A002.e or 6A998.b.	RS Column 1.
AT applies to entire entry, except “software” for equipment controlled by 6A991.	AT Column 1.
AT applies to “software” for equipment controlled by 6A991.	AT Column 2.

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value.

Related Controls: N/A.

Related Definitions: N/A.

Items:

The list of items controlled is contained in the ECCN heading.

**6D992 “Software” specially designed for the “development” or “production” of equipment controlled by 6A992, 6A994, or 6A995.**

LICENSE REQUIREMENTS

Reason for Control: AT

Control(s)

Country Chart

AT applies to entire entry .....

AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading.

**6D993 Other “software” not controlled by 6D003.**

LICENSE REQUIREMENTS

Reason for Control: AT

Control(s)	Country Chart
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number; parts and accessories in \$ value

Related Controls: N/A

Related Definitions: N/A

Items: a. Air Traffic Control (ATC) “software” application “programs” hosted on general purpose computers located at Air Traffic Control centers, and capable of automatically handing over primary radar target data (if not correlated with secondary surveillance radar (SSR) data) from the host ATC center to another ATC center;

E. TECHNOLOGY

**6E001 “Technology” According to the General Technology Note for the “Development” of Equipment, Materials or “Software” Controlled by 6A (Except 6A018, 6A991, 6A992, 6A994, 6A995, 6A996, 6A997, or 6A998), 6B (Except 6B995), 6C (Except 6C992 or 6C994), or 6D (Except 6D991, 6D992, or 6D993).**

LICENSE REQUIREMENTS

Reason for Control: NS, MT, NP, RS, CC, AT, UN.

Control(s)	Country chart
NS applies to “technology” for items controlled by 6A001 to 6A008, 6B004 to 6B008, 6C002 to 6C005, or 6D001 to 6D003.	NS Column 1.
MT applies to “technology” for items controlled by 6A002, 6A007, 6A008, 6A102, 6A107, 6A108, 6B008, 6B108, 6D001, 6D002, 6D102 or 6D103 for MT reasons.	MT Column 1.

Control(s)	Country chart
NP applies to "technology" for equipment controlled by 6A003, 6A005, 6A202, 6A203, 6A205, 6A225, 6A226 or 6D001 for NP reasons.	NP Column 1.
RS applies to "technology" for equipment controlled by 6A002.a.1, .a.2, .a.3, .c, or e, 6A003.b.3 or .b.4, or 6A008.j.1.	RS Column 1.
CC applies to "technology" for equipment controlled by 6A002 for CC reasons.	CC Column 1.
AT applies to entire entry .....	AT Column 1.
UN applies to "technology" for equipment controlled by 6A002 or 6A003 for UN reasons.	Rwanda.

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A.

TSR: Yes, except for the following:

- (1) Items controlled for MT reasons;
- (2) "Technology" for commodities controlled by 6A002.e, 6A004.e, or 6A008.j.1;
- (3) "Technology" for "software" specially designed for "space qualified" "laser" radar or Light Detection and Ranging (LIDAR) equipment defined in 6A008.j.1 and controlled by 6D001 or 6D002;
- (4) Exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "technology" for the "development" of the following: (a) Items controlled by 6A001.a.2.a.1, 6A001.a.2.a.2, 6A001.a.2.a.4, 6A001.a.2.a.5, 6A001.a.2.b, 6A001.a.2.e., 6A002.a.1.c, 6A008.1.3, 6B008, 6D003.a; (b) Equipment controlled by 6A001.a.2.c or 6A001.a.2.f when specially designed for real time applications; or (c) "Software" controlled by 6D001 and specially designed for the "development" or "production" of equipment controlled by 6A008.1.3 or 6B008; or
- (5) Exports or reexports to Rwanda.

LIST OF ITEMS CONTROLLED

Unit: N/A

*Related Controls:* "Technology" according to the General Technology Note for the "development" of the following commodities is subject to the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121): "Space qualified" (1.) Components for optical systems defined in 6A004.c and optical control equipment defined in 6A004.d.1.; (2.) Solid-state detectors defined in 6A002.a.1, "imaging sensors" (e.g., "monospectral imaging sensors" and "multispectral imaging sensors") defined in 6A002.b.2.b.1, and cryocoolers defined in 6A002.d.1 unless on or after September 23, 2002, the Department of State issues a commodity jurisdic-

tion determination assigning the export licensing authority to the Department of Commerce, Bureau of Industry and Security. See also 6E101, 6E201, and 6E991.

*Related Definitions:* N/A

Items:

The list of items controlled is contained in the ECCN heading.

**6E002 "Technology" According to the General Technology Note for the "Production" of Equipment or Materials Controlled by 6A (Except 6A018, 6A991, 6A992, 6A994, 6A995, 6A996, 6A997 or 6A998), 6B (Except 6B995) or 6C (Except 6C992 or 6C994).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, NP, RS, CC, AT, UN.

Control(s)	Country chart
NS applies to "technology" for equipment controlled by 6A001 to 6A008, 6B004 to 6B008, or 6C002 to 6C005.	NS Column 1.
MT applies to "technology" for equipment controlled by 6A002, 6A007, 6A008, 6A102, 6A107, 6A108, 6B008, or 6B108 for MT reasons.	MT Column 1.
NP applies to "technology" for equipment controlled by 6A003, 6A005, 6A202, 6A203, 6A205, 6A225 or 6A226 for NP reasons.	NP Column 1.
RS applies to "technology" for equipment controlled by 6A002.a.1, .a.2, .a.3, .c or .e, 6A003.b.3 or .b.4, or 6A008.j.1.	RS Column 1.
CC applies to "technology" for equipment controlled by 6A002 for CC reasons.	CC Column 1.
AT applies to entire entry .....	AT Column 1.
UN applies to "technology" for equipment controlled by 6A002 or 6A003 for UN reasons.	Rwanda.

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A.

TSR: Yes, except for the following:

- (1) Items controlled for MT reasons;
- (2) "Technology" for commodities controlled by 6A002.e, 6A004.e, 6A008.j.1;
- (3) Exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "technology" for the "development" of the following: (a) Items controlled by 6A001.a.2.a.1, 6A001.a.2.a.2, 6A001.a.2.a.4, 6A001.a.2.a.5, 6A001.a.2.b, and 6A001.a.2.c; and (b) Equipment controlled by 6A001.a.2.e and 6A001.a.2.f when specially designed for real time applications; or (c) "Software" controlled by 6D001 and specially

designed for the “development” or “production” of equipment controlled by 6A002.a.1.c, 6A008.1.3 or 6B008; or

(4) Exports or reexports to Rwanda.

LIST OF ITEMS CONTROLLED

Unit: N/A

*Related Controls:* “Technology” according to the General Technology Note for the “production” of the following commodities is subject to the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121) when intended for use on a satellite: “Space qualified” (1.) Components for optical systems defined in 6A004.c and optical control equipment defined in 6A004.d.1.; (2.) Solid-state detectors defined in 6A002.a.1, “imaging sensors” (e.g., “monospectral imaging sensors” and “multispectral imaging sensors”) defined in 6A002.b.2.b.1, and cryocoolers defined in 6A002.d.1 unless on or after September 23, 2002, the Department of State issues a commodity jurisdiction determination assigning the export licensing authority to the Department of Commerce, Bureau of Industry and Security. See also 6E992.

*Related Definitions:* N/A

*Items:*

The list of items controlled is contained in the ECCN heading.

**6E003 Other “technology”, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
TSR: Yes

LIST OF ITEMS CONTROLLED

Unit: N/A

*Related Controls:* See also 6E993

*Related Definitions:* N/A

*Items:* a. Acoustics. None.

b. Optical sensors. None.

c. Cameras. None.

d. Optics, “technology”, as follows:

d.1. Optical surface coating and treatment “technology” “required” to achieve uniformity of 99.5% or better for optical coatings 500 mm or more in diameter or major axis length and with a total loss (absorption and scatter) of less than  $5 \times 10^{-3}$ ;

N.B.: See also 2E003.f.

d.2. Optical fabrication “technology” using single point diamond turning techniques to produce surface finish accuracies of better than 10 nm rms on non-planar surfaces exceeding 0.5 m<sup>2</sup>;

e. Lasers. “Technology” “required” for the “development”, “production” or “use” of specially designed diagnostic instruments or targets in test facilities for “SHPL” testing or testing or evaluation of materials irradiated by “SHPL” beams;

f. Magnetometers. “Technology” “required” for the “development” or “production” of fluxgate “magnetometers” or fluxgate “magnetometer” systems, having any of the following:

f.1. A “noise level” of less than 0.05 nT rms per square root Hz at frequencies of less than 1 Hz; or

f.2. A “noise level” of less than  $1 \times 10^{-3}$  nT rms per square root Hz at frequencies of 1 Hz or more.

**6E101 “Technology” according to the General Technology Note for the “use” of equipment or “software” controlled by 6A002, 6A007.b and .c, 6A008, 6A102, 6A107, 6A108, 6B108, 6D102 or 6D103.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: N/A

*Related Controls:* N/A

*Related Definitions:* (1) This entry only controls “technology” for equipment controlled by 6A008 when it is designed for airborne applications and is usable in “missiles”. (2) This entry only controls “technology” for items in 6A002.a.1, a.3, and .e that are specially designed or modified to protect “missiles” against nuclear effects (e.g., Electromagnetic Pulse (EMP), X-rays, combined blast and thermal effects), and usable for “missiles.” (3) This entry only controls “technology” for items in 6A007.b and .c when the accuracies in 6A007.b.1 and b.2 are met or exceeded.

*Items:* The list of items controlled is contained in the ECCN heading.

**6E201 “Technology” according to the General Technology Note for the “use” of equipment controlled by 6A003.a.2, 6A003.a.3, 6A003.a.4, 6A005.a.1.c, 6A005.a.2.a, 6A005.a.4.c, 6A005.a.6, 6A005.c.1.b, 6A005.c.2.b.2.a, 6A005.c.2.b.2.b, 6A005.c.2.c.2, or 6A005.d.2.c., 6A202, 6A203, 6A205, 6A225 or 6A226.**

LICENSE REQUIREMENTS

*Reason for Control:* NP, AT

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*Control(s)* *Country Chart*  
 NP applies to entire entry ..... NP Column 1  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*ECCN Controls:* This entry only controls “technology” for “lasers” in 6A005 that are controlled for NP reasons.  
*Items:* The list of items controlled is contained in the ECCN heading.

**6E991 “Technology” for the “Development”, “Production” or “Use” Equipment Controlled by 6A991, 6A996, 6A997, or 6A998.**

LICENSE REQUIREMENTS

*Reason for Control:* RS, AT

Control(s)	Country chart
RS applies to “technology” for equipment controlled by 6A998.b.	RS Column 1.
AT applies to entire entry except “technology” for equipment controlled by 6A991.	AT Column 1.
AT applies to “technology” for equipment controlled by 6A991.	AT Column 2.

LICENSE EXCEPTIONS

CIV: N/A.  
 TSR: N/A.

LIST OF ITEMS CONTROLLED

*Unit:* N/A.  
*Related Controls:* N/A.  
*Related Definitions:* N/A.  
*Items:*  
 The list of items controlled is contained in the ECCN heading.

**6E992 “Technology” for the “development” or “production” of equipment, materials or “software” controlled by 6A992, 6A994, or 6A995, 6B995, 6C992, 6C994, or 6D993.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

*Control(s)* *Country Chart*  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**6E993 Other “technology”, not controlled by 6E003.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

*Control(s)* *Country Chart*  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* a. Optical fabrication technologies for serially producing optical components at a rate exceeding 10 m<sup>2</sup> of surface area per year on any single spindle and with:

- a.1. An area exceeding 1 m<sup>2</sup>; and
- a.2. A surface figure exceeding lambda/10 rms at the designed wavelength;
- b. “Technology” for optical filters with a bandwidth equal to or less than 10 nm, a field of view (FOV) exceeding 40° and a resolution exceeding 0.75 line pairs per milliradian;

**EAR99 Items subject to the EAR that are not elsewhere specified in this CCL Category or in any other category in the CCL are designated by the number EAR99.**

*Category 7—Navigation and Avionics*

A. SYSTEMS, EQUIPMENT AND COMPONENTS

N.B. 1: For automatic pilots for underwater vehicles, see Category 8. For radar, see Category 6.

N.B. 2: For inertial navigation equipment for ships or submersibles see item 9.e on the Wassenaar Munitions List.

**7A001 Linear Accelerometers Designed for Use in Inertial Navigation or Guidance Systems and Having Any of the Following Characteristics (See List of Items Controlled), and Specially Designed Components Therefor**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

*Control(s)* *Country Chart*  
 NS applies to entire entry ..... NS Column 1  
 MT applies to entire entry ..... MT Column 1  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.  
*Related Controls:* See also 7A101 and 7A994.  
 For angular or rotational accelerometers,

see 7A002. MT controls do not apply to accelerometers that are specially designed and developed as Measurement While Drilling (MWD) sensors for use in downhole well service applications.

*Related Definitions:* N/A.

*Items:*

- a. A "bias" "stability" of less (better) than 130 micro g with respect to a fixed calibration value over a period of one year;
- b. A "scale factor" "stability" of less (better) than 130 ppm with respect to a fixed calibration value over a period of one year; or
- c. Specified to function at linear acceleration levels exceeding 100 g.

**7A002 Gyros, and Angular or Rotational Accelerometers, Having Any of the Following Characteristics (See List of Items Controlled), and Specially Designed Components Therefor**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* See also 7A102 and 7A994.

For linear accelerometers, see 7A001.

*Related Definitions:* N/A.

*Items:*

- a. A "drift rate" "stability", when measured in a 1 g environment over a period of three months and with respect to a fixed calibration value, of:
  - a.1. Less (better) than 0.1° per hour when specified to function at linear acceleration levels below 10 g; or
  - a.2. Less (better) than 0.5° per hour when specified to function at linear acceleration levels from 10 g to 100 g inclusive; or
  - b. Specified to function at linear acceleration levels exceeding 100 g.

**7A003 Inertial Navigation Systems (INS) and specially designed components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See also 7A103 and 7A994. Inertial Navigation Systems (INS) and inertial equipment, and specially designed components therefor specifically designed, modified or configured for military use are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (See 22 CFR part 121.)

*Related Definitions:* "Data-Based Referenced Navigation" ("DBRN") systems are systems which use various sources of previously measured geo-mapping data integrated to provide accurate navigation information under dynamic conditions. Data sources include bathymetric maps, stellar maps, gravity maps, magnetic maps or 3-D digital terrain maps.

*Items:*

a. Inertial navigation systems (gimballed or strapdown) and inertial equipment designed for "aircraft", land vehicle or "spacecraft" for attitude, guidance or control, having any of the following characteristics, and specially designed components therefor:

a.1. Navigation error (free inertial) subsequent to normal alignment of 0.8 nautical mile per hour (nm/hr) Circular Error Probable (CEP) or less (better); or

a.2. Specified to function at linear acceleration levels exceeding 10 g.

b. Hybrid Inertial Navigation Systems embedded with Global Navigation Satellite System(s) (GNSS) or with "Data-Based Referenced Navigation" ("DBRN") System(s) for attitude, guidance or control, subsequent to normal alignment, having an INS navigation position accuracy, after loss of GNSS or "DBRN" for a period of up to 4 minutes, of less (better) than 10 meters Circular Error Probable (CEP).

NOTE 1: The parameters of 7A003.a and 7A003.b are applicable with any of the following environmental conditions:

1. Input random vibration with an overall magnitude of 7.7 g rms in the first half hour and a total test duration of one and one half hour per axis in each of the three perpendicular axes, when the random vibration meets the following:

a. A constant power spectral density (PSD) value of 0.04 g<sup>2</sup>/Hz over a frequency interval of 15 to 1,000 Hz; and

b. The PSD attenuates with frequency from 0.04 g<sup>2</sup>/Hz to 0.01 g<sup>2</sup>/Hz over a frequency interval from 1,000 to 2,000 Hz;

2. A roll and yaw rate of equal to or more than +2.62 rad/s (150 deg/s); or

3. According to national standards equivalent to 1. or 2. of this note.

NOTE 2: 7A003 does not control inertial navigation systems that are certified for use

on "civil aircraft" by civil authorities of a country in Country Group A:1.

TECHNICAL NOTES: 1. 7A003.b refers to systems in which an INS and other independent navigation aids are built into a single unit (embedded) in order to achieve improved performance.

2. "Circular Error Probable" ("CEP")—In a circular normal distribution, the radius of the circle containing 50 percent of the individual measurements being made, or the radius of the circle within which there is a 50 percent probability of being located.

**7A004 Gyro-astro compasses, and other devices which derive position or orientation by means of automatically tracking celestial bodies or satellites, with an azimuth accuracy of equal to or less (better) than 5 seconds of arc.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* See also 7A104 and 7A994  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**7A005 Global navigation satellite systems (i.e. GPS or GLONASS) receiving equipment, and specially designed components therefor. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

NOTE TO 7A005: See also 7A105 and 7A994.

**7A006 Airborne altimeters operating at frequencies other than 4.2 to 4.4 GHz inclusive, having any of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See also 7A106, 7A994 and Category 6 for controls on radar.

*Related Definitions:* N/A

*Items:* a. "Power management"; or

b. Using phase shift key modulation.

**7A007 Direction finding equipment operating at frequencies above 30 MHz and specially designed components therefor. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**7A101 Accelerometers, other than those controlled by 7A001, with a threshold of 0.05 g or less, or a linearity error within 0.25% of full scale output, or both, which are designed for use in inertial navigation systems or in guidance systems of all types and specially designed components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* This entry does not control accelerometers which are specially designed and developed as MWD (Measurement While Drilling) sensors for use in downhole well service operations.  
*Related Definitions:* N/A  
*Items:* The list of items is included in the entry heading.

**7A102 All types of gyros, other than those controlled by 7A002, usable in "missiles", with a rated "drift rate" "stability" of less than 0.5° (1 sigma or rms) per hour in a 1 g environment and specially designed components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* (1) Drift rate is defined as the time rate of output deviation from the desired output. It consists of random and systematic components and is expressed as an equivalent angular displacement per unit time with respect to inertial space. (2) Stability is defined as standard deviation (1 sigma) of the variation of a particular parameter from its calibrated value measured under stable temperature conditions. This can be expressed as a function of time.

*Items:* The list of items controlled is contained in the ECCN heading.

**7A103 Instrumentation, navigation equipment and systems, other than those controlled by 7A003, and specially designed components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) Items described in 7A103.b are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (See 22 CFR part 121). (2) Inertial navigation systems and inertial equipment, and specially designed components therefor specifically designed, modified or configured for military use are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (See 22 CFR part 121.)

*Related Definitions:* N/A

*Items:* a. Inertial or other equipment using accelerometers or gyros controlled by 7A001, 7A002, 7A101 or 7A102 and systems incorporating such equipment;

NOTE: 7A103.a does not control equipment containing accelerometers specially designed and developed as MWD (Measurement While Drilling) sensors for use in down-hole well services operations.

b. Integrated flight instrument systems, which include gyrostabilizers or automatic pilots, designed or modified for use in "missiles".

c. Integrated Navigation Systems, designed or modified for use in "missiles" and capable of providing a navigational accuracy of 200m Circular Error Probable (CEP) or less.

*Technical Note:* An 'integrated navigation system' typically incorporates the following components:

1. An inertial measurement device (e.g., an attitude and heading reference system, inertial reference unit, or inertial navigation system);
2. One or more external sensors used to update the position and/or velocity, either periodically or continuously throughout the flight (e.g., satellite navigation receiver, radar altimeter, and/or Doppler radar); and
3. Integration hardware and software.

**7A104 Gyro-astro compasses and other devices, other than those controlled by 7A004, which derive position or orientation by means of automatically tracking celestial bodies or satellites and specially designed components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* This entry controls specially designed components for gyro-astro compasses and other devices controlled by 7A004

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

**7A105 Receiving equipment for Global Navigation Satellite Systems (GNSS) (e.g. GPS, GLONASS, or Galileo) having any of the following characteristics, and specially designed components therefor. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

1. Designed or modified for use in "missiles"; or
2. Designed or modified for airborne applications and having any of the following:
  - a. Capable of providing navigation information at speeds in excess of 600 m/s (1,165 nautical mph).
  - b. Employing decryption, designed or modified for military or governmental services, to gain access to GNSS secured signal/data; or
  - c. Being specially designed to employ anti-jam features ( e.g. null steering antenna or electronically steerable antenna) to function in an environment of active or passive countermeasures.

NOTE TO 7A105: See also 7A005 and 7A994.

**7A106** Altimeters, other than those controlled by 7A006, of radar or laser radar type, designed or modified for use in “missiles”. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)

**7A115** Passive sensors for determining bearing to specific electromagnetic source (direction finding equipment) or terrain characteristics, designed or modified for use in “missiles”. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)

**7A116** Flight control systems (hydraulic, mechanical, electro-optical, or electro-mechanical flight control systems (including fly-by-wire systems) and attitude control equipment) designed or modified for “missiles”. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)

**7A117** “Guidance sets” capable of achieving system accuracy of 3.33% or less of the range (e.g., a “CEP” of 10 km or less at a range of 300 km). (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)

**7A994** Other navigation direction finding equipment, airborne communication equipment, all aircraft inertial navigation systems not controlled under 7A003 or 7A103, and other avionic equipment, including parts and components, n.e.s.

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
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AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

B. TEST, INSPECTION AND PRODUCTION EQUIPMENT

**7B001** Test, calibration or alignment equipment specially designed for equipment controlled by 7A (except 7A994).

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NS applies to entire entry ..... NS Column 1

MT applies to entire entry ..... MT Column 1

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) See also 7B101, 7B102 and 7B994.

(2) This entry does not control test, calibration or alignment equipment for Maintenance level I.

*Related Definition:* (1) Maintenance Level I:

The failure of an inertial navigation unit is detected on the aircraft by indications from the Control and Display Unit (CDU) or by the status message from the corresponding sub-system. By following the manufacturer’s manual, the cause of the failure may be localized at the level of the malfunctioning line replaceable unit (LRU). The operator then removes the LRU and replaces it with a spare. (2) Maintenance Level II: The defective LRU is sent to the maintenance workshop (the manufacturer’s or that of the operator responsible for level II maintenance). At the maintenance workshop, the malfunctioning LRU is tested by various appropriate means to verify and localize the defective shop replaceable assembly (SRA) module responsible for the failure. This SRA is removed and replaced by an operative spare. The defective SRA (or possibly the complete LRU) is then shipped to the manufacturer. Maintenance Level II does not include the removal of controlled accelerometers or gyro sensors from the SRA.

*Items:* The list of items controlled is contained in the ECCN heading.

**7B002** Equipment, as follows (see List of Items Controlled), specially designed to characterize mirrors for ring “laser” gyros.

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See also 7B102 and 7B994

*Related Definitions:* N/A

*Items:* a. Scatterometers having a measurement accuracy of 10 ppm or less (better);

b. Profilometers having a measurement accuracy of 0.5 nm (5 angstrom) or less (better).

**7B003 Equipment specially designed for the “production” of equipment controlled by 7A (except 7A994).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* (1) See also 7B103, (this entry is subject to the licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls (see 22 CFR part 121)) and 7B994.

(2) This entry includes: Inertial Measurement Unit (IMU module) tester; IMU platform tester; IMU stable element handling fixture; IMU platform balance fixture; gyro tuning test station; gyro dynamic balance station; gyro run-in/motor test station; gyro evacuation and fill station; centrifuge fixtures for gyro bearings; accelerometer axis align station; and accelerometer test station.

*Related Definitions:* N/A.

*Items:* The list of items controlled is contained in the ECCN heading.

**7B101 Production equipment”, and other test, calibration, and alignment equipment, other than that described in 2B119 to 2B122, 7B003, and 7B102, designed or modified to be used with equipment controlled by 7A001 to 7A004 or 7A101 to 7A104.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT.

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1.
AT applies to entire entry .....	AT Column 1.

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* (1) See also 2B119 to 2B122, 7B003, 7B102, and 7B994.

(2) This entry includes: inertial measurement unit (IMU module) tester; IMU platform tester; IMU stable element handling fixture; IMU platform balance fixture; gyro tuning test station; gyro dynamic balance stations; gyro run-in/motor test stations; gyro evacuation and filling stations; centrifuge fixtures for gyro bearings; accelerometer axis align stations; and accelerometer test stations.

*Related Definitions:* N/A.

*Items:* The list of items controlled is contained in the ECCN heading.

**7B102 Equipment, other than those controlled by 7B002, designed or modified to characterize mirrors, for laser gyro equipment, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.

*Related Controls:* N/A.

*Related Definitions:* N/A.

*Items:*

a. Scatterometers having a threshold accuracy of 10 ppm or less (better).

b. Reflectometers having a threshold accuracy of 50 ppm or less (better).

c. Prolifometers having a threshold accuracy of 0.5nm (5 angstrom) or less (better).

**7B103 Specially designed “production facilities” for equipment controlled by 7A117. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**7B994 Other equipment for the test, inspection, or “production” of navigation and avionics equipment.**

LICENSE REQUIREMENTS

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*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

C. MATERIALS [RESERVED]

D. SOFTWARE

**7D001 “Software” specially designed or modified for the “development” or “production” of equipment controlled by 7A (except 7A994) or 7B (except 7B994).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, RS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to “software” for equipment controlled by 7A001 to 7A004, 7A006, 7B001, 7B002 or 7B003.	NS Column 1
MT applies to entire entry .....	MT Column 1
RS applies to “software” for inertial navigation systems inertial equipment, and specially designed components therefor, for “civil aircraft” DRS Column 1.	RS Column 1
AT applies to entire entry .....	AT Column 1

NS applies to “software” for equipment controlled by 7A001 to 7A004, 7A006, 7B001, 7B002 or 7B003.

MT applies to entire entry .....

RS applies to “software” for inertial navigation systems inertial equipment, and specially designed components therefor, for “civil aircraft” DRS Column 1.

AT applies to entire entry .....

LICENSE EXCEPTIONS

CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) See also 7D101 and 7D994.

(2) The “software” related to 7A003.b, 7A005, 7A007, 7A103.b, 7A105, 7A106, 7A115, 7A116, 7A117, or 7B103 are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (See 22 CFR part 121.) (3) “Software” for inertial navigation systems and inertial equipment, and specially designed components therefor, not for use on civil aircraft are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (See 22 CFR part 121.)

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**7D002 “Source code” for the “use” of any inertial navigation equipment including in-**

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**ertial equipment not controlled by 7A003 or 7A004, or Attitude and Heading Reference Systems (AHRS) (except gimballed AHRS).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

NS applies to entire entry .....

MT applies to entire entry .....

AT applies to entire entry .....

LICENSE EXCEPTIONS

CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* (1) See also 7D102 and 7D994.

(2) This entry does not control “source code” for the “use” of gimballed AHRS

*Related Definition:* AHRS generally differ from inertial navigation systems (INS) in that an AHRS provides attitude and heading information and normally does not provide the acceleration, velocity and position information associated with an INS

*Items:* The list of items controlled is contained in the ECCN heading

**7D003 Other “software”, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

NS applies to entire entry .....

MT applies to entire entry .....

AT applies to entire entry .....

LICENSE EXCEPTIONS

IV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See also 7D103 and 7D994

*Related Definitions:* ‘Data-Based Referenced Navigation’ (‘DBRN’) systems are systems which use various sources of previously measured geo-mapping data integrated to provide accurate navigation information under dynamic conditions. Data sources include bathymetric maps, stellar maps, gravity maps, magnetic maps or 3-D digital terrain maps.

*Items:*

a. “Software” specially designed or modified to improve the operational performance or reduce the navigational error of systems to the levels controlled by 7A003 or 7A004;

b. “Source code” for hybrid integrated systems that improves the operational performance or reduces the navigational error of systems to the level controlled by 7A003 by continuously combining inertial data with any of the following:

- b.1. Doppler radar velocity data;
- b.2. Global navigation satellite systems (i.e., GPS or GLONASS) reference data; or
- b.3. Data from 'Data-Based Referenced Navigation' ('DBRN') systems;
- c. "Source code" for integrated avionics or mission systems that combine sensor data and employ "expert systems";
- d. "Source code" for the "development" of any of the following:
  - d.1. Digital flight management systems for "total control of flight";
  - d.2. Integrated propulsion and flight control systems;
  - d.3. Fly-by-wire or fly-by-light control systems;
  - d.4. Fault-tolerant or self-reconfiguring "active flight control systems";
  - d.5. Airborne automatic direction finding equipment;
  - d.6. Air data systems based on surface static data; or
  - d.7. Raster-type head-up displays or three dimensional displays;
  - e. Computer-aided-design (CAD) "software" specially designed for the "development" of "active flight control systems", helicopter multi-axis fly-by-wire or fly-by-light controllers or helicopter "circulation controlled anti-torque or circulation-controlled direction control systems" whose "technology" is controlled by 7E004.b, 7E004.c.1 or 7E004.c.2.

**7D101 "Software" specially designed or modified for the "use" of equipment controlled by 7A001 to 7A006, 7A101 to 7A106, 7A115, 7A116, 7B001, 7B002, 7B003, 7B101, 7B102, or 7B103.**

LICENSE REQUIREMENTS

Reason for Control: MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
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MT applies to entire entry ..... MT Column 1  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) The "software" related to 7A003.b, 7A005, 7A103.b, 7A105, 7A106, 7A115, 7A116, 7A117, or 7B103 are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (See 22 CFR part 121.) (2) "Software" for inertial navigation systems and inertial equipment, and specially designed components therefor, not designed for use on civil aircraft by civil aviation authorities of a country listed in Country Group A:1 is subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (See 22 CFR part 121.)

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**7D102 Integration "software", as follows (See List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
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MT applies to entire entry ..... MT Column 1  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* The "software" related to 7A003.b or 7A103.b are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (See 22 CFR part 121.)

*Related Definitions:* N/A

*Items:*

- a. Integration "software" for the equipment controlled by 7A103.b.
- b. Integration "software" specially designed for the equipment controlled by 7A003 or 7A103.a.

**7D103 "Software" specially designed for modelling or simulation of the "guidance sets" controlled by 7A117 or for their design integration with "missiles". (This entry is subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**7D994 "Software", n.e.s., for the "development", "production", or "use" of navigation, airborne communication and other avionics.**

LICENSE REQUIREMENTS

Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart</i>
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AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

E. TECHNOLOGY

**7E001 “Technology” according to the General Technology Note for the “development” of equipment or “software” controlled by 7A (except 7A994), 7B (except 7B994) or 7D (except 7D994).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, RS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to “technology” for items controlled by 7A001 to 7A004, 7A006, 7B001 to 7B003, 7D001 to 7D003.	NS Column 1
MT applies to entire entry .....	MT Column 1
RS applies to “technology” for inertial navigation systems, inertial equipment and specially designed components therefor, for civil aircraft.	RS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* (1) See also 7E101 and 7E994. (2) The “technology” related to 7A003.b, 7A005, 7A007, 7A103.b, 7A105, 7A106, 7A115, 7A116, 7A117, 7B103, software in 7D101 specified in the Related Controls paragraph of ECCN 7D101, 7D102.a, or 7D103 are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Control (see 22 CFR part 121).

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**7E002 “Technology” according to the General Technology Note for the “production” of equipment controlled by 7A (except 7A994) or 7B (except 7B994).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, RS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to “technology” for equipment controlled by 7A001 to 7A004, 7A006 or 7B001 to 7B003.	NS Column 1
MT applies to entire entry .....	MT Column 1
RS applies to “technology” for inertial navigation systems, inertial equipment and specially designed components therefor, for civil aircraft.	RS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* (1) See also 7E102 and 7E994.

(2) The “technology” related to 7A003.b, 7A005, 7A007, 7A103.b, 7A105, 7A106, 7A115, 7A116, 7A117, or 7B103 are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (see 22 CFR part 121)

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**7E003 “Technology” according to the General Technology Note for the repair, refurbishing or overhaul of equipment controlled by 7A001 to 7A004.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* See also 7E994. This entry does not control maintenance “technology” directly associated with calibration, removal or replacement of damaged or unserviceable LRUs and SRAs of a “civil aircraft” as described in Maintenance Level I or Maintenance Level II

*Related Definition:* Refer to the Related Definitions for 7B001

*Items:* The list of items controlled is contained in the ECCN heading

**7E004 Other “technology”, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* See also 7E104 and 7E994

*Related Definitions:* “Primary flight control” means an “aircraft” stability or maneuvering control using force/moment generators, i.e., aerodynamic control surfaces or propulsive thrust vectoring.

*Items:* a. “Technology” for the “development” or “production” of:

a.1. Airborne automatic direction finding equipment operating at frequencies exceeding 5 MHz;

a.2. Air data systems based on surface static data only, i.e., that dispense with conventional air data probes;

a.3. Raster-type head-up displays or three dimensional displays for "aircraft";

a.4. Inertial navigation systems or gyro-astro compasses containing accelerometers or gyros controlled by 7A001 or 7A002;

a.5. Electric actuators (i.e., electromechanical, electrohydrostatic and integrated actuator package) specially designed for "primary flight control";

a.6. "Flight control optical sensor array" specially designed for implementing "active flight control systems";

b. "Development" "technology", as follows, for "active flight control systems" (including fly-by-wire or fly-by-light):

b.1. Configuration design for inter-connecting multiple microelectronic processing elements (on-board computers) to achieve "real time processing" for control law implementation;

b.2. Control law compensation for sensor location or dynamic airframe loads, i.e., compensation for sensor vibration environment or for variation of sensor location from the center of gravity;

b.3. Electronic management of data redundancy or systems redundancy for fault detection, fault tolerance, fault isolation or re-configuration;

NOTE: 7E004.b.3. does not control "technology" for the design of physical redundancy.

b.4. Flight controls that permit inflight re-configuration of force and moment controls for real time autonomous air vehicle control;

b.5. Integration of digital flight control, navigation and propulsion control data into a digital flight management system for "total control of flight";

NOTE: 7E004.b.5 does not control:

1. "Development" "technology" for integration of digital flight control, navigation and propulsion control data into a digital flight management system for "flight path optimization";

2. "Development" "technology" for "aircraft" flight instrument systems integrated solely for VOR, DME, ILS or MLS navigation or approaches.

b.6. Full authority digital flight control or multisensor mission management systems employing "expert systems";

N.B.: For "technology" for Full Authority Digital Engine Control ("FADEC"), see 9E003.a.9.

c. "Technology" for the "development" of helicopter systems, as follows:

c.1. Multi-axis fly-by-wire or fly-by-light controllers that combine the functions of at

least two of the following into one controlling element:

c.1.a. Collective controls;

c.1.b. Cyclic controls;

c.1.c. Yaw controls;

c.2. "Circulation-controlled anti-torque or circulation-controlled directional control systems";

c.3. Rotor blades incorporating "variable geometry airfoils" for use in systems using individual blade control.

**7E101 "Technology", according to the General Technology Note for the "use" of equipment controlled by 7A001 to 7A006, 7A101 to 7A106, 7A115 to 7A117, 7B001, 7B002, 7B003, 7B101, 7B102, 7B103, or 7D101 to 7D103.**

LICENSE REQUIREMENTS

Reason for Control: MT, RS, AT

Control(s)	Country Chart
MT applies to entire entry .....	MT Column 1
RS applies to "use" of inertial navigation systems, inertial equipment and specially designed components therefor, for civil aircraft.	RS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: N/A

Related Controls: (1) The "technology" related to 7A003.b, 7A005, 7A103.b, 7A105, 7A106, 7A115, 7A116, 7A117, 7B103, software specified in the Related Controls paragraph of ECCN 7D101, 7D102.a, or 7D103 are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. (See 22 CFR part 121.) (2) "Technology" for inertial navigation systems and inertial equipment, and specially designed components therefor, not for use on civil aircraft are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. (See 22 CFR part 121.)

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

**7E102 "Technology" for protection of avionics and electrical subsystems against electromagnetic pulse (EMP) and electromagnetic interference (EMI) hazards, from external sources, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: MT, AT

*Control(s)*                      *Country Chart*

MT applies to entire entry ..... MT Column 1  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED  
*Unit:* N/A  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* a. Design “technology” for shielding systems;  
     b. Design “technology” for the configuration of hardened electrical circuits and sub-systems;  
     c. Design “technology” for the determination of hardening criteria of .a and .b of this entry.

**7E104 Design “Technology” for the integration of the flight control, guidance, and propulsion data into a flight management system, designed or modified for “missiles”, for optimization of rocket system trajectory. (This entry is subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)**

**7E994 “Technology”, n.e.s., for the “development”, “production”, or “use” of navigation, airborne communication, and other avionics equipment.**

LICENSE REQUIREMENTS  
*Reason for Control:* AT

*Control(s)*                      *Country Chart*

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: N/A

LIST OF ITEMS CONTROLLED  
*Unit:* N/A  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading

**EAR99 Items subject to the EAR that are not elsewhere specified in this CCL Category or in any other category in the CCL are designated by the number EAR99.**

*Category 8—Marine*

A. SYSTEMS, EQUIPMENT AND COMPONENTS

**8A001 Submersible vehicles and surface vessels, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

*Control(s)*                      *Country Chart*

NS applies to entire entry ..... NS Column 2  
 AT applies to entire entry ..... AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS  
 LVS: \$5000; N/A for 8A001.b and .d  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED  
*Unit:* Equipment in number; parts and accessories in \$ value  
*Related Controls:* For the control status of equipment for submersible vehicles, see: Category 5, Part 2 “Information Security” for encrypted communication equipment; Category 6 for sensors; Categories 7 and 8 for navigation equipment; Category 8A for underwater equipment.  
*Related Definitions:* N/A

*Items:* a. Manned, tethered submersible vehicles designed to operate at depths exceeding 1,000 m;  
     b. Manned, untethered submersible vehicles, having any of the following:  
         b.1. Designed to operate autonomously and having a lifting capacity of all the following:  
             b.1.a. 10% or more of their weight in air;  
             and  
             b.1.b. 15 kN or more;  
             b.2. Designed to operate at depths exceeding 1,000 m; *or*  
             b.3. Having all of the following:  
                 b.3.a. Designed to carry a crew of 4 or more;  
                 b.3.b. Designed to operate autonomously for 10 hours or more;  
                 b.3.c. Having a range of 25 nautical miles or more; *and*  
                 b.3.d. Having a length of 21 m or less;

TECHNICAL NOTES: 1. For the purposes of 8A001.b, “operate autonomously” means fully submerged, without snorkel, all systems working and cruising at minimum speed at which the submersible can safely control its depth dynamically by using its depth planes only, with no need for a support vessel or support base on the surface, sea-bed or shore, and containing a propulsion system for submerged or surface use.

2. For the purposes of 8A001.b, “range” means half the maximum distance a submersible vehicle can cover.

c. Unmanned, tethered submersible vehicles designed to operate at depths exceeding 1,000 m, having any of the following:  
     c.1. Designed for self-propelled manoeuvre using propulsion motors or thrusters controlled by 8A002.a.2; *or*  
     c.2. Having a fiber optic data link;  
     d. Unmanned, untethered submersible vehicles, having any of the following:

- d.1. Designed for deciding a course relative to any geographical reference without real-time human assistance;
- d.2. Having an acoustic data or command link; or
- d.3. Having a fiber optic data or command link exceeding 1,000 m;
- e. Ocean salvage systems with a lifting capacity exceeding 5 MN for salvaging objects from depths exceeding 250 m and having any of the following:
  - e.1. Dynamic positioning systems capable of position keeping within 20 m of a given point provided by the navigation system; or
  - e.2. Seafloor navigation and navigation integration systems for depths exceeding 1,000 m with positioning accuracies to within 10 m of a predetermined point;
- f. Surface-effect vehicles (fully skirted variety) having all of the following characteristics:
  - f.1. A maximum design speed, fully loaded, exceeding 30 knots in a significant wave height of 1.25 m (Sea State 3) or more;
  - f.2. A cushion pressure exceeding 3,830 Pa; and
  - f.3. A light-ship-to-full-load displacement ratio of less than 0.70;
- g. Surface-effect vehicles (rigid sidewalls) with a maximum design speed, fully loaded, exceeding 40 knots in a significant wave height of 3.25 m (Sea State 5) or more;
- h. Hydrofoil vessels with active systems for automatically controlling foil systems, with a maximum design speed, fully loaded, of 40 knots or more in a significant wave height of 3.25 m (Sea State 5) or more;
- i. Small waterplane area vessels having any of the following:
  - i.1. A full load displacement exceeding 500 tons with a maximum design speed, fully loaded, exceeding 35 knots in a significant wave height of 3.25 m (Sea State 5) or more; or
  - i.2. A full load displacement exceeding 1,500 tons with a maximum design speed, fully loaded, exceeding 25 knots in a significant wave height of 4 m (Sea State 6) or more.

TECHNICAL NOTE: A small waterplane area vessel is defined by the following formula: waterplane area at an operational design draught less than  $2 \times$  (displaced volume at the operational design draught)<sup>2/3</sup>.

**8A002 Systems and equipment, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

- LVS: \$5000; N/A for 8A002.o.3.b
- GBS: Yes for 8A002.e.2 and manipulators for civil end-uses (e.g., underwater oil, gas or mining operations) controlled by 8A002.i.2 and having 5 degrees of freedom of movement
- CIV: Yes for 8A002.e.2 and manipulators for civil end-uses (e.g., underwater oil, gas or mining operations) controlled by 8A002.i.2 and having 5 degrees of freedom of movement

LIST OF ITEMS CONTROLLED

Unit: Equipment in number  
 Related Controls: See also 8A992 and for underwater communications systems, see Category 5, Part I—Telecommunications). 8A002 does not control closed and semi-closed circuit (rebreathing) apparatus that is controlled under 8A018.a. See also 8A992 for self-contained underwater breathing apparatus that is not controlled by 8A002 or released for control by the 8A002.q Note.  
 Related Definitions: N/A  
 Items:

- a. Systems and equipment, specially designed or modified for submersible vehicles, designed to operate at depths exceeding 1,000 m, as follows:
  - a.1. Pressure housings or pressure hulls with a maximum inside chamber diameter exceeding 1.5 m;
  - a.2. Direct current propulsion motors or thrusters;
  - a.3. Umbilical cables, and connectors therefor, using optical fiber and having synthetic strength members;
- b. Systems specially designed or modified for the automated control of the motion of submersible vehicles controlled by 8A001 using navigation data and having closed loop servo-controls:
  - b.1. Enabling a vehicle to move within 10 m of a predetermined point in the water column;
  - b.2. Maintaining the position of the vehicle within 10 m of a predetermined point in the water column; or
  - b.3. Maintaining the position of the vehicle within 10 m while following a cable on or under the seabed;
- c. Fiber optic hull penetrators or connectors;
- d. Underwater vision systems, as follows:
  - d.1. Television systems and television cameras, as follows:
    - d.1.a. Television systems (comprising camera, monitoring and signal transmission equipment) having a limiting resolution when measured in air of more than 800 lines and specially designed or modified for remote operation with a submersible vehicle;
    - d.1.b. Underwater television cameras having a limiting resolution when measured in air of more than 1,100 lines;

d.1.c. Low light level television cameras specially designed or modified for underwater use containing all of the following:

d.1.c.1. Image intensifier tubes controlled by 6A002.a.2.a; *and*

d.1.c.2. More than 150,000 "active pixels" per solid state area array;

TECHNICAL NOTE: Limiting resolution in television is a measure of horizontal resolution usually expressed in terms of the maximum number of lines per picture height discriminated on a test chart, using IEEE Standard 208/1960 or any equivalent standard.

d.2. Systems, specially designed or modified for remote operation with an underwater vehicle, employing techniques to minimize the effects of back scatter, including range-gated illuminators or "laser" systems;

e. Photographic still cameras specially designed or modified for underwater use below 150 m having a film format of 35 mm or larger, and having any of the following:

e.1. Annotation of the film with data provided by a source external to the camera;

e.2. Automatic back focal distance correction; *or*

e.3. Automatic compensation control specially designed to permit an underwater camera housing to be usable at depths exceeding 1,000 m;

f. Electronic imaging systems, specially designed or modified for underwater use, capable of storing digitally more than 50 exposed images;

g. Light systems, as follows, specially designed or modified for underwater use:

g.1. Stroboscopic light systems capable of a light output energy of more than 300 J per flash and a flash rate of more than 5 flashes per second;

g.2. Argon arc light systems specially designed for use below 1,000 m;

h. "Robots" specially designed for underwater use, controlled by using a dedicated "stored program controlled" computer, having any of the following:

h.1. Systems that control the "robot" using information from sensors which measure force or torque applied to an external object, distance to an external object, or tactile sense between the "robot" and an external object; *or*

h.2. The ability to exert a force of 250 N or more or a torque of 250 Nm or more and using titanium based alloys or "fibrous or filamentary" "composite" materials in their structural members;

i. Remotely controlled articulated manipulators specially designed or modified for use with submersible vehicles, having any of the following:

i.1. Systems which control the manipulator using the information from sensors which measure the torque or force applied to an external object, or tactile sense between the manipulator and an external object; *or*

i.2. Controlled by proportional master-slave techniques or by using a dedicated "stored program controlled" computer, and having 5 degrees of freedom of movement or more;

NOTE: Only functions having proportional control using positional feedback or by using a dedicated "stored program controlled" computer are counted when determining the number of degrees of freedom of movement

j. Air independent power systems, specially designed for underwater use, as follows:

j.1. Brayton or Rankine cycle engine air independent power systems having any of the following:

j.1.a. Chemical scrubber or absorber systems specially designed to remove carbon dioxide, carbon monoxide and particulates from recirculated engine exhaust;

j.1.b. Systems specially designed to use a monoatomic gas;

j.1.c. Devices or enclosures specially designed for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; *or*

j.1.d. Systems specially designed:

j.1.d.1. To pressurize the products of reaction or for fuel reformation;

j.1.d.2. To store the products of the reaction; *and*

j.1.d.3. To discharge the products of the reaction against a pressure of 100 kPa or more;

j.2. Diesel cycle engine air independent systems, having all of the following:

j.2.a. Chemical scrubber or absorber systems specially designed to remove carbon dioxide, carbon monoxide and particulates from recirculated engine exhaust;

j.2.b. Systems specially designed to use a monoatomic gas;

j.2.c. Devices or enclosures specially designed for underwater noise reduction in frequencies below 10 kHz or special mounting devices for shock mitigation; *and*

j.2.d. Specially designed exhaust systems that do not exhaust continuously the products of combustion;

j.3. Fuel cell air independent power systems with an output exceeding 2 kW having any of the following:

j.3.a. Devices or enclosures specially designed for underwater noise reduction in frequencies below 10 kHz or special mounting devices for shock mitigation; *or*

j.3.b. Systems specially designed:

j.3.b.1. To pressurize the products of reaction or for fuel reformation;

j.3.b.2. To store the products of the reaction; *and*

j.3.b.3. To discharge the products of the reaction against a pressure of 100 kPa or more;

j.4. Stirling cycle engine air independent power systems, having all of the following:

j.4.a. Devices or enclosures specially designed for underwater noise reduction in frequencies below 10 kHz or special mounting devices for shock mitigation; *and*

j.4.b. Specially designed exhaust systems which discharge the products of combustion against a pressure of 100 kPa or more;

k. Skirts, seals and fingers, having any of the following:

k.1. Designed for cushion pressures of 3,830 Pa or more, operating in a significant wave height of 1.25 m (Sea State 3) or more and specially designed for surface effect vehicles (fully skirted variety) controlled by 8A001.f; *or*

k.2. Designed for cushion pressures of 6,224 Pa or more, operating in a significant wave height of 3.25 m (Sea State 5) or more and specially designed for surface effect vehicles (rigid sidewalls) controlled by 8A001.g;

l. Lift fans rated at more than 400 kW specially designed for surface effect vehicles controlled by 8A001.f or 8A001.g;

m. Fully submerged subcavitating or supercavitating hydrofoils specially designed for vessels controlled by 8A001.h;

n. Active systems specially designed or modified to control automatically the sea-induced motion of vehicles or vessels controlled by 8A001.f, 8A001.g, 8A001.h or 8A001.i;

o. Propellers, power transmission systems, power generation systems and noise reduction systems, as follows:

o.1. Water-screw propeller or power transmission systems, as follows, specially designed for surface effect vehicles (fully skirted or rigid sidewall variety), hydrofoils or small waterplane area vessels controlled by 8A001.f, 8A001.g, 8A001.h or 8A001.i:

o.1.a. Supercavitating, super-ventilated, partially-submerged or surface piercing propellers rated at more than 7.5 MW;

o.1.b. Contrarotating propeller systems rated at more than 15 MW;

o.1.c. Systems employing pre-swirl or post-swirl techniques for smoothing the flow into a propeller;

o.1.d. Light-weight, high capacity (K factor exceeding 300) reduction gearing;

o.1.e. Power transmission shaft systems, incorporating "composite" material components, capable of transmitting more than 1 MW;

o.2. Water-screw propeller, power generation systems or transmission systems designed for use on vessels, as follows:

o.2.a. Controllable-pitch propellers and hub assemblies rated at more than 30 MW;

o.2.b. Internally liquid-cooled electric propulsion engines with a power output exceeding 2.5 MW;

o.2.c. "Superconductive" propulsion engines, or permanent magnet electric propulsion engines, with a power output exceeding 0.1 MW;

o.2.d. Power transmission shaft systems, incorporating "composite" material components, capable of transmitting more than 2 MW;

o.2.e. Ventilated or base-ventilated propeller systems rated at more than 2.5 MW;

o.3. Noise reduction systems designed for use on vessels of 1,000 tons displacement or more, as follows:

o.3.a. Systems that attenuate underwater noise at frequencies below 500 Hz and consist of compound acoustic mounts for the acoustic isolation of diesel engines, diesel generator sets, gas turbines, gas turbine generator sets, propulsion motors or propulsion reduction gears, specially designed for sound or vibration isolation, having an intermediate mass exceeding 30% of the equipment to be mounted;

o.3.b. Active noise reduction or cancellation systems, or magnetic bearings, specially designed for power transmission systems, and incorporating electronic control systems capable of actively reducing equipment vibration by the generation of anti-noise or anti-vibration signals directly to the source;

p. Pumpjet propulsion systems having a power output exceeding 2.5 MW using divergent nozzle and flow conditioning vane techniques to improve propulsive efficiency or reduce propulsion-generated underwater-radiated noise.

q. Self-contained, closed or semi-closed circuit (rebreathing) diving and underwater swimming apparatus.

NOTE: 8A002.q does not control an individual apparatus for personal use when accompanying its user.

**8A018 Items on the International Munitions List.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT, UN.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
AT applies to entire entry .....	AT Column 1.
UN applies to entire entry .....	Rwanda.

LICENSE EXCEPTIONS

LVS: \$5000, except N/A for Rwanda

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See also 8A002 and 8A992.

*Related Definitions:* N/A

*Items:*

a. Closed and semi-closed circuit (rebreathing) apparatus specially designed for military use, and specially designed components for use in the conversion of open-circuit apparatus to military use;

b. Naval equipment, as follows:

b.1. Diesel engines of 1,500 hp and over with rotary speed of 700 rpm or over specially designed for submarines;

b.2. Electric motors specially designed for submarines, *i.e.*, over 1,000 hp, quick reversing type, liquid cooled, and totally enclosed;

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b.3. Nonmagnetic diesel engines, 50 hp and over, specially designed for military purposes. (An engine shall be presumed to be specially designed for military purposes if it has nonmagnetic parts other than crankcase, block, head, pistons, covers, end plates, valve facings, gaskets, and fuel, lubrication and other supply lines, or its nonmagnetic content exceeds 75 percent of total weight.);

b.4. Marine boilers designed to have any of the following characteristics:

b.4.a. Heat release rate (at maximum rating) equal to or in excess of 190,000 BTU per hour per cubic foot of furnace volume; *or*

b.4.b. Ratio of steam generated in pounds per hour (at maximum rating) to the dry weight of the boiler in pounds equal to or in excess of 0.83;

b.5. Submarine and torpedo nets; *and*  
 b.6. Components, parts, accessories, and attachments for the above.

**8A992 Underwater systems or equipment, not controlled by 8A002 or 8A018, and specially designed parts therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
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AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* See also 8A002 and 8A018

*Related Definitions:* N/A

*Items:* a. Underwater vision systems, as follows:

a.1. Television systems (comprising camera, lights, monitoring and signal transmission equipment) having a limiting resolution when measured in air of more than 500 lines and specially designed or modified for remote operation with a submersible vehicle;  
*or*

a.2. Underwater television cameras having a limiting resolution when measured in air of more than 700 lines;

TECHNICAL NOTE: Limiting resolution in television is a measure of horizontal resolution usually expressed in terms of the maximum number of lines per picture height discriminated on a test chart, using IEEE Standard 208/1960 or any equivalent standard.

b. Photographic still cameras specially designed or modified for underwater use, having a film formate of 35 mm or larger, and having autofocussing or remote focussing specially designed for underwater use;

c. Stroboscopic light systems, specially designed or modified for underwater use, capa-

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ble of a light output energy of more than 300 J per flash;

d. Other underwater camera equipment, n.e.s.;

e. Other submersible systems, n.e.s.;

f. Boats, n.e.s., including inflatable boats, and specially designed components therefor, n.e.s.;

g. Marine engines (both inboard and outboard) and submarine engines, n.e.s.; and specially designed parts therefor, n.e.s.;

h. Other self-contained underwater breathing apparatus (scuba gear) and related equipment, n.e.s.;

i. Life jackets, inflation cartridges, compasses, wetsuits, masks, fins, weight belts, and dive computers;

j. Underwater lights and propulsion equipment;

k. Air compressors and filtration systems specially designed for filling air cylinders.

**B. TEST, INSPECTION AND PRODUCTION EQUIPMENT**

**8B001 Water tunnels, having a background noise of less than 100 dB (reference 1 µPa, 1 Hz) in the frequency range from 0 to 500 Hz, designed for measuring acoustic fields generated by a hydro-flow around propulsion system models.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NS applies to entire entry ..... NS Column 2  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: \$3000  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**C. MATERIALS**

**8C001 Syntactic foam designed for underwater use, having all of the following (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
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NS applies to entire entry ..... NS Column 2  
 AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A

CIV: N/A
LIST OF ITEMS CONTROLLED
Unit: \$ value
Related Controls: N/A
Related Definition: Syntactic foam consists of hollow spheres of plastic or glass embedded in a resin matrix
Items: a. Designed for marine depths exceeding 1,000 m; and
b. A density less than 561 kg/m³.

D. SOFTWARE

8D001 "Software" specially designed or modified for the "development", "production" or "use" of equipment or materials controlled by 8A (except 8A018 or 8A992), 8B or 8C.

LICENSE REQUIREMENTS

Reason for Control: NS, AT

Control(s) Country Chart

NS applies to entire entry ..... NS Column 1
AT applies to entire entry ..... AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes, except for the following:

- (1) Items controlled for MT reasons; or
(2) Exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "software" specially designed for the "development" or "production" of equipment controlled by 8A001.b, 8A001.d, or 8A002.o.3.b.

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

8D002 Specific "software" specially designed or modified for the "development", "production", repair, overhaul or refurbishing (re-machining) of propellers specially designed for underwater noise reduction.

LICENSE REQUIREMENTS

Reason for Control: NS, AT

Control(s) Country Chart

NS applies to entire entry ..... NS Column 1
AT applies to entire entry ..... AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: See also 8D992

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

8D992 "Software" specially designed or modified for the "development", "production" or "use" of equipment controlled by 8A992.

LICENSE REQUIREMENTS

Reason for Control: AT

Control(s) Country Chart

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

E. TECHNOLOGY

8E001 "Technology" according to the General Technology Note for the "development" or "production" of equipment or materials controlled by 8A (except 8A018 or 8A992), 8B or 8C.

LICENSE REQUIREMENTS

Reason for Control: NS, AT

Control(s) Country Chart

NS applies to entire entry ..... NS Column 1

AT applies to entire entry ..... AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes, except for the following:

- (1) Items controlled for MT reasons; or
(2) Exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "technology" for items controlled by 8A001.b, 8A001.d or 8A002.o.3.b.

LIST OF ITEMS CONTROLLED

Unit: N/A

Related Controls: N/A

Related Definitions: N/A

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*Items:* The list of items controlled is contained in the ECCN heading

**8E002 Other “technology”, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* See also 8E992

*Related Definitions:* N/A

*Items:* a. “Technology” for the “development”, “production”, repair, overhaul or refurbishing (re-machining) of propellers specially designed for underwater noise reduction;

b. “Technology” for the overhaul or refurbishing of equipment controlled by 8A001, 8A002.b, 8A002.j, 8A002.o or 8A002.p.

**8E992 “Technology” for the “development”, “production” or “use” of equipment controlled by 8A992.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* N/A

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**EAR99 Items subject to the EAR that are not elsewhere specified in this CCL Category or in any other category in the CCL are designated by the number EAR99.**

*Category 9—Propulsion Systems, Space Vehicles and Related Equipment*

A. SYSTEMS, EQUIPMENT AND COMPONENTS

N.B.: For propulsion systems designed or rated against neutron or transient ionizing, see the U.S. Munitions List, 22 CFR part 121.

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**9A001 Aero gas turbine engines incorporating any of the “technologies” controlled by 9E003.a, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to only to those engines that meet the characteristics listed in 9A101.	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value

*Related Controls:* See also 9A101 and 9A991

*Related Definitions:* N/A

*Items:* a. Not certified for the specific “civil aircraft” for which they are intended;

NOTE: For the purpose of the “civil aircraft” certification process, a number of up to 16 civil certified engines, assemblies, or components including spares is considered appropriate.

b. Not certified for civil use by the aviation authorities in Country Group A:1;

c. Designed to cruise at speeds exceeding Mach 1.2 for more than thirty minutes.

**9A002 Marine gas turbine engines with an ISO standard continuous power rating of 24,245 kW or more and a specific fuel consumption not exceeding 0.219 kg/kWh in the power range from 35 to 100%, and specially designed assemblies and components therefor.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$5000

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Number

*Related Controls:* N/A

*Related Definition:* The term “marine gas turbine engines” includes those industrial, or aero-derivative, gas turbine engines adapted for a ship’s electric power generation or propulsion

*Items:* The list of items controlled is contained in the ECCN heading

**9A003 Specially designed assemblies and components, incorporating any of the “technologies” controlled by 9E003.a, for gas turbine engine propulsion systems, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$5000  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Number  
*Related Controls:* N/A  
*Related Definition:* N/A  
*Items:* a. Controlled by 9A001;

b. Whose design or production origins are either countries in Country Group D:1 or unknown to the manufacturer.

**9A004 Space launch vehicles and “spacecraft”.**

LICENSE REQUIREMENTS

*Reason for Control:* NS and AT

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number. Components, parts and accessories in \$ value. Related Controls: (1.) See also 9A104. (2.) Space launch vehicles are under the jurisdiction of the Department of State. (3.) Effective March 15, 1999, all satellites, including commercial communications satellites, are subject to the ITAR. Effective March 15, 1999, all license applications for the export of commercial communications satellites will be processed by the State Department, Office of Defense Trade Controls. Retransfer of jurisdiction for commercial communications satellites and related items shall not affect the validity of any export license issued by the Department of Commerce prior to March 15, 1999, or of any export license application filed under the Export Administration Regulations on or before March 14, 1999, and subsequently issued by the Department of Commerce. Commercial communications satellites licensed by the Department of Commerce, including those already exported, remain subject to the EAR and all terms and conditions of issued export licenses until their stated expiration date. All licenses

issued by the Department of Commerce for commercial communications satellites, including licenses issued after March 15, 1999, remain subject to SI controls throughout the validity of the license. Effective March 15, 1999, Department of State jurisdiction shall apply to any instance where a replacement license would normally be required from the Department of Commerce. Transferring registration or operational control to any foreign person of any item controlled by this entry must be authorized on a license issued by the Department of State, Office of Defense Trade Controls. This requirement applies whether the item is physically located in the United States or abroad. (4.) All other “spacecraft” not controlled under 9A004 and their payloads, and specifically designed or modified components, parts, accessories, attachments, and associated equipment, including ground support equipment, are subject to the export licensing authority of the Department of State unless otherwise transferred to the Department of Commerce via a commodity jurisdiction determination by the Department of State. (5.) Exporters requesting a license from the Department of Commerce for “spacecraft” and their associated parts and components, other than the international space station, must provide a statement from the Department of State, Office of Defense Trade Controls, verifying that the item intended for export is under the licensing jurisdiction of the Department of Commerce. All specially designed or modified components, parts, accessories, attachments, and associated equipment for “spacecraft” that have been determined by the Department of State through the commodity jurisdiction process to be under the licensing jurisdiction of the Department of Commerce and that are not controlled by any other ECCN on the Commerce Control List will be assigned a classification under this ECCN 9A004. (6.) Technical data required for the detailed design, development, manufacturing, or production of the international space station (to include specifically designed parts and components) remains under the jurisdiction of the Department of State. This control by the ITAR of detailed design, development, manufacturing or production technology for NASA’s international space station does not include that level of technical data necessary and reasonable for assurance that a U.S.-built item intended to operate on NASA’s international space station has been designed, manufactured, and tested in conformance with specified requirements (e.g., operational performance, reliability, lifetime, product quality, or delivery expectations). All technical data and all defense services, including all technical assistance, for launch of the international space station, including launch vehicle compatibility, integration, or processing data, are controlled

and subject to the jurisdiction of the Department of State, in accordance with 22 CFR parts 120 through 130.

*Items:* a. The international space station being developed, launched and operated under the supervision of the U.S. National Aeronautics and Space Administration. Hardware specific to the international space station transferred to the Department of Commerce by commodity jurisdiction action is also included.

b. Specific items as may be determined to be not subject to the ITAR through the commodity jurisdiction procedure administered by the Department of State after March 15, 1999.

**9A005 Liquid rocket propulsion systems containing any of the systems or components controlled by 9A006. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9A006 Systems and components specially designed for liquid rocket propulsion systems. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9A007 Solid rocket propulsion systems. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9A008 Components specially designed for solid rocket propulsion systems. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9A009 Hybrid rocket propulsion systems. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9A010 Specially designed components, systems and structures for launch vehicles, launch vehicle propulsion systems or "spacecraft". (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9A011 Ramjet, scramjet or combined cycle engines and specially designed components therefor. (These items are subject to the export licensing authority of the U.S. Department of State, Office of De-**

**fense Trade Controls. See 22 CFR part 121.)**

**9A012 Non-military unmanned aerial vehicles, having any of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS  
*Reason for Control:* NS, MT, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 1
MT applies to non-military unmanned air vehicle systems (UAVs) and remotely piloted vehicles (RPVs) that are capable of a maximum range of at least 300 kilometers (km), regardless of payload.	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value

*Related Controls:* See the U.S. Munitions List Category VIII (22 CFR part 121).

*Related Definitions:* N/A

*Items:*

a. An autonomous flight control and navigation capability (*e.g.*, an autopilot with an Inertial Navigation System); *or*

b. Capability of controlled-flight out of the direct vision range involving a human operator (*e.g.*, televisual remote control).

NOTE: 9A012 does not control model aircraft.

**9A018 Equipment on the International Munitions List.**

LICENSE REQUIREMENTS  
*Reason for Control:* NS, RS, AT, UN.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
RS applies to 9A018.a and b .....	RS Column 2.
AT applies to entire entry .....	AT Column 1.
UN applies to entire entry .....	Rwanda.

LICENSE EXCEPTIONS

LVS: \$1500, except N/A for Rwanda  
GBS: N/A  
CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value

*Related Controls:* (a) Parachute systems designed for use in dropping military equipment, braking military aircraft, slowing spacecraft descent, or retarding weapons delivery; AND (b) Instrument flight trainers for combat simulation are subject to the export licensing authority of the U.S.

Department of State, Office of Defense Trade Controls. (See 22 CFR part 121, Category VIII.)

*Related Definition:* This entry controls parachute systems designed for use in dropping personnel only.

*Items:* a. Military trainer aircraft bearing "T" designations:

- a.1. Using reciprocating engines; or
- a.2. Turbo prop engines with less than 600 horse power (h.p.);
- a.3. T-37 model jet trainer aircraft; and
- a.4. Specially designed component parts.
- b. Vehicles specially designed or modified for military purposes. (See §770, Interpretation 8)
- c. Pressure refuelers, pressure refueling equipment, and equipment specially designed to facilitate operations in confined areas; and ground equipment, n.e.s., developed specially for military aircraft and helicopters, and specially designed parts and accessories, n.e.s.;
- d. Pressurized breathing equipment specially designed for use in military aircraft and helicopters;
- e. Military parachutes and complete canopies, harnesses, and platforms and electronic release mechanisms therefor, except such types as are in normal sporting use;
- f. Military instrument flight trainers, except for combat simulation; and components, parts, attachments and accessories specially designed for such equipment.

**9A101 Lightweight turbojet and turbopfan engines (including turbocompound engines) usable in "missiles", other than those controlled by 9A001, as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment in number; parts and accessories in \$ value

*Related Controls:* 9A101.b controls only engines for non-military unmanned air vehicles [UAVs] or remotely piloted vehicles [RPVs], and does not control other engines designed or modified for use in "missiles", which are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (see 22 CFR part 121).

*Related Definitions:* N/A

*Items:*

a. Engines having both of the following characteristics:

- a.1. Maximum thrust value greater than 400 N (achieved un-installed) excluding civil certified engines with a maximum thrust value greater than 8,890 N (achieved un-installed), *and*
- a.2. Specific fuel consumption of 0.15 kg/N/hr or less (at maximum continuous power at sea level static and standard conditions); *or*
- b. Engines designed or modified for use in "missiles", regardless of thrust or specific fuel consumption.

**9A104 Sounding rockets, capable of a range of at least 300 km. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9A105 Liquid propellant rocket engines. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9A106 Systems or components, other than those controlled by 9A006, usable in "missiles", as follows (see List of Items Controlled), and specially designed for liquid rocket propulsion systems.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Equipment and components in number; parts and accessories in \$ value

*Related Controls:* Items described in 9A106.a, .b, and .c are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (See 22 CFR part 121)

*Related Definitions:* N/A

*Items:* a. Ablative liners for thrust or combustion chambers;

- b. Rocket nozzles;
  - c. Thrust vector control sub-systems;
- Technical Note:* Examples of methods of achieving thrust vector control controlled by 9A106.c includes:
1. Flexible nozzle;
  2. Fluid or secondary gas injection;
  3. Movable engine or nozzle;
  4. Deflection of exhaust gas steam (jet vanes or probes); or
  5. Thrust tabs.

d. Liquid and slurry propellant (including oxidizers) control systems, and specially designed components therefor, designed or modified to operate in vibration environments of more than 10 g rms between 20 Hz and 2000 Hz.

NOTE: The only servo valves and pumps controlled by 9A106.d, are the following:

a. Servo valves designed for flow rates of 24 liters per minute or greater, at an absolute pressure of 7 Mpa or greater, that have an actuator response time of less than 100 ms;

b. Pumps, for liquid propellants, with shaft speeds equal to or greater than 8,000 rpm or with discharge pressures equal to or greater than 7 Mpa.

e. Flight control servo valves designed or modified for use in "missiles" and designed or modified to operate in a vibration environment of more than 10g RMS over the entire range between 20Hz and 2KHz.

**9A107 Solid propellant rocket engines, usable in rockets with a range capability of 300 Km or greater, other than those controlled by 9A007, having total impulse capacity of 0.841 Mns or greater. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9A108 Solid rocket propulsion components, other than those controlled by 9A008, usable in rockets with a range capability of 300 Km or greater. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9A109 Hybrid rocket motors, usable in rockets with a range capability of 300 Km or greater, other than those controlled by 9A009, and specially designed components therefor. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9A110 Composite structures, laminates and manufactures thereof, other than those controlled by entry 9A010, specially designed for use in "missiles" or the subsystems controlled by entries 9A005, 9A007, 9A105.a, 9A106 to 9A108, 9A116, or 9A119.**

LICENSE REQUIREMENTS

Reason for Control: MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Kilograms

*Related Controls:* (1) See also 1A002. (2) "Composite structures, laminates, and manufactures thereof, specially designed for use in missile systems are under the licensing authority of the Directorate of Defense Trade Controls, U.S. Department of State, except those specially designed for non-military unmanned air vehicles controlled in 9A012.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**9A111 Pulse jet engines, usable in "missiles", and specially designed components therefor. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9A115 Apparatus, devices and vehicles, designed or modified for the transport, handling, control, activation and launching of "missiles". (These items are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)**

**9A116 Reentry vehicles, usable in "missiles", and equipment designed or modified therefor. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9A117 Staging mechanisms, separation mechanisms, and interstages therefor, usable in "missiles". (These items are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)**

**9A118 Devices to regulate combustion usable in engines which are usable in rockets with a range capability greater than 300 Km or greater, controlled by 9A011 or 9A111. (These items are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9A119 Individual rocket stages, usable in rockets with a range capability greater than 300 Km or greater, other than those controlled by 9A005, 9A007, 9A009, 9A105, 9A107 and 9A109. (These items are subject to the export licensing authority of**

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the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)

**9A980 Nonmilitary mobile crime science laboratories; and parts and accessories, n.e.s.**

LICENSE REQUIREMENTS

Reason for Control: CC

<i>Control(s)</i>	<i>Country Chart</i>
CC applies to entire entry .....	CC Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

**9A990 Diesel engines, n.e.s., and tractors and specially designed parts therefor, n.e.s.**

LICENSE REQUIREMENTS

Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry except 9A990.a	AT Column 1
AT applies to 9A990.a only .....	AT Column 2

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: N/A

Related Definitions: N/A

Items: a. Diesel engines, n.e.s., for trucks, tractors, and automotive applications of continuous brake horsepower of 400 BHP (298 kW) or greater (performance based on SAE J1349 standard conditions of 100 Kpa and 25°)

b. Off highway wheel tractors of carriage capacity 9 mt (20,000 lbs) or more; and parts and accessories, n.e.s.

c. On-Highway tractors, with single or tandem rear axles rated for 9 mt per axel (20,000 lbs.) or greater and specially designed parts.

**9A991 "Aircraft", n.e.s., and gas turbine engines not controlled by 9A001 or 9A101 and parts and components, n.e.s.**

LICENSE REQUIREMENTS

Reason for Control: AT, UN.

<i>Control(s)</i>	<i>Country chart</i>
AT applies to entire entry .....	AT Column 1.

<i>Control(s)</i>	<i>Country chart</i>
UN applies to 9A991.a .....	Rwanda.

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Number

Related Controls: N/A

Related Definitions: N/A

Items: a. Military aircraft, demilitarized (not specifically equipped or modified for military operation), as follows:

a.1. Cargo, "C-45 through C-118" inclusive, and "C-121,"

a.2. Trainers, bearing a "T" designation and using piston engines,

a.3. Utility, bearing a "U" designation and using piston engines,

a.4. Liaison, bearing an "L" designation, and

a.5. Observation, bearing an "O" designation and using piston engines;

b. Civil aircraft; and

NOTE: Specify make and model of aircraft and type of avionics equipment on aircraft.

c. Aero gas turbine engines, and specially designed parts therefor.

NOTE: 9A991.c does not control aero gas turbine engines that are destined for use in civil "aircraft" and that have been in use in bona fide civil "aircraft" for more than eight years.

d. Aircraft parts and components, n.e.s.

e. Pressurized aircraft breathing equipment, n.e.s.; and specially designed parts therefor, n.e.s.

**9A992 Complete canopies, harnesses, and platforms and electronic release mechanisms therefor, except such types as are in normal sporting use.**

LICENSE REQUIREMENTS

Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Number

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

B. TEST, INSPECTION AND PRODUCTION EQUIPMENT

**9B001 Specially Designed Equipment, Tooling and Fixtures, As Follows (See List of Items Controlled), for Manufacturing Gas Turbine Blades, Vanes or Tip Shroud Castings**

LICENSE REQUIREMENTS  
Reason for Control: NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies only to equipment for engines that meet the characteristics described in 9A001.	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

LVS: \$5000, except N/A for MT  
GBS: Yes, except N/A for MT  
CIV: Yes, except N/A for MT

LIST OF ITEMS CONTROLLED

Unit: \$ value.

*Related Controls:* For specially designed production equipment of systems, sub-systems and components controlled by 9A005 to 9A009, 9A011, 9A101, 9A105 to 9A109, 9A111, and 9A116 to 9A119 usable in "missiles" see 9B115. See also 9B991.

*Related Definitions:* N/A.

*Items:*

- a. Directional solidification or single crystal casting equipment;
- b. Ceramic cores or shells.

**9B002 On-line (real time) control systems, instrumentation (including sensors) or automated data acquisition and processing equipment, specially designed for the "development" of gas turbine engines, assemblies or components incorporating "technologies" controlled by 9E003.a.**

LICENSE REQUIREMENTS  
Reason for Control: NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies only to equipment for engines that meet the characteristics described in 9A001.	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$3000, except N/A for MT  
GBS: Yes, except N/A for MT  
CIV: Yes, except N/A for MT

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**9B003 Equipment specially designed for the "production" or test of gas turbine brush seals designed to operate at tip speeds exceeding 335 m/s, and temperatures in excess of 773 K (500°C), and specially designed components or accessories therefor.**

LICENSE REQUIREMENTS  
Reason for Control: NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies only to equipment for engines that meet the characteristics described in 9A001.	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$5000, except N/A for MT  
GBS: Yes, except N/A for MT  
CIV: Yes, except N/A for MT

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* See also 9B115

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**9B004 Tools, dies or fixtures for the solid state joining of "superalloy", titanium or intermetallic airfoil-to-disk combinations described in 9E003.a.3 or 9E003.a.6 for gas turbines.**

LICENSE REQUIREMENTS  
Reason for Control: NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies only to equipment for engines that meet the characteristics described in 9A001.	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$3000, except N/A for MT  
GBS: Yes, except N/A for MT  
CIV: Yes, except N/A for MT

LIST OF ITEMS CONTROLLED

Unit: Number

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**9B005 On-line (real time) control systems, instrumentation (including sensors) or automated data acquisition and processing equipment, specially designed for**

use with any of the following wind tunnels or devices (see List of Items Controlled).

LICENSE REQUIREMENTS

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value  
 Related Controls: See also 9B105  
 Related Definitions: N/A

Items: a. Wind tunnels designed for speeds of Mach 1.2 or more, except those specially designed for educational purposes and having a test section size (measured laterally) of less than 250 mm;

TECHNICAL NOTE: Test section size in 9B005.a means the diameter of the circle, or the side of the square, or the longest side of the rectangle, at the largest test section location.

b. Devices for simulating flow-environments at speeds exceeding Mach 5, including hot-shot tunnels, plasma arc tunnels, shock tubes, shock tunnels, gas tunnels and light gas guns; or

c. Wind tunnels or devices, other than two-dimensional sections, capable of simulating Reynolds number flows exceeding  $25 \times 10^6$ .

**9B006 Acoustic vibration test equipment capable of producing sound pressure levels of 160 Db or more (referenced to 20 uPa) with a rated output of 4 kW or more at a test cell temperature exceeding 1,273 K (1,000 °C), and specially designed quartz heaters therefor.**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$3000  
 GBS: Yes  
 CIV: Yes

LIST OF ITEMS CONTROLLED

Unit: Number  
 Related Controls: See also 9B106. Note that some items in 9B006 may also be controlled under 9B106  
 Related Definitions: N/A  
 Items: The list of items controlled is contained in the ECCN heading

**9B007 Equipment specially designed for inspecting the integrity of rocket motors using non-destructive test (NDT) techniques other than planar X-ray or basic physical or chemical analysis.**

LICENSE REQUIREMENTS

Reason for Control: NS, MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 1
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GSB N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Number  
 Related Controls: N/A  
 Related Definitions: N/A  
 Items: The list of items controlled is contained in the ECCN heading

**9B008 Transducers specially designed for the direct measurement of the wall skin friction of the test flow with a stagnation temperature exceeding 833 K (560 °C).**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$5000  
 GSB N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Number  
 Related Controls: N/A  
 Related Definitions: N/A  
 Items: The list of items controlled is contained in the ECCN heading

**9B009 Tooling specially designed for producing turbine engine powder metallurgy rotor components capable of operating at stress levels of 60% of ultimate tensile strength (UTS) or more and metal temperatures of 873 K (600 °C) or more.**

LICENSE REQUIREMENTS

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry .....	NS Column 2
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: \$5000  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

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Unit: Equipment in number; parts and accessories in \$ value

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

9B105 Wind tunnels for speeds of Mach 0.9 or more, usable for "missiles" and their subsystems.

LICENSE REQUIREMENTS

Reason for Control: MT, AT

Control(s) Country Chart

MT applies to entire entry ..... MT Column 1
AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: See also 9B005

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

9B106 Environmental chambers and anechoic chambers, as follows (see List of Items Controlled).

LICENSE REQUIREMENTS

Reason for Control: MT, AT

Control(s) Country Chart

MT applies to entire entry ..... MT Column 1
AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: N/A

Related Definitions: N/A

Items:

a. Environmental chambers capable of simulating all of the following flight conditions:

a.1. Vibration environments of 10 g RMS or greater between 20 Hz and 2,000 Hz imparting forces of 5 kN or greater; and

a.2. Any of the following:

a.2.a. Altitude of 15,000 m or greater; or

a.2.b. Temperature range of at least 223 K (-50C) to 398 K (+125C);

b. Anechoic chambers capable of simulating all of the following flight conditions:

b.1. Acoustic environments at an overall sound pressure level of 140 dB or greater (referenced to 2 x 10^-5 N/m^2) or with a rated power output of 4kW or greater; and

b.2. any of the following:

b.2.a. Altitude of 15,000 m or greater; or

b.2.b. Temperature range of at least 223K (-50°C) to 398 K (+125°C).

9B115 Specially designed "production equipment" for the systems, sub-systems and components controlled by 9A004 to 9A009, 9A011, 9A101, 9A104 to 9A109, 9A111, 9A116 to 9A119.

LICENSE REQUIREMENTS

Reason for Control: MT, AT

Control(s) Country chart

MT applies to entire entry ..... MT Column 1
AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number; components in \$ value

Related Controls: Although items described in ECCNs 9A004 to 9A009, 9A011, 9A101, 9A104 to 9A109; 9A111, 9A116 to 9A119 are subject to the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121), the "production equipment" controlled in this entry that is related to these items is subject to the export licensing authority of BIS.

Related Definitions: NA.

Items: The list of items controlled is contained in the ECCN heading.

9B116 Specially designed "production facilities" for the systems, sub-systems, and components controlled by 9A004 to 9A009, 9A011, 9A012, 9A101, 9A104 to 9A109, 9A111, 9A116 to 9A119.

LICENSE REQUIREMENTS

Reason for Control: MT, AT

Control(s) Country chart

MT applies to entire entry ..... MT Column 1
AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS

LVS: N/A

GBS: N/A

CIV: N/A

LIST OF ITEMS CONTROLLED

Unit: Equipment in number; components in \$ value

Related Controls: Although items described in ECCNs 9A004 to 9A009, 9A011, 9A101, 9A104 to 9A109; 9A111, 9A116 to 9A119 are subject to the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121), the "production equipment" controlled in this entry that is related to these items is subject to the export licensing authority of BIS.

Related Definitions: NA.

Items: The list of items controlled is contained in the ECCN heading.

**9B117 Test benches and test stands for solid or liquid propellant rockets or rocket motors, having either of the following characteristics (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* See also 9B990  
*Related Definitions:* N/A  
*Items:* a. The capacity to handle more than 90 Kn of thrust; or  
 b. Capable of simultaneously measuring the three axial thrust components.

**9B990 Vibration test equipment and specially designed parts and components, n.e.s.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading

**9B991 Specially designed equipment, tooling or fixtures, not controlled by 9B001, as described in the List of Items Controlled, for manufacturing or measuring gas turbine blades, vanes or tip shroud castings.**

LICENSE REQUIREMENTS

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value.  
*Related Controls:* N/A.  
*Related Definitions:* N/A.

*Items:*

- a. Automated equipment using non-mechanical methods for measuring airfoil wall thickness;
- b. Tooling, fixtures or measuring equipment for the "laser", water jet or ECM/EDM hole drilling processes controlled by 9E003.c;
- c. Ceramic core leaching equipment;
- d. Ceramic core manufacturing equipment or tools;
- e. Ceramic shell wax pattern preparation equipment;
- f. Ceramic shell burn out or firing equipment.

C. MATERIALS

**9C110 Resin impregnated fiber prepregs and metal coated fiber preforms therefor, for composite structures, laminates and manufactures specified in 9A110, made either with organic matrix or metal matrix utilizing fibrous or filamentary reinforcements having a specific tensile strength greater than  $7.62 \times 10^4$  m and a specific modulus greater than  $3.18 \times 10^6$  m.**

LICENSE REQUIREMENTS

*Reason for Control:* MT, AT

<i>Control(s)</i>	<i>Country chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

LVS: N/A  
 GBS: N/A  
 CIV: N/A

LIST OF ITEMS CONTROLLED

*Unit:* Kilograms  
*Related Controls:* (1) See also 1C010 and 1C210.c.  
 (2) The only resin impregnated fiber prepregs controlled by entry 9C110 are those using resins with a glass transition temperature ( $T_g$ ), after cure, exceeding 418 K (145 °C) as determined by ASTM D4065 or national equivalents.

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading.

D. SOFTWARE

**9D001 "Software" specially designed or modified for the "development" of equipment or "technology" controlled by 9A (except 9A018, 9A990 or 9A991), 9B (except 9B990 or 9B991) or 9E003.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country chart</i>
NS applies to "software" for items controlled by 9A001 to 9A003, 9A012, 9B001 to 9B009, and 9E003.	NS Column 1

Control(s)	Country chart
MT applies to "software" for equipment controlled by 9A106.a and .b, or 9B116 for MT reasons.	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) "Software" "required" for the "development" of items controlled by 9A004 is subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. (See 22 CFR part 121.)

(2) "Software" "required" for the "development" of equipment or "technology" subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls is also subject to the same licensing jurisdiction. (See 22 CFR part 121.)

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**9D002 "Software" specially designed or modified for the "production" of equipment controlled by 9A (except 9A018, 9A990, or 9A991) or 9B (except 9B990 or 9B991).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

Control(s)	Country chart
NS applies to "software" for equipment controlled by 9A001 to 9A003, 9A012, 9B001 to 9B009, or 9E003.	NS Column 1
MT applies to "software" for equipment controlled by 9B116 for MT reasons.	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) "Software" "required" for the "production" of items controlled by 9A004 is subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (See 22 CFR part 121.) (2) "Software" "required" for the "production" of equipment or "technology" subject to the export licens-

ing authority of the U.S. Department of State, Office of Defense Trade Controls is also subject to the same licensing jurisdiction. (See 22 CFR part 121.)

*Related Definitions:* N/A

*Items:* The list of items controlled is contained in the ECCN heading

**9D003 "Software" specially designed or modified for the "use" of full authority digital electronic engine controls (FADEC) for propulsion systems controlled by 9A (except 9A018, 9A990 or 9A991) or equipment controlled by 9B (except 9B990 or 9B991), as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

Control(s)	Country Chart
NS applies to "software" for "use" of FADEC for equipment controlled by 9A001 to 9A003.	NS Column 1
MT applies to "software" required for the "use" of FADEC for gas turbine engines controlled by 9A101, 9A106, or 9A110.	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: Yes, except N/A for MT  
TSR: Yes, except N/A for MT

LIST OF ITEMS CONTROLLED

Unit: \$ value

*Related Controls:* (1) See also 9D103. (2) "Software" "required" for the "use" of equipment or "technology" subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls is also subject to the same licensing jurisdiction. (See 22 CFR part 121.)

*Related Definitions:* N/A

*Items:* a. "Software" in digital electronic controls for propulsion systems, aerospace test facilities or air breathing aero-engine test facilities;

b. Fault-tolerant "software" used in "FADEC" systems for propulsion systems and associated test facilities.

**9D004 Other "software", as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

*Reason for Control:* NS, MT, AT

Control(s)	Country Chart
NS applies to entire entry .....	NS Column 1
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* a. 2D or 3D viscous “software” validated with wind tunnel or flight test data required for detailed engine flow modelling;

b. “Software” for testing aero gas turbine engines, assemblies or components, specially designed to collect, reduce and analyze data in real time, and capable of feedback control, including the dynamic adjustment of test articles or test conditions, as the test is in progress;

c. “Software” specially designed to control directional solidification or single crystal casting;

d. “Software” in “source code”, “object code” or machine code required for the “use” of active compensating systems for rotor blade tip clearance control.

NOTE: 9D004.d does not control “software” embedded in uncontrolled equipment or required for maintenance activities associated with the calibration or repair or updates to the active compensating clearance control system.

**9D018 “Software” for the “use” of equipment controlled by 9A018.**

LICENSE REQUIREMENTS  
*Reason for Control:* NS, RS, AT, UN.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
RS applies to 9A018.a and .b .....	RS Column 2.
AT applies to entire entry .....	AT Column 1.
UN applies to entire entry .....	Rwanda.

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: Yes for Australia, Japan, New Zealand, and NATO only

LIST OF ITEMS CONTROLLED  
*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading

**9D101 “Software” specially designed or modified for the “use” of commodities controlled by 9B105, 9B106, 9B116, or 9B117.**

LICENSE REQUIREMENTS  
*Reason for Control:* MT, AT

Control(s)	Country Chart
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS  
 CIV: N/A  
 TSR: N/A  
 LIST OF ITEMS CONTROLLED

*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading

**9D103 “Software” specially designed for modelling, simulation or design integration of “missiles”, or the subsystems controlled by 9A005, 9A007, 9A105.a, 9A106, 9A108, 9A116 or 9A119. (This entry is subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)**

**9D104 “Software” specially designed and modified for the “use” of equipment controlled by 9A001, 9A005, 9A006.d, 9A006.g, 9A007.a, 9A008.d, 9A009.a, 9A010.d, 9A011, 9A012 (for MT controlled items only), 9A101, 9A105, 9A106.c and .d, 9A107, 9A108.c, 9A109, 9A111, 9A115.a, 9A116.d, 9A117, or 9A118.**

LICENSE REQUIREMENTS  
*Reason for Control:* MT, AT

Control(s)	Country chart
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

*License Exceptions*  
 CIV: N/A  
 TSR: N/A  
 LIST OF ITEMS CONTROLLED  
*Unit:* \$ value  
*Related Controls:* “Software” for commodities controlled by 9A005 to 9A011, 9A105, 9A106.c, 9A107 to 9A109, 9A111, 9A115, 9A116, 9A117, and 9A118 are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls (see 22 CFR part 121).  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**9D105 “Software” that coordinates the function of more than one subsystem, specially designed or modified for “use” in “missiles.” (These items are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls. See 22 CFR part 121.)**

**9D990 “Software”, n.e.s., for the “development” or “production” of equipment controlled by 9A990 or 9B990.**

LICENSE REQUIREMENTS  
*Reason for Control:* AT

Control(s)	Country Chart
AT applies to “software” for equipment under 9A990 except 9A990.a.	AT Column 1

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*Control(s)*                      *Country Chart*

AT applies to "software" for equipment under 9A990.a only. AT Column 2

LICENSE EXCEPTIONS  
CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED  
*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading

**9D991 "Software", for the "development" or "production" of equipment controlled by 9A991 or 9B991.**

LICENSE REQUIREMENTS  
*Reason for Control:* AT

*Control(s)*                      *Country Chart*

AT applies to entire entry ..... AT Column 1

LICENSE EXCEPTIONS  
CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED  
*Unit:* \$ value  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading

E. TECHNOLOGY

NOTE: "Development" or "production" "technology" controlled by 9E001 to 9E003 for gas turbine engines remains controlled when used as "use" "technology" for repair, rebuild and overhaul. Excluded from control are: technical data, drawings or documentation for maintenance activities directly associated with calibration, removal or replacement of damaged or unserviceable line replaceable units, including replacement of whole engines or engine modules.

**9E001 "Technology" according to the General Technology Note for the "development" of equipment or "software" controlled by 9A001.c, 9A004 to 9A011, 9B (except 9B990 or 9B991), or 9D (except 9D990 or 9D991).**

LICENSE REQUIREMENTS  
*Reason for Control:* NS, MT, AT

*Control(s)*                      *Country Chart*

NS applies to "technology" for items controlled by 9A001.c, 9B001 to 9B009, 9D001 to 9D004. NS Column 1

*Control(s)*                      *Country Chart*

MT applies to "technology" for items controlled by 9B001, 9B002, 9B003, 9B004, 9B005, 9B007, 9B105, 9B106, 9B116, 9B117, 9D001, 9D002, 9D003, and 9D004 for MT reasons. MT Column 1

AT applies to entire entry ..... AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS  
CIV: N/A  
TSR: N/A

LIST OF ITEMS CONTROLLED  
*Unit:* N/A

*Related Controls:* (1) See also 9E101 and 1E002.f (for controls on "technology" for the repair of controlled structures, laminates or materials). (2) The "technology" required for the "development" of equipment controlled by 9A004 is subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (See 22 CFR part 121.) (3) "Technology", required for the "development" of equipment or "software" subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls, is also subject to the same licensing jurisdiction. (See 22 CFR part 121)

*Related Definitions:* "Development" or "production" "technology" controlled by 9E for gas turbine engines remains controlled when used as "use" "technology" for repair, rebuild and overhaul. Excluded from control are: technology, drawings or documentation for maintenance activities directly associated with calibration, removal or replacement of damaged or unserviceable line replaceable units, including replacement of whole engines or engine modules

*Items:* The list of items controlled is contained in the ECCN heading

**9E002 "Technology" according to the General Technology Note for the "production" of equipment controlled by 9A001.c, 9A004 to 9A011 or 9B (except 9B990 or 9B991).**

LICENSE REQUIREMENTS  
*Reason for Control:* NS, MT, AT

*Control(s)*                      *Country Chart*

NS applies to entire entry ..... NS Column 1  
MT applies to "technology" for equipment controlled by 9B001, 9B002, 9B003, 9B004, 9B005, 9B007, 9B105, 9B106, 9B116, and 9B117 for MT reasons. MT Column 1

AT applies to entire entry ..... AT Column 1

LICENSE REQUIREMENT NOTES: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: N/A.

Related Controls: (1) See also 9E102. (2) See also 1E002.f for "technology" for the repair of controlled structures, laminates or materials. (3) The "technology" required for the "development" of equipment controlled by 9A004 is subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (See 22 CFR part 121.) (4) "Technology", required for the "development" of equipment or "software" subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls, is also subject to the same licensing jurisdiction. (See 22 CFR part 121).

Related Definitions: N/A.

Items:

The list of items controlled is contained in the ECCN heading.

**9E003 Other "technology", as follows (see List of Items Controlled).**

LICENSE REQUIREMENTS

Reason for Control: NS, SI, AT.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
SI applies to 9E003.a.1 through a.11, and h. See §742.14 of the EAR for additional information..	
AT applies to entire entry .....	AT Column 1.

License Requirement Notes: See §743.1 of the EAR for reporting requirements for exports under License Exceptions.

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: N/A.

Related Controls: (1.) Hot section "technology" specifically designed, modified, or equipped for military uses or purposes, or developed principally with U.S. Department of Defense funding, is subject to the licensing authority of the U.S. Department of State. (2.) "Technology" is subject to the EAR when actually applied to a commercial aircraft engine program. Exporters may seek to establish commercial application either on a case-by-case basis through submission of documentation demonstrating application to a commercial program in requesting an export license from the Department Commerce in respect to a specific export, or in the case of use for broad categories of aircraft, engines, or components, a commodity jurisdiction

determination from the Department of State.

Related Definitions: N/A.

Items:

a. "Technology" "required" for the "development", "production" of any of the following gas turbine engine components or systems:

a.1. Gas turbine blades, vanes or tip shrouds made from directionally solidified (DS) or single crystal (SC) alloys having (in the 001 Miller Index Direction) a stress-rupture life exceeding 400 hours at 1,273 K (1,000 °C) at a stress of 200 MPa, based on the average property values;

a.2. Multiple domed combustors operating at average burner outlet temperatures exceeding 1,813 K (1,540 °C) or combustors incorporating thermally decoupled combustion liners, non-metallic liners or non-metallic shells;

a.3. Components manufactured from any of the following:

a.3.a. Organic "composite" materials designed to operate above 588 K (315 °C);

a.3.b. Metal "matrix" "composite", ceramic "matrix", intermetallic or intermetallic reinforced materials controlled by 1C007; or

a.3.c. "Composite" material controlled by 1C010 and manufactured with resins controlled by 1C008.

a.4. Uncooled turbine blades, vanes, tip-shrouds or other components designed to operate at gas path temperatures of 1,323 K (1,050 °C) or more;

a.5. Cooled turbine blades, vanes or tip-shrouds, other than those described in 9E003.a.1, exposed to gas path temperatures of 1,643 K (1,370 °C) or more;

a.6. Airfoil-to-disk blade combinations using solid state joining;

a.7. Gas turbine engine components using "diffusion bonding" "technology" controlled by 2E003.b;

a.8. Damage tolerant gas turbine engine rotating components using powder metallurgy materials controlled by 1C002.b;

a.9. Full authority digital electronic engine control (FADEC) for gas turbine and combined cycle engines and their related diagnostic components, sensors and specially designed components;

a.10. Adjustable flow path geometry and associated control systems for:

a.10.a. Gas generator turbines;

a.10.b. Fan or power turbines;

a.10.c. Propelling nozzles; or

NOTE 1: Adjustable flow path geometry and associated control systems in 9E003.a.10 do not include inlet guide vanes, variable pitch fans, variable stators or bleed valves for compressors.

NOTE 2: 9E003.a.10 does not control "development" or "production" "technology" for adjustable flow path geometry for reverse thrust.

a.11. Wide chord hollow fan blades without part-span support;

b. "Technology" "required" for the "development" or "production" of any of the following:

b.1. Wind tunnel aero-models equipped with non-intrusive sensors capable of transmitting data from the sensors to the data acquisition system; or

b.2. "Composite" propeller blades or propfans capable of absorbing more than 2,000 kW at flight speeds exceeding Mach 0.55;

c. "Technology" "required" for the "development" or "production" of gas turbine engine components using "laser", water jet, ECM or EDM hole drilling processes to produce holes having any of the following sets of characteristics:

c.1. All of the following:

c.1.a. Depths more than four times their diameter;

c.1.b. Diameters less than 0.76 mm; and

c.1.c. Incidence angles equal to or less than 25°; or

c.2. All of the following:

c.2.a. Depths more than five times their diameter;

c.2.b. Diameters less than 0.4 mm; and

c.2.c. Incidence angles of more than 25°;

TECHNICAL NOTE: For the purposes of 9E003.c, incidence angle is measured from a plane tangential to the airfoil surface at the point where the hole axis enters the airfoil surface.

d. "Technology" "required" for the "development" or "production" of helicopter power transfer systems or tilt rotor or tilt wing "aircraft" power transfer systems;

e. "Technology" for the "development" or "production" of reciprocating diesel engine ground vehicle propulsion systems having all of the following:

e.1. A box volume of 1.2 m<sup>3</sup> or less;

e.2. An overall power output of more than 750 kW based on 80/1269/EEC, ISO 2534 or national equivalents; and

e.3. A power density of more than 700 kW/m<sup>3</sup> of box volume;

TECHNICAL NOTE: Box volume: the product of three perpendicular dimensions measured in the following way:

Length: The length of the crankshaft from front flange to flywheel face;

Width: The widest of the following:

a. The outside dimension from valve cover to valve cover;

b. The dimensions of the outside edges of the cylinder heads; or

c. The diameter of the flywheel housing;

Height: The largest of the following:

a. The dimension of the crankshaft centerline to the top plane of the valve cover (or cylinder head) plus twice the stroke; or

b. The diameter of the flywheel housing.

f. "Technology" "required" for the "production" of specially designed components, as follows, for high output diesel engines:

f.1. "Technology" "required" for the "production" of engine systems having all of the following components employing ceramics materials controlled by 1C007:

f.1.a. Cylinder liners;

f.1.b. Pistons;

f.1.c. Cylinder heads; and

f.1.d. One or more other components (including exhaust ports, turbochargers, valve guides, valve assemblies or insulated fuel injectors);

f.2. "Technology" "required" for the "production" of turbocharger systems, with single-stage compressors having all of the following:

f.2.a. Operating at pressure ratios of 4:1 or higher;

f.2.b. A mass flow in the range from 30 to 130 kg per minute; and

f.2.c. Variable flow area capability within the compressor or turbine sections;

f.3. "Technology" "required" for the "production" of fuel injection systems with a specially designed multifuel (e.g., diesel or jet fuel) capability covering a viscosity range from diesel fuel (2.5 cSt at 310.8 K (37.8 °C)) down to gasoline fuel (0.5 cSt at 310.8 K (37.8 °C)), having both of the following:

f.3.a. Injection amount in excess of 230 mm<sup>3</sup> per injection per cylinder; and

f.3.b. Specially designed electronic control features for switching governor characteristics automatically depending on fuel property to provide the same torque characteristics by using the appropriate sensors;

g. "Technology" "required" for the "development" or "production" of high output diesel engines for solid, gas phase or liquid film (or combinations thereof) cylinder wall lubrication, permitting operation to temperatures exceeding 723 K (450 °C), measured on the cylinder wall at the top limit of travel of the top ring of the piston.

h. "Technology" not otherwise controlled in 9E003.a.1 through a.10 and currently used in the "development", "production", or overhaul of hot section parts and components of civil derivatives of military engines controlled on the U.S. Munitions List.

**9E018 "Technology" for the "development", "production", or "use" of equipment controlled by 9A018.**

LICENSE REQUIREMENTS

*Reason for Control:* NS, RS, AT, UN.

Control(s)	Country chart
NS applies to entire entry .....	NS Column 1.
RS applies to 9A018.a and .b .....	RS Column 2.
AT applies to entire entry .....	AT Column 1.
UN applies to entire entry .....	Rwanda.

LICENSE EXCEPTIONS

CIV: N/A

TSR: Yes for Australia, Japan, New Zealand, and NATO only

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LIST OF ITEMS CONTROLLED

Unit: N/A

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

**9E101 “Technology” according to the General Technology Note for the “development” or “production” of commodities or software controlled by 9A012, 9A101, 9A104 to 9A111, 9A115 to 9A119, 9D101, 9D103, 9D104 or 9D105.**

LICENSE REQUIREMENTS

Reason for Control: MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: N/A

Related Controls: “Technology” controlled by 9E101 for items in 9A012, 9A101.b, 9A104, 9A105, to 9A109, 9A110 that are specially designed for use in missile systems and subsystems, 9A111, 9A115, 9A116 to 9A119, 9D103, and 9D105 are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls (see 22 CFR part 121).

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

**9E102 “Technology” according to the General Technology Note for the “use” of space launch vehicles specified in 9A004, or commodities or software controlled by 9A005 to 9A012, 9A101, 9A104 to 9A111, 9A115 to 9A119, 9B105, 9B106, 9B115, 9B116, 9B117, 9D101, 9D103, 9D104 or 9D105.**

LICENSE REQUIREMENTS

Reason for Control: MT, AT

<i>Control(s)</i>	<i>Country Chart</i>
MT applies to entire entry .....	MT Column 1
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: N/A

Related Controls: (1) For the purpose of this entry, “use” “technology” is limited to items controlled for MT and their subsystems.

(2) “Technology” controlled by 9E102 for commodities or software subject to the ex-

port licensing jurisdiction of the Department of State in 9A004 to 9A012, 9A101.b, 9A104, 9A105, 9A106.a to .c, 9A107 to 9A109, 9A110 that are specially designed for use in missile systems and subsystems, 9A111, 9A115 to 9A119, 9B115, 9B116, 9D103, specified software in 9D104, and 9D105 are subject to the export licensing authority of the U.S. Department of State, Directorate of Defense Trade Controls (see 22 CFR part 121).

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

**9E990 “Technology”, n.e.s., for the “development” or “production” or “use” of equipment controlled by 9A990 or 9B990.**

LICENSE REQUIREMENTS

Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to “technology” for equipment under 9A990 and 9B990 except 9A990.a.	AT Column 1
AT applies to “technology” for equipment under 9A990.a only.	AT Column 2

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

**9E991 “Technology”, for the “development”, “production” or “use” of equipment controlled by 9A991 or 9B991.**

LICENSE REQUIREMENTS

Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry .....	AT Column 1

LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

LIST OF ITEMS CONTROLLED

Unit: \$ value

Related Controls: N/A

Related Definitions: N/A

Items: The list of items controlled is contained in the ECCN heading

**9E993 Other “technology”, not described by 9E003, as follows (see List of Items Controlled)**

LICENSE REQUIREMENTS

Reason for Control: AT.

<i>Control(s)</i>	<i>Country chart</i>
AT applies to entire entry .....	AT Column 1.

## LICENSE EXCEPTIONS

CIV: N/A

TSR: N/A

## LIST OF ITEMS CONTROLLED

Unit: \$ value.

Related Controls: N/A.

Related Definitions: N/A.

## Items:

a. Rotor blade tip clearance control systems employing active compensating casing "technology" limited to a design and development data base; *or*

b. Gas bearing for turbine engine rotor assemblies.

**EAR99 Items subject to the EAR that are not elsewhere specified in this CCL Category or in any other category in the CCL are designated by the number EAR99.**

[63 FR 2459, Jan. 15, 1998]

EDITORIAL NOTE: For FEDERAL REGISTER citations affecting Supplement No. 1 to Part 774, see the List of CFR Sections Affected, which appears in the Finding Aids section of the printed volume and on GPO Access.

SUPPLEMENT NO. 2 TO PART 774—GENERAL TECHNOLOGY AND SOFTWARE NOTES

1. *General Technology Note.* The export of "technology" that is "required" for the "development", "production", or "use" of items on the Commerce Control List is controlled according to the provisions in each Category. "Technology" "required" for the "development", "production", or "use" of a controlled product remains controlled even when applicable to a product controlled at a lower level.

License Exception TSU is available for "technology" that is the minimum necessary for the installation, operation, maintenance (checking), and repair of those products that are eligible for License Exceptions or that are exported under a license.

*N.B.:* This does not allow release under a License Exception of the repair "technology" controlled by 1E002.e, 1E002.f, 8E002.a, or 8E002.b.

*N.B.:* The "minimum necessary" excludes "development" or "production" technology and permits "use" technology only to the extent "required" to ensure safe and efficient use of the product. Individual ECCNs may further restrict export of "minimum necessary" information.

2. *General Software Note.* License Exception TSU ("mass market" software) is available to all destinations, except Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria, for release of software that is generally available to the public by being:

a. Sold from stock at retail selling points, without restriction, by means of:

1. Over the counter transactions;
2. Mail order transactions;
3. Electronic transactions; *or*
4. Telephone call transactions; *and*
- b. Designed for installation by the user without further substantial support by the supplier.

NOTE: The General Software Note does not apply to "software" controlled by Category 5—part 2 ("Information Security"). For "software" controlled by Category 5, part 2, see Supplement No. 1 to part 774, Category 5, part 2, Note 3—Cryptography Note.

[68 FR 10608, Mar. 5, 2003]

SUPPLEMENT NO. 3 TO PART 774—STATEMENTS OF UNDERSTANDING

*Statement of Understanding—medical equipment:* Commodities that are "specially designed for medical end-use" that "incorporate" commodities or software on the Commerce Control List (Supplement No. 1 to part 774 of the EAR) that do not have a reason for control of Nuclear Nonproliferation (NP), Missile Technology (MT), or Chemical & Biological Weapons (CB) are designated by the number EAR99 (i.e., are not elsewhere specified on the Commerce Control List).

NOTES APPLICABLE TO STATE OF UNDERSTANDING RELATED TO MEDICAL EQUIPMENT: (1) "Specially designed for medical end-use" means designed for medical treatment or the practice of medicine (does not include medical research).

(2) "Incorporate" into medical equipment means to integrate with, or work indistinguishably into such equipment.

(3) Except for such software that is made publicly available consistent with §734.3(b)(3) of the EAR, commodities and software "specially designed for medical end-use" remain subject to the EAR.

(4) See also §770.2(b) interpretation 2, for other types of equipment that incorporate items on the Commerce Control List that are subject to the EAR.

(5) For computers used with medical equipment, see also ECCN 4A003 note 2 regarding the "principal element" rule.

(6) For commodities and software specially designed for medical end-use that incorporate an encryption or other "information security" item subject to the EAR, see also Note 1 to Category 5, Part II of the Commerce Control List.

[68 FR 68996, Dec. 10, 2003]

**PARTS 775-799 [RESERVED]**