

7. Substrate bias parameters.

**2E018 "Technology" for the "use" of equipment controlled by 2B018.**

**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 "technology" for equipment controlled by 2B018 for MT reasons.	MT 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: 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, 2B109, 2B116, or 2D101.**

**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 2B004, 2B104, 2B109, and 2B116.	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: This entry controls only "technology" for 2B009 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, 2B009, 2B201, 2B204, 2B207, 2B209, 2B225 to 2B232, 2D201 or 2D202.**

**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**

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, and 2B290.**

**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.

**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.

**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. 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 § 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, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry	NS Column 2
MT applies to 3A001.a.1.a	MT Column 1
AT applies to entire entry	AT Column 1

**License Exceptions**

LVS: N/A for MT; \$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, except 3A001.a.1.a, b.1, b.3 to b.7, .c to .f

CIV: Yes, except 3A001.a.1, a.2, a.3.a (for processors with a CTP greater than 500 Mtops), a.5, a.6, a.9, a.10, and a.12, .b, .c, .d, .e, and .f

#### List of Items Controlled

*Unit:* Number

*Related Controls:* See also 3A101, 3A201, and 3A991

*Related Definitions:* For the purposes of integrated circuits in 3A001.a.1,  $5 \times 10^3 \text{ Gy (Si)} = 5 \times 10^5 \text{ Rads (Si)}$ ;  $5 \times 10^6 \text{ Gy (Si)} = 5 \times 10^8 \text{ Rads (Si)/s}$ .

*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  $5 \times 10^3 \text{ Gy (Si)}$ , or higher; *or*

a.1.b. A dose rate upset of  $5 \times 10^6 \text{ Gy (Si)/s}$ , or higher;

a.2. Integrated circuits described in 3A001.a.3 to 3A001.a.10 or 3A001.a.12, electrical erasable programmable read-only memories (EEPROMs), flash memories and 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 automobiles or railway train applications.

a.3. "Microprocessor microcircuits", "micro-computer microcircuits" and microcontroller microcircuits, having any of the following characteristics:

**Note:** 3A001.a.3 includes digital signal processors, digital array processors and digital coprocessors.

a.3.a. A "composite theoretical performance" ("CTP") of 260 million theoretical operations per second (Mtops) or more and an arithmetic logic unit with an access width of 32 bit or more;

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 for external interconnection in a parallel processor with a transfer rate exceeding 2.5 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 to maximum resolution of less than 10 ns;

a.5.a.2. A resolution of 12 bit with a total conversion time to maximum resolution of less than 200 ns; *or*

a.5.a.3. A resolution of more than 12 bit with a total conversion time to maximum resolution of less than 2  $\mu\text{s}$ ;

a.5.b. Digital-to-analog converters with a resolution of 12 bit or more, and a "settling time" of less than 10 ns;

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 gate arrays having any of the following:

a.7.a. An equivalent usable gate count of more than 30,000 (2 input gates); *or*

a.7.b. A typical "basic gate propagation delay time" of less than 0.4 ns;

a.8. Field programmable logic arrays having any of the following:

a.8.a. An equivalent usable gate count of more than 30,000 (2 input gates); *or*

a.8.b. A toggle frequency exceeding 133 MHz;

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 208 terminals;

a.10.b. A typical "basic gate propagation delay time" of less than 0.35 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 300 (2 input gates); *or*

a.11.b. A toggle frequency exceeding 1.2 GHz;

a.12. Fast Fourier Transform (FFT)

processors having any of the following:

a.12.a. A rated execution time for a 1,024 point complex FFT of less than 1 ms;

a.12.b. A rated execution time for an N-point complex FFT of other than 1,024 points of less than  $N \log_2 N / 10,240 \text{ ms}$ , where N is the number of points; *or*

a.12.c. A butterfly throughput of more than 5.12 MHz;

b. Microwave or millimeter wave components, as follows:

b.1. Electronic vacuum tubes and cathodes, as follows:

**Note:** 3A001.b.1 does not control tubes designed or rated to operate in the ITU allocated bands at frequencies not exceeding 31 GHz.

b.1.a. Travelling wave tubes, pulsed or continuous wave, as follows:

b.1.a.1. Operating at frequencies higher than 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 an "instantaneous 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 GHz) times frequency (expressed in kW) 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, with any of the following:

b.1.c.1. A turn on time to rated emission of less than 3 seconds; *or*

b.1.c.2. Producing a continuous emission current density at rated operating conditions exceeding  $5 \text{ A/cm}^2$ ;

b.2. Microwave integrated circuits or modules containing "monolithic integrated circuits" operating at frequencies exceeding 3 GHz;

**Note:** 3A001.b.2 does not control circuits or modules for equipment designed or rated to operate in the ITU allocated bands at frequencies not exceeding 31 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 ( $F_{\text{max}}/F_{\text{min}}$ ) in less than 10  $\mu\text{s}$  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  $\text{cm}^3$ ;

**Note:** 3A001.b.8 does not control equipment designed or rated for operation in an ITU allocated band.

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. Electromagnetic amplification:
- d.1.a. At frequencies equal to or less than 31 GHz with a noise figure of less than 0.5 dB; *or*
- d.1.b. At frequencies exceeding 31 GHz;
- d.2. 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  $10^{-14}$  J; *or*
- d.3. 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:

N.B.: See also 3A201.a.

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:

N.B.: See also 3A201.b.

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>;

**Note:** 3A001.e.3 does not control "superconductive" electromagnets or solenoids specially designed for Magnetic Resonance Imaging (MRI) medical equipment.

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  $\pm 2.5$  seconds of arc.

**3A002 General purpose electronic 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: \$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:* See also 3A202 and 3A992

*Related Definitions:* N/A

*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  $\pm 0.1$   $\mu$ 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 180 Mbit/s;

**Note:** 3A002.a.2 does not control digital video magnetic tape recorders specially designed for television recording using a signal format standardized or recommended by the CCIR or the IEC 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 3A202.

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.

b. "Frequency synthesizer", "assemblies" having a "frequency switching time" from one selected frequency to another of less than 1 ms;

c. "Signal analyzers", as follows:  
 c.1. "Signal analyzers" capable of analyzing frequencies exceeding 31 GHz;  
 c.2. "Dynamic signal analyzers" having a "real-time bandwidth" exceeding 25.6 KHz;

**Note:** 3A002.c.2 does not control those "dynamic signal analyzers" using only constant percentage bandwidth filters.

**Technical Note:** Constant percentage bandwidth filters are 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 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 40 GHz;  
 f. Microwave test receivers having all of the following:

f.1. A maximum operating frequency exceeding 40 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

<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:* 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.

**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:* This entry does not control magnets that are specially designed for and exported as parts of medical nuclear magnetic resonance (NMR) imaging systems. Such parts may be exported in separate shipments from different sources, provided that the related export control documents clearly specify that the parts are for medical NMR imaging systems that are being exported.

*Related Definition:* N/A  
*Items:* a. Capacitors with the following characteristics:

a.1. Voltage rating greater than 1.4 kV, energy storage greater than 10 J, capacitance greater than 0.5  $\mu$ F and series inductance less than 50 Nh; or  
 a.2. Voltage rating greater than 750 V, capacitance greater than 0.25  $\mu$ F and series inductance less than 10 Nh;

b. Superconducting solenoidal electromagnets with all of the following characteristics:

b.1. Capable of creating magnetic fields of more than 2 teslas (20 kilogauss);  
 b.2. With an L/D ratio (length divided by inner diameter) greater than 2;  
 b.3. With an inner diameter of more than 300 mm; and

b.4. With a magnetic field uniform to better than 1% over the central 50% of the inner volume;

**Note:** 3A201.b does not specify 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 with peak energy of 500 keV or greater, as follows, except accelerators that are component parts of devices designed for purposes other than electron beam or X-ray radiation (electron microscopy, for example) and those designed for medical purposes:

c.1. Having 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, where K is defined as:

$K = 1.7 \times 10^3 V^2.65 Q$ , where V is the peak electron energy in million electron volts and Q is the total accelerated charge in coulombs if the accelerator beam pulse duration is less than or equal to 1 microsecond; if the accelerator beam pulse duration is greater than 1 microsecond, Q is the maximum accelerated charge in 1 microsecond {Q equals the integral of i with respect to t, over the lesser of 1 microsecond or the time duration of the beam pulse (Q={integral} idt), where i is beam current in amperes and t is time in seconds}; or

c.2. Having an accelerator peak electron energy of 25 MeV or greater and a peak power greater than 50 MW. {Peak power = (peak potential in volts)  $\times$  (peak beam current in amperes)}.

**Technical Notes:** a. Time duration of the beam pulse—In machines, based on microwave accelerating cavities, the time duration of the beam pulse is the lesser of 1 microsecond or the duration of the bunched beam packet resulting from one microwave modulator pulse.

b. Peak beam current—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 controlled by 0B001.c.11, having all of the 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:* Frequency changers (also known as converters or inverters)

especially designed or prepared to supply motor stators and having the characteristics described in 3A225.b and .d, together with a total harmonic distortion of less than 2 percent and an efficiency of greater than 80 percent are subject to the export licensing authority of the Nuclear Regulatory Commission. (See 10 CFR part 110.)

**Related Definition:** Motor stators are especially designed or prepared ring-shaped stators for high-speed multiphase AC hysteresis (or reluctance) motors for synchronous operation within a vacuum in the frequency range of 600 Hz to 2,000 Hz, and a power range of 50 VA to 1,000 VA. The stators consist of multiphase windings on a laminated low-loss iron core comprising thin layers typically to 2.0 mm (.008 in) thick or less.

- 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 Direct current high-power supplies, other than those controlled by 0B001.j.6, capable of continuously producing, over a time period of 8 hours, 100 V or greater with current output of 500 A or greater and with current or voltage regulation better than 0.1%.**

**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:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**3A227 High-voltage direct current power supplies, other than those controlled by 0B001.j.5, capable of continuously producing, over a time period of 8 hours, 20,000 V or greater with current output of 1 A or greater and with current or voltage regulation better than 0.1%.**

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

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

**3A228 Switching devices, 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:* Number  
*Related Controls:* N/A  
*Related Definitions:* N/A  
*Items:* a. Cold-cathode tubes (including gas krytron tubes and vacuum spraytron tubes), whether gas filled or not, operating similarly to a spark gap, containing three or more electrodes, and having all of the following characteristics:

- a.1. Anode peak voltage rating of 2,500 V or more;
- a.2. Anode peak current rating of 100 A or more; and
- a.3. Anode delay time of 10 microsecond or less;
- b. Triggered spark-gaps having an anode delay time of 15 microsecond or less and 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 2,000 V;
  - c.2. Anode peak current rating of 500 A or more; and
  - c.3. Turn-on time of 1 microsecond 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

*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 also U.S. Munitions List  
*Related Definitions:* N/A

- Items:* a. Explosive detonator firing sets designed to drive multiple controlled detonators controlled by 3A232;  
 b. Modular electrical pulse generators (pulsers) designed for portable, mobile or ruggedized use (including xenon flash-lamp drivers) having all the following characteristics:
  - b.1. Capable of delivering their energy in less than 15 microsecond;

- b.2. Having an output greater than 100 A;
- b.3. Having a rise time of less than 10 microsecond into loads of less than 40 ohms (rise time is the time interval from 10% to 90% current amplitude when driving a resistive load);
  - b.4. Enclosed in a dust-tight enclosure;
  - b.5. No dimension greater than 254 mm;
  - b.6. Weight less than 25 kg; and
  - b.7. Specified for use over an extended temperature range 223 K (-50° C) to 373 K (100° C) or specified as suitable for aerospace use.

**3A230 High-speed pulse generators with output voltages greater than 6 volts into a less than 55 ohm resistive load, and with pulse transition times less than 500 picoseconds.**

**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:* N/A  
*Related Definitions:* In this entry, "pulse transition time" is defined as the time interval between 10% and 90% voltage amplitude.

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

**3A231 Neutron generator systems, including tubes, designed for operation without an external vacuum system and utilizing electrostatic acceleration to induce a tritium-deuterium nuclear reaction.**

**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, 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.

**3A232 Detonators and multipoint initiation systems, 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

*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:* This entry does not control detonators using only primary explosives, such as lead azide.

*Related Definition:* The detonators of concern 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 (Pentaerythritoltetranitrate). 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 an EB or a slapper-type detonator. Also, the word initiator is sometimes used in place of the word detonator.

*Items:* a. Electrically driven explosive detonators, the following:

- 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 greater than 5000 mm<sup>2</sup>) from a single firing signal (with an initiation timing spread over the surface of less than 2.5 microseconds).

detonators designed to nearly simultaneously initiate an explosive surface (over greater than 5000 mm<sup>2</sup>) from a single firing signal (with an initiation timing spread over the surface of less than 2.5 microseconds).

**3A233 Mass spectrometers, other than those controlled by 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

*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:* Specially designed or prepared magnetic or quadruple mass spectrometers that have the following characteristics and are capable of taking on-line samples of feed, product, or tails from UF<sub>6</sub> gas streams are subject to the export licensing authority of the Nuclear Regulatory Commission. (See 10 CFR part 110.): (a) Unit resolution for mass greater than 320; (b) Ion sources that are constructed of or lined with nichrome or

that are monel or nickel-plated; (c) Electron bombardment ionization sources; (d) Having a collector system suitable for isotopic analysis.

*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 as follows:

e.1. Having a source chamber constructed from, lined with or plated with stainless steel or molybdenum and have a cold trap capable of cooling to 193 K (−80° C) or less; or

e.2. Having a source chamber constructed from, lined with or plated with materials resistant to UF<sub>6</sub>; or

f. Mass spectrometers equipped with a microfluorination ion source designed for use with 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

*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:* Number

*Related Controls:* N/A

*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 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 a clock frequency exceeding 25 MHz;

- 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. Field programmable logic arrays having either of the following:

c.1. An equivalent gate count of more than 5000 (2 input gates); or

c.2. A toggle frequency exceeding 100 MHz;

d. 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:

d.1. More than 144 terminals; or

d.2. A typical "basic propagation delay time" of less than 0.4 ns.

e. Travelling wave tubes, pulsed or continuous wave, as follows:

e.1. Coupled cavity tubes, or derivatives thereof;

e.2. Helix tubes, or derivatives thereof, with any of the following:

e.2.a.1. An "instantaneous bandwidth" of half an octave or more; and

e.2.a.2. The product of the rated average output power (expressed in kW) and the maximum operating frequency (expressed in GHz) of more than 0.2;

e.2.b.1. An "instantaneous bandwidth" of less than half an octave; and

e.2.b.2. The product of the rated average output power (expressed in kW) and the maximum operating frequency (expressed in GHz) of more than 0.4;

f. Flexible waveguides designed for use at frequencies exceeding 40 GHz;

g. 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:

g.1. A carrier frequency exceeding 1 GHz; or

g.2. A carrier frequency of 1 GHz or less; and

g.2.a. A frequency side-lobe rejection exceeding 55 dB;

g.2.b. A product of the maximum delay time and bandwidth (time in microseconds and bandwidth in MHz) of more than 100; or

g.2.c. A dispersive delay of more than 10 microseconds.

h. Batteries, as follows:

**Note:** 3A991.h does not control batteries with volumes equal to or less than 26 cm<sup>3</sup> (e.g., standard C-cells or UM-2 batteries).

h.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);

h.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.

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

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

i.1. Maximum energy delivered during the discharge divided by the duration of the discharge of more than 500 kJ per minute;

i.2. Inner diameter of the current carrying windings of more than 250 mm; and

i.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>.

j. 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:

j.1. Resonant operating frequencies exceeding 1 MHz;

j.2. A stored energy density of 1 MJ/M<sup>3</sup> or more; and

j.3. A discharge time of less than 1 ms;

k. Hydrogen/hydrogen-isotope thyratrons of ceramic-metal construction and rate for a peak current of 500 A or more.

### 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;

### B. Test, Inspection and Production Equipment

#### 3B001 Equipment for the manufacturing of semiconductor devices or materials 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 and a.3; and for equipment controlled under 3B001.e, they cannot be connected to equipment controlled by 3B001.a.2, a.3, and .f.

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 ± 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 sources;

b. "Stored program controlled" equipment designed for ion implantation, having any of the following:

b.1. An accelerating voltage exceeding 200 keV;

b.2. Being specially designed and optimized to operate at an accelerating voltage of less than 10 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. Magnetic confinement; or

c.1.b. Electron cyclotron resonance (ECR);

c.2. Equipment specially designed for equipment controlled by 3B001.e. and having any of the following:

c.2.a. Magnetic confinement; or

c.2.b. ECR;

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. Magnetic confinement; or
- d.1.b. ECR;

d.2. Equipment specially designed for equipment controlled by 3B001.e. and having any of the following:

- d.2.a. Magnetic confinement; or
- d.2.b. ECR;

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 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 400 nm; or
- f.1.b. Capable of producing a pattern with a minimum resolvable feature size of 0.7 μm or less;

**Note:** The minimum resolvable feature size is calculated by the following formula:

(an exposure light source wavelength in μm) × (K factor)

$$MRF = \frac{\text{numerical aperture}}{\dots}$$

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 focussed electron beam, ion beam or "laser" beam, having any of the following:

- f.2.a. A spot size smaller than 0.2 μm;
- f.2.b. Being capable of producing a pattern with a feature size of less than 1 μm; or
- f.2.c. An overlay accuracy of better than ± 0.20 μm (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 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 60 MHz;

**Note:** 3B002.b does not control test equipment specially designed for testing:

- 1. "Assemblies" or a class of "assemblies" for home or entertainment applications;
- 2. Uncontrolled electronic components, "assemblies" or integrated circuits.

c. For testing microwave integrated circuits at frequencies exceeding 3 GHz;

**Note:** 3B002.c does not control test equipment specially designed for testing microwave integrated circuits for equipment designed or rated to operate in the ITU allocated bands at frequencies not exceeding 31 GHz.

d. Electron beam systems designed for operation at 3 keV or below, or "laser" beam systems, for the non-contactive probing of powered-up semiconductor devices, having all of the following:

- d.1. Stroboscopic capability with either beam-blanking or detector strobing; and
- d.2. An electron spectrometer for voltage measurement with a resolution of less than 0.5 V.

**Note:** 3B002.d does not control scanning electron microscopes, except when specially designed and instrumented for the non-contactive probing of powered-up semiconductor devices.

**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:* N/A

*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 "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 2.5 x 10<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%;

b.1.d.2. Rotation of individual wafers during processing; or

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. Accelerating voltage for more than 200 keV; or

b.1.g.3. 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 105 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 methods, including both projection image transfer equipment and step and repeat 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); or

b.2.f.3. Machine-to-machine overlay no better than  $\pm 0.3$  micrometer;

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>
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 "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 "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 "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 x 32 line elements;

b.5. Electron beam test systems, capable of operating at or below 3,000 eV, 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 m<sup>3</sup> 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

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

<i>Control(s)</i>	<i>Country Chart</i>
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:* 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; or

c. III/V compounds of gallium or indium.

**3C002 Resist material and "substrates" coated with controlled resists.**

**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:* \$ 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 370 nm;

b. All resists designed for use with electron beams or ion beams, with a sensitivity of 0.01 µcoulomb/mm<sup>2</sup> or better;

c. All resists designed for use with X-rays, with a sensitivity of 2.5 mJ/mm<sup>2</sup> 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

<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:* \$ value

*Related Controls:* This entry controls only compounds whose metallic, partly metallic or non-metallic element is directly linked

<p>to carbon in the organic part of the molecule.  <i>Related Definition:</i> N/A  <i>Items:</i> a. Organo-metallic compounds of aluminium, 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%.</p>	<p><i>Control(s)</i>            NS applies to entire entry            AT applies to entire entry  <b>License Exceptions</b>            CIV: N/A            TSR: Yes  <b>List of Items Controlled</b>  <i>Unit:</i> \$ value  <i>Related Controls:</i> N/A  <i>Related Definitions:</i> N/A  <i>Items:</i> The list of items controlled is contained in the ECCN heading.</p>	<p><i>Country Chart</i>            NS Column 1            AT Column 1</p>	<p><i>Items:</i> The list of items controlled is contained in the ECCN heading.  <b>3D102 "Software" specially designed for the "development" or "production" of equipment controlled by 3A001.a.1.a or 3A101.</b>  <b>License Requirements</b>  <i>Reason for Control:</i> MT, AT</p>
<p><b>3C004 Hydrides of phosphorus, arsenic or antimony, having a purity better than 99.999%, even diluted in inert gases or hydrogen.</b>  <b>License Requirements</b>  <i>Reason for Control:</i> NS, AT</p>	<p><b>3D003 Computer-aided-design (CAD) "software" designed for semiconductor devices or integrated circuits, having any of the following (see List of Items Controlled).</b>  <b>License Requirements</b>  <i>Reason for Control:</i> NS, AT</p>	<p><i>Control(s)</i>            MT applies to entire entry            AT applies to entire entry</p> <p><i>Country Chart</i>            MT Column 1            AT Column 1</p>	<p><i>Control(s)</i>            MT applies to entire entry            AT applies to entire entry</p> <p><i>Country Chart</i>            MT Column 1            AT Column 1</p>
<p><i>Control(s)</i>            NS applies to entire entry            AT applies to entire entry  <b>License Exceptions</b>            LVS: \$3000            GBS: N/A            CIV: N/A  <b>List of Items Controlled</b>  <i>Unit:</i> \$ value  <i>Related Controls:</i> This entry does not control hydrides containing less than 20% molar or more of inert gases or hydrogen.  <i>Related Definition:</i> N/A  <i>Items:</i> The list of items controlled is contained in the ECCN heading.</p>	<p><i>Control(s)</i>            NS applies to entire entry            AT applies to entire entry  <b>License Exceptions</b>            CIV: N/A            TSR: Yes  <b>List of Items Controlled</b>  <i>Unit:</i> \$ value  <i>Related Controls:</i> This entry does not control "software" specially designed for schematic entry, logic simulation, placing and routing, layout verification or pattern generation tape.  <i>Related Definitions:</i> (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.  <i>Items:</i> a. Design rules or circuit verification rules;            b. Simulation of the physically laid out circuits; or            c. Lithographic processing simulators for design.</p>	<p><i>Control(s)</i>            NS applies to entire entry            AT applies to entire entry</p> <p><i>Country Chart</i>            NS Column 1            AT Column 1</p>	<p><b>License Exceptions</b>            CIV: N/A            TSR: N/A  <b>List of Items Controlled</b>  <i>Unit:</i> \$ value  <i>Related Controls:</i> N/A  <i>Related Definitions:</i> N/A  <i>Items:</i> The list of items controlled is contained in the ECCN heading.  <b>3D980 "Software" specially designed for the "development", "production", or "use" of items controlled by 3A980 and 3A981.</b>  <b>License Requirements</b>  <i>Reason for Control:</i> CC, AT</p>
<p><b>D. Software</b>  <b>3D001 "Software" specially designed for the "development" or "production" of equipment controlled by 3A001.b to 3A002.g or 3B (except 3B991 and 3B992).</b>  <b>License Requirements</b>  <i>Reason for Control:</i> NS, AT</p>	<p><b>3D101 "Software" specially designed for the "use" of equipment controlled by 3A101.b.</b>  <b>License Requirements</b>  <i>Reason for Control:</i> MT, AT</p>	<p><i>Control(s)</i>            NS applies to "software" for equipment controlled by 3A001.b to 3A001.f, 3A002, and 3B.            AT applies to entire entry</p> <p><i>Country Chart</i>            NS Column 1            AT Column 1</p>	<p><i>Control(s)</i>            CC applies to entire entry            AT applies to entire entry</p> <p><i>Country Chart</i>            CC Column 1            AT Column 1</p> <p><b>License Exceptions</b>            CIV: N/A            TSR: N/A  <b>List of Items Controlled</b>  <i>Unit:</i> \$ value  <i>Related Controls:</i> N/A  <i>Related Definitions:</i> N/A  <i>Items:</i> The list of items controlled is contained in the ECCN heading.  <b>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.</b>  <b>License Requirements</b>  <i>Reason for Control:</i> AT</p>
<p><i>Control(s)</i>            NS applies to "software" for equipment controlled by 3A001.b to 3A001.f, 3A002, and 3B.            AT applies to entire entry  <b>License Requirement Notes:</b> See § 743.1 of the EAR for reporting requirements for exports under License Exceptions.  <b>License Exceptions</b>            CIV: N/A            TSR: Yes  <b>List of Items Controlled</b>  <i>Unit:</i> \$ value  <i>Related Controls:</i> See also 3D101  <i>Related Definitions:</i> N/A  <i>Items:</i> The list of items controlled is contained in the ECCN heading.</p>	<p><i>Control(s)</i>            MT applies to entire entry            AT applies to entire entry  <b>License Exceptions</b>            CIV: N/A            TSR: N/A  <b>List of Items Controlled</b>  <i>Unit:</i> \$ value  <i>Related Controls:</i> N/A  <i>Related Definitions:</i> N/A</p>	<p><i>Control(s)</i>            MT applies to entire entry            AT applies to entire entry</p> <p><i>Country Chart</i>            MT Column 1            AT Column 1</p>	<p><i>Control(s)</i>            AT applies to entire entry</p> <p><i>Country Chart</i>            AT Column 1</p> <p><b>License Exceptions</b>            CIV: N/A            TSR: N/A  <b>List of Items Controlled</b>  <i>Unit:</i> \$ value  <i>Related Controls:</i> N/A  <i>Related Definitions:</i> N/A  <i>Items:</i> The list of items controlled is contained in the ECCN heading.</p>
<p><b>3D002 "Software" specially designed for the "use" of "stored program controlled" equipment controlled by 3B (except 3B991 and 3B992).</b>  <b>License Requirements</b>  <i>Reason for Control:</i> NS, AT</p>	<p><i>Control(s)</i>            MT applies to entire entry            AT applies to entire entry  <b>License Exceptions</b>            CIV: N/A            TSR: N/A  <b>List of Items Controlled</b>  <i>Unit:</i> \$ value  <i>Related Controls:</i> N/A  <i>Related Definitions:</i> N/A</p>	<p><i>Control(s)</i>            MT applies to entire entry            AT applies to entire entry</p> <p><i>Country Chart</i>            MT Column 1            AT Column 1</p>	<p><i>Control(s)</i>            AT applies to entire entry</p> <p><i>Country Chart</i>            AT Column 1</p> <p><b>License Exceptions</b>            CIV: N/A            TSR: N/A  <b>List of Items Controlled</b>  <i>Unit:</i> \$ value  <i>Related Controls:</i> N/A  <i>Related Definitions:</i> N/A  <i>Items:</i> The list of items controlled is contained in the ECCN heading.</p>

**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 and 3B992) or 3C.**

**License Requirements**

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

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to "technology" for items controlled by 3A001, 3A002, 3B001 and 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 3A201, 3A225 to 3A233 for NP reasons.	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**

CIV: N/A  
TSR: Yes, except N/A for MT

**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 one 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.

*Related Definition:* N/A

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

**3E002 Other "technology" for the "development" or "production" of items 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 Exceptions**

CIV: N/A  
TSR: Yes

**List of Items Controlled**

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

**3E101 "Technology" according to the General Technology Note for the "use" of equipment or "software" controlled by 3A001.a.1.a. or 3A101.**

**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 3A201, 3A225 to 3A233.**

**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**

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 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).

N.B. 1: 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. 2: For the control status of "software" specially designed for packet switching, see ECCN 5D001 (Telecommunications).

**Note 2:** 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
AT applies to entire entry	AT Column 1

NP applies to electronic computers with a CTP greater than 2,000 Mtops, 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 2,000 Mtops, unless a License Exception is available. XP controls vary according to destination and end-user and end-use. 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.) See also 4A101.  
*Related Definitions:* For the purposes of integrated circuits in 4A001.a.2,  $5 \times 10^3 \text{ Gy(Si)} = 5 \times 10^5 \text{ Rads (Si)}$ ;  $5 \times 10^6 \text{ Gy (Si)/s} = 5 \times 10^8 \text{ Rads (Si)/s}$ .  
*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  $5 \times 10^3 \text{ Gy (Si)}$ ; or  
 a.2.b. A dose rate upset of  $5 \times 10^6 \text{ Gy (Si)/s}$ ;

a.2.c. Single Event Upset of  $1 \times 10^{-7} \text{ Error/bit/day}$ ;

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
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

NP applies to hybrid computers with a CTP greater than 2,000 Mtops, 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 2,000 Mtops, unless a License Exception is available. XP controls vary according to destination and end-user and end-use. 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 bits (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, and specially designed components therefor.**

**License Requirements**

*Reason for Control:* NS, MT, CC, AT, NP, XP

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to 4A003.b and .c.	NS Column 1
NS applies to 4A003.a, d, .e, .f, 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
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 $\geq 6$ but $\leq 2,000$ Mtops).	AT Column 1

NP applies to digital computers with a CTP greater than 2,000 Mtops, 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 2,000 Mtops, unless a License Exception is available. XP controls vary according to destination and end-user and end-use. See § 742.12 of the EAR for additional information.

**Note:** For all destinations, except Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria, no license is required (NLR) for computers with a CTP of 2,000 Mtops, and for assemblies described in 4A003.c that are not capable of exceeding a CTP of 2,000 Mtops in aggregation. Computers controlled in this entry for MT reasons are not eligible for NLR.

**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 "digital" computers controlled by 4A003.b and having a CTP exceeding 10,000 MTOPS; or "electronic assemblies" controlled by 4A003.c and capable of enhancing performance by aggregation of "computing elements" so that the CTP of the aggregation exceeds 10,000 MTOPS.  
 GBS: Yes, for 4A003.d, .e, .f, and .g and specially designed components therefor, exported separately or as part of a system.  
 CTP: Yes, for computers controlled by 4A003.a, .b and .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 or digital-to-analog conversions exceeding the limits of 3A001.a.5.a). See § 740.7 of the EAR.  
 CIV: Yes, for 4A003.d (having a 3-D vector rate less than 10 M vectors/sec), .e, .f and .g.

**List of Items Controlled**

*Unit:* Equipment in number; parts and accessories in \$ value  
*Related Controls:* See also 4A994  
*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 2,000 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, 4A003.e or 4A003.f.

**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. Graphics accelerators and graphics coprocessors exceeding a "three dimensional Vector Rate" of 3,000,000;

- e. Equipment performing analog-to-digital conversions exceeding the limits in 3A001.a.5;

- f. Equipment containing "terminal interface equipment" exceeding the limits in 5A001.b.3;

**Note:** For the purposes of 4A003.f, "terminal interface equipment" includes "local area network" interfaces and other communications interfaces. "Local area network" interfaces are evaluated as "network access controllers".

- g. Equipment specially designed to provide external interconnection of "digital computers" or associated equipment that allows communications at data rates exceeding 80 Mbyte/s.

**Note:** 4A003.g does not control internal interconnection equipment (e.g., backplanes, buses) or passive interconnection equipment.

**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>
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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>
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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>
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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>
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AT applies to entire entry	AT Column 1
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**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. Electronic computers and related equipment, and "electronic assemblies" and specially 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. "Assemblies" not controlled by 4A003 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 Bytes/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", not controlled by 4A003, having a "composite theoretical performance" ("CTP") exceeding 8.5 million theoretical operations per second (Mtops);

g. Graphics accelerators or graphics coprocessors, not controlled by 4A003, that exceeds a "3-D vector rate" of 400,000 or, if supported by 2-D vectors only, a "2-D 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".

**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

<i>Control(s)</i>	<i>Country Chart</i>	<i>Control(s)</i>	<i>Country Chart</i>
AT applies to entire entry	AT Column 1	MT applies to "software" for equipment controlled by 4A001 to 4A003 for MT reasons.	MT 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

<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**

**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 4D993 or 4D994).**

**License Requirements**

*Reason for Control:* NS, MT, CC, AT, NP, XP

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to "software" for equipment controlled by 4A001 to 4A004, 4D001 to 4D003.	NS Column 1

CC applies to "software" for equipment controlled by 4A003 for CC reasons.

AT applies to entire entry AT Column 1

NP applies to "software" for computers with a CTP greater than 2,000 Mtops, 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 2,000 Mtops, unless a License Exception is available. See § 742.3(b) of the EAR for information on applicable licensing review policies.

**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 and for "software" for equipment or "software" requiring a license and *except* for "software" specially designed for the "development", or "production" of equipment controlled as follows, for exports and reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom: (a) "Digital" computers controlled by 4A003.b and having a CTP exceeding 10,000 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 10,000 MTOPS.

**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.

**4D002 "Software" specially designed or modified to support "technology" controlled by 4E (except 4E980, 4E992, and 4E993).**

**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 1
MT applies to "software" for equipment controlled by 4E for MT reasons.	MT Column 1
AT applies to entire entry	AT Column 1

NP applies to "software" for computers with a CTP greater than 2,000 Mtops, 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 2,000 Mtops, unless

a License Exception is available. See § 742.3(b) of the EAR for information on applicable licensing review policies.

**License Exceptions**

CIV: N/A

TSR: Yes, except N/A for MT and 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

<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 Exception.

**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. "Expert systems" or "software" for "expert system" inference engines providing both:

- b.1. Time dependent rules; and
- b.2. Primitives to handle the time characteristics of the rules and the facts;
- c. "Software" having characteristics or performing functions exceeding the limits in Category 5, Part 2 ("Information Security");
- d. Operating systems specially designed for "real time processing" equipment that guarantees a "global interrupt latency time" of less than 20 µs.

**4D102 "Software" specially designed or modified for the "development", "production" or "use" of equipment controlled by 4A101.**

**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.

**4D980 "Software" specially designed 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: \$ value

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: N/A

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" not controlled by 4D003 that are specially designed for "real time processing" equipment that guarantees a "global interrupt latency time" of less than 30 microseconds.

**4D994 "Software" specially designed or modified for the "development", "production", or "use" of equipment controlled by 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

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 or 4D (except 4A980, 4A993 or 4A994).**

**License Requirements**

Reason for Control: NS, MT, CC, AT, NP, XP

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to "technology" for equipment controlled by 4A001 to 4A004, 4D001 to 4D003.	NS Column 1
MT applies to "technology" for items controlled by 4A001 to 4A003, 4A101, 4D001, 4D102 or 4D002 for MT reasons.	MT Column 1
CC applies to "technology" for equipment controlled by 4A003 for CC reasons.	CC Column 1
AT applies to entire entry	AT Column 1

NP applies to "technology" for computers with a CTP greater than 2,000 Mtops, 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 2,000 Mtops, unless a License Exception is available. See § 742.3(b) of the EAR for information on applicable licensing review policies.

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

**License Exceptions**

CIV: N/A

TSR: Yes for "technology" directly related for hardware under a License Exception. N/A for MT and for "technology" for the "development" or "production" of equipment or "software" for export and reexport to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "technology" for: (a) "Digital" computers controlled by 4A003.b and having a CTP exceeding 10,000 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 10,000 MTOPS.

**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.

**4E980 "Technology" 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  
AT applies to entire entry

CC Column 1  
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" 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

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: 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

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. "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.**

**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*

	Effective calculating Rate, R
XP only ..... (R <sub>xp</sub> ) .....	1÷3 * (t <sub>xp add</sub> ), if no add is implemented use: 1÷ (t <sub>xp mult</sub> ) If neither add nor multiply is implemented use the fastest available arithmetic operation as follows: 1÷3 * t <sub>xp</sub> . See Notes X & Z.
FP only (R <sub>fp</sub> ) ..... Both FP and XP (R) .....	max 1÷t <sub>fp add</sub> , 1÷t <sub>fp mult</sub> . See Notes X & Y. Calculate both R <sub>xp</sub> , R <sub>fp</sub> .
For simple logic processors not implementing any of the specified arithmetic operations.	1÷3 * t <sub>log</sub> . Where t <sub>log</sub> is the execute time of the XOR, or for logic hardware not implementing the XOR, the fastest simple logic operation. See Notes X & Z.
For special logic processors not using any of the specified arithmetic or logic operations.	R = R' * WL/64. Where R' is the number of results per second, WL is the number of bits upon which the logic operation occurs, and 64 is a factor to normalize to a 64 bit operation.

**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:

$$t = \frac{\text{cycle time}}{\text{the number of identical operations per machine cycle}}$$

"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:

$$R_{fp} = \frac{1}{t_{fpdivide}}$$

If the "CE" implements FP reciprocal but not FP add, FP multiply or FP divide, then

$$R_{fp} = \frac{1}{t_{fpreciprocal}}$$

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:  
 TP = 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 exponent 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<sub>xp</sub>);
- Each FP-only "CE" (R<sub>fp</sub>);
- 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<sub>fp</sub>, TP<sub>xp</sub>))

"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.d.

"CTP" = TP<sub>1</sub> + C<sub>2</sub> \* TP<sub>2</sub> + \* \* \* + C<sub>n</sub> \* TP<sub>n</sub>, 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<sub>2</sub> = C<sub>3</sub> = C<sub>4</sub> = \* \* \* = C<sub>n</sub> = 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>:

$$C_i = \frac{0.75}{\sqrt{m}} \quad (i = 2, \dots, n)$$

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 memory 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:

$$C_i = 0.75 * k_i \quad (i=2, * * *, 32) \text{ (see Note below)}$$

$$= 0.60 * k_i \quad (i=33, * * *, 64)$$

$$= 0.45 * k_i \quad (i=65, * * *, 256)$$

$$= 0.30 * k_i \quad (i > 256)$$

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>r</sub>, 1), and

K<sub>r</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.:

$$TP_1 \geq TP_2 \geq * * * > TP_n, \text{ and}$$

in the case of TP<sub>i</sub> = TP<sub>i+1</sub>, from the largest to smallest; i.e.:

$$C_i \geq C_{i+1}$$

**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, materials and "software" thereof which are specially designed for telecommunications equipment or systems is determined in Category 5, Part 1.

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

*Control(s)* Country Chart

NS applies to 5A001.a ..... NS Column 1  
 NS applies to 5A001.b, .c, NS Column 2  
 .d, or .e.

Control(s)	Country Chart		
AT applies to entire entry	AT Column 1	<p>integrated and operated in any satellite system for civil use.</p> <p>b.2. Being underwater communications systems having any of the following characteristics:</p> <p>b.2.a. An acoustic carrier frequency outside the range from 20 kHz to 60 kHz;</p> <p>b.2.b. Using an electromagnetic carrier frequency below 30 kHz; or</p> <p>b.2.c. Using electronic beam steering techniques;</p> <p>b.3. Being equipment containing any of the following:</p> <p>b.3.a. "Network access controllers" and their related common medium having a "digital transfer rate" exceeding 156 Mbit/s; or</p> <p>b.3.b. "Communication channel controllers" with a digital output having a "data signalling rate" exceeding 2.1 Mbit/s per channel;</p> <p><b>Note:</b> 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 5A001.b.3.</p> <p>b.4. Employing a "laser" and having any of the following characteristics:</p> <p>b.4.a. A transmission wavelength exceeding 1,000 nm; or</p> <p>b.4.b. Employing analog techniques and having a bandwidth exceeding 45 MHz;</p> <p><b>Note:</b> 5A001.b.4.b does not control commercial TV systems.</p> <p>b.4.c. Employing coherent optical transmission or coherent optical detection techniques (also called optical heterodyne or homodyne techniques);</p> <p>b.4.d. Employing wavelength division multiplexing techniques; or</p> <p>b.4.e. Performing "optical amplification";</p> <p>b.5. Being radio equipment operating at input or output frequencies exceeding 31 GHz;</p> <p><b>Note:</b> 5A001.b.5 does not control equipment designed or modified for operation in any ITU allocated band.</p> <p>b.6. Being radio equipment employing any of the following:</p> <p>b.6.a. Quadrature-amplitude-modulation (QAM) techniques above level 4 if the "total digital transfer rate" exceeds 8.5 Mbit/s;</p> <p>b. QAM techniques above level 16 if the "total digital transfer rate" is equal to or less than 8.5 Mbit/s; or</p> <p>c. Other digital modulation techniques and having a "spectral efficiency" exceeding 3 bit/sec/Hz;</p> <p><b>Notes:</b> 1. 5A001.b.6 does not control equipment specially designed to be integrated and operated in any satellite system for civil use.02</p> <p>2. 5A001.b.6 does not control radio relay equipment for operation in an ITU allocated band:</p> <p>a. Having any of the following:</p> <p>a.1. Not exceeding 960 MHz; or</p> <p>a.2. With a "total digital transfer rate" not exceeding 8.5 Mbit/s; and</p> <p>b. Having a "spectral efficiency" not exceeding 4 bit/sec/Hz.</p> <p>b.7. Being radio equipment operating in the 1.5 MHz to 87.5 MHz band and having any of the following characteristics:</p>	<p>b.7.a. Incorporating adaptive techniques providing more than 15 dB suppression of an interfering signal; or</p> <p>b.7.b. Having all of the following:</p> <p>b.7.b.1. Automatically predicting and selecting frequencies and "total digital transfer rates" per channel to optimize the transmission; and</p> <p>b.7.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 1.5 MHz to 30 MHz frequency range or 250 W or more in the 30 MHz to 87.5 MHz frequency range, over an "instantaneous bandwidth" of one octave or more and with an output harmonic and distortion content of better than -80 dB;</p> <p>b.8. Being radio equipment employing "spread spectrum" or "frequency agility" (frequency hopping) techniques having any of the following characteristics:</p> <p>b.8.a. User programmable spreading codes; or</p> <p>b.8.b. A total transmitted bandwidth which is 100 or more times the bandwidth of any one information channel and in excess of 50 kHz;</p> <p><b>Note:</b> 5A001.b.8.b does not control cellular radio equipment operating in civil bands.</p> <p><b>Note:</b> 5A001.b.8 does not control equipment operating at an output power of 1.0 Watt or less.</p> <p>b.9. Being digitally controlled radio receivers having all of the following:</p> <p>b.9.a. More than 1,000 channels;</p> <p>b.9.b. A "frequency switching time" of less than 1 ms;</p> <p>b.9.c. Automatic searching or scanning of a part of the electromagnetic spectrum; and</p> <p>b.9.d. Identification of the received signals or the type of transmitter; or</p> <p><b>Note:</b> 5A001.b.9 does not control cellular radio equipment operating in civil bands.</p> <p>b.10. Employing functions of digital "signal processing" to provide voice coding at rates of less than 2,400 bit/s.</p> <p>c. "Stored program controlled" switching equipment and related signalling systems, having any of the following characteristics, functions or features, and specially designed components and accessories therefor:</p> <p><b>Note:</b> Statistical multiplexers with digital input and digital output which provide switching are treated as "stored program controlled" switches.</p> <p>c.1. "Common channel signalling" operating in either non-associated or quasi-associated mode of operation;</p> <p>c.2. "Dynamic adaptive routing";</p> <p><b>Note:</b> 5A001.c.2 does not control packet switches or routers with ports or lines not exceeding the limits in 5A001.c.3.</p> <p>c.3. Being packet switches, circuit switches and routers with ports or lines exceeding any of the following:</p> <p>c.3.a. A "data signalling rate" of 2.1 Mbit/s per channel for a "communications channel controller"; or</p> <p><b>Note:</b> 5A001.c.3.a does not control multiplexed composite links composed only of communication channels not individually controlled by 5A001.c.3.a.</p>
<p><b>License Requirement Notes:</b> See § 743.1 of the EAR for reporting requirements for exports under License Exceptions.</p> <p><b>License Exceptions</b></p> <p>LVS: N/A for 5A001.a and b.9;</p> <p>\$5000 for 5A001.b.1 to b.8 and b.10, .c, and .e</p> <p>\$3000 for 5A001.d</p> <p>GBS: Yes, except 5A001.a and b.9</p> <p>CIV: Yes, except 5A001.a, b.8, and b.9</p>			
<p><b>List of Items Controlled</b></p>			
<p><i>Unit:</i> Equipment in number; parts and accessories in \$ value</p>			
<p><i>Related Controls:</i> See also 5A101 and 5A991</p>			
<p><i>Related Definitions:</i> N/A</p>			
<p><i>Items:</i> a. Any type of telecommunications equipment having any of the following characteristics, functions or features:</p>			
<p>a.1. Specially designed to withstand transitory electronic effects or electromagnetic pulse effects, both arising from a nuclear explosion;</p>			
<p>a.2. Specially hardened to withstand gamma, neutron or ion radiation; or</p>			
<p>a.3. Specially designed to operate outside the temperature range from 218 K (-55°C) to 397 K (124°C).</p>			
<p><b>Note:</b> 5A001.a.3 applies only to electronic equipment.</p>			
<p><b>Note:</b> 5A001.a.2 and 5A001.a.3 do not apply to equipment on board satellites.</p>			
<p>b. Telecommunication transmission equipment and systems, and specially designed components and accessories therefor, having any of the following characteristics, functions or features:</p>			
<p><b>Note:</b> Telecommunication transmission equipment:</p>			
<p>a. Categorized as follows, or combinations thereof:</p>			
<p>1. Radio equipment (e.g., transmitters, receivers and transceivers);</p>			
<p>2. Line terminating equipment;</p>			
<p>3. Intermediate amplifier equipment;</p>			
<p>4. Repeater equipment;</p>			
<p>5. Regenerator equipment;</p>			
<p>6. Translation encoders (transcoders);</p>			
<p>7. Multiplex equipment (statistical multiplex included);</p>			
<p>8. Modulators/demodulators (modems);</p>			
<p>9. Transmultiplex equipment (see CCITT Rec. G701);</p>			
<p>10. "Stored program controlled" digital crossconnection equipment;</p>			
<p>11. "Gateways" and bridges;</p>			
<p>12. "Media access units"; and</p>			
<p>b. Designed for use in single or multi-channel communication via any of the following:</p>			
<p>1. Wire (line);</p>			
<p>2. Coaxial cable;</p>			
<p>3. Optical fiber cable;</p>			
<p>4. Electromagnetic radiation; or</p>			
<p>5. Underwater acoustic wave propagation.</p>			
<p>b.1. Employing digital techniques,</p>			
<p>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;</p>			
<p><b>Note:</b> 5A001.b.1 does not control equipment specially designed to be</p>			

c.3.b. A "digital transfer rate" of 156 Mbit/s for a "network access controller" and related common medium;

c.4. "Optical switching";

c.5. Employing "Asynchronous Transfer Mode" ("ATM") techniques.

d. Optical fiber communication cables, optical fibers and accessories, as follows:

d.1. Optical fibers and optical fiber cables of more than 50 m in length having any of the following characteristics:

d.1.a. Designed for single mode operation; or

d.1.b. For optical fibers, 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%.

N.B.: Equivalent national standards may be used for executing the proof test.

d.2. Optical fiber cables and accessories designed for underwater use.

**Note:** 5A001.d.2 does not control standard civil telecommunication cables and accessories.

N.B.: For fiber-optic hull penetrators or connectors, see 8A002.c.

e. "Electronically steerable phased array antennae" operating above 31 GHz.

**Note:** 5A001.e 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 usable for "missiles".**

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

**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:* N/A

*Related Definitions:* N/A

*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. Transmission equipment, as follows:

b.1. Modems using the "bandwidth of one voice channel" with a "data signalling rate" exceeding 9,600 bits per second;

b.2. "Communication channel controllers" with a digital output having a "data signalling rate" exceeding 64,000 bit/s per channel; or

b.3. "Network access controller" and their related common medium having a "digital transfer rate" exceeding 33 Mbit/s.

b.4. Being "stored program controlled" digital cross connect equipment with "digital transfer rate" exceeding 8.5 Mbit/s per port.

b.5. Radio equipment operating at input or output frequencies exceeding:

b.5.1. 31 GHz for satellite-earth station applications; or

b.5.2. 26.5 GHz for other applications;

**Note:** 5A991.b.5. 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.6. Providing functions of digital "signal processing" as follows:

b.6.a. Voice coding at rates less than 2,400 bit/s;

b.6.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 signalling systems as follows:

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 signalling channel (e.g., 2B+D); or

c.2.b. The capability that a signalling 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.b. 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 crossconnect equipment with "digital transfer rate" exceeding 8.5 Mbit/s per port.

c.8. Being packet switches, circuit switches and routers with ports or lines exceeding any of the following:

c.8.a. A "data signalling rate" of 64,000 bit/s per channel for a "communications channel controller"; or

**Note:** 5A991.c.8.a. does not control multiplex composite links composed only of communication channels not individually controlled by 5A001.b.1.

c.8.b. A "digital transfer rate" of 33 Mbit/s for a "network cess controller" and related common media;

d. Centralized network control having all of the following characteristics:

d.1. Receives data from the nodes; and  
d.2. Process these data in order to provide control of traffic not requiring operator decisions, and thereby performing "dynamic adaptive routing";

**Note:** 5A991.d. does not preclude control of traffic as a function of predictable statistical traffic conditions.

e. 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)).

f. Mobile communications equipment, n.e.s., and assemblies and components therefor; or

g. Radio relay communications equipment designed for use at frequencies equal to or exceeding 19.7 GHz and assemblies and components therefor, n.e.s.

B. Test, Inspection and Production Equipment

**5B001 Equipment and specially designed components or accessories therefor, specially designed for the "development", "production" or "use" of equipment, materials, functions or features controlled by 5A001, 5B001, 5C001, 5D001 or 5E001.**

**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

GBS: Yes

CIV: Yes

**List of Items Controlled**

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

Related Controls: See also 5B991. This entry does not control optical fibers and "optical fiber preform" characterization equipment not using semiconductor "lasers".

Related Definition: N/A

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

**5B991 Telecommunications test equipment, n.e.s.**

**License Requirements**

Reason for Control: AT

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

**License Exceptions**

LVS: \$1,000 for Syria; N/A to Iran

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**

**5C001 Preforms of glass or of any other material optimized for the manufacture of optical fibers controlled by 5A001.d.**

**License Requirements**

Reason for Control: NS, AT

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

**Control(s)**

**Country Chart**

AT applies to entire entry AT Column 1

**License Exceptions**

LVS: \$3000

GBS: Yes

CIV: 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.

**D. Software**

**5D001 "Software", as described in the List of Items Controlled.**

**License Requirements**

Reason for Control: NS, AT

Control(s)	Country Chart
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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.b or .c, when specially designed or modified for equipment, functions or features controlled by 5A001.b.9

TSR: Yes, except for exports and reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, 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.9

**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, 5B001 or 5C001.

b. "Software" specially designed or modified to support "technology" controlled by 5E001.

c. Specific "software" as follows:

c.1. "Software", other than in machine-executable form, specially designed or modified for the "use" of digital cellular radio equipment or systems;

c.2. "Software" specially designed or modified to provide characteristics, functions or features of equipment controlled by 5A001 or 5B001;

c.3. "Software" which provides the capability of recovering "source code" of telecommunications "software" controlled by 5A001, 5B001, or 5C001;

c.4. "Software", other than in machine-executable form, specially designed for "dynamic adaptive routing".

N.B.: For "software" for "signal processing" see also 4D and 6D.

**5D101 "Software" designed or modified for the "development", "production" or "use of items controlled by 5A101.**

**License Requirements**

Reason for Control: MT, AT

Control(s)	Country Chart
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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.

**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
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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**

**5E001 "Technology", (see List of Items Controlled).**

**License Requirements**

Reason for Control: NS, AT

Control(s)	Country Chart
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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, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "technology" controlled by 5E001.a for the "development" or "production" of items controlled by 5A001.b.9 or 5D001.a.

**List of Items Controlled**

Unit: \$ value

Related Controls: 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, materials or "software" controlled by 5A001, 5B001, 5C001 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 processing and application of coatings to optical fiber specially designed to make it suitable for underwater use;
  - b.4. "Technology" for the "development" of equipment employing "Synchronous Digital Hierarchy" ("SDH") or "Synchronous Optical Network" ("SONET") techniques;
  - b.5. "Technology" for the "development" of "switch fabric" exceeding 64,000 bit/s per information channel other than for digital cross connect integrated in the switch;
  - b.6. "Technology" for the "development" of centralized network control or "dynamic adaptive routing";
  - b.7. "Technology" for the "development" of digital cellular radio systems;
  - b.8. "Technology" for the "development" of broadband "Integrated Services Digital Network" ("ISDN");
  - b.9. "Technology" for the "development" of QAM techniques, for radio equipment, above level 4;
  - b.10. "Technology" for the "development" of "spread spectrum" or "frequency agility" (frequency hopping) techniques.

**5E101 "Technology" according to the General Technology Note for the "development", "production" or "use" of equipment 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.

**5E111 "Technology" according to the General Technology Note for the "development", "production", or "use" of "software" controlled by 5D101.**

**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: 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.**

**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.

**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.**

**Part 2—"Information Security"**

**Note:** 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.

**A. Systems, Equipment and Components**

**5A002 Systems, equipment, application specific "assemblies", modules or integrated circuits for "information security", and specially designed components therefor.**

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

**License Exceptions**  
LVS: N/A  
GBS: N/A  
CIV: N/A

**List of Items Controlled**  
Unit: \$ value

**Related Controls:** See also 5A992. This entry does not control: (a) "Personalized smart cards" or specially designed components therefor, with any of the following characteristics: (1) Not capable of message traffic encryption or encryption of user-supplied data or related key management functions therefor; or (2) When restricted for use in equipment or systems excluded from control under the note to 5A002.c, or under paragraphs b through h of this note. (b) Equipment containing "fixed" data compression or coding techniques; (c) Receiving equipment for radio broadcast, pay television or similar restricted audience television of the consumer type, without digital encryption and where digital decryption is limited to the video, audio or management functions; (d) Portable or mobile radiotelephones for civil use (e.g., for use with commercial civil cellular radiocommunications systems) that are not capable of end-to-end encryption; (e) Decryption functions specially designed to allow the execution of copy-protected "software", provided the decryption functions are not user-accessible; (f) Access control equipment, such as automatic teller machines, self-service statement printers or point of sale terminals, that protects password or personal identification numbers (PIN) or similar data to prevent unauthorized access to facilities but does not allow for encryption of files or text, except as directly related to the password or PIN protection; (g) Data authentication equipment that calculates a Message Authentication Code (MAC) or similar result to ensure no alteration of text has taken place, or to authenticate users, but does not allow for encryption of data, text or other media other than that needed for the authentication; (h) Cryptographic equipment specially designed and limited for use in machines for banking or money transactions, such as automatic teller machines, self-service statement printers or point of sale terminals.

**Related Definitions:** For the control of global navigation satellite systems receiving equipment containing or employing decryption (i.e., GPS or GLONASS see 7A005)

**Items:** a. Systems, equipment, application specific "assemblies", modules or integrated circuits for "information security", and specially designed components therefor:  
a.1. Designed or modified to use "cryptography" employing digital techniques to ensure "information security";  
a.2. Designed or modified to perform cryptoanalytic functions;  
a.3. Designed or modified to use "cryptography" employing analog techniques to ensure "information security";

**Note:** 5A002.a.3 does not control the following:

1. Equipment using "fixed" band scrambling not exceeding 8 bands and in which the transpositions change not more frequently than once every second;
2. Equipment using "fixed" band scrambling exceeding 8 bands and in which the transpositions change not more frequently than once every ten seconds;

3. Equipment using "fixed" frequency inversion and in which the transpositions change not more frequently than once every second;

4. Facsimile equipment;  
5. Restricted audience broadcast equipment; and

6. Civil television equipment;  
a.4. Designed or modified to suppress the compromising emanations of information-bearing signals;

**Note:** 5A002.a.4 does not control equipment specially designed to suppress emanations for reasons of health and safety.

a.5. Designed or modified to use cryptographic techniques to generate the spreading code for "spread spectrum" or the hopping code for "frequency agility" systems;

a.6. 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.7. Communications cable systems designed or modified using mechanical, electrical or electronic means to detect surreptitious intrusion.

**5A992 "Information security" equipment, n.e.s.; (e.g., cryptographic, cryptoanalytic, and cryptologic equipment, n.e.s.), and 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:* \$ 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**

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

**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

<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 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 the export licensing purposes encryption software is treated under the EAR in the same manner as a commodity included in ECCN 5A002. License Exceptions for commodities are not applicable.

**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, and it is not eligible for the General Software Note ("mass market" treatment under License Exception TSU for mass market software). After a one-time BXA review, certain encryption software may be released from EI controls and made eligible for the General Software Note treatment as well as other provisions of the EAR applicable to software. Refer to § 742.15(b)(1) of the EAR and Supplement No. 6 to part 742 of the EAR.

**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:* See also 5D992. This entry does not control "software" "required" for the "use" of equipment excluded from control under 5A002 or "software" providing any of the functions of equipment excluded from control under 5A002  
*Related Definitions:* N/A

*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 "Software" not controlled by 5D002.**

**License Requirements**  
*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
AT applies to 5D992.a and .b.	AT Column 1
AT applies to 5D992.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:* a. "Software", specially designed or modified for the "development", "production", or "use" of information security or cryptologic equipment (e.g., equipment controlled by 5A992)  
b. "Software" having the characteristics, or performing or simulating the functions of the equipment controlled by 5A992.  
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

<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 the EAR

**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:* See also 5E992

*Related Definitions:* N/A

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

**5E992 "Technology", n.e.s., for the "development", "production", or "use" of "information security" or cryptologic equipment (e.g., equipment controlled by 5A992), or "software" controlled by 5D992.**

**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
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**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 6—Sensors and Lasers*

**A. Systems, Equipment and Components**

**6A001 Acoustics.**

**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
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AT applies to entire entry	AT Column 1
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**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.2.a.1, a.2.a.2, a.2.a.7, a.2.b; processing equipment controlled by 6A002.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 6A002.a.2.e.3 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 224 Db (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;

**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. Designed to withstand pressure during normal operation at depths exceeding 1,000 m; or

a.1.c.4. 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 having any of the following:

**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.1.d.1. 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; or

a.1.d.2. Designed to withstand pressure at depths exceeding 1,000 m;

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 (transducers) having any of the following characteristics:

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;

a.2.a.2.b. Piezoelectric polymers; or

a.2.a.2.c. Flexible piezoelectric ceramic materials;

a.2.a.3. A hydrophone sensitivity better than  $-180 \text{ Db}$  at any depth with no acceleration compensation;

a.2.a.4. When designed to operate at depths not exceeding 35 m, a hydrophone sensitivity better than  $-186 \text{ Db}$  with acceleration compensation;

a.2.a.5. When designed for normal operation at depths exceeding 35 m, a hydrophone sensitivity better than  $-192 \text{ Db}$  with acceleration compensation;

a.2.a.6. When designed for normal operation at depths exceeding 100 m, a hydrophone sensitivity better than  $-204 \text{ Db}$ ; or

a.2.a.7. 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  $1 \mu\text{Pa}$ . For example, a hydrophone of  $-160 \text{ Db}$  (reference 1 V per  $\mu\text{Pa}$ ) would yield an output voltage of  $10^{-8}$  V in such a field, while one of  $-180 \text{ Db}$  sensitivity would yield only  $10^{-9}$  V output. Thus,  $-160 \text{ Db}$  is better than  $-180 \text{ Db}$ .

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. Hydrophone group spacing of 12.5 m to less than 25 m and designed or able to be modified to operate at depths exceeding 35 m;

**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. Hydrophone group spacing of 25 m or more and designed to operate at depths exceeding 100 m;

a.2.b.4. Heading sensors controlled by 6A001.a.2.d;

a.2.b.5. Longitudinally reinforced array hoses;

a.2.b.6. An assembled array of less than 40 mm in diameter;

a.2.b.7. 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.8. 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. Any of the following:

a.2.d.2.a. Designed to be incorporated within the array hosing and 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.d.2.b. Designed to be mounted external to the array hosing and having a sensor unit capable of operating with 360° roll 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;

a.2.e.2. Incorporating 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.e.3. 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

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry	NS Column 2
MT applies to optical detectors in 6A002.a.1, a.3, and .e that are specially designed or rated as electromagnetic (including "lasers") and ionized particle radiation resistant.	MT Column 1
RS applies to 6A002.a.1, a.2, a.3 and .c.	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:* Parts and accessories in \$ value

*Related Controls:* See also 6A102, 6A202, and 6A992

*Related Definitions:* (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 are subject to the export licensing authority of U.S. Department of State, Office of Defense Trade Controls (22 CFR part 121). (2) "Space qualified" "monospectral imaging sensors", and "multispectral imaging sensors" defined in 6A002.b, and "space-qualified" "focal plane arrays" defined in 6A002.e, specially designed or modified for items on the U.S. Munitions List are subject to the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121)

*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 15  $\mu$ m or less; and

a.2.a.3. Photocathodes, as follows:

a.2.a.3.a. S-20, S-25 or multialkali photocathodes with a luminous sensitivity exceeding 240  $\mu$ 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 control 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 15  $\mu$ 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 Note:** Linear or two-dimensional multi-element detector arrays are referred to as "focal plane arrays".

**Notes:** 1. 6A002.a.3 includes photoconductive arrays and photovoltaic arrays.

2. 6A002.a.3 does not control silicon "focal plane arrays", multi-element (not to exceed 16 elements) encapsulated photoconductive cells or pyroelectric detectors using any of the following:

a. Lead sulphide;

b. Triglycine sulphate and variants;

c. Lead-lanthanum-zirconium titanate and variants;

d. Lithium tantalate;

e. Polyvinylidene fluoride and variants;

f. Strontium barium niobate and variants;

or

g. Lead selenide.

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" "focal plane arrays", having individual elements with a peak response in the wavelength range exceeding 1,200 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 μr (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 mr (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

<i>Control(s)</i>	<i>Country Chart</i>
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.5, 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:* See also 6A203. See 8A002.d and .e for cameras specially designed or modified for underwater use.

*Related Definitions:* N/A

*Items:* a. Instrumentation cameras, as follows:

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 for normal 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/μs;

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 μs per full frame; and

a.5.b. A read out time allowing a framing rate of more than 125 full frames per second.

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 any of the following:

b.1.a. More than 4 × 10<sup>6</sup> "active pixels" per solid state array for monochrome (black and white) cameras;

b.1.b. More than 4 × 10<sup>6</sup> "active pixels" per solid state array for color cameras incorporating three solid state arrays; or

b.1.c. More than 12 × 10<sup>6</sup> "active pixels" for solid state array color cameras incorporating one solid state array;

b.2. Scanning cameras and scanning camera systems, having all of the following:

b.2.a. Linear detector arrays with more than 8,192 elements per array; and  
 b.2.b. Mechanical scanning in one direction;

b.3. Imaging cameras incorporating image intensifiers 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.

**6A004 Optics.**

**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

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:* 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  $\mu$ r (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  $\mu$ r (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 r (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 r (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.

#### 6A005 "Lasers", 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 6A005.a.1.c, a.2.a (with an output power > 40W), a.4.c, a.6, (argon ion lasers only), c.1.b (with an output power > 30W), c.2.c.2.a (with an output power > 40W), c.2.c.2.b (with an output power > 40W), c.2.d.2.b (with an output power > 40W), and d.2.c.	NP Column 1
AT applies to entire entry	AT Column 1

##### 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.g.1.

CIV: 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.g.1.

##### List of Items Controlled

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

Related Controls: See also 6A205, 6A995, 0B001.g.5 and 0B001.b.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 or CW 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 or CW 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 or CW 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 or CW output power exceeding 30 W;

a.2. Metal vapor "lasers", as follows:

a.2.a. Copper (Cu) "lasers" having an average or CW output power exceeding 20 W;

a.2.b. Gold (Au) "lasers" having an average or CW 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 or CW 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  $\mu$ s 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  $\mu$ s; 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. Gas discharge and ion "lasers" (i.e., 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. Individual, multiple-transverse mode semiconductor "lasers" and arrays of individual semiconductor "lasers", having any of the following:

b.1. An output energy exceeding 500  $\mu$ J per pulse and a pulsed "peak power" exceeding 10 W; or

b.2. 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.d.

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:

(For shared aperture optical elements, capable of operating in "Super-High Power Laser" ("SHPL") applications, see the U.S. Munitions List.)

f.1. Dynamic wavefront (phase) measuring equipment capable of mapping at least 50 positions on a beam wavefront having any of 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

<i>Control(s)</i>	<i>Country Chart</i>
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 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 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 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 2
MT applies to items that are designed for airborne applications and that are usable in systems controlled 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**

LVS: \$5000; N/A for MT and 6A008.l.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:* See also 6A108 and 6A998.

This entry does not control: (1) Secondary surveillance radar (SSR); (2) Car radar designed for collision prevention; (3) Displays or monitors used for Air Traffic Control (ATC) having no more than 12 resolvable elements per mm; (4) Meteorological (weather) radar.

*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 enroute 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 enroute 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 μr (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 used 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

*Control(s)* *Country Chart*

NS applies to entire entry NS Column 1  
AT applies to entire entry AT Column 1

**License Exceptions**

LVS: \$500  
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, for use in 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 that meet or exceed a total irradiation dose of 5 x 10<sup>5</sup> rads (Si).**

**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.

**6A107 Gravity meters (gravimeters), gravity gradiometers, and specially designed components therefore, other than those controlled by 6A007.b and .c, designed or modified for airborne or marine use, having a static or operational accuracy of 7 x 10<sup>-6</sup> m/sec<sup>2</sup> (0.7 milligal) or better, and a time to steady-state registration of two minutes or less.**

**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:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

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

**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";

b. Precision tracking systems, usable for "missiles", as follows:

b.1. Tracking systems that use a code translator 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 with a photocathode area of greater than 20 cm<sup>2</sup> having an anode pulse rise time of less than 1 ns.**

**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:* N/A  
*Related Definitions:* N/A  
*Items:* The list of items controlled is contained in the ECCN heading.

**6A203 Cameras and components, other than those controlled by 6A003, 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 and components in number; parts and accessories in \$ value  
*Related Controls:* N/A  
*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; or  
a.2. Streak cameras with writing speeds greater than 0.5 mm per microsecond;  
**Note:** Components of such cameras include their synchronizing electronic units and rotor assemblies consisting of turbines, mirrors and bearings.

b. Electronic streak and framing cameras and tubes, as follows:  
b.1. Electronic streak cameras capable of 50 ns or less time resolution and streak tubes therefor;  
b.2. Electronic (or electronically shuttered) framing cameras capable of 50 ns or less frame exposure time;  
b.3. Framing tubes and solid-state imaging devices for use with cameras controlled by 6A203.b.2, as follows:  
b.3.a. Proximity focused image intensifier tubes having the photocathode deposited on a transparent conductive coating to decrease photocathode sheet resistance;  
b.3.b. Gate 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.3.c. Kerr or pocket cell electro-optical shuttering; or

b.3.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.2;

c. Radiation-hardened TV cameras, or lenses therefor, specially designed or rated as radiation hardened to withstand greater than  $50 \times 10^3$  grays (Silicon) ( $5 \times 10^6$  rad (Silicon)) without operational degradation.

**6A205 "Lasers", other than those controlled 6A005, 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 also 0B001.g.5 and 0B001.h.6  
*Related Definitions:* N/A  
*Items:* a. Argon ion "lasers" with greater than 40 W average output power operating at wavelengths between 400 nm and 515 nm;  
b. Tunable pulsed single-mode dye oscillators capable of an average power output of greater than 1 W, a repetition rate greater than 1 kHz, a pulse less than 100 ns, and a wavelength between 300 nm and 800 nm;  
c. Tunable pulsed dye laser amplifiers and oscillators, with an average power output of greater than 30 W, a repetition rate greater than 1 kHz, a pulse width less than 100 ns, and a wavelength between 300 nm and 800 nm, except single mode oscillators;  
d. Pulsed carbon dioxide "lasers" with a repetition rate greater than 250 Hz, an average power output of greater than 500 W, and a pulse of less than 200 ns operating at wavelengths between 9,000 nm and 11,000 nm;  
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:  
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 in excess of 1 km/s during time intervals of less than 10 microsecond (VISARs, Doppler laser interferometers (DLIs), etc.).**

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

**6A994 Optics, not controlled by 6A004.**

**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: 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>
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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: 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;
      - c.2.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 Airborne radar equipment, n.e.s., and specially designed components 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: N/A

Related Definitions: N/A

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

**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>
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NS applies to entire entry NS Column 2

<i>Control(s)</i>	<i>Country Chart</i>	<i>Reason for Control: MT, AT</i>	<i>Control(s)</i>	<i>Country Chart</i>	<b>6C004 Optical materials, as follows (see List of Items Controlled).</b>
AT applies to entire entry	AT Column 1				<b>License Requirements</b> <i>Reason for Control:</i> NS, AT
<b>License Exceptions</b> LVS: \$5000 GBS: Yes for 6B004.b CIV: Yes for 6B004.b		MT applies to entire entry AT applies to entire entry	MT Column 1 AT Column 1		<i>Control(s)</i> <i>Country Chart</i>
<b>List of Items Controlled</b> <i>Unit:</i> Number <i>Related Controls:</i> This entry does not control microscopes. <i>Related Definitions:</i> N/A <i>Items:</i> 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.		<b>License Exceptions</b> LVS: N/A GBS: N/A CIV: N/A			NS applies to entire entry      NS Column 2 AT applies to entire entry      AT Column 1
<b>6B007 Equipment to produce, align and calibrate land-based gravity meters with a static accuracy of better than 0.1 mgal.</b>		<b>List of Items Controlled</b> <i>Unit:</i> Number <i>Related Controls:</i> N/A <i>Related Definitions:</i> N/A <i>Items:</i> The list of items controlled is contained in the ECCN heading.			<b>License Exceptions</b> LVS: \$1500 GBS: Yes for 6C004.a and .e CIV: Yes for 6C004.a and .e
<b>License Requirements</b> <i>Reason for Control:</i> NS, AT		<b>6B995 Specially designed or modified equipment, including tools, dies, fixtures or gauges, and other specially designed components and accessories therefor:</b>			<b>List of Items Controlled</b> <i>Unit:</i> \$ value <i>Related Controls:</i> See also 6C994 <i>Related Definitions:</i> N/A <i>Items:</i> 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 $10^{-6}$ 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 $5 \times 10^{-6}$ ; f. Synthetically produced diamond material with an absorption of less than $10^{-5}$ cm <sup>-1</sup> for wavelengths exceeding 200 nm but not exceeding 14,000 nm.
<i>Control(s)</i>	<i>Country Chart</i>	<i>Control(s)</i>	<i>Country Chart</i>		
NS applies to entire entry AT applies to entire entry	NS Column 2 AT Column 1	AT applies to entire entry	AT Column 1		
<b>License Exceptions</b> LVS: \$5000 GBS: N/A CIV: N/A		<b>License Requirements</b> <i>Reason for Control:</i> AT			
<b>List of Items Controlled</b> <i>Unit:</i> Number <i>Related Controls:</i> N/A <i>Related Definitions:</i> N/A <i>Items:</i> The list of items controlled is contained in the ECCN heading.		<b>License Exceptions</b> LVS: N/A GBS: N/A CIV: N/A			
<b>6B008 Pulse radar cross-section measurement systems having transmit pulse widths of 100 ns or less and specially designed components therefor.</b>		<b>List of Items Controlled</b> <i>Unit:</i> Equipment in number; parts and accessories in \$ value <i>Related Controls:</i> N/A <i>Related Definitions:</i> N/A <i>Items:</i> 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".			
<b>License Requirements</b> <i>Reason for Control:</i> NS, MT, AT		<b>C. Materials</b>			
<i>Control(s)</i>	<i>Country Chart</i>	<b>6C002 Optical sensor materials, as follows (see List of Items Controlled).</b>			
NS applies to entire entry MT applies to entire entry AT applies to entire entry	NS Column 2 MT Column 1 AT Column 1	<b>License Requirements</b> <i>Reason for Control:</i> NS, AT			
<b>License Exceptions</b> LVS: N/A GBS: N/A CIV: N/A		<i>Control(s)</i>	<i>Country Chart</i>		
<b>List of Items Controlled</b> <i>Unit:</i> Number <i>Related Controls:</i> See also 6B108 <i>Related Definitions:</i> N/A <i>Items:</i> The list of items controlled is contained in the ECCN heading.		NS applies to entire entry AT applies to entire entry	NS Column 2 AT Column 1		
<b>6B108 Systems, other than those controlled by 6B008, specially designed for radar cross section measurement usable for "missiles" and other subsystems.</b>		<b>License Exceptions</b> LVS: \$3000 GBS: N/A CIV: N/A			
<b>License Requirements</b>		<b>List of Items Controlled</b> <i>Unit:</i> Number <i>Related Controls:</i> See also 6C992 <i>Related Definitions:</i> N/A <i>Items:</i> a. Elemental tellurium (Te) of purity levels of 99.9995% or more; b. Single crystals of cadmium telluride (CdTe), cadmium zinc telluride (CdZnTe) or mercury cadmium telluride (HgCdTe) of any purity level, including epitaxial wafers thereof.			
					<b>6C005 Synthetic crystalline "laser" host material in unfinished form, as follows (see List of Items Controlled).</b>
					<b>License Requirements</b> <i>Reason for Control:</i> 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
					<b>License Exceptions</b> LVS: \$1500 GBS: N/A CIV: N/A
					<b>List of Items Controlled</b> <i>Unit:</i> Kilograms <i>Related Controls:</i> N/A <i>Related Definitions:</i> N/A <i>Items:</i> a. Titanium doped sapphire;

<p>b. Alexandrite.</p> <p><b>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).</b></p> <p><b>License Requirements</b> Reason for Control: AT</p>	<p><i>Control(s)</i></p>	<p><i>Country Chart</i></p>	<p>Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "software" for items controlled by 6D003.a.</p> <p><b>List of Items Controlled</b> <i>Unit:</i> \$ value <i>Related Controls:</i> See also 6D103 and 6D993 <i>Related Definitions:</i> N/A <i>Items:</i> 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 bottom or bay cable systems and having beamforming or "source code" for "real time processing" of acoustic data for passive reception; 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.</p> <p><b>Technical Note:</b> "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.</p> <p><b>6D102 "Software" specially designed for the "use" of goods controlled by 6A108.</b></p> <p><b>License Requirements</b> Reason for Control: MT, AT</p>
<p>AT applies to entire entry</p> <p><b>License Exceptions</b> LVS: N/A GBS: N/A CIV: N/A</p> <p><b>List of Items Controlled</b> <i>Unit:</i> Equipment in number; parts and accessories in \$ value <i>Related Controls:</i> N/A <i>Related Definitions:</i> N/A <i>Items:</i> The list of items controlled is contained in the ECCN heading.</p> <p><b>6C994 Optical materials.</b></p> <p><b>License Requirements</b> Reason for Control: AT</p>	<p><i>Control(s)</i></p>	<p><i>Country Chart</i></p>	<p>MT applies to "software" for equipment controlled by 6A008 or 6B008 for MT reasons. NP applies to "software" for equipment controlled by 6A005 for NP reasons. AT applies to entire entry</p> <p><b>License Requirement Notes:</b> See § 743.1 of the EAR for reporting requirements for exports under License Exceptions.</p> <p><b>License Exceptions</b> CIV: N/A TSR: Yes, except N/A for MT and for exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "software" for items controlled by 6A008.l.3 or 6B008.</p> <p><b>List of Items Controlled</b> <i>Unit:</i> \$ value <i>Related Controls:</i> See also 6D991 <i>Related Definitions:</i> N/A <i>Items:</i> The list of items controlled is contained in the ECCN heading.</p> <p><b>6D002 "Software" specially designed for the "use" of equipment controlled by 6A002.b, 6A008 or 6B008.</b></p> <p><b>License Requirements</b> Reason for Control: NS, MT, AT</p>
<p>AT applies to entire entry</p> <p><b>License Exceptions</b> LVS: N/A GBS: N/A CIV: N/A</p> <p><b>List of Items Controlled</b> <i>Unit:</i> Equipment in number; parts and accessories in \$ value <i>Related Controls:</i> N/A <i>Related Definitions:</i> N/A <i>Items:</i> a. Low optical absorption materials, as follows: a.1. Bulk fluoride compounds containing ingredients with a purity of 99.999% or better; or <b>Note:</b> 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.</p> <p><b>D. Software</b></p> <p><b>6D001 "Software" specially designed for the "development" or "production" of equipment controlled by 6A004, 6A005, 6A008 or 6B008.</b></p> <p><b>License Requirements</b> Reason for Control: NS, MT, NP, AT</p>	<p><i>Control(s)</i></p>	<p><i>Country Chart</i></p>	<p>NS applies to entire entry MT applies to "software" for equipment controlled by 6A008 or 6B008 for MT reasons. AT applies to entire entry</p> <p><b>License Exceptions</b> CIV: N/A TSR: Yes, except N/A for MT</p> <p><b>List of Items Controlled</b> <i>Unit:</i> \$ value <i>Related Controls:</i> See also 6D102 and 6D992 <i>Related Definitions:</i> N/A <i>Items:</i> The list of items controlled is contained in the ECCN heading.</p> <p><b>6D003 Other "software", as follows (see List of Items Controlled).</b></p> <p><b>License Requirements</b> Reason for Control: NS, AT</p>
<p>NS applies to "software" for equipment controlled by 6A004, 6A005, 6A008 or 6B008.</p>	<p><i>Control(s)</i></p>	<p><i>Country Chart</i></p>	<p>NS applies to entire entry AT applies to entire entry</p> <p><b>License Requirement Notes:</b> See § 743.1 of the EAR for reporting requirements for exports under License Exceptions.</p> <p><b>License Exceptions</b> CIV: Yes for 6D003.h.1 TSR: Yes, except for exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France,</p> <p><b>6D102 "Software" specially designed for the "use" of goods controlled by 6A108.</b></p> <p><b>License Requirements</b> Reason for Control: MT, AT</p>
<p>AT applies to entire entry</p> <p><b>License Exceptions</b> CIV: N/A TSR: N/A</p> <p><b>List of Items Controlled</b> <i>Unit:</i> \$ value</p>	<p><i>Control(s)</i></p>	<p><i>Country Chart</i></p>	<p>MT applies to entire entry AT applies to entire entry</p> <p><b>License Exceptions</b> CIV: N/A TSR: N/A</p> <p><b>List of Items Controlled</b> <i>Unit:</i> \$ value</p>

*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, obtained from the systems controlled by 6A108.b, enabling determination of vehicle position throughout its flight path.**

**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

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

**6D104 “Software” specially designed for the “use” of equipment controlled by 6A002, 6A003, 6A007, 6A102, and 6B108, for MT reasons.**

**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.

**6D991 “Software” specially designed for the “development”, “production”, or “use” of equipment controlled by 6A991, 6A996, 6A997, or 6A998.**

**License Requirements**

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country Chart</i>
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AT applies to entire entry, except “software” for equipment controlled by 6A991.	AT Column 1
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AT applies to “software” for equipment controlled by 6A991.	AT Column 2
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**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

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

<i>Control(s)</i>	<i>Country Chart</i>
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AT applies to entire entry	AT Column 1
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**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 (6C992 or 6C994) or 6D (except 6D991, 6D992, or 6D993).**

**License Requirements**

*Reason for Control:* NS, MT, NP, RS, CC, AT, UN

<i>Control(s)</i>	<i>Country Chart</i>
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NS applies to “technology” for items controlled by 6A001 to 6A008, 6B004 to 6B008, 6C002 to 6C005, or 6D001 to 6D003.	NS Column 1
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*Control(s)*

*Country Chart*

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

NP applies to “technology” for equipment controlled by 6A003, 6A005, 6A202, 6A203, 6A205, 6A225 or 6A226 for NP reasons.

NP Column 2

RS applies to “technology” for equipment controlled by 6A002 or 6A003 for RS reasons.

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 N/A for MT and for exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of “technology” for the “development” of equipment or “software” in 6A001.a.2.a.1, 6A001.a.2.a.2, 6A001.a.2.a.7, 6A001.a.2.b, 6A001.a.2.c and 6A001.a.2.e when specially designed for real time application, 6A002.a.1.c, 6A008.1.3, 6B008, 6D003.a, or 6D001 when specially designed for the “development” or “production” of equipment controlled by 6A001.a.2.a.1, 6A001.a.2.a.2, 6A001.a.2.a.7, 6A001.a.2.b, 6A001.a.2.c, and 6A001.a.2.e as set forth above.

**List of Items Controlled**

*Unit:* N/A

*Related Controls:* 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 (6C992 or 6C994).**

**License Requirements**

*Reason for Control:* NS, MT, NP, RS, AT, CC, 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 or 6A003 for RS reasons.	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 N/A for MT and for exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, or the United Kingdom of "technology" for the "development" of equipment in 6A001.a.2.a.1, 6A001.a.2.a.2, 6A001.a.2.a.7, 6A001.a.2.b, 6A001.a.2.c and 6A001.a.2.e when specially designed for real time application, 6A002.a.1.c, 6A008.1.3, or 6B008.

**List of Items Controlled**

Unit: N/A  
 Related Controls: 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

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  
**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

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: (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 rated as electromagnetic (including "laser") and ionized-particle radiation resistant. (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.

**6E102 "Technology" according to the General Technology Note for the "use" of "software" controlled by 6D001 and 6D002, for MT reasons.**

**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: 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.c.1.b, 6A005.c.2.c.2, 6A005.c.2.d.2.b, 6A202, 6A203, 6A205, 6A225 or 6A226.**

**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: N/A  
 Related Controls: N/A  
 Related Definitions: This entry only controls "technology" for items in 6A005.a.2.a with an output power >40 W, 6A005.a.6 argon "lasers" only, 6A005.c.1.b with an output power >30 W, 6A005.c.2.c.2.a with an output power >40 W, 6A005.c.2.c.2.b with an output power >40 W, and 6A005.c.2.d.2.b with an output power >40 W.

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: AT

Control(s)	Country Chart
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

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

<i>Control(s)</i>	<i>Country Chart</i>
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AT applies to entire entry	AT Column 1
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**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.: For automatic pilots for underwater vehicles, see Category 8. For radar, see Category 6.

**Note to Category 7A:** For inertial navigation equipment for ships or submersibles see item 9.e on the Wassenaar Munitions List.

**7A001** 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

<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:* See also 7A101 and 7A994.

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 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>
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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:* See also 7A102 and 7A994

*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 (gimbal or strapdown) and inertial equipment designed for "aircraft", land vehicle or "spacecraft" for attitude, guidance or control, 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>
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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:* See also 7A103 and 7A994.

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. Navigation error (free inertial) subsequent to normal alignment of 0.8 nautical mile per hour (50% Circular Error Probable (CEP)) or less (better); or

- b. Specified to function at linear acceleration levels exceeding 10 g.

**Note:** The parameters of 7A003.a 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; or
2. A roll and yaw rate of equal to or more than +2.62 radian/s (150 deg/s); or
3. According to national standards equivalent to 1. or 2. of this note.

**Note:** 7A003 does not control inertial navigation systems that are certified for use on "civil aircraft" by civil authorities of a "participating state" in Country Group A:1.

**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>
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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:* 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.)

**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>
S 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 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".

**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 Global Positioning Systems (GPS) or similar satellite receivers, other than those controlled by 7A005, and 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.)

**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>
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) Global Positioning Satellite receivers having the following characteristics are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (22 CFR part 121): (a) Designed for encryption or decryption (e.g., Y-code) of GPS precise positioning service (PPS) signal; (b) Designed for producing navigation results above 60,000 feet altitude and at 1,000 knots velocity or greater; (c) Specifically designed or modified for use with a null-steering antenna or including a null-steering antenna designed to reduce or avoid jamming signals; or (d) Designed or modified for use with unmanned air vehicle systems capable of delivering at least a 500 kg payload to a range of at least 300 km. (GPS receivers designed or modified for use with military unmanned air vehicle systems with less capability are considered to be specially designed, modified or configured for military use are controlled by 22 CFR part 121. (2) This entry controls direction finding equipment that is not subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls (22 CFR part 121).

*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>
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 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

*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:* (1) See also 7B103 and 7B994. 2.) This entry includes: inertial measurement unit tester (IMU module); IMU platform tester; IMU stable element handling fixture; IMU platform balance fixture; gyro tuning test stations; gyro dynamic balance stations; gyro run-in/motor test stations; gyro evacuation and fill stations; 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

**7B102** Equipment, as follows (see List of Items Controlled), other than those controlled by 7B002, specially designed to characterize mirrors, for laser gyro equipment.

**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 measurement accuracy of 10 ppm or less (better).  
 b. Reflectometers having a measurement accuracy of 50 ppm or less (better).  
 c. Prolifometers having a measurement 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**

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

Control(s)	Country Chart
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.	
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 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 or Attitude and Heading Reference Systems (AHRS) (except gimballed AHRS) including inertial equipment not controlled by 7A003 or 7A004.**

**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: (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

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

**List of Items Controlled**

Unit: \$ value  
 Related Controls: See also 7D103 and 7D994  
 Related Definitions: N/A  
 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 navigation data:  
 b.1. Doppler radar velocity;  
 b.2. Global navigation satellite systems (i.e., GPS or GLONASS) reference data; or  
 b.3. Terrain data from data bases;  
 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 for the "use" of equipment controlled by 7A001 to 7A006, 7A101 to 7A106, 7A115, 7B001, 7B002, 7B003, 7B102 or 7B103.**

**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) 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" for the equipment controlled by 7A003 or 7A103.**

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

**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

<p><i>Control(s)</i>      <i>Country Chart</i></p> <p>AT applies to entire entry      AT Column 1</p> <p><b>License Exceptions</b> CIV: N/A TSR: N/A</p> <p><b>List of Items Controlled</b> <i>Unit:</i> \$ value <i>Related Controls:</i> N/A <i>Related Definitions:</i> N/A <i>Items:</i> The list of items controlled is contained in the ECCN heading.</p> <p><b>E. Technology</b></p> <p><b>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).</b></p> <p><b>License Requirements</b> <i>Reason for Control:</i> MT, NS, RS, AT</p>	<p><i>Control(s)</i>      <i>Country Chart</i></p> <p>NS applies to "technology" for items controlled by 7A001 to 7A004, 7A006, 7B001 to 7B003, 7D001 to 7D003.</p> <p>MT applies to entire entry      MT Column 1</p> <p>RS applies to "technology" for inertial navigation systems, inertial equipment and specially designed components therefor, for civil aircraft.      RS Column 1</p> <p>AT applies to entire entry      AT Column 1</p> <p><b>License Exceptions</b> CIV: N/A TSR: N/A</p> <p><b>List of Items Controlled</b> <i>Unit:</i> N/A <i>Related Controls:</i> (1) See also 7E101 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 Control (see 22 CFR part 121) <i>Related Definitions:</i> N/A <i>Items:</i> The list of items controlled is contained in the ECCN heading</p> <p><b>7E002 "Technology" according to the General Technology Note for the "production" of equipment controlled by 7A (except 7A994) or 7B (except 7B994).</b></p> <p><b>License Requirements</b> <i>Reason for Control:</i> NS, MT, RS, AT</p>	<p><i>Control(s)</i>      <i>Country Chart</i></p> <p>NS applies to entire entry      NS Column 1</p> <p>MT applies to entire entry      MT Column 1</p> <p>AT applies to entire entry      AT Column 1</p> <p><b>License Exceptions</b> CIV: N/A TSR: N/A</p> <p><b>List of Items Controlled</b> <i>Unit:</i> N/A <i>Related Controls:</i> 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 <i>Related Definition:</i> Refer to the Related Definitions for 7B001 <i>Items:</i> The list of items controlled is contained in the ECCN heading</p> <p><b>7E003 "Technology" according to the General Technology Note for the repair, refurbishing or overhaul of equipment controlled by 7A001 to 7A004.</b></p> <p><b>License Requirements</b> <i>Reason for Control:</i> NS, MT, AT</p>	<p><i>Control(s)</i>      <i>Country Chart</i></p> <p>NS applies to entire entry      NS Column 1</p> <p>MT applies to entire entry      MT Column 1</p> <p>AT applies to entire entry      AT Column 1</p> <p><b>License Exceptions</b> CIV: N/A TSR: N/A</p> <p><b>List of Items Controlled</b> <i>Unit:</i> N/A <i>Related Controls:</i> 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) <i>Related Definitions:</i> N/A <i>Items:</i> The list of items controlled is contained in the ECCN heading</p> <p><b>7E004 Other "technology", as follows (see List of Items Controlled).</b></p> <p><b>License Requirements</b> <i>Reason for Control:</i> NS, MT, AT</p>	<p><i>Related Controls:</i> See also 7E104 and 7E994 <i>Related Definitions:</i> N/A <i>Items:</i> 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 interconnecting 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 reconfiguration;         <b>Note:</b> 7E004.b.3. does not control "technology" for the design of physical redundancy.         b.4. Flight controls that permit inflight reconfiguration 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";         <b>Note:</b> 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;</p>
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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", other than "technology" controlled by 7E003, 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, 7B102, 7B103, 7D101 to 7D103.**

**License Requirements**

*Reason for Control:* MT, RS, AT

<i>Control(s)</i>	<i>Country Chart</i>
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, 7A016, 7A115, 7A116, 7A117, 7B103, or 7D103 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.) "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, 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

**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

<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:* a. Design "technology" for shielding systems;

b. Design "technology" for the configuration of hardened electrical circuits and subsystems;

c. Design "technology" for the determination of hardening criteria of .a and .b of this entry.

**7E104 "Technology" for the integration of the flight control, guidance, and propulsion data into a flight management system for optimization of rocket system trajectory. (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.)**

**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

<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 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

<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; 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

<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; 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.

*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 equipment for 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 8A002.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;

**8A018 Items on the International Munitions List.**

**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: \$5000

GBS: N/A

CIV: N/A

**List of Items Controlled**

*Unit:* \$ value

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:* a. Closed and semi-closed circuit (rebreathing) apparatus for diving and underwater swimming, 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;

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, and specially designed parts 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:* \$ value

*Related Controls:* N/A

*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 format of 35 mm or larger, and having autofocus or remote focusing specially designed for underwater use;

c. Stroboscopic light systems, specially designed or modified for underwater use, capable 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. Pressure regulators, air cylinders, hoses, valves and backpacks for the apparatus described in paragraph 8A002.q;

j. Life jackets, inflation cartridges, compasses, wetsuits, masks, fins, weight belts, and dive computers;

k. Underwater lights and propulsion equipment;

l. 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>
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>
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/m<sup>3</sup>.

**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

<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, except for exports or reexports to destinations outside of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, 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

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

**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

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

**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

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

NS Column 1  
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, 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

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

**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>
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NS applies to entire entry  
AT applies to entire entry

NS Column 1  
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>
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AT applies to entire entry

**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**

(For propulsion systems designed or rated against neutron or transient ionizing radiation, see the U.S. Munitions List, 22 CFR part 121.)

**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, SI, AT

<i>Control(s)</i>	<i>Country Chart</i>
NS applies to entire entry	NS Column 1
SI applies to commercial communications satellites controlled by 9A004 that include the individual munitions list systems, components, or parts identified on the United States Munitions List (USML). 22 CFR part 121. See §742.14 of the EAR for additional information.	SI 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) This entry describes space launch vehicles (not including their payloads) and other “spacecraft”. (3) Commercial communications satellites are subject to Commerce licensing jurisdiction even if they include the individual munitions list systems, components, or parts identified on the United States Munitions List (USML). In all other cases, these systems, components, or parts remain on the USML, except that satellite fuel, ground support equipment, test equipment, payload adapter/interface hardware, replacement parts for the preceding items, and non-embedded, solid propellant orbit transfer orbit transfer engines (“kick motors”) are subject to Commerce licensing jurisdiction (and not controlled on the USML) when they are to be utilized for the specific

commercial communications satellite launch, provided the solid propellant “kick motor” being utilized is not specifically designed or modified for military use or capable of being restarted after achievement of mission orbit (such orbit transfer engines are always controlled on USML). Technical data (as defined in 120.10 of the International Traffic in Arms Regulations (ITAR)) and defense services (as defined in 120.9 of the ITAR) related to the systems, components, or parts on the USML are always controlled under the USML, even when the satellite itself is licensed by the Department of Commerce. (4) Military communications satellites or multi-mission satellites, including commercial communications satellites having additional non-communication mission(s) or payload(s) are under the jurisdiction of the Department of State. (5) Other “spacecraft” not subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls under 22 CFR part 121. This entry includes the international space station being developed, launched and operated under the supervision of the U.S. National Aeronautics and Space Administration. Exporters requesting a license from the Department of Commerce for spacecraft other than the international space station or a commercial communications satellite specified in 9A004 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. (6) All other spacecraft, including all other satellites not controlled under 9A004 and components, parts, accessories, attachments, associated equipment, and ground support equipment therefor are subject to the export licensing authority of the Department of State. (7) Items on the USML that are included in a commercial communications satellite to be exported under a Commerce license must be specifically listed on the Commerce license application. Such items when not included in a specific commercial communications satellite are under the jurisdiction of the Department of State. (8) Technical data provided to the launch provider (form, fit, function, mass, electrical, mechanical, dynamic/ environmental, telemetry, safety, facility, launch pad access, and launch parameters) for commercial communications satellites that describe the interfaces for mating of the satellite to the launch vehicle and parameters for launch (e.g. orbit, timing) of the satellite, are under Commerce jurisdiction. Other technical data and all defense services and technical assistance for satellite and/or launch vehicles, including compatibility, integration, or processing data are controlled and subject to licensing by the Department of State, in accordance with 22 CFR parts 120 through 130. Approval for such technical assistance will require a Technical Assistance Agreement (TAA) and may require U.S. Government oversight. (9) Once a satellite is launched, items remaining unlaunched are required to be returned immediately to

the United States. If the satellite launch is canceled or unduly delayed, the satellite and all support equipment must be returned immediately to the United States.

(10) Detailed design, development, production, or manufacturing data for all spacecraft, including satellites, regardless of which agency has jurisdiction over the export, and all systems components, parts, accessories, attachments, and associated equipment (including ground support equipment) specifically designed or modified for articles on the USML (including software source code and operating algorithms) are subject to licensing by the Department of State. This does not include that level of technical data (including marketing data) necessary and reasonable for a purchaser to have assurance that a U.S.-built item intended to operate in space has been designed, manufactured and tested in conformance with specified contract requirements (e.g., operational performance, reliability, lifetime, product quality, or delivery expectations) as well as data necessary for normal in-orbit satellite operations, to evaluate in-orbit anomalies, and to operate and maintain associated ground station equipment (except encryption hardware). (11) For the control status of products contained in "spacecraft" payloads, see the appropriate categories

*Related Definitions:* Transferring registration or operational control to any foreign person of any commercial communications satellite controlled by this entry must be authorized on a license issued by the Bureau of Export Administration. This requirement applies whether the commercial communications satellite is physically located in the United States or abroad

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

**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 Defense Trade Controls. See 22 CFR part 121.)**

**9A018 Equipment on the International Munitions List.**

**License Requirements**

*Reason for Control:* NS, RS, AT

<i>Control(s)</i>	<i>Country Chart</i>
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

**License Exceptions**

LVS: \$1500  
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.

**9A018 Equipment on the International Munitions List.**

**License Requirements**

*Reason for Control:* NS, RS, AT

<i>Control(s)</i>	<i>Country Chart</i>
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

**License Exceptions**

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

**List of Items Controlled**

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

*Related Controls:* (1) This entry controls parachute systems designed for use in dropping personnel only. (2) Parachute systems designed for use in dropping military equipment, braking military aircraft, slowing spacecraft descent, or retarding weapons delivery; AND 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.)

*Related Definitions:* N/A

*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. Ground vehicles and components therefor, specially designed or modified for military purposes. (See part 770 of the EAR, Interpretation 8)

c. Pressurized breathing equipment specially designed for use in military aircraft and helicopters;

d. Military parachutes;

e. Military instrument flight trainers, except for combat simulation; and components, parts, attachments and accessories specially designed for such equipment.

**9A101 Lightweight turbojet and turbofan 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:* (1) Items controlled in 9A101.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) Engines designed or modified for missiles (except engines for non-military unmanned air vehicles [UAVs] or remotely piloted vehicles [RPVs]), regardless of thrust or specific fuel consumption, 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 1000 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 0.13 kg/N/hr or less (at sea level static and standard conditions); or

b. Engines designed or modified for use in "missiles".

**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 Liquid rocket propulsion systems or components, other than those controlled by 9A006, usable in rockets with a range capability of 30 Km or greater, 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 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.

**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, and resin impregnated fiber prepreps and metal coated fiber preforms**

**therefor, 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 1A002, 1C010, and 1C210. (2) The only resin impregnated fiber prepreps controlled by entry 9A110 are those using resins with a glass transition temperature ( $T_g$ ), after cure, exceeding 418 K (145° C) as determined by ASTM D4065 or equivalents. (3) "Composite structures, laminates, and manufactures thereof, specially designed for use in missile systems are under the licensing authority of the Office of Defense Trade Controls, U.S. Department of State, except those specially designed for non-military unmanned air vehicles controlled in 9A120

*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 Launch support 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.)

**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, usable 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.)

**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 the U.S. Department of State, Office of Defense Trade Controls. See 22 CFR part 121.)

**9A120 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.**

#### 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

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

**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>
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CC applies to entire entry	CC Column 1
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#### 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>
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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 axle (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>
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AT applies to entire entry	AT Column 1
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 avionic 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>
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AT applies to entire entry	AT Column 1
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#### 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 or measuring gas turbine blades, vanes or tip shroud castings.**

#### 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 only to equipment for engines that meet the characteristics described in 9A001.	MT Column 1

AT applies to entire entry

	AT Column 1
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**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;

c. Ceramic core manufacturing equipment or tools;

d. Ceramic shell wax pattern preparation equipment.

**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

*Control(s)*                      *Country Chart*

NS applies to entire entry    NS Column 1  
 MT applies only to equip-    MT Column 1  
   ment for engines that  
   meet the characteristics  
   described in 9A001.  
 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

*Control(s)*                      *Country Chart*

NS applies to entire entry    NS Column 1  
 MT applies only to equip-    MT Column 1  
   ment for engines that  
   meet the characteristics  
   described in 9A001.  
 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

*Control(s)*                      *Country Chart*

NS applies to entire entry    NS Column 1  
 MT applies only to equip-    MT Column 1  
   ment for engines that  
   meet the characteristics  
   described in 9A001.  
 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, 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 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 25x10<sup>6</sup>.

**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

*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  
 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

*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  
 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

*Control(s)*                      *Country Chart*

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

*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:* 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